GOLDCORP INC.

# VOLUME I

## The Coffee Gold Mine

COFFEE GOLD MINE
PROJECT PROPOSAL FOR EXECUTIVE COMMITTEE SCREENING

Pursuant to the *Yukon Environmental and Socio-economic Assessment Act*

March 2017

GOLDCORP

# VOLUME I

# THE COFFEE GOLD MINE

# (Binder 1 of 1)

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## GOLDCORP INC.

# EXECUTIVE SUMMARY

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# INTRODUCTION

Kaminak Gold Corporation, a wholly owned subsidiary of Goldcorp Inc. (Goldcorp or Proponent) proposes to develop the Coffee Gold Mine (Project). The Project includes four open pits that will process 5 million tonnes of ore per year on a gold heap leach over an operational mine life of 12 years. Goldcorp's objective is to design, develop, operate, close, and reclaim the Project in an economically rewarding, environmentally sound, and socially responsible manner. Goldcorp appreciates and is committed to close consultation and partnership with First Nations, local communities, and stakeholders as the Project progresses.

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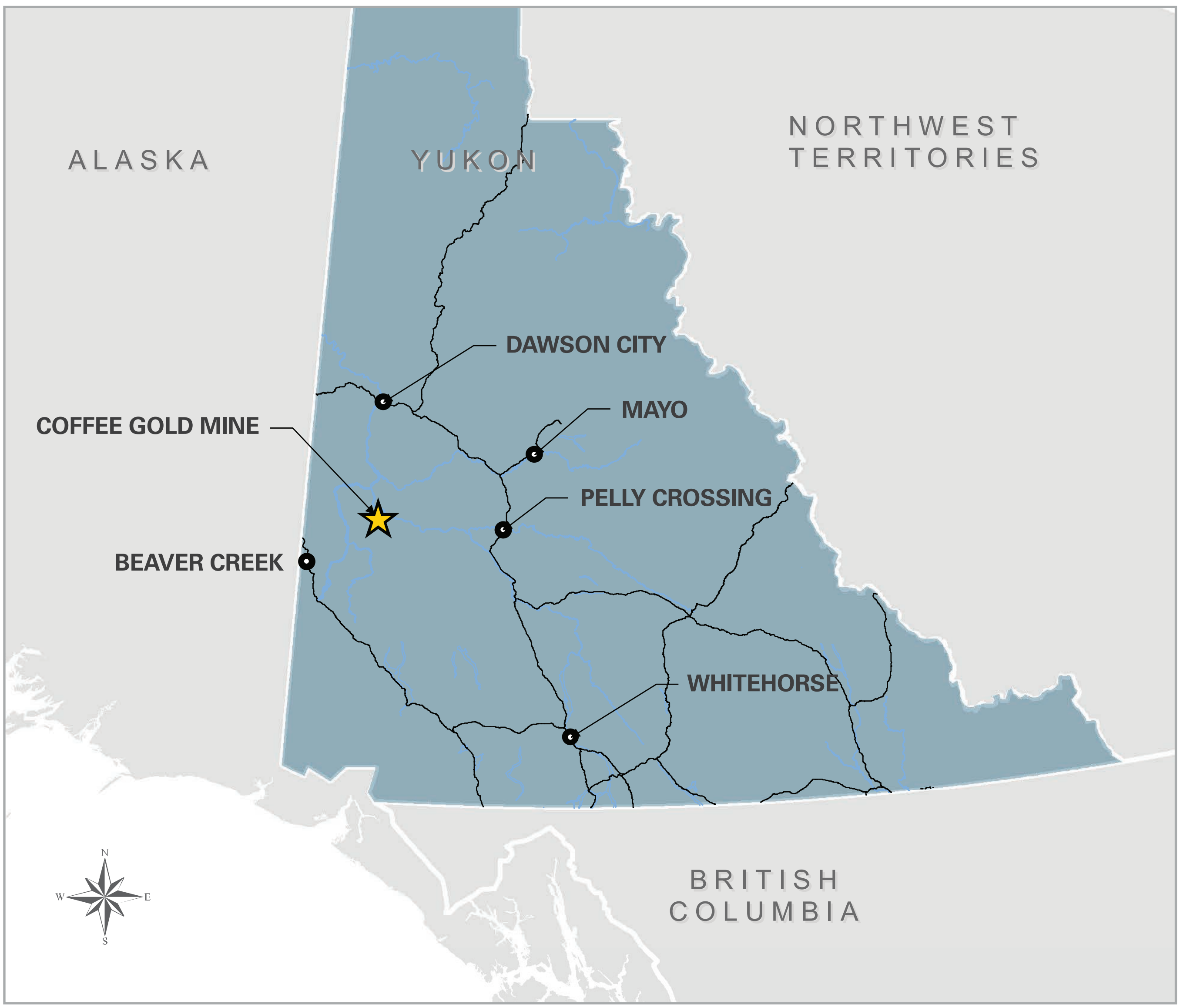
The mine site is located on Crown land, approximately 130 kilometres (km) south of the City of Dawson and 330 km northwest of Whitehorse in west-central Yukon. The mine site is located within Tr’ondëk Hwëch’in traditional territory and in the asserted territory of White River First Nation. Access to the mine site will be via the Northern Access Route, a 214-km all-weather road, south from the North Klondike Highway east of the City of Dawson. The road alignment is located within Tr’ondëk Hwëch’in traditional territory, with some portions located within the shared traditional territories of Selkirk First Nation and the First Nation of Na-cho Nyäk Dun. A portion of the Northern Access Route is also located within the asserted territory of White River First Nation.

Goldcorp proposes a construction phase that will occur over 2.5 years. Mining will continue over 12 years during the operation phase. Progressive reclamation activities will begin as early as Year 2 in the operation phase when mining at the Double Double pit is completed. The Project’s active reclamation and closure phase (Years 13 to 23) will commence when all mining and processing activities have been completed, and will be followed by a post-closure phase from Year 24 onwards, as determined to be required.



# PROPOSAL STRUCTURE

The Project Proposal describes the potential environmental and socio-economic effects of the Project, and outlines how Goldcorp plans to mitigate these effects. The Project Proposal includes five volumes, each focused on a different theme. Each volume comprises multiple technical appendices that provide the detail and rationale for decisions and conclusions made in the analyses. The structure of the Project Proposal was informed by input and feedback received during early project engagement.

**Volume I:** The Coffee Gold Project

**Volume II:** Physical Environment

**Volume III:** Biophysical Environment

**Volume IV:** Human Environment

**Volume V:** Additional YESAA Requirements

# PROJECT BENEFITS

The purpose of the Project is to develop a productive gold mine in Yukon that aligns with Goldcorp's business goals while generating economic, research, educational, and cultural opportunities for First Nations, local communities, and Yukon.

**The Project will:**

- **Place an emphasis on hiring qualified local, regional, and First Nations residents.**
- **Provide numerous training, education, and career development opportunities for employees.**
- **Create up to 448 indirect jobs and 663 direct jobs during the construction phase.**
- **Create up to 65 indirect jobs and 372 direct jobs during the operation phase.**
- **Contribute an annual average of $251.1 million to Yukon's GDP during mine production.**
- **Contribute government revenues of approximately $427.5 million.**
- **Generate over $2 billion CAD of gross revenue.**

# ENVIRONMENTAL ASSESSMENT PROCESS

Before any authorizations can be granted for the Project, it is required to undergo an assessment under the *Yukon Environmental and Socio-economic Assessment Act*. The Executive Committee of the Yukon Environmental and Socio-economic Assessment Board will conduct a screening of this Project Proposal. The screening process will provide opportunities for input and comments on the Project, potential environmental and socio-economic effects and proposed mitigations, and the draft findings of the Executive Committee.

The Project will also require various other licences, permits, and other types of approvals prior to proceeding with construction and operations. This will include Type A and Type B Water Licences under the Yukon *Waters Act* and a Quartz Mining Licence under the *Quartz Mining Act*. It is expected that Fisheries and Oceans Canada, Natural Resources Canada, and Transport Canada will be involved as decision bodies for the Executive Committee Screening, since the Project will require permits granted by these federal agencies.

# CONSULTATION

Meaningful consultation and engagement has and continues to be an integral part of the Project throughout the exploration, scoping, design, assessment, permitting phases and beyond. Goldcorp's consultation program was designed to meet or exceed the regulatory and legal requirements of YESAA. **Goldcorp and its subsidiary, Kaminak Gold Corporation, have been conducting consultation activities with First Nations, potentially affected communities, interested persons, the public, and both Yukon and federal government agencies since 2009.** The input received has allowed Goldcorp to design the Project to minimize many of the issues that have been raised.

## First Nations Consultation

The main objectives of Goldcorp's First Nations consultation program are to work collaboratively with Tr'ondëk Hwëch'in, White River First Nation, Selkirk First Nation, and First Nation of Na-Cho Nyäk Dun to understand the landscape where the Project is situated, and work together to design a Project that minimizes potential adverse effects while maximizing benefits to all interested persons. Consultation with First Nations included a variety of events and activities, including community meetings and open houses, meetings with First Nations governments, one-on-one and small group targeted interviews with key informants, and site visits. During each consultation event, feedback from First Nations was documented, and influenced project design where applicable. Concerns and questions were responded to during consultation events, and, where required, follow-up with the inquiring party occurred to address information requests, questions, and concerns related to the Project.

## Affected Communities and Interested Persons Consultation

The City of Dawson is the closest municipality to the Project and, as the proposed access point for the Northern Access Route, will likely be the Yukon community most affected by the Project. As such, the consultation program involved a focused effort in the City of Dawson, which included meetings with the City's Mayor and Council and community meetings.

Several wildlife co-management bodies are specified under the *Yukon Environmental and Socio-economic Assessment Act* as Interested Persons in assessments that involve a project's potential effects on the fish or wildlife under their mandates. Goldcorp initiated consultation with the Yukon Fish and Wildlife Management Board, Salmon Subcommittee, and Dawson District Renewable Resources Council to understand their views on the Project. Meetings to date have been documented with a combination of meeting minutes, sign-in sheets, photographs, and comment cards.

## Public Consultation

Public consultation events included open houses, community meetings, and individual or small group meetings with members of the community and community organizations that may be affected by the Project. While public consultation efforts were focused in the City of Dawson based on its proximity to the Project, the location of the Northern Access Route, and potential level of effects, Goldcorp also held consultation events in Whitehorse, Beaver Creek, and Pelly Crossing.

## Government and Agency Consultation

Goldcorp has been engaging with territorial and federal agencies since 2013, and established an informal Regulators and Assessors Working Group in early 2016 to facilitate consistent engagement with territorial and federal agencies through the Project design period. Goldcorp's government agency engagement included regular meetings, discussions, and teleconferences, as well as site visits.

**Goldcorp's Approach to Addressing Identified Concerns is to:**

- Minimize potential adverse social and economic effects.
- Acknowledge requirement for economic benefits to the region, employment, and training.
- Identify cumulative effects and associated concerns.
- Focus on continued consultation to ensure the Project generates mutual benefits to First Nations, governments, the Yukon public, and Goldcorp.

Goldcorp recognizes the efforts made by the many people and organizations that shared their thoughts and ideas about the Project. Goldcorp has collected and studied this input, and has shared it with the assessment teams to shape the Project's design and development. The Project Proposal describes how consultation input has increased understanding of potential effects and influenced decisions on major elements of the Project including the Northern Access Route, waste rock storage facilities, reclamation objectives, and procurement.

# PROJECT DESCRIPTION

## Open Pits

Four open pits – Latte, Double Double, Supremo, and Kona – will be mined over approximately 12 years using conventional shovel and truck methods. Mining will occur at an annual rate of 5 million tonnes (Mt). Conceptual design indicates a total of 60.1 Mt of mined ore over the life of the mine.

## Waste Rock Storage Facilities

The Project includes the Alpha and Beta waste rock storage facilities. Approximately 300 Mt of waste materials will be mined from the Project's open pits over the life of the mine. The majority of this waste material will be placed in the waste rock storage facilities, and some suitable waste rock will be used to construct mine site infrastructure.


## Heap Leach Facility

The heap leach facility will be constructed in five stages and is designed to store up to 67.3 Mt of crushed ore. A cyanide solution will be used to leach the gold from the crushed ore. The heap leach liner system has been designed to collect both process and rinse solutions while protecting surface and groundwater quality throughout the mine's operating life.

## Northern Access Route

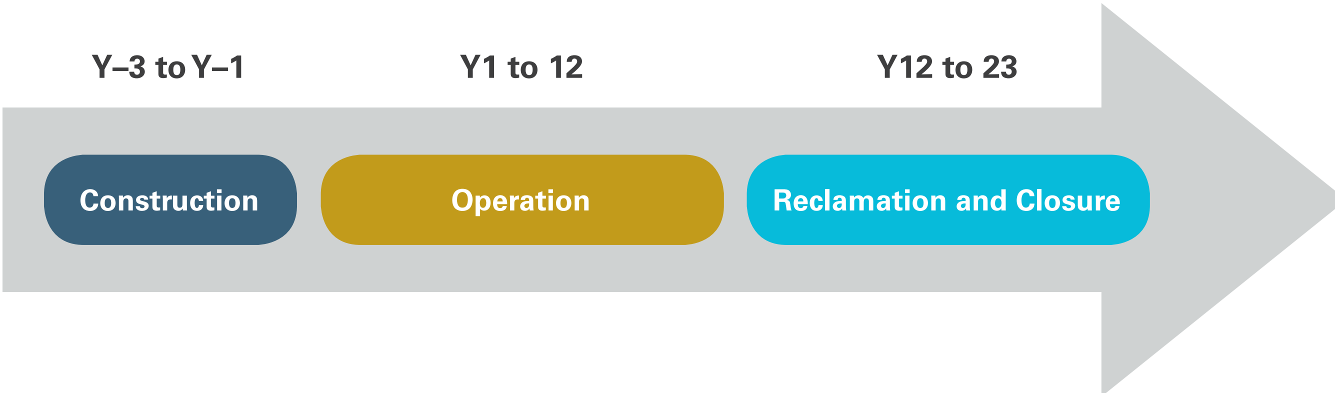
The Northern Access Route extends from the junction of the North Klondike Highway and Hunker Creek Road to the Coffee airstrip on the south side of the Yukon River. First following existing government maintained roads up to Sulphur Creek, the Northern Access Route will then generally follow existing roads utilized by placer miners, and will be maintained in winter. Barges and Ice bridges will be used for Yukon and Stewart River crossings. In addition to upgrades and realignment along certain portions of the route, 37 km of new road construction will be required to extend the road to the mine site.

## Other Mine Site Infrastructure

The Project will also include the following mine site infrastructure:

- Temporary ore storage stockpiles
- Crusher system
- Plant site, including equipment to extract the gold from the process solution and safely store consumables
- Camp site, including sewage treatment, waste management facilities, and power generation
- Bulk explosive storage area
- Site water management infrastructure
- Mine site and haul roads
- Ancillary infrastructure, including the airstrip.

## Project Schedule




The construction phase of the Project will span a period of 30 months. The initial stage of construction will be focused on the construction of the Northern Access Route since it is the route for transportation of equipment and materials required for mine site construction. The start of construction and installation of infrastructure at the mine site is planned for the second quarter of Year –2.

The operation phase will begin in Year 1 and will last for 12 years. During this time, activities will focus on mining and backfilling the open pits, developing the waste rock storage facilities, and conducting all ore processing activities including heap leach development and subsequent progressive reclamation.

The reclamation and closure phase will include two stages: post-mining closure and active closure. The post-mining closure stage will be triggered by the cessation of mining activities, and will occur over a six-year period. During this stage, ore processing will continue, infrastructure will be dismantled or decommissioned, and equipment will be removed from active service once it is no longer required. Active closure will occur over a five-year period. During this stage, water treatment requirements will continue until effluent from the decommissioned process facility is of suitable quality for discharge to local watersheds, and reclamation and closure activities for remaining infrastructure will be completed.

The post-closure phase will start when acceptable water quality is achieved and water management infrastructure has been decommissioned. This phase is expected occur from Year 24 onwards, as determined to be required. Water quality will be monitored once per year in summer until all closure objectives and regulatory requirements have been met. Annual monitoring will be conducted on the pit lakes, waste rock storage facilities, and the heap leach facility area, and corrective measures will be undertaken as necessary.

## Alternatives Assessment

When designing the Project, Goldcorp selected preferred options from a variety of alternatives. Goldcorp incorporated technical, economic, environmental, and socio-economic considerations into decision-making. Four steps are used to determine the preferred option for each component of the Project:

1. Identify technically and economically feasible alternative means.
2. List potentially significant Project-specific, and cumulative changes on intermediate components and potential Project-specific and cumulative effects on valued components.
3. Select the approach for the analysis of alternative means.
4. Assess the effects of alternative means.

This decision-making process was used to identify the preferred Project alternative for the following components:

| | |
|---|---|
| **Mining method** | **Waste movement method** |
| **Ore movement method** | **Ore processing method** |
| **Mine accommodation** | **Heap leach facility site** |
| **Mine site access routes** | **Power source** |
| **Waste rock storage facilities site** | |

# ASSESSMENT METHODOLOGY

The methodology used to identify and assess potential environmental and socio-economic effects of the Project follows recommended guidelines from the Yukon Environmental and Socio-economic Assessment Board and instructions under the *Yukon Environmental and Socio-economic Assessment Act*. The assessment methodology follows five main steps, namely:

- Issues scoping
- Establishing baseline conditions
- Assessing potential effects
- Assessing cumulative effects
- Identifying effects monitoring and adaptive management.

To help understand the likely effects of the Project, this methodology was then applied to valued components (VCs) – important elements of social and biophysical environments (e.g., community infrastructure and services, surface water quality, wildlife and wildlife habitat). Changes to intermediate components (ICs), elements that interact with and can influence VCs, were also analyzed. During initial issues scoping, a list of candidate ICs and VCs was compiled, and 18 components were carried through to the assessment.

For each IC and VC assessment, boundaries were set using geography (spatial), time (temporal), administrative, and other technical information (e.g., watershed boundaries for hydrology).

Following the establishment of boundaries, existing conditions were described based on available information, including the following:

- Federal, territorial, First Nation, and local government jurisdictions, mandates, agreements, and interests
- Available local and regional socio-economic and environmental information
- Baseline reports describing desktop and field studies conducted for the Project
- Available Traditional Knowledge
- Scientific and other information.

Each IC analysis and VC assessment describes potential Project-related changes or effects by: identifying potential Project interactions, evaluating potential Project-specific changes or effects, and describing proposed mitigation measures. Mitigation measures are developed to eliminate or reduce the frequency, magnitude, or severity of predicted changes or effects. Based on the anticipated effectiveness of these measures, residual changes to ICs and residual effects to VCs were characterized. For VCs, the significance and likelihood of each predicted residual effect was determined.

All residual changes or effects remaining after the implementation of mitigation measures were considered in a cumulative change analysis or effects assessment. *The Assessor's Guide to the Assessment of Cumulative Effects* described cumulative effects as "changes to environmental or socio-economic components caused by an activity (related to a project being assessed) in combination with other past, present, and future activities".

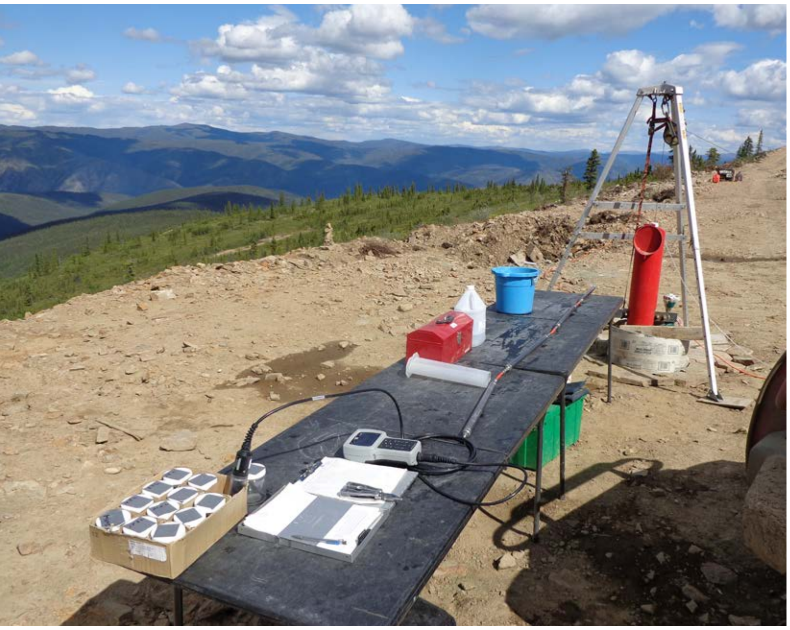
Finally, each IC analysis and VC assessment section describes whether or not monitoring will be required to verify predictions and comply with regulatory requirements.

# VALUED AND INTERMEDIATE COMPONENTS

During initial issues scoping, a list of candidate VCs and ICs was compiled based on Project relevance and importance to First Nations, government agencies, and stakeholders, as identified during consultation and engagement. Based on this exercise, 13 VCs and 5 ICs were selected for further study in the assessment.

| | |
|---|---|
| **Physical Environment** | **Groundwater (IC)** |
| | **Surface Hydrology (IC)** |
| | **Air Quality and Greenhouse Gas Emissions (IC)** |
| | **Noise (IC)** |
| | **Surficial Geology, Terrain, and Soils** |
| | **Surface Water Quality** |
| **Biophysical Environment** | **Fish and Fish Habitat** |
| | **Vegetation** |
| | **Wildlife and Wildlife Habitat** |
| | **Birds and Bird Habitat** |
| **Human Environment** | **Demographics (IC)** |
| | **Economic Conditions** |
| | **Social Economy** |
| | **Community Infrastructure and Services** |
| | **Education Services** |
| | **Land and Resource Use** |
| | **Community Health and Well-being** |
| | **Heritage Resources** |

# Groundwater



Goldcorp evaluated the potential Project-related changes to groundwater. Groundwater is an important component of the physical landscape, and is considered an IC because it influences other components including surface hydrology, surface water quality, and fish and fish habitat.

Changes to groundwater quantity and groundwater quality were analyzed. Groundwater quantity refers to the distribution of groundwater and related volume changes; groundwater quality refers to its chemical composition. Potential changes to groundwater quantity may include a change in water levels and volume downstream of the mine site and the Northern Access Route. Groundwater quality may be changed downstream of the mine site due to mine contact water infiltrating into the groundwater system.

To minimize the potential for these changes to occur, Goldcorp has incorporated key mitigation into the Project's design. Progressive reclamation and closure activities will begin as mining is completed in each open pit and will continue throughout the mine life. In addition, surface water will be diverted from contact with mine infrastructure (e.g., heap leach facility, waste rock storage facilities), and redirected into creeks to minimize the volume of contact (mine-impacted) water.

The heap leach pad will be lined, and permafrost will be protected as much as possible under key mine infrastructure. Waste rock will be used to backfill mined-out pits, which will reduce the overall footprint of the waste rock storage facilities. Where practical along the Northern Access Route, the existing surface material will be left intact in areas of undisturbed, shallow, ice-rich permafrost, and the road will be constructed by filling over a geotextile separation layer. This will serve to reduce active layer melt.

To evaluate Project changes to groundwater, a detailed numerical groundwater model was used to determine potential Project-related changes to groundwater quantity. Similarly, a water quality model, developed in tandem with the water balance model, supported a qualitative assessment of Project-related changes to groundwater quality.

Although Goldcorp has incorporated key mitigation measures into the design of the Project, the Project may still influence groundwater at the mine site; however, these changes are likely to be minimal. Limited Project-related changes to groundwater quantity are predicted to occur as result of the Project; baseflows changes to receiving creeks are minimal. For groundwater quality, several source parameters have been identified that could exceed baseline groundwater concentrations, including arsenic in the Halfway Creek drainage, and arsenic and uranium in the Latte Creek drainage; the effects of these exceedances are assessed in surface water quality. While these changes are likely to occur through the Post-closure Phase, they are likely to occur at local scale without affecting the larger, much deeper regional groundwater system. Those parameters with source term concentrations exceeding groundwater concentrations have been flagged for future monitoring as they may become artificially elevated in groundwater.

A groundwater monitoring program is currently in place and a high-quality baseline dataset exists, which can be used to evaluate Project related changes to groundwater. The current monitoring network will continue and additional groundwater monitoring stations will be installed around key mine facilities to verify groundwater model assumptions and predictions.

## Surface Hydrology

Surface hydrology was evaluated for potential Project-related changes because of the importance of local watercourses in the Project area and in Yukon. Traditional Knowledge emphasizes the linkages between air, land, and water resources; furthermore, the maintenance and protection of these resources is highly important to people, fish, wildlife, and plants. In addition, the Yukon Environmental and Socio-economic Assessment Board requested a thorough review of water resources for the Project Proposal, since the management, use, and discharge of water from a mine site is governed by both territorial and federal legislation.

The surface hydrology analysis focuses on the potential Project-related changes to flow conditions in local creeks and streams. Changes to surface hydrology were analyzed with respect to annual runoff, monthly runoff distribution, low flows, peak flows, and duration and frequency of flows. To predict Project-related changes to surface hydrology, a detailed site-wide water balance model was assembled using GoldSim modelling software.

Activities at the mine site will alter the extent of some watershed boundaries, as surface water will be rerouted. In addition, surface characteristics will change as pits are developed, ore is stockpiled and placed on the heap leach facility, waste rock is deposited in the waste rock storage facilities, and water management infrastructure is constructed and operated. Along the Northern Access Route, construction activities (e.g., clearing and grubbing, cut and fill of slopes, installation of watercourse crossings) and runoff during operation will change surface hydrology.

Due to the inherent linkages in the water balance between groundwater and surface water flows, the Project design measures for the mine site that are relevant for groundwater are also relevant for surface hydrology and surface water quality. Surface water will be diverted from contact with mine infrastructure (e.g., heap leach facility, waste rock storage facilities) and redirected into creeks to minimize the volume of contact water. Along the Northern Access Route, potential adverse changes resulting from the road will be minimized and controlled by implementing standard operating procedures and best management practices.

After the implementation of mitigation measures, flow enhancements (i.e., increases) are generally predicted for YT-24 and Halfway Creeks; however these increases are more pronounced in the upper portions of the watersheds, particularly in Halfway Creek. Small reduction in flow are predicted in the upper portions of Latte Creek; these flow reductions are not discernable at the larger watershed scale (e.g., confluence of Coffee and Latte Creeks). No flow changes are predicted for the Yukon River. No or minimal changes are predicted for surface hydrology along the Northern Access Route.

A robust and spatially representative hydrometric monitoring program is currently in place, and a high-quality baseline dataset exists to measure Project related changes to streamflow and confirm the predictions of the water balance model. Surface water monitoring will inform the day-to-day operation of the site and associated water management activities. Goldcorp will also carry out monitoring and surveillance of the surface water drainage system near stream crossings and sensitive habitats throughout the life of the Project.

## Air Quality and Greenhouse Gas Emissions

Goldcorp evaluated changes to air quality and greenhouse gas emissions because they are part of a pathway of environmental and socio-economic effects to one or more biophysical or human receptors. Traditional Knowledge and consultation identified the importance of air quality as part of a holistic assessment of Project interactions and changes. In addition, The Yukon Environmental and Socio-economic Assessment Board identified Project-related air quality changes (e.g., smoke, dust) as a concern for Yukon residents. Air quality may also affect the wildlife and wildlife habitat, and land and resource use. Greenhouse gas emissions are an important aspect of the natural environment, and are changing the global environment and affecting global climate change.

Potential changes to air quality indicator emissions are based on the Project's peak operational year; i.e., the "worst-case" scenario. Greenhouse gas emissions were quantified for Project phases, and are based on vehicle, equipment, and power generator operation; nitrate and fuel oil-based explosives detonation; and waste incineration. The effects are expected to include generation of airborne particulate matter, combustion by-products, and the release of airborne pollutants.

Mitigation measures that will be implemented include incorporating Project design measures to reduce emissions, minimizing vehicle traffic, managing dust, conducting progressive reclamation, backfilling open pits, and using waste heat.

Project-related residual changes to air quality from the mine site are predicted to comply with relevant air quality objectives and guidelines within 500 metres of the mine site boundary following implementation of mitigation measures. Additionally, Changes to air quality as a result of vehicular traffic on the Northern Access Route have been modelled to be limited to within 1 kilometer of the roadway. These changes are likely to persist though construction, operation, and reclamation and closure.

Project will be an inconsequential addition to Canada's greenhouse gas emissions, and a minor portion of the Territory's overall greenhouse gas emissions.

Ongoing air quality monitoring will be conducted to monitor Project changes to air quality and assess the effectiveness of mitigation as well as ensuring Project compliance with the applicable air quality standards.

## Noise

Goldcorp selected noise as an IC through review of the regulatory framework and discussions with First Nations. Noise levels are important to people and wildlife as it can influence their health and well-being through sleep disturbance, annoyance stress, and, in the case of wildlife, habitat avoidance.

Changes in noise levels are expected from Project activities. Primary sources of Project noise include blasting in the open pits, ore crushing, hauling, and vehicle and air traffic.

Mitigation measures that will be implemented include incorporating Project design measures to reduce emissions, minimizing vehicle traffic, managing dust, conducting progressive reclamation, backfilling open pits, and using waste heat.

Based on acoustic modeling, changes in noise levels are expected from Project activities. Following implementation of mitigation measures, noise generated by the Project is expected to remain at the mine site during all phases of the Project, decreasing through reclamation and closure. The closest identified receptor is located more than 10 km downriver from the confluence Coffee Creek and the Yukon River; at this location, Project noise at this location will be compliant with guidelines. Sound levels along the Northern Access Route are expected to be within relevant daytime guidelines approximately 68 m from either side of the road centreline.

Goldcorp will monitor noise levels through the life of the Project, and will adaptively manage any unexpected issues that arise.

## Surficial Geology, Terrain, and Soils

Surficial geology, terrain, and soils were selected as a VC because they are important because they form the foundation of landscapes and ecosystems, which in turn support biological and cultural functions and values. The assessment of surficial geology, terrain, and soils was based on consultation and engagement with government agencies, First Nations, and the public and on data collected from field surveys and mapping exercises focused on understanding terrain and terrain stability, soils, and permafrost.

Project-related effects on terrain stability, unique landforms, and soil quality were assessed. Terrain stability is important for the safe and effective planning of mine and access infrastructure. Unique landforms are distinctive features of the landscape and may provide specific habitats for plants or wildlife. During consultation activities, Goldcorp heard that landscape features such as tors and pingos are used as lookouts. In addition, soil quality is important because it is integral to the maintenance of overall ecological health and for reclamation success. The location of the Project within a zone of discontinuous permafrost is addressed for both terrain stability and soil quality.

Goldcorp is designing the Project to the highest applicable health, safety, and environmental standards. The ridgeline location of the heap leach facility was selected in part because it is the most stable configuration, and is amenable to progressive reclamation. Project design has included avoiding the placement of infrastructure in areas prone to mass movements, slope erosion, or fluvial processes where feasible, and site selection and engineering practices continue to be incorporated into Project design to reduce potential effects from permafrost disturbance. The Northern Access Route is designed to avoid, reduce, or control adverse effects, including a route adjustment to avoid pingos.

After the implementation of mitigation measures, residual effects are likely to occur due to decreases in terrain stability due to construction activities; changes in terrain stability due to permafrost disturbance; disturbance of unique landforms, including some tors and pingos that will be removed for the Project; and changes in soil quality due to soil disturbance. These residual effects are localized to the Project footprint, and are all likely to be not significant.

## Surface Water Quality

Including the biological, chemical, and physical characteristics of water, surface water quality was selected as a VC because it is an environmental component of importance to key stakeholders, including First Nations, and it is protected under both territorial and federal legislation. Surface water quality is influenced by groundwater, surface hydrology, and air quality, as well as surficial geology, terrain, and soils. Surface water quality, in turn, influences other VCs including fish and fish habitat, vegetation, wildlife and wildlife habitat, and birds and bird habitat. Surface water quality is important for communities, the economy and land and resource use.

A multi-year baseline water quality monitoring program was undertaken to characterize pre-Project conditions of the creeks and rivers downstream of the mine site: Latte Creek, Coffee Creek, YT-24 (a small tributary to the Yukon River), Halfway Creek, and the Yukon River (i.e., the receiving environment). The mine site is located above the headwaters of Latte Creek, Halfway Creek, and YT-24. Latte Creek is a tributary to Coffee Creek, which flows into the Yukon River, while Halfway Creek and YT-24 are direct tributaries to the Yukon River. Baseline data were also collected for Independence Creek, which lies outside of the area of Project disturbance, and is used currently as a reference watershed. The baseline dataset includes 1 to 5 years of baseline data per monitoring station (18 stations) within the period extending from 2010 to January 2016, with sampling typically occurring monthly.

Water chemistry in the Latte Creek and lower Coffee Creek drainages is influenced by varying proportions of snowmelt-driven surface runoff and groundwater inputs to surface flow, based on the seasonal water balance. Seasonality in water chemistry is more pronounced upstream in the catchment. Several water quality parameters naturally exceed corresponding guidelines during the open water periods. Peak summer flows typically coincide with annual maximum amounts of total suspended solids, dissolved organic carbon, dissolved aluminum, total iron, and particulate-bound metals. During winter low-flow periods, uranium concentrations are consistently above corresponding guidelines on an annual basis.

Base flow in YT-24 is not strongly associated with groundwater, as it has little or no water flow in winter. When flowing, surface water in YT-24 is characterized by moderately soft, low ionic-strength waters. Several parameters naturally exceed guidelines. Measured total suspended solids concentrations are typically low, although peak flow events are associated with elevated total suspended solids.

Similar to the Coffee Creek catchment, water chemistry in Halfway Creek is driven by varying proportions of melt-water surface runoff and groundwater inputs to surface flows. Halfway Creek is characterized by soft water and low levels of major ions during freshet periods. Several water quality parameters show a distinct seasonal signature. The dominance of groundwater inputs in winter contributes to annual peaks in certain parameters, most notably uranium.

The Yukon River is characterized by consistently hard waters with low to moderate levels of major ions. The strong seasonal water quality signature is largely absent from the Yukon River, presumably due to its large catchment. The Yukon River shows concentration peaks for certain organic parameters during summer high flows. Mean monthly concentrations of total and dissolved trace elements and most notably for uranium are typically low and below applicable guidelines.

A Goldsim surface water quality model, based on the water balance model, was developed for the mine site to predict water quality for key locations within the receiving environment throughout all phases of the Project. The baseline surface water quality data were incorporated into the water balance model. The surface water model incorporates the site-wide mitigation strategies developed for the Project. Potential Project-related effects to surface water quality may include erosion and sedimentation, leaching from mine materials, leaching of nitrogen residues generated from blasting, discharge of camp waste water, leaching of residues from the heap leach facility, groundwater and surface water interactions and seepage, and atmospheric deposition.

Due to the linkages in the water balance between groundwater and surface water flows, the Project design measures for the mine site that are relevant for groundwater and surface hydrology are also relevant for surface water quality. Project design measures such as managing waste rock will minimize effects to surface water quality associated with sedimentation and erosion, leaching from materials, and atmospheric deposition. Project phasing and development schedules, waste-handling options, progressive reclamation, and water management infrastructure and planning commitments will be implemented and are anticipated to reduce the potential for Project-related effects on surface water quality.

Residual Project effects are predicted to occur in Latte Creek, YT-24, and Halfway Creek, with the greatest relative change predicted to occur in Halfway Creek, driven by mine-related increases to uranium. This effect is more pronounced in the upper watershed. Small relative exceedances of the arsenic water quality guideline are predicted to occur for a limited period of time in YT-24. In upper Latte Creek, small exceedances of the water quality guideline (open-water months) and proposed site specific water quality objective (months of ice-cover) are predicted. These residual effects are all assessed as not significant, primarily due to the low relative magnitude of parameter exceedances above guidelines and the proposed site specific water quality objectives. No residual effects are predicted to occur in Coffee Creek or Yukon River.

Surface water quality monitoring will include monitoring at selected stations on Latte Creek, Coffee Creek, YT-24, Halfway Creek, and on the Yukon River, as well as Independence Creek. Water quality in the receiving environment downstream of the mine will reflect the ultimate effects of the mine, and is expected to be subject to specific regulatory requirements.

## Fish and Fish Habitat

Fish and fish habitat was selected as a VC for the assessment due to its importance to local First Nation communities and other residents, and is of broad interest to regulators and other stakeholders. The environmental components important to the health of fish include availability of habitat, water and sediment quality, as well as the presence of benthic invertebrates and phytoplankton as food sources.

The assessment of fish and fish habitat addresses the key fish species that interact with the Project, and that are of primary importance to First Nations. Three species were selected for detailed assessment: Arctic Grayling (*Thymallus arcticus*), Chinook Salmon (*Oncorhynchus tshawytscha*), and Chum Salmon (*Oncorhynchus keta*). These species provide a valued food source, are of recreational value and, in the case of the salmon, commercial and cultural value to First Nations. Effects to Arctic Grayling and Chinook Salmon were evaluated with respect to habitat suitability, habitat accessibility, contaminant toxicity, stream productivity, and fish mortality. Effects to Chum Salmon were evaluated with respect to habitat suitability and fish mortality, since Chum Salmon only use the Yukon and Stewart rivers, and side channels, for spawning.

Potential effects on fish and fish habitat may include creation of barriers to fish movements, changes in habitat suitability due to flow changes in local creeks, contaminant toxicity associated with changes in water quality, changes in stream productivity, and direct or indirect mortality of fish. Much of the mine site is located upstream of watercourses that support fish.

Goldcorp has implemented several measures into the Project design that will reduce the potential for the Project to adversely affect downstream surface water quality and resulting fish and fish habitat. For example, the heap leach facility is located on a ridge-top in an area above watercourses, waste rock storage is being centralized, and infrastructure is proposed to minimize and control water that is influenced by the mine site.

The Northern Access Route directly interacts with fish and fish habitat at stream and river crossings and a back channel adjacent to the Stewart River. Potential adverse effects of the Northern Access Route on habitat suitability and accessibility will be mitigated through the selection and installation of appropriately sized culverts and bridges to prevent constriction of the stream channels. This will minimize the risk of barriers developing over time (e.g., hanging culverts) or changes in flows and bedload that may cause degradation of the streambed immediately below the road crossing. In addition, the choice to use barges and ice crossings for the Stewart and Yukon rivers eliminates the instream footprint of a large bridge. Additional Project design measures that reduce the potential for changes to surface hydrology and surface water quality also reduce the potential for Project-related effects on downstream fish and fish habitat.

Residual effects to fish and fish habitat are likely to remain even with the implementation of Project design and mitigation measures. For Arctic Grayling, a significant positive residual effect in habitat accessibility along the Northern Access Route is predicted due to the replacement and upgrading of crossing structures. Adverse residual effects are likely to occur for Arctic Grayling due to increased contaminant toxicity in the Latte, Halfway and YT-24 creek watersheds where Arctic Grayling use portions of these creeks for summer rearing; these residual effects are likely to be not significant given the low magnitude of changes in contaminant concentrations and seasonal habitat use.

Chinook Salmon are not as widespread in the local assessment area as Arctic Grayling. Additionally, Chinook Salmon have not been documented in the vicinity of the water crossings along the Northern Access Route where fish passages will be restored. The Project is expected to have a positive effect to habitat suitability due to an increase in overall flows in the lower Halfway Creek. Habitat alteration is anticipated to only occur in a limited area and will not affect the limited quality of habitat in the local assessment area. Contaminant toxicity, although predicted in Halfway Creek, is not expected to have a significant residual effect due to juvenile Chinook Salmon having limited use of the watershed and a small magnitude of change in concentrations of contaminants. Overall, the residual effects of the Project are assessed as neutral or not significant to Chinook Salmon.

Chum Salmon in the local assessment area are limited to the Yukon and Stewart rivers. There is no effect to their habitat suitability. Habitat alteration along the Yukon and Stewart rivers during the construction stage is not anticipated to limit Chum Salmon in the local assessment area. Chum Salmon have also not been documented in the vicinity of the water crossings along the Northern Access Route where fish passages will be restored. In addition, there are no predicted residual effects associated with contaminant toxicity or stream productivity to Chum Salmon as they are not present in Halfway Creek. Therefore, overall, the residual effects of the Project are assessed as neutral or not significant to Chum Salmon.

## Vegetation

Vegetation was identified as a VC because the Project occurs in a vegetated area of Yukon's boreal forest region. Vegetation is a component of biodiversity, is a key component of wildlife habitat, and is valued by First Nations and other local people who may rely on certain species as a subsistence and economic resource.

Five subcomponents were selected to focus the assessment of vegetation under the vegetation VC because they are considered representative of other species or groups that are similar in nature, found in similar habitats, or can be similarly affected by Project activities: ecological communities, wetland habitats, traditional and medicinal plants, rare plants, and vegetation health.

Potential effects based on Project-related interactions are expected to include habitat loss due to surface disturbance and overall Project footprint, dust deposition during construction and operational activities, and the risk of introduction and spread of invasive plant species from vehicle traffic and material transport. The mitigation measures that will be used include implementing Project design measures, minimizing habitat loss, limiting activities to the Project footprint, minimizing dust and emissions, reducing fire hazards, protecting rare plants, training personnel, and minimizing the risk of introducing and spreading invasive plants.

After the implementation of mitigation measures, residual effects are expected for ecological communities, wetland habitats, traditional and medicinal plants, and rare plants due to habitat loss. All of these residual effects are predicted to be not significant as the magnitude of these effects is very low, partially reversible, and the ecological communities are not considered rare and are likely present and widely distributed throughout the regional assessment area. Vegetation health will be residually affected by dust deposition, which is moderate in magnitude, partially reversible, and considered not significant, largely due to the limited spatial extent where the effect may occur, which does not pose a threat to the long-term persistence and viability of vegetation communities.

The residual effect of habitat loss was carried forward to the vegetation cumulative effects assessment due to the potential to interact with other projects and activities. After the implementation of mitigation measures, a residual cumulative effect is predicted in conjunction with future quartz mining activities, placer projects, and the existing road. This effect will likely be not significant as the Project's contribution to habitat loss will be partially reversed following the successful reclamation of disturbed areas, and it is unlikely that there will be enough simultaneously occurring, large-scale anthropogenic disturbances to reduce the amount of regional vegetation available.

## Wildlife and Wildlife Habitat

Wildlife and wildlife habitat were selected as a VC because it was identified as a priority during consultation and engagement. First Nations, the government of Yukon, the Yukon Environmental and Socio-economic Assessment Board and other stakeholders all indicated an interest in Project-related effects to wildlife and wildlife habitat. Several wildlife species in the Project area have been identified as Species at Risk.

Seven subcomponents were selected to focus the assessment of wildlife and wildlife habitat VC: Fortymile Caribou, Klaza Caribou, Moose, Thinhorn Sheep, Grizzly Bear, Wolverine, and Little Brown Myotis. These species or herds meet more than one of the following selection criteria: there is clear interaction with the Project; the population is known to be sensitive to disturbance; they are habitat specialists; they are culturally important; they are considered a species at risk; and they were identified in engagement meetings.

Potential effects based on Project-related interactions are expected to include habitat loss, reduced habitat effectiveness, mortality risk, and alteration to movement. The mitigation measures that will be used include implementing Project design measures, minimizing habitat disturbance, delivering wildlife awareness orientation training to Project personnel, reducing human-wildlife encounter risks, following wildlife protection protocols, managing traffic, reducing barriers to movement, managing aircraft operations, and preventing wildlife entrapment.

Project-related residual effects are likely for the following wildlife species:

- Habitat loss/reduced habitat effectiveness (due to surface disturbance and overall Project footprint): Fortymile Caribou, Klaza Caribou, Moose, Thinhorn Sheep, Grizzly Bear, Wolverine, and Little Brown Myotis
- Mortality risk (due to Project-related traffic along the Northern Access Route): Fortymile Caribou and Moose
- Movement alteration (due to noise and construction and operational footprints of the Project): Fortymile Caribou and Thinhorn Sheep

The Project-related effects listed above are considered not significant for the following reasons; effects to Fortymile and Klaza Caribou are low in magnitude due to a prohibition on hunting for Fortymile Caribou and continuous population growth since the 1970s, and limited amount of Klaza Caribou annual range that may be altered by the Project. For Moose, the potential effects above are considered not significant due to higher resiliency to habitat disturbance, preference for younger habitats, and minimal increases in annual mortality. Thinhorn Sheep populations are secure in Yukon and there is no known harvest of Sheep in the regional assessment area. Grizzly Bears have large home ranges and Grizzly Bear density in the regional assessment area is considered to be low, and therefore the Project will likely affect a very small portion of an individual bear's range. Wolverine populations are high in Yukon, and the Project is not likely to have an adverse effect on potential denning habitat at the regional level. Finally, the residual effects for Little Brown Myotis were assessed as low in magnitude due to the low proportion of potential roosting habitat affected by the Project.

In summary, the residual effects above are predicted to be not significant, with a medium to high degree of certainty. The magnitude of these residual effects is low and is restricted to within the local assessment area (only moose mortality is regional in geographic extent). Residual effects on wildlife and wildlife habitat will be partially to completely reversible by completion of the Project's post-closure phase.

All residual effects listed above were carried forward to the cumulative effects assessment due to their potential to interact with other projects and activities. After the implementation of Project mitigation measures, a residual cumulative effect is predicted in conjunction with past, present, and future quartz mining activities, including exploration; placer projects; the existing road; and general disturbance. The residual cumulative effects on a regional scale are generally summarized as low to moderate in magnitude, seasonal or year-round in timing; frequent or infrequent; long-term in duration; partially reversible; and in all scenarios considered regionally not significant with a low to high rated level of assessment confidence, depending on the subcomponent and effect.

## Birds and Bird Habitat

Birds and bird habitat were selected as a VC due to the potential for the Project to adversely affect individual birds, populations, and habitats. Birds and their habitat are important because of their value to First Nations and other local people who may rely on certain species as a subsistence and economic resource.

Six subcomponents were selected to focus the assessment of birds and bird habitat because they are considered representative of other bird species in the region based on similar habitat requirements: Sharp-tailed Grouse, Cliff-nesting Raptors, Passerines, Upland-Associated Species at Risk, Wetland-Associated Species at Risk, and Bank Swallows. Fine-scale habitat suitability mapping was completed around the mine site and Northern Access Route to aid in evaluating the current status of these subcomponents.

Potential effects based on Project-related interactions are expected to include habitat loss, reduced habitat effectiveness due to sensory disturbance, increased mortality risk, increased contaminants uptake, and damage or destruction of active nests. Mitigation measures that will be used include implementing Project design measures to minimize the footprint and avoid sensitive bird habitat, minimizing habitat disturbance, avoiding disturbance during breeding seasons, and protecting active and identified nests.

After the implementation of mitigation measures, residual effects are expected to remain for most subcomponents due to habitat loss and reduced habitat effectiveness; however, all of these residual effects are predicted to be not significant as they are not anticipated to have any population-level effects and any habitat loss or reduced habitat effectiveness is predicted to be low (less than 10% of high suitability habitat within the regional assessment area). No residual effects are likely to occur for Bank Swallow.

The residual effects of habitat loss and reduced habitat effectiveness were carried forward to the cumulative effects assessment due to the potential to interact with other projects and activities. After the implementation of mitigation measures, residual cumulative effects are predicted for both habitat loss and reduced habitat effectiveness. These effects are predicted to be not significant as the Project's contribution to habitat loss will be partially reversed following the successful reclamation of disturbed areas.

## Demographics

Project-related employment may attract new residents to Yukon, which will change the size of the population and growth rates, the proportion of the population of certain ages, and the proportion of males to females. Changing demographics in turn may affect other VCs identified in the assessment, including economic conditions, social economy, education services, community infrastructure and services, and community health and well-being.

The analysis of potential changes to demographics focused on potential changes to population size and growth, gender and age distribution, and mobility. The study area includes the communities of the City of Dawson, Mayo, Pelly Crossing, Beaver Creek, and Whitehorse. The Project is likely to increase total population size, which will reverse when the Project moves toward reclamation and closure and post-closure. Changes to gender distribution, age distribution, and mobility are likely to be negligible. The additional employment opportunities associated with other anticipated major mining projects are likely to result in a cumulative increase in employment opportunities in Yukon. Whitehorse is expected to be resilient to increased migration into the community because of employment opportunities due to its larger overall population. Smaller communities are less resilient to demographic changes and are therefore likely to experience cumulative changes to populations. Goldcorp is committed to working with governments to help manage any Project-related changes in population demographics.

## Economic Conditions

Economic conditions was selected as a VC to include the proposed Project's likely interactions with employment and income distribution, the labour market, and sustainable economic development while reflecting local values and feedback. The Project will increase the need for goods and services, and will generate significant employment opportunities, particularly during the Project's construction and operation phases. Goldcorp's focus on local purchasing and hiring may influence local and regional economic conditions, including the region's sustainable economic development.

Potential effects based on Project-related interactions will likely include increased direct, indirect, and induced employment opportunities, increased income levels, and changes in income distribution patterns, increased contracting and procurement opportunities, territorial economic growth, and changes in government fiscal flows. The potential effects of the Project on economic conditions are anticipated to be beneficial or neutral.

While most residual effects are anticipated to extend across both the local and regional assessment areas, how they materialize in each community will be unique. In many cases, the magnitude of the residual effect is anticipated to be greater in smaller local communities, in particular the City of Dawson. Goldcorp has proposed measures to enhance potential beneficial effects of the Project including: local hiring practices, local contracting and procurement practices, education and training activities, engagement planning, and a workforce transition strategy.

## Social Economy

Social economy was selected as a VC to address the potential for the Project to result in direct environmental changes, as well as cause an increase in the demand for goods and services in the non-wage and traditional economies. Often closely linked to cultural and community practices valued by First Nations and local people, non-wage and traditional economies represent the cash-in-kind component of the mixed economy in Yukon.

Residual effects are expected to remain for subsistence activities, the quantity and diversity of traditional economy activities, and to the level of engagement in the traditional economy. With respect to the non-wage economy, the development of the Project will cause a direct change in access to the lands and resources in the areas surrounding the section of the NAR from Stewart River north to the southern end of the existing road. Increases to the road network and improvement to the overall condition of the road, represent changes to how individuals and/or households may be able to access the land and resources. A Project-related population increase may therefore increase the amount of people who are available to participate in the non-wage economy, a change the proportion of households who consume wild foods obtained through subsistence activities may occur. Project-related increases to local business and employment opportunities may also influence the local population to conduct non-wage economic activities, and an increase in the amount of income available to support non-wage activities. The traditional economy may be affected by an increase in the road network which may result in changes to how people access land and resources, which may further translate into changes to the proportion of households consuming wild foods obtained through traditional economic activities.

Residual effects are anticipated to begin in the construction phase, and will extend through the operation and reclamation and closure phases. Project-related residual effects are likely to be not significant, but adverse residual effects were carried forward for further examination in the cumulative effects assessment.

Two cumulative residual adverse effects were identified for non-wage economy (access-related potential cumulative effect on ability to conduct subsistence activities; and decrease in availability of time and potential cumulative effect on ability to conduct subsistence activities). Additionally, two cumulative adverse residual effects on traditional economy were examined: an access-related potential cumulative effect on the ability to conduct traditional economic activities; and income-related potential cumulative effects on the ability to engage in traditional economic activities) were examined. These cumulative effects are likely to extend across both the local and regional assessment areas, and will include residual effects from quartz exploration, placer mining and existing road networks. How these cumulative effects will materialize for each First Nation and for respective citizens or members will vary. The Project is not likely to result in significant adverse cumulative effects to the social economy VC.

## Community Infrastructure and Services

Community infrastructure and services includes four subcomponents to focus the assessment on issues raised during the consultation process: housing and accommodation; physical infrastructure; community services; and transportation. This VC considered how an in-migration of Project employees may result in increased demand for infrastructure and services, and if this would align with local community desires and values.

The Project's expected in-migration of workers will increase demand for housing and result in a decrease in housing availability. The population increase is also likely to increase the demand on physical infrastructure, including water and wastewater infrastructure, solid waste disposal, and electrical and communications infrastructure in the local assessment area. Community services will also be more in demand, including services for families with young children (e.g., day care and family support) and health and social services. In addition, transportation of fuel, equipment and materials, and supplies will increase overall traffic volumes, and could increase demands on first responders (ambulance, fire, RCMP) and health services in the City of Dawson and Whitehorse.

Potential adverse effects related to transportation can be mitigated through the implementation of management plans. Goldcorp's commitments under the International Cyanide Management Code and Project design measures such as increased engineering standards for the Northern Access Route. Following the implementation of mitigation measures, residual effects are expected to remain for the housing and accommodation, physical infrastructure, and community services subcomponents of this VC. Goldcorp will prioritize local hiring and make available fly-in opportunities for staff to decrease magnitude of in-migration and the resulting demand on housing, physical infrastructure, and local services in the City of Dawson. Given the larger population and breadth of services in Whitehorse, adverse effects related to Project-related in-migration are not likely to be significant. Goldcorp will continue to work with local and territorial governments to decrease Project-related residual effects to community infrastructure and services.

## Education Services

Education services was selected as a VC because potential Project-related demographic changes in local communities may affect access to and delivery of different types and levels of education. The assessment reflects issues raised during consultation of increased enrollment in primary and secondary schools, effects on the education of students whose parent(s) would be working at the Project, and the ability to maximize potential benefits related to education and training.

Potential effects based on Project-related interactions include an increased demand for primary, secondary, and post-secondary education, and increased demand for industry-specific, community-based training. Recognizing the importance of education, Goldcorp continues to collaborate with Tr'ondëk Hwëch'in and Yukon College to develop a fully accredited Environmental Monitor program. The program is delivered in two-week modules, taught at the Project site, and includes Tr'ondëk Hwëch'in Elders. Course completion by First Nations students will allow students to be hired as Environmental Monitors with Goldcorp and potentially with other projects. Additional mitigation measures for education services comprise several topics, including local hiring practices, training activities, cultural awareness training, First Nations mentorship, and development and implementation of an engagement plan.

Enrollment pattern effects are anticipated to occur in the local assessment area as a result of increases in population resulting from direct, indirect, and induced employment related to Project expenditures and purchases of goods and services, which may affect enrollment patterns in primary and secondary schools. The prioritization of local hiring in the City of Dawson and the relatively small potential magnitude of the increase in families with school-age children in Whitehorse will not likely result in a significant change to access or delivery of educational services in either community. Goldcorp will continue to communicate hiring priorities and plans to the government of Yukon as they are largely responsible for delivering primary and secondary education in Yukon. Goldcorp will also continue to share information about Project-related employment opportunities, and the education and experience needed for those positions, to prioritize local hiring and beneficial effects.

## Land and Resource Use

Land and resource use was selected as a VC to assess how Project-related changes at the mine site and along the Northern Access Route may interact with land-based activities. Information received during consultation and available Traditional Knowledge supported both the identification of sub-components and an understanding of how effects relate to local values. As a result of consultation, two subcomponents were identified for the assessment: non-traditional land and resource use and current traditional land and resource use.

Potential effects are expected to include changes in access to land and resources, changes in sensory conditions during land and resource use, change in the availability of land and resources, changes in the quality of land and resources, and changes in the quality of cultural resources. The mitigation measures related to the mine site include implementing Project design measures to minimize footprint and avoid sensitive areas, minimizing disturbance, and conducting phased mine development and progressive reclamation and closure activities. The potential adverse residual effects from a decrease in available land for traditional and non-traditional land and resource uses will likely not significant as the area of the Project footprint is less than 0.3% of the regional assessment areas.

The Northern Access Route is designed to follow an existing network of uncontrolled roads south of the City of Dawson. Several measures are being taken to optimize Project-related traffic and mitigate effects along the Northern Access Route including: flying in crew changes, consolidation of consumables onto truck-trailers, and implementation of management plans including those for access route construction and operation management. Access by non-Project vehicles south of the Goldcorp crossing at the Stewart River will be controlled. Increased access related effects will likely be not significant and will extend access to lands and resources into the areas of the regional assessment area along the Northern Access Route up to the Stewart River where access further south will be limited. For safety reasons, access to the mine site will be controlled for non-Project personnel. The Northern Access Route will be maintained in winter, thus increasing seasonal access to land and resources, which is potentially a beneficial and adverse effect. Goldcorp intends to continue working with other road users to refine the management of the Northern Access Route. Effects to the quality of intangible cultural and spiritual resources will be enhanced by traditional economy enhancement measures, an engagement plan, and a heritage resources protection plan. As a result of implementing mitigation measures, no significant residual effects are anticipated.

Residual effects to sensory conditions for traditional and non-traditional uses may result from changes to air quality, noise, water quality and visual quality, however due to the limited spatial overlap between these changes and the lands and resources accessed by users, these effects will not likely be significant.

Residual cumulative effects due to interactions with other projects and activities were assessed for the Project at the scale of the regional assessment area. The projects and activities considered in the cumulative effects assessment included quartz and placer mining projects, and existing disturbance including road networks and use. The contribution of the Project to the cumulative effects on non-traditional and current traditional land and resource use is generally low. Cumulative adverse effects to access, sensory conditions, availability of land, quality of land and resources, and the quality of intangible cultural and spiritual resources are not likely to be significantly different from current conditions.

## Community Health and Well-Being

Community health and well-being is identified as a VC to consider the Project's potential to affect the health and well-being of the Project workforce directly and indirectly, as well as their families and other community members and resources. Indirect influences on health and well-being may occur through Project-related effects on environmental quality, quality of experiences, lifestyle choices, or other human health influences in the vicinity of the Project.

The community health and well-being VC reflects the fundamental importance of health and well-being to people who live and work in the region where the Project will be developed. The VC incorporates an assessment of health effects of noise or contaminant exposures; decreased confidence in safety of country foods and decreased food security; collisions on the Northern Access Route; workplace injuries; increased crime (theft) along the Northern Access Route; and potential adverse effects to mental health and wellness due to stress or increased substance use. Subcomponents for the community health and well-being VC include the environmental, biomedical, and social determinants of health: air quality, noise and vibration, country food quality, crime, food security, accidents and injuries, infectious disease, mental health and wellness, and health services structure and capacity.

Goldcorp has designed the mine site and will manage on-site activities to mitigate likely effects on employees. Infrastructure location for noise attenuation, dust suppression, explosives storage and use, International Cyanide Management Code compliance, *Yukon Occupational Health and Safety Act* compliance, and implementation of management plans will all help mitigate adverse effects related to air quality, noise and vibration, and accidents and injuries. These mitigations will likely decrease physical environment stressors, increase employee engagement, and enhance overall safety and security of the Project and Project-related activities. Goldcorp's safety culture extends beyond the workplace, and reinforces Goldcorp's vision to ensure that work environments are *Safe Enough for our Families*. Goldcorp has developed a formal set of 'Golden Rules' in a *Golden Guide* employee handbook, which dictates key principles to enable employees to remain safe in the workplace and maintain the highest preventative measures. Under their Occupational and Health and Safety Policy, Goldcorp will "Promote health and safety in all aspects of our work, family, and local community," extending the commitment to safety beyond the Project.

With the application of mitigations, the Project may still result in residual effects related to an increase in crime and an increase in infectious disease rates resulting from sexually transmitted infections and other infectious diseases, while potentially experiencing some decreases in mental health, and increased demand for mental health services in local assessment area communities. Due to an increase in indirect and induced employment in local assessment area communities and an increase in income for local employees and contractors in local assessment area communities. Increased access along the NAR may also lead to an increase in property crime. In cooperation with other road users, Goldcorp will consider road management options that can help mitigate security concerns. Effects related to increased frequencies of infectious disease and mental illness due to an influx of workers into local assessment area communities, a change in worker lifestyle because of shift work, and from potential increased substance abuse from stress or increased income are likely to be not significant, primarily due to an existing level of support provided by governments and broad community member experience with mining industry employment.

The Project is considered likely to have a positive effect on food security by providing increased employment and income, which will subsequently improve purchasing power to buy nutritious foods. An adverse effect to mental health services in local assessment area communities due to insufficient services available to support the population increase in local assessment area communities is predicted to occur, while health services in the larger local assessment area communities of Dawson and Whitehorse are currently generally sufficient to meet the needs of the existing population, the mental health services in the smaller local assessment area communities of Beaver Creek, Mayo, and Pelly Crossing may not be sufficient. These residual effects are predicted to be of low magnitude, since existing infrastructure is likely to have sufficient capacity to absorb some increased in demands. The effect will be continuous, long-term, and fully reversible in duration as it is linked to the Project construction and operation workforce.

## Heritage Resources

Heritage resources are selected as a VC due to the potential for the proposed Project to adversely affect archaeological, historical, or paleontological resources. Heritage Resources are protected by legislation and are important to First Nations citizens because they demonstrate the long-term use of First Nation traditional territories, and provide a physical link to their cultural history. For the purposes of the assessment, heritage resources is divided into two subcomponents: archaeological and historical resources, and paleontological resources.

Potential effects based on Project-related interactions are expected to include damage, disturbance, removal, or destruction of heritage resources due to Project-related construction and operation activities including: clearing and grubbing, site grading, deposition of imported fills, and general ground disturbance. Goldcorp has completed a heritage resources overview assessment and heritage resources impact assessment for both the Northern Access Route and the mine site. Mitigation measures for heritage resources will be implemented prior to any ground disturbance or clearing activities, following relevant regulatory approvals, Project-specific HRIA reports, and First Nation consultation advice.

Following implementation of mitigation measures, and based on the determination that potential effects to heritage resources will be fully mitigated in accordance with applicable legislation and guidelines, no potential residual or Project-related cumulative effects on heritage resources are likely as a result of the Project. Other projects in the vicinity of the local assessment area must also comply with Yukon legislation and relevant First Nations guidance, and must similarly minimize residual effects to heritage resources; therefore, the Project is not likely to contribute to residual effects from other projects and activities in a way that would result in adverse cumulative effects; thus, a cumulative effects assessment is not warranted.

# ACCIDENTS AND MALFUNCTIONS

The Project assessment discusses and considers the significance of any effects to VCs of accidents (unexpected occurrences or unintended actions) or malfunctions (failure of a piece of equipment, device, or system to function normally). This assessment identifies the cause, type, nature, likelihood, and predicted consequence of accidents or malfunctions associated with Project components and activities during each Project phase. It also presents mitigation measures (e.g., design standards, preventative measures, management plans, emergency response and contingency plans and procedures) to be implemented to manage risk and prevent or reduce the incidence and magnitude of such unplanned events.

Goldcorp followed a three-step process to assess potential Project-related accidents and malfunctions:

1. Identify potential accidents and malfunctions that might occur during the life of the Project using historical performance data and professional judgment.
2. Analyze the potential interactions between each event scenario and relevant IC and VC receptors to establish the potential significance and severity of the effects.
3. Conduct a risk and significance assessment using the likelihood and severity of the unplanned event in each scenario.

Potential accidents and malfunctions were categorized into specific and distinct types of accidents and malfunctions that could occur for the Project:

**Containment failure**

- Diesel fuel spill
- Cyanide spill
- Heap leach facility
- Sediment release

**Earthworks failure**

- Failure or slumping of pit walls

**Transportation accidents**

**Fires or explosions**

A worst case scenario was assessed for each accident or malfunction category. Risks to VCs for all accidents and malfunctions were assessed as not significant, with the exception of potential fatalities (e.g., a as result of a potential traffic accident). To minimize the risk of a Project fatality, Goldcorp will implement its strict safety standards for all Project staff and employees as part of the Health and Safety program, which addresses training, communication protocols, speed limits, and zero tolerance for alcohol or drug use while at site. Goldcorp will also have an Emergency Response Plan, including trained Emergency Responses personnel, in place during all Project phases.

All construction, operation, reclamation and closure, and post-closure activities will be governed by Environmental Management Plans (including an Emergency Response Plan) to minimize and respond to the effects of accidents and malfunctions.

# EFFECTS OF THE ENVIRONMENT ON THE PROJECT

Goldcorp has assessed the potential effects of the environment on the Project and the consequences of those environmental conditions on Project components and activities. The assessment includes a description of critical site conditions and operational timing sensitivities, as well as consideration of the relative severity of the potential consequences.

## Extreme Weather Conditions

Extreme weather events are defined as events of unusual, severe, or unseasonal weather at the extremes of the typical historical distribution. The Project has been designed to accommodate extreme weather events and prevent potential effects associated with high precipitation and extreme temperatures. To accommodate periods of drought, the Project has been designed to incorporate measures to conserve, store, and recycle process and mine contact water for use during low precipitation periods. The design of the Project also includes considerations for extreme cold temperatures.

## Flood Events

In Yukon, floods are typically the result of high-precipitation events, rapid snowmelt, or a combination of the two. Flooding risk to Project infrastructure at the mine site is considered very low due to its location at the height of land along the ridge between Latte Creek and Halfway Creek. For floods along the Northern Access Route, it is likely that road closures would be required if there is potential for crossings to partially obstruct flows resulting in elevated upstream water levels that could overtop the road surface. Road closures under these conditions would be temporary, and the road would re-open once water levels recede and structural checks of the crossings have been made.

## Permafrost Hazards

Permafrost is ground that remains frozen for longer than two consecutive years, and may or may not contain significant amounts of ice. If Project activities cause the ground ice to melt, slumping and instability can occur. The Project is located across varying zones of permafrost. Project components have been designed according to existing permafrost conditions at the mine site and along the Northern Access Route. The site selection of Project infrastructure was influenced by the depth and type of permafrost present at design locations. If necessary, ice-rich permafrost may be excavated and replaced with frost stable materials.

## Terrain and Geohazards

The terrain stability assessment for the Project focused on the potential for earth movements, erosion, and avalanches with the potential to affect the Project. Given the uncertain nature of the extent of terrain hazards, Goldcorp has adopted design-based mitigation measures for potentially sensitive structures, and will establish monitoring and response measures prior to construction. Site selection for potentially sensitive components were based on engineering assessments that considered geotechnical conditions, investigations, and stability analyses. An annual geotechnical inspection will be carried out by a qualified geotechnical engineer licensed to practice in Yukon during mine operations until closure has been completed. Terrain and geohazard conditions will be monitored for potential changes in conditions that may influence terrain stability for the life of the Project.

## Seismic Activity Hazards

The Project is located in an area of relatively low seismic activity in the St. Elias region, which includes southwestern Yukon Territory, northwestern British Columbia, and southeastern Alaska. Goldcorp completed a review of the regional tectonics and historical seismicity in the southwest Yukon region to enable selection of appropriate design earthquake events for key Project components. The Project has been designed to ensure that components will withstand exposure to seismic activity up to criteria consistent with current standards in the National Building Code of Canada, which incorporates technical considerations into building design requirements for buildings to be built based on local seismic conditions. All Project structures are designed to withstand a seismic event meeting or exceeding the 1-in-500 year return period, which is consistent with best practices and industry standards.

## Wildfire Hazards

Wildfires are a common landscape disturbance throughout boreal cordillera ecosystems, and the forest cover of most of Yukon's forest is a patchwork mosaic resulting from successive forest fires. Wildfire occurrence and intensity depends on ignition potential, fuel source, weather conditions, and suppression capacity. The mine site will be largely cleared of vegetation, which will reduce the risk of wildfires travelling into the mine site. Goldcorp will follow all applicable requirements in the National Fire Code of Canada through all Project phases. Should a wildfire threaten the Project or Project-related activities, the Emergency Response Plan provides a plan for the temporary shutdown of Project activities to protect the mine site from the wildfire and evacuation of Project personnel.

## Climate Change

Goldcorp assessed potential climate change effects on the Project to guide effective long-term Project planning. The Project has been designed to ensure that the design specifications used for all key site components have incorporated the potential effects linked to climate change. To accommodate for uncertainties surrounding climate change effects on the Project, Goldcorp will follow an adaptive management approach to climate change. This approach will focus on using site-specific climate data to continuously improve policies and practices, and will allow for flexible responses to early signals of climate change when timing and magnitude are uncertain.

# ENVIRONMENTAL AND SOCIO-ECONOMIC MANAGEMENT PROGRAM


Goldcorp is committed to implementing best management practices to minimize potential adverse effects to the environment, local communities, employee and public health and safety, and overall safety and stability of Project infrastructure and facilities. Accordingly, a number of environmental and socio-economic management plans have been or will be developed for the Project. The key components of each environmental management plan are:

- Purpose and objectives
- Applicable legislation, regulations, and required authorizations
- Roles, responsibilities, and training
- Detailed instructions and methods for implementation of plan mechanisms
- Monitoring, reporting, and communication procedures.

The following management plans have been developed for the Project as part of the Project Proposal:

- Access Route Construction Management Plan
- Access Route Operational Management Plan
- Conceptual Reclamation and Closure Plan
- Waste Rock and Overburden Management Plan
- Water Management Plan
- Wildlife Protection Plan

The following management plans will be developed for the Project during detailed design for the Project licensing stage:

- Explosives Management Plan
- Cyanide Management Plan
- Dust Management Plan
- Emergency Response Plan
- Erosion and Sediment Control Plan
- Fish and Aquatic Habitat Protection Plan
- Frozen Material Management Plan
- Hazardous Materials Management Plan
- Heap Leach and Process Facilities Plan
- Heritage Resources Protection Plan
- Mine Development and Operations Plan
- Metal Leaching / Acid Rock Drainage Management Plan
- Noise Management Plan
- Socio-economic Management Plan
- Spill Contingency Plan
- Vegetation Protection Plan
- Waste Management Plan

# CONCLUSION

Years of collaboration, consultation, study, analysis, and interpretation support the findings presented in this Project Proposal for the proposed Coffee Gold Mine. Goldcorp has used alternatives and changes in Project design, applied best management practices, and proposes effects-specific mitigation to avoid or decrease likely effects of the Project. The results of the effects assessment on valued components and change analyses on intermediate components indicate that both Project-related residual and cumulative adverse effects are likely to be not significant.

Goldcorp is committed to meaningful consultation with First Nations and engagement with stakeholders and members of the public, and intends to continue to provide opportunities for input and direction as the Coffee Gold Mine proceeds through the assessment and permitting processes and throughout the life of the mine. Consultation has influenced the process of site selection, engineering design, implementation of mitigation measures, adherence to best management practices, and implementation of effective environmental management plans. As a result, Goldcorp believes that it can construct, operate, reclaim, and close the Project in a way that meets Yukon's goal of promoting sustainable development while avoiding or minimizing significant adverse environmental and socio-economic effects.

**GOLDCORP COFFEE GOLD MINE**

Executive Summary | March 2017

GOLDCORP

# Coffee Gold Mine
# YESAB Project Proposal

# VOLUME I – The Coffee Gold Mine
# Sections 1.0 to 5.0

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# ACRONYMS, ABBREVIATIONS, SYMBOLS, AND MEASUREMENTS

| Acronym / Abbreviation | Definition |
|---|---|
| 3D | three-dimensional |
| AAQO | Ambient Air Quality Objectives |
| AAQS | Ambient Air Quality Standards |
| ADR | adsorption, desorption, and recovery |
| AFN | Assembly of First Nations |
| Ag | silver |
| Al | aluminum |
| AN | ammonium nitrate |
| ANFO | Ammonium Nitrate/Fuel Oil |
| APS | Aboriginal Persons Survey |
| ARD | acid rock drainage |
| As | arsenic |
| ATV | all-terrain vehicle |
| Au | gold |
| AWOS | Automated Weather Observation System |
| BC | British Columbia |
| BEM | Broad Ecosystem Mapping |
| BMP | best management practice |
| BNOISE2 | Blast Noise Version 2 |
| C | carbon |
| CAC | criterion air contaminant |
| $CACO_3$ | calcium carbonate |
| CAD | Canadian dollars |
| CAPEX | capital expenditure |
| CBPR | community-based participatory research |
| CCL | compacted clay liner |
| CCME | Canadian Council of Ministers of the Environment |
| Cd | cadmium |
| CEA | Cumulative Effects Assessment |
| CEO | Chief Executive Officer |
| CEPA 1999 | *Canadian Environmental Protection Act, 1999* |
| CESA | Cumulative Effects Study Area |
| CFO | Chief Financial Officer |
| $CH_4$ | methane |

| Acronym / Abbreviation | Definition |
|---|---|
| CIC | carbon-in-carbon |
| CIM | Canadian Institute of Mining |
| CMHC | Canada Mortgage and Housing Corporation |
| CNIM | Centre for Northern Innovation in Mining |
| Co | cobalt |
| CO | carbon monoxide |
| $CO_2$ | carbon dioxide |
| $CO_2e$ | carbon dioxide equivalent |
| $CO_2e$/yr | carbon dioxide equivalent per year |
| Code | Environmental Code of Practice for Metal Mines |
| Coffee Property | The total property owned by Goldcorp, consisting of all 3.021 contiguous claims in the Coffee Claim Block |
| COPC | contaminant (or chemical) of potential concern |
| COSEWIC | Committee on the Status of Endangered Wildlife in Canada |
| CPI | Consumer Price Index |
| Cr | chromium |
| CRA | Canada Revenue Agency |
| CRC | Consolidated Regulations of Canada |
| CSI | Crime Severity Index |
| Cu | copper |
| CWD | Canadian Wildlife Service |
| Cyanide Code | International Cyanide Management Code |
| CYFN | Council of Yukon First Nations |
| Dawson | City of Dawson |
| DFO | Fisheries and Oceans Canada |
| DNA | deoxyribonucleic acid |
| DO | dissolved oxygen |
| e-DNA | Environmental DNA |
| EASR | Environmental Activity and Sector Registry |
| ECA | Exploration Cooperation Agreement |
| ECCA | Exploration Communication and Cooperation Agreement |
| EEM | effluent effects monitoring |
| ECCC | Environment and Climate Change Canada |
| ELC | Ecological and Landscape Class |
| EMP | Environmental Management Plan |
| EMR | Energy, Mines and Resources |
| EMS | emergency medical services |
| EP-1N | north event pond |

| Acronym / Abbreviation | Definition |
|---|---|
| EP-1S | south event pond |
| EP-2 | event pond 2 |
| EPCM | Engineering, Procurement, and Construction Management |
| ERP | Emergency Response Plan |
| ERT | emergency response team |
| FCASP | Federal Contaminated Sites Action Plan |
| Fe | iron |
| $Fe^{2+}$ | iron II |
| FC-RAA | Fortymile Caribou Regional Assessment Area |
| FIFO | fly in / fly out |
| FMCH | Fortymile Caribou herd |
| FNNND | First Nation of Na-cho Nyäk Dun |
| FRMP | Forest Resources Management Plan |
| FTA | Federal Transport Authorite (U.S.) |
| FTE | full-time equivalent |
| GCL | geosynthetic clay liner |
| GDP | gross domestic product |
| GHG | greenhouse gas |
| GIS | geographic information system |
| g | gravity |
| GMA | Game Management Area |
| GMZ | Game Management Zone |
| Goldcorp | Kaminak Gold Corporation, a wholly owned subsidiary of Goldcorp Inc. |
| GPS | geographic (or global) positioning system |
| HAP | Health Action Plan |
| HCN | hydrogen cyanide |
| H:V | horizontal to vertical |
| HDPE | high-density polyethylene |
| Hg | mercury |
| HHRA | Human Health Risk Assessment |
| HIA | Health Impact Assessment |
| HIV | human immunodeficiency virus |
| HLF | Heap Leach Facility |
| HR | human resources |
| HRIA | Heritage Resources Impact Assessment |
| HROA | Heritage Resources Overview Assessment |
| HRPP | Heritage Resources Protection Plan |

| Acronym / Abbreviation | Definition |
|---|---|
| HSS | Health and Social Services |
| HVAC | heating ,ventilation, and air conditioning |
| IBA | Impact Benefit Agreement |
| IC | Intermediate Component |
| ICSP | Integrated Community Sustainability Plan |
| IFR | Instrument Flight Rules |
| IMS | ice mapping system |
| IO | input-output |
| IPCC | Intergovernmental Panel on Climate Changte |
| IR | Information Request |
| IRR | Internal Rate of Return |
| ITP | inspection and test plan |
| K | Kindergarten |
| Kaminak | Kaminak Gold Corporation |
| KC-RAA | Klaza Caribou Regional Assessment Area |
| KCH | Klaza Caribou herd |
| KCS | Klondike Conservation Society |
| KDO | Klondike Development Organization. |
| LAA | Local Assessment Area |
| LD50 | amount of an ingested substance that causes 50% fatality |
| LLDPE | linear low-density polyethylene |
| LMB | Land Management Branch |
| LMU | Land Management Unit |
| LNG | liquefied natural gas |
| LOM | life-of-mine |
| LSA | Local Study Area |
| LSCFN | Little Salmon / Carmacks First Nation |
| LTECF | Livingstone Trail Environmental Control Facility |
| M | million |
| MAD | mean annual discharge |
| MBCA | *Migratory Birds Convention Act, 1994* |
| MBR | membrane bioreactor |
| MCC | motor control centre |
| MED | marine emergency duties |
| MIHR | Mining Industry Human Resources (Council) |
| ML | metals leaching |
| ML/ARD | metals leaching/acid rock drainage |

| Acronym / Abbreviation | Definition |
|---|---|
| MMER | Metal Mining Effluent Regulations |
| Mn | manganese |
| $Mn^{2+}$ | manganese II |
| Mo | molybdenum |
| MOE | Ministry of Environment |
| MRT | Mine Rescue Team |
| MT | Middle Transitional |
| N | north |
| $N_2O$ | nitrous oxide |
| NaCN | sodium cyanide |
| NAG | non-acid generating |
| NAICS | North American Industrial Classification System |
| NAR | Northern Access Route |
| NBCC | National Building Code of Canada |
| NE | northeast |
| NFPA | National Fire Protection Association |
| $NH_3$ | ammonia |
| NHS | National Household Survey |
| Ni | nickel |
| $NO_2$ | nitrogen dioxide |
| $NO_3$ | inorganic nitrate |
| $NO_x$ | nitrogen oxides |
| NOC | National Occupational Classification |
| NPAG | non-potentially acid generating |
| NPI | National Pollution Inventory |
| NPISH | Non-profit Institutions Serving Households |
| NPRI | National Pollutant Release Inventory |
| NPV | net present value |
| NRCan | Natural Resources Canada |
| NTS | National Topographic System |
| NW | northwest |
| NWP | Navigable Protection Program |
| NWT | Northwest Territories |
| OCP | Official Community Plan |
| ODALS | Omni-directional Approach Lighting System |
| OGC | Oil and Gas Commission |
| OIC | Order-in-Council |

| Acronym / Abbreviation | Definition |
|---|---|
| OPEX | operational expenditures |
| OX | oxide |
| PAG | potentially acid generating |
| Pb | lead |
| PGA | peak ground acceleration |
| PEA | preliminary economic assessment |
| PGS | peak ground acceleration |
| PHA | Permit Hunt Authorization |
| PLC | programmable logic controller |
| PM | particulate matter |
| $PM_{2.5}$ | fine particulate matter of 2.5 microns or less |
| $PM_{10}$ | fine particulate matter of 10 microns or less |
| PMP | probable maximum precipitation |
| PPE | personal protective equipment |
| Project | proposed Coffee Gold Mine |
| Proponent | Kaminak Gold Corporation, a wholly owned subsidiary of Goldcorp Inc. |
| PSL | permissible sound level |
| PWGSC | Public Works and Government Services Canada |
| PYLL | potential years of life lost |
| Q1 | first quarter |
| Q2 | second quarter |
| Q3 | third quarter |
| Q4 | fourth quarter |
| QA/QC | quality assurance / quality control |
| QMA | *Quartz Mining Act* |
| QML | Quartz Mining Licence |
| QMS | quality management system |
| RAA | Regional Assessment Area |
| RCMP | Royal Canadian Mounted Police |
| ROM | run-of-mine |
| RISC | Resource Inventory Standards Committee |
| RPP | Registered Professional Planner |
| RSA | Regional Study Area |
| RSS | Robert Service School |
| RSY | Revised Statutes of Yukon |
| RTC | Registered Trapping Concession |
| S | south |

| Acronym / Abbreviation | Definition |
|---|---|
| $S^{2-}$ | sulfide |
| SARA | *Species at Risk Act* |
| Sb | antimony |
| SDR | systematic data recovery |
| SE | southeast |
| Se | selenium |
| SEEA | socio-economic effects assessment |
| Sea Can | 20-foot shipping container |
| SEMS | Sustainability Excellence Management System |
| SFN | Selkirk First Nation |
| SGA | Self Governing Agreement |
| SLRA | Screening-level Risk Assessment |
| SI | International System of Units |
| SNAP | Scenarios Network for Alaska and Arctic Planning |
| $SO_2$ | sulphur dioxide |
| $SO_4$ | sulfate |
| SOR | Statutory Orders and Regulations |
| SOVA | School of Visual Arts |
| STI | sexually transmitted infection |
| STP | sewage treatment plant |
| SW | southwest |
| SY | Statutes of Yukon |
| SU1 | Supremo Phase 1 |
| SU2 | Supremo Phase 2 |
| SU3 | Supremo Phase 3 |
| SU3N | Supremo Phase 3 North |
| SU4N | Supremo Phase 4 North |
| SU4S | Supremo Phase 4 South |
| SU5N | Supremo Phase 5 North |
| SU5S | Supremo Phase 5 South |
| T-Cd | Total cadmium |
| T-Cr | Total |
| TB | tuberculosis |
| TDGA | *Transportation of Dangerous Goods Act* |
| TH | Tr'ondëk Hwëch'in |
| TIA | tailings impoundment area |
| TLUS | Traditional Land Use Study |

| Acronym / Abbreviation | Definition |
|---|---|
| TK | Traditional Knowledge |
| TR | technical report |
| TS-RAA | Thinhorn Sheep Regional Assessment Area |
| TSP | total suspended particulate |
| TSS | total suspended solids |
| TWG | Technical Working Group |
| U | uranium |
| UFA | Umbrella Final Agreement |
| UNESCO | United Nations Educational, Scientific, and Cultural Organization |
| U.S. | United States |
| USGS | United States Geological Survey |
| UT | Upper Transitional |
| UTM | Universal Transverse Mercator |
| UV | ultraviolet |
| VBY | Volunteer Bénévoles Yukon |
| VC | Valued Component |
| VKT | vehicle kilometres travelled |
| VLP | valley leach pad |
| VOC | volatile organic compound |
| VP | Vice President |
| WBM | water balance model |
| WGH | Whitehorse General Hospital |
| WHO | World Health Organization |
| WQG | water quality guidelines |
| WRFN | White River First Nation |
| WRSF | Waste Rock Storage Facility |
| WSC | Water Survey of Canada |
| WUL | Water Use Licence |
| YBS | Yukon Bureau of Statistics |
| YDA | Dawson City Airport |
| YEC | Yukon Energy Corporation |
| YESAA | *Yukon Environmental and Socio-economic Assessment Act* |
| YESAB | Yukon Environmental and Socio-economic Assessment Board |
| YG | Government of Yukon |
| YGED | Yukon Government Economic Development |
| YHC | Yukon Housing Corporation |
| YOMS | Yukon Occupational Modelling System |

| Acronym / Abbreviation | Definition |
|---|---|
| YT-24 | Yukon Tributary 24 (unnamed tributary) |
| YWB | Yukon Water Board |
| YWCHSB | Yukon Workers Compensation Health and Safety Board |
| YXY | Eric Nielsen Whitehorse Airport |
| Zn | zinc |

## SYMBOLS, AND MEASUREMENTS

| Symbol/Unit of Measure | Definition |
|---|---|
| µ | microgram |
| µg/g ww | micrograms per gram wet weight |
| µg/L | micrograms per litre |
| µS/cm | micro Siemens per centimetre |
| dB | decibel |
| dBA | A-weighted decibel |
| dBL | linear (unweighted) decibel |
| ft. | feet |
| g | gram |
| g/L | grams per litre |
| g/t | grams per tonne |
| ha | hectare |
| hr | hour |
| Hz | Herz |
| kg | kilogram |
| km | kilometre |
| km/hr | kilometres per hour |
| $km^2$ | square kilometres |
| kPA | kilopascal |
| kt | kilotonne |
| kW | kilowatt |
| L | litre |
| $L_{eq}$ | energy-averaged, A-weighted sound level for a complete time period |
| $L_P$ | Sound pressure level |
| $L_{peak}$ | maximum value reached by the sound pressure |
| L/s | litres per second |
| $L/s/km^2$ | litres per second per square kilometre |
| $L_W$ | sound power level |

| Symbol/Unit of Measure | Definition |
|---|---|
| m | metre |
| $m^2$ | square metre |
| $m^3$ | cubic metre |
| $m^3$/day | cubic metres per day |
| $m^3$/hr | cubic metres per hour |
| $m^3$/s | cubic metres per second |
| M | million |
| masl | metres above sea level |
| mg | milligram |
| mg/km | milligrams per kilometre |
| mg/L | milligrams per litre |
| ML | million litres |
| mm | millimetre |
| mm/yr | millimetres per year |
| $Mm^3$ | million cubic metres |
| M oz. | million ounces |
| Mt | million tonnes |
| Mt/a | million tonnes per annum |
| MW | megawatt |
| No. | number |
| oz. | ounce |
| ppb | parts per billion |
| ppm | parts per million |
| s | second |
| sq. mil. | square mile |
| t | tonnes |
| tpd | tonnes per day |
| V | volt |

# PREAMBLE

Kaminak Gold Corporation, a wholly owned subsidiary of Goldcorp Inc. (Goldcorp or Proponent), proposes to develop the Coffee Gold Mine (Project), an open pit gold mine located approximately 130 kilometres (km) south of the City of Dawson in west-central Yukon. Goldcorp is working closely with First Nations, Yukon government and the Government of Canada, local communities, and the public to ensure that the Project is designed, constructed, operated, and closed in a safe, environmentally sound, culturally respectful, and socially responsible manner. Goldcorp acknowledges and appreciates the contributions of time, information, and advice made by all participants in the Project's consultation and engagement process, and all those who provided input during Project Proposal preparation. The Proposal describes how the information received was considered, how the Project has evolved based on this input, and how Goldcorp will manage and monitor potential environmental and socio-economic effects of the Project.

If you have questions about the Project or the Project Proposal, contact:

**Goldcorp Inc.**

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Goldcorp has prepared this Project Proposal so that is readable and accessible for all reviewers. The Proposal also meets the technical requirements of a screening by the Executive Committee of the Yukon Environmental and Socio-economic Assessment Board (YESAB). The Project Proposal is the result of the collaboration and significant effort by a team of consulting firms, contractors, technical specialists, and supporting companies. The table below recognizes the organizations and individuals who contributed technical guidance and expertise in the development of the Project Proposal.

**Table 1 Organizations and Areas of Expertise**

| Company / Organization | Area of Expertise |
|---|---|
| Environmental Dynamics Inc. | Vegetation, Fish and Fish Habitat, Wildlife and Wildlife Habitat, and Birds and Bird Habitat |
| Hemmera Envirochem Inc. | Environmental Assessment coordination and methodology, regulatory engagement, First Nations and Community Consultation, Socio-economic VCs and ICs, non-discipline Project Proposal sections, and Environmental and Socio-economic Management Program |
| JDS Engineering | Mine Engineering Design and Evaluation |
| Lorax Environmental | Groundwater, Hydro-meteorology, Hydrology, Water Balance, and Surface Water Quality |
| The Mines Group | Heap Leach Facility Design and Evaluation |
| Onsite Engineering | Engineering Design and Evaluation for Northern Access Route |
| RRD International | Heap Leach Facility Design and Evaluation oversight |
| Stantec Consulting and Ecofor | Heritage Resources |
| SRK Consulting | Geotechnical engineering and design, Water Management Design and Evaluation |
| Tetra Tech EBA | Air Quality, Greenhouse Gas Emissions, Noise, and Surficial Geology, Terrain, and Soils, Permafrost |

The Project Proposal is structured so that reviewers can more easily focus review on particular aspects of the Project. The Proposal consists of three components presented in five volumes:

- **An Executive Summary** – a plain-language, stand-alone document that provides an overview of the Project, assessment methods, and assessment findings, as well as a summary of Goldcorp commitments to mitigate adverse environmental and socio-economic effects
- **A Main Document** – including detailed information about the Project and Project alternatives, consultation and engagement activities, assessment methods and assessment findings, including mitigation and monitoring, presented at a level of detail that addresses YESAB Executive Committee screening requirements (Volumes I – V)
- **Technical Appendices** – including baseline studies, modelling reports, assessment reports, and management plans presented at the level of detail required for the Project to fully satisfy YESAB Executive Committee screening requirements and to enter licensing and permitting (Volumes I-V).

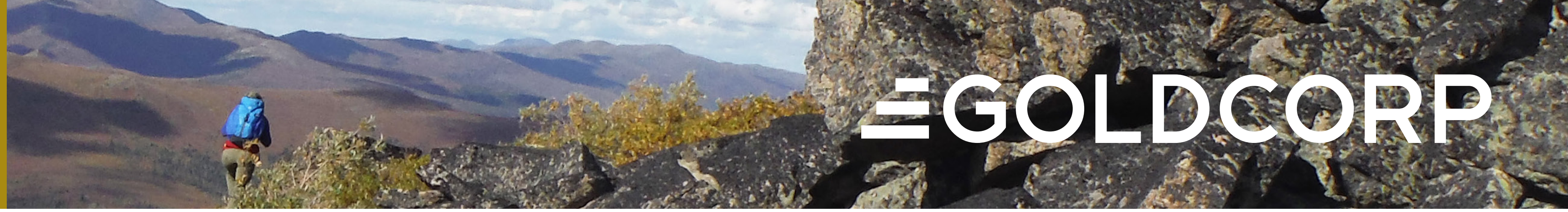
A Document Map (Figure 1) illustrates the layout and organization of each volume of the Project Proposal, including the relationship between the main document sections and the supporting appendices.

Detailed summaries of potential effects to the environmental and socio-economic Valued Components (VCs) and Intermediate Component (ICs) identified for this Project are provided in change analysis or assessment reports that have been prepared for each VC and IC. These reports are located in the appendices of Volume II, Volume III, and Volume IV, and include the following:

| Valued Components / Intermediate Components | Assessment Report Location |
|---|---|
| Groundwater | Appendix 7-B Groundwater IC Report |
| Hydrology | Appendix 8-B Hydrology IC Report |
| Air Quality and Greenhouse Gas Emissions | Appendix 9-B Air Quality and GHG Emissions IC Report |
| Noise | Appendix 10-B Noise IC Report |
| Surficial Geology, Terrain, and Soils | Appendix 11-B Surficial Geology, Terrain, and Soils IC Report |
| Surface Water Quality | Appendix 12-A Surface Water Quality IC Report |
| Fish and Fish Habitat | Appendix 14-B Fish and Fish Habitat VC Report |
| Vegetation | Appendix 15-B Vegetation VC Report |
| Wildlife and Wildlife Habitat | Appendix 16-B Wildlife and Wildlife Habitat VC Report |
| Birds and Bird Habitat | Appendix 17-B Birds and Bird Habitat VC Report |
| Demographics | Appendix 19-A Demographics IC Report |
| Economic Conditions | Appendix 20-A Economic Conditions VC Report |
| Social Economy | Appendix 21-A Social Economy VC Report |
| Community Infrastructure and Services | Appendix 22-A Community Infrastructure and Services VC Report |
| Education Services | Appendix 23-A Education Services VC Report |
| Land and Resource Use | Appendix 24-A Land and Resource Use VC Report |
| Community Health and Well-being | Appendix 25-A Community Health and Well-being VC Report |
| Heritage Resources | Appendix 26-A Heritage Resources VC Report |

Document Map

# COFFEE GOLD MINE
# YESAB PROJECT PROPOSAL

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Appendix 16-B: Wildlife and Wildlife Habitat VC Assessment Report

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LEGEND: VOLUMES SECTIONS APPENDICES

# 1.0 PROJECT OVERVIEW

Kaminak Gold Corp., a wholly owned subsidiary of Goldcorp Inc. (Goldcorp or Proponent) proposes to develop the Coffee Gold Mine (Project) in west-central Yukon, approximately 130 kilometres (km) south of the City of Dawson and 330 km northwest of Whitehorse (**Figure 1.1-1**). The Project will consist of a new open pit heap leach gold mine using conventional shovel and truck mining methods with an ore production rate of five million tonnes per year over a 12-year operational mine life. Conceptual design indicates a total of 60.1 Mt of mined ore over the life of the mine, containing 2.5 million ounces of gold.

The Mine Site is located on Crown land, with the exception of two fee simple parcels in the vicinity of the Yukon River. The Mine Site is located within Tr'ondëk Hwëch'in Traditional Territory (**Figure 1.1-1**). The Mine Site is also located within the asserted territory of White River First Nation. Road access to the Mine Site, which is included in the Project, will be provided via the Northern Access Route, a 214-km all-season access road, south from the North Klondike Highway and east of the City of Dawson. The road alignment is located within Tr'ondëk Hwëch'in Traditional Territory, with some portions located within the shared Traditional Territories of Selkirk First Nation and the First Nation of Na-cho Nyäk Dun (**Figure 1.1-1**). A portion of the Northern Access Route is also located within the asserted territory of White River First Nation.

The Proponent proposes to construct the Project over a 2.5-year period, referred to as the Construction Phase of the Project. Since mining of waste rock and ore will begin during Construction, this phase also includes the pre-production period. After recovery of first gold at the end of Year –1, the mine will enter the Operation Phase. Mining will continue over 12 years. During the Operation Phase, progressive reclamation activities will be ongoing, beginning as early as Year 2 when mining at the Double Double pit is completed. The Project's active Reclamation and Closure Phase (Years 13 to 23) will commence when all mining and processing have been completed, to be followed by a Post-closure Phase from Year 24 onwards.

The Project is expected to generate over $2 billion Canadian dollars of gross revenue and provide a maximum of approximately 372 jobs during the Operation Phase.

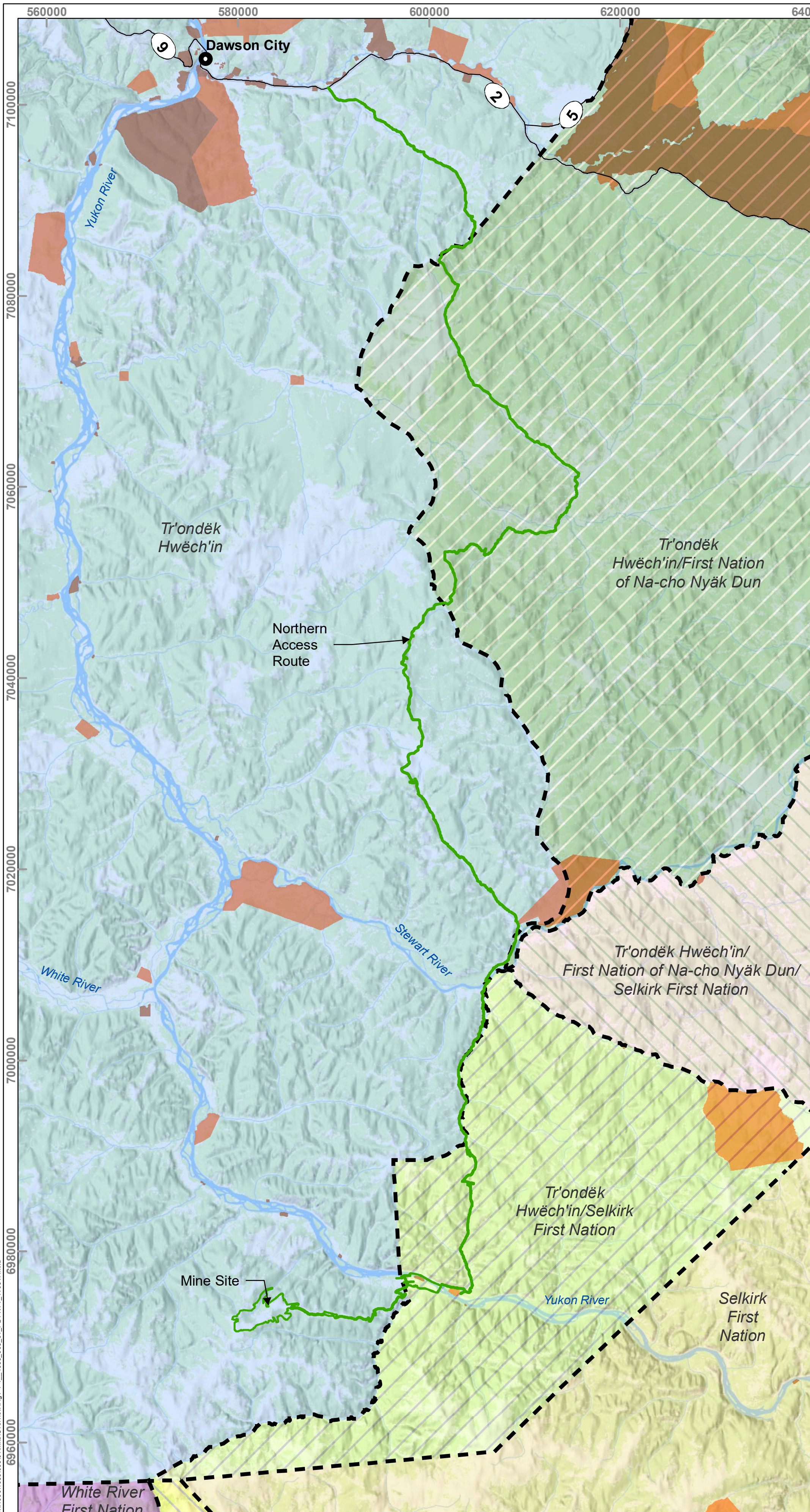
As described in detail in **Section 2.0 Project Description**, key Mine Site components will include:

- Four Open Pits – Latte, Double Double, Supremo, and Kona
- Two Waste Rock Storage Facilities – Alpha and Beta
- Stockpiles including a temporary organics stockpile, a frozen soil storage area, and a run-of-mine (ROM) stockpile
- Crusher System including crushing circuits and crushed ore stockpiles or crushed ore hopper systems
- Heap Leach Facility including lined heap leach pad, associated event ponds, a rainwater pond, and associated piping and water management infrastructure

- Plant Site including process plant, reagent storage area, laboratory, truck shop and warehouse building, power plant, and bulk fuel storage
- Camp Site including dormitories, kitchen, dining, and recreation complex buildings, mine dry and office complex, emergency response and training building, fresh (potable) water and fire water systems, sewage treatment plant, and waste management building
- Bulk Explosive Storage Area
- Mine Site and Haul Roads
- Site Water Management Infrastructure including sedimentation ponds and conveyance structures.

COFFEE GOLD MINE

**Coffee Gold Mine Location and First Nations Traditional Territories**





## Legend

- Highway
- Watercourse
- Settlement Lands - Category
- Settlement Lands - Category B

**Traditional Territories**

- Traditional Territory Boundary
- Traditional Territory of Selkirk First Nation
- Traditional Territory of Tr'ondëk
- Shared Traditional Territory of Tr'ondëk Hwëch'in, First Nation of Na-cho Nyäk Dun
- Shared Traditional Territory of Tr'ondëk Hwëch'in, First Nation of Na-cho Nyäk Dun, Selkirk First Nation
- Shared Traditional Territory of Tr'ondëk Hwëch'in, Selkirk First Nation
- Traditional Territory of White River First Nation
- Shared Traditional Territory of White River First Nation, Selkirk First Nation

## Notes

1. This map is not intended to be a "stand-alone" document, but a visual aid of the information contained within the referenced Report. It is intended to be used in conjunction with the scope of services and limitations described therein.

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GOLDCORP

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## 1.1 PROPONENT INFORMATION

Goldcorp is a leading gold producer focused on responsible mining practices with safe, low-cost production throughout the Americas. Goldcorp is a Canadian company headquartered in Vancouver, British Columbia (BC), and has more than 15,000 employees and contractors worldwide. Goldcorp's operating assets include four mines in Canada, one mine in Mexico, and two in Central and South America, in addition to a pipeline of organic growth projects.

Goldcorp's practice is to engage early and work to build strong relationships with First Nations and local communities, recognizing that successful and meaningful engagement must be collaborative and ongoing throughout all Project phases.

At Goldcorp, safe, responsible mining and sustainability excellence are company-wide commitments, which are in place to achieve a balance of economic prosperity, environmental stewardship, and social responsibility that extends beyond the operating lives of mining operations. The Goldcorp vision, **Together, Creating Sustainable Value**, is built upon six pillars (People, Safety, Sustainability, Safe Production, Margins, and Reserves) that guide and describe Goldcorp's approach to business. Goldcorp believes that when it invests in the top three pillars (People, Safety, and Sustainability), growth in the bottom three pillars (Production, Margins, and Reserves) will naturally follow.

With sustainability a core part of its business, Goldcorp aims to create a culture and working environment that sets the standard for sustainable mining operations. In keeping with its commitment to social responsibility, Goldcorp has adopted a number of voluntary codes and other external instruments that are considered particularly relevant to business. Goldcorp will continue to monitor the advancement of sustainable development initiatives in civil society to ensure that it remains a responsible company wherever it does business. **Table 1.1-1** summarizes Goldcorp's external commitments and initiatives. The most relevant initiatives are described in more detail below.

**Table 1.1-1 External Commitments and Initiatives**

| External Standards and Commitments | Industry Associations | Membership Organizations |
|---|---|---|
| • The Catalyst Accord Canada<br>• Extractive Industries Transparencies Initiative<br>• International Cyanide Management Code<br>• World Gold Council's Conflict-Free Gold Standard<br>• United Nations Global Compact<br>• United Nations Declaration of Human Rights<br>• The Voluntary Principles on Security and Human Rights | • Association for Mineral Exploration BC<br>• International Council on Mining and Metals<br>• Mine Alliance (Quebec)<br>• Mining Association of Canada<br>• Mining Industry Roundtable on Safety<br>• Ontario Mining Association<br>• Prospectors and Developers Associations of Canada<br>• World Gold Council | • Business for Social Responsibility<br>• Devonshire Initiative<br>• World Economic Forum<br>• Transparency International<br>• Voluntary Principles on Security and Human Rights Plenary (as of 2016)<br>• Boreal Leadership Council |

**Source:** http://csr.goldcorp.com/2015/about-us/commitment-to-external-initiatves

#### Business for Social Responsibility

Goldcorp is a member of Business for Social Responsibility, which has been a leader in corporate responsibility since 1992. Business for Social Responsibility's expertise in human rights, the environment, economic development, governance, and accountability has allowed the organization to guide more than 250 global companies in developing sustainable practices through consulting, research, and cross-sector collaboration.

For more information on Business for Social Responsibility, visit http://www.bsr.org.

#### Carbon Disclosure Project

The Carbon Disclosure Project is an independent, non-profit organization that aims to create a lasting relationship between shareholders and corporations by working to disclose corporate climate change information. Its goal is to encourage a rational response to climate change by facilitating a dialogue supported by harmonized quality data. Goldcorp made its first submission to the Carbon Disclosure Project in 2007 and continues to report on an annual basis.

For more information on the Carbon Disclosure Project, visit cdp.net.

#### International Council on Mining and Metals

The International Council on Mining and Metals (ICMM) aims to lead in the promotion of good practice and internationally improved performance throughout the sector. An industry group that addresses challenges within the mining sector, it provides a forum where industry and key stakeholders can collaborate on solutions to shared challenges. The ICMM is a key contributor to sustainable development, as it requires all members to perform based on principles of sustainable development.

Goldcorp is a member of the ICMM, demonstrating the commitment to responsible production of minerals and metals by implementing the ICMM Sustainable Development Framework.

For more information on the ICMM, visit http://www.icmm.com.

**International Cyanide Management Code**

The International Cyanide Management Code (Cyanide Code) is a voluntary industry program for companies involved in the production of gold by the cyanidation process, and focuses on the management of cyanide and cyanide solutions. The Cyanide Code addresses the production of cyanide, its transport from the producer to the mine, its on-site storage and use, decommissioning and financial assurance, worker safety, emergency response, training, stakeholder involvement, and verification of implementation. Goldcorp became a signatory to the Cyanide Code in July 2007. All Goldcorp operating mines, with the exception of Eleonore, have been certified under the International Cyanide Management Code and are re-certified on a rolling three year basis. Eleonore recently came into production and is scheduled for certification in 2017. In addition, Goldcorp's El Sauzal mine, now closed, was the first successfully decommissioned mine under the Code. For more information on the Cyanide Code, visit http://www.cyanidecode.org.

**Mining Association of Canada – Towards Sustainable Mining**

The Towards Sustainable Mining (TSM) program was established in 2004. Its main objective is to enable mining companies to meet society's needs for minerals, metals, and energy products in the most socially, economically, and environmentally responsible way. Adhering to the principles of TSM, Mining Association of Canada members demonstrate leadership by: engaging with communities; driving world-leading environmental practices; and committing to the safety and health of employees and surrounding communities.

The TSM Guiding Principles are backed by a suite of six protocols that mining companies use to measure and publicly report their performance in annual TSM Progress Reports.

Each protocol comprises a set of indicators that are designed to measure the quality and comprehensiveness of facility-level management systems, and are intended to provide a public overview of the industry's performance in key environmental and social areas. Several protocols are also accompanied by framework documents that describe in detail the commitments of member companies in these areas. The TSM Assessment Protocols are: Aboriginal and Community Outreach, Energy and GHG Emissions Management, Tailings Management, Biodiversity Conservation Management, Safety and Health, and Crisis Management and Communications Planning.

Goldcorp joined the Mining Association of Canada in 2015, and is actively working toward meeting the requirements of the TSM protocols on which they will be audited in the near future.

For more information on the Mining Association of Canada, visit http://mining.ca.

**The Catalyst Accord Canada**

Catalyst Canada is a non-profit organization committed to building an inclusive environment by expanding the opportunities for women and business. In 2014, Goldcorp became a signatory to The Catalyst Accord, an initiative that encourages corporate Canada to increase diversity and inclusion on boards of directors. By committing to The Catalyst Accord, Goldcorp made a public pledge to increase representation of women on its Board of Directors to 25%. By 2017, the Company had exceeded this target, with currently 33% of board seats filled by women. To learn more visit http://www.catalyst.org/regions/canada.

**The Global Reporting Initiative**

The Global Reporting Initiative sustainability reporting framework sets out specific criteria and indicators that organizations can use to measure and report their economic, environmental, and social performance. Sustainability reports based on the framework can be used to compare performance against set standards and voluntary initiatives, compare organizational performance over time, and demonstrate organizational commitment to sustainable development.

Through its commitments to the ICMM, Goldcorp has committed to using the Global Reporting Initiative sustainability reporting framework as the basis for its sustainability reporting. Goldcorp has been reporting to and against the Global Reporting Initiative since 2007.

For more information on the Global Reporting Initiative, visit http://www.globalreporting.org.

**United Nations Global Compact**

The United Nations (UN) Global Compact is a commitment between the United Nations and responsible businesses. The agreement provides a framework for businesses to align operational strategies in accordance with 10 principles in the areas of human rights, labour, environment, and anti-corruption. This voluntary initiative is based on public accountability, transparency, and disclosure to complement regulation and provide a space for innovation.

Goldcorp became a signatory to the UN Global Compact in 2009, demonstrating its commitment to embrace, support, and enact, within its sphere of influence, a set of core values in the areas of human rights, labour standards, the environment, and anti-corruption.

In July 2015, Goldcorp became a signatory to the Women's Empowerment Principles, a joint initiative of UN Global Compact and UN Women. The Principles include seven steps to guide business on how to empower women in the workplace, marketplace, and community, and emphasize the business case for corporate action to promote gender equality and women's empowerment.

These principles are aligned with Goldcorp's value of Empowering Others and its commitment to foster an open, diverse, and inclusive workplace that promotes gender diversity.

For more information on the United Nations Global Compact, visit http://www.unglobalcompact.org.

### 1.1.1 Sustainability Excellence Management System

In order to meet sustainability commitments, Goldcorp has implemented the Sustainability Excellence Management System (SEMS), which provides the framework and standards for Goldcorp sustainability management, and ensures a consistency of approach for implementing these global policies across the company. SEMS brings a systematic approach to dealing with sustainability aspects at Goldcorp.

Straight forward in design and implemented globally, SEMS is integrated into all core business functions throughout the company, and emphasizes sustainability, responsibility, and accountability at all organizational levels. SEMS contains overarching standards applicable to all SEMS sustainability functions (SEMS Standards) and standards specific to safety and health, environmental performance, social performance, and security. SEMS applies to all Goldcorp properties, including the proposed Coffee Mine Project, as well as exploration projects, development projects, operating mines, or reclaimed or closed sites.

Goldcorp continuously reviews the efficacy of the systems and strives to improve in all areas. This commitment to continuous improvement includes an ongoing program of evaluating management systems and processes, training programs, and technology transfer. Continuous improvement also includes benchmarking the best-of-class practices of other companies and incorporating these practices as appropriate into SEMS. Performance is routinely measured against established targets and performance indicators as an ongoing tool for continuous improvement.

These SEMS Standards represent a minimum expected level of performance. Where local legislation or regulation exceeds the requirements of these standards, Goldcorp will meet those more stringent requirements. SEMS contains standards for all phases of the mine life cycle from property acquisition and exploration through engineering and commissioning, to operations, closure, and post-closure.

### 1.1.2 CORPORATE AND MANAGEMENT STRUCTURE

Goldcorp is a publicly traded company with a Board of Directors and a very experienced senior management team. The senior executives and Board members are instrumental in establishing the Goldcorp corporate culture of sustainable growth and continued success. Goldcorp mines and projects operate under the leadership of the Mine General Managers.

Goldcorp has placed in the Coffee Gold Mine a management team that consists of individuals with many years of combined experience at all mine life stages and in many jurisdictions. Several team members transitioned from the previous Project team upon the Project's acquisition by Goldcorp.

**Buddy Crill, Mine General Manager**

Buddy Crill holds a Bachelor of Science in Electrical Engineering from the University of Idaho, and has 24 years of progressive technical and management experience in both the mining and electric utility industries. Buddy has contributed significantly to the engineering, operational readiness, commissioning, start-up, and operational continuous improvement on a number of mine and power plant projects. He specializes in the application of innovative technologies and operational systems to improve energy efficiency, increase equipment availability and utilization, and reduce operating costs to ensure long-term financial success.

**Roger Souckey, Director, Sustainability and Human Resources**

Roger Souckey has over 28 years of mining experience within Canada and the United States of America, and is currently the Director of Sustainability and Human Resources on the Project. His involvement and passion for community engagement derives not only from being involved on the industry side, but also from extensively working with Indigenous groups. Roger started his career in mining as an underground miner, and through the years, he worked his way through Goldcorp's organization, gaining exposure to most aspects of the business. He has completed his Masters Certificate in Public Management through York University – Schulich School of Business. He is currently an active member of the Ontario Mining Association and the Mining Association of Canada.

**Jennie Gjertsen, Environmental and Permitting Manager**

Jennie Gjertsen holds a Bachelor of Science from the University of British Columbia, and has worked in the environmental and sustainability area of mining for 10 years. The Coffee Gold Mine is Jennie's third Yukon mining project. She specializes in permitting and compliance, operational implementation of licences and environmental management plans, reclamation and closure planning, and mine water management.

**James Scott, Engineering Manager**

James Scott has more than 10 years of experience in mineral exploration and development. Since 2008, he has worked and managed multiple advanced projects in Yukon and northern BC. James joined the Coffee Gold Mine team in 2011, and is currently responsible for managing the engineering disciplines for the design and development of the Project. James holds a Bachelor of Science in Earth Science from Carleton University and a Master of Science in Geology from the University of Alberta.

**Tim Smith, Exploration Manager**

Tim Smith has a Master of Science in Geology and 21 years of experience in mineral exploration and mining. A professional geologist, Tim has played key roles in the discovery, exploration, development, and mining of several open pit and underground mines.

Tim was Exploration Manager and subsequently VP Exploration with Kaminak Gold Corp. from 2010 to 2016, leading the exploration team through the discovery and delineation of the Coffee gold deposit. As Exploration Manager, Tim is responsible for the continued exploration and delineation of resources at the Coffee deposit.

**Catherine Tegelberg, Corporate Social Responsibility Superintendent**

Catherine Tegelberg joined the Coffee project in October 2016 as the Corporate Social Responsibility (CSR) Superintendent. Catherine got her start in mining at a nickel/cobalt operation in Madagascar, where she worked in CSR for two years. She has been with Goldcorp for the last four years in the corporate CSR team, most recently as the Manager of CSR and Compliance. In this role she directed policy and procedure on topics, such as grievance mechanisms and community investments. She also oversaw implementation of the social performance aspects of Goldcorp's Sustainability Excellence Management System. Catherine holds a Master's degree in International Studies from Simon Fraser University. In addition to Madagascar, she has lived in Guatemala, Nicaragua, and Bolivia.

**Jasmin Dobson, Environmental Superintendent**

Jasmin Dobson holds a Bachelor of Science from Royal Roads University, and has worked in the fields of environmental assessment and mining for six years. Jasmin has participated in several environmental assessments of northern mining projects; the Coffee Gold Mine is the second Yukon mining project in which she is directly involved at the mine operational level. Jasmin specializes in licence and permit compliance; operational implementation of licences and permits; development and implementation of environmental management plans; and operational mine water management.

### 1.1.3 TECHNICAL AND CONSULTANT TEAM

Goldcorp has assembled a team of highly qualified professionals with substantial northern experience to provide engineering and technical support during the Project's Feasibility Study, planning and design, environmental and socio-economic assessment studies, consultation and engagement activities, and Project Proposal preparation. The qualifications and experience of this team, most of whom are based in Yukon and BC, are briefly described below.

HEMMERA

**Hemmera Envirochem Inc.** – As lead for Goldcorp's Assessment, Licensing, and Permitting team, Hemmera Envirochem Inc. (Hemmera) is responsible for the coordination of assessment activities and the production of the Project Proposal, and submission of Water Licence and Quartz Mining Licence applications. Hemmera is also playing a lead role during consultation and engagement, and is the Human Environment discipline lead. Hemmera team members are based in Whitehorse, Yukon as well as Burnaby and Victoria, BC. Collectively, they bring a wide range of northern and regulatory experience to the Kaminak team. Michael Muller is the Project Director; Tim Abercrombie is the Project Management Lead; Lisa DeSandoli is the Environmental Assessment Manager; Kelly Constable is Lead of Consultation and Engagement; and Trista Hill directs the Human Environment and Socio-economic effect assessments.

LORAX ENVIRONMENTAL

**Lorax Environmental** – Responsible for aspects of the Project related to water balance, water chemistry, hydrogeology, and surface hydrology, the Lorax Environmental team is led by David Flather, who has extensive experience in the North, including Yukon. The Lorax team comprises a diverse group of highly skilled professionals with experience throughout Canada, including Colin Fraser, Laura Findlater, and John Dockrey.

EDI
ENVIRONMENTAL DYNAMICS INC.

**Environmental Dynamics Inc**. – Responsible for the terrestrial and aquatic science aspects of the Project including: fish and fish habitat, vegetation, and wildlife, Environmental Dynamics Inc. (EDI) is based in Whitehorse, and has extensive Yukon experience. Team leads at EDI are Anne McLeod (wildlife), Pat Tobler (fish and aquatic resources), and Mike Setterington.

**Tetra Tech** – Responsible for aspects of the Project related to surficial geology, terrain and soils, permafrost, climate, hydro-meteorology, air quality and greenhouse gas emissions, and noise, Tetra Tech is internationally renowned as a leader in mine engineering, design, and regulatory permitting, particularly in northern climates. Team members include Kevin Jones, Vladislav Roujanski, Tania Perzoff, Kristina Gardner, Tricia Pellerin, and Travis Miguez.

**SRK Consulting** – Responsible for the geotechnical aspects of the Project, SRK Consulting is responsible for preparing the water management plan design. The team members include Michael Levy, Tom Sharp, and Dylan MacGregor.

**JDS Energy & Mining Inc.** – Responsible for mine engineering and project management for the Project's Feasibility Study, which was completed in February 2016, the JDS Energy & Mining Inc. team is led by Trevor Herd and Dino Pilotto. The diverse and experienced team of industry veterans at JDS are backed by decades of experience, and continue to provide engineering expertise during the Project's regulatory processes.

**Onsite Engineering Ltd.** – Responsible for aspects of the Mine Site access road and the Northern Access Route from the City of Dawson, Onsite Engineering Ltd. is led by Jeremy Araki.

**The Mines Group and RRD International** – Responsible for design of the Project's Heap Leach Facility, The Mines Group, including Anthony Crews and Kenneth Myers, and RRD International's Mark Smith each have over 30 years of experience.

**Ecofor** – Responsible for conducting heritage resource reviews and field programs and supporting development of assessment materials and mitigation measures. The team members include Tim Bennet and James Mooney

### 1.1.4 PRIMARY CONTACT

The primary contact for the Yukon Environmental and Socio-economic Assessment Board (YESAB) Executive Committee screening review of the Project is as follows:

Jennie Gjertsen, Environmental and Permitting Manager, Coffee Gold Project
Goldcorp Inc.
Suite 3400 – 666 Burrard Street
Vancouver, BC V6C 2X8
Phone Number REDACTED

Email Address REDACTED

## 1.2 PROJECT BACKGROUND

The Coffee Property had been subject to significant exploration in recent years. From the turn of the century until 1981, the Coffee Property and surrounding area was explored by sporadic placer expeditions with limited reconnaissance activities for porphyry copper in the 1960s and 1970s. A brief exploration program conducted in 1999 and 2000 resulted in the identification of an open-ended soil gold anomaly. Further grid and ridgetop soil sampling was conducted in 2006 and 2007. In 2009, the Coffee Property was acquired by the original Kaminak Gold Corp. (KGC) from Shawn Ryan. Upon acquisition of the property, the exploration programs were expanded with surficial trenching and soil sampling to identify bedrock mineralization. Through these programs, KGC identified a number of high-tenure soil anomalies for drill follow-up. In subsequent years, KGC continued the soil sampling and trenching programs, and began drilling programs to test the identified soil anomalies. From 2010 to 2015, KGC completed more than 270,000 metres of drilling across the property, focusing on the Supremo, Latte, Double Double, and Kona deposits. These efforts led to the completion of a mineral reserve estimate released in 2015, which outlines 46.4 million tonnes at 1.45 grams per tonne of gold, containing 2.16 million ounces of gold (JDS 2016). In July 2016, KGC and the Coffee Property were fully acquired by Goldcorp with the intent to proceed with the Project through assessment, licensing, and permitting to construction and operation.

## 1.3 PROJECT PURPOSE

The purpose of the Project is to develop a productive gold mine in Yukon that meets Goldcorp's business goals while generating economic and social benefits for First Nations, local communities, the City of Dawson, and Yukon as a whole. Goldcorp's objective is to design, develop, operate, close, and reclaim the Project in an economically rewarding, environmentally sound, and socially responsible manner, in close consultation and partnership with First Nations, local communities, and stakeholders. At Goldcorp, responsible mining is a company-wide commitment that is central to the way business decisions are made. Goldcorp strives to conduct business to ensure lasting social progress and economic growth for all stakeholders throughout the life of a Goldcorp mine and well beyond. As reflected in consultation and engagement undertaken to date (see **Section 3.0 Consultation**), Goldcorp is committed to being a responsible steward of the environment and to maintaining the highest health and safety standards possible. Goldcorp maintains a principled and conscientious approach to corporate citizenship to enhance the Project's ability to generate sustained socio-economic benefits, including business, training, and employment opportunities. Goldcorp programs are designed to be catalysts for positive, lasting contributions in local communities while working in partnership with First Nations and local, territorial, and national governments.

Goldcorp will guide the design, construction, and operation of the Project in accordance with the highest applicable health, safety, and environmental standards. Goldcorp provides the employees at all of its projects with the tools and training required to minimize the effects of Project-related activities on the environment. Upon completion of mining at the Project, Goldcorp will implement a technically feasible reclamation and closure plan that is environmentally sound while respecting the regulatory regime, laws, traditional and current land uses, and public interests.

## 1.4 REQUIRED AUTHORIZATIONS AND REGULATORY APPROVALS

The Project is subject to an environmental and socio-economic assessment pursuant to the *Yukon Environmental and Socio-economic Assessment Act*, SC 2003, c.7 (YESAA), which states that:

> Any activity listed under paragraph (1)(a) – and not excepted under paragraph (1)(b) – is subject to assessment if proposed to be undertaken in Yukon and if (c) an authorization or the grant of an interest in land by a government agency, an independent regulatory agency, municipal government or First Nation is required for the activity to be undertaken (section 47(2)).

Further, as provided for in the Assessable Activities, Exceptions and Executive Committee Projects Regulations (SOR/2005-379), since the Project involves the construction, decommissioning, or abandonment of a gold mine with an ore production capacity of 300 tonnes per day or more, it is subject to a YESAB Executive Committee screening. Consequently, other requisite licences and permits may not be issued by federal or territorial regulators, municipal governments, or First Nations until decision documents allowing the Project to proceed have been issued by all involved decision bodies. The agencies that are expected to declare themselves decision bodies for the Project Executive Committee screening are:

- Yukon Government Delegated Lead - Executive Council Office, Development Assessment Branch
- Federal Government, any department responsible for issuance of a regulatory instrument in relation to the Project, including:
  - Fisheries and Oceans Canada
  - Natural Resources Canada
  - Transport Canada.

Under YESAA, a federal agency, territorial minister, territorial agency, municipal government, or First Nation that is a decision body for the purposes of the Project cannot: 1) undertake the Project; 2) require the Project to be undertaken; or 3) take any action that would enable the Project to proceed until it has issued a decision document under YESAA (section 75, 76, or 77) allowing the Project to be undertaken.

To facilitate YESAB's adequacy review of the Project Proposal, a Table of Concordance that identifies the information specifically requested in YESAB's *Proposal Checklist for Executive Committee Screenings* (YESAB 2015) is included in Volume I as **Appendix 1-A Table of Concordance**.

Legislation and required licences, permits, and other types of approvals applicable to the Project and respective decision-making authorities are identified in **Appendix 1-B Applicable Territorial and Federal Legislation, Regulations, and Regulatory Approvals**. Of key importance are the Type A Water Licence under the Yukon *Waters Act*, SY 2003, c.19, and the Quartz Mining Licence under the *Quartz Mining Act*, SY 2003, c.14. It is expected that Fisheries and Oceans Canada, Natural Resources Canada, and Transport Canada will be involved as decision bodies for the Executive Committee Screening since the Project will require permits granted by these federal agencies.

### 1.5 REFERENCES

JDS Energy and Mining Inc. (JDS). 2016. Feasibility Study Report for the Coffee Gold Project, Yukon Territory, Canada. Prepared for Kaminak Gold Corporation. February 18, 2016.

Yukon Environmental and Socio-economic Advisory Board (YESAB). 2015. Proposal Checklist for Executive Committee Screenings.

# 2.0 PROJECT DESCRIPTION

This section describes the location of the Coffee Gold Mine (Project), primary and ancillary Project components, the schedule to construct, operate, close, and reclaim the Project, and specific activities to be carried out during each phase of the Project. The descriptions provided below are conceptual in nature and provide the level of detail necessary for the assessment stage of the Project. Descriptions are based on Project details developed during and after the Project Feasibility Study (JDS 2016).

Detailed design and implementation procedures will be developed following Project approvals. All design, methodology, or procedural changes will conform to the commitments made by Kaminak Gold Corporation, a wholly owned subsidiary of Goldcorp Inc. (Goldcorp or Proponent), as set out in **Section 32.0 Project Design Measures and Commitments**, as well as the terms and conditions required in the Decision Document resulting from the Yukon Environmental and Socio-economic Assessment Board (YESAB) Executive Screening process, the Quartz Mining License, Type A Licence under the Yukon *Waters Act,* SY 2003, c. 19, permits under the Yukon *Environment Act*, RSY 2002, c. 76, and other permits (refer to **Section 1.4 Required Authorizations and Regulatory Approvals**).

In the absence of an updated guidance document, this section was informed by the *Proponent's Guide to Information Requirements for Executive Committee Project Proposal Submissions* (YESAB 2005), specifically Part 1, Section 5.0 Project Description, and Part 2 Additional Requirements for Hardrock (Quartz) Mining Projects. The required information is presented in the following sections:

- **Section 2.1 Project Description Overview**
- **Section 2.2 Project Location**
- **Section 2.3 Project Components**
- **Section 2.4 Project Phases and Schedule**
- **Section 2.5 Construction Phase Activities**
- **Section 2.6 Operation Phase Activities**
- **Section 2.7 Reclamation and Closure Phase Activities**
- **Section 2.8 Post-closure Phase Activities**
- **Section 2.9 Seasonal or Temporary Closure Activities**
- **Section 2.10 Alternatives and Chosen Approach**.

The following management plans, which provide additional information on infrastructure design and phase-specific activities including monitoring, are referenced throughout this section where relevant:

- Access Route Construction Management Plan (**Appendix 31-A**)
- Access Route Operational Management Plan (**Appendix 31-B**)

- Conceptual Reclamation and Closure Plan (**Appendix 31-C**)
- Waste Rock and Overburden Management Plan (**Appendix 31-D**)
- Water Management Plan (**Appendix 31-E**).

## 2.1 PROJECT DESCRIPTION OVERVIEW

The Project, which is fully owned by Goldcorp, is a proposed gold mine located in the White Gold District of west-central Yukon, approximately 130 kilometres (km) south of the City of Dawson. The Project contains a substantial oxide resource that will be mined by open pit mining methods and recovered with heap leach processing. The Project is planned to have a 30-month Construction Phase, a 12-year Operation Phase, an 11-year Reclamation and Closure Phase that includes Post-mining and Active Closure stages, and a Post-closure Phase as determined to be required.

The Project includes a 214-km, all-weather access road with river barge crossings, referred to as the Northern Access Route (NAR), which will provide access between the City of Dawson and the Mine Site. At the commencement of the Construction Phase, existing sections of the NAR will be upgraded and approximately 37 km of new road will be constructed, along with the construction or upgrade of barge landings at the Stewart River and Yukon River crossings. During the open water period, barges will be utilized to ferry transport trucks delivering fuel and freight across the rivers, and during the winter months, ice crossings will be constructed to allow transport trucks to drive across the rivers. Air transportation and the use of airstrips at the Mine Site will provide year-round access, and will be utilized to transport most mine personnel to and from site by charter aircraft from Whitehorse and other communities, as well as some freight.

Four Open Pits (called Latte, Double Double, Supremo, and Kona) will be developed using standard drill and blast methods, and mined using conventional shovel and truck methods. The ore production rate is approximately five million tonnes (Mt) per year, producing an estimated total of 60.1 Mt of heap leach feed over the 12-year Operation Phase. The conceptual-level estimate for waste material to be moved over the life of mine (LOM) is 300 Mt based on an average strip ratio (i.e., ratio of the amount of waste to the amount of ore) of 5.0:1. As detailed design is advanced and operational realities such as ore dilution and grade control are realized, the exact amount of ore and waste and the stripping ratio may change.

Material will be excavated from the open pits at an average rate of 100,000 tonnes per day (tpd). Waste rock will then be transported to the Alpha Waste Rock Storage Facility (WRSF), Beta WRSF, backfilled, or used as construction material for embankments, water management structures, site roads, haul roads, or as construction fill within the Camp and Plant Sites and Heap Leach Facility (HLF). Ore will be transported to the Crusher System, or placed in the run-of-mine (ROM) stockpile. Ore will undergo crushing or screening at an average rate of approximately 18,200 tpd (with a peak of 25,000 tpd), then transported to and stacked on a lined heap leach pad. The ROM stockpile will be large enough to accommodate ore stockpiling, particularly during the months of January through March when the crusher may not be in operation.

Gold extraction will utilize sodium cyanide heap leaching technology. A diluted solution of alkaline cyanide (referred to as the barren solution) will be applied to the stacked ore (also referred to as heap leach) on the heap leach pad using drip irrigation. As the barren solution percolates through the heap leach, gold will react with the cyanide and dissolve into the solution. This gold-bearing solution (referred to as the pregnant solution) will be collected at the base of the heap leach pad. The pregnant solution will then be transported by pipe to the process facility where it will be processed via conventional gold recovery methods at an on-site adsorption, desorption, and recovery (ADR) carbon plant. The end product of the ADR plant is poured doré bars, which will be shipped off-site by aircraft for further refinement. Conceptual design indicates a total of 60.1 Mt of mined ore over the life of the mine, containing 2.5 million ounces of gold.

A water treatment plant will be constructed during the Operation Phase to treat excess process water (e.g., water produced during rinsing of the heap leach as part of mine closure activities) and operated through the Reclamation and Closure Phase. The treatment plant will also allow for progressive rinsing and reclamation of the heap leach facility during operations and will discharge to Halfway Creek. The treatment process will include oxidizing residual cyanide and metals removal using a biological reduction process targeting uranium. The biological reduction process will also treat numerous other metals in the heap leachate including arsenic. The process will also remove nitrate from heap solutions, anticipated to be elevated due to in situ cyanide degradation. Treated water from the water treatment plant will initially be used for additional rinsing of the heap leach. Treated excess water in the heap leach facility will be discharged to Halfway Creek or the Latte Pit once the treated water quality meets effluent discharge criteria.

In addition to the process plant and water treatment plant, the Plant Site will include a reagent storage area, assay laboratory, truck shop, warehouse buildings, a power plant (including power generation and distribution), and bulk fuel storage tanks with a fuel distribution system. The Camp Site will include camp facilities for a maximum of 400 persons with associated potable water and wastewater treatment, fire suppression systems, mine dry, office, and emergency response and training buildings; and a waste management facility.

When mining or processing activities have been completed or when areas are no longer needed for mining, reclamation and closure activities will be conducted, either progressively during the Operation Phase or subsequently during the Reclamation and Closure Phase. Reclamation and closure planning, which has been a primary consideration from the onset of mine planning and design, has focused on achieving short- and long-term erosion control, ensuring that future land use is compatible with surrounding lands, and returning the area to a landscape that is compatible with original land uses. Details pertaining to reclamation and closure are provided in **Appendix 31-C Conceptual Reclamation and Closure Plan.**

## 2.2 PROJECT LOCATION

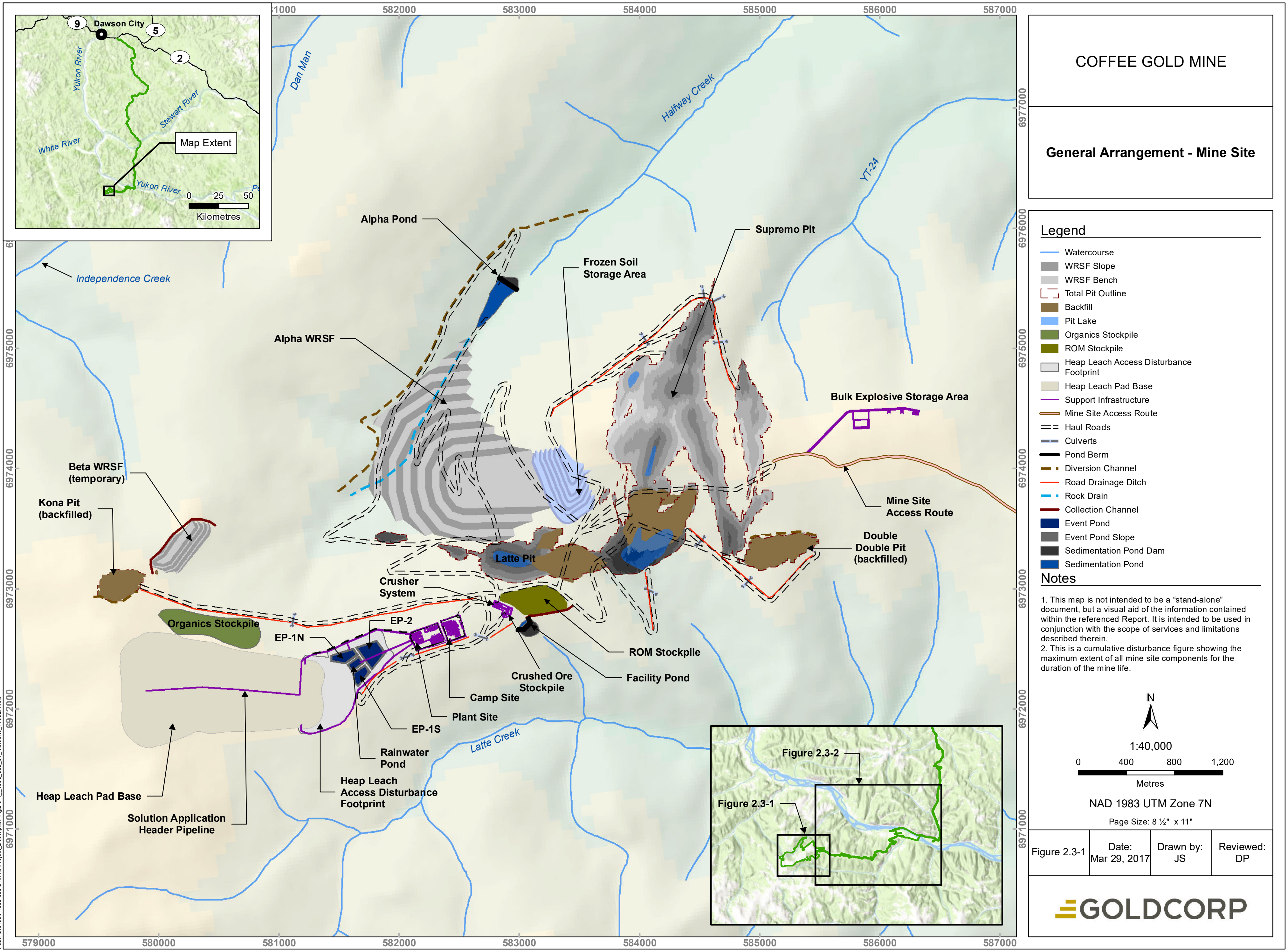
The Mine Site is located within the Coffee claim block (or Property) on the south side of the Yukon River in the White Gold District of west-central Yukon, approximately 130 km south of the City of Dawson, 160 km west-northwest of Carmacks, and 340 km northwest of the Yukon capital of Whitehorse. The Mine Site is located within the traditional territory of Tr'ondëk Hwëch'in and the asserted area of White River First Nation. The NAR is located within the traditional territory of Tr'ondëk Hwëch'in, and portions of the route are located within the shared traditional territories of Selkirk First Nation and the First Nation of Na-cho Nyäk Dun and the asserted area of White River First Nation. Additional details specific to the Project area pertaining to ecological characteristics, land tenure, regional land use planning, and land and resource use are presented in **Section 4.0 Project Setting**.

## 2.3 PROJECT COMPONENTS

This section describes principal Project components, along with ancillary components that are necessary to support Project activities. Information provided below for each Project component includes; its location, key design features, and, where applicable, the results of any relevant investigations to establish site conditions (e.g., seismicity, geotechnical parameters, hydrology, etc.). The proposed overall site layout for the Mine Site and adjacent watercourses is shown in **Figure 2.3-1**, **Figure 2.3-2**, and **Figure 2.3-3**. Principal components at the Mine Site include:

- Four Open Pits – Latte, Double Double, Kona, and Supremo
- Two WRSFs – Alpha and Beta
- Stockpiles including a temporary organics stockpile, frozen soil storage area, and a ROM stockpile
- Crusher System including crushing circuits, crushed ore stockpiles, or crushed ore hopper systems
- Heap Leach Facility including lined heap leach pad, associated event ponds, a rainwater pond, and associated piping and water management infrastructure
- Plant Site including process plant, reagent storage area, laboratory, truck shop and warehouse building, power plant, and bulk fuel storage
- Camp Site including dormitories, and kitchen, dining, and recreation complex buildings, mine dry and office complex, emergency response and training building, fresh (potable) water and fire water systems, sewage treatment plant, and waste management facility
- Bulk Explosive Storage Area
- Mine Site and Haul Roads
- Site Water Management Infrastructure including sedimentation ponds and conveyance structures.

Ancillary Components include the NAR, airstrip, laydown areas, and the Coffee exploration camp. Some minor or ancillary facilities may be relocated, modified, or added as detailed design is completed; these changes are not expected to affect the overall Project footprint.



COFFEE GOLD MINE
General Arrangement - Mine Site
Legend
Watercourse
WRSF Slope
WRSF Bench
Total Pit Outline
Backfill
Pit Lake
Organics Stockpile
ROM Stockpile
Heap Leach Access Disturbance Footprint
Heap Leach Pad Base
Support Infrastructure
Mine Site Access Route
Haul Roads
Culverts
Pond Berm
Diversion Channel
Road Drainage Ditch
Rock Drain
Collection Channel
Event Pond
Event Pond Slope
Sedimentation Pond Dam
Sedimentation Pond
Notes
1. This map is not intended to be a "stand-alone" document, but a visual aid of the information contained within the referenced Report. It is intended to be used in conjunction with the scope of services and limitations described therein.
2. This is a cumulative disturbance figure showing the maximum extent of all mine site components for the duration of the mine life.
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Figure 2.3-1
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Dawson City
9
5
2
Yukon River
Stewart River
White River
Map Extent
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Kilometres
Independence Creek
Dan Man
Halfway Creek
YT-24
Alpha Pond
Frozen Soil Storage Area
Supremo Pit
Alpha WRSF
Bulk Explosive Storage Area
Beta WRSF (temporary)
Kona Pit (backfilled)
Mine Site Access Route
Double Double Pit (backfilled)
Latte Pit
Crusher System
Organics Stockpile
EP-2
EP-1N
ROM Stockpile
Facility Pond
Crushed Ore Stockpile
Camp Site
Plant Site
EP-1S
Rainwater Pond
Latte Creek
Heap Leach Access Disturbance Footprint
Heap Leach Pad Base
Solution Application Header Pipeline
Figure 2.3-2
Figure 2.3-1
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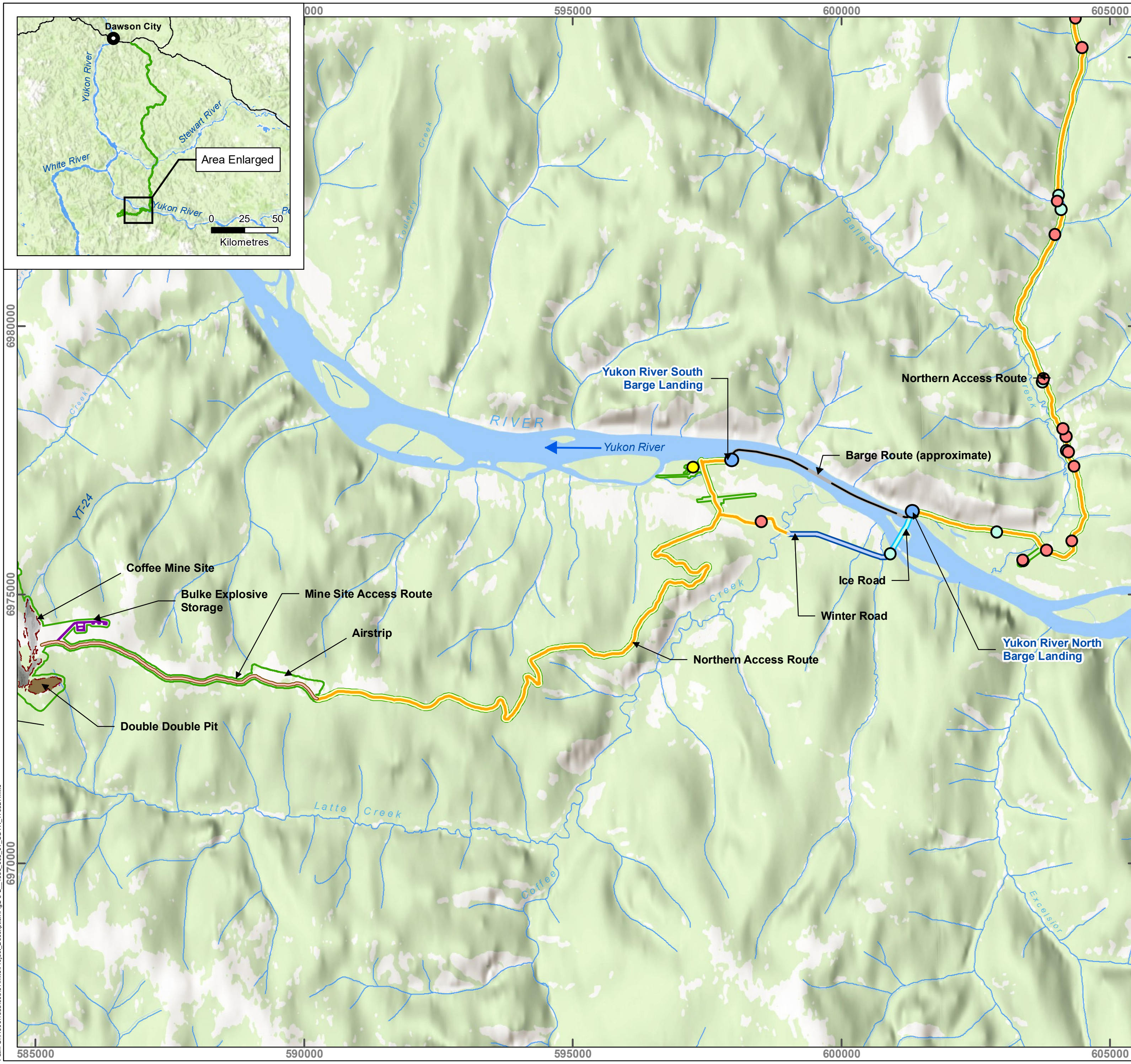


# COFFEE GOLD MINE

## General Arrangement - Mine Site Access

### Legend

- Watercourse
- Flow Direction
- Project Footprint
- Yukon River Barge Route
- Yukon River Ice Road
- Winter Road
- Mine Site Access Route
- Northern Access Route
- Licensed Camps
- Potential Borrow Sources
- Potential Spoil Sites
- Barge Landing

### Notes

1. This map is not intended to be a “stand-alone” document, but a visual aid of the information contained within the referenced Report. It is intended to be used in conjunction with the scope of services and limitations described therein.

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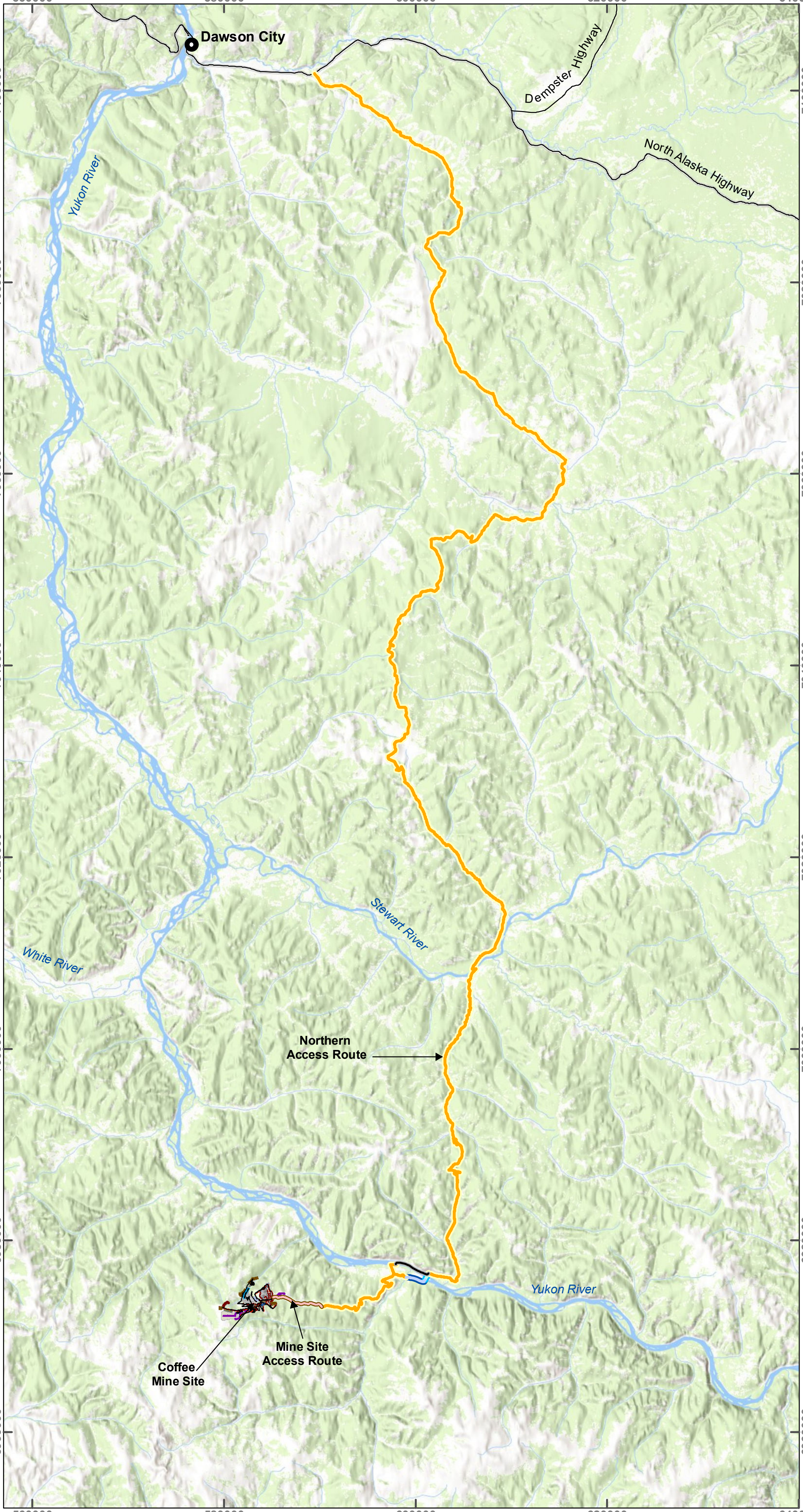


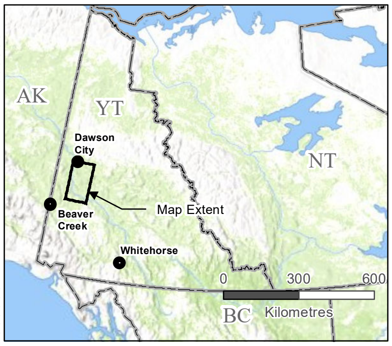


# COFFEE GOLD MINE

## General Arrangement – Northern Access Route

## Legend

- Highway
- Stewart River Ice and Barge Crossings
- Yukon River Barge Route
- Yukon River Ice Road
- Winter Road
- Mine Site Access
- Northern Access

## Notes

1. This map is not intended to be a “stand-alone” document, but a visual aid of the information contained within the referenced Report. It is intended to be used in conjunction with the scope of services and limitations described therein.

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GOLDCORP

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Details related to construction of components as well as mine operation activities at the components are provided in **Section 2.5 Construction Phase Activities** and **Section 2.6 Operation Phase Activities**, respectively, noting that the development of some Project components occurs in both phases. Closure activities are described in **Section 2.6.7 Operational Closure Activities** for those components that are progressively reclaimed while open pit mining is underway (i.e., during the Operation Phase), and a summary of closure activities after the cessation of open pit mining is provided in **Section 2.7 Reclamation and Closure Phase Activities**.

### 2.3.1 Open Pits

The Project includes four open pits named Latte, Double Double, Supremo, and Kona. To maximize economic returns and achieve the target throughput of 5.0 Mt per year during the 12-year Operation Phase, the open pit mining sequence is planned to begin with the Latte pit and Double Double pit, followed by Kona pit and finishing with Supremo pit. Although Latte and Supremo have multiple phases and pushbacks due to their size, currently Double Double and Kona are both planned to be mined in a single phase.

Open pit dimensions and conceptual material quantities for each pit are provided in **Table 2.3-1**. These quantities may change slightly as the Project advances to the detailed design phase. Design parameters are provided below, and additional details can be found in **Appendix 31-D Waste Rock and Overburden Management Plan**. Conceptual pit shell shapes for each open pit, including plan-view and cross-section figures, as well as slopes and bench heights for each pit, will be developed during detailed design.

**Table 2.3-1 Open Pit Dimensions and Life of Mine Quantities of Contained Ore and Waste Rock**

| Open Pit | Max. Length (m) | Max. Width (m) | Max. Depth (m) | Ore (Mt) | Waste Rock (Mt) |
|---|---|---|---|---|---|
| Latte | 1,500 | 300 | 150 | 15 | 36 |
| Double Double | 600 | 250 | 100 | 1.5 | 17 |
| Kona | 380 | 220 | 90 | 1.6 | 5 |
| Supremo | 2,100 | 500 | 140 | 42 | 242 |
| **Total** | N/A | N/A | N/A | **60.1** | **300** |

### 2.3.2 Waste Rock Storage Facilities

As shown in **Table 2.3-1**, an estimated total of 300 Mt of waste rock will be produced over the LOM. Waste rock will primarily consist of a competent mixture of gneiss, schist, and granite with a minor amount of amphibolite. Geochemical characterization indicates that waste rock is non-acid generating (NAG) and seepage water from waste rock is anticipated to be circumneutral. As such, no special handling to mitigate acid rock drainage potential of waste rock is expected. Waste rock has some metal leaching potential, most notably for uranium. Although the majority of waste rock from the open pits is planned to be deposited in the Alpha WRSF or Beta WRSF, some suitable waste rock will be used in the construction of Mine Site infrastructure (e.g., site roads, sedimentation embankments, water management structures, laydown areas, heap leach pad and associated ponds). As opportunities arise operationally, pits may be selectively backfilled.

The Alpha WRSF, designed with an ultimate capacity of approximately 250 Mt and a 210-hectare (ha) footprint, will be located north of the Latte Pit and west of the Supremo Pit. The Alpha WRSF will be located within the upper reaches of the Halfway Creek drainage basin.

Geotechnical investigations were undertaken to characterize the subsoil conditions within the Alpha WRSF foundation footprint to inform its designs (**Appendix 31-D Waste Rock and Overburden Management Plan**). The foundation conditions generally consist of approximately 1 metre (m) of residual soil or colluvium underlain by weathered bedrock. Relatively competent bedrock is typically encountered within approximately 3 m of the ground surface. The Alpha WRSF will be constructed in an area of discontinuous permafrost, which may contain excess ice in some areas. The organic layer will be left in-place within the Alpha WRSF footprint to preserve the permafrost conditions, except where foundation soil conditions require removal to bedrock as determined by the results of the detailed geotechnical investigation and design studies, which are currently scheduled for 2017.

Due to its coarse particle size, the Alpha WRSF is anticipated to be free-draining and will allow water to pass through the waste rock without buildup of significant pore water pressures. An integral design component of the Alpha WRSF will be a rock drain that will allow surface water to pass beneath the WRSF. Where appropriate, surface water will be managed by a series of diversion channels around the facility as discussed in **Section 2.3.10 Site Water Management Infrastructure**.

The Beta WRSF will be constructed adjacent to the Kona pit, and will be located within the upper reaches of the Halfway Creek drainage basin. Although the waste rock from the Kona pit is NAG, a small area of ore exposed in the completed pit wall has weak potential acid generation (PAG) tendencies. To limit exposure of this ore seam to potential oxidation, the Kona pit will be backfilled with waste rock prior to closure. Backfilling will occur during the winter with frozen waste rock to re-establish permafrost in the Kona pit upon completion of mining in Year 11. The Beta WRSF will have a maximum height of 60 m and have a capacity of approximately 5 Mt or 1.5% of the total waste rock generated.

Design details for the Alpha WRSF and Beta WRSF are summarized in **Table 2.3-2**.

**Table 2.3-2 Waste Rock Storage Facility Design Details**

| WRSF | Maximum Height (m) | Area (ha) | Capacity (Mt) |
|---|---|---|---|
| Alpha WRSF | 320 | 210 | 250 |
| Beta WRSF | 60 | 11.3 | 5 |

Detailed information on foundation conditions, design details, physical stability analyses, and other design considerations including water management are presented in **Appendix 31-D Waste Rock and Overburden Management Plan.**

### 2.3.3 STOCKPILES

#### *2.3.3.1 Temporary Organics Stockpile*

During Mine Site construction, organic material and topsoil (an estimated average thickness of 30 cm) will be stripped from the footprint of the Open Pits, heap leach pad, foundations of other infrastructure, and other areas as may be required in detailed design and then stockpiled for reclamation purposes. The temporary organics stockpile located immediately north of the heap leach pad will be used for stockpiling this material until it is needed for site reclamation and revegetation activities. The temporary organics stockpile has been designed with a footprint of 16.3 ha and a maximum capacity of 2.1 million cubic metres ($Mm^3$) with side slopes at the angle of repose (approximately 1.7H:1V (horizontal to vertical). The current estimated total amount of organics to be stripped from the site is approximately 1.5 $Mm^3$, which includes a 15 percent (%) bulking factor. Sediment and erosion control measures will be put in place downslope of the temporary stockpile during stockpile development.

#### *2.3.3.2 Frozen Soil Storage Area*

Frozen soil that is not immediately re-used as fill will be deposited in a designated frozen soil storage area located adjacent to the Alpha WRSF. A total of approximately 1.9 $Mm^3$ of frozen soil is estimated to be excavated during construction of the mine (including bulking), of which approximately 0.2 $Mm^3$ will likely not be suitable for immediate re-use as fill during construction and will require storage in the frozen soil storage area. A waste rock berm will be constructed on the downhill slope of this storage area to enhance stability of the stored materials. Additional details regarding the design and operation of the frozen soil storage area will be developed as part of a Frozen Materials Management Plan (**Section 31.0**).

#### *2.3.3.3 Run of Mine Stockpile*

Ore transported from the Open Pits will either report directly to the Crusher System, or onto ROM stockpile, which will be located near the south edge of the Latte pit. Should it be determined that crushing is not necessary for some or all ore, ROM ore may be hauled directly to the HLF, thus bypassing the crushing circuit and ROM stockpile. Given that the Crusher System and HLF may not be operated during periods of extreme cold each year, the ROM stockpile will be used for temporary storage of ore from the Open Pits when necessary.

The stockpile has been designed with a maximum capacity of 1.5 Mt of ROM ore contained within a design footprint of 9.5 ha. To minimize potential effects of ARD associated with the ROM stockpile, the ROM pad will be lined and the drainage will be collected throughout mine life. Collected drainage will be used as process make-up water to minimize contact water that reports to the receiving environment.

The ROM stockpile will be constructed on top of a graded waste rock pad, from an average elevation of 1,125 masl up to 1,150 masl, resulting in an overall height of approximately 25 m for the ROM material. The waste rock and ROM material slopes will be at their natural angle of repose (approximately 1.5H:1V). A 20-m wide safety berm or offset will be left between the crest of the waste rock foundation pad and the toe of the ROM stockpile along the south side where the pad height will reach its maximum of 25 m. This will result in a maximum overall slope angle of approximately 2.0H:1V. The waste rock foundation pad will require approximately 2 Mt of material to construct.

### 2.3.4 Crusher System

A Crusher System, located south of Latte pit, will be employed to reduce the size of the ore. A two-stage crushing circuit will be used to create a final product size which is amenable to heap leaching of the ore. At start up, a heap feed size with a P80 (product size) of 50 mm will be used. Final product size may be adjusted during operations as heap performance is monitored and optimized. Crushed ore material will be mobilized to the HLF or stored in the fine ore stockpile, which has capacity for 3,000 tonnes (t) of ore, or stored in a fine ore hopper for direct truck loading.

The crushing plant is planned to operate at an average 18,200 tpd throughput rate, with a maximum of 25,000 tpd. During mine operation, this rate may increase as processes are optimized. Current estimates indicate that the crushing circuit will run for approximately 275 days per year; however, this will depend directly on the seasonal conditions each year and the amount of heat available in the HLF for processing. If conditions allow, crushing may be performed year-round.

### 2.3.5 Heap Leach Facility

The HLF will be located on the ridgeline to the west of the process plant, with the eastern edge of the leach pad located approximately 2 km west of the Latte pit. The HLF consists of a conventional heap leach pad, three event ponds, a rainwater pond, solution distribution (for delivery of barren solution to the heap), and collection piping (of pregnant solution and rinse water to the event ponds and process plant). The general arrangement of the HLF is provided in **Figure 2.3-4.**

Although the process plant, containing a conventional ADR plant for gold recovery, is part of HLF operation, this component is described separately below (**Section 2.3.6 Plant Site**).

#### *2.3.5.1 Heap Leach Pad*

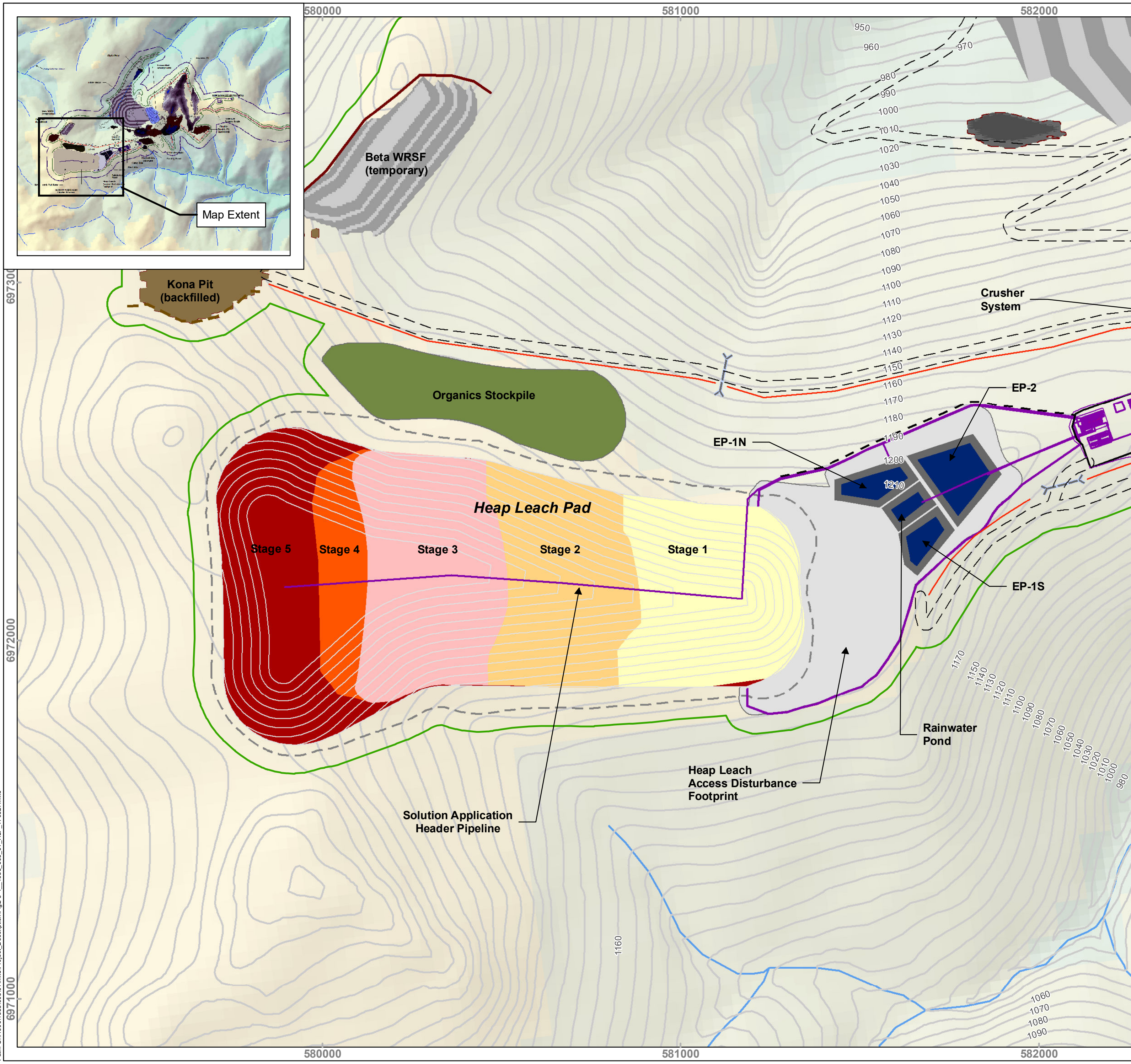
The heap leach pad will be a conventional, relatively level pad, constructed directly on bedrock or structural fill after the removal of topsoil and ice-rich material by grading the local terrain and using competent waste rock for fill that supports a multi-lift, free-draining heap. The results of geotechnical investigations, stability and settlement analyses, and the characterization of foundation conditions at the HLF are provided in **Appendix 2-C Engineering Studies**.

The heap leach pad design is based on staged construction with initial capacity of approximately 7.2 Mt expanding to the ultimate capacity of 67.3 Mt in five stages. Since only 60.1 Mt of ore are currently planned to be loaded on the HLF, the design capacity is greater than anticipated ore tonnage (**Figure 2.3-4**). For each stage, **Table 2.3-3** identifies the year of construction, the heap crest elevation, the pad area, and the cumulative capacity. The total surface area of the Stage 5 heap leach pad is designed to accommodate 67.3 Mt of stacked ore will be 971,700 m$^2$.

**Table 2.3-3 Design Details for Heap Leach Pad Stages**

| Heap Leach Pad Stage | Construction Year | Cumulative Pad Stage Area (m$^2$) | Pad Cumulative Capacity (Mt) | Heap Crest Elevation (masl) |
|---|---|---|---|---|
| 1 | Year -1 | 271,289 | 7.2 | 1270 |
| 2 | Year 1 | 498,116 | 19.2 | 1300 |
| 3 | Year 3 | 754,397 | 39.4 | 1340 |
| 4 | Year 7 | 819,050 | 47.3 | 1350 |
| 5 | Year 10 | 971,700 | 67.3 | 1370 |

The heap leach pad will be lined as described in **Section 2.5.7 Heap Leach Pad Construction**. The leach pad liner system was designed to collect process and rinse solutions and protect surface and groundwater quality through the operating life and after HLF closure.




COFFEE GOLD MINE

**Heap Leach Facility Layout**

## Legend

- Watercourse
- Project Footprint
- Heap Leach Pad Stage 1
- Heap Leach Pad Stage 2
- Heap Leach Pad Stage 3
- Heap Leach Pad Stage 4
- Heap Leach Pad Stage 5
- Heap Leach Pad Ultimate Footprint

## Notes

1. This map is not intended to be a "stand-alone" document, but a visual aid of the information contained within the referenced Report. It is intended to be used in conjunction with the scope of services and limitations described therein.
2. This is a cumulative disturbance figure showing the maximum extent of all mine site components for the duration of the mine life.

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| Figure 2.3-4 | Date: Mar 27, 2017 | Drawn by: JS | Reviewed: DP |
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The average heap height at full construction will be 50 m, with a typical maximum heap height of 60 m, and local maximum heights reaching approximately 80 m in some areas (as measured vertically above the leach pad liner). The liner and drainage systems are designed for much higher loads and thus the 80-m height is not a firm limit but rather a convenience of the geometry; principally, to provide ample room on the crest of the last lift for haul trucks to operate. As the heap is stacked, the side slopes will be benched such that the face of each lift is stacked at the angle of repose of the crushed ore (1.3H to 1.5H:1V), and benches between each lift will create an overall toe-to-crest slope angle of 2.5H:1V. Bench widths will vary between 12.0 m and 14.4 m depending on the angle of repose.

Because the heap will be free-draining with no in-heap solution storage, there will be no dams or embankments associated with the leach pad. The north and south halves of the leach pad are separated hydraulically; the south half slopes and drains to the southeast while the north half slopes and drains to the northeast. The pad will also contain north and south event and rain water channels in order to route water from the heap leach pad to the event ponds. The design also includes hydraulic separation of the leach solutions by cell (approximately every 100 m of pad in the east-west or long axis direction) and by stage (Stages 1 through 5). Each cell will be separated by a drainage ditch or berm, preventing solution in one cell from entering the adjacent cell. The stages will be separated in a similar way but with a larger berm to provide more definitive separation.

#### *2.3.5.2 Event and Rainwater Ponds*

Conventional external ponds for events and clean water storage from precipitation runoff will be constructed as storage volume requirements increase, as determined by the leach pad area. Small embankment dams will be used to create four ponds: the south event pond 1 (EP-1S), north event pond 1 (EP-1N), event pond 2 (EP-2), and the rainwater pond (**Figure 2.3-4**). The capacity of the ponds is summarized in **Figure 2.3-4**, along with the last year in which they may be constructed. This construction schedule may need to be accelerated if ore stacking exceeds the designed nominal 5 Mt per annum. Water will be routed from the heap leach pad to the event ponds via the north and south event and rain water channels. The event ponds are designed to contain a combination of upset conditions including:

- Heap draining during an extended power or pumping outage
- Extreme precipitation and freshet events
- Cumulative water storage during wet years or temporary shut-downs.

The rainwater pond is designed to temporarily store clean water diverted by the raincoats (described below) for use as makeup water during drier periods, as well as for freshwater for rinsing during progressive reclamation of the pad stages.

**Table 2.3-4 Event Ponds and Rainwater Pond**

| Pond | Construction Year | Storage Capacity (m³) |
|---|---|---|
| EP-1N | Year -1 | 112,349 (122,184) |
| EP-1S | Year -1 | 89,777 (97,810) |
| EP-2 | Year 6 | 222,874 (240,468) |
| Rainwater | Year 3 | 47,000 (51,925) |

**Note:** Storage capacity to freeboard elevation (to crest elevation)

### *2.3.5.3 Solution Distribution and Collection*

The processing of heap leach ore will entail the use of dilute cyanide solutions. Barren solution will be irrigated onto the heap using drip irrigation. The solution will be pumped at a nominal rate of 455 cubic metres per hour ($m^3$/hr) (design capacity of 600 $m^3$/hr) from the process plant. The pipeline, consisting of a carbon steel carrier pipe inside a fiberglass reinforced plastic containment pipe, will be buried to a minimum depth of 1.5 m below grade to prevent solution freezing.

Pregnant (gold-bearing) solution will be collected into the buried piping network at the base of the heap leach pad above the liner system, and will flow for approximately 1 km from the northern and southern sides of the HLF to the process plant by gravity for gold recovery or, in the case of an upset, the event ponds. The event ponds will be fenced to prevent access by animals. The pregnant solution carrier pipe, sized for a nominal flow rate of 455 $m^3$/hr (design capacity of 600 $m^3$/hr) will be installed within a containment pipe, and will be buried at a minimum depth of 1.5 m. These lines will be installed with a leak detection system that monitors air pressure in the annular void between the two pipes.

Rinse pipelines will be installed in the same trench as the barren and pregnant solution pipelines, and will be designed to handle a flow rate of 230 $m^3$/hr. The rinse pipelines will be utilized to transfer rinse solution between the plant and the heap leach pad, and will also provide standby piping for the barren and pregnant solutions.

### *2.3.5.4 Raincoat Covers*

During the Operation Phase and early in the Reclamation and Closure Phase, geomembrane covers referred to as raincoats will be used over the heap to reduce the volume of meteoric water infiltrating into the heap and entering the process solution, and to increase heat retention in the heap during the winter. The mine and HLF water balance will be actively managed through best management practices regarding raincoat use and timing of use. The raincoats will remain in use over portions of the heap until completion of the Reclamation and Closure Phase.

Progressive reclamation of the heap leach pad will entail rinsing individual sections of the heap leach ore once they have undergone the complete gold recovery cycle. The heap will be rinsed (via solution from the rinse pipelines) and capped in stages; as each stage is capped, the raincoats for that area will be removed and used in other areas or incorporated as part of the closure capping.

#### *2.3.5.5 Water Treatment Plant*

A water treatment plant will be required late in the mine life to treat heap leach rinse solutions, as a number of water quality parameters (e.g., copper, iron, uranium) are predicted to remain elevated in rinse solutions above both Metal Mining Effluent Regulation limits (Government of Canada 2016) and proposed water quality objectives for Halfway Creek. The water treatment plant will be located within the Plant Site pad either within an existing building, or in a dedicated building for this purpose. The proposed water treatment system will be a two-stage process. The first stage of the treatment process, which requires the addition of hydrogen peroxide to oxidize residual cyanide, requires a carbon or stainless steel tank with an agitator, as well as a dedicated metering pump to dose the tank with hydrogen peroxide. The tank effluent will flow by gravity to the second stage of the process, which is currently planned to utilize a biological reactor system termed Electrochemical Biological Reactor. Further details of the water treatment plant and Electrochemical Biological Reactor are provided in **Appendix 31-C Conceptual Closure and Reclamation Plan** and **Appendix 31-E Water Management Plan**.

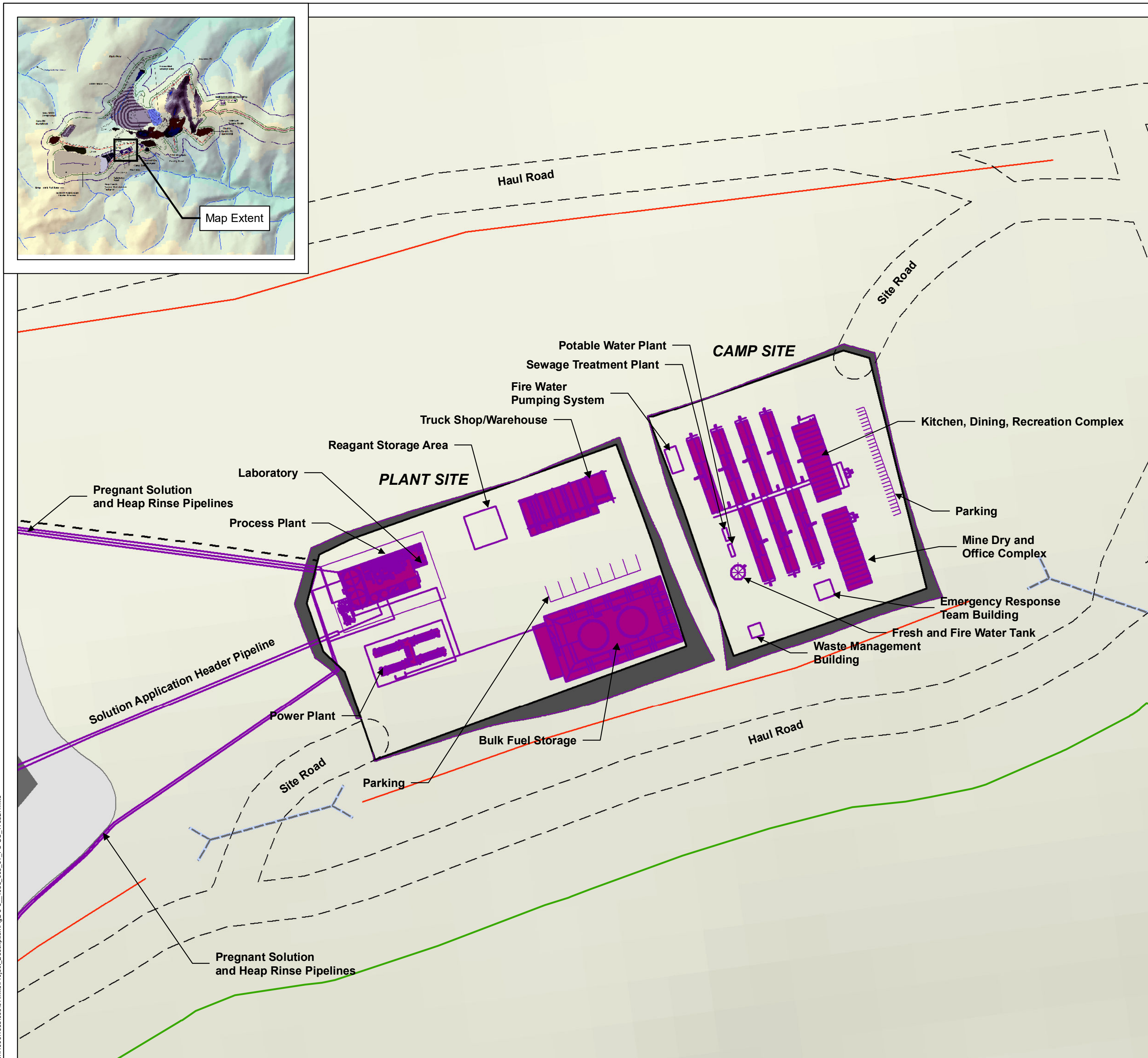
### 2.3.6 PLANT SITE

Infrastructure at the Plant Site includes the process plant, reagent storage area, laboratory, truck shop and warehouse building, power plant, and bulk fuel storage. The conceptual level Plant Site layout is shown in **Figure 2.3-5**, and a description of each component is provided below. Detailed engineering design has not been completed at this stage, and some buildings or other infrastructure may be relocated to elsewhere within the Project footprint. No changes are anticipated that will be affect the results of the effects assessment completed for the Project in this Project Proposal.

#### *2.3.6.1 Process Plant and Reagent Storage Area*

The process plant will be located adjacent to the HLF to minimize pumping and pipeline requirements for pregnant and barren solutions. The process plant will be founded on competent bedrock and/or engineered fill to eliminate the potential for differential settlement.

The process plant building will house the barren solution, pregnant solution, raw water, and rinse water tanks, the carbon-in-carbon (CIC) ADR circuits (including a secure limited-access gold room), a control room and office, and a laydown area, as shown in the conceptual-level layout provided in **Figure 2A-2** in **Appendix 2-A.** The process plant will have concrete walls around all tanks containing cyanide and other reagents. The containment of the concrete walls will include a minimum of 110% of the largest tank volume. There will also be additional containment around the acid wash, strip, and reagent mixing areas. Tank and column loads will be supported on pads and pedestals. The plant will be equipped with an overhead crane for equipment maintenance, as well as dust control and fume extraction systems.




# COFFEE GOLD MINE

## Plant Site and Camp Site Layouts

### Legend

- Watercourse
- Project Footprint
- Culverts
- Road Drainage Ditch
- Event Pond Slope
- Heap Leach Access Disturbance Footprint

### Notes

1. This map is not intended to be a "stand-alone" document, but a visual aid of the information contained within the referenced Report. It is intended to be used in conjunction with the scope of services and limitations described therein.
2. This is a cumulative disturbance figure showing the maximum extent of all mine site components for the duration of the mine life.

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Process reagents (i.e., sodium cyanide briquettes, sodium hydroxide, and hydrochloric acid and anti-scalant solutions) will be stored in the plant. Other reagents will be stored to the east of the process plant in an area designated for reagent storage. Further details of reagent storage and handling will be developed as part of a Hazardous Materials Management Plan (**Section 31.0**). Laydown areas for major process plant consumables are described in **Section 2.3.11.3 Laydown Areas**.

The process plant will be heated by a combination of waste heat from the power plant (see **Section 2.3.6.4 Power Plant**) along with heat captured from the barren solution boiler, located adjacent to the process plant building. The boiler is designed to heat the solution by 8 degrees Celcius (° C) to provide a minimum discharge temperature at the heap leach pad drip emitters of 6° C. Redundancy for process plant heating will come from a truck shop bypass line that allows the truck shop to be isolated from the power plant waste-heat recovery loop. By isolating the truck shop, it will be possible to direct the heat to the process plant if the barren solution boiler is not operational.

#### *2.3.6.2 Laboratory*

A small laboratory will allow for the testing of samples from exploration, mining, processing activities, oil analysis, as well as minor environmental testing (e.g., total suspended solids monitoring from water samples). Environmental samples for major environmental testing will be sent off-site to an accredited laboratory for third-party analysis and reporting. The laboratory will be equipped to perform sample preparation and assays by atomic absorption, fire assay, and cyanide soluble analyses. A metallurgical test work area will also be included for process optimization.

#### *2.3.6.3 Truck Shop and Warehouse Building*

A truck shop and warehouse will accommodate facilities for repair and maintenance of mining equipment and light vehicles, and as a warehouse for spare parts, consumables, and other materials and equipment. The truck shop is designed with service bays with the capacity to service and repair major mining equipment. The shop facilities will also include a wash bay, which will use recirculated water. If excess water is produced from the wash bay, it will be run through an oil-water separator and discharged to Latte pit or a HLF event pond. The facilities will include automatic hose reels for dispensing engine oil, transmission fluid, hydraulic oil, air, solvent, diluted coolant, and grease. The truck shop will be equipped with an overhead crane. The building is planned to be heated by glycol air handlers and unit heaters. As a contingency, waste oil heaters may also be used.

#### *2.3.6.4 Power Plant*

A power plant capable of continuously generating at least 3.5 megawatts of electrical power will be installed with N+2 redundancy to allow for reliable operations. Each generator will be 1 megawatts or larger, and will be capable of burning both diesel and natural gas fuels. The power plant will consist of the electric generators, electrical switchgear, control systems, and waste heat recovery equipment. The generators will be housed in a sound-attenuated enclosure. The estimated electrical energy requirements at the Mine Site for peak loads, average annual, summer, and winter loads, as well as annual loads are summarized in **Table 2.3-5**. Power will be distributed throughout the Mine Site at an appropriate distribution voltage via five distribution feeders, including two spare positions.

**Table 2.3-5 Mine Site Electrical Energy Requirements**

| Mine Site Component | Connected (kW) | Peak (kW) | Average Annual (kW) | Average Summer (kW) | Average Winter (kW) | Energy Annual (000 kWh) |
|---|---|---|---|---|---|---|
| Ore Crushing and Handling | 1,578 | 1,219 | 669 | 886 | 8 | 5,861 |
| Process Plant | 2,603 | 1,227 | 825 | 805 | 886 | 7,227 |
| Other Mine Site Infrastructure | 1,344 | 833 | 684 | 681 | 692 | 5,988 |
| **Total** | **5,525** | **3,278** | **2,178** | **2,371** | **1,585** | **19,075** |

**Note:** kW – kilowatt

During normal power plant operation, genset waste-heat recovery units will be used to heat buildings. Additional temporary heating units will be installed at the camp and power plant, if required, to meet peak winter demands.

As detailed Project engineering related to power generation is advanced, the Proponent will continue to look for opportunities for sustainable power including, but not limited to solar, wind, or biomass.

Due to the isolated nature of some infrastructure, such as the sedimentation ponds and the airstrip, some localized small-scale power generation may be required, which will be independent of the larger mine power distribution system. The details of the needs for these infrastructure components will be determined in detailed design and are not anticipated to materially affect the assessment.

#### *2.3.6.5 Bulk Fuel Storage*

Fuel required for mine operations will be stored in 4 million litre (L) field-erected diesel tanks and up to 500,000L liquefied natural gas (LNG) bullet tanks. Fuel storage capacity has been designed for a 15-week period of diesel and LNG consumption at full production to supply mining and ancillary equipment, and power generation. This capacity accommodates the periods when no fuel deliveries by road to site are possible. Since no river access will be possible during fall freeze-up (approximately six weeks) and spring thaw (approximately four weeks), the mine plan provides for on-site storage of a sufficient supply of fuel and consumable materials during these periods.

The fuel tank farm bund (a type of constructed retaining wall) will be lined with high-density polyethylene (HDPE) for spill containment. Fuel-dispensing equipment for mining, plant services, and freight vehicles will be located adjacent to the fuel tank bund, and the fuelling area will drain into the bund. A fuel transfer module will provide fuel to the power plant day tank and consumers in the process plant. The conceptual fuel tank farm layout and cross-section drawings will be developed during detailed design. Fuel containment areas may at times accumulate water, which will be emptied periodically and recycled through the truck wash system in the truck shop.

### 2.3.7 CAMP SITE

Camp accommodations, the mine dry and office complex, and the emergency response and training buildings are anticipated to be modular units, which will be located along the ridge top between the Plant Site and the Crusher System. The camp and other buildings will comply with building and fire code requirements (e.g., National Fire Code of Canada, National Building Code of Canada), as well as highway transportation size restrictions. Buildings will be set back a minimum of 10 m from the crest of fill slopes.

A conceptual Camp Site general arrangement is provided in **Figure 2.3-4**, and a description for each of the main components of the Camp Site is provided below. Conceptual layouts of the dormitories, kitchen and recreation buildings, and office buildings will be developed during detailed design.

#### *2.3.7.1 Camp Facilities*

Camp accommodations, consisting of single-occupancy rooms with central washrooms, are planned to include several dormitory wings and centralized kitchen, dining, and recreation buildings that will include a complete kitchen, dry food storage, walk-in freezer-cooler, dining room, first-aid room, mudroom, housekeeping facilities, reception desk, lobby, and recreation area. The camp facilities will allow for a maximum of 400 persons.

#### *2.3.7.2 Mine Dry and Office Complex*

The single large mine dry and office complex will connect to the core camp facilities via Arctic corridors. The mine dry will be capable of accommodating a full shift of workers during shift change, with separate male and female facilities, including clean and dirty lockers and washroom facilities. The office will contain a large open office area, private offices, a boardroom and meeting rooms, and a mine operations line-up area.

#### *2.3.7.3 Communications System*

Office operations and the site in general will be supported by a site-wide communication system to create a safe and efficient operating environment. Communications are planned to be facilitated by a microwave communications link to the Whitehorse-Dawson fiber backbone, which will be backed up by satellite internet connectivity, Voice over Internet Protocol phones, ultra-high frequency radio, high-precision global positioning system (GPS), and a wireless network. A digital radio system consisting of handheld, mobile, and base digital radios will provide wide-area communications coverage.

#### *2.3.7.4 Emergency Response Team Building*

An emergency response building will be located adjacent to the mine dry and office complex. The building will house an ambulance and a fire truck. An emergency medical responder on site 24 hours a day to provide emergent care. Additional information regarding emergency response infrastructure and equipment will be developed as part of an Emergency Response Plan (**Section 31.0**).

#### *2.3.7.5 Potable Water and Fire Water Infrastructure*

Fresh water supplied from wells (to be developed) at the current exploration camp will be transported by a water truck to the fresh and fire water tank at the Camp Site. Fresh water may also be sourced from the creeks surrounding the Project site. Fire water will be drawn from the bottom of the tank. A potable water well closer to the Project site may also be developed.

Water will be pumped from the fresh and fire water tank to the potable water treatment plant. Potable water treatment will consist of filtration, ultra violet disinfection, and chlorine disinfection. Treated water from the potable water treatment plant will be stored in an insulated and heated potable water storage tank capable of accommodating potable water demand variances for distribution to camp, office, plant, and mine dry facilities as needed. The capacity of the potable water treatment plant will be sufficient to treat 90,000 L per day and is currently designed to support 300 people based on an average consumption of 275 L per person per day.

#### *2.3.7.6 Waste Management Infrastructure*

In addition to waste material or water generated from mining and ore processing activities, several types of waste will be generated during the Project, including hazardous and non-hazardous wastes, recyclable materials, contaminated soil, and sewage. A summary of waste management infrastructure is provided below and additional details will be developed as part of a Waste Management Plan (**Section 31.0**).

A waste management area, located near the Alpha WRSF or airstrip, will be used for sorting waste and recyclable materials. Some waste sorting will occur at the Camp Site in a designated area prior to transportation to waste management area. Food waste from the kitchen facilities will be segregated and either incinerated at least daily to minimize wildlife attraction associated with the disposal of food waste, or composted in a suitably designed facility.

The waste management area will include the landfill, land farm (for storage and treatment of hydrocarbon-contaminated soil), and waste incinerator, which will be located outside of the Camp Site near the Alpha WRSF or airstrip. They are briefly described here as they support waste management activities. Details on these supporting areas are as follows:

- Both the landfill (for the disposal of non-hazardous and non-recyclable waste materials) and the land farm (for the storage and aeration of hydrocarbon-contaminated materials) will be placed on pads constructed from overburden material removed during site earthworks at other Mine Site areas.

- The land farm will consist of HDPE-lined cells to allow active treatment of contaminated soil and snow.
- A dual-chamber and diesel-fired waste incinerator will be located at the waste management area. It will be capable of burning all daily site waste, with design capacity based on a maximum of 300 people, each generating 3 kilograms of waste per day, or a total of 900 kilograms per day.

#### *2.3.7.7 Sewage Treatment Plant*

The sewage treatment plant will be pre-assembled prior to transportation to and installation at the Camp Site. Sewage will be treated by a membrane bioreactor plant that includes influent screening, an equalization and bioreactor tank (to handle the daily peaks in flow), a membrane system, a treated effluent storage tank, and ultra-violet disinfection. The treated effluent will be regularly tested prior to being discharged to Halfway Creek.

Sewage treatment plant sludge will be disposed of in a way that will not be an attractant to wildlife or pose any human health risk, either through the waste incinerator, burial in a landfill cell, deposition to existing sewage lagoons, or potentially used in the compositing facility to create additional quality soil for reclamation.

### 2.3.8 BULK EXPLOSIVE STORAGE AREA

Explosives storage at the Project site will consist of three main components: bulk ammonium nitrate (AN) storage, bulk emulsion storage, and explosive storage magazines. The location of the approximately 3-hectare area and the layout of the components within the area are shown on **Figure 2A-3** in **Appendix 2-A**. The storage facilities are designed according to government regulations, including explosive material separation distances outlined by the Explosives Regulatory Division of Natural Resources Canada (Government of Canada 2015).

The AN storage area is sized to allow for 15 weeks of storage or a maximum of 3,075 tonnes of AN prill (pellets), and will be lined with a HDPE liner to provide spill containment. Bulk AN prill will be shipped to site either in 25-t bulk transport trailers or in 1-t tote bags. When the NAR is open, AN prill will be shipped in trailers and stored in the AN silo at the AN facility. Sufficient quantities of AN prill will be stockpiled in tote bags at the AN facility prior to the close of the NAR during freeze-up and break-up to allow for ongoing blasting operations during these periods. The tote bags will be moved from the AN storage area and transferred into the AN silo via an auger system, as required.

Bulk emulsion product required for open pit blasting will be shipped to site in 20-t tanker trailers and offloaded, either into the 60-t emulsion silo located at the AN storage facility or into 20-foot (ft.) ISO containers located at the emulsion storage area.

Packaged explosives and explosive detonators will be stored in approved explosive magazines located on separate pads. The powder magazine will be a 40 ft. container magazine capable of holding 32 tonnes of explosives while the cap magazine will be a 20 ft. container magazine capable of holding approximately 600 cases of detonators. Each magazine will be surrounded on three sides with earthen berms to prevent movement and significantly reduce the separation distances from other areas of the mine operations.

### 2.3.9 Mine Site and Haul Roads

The Mine Site road network will include a total of approximately 37 km of mine site haul roads, including the roads used by site personnel to access Mine Site areas and the airstrip. While staying within the overall Project footprint, the exact layout and location of haul roads will be modified as required during mine construction and operations to facilitate safe travel of light and heavy vehicle traffic around the Mine Site.

#### *2.3.9.1 Mine Site Roads*

Mine Site roads will be used for smaller vehicles (e.g., light trucks) to access the airstrip, Bulk Explosive Storage Area, and other site infrastructure. The mine site roads, which are designed for light and medium trucks, will be constructed with embankment (rock) fill material with a minimum travelling surface width of 8 m and a maximum grade of 8%. Road bed material thicknesses will depend on existing ground conditions. The embankment material will be sourced from infrastructure earthwork activities or from Open Pit waste material.

#### *2.3.9.2 Haul Roads*

External pit haul roads will be used by mining equipment and heavy-duty vehicles to access the open pits, ore crusher, ROM stockpile, WRSFs, and HLF. To the extent possible, these roads will be constructed using all-fill techniques to achieve design alignment and grade, with NAG material sourced from the open pits. The haul roads will be a designed width of 30 m, and the depth of roadbed material will vary depending on the existing ground conditions.

### 2.3.10 Site Water Management Infrastructure

As described in **Section 4.0 Project Setting** and shown in **Figure 2.3-1**, surface water near the Mine Site is located near the headwaters of three watersheds, including Halfway Creek, YT-24, and Latte Creek. Surface drainages within the Mine Site are limited to small seeps and springs, which may be encountered during mine development. This section describes the water management system that will be used to attenuate and control surface runoff originating from Mine Site components, with the exception of infrastructure for managing contact and non-contact water at the HLF (see **Section 2.3.5 Heap Leach Facility**). Details of erosion and sediment control practices that will be used for the Project will be developed as part of an Erosion and Sediment Control Plan (**Section 31.0**).

The water management system configuration within the Mine Site is shown in **Figure 2.3-6** and includes conveyance structures (e.g., diversion channels, diversion berms) and sedimentation ponds. Non-contact water is diverted away from mine infrastructure to the extent possible to reduce infiltration into WRSFs and pit inflows, while contact water is intercepted and conveyed by conveyance structures to sedimentation ponds and pit lakes. Descriptions of conveyance structures and sedimentation ponds are provided below.

#### *2.3.10.1 Conveyance Structures*

Four types of conveyance structures are included in the Mine Site design, based on the location of the structure and its purpose:

- Waste rock perimeter collection channels
- Drainage ditches
- Diversion berms
- Waste rock bench diversion ditches

Typical cross-sections are provided in **Figure 2A-4** in **Appendix 2-A**. Additional design information is provided in **Appendix 31-E Water Management Plan.**

***Waste Rock Perimeter Collection Channels***

The waste rock collection channels will be situated around the perimeter of the WRSFs, and will be excavated into existing ground. These collection channels will collect waste rock runoff and captured flows and divert to the downstream sedimentation ponds.

Each channel will be constructed prior to waste rock placement as needed. Overburden material will be stripped from the existing ground as part of WRSF preparation. The channel will be excavated into the underlying material and the stripped overburden material will be placed to form a small berm downgradient of the excavation limits. This berm will be capped with stripped organic soils.

The channel excavation footprint will be lined with a nonwoven geotextile, followed by a layer of riprap. The riprap thickness will be two times the median rock size diameter. Further design details will be developed during detailed design.

***Drainage Ditches***

Mine site and haul roads will be sloped inwards. Runoff from these roads will drain across the roads to the upgradient side slope, where the drainage ditch will run parallel to the road. These ditches will direct runoff to a downgradient conveyance structure, such as a culvert, or in some cases, an open pit. Best management practices will be applied along roads to reduced erosion.

Drainage ditches will be excavated into the original ground at the toe of the haul road embankments, in a similar fashion to the waste rock perimeter collection channels being located at the toe of the WRSFs. The ditches will be designed with a minimum channel depth and width of 1.0 m. A non-woven geotextile will be placed along the top of the exposed soils, followed by a layer of riprap.

***Diversion Berms***

Non-contact water will be diverted around the Double Double Pit, Kona Pit, and upgradient of the rock drain under the Alpha WRSF by a diversion berm, and discharged towards the valley bottom. The diversions will consist of either building a berm on the natural slope or creating a v-notch channel on natural ground. The Alpha WRSF diversion berm along the west toe of the facility will be formed by an access road to the Alpha Pond. The berms will be built after stripping the organic top soils and a layer of riprap will be placed along the berm face and channel bottom to reduce erosion of natural soils.

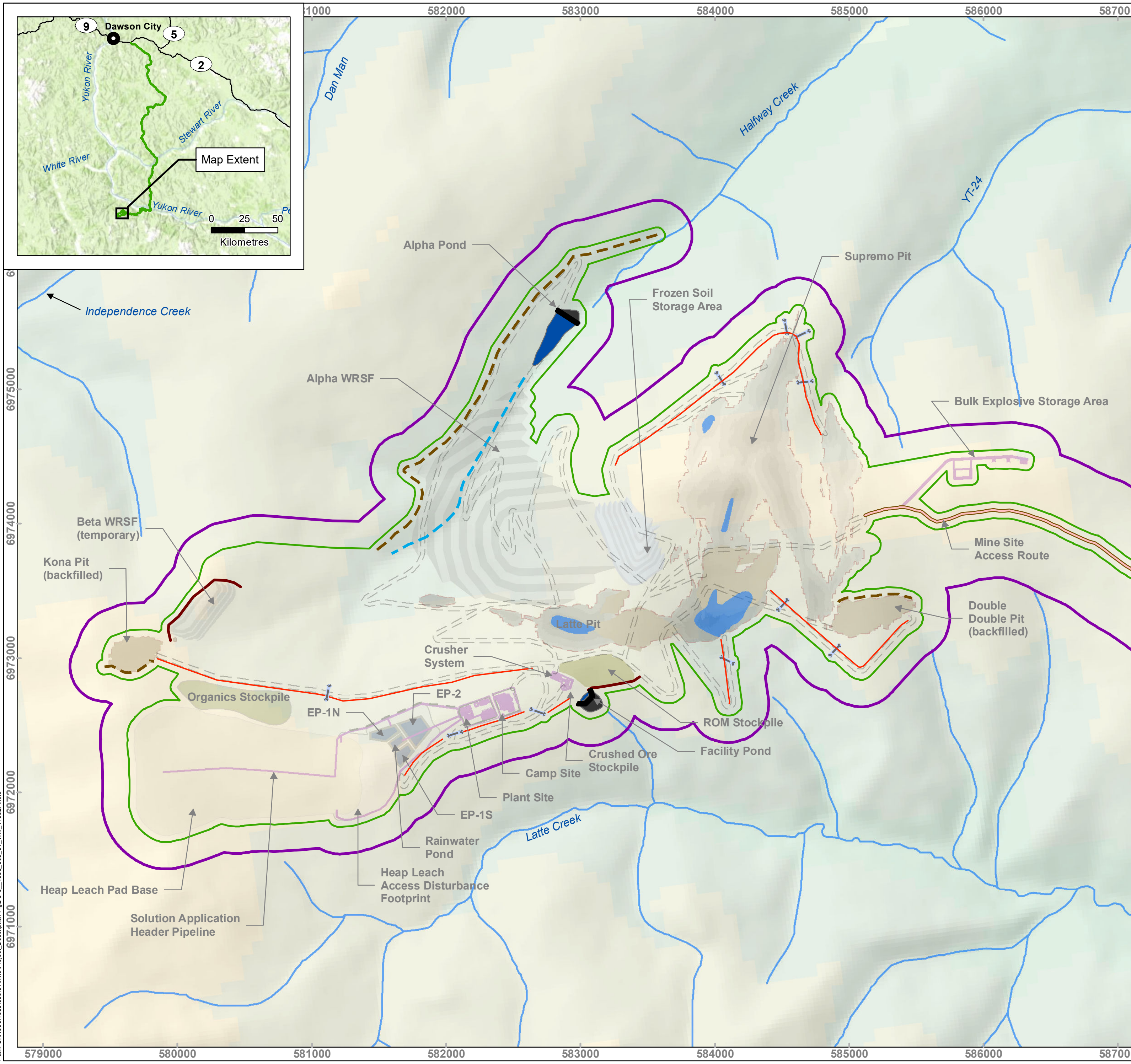
***Waste Rock Bench Diversion Ditches***

The benches on the WRSFs will be designed to slope inwards away from the WRSF crests. Runoff will be concentrated along the inside of each bench and prevented from running over the WRSF face by a series of diversion berms, creating the waste rock bench diversion ditches. Runoff will be diverted to the perimeter of the WRSFs and collected in the waste rock toe collection channels at the WRSF perimeter. Maintaining this drainage pattern during operations may be challenging, and a variation of channels and berm cuts directing runoff down the WRSF face may be considered for minor runoff volumes. The channels will have a v-shaped cross section, and will have a minimum slope of 1% towards the waste rock perimeter collection channels.

#### *2.3.10.2 Sedimentation Ponds*

Surface runoff within the Mine Site will be directed via conveyance structures to the Alpha and Facility sedimentation ponds, both located downstream of proposed mining areas. These ponds will settle the total suspended solids (TSS) load prior to discharge, and reduce the peak discharge rate of a storm by attenuating (storing and releasing) runoff and discharging it at a lower peak rate. Information regarding discharge values is included in **Appendix 31-E Water Management Plan**.

The Alpha and Facility sedimentation ponds will consist of an embankment (dam), a storage basin, an outlet, and an emergency spillway. The dams will be constructed of ROM rock or locally sourced material. The upstream faces of the dams will be lined with an impervious liner, which will be covered by a fine-grained material, and a layer of riprap will also be placed on the upstream face.




# COFFEE GOLD MINE

## Mine Site Layout with Water Management Infrastructure

### Legend

- Watercourse
- Project Footprint
- Project Area
- Total Pit Outline
- WRSF Slope
- WRSF Bench
- Backfill
- Pit Lake
- Organics Stockpile
- ROM Stockpile
- Heap Leach Access Disturbance Footprint
- Heap Leach Pad Base
- Support Infrastructure
- Mine Site Access Route
- Haul Roads
- Culverts
- Pond Berm
- Diversion Channel
- Road Drainage Ditch
- Underdrain
- Collection Channel
- Event Pond
- Event Pond Slope
- Sedimentation Pond Dam
- Sedimentation Pond

### Notes

1. This map is not intended to be a "stand-alone" document, but a visual aid of the information contained within the referenced Report. It is intended to be used in conjunction with the scope of services and limitations described therein.
2. This is a cumulative disturbance figure showing the maximum extent of all mine site components for the duration of the mine life.

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The volume of runoff collected by the ponds will vary, depending on a combination of factors, including seasonal conditions, the stage of Mine Site development, and the nature of on-site activities. The drainage area and capacity of the ponds are summarized in **Table 2.3-6**. The Alpha Pond has the capacity to hold the 100-year freshet flow while discharging water at a maximum rate of 5,000 gallons per minute. The Facility Pond has been sized to accommodate a volume greater than the expected one-day rainfall (i.e., volume of water equal to the 10-year, 24-hour storm event runoff volume), which will allow for extended water retention and increased settlement of TSS.

**Table 2.3-6 Drainage Area and Capacity of Sedimentation Ponds**

| Sedimentation Pond | Drainage Area ($km^2$) | Required Storage Volume ($m^3$) |
|---|---|---|
| Alpha | 6.27 | 357,400 |
| Facility | 0.32 | 9,400 |

The ponds will retain runoff volumes by controlling outflow, and will also allow runoff volumes for the 10-year, 24-hour storm event to remain for a minimum of 48 hours[1]. The TSS load during larger runoff events will be managed by adding flocculent at the pond inlet, if necessary, to enhance settling (refer to **Appendix 31-E Water Management Plan** for more information on flocculent use). If necessary, sediment accumulated within the pond will be removed periodically and transported either to dedicated cells within the WRSF or to pits in which mining activity has ceased.

### 2.3.11 ANCILLARY INFRASTRUCTURE

Ancillary components include the NAR, airstrip, laydown areas, and the Coffee exploration camp.

#### *2.3.11.1 Northern Access Route*

The NAR will be operated on a year-round basis except for periods when the Stewart River and Yukon River are either freezing up in the fall through early winter or breaking up in the spring. During the open-water period, barges will be utilized to ferry transport trucks delivering fuel and freight across the Stewart and Yukon Rivers. During the winter months when the rivers are frozen, ice crossings will be used to enable transport trucks to drive across the rivers.

The NAR consists of an all-season road that extends approximately 214 km from the junction of the North Klondike Highway and Hunker Creek Road, 16 km southeast of the City of Dawson to the Project airstrip on the south side of the Yukon River. The route crosses the Stewart and Yukon Rivers by barge in the summer and ice road in the winter. The NAR will follow 62.7 km of existing Yukon government-maintained road to the Sulphur-Dominion Junction, and will then follow approximately 100 km of existing placer mine

[1] Detailed design of riser pipes and orifice sizing will take place once the pond configurations have been finalized after a detailed geotechnical investigation of the subsurface in the proposed dam locations.

roads (where upgrades will be conducted to improve road user safety, and provide all-season access). Approximately 37 km of new roads will be constructed to support Project Construction, Operation, and Reclamation and Closure Phase activities.

The upgraded and newly constructed sections of the NAR road will primarily consist of a single-lane road with pullouts that will support two-way traffic. The finished road will have a width of approximately 5 m, and maximum gradients of between 8% and 10%, and design speeds will be between 30 km per hour and 50 km per hour, depending on the terrain. In addition, the NAR will require barge and ice road crossings at the Stewart and Yukon rivers.

Four barge landings will be required on either side of the Stewart and Yukon rivers. Each barge landing consists of a concrete ramp for docking of the upstream-facing barge. The ramp will be on a grade that will help minimize stream bottom interference. Each barge landing will have an industrial site to allow for a B-Train tractor-trailer configuration to easily embark and disembark from the barge then to proceed onto the road. Industrial sites will also allow for storage of the barge, maintenance supplies, and emergency response materials.

On the southern bank at each barge crossing, barge fuel will be stored in a single 20,000-L double-walled tank that will be placed a minimum of 30 m from the waterline inside HDPE-lined berms. The fuel tank will be filled by fuel trucks as required.

Two barges will be operated, one on the Stewart River and the other on the Yukon River. Each barge will be operated by a certified captain and a labourer assistant. They will not operate during the estimated six-week period during freeze-up prior to ice road use, or when the ice is breaking up in the spring.

Ice roads will be established annually during LOM to allow for winter river crossings, as detailed in **Section 2.5.1.4.** In conjunction with the ice road on the Yukon River, a 4.1-km-long winter road located south of the Yukon River will be constructed annually. The winter road on the south side of the Yukon River will be constructed seasonally from the east side of the bridge crossing Coffee Creek to the barge landing on the south side of the Yukon River. Since no river access will be possible during fall freeze-up and spring thaw, the mine plan provides for on-site storage of a sufficient supply of fuel and consumable materials during these periods.

Detailed information pertaining to design criteria and specific requirements for route construction and operation (including barge landings and barge operation, and ice and winter road construction and operation) are provided in **Appendix 31-A Access Route Construction Management Plan** and **Appendix 31-B Access Route Operational Management Plan**, respectively.

#### *2.3.11.2 Airstrip*

Air transportation will be the primary means of transportation for Mine Site personnel and incidental freight. Fixed wing aircraft will be chartered from Whitehorse or the City of Dawson for delivery of bulk freight on an as-needed basis (e.g., for catering supplies during periods when the NAR is closed). Site personnel will be mobilized to site from Whitehorse and Dawson.

A 1,220-m-long by 35-m-wide all-weather airstrip will be located approximately 7 km east of the Camp Site. The airstrip is designed to accommodate turboprop passenger aircraft (Hawker Siddeley 748 or similar), as well as cargo aircraft (de Havilland DHC-5A Buffalo or similar). The taxiway to the apron area will be approximately 10 m wide with 6-m-wide graded areas on each side. The apron will be large enough to maneuver and park two aircraft. A pre-fabricated modular operations centre containing radio equipment for ground-to-air communications will be located on the airstrip apron.

The airstrip will be equipped with a GPS Instrument Approach system allowing for instrument flight rules approaches and departures under suitable weather conditions. Lighting will include runway edge lighting, taxiway edge lighting, precision approach path indicators, and an omni-directional approach lighting system. A dedicated diesel generator located at the flight operations centre will provide power for airstrip operations; alternative power generation options for airstrip operations will be evaluated during detailed design, and may include renewable power, if feasible.

The existing airstrip on site near the Coffee exploration camp will also be maintained and used in the event that inclement weather prevents the use of the main airstrip. This additional airstrip will allow for increased worker safety and operational flexibility.

#### *2.3.11.3 Laydown Areas*

Laydown areas for major process plant consumables will be located to the west of the truck shop building and at the crusher area. Materials that do not require protection from the elements may be stored in the area south of the reagent storage area. Additional laydown areas will be created as needed, but will not exceed the laydown areas presented in **Figure 2.3-1**.

#### *2.3.11.4 Coffee Exploration Camp*

The existing permitted exploration camp near the Yukon River (Quartz Mining Licence #LQ00312) will be used to accommodate personnel working on the Mine Site until the camp facilities are operational at the Camp Site. The exploration camp will continue to be maintained to allow for the potential use of the site for accommodating exploration personnel, contractors, visitors, recreation, or for cultural events and activities.

## 2.4 PROJECT PHASES AND SCHEDULE

The Project phases are defined as follows:

- Construction Phase: Q2 Year –3 to end of Year –1 (30 months)
- Operation Phase: Year 1 to end of Year 12 (12 years)
- Reclamation and Closure Phase: Year 13 to end of Year 23, including a 6-year Post-mining Closure Stage and a 5-year Active Closure Stage (11 years)
- Post-closure Phase: Year 24 onwards as determined to be required.

The overall Project schedule is provided in **Figure 2.4-1**, and detailed schedules specific to each of the Construction, Operation, and Reclamation and Closure Phases are described in **Sections 2.5** to **2.7**, respectively. These phases broadly describe the activities occurring within a particular time period; however, some activities will continue from one phase to another as Mine Site development advances with operational activities (e.g., Open Pits, WRSFs). When areas that support mine operations are no longer required, they will be progressively reclaimed, as described in **Section 2.6.7 Operational Closure Activities**.

The overall Project schedule outlined is the expected scenario for mine construction and operation; detailed activities are subject to change depending on detailed mine planning and the timing of receipt of authorizations.

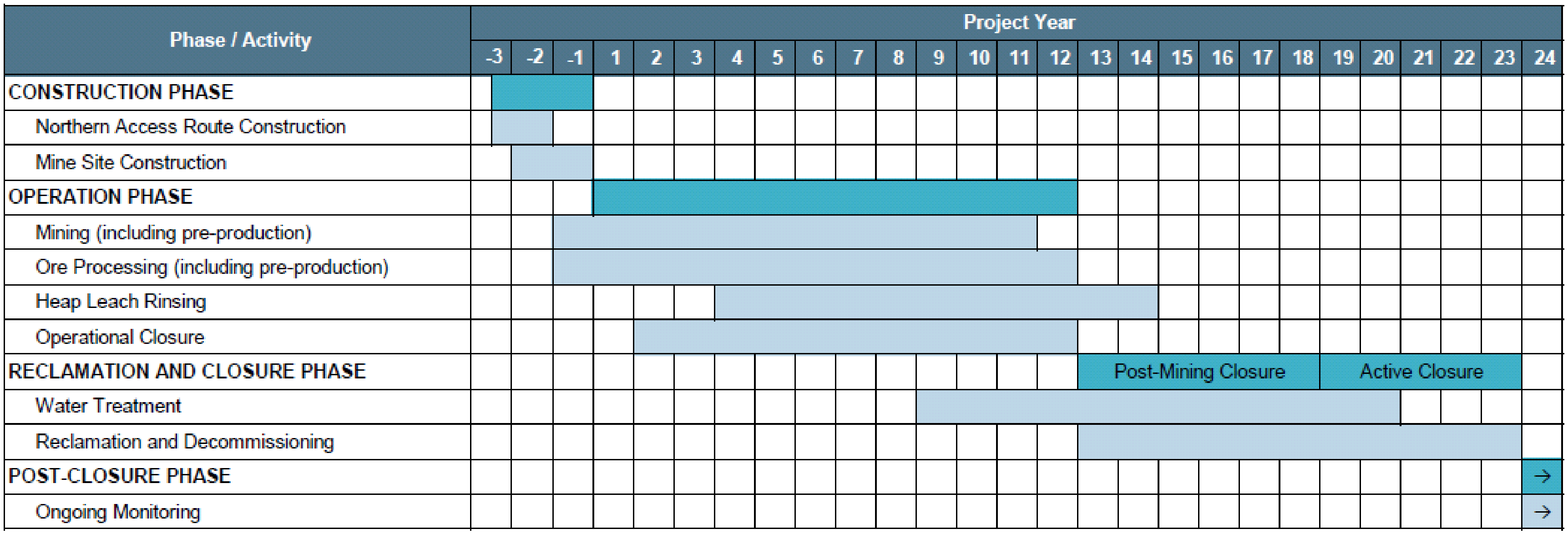



**Figure 2.4-1 Schedule of Key Activities by Project Phase**

## 2.5 CONSTRUCTION PHASE ACTIVITIES

The Construction Phase of the Project is expected to commence in Q2 of Year –3 and will be completed by the end of Year –1. The anticipated duration of construction is approximately 30 months, with the initial stage of construction focused on NAR construction as it is the primary means by which equipment and materials required for Mine Site construction will be delivered to site. The start of construction and installation of infrastructure at the Mine Site is planned for the second quarter of Year –2.

Key activities during the Construction Phase are summarized by Project component in **Table 2.5-1.** Clearing and grubbing of the Mine Site in Year –2, as well as pre-production mining activities in Year –1, are intended to provide sufficient material for on-site construction (e.g., as foundation and fill material for roads and other infrastructure), and an estimated 3.5 Mt of ore for heap leach start-up. Although pre-production activities and activities associated specifically with mining and processing will occur during the Construction Phase, information pertaining to these activities is provided in **Section 2.6 Operation Phase Activities**.

The layout of the Mine Site at the end of the Construction Phase is shown in **Figure 2.5-1**. Construction Phase activities associated with the main Project components are described in the following subsections in the general order in which they will be conducted.

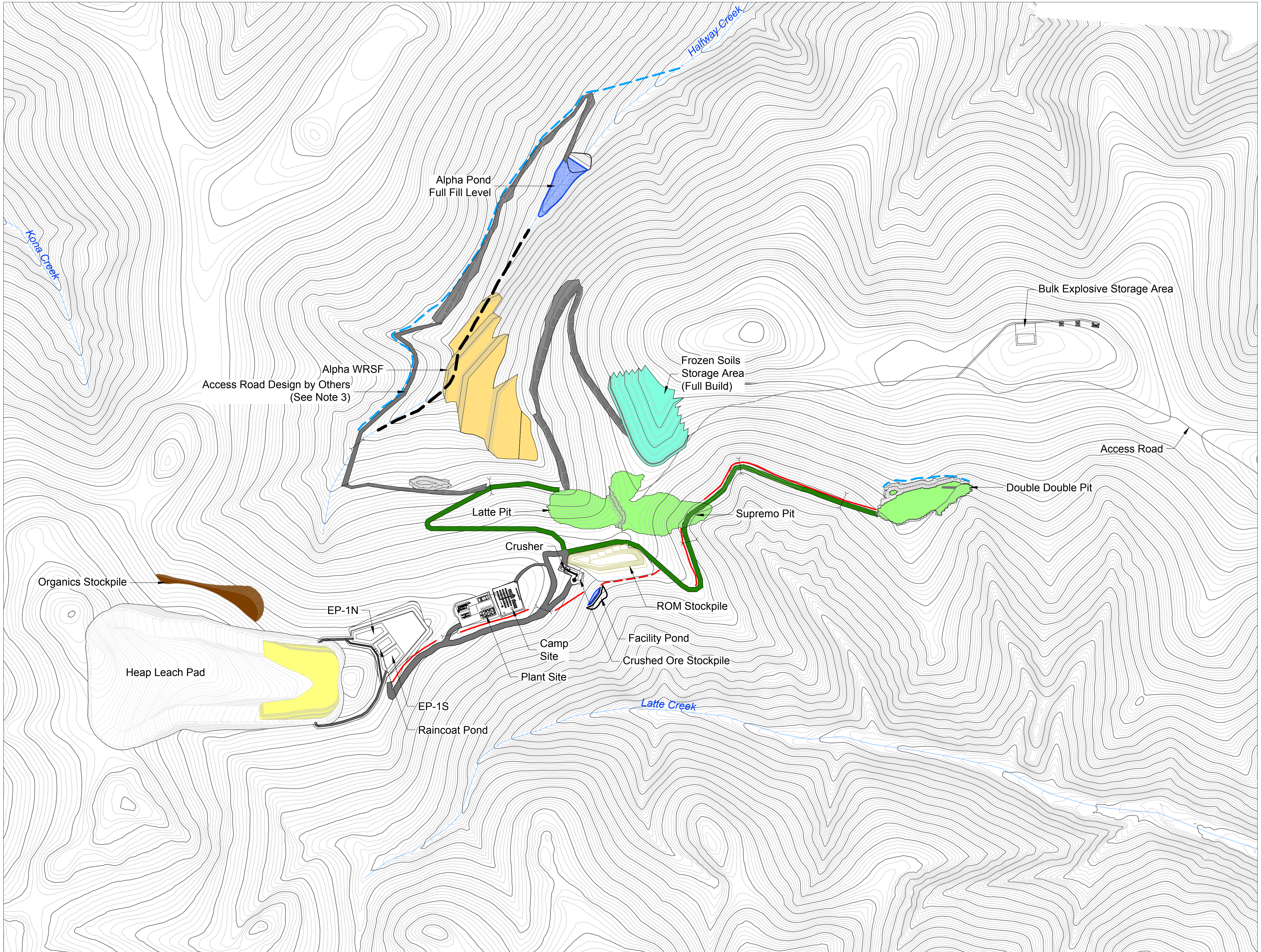
**Table 2.5-1 Summary of Key Construction Phase Activities**

| Project Component | Key Construction Phase Activities |
|---|---|
| **Overall Mine Site** | Confirmatory geotechnical drilling in select areas at the Mine Site, as necessary |
| | Mobilization of mobile equipment and construction materials |
| | Clearing, grubbing, and grading of areas to be developed within the mine site |
| | Material handling |
| **Open Pits** | Development of Latte pit and Double Double pit |
| | Dewatering of pits (as required) |
| **WRSFs** | Development and use of Alpha WRSF |
| **Stockpiles** | Development and use of temporary organics stockpile for vegetation and topsoil |
| | Development and use of frozen soil storage area |
| | Development and use of ROM stockpile for temporary storage of ROM ore |
| **Crusher System** | Construction and operation of crushing circuit |
| | Construction and operation of crushed ore stockpile |
| **Heap Leach Facility** | Staged HLF construction, including associated event ponds, rainwater pond, piping, and water management infrastructure |
| | Heap leach pad loading |
| **Plant Site** | Construction and operation of process plant |
| | Construction and operation of reagent storage area and on-site use of processing reagents |

| Project Component | Key Construction Phase Activities |
|---|---|
| | Construction and operation of laboratory, truck shop, and warehouse building |
| | Construction and operation of power plant |
| | Construction and operation of bulk fuel/LNG storage and on-site use of diesel fuel or LNG |
| **Camp Site** | Construction and operation of dormitories, kitchen, dining, and recreation complex buildings; mine dry and office complex; emergency response and training building; fresh (potable) water and fire water use systems; and sewage treatment plant |
| | Construction and operation of waste management building and waste management area |
| **Bulk Explosive Storage Area** | Construction of storage facilities for explosives components and on-site use of explosives |
| **Mine Site and Haul Roads** | Upgrade, construction, and maintenance of mine site service roads and haul roads |
| **Site Water Management Infrastructure** | Development and use of sedimentation ponds and conveyance structures, including discharge of compliant water |
| | Initial supply of HLF process water |
| | Ongoing use of site contact water (i.e., precipitation, stored rainwater) as HLF process water |
| **Ancillary Components** | Upgrade of existing road sections for NAR, including installation of culverts and bridges |
| | Construction of new road sections for NAR, including installation of culverts and bridges |
| | Development, operation, and maintenance of temporary work camps along road route |
| | Vehicle traffic, including mobilization and re-supply of freight and consumables |
| | Development, operation, and maintenance of barge landing sites on Yukon River and Stewart River |
| | Barge traffic on Stewart River and Yukon River, including barge mobilization of equipment for NAR construction |
| | Annual construction, operation, maintenance, and removal of Stewart River and Yukon River ice roads |
| | Annual construction and operation of winter road on the south side of the Yukon River |
| | Construction, operation, and maintenance of permanent bridge over Coffee Creek |
| | Construction and maintenance of gravel airstrip |
| | Air traffic |
| | Use of all laydown areas |
| | Use of Coffee Exploration Camp |

# COFFEE GOLD MINE

## Mine Site General Arrangement at End of Year -1




### Legend

- Diversion Berm
- Rock Drain
- Road Drainage Ditch
- Waste Rock Collection Channel
- Active Pit
- Frozen Soils Storage Area
- Pit Backfill
- Pit Footprint
- Sedimentation Pond
- Waste Rock Storage Facility
- Heap Stack
- Access Road
- Haul Road
- Culvert

### Notes

1. This figure is not intended to be a "stand-alone" document, but a visual aid to the information contained within the referenced Report. It is intended to be used in conjunction with the scope of services and limitations described therein.
2. Contours shown at a 5 meter contour interval.
3. Access road design to be finalized in next phase.

N

1:25000

0 2500 5000 7500 10000

Metres

NAD 1983 UTM Zone 7N

Page Size: 11" x 17"

| Figure 2.5-1 | Date: Mar 30, 2017 | Drawn by: TAH | Reviewed: DP/TS |
|---|---|---|---|

GOLDCORP

### 2.5.1 NORTHERN ACCESS ROUTE

The NAR will require upgrading of existing road sections, construction of new road sections, construction of new barge landing sites, and annual construction of ice roads across the Stewart and Yukon Rivers, plus the establishment of a winter road on the south side of the Yukon River. These activities are described in **Sections 2.5.1.1** to **2.5.1.5** below. Construction-related activities will commence in Q2 of Year –3 and will be substantially complete prior to the start of Mine Site construction in Year –2. Additional details pertaining to temporary construction camps, construction methods, access tie-in and staging areas, access control, potential borrow sources, bridge and culvert installations, barge landings, geochemical and geotechnical testing, and construction best management practices are provided in **Appendix 31-A Access Route Construction Management Plan**.

Details pertaining to the transportation of freight and fuel via the NAR during the Construction Phase after upgrades and construction activities are complete are provided in **Section 2.5.10.5 Freight and Fuel Requirements**.

#### *2.5.1.1 Road Section Upgrades*

To upgrade sections of the NAR road, the following construction activities will be conducted where required:

- Improving horizontal and vertical alignments
- Adding pullouts and turnouts
- Improving surface and road-side drainage, including upgrading watercourse crossings (i.e., bridges and culverts)
- Surfacing the road for all-weather conditions.

#### *2.5.1.2 New Road Section Construction*

An approximately 30-m-wide corridor of trees will be cleared before forestry road-type construction commences. This width will vary depending on cut and fill slopes, as well as proximity to riparian areas. All sections will be constructed on exposed mineral soil by removing overburden material, with the exception of sections built over undisturbed, shallow, ice-rich permafrost and winter roads. In areas underlain with ice-rich permafrost, the existing overburden material will be left intact, and the road will be constructed by placing fill over a geotextile layer.

Wherever possible, conventional cut and fill construction will be utilized to minimize material transport. Alternative construction techniques will be required in some sections, such as in sections with permafrost that will require full bench end haul construction, and where the road prism passes through near-surface bedrock; in these circumstances, construction will require surficial material earthworks and ripping and blasting of rock. Most sections of road will have a surfacing depth of 0.15 m to 0.3 m; the subgrade will be compacted with a drum roller. Cut slope and fill slope angles will vary by material type.

#### 2.5.1.3 Barge Landing Construction and Barge Use

Foundations for the concrete barge ramps will be constructed with compacted free-draining angular fill and will be armoured with either riprap or cast-in-place concrete. Ramp construction will be completed at low water above the water level.

#### 2.5.1.4 Ice Roads on Stewart and Yukon Rivers

Annual construction of the ice roads over the Stewart and Yukon Rivers will begin in mid-November or early December starting in Year –2 when the rivers are frozen and able to support light tracked-equipment. The ice roads are anticipated to be open an average of 137 days per year to haul vehicles once all the portages have been constructed. An independent ice engineer will verify ice thicknesses and provide loading charts for the various vehicle configurations. Once the ice roads are constructed and deemed suitable for hauling, they will be monitored and maintained to allow for safe and continuous operation until spring thaw, which typically occurs in late April.

#### 2.5.1.5 Winter Road South of Yukon River

A 4.1-km winter road will also be constructed annually on the south side of the Yukon River. The road will minimize the distance traveled on ice roads over the Yukon River, minimizing the exposure of road users to safety concerns and reliability or maintenance issues associated with ice roads. Outside of riparian areas, the winter road prism will primarily consist of snow and ice with a maximum content of other material (soil and organic matter) of 20%, and all cuts will be minimized. Within riparian areas, there will be no cuts and only clean snow and ice will be used to construct the road prism. There is one watercourse crossing along the winter road route, but it will not require the installation of a culvert as the crossing is expected to freeze solid. The crossing will be infilled with clean snow and ice to meet road grade.

### 2.5.2 MINE SITE EARTHWORKS

Beginning in Year –2, typical site preparation activities including clearing, grubbing, and rough grading of areas will commence at the Mine Site. Topsoil and overburden will be stripped from the footprints of infrastructure and either stockpiled or used as fill depending on the source, ice content, and material type. Organic topsoil will be stored in the temporary organics stockpile for later use as a growing medium for vegetation during reclamation activities. Ice-rich material will be stored in the frozen soil storage area. Overburden will be transported to a designated location at the Alpha WRSF.

Geochemical characterization of overburden samples collected across the Mine Site show that overburden is NAG and has low metal leaching potential; hence, no segregation or special handling of overburden is required to mitigate metal leaching and acid rock drainage potential. If PAG material is identified in overburden during the mine waste monitoring program, contingency measures will be adopted as described in a Metal Leaching and Acid Rock Drainage Management Plan (**Section 31.0**).

### 2.5.3 PLANT SITE

The Plant Site will be constructed on a levelled pad. The Plant Site pad will have cuts of up to approximately 6 m at the uphill (northwest) corner and fills of up to approximately 12 m on the downhill (southeast) corner.

This cut depth is anticipated to reach competent bedrock, but this will be confirmed during detailed design studies. Drilling and blasting is anticipated to be required to excavate to competent bedrock and possibly for the upper weathered bedrock and soil, if excavated in winter. Frozen soil or weathered rock not suitable for use will be placed in the Alpha WRSF (which includes the frozen soil storage area).

Where structural fill is to be placed on an existing natural slope, the fill will be keyed into the natural slope by excavating steps into the slope at the edge of successive lifts of structural fill. Rock-fill pads will be constructed in lifts no greater than 1.5m with the maximum rock size limited to 0.9 m. Engineered slopes constructed of structural or rock fill will be made at a gradient of 2H:1V or flatter. Buildings will be set back a minimum of 10 m from the crest of fill slopes.

#### *2.5.3.1 Plant Site Buildings*

The pre-engineered process plant building will be erected starting in Year –2, with internal components and pipelines (including external pipelines to the HLF) installed in Year –1. The pre-engineered truck shop and warehouse building will also be erected in Year –2.

#### *2.5.3.2 Power Plant and Power Distribution*

Given the modular and expandable nature of the power plant, the first gensets are expected to be mobilized in Year –2 to provide power to support construction activities. Additional genset(s) will be added in Year –1 in advance of process plant start-up.

#### *2.5.3.3 Bulk Fuel Storage*

The diesel fuel tanks will be field-constructed within the bulk fuel storage area in Year –2. The fuel tank farm bund will be constructed concurrently, and the bund will be lined with HDPE for spill containment. Additional infrastructure for tank filling and fuel dispensing infrastructure will be installed once tank construction is completed. The LNG fuel tanks, if utilized, will be installed in Year –1 or later in the mine life, depending on the availability of cost-competitive LNG.

### 2.5.4 CAMP SITE

The Camp Site will have cuts of up to 3.5 m at the uphill (northwest) corner, and fills of up to 10 m on the downhill (southeast) corner. Fill will consist of free-draining, coarse, granular materials, and preferably angular durable rock fill to prevent build-up of excess pore pressures. Where structural fill is to be placed on an existing natural slope, the fill will be keyed into the natural slope by excavating steps into the slope at the edge of successive lifts of structural fill. Rock-fill pads will be constructed in lifts no greater than 1.5 m with the maximum rock size limited to 0.9 m. Engineered slopes constructed of structural or rock fill will be made at a gradient of 2H:1V or flatter. Buildings will be set back a minimum of 10 m from the crest of fill slopes. The modular camp facilities and mine dry and office complex building will be transported to site and will rest on wood cribbing. Other supporting infrastructure such as the fresh water and fire water systems, sewage treatment plant, and waste management building will also be installed.

### 2.5.5 Waste Rock Storage Facilities

The development of the Alpha WRSF will commence in Year –1. Geotechnical work will be ongoing and will be completed prior to WRSF construction in order to finalize WRSF construction methodology and final configurations.

Since the Alpha WRSF will be developed as mine operations progress, construction and operation activities are described in **Section 2.6.2 Waste Rock Storage Facilities**. The Beta WRSF is also described in this section.

### 2.5.6 Open Pits

Stripping and excavation of the Latte and Double Double pits will commence in Year –1, with approximately 15 Mt of waste rock consumed in construction activities and approximately 3.5 Mt of ore designated for the crusher and delivery to the heap leach pad. Details pertaining to the development (including pre-production activities) of the open pits during the Construction and Operation Phases are provided in **Section 2.6.1.1 Mining**.

### 2.5.7 Heap Leach Facility

The heap leach pad is currently scheduled to be constructed in five stages, with Stage 1 construction commencing in Year –2. The primary pad construction steps are summarized below.

#### *2.5.7.1 Subgrade Preparation*

Major grading of the pad area is proposed for Year –2 with the final grade completed in Year –1. The pad will be graded and constructed in a nominally balanced cut-and-fill manner using locally borrowed (within the heap boundary) rock for structural fill, supplemented as needed by mine waste including waste rock and, if available, thaw-stable soil. Finer material from the rock or thaw-stable soil will be used in the top lift of fill then compacted to create a smooth, non-puncturing surface for installation of the leach pad liner system.

#### *2.5.7.2 Leach Pad Liner System*

The leach pad liner system consists of two synthetic liners with leak detection below and a hydraulic head control or drainage layer on top. From the bottom layer up, each system component is described below, and detailed information is provided in a Heap Leach and Process Facilities Management Plan (**Section 31.0**).

Leak detection will be accomplished by three separate systems: electrical leak location surveys performed after construction of each stage of the leach pad, horizontal wick drains installed under each collection ditch or berm[2] to operate as large-scale lysimeters, and monitoring wells installed away from the pad.

The leach pad will have a liner system comprising a 2.0-millimetre (mm)-thick linear low density polyethylene (LLDPE) geomembrane over a reinforced geosynthetic clay liner (GCL) liner. The bottom side of the LLDPE liner will be aggressively textured to provide a close bond with the GCL.

A 500-mm-thick drainage layer composed of crushed gravel and drainage pipes will be installed over the synthetic liners. This overliner system will protect the geomembrane liner from damage during ore stacking and operations, and will drain process and rinse waters out of the system in a manner that will minimize hydraulic head over the liner.

#### *2.5.7.3 Heap Leach Facility Ponds*

Event ponds EP-1N and EP-1S will be constructed in Year –1 to provide containment for the drainage from Stages 1, 2, and 3 of the heap leach pad. These ponds will be lined with two HDPE geomembranes, separated by a drainage layer and underlain by a GCL.

### 2.5.8 AIRSTRIP

The 1,220-m-long, 35-m-wide all-weather airstrip will be constructed in Year –2 using local cut-and-fill material, which will be placed in 300-mm lifts and compacted. Airstrip graded areas will be capped with a minimum 300-mm layer of 19-mm minus granular crushed rock. Site support equipment will be used for airstrip surface maintenance and snow removal. On an as-needed basis, the mine's water truck will be utilized to spread chemical dust control product and/or water during the summer months.

In conjunction with airstrip construction, the pre-fabricated modular operations centre will be installed at the airstrip apron along with a diesel generator, followed by the installation of radio equipment, the GPS Instrument Approach system, precision approach path indicators, and lighting systems.

Once the airstrip is operational in Year –2, catering supplies will be transported to site by aircraft during the road closure period, with an estimated 13 t and 35 t required in Year –2 and Year –1, respectively. Charter aircraft will commence using of this airstrip instead of the exploration airstrip for the transport of employees and contractors to and from the Project.

[2] The collection ditches and berms create cells within each stage of the leach pad to allow solution control during operations and rinsing, and these will be spaced every 100 m.

### 2.5.9 SITE WATER MANAGEMENT INFRASTRUCTURE

Site-wide water management plans, which are based on the mine plan, were developed for the Construction, Operation, and Reclamation and Closure Phases of the Project. In summary, contact water will be intercepted by engineered structures and ditches that ultimately flow to either local settling sumps, or to the sedimentation ponds, and non-contact water will be diverted away from active mining areas to avoid potential contamination. The water management system will be operated and maintained to meet site water quality and quantity discharge criteria. Detailed information on water management activities, including monitoring requirements, is provided in **Appendix 31-E Water Management Plan.**

### 2.5.10 SUPPLEMENTAL CONSTRUCTION PHASE REQUIREMENTS

#### *2.5.10.1 Waste Management*

Responsible and economically viable waste management initiatives, including waste minimization, recycling, and proper disposal will be implemented during all phases of the Project in accordance with applicable regulations and requirements. Handling and disposal methods for each waste type are summarized in

**Table** 2.5-2 and detailed information will be developed as part of a Waste Management Plan (**Section 31.0**).

**Table 2.5-2 Waste Types to be Generated during the Project**

| Waste Type | Description | Handling Method | Disposal Method |
|---|---|---|---|
| Hazardous wastes | Waste oil, glycol, lubricants, solvents, paints, batteries, and miscellaneous chemicals | Hazardous wastes will be sorted by material type and temporarily stored in sealed containers in an enclosure. | Hazardous waste will be back-hauled off-site for disposal at an approved facility. |
| Non-hazardous wastes | General domestic waste produced in camp | Waste will be sorted by material type, bagged, and segregated daily. | Food waste will be incinerated or composted to eliminate wildlife attraction.<br>Inert waste that is not to be reused and practically recycled will be transported to and stored at the landfill. |
| Recyclable waste | General domestic waste produced in camp | Waste will be sorted by material type, bagged, and segregated daily. | Recyclable waste will be back-hauled to suitable off-site recycling facilities, where practical. |
| Contaminated soil | Soils contaminated with hydrocarbons | Soils will be trucked to the land farm. | Soil will be stored and treated in a land farm. |
| Sewage | Human sewage and grey water | Sewage will be managed and treated on-site. | An on-site sewage treatment plant will be used to treat all sanitary wastewater. |

#### *2.5.10.2 Quality Assurance and Quality Control*

The Field Engineering team will be responsible for site quality assurance. The Field Engineering Lead will confirm that work has been performed according to the site's inspection and test plans (ITP) and that the contractor can demonstrate all work is undertaken in compliance with Project requirements.

Discipline Field Engineers will be responsible for witnessing all hold points on contractor ITPs. The Field Engineers will carry out independent inspections and confirm acceptance in the quality assurance portion of the contractor's ITP checklist. The Field Engineer is responsible for confirming acceptance or rejection of the inspected work, providing final sign-off of the work, and allowing subsequent work to proceed.

The contractor will be responsible for quality control (QC), inspections, and testing activities, which are performed to confirm that construction works are in compliance with the Project requirements defined in drawings and specifications. The ITPs will guide the QC process and will include the following parameters:

- Sequence of work
- Scope of work to be inspected and tested
- Frequency of inspection or testing
- Test methods
- Acceptance criteria
- QC responsible party
- Required verification and checklists to record the evidence of work completed
- Witness points and hold points.

#### *2.5.10.3 Monitoring*

Monitoring activities will be conducted during the Construction Phase to verify effect predictions associated with construction activities, determine whether mitigation measures are effective, determine whether infrastructure components are performing according to design and operating requirements, and determine whether compliance with regulatory approvals. Specific details for monitoring of infrastructure as well as the aquatic and terrestrial environments will be developed in the management and protection plans that are outlined in **Section 31.0 Environmental and Socio-economic Management Programs.**

#### *2.5.10.4 Equipment Fleet*

The Project's equipment fleet will be owner-operated, diesel-powered, and suitable for a standard open pit mining operation involving conventional drill, blast, load, and haul. A preliminary list of equipment that may be used at the Mine Site has been provided below. The equipment included here are representative of the size and type of equipment that may be required. Equipment revisions, substitutions, or alternatives will be evaluated during detailed design for the purpose of increased efficiency, reliability, and safety.

- Komatsu D275 track dozers for shovel support and clean-up, WRSF maintenance, road construction, high-wall cleaning, and other activities, as needed
- Komatsu WD500 wheel dozers for WRSF maintenance, drill pattern clean-up, and shovel floor maintenance
- Komatsu GD825 graders for road, pit, and WRSF floor maintenance, and road construction
- Komatsu HD1500 trucks (144 t) for haulage of ROM and crushed ore, and waste rock
- Komatsu PC3000 hydraulic front shovels (15 $m^3$) for primary loading
- DX800 drills (76 mm) for secondary blasting and pre-split drilling
- D50KS drills (152 mm for ore and 229 mm for waste rock)
- Water trucks (75 $m^3$)
- Komatsu PC800 hydraulic excavators (4.5 $m^3$) for secondary loading, re-handle, and shovel support
- Komatsu WA900 wheel front-end loaders (11.5 $m^3$) for secondary loading, re-handle, and shovel support
- Fuel trucks to supply fuel to all hydraulic diesel excavators, dozers, and drills
- A lube truck for the supply of lubricants, hydraulic fluids, and cooling water to all open pit equipment
- Mobile mechanical trucks and a tire manipulator
- A low-boy transporter trailer (100-t weight capacity) for transportation of dozers, drills, a small back hoe, and major equipment components
- Mobile lights for lighting of pits, WRSFs, and construction areas
- Mobile crane
- Forklifts and manlifts
- Light vehicles and buses for personnel transport.

The main criterion for loading equipment selection was the ability to effectively load a haulage fleet capable of sustaining an average mining rate of 100,000 tpd while allowing for selective mining. The Project's haul fleet will be selected based on the requirement to load 5 Mt per year to the heap leach pads and provide a cost-effective means of supporting this total annual mining rate. Further analysis regarding site-specific equipment requirements will be carried out during the Project's detailed engineering and procurement stages.

#### *2.5.10.5 Freight and Fuel Requirements*

Following the completion of upgrade and construction activities at the end of Year –3, the NAR will be used to haul construction materials, equipment, and consumables including fuel to the Mine Site. The estimated annual freight tonnage, fuel volume, and number of truck loads required to support Construction Phase activities in Year –2 and Year –1 are summarized in **Table 2.5-3**.

**Table 2.5-3 Estimated Annual Freight Tonnage, Fuel Volumes, and Truck Loads during the Construction Phase**

| Year | Freight (t) | Freight Loads | Fuel Volume (000 L) | Fuel Loads | Total Loads |
|---|---|---|---|---|---|
| Year –2 | 7,336 | 294 | 3,289 | 71 | 365 |
| Year –1 | 17,836 | 714 | 14,339 | 309 | 1,023 |

Since river access will not be possible during fall freeze-up and spring thaw, on-site storage will provide for sufficient storage of fuel and consumable materials during these periods.

#### *2.5.10.6 Workforce*

During construction of the NAR and Mine Site, varying numbers of personnel will be required with a maximum workforce of approximately 663 personnel. The workforce will vary seasonally and over the course of the Construction Phase, progressively increasing as construction proceeds, and then decreasing as the Construction Phase transitions to mining operations. Construction personnel will include both Goldcorp employees and contractors in the following roles:

- A management team, including managers, human resources, and health and safety personnel
- Technical staff, including engineers, planners, surveyors, geologists, etc.
- Supervisory staff, including superintendents, foremen, clerks, etc.
- Mechanics, welders, and electricians
- Camp services staff including kitchen and janitorial personnel
- Drillers and blasters
- Equipment operators
- Labourers and trainees.

## 2.6 OPERATION PHASE ACTIVITIES

The Operation Phase will begin in Year 1 and will continue through to the end of Year 12. The key activities occurring during this phase are summarized in **Table 2.6-1**. The annual progression of infrastructure development and operational closure (e.g., pit backfilling, progressive reclamation of the heap leach pad) from Year 1 through Year 11 are shown in **Figure 2A-5** through **Figure 2A-15 in Appendix 2-A.** The layout of the Mine Site at the end of the Operation Phase (Year 12) is shown on **Figure 2.6-1**.

This section describes the ongoing development of Project components to be constructed in Year **–**2 and Year **–**1 (as described in **Section 2.5 Construction Phase Activities**), additional components, and the main operational activities that will occur during the Operation Phase. For a description of the operational equipment fleet, refer to **Section 2.5.10.4 Equipment Fleet.**

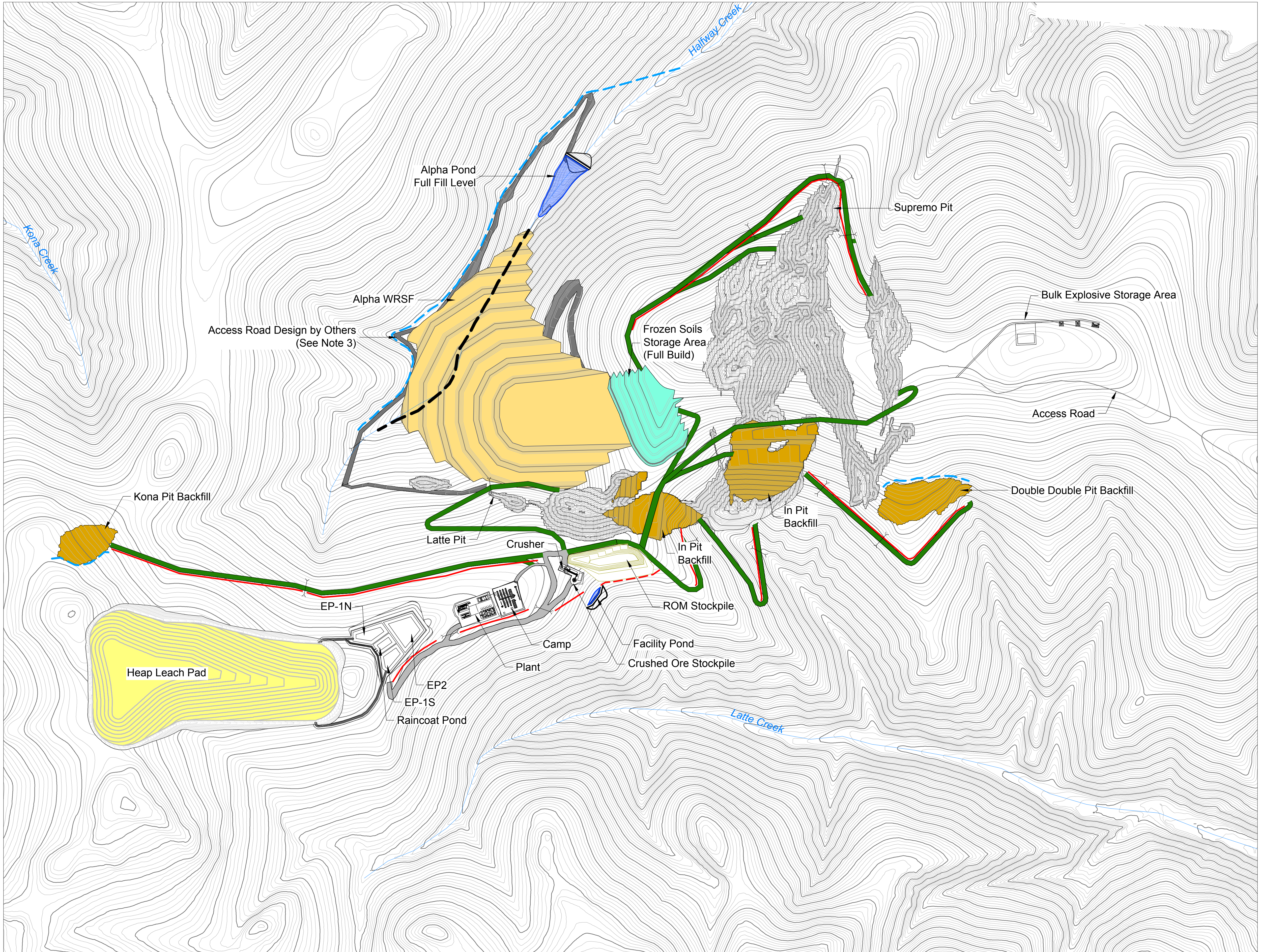
### Table 2.6-1 Summary of Key Operation Phase Activities

| Project Component | Key Operation Phase Activities |
|---|---|
| **Overall Mine Site** | Material handling |
| | Excavation of contaminated soil followed by on-site treatment or temporary storage and off-site disposal |
| | Progressive reclamation of disturbed areas within Mine Site footprint |
| **Open Pits** | Development of Kona pit and Supremo pit and continued development of Double Double pit and Latte pit |
| | Cessation of mining at Double Double pit, Latte pit, Kona pit, and Supremo pit |
| | Partial backfill of Latte pit and Supremo pit |
| | Backfill of Double Double pit and Kona pit |
| | Dewatering of pits (as required) |
| **Waste Rock Storage Facilities** | Continued development and use of Alpha WRSF |
| | Development and use of Beta WRSF |
| **Stockpiles** | Continued use of temporary organics stockpile for vegetation and topsoil |
| | Continued use of frozen soil storage area |
| | Continued use of ROM stockpile for temporary storage of ROM ore |
| **Crusher System** | Crusher operation |
| | Continued use of crushed ore stockpile |
| **Heap Leach Facility** | Continued staged HLF construction, including related water management structures and year-round operation |
| | Progressive closure and reclamation of HLF |
| **Plant Site** | Process plant operation |
| | Continued on-site use of processing reagents |
| | Continued on-site use of diesel fuel or LNG |
| **Camp Site** | Continued use of facilities |
| **Bulk Explosive Storage Area** | Continued on-site use of explosives |
| **Mine Site and Haul Roads** | Use and maintenance of mine site service roads and haul roads |
| **Site Water Management Infrastructure** | Continued use of sedimentation ponds conveyance structures |
| | Ongoing use of site contact water (i.e., precipitation, stored rainwater) as HLF process water |
| | Installation and operation of water treatment facility for HLF rinse water |
| **Ancillary Components** | NAR road maintenance (e.g., aggregate re-surfacing, sanding, snow removal) |
| | NAR vehicle traffic, including mobilization and re-supply of freight and consumables |
| | Operation and maintenance of barge landing sites on Stewart River and Yukon River |
| | Barge traffic on Stewart River and Yukon River |
| | Annual construction, operation, maintenance, and removal of Stewart River and Yukon River ice roads |

| Project Component | Key Operation Phase Activities |
|---|---|
| | Annual construction and operation of winter road on the south side of the Yukon River |
| | Operation and maintenance of gravel air strip |
| | Air traffic |
| | Use of all laydown areas |
| | Use of Coffee Exploration Camp if required |

COFFEE GOLD MINE

## Mine Site General Arrangement at End of Year 12




### Legend

- Diversion Berm
- Rock Drain
- Road Drainage Ditch
- Waste Rock Collection Channel
- Active Pit
- Frozen Soils Storage Area
- Pit Backfill
- Pit Footprint
- Sedimentation Pond
- Waste Rock Storage Facility
- Heap Stack
- Access Road
- Haul Road
- Culvert

### Notes

1. This figure is not intended to be a "stand-alone" document, but a visual aid to the information contained within the referenced Report. It is intended to be used in conjunction with the scope of services and limitations described therein.
2. Contours shown at a 5 meter contour interval.
3. Access Road design to be finalized in next phase.

N

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Metres

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### 2.6.1 OPEN PITS

#### *2.6.1.1 Mining*

Over the LOM, the four pits are expected to produce a total of 60.1 Mt of ore at an average gold head grade of 1.29 grams per tonne (g/t). The contained gold is estimated to be 2.5 million ounces. Ore mined during the pre-production period in Year –1 will be placed in the ROM stockpile until the heap leach pad is ready to load ore. The process plant is planned to be operational by early Q3 of Year –1, allowing for commencement of leach solution application at the heap leach pad and production of first gold in Q4 of Year –1.

By the end of Year 11, open pit mining will cease and the ROM stockpile will be depleted. A summary of the conceptual LOM production schedule by year over the Operation Phase is provided in **Table 2.6-2**. Details pertaining to drilling, blasting, ore and waste handling, as well as the progressive development of WRSFs are provided in the subsections and sections that follow.

#### *2.6.1.2 Drilling*

Two types of blast hole drilling will be used in the open pit mine development:

- Blast pattern drilling to allow for fragmenting of rock for mining
- Wall stability control and secondary drilling as required.

#### *2.6.1.3 Blasting*

Based on the assumption that most explosive loading will be in dry blast holes, 85% ammonium nitrate and fuel oil is planned to be used for blasting and an estimated 15% emulsion has been assumed to account for wet loading conditions. Dewatering of the blast holes may be undertaken to limit the use of emulsion, or bag liners may be used.

#### *2.6.1.4 Ore and Waste Rock Hauling*

The ore and waste rock excavated from each of the Open Pits will be transported to the WRSF, crushing plant, or coarse ore stockpile. Since geochemical characterization indicates that waste rock is NAG, special handling and segregation procedures to mitigate acid rock drainage potential will not be required. If PAG material is identified as part of regular monitoring activities, contingency measures will be adopted as described in a Metal Leaching and Acid Rock Drainage Management Plan (**Section 31.0**).

Hydraulic front shovels will primarily undertake the mining of ore and waste material, while front-end loaders and smaller excavators will complement the main shovel fleet (e.g., on the lower, confined benches of the open pits). Primary haulage from the open pits is planned to be done with 144-t haul trucks, although alternative haulage technologies may be utilized if it is determined that they can provide enhanced efficiency, reliability, and safety.

**Table 2.6-2 Summary of Life of Mine Production Schedule by Year**

| Description | Unit | Total | Y-1 | Y1 | Y2 | Y3 | Y4 | Y5 | Y6 | Y7 | Y8 | Y9 | Y10 | Y11 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Total Ore | kt | 60,148 | 3,698 | 5,133 | 5,795 | 6,983 | 4,296 | 4,458 | 5,022 | 4,567 | 5,088 | 5,537 | 5,797 | 3,768 |
| Total Mined grade | g/t | 1.29 | 1.23 | 1.61 | 1.18 | 1.26 | 1.37 | 1.39 | 1.41 | 1.50 | 1.11 | 0.99 | 1.21 | 1.31 |
| Total gold contained | koz | 2,492 | 145 | 266 | 219 | 283 | 188 | 199 | 227 | 219 | 182 | 175 | 225 | 158 |
| Total Waste | kt | 299,250 | 15,015 | 22,885 | 22,202 | 21,028 | 29,719 | 29,561 | 29,003 | 29,441 | 28,925 | 28,463 | 28,194 | 14,810 |
| Strip Ratio | t:t | 5.0 | 4.1 | 4.5 | 3.8 | 3.0 | 6.9 | 6.6 | 5.8 | 6.4 | 5.7 | 5.1 | 4.9 | 3.9 |
| Total Material | kt | 359,398 | 18,714 | 28,018 | 27,997 | 28,012 | 34,016 | 34,020 | 34,025 | 34,009 | 34,013 | 34,000 | 33,991 | 18,578 |
| Average Mined | t/day | N/A | 51,272 | 76,764 | 76,706 | 76,747 | 93,195 | 93,206 | 93,221 | 93,176 | 93,188 | 93,152 | 93,127 | 50,901 |
| Total HLF feed | kt | 60,148 | 3,500 | 5,000 | 5,000 | 5,000 | 5,000 | 5,000 | 5,000 | 5,000 | 5,000 | 5,000 | 5,000 | 5,000 |
| HLF head grade | g/t | 1.29 | 1.24 | 1.59 | 1.19 | 1.28 | 1.33 | 1.36 | 1.40 | 1.47 | 1.11 | 1.05 | 1.21 | 1.26 |
| Au contain ounces | koz | 2,492 | 139 | 255 | 190 | 205 | 213 | 218 | 225 | 235 | 178 | 168 | 194 | 202 |
| Au recovery | % | 86.2 | 87.2 | 82.7 | 82.5 | 80.0 | 86.8 | 87.6 | 85.4 | 86.0 | 89.2 | 89.3 | 89.2 | 88.6 |

**Note:** Conceptual-level production estimate only.
kt - kilotonne; koz – thousand ounces; t/day – tonnes per day.

Ore hauled from the Open Pits will either be transported to the crusher system or to the ROM stockpile for temporary storage until it is crushed. Ore will likely be stockpiled when the crusher is not running and crushed ore is not being added to the HLF (i.e., January through March), or during scheduled periods when the mining rate or ore exceeds the throughput rate of the crusher. Crushing is described in **Section 2.6.3.1**.

**Table 2.6-3** summarizes potential annual tonnage of waste rock allocated to the WRSF and in-pit backfill during the Operation Phase.

**Table 2.6-3 Annual Waste Rock Allocations by Destination**

| Destination (Mt) | Y- 1 | Y1 | Y2 | Y3 | Y4 | Y5 | Y6 | Y7 | Y8 | Y9 | Y10 | Y11 | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Alpha WRSF | 15.7 | 22.1 | 18.9 | 15.5 | 21.8 | 29.5 | 26.4 | 20.5 | 27.4 | 24.8 | 10.4 | 12.1 | 245.1 |
| Beta WRSF | - | 0.2 | 3.9 | 1.1 | - | - | - | - | - | - | - | - | 5.2 |
| In-pit Backfill | - | - | - | 4.1 | 8.5 | - | 2.9 | 9.2 | 0.1 | 3.9 | 17.8 | 2.4 | 48.9 |
| **TOTAL** | **15.7** | **22.3** | **22.8** | **20.8** | **30.2** | **29.5** | **29.3** | **29.7** | **27.6** | **28.7** | **28.2** | **14.6** | **299.5** |

### 2.6.2 Waste Rock Storage Facilities

Construction of the Alpha WRSF will commence in Year –1, and it will remain in operation until the end of mine life in Year 12. The permanent Alpha WRSF will be constructed and maintained to meet closure criteria and will not require progressive re-sloping. At the end of active waste dumping, minor re-sloping may be carried out in order to achieve long-term erosional stability, and appropriate water conveyance for closure. Given the limited material available and suitable for covers, the Alpha WRSF is not planned to be covered or vegetated. Goldcorp is committed to looking for opportunities to allow for re-vegetative success of the Alpha WRSF as part of ongoing reclamation research. Waste rock from the Kona Pit will be stored temporarily in the Beta WRSF during mining and then backfilled into the mined-out pit. Construction will occur between the end of Year 1 and the beginning of Year 3.

Non-organic soils excavated from the WRSF foundations will be either stored in the frozen soil storage area or spread in thin lifts in one of the WRSFs. All organics will be stored in the temporary organics stockpile for use in reclamation. Overburden materials placed in the WRSF will be placed with coarse, durable waste rock at a ratio such that the overall strength of the mixture is dictated by the waste rock to ensure stability. In addition, overburden soil materials will not be concentrated along the foundation or within the final side slopes of the WRSF.

Clearing and stripping activities will be undertaken in as short of a time period as practicable in advance of waste rock placement in order to minimize the exposure period of the de-vegetated ground. This will limit the potential thawing and erosion of the areas. Organic soils will be left in place within the footprint of the rock drains to reduce thermal disturbance. Suitable rock will be placed to a minimum height of approximately 3 m, depending on the final design details of the WRSF and rock drain.

### 2.6.3 HEAP LEACH FACILITY, CRUSHER SYSTEM, AND PROCESS PLANT

The five-stage leach pad will be developed progressively over LOM. Each pad stage will be separated from the adjacent stage by a ditch or berm and drainage pipe, providing hydraulic (solution) isolation between stages. In addition, cells will be created within each stage by constructing a drainage ditch or berm with a drainage pipe every 100 m. The berms and ditches will allow high-resolution tracking of solution chemistry (especially gold tenor) and will aid in progressive closure by allowing rinsing of the older portions of the heap beginning by Year 4.

The rainwater (clean water) pond will be constructed in or before Year 3 to coincide with the use of raincoats. Event pond EP-2 will be constructed in or before Year 6 to increase containment for the drainage from Stage 4. These ponds will be lined with two HDPE geomembranes, which will be separated by a drainage layer and underlain by a GCL.

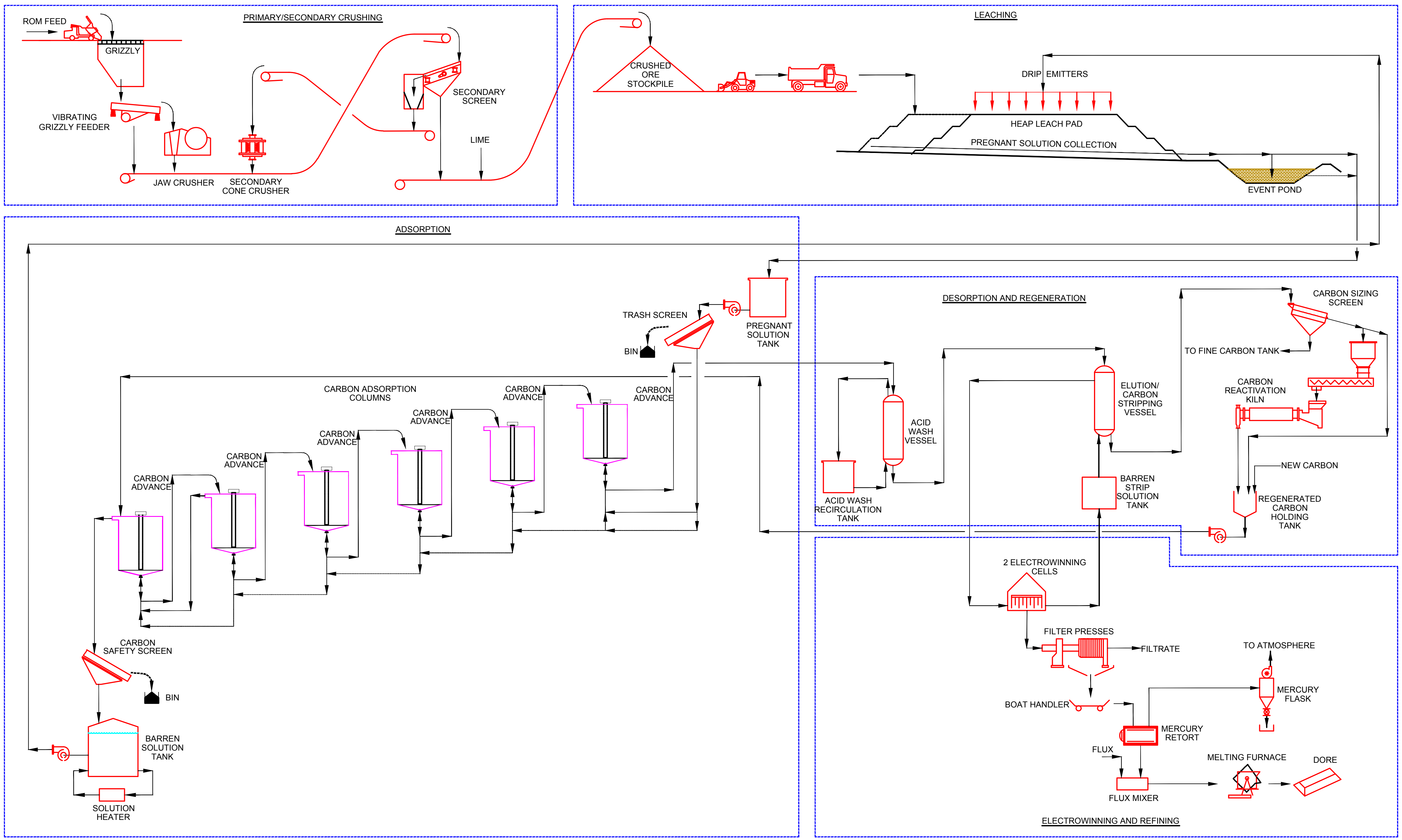
The primary ore processing processes of crushing, leaching, adsorption, desorption and regeneration, and electrowinning and refining are illustrated in **Figure 2.6-2**. These processes are described below.

#### *2.6.3.1 Crushing*

The two-stage crushing circuit is planned to operate approximately 275 days per year; however, this timing will depend directly on the seasonal conditions each year and the amount of heat available in the HLF for processing. If conditions allow, crushing will be performed year-round. Mobile or semi-mobile crushers may be utilized year-round near active mining faces prior to transportation of both ore and waste. If utilized, only ore will proceed to secondary crushing, which will take place seasonally following the same schedule as above. The ROM stockpile will also be used to feed the crusher if mining operations are suspended.

#### *2.6.3.2 Crushed Ore Stacking on Heap Leach Pad*

Ore stacking on the heap leach pad will commence in Year –1 and continue through Year 12, with 3.5 Mt of ore being hauled to the heap leach pad during Year –1, and approximately 5 Mt in subsequent years. Ore stacking will be seasonal, and will depend on ambient temperature and heap performance. It is anticipated that a minimum seasonal loading range will be from approximately April 1 to December 31, while irrigation and leaching will occur 356 days per year (described below).




# COFFEE GOLD MINE

## Process Flowsheet

### Legend

### Notes

1. This figure is not intended to be a stand-alone document, but a visual aid to the information contained within the referenced Report. It is intended to be used in conjunction with the scope of services and limitations descriped therein.
2. This is a re-creation of JDS drawing number 100-PF-001, Rev. B, project number KAMCOF12E.

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| Figure 2.6-2 | Date: Mar 27, 2017 | Drawn by: JS | Reviewed: CPK |
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Ore will be stacked using trucks or stackers and dozers in 10-m lifts to a total average height of approximately 50 m and a maximum of 80 m (measured vertically over the liner system). Stage 1 is sized for an ore depth of 30 m to create a sufficiently large thermal mass to allow winter irrigation. As the heap is stacked, the side slopes will be benched such that the face of each lift is 1.3H to 1.5H:1V. The benches will vary between 12.0 m and 14.4 m wide to create an overall toe-to-crest slope angle of 2.5H:1V. The last two lifts of ore will be stacked to minimize earthworks during the Reclamation and Closure Phase.

#### *2.6.3.3 Heap Leaching and Rinsing*

The processing of heap leach ore will entail the use of dilute cyanide solutions under pH conditions ranging between pH 10.5 and 11.0. Details regarding the containment and handling of cyanide will be developed as part of a Cyanide Management Plan (**Section 31.0**).

As a first step in the leaching process, barren solution will be pumped from the barren tank to the pad in a double-walled pipeline and irrigated onto the stacked ore using drip emitters. During the winter, the emitters will be buried to a depth of at least 1 m to reduce the likelihood of freezing. Beginning at the end of Year 1, the installed drip area will be doubled before the onset of winter each year to allow for backup piping in the event that the primary area freezes. The barren solution will be heated as needed by genset waste heat and boiler-generated heat to 8° C to provide a minimum discharge temperature at the drip emitters of 6° C to maintain the thermal balance in the HLF. Upon application of the barren solution to the heap leach pad, the barren solution will percolate down through the crushed ore in the pad, dissolving gold from the ore. The pregnant or gold-enriched solution will flow from the pregnant solution collection area at the toe of the pad via a pipeline to the process plant.

Raincoat placement is anticipated to start on Stage 1 of the heap in Year 3, and will progressively increase through operations until the heap leach pad is closed. The placement of raincoats will be determined during operations by monitoring the HLF water balance, and the technology primarily will be used to minimize infiltration of meteoric water into the heap.

Rinse pipelines are planned to be utilized starting in Year 4 to transfer rinse solution between the plant and the heap leach pad. Preliminary rinsing will commence in the first cells of Stage 1 using detoxified barren solution (to reduce the pH and cyanide levels in the effluent). Preliminary rinsing will continue until the chemistry of the heap effluent reaches approximate equilibrium with the rinse solution, and at approximately the same rate as the westward advancement or stacking of the heap. Treatment goals for preliminary rinsing are only to reduce cyanide concentrations of the heap and effluent and to lower the pH of the heap to values less than pH 9.0; treatment of rinsing water is not designed to meet environmental discharge criteria.

As each area approaches target water chemistry, the detoxified solution will be replaced or supplemented with fresh makeup water (stored in the rainwater pond during or following the spring freshet or mid-summer thunder showers) for the final rinse cycle. The effluent from final rinsing will then be used as either rinse water for preliminary rinsing in other areas, or makeup water for the process circuit until active leaching for gold recovery is completed. Final rinsing will begin one year after preliminary rinsing (assumed to be Year 5 or Year 6) and will continue until the entire heap has been rinsed, which is predicted to be Year 15, but the duration of rinsing may extend up to Year 20 depending on the demonstrated performance of the rinsing and treatment circuit. Beginning in about Year 9, it is expected that the HLF will produce surplus water. Before this time, a water treatment plant will be required (see **Section 2.6.3.7** below).

Beginning in about Year 5 and continuing annually until Year 15 to Year 18, the heap will be graded to provide proper drainage for runoff and freshet, the surface of the heap will be compacted, and an engineered cover system will be installed. Heap covering will include a GCL covered by soil or rock on flat areas, and soil or rock on sloped areas. The cover system is intended to reduce infiltration and provide growth media for vegetation.

#### *2.6.3.4 Adsorption*

The next stage of gold recovery involves CIC adsorption, where gold in solution is adsorbed onto carbon particles. The pregnant solution will be stored in a pregnant solution tank before being pumped to the CIC circuit, which will consist of a series of six cascading carbon columns. The solution overflow from the final column will discharge onto a carbon safety screen in order to recover any carbon. The barren solution, which at this stage will have had most of the gold in solution adsorbed, will be discharged from the final carbon column and pumped to the barren solution tank. Cyanide solution, caustic solution, anti-scalant, and makeup water plus heat will be added to the barren tank as needed, and the barren solution will be pumped back to the heap leach pad.

#### *2.6.3.5 Desorption and Regeneration*

The desorption process will include the following steps (each step is shown in **Figure 2.6-2**):

- Acid washing of carbon to remove inorganic foulants
- Stripping of carbon to produce a gold-rich solution
- Thermal regeneration of carbon to remove organic foulants
- Carbon stripping to recover gold into solution.

#### *2.6.3.6 Electrowinning and Refining*

Pregnant solution will flow through one of the electrowinning cells via gravity. In the electrowinning cell, gold will be plated onto knitted mesh steel wool cathodes. The loaded cathodes will be power-washed to remove the gold-bearing sludge and any remaining steel wool, which will be filtered to remove excess moisture before being retorted to remove any mercury. The retort residue will be mixed with fluxes consisting of borax, silica, and soda ash before being smelted in a melting furnace to produce gold doré and slag. The doré will be stored in a vault while waiting for transport off site to a refinery for further purification. Slag will be processed to remove prills for re-melting in the furnace.

#### *2.6.3.7 Heap Leach Facility Water Treatment*

The water treatment plant will be commissioned before Year 9 to treat excess water to concentrations acceptable for discharge to Halfway Creek. Treated water will flow towards the Alpha underdrain and report to the Alpha Pond prior to release to Halfway Creek during operations and early closure while the water treatment plant is in operation. The water treatment plant will remain in place in the event it is required until Year 20.

Active water treatment will only occur on heap leach rinse solutions. A number of parameters are predicted to remain elevated in rinse solutions above Metal Mining Effluent Regulation Limits and well above proposed water quality objectives for Halfway Creek; therefore, treatment is required prior to release to the environment. The proposed water treatment system is a two-stage process. The first stage of the treatment process will be to add hydrogen peroxide to oxidize residual cyanide while the second stage will utilize a biological reactor system termed Electrochemical Biological Reactor.

Water treatment of surplus drain-down rinse water deriving from the closed sections of the heap will commence in Year 9. Currently, the water treatment plant is expected to operate approximately six months of the year (May to October) through to Year 15, and may extend, if required, up to Year 20. The average treatment rate will be 4 L per second starting in Year 9, increasing to 10 L per second over the duration of the final rinsing process. Treated water from the water treatment plant will either be discharged to the environment or used in additional rinsing of the heap. When discharged to the environment, water will be directed to the Alpha WRSF underdrain and ultimately Halfway Creek. Following the cessation of water treatment when water quality is acceptable for direct discharge from the closed HLF to the environment, water will either be directly discharged to Latte pit, or directed to passive treatment cells for final polishing and then discharged to Latte pit.

### 2.6.4 SITE WATER MANAGEMENT INFRASTRUCTURE

Similar to site water management during the Construction Phase, the water management system will be operated and maintained during the Operation Phase to meet site water quality and quantity discharge objectives. Additional measures may be undertaken as necessary, including pond maintenance and the addition of flocculants at the inlet end of each pond to increase the rate of settling. Pond maintenance will include the removal of sediment when the permanent pool storage depth is less than 1 m at the riser, or at a minimum prior to winter freeze-up. Sediment will be transported to the Alpha WRSF for storage. Refer to **Appendix 31-E Water Management Plan** for additional details pertaining to Operation Phase activities.

### 2.6.5 MINE SITE AND HAUL ROADS

Mine site and haul roads will be operational and maintained year-round. The amount of dust generated from road traffic will depend on the dryness of the road surface; the number, weight, and speed of vehicles; and maintenance of the driving surface. The road will be regularly graded and granular material will be added to the driving surface to maintain safe operating conditions and reduce the amount of dust. Additional details regarding measures to mitigate dust will be developed as part of a Dust Management Plan (**Section 31.0**).

### 2.6.6 NORTHERN ACCESS ROUTE

The NAR will be operated on a year-round basis with the exception of periods when the Stewart River and Yukon River are either freezing up in the fall through early winter or breaking up in the spring, as previously described in **Section 2.5.1 Northern Access Route**. The NAR is expected to be open an average of 295 days per year, with barge service beginning in late May and ending in early November.

The majority of day-to-day maintenance activities will be performed by Goldcorp site support crews, or by third-party contractors. A dedicated motor grader will operate on the route, and a third-party contractor will supply and deliver aggregate material for re-surfacing and sanding of passes during the winter.

**Appendix 31-B Access Route Operational Management Plan** provides additional information pertaining to the following:

- Traffic management including traffic control measures, road safety measures (signage, right-of-way standards, and radio procedures), and incident response plans
- Road maintenance including watercourse crossing inspections and maintenance, snow removal and snow management, dust management, and measures to protect wildlife
- Barge operation, maintenance, and fueling requirements
- Ice road construction, monitoring, maintenance, and operations
- Best management practices.

### 2.6.7 OPERATIONAL CLOSURE ACTIVITIES

Reclamation and closure activities will be undertaken in a progressive manner, where practicable, when Open Pits, WRSF, stages of the heap leach pad, and other areas such as laydown areas are no longer required to support mine operations. This will ultimately advance the return of disturbed areas to self-sustaining biological ecosystems while reducing the overall final cost of reclamation. Progressive reclamation activities will commence in Year 2, and will continue to the end of the Operation Phase in Year 12. Goldcorp intends to maximize all opportunities for operational implementation of progressive reclamation activities.

**Table 2.6-4** summarizes the operational closure activities that are planned for the Heap Leach Facility and Open Pits during this period.

**Table 2.6-4 Summary of Key Operational Closure Activities**

| Project Component | Key Operational Closure Activities |
|---|---|
| **Overall Mine Site** | Progressive reclamation of disturbed areas within the Mine Site footprint that are no longer required to support mine operations |
| | Routine monitoring will occur in accordance with conditions of mine operating licenses |
| **Open Pits** | Partial backfill of Latte and Supremo pits |
| | Complete backfill of Kona and Double Double pits |
| **Heap Leach Facility** | Progressive reclamation and closure of early stages of HLF |
| **Mine Site and Haul Roads** | Closure of haul roads at Latte, Supremo, Kona, and Double Double pits |
| **Site Water Management Infrastructure** | Installation of water treatment facility and commencement of water treatment of drain-down rinse water from closed HLF stages |

## 2.6.8 Supplemental Operation Phase Requirements

### *2.6.8.1 Waste Management*

Waste management protocols during the Operation Phase will also include waste minimization, recycling, and proper disposal, as previously described in **Section 2.5.10.1 Waste Management**.

### *2.6.8.2 Monitoring*

Monitoring activities will continue during the Operation Phase to verify effects predictions associated with construction and operation activities, determine whether mitigation measures are effective, determine whether infrastructure are performing according to design and operating requirements, and determine whether compliance with regulatory approvals. Specific details for monitoring of infrastructure as well as the aquatic and terrestrial environments will be provided in the management and protection plans developed in **Section 31.0 Environmental and Socio-economic Management Programs.**

### *2.6.8.3 Freight and Fuel Requirements*

Estimated freight and fuel quantities and the number of trucks to haul these quantities (i.e., loads) over the Operation Phase are summarized in **Table 2.6-5** for Year 1 to Year 12 (not including Year –1 pre-production, which is outlined in **Table 2.5-3** for the Construction Phase These estimates, based on diesel fuel, may increase or decrease by 15%.

**Table 2.6-5 Estimated Annual Freight Tonnage, Fuel Volumes, and Truck Loads during Operation Phase**

| Year | Freight (t) | Freight Loads | Fuel Volume (000 L) | Fuel Loads | Total Loads |
|---|---|---|---|---|---|
| Year 1 to Year 11 | 23,000 | 900 | 32,000 | 700 | 1,600 |
| Year 12 | 11,500 | 900 | 32,000 | 700 | 1,600 |
| **Total** | **264,500** | **10,800** | **384,000** | **8,400** | **19,200** |

Fuel off-loading at the Project site will be performed by the tanker drivers utilizing pumping systems at the bulk fuel storage facilities. Freight off-loading will be performed by the site support crew's heavy equipment operators using fleet equipment, with assistance from labourers and haul truck drivers. Any freight that has been identified for removal from site will be loaded onto empty freight trucks for back-haul off-site. For information on the equipment fleet, refer to **Section 2.5.10.4 Equipment Fleet**.

#### *2.6.8.4 Workforce*

Based on operating 24 hours per day, seven days per week, and 365 days per year, a maximum of approximately 372 personnel will be employed during the Operation Phase. The majority of management, supervisory, production, maintenance, and technical services personnel will be on a two-week-in, two-week-out rotation. Management and technical staff will work the day shift only, while operation and maintenance personnel will cover two 12-hour shifts per day.

## 2.7 RECLAMATION AND CLOSURE PHASE ACTIVITIES

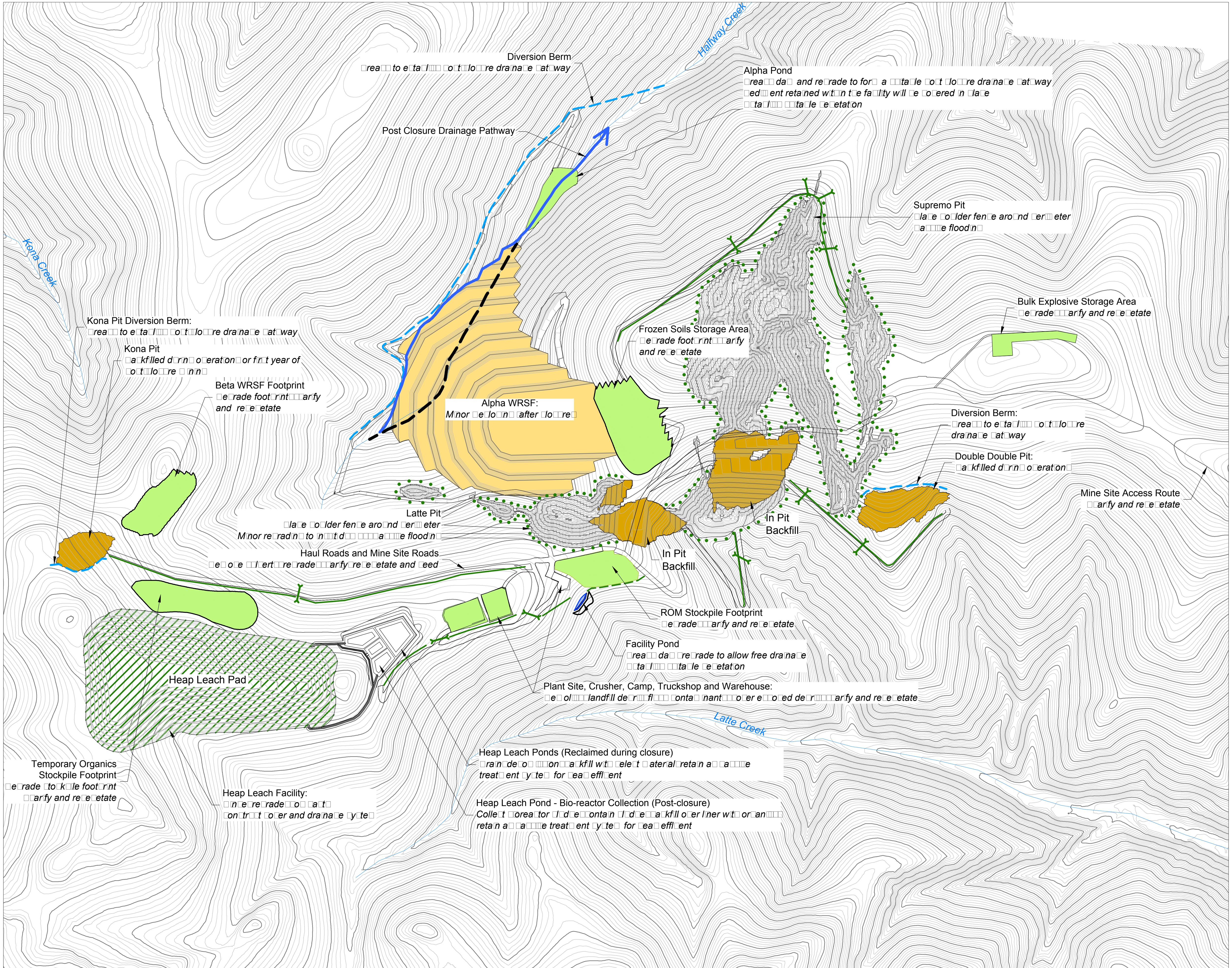
The Project was planned with closure in mind, ensuring the integration of reclamation and closure considerations into the mine plan for construction and operation activities, including the timing of such activities. Several key principles were integrated into Project planning including reclaiming disturbed areas progressively during the Operation Phase (as described in **Section 2.6.7 Operational Closure Activities**), reducing affected water and controlling contaminants at source, and planning for long-term monitoring and maintenance, while minimizing long-term operational activities. **Appendix 31-C Conceptual Reclamation and Closure Plan** describes Reclamation and Closure Phase and Post-closure Phase activities. A summary description of key activities is provided below for the Reclamation and Closure Phase and in **Section 2.8 Post-closure Phase Activities** for the Post-closure Phase.

There are two stages within the Reclamation and Closure Phase: Post-mining Closure and Active Closure. The schedule of key activities during these stages is summarized below in **Table 2.7-1**. Refer to **Appendix 31-C Conceptual Reclamation and Closure Plan** for a detailed description of Reclamation and Closure Phase activities, including monitoring.

The layout of the Mine Site at the end of the Reclamation and Closure Phase is shown on **Figure 2.7-1**.

### Table 2.7-1 Summary of Key Reclamation and Closure Phase Activities

| Project Component | Key Reclamation and Closure Phase Activities |
|---|---|
| **Overall Mine Site** | Reclamation of disturbed areas within mine site footprint |
| | Excavation of contaminated soil followed by on-site treatment or temporary storage and off-site disposal |
| **Open Pits** | Reclamation of Double Double pit, Latte pit, Supremo pit, and Kona pit |
| **WRSFs** | Reclamation of Alpha WRSF |
| | Reclamation of Beta WRSF footprint area |
| **Stockpiles** | Reclamation of temporary organics stockpile area, frozen soil storage area, and ROM stockpile area |
| **Crusher System** | Dismantling and removal of crusher facility and stockpile |
| **Heap Leach Facility** | Closure of HLF and related water management structures |
| **Plant Site** | Dismantling and removal of process plant, reagent storage area, laboratory, truck shop and warehouse building, power plant, and bulk fuel storage |
| **Camp Site** | Dismantling and removal or dormitories and kitchen, dining, and recreation complex buildings, mine dry and office complex, emergency response and training building, fresh (potable) water and fire water systems, sewage treatment plant, and waste management building |
| **Bulk Explosive Storage Area** | Dismantling and removal of explosives storage facility |
| **Mine Site and Haul Roads** | Decommissioning and reclamation of mine site service roads and haul roads |
| **Site Water Management Infrastructure** | Decommissioning and reclamation of selected water management infrastructure, construction of long term water management infrastructure, including water deposition to creek systems |
| | Operation and maintenance of HLF water treatment facility |
| | Decommissioning and removal of HLF water treatment plant |
| **Ancillary Components** | NAR road maintenance (e.g., aggregate re-surfacing, sanding, snow removal) |
| | NAR vehicle traffic |
| | Operation and maintenance of barge landing sites on Stewart River and Yukon River |
| | Annual resupply of consumables and materials for active closure via barge on the Yukon River |
| | Annual construction, maintenance, and decommissioning of Stewart River and Yukon River ice roads |
| | Decommissioning of new road portions |
| | Air traffic |
| | Decommissioning and reclamation of airstrip |
| | Operation of Coffee Exploration Camp to support monitoring activities |




# COFFEE GOLD MINE

## Mine Site General Arrangement
## Year 2

### Legend

- Diversion Berm
- Rock Drain
- Reclaimed Road Diversion Ditch
- Reclaimed Waste Rock Collection Channel
- Reclaimed Footprint
- Reclaimed Heap Leach Pad
- Pit Backfill
- Pit Footprint
- Sedimentation Pond
- Waste Rock Storage Facility (WRSF)
- Removed Culvert Alignment
- Boulder Fence

### Other Infrastructure (not shown)

Power Plant
Fuel Storage Farm
Utilities
Laydown and Storage Areas
Waste Management Infrastructure

### Other Reclamation Areas

Airstrip: Lighting, navigation equipment, and culverts will be removed.
Regrade to promote positive drainage to eliminate potential hazards.
Scarify and revegetate.
Exploration Airstrip: Lighting, navigation equipment and culverts will be removed
Regrade to promote positive drainage to eliminate potential hazards
Scarify and revegetate.
Northern Access Route: Decommissioned at closure.
Culverts and bridges removed, regrade to maintain pre-construction surface drainage.
Remove barge landings
Regrading to promote positive drainage.
Scarify road.

### Notes

1. This figure is not intended to be a "stand-alone" document, but a visual aid to the information contained within the referenced Report. It is intended to be used in conjunction with the scope of services and limitations described therein.
2. Contours shown at a 5 meter contour interval

N

1:25,000

0 2500 5000 7500 10000

Metres

NAD 1983 UTM Zone 7N

Page Size: 11" x 17"

| Figure 2.7-1 | Date: Mar 30, 2017 | Drawn by: TAH | Reviewed: DBM |
|---|---|---|---|

GOLDCORP

Path: P:\01_SITES\Coffee Gold\1040_AutoCAD\Conceptual Reclam and Closure Plan\Final Closure.dwg

### 2.7.1 POST-MINING CLOSURE STAGE

The Post-mining Closure Stage will be triggered by the cessation of mining and other operations activities, and is anticipated to occur over a six-year period from Year 13 to Year 18. During this stage, ore processing will continue, and infrastructure will be dismantled or decommissioned and equipment will be removed from active service once it is no longer required. Infrastructure at the Camp Site will remain operational until the end of the stage, at which time it will be decommissioned.

The NAR will be operational during this stage to permit the transport of equipment, fuel, and consumables to the Mine Site, and the removal of hazardous materials and other wastes (e.g., recyclables) and equipment. The NAR will be decommissioned at the end of this stage, unless otherwise directed by First Nations or regulators. The airstrip will be used by fixed wing aircraft to deliver select materials, perishables, and passengers on an as needed basis, and will be decommissioned at the end of this stage.

Reclamation activities at disturbed areas will continue and subsequent monitoring of these reclaimed areas will be undertaken. Monitoring of infrastructure and the aquatic and terrestrial environments will be conducted as per details outlined in **Appendix 31-C Conceptual Reclamation and Closure Plan**. Surveillance monitoring of the Mine Site will include routine, annual, and event-driven inspections.

### 2.7.2 ACTIVE CLOSURE STAGE

Active Closure is expected to occur over a five-year period from Year 19 to the end of Year 23. During this stage, water treatment requirements will continue until effluent is of suitable quality for discharge, and reclamation and closure activities for remaining infrastructure will be completed.

Access to the Mine Site during this stage will be during the summer. The exploration airstrip will be used on an as-needed basis, and personnel will be housed at the Coffee exploration camp. Temporary facilities will be used for fuel storage, potable water treatment, sewage treatment, and communications, with power supplied by a generator.

Reclamation activities at disturbed areas will continue and subsequent monitoring of these reclaimed areas will be undertaken. Monitoring of infrastructure and the aquatic and terrestrial environments will be conducted as per details outlined in **Appendix 31-C Conceptual Reclamation and Closure Plan** to achieve compliance and observe progress toward the return of the Mine Site to pre-mining conditions. Surveillance monitoring of the Mine Site will include routine, annual, and event-driven inspections.

## 2.8 POST-CLOSURE PHASE ACTIVITIES

The Post-closure Phase will start when post-closure water quality objectives are met and subsequently the remaining water management infrastructure has been decommissioned. This phase is expected to occur from Year 24 onwards as determined to be required.

Access to the Mine Site will occur during the summer, primarily by aircraft using the exploration airstrip. Personnel will be housed at the Coffee exploration camp. Temporary facilities will be used for fuel storage, potable water treatment, sewage treatment, and communications, with power supplied by a generator. These temporary facilities will be decommissioned when Post-closure Phase monitoring is complete.

Water quality will be monitored once per year in summer from pit lakes, Alpha WRSF, and the Mine Site discharge points until all closure objectives and regulatory requirements have been met. Annual surveillance monitoring of the pit lakes, WRSF, and HLF area will be conducted to identify apparent physical changes, and corrective measures undertaken as necessary. The surveillance monitoring program will be revised based on site conditions, and requirements modified as necessary. Refer to **Appendix 31-C Conceptual Reclamation and Closure Plan** for more information.

## 2.9 Seasonal or Temporary Closure Activities

Seasonal closure refers to the cessation of activities in a specific season (e.g., winter season) while temporary closure refers to a closure in which operational activities cease with the intent of resuming activities in the near future. While both seasonal and temporary closures are not planned for the Project, Goldcorp will have appropriate measures in place to prevent potential risk to the environment or personnel.

To minimize outstanding liability and risks while the site is in seasonal or temporary closure, the primary objectives during such a period will be to:

- Confirm that all mine-related infrastructure and facilities are physically and chemically stable and performing in accordance with designs.
- Confirm that all mine-related infrastructure and processes can withstand severe climatic and seismic events.
- Eliminate or minimize health and safety hazards to site personnel and area wildlife by achieving conditions similar to local area features or preventing access to areas that are not reclaimed that pose a risk.
- Confirm that mine-related disturbances (e.g., building sites, hazardous materials storage sites, roads, etc.) will not adversely affect aquatic and terrestrial environments to prevent future long-term uses or a self-sustaining ecosystem.

Prior to the onset of care and maintenance activities during a seasonal or temporary closure, it is likely that operations personnel will complete all necessary outstanding repairs; winterize water collection and diversion systems, mobile equipment, buildings, and other site infrastructure; and that waste materials stored in waste transfer areas are transported to appropriate disposal, recycling, or salvage facilities.

### 2.9.1 SEASONAL CLOSURE

A seasonal closure is most likely to occur prior to the Construction Phase or early in the development of the mine (Year –3 or Year –2), and in conjunction with a suspension of NAR operation when the Stewart and Yukon Rivers are freezing up in the fall through early winter.

A care and maintenance program during a seasonal closure would require a reduced workforce to conduct the following activities:

- Inspect and maintain property assets.
- Maintain site security and restricted access to authorized personnel only.
- Confirm that barriers and warning signs are in place around hazardous areas (e.g., excavations, open pits).
- Confirm that hazardous materials and explosives are safely stored.
- Secure machinery and mobile equipment when not required.
- Implement measures outlined in the Project's management plans, as necessary.
- Continue with inspection, monitoring, and reporting activities as per licence and permit requirements.

During a seasonal closure that occurs late in the Construction Phase or early in the Operation Phase, additional activities may be required to achieve primary objectives. Such activities applicable to a more developed mine site are likely to be similar to those described below for temporary closure (e.g., recirculation of heap leach process solutions if the HLF has been commissioned).

General measures and activities that are likely to be undertaken during seasonal closure are described in further detail in **Appendix 31-C Conceptual Reclamation and Closure Plan**.

### 2.9.2 TEMPORARY CLOSURE

A temporary suspension of operational activities may result following a change in market conditions or mine-related factors, and may be either planned or unplanned. For planning purposes, it is assumed that a temporary closure would occur at the commencement of the Operation Phase (Year 1); it is also assumed that the suspension of operations during a temporary closure would last for more than a continuous six-month period, but fewer than three years. The duration of temporary closure will ultimately be defined by conditions specified in water use and mining licences.

The key measures to be undertaken during a temporary closure period are associated with ensuring that the site is secure and safe to minimize health and safety risks, and ensuring compliance with all regulatory and licensing requirements to manage risks associated with potential abandonment of a site.

At the onset of temporary closure, a care and maintenance program will be implemented to a level such that all mining infrastructure and processes are in operable condition for a period of up to three years so that full operations can resume in a timely manner should the decision be made to recommence production. Temporary closure activities would continue until mining resumes or until the decision is made to permanently close the mine (i.e., if prevailing conditions for the resumption of operations are not favourable).

General measures and activities that are likely to be undertaken during temporary closure are described in further detail in **Appendix 31-C Conceptual Reclamation and Closure Plan**.

## 2.10 PROJECT ALTERNATIVES AND CHOSEN APPROACH

This section describes the methodology and criteria used by Kaminak Gold Corporation, a wholly owned subsidiary of Goldcorp Inc. (Goldcorp or Proponent) and its consultants to select preferred options from a variety of alternative means for developing the proposed Coffee Gold Mine (Project). The alternatives assessment identifies both potential Project alternatives and alternative means of carrying out the Project.

In the absence of specific guidelines from the Yukon Environmental and Socio-economic Assessment Board, this alternatives assessment adheres to the Operational Policy Statement entitled *Addressing "Purpose of" and "Alternative Means" under the Canadian Environmental Assessment Act, 2012* (CEA Agency 2015). The Canadian Environmental Assessment Agency Operational Policy Statement provides a rigorous, defensible methodology for assessing alternative means for a project, and incorporates technical, economic, environmental, and socio-economic considerations into decision-making. Under the Canadian Environmental Assessment Agency Operational Policy Statement, alternative means of carrying out the Project are defined as the various technically and economically feasible ways that the Project may be implemented or carried out. A similar definition is used in Yukon (YESAB 2005).

Throughout the design process, Goldcorp has made numerous decisions on how to develop and implement the Project throughout the Construction, Operation, Reclamation and Closure, and Post-closure phases based on Project economic, technical, environmental, and social criteria. The decision-making process to identify the preferred Project alternative for the following components is reported in this section, and includes:

- Mining method (**Section 2.10.5.1**)
- Ore processing method (**Section 2.10.5.2**)
- Heap Leach Facility (HLF) site (**Section 2.10.5.3**)
- Waste Rock Storage Facilities (WRSFs) site (**Section 2.10.5.4**)
- Ore movement method (**Section 2.10.5.5**)
- Mine accommodation (**Section 2.10.5.6**)

- Mine Site access routes (**Section 2.10.5.7**)
- Power source (**Section 2.10.5.8**).

### 2.10.1 METHODOLOGY

As recommended by the Operation Policy Statement (CEA Agency 2015), four steps are used to determine the preferred option for each component of the Project:

- Step 1: Identify technically and economically feasible alternative means.
- Step 2: List potentially significant Project-related effects on key Intermediate Components (ICs) and Valued Components (VCs).
- Step 3: Select approach for the analysis of alternative means.
- Step 4: Assess effects of alternative means (see subsequent sections of the Project Proposal).

Steps 2 through 4 only apply for alternative means analyses if more than one option is selected from Step 1.

#### *2.10.1.1 Performance Objectives, Criteria, and Indicators*

Performance objectives are used to assist with the screening and subsequent assessment of identified alternatives. Performance objectives are meaningful attributes that are essential for Project success, and provide a basis for distinguishing between individual alternatives. The performance objectives used for this assessment are described in **Table 2.10-1**.

For each Project component screened in the detailed assessment, the attributes for the alternative means of developing the Project were evaluated against the four performance objectives. Each alternatives assessment is summarized in an evaluation table that demonstrates how attributes and alternatives have been ranked against the applicable performance objectives. Attributes are characterized as being **preferred, acceptable, challenging**, or **unacceptable**, depending on how well they meet the requirements and goals for each performance objective using the rationale and colour scheme provided in **Table 2.10-1**.

As summarized in the alternatives assessment evaluation tables, after the attributes were rated, each alternative was then evaluated as a whole, receiving an overall rating of preferred, acceptable, challenging, or unacceptable depending on how its attribute ratings compared against other alternatives. Where attributes have been determined to be acceptable for different alternatives, preference between them is set based on relative advantage or disadvantage.

### Table 2.10-1 Alternatives Assessment Performance Criteria

| Section Criteria | Considerations | Rankings | | | |
|---|---|---|---|---|---|
| | | Preferred | Acceptable | Challenging | Unacceptable |
| **Technical Feasibility**<br>Considers applicability, system integrity, and reliability as appropriate to the issue to describe the suitability or expected technical performance of a given alternative. | • Potential for increased capacity<br>• Transportation<br>• Flexibility regarding technical, operation, and environmental uncertainties<br>• Proposed technologies and the advantages and disadvantages of the technologies considered<br>• Technical feasibility and risks<br>• Availability of construction material and volume requirements<br>• Post-closure risks and uncertainties | Predictably effective with contingencies if the alternative does not perform as expected. | Appears effective based on modelling / theoretical results; contingencies are available if the alternative fails to perform as expected. | Appears marginally effective based on modelling / theoretical results; contingencies may not be available if the alternative fails to perform as expected. | Effectiveness appears dubious or relies on unproven technologies (not including innovative design or technologies with adequate justification). |
| **Economic Viability**<br>Explores if the Project can sustain operations based on current and projected revenues versus current and planned expenditures. | • Capital, Operational, Reclamation- and Closure, and Post-closure costs<br>• Economic risks and benefits<br>• Regulatory review and construction timeline costs | Facilitates a competitive return on investment. | Facilitates an acceptable return on investment. | May or may not facilitate an acceptable return on investment. | Cannot be financially supported by the Project. |
| **Environmental Considerations**<br>Considers the overall environmental effects of the Project, ability to mitigate effects, and amenability to reclamation. | • Overall affected land footprint size<br>• Issues related to water quality, atmosphere, hydrology, and hydrogeology<br>• Considerations related to climate change adaptation<br>• Effects to biological VCs<br>• Amenability to reclamation | Minimizes adverse effects on VCs / ICs without mitigation; no significant adverse Project or cumulative effects expected. | Minimizes adverse effects on VCs / ICs with mitigation; no significant adverse Project or cumulative effects expected. | May cause significant adverse Project or cumulative effects on VCs / ICs. | Likely to cause significant adverse Project or cumulative effects on VCs / ICs. |

| Section Criteria | Considerations | Rankings | | | |
|---|---|---|---|---|---|
| | | Preferred | Acceptable | Challenging | Unacceptable |
| **Human Environment Considerations**<br>Evaluates if the Project will cause positive or adverse changes on socio-economic VCs / ICs. | • Overall perceived consequences, benefits, and relative preferences from community members, First Nations, Yukon Government<br>• Preservation of archaeological or cultural sites and heritage resources<br>• Potential effects on Yukon First Nations<br>• Maintenance of traditional lifestyle or spiritual well-being<br>• Uses such as recreational, tourism, industrial<br>• Safety considerations | Minimizes adverse effects on VCs / ICs without mitigation; no significant adverse Project or cumulative effects expected. | Minimizes adverse effects on VCs / ICs with mitigation; no significant adverse Project or cumulative effects expected. | May cause significant adverse Project or cumulative effects on VCs / ICs. | Likely to cause significant adverse Project or cumulative effects on VCs / ICs. |

### 2.10.2 SCREENING

Potential Project alternative means were identified by first screening out the basic technical and economic feasibility criteria of preliminary options during the Pre-feasibility and Feasibility studies. These processes resulted in a list of alternative means, provided in **Table 2.10-2**, to be carried forward for further analysis (see **Section 2.10.5.1** through **Section 2.10.5.8**). Project alternatives are described in **Section 2.10.4**.

### Table 2.10-2 Alternative Means of Undertaking the Project

| Project Component or Activity | Alternative |
|---|---|
| Mining Method | Option 1: Underground mining |
| | Option 2: Open pit mining |
| Ore Processing Method | Option 1: Heap leach processing |
| | Option 2: On-off leaching |
| | Option 3: Grinding ore with cyanidation of ore slurry |
| Heap Leach Facility Site | Option 1: Ridgetops A and B Leach Pads |
| | Option 2: Ridgetop 2016 FS Pad |
| | Option 3: Valley C Leach Pad, Non-impounding (i.e., free draining) valley heap leach pad |
| | Option 4: KP Valley Leach Pad, Impounding valley heap leach pad with in-heap pond |
| Waste Rock Storage Facilities Site | Option 1 (Base Case):<br>• Three WRSFs (Alpha, South and North)<br>• WRSF sites optimized for minimal cost for haulage<br>• Backfilling of approximately 54 MT |
| | Option 2:<br>• Three WRSFs (Alpha, South and North)<br>• South WRSF site maximized to store as much as possible, North WRSF minimized, Alpha WRSF kept roughly the same as Base Case<br>• Backfilling strategy same as Base Case |
| | Option 3:<br>• Two WRSFs (Alpha and South)<br>• South WRSF Site maximized to store as much as possible, North WRSF Site eliminated, Alpha WRSF Site increased to accommodate remainder of waste material<br>• Backfilling strategy same as Base Case |
| | Option 4:<br>• One WRSF (Alpha)<br>• Backfilling strategy same as Base Case |

| Project Component or Activity | Alternative |
|---|---|
| | Option 5:<br>• One WRSF (South)<br>• Backfilling maximized to the greatest extent possible |
| | Option 6:<br>• Three WRSFs (Alpha, South and North)<br>• Backfilling fully optimized, based on handling/hauling costs |
| | Option 7:<br>• Two WRSFs (Alpha and North)<br>• South WRSF Site eliminated, Alpha WRSF Site and North WRSF Site optimized;<br>• Backfilling strategy same as Base Case |
| Ore Movement Method | Option 1: Conveyer system |
| | Option 2: Truck hauling |
| Mine Accommodation | Option 1: On-site Accommodations |
| | Option 2: Accommodation in nearby communities with daily transport to and from Project |
| Mine Site Access Road Route | Option 1: Freegold |
| | Option 1a: Freegold Bypass |
| | Option 2: Minto |
| | Option 3: Onion Creek |
| | Option 4: Snag Road |
| | Option 5: City of Dawson |
| | Option 6: Pelly Farm |
| | Option 7: Mt. Nansen Road |
| | Option 8: Mt. Nansen Bypass |
| Power Source | Option 1: Diesel Generators |
| | Option 2: Diesel Generators and Transmission Line |
| | Option 3: Bi-fuel (Diesel / LNG) Generators |

**Notes:** LNG - liquefied natural gas; MT - million tonnes

### 2.10.3 ALTERNATIVES TO THE PROJECT

Unlike other types of projects for which a number of alternatives to the project may be available, the Project is unique because the ore body has a fixed location, and the only way to proceed with a mining venture is to mine the ore body in place. The size of the Project, including the ore reserve and crushing throughput, has been optimized for economic return (JDS 2016). Reducing the size of the Project affects economic return quickly, and would make the Project less robust to metal price fluctuations.

The evaluated alternatives to the Project are:

- **Alternative 1**: Proceed with the Project in the near-term, as planned.
- **Alternative 2**: Delay the Project.
- **Alternative 3**: Abandon the Project (the no development scenario).

#### *2.10.3.1 Technical Feasibility*

The alternatives are technically feasible. The Project is technically feasible, and would remain so at a future date. Alternative 3, the no development scenario, requires no technical feasibility evaluation.

#### *2.10.3.2 Economic Viability*

Proceeding with the Project in the near-term as planned provides a competitive return on investment, and is the preferred alternative. Delaying the Project would only be an acceptable alternative if future economic conditions could be reliably predicted to be more favourable. Future economic conditions are difficult to predict, increasing the economic risks of delay for the Project. There is no assurance that future economic conditions would equally or more strongly support a decision to proceed with the Project than currently exists under the above base-case gold price for copper and gold; therefore, the alternative of delaying the Project does not meet the minimal acceptable criterion for economic viability.

Abandoning the Project or selecting the no development scenario is also an unacceptable alternative because it does not meet the Project goals of providing a competitive return on investment or helping to meet the current and forecasted demand for gold.

#### *2.10.3.3 Summary*

All three alternatives are considered to be technically feasible; however, only Alternative 1 is considered to be economically viable. Alternative 1, proceed with the Project in near-term, as planned, is thus the preferred alternative.

### 2.10.4 Alternative Means of Carrying Out the Project

This section presents the alternative means identified for carrying out the Project, and provides details on the mining method, ore processing method, HLF site, WRSF site, method of moving ore, mine accommodations, access routes to the Mine Site, and selection of the preferred power source.

#### *2.10.4.1 Consultation and Engagement*

The consultation and engagement efforts with regards to alternatives focus on siting of the access road and WRSFs based on feedback from regulatory agencies, First Nations, stakeholders, and the public. Goldcorp undertook a number of consultation and engagement activities, including, but not limited to:

- A presentation delivered to Tr'ondëk Hwëch'in (TH) on the Access Road Options Study and the preferred option in April 2015
- A meeting held with representatives of the Ministry of Highway and Public Works and the Ministry of Energy, Mines and Resources to provide the rationales for the preferred access road option in July 2015.
- Workshops held with First Nations (i.e., Selkirk First Nation (SFN), Tr'ondëk Hwëch'in (TH), and White River First Nation (WRFN)) to solicit input on WRSF site options in early February 2017.

Further details of consultation and engagement efforts are presented in **Section 3.0 Consultation**.

#### *2.10.4.2 Mining Method*

The main methods for recovering ore from hard rock mines are open pit and underground mining. Both methods use drilling, blasting, and heavy equipment, but have different environmental, social, technical, and economic considerations.

Open pit mining is the industry-standard practice for large-tonnage metal mining in western Canada, particularly for lower-grade ore deposits. The decision to undertake underground mining instead of open pit mining is constrained by technical and economic considerations based on the deposit position, type, and ore grade. These factors influence the potential production rates that can be achieved, and ultimately determine the feasibility of underground mining.

Open pit mining is ideal for extraction of ore bodies that extend from the surface to considerable depths, and that have substantial horizontal dimensions with relatively little overburden. The method is flexible, allowing for large variations in production schedules at relatively short notice, and can be highly mechanized. Open pit mines are developed by excavating rock along a series of regularly spaced horizontal lifts or benches, starting with overburden, to access ore. Given favourable stripping ratios and climatic conditions, open pit mining produces ore at a fraction of the cost of underground mining.

Underground mining is generally more selective, producing less waste rock than open pit mining, and poses fewer surface impacts. Conversely, underground mining is also associated with lower production rates, greater equipment and employment needs; and additional expenditures for air ventilation and ground support. As such, underground mining has higher overall operating costs than open pit mining.

***Technical Feasibility***

The main components that were considered in the evaluation and subsequent selection of open pit mining in place of underground mining methods include: ore deposit geometry and size, production rate, and ground conditions.

For the Coffee deposit, open pit mining was selected and is more technically sound due to the following characteristics: proximity of ore to surface, size and geometry of the current defined ore body, and ability to mine at a faster rate. The primary disadvantages associated with open pit mining include optics (and the ability to permit the mine), and creation of a larger volume of waste rock, which then requires handling and storage at a cost. The Coffee Project site does not have any limitations in terms of storage areas for the waste rock associated with extraction of the ore using open pit mining methods.

***Economic Viability***

Open pit mining at the Project is less costly than underground mining, as it requires less specialized equipment, less infrastructure (i.e. air ventilation and ground support required in underground mining), and is cheaper to mine per tonne of rock. Open pit mining does incur costs for increased waste handling, storage, and water management due to the non-selective nature of the method; however, this additional cost does not offset the savings in using open pit mining versus underground. The Project's Feasibility Study (JDS 2016) determined that open pit mining can support and provide a favourable economic return and for this reason, open pit mining was selected.

***Identification of Preferred Means***

**Table 2.10-3** presents a summary of the mining method alternatives considered for the Project. Open pit mining was selected as the technically and economically preferred mining method for the Project.

**Table 2.10-3 Summary of Technical Feasibility and Economic Viability for Mining Methods**

| Alternative Means | Technical Feasibility | Economic Viability | Selected Alternative? (Yes/No) |
|---|---|---|---|
| Open Pit Mining | **Preferred**<br>Most appropriate method for current Project ore body geometry and configuration | **Preferred**<br>Most cost-effective method for Project ore body configuration | **Yes** |
| Underground Mining | **Acceptable**<br>Technically acceptable | **Challenging**<br>More costly, and may result in a non-economically viable mining method for the Project | **No** |

#### *2.10.4.3 Ore Processing Method*

The ore processing method for this project is cyanidation of crushed rock to extract gold. Test work indicated high recoveries are achievable for the project with minimal crushing (80% passing ($P_{80}$) 50 mm).

Heap leaching involves a two-stage crushing circuit and then loading crushed material into trucks for transported to the heap leach facility (HLF). The material is stacked in lifts and then leached with a weak cyanide solution distributed through a network of pipes and drip emitters. The pregnant solution from the heap leach pad is then piped to the Adsorption, Desorption and Regeneration (ADR) and refinery plant. The barren solution may be heated, and then reagents are added before it is pumped back to the heap leach pad.

On-off leaching involves placing crushed ore onto a dedicated prepared surface, stacking, and then leaching. Once the leach process is completed, the spent ore is removed, making way for more fresh ore. As the spent material is reclaimed, typically with a bucket wheel excavator, the stacking system places fresh ore in the reclaimed area. The pregnant solution from the pads is sent to the ADR and refinery plant to recover the gold into doré bars.

Fine grinding of ore, followed by the cyanidation of the ore slurry for gold recovery, is a common ore processing method. In this process, crushed material is further reduced in a grinding circuit to produce a particle size that can be leached in a shorter time period. Cyanide solution is added to mechanically agitated leach tanks to extract the gold and the resulting pregnant solution is processed in an ADR and refinery area similar to the HL and on-off pad options. Due to the smaller particle size involved, metal recovery can be higher than for either heap leaching method discussed above; however, a tailings impoundment area (TIA) would be required for safe long-term storage of the milled product.

***Technical Feasibility***

The primary technical concern for heap leach operations in a cold climate is maintaining the internal temperature of the heap to prevent freezing of the process solution (weak cyanide). Successful precedents for heap leach facilities in cold climates worldwide include the nearby Brewery Creek Mine in Yukon (EBA Tetra Tech 2011) and Fort Knox Mine in Alaska (Sims 2015). Operational experience at the Brewery Creek Mine demonstrated that cyanide solution temperatures can be maintained above freezing throughout Yukon winters. Annually, solution temperatures in the heap pad ranged between 6 degrees Celsius (°C) and 13°C, indicating that the pad freeze-up scenario is less likely for potential future operations in Yukon (EBA Tetra Tech 2011).

The on-off pads would be difficult to operate in a cold climate due to the small size of the pads under leach. The pads are leached and then the ore is replaced on a much shorter interval, increasing the likelihood of the leach solution freezing. Once the on-off pads have been leached to completion, the material must be removed and transported to a disposal site so fresh ore can be added. The leached ore would need to be rinsed and treated for residual cyanide in a contained area before reclamation can be completed. The logistics for this option with respect to double handling and safe disposal of the leached ore in addition to the freezing issues make this option technically difficult to manage. Due to these challenges this option was not considered further.

Conventional fine grinding and cyanidation also has multiple successful precedents in cold climates, including in arctic and sub-arctic North America for the Fort Knox Mine in Alaska (Sims 2015), the Meadowbank Gold Mine in Nunavut (Agnico Eagle 2016), Lupin Gold Mine in Nunavut (WPC Resources 2015), Con Mine in Northwest Territories (NNS 2015), and Kemess Mine in northern British Columbia (AuRico Gold 2014). The primary advantage of conventional milling and cyanidation is the increased metal recovery over other technologies (EBA Tetra Tech 2011). The primary disadvantage is the higher capital and operating costs associated with process plant including the construction, operation, and closure of a TIA and associated infrastructure required. Long-term geotechnical and environmental monitoring may be associated with the permanent storage of tailings, particularly if a containment dam is required. The additional ore processing has not been found to substantially increase gold recovery to make this a cost-effective option for this Project compared to heap leaching and was not considered further.

***Economic Viability***

Fine grinding with cyanidation of ore slurry involves higher costs than for heap leaching due to additional grinding, tailings processing, and the need to construct, operate, and reclaim or close a TIA. The use of on-off pads involves additional material handling, as well as separate treatment and storage facilities, and is therefore more costly than heap leach processing. Thus, heap leaching of the crushed material offered the most cost-efficient method of gold recovery for the Project based on the high recoveries that can be achieved at a coarse crush size.

***Identification of Preferred Means***

**Table 2.10-4** presents the summary of the technical and economic analysis of the ore processing methods. Heap leach processing is the only technically and economically feasible method of ore processing method evaluated for the Project, and is the selected ore processing method.

**Table 2.10-4 Summary of Technical Feasibility and Economic Viability of Alternative Means for Ore Processing Method**

| Alternative Means | Technical Feasibility | Economic Viability | Selected Alternative? (Yes/No) |
|---|---|---|---|
| Heap leach processing | **Preferred**<br>Successful precedent exists in cold climates, including the nearby Brewery Creek Mine; most efficient gold extraction technology for oxidized ores. The material is amenable to leaching at a $P_{80}$ of 50 mm requiring only 2 stages of crushing. | **Preferred**<br>Most cost-efficient option<br>High gold extraction with low capital and operating costs. Similar recovery to conventional milling option. | **Yes** |
| On-off pads | **Unacceptable**<br>Solution control is less complex. Smaller pads require reduction in solution pumping distances and pump size.<br>Thermal issues as a result of pad size; potential for freezing is high. Disposal is difficult due to contamination and treatment requirements, creating closure challenges. | **Challenging**<br>Additional material handling costs.<br>Lower capital and operating costs than fine grinding with cyanidation of ore slurry. | **No** |
| Fine Grinding with cyanidation of ore slurry | **Acceptable**<br>The construction, operation, and closure of the TIA would be required; successful precedent exists for similar climatic conditions. | **Unacceptable**<br>Least cost-efficient option<br>Additional power and transportation costs associated with milling and grinding ore, and transporting reagents; high costs associated with construction, operation, and reclamation and closure of TIA. | **No** |

### *2.10.4.4 Heap Leach Facility Site*

The Project will use heap leach technology to extract gold from the ore (see **Section 2.9.4.2**); with a capacity to 61.4 Mt. Two leach pad technologies were determined to be appropriate for the Project: conventional free-draining pads, and valley fills. Conventional free-draining leach pads are relatively flat, either graded, smooth, or terrain-contouring on gentle slopes. Lifts are generally thin; i.e., 5 metres (m) to 15 m. Valley fill systems are leach pads designed in natural valleys using either a buttress dam at the bottom of the valley, or a levelling fill within the valley (Thiel and Smith 2004).

Investigations of the two technologies led to four facility site options for siting the HLF (The Mines Group 2015a, 2015b). Options 1 and 2 involve ridgetop storage, and Options 3 and 4 valley fill (**Figure 2.9-1**), as described below.

***Option 1 – Ridgetop A and B Leach Pads***

This option involves conventional, multi-lift (nominally 10 m), free-draining ridge-top leach pads to the southwest of the Latte, Double Double, and Supremo pits, and south of the Kona pit (**Figure 2.10-1**). Ridgetop A would be constructed with a total capacity of 25 Mt. A starter pad would be built at Ridgetop A with a minimum capacity of 5 Mt. Construction would involve cut and fill using a maximum pad slope of 5 percent (%). Fill would principally be used to provide setback and a 10-m-wide access road on the edge of the pad. Ridgetop B would be immediately adjacent to and west of Ridgetop A, and commence operations in about Year 5 with a similar starter pad. This option has the shortest haul distance from the crushing plant and would provide a combined capacity of 60 Mt.

***Option 2 – 2016 FS Leach Pad***

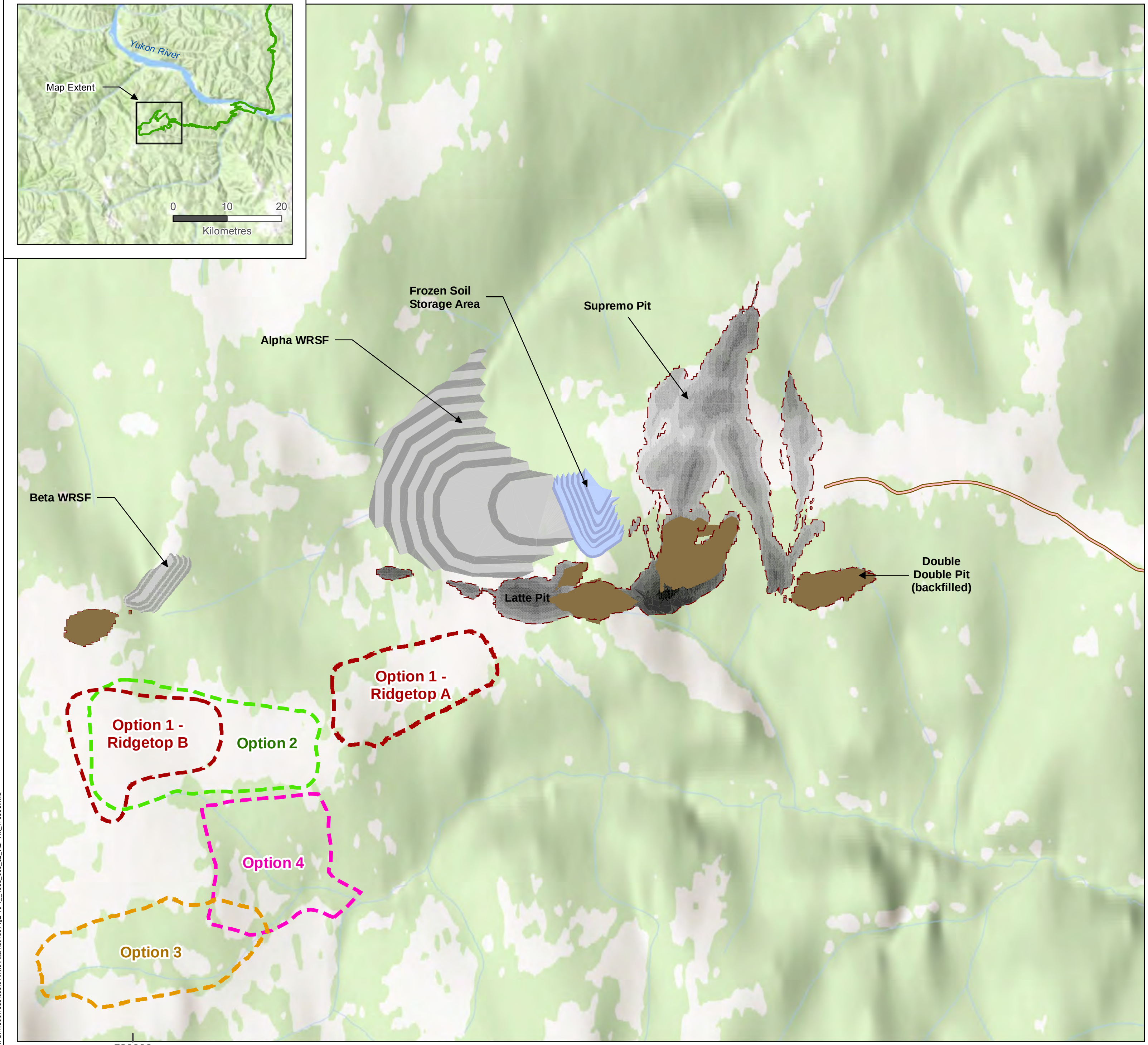
This option involves one conventional leach pad at the ridgetop west of the Latte pit and south of the Kona pit (**Figure 2.9-1**). The ridge-top HLF would consist of a conventional, multi-lift free-draining heap over a gently sloping heap leach pad, which would extend along the axis of the ridge to the west of the process plant. Construction of a starter pad would be constructed in Year -1 with a nominal capacity of 3.5 Mt and an ore depth of 30 m to maintain thermal integrity. The leach pad would be constructed on a graded area along the ridgeline in stages. Each stage would be large enough to provide capacity for 1.5 to 3 years of operation. Ore would be stacked at 5Mt per year starting in Year 1 and benched at 2.5H:1V (horizontal to vertical) overall slopes to a maximum height of approximately 80 m (measured vertically over the liner system). The nominal capacity of the HLF is 61.4 Mt with an expansion capacity to approximately 67 Mt.

***Option 3 – Valley C Leach Pad***

With this option, non-impounding (free-draining) Valley C, located in the valley west of and adjacent to the KP site (see Option 4). A free draining configuration was selected as there is room for conventional ponds at this location, and external ponds are considered to be safer and lower risk than internal ponds (Breitenbach and Smith 2012). External ponds cost less to construct than internal ponds and require less waste rock (Smith and Parra 2014). This option would involve management of steep slopes primarily on the southern abutment side of the valley heap leach pad, as well as permafrost removal; however, overall, this valley gradient is gentler than the KP valley gradient. The initial leach pad would be constructed to an elevation of 1,180 metres above sea level (masl) (base at 1,140 masl) with the ultimate heap crest at elevation 1,290 masl. The starter capacity would be 5.3 Mt, with an ultimate capacity of 61 Mt.

***Option 4 – KP Valley Leach Pad***

With this option, an impounding (in-heap pond) valley leach pad would be located south of the proposed Options 1 and 2 HLF. Impounding valley fill facilities that have steep construction slopes, the impoundment of significant quantities of process solutions behind a large dam, the potential for large stresses and the resulting large deformations in the liner system as the ore settles down slope against the fixed liner system, and the problems which can arise when liners leak are higher risk than free-draining heaps (Breitenbach and Smith 2012). Primarily due to the site preparation involving steep slopes, construction of the starter pad would require at least two full summer seasons, and there is a reasonable assumption that this pad would not be completed until the third summer. The starter capacity would be an estimated 12 Mt, with an ultimate capacity of 60 Mt and final height of 128 m. Approximately 3 Mt of pre-production waste would be used to construct the impoundment dam and platform. Permafrost removal effort would be similar to Option 3.




COFFEE GOLD MINE

**Heap Leach Facility Alternatives**

Legend

- Mine Site Access Route
- Option 1 - Two Conventional Leach Pads
- Option 2 - One Conventional Leach Pad (Selected)
- Option 3 - Non-Impounding Valley Leach Pad
- Option 4 - Impounding Valley Leach Pad
- Backfill
- WRSF Slope
- WRSF Bench
- Frozen Soil Storage Area Slope
- Frozen Soil Storage Area Bench

Notes

1. This map is not intended to be a “stand-alone” document, but a visual aid of the information contained within the referenced Report. It is intended to be used in conjunction with the scope of services and limitations described therein.

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| Figure 2.10-1 | Date: Mar 22, 2017 | Drawn by: JS | Reviewed: DP |
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GOLDCORP

***Technical Feasibility***

Valley fill and conventional storage are both leach technologies with long-established precedents. Conventional leach pads have been used since the 1600s on unlined ore dumps (dump leaching), and since the late 1970s on lined leach pads (heap leaching). These pads tend to be free-draining. Valley leach pad technology was first introduced at the Zortman-Landusky gold mine in Montana in 1979. Valley leach pad technology, where two or three sides of the heap are contained by natural topography, can take two forms: impounding and free-draining. Free-draining pads store process solutions and storm water, snowmelt, and cumulative wet season surplus by gravity flow to external ponds. Impounding valley leach pads differ from conventional leach pads by storing various combinations of process liquid solution and surplus water within internal ponds by using the interstitial pore volume of the ore. A detailed technical comparison of the four options is presented in **Table 2.10-5**.

**Table 2.10-5 Technical Benefits and Disadvantages of Project Heap Leach Location Options**

| Alternative Means | Technical Advantages | Technical Disadvantages |
|---|---|---|
| | • Well-established technology<br>• Amenable to progressive reclamation<br>• Safest configuration in the event of an earthquake<br>• Easiest configuration to construct | • Large volume earthworks typically required |
| | • Lower volume earthworks typically involved<br>• Well-established technology | • Higher risk of failure than Options 1 and 2 due to increased slope and stacking height<br>• Potential inefficiencies from differential leaching due to depth variability of heap<br>• Not amenable to progressive reclamation<br>• Very difficult to repair damaged liners<br>• Higher chance of failure in the event of an earthquake due to steep slopes and differential saturation of heap<br>• Challenges constructing on slopes, with respect to variable soil conditions, excavating on a gradient, and placement of liner |

| Alternative Means | Technical Advantages | Technical Disadvantages |
|---|---|---|
| | • Lower volume earthworks typically involved<br>• Generally only appropriate for use if a non-impounding area is not available (i.e., in restricted mountainous terrain) | • Highest risk of failure or seepage issues<br>• Challenging precedent; e.g., Zortman-Landusky and Summitville Mines are United States (US) Environmental Protection Agency (EPA) Superfund sites primarily due to containment issues with the heap leach impoundment<br>• Challenges constructing on slopes with respect to variable soil conditions, excavating on a gradient, and placement of liner<br>• Increased impoundment volume required due to water storage; storage volume of internal ponds may be much larger than for external ponds<br>• Additional water storage increases wear on liner and chance of leaks and seepage<br>• Saturated storage may decrease leaching efficiency<br>• Potential inefficiencies from differential leaching due to depth variability of heap<br>• Very difficult to repair damaged liners<br>• Not amenable to progressive reclamation<br>• Heap is prone to liquefaction and failure in the event of an earthquake<br>• Options for removal of water from the facility (gravity drains through a liner system and dam, or pumps in vertical caissons) have high failure rates |

Option 3, even though it is free-draining, still involves pad construction and liner placement on steep slopes. Construction on steep slopes is always more challenging than construction on a flatter surface. The existing creek within the footprint would also provide significant construction challenges and high potential for construction delays as construction of under-drains or other water management infrastructure would be necessary. Any seepage though the facilities liners may come into direct contact with the water, and would be more difficult to contain and treat. Water diversion structures around the facility are also generally more difficult to construct the steeper the slope (Breitenbach and Smith 2012). The facility is also not amendable to progressive reclamation, increasing the overall closure risk. Significant technical challenges exist for constructing, operating, and closing this facility; therefore, Option 3 does not meet performance objectives for the Project, and is not considered further in this assessment.

For the reasons outlined in **Table 2.10-5**, including increased wear on liners from the impounded water creating high potential seepage rates through liners, impounding valley fill facilities such as Option 4 can have significantly higher failure rates than a free-draining impoundments. For similar issues, impounding valley fill facilities have also become United States Environmental Protection Agency Superfund sites (Zortman-Landusky Mine Montana; Summitville, Colorado), having caused projects to be redesigned to minimize the use of the valley fill impoundment (Veladero Mine, Argentina) or decommissioned early (Carlota Mine, Arizona). Due to this increased risk and history of failures, this heap leach technology is typically only used if a non-impounding option is not available for a project (Breitenbach and Smith 2012). This increased risk of failure is considered unacceptable for the Project; Option 4 does not meet performance objectives for the Project, and is not considered further in this assessment.

Options 1 and 2 involve ridgetop construction. While these options may involve the highest volumes of earthworks to appropriately prepare the site, non-impounding heap leaches located on relatively flat slopes are by far the safest heap leach facilities to construct, operate, and close. Due to the less challenging construction requirements as compared to Options 3 and 4, construction delays are less likely. These options are also amenable to progressive reclamation, and have the lowest risk of leaks and other forms of failure; therefore, Options 1 and 2 meet the performance objectives for the Project and are considered further in this assessment.

***Economic Viability***

A trade-off study of HLF alternatives concluded that the optimum site and style of leach pad will be a conventional, non-impounding pad with a free-draining heap located on the ridge top to the west of the ADR plant (The Mines Group 2015a). This location and configuration provide the lowest initial capital cost, the lowest life-of-mine total capital cost, and the lowest risk. Faster construction of the pads ultimately improves long-term economic viability. For the ridgetop options, with an early spring construction start (permafrost excavation), the starter pad could be ready for ore in under 14 months. **Table 2.10-6** presents the summary of the technically and economically feasible site alternatives for the proposed HLF.

**Table 2.10-6 Summary of Technical Feasibility and Economic Viability of Alternative Means for Heap Leach Facility Site**

| Alternative Means | Technical Feasibility | Economic Viability | Carried Forward? (Yes/NoYes/No) |
|---|---|---|---|
| **Option 1: Ridgetops A and B Leach Pads** | **Preferred**<br>Technically feasible; HLF is designed in staged cells, which are amenable to progressive reclamation. | **Acceptable**<br>Economically viable; lower cost and shorter construction schedule compared to valley options. Initial capital cost of $20.1 M. | **Yes** |
| **Option 2: 2016 FS Leach Pad** | **Preferred**<br>Technically feasible; HLF is designed in staged cells, which are amenable to progressive reclamation. | **Preferred**<br>Economically viable; lower cost and shorter construction schedule compared to valley options. Lower cost for operational expansion, as no new pad and pumping system needs to be developed for separate pad as in Option 1. | **Yes** |
| **Option 3: Non-impounding Valley C Pad** | **Challenging**<br>Technically feasible; higher risk than ridgetop heap leach pads due to construction on slopes; not amenable to progressive reclamation. | **Unacceptable**<br>Initial capital cost of $29.2 M. Higher risks for cost escalation and delays in delivery. | **No** |
| **Option 4: Impounding KP VFP** | **Challenging**<br>Technically feasible; higher risk than ridgetop heap leach pads due to construction on slopes and need for an impounding facility; higher risk than non-impounding valley heap leach pads; not amenable to progressive reclamation. | **Unacceptable**<br>Unacceptably high initial capital cost of $72.6 M and longest construction period; higher risks for cost escalation and delays in delivery. | **No** |

***Environmental and Socio-economic Effects***

No potentially significant adverse environmental or socio-economic effects are predicted to occur with either ridgetop option. However, to minimize potential effects from Project-related activities it is generally preferable to minimize the overall footprint of a potential project.

Using two heap leach pads rather than one would increase the amount of hauling, site preparation, and other associated construction, operation, and reclamation and closure activities required for the Project. By increasing the number of associated activities, the potential for increased effects to environmental and socio-economic VCs similarly increases.

For these reasons, it was determined that Option 1 using one heap leach pad rather than two would be the preferred HLF option for the Project, as summarized in **Table 2.10-7**.

**Table 2.10-7 Summary of Environmental and Socio-economic Effects for Heap Leach Facility Sites**

| Alternative Means | Environmental Effects | Socio-economic Effects | Selected Alternative? (Yes/No) |
|---|---|---|---|
| **Option 1: Ridgetops A and B Leach Pads** | **Acceptable**<br>Increases overall footprint, which increases potential effects to environmental VCs. | **Acceptable**<br>Increases overall footprint, which increases potential effects to socio-economic VCs. | **No** |
| **Option 2: 2016 FS** | **Preferred**<br>Minimizes overall footprint, which reduces potential effects to environmental VCs. | **Preferred**<br>Minimizes overall footprint, which reduces potential effects to socio-economic VCs. | **Yes** |

***Identification of Preferred Means***

Due to the technical and economic factors considered above, the ridge-top options are preferred over valley fill options as they provide the lowest risk of failure, the lowest initial capital cost, and the lowest life-of-mine total capital cost. The ridge-top options also reduce the construction schedule by one year over Options 3 and 4 because of the reduction in earth works and the elimination of a need for early waste rock to build a dam, which also affects the mine pre-stripping schedule and costs.

Based on the environmental and socio-economic factors considered above, it was determined that one conventional leach pad located at the ridgetop west of the Latte pit and south of the Kona pit (i.e., Ridgetop B) would be optimal for the project. In the Project's Feasibility Study (JDS 2016), Option 2 was shown to accommodate the entire ore reserve considered during the Project while maintaining close proximity to the process plant. As a result, Option 2 was chosen as the preferred alternative for the HLF site.

### *2.10.4.5 Waste Rock Storage Facilities Site*

A total of 300 MT of waste rock will be removed from the Latte, Double Double, Supremo, and Kona pits over the life of the mine. Geochemical characterization indicates that waste rock is non-acid generating and has low metal leaching potential. Although the waste rock from the Kona pit is non-acid generating, a small area of ore exposed in the completed pit wall has weak potential acid generation (PAG) tendencies. Waste rock from the Kona pit will be stored separately in the Beta WRSF adjacent to the Kona pit. To limit exposure of Kona pit wall ore seam to potential oxidation, the Kona pit will either be flooded at closure, or an appropriate proportion of waste rock from the Beta WRSF will be backfilled into the pit upon completion of mining. As the Beta WRSF is universal for all WRSF options to be evaluated, it will not be carried forward for further assessment.

For the Latte, Double Double, and Supremo pits, three WRSF sites (i.e., Alpha (West), South and North WRSF Sites) have been identified for evaluation. As the Project has multiple pits, the options evaluated included storage of all waste rock (other than waste from the Kona pit) in one large storage facility, or storage of waste rock in multiple facilities located proximal to each of the pits. Seven options were evaluated and the WRSF configurations are shown in **Appendix 2-B Alternative Studies** (Trade-off Study on Waste Rock Storage). Key features of these options are shown in **Table 2.10-8**.

***Technical Feasibility***

Geotechnical investigations and subsequent analyses indicate that the foundation conditions are considered conducive to construction of the Alpha, South, and North WRSFs. Permafrost is deep beneath the Alpha and North WRSFs and non-existent to shallow beneath the South WRSF. Depending on the configuration, the WRSFs may be constructed on permafrost soils, which are expected to provide suitable foundation conditions for WRSFs, provided the foundation soils remain frozen. In the case of the North WRSF, it would be necessary to ensure the foundation remains frozen by placing the first lift (approximately 5 m) during the winter season. Geotechnical evaluations planned for 2017 will assist in determining the appropriate construction methodology for the Alpha WRSF in order to maintain adequate interim and long-term stability.

The Alpha would be built from the bottom up by placing material at its natural angle of repose in 40-m lifts. The toe of each subsequent lift would be set back 60 m from the crest of the previous lift, resulting in an overall angle of 3.0:1 (H:V). Flow-through rock drains are planned beneath the WRSF.

The North WRSF would be constructed from the bottom up, and may pose technically challenging conditions. Access would be required to the toe of the facility and long-term facility stability may be difficult to achieve.

The South WRSF would be constructed from the top (ultimate crest) downward as bottom-up construction (i.e., hauling to the base of the dump and constructing the dump upwards in lifts) is not considered practical due to the large elevation difference and steep terrain between the pits and the ultimate toe of the WRSFs. Individual lifts of waste rock should not exceed 50 m in height except for the first lifts of the South WRSF where thicker bottom lifts will be required due to the steep terrain and valley inverts. Approximately 56-m-wide berms would be left between each lift resulting in an overall slope angle of 2.5:1 (H:V). Flow-through rock drains are planned beneath the WRSF.

Alpha and South WRSFs are all assessed to be technically feasible. The North WRSF is considered to be technically challenging. Each of the WRSF site options involves a subset of these WRSFs (i.e., ranging from one to three WRSFs), as such all options are considered technically feasible or challenging (if it includes the North WRSF). While the options with three WRSFs (i.e., Options 1, 2 and 6) provide the most flexibility in the mine plan, the options with two WRSFs (i.e., Options 3 and 7) provide somewhat limited flexibility and those with one single WRSF provide the least flexibility (i.e., Options 4 and 5). Single WRSF would add risk should significant WRSF instability arise. Extensive backfilling (i.e., Option 5) could potentially sterilize future resources and is thus considered financially unacceptable.

***Economic Viability***

To compare WRSF site options, a trade-off study was conducted using the life of mine (LOM) production schedule as the basis to estimate WRSF development sequences. Components that were evaluated and modified for each scenario included haul profiles, equipment productivities, along with truck fleet requirements. The modified parameters were developed for each alterative in order to provide an economic comparison (**Appendix 2-B Alternative Studies**, Trade-off Study on Waste Rock Storage).

Option 1 was established as the “Base Case”. It included the construction of three WRSFs (Alpha, South and North), and the location of these was optimized to minimize haulage costs. Increases and reductions in cost are outlined below relative to this economic scenario. Increases to capital cost are primarily from the addition of haul trucks and increases to operating costs represent the additional cost attributed to the increase in the average haulage distance.

Option 2 was similar to the “Base Case” and included the development of three WRSFs, however, minimized the amount of waste reporting to the North WRSF. The waste rock not reporting to the North WRSF in this option was diverted to the South WRSF. The Alpha WRSF was unchanged from the base case in terms of tonnage. This option required the addition of two trucks to the fleet and increased the average one-way haulage distance by 0.2 kilometers (km). These additions resulted in a $21 M increase in operating and a $4.6 M increase in capital costs.

Option 3 evaluated the development of only two WRSFs, eliminating the North WRSF. As in option 2, the South WRSF was maximized, and the remaining waste rock was planned to be hauled to the Alpha WRSF. This option required the addition of three trucks to the fleet and increased the average one-way haulage distance by 0.1 km. These additions resulted in a $17 M increase in operating and a $6.9 M increase in capital costs.

Option 4 included the development of only one WRSF. All waste rock would report to the one location at Alpha WRSF. This option required the addition of five trucks to the fleet and increased the average one-way haulage distance by 0.5 km. These changes resulted in a $48 M increase operating costs and an $11.5 M increase in capital costs.

Option 5 evaluated the development of only one WRSF, as in option 4, however, the South WRSF was selected. In addition, this option maximized backfilling of the mined out pits. This option required the addition of five trucks to the fleet, and increased the average one-way haulage distance by 0.5 km. The effect on economics was a $49 M increase in operating and $11.5 M increase in capital costs. Additionally, this option buries an unknown amount of potential resources with a yet to be determined value.

Option 6 included the same layout and distribution as the base case with three WRSFs, however optimized backfilling of waste rock in order to minimize handling and hauling costs. This option did not require any additions to the fleet and reduced the average one-way haulage distance by 0.1 km. This scenario resulted in a $5 M reduction in operating costs, with no change to capital costs. Additionally, this option buries an unknown amount of potential resources with a yet to be determined value.

Option 7 analyzed a scenario where two WRSFs (Alpha and North) were developed, and the South WRSF was eliminated. Both facilities were maximized, and the remainder was assumed to be backfilled. This option required the addition of four trucks to the fleet and increased the average one-way haulage distance by 0.3 km. This option resulted in a $29 M increase in operating and a $9.2 M increase in capital costs.

**Table 2.10-8** presents the summary of the technically and economically feasible site alternatives for the proposed WRSFs.

WRSF scenarios 1, 2, 3, 4, and 7 as described above are considered economically viable, and do not cause the Project to be uneconomic. Options 5 and 6 potentially sterilize future resources and are thus considered economically unacceptable for the Project. These options are not considered further in this assessment.

**Table 2.10-8 Summary of Technical Feasibility and Economic Viability of Waste Rock Storage Facility Alternatives**

| Alternative Means | Technical Feasibility | Economic Viability* | Carried Forward? (Yes/No) |
|---|---|---|---|
| Option 1 (Base Case):<br>• Three WRSFs (Alpha, South and North)<br>• WRSF sites optimized for minimal haulage cost.<br>• Backfilling of approximately 54 MT | **Challenging**<br>• Technically feasible<br>• Multiple WRSFs allow for flexibility in mine plan<br>• North WRSF poses long-term stability challenges | **Acceptable**<br>• Economically viable | **Yes** |
| Option 2:<br>• Three WRSFs (Alpha, South and North)<br>• South WRSF storage maximized<br>• North WRSF minimized<br>• Alpha WRSF roughly the same as Base Case<br>• Backfilling of approximately 54 Mt | **Challenging**<br>• Technically feasible<br>• Multiple WRSFs allows for flexibility in mine plan<br>• North WRSF poses long-term stability challenges | **Acceptable**<br>• Economically viable<br>• Higher operating cost (+$21 M)<br>• Higher capital cost (+$4.6 M) | **Yes** |
| Option 3:<br>• Two WRSFs (South and Alpha)<br>• South WRSF storage maximized<br>• Alpha WRSF storage increased to accommodate remainder of waste<br>• North WRSF eliminated<br>• Backfilling of approximately 54 MT | **Acceptable**<br>• Technically feasible<br>• Only two WRSFs limits flexibility in mine plan | **Acceptable**<br>• Economically viable<br>• Higher operating cost (+$17 M)<br>• Higher capital cost (+$6.9 M) | **Yes** |
| Option 4:<br>• One WRSF (Alpha)<br>• Backfilling of approximately 54 MT | **Acceptable**<br>• Technically feasible<br>• Only one WRSF limits flexibility in mine plan<br>• Single WRSF adds risk should significant geotechnical instability arise | **Challenging**<br>• Economically viable<br>• Higher operating cost (+$48 M)<br>• Higher capital cost (+$11.5 M) | **Yes** |
| Option 5:<br>• One WRSF (South)<br>• Backfilling maximized | **Acceptable**<br>• Only one WRSF limits flexibility in mine plan<br>• Single WRSF adds risk should significant geotechnical instability arise | **Unacceptable**<br>• Buries potential resources<br>• Higher capital cost (+$49 M)<br>• Higher operating cost (+$11.5 M) | **No** |

| Alternative Means | Technical Feasibility | Economic Viability* | Carried Forward? (Yes/No) |
|---|---|---|---|
| Option 6:<br>• Three WRSFs (Alpha, South, and North)<br>• Backfilling optimized, based on handling/hauling costs | **Challenging**<br>• Multiple WRSFs and optimal backfilling allow for flexibility in mine plan.<br>• North WRSF poses long-term stability challenges | **Unacceptable**<br>• Buries potential resources<br>• Lower capital cost (-$5 M)<br>• Same operating costs | **No** |
| Option 7:<br>• Two WRSFs (Alpha and North)<br>• South WRSF eliminated<br>• Alpha WRSF Site and North WRSF Site optimized<br>• Backfilling 54 Mt | **Challenging**<br>• Technically feasible<br>• Only two WRSAs limits flexibility in mine plan<br>• North WRSF poses long-term stability challenges | **Acceptable**<br>• Economically viable<br>• Higher capital cost (+$29 M)<br>• Higher operating cost (+$9.2 M) | **Yes** |

*all cost comparisons in "Economic Viability" column are compared to Scenario 1 – identified as the "base case"

***Environmental and Socio-economic Effects***

Assessment of the environmental implications of the various waste rock storage facility options was carried out using the Water Balance Water Quality model developed for the Coffee Gold Project. The model predicts changes to flow and water quality in the receiving environment at various nodes in Latte Creek, Halfway Creek, YT-24, Coffee Creek and Yukon River. The model incorporates site specific hydrology, climate and precipitation and baseline water quality and incorporates mine contact water source terms from infiltration through waste rock and contact with pit wall to predict water quality and flow changes in mine site project area streams. For the water quality modeling for the alternatives assessment, simplifying assumptions for WRSF geochemical source terms had to be applied as the composition of rock types within each WRSF scenario were not known. As such, the results were considered high level but sufficient for comparative purposes.

Surface water quality modelling was conducted for the Options 1 (Base Case), 2, 3, 4, and 7 (**Appendix 2-B Alternative Studies**, Waste Rock Alternatives Assessment). Water quality predictions for each option were evaluated in the context of which option minimized changes to water quality to streams directly affected by mine discharges, namely Latte Creek, Halfway Creek and YT-24.

Key findings of the water quality modeling of the waste rock storage alternatives were as follows:

- Options that included the North WRSF (e.g., Options 1, 2, and 7) in the YT-24 catchment would have the high potential to cause exceedances of applicable water quality guidelines (e.g. Canadian Council of Ministers of the Environment (CCME) and/or British Columbia Ministry of Environment (BCMOE)) for the protection of aquatic life. Most notable parameters included $NO_3$, $NO_2$, $SO_4$, As, Sb, U and Zn. The magnitude of the concentrations generally scale with the amount of waste stored in the North WRSF. Options that eliminate the North WRSF (Options 3 and 4) limited changes to surface water quality and reduced the potential for significant effects in YT-24.
- Options that maximized waste rock storage in the South WRSF in the Latte Creek catchment (Options 2, 3, and to a lesser extent 1) had the potential to cause exceedances for $SO_4$ and increases in U above currently naturally elevated concentrations in Latte Creek. For Option 4, where a South WRSF is eliminated, small or negligible changes to water quality in Latte Creek were predicted. Recognizing that Latte Creek is a major tributary of Coffee Creek, and that fish usage (e.g., Arctic Grayling (*Thymallus arcticus*)) has been documented throughout Latte Creek, options that eliminate the South WRSF were viewed favorably in light of the water quality predictions.
- Option 4 evaluated a single WRSF (Alpha WRSF) in Halfway Creek with no waste rock storage in YT-24 or Latte Creek catchments. Halfway Creek has the poorest natural background water quality of the project area streams, most notably for U. Baseline U concentrations in Halfway Creek can exceed 0.1 mg/L and this compares with the CCME water quality guideline of 0.015 mg/L for the protection of aquatic life. Water quality predictions for Option 4 indicated that potential water quality exceedances may occur for $SO_4$ and Zn, but these exceedances were predicted to be well within a factor of 2 of the water quality guideline. Increases in U concentrations were predicted during the open water period, but the concentrations were less than the natural variability observed in Halfway Creek.
- None of the WRSF options evaluated resulted in predicted measurable changes to water quality in Coffee Creek or the Yukon River.

The main conclusion of the alternatives assessment, from a water quality perspective, was that consolidating waste rock into a single WRSF in Halfway Creek, reduced the potential for effects in Latte Creek and YT-24. In addition, a single WRSF provided more flexibility and control of management of contact water.

Baseline studies for fish and fish habitat have identified differing fish and fish habitat values in each of the three potentially affected watersheds (see **Section 14 Fish and Fish Habitat**), as follows:

- Coffee Creek: Provides year-round fish habitat for Arctic Grayling, juvenile Chinook Salmon (Oncorhynchus tshawytscha), and Slimy Sculpin (Cottus cognatus)
- Latte Creek (tributary to Coffee Creek): provides summer rearing habitat for sub-adult and adult Arctic Grayling
- Halfway Creek: Provides some summer rearing habitat. Arctic Grayling and juvenile Chinook Salmon have been documented in the lower 350 m of Halfway Creek.

- YT-24: No fish have been captured within the creek; however, potential summer rearing habitat exists in the lower 400 m.

Note that Project-related effects on Slimy Sculpin were not included in this assessment, and will not be evaluated further here.

Project consultation identified that Coffee Creek watershed has extensive traditional use values. The extent of use described during the consultation process is fully explained in **Section 24.0 Land and Resource Use**, but includes the following noted uses and values:

- Tr’ondëk Hwëch’in
  - TH citizens have noted extensive traditional and current use of Coffee Creek and the surrounding corridor, including use as a gathering place for TH in the past (Yukon River Commercial Fishing Association and TH 1997), for its contribution to an extensive traditional transportation network (TH 2012a), as a hunting and trapping area (Interview 14, Pers. Comm. 2016, Dobrowolsky 2014, TH 2012b), as an important fishing location (TH 2012b), as a current area for fish camps (Interview 22, Pers. Comm. 2016, Interview 14. Pers. Comm. 2016), and as an area where medicinal plants were gathered (Interview 14, Pers. Comm. 2016).
  - Coffee Creek continues to be of cultural and spiritual importance to TH citizens, as it is known as a birth and burial place for many citizens. Several contributors to the Coffee Creek Traditional Knowledge Survey recounted the names of friends and family who are buried at Coffee Creek, including the cemetery (TH 2012a).
  - TH citizens have also noted that the Coffee Creek corridor should be considered as a protected corridor, in part because of the cultural value that it reflects. This is demonstrated in a number of ways, including a TH traditional song about Coffee Creek (TH 2012b, TH 2012a).
- White River First Nation
  - WRFN citizens have noted extensive traditional use of Coffee Creek and the surrounding corridor, including as a living and gathering area (Bates et al. 2014; Easton et al. 2013; TH 2012a; Yukon River Commercial Fishing Association and TH 1997), a fishing location (Easton et al. 2013), as a transportation corridor (Easton et al. 2013), as a hunting and trapping area (Bates et al. 2014), and as a traditional plant harvesting area (Bates et al. 2014; TH 2012a).
  - WRFN citizens have noted the Coffee Creek area to be of cultural and spiritual significance. Cultural activities have included potlatches, ceremonies, and other cultural events (Bates et al. 2014; Easton et al. 2013). Additionally, the Coffee Creek area is birth and burial place for some WRFN ancestors (Bates et al. 2014).
- First Nation of Na-cho Nyäk Dun
  - Coffee Creek was an important gathering place where Yukon First Nations would historically stop during their seasonal round; this includes ancestors of FNNND (TTH 2012a).
- Selkirk First Nation
  - Coffee Creek was historically an important place where SFN ancestors would gather and live (Easton et al. 2013; Yukon River Commercial Fishing Association and TH 1997; Tr’ondëk Hwëch’in 2012a). SFN citizens have noted that a village used to exist in the Coffee Creek area,

and that this area was an active trading post (TH 2012a). SFN citizens have also noted that the Coffee Creek area was used as a transportation corridor, for hunting and trapping (TH 2012a), and as an important fishing area Yukon River Commercial Fishing Association and TH 1997).

- SFN citizens have noted the Coffee Creek area to be of cultural and spiritual significance. Additionally, the Coffee Creek area is thought to be the burial place for some SFN ancestors (Easton et al. 2013; TH 2012a).
- SFN holds Category B Settlement Lands at the mouth of Coffee Creek (**Section 1.0 Project Overview**, **Figure 1.1-1**).

Neither Halfway Creek nor YT-24 were noted by First Nations as having traditional or current use values.

Although modelling results demonstrated that for the Base Case no significant effects would occur to water quality in lower Coffee Creek, the presence of waste rock in this creek may lead to a potential change in both the Traditional Land Use and the Social Economy VCs. This initial assumption must be confirmed through consultation, and, if true, the effect may be reduced through mitigation efforts (e.g. by sharing monitoring results with First Nations). However, due to this extra risk and uncertainties involved, and as summarized in **Table 2.10-10**, it was determined that removing the long-term storage of waste rock from the Coffee Creek watershed was preferred for the Project. As well, removing long-term storage of waste rock from YT-24 is also preferred, as model results have demonstrated potential exceedances of $NO_3$, $NO_2$, $SO_4$, As, Sb, U and Zn in YT-24 with the presence of the North WRSF. The preferred option, therefore, is Option 4, where all waste rock is stored in Halfway Creek in the Alpha WRSF. While there is some fish and fish habitat present in the lower 350 m of Halfway Creek, no significant adverse residual effects are likely to occur for fish and fish habitat, including in Halfway Creek (**Section 14.0 Fish and Fish Habitat**).

**Table 2.10-9 Summary of Environmental and Socio-economic Effects for Waste Rock Storage Facilities Site**

| Alternative Means | Environmental Effects | Socio-economic Effects | Selected Alternative? (Yes/No) |
|---|---|---|---|
| | **Challenging** | **Challenging** | |
| Option 1 (Base Case):<br>Three WRSFs (Alpha, South and North)<br>WRSF sites optimized for minimal cost for haulage<br>Backfilling of approximately 54 MT | Three drainages affected (Halfway Creek, Latte Creek and YT-24):<br>Halfway Creek has naturally occurring seasonally high levels of uranium with limited aquatic value in the upper reaches.<br>Latte Creek has naturally occurring seasonally high levels of uranium with high aquatic value throughout the catchment. Value increases downstream closer to its confluence with Coffee Creek. Coffee Creek has very high aquatic value.<br>YT-24 is a seasonal surface runoff stream with little natural uranium and limited aquatic value.<br>Uranium is predicted to exceed generic surface water quality guideline in Halfway and Latte creeks, but remains below proposed site-specific surface water quality objective. Modeling indicates that multiple parameter exceedances of aquatic life guidelines are probable in YT-24. | Limiting impacts to drainages with higher aquatic life value may be preferred by First Nations<br>Latte Creek drains into Coffee Creek. Storage of waste rock in Latte Creek increases the potential for degradation of water quality in Coffee Creek. While modeling does not indicate measurable changes to Coffee Creek due to waste rock in the Latte drainage, the option does pose a low-level risk to Coffee Creek. | **No** |
| | **Challenging** | **Challenging** | |

| Alternative Means | Environmental Effects | Socio-economic Effects | Selected Alternative? (Yes/No) |
|---|---|---|---|
| Option 2:<br>Three WRSFs (Alpha, South and North)<br>South WRSF site maximized to store as much as possible<br>North WRSF minimized<br>Alpha WRSF kept roughly the same as Base Case<br>Backfilling strategy same as Base Case | Three drainages affected (Halfway Creek, Latte Creek and YT-24):<br>Halfway Creek has naturally occurring seasonally high levels of uranium with limited aquatic value in the upper reaches.<br>Latte Creek has naturally occurring seasonally high levels of uranium with high aquatic value throughout the catchment. Value increases downstream closer to its confluence with Coffee Creek. Coffee Creek has very high aquatic value.<br>YT-24 is a seasonal surface runoff stream with little natural uranium and limited aquatic value.<br>Uranium is predicted to exceed generic surface water quality guideline in Halfway and Latte creeks, but remains below proposed site-specific surface water quality objective. Modeling indicates that multiple parameter exceedances of aquatic life guidelines are probable in YT-24, but the relative magnitude of exceedances is lower than in Option 1. | Limiting impacts to drainages with higher aquatic life value may be preferred by First Nations.<br>Latte Creek drains into Coffee Creek. Storage of waste rock in Latte Creek increases the potential for degradation of water quality in Coffee Creek. While modeling does not indicate measurable changes to Coffee Creek due to waste rock in the Latte drainage, the option does pose a low-level risk to Coffee Creek. Owing to the maximized quantity of waste rock in Latte Creek, the risk to Coffee Creek, while still low, would be higher than for Option 1 | **No** |
| | **Acceptable** | **Challenging** | |
| Option 3:<br>Two WRSFs (Alpha and South)<br>South WRSF Site maximized to store as much as possible<br>North WRSF Site eliminated<br>Alpha WRSF Site increased to accommodate remainder of waste material<br>Backfilling strategy same as Base Case | Two drainages affected (Halfway Creek and Latte Creek):<br>Halfway Creek has naturally occurring seasonally high levels of uranium with limited aquatic value in the upper reaches.<br>Latte Creek has naturally occurring seasonally high levels of uranium with high aquatic value throughout the catchment. Value increases downstream closer to its confluence with Coffee Creek. Coffee Creek has very high aquatic value.<br>Uranium is predicted to exceed generic surface water quality guideline in Halfway and Latte creeks, but remains below proposed site-specific surface water quality objective. Water quality predictions in YT-24 are improved over Options 1 and 2. Uranium in YT-24 not predicted to exceed surface water quality guideline | Limiting impacts to drainages with higher aquatic life value may be preferred by First Nations.<br>Latte Creek drains into Coffee Creek. Storage of waste rock in Latte Creek increases the potential for degradation of water quality in Coffee Creek. While modeling does not indicate measurable changes to Coffee Creek due to waste rock in the Latte drainage, the option does pose a low-level risk to Coffee Creek. Owing to the maximized quantity of waste rock in Latte Creek, the risk to Coffee Creek, while still low, would be higher than for Option 1. | **No** |

| Alternative Means | Environmental Effects | Socio-economic Effects | Selected Alternative? (Yes/No) |
|---|---|---|---|
| Option 4:<br>One WRSF (Alpha)<br>Backfilling strategy same as Base Case | **Preferred**<br>Only one drainage affected (Halfway Creek):<br>Halfway Creek has naturally occurring seasonally high levels of uranium with limited aquatic value in the upper reaches.<br>Little change from background water quality predicted for YT-24 and Latte Creek. Uranium is predicted to exceed generic surface water quality guideline in Halfway Creek, but remains below proposed site-specific surface water quality objective. | **Preferred**<br>Eliminates waste rock storage in Coffee Creek watershed, which has the highest identified traditional and current land use values. | **Yes** |
| Option 7:<br>Two WRSFs (Alpha and North)<br>South WRSF Site eliminated<br>Alpha WRSF Site and North WRSF Site optimized<br>Backfilling strategy same as Base Case | **Challenging**<br>Two drainages affected (Halfway Creek and YT-24):<br>Halfway Creek has naturally occurring seasonally high levels of uranium with limited aquatic value in the upper reaches.<br>YT-24 is a seasonal surface runoff stream with little natural uranium and limited aquatic value.<br>Uranium is predicted to exceed generic surface water quality guideline in Halfway Creek, but remains below proposed site-specific surface water quality objective. Modeling indicates that multiple parameter exceedances of aquatic life guidelines are probable in YT-24. Little change from background water quality in Latte Creek. | **Acceptable**<br>Eliminates waste rock storage in Coffee Creek watershed, which has the highest identified traditional and current use values. | **No** |

***Identification of Preferred Means***

Due to the technical and economic factors considered above, Option 1 (Base Case) and Option 6, both with three WRSFs (i.e., Alpha, South and North), are preferred over Option 4, which has only one WRSF (i.e., Alpha) because they provide the most flexibility for mine planning and the lowest life-of-mine capital costs and operating costs.

Based on the environmental and socio-economic factors considered above, it was determined that Option 4 (i.e., single Alpha WRSF) would be optimal for the Project. This option was shown to largely minimize the overall footprint, and reduce impacts in two catchments. As well, by removing long-term waste rock storage from a drainage that led to Latte Creek, this option reduces impacts to the Coffee Creek corridor, which has high traditional and current use values for First Nations. While there is some fish habitat present in lower Halfway Creek, the effects assessment demonstrates that no significant effects are predicted for fish and fish habitat in Halfway Creek. Although this option does have a higher overall cost than several other options considered, it is expected that some of this cost may be recovered through reclamation and closure efficiencies and some operational costs. Option 4 is the preferred WRSF alternative.

#### *2.10.4.6 Ore Movement Method*

Crushed ore will be transported from the crushing plant to the HLF to allow for gold extraction. Two transportation options were investigated by Goldcorp: transportation via a conveyer and hauling by truck (JDS 2016). For both options, 18,000 tonnes per day of crushed ore with a $P_{80}$ of 50 mm would be transported from April through December each year. The crushed ore would be transported approximately 1.6 km from the crushing plant to the HLF, and distributed along the approximately 1.8-km length of the HLF.

The conveyor system option investigated would consist of a 2-km-long, 36-inch-wide conveyor with ancillary structures, and an access road. The conveyor system would convey crushed ore to the heap leach pad where a CAT D9 dozer would be used to spread the crushed ore over the heap leach pad. In Year 3 to Year 9, additional conveying throughout the heap leach pad with spreading extensions would be required.

The truck-hauling option investigated would consist of three CAT 785 haul trucks and ancillary roads for delivering the crushed ore to the heap leach pad. A CAT D10 dozer would be used for spreading. An additional two CAT 785 haul trucks will be required for heap leach pad expansions from Year 3 to Year 9.

***Technical Feasibility***

The truck-hauling option provides operational efficiencies by allowing trucks to be substituted into the mining fleet. The truck hauling allows for greater flexibility in leach pad geometry since stacking would not be limited to rectangular discharge patterns produced by a radial stacker used with a conveyor.

Both options investigated are technically feasible, however, and have successful precedent in similar climates. For example, the Ekati Diamond Mine in the Northwest Territories and the Mary River Project in Nunavut use the traditional truck hauling of ore, while the Eagle Gold Project in Yukon and the Cantung Mine in the Northwest Territories use the conveyor system.

***Economic Viability***

The economic evaluation shows that the net present value (NPV) of the conveyor system is higher than the truck-hauling option (JDS 2016), which is largely due to the higher operating cost of maintaining and running haul trucks. The initial capital cost of the conveyor system is much higher than truck hauling, however, primarily due to the construction costs for the conveyer. This lower initial capital cost is beneficial to Project financing.

The mine plan requires 3.5 M tonnes of ore to be stacked on the initial heap prior to the end of Year –1. This requirement is based on the thermal energy of the heap, and the total volume of rock necessary to prevent freezing of the heap in the winter of operations. The flexibility of the truck system reduces risks associated with achieving the 3.5 Mt minimum heap size. The conveyor system is less flexible, takes more time to re-locate and re-configure on a starter pad, and requires downtime at every move in order to complete the re-configuration for each new stacking phase. Due to these considerations, and adding the geometry of the heap at the beginning of mine life, the conveyor stacking system is considered to present an unacceptable risk.

Evaluation of the conveyor system may be considered in the future after the initial lifts are placed on the heap leach facility and the heap is operating smoothly. However, this would require changes in mining haul fleet demands in order to offset the capital necessary for acquisition of the conveyor system. Such changes are not currently anticipated.

***Identification of Preferred Means***

**Table 2.10-10** presents the summary of the technically and economically feasible alternatives to the Project. Truck hauling is the technically and economically preferred ore movement method for the Project. A conveyor system is economically unfeasible for the Project, and is not considered further in this assessment. Truck hauling is the selected ore movement method for the Project.

**Table 2.10-10 Summary of Technical Feasibility and Economic Viability of Alternative Means for Ore Movement Method**

| Alternative Means | Technical Feasibility | Economic Viability | Selected Alternative? (Yes/No) |
|---|---|---|---|
| Truck Hauling | **Preferred** | **Preferred** | **Yes** |
| | Mature technology, existing documentation of successful implementation at similar operations. This option also allows for operational efficiencies and flexibility. | Hauling crushed ore to the HLF has a lower overall NPV than conveying but requires a lower initial capital expenditure, which is beneficial to Project financing. | |
| Conveyor System | **Challenging** | **Challenging** | **No** |
| | Mature technology; existing documentation of successful implementation at similar operations.<br>Challenging for start-up due to timeline risks and criticality of achieving a minimum volume of ore in Year -1. | Conveying crushed ore to the HLF has a higher overall NPV but requires high initial capital expenditures. | |

#### *2.10.4.7 Mine Accommodations*

Based on operating 24 hours per day, seven days per week, and 365 days per year, up to approximately 372 full time personnel will be employed during the Operation Phase, with up to 400 personnel on-site at any given time. Construction-phase employment will be higher, with up to approximately 663 personnel employed, and up to 400 personnel on-site at any given time. The majority of management, supervisory, production, maintenance, and technical services personnel will be on a two-week-in, two-week-out rotation. Management and technical staff will work the day shift only, while operation and maintenance personnel will cover two 12-hour shifts per day.

During the early Construction Phase (Year –3), employees will be housed in temporary work camps on-site (Mine Site and along the Northern Access Route (NAR)). Once the Project progresses to later-stage construction and operation activities, temporary camps would become inadequate for staff accommodations. Goldcorp evaluated two options for personnel accommodation during the late Construction and the entire Operation phases: on-site and off-site accommodation.

With respect to off-site accommodation, speed restrictions for Project traffic along the NAR (i.e., 30 km per hour to 50 km per hour; refer to **Appendix 31-A Access Route Construction Management Plan** and **Appendix 31-B Access Route Operational Management Plan**) mean the travel time for workers to and from the Mine Site would take up to 8 hours. This is not feasible for a daily commute, and on-site accommodation for employees at the Mine Site is the only feasible Project alternative.

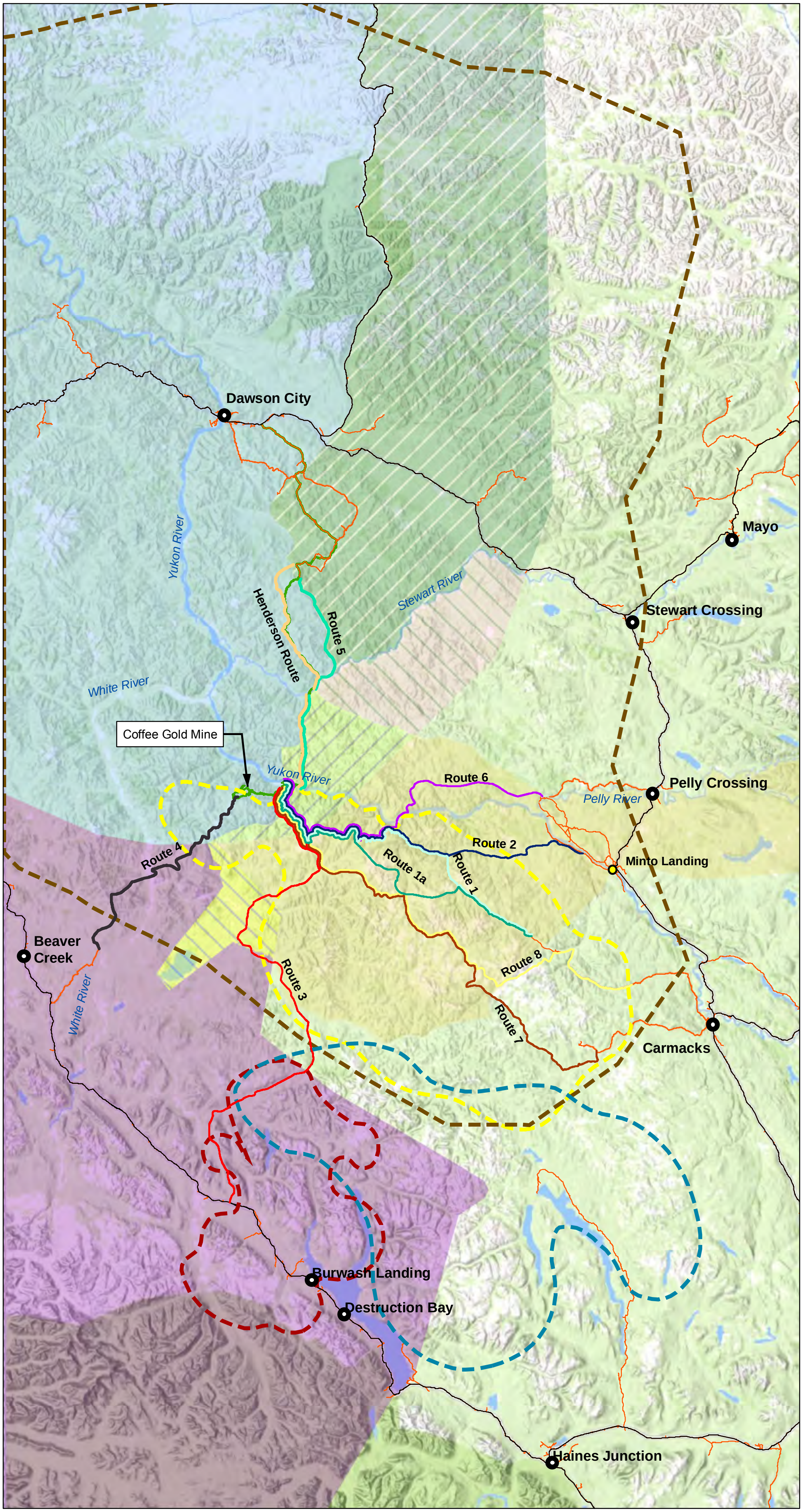
#### *2.10.4.8 Mine Site Access Routes*

While air transport to the Project's airstrip will provide a technically feasible and cost-effective means of access to and from the Mine Site for most personnel and incidental freight, as well as outgoing shipments of gold doré, non-air transportation alternatives will be required to transport heavy equipment, fuel, and other material not appropriate for air travel to site. Freight and equipment are to be transported to site using standard highway trucks and tridem flat-deck trailers or, for oversize equipment, a variety of trailer configurations. All fuel will be transported in off-highway 46,500-litre capacity triaxle fuel tanker trucks (i.e., standard tridem tankers).

Based on Goldcorp's preliminary identification of potential routes (JDS 2015), alternatives considered for moving freight, equipment, and fuel to the Mine Site included transportation by barge on the Yukon River from Whitehorse, as well as nine road routes (see **Figure 2.10-2** and **Table 2.10-11** for information on the road routes).Since the barge route would only be available during the relatively short (i.e., five-month) ice-free period, it would not accommodate year-round Project transportation needs. On this basis, it was determined to be technically infeasible and is not considered further in this analysis.

# COFFEE GOLD MINE

## Mine Site Access Route Alternatives





### Legend

- Highway
- Existing Road
- Project Footprint
- Aishihik caribou herd
- Kluane caribou herd
- Fortymile caribour herd RAA/Projected Yukon range
- Klaza herd RAA/Annual Range
- Traditional Territory of Selkirk First Nation
- Traditional Territory of Tr'ondëk Hwëch'in
- Shared Traditional Territory of Tr'ondëk Hwëch'in, First Nation of Na-cho Nyäk Dun
- Shared Traditional Territory of Tr'ondëk Hwëch'in, First Nation of Na-cho Nyäk Dun, Selkirk First Nation
- Shared Traditional Territory of Tr'ondëk Hwëch'in, Selkirk First Nation
- Traditional Territory of White River First Nation
- Shared Traditional Territory of White River First Nation, Selkirk First Nation

**Alternative Route Options**

- Henderson Route
- Route 1 (Freegold)
- Route 1a (Freegold bypass)
- Route 2 (Minto)
- Route 3 (Onion Creek)
- Route 4 (Snag Road)
- Route 5 (Dawson)
- Route 6 (Pelly Farm)
- Route 7 (Mt. Nansen)
- Route 8 (Mt. Nansen bypass)

### Notes

1. This map is not intended to be a "stand-alone" document, but a visual aid of the information contained within the referenced Report. It is intended to be used in conjunction with the scope of services and limitations described therein.
2. First Nations Traditional Territory from geomaticsyukon.ca, 2016.
3. Caribou herd data from EDI, 2016.
4. Access route options are conceptual only.

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| Figure 2.10-2 | Date: Mar 28, 2017 | Drawn by: JS | Reviewed: DP |
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**Table 2.10-11 Mine Site Access Route Alternatives – Road Types and Distances**

| Option / Route | | Barge Crossing / Ice Road Component | Distance (km) | | | | | | Major River Crossings |
|---|---|---|---|---|---|---|---|---|---|
| # | Name | | Paved Road End Point | Paved Road* | Existing Gravel Road | New Gravel Road | Total Gravel Road | Total Distance* | |
| 1 | Freegold | No | Carmacks | 177 | 74 | 150 | 224 | 401 | None |
| 1a | Freegold Bypass | No | Carmacks | 177 | 74 | 158 | 232 | 409 | None |
| 2 | Minto | Yes | Minto | 252 | 5 | 157 | 162 | 414 | Yukon River |
| 3 | Onion Creek | Yes | Turnoff | 320 | - | 232 | 232 | 552 | Tributary of Donjek River (potential swamp and lake crossing) |
| 4 | Snag Road | Bridge | Snag Turnoff | 424 | 28 | 101 | 129 | 553 | White River |
| 5 | Northern Access Route | Yes | City of Dawson | 532 | 98 | 90 | 188 | 720 | Stewart and Yukon Rivers |
| 6 | Pelly Farm | Yes | Pelly Crossing | 283 | 46 | 154 | 200 | 483 | Yukon River |
| 7 | Mt. Nansen Road | No | Carmacks | 177 | 56 | 208 | 264 | 441 | None |
| 8 | Mt. Nansen Bypass | No | Carmacks | 177 | 43 | 171 | 217 | 391 | None |

**Note:** *Paved road and total distances are from Whitehorse

**Source:** JDS 2015

Information regarding each road route alternative was developed based on GeoYukon 1:50,000 maps (i.e., elevations, watercourse / waterbody locations), professional experience, site-specific knowledge, and topographical inference. Surface and three-dimensional (3D) road route selection was undertaken using AutoCAD Civil 3D (2012), MineSight 3D (version 9.5), and BC-Alberta NAD 83. For comparative purposes, all paved road and total road distances were estimated with Whitehorse as the point of origin. Where grades exceeded 12%, road length was increased to provide for switchbacks that would reduce this gradient.

Each road route consists of three fundamental components:

- Paved highway from Whitehorse to a turnoff onto an unpaved road
- Existing gravel road, some sections which may require upgrade
- New gravel road to be constructed for the Project.

Route Number (No.) 4 Snag Road would require construction of a new bridge across the White River, routes 2, 3, 5 and 6 would rely on barge service and ice roads at major river crossings (e.g., Yukon River, Stewart River). Road access would not be available along these four routes for approximately six weeks during both spring break-up and winter freeze-up shoulder periods.

As shown in **Table 2.10-11**, Route No. 5 NAR, which would include the paved Klondike Highway from Whitehorse to the City of Dawson, and a combination of existing placer and new gravel roads between the City of Dawson and the mine site, would be the longest route and would involve the crossings of two major waterbodies, the Stewart and Yukon Rivers.

The shortest alternative would be Route No. 8 Mt. Nansen Bypass, which would follow the paved Klondike Highway from Whitehorse to Carmacks and require no major watercourse crossings.

***Technical Feasibility and Economic Viability***

Terrain conditions are an important consideration given the technical and economic feasibility of constructing new roads. **Table 2.10-12** identifies road types associated with a particular combination of terrain and gradient in the Project area, and assigns unit construction costs to that road type. As shown, alternatives involving rock excavation and blasting would be associated with higher unit construction costs (i.e., Type 1 (a, r), Type 2 (r), and Type 3 (r)). Also, technical challenges during construction typically increase in steep terrain, as reflected in the higher costs associated with Road Type 3 and Type 3 (r).

Each road route alternative was assigned one or more road-type categories based on terrain, gradient, and ground type (i.e., standard soil, muskeg / bog, rock).

**Table 2.10-12 Road Type Categories and Definitions for Mine Site Access Route Alternatives**

| Road Type | Terrain | Gradient | Description | Cost / km |
|---|---|---|---|---|
| Type 1 (a) | Flat | < 4% | No rock or muskeg | $247,000 |
| Type 1 (a, r) | Flat | < 4% | Rock substrate | $430,000 |
| Type 1 (b) | Flat | < 4% | Ridge top, no clearing / grubbing, no rock or muskeg | $132,000 |
| Type 1 (c) | Flat | < 4% | Muskeg with road fill (within 1 km of borrow pit) | $276,000 |
| Type 2 | Hillside | < 4% | No rock or muskeg | $274,000 |
| Type 2 (r) | Hillside | < 4% | Rock substrate | $493,000 |
| Type 3 | Steep | 4% – 8% | No rock or muskeg | $349,000 |
| Type 3 (r) | Steep | 8% – 12% | Rock substrate | $657,000 |

**Source: J**DS 2015

**Table 2.10-13** presents the associated length and road type of the new gravel road that would be required for each road route alternative.

**Table 2.10-13 Road Types and Lengths for New Gravel Road Sections of Road Route Alternatives**

| Route | | Road Type and Length of New Gravel Road (km) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| # | Name | Type 1 (a) | Type 1 (a,r) | Type 1 (b) | Type 1 (c) | Type 2 | Type 2 (r) | Type 3 | Type 3 (r) | Total |
| 1 | Freegold | 25 | 2 | 50 | - | 28 | - | 44 | 3 | 150 |
| 1a | Freegold Bypass | 7 | 2 | 31 | - | 26 | 2 | 69 | 23 | 158 |
| 2 | Minto | 15 | 1 | 53 | 6 | 20 | - | 60 | 3 | 157 |
| 3 | Onion Creek | 4 | - | 16 | 115 | 18 | 3 | 64 | 14 | 232 |
| 4 | Snag Road | 4 | 2 | 15 | 5 | 11 | - | 64 | 1 | 101 |
| 5 | Norther Access Route | 1 | - | 59 | - | 3 | - | 27 | - | 90 |
| 6 | Pelly Farm | 7 | 1 | 75 | - | 6 | 1 | 63 | 2 | 154 |
| 7 | Mt. Nansen Road | 1 | - | 29 | 12 | 61 | 4 | 81 | 10 | 208 |
| 8 | Mt. Nansen Bypass | 1 | 1 | 31 | - | 26 | 3 | 98 | 12 | 171 |

**Source: J**DS 2015

**Table 2.10-14** compares the construction and operating costs, with variable discount rates, of the road route alternatives. Net present valuations at 5%, 15%, and 25% discount rates are similar for Route Nos. 1, 2, 5, and 6. Since all other road route alternatives have higher NPVs, they were not considered further in the alternatives analysis. Route Nos. 1, 2, and 6 offer slight economic advantages over Route No. 5 at lower discount rates; the lower construction capital costs associated with Route No. 5 is advantageous at discount rates above 20%. Additionally, Route No. 5 is associated with additional capital expenditure cost savings of up to $50,000 per km on the initial 50 km (North Klondike Highway to Stewart River crossing), depending on the existing road condition.

**Table 2.10-14 Economic Comparison of Mine Site Access Road Route Alternatives**

| Route | | 10 Year Life of Mine Costs ($M) | | | | | |
|---|---|---|---|---|---|---|---|
| **#** | **Name** | **Construction** | **Operation** | **Total** | **NPV 5%** | **NPV 15%** | **NPV 25%** |
| 1 | Freegold | 45 | 48 | 93 | 81 | 64 | 55 |
| 1a | Freegold Bypass | 60 | 50 | 110 | 96 | 79 | 69 |
| 2 | Minto | 43 | 53 | 96 | 82 | 65 | 55 |
| 3 | Onion Creek | 78 | 60 | 138 | 121 | 100 | 88 |
| 4 | Snag Road | 58 | 51 | 109 | 94 | 77 | 67 |
| 5 | Northern Access Route | 29 | 85 | 114 | 94 | 67 | 52 |
| 6 | Pelly Farm | 43 | 60 | 103 | 88 | 68 | 57 |
| 7 | Mt. Nansen Road | 71 | 55 | 126 | 111 | 91 | 81 |
| 8 | Mt. Nansen Bypass | 62 | 47 | 109 | 96 | 79 | 70 |

**Note:** NPV percentage indicates the evaluated discount rate

**Source:** JDS 2015

A summary of findings with respect to the technical feasibility and economic viability of the access route options is presented in **Table 2.10-15**.

**Table 2.10-15 Summary of Technical Feasibility and Economic Viability of Alternative Means for Mine Site Access Road Route**

| Route | | Technical Feasibility | Economic Viability | Carried Forward? (Yes/No) |
|---|---|---|---|---|
| **#** | **Name** | | | |
| n/a | Barge | **Unacceptable**<br>Not feasible due to short ice-free period (approximately 5 months). | **N/A**<br>Economic viability was not assessed as alternative is not technically feasible. | **No** |
| 1 | Freegold | **Acceptable**<br>Moderate amount of new road construction required at 150 km. | **Preferred**<br>Lowest NPV at 5% and 15% discount rates; second lowest NPV at 25% discount rate; lowest operating costs. | **Yes** |
| 1a | Freegold Bypass | **Acceptable**<br>Moderate amount of new road construction required at 158 km. | **Unacceptable**<br>Unacceptably high NPV, driven by a combination of high construction and operating costs; longest length of Type 3 (r) (23 km) new road construction of all alternatives. | **No** |

| Route # | Route Name | Technical Feasibility | Economic Viability | Carried Forward? (Yes/No) |
|---|---|---|---|---|
| 2 | Minto | **Acceptable**<br>• Moderate amount of new road construction required at 157 km. | **Acceptable**<br>• Relatively low construction and operating costs, and acceptable NPVs across all discount rates<br>• Requires 63 km of Type 3, Type 3(r), and associated switchbacks | **Yes** |
| 3 | Onion Creek | **Challenging**<br>• Longest length of new road construction (232 km) of all alternatives<br>• Multiple river crossings and a number of potential swamp and lake traverses | **Unacceptable**<br>• Unacceptably high NPV, driven by high construction costs, which in turn are mainly due to requirement for a large number of culverts and a new bridge, as well as 78 km of Type 3 and Type 3(r) road and associated switchbacks | **No** |
| 4 | Snag Road | **Acceptable**<br>• Small amount of new road construction required at 101 km<br>• Bridge required over White River | **Unacceptable**<br>• Unacceptably high NPV, driven by high construction costs, which in turn are largely due to need for bridge installation and 65 km of Type 3 and Type 3(r) road and associated switchbacks. | **No** |
| 5 | Northern Access Route | **Preferred**<br>• Favourable terrain; shortest length of new road construction (90 km) | **Acceptable**<br>• Lowest construction cost, with potential for further reductions<br>• Longest total haul distance from Whitehorse<br>• High operating cost | **Yes** |
| 6 | Pelly Farm | **Acceptable**<br>• Moderate amount of new road construction required at 154 km | **Acceptable**<br>• Relatively low construction and operating costs | **Yes** |
| 7 | Mt. Nansen Road | **Challenging**<br>• Very high length of new road construction at 208 km. | **Unacceptable**<br>• Unacceptably high NPV, driven by high construction costs | **No** |
| 8 | Mt. Nansen Road Bypass | **Challenging**<br>• Very high length of new road construction at 171 km | **Unacceptable**<br>• Unacceptably high NPV, driven by high construction costs, which in turn are largely due to need for 110 km of Type 3 and Type 3(r) road and associated switchbacks | **No** |

***Environmental and Socio-economic Acceptability***

Based on their potential technical feasibility and economic viability, four road route alternatives were carried forward for further analysis regarding environmental and socio-economic acceptability:

- No. 1 Freegold
- No. 2 Minto
- No. 5 Northern Access Route
- No. 6 Pelly Farm.

Environmental and socio-economic factors considered in the evaluation of each these road route alternatives are described in **Table 2.10-16**.

**Table 2.10-16 Summary of Environmental and Socio-economic Effects for Mine Site Access Routes**

| Route # | Route Name | Environmental Effects | Socio-Economic Effects | Selected Alternative? (Yes/No) |
|---|---|---|---|---|
| 1 | Freegold | **Challenging**<br>• Potentially significant adverse effects to caribou.<br>• Road falls within the overall range of the Klaza caribou herd. Habitat quantity and quality can be degraded due to human activities within this range. | **Challenging**<br>• Potentially significant adverse effects to traditional land use.<br>• Road falls within the overall range of the Klaza caribou herd. Klaza caribou are highly valued for subsistence, dietary, and cultural values. | **No** |
| 2 | Minto | **Challenging**<br>• Potentially significant adverse effects to caribou.<br>• Road falls within the overall range of the Klaza caribou herd. Habitat quantity and quality can be degraded due to human activities within this range. | **Challenging**<br>• Potentially significant adverse effects to traditional land use.<br>• Road falls within the overall range of the Klaza caribou herd. Klaza caribou are highly valued for subsistence, dietary, and cultural values. | **No** |
| 5 | Northern Access Route | **Preferred**<br>• Existing placer mining operations along the route.<br>• No significant adverse environmental effects predicted. | **Preferred**<br>• No significant adverse socio-economic effects predicted. | **Yes** |
| 6 | Pelly Farm | **Challenging**<br>• Potentially significant adverse effects to caribou<br>• Road falls within the overall range of the Klaza caribou herd. Habitat quantity and quality can be degraded due to human activities within this range. | **Challenging**<br>• Potentially significant adverse effects to traditional land use.<br>• Road falls within the overall range of the Klaza caribou herd. Klaza caribou are highly valued for subsistence, dietary, and cultural values. | **No** |

***Identification of Preferred Means***

Route No. 5 NAR was identified as the preferred access road route based on the following considerations:

- Goldcorp's desire to build on its strong relationships with the TH First Nation and the City of Dawson.
- Presence of existing roads over approximately 83% of the route (i.e., 177 km of the 214-km route), minimizing the potential for additional land disturbance.
- Least potential for adverse effects to wildlife based on review of Yukon Environment wildlife distribution maps – a large portion of the other route options (i.e., Option 1 Freegold, Option 2 Minto, and Option 6 Pelly Farm) falls within the overall range of the Klaza caribou herd; Klaza caribou are highly valued for subsistence, dietary, and cultural values. Given understood concern over potential adverse effects to this herd through review of the Casino Mine Project Proposal; Goldcorp has elected to avoid unnecessary effects to the Klaza herd from the Project.

Consultation meetings to introduce and discuss the concept of the road route from the City of Dawson to the Mine Site have been held with TH, Yukon Government, the City of Dawson, and local placer miners in the Klondike region. Concerns raised around the NAR involve changes in access, particularly around changes in access for hunters, and the spread of invasive species. These issues are addressed in **Section 24.0 Land and Resource Use**, and **Section 15.0 Vegetation**. No significant adverse residual effects are expected to occur as a result of NAR for either issue.

#### *2.10.4.9 Power Source Selection*

Goldcorp evaluated multiple options to provide power to the Project site during the Construction, Operation, and Reclamation and Closure Phases of the Project. The peak power requirement is estimated to be 3,278 kilowatts during the Operation Phase. The annual power requirement is estimated to be 19,075,219 kilowatt-hours per year.

Three power supply options were evaluated for the Project:

- **Option 1** Diesel Generators – A single captive power plant would be used to meet the electrical power demand necessary to support the Project. The power plant would comprise four diesel-fired reciprocating engine generator sets (gensets) in a N+2 (2+2) arrangement. Each generator would be prime rated for 2,250 megawatts (MW) running at 1,800 revolutions per minute and generating power of 4,160 volts. The peak gross power would be 4.5 MW (two operating gensets at 100%; 2 x 2.25 MW).
- **Option 2** Diesel Generators and Transmission Lines – The Construction Phase and the first two years of the Operation Phase would solely run on diesel-generated power. During the third year, power would be switched over to the Yukon power grid, and the diesel generators would be used for emergency or back-up power. Option 2 would require construction of a transmission line from the Project area to connect to an existing transmission line.
- **Option 3** Bi-fuel (diesel / liquefied natural gas (LNG)) Generators – The power plant would comprise four diesel-fired reciprocating gensets as outlined in Option 1. The four diesel gensets would be equipped with a natural gas conversion kit that would allow diesel fuel to be substituted with up to 70% LNG.

***Technical Feasibility***

Option 1, Option 2, and Option 3 are all technically feasible; however, the construction of the transmission line for Option 2 would be challenging given geographic and climate conditions.

***Economic Viability***

If costs of diesel fuel are as low as experienced in 2016, the power generating (operating) cost difference between natural gas and diesel fuel would not justify the additional approximately $1.5M capital expense associated with LNG storage and vaporization. Diesel fuel costs are expected to rise in the future, however, and significant power generation cost savings may be realized by substituting LNG for diesel. Additionally, carbon taxes for the Project with diesel fuel as the primary power source are in the range of $6 Million to $7 Million; having the option to convert to LNG may reduce the carbon footprint of the Project and the corresponding taxes paid.

Technical and logistical issues with constructing a transmission line make Option 2 prohibitively costly.

***Identification of Preferred Means***

The technical and economic feasibility of the three power supply options are described in **Table 2.10-17**. The selected power alternative is Option 3 Bi-fuel generators. All power for the Project will be supplied by diesel generators; however, the generators will have equipped natural gas conversion kits due to the flexibility and potential cost savings from switching to LNG should the prices of fuels change. Additionally, carbon taxes for the Project with diesel fuel as the primary power source are in the range of $6 Million to $7 Million; having the option to convert to LNG will reduce the carbon footprint of the Project and the corresponding taxes paid.

**Table 2.10-17 Summary of Technical Feasibility and Economic Viability of Alternative Means for Power Source Selection**

| Alternative Means | Technical Feasibility | Economic Viability | Selected Alternative? (Yes/No) |
|---|---|---|---|
| Option 1: Diesel Generators | **Acceptable**<br>• Technically feasible<br>• Well-known technology and commonly utilized for industrial power sources | **Acceptable**<br>• Currently the most economically feasible option; however, this option results in economic risk if the price of diesel fuel rises during the Project's Operation phase.<br>• Will not have the option to reduce future potential carbon taxes. | **No** |

| Alternative Means | Technical Feasibility | Economic Viability | Selected Alternative? (Yes/No) |
|---|---|---|---|
| Option 2: Diesel Generators and Transmission Line | **Challenging**<br>• Well-known technology and commonly utilized for mining power sources<br>• Construction of transmission line is challenging given geographic and climatic conditions | **Unacceptable**<br>• Construction of the transmission line is prohibitively costly. | **No** |
| Option 3: Bi-fuel (diesel / LNG) generators | **Acceptable**<br>• Technically feasible<br>• Well-known technology and commonly used for industrial power sources | **Preferred**<br>• Project economic risk is mitigated by having the option to respond to a rise in diesel prices by capability of switching Project power supply to LNG.<br>• Incremental cost for bi-fuel capability is low, however conversion for LNG storage is prohibitive at current diesel prices. | **Yes** |

## 2.11 COLD WEATHER TECHNOLOGIES

Goldcorp has reviewed and integrated feasible technologies into the design of the proposed Project, focusing on technologies that are viable in cold climates. Additional information on the review and selection of particular technologies to be applied to the Project is provided in **Section 2.9 Project Alternatives and Chosen Approach.** Cold weather considerations for the HLF and distribution system and for winter road access are discussed in this section.

The prevailing climate conditions at the Project site are representative of the typical climate for central Yukon (**Appendix 8-A Hydro-meteorology Baseline Study Report**). The average annual temperatures at the Project site range from –5.2 °C to –2.8 °C. The coldest temperatures at the Project site occur in January, with an average monthly temperature of –23 °C. The minimum temperature recorded at the Project site during the meteorology baseline data collection program was –37.6 °C (January 28, 2013). The main mineralized zones of the Project occur at an elevation of 1,180 masl. At this elevation, temperatures are strongly influenced by the topography of the area. Valley bottom temperature inversions occur during the winter months, resulting in ridgetop temperatures that may be up to 10 °C warmer than measurements recorded at valley bottom stations.

The Project has been designed for operation in cold northern climates. Operational restrictions include the suspension of crushing and heap leach activities during the three coldest months of the year (January through March). During these months, run-of-mine ore will be stockpiled for crushing once normal operating conditions resume in April of each year. In additional to operational considerations for the HLF, barge operations will also be suspended during the winter months. In lieu of the barge crossings, the Project will be resupplied via ice crossings of major watercourses on the NAR.

### 2.11.1 Heap Leach Facility

Heap leach technology has been demonstrated to be viable in climates similar to those of in the west-central Yukon. Examples of successful heap leach operations include the Brewery Creek Mine in Yukon and the Fort Knox Mine in Alaska. According to the Brewery Creek Case Study (EBA Tetra Tech 2011), heap leach freezing is less likely for future Yukon mining operations under similar climatic conditions as long as best operational practices are implemented.

The Proponent conducted an industry practices review for heap leach facilities and distribution systems, and utilized thermodynamic modelling to predict Project HLF conditions and determine design criteria to address the prolonged periods of cold temperatures in the Project area.

#### *2.11.1.1 Industry Practices Review*

Goldcorp conducted an industry practices review that focused on 28 heap leach operations developed in artic and subarctic climates (Sinha and Smith 2015). Results of this review indicate that conventional heap leach operations are the dominant technology employed (57%), and that gold is the primary metal mined (86%). Other notable results from the review are presented as follows:

- Winter ore stacking strongly influences operating temperatures (majority of operations studied avoided stacking ore in coldest months).
- Temperature-related operational issues were most common during the first two winters following commissioning, suggesting that additional measures are required to maintain temperatures above freezing in the early years.
- Operations with similar average winter temperatures to the Project report success heating barren solution with waste electrical generation heat only.
- Special provisions are required to protect liner systems of exposed ponds from freezing during the winter, and avoid spring water shortages during the step-up ore stacking resume period.
- Adaptive management and temperature-based planning adjustments such as additional solution heating, deeper drip burial, and shorter stacking season can be implemented to adjust for colder-than-average winter temperatures.
- Insulating or burying all piping may be required to facilitate successful operation and year-round irrigation of the heap. Several operators recommend providing spare irrigation areas in the event that piping freezes.

#### *2.11.1.2 Thermodynamic Modelling*

Goldcorp utilized thermodynamic models to predict ore and solution temperatures in the HLF under multiple operational scenarios. Results from the first model indicate the relative sensitivity of operating temperatures to a range of operating criteria, such as temperature at stacking. The second model was used to identify the heap leach design parameters that generated the most optimal scenario to prevent freezing. The models factored in mean monthly temperatures ranging from –22.5 °C in the winter to 13.6 °C in the summer, while in situ ore temperatures ranged from –1.5 °C to 0 °C.

The thermodynamic model used for the Project included consideration of the following as key inputs:

- Meteorological data (ambient air temperature, wind speed, solar radiation, and relative humidity)
- Surface cover characteristics (solar absorptivity and thermal resistivity) of exposed ore or cover materials (geomembrane)
- Ore properties (heat capacity, lift thickness, lift area, and ore temperatures at stacking)
- Solution properties (flow rate, total dissolved solids, and barren solution temperatures).

The thermodynamic models included several assumptions to ensure that the models were conservative in forecasting operating temperature conditions. These assumptions include:

- The temperature of the ore stacked on the heap will be equal to the average daily ambient temperature on the day the ore was stacked. This is a conservative assumption because stacking will generally not occur during the coldest hours of the day, and operators can elect not to stack ore during the coldest days. The model also did not factor in solar heat gained by ore during handling.
- The on-site weather station data suggests that the mine site temperature is slightly warmer than data used for thermodynamic modelling due to winter inversions.
- Waste heat from the electrical generation plant will be available to heat the barren solution from the processing plant from April to December of each year. Available waste heat from electrical generation will be significantly lower from January to March due to lower electrical demand as crushing activities will be suspended and the majority of waste heat will be directed to heating camp and administration buildings; therefore, it is assumed that no waste heat will be available during the colder months (November through March). A boiler will be used to provide heat to the barren solution before the solution is pumped to the heap leach pad.
- The ore generated from the Kona pit is sulphide bearing, and will generate additional heat in the heap through sulphide oxidation; this was not included in the model as the small volume of sulphide-bearing ore (2% of total ore) will be isolated in the heap to improve closure performance.

The results of the thermodynamic models were used to develop design and operational criteria for the HLF. The results indicate that seasonal ore stacking in combination with burial of distribution lines and heating of the barren leach solution will be required to maintain temperatures above freezing during Stage 1 of the HLF (Year –1 to Year 3). Once the size of the HLF increases and thermal geomembrane covers are added in Year 3 (HLF Stage 2), heating of the barren leach solution will no longer be required to maintain temperatures above freezing in the heap. Based on the models, the following design criteria for the HLF will be incorporated:

- Minimum loading of 3.5 million tonnes of ore to the heap leach pad (minimum 30-m ore depth) in Year –1 to maintain thermal integrity.
- Buried drip lines (or covered with a layer of crushed ore) at least 1 m deep.
- Ore crushing and stacking will occur from April to December only.
- Barren solution heating from November to March of each year from Year –1 to Year 3. Barren solution will be heated to 8 °C above the pregnant solution temperature to maintain a 6 °C differential temperature at drip lines after heat loss through piping.
- Beginning in Year 3, geomembranes will be employed as raincoats, during spring snowmelt and summer rain seasons to reduce infiltration of precipitation from entering the process circuit. Based on the model and experience from other operations (e.g., Veladero, Argentina) the geomembrane also acts as a thermal insulator, and will be maintained throughout the winter. The thermodynamic model predicted that the geomembrane will increase pregnant solution temperatures by 4 °C in the winter.
- A spare irrigational area equal to 100% of the primary irrigation area will be provided in every winter beginning in Year 1 based on recommendations from personnel at the Veladero Mine in Argentina. This area will allow irrigation to continue even in the event that the primary irrigation network freezes.

#### *2.11.1.3 Design Measures*

Based on the thermodynamic models for the Project and the industry review of cold climate heap leach operations, Goldcorp has identified a number of measures to minimize the risk of freezing in the HLF. Variables influencing the temperatures in the HLF include:

- The ambient atmospheric temperature at the time of stacking
- Covering or burial of drip irrigation lines
- Raincoats and other thermal heap leach covers
- Temperature of barren leach solution applied to the HLF
- The thermal mass of the HLF itself.

The design criteria measures described above are proven to be effective in climates similar to central Yukon. Goldcorp has evaluated these measures and determined that the measures are technically and economically feasible and that the measures will likely be effective in preventing freezing of the HLF.

### 2.11.2 Winter Road Access

The NAR crosses two major rivers, the Stewart River and the Yukon River, enroute to the mine site. Barges will transport supply trucks across each river during periods of open flow, and ice crossings will be constructed to allow trucks to cross when frozen. Ice crossing and barge operating periods are based on historical averages from crossings over various rivers in Yukon, such as Dawson Ferry and the Minto Mine barge operation. Data obtained from ferry and ice crossings in the Northwest Territories was also considered. The NAR is expected to be operational an average of 295 days per year.

Winter ice crossings will be constructed annually on the Stewart and Yukon Rivers and on Coffee Creek. Construction of ice crossings will commence in mid-December and are expected to be in operation until late April. A six-week period is expected for the rivers to freeze up to an ice thickness sufficient to support heavy equipment to allow trucks to cross. The winter ice crossing construction of river crossings will begin in early December of each year. During ice-crossing construction, natural freezing in the rivers will be augmented by pumping water on the surface ice to enhance ice thickening rates. Once the ice crossing is deemed suitable for hauling, the ice crossing will be monitored and maintained to ensure safe and continuous operation.

Break-up is anticipated be approximately four weeks from the last use of the ice crossing before barge services will be able to transport supply trucks across each river. No transportation across rivers will be possible during the spring thaw and fall freeze-up periods each year. In preparation for this, 15-week reserves of fuel and consumable materials will be stored at the mine site in advance of these periods.

The effectiveness of winter ice crossings in Yukon is well established. The procedures for yearly construction, maintenance, and decommissioning are proven to be effective in Yukon. The winter ice roads are considered technically and economically feasible and effective for providing winter road access to the mine site for resupply.

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# 3.0 CONSULTATION

## 3.1 INTRODUCTION

Kaminak Gold Corporation, a wholly owned subsidiary of Goldcorp Inc. (Goldcorp or Proponent) recognizes that meaningful consultation and engagement has been and will continue to be an integral part of the proposed Coffee Gold Mine (Project) throughout the exploration, scoping, design, assessment, and permitting phases and beyond. This section outlines Goldcorp's approach to consultation and engagement, the issues and interests raised during consultation and engagement, and how such issues and interests have been considered and addressed.

Goldcorp's approach to consultation was developed in accordance with s. 50(3) of the *Yukon Environmental and Socio-economic Assessment Act*, SC 2003, c. 7 (YESAA), and the Yukon Environmental and Socio-economic Assessment Board's (YESAB's) *Proponent's Guide to Information Requirements for Executive Committee Project Proposal Submissions*. The Proponent has been conducting consultation and engagement activities with potentially affected First Nations, potentially affected communities, interested persons, the public, and both Yukon and federal government agencies since 2009, and will continue to support current and future stages of Project development. It is noted that Goldcorp acquired Kaminak in July 2016 and all consultation and engagement activities prior to that date were carried out by Kaminak Gold Corporation; however, for consistency with the rest of this Project Proposal, all references will be to Goldcorp or the Proponent henceforth.

Further details of all consultation and engagement activities that have occurred to date, as well as copies of materials used are available in **Appendix 3-A Potentially Affected First Nations Consultation Records and Materials**, **Appendix 3-B Potentially Affected Communities Consultation and Interested Persons Engagement Records and Materials**, **Appendix 3-C Public Engagement Records and Materials**, and **Appendix 3-D Government Agency Engagement Records and Materials**.

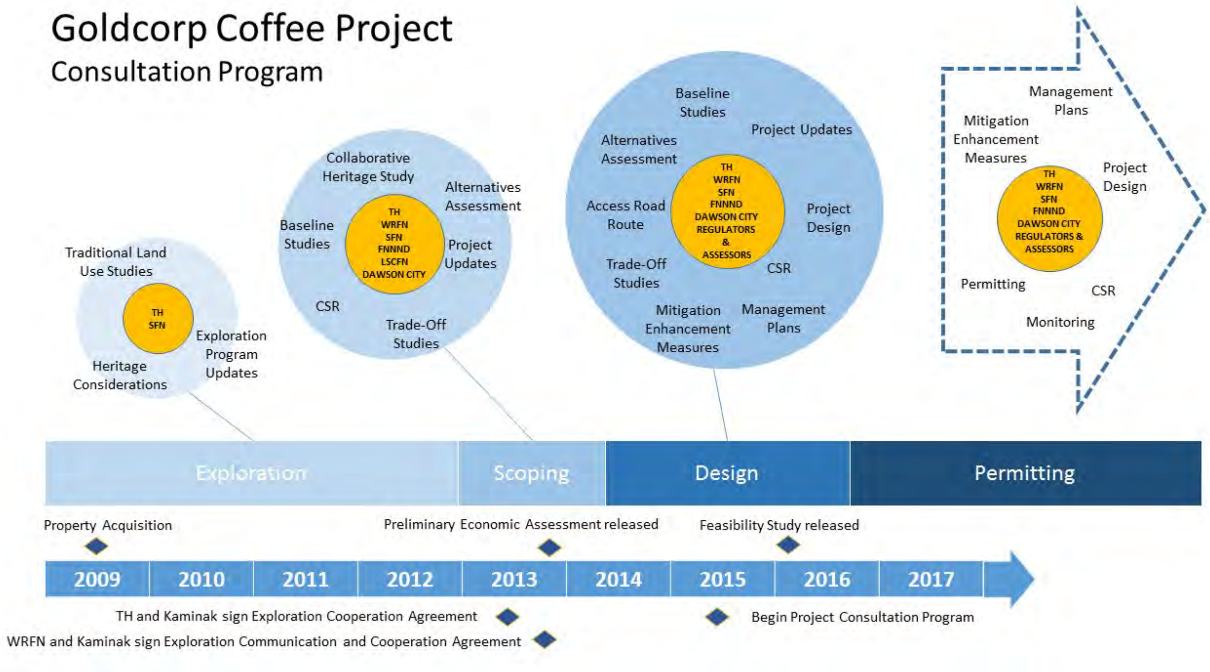


**Figure 3.1-1 Consultation and Engagement Program Progress**

### 3.1.1 Consultation Requirements

Goldcorp's Consultation and Engagement program was designed to meet or exceed the regulatory and legal requirements of YESAA, which states that proponents shall "consult any first nation in whose territory, or the residents of any community in which, the project will be located or might have significant environmental or socio-economic effects" prior to submitting their Project Proposal to YESAB's Executive Committee.

The definition of consultation under YESAA further outlines that proponents should provide the following to parties that are to be consulted:

- **(a)** by providing, to the party to be consulted,
    - **(i)** notice of the matter in sufficient form and detail to allow the party to prepare its views on the matter,
    - **(ii)** a reasonable period for the party to prepare its views, and
    - **(iii)** an opportunity to present its views to the party having the duty to consult; and
- **(b)** by considering, fully and fairly, any views so presented (YESAA 2003).

A summary of how the above criteria have been addressed within this section is provided in **Table 3.1-1**. The principles and policies of Goldcorp's consultation and engagement program that are in place to ensure that Goldcorp fulfills these consultation requirements are further discussed in subsequent sections.

**Table 3.1-1 Guide to Supporting Information**

| YESAA Criteria | Information Format | Section Reference |
|---|---|---|
| Provision of Notice in Sufficient Form and Detail | Emails, letters, meetings, teleconferences and other correspondence that demonstrate the sharing of information such as baseline studies, | Summaries included in **Section 3.3**, **Section 3.4**, **Section 3.5**, and **Section 3.6**.<br>Details included in **Appendix 3-A**, **Appendix 3-B**, **Appendix 3-C**, and **Appendix 3-D**. |
| Reasonable Period of Time to Prepare Views | Timeline of events, dates of invitations to consultation events, notes, or meeting summaries describing information shared with parties being consulted | Summaries included in **Section 3.3**, **Section 3.4**, **Section 3.5**, and **Section 3.6**.<br>Details included in **Appendix 3-A**, **Appendix 3-B**, **Appendix 3-C**, and **Appendix 3-D**. |
| Opportunity to Present Views | Dates, times, locations of where and when parties being consulted presented their views, notes, or meeting summaries articulating the views of the parties being consulted | Dates, times, and locations of events are summarized in **Section 3.3**, **Section 3.4**, **Section 3.5**, and **Section 3.6**.<br>Views presented by parties are summarized in **Section 3.3**, **Section 3.5**, and **Section 3.6**.<br>Details included in **Appendix 3-A**, **Appendix 3-B**, **Appendix 3-C**, and **Appendix 3-D**. |

| YESAA Criteria | Information Format | Section Reference |
|---|---|---|
| Full and Fair Consideration of Views Presented | Details as to what activities were affected/altered/modified by views; a list of mitigation measures that will be implemented or have been committed to regarding First Nation or residents of potentially affected communities' interests | Summaries included in **Section 3.3**, **Section 3.5**, and **Section 3.6**.<br>Details included in **Appendix 3-A**, **Appendix 3-B**, **Appendix 3-C**, and **Appendix 3-D**.<br>Descriptions of how input received has affected the Project, and the understanding and mitigation of potential effects are in included each Valued Component (VC) or Intermediate Component (IC) section. |

### 3.1.2 Consultation and Engagement Overview

Engagement with potentially affected First Nations regarding exploration activities and environmental and heritage studies at the Coffee property began in 2009, and Project-focused consultation and engagement with potentially affected First Nations, potentially affected local communities, interested persons, the public, and government agencies began in 2013. A list of all parties consulted is shown in **Table 3.1-2**. Parties that were consulted were identified using the requirements of YESAA as outlined above in **Section 3.1.1**, with the exception of other parties, such as the Klondike Placer Miners Association, Dawson City Chamber of Commerce, and the Yukon Conservation Society, which were identified through best practices, including feedback and recommendations regarding additional groups of interest from those being consulted. The methods used to identify interests through Goldcorp's consultation and engagement program are further discussed in **Section 3.2.3**.

**Table 3.1-2 Parties Consulted**

| Category | Consulted Party |
|---|---|
| Potentially Affected First Nations | Tr'ondëk Hwëch'in<br>White River First Nation<br>Selkirk First Nation<br>First Nation of Na-Cho Nyäk Dun |
| Potentially Affected Communities | City of Dawson |
| Interested Persons | Dawson District Renewable Resources Council<br>Yukon Fish and Wildlife Management Board<br>Yukon Fish and Wildlife Management Board Salmon Sub-Committee |
| Yukon Government Agencies | Government of Yukon (YG) Development Assessment Branch<br>YG Energy, Mines and Resources<br>YG Environment<br>YG Health and Social Services<br>YG Highways and Public Works<br>Yukon Water Board<br>Yukon Environmental and Socio-economic Assessment Board |
| Federal Government Agencies | Canadian Northern Economic Development Agency<br>Fisheries and Oceans Canada<br>Environment and Climate Change Canada<br>Natural Resources Canada<br>Transport Canada |
| Other Stakeholders | Chief Isaac Group, President and Chief Executive Officer<br>Dawson Ambulance<br>Dawson City Chamber of Commerce<br>Dawson Fire Department<br>Dawson City Community Health Centre<br>Road Stakeholders (e.g. placer miners)<br>Dawson Wildland Fire<br>Klondike Placer Miner Association<br>Klondike Visitors Association<br>Local businesses<br>Dawson Royal Canadian Mounted Police<br>Trapping Concession #54<br>Trapping Concession #57<br>Trapping Concession #58<br>Trapping Concession #62<br>Trapping Concession #115<br>Whitehorse Community/Public<br>Yukon Conservation Society<br>Yukon Fish and Game Association<br>Yukon Quest<br>Yukon River Quest<br>Yukon Ultra<br>Other interested parties |

## 3.2 CONSULTATION AND ENGAGEMENT APPROACH

The primary objective of Goldcorp's consultation and engagement program is to inform all potentially affected First Nations and communities, as well as interested persons and other stakeholders, of the Project and to receive and incorporate the feedback from these groups into Project design, studies, mitigation, and management. The knowledge gained in the consultation and engagement process has been, and will continue to be, used to reduce potential effects to and maximize benefits for all potentially affected parties. Through detailed and transparent information sharing, Goldcorp's consultation and engagement program also works to promote positive, productive, and lasting relationships with all potentially affected First Nations and communities. The principles, practices, and methods that support achieving this objective are described in subsequent sections.

### 3.2.1 PRINCIPLES

The principles and policies of the Proponent's approach to consultation and engagement is driven by Goldcorp's values and commitment to working in an open and transparent way with local residents, potentially affected First Nations, and stakeholders as partners in Project design and planning processes. Goldcorp's consultation and engagement program is guided by the following principles:

- **Goldcorp's Values – Respecting All Stakeholders:** Respect is about building partnerships, being a team player, and treating people fairly. Goldcorp is in business to provide benefits to a broad range of stakeholders; investors, employees, neighbours – and the only way to do this is by respecting and listening to those who are affected by what Goldcorp does.
- **Timeliness**: Ensure that all consulted parties are provided with timely and relevant Project-related information.
- **Participation**: Ensure that all consulted parties are provided with reasonable opportunities to present and communicate their views and interests to both Goldcorp and relevant regulatory agencies throughout various stages of the Project review process.
- **Partnerships and Collaboration**: Create opportunities for all consulted parties to provide input and consider this input while developing the consultation and engagement program.
- **Responsiveness**: Ensure that the interests and views of all consulted parties are fully considered in the development and implementation of the Project.
- **Respectful Relationships**: Ensure a commitment to building, maintaining, and enhancing productive and effective working relationships.

### 3.2.2 PRACTICES

Goldcorp's consultation and engagement program is guided by the following practices:

- Treat potentially affected First Nations, potentially affected and local communities, and stakeholders as partners by including them as early as possible in the consultation and engagement program.
- Be open and transparent with all consulted parties when communicating Project information and the YESAB and permitting process.
- Work closely with all consulted parties to incorporate local knowledge into the development of the Project Proposal and Project policies, including the design of monitoring programs.
- Log and track all consultation and engagement activities to facilitate follow-up in a timely manner on issues and comments and questions where applicable.

In addition to the above practices, Goldcorp is committed to incorporating potentially affected First Nations' Traditional Knowledge (TK)[3] into the Project where applicable and commercially practicable, including Project design and assessment. As such, the consultation and engagement program includes specific efforts to collaborate with potentially affected First Nations, particularly with regard to understanding the Project's potential interactions with and effects on the landscape and the people who hold a connection to the landscape.

### 3.2.3 METHODS

Goldcorp's primary methods of consulting and engaging with potentially affected First Nations, potentially affected and local communities, and government agencies included: personal communication with key representatives of organizations being consulted; regular community meetings; open houses; site tours; Project Proposal document review in advance of submission; and working group meetings (**Table 3.2-1**). In addition to a dedicated feedback mechanism with a phone number, email and mailing address in Whitehorse, Goldcorp also staffed an office in the City of Dawson (Dawson) for one week per month in January, February, and March of 2017 to provide Tr'ondëk Hwëch'in (TH) citizens and Dawson community members with an additional opportunity to drop in to receive Project information and provide feedback. Drop-in visitors were also welcomed at the Whitehorse office.

Goldcorp has provided capacity funding to certain potentially affected First Nations to support the review of technical Project information related to the specific interests of the First Nation.

3 As described by Tr'ondëk Hwëch'in, TK is knowledge shared among generations, and can include knowledge about the physical landscape, moral or societal values, ways of living, and spiritual relationships with the world. Traditional Knowledge is both the knowledge transmitted and the process and motivation by which this knowledge is passed from generation to generation.

### Table 3.2-1 Consultation and Engagement Methods and Materials

| Consultation and Engagement Method | Materials |
|---|---|
| Personal communications | Personal communications included emails, letters, newsletters, phone calls, and individual meetings. Materials included any items specific to the topic discussed, such as a maps, figures, or documents for reference. |
| Potentially affected First Nation Citizens/Member Meetings, Community Meetings, and Open Houses | At potentially affected First Nations citizens/members meetings, community meetings, and open houses, PowerPoint presentations were delivered, and hard copies of the presentations were available to attendees. Goldcorp's community feedback protocol information was available at all events taking place from November 2016 onward. Prior to November 2016, feedback forms and contact information, including mailing addresses, were available at all such meetings. |
| Site Tours | During site tours, packages with high-level Project information were provided. |
| Technical Workshops/Working Groups | At technical workshops and working groups, PowerPoint presentations were delivered electronically in advance where possible, and immediately following the meeting where not possible. Hard copies of presentations were provided to attendees at all meetings, as well as a hard copy calendar of upcoming events and meetings at workshops/working groups. Information to be discussed in technical workshops was provided in advance. |
| Document Review | Draft Project Proposal sections were provided for review via Goldcorp's online sharing portal (Open Text Core); feedback forms were provided to capture specific feedback and provide a written record of feedback, questions, and information requests and Goldcorp's response. Workshops were held to discuss documents shared and address key issues and interests. |
| Community Feedback Protocol (Figure 3.2-1 Community Feedback Protocol) | Beginning in October 2016, Goldcorp implemented a community feedback protocol whereby any person is able to contact Goldcorp to provide feedback regarding the Project via email, telephone, in person, or in writing. The timeline for response was provided along with contact information. |


**Figure 3.2-1 Community Feedback Protocol**

In keeping with Goldcorp's values and commitment to transparent communication, the Proponent designed a document sharing process to identify the information to be provided to potentially affected First Nations and the schedule for both receiving such information and providing feedback to Goldcorp. Tr'ondëk Hwëch'in, Selkirk First Nation (SFN), and White River First Nation (WRFN) were approached to determine interest in this document sharing process based on the potential interaction between the Project and TH, SFN, and WRFN territory. The Proponent shared Project Proposal documents with TH, SFN, and WRFN for review and feedback. Tr'ondëk Hwëch'in participated in the written and workshop feedback processes. Documents were also shared with SFN and feedback to date has been through participation in workshops only. White River First Nation participated in the written feedback process for the Baseline Studies, then elected to reserve written feedback for the YESAB process; WRFN did not participate in workshops that Goldcorp offered to WRFN associated with the Project Proposal document sharing process.

At the time that the document sharing process was implemented, the Proponent had not yet met with the First Nation of Na-cho Nyäk Dun (FNNND) which was scheduled for January 31, 2017. As such, it was not appropriate to include FNNND in the document reviews having not had detailed discussions about the Project. The interaction between the Project and FNNND territory includes the northern portion of the Northern Access Route (NAR), most of which is the gazette portion maintained seasonally by the Government of Yukon (YG). Goldcorp remains open to further dialogue with FNNND on the portion of the road in their traditional territory.

The Proponent split Project Proposal documents to be shared into three groups: Baseline Studies, Batch 1 and Batch 2, to help manage the volume of review required. Baseline Studies documents included baseline studies for all Valued Component (VC) and Intermediate Component (IC) reports; Batch 1 documents included VC and IC reports that were not expected to change substantially with ongoing Project changes; and Batch 2 documents included VC and IC reports that had largely been updated or were in the process of being updated to reflect recent Project changes. Additionally, the Proponent hosted multiple workshops to present potential changes to the Mine plan (Waste Rock Storage Facility Alternatives Assessment), and solicit feedback and input from potentially affected First Nations. The Proponent requested feedback within 30 days of providing Baseline Studies documents, and within 15 days of providing the Waste Rock Storage Facility (WRSF) alternatives assessment information and Batch 1 and Batch 2 documents. Documents were provided through Goldcorp's online sharing portal, Open Text Core, and on a USB flash drive.

Document sharing feedback forms specific to the document sharing process were provided to TH, SFN, and WRFN written feedback and response on Project Proposal documents. This document sharing process was communicated to those First Nations and is summarized in **Table 3.2-2** through **Table 3.2-8**.

### Table 3.2-2 Baseline Document Sharing Schedule Summary

| Reasonable Time to Prepare Views and Opportunity to Present Views for Baseline Document Sharing | |
|---|---|
| **Activity** | **Date** |
| Goldcorp provides baseline studies to TH, SFN, and WRFN for review and input | November 3 (TH and WRFN), December 1 (SFN) |
| Information Requests and written feedback for baseline studies from TH, SFN, and WRFN requested deadline. | Within 30 days of Goldcorp providing the baseline studies: December 3 (TH and WRFN)<br>January 15* (SFN)<br>*Note: extra 15 days to account for holiday office closure. |
| Information Requests and written feedback for baseline studies from TH and WRFN received. Information Requests and written feedback are opportunities for potentially affected First Nations participating in Project Proposal document review to present views on the baseline studies. | TH provided January 25, 2017; WRFN provided January 26, 2017 |

### Table 3.2-3 Baseline Documents

| Project Proposal Section | Section Name |
|---|---|
| Section 7.0 | Groundwater Analysis |
| Appendix 7-A | Baseline Hydrogeology Assessment |
| Appendix 8-A | Hydro-meteorology Baseline |
| Appendix 9-A | Baseline Air Quality and Noise |
| Appendix 11-A | Surficial Geology, Permafrost, and Terrain Stability |
| Appendix 12-A | Baseline Water Quality Report |
| Appendix 12-C | Water Balance and Water Quality Model Report |
| Appendix 12-D | Geochemical Characterization Report |
| Appendix 14-A | Fisheries and Aquatic Resources Baseline |
| Appendix 15-A | Vegetation Baseline |
| Appendix 16-A | Wildlife Baseline |
| Appendix 16-C-1 | Moose Late Winter Habitat Suitability Report |
| Appendix 16-C-2 | Thinhorn Sheep Habitat Suitability Report |
| Appendix 16-C-3 | Grizzly Bear Habitat Model Report |
| Appendix 16-C-4 | Wolverine Denning Habitat Model Report |
| Appendix 16-D | Wildlife Field Program Report |
| Appendix 16-E | Wildfire Burn Probability Analysis |
| Appendix 17-A | Bird Baseline \ |
| Appendix 18-A | Socio-economic Baseline Report |
| Appendix 18-B | Human Health Risk Assessment |
| Section 22.0 Community Health and Well-being Assessment | Health Impact Assessment[4] |

4 Based on feedback from TH, the HIA is now integrated into the Community Health and Well-being assessment.

### Table 3.2-4 Waste Rock Storage Facility Alternatives Assessment Document Sharing Schedule Summary

| Reasonable Time to Prepare Views and Opportunity to Present Views for WRSF Alternatives Assessment Document Sharing | |
|---|---|
| **Activity** | **Date** |
| Goldcorp provides WRSF alternatives assessment summary documents and updated Project Description to TH, SFN, WRFN | January 13, 2017 (sent to TH, SFN, WRFN) |
| Information Requests and written feedback for WRSF alternatives summary from TH, SFN, WRFN requested deadline. Information Requests and written feedback are opportunities for potentially affected First Nations participating in Project Proposal document review to present views on the information provided in the WRSF alternatives assessment summary documents. | Within 14 days of providing the documentation; January 27, 2017 |
| Information Requests and written feedback for WRSF alternatives assessment summary documents received from TH | TH provides on January 26, 2017 |
| Workshops with TH, SFN, WRFN on WRSF alternatives assessment. Workshops are an opportunity for TH, SFN, and WRFN to present views on the information provided on January 13, 2017 and for Goldcorp to consider these views. | SFN and WRFN – February 2, 2017<br>TH – February 3, 2017 |

### Table 3.2-5 Batch 1 Project Documents Sharing Schedule Summary

| Reasonable Time to Prepare Views and Opportunity to Present Views for Batch 1 Document Sharing | |
|---|---|
| **Activity** | **Date** |
| Goldcorp provides Batch 1 documents to potentially affected First Nations participating in Project Proposal document review | January 31, 2017 (sent to TH, SFN, WRFN) |
| Requested deadline for Information Requests and written feedback for Batch 1 documents from potentially affected First Nations participating in Project Proposal document review. Information Requests and written feedback are opportunities for potentially affected First Nations participating in Project Proposal document review to present views on the information provided in Batch 1. | February 21, 2017 |
| Information Requests and written feedback for Batch 1 are received from TH | February 22, 27, and 28, 2017 |
| Workshops with TH and SFN on Batch 1 documents*. Workshops are an opportunity for TH and SFN to present views on information provided on January 31, 2017 and for Goldcorp to consider these views.<br>*Note: workshops were offered to all potentially affected First Nations participating in Project Proposal document review. | TH - February 22, 2017<br>SFN - March 3, 2017 |

### Table 3.2-6 Batch 1 Documents

| Project Proposal Section | Section Name |
|---|---|
| Appendix 7-B | Groundwater Intermediate Component Analysis |
| Appendix 8-B | Hydrology Intermediate Component Analysis |
| Appendix 9-B | Air Quality and Greenhouse Gas Emissions Intermediate Component Analysis |
| Appendix 10-A | Noise Intermediate Component Analysis |
| Appendix 11-B | Surficial Geology, Terrain, and Soils Effects Valued Component Assessment |
| Appendix 15-B | Vegetation Valued Component Assessment |
| Appendix 17-B | Birds and Bird Habitat Valued Component Assessment |
| Appendix 21-A | Social Economy Valued Component Assessment |
| Appendix 22-A | Community Infrastructure and Services Valued Component Assessment |
| Appendix 24-A | Land and Resource Use Valued Component Assessment |

### Table 3.2-7 Batch 2 Project Documents Sharing Schedule Summary

| Reasonable Time to Prepare Views and Opportunity to Present Views for Batch 2 Document Sharing | |
|---|---|
| **Activity** | **Date** |
| Goldcorp provides Batch 2 documents to potentially affected First Nations participating in Project Proposal document review | February 23, 2017 (sent to TH, SFN, WRFN) |
| Requested deadline for Information Requests and written feedback for Batch 2 from potentially affected First Nations participating in Project Proposal document review. Information Requests and written feedback are opportunities for potentially affected First Nations participating in Project Proposal document review to present views on the information provided in Batch 2. | March 8, 2017 |
| Information Requests and written feedback for Batch 1 are received from TH | March 8 and 20, 2017 |
| Workshops with TH and SFN on Batch 2 documents*. Workshops are an opportunity for TH and SFN to present views on information provided on February 23, 2017 and for Goldcorp to consider these views.<br>*Note: workshops were offered to all potentially affected First Nations participating in Project Proposal document review. | March 8, 9, 2017 |

### Table 3.2-8 Batch 2 Documents

| Project Proposal Section | Section Name |
|---|---|
| Section 00 | Preamble |
| Section 1.0 | Project Overview |
| Section 2.0 | Project Description |
| Section 4.0 | Project Setting |
| Section 5.0 | Assessment Methodology |
| Appendix 12-B | Surface Water Quality Valued Component Assessment |
| Appendix 14-B | Fish and Fish Habitat Valued Component Assessment |

| Project Proposal Section | Section Name |
|---|---|
| Appendix 16-B | Wildlife and Wildlife Habitat Valued Component Assessment Report |
| Appendix 19-A | Demographics Intermediate Component Analysis |
| Appendix 20-A | Economic Conditions Valued Component Assessment |
| Appendix 23-A | Education Services Valued Component Assessment |
| Appendix 25-A | Community Health and Well-being Valued Component Assessment |
| Appendix 26-A | Heritage Resources Valued Component Assessment |
| Appendix 31-A | Access Route Construction Management Plan |

As a part of the socio-economic effects assessment for the Project Proposal (see **Section 18.0 Introduction to Human Environment** through **Section 26.0 Heritage Resources Assessment**), focus groups and interviews were held with key informants, local businesses, first responders, service providers, trapping concession holders, and Traditional knowledge holders.

**Appendix 3-A Potentially Affected First Nations Consultation Records and Materials**, **Appendix 3-B Potentially Affected Communities Consultation and Interested Persons Engagement Records and Materials**, **Appendix 3-C Public Engagement Records and Materials**, and **Appendix 3-D Government Agency Engagement Records and Materials** provide a detailed record of consultation and engagement between Goldcorp and consulted parties. These records contain information including date, contact type, incoming or outgoing status, and a summary of the consultation outcomes.

## 3.3 Potentially Affected First Nations Consultation

### 3.3.1 Overview

A primary objective of Goldcorp's consultation and engagement program are to work with potentially affected First Nations as partners to develop a full understanding of the landscape in which the Project is situated to design a Project that minimizes potential adverse effects and provides benefits to potentially affected First Nations. To achieve these objectives, Goldcorp's consultation and engagement program included, and continues to include, multiple opportunities for feedback and collaboration while allowing potentially affected First Nations time to review information in detail, identify their specific interests, and discuss them with Goldcorp. A key aspect of Goldcorp's program is early engagement to understand the consultation process which each First Nation prefers, including specific considerations such as timing, frequency of consultation events, topics addressed, and the level of detail of information provided.

To date, the Proponent has met with the four potentially affected First Nations. A summary of consultation methods can be found above in **Table 3.2-1**.

To support potentially affected First Nations involvement in the consultation process, the Proponent provided the opportunity for capacity funding to Tr'ondëk Hwëch'in, Selkirk and WRFN. Tr'ondëk Hwëch'in and WRFN both currently receive capacity funding for technical review of the Project through their respective agreements with the Proponent, and the Proponent is currently addressing administrative matters with SFN to provide capacity funding for their technical review. Traditional Land Use studies (TLUS) have been undertaken with TH, SFN, and WRFN for the Project to ensure that there is a fulsome understanding of the Project area, including understanding Coffee Creek as an important gathering place. A summary of TLUS undertaken for the Project is included in **Table 3.3-1**.

**Table 3.3-1 Traditional Land Use Studies**

| Study | Participants | Notes |
|---|---|---|
| Tr'ondëk Hwëch'in Coffee Creek Traditional Knowledge Survey (2012) | TH | |
| Collaborative Heritage Study (initiated 2013, completed 2014) | TH, SFN, WRFN | SFN did not participate to completion, and was provided updates and the final report. |
| White River First Nation Knowledge and Use Study (2014) | WRFN | Focus on Coffee Creek and surrounding area. |
| White River First Nation Knowledge and Use Study (2017) | WRFN | Focus on NAR and surrounding area. |
| Selkirk First Nation Traditional Land Use Study (title to be determined; ongoing) | SFN | Initiated; in progress. |

#### *3.3.1.1 Tr'ondëk Hwëch'in Overview*

The Proponent began engaging TH following acquisition of the Coffee Property in 2009 to obtain input and identify any initial potentially affected First Nations interests. Since that time, consultation with TH has been ongoing, as facilitated through the Exploration Cooperation Agreement (ECA) signed on May 16, 2013 by the Proponent and TH. The ECA established the TH Advisory Committee as a formalized mechanism for collaboration and feedback. Additionally, the ECA provides certainty by defining the expectations of both parties, clearly identifying a communication and engagement process, defining how TK will be collected, shared, used and protected, and identifying employment and business opportunities.

The TH Technical Working Group (TWG) was also formed through the TH Advisory Committee with the main purpose of providing The Proponent with ongoing advice and detailed information to inform their environmental baseline and effects assessment programs for the Project. The TH TWG also focused attention on the human, social, and cultural effects of the Project. Additionally, Goldcorp fully funded the following TH Government positions: TH Coffee Gold Community Liaison (ongoing), TH Coffee Gold Health, Social and Heritage Analyst (term completion in summer 2016), and TH Coffee Gold Natural Resources and Heritage Analyst (term completion in summer 2016). These positions formed a small research team that is responsible for thoroughly assessing the Project in relation to TH interests and rights.

**Table 3.3-2 Tr'ondëk Hwëch'in Government Positions Fully Funded by the Proponent**

| Position | Role |
|---|---|
| TH Coffee Gold Community Liaison (ongoing) | The TH Liaison is responsible for facilitating and assisting with the work of the TH Analysts, as well as acting as a bridge between Goldcorp and TH citizens, providing information to TH citizens and feedback to Goldcorp wherever possible. |
| TH Coffee Gold Health, Social and Heritage Analyst, and TH Coffee Gold Natural Resources and Heritage Analyst (concluded Summer 2016) | The roles of the two TH Analysts were to identify potential effects on Natural Resources and Heritage values and Social and Heritage values. This included carrying out field investigations and research related to the Project and how the Project may interact with TH interests; consulting with TH councils, committees, departments, and citizens; and providing information to TH staff. TH Analysts also responded to information requests from the TH TWG and TH departments, and assisted with logistics and preparation for the presentation of permits, plans, and other milestones to TH and the Dawson community. |

The TH Liaison and Analysts worked closely with the Proponent to gather local knowledge and provide feedback from the TH community to the Proponent, guiding mitigation strategies and identifying best practices to reduce potential adverse Project-related effects within TH Traditional Territory. The work of the TH Liaison is ongoing, and the scope of this role continues to grow and develop based on the needs of TH with respect to the Coffee Project.

Following Goldcorp's acquisition of Kaminak, TH requested to discontinue the TWG, in favour of obtaining support from a team of technical consultants to review and provide feedback on Coffee Project information. TH and their technical team participated in the Project Proposal information sharing and feedback process prior to submission, which included written feedback as well as workshops to discuss information shared and key issues. Goldcorp and TH's technical teams participated in the document review and written feedback process, and in teleconferences on an as-needed basis to clarify and discuss key topics of interest for the TH technical team. In addition, TH participated in workshops for all of the WRSF alternatives assessment, as well as Batch 1 and Batch 2 information sharing events, and attended an additional workshop to review the Human Health Risk Assessment and Health Impact Assessment[5] delivered at the request of TH. Ongoing collaboration with TH includes the roles of Environmental Monitors, as well as discussion of economic opportunities. Goldcorp continues to engage with TH on Information Requests received in the written document review and feedback process, as well as on Project-specific details such as water quality objectives and management plans.

In addition to consultation with TH leadership and citizens, the Proponent has worked with the Tr'ondëk Hwëch'in development corporation, Chief Isaac Group of companies (Chief Isaac Inc.), on various contracts associated with the current exploration at the Project site, and continues to engage Chief Isaac Inc. on opportunities associated with the Project.

5 Based on feedback from TH, the HIA is now integrated into the Community Health and Well-being assessment.

#### 3.3.1.2 Selkirk First Nation Overview

The Proponent approached SFN on February 25, 2013 to initiate a relationship and understand how SFN would like to be consulted on the Project. Based on feedback received in a letter from SFN in November 2014, the Proponent has endeavoured to respect SFN's request that SFN will contact the Proponent when SFN is available and willing to meet to discuss the Project. Since this correspondence in 2014, the Proponent has regularly updated SFN by letter on the Project, met in October 2015 to discuss the relationship between SFN and the Proponent, and provided a Project update in a meeting in Pelly Crossing on June 16, 2016. Following the acquisition of Kaminak by Goldcorp, the Proponent has worked to renew the relationship with SFN, meeting with SFN leadership in November 2016 and holding multiple meetings with the SFN technical team since then. SFN invited Goldcorp to Pelly Crossing in March 2017 to introduce the company and the Project team to SFN citizens. Selkirk First Nation attended workshops for the WRSF alternatives assessment, as well as the Batch 1 and Batch 2 information sharing events. Goldcorp has offered SFN capacity funding for technical review and TLUS work that is ongoing, and administrative matters related thereto were being finalized at the time of submission. Goldcorp's consultation with SFN is ongoing.

Goldcorp has also met with the Selkirk Development Corporation to understand their capacity and previous experience with mining.

#### 3.3.1.3 White River First Nation Overview

The Proponent has been engaging with WRFN since 2012, signing the Exploration Communication and Cooperation Agreement with WRFN on June 13, 2014. Goldcorp recently funded and received an additional Traditional Knowledge and Use Study as it relates to the NAR with WRFN. The Proponent has agreed to funding for technical review through a Confidentiality and Funding agreement currently under development with WRFN. Consultation with WRFN on the Project included multiple meetings with representatives of WRFN in addition to multiple community meetings and an open house. The Proponent funded WRFN to employ technical consultants to assist in the review of technical information on the Project as a result of WRFN's Exploration Communication and Cooperation Agreement with the Proponent. The technical team from WRFN participated in the document review and provided written feedback for the baseline information sharing event, and also participated in the WRSF alternatives assessment workshop; however, WRFN has since communicated to the Proponent that it is their preference to provide written feedback on the Project Proposal in the YESAB process. Goldcorp continues to share Project information through the Batch 1 and Batch 2 information sharing events with WRFN and provide opportunities for meetings to discuss and receive feedback on the information provided.

#### *3.3.1.4 First Nation of Na-cho Nyäk Dun Overview*

The Proponent initiated consultation with the First Nation of Na-cho Nyäk Dun (FNNND) in a letter to FNNND government on July 13, 2015. In a meeting between the Proponent and FNNND government, FNNND noted the fact that the portion of the NAR that is on FNNND Traditional Territory is in an area of overlap with TH Traditional Territory and noted that there was a “friendship agreement” between the two First Nations. Following the acquisition of Kaminak by Goldcorp, the Proponent contacted the FNNND government in September 2016 to initiate an introductory meeting. The Proponent and FNNND council met in Mayo in January 2017 a date selected at FNNND’s request. Due to unforeseen circumstances, certain key members of the FNNND council were unable to attend the meeting, therefore the council reserved discussion on future consultation until they were available. At the time of submission, further consultation meetings were planned for April 2017.

#### *3.3.1.5 Little Salmon Carmacks First Nation Overview*

A previous access route alignment option considered during Project planning crossed into Little Salmon / Carmacks First Nation’s (LSCFN’s) Traditional Territory, and as such LSCFN was consulted by the Proponent, beginning in 2013. Through consultation with LSCFN, the Proponent learned of important habitat for the Klaza Caribou herd located on the Proponent’s previous access route alignment and LSCFN’s concerns regarding potential effects to the Klaza Caribou as a result of the proposed route. After the Proponent’s road options analysis was completed in late 2014 (see **Section 2.10 Project Alternatives and Chosen Approach**), the Proponent selected an alternative route (i.e., proposed NAR), which does not cross LSCFN’s Traditional Territory and avoids the Klaza Caribou herd habitat. As a result, LSCFN is no longer an affected First Nation. The Proponent updated LSCFN of this decision in letter correspondence on July 13, 2015, and offered to continue to meet with LSCFN at the level and frequency desired by LSCFN. At that point, LSCFN did not request further engagement from Kaminak. The Proponent remains open to continued engagement with LSCFN, should that be of interest.

### 3.3.2 CONSULTATION UNDERTAKEN TO DATE

Consultation with potentially affected First Nations included a variety of events and activities, including community meetings and open houses, meetings with potentially affected First Nations governments, Project Proposal document sharing and written feedback processes, technical workshops, one-on-one and small, targeted group interviews with key individuals, and site visits. Dates and timing of consultation events and activities were coordinated the parties being consulted; when possible, meeting information was provided in advance of the meeting. During consultation events, feedback from potentially affected First Nations was documented and assisted in guiding Project design where applicable. Questions and comments raised were responded to during consultation events, and as required, follow-up was undertaken to address any information requests, questions, and comments related to the Project.

Consultation events with potentially affected First Nations groups are summarized in **Table 3.3-3** to **Table 3.3-6**. These events have been documented with a combination of meeting minutes, sign-in sheets, photographs, or comment cards. This supporting information and material can be found in **Appendix 3-A**.

**Table 3.3-3 Summary of Tr'ondëk Hwëch'in Consultation**

| Notice in Sufficient Form and Detail (provided via email unless otherwise specified) | Date of Related Meeting or Event | Time to Prepare Views | Description of Meeting /Event / Opportunity to Present Views | Meeting / Event Purpose and Views Presented by TH | Consideration of Views by the Proponent |
|---|---|---|---|---|---|
| **March 20, 2015:** TH provides agenda for meeting (3A-568) | March 25, 2015 | 5 days to prepare views based on agenda items | **TH Advisory Committee Meeting** (location: Dawson) | Initial meeting. Minutes are confidential. | Minutes are confidential. |
| **March 25, 2015:** the Proponent provides agenda for meeting (3A-578) | April 24, 2015 | 9 days to prepare views based on agenda items | **TH Advisory Committee Meeting** (location: teleconference) | TH and the Proponent discuss implementation and monitoring of the agreement, discuss Project access route. | Minutes are confidential. |
| **May 5, 2015:** TH and the Proponent confirm meeting date (3A-618) | May 14, 2015 | 9 days to prepare views based on meeting purpose communicated at time of meeting confirmation | **TH Chief and Council Meeting** (location: Dawson) | TH and the Proponent discuss the TH Advisory Committee, setting up a Technical Working Group (TWG), and receiving baseline studies for the Project. The Proponent provides an overview of the NAR, and highlights potential benefits and opportunities for TH Chief and Council. | Further details found in Appendix 3-A (3A-635). |
| **May 14, 2015:** TH and the Proponent confirm meeting date (3A-633) | May 17, 2015 | 23 days to prepare views based on meeting request sent by the Proponent on April 24, 2015 via email; NAR information provided by the Proponent April 24, 2015 via email for TH to prepare views (3A-608) | **TH Chief and Council Meeting** (location: Dawson) | TH and the Proponent discuss the Project and information provided by the Proponent previously regarding the NAR selection and tradeoff study of other routes. TH notes that environmentally the NAR is best, and is comfortable with the Proponent continuing an investigation of the NAR. | Further details found in Appendix 3-A (3A-638). |
| Advertised by TH; flyers posted physically throughout Dawson by TH | June 17, 2015 | | **TH Citizens Meeting** (location: Dawson) | The Proponent presents information on the Project and NAR to TH citizens in Dawson. The meeting is an opportunity for TH citizens to ask questions and present views on the Project. Hard copy information package provided to all attendees of the meeting. Views presented included, but were not limited to the following topics:<br>• Cyanide and ore processing<br>• Closure and reclamation<br>• Local employment opportunities | Further details found in Appendix 3-A (3A-687).<br>Answers to inquiries from TH citizens were provided by the Proponent during the meeting. No inquiries from attendees in this meeting required additional follow-up. Comments and inquiries were documented. Contact information for the Proponent was provided in the case that attendees wished to follow up with the Proponent. |
| **November 24, 2015:** TH copies the Proponent in a letter to YG to set up a tri-party meeting regarding the NAR. (3A-863)<br>**November 27, 2015:** Meeting details and logistics are set (3A-864) | November 30, 2015 | TH provides 6 days' notice to the proponent when requesting the meeting | **TH Meeting** (location: Dawson) | The Proponent, TH, and YG meet to discuss the NAR. This meeting is an opportunity for TH to present views on the NAR. TH expresses concerns regarding effects to wildlife associated with the NAR as well as interests in preferential contracting to TH for NAR construction. | Further details found in Appendix 3-A (3A-866).<br>The Proponent responds to TH's inquiries and concerns in the meeting, will follow up with TH regarding NAR contracting conversations with Chief Isaac Inc. |
| **November 12, 2015:** Sent meeting invitation (3A-858) | December 1, 2015 | 26 days to prepare views based on meeting purpose communicated in meeting invitation | **TH TWG Meeting** (location: Dawson) | The Proponent and TH meet to discuss the Project design and collaboration between TH and the Proponent on the Project Proposal through the TH TWG. This is an opportunity for TH to present views on the Project design and consultation and collaboration between TH and the Proponent. Views presented included, but were not limited to the following topics:<br>• Heap Leach Facility design<br>• Water Management<br>• NAR | Further details found in Appendix 3-A (3A-873).<br>The Proponent responds to TH's inquiries and concerns in the meeting. The purpose of the next meeting on December 2, 2015 is to discuss and plan a series of TH TWG meetings for TH to prepare views and present views in the 6 months to follow (January through June 2016). |
| **November 12, 2015:** Sent meeting invitation (3A-858) | December 2, 2015 | 27 days to prepare views based on meeting purpose communicated in meeting invitation | **TH TWG Meeting** (location: Dawson) | The Proponent and TH meet to discuss roles and the purpose of the TH TWG. This is an opportunity for TH to present views on the TH TWG structure and purpose, as well as TH TWG meeting topics and schedule for the 6 months to follow (January through June 2016) | Further details found in Appendix 3-A (3A-822).<br>The Proponent responds to TH's inquiries in the meeting. The schedule for subsequent meetings is tentatively set. |

| Notice in Sufficient Form and Detail (provided via email unless otherwise specified) | Date of Related Meeting or Event | Time to Prepare Views | Description of Meeting /Event / Opportunity to Present Views | Meeting / Event Purpose and Views Presented by TH | Consideration of Views by the Proponent |
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| **November 19, 2015:** Sent flyer to be distributed by TH (3A-861)<br>Flyers posted physically through Dawson by TH | December 2, 2015 | 12 days' notice of the meeting topic provided to citizens | **TH Citizens Meeting**<br>(location: Dawson) | The Proponent presents Project information and plans for Project activities to TH citizens. This is an opportunity for TH citizens to present views on the Project. Hard copies of information packages were provided to all attendees. Views presented included, but were not limited to the following topics:<br>• Ore processing<br>• Local training and employment opportunities | Further details can be found in Appendix 3-A (3A-833).<br>Answers to inquiries from TH citizens were provided by the Proponent during the meeting. No inquiries from attendees in this meeting required additional follow-up. Comments and inquiries were documented. Contact information for the Proponent was provided in the case that attendees wished to follow up with the Proponent. |
| **January 4, 2016:** TH and the Proponent confirm teleconference (3A-909) | January 7, 2016 | 3 days to prepare views based on the meeting purpose communicated at time of meeting confirmation | **TH Heritage Department Meeting**<br>(location: teleconference) | The Proponent and TH discuss the current TK information available for the Project and objectives for the Project Proposal. This meeting is an opportunity for TH to present views and information for the Proponent to consider. | Further details can be found in Appendix 3-A (3A-917).<br>The Proponent considers TH's holistic approach to TK and commits to incorporating TK throughout the Project Proposal. |
| | January 12, 2016 | | **TH Advisory Committee Meeting**<br>(location: Dawson) | General project update. Minutes are confidential. | Minutes are confidential. |
| **December 11, 2015:** Sent meeting invitation (3A-899)<br>**January 20, 2016:** Sent meeting agenda (3A-938)<br>**January 22, 2016:** Sent updated meeting agenda (3A-942)<br>**February 2, 2016**: Sent presentation (3A-979)<br>**February 19, 2016:** Sent meeting notes (presentation attached) (3A-1087) | February 9, 2016 | 20 days to prepare views based on agenda (note: the proponent updated the agenda on January 22, 2016 based on feedback from TH)<br>7 days to prepare views based on meeting presentation and materials sent on February 2, 2016 | **TH TWG Meeting**<br>(location: Dawson) | The Proponent and TH meet to discuss technical aspects of the Project as set out in the TH TWG meetings plan developed in the meeting on December 2, 2015. This is an opportunity for TH to raise views on the information provided in advance of the meeting on February 2, 2016 and during the meeting on technical aspects of the Project, such as site infrastructure, site geology, water characteristics, and Project engineering. Views presented included, but were not limited to the following topics:<br>• Heap Leach Facility design, operations, and closure<br>• Water quality<br>• Site stability (permafrost) | Further details can be found in Appendix 3-A (3A-994).<br>The Proponent responds to TH's inquiries and concerns in the meeting, and recorded and followed up on outstanding items from the meeting via email and/or in TH TWG meetings in April 2016. Action items and follow up items are iterated in Appendix 3-A (3A-1006). |
| **December 11, 2015:** Sent meeting invitation (3A-899)<br>**January 20, 2016:** Sent meeting agenda (3A-938)<br>**January 22, 2016:** Sent updated meeting agenda (3A-942)<br>**February 2, 2016**: Sent presentation (3A-979)<br>**February 22, 2016:** Sent meeting notes (presentation attached) (3A-1087) | February 10, 2016 | 20 days to prepare views based on agenda (note: the proponent updated the agenda on January 22, 2016 based on feedback from TH)<br>7 days to prepare views based on meeting presentation and materials sent on February 2, 2016 | **TH TWG Meeting**<br>(location: Dawson) | The Proponent and TH meet to continue discussing technical aspects of the Project. This is an opportunity for TH to present views on the information provided in advance of the meeting on February 2, 2016 and during the meeting on technical aspects of the Project such as water quality baseline and valued components. Views presented included, but were not limited to the following topics:<br>• Wildlife<br>• Valued Components<br>• Ongoing consultation on the Project Proposal | Further details can be found in Appendix 3-A (3A-1019).<br>The Proponent responds to TH's inquiries and concerns in the meeting, and recorded and followed up on outstanding items from the meeting via email and/or in TH TWG meetings in April 2016. Action items and follow up items are iterated in Appendix 3-A (3A-1023). |
| **January 26, 2016:**<br>Sent flyer to be distributed by TH (3A-955)<br>Flyers posted physically throughout Dawson by TH | | 15 days' notice of the meeting topic provided to citizens | **TH Citizens Meeting**<br>(location: Dawson) | The Proponent presents Project information and baseline water quality findings to TH citizens. This is an opportunity for TH citizens to present views on the Project and baseline water quality findings. Hard copies of information packages were provided to all attendees. Views presented included, but were not limited to the following topics:<br>• Employment and training of TH citizens to work for the Proponent at the Project<br>• Heap Leach Facility design and ore processing<br>• Reclamation and closure | Further details can be found in Appendix 3-A (3A-1032).<br>Answers to inquiries from TH citizens were provided by the Proponent during the meeting. No inquiries from attendees in this meeting required additional follow-up. Comments and inquiries were documented. Contact information for the Proponent was provided in the case that attendees wished to follow up with the Proponent. |

| Notice in Sufficient Form and Detail (provided via email unless otherwise specified) | Date of Related Meeting or Event | Time to Prepare Views | Description of Meeting /Event / Opportunity to Present Views | Meeting / Event Purpose and Views Presented by TH | Consideration of Views by the Proponent |
|---|---|---|---|---|---|
| **December 11, 2015:** Sent meeting invitation (3A-899)<br>**January 20, 2016:** Sent meeting agenda (3A-938)<br>**January 22, 2016:** Sent updated meeting agenda (3A-942)<br>**February 6, 2016**: Sent presentation and handouts (3A-990)<br>**February 19, 2016:** Sent meeting notes (presentation attached) (3A-1087) | February 11, 2016 | 20 days to prepare views based on agenda (note: the proponent updated the agenda on January 22, 2016 based on feedback from TH)<br>5 days to prepare views based on meeting presentation and materials sent on February 6, 2016 | **TH TWG Meeting** (location: Dawson) | The Proponent and TH meet to discuss the Project emergency management planning, adaptive management, and TH Citizen employee support both on- and off-site. This is an opportunity for TH to present views on the information provided in advance of the meeting on February 6, 2016 and during the meeting on the above-noted aspects of the Project. Views presented included, but were not limited to the following topics:<br>• Emergency response<br>• Wildlife management and the NAR<br>• Land Use (hunting)<br>• Employment and training of TH citizens to work for the Proponent at the Project | Further details can be found in Appendix 3-A (3A-1059).<br>The Proponent responds to TH's inquiries and concerns in the meeting, and recorded and followed up on outstanding items from the meeting via email and/or in TH TWG meetings in March and April 2016. Action items and follow up items are iterated in Appendix 3-A (3A-1067). |
| **February 25, 2016:** Sent meeting invitation (3A-1096) | March 4, 2016 | 7 days to prepare views based on the meeting purpose communicated in meeting invitation | **TH Meeting** (location: Dawson) | The Proponent's terrestrial baseline expert and TH meet to review the terrestrial environment baseline studies. This is an opportunity for TH to presnt views on the terrestrial environment baseline studies and Wildlife Management Plan for the Project. | Further details can be found in Appendix 3-A (3A-1152).<br>The Proponent's rep responds to TH's inquires and concerns in the meeting, recorded and followed up on outstanding items from the meeting via email and/or in TH TWG meetings in April 2016. Action items and follow up items are iterated in Appendix 3-A (3A-1155). |
| **February 25, 2016:** TH and the Proponent coordinate the meeting (3A-1133) | March 8, 2016 | 11 days to prepare views based on the meeting purpose communicated during meeting coordination | **TH Meeting** (location: Dawson) | The Proponent and TH meet to discuss training and employment of TH citizens for the Project. This is an opportunity for TH to present views on the topic. Views presented included, but were not limited to:<br>• Employment and training of TH citizens to work for the Proponent at the Project | Further details can be found in Appendix 3-A (3A-1167).<br>The Proponent responds to TH's inquiries and concerns in the meeting, and recorded and followed up on outstanding items from the meeting via email. The Proponent continues to work with TH on developing a list of jobs for the Project and career profiles for TH's Education and Training Department. Action items and follow up items are iterated in Appendix 3-A (3A-1169). |
| **March 9, 2016:** Sent flyers for TH to distribute (3A-1172), coordinated media advertising (news, rolling TV ad, radio)<br>Flyers posted physically throughout Dawson by TH | March 21, 2016 | 12 days' notice of the meeting topic provided to citizens | **TH Citizens Meeting** (location: Dawson) | The Proponent presents Project information and socio-economic baseline and Traditional Economy study findings to TH citizens. This is an opportunity for TH citizens to present views on the Project and socio-economic baseline and Traditional Economy study findings. Hard copies of information packages were provided to all attendees. Views presented included, but were not limited to the following topics:<br>• Infrastructure and services capacity in Dawson<br>• Employment and training of TH citizens to work for the Proponent at the Project, including students | Further details can be found in Appendix 3-A (3A-1190).<br>Answers to inquiries from TH citizens were provided by the Proponent during the meeting. No inquiries from attendees in this meeting required additional follow-up. Comments and inquiries were documented. Contact information for the Proponent was provided in the case that attendees wished to follow up with the Proponent. |

| Notice in Sufficient Form and Detail (provided via email unless otherwise specified) | Date of Related Meeting or Event | Time to Prepare Views | Description of Meeting /Event / Opportunity to Present Views | Meeting / Event Purpose and Views Presented by TH | Consideration of Views by the Proponent |
|---|---|---|---|---|---|
| **December 11, 2015:** Sent meeting invitation (3A-899)<br>**January 22, 2016:** Sent updated meeting invitation (3A-942)<br>**March 7, 2016:** Sent working meeting agenda (3A-1161)<br>**March 15, 2016:** Sent presentation (3A-1178)<br>**March 18, 2016:** TH sent finalized meeting agenda to Proponent (3A-1183)<br>**April 2, 2016:** Sent meeting notes (with presentation) (3A-1272) | March 22, 2016 | 15 days to prepare views based on agenda (note: TH provided an updated agenda on March 18, 2016)<br>7 days to prepare views based on meeting materials provided March 15, 2016 | **TH TWG Meeting** (location: Dawson) | The Proponent and TH meet to discuss the socio economic baseline and draft valued components for the Project. This is an opportunity for TH to present views on the information provided in advance of the meeting on March 15, 2016 and during the meeting on the above-noted aspects of the Project. Views presented included, but were not limited to the following topics:<br>• Socio-economic effects and monitoring<br>• Valued Components in the Project Proposal<br>• Reclamation and closure | Further details can be found in Appendix 3-A (3A-1200).<br>The Proponent responds to TH's inquiries and concerns in the meeting, and recorded and followed up on outstanding items from the meeting via email and/or in TH TWG meetings in April 2016. As a result of the views presented by TH in this meeting, the Proponent changes the "Traditional Economy" Valued Component structure and title to "Social Economy", with "Traditional Economy" and "Non-wage Economy" sub-components. Action items and follow up items are iterated in Appendix 3-A (3A-1215) |
| **December 11, 2015:** Sent meeting invitation (3A-899)<br>**January 22, 2016:** Sent updated meeting invitation (3A-942)<br>**March 7, 2016:** Sent working meeting agenda (3A-1161)<br>**March 15, 2016:** Sent presentation (3A-1178)<br>**March 18, 2016:** Sent meeting agenda (3A-1183)<br>**April 2, 2016:** Sent meeting notes (with presentation) (3A-1272) | March 23, 2016 | 15 days to prepare views based on agenda (note: TH provided an updated agenda on March 18, 2016)<br>8 days to prepare views based on meeting materials provided March 15, 2016 | **TH TWG Meeting** (location: Dawson) | The Proponent and TH meet to continue discussing the socio economic baseline and socio economic mitigations for the Project. This is an opportunity for TH to present views on the information provided in advance of the meeting on March 15, 2016 and during the meeting on the above-noted aspects of the Project. Views presented included, but were not limited to the following topics:<br>• Effects of increased access related to the NAR<br>• Employment and training of TH citizens to work for the Proponent at the Project<br>• Socio-economic effects and mitigations | Further details can be found in Appendix 3-A (3A-1224).<br>The Proponent responds to TH's inquiries and concerns in the meeting, no inquiries from attendees in this meeting required additional follow-up. |
| **March 30, 2016:** TH advertised event via flyers; the Proponent coordinated media advertising for the event (news, rolling TV ad, radio)<br>Flyers posted physically throughout Dawson by TH | April 11, 2016 | 11 days' notice of the meeting topic provided to citizens | **TH Citizens Meeting** (location: Dawson) | The Proponent presents Project information and the wildlife and fish baseline study findings to TH citizens. This is an opportunity for TH citizens to present views on the Project and the wildlife and fish baseline study findings. Hard copies of information packages were provided to all attendees. Views presented included, but were not limited to the following topics:<br>• Wildlife and the NAR<br>• NAR management and accident response | Further details can be found in Appendix 3-A (3A-1307).<br>Answers to inquiries from TH citizens were provided by the Proponent during the meeting. No inquiries from attendees in this meeting required additional follow-up. Comments and inquiries were documented. Contact information for the Proponent was provided in the case that attendees wished to follow up with the Proponent. |
| **December 11, 2015:** Sent meeting invitation (3A-899)<br>**January 22, 2016:** Sent updated meeting invitation (3A-942)<br>**March 31, 2016:** Sent working meeting agenda (3A-1266)<br>**April 5, 2016:** Sent presentation and updated meeting agenda (3A-1287, 1293)<br>**April 30, 2016:** Sent meeting notes (with presentation) (3A-1540) | April 12, 2016 | 12 days to prepare views based on agenda (note: updated agenda April 5, 2016)<br>7 days to prepare views based on meeting materials provided April 5, 2016 | **TH TWG Meeting** (location: Dawson) | The Proponent and TH meet to discuss the wildlife and fish baseline studies for the Project. This is an opportunity for TH to present views on the information provided in advance of the meeting on April 5, 2016 and during the meeting on the above-noted aspects of the Project. Views presented included, but were not limited to the following topics:<br>• Data collection methods for the fish and terrestrial baseline studies<br>• Caribou | Further details can be found in Appendix 3-A (3A-1318).<br>The Proponent responds to TH's inquiries and concerns in the meeting, and recorded and followed up on outstanding items from the meeting via email and/or in TH TWG meetings in May 2016. As a result of views presented by TH in this meeting, the Proponent's fish and aquatics technical team added sampling sites for the fish and aquatics baseline data collection program starting in the 2016 field season. Action items and follow up items are iterated in Appendix 3-A (3A-1330). |

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|---|---|---|---|---|---|
| **December 11, 2015:** Sent meeting invitation (3A-899)<br>**January 22, 2016:** Sent updated meeting invitation (3A-942)<br>**March 31, 2016:** Sent working meeting agenda (3A-1266)<br>**April 5, 2016:** Sent updated meeting agenda (3A-1287)<br>**April 6, 2016:** Sent presentation (3A-1297)<br>**April 30, 2016:** Sent meeting notes (with presentation) (3A-1540) | April 13, 2016 | 13 days to prepare views based on agenda (note: updated agenda April 5, 2016)<br>7 days to prepare views based on meeting materials provided April 6, 2016 | **TH TWG Meeting**<br>(location: Dawson) | The Proponent and TH meet to discuss wildlife and fish effects assessment and mitigations, water quality baseline and water balance, water management for the Project. This is an opportunity for TH to present views on the information provided in advance of the meeting on April 6, 2016 and during the meeting on the above-noted aspects of the Project. Views presented included, but were not limited to the following topics:<br>• Water quality<br>• Wildlife and the NAR | Further details can be found in Appendix 3-A (3A-1358).<br>The Proponent responds to TH's inquiries and concerns in the meeting, and recorded and followed up on outstanding items from the meeting via email and/or in TH TWG meetings in May 2016. As a result of views presented by TH in this meeting, the Proponent commits to including traditional and medicinal plants as a sub-component to the vegetation VC. The Proponent notes that follow up with TH is required for more information from TH on this new VC sub-component. |
| **March 30, 2016:** TH advertised event via flyers; the Proponent coordinated media advertising (news, rolling TV ad, radio)<br>Flyers posted physically throughout Dawson by TH | | 13 days' notice of the meeting topic provided to citizens | **TH Citizens Meeting**<br>(location: Dawson) | The Proponent presents Project information and presents on reclamation and closure to TH citizens. This is an opportunity for TH citizens to present views on the Project information provided on reclamation and closure. Hard copies of information packages were provided to all attendees. Views presented included, but were not limited to the following topics:<br>• Reclamation and closure<br>• NAR management | Further details can be found in Appendix 3-A (3A-1351).<br>Answers to inquiries from TH citizens were provided by the Proponent during the meeting. No inquiries from attendees in this meeting required additional follow-up. Comments and inquiries were documented. Contact information for the Proponent was provided in the case that attendees wished to follow up with the Proponent. |
| **December 11, 2015:** Sent meeting invitation (3A-899)<br>**January 22, 2016:** Sent updated meeting invitation (3A-942)<br>**April 4, 2016:** Sent working meeting agenda (3A-1279)<br>**April 6, 2016:** Sent updated meeting agenda (3A-1299)<br>**April 8, 2016:** Sent presentation (3A-1304)<br>**April 30, 2016:** Sent meeting notes (with presentation) (3A-1540) | April 14, 2016 | 10 days to prepare views based on agenda (note: updated agenda April 6, 2016)<br>6 days to prepare views based on meeting materials provided April 8, 2016 | **TH TWG Meeting**<br>(location: Dawson) | The Proponent and TH meet to discuss reclamation and closure for the Project. This is an opportunity for TH to present views on the information provided in advance of the meeting on April 8, 2016 and during the meeting on the above-noted aspects of the Project. Views presented included, but were not limited to the following topics:<br>• Reclamation and closure<br>• Employment and training of TH citizens to work for the Proponent at the Project, including students | Further details can be found in Appendix 3-A (3A-1379).<br>The Proponent responds to TH's inquiries and concerns in the meeting, and recorded and followed up on outstanding items from the meeting via email and/or in TH TWG meetings in May 2016. Action items and follow up items are iterated in Appendix 3-A (3A-1393). |
| **December 11, 2015:** Sent meeting invitation (3A-899)<br>**January 22, 2016:** Sent updated meeting invitation (3A-942)<br>**April 4, 2016:** Sent working meeting agenda (3A-1279)<br>**April 6, 2016:** Sent updated meeting agenda (3A-1299)<br>**April 8, 2016:** Sent presentation (3A-1304)<br>**April 30, 2016:** Sent meeting notes (with presentation) (3A-1540) | April 15, 2016 | 11 days to prepare views based on agenda (note: updated agenda April 6, 2016)<br>7 days to prepare views based on meeting materials provided April 8, 2016 | **TH TWG Meeting**<br>(location: Dawson) | The Proponent and TH meet to discuss reclamation and closure, climate change, and permafrost for the Project. This is an opportunity for TH to present views on the information provided in advance of the meeting on April 8, 2016 and during the meeting on the above-noted aspects of the Project. Views presented included, but were not limited to the following topics:<br>• Water quality<br>• Reclamation and closure<br>• Climate change considerations for the Project | Further details can be found in Appendix 3-A (3A-1406).<br>The Proponent responds to TH's inquiries and concerns in the meeting, and recorded and followed up on outstanding items from the meeting via email and/or in TH TWG meetings in May 2016. Action items and follow up items are iterated in Appendix 3-A (3A-1412). |

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|---|---|---|---|---|---|
| **April 4, 2016:** Meeting date confirmed (3A-1278) | April 18, 2016 | 14 days to prepare views based on meeting topic communicated at time of meeting confirmation | **TH and Regulators and Assessors Meeting** (location: Whitehorse) | The Proponent meets with TH and Yukon Government to discuss wildlife effects assessment and mitigation. This is an opportunity for TH to present views on effects to wildlife and mitigation strategies as it relates to the Project. | Further details can be found in Appendix 3-A (3A-1420).<br>The Proponent responds to TH's inquiries and concerns in the meeting. No inquiries from attendees in this meeting required additional follow-up. Comments and inquiries were documented. Contact information for the Proponent was provided in the case that attendees wished to follow up with the Proponent. |
| **April 15, 2016:** Discussion in TH TWG meeting about meeting scheduling, set date (discussion is in person)<br>**April 24, 2016:** Send meeting invitation, agenda, presentation (3A-1458) | April 26, 2016 | 11 days to prepare views based on meeting topic discussed at time of meeting coordination<br>2 days to prepare views based on meeting materials provided in advance | **TH TWG Meeting** (location: teleconference) | The Proponent and TH meet to discuss the air quality and noise baseline for the Project. This is an opportunity for TH to present views on the information provided in advance of the meeting on April 24, 2016 as well as on topics discussed during the meeting. Views presented included, but were not limited to the following topics:<br>• Noise effects on wildlife<br>• Effects assessment methodology | Further details can be found in Appendix 3-A (3A-1470).<br>The Proponent responds to TH's inquiries and concerns in the meeting, and recorded and followed up on outstanding items from the meeting via email. Action items and follow up items are iterated in Appendix 3-A (3A-1475, 3A-1480, 3A-1483, 3A-1487). |
| **April 15, 2016:** Sent meeting invitation (3A-1419) | April 27, 2016 | 12 days to prepare views based on meeting topic discussed at time of meeting coordination and indicated in meeting invitation | **TH Meeting** (location: Vancouver) | The Proponent and TH meet to discuss employment, training, Comprehensive Community Benefit Agreements, and wildlife mitigation. This is an opportunity for TH to present views on the topics noted above. | Further details can be found in Appendix 3-A (3A-1497).<br>The Proponent responds to TH's inquiries and concerns in the meeting, and recorded and followed up on outstanding items from the meeting via email. Action items and follow up items are iterated in Appendix 3-A (3A-1503). |
| **April 15, 2016:** Sent meeting invitation (3A-1419) | April 28, 2016 | 13 days to prepare views based on meeting topic discussed at time of meeting coordination and indicated in meeting invitation | **TH Meeting** (location: Vancouver) | The Proponent and TH meet to review and discuss the Project Proposal and valued components. This is an opportunity for TH to present views on the topics noted above. Views presented included, but were not limited to the following topics:<br>• Effects assessment methodology,<br>• Socio economic baseline<br>• Cumulative effects<br>• Section 4.3 of the Project Proposal to be written by TH | Further details can be found in Appendix 3-A (3A-1507).<br>The Proponent responds to TH's inquiries and concerns in the meeting, and recorded and followed up on outstanding items from the meeting via email. Action items and follow up items are iterated in Appendix 3-A (3A-1518). |
| **April 15, 2016:** Sent meeting invitation (3A-1419) | April 29, 2016 | 14 days to prepare views based on meeting topic discussed at time of meeting coordination and indicated in meeting invitation | **TH Meeting** (location: Vancouver) | The Proponent and TH meet to discuss water management and the water balance model as a result of outstanding questions from April TH TWG meetings. This is an opportunity for TH to present views on the topics noted above. Views presented included, but were not limited to the following topics:<br>• Water management<br>• Water quality modeling | Further details can be found in Appendix 3-A (3A-1527).<br>The Proponent responds to TH's inquiries and concerns in the meeting, and recorded and followed up on outstanding items from the meeting via email. Action items and follow up items are iterated in Appendix 3-A (3A-1533). |

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|---|---|---|---|---|---|
| **April 15, 2016:** Discussion in TH TWG meeting about meeting scheduling, date is set (discussion is in person)<br>**April 28, 2016:** Discussion with TH about changing meeting date (discussion is during a teleconference)<br>**April 29, 2016:** Sent meeting invitation (3A-1534)<br>**May 4, 2016:** Sent presentation (3A-1558)<br>**May 11, 2016:** Sent meeting notes (with presentation) (3A-1575) | May 5, 2016 | 16 days to prepare views based on meeting topic communicated at time of meeting confirmation<br>1 day to prepare views based on meeting materials provided in advance | **TH TWG Meeting**<br>(location: teleconference) | The Proponent and TH meet To review and discuss the Proponent's water management design as a result of outstanding questions from April TH TWG meetings. This is an opportunity for TH to present views on the topics noted above. Views presented included, but were not limited to the following topics:<br>• Water management design and infrastructure<br>• Sedimentation ponds design and function | Further details can be found in Appendix 3-A (3A-1559).<br>The Proponent responds to TH's inquiries and concerns in the meeting, and recorded and followed up on outstanding items from the meeting via email. Action items and follow up items are iterated in Appendix 3-A (3A-1564). |
| **August 31, 2016:** TH informs Goldcorp they are no longer available to meet September 6, suggest September 8. Goldcorp replies that September 26 is the next available date for the CEO to meet with Chief and Council. Following this, Goldcorp CEO notifies TH that the meeting is to be changed from September 26 to October 3 due to extenuating circumstances<br>**September 28, 2016:** TH provides meeting agenda for October 3 meeting | October 3, 2016 | 31 days to prepare views based on meeting purpose communicated at time of meeting confirmation | **TH Chief and Council Meeting**<br>(location: Goldcorp Vancouver) | The Proponent and TH meet to introduce Goldcorp to TH Chief and Council and to discuss engagement moving forward. This is an opportunity for TH to present views on the Project and engagement moving forward. Views presented included, but were not limited to the following topics:<br>• Project description<br>• NAR route selection | Further details can be found in Appendix 3-A (3A-1691).<br>The Proponent responds to TH's inquiries and concerns in the meeting, and followed up on topics from the meeting via email (3A-1696). |
| **October 5, 2016:** Proposed dates (3A-1697)<br>**October 18, 2016:** Confirmed date via telephone<br>**October 20, 2016:** Flyer sent to TH (3A-1703)<br>Flyers posted physically throughout Dawson by TH | October 26, 2016 | 6 days' notice of the meeting topic provided to citizens | **TH Citizens Dinner**<br>(location: Dawson City) | The Proponent presents Project information and introduces Goldcorp's company values and Canadian operations to TH citizens. The Proponent also describes the Project timeline and provides NAR documentation via USB to TH as requested on October 3, 2016. This is an opportunity for TH citizens to present views on the Project. Hard copies of information presented were available to all attendees. Views presented included, but were not limited to the following topics:<br>• TH cultural values<br>• Training and employment of TH citizens<br>• Heap leach processing | Further details can be found in Appendix 3-A (3A-1707).<br>Answers to inquiries from TH citizens were provided by the Proponent during the meeting. No inquiries from attendees in this meeting required additional follow-up. Comments and inquiries were documented. Contact information for the Proponent was provided in the case that attendees wished to follow up with the Proponent. |
| **October 5, 2016:** Proposed dates(3A-1697)<br>**October 18, 2016:** Confirmed date via telephone | October 27, 2016 | 1 day to prepare views based on information shared and TH citizens' comments at the October 26, 2016 TH citizens meeting | **TH Chief and Council Meeting**<br>(location: Dawson) | The Proponent meets with TH Chief and Council to discuss information shared at TH citizen's dinner and answer questions for Chief and Council. This is an opportunity for TH Chief and Council to present views on the Project. | Further details can be found in Appendix 3-A (3A-1719).<br>Answers to inquiries from TH Chief and Council were provided by the Proponent during the meeting. No inquiries from attendees in this meeting required additional follow-up. Comments and inquiries were documented. Contact information for the Proponent was provided in the case that attendees wished to follow up with the Proponent. |
| | November 2, 2016 | | **TH Meeting**<br>(location: Goldcorp Vancouver) | The Proponent meets with TH to discuss consultation moving forward, consultation schedule, capacity funding, Project updates, baseline report input, financial model, current agreement. This is an opportunity for TH to present views on the above noted topics. | Meeting minutes are confidential. |

| Notice in Sufficient Form and Detail (provided via email unless otherwise specified) | Date of Related Meeting or Event | Time to Prepare Views | Description of Meeting /Event / Opportunity to Present Views | Meeting / Event Purpose and Views Presented by TH | Consideration of Views by the Proponent |
|---|---|---|---|---|---|
| **(Document Sharing)** | November 3, 2016 | Written feedback timelines are summarized in **Table 3.2-2**. The Proponent requested 30 days for TH to provide written feedback (views) on the baseline studies for the Project. TH presented views in written form after 83 days. | **Provide Baseline Studies to TH** | The Proponent provides all baseline studies for the Project to TH for review and feedback as discussed in the meeting on October 3, 2016. This is an opportunity for TH to present views on the baseline studies for the Project via written feedback. Written feedback timelines are summarized in **Table 3.2-2** and the written feedback process is described in **3.2.3**. | The Proponent considers and responds to feedback from TH in writing; responses to feedback from TH provided via email on February 8, 2017. TH's feedback (84 views presented) and the Proponent's consideration and responses (84 responses) are documented in Appendix 3-A (3A-2078).<br>As a result of TH's review of the baseline studies for the Project, TH also requested teleconferences between TH and the Proponents' technical experts. These teleconferences occurred on December 6, 8, 9, and 13 of 2016. |
| **November 22, 2016:** TH and Goldcorp confirm meeting (3A-1785) | November 29, 2016 | 7 days to prepare views based on meeting topic communicated when confirming meeting | **TH Meeting**<br>(location: teleconference) | The Proponent and TH meet to discuss the role of TH Community Liaison, the current agreement, and new members of the Advisory Committee. This is an opportunity for TH to present views on the topics noted above. | Further details can be found in Appendix 3-A (3A-1810).<br>The Proponent responds to TH's inquiries and concerns in the meeting, and followed up on topics from the meeting via email. Follow up items include meeting again early in 2017 after TH determines the members of the Advisory Committee. |
| **December 2, 2016:** Request from TH to hold teleconferences (3A-1834)<br>**December 5, 2016:** Invitation sent to TH (3A-1838)<br>**December 16, 2016:** additional information requested in teleconference provided via Open Text Core (3A-1900) | December 6, 2016 | 33 days to prepare views based on baseline documents provided on November 3, 2016 | **TH Technical Meeting**<br>(location: teleconference) | The Proponent and their technical consultants and TH and their technical consultant meet to discuss water quality and geochemical characterization on site. This is an opportunity for TH to present views on the topics above. Views presented included, but were not limited to the following topics:<br>• High level discussion of reclamation and closure of the heap leach<br>• Event pond design | Further details can be found in Appendix 3-A (3A-1853).<br>The Proponent responds to TH's inquiries and concerns in the meeting, and recorded and followed up on outstanding items from the meeting via email. Action items and follow up items are iterated in Appendix 3-A (3A-1900). |
| **December 2, 2016:** Request from TH to hold teleconferences (3A-1835)<br>**December 5, 2016:** Invitation sent to TH (3A-1839)<br>**December 16, 2016:** additional information requested in teleconference provided via Open Text Core (3A-1901) | December 8, 2016 | 35 days to prepare views based on baseline documents provided on November 3, 2016 | **TH Technical Meeting**<br>(location: teleconference) | The Proponent and their technical consultants and TH and their technical consultants meet to discuss water quality. This is an opportunity for TH to present views on water quality. Views presented included, but were not limited to the following topics:<br>• Water quality sampling sites and frequency | Further details can be found in Appendix 3-A (3A-1871).<br>The Proponent responds to TH's inquiries and concerns in the meeting, and recorded and followed up on outstanding items from the meeting via email. Action items and follow up items are iterated in Appendix 3-A (3A-1901). |
| **December 2, 2016:** Request from TH to hold teleconferences (3A-1834)<br>**December 5, 2016:** Invitation sent to TH (3A-1841)<br>**December 16, 2016:** additional information requested in teleconference provided via Open Text Core (3A-1904)<br>**January 6, 2017:** Meeting in Whitehorse coordinated to follow up on a request for a meeting on wildlife modelling (3A-1936) | December 9, 2016 | 36 days to prepare views based on baseline documents provided on November 3, 2016 | **TH Technical Meeting** (location: teleconference) | The Proponent and their technical consultants and TH and their technical consultants meet to discuss ecosystem mapping and wildlife baseline. This is an opportunity for TH to present views on the above noted topics. Views presented included, but were not limited to the following topics:<br>• Habitat modeling<br>• Baseline data collection methodology | Further details can be found in Appendix 3-A (3A-1880).<br>The Proponent responds to TH's inquiries and concerns in the meeting, and recorded and followed up on outstanding items from the meeting via email. As a result of views presented by TH, the Proponent's technical consultants met with TH's technical consultants to discuss wildlife modelling on January 9, 2017. Action items and follow up items are iterated in Appendix 3-A (3A-1904). |

| Notice in Sufficient Form and Detail (provided via email unless otherwise specified) | Date of Related Meeting or Event | Time to Prepare Views | Description of Meeting /Event / Opportunity to Present Views | Meeting / Event Purpose and Views Presented by TH | Consideration of Views by the Proponent |
|---|---|---|---|---|---|
| **December 2, 2016:** Request from TH to hold teleconferences (3A-1834)<br>**December 5, 2016:** Invitation sent to TH (3A-1839)<br>**December 16, 2016:** additional information requested in teleconference provided via Open Text Core (3A-1901) | December 9, 2016 | 36 days to prepare views based on baseline documents provided on November 3, 2016 | **TH Technical Meeting** (location: teleconference) | The Proponent and their technical consultants and TH and their technical consultants meet to discuss water quality and the fish and fish habitat baseline, discussion of toxicology results. This is an opportunity for TH to present views on the above noted topics. Views presented included, but were not limited to the following topics:<br>• Water quality<br>• Chum spawning survey results | Further details can be found in Appendix 3-A (3A-1879).<br>The Proponent responds to TH's inquiries and concerns in the meeting, and recorded and followed up on outstanding items from the meeting via email. As a result of views presented by TH, the Proponent's technical consultants consider additional chum spawning survey work for the 2017 field season. Action items and follow up items are iterated in Appendix 3-A (3A-1901). |
| **December 2, 2016:** Request from TH to hold teleconferences (3A-1834)<br>**December 6, 2016:** Goldcorp emails TH to discuss scheduling (3A-1851)<br>**December 10, 2016:** Invitation sent to TH (3A-1881)<br>**January 6, 2017:** Human Health Risk Assessment (HHRA) provided<br>**January 27, 2017:** Health Impact Assessment (HIA) provided | December 13, 2016 | 40 days to prepare views based on baseline documents provided on November 3, 2016 | **TH Technical Meeting** (location: teleconference) | The Proponent and their technical consultants and TH and their technical consultants meet to discuss the Human Environment (socio-economic) baseline. This is an opportunity for TH to present views on the Human Environment baseline. Views presented included, but were not limited to the following topics:<br>• Socio-economic VC scoping<br>• Consultation to date | Further details can be found in Appendix 3-A (3A-1889).<br>The Proponent responds to TH's inquiries and concerns in the meeting, and recorded and followed up on outstanding items from the meeting via email. As a result of the views presented by TH in this meeting, the Proponent provides the HHRA and HIA following the meeting on January 6 and 27, 2017, respectively (3A-1895). Action items and follow up items are iterated in Appendix 3-A (3A-1904). |
| **December 16, 2016:** Meeting requested by TH and agreed to by Goldcorp for December 19 (3A-1896) | December 19, 2016 | Requested by TH; 3 days to prepare views based on meeting topic communicated at time of meeting confirmation | **TH Meeting** (location: Teleconference) | The Proponent and TH meet to discuss information shared to date with TH and gaps in that information, the financial model delivery date, and upcoming meetings. | Further details can be found in Appendix 3-A (3A-1913).<br>The Proponent responds to TH's inquiries and concerns in the meeting, and recorded and followed up on outstanding items from the meeting via email. The Proponent provides the financial model, as requested, on January 11, 2017 (3A-1954). |
| **December 20, 2016:** Goldcorp inquires about availability for meeting in first two weeks of January (3A-1914)<br>**January 3, 2017:** Invitation sent (3A-1936)<br>**February 8, 2017:** Information Request responses provided (3A-2078) | January 9, 2017 | 19 days to prepare views based on meeting topic communicated at time of meeting requested on December 20, 2016. | **TH Technical Meeting** (location: Whitehorse) | The Proponent and their technical consultants and TH and their technical consultant meet to discuss wildlife modeling and the wildlife baseline feedback from TH. This meeting is a result of views presented during a teleconference on the same topic between TH and the Proponent on December 9, 2016. This is an opportunity for TH to present additional views on the topic. | Further details can be found in Appendix 3-A (3A-1939).<br>The Proponent and their technical consultants respond to TH's inquiries and concerns in the meeting, and recorded and followed up on outstanding items from the meeting via email. Based on the views presented by TH in this meeting, additional information is provided to TH via email on February 8, 2017 (3A-2078). |
| **December 19, 2016:** TH requests a teleconference prior to the schedule January 24 meeting; Goldcorp agrees and the date is set (3A-1913) | January 10, 2017 | Requested by TH; 22 days to prepare views based on meeting topic communicated at time of meting confirmation. | **TH Meeting** (location: teleconference) | The Proponent and TH meet to discuss the WRSF alternatives assessment information that was to be provided January 13, 2017. This is an opportunity for TH to present views on updated Project information and upcoming engagement and engagement to date. | Further details can be found in Appendix 3-A (3A-1946).<br>The Proponent responds to TH's inquiries and concerns in the meeting, and recorded and followed up on action items from the meeting via email. Action items included coordinating future meetings on a number of topics. |

| Notice in Sufficient Form and Detail (provided via email unless otherwise specified) | Date of Related Meeting or Event | Time to Prepare Views | Description of Meeting /Event / Opportunity to Present Views | Meeting / Event Purpose and Views Presented by TH | Consideration of Views by the Proponent |
|---|---|---|---|---|---|
| **(Document Sharing)** | January 13, 2017 | Written feedback timelines are summarized in **Table 3.2-4** The Proponent requested 15 days for TH to provide written feedback (views) on the Waste Rock Storage Facilities Alternatives Assessment documents for the Project. TH presented views in written form after 14 days. | **Provide Waste Rock Storage Facilities Alternatives Assessment information and Document Sharing and Feedback Plan to TH** | The Proponent provides all Waste Rock Storage Facilities Alternatives Assessment information for review and feedback prior to workshop on February 3, 2017. This is an opportunity for TH to present views on the information shared for the Project via written feedback. Written feedback timelines are summarized in **Table 3.2-4** and the written feedback process is described in **3.2.3**. | The Proponent considers and responds to feedback from TH in writing; responses to feedback from TH provided via email on February 2, 2017. TH's feedback (11 views presented) and the Proponent's consideration and responses (11 responses) are documented in Appendix 3-A (3A-2036).<br>The Proponent considered the views presented in written form, as well as views presented in the February 3 workshop, February 9 letter, and February 27 teleconference in the decision-making process for the change to mine plan to use the alpha WRSF.. |
| **(Informal Meetings)** | January 17, 2017 | | **TH Community Liaison Meeting** (location: Dawson) | The Proponent and TH meet to review the Project with the TH community liaison. This is an opportunity for TH to present views on the ongoing collaborations between the Proponent and TH. | The Proponent responds to comments and inquiries from TH during the meeting. |
| | | | **TH Executive Director Meeting** (location: Dawson) | The Proponent and TH meet to review the role of the TH community liaison, inquire about progress of determining members of TH Advisory Committee for the existing agreement. This is an opportunity for TH to present views on engagement processes with the Proponent and the members of the TH Advisory Committee. | The Proponent responds to comments and inquiries from TH during the meeting. |
| **(Informal Meeting)** | January 18, 2017 | | **TH Education and Training Coordinator Meeting** (location: Dawson) | The Proponent and TH meet to discuss needs for training for the community as it relates to the Project, information needs to understand community capacity. This is an opportunity for TH to present views on engagement processes with the Proponent for training and employment initiatives with TH. | The Proponent responds to comments and inquiries from TH during the meeting. |
| **January 10, 2017:** Meeting date confirmed in teleconference (3A-1946) | January 24, 2017 | 14 days to prepare views based on meeting topics of interest communicated (by TH) in the January 10 teleconference | **TH Meeting** (location: Vancouver) | The Proponent and TH meet to discuss the updated Project Proposal submission timeline and TH input in Project Proposal section writing. This is an opportunity for TH to present views on the engagement processes with the Proponent and TH's contributions to the Project Proposal. | Further details can be found in Appendix 3-A (3A-1995).<br>The Proponent responds to comments and inquiries from TH during the meeting. Comments and action items are documented and followed up on via email. Follow up items include the Proponent inquiring about TH continuing to author section 4.3 of the Project Proposal and scheduling engagement sessions with TH citizens. The Health Impact Assessment (HIA) is provided to TH via email on January 27 based on views raised by TH in this meeting (3A-2010). |
| **(Document Sharing)** | January 31, 2017 | Written feedback timelines are summarized in **Table 3.2-5** The Proponent requested 20 days for TH to provide written feedback (views) on the Batch 1 documents for the Project. TH presented views in written form after 20 days. | **Provide Batch 1 information to TH** | The Proponent provides all Batch 1 VC and IC reports as scheduled for review and feedback prior to workshop on February 22, 2017. This is an opportunity for TH to present views on the information shared for the Project via written feedback. Written feedback timelines are summarized in **Table 3.2-5** and the written feedback process is described in **3.2.3**. | The Proponent considers and responds to feedback from TH in writing; responses to feedback from TH provided via email on March 9, 10, 14, 15, and 26, 2017. TH's feedback (96 views presented) and the Proponent's consideration and responses (69 written responses provided before March 31, 2017) are documented in Appendix 3-A (3A-2275, 3A-2301, 3A-2332). While remaining written responses provided after March 31, 2017, all views presented by TH in written form were considered in the development of the Project Proposal. |

| Notice in Sufficient Form and Detail (provided via email unless otherwise specified) | Date of Related Meeting or Event | Time to Prepare Views | Description of Meeting /Event / Opportunity to Present Views | Meeting / Event Purpose and Views Presented by TH | Consideration of Views by the Proponent |
|---|---|---|---|---|---|
| **January 20, 2017:** Invitation sent to TH (3A-1991)<br>**February 3, 2017:** Sent meeting materials (3A-2067) | February 3, 2017 | 26 days to prepare views based on Waste Rock Storage Facility Alternatives Assessment documents provided on January 13, 2017. | **TH Waste Rock Storage Facility Alternatives Assessment Workshop**<br>(location: Whitehorse) | The Proponent and TH meet to discuss the WRSF alternatives information provided January 13. This is an opportunity for TH to present views on the information provided. Views presented included, but were not limited to the following topics:<br>• Concerns related to Chinook salmon<br>• Water quality and water management | Further details can be found in Appendix 3-A (3A-2059).<br>The Proponent and their technical consultants respond to TH's inquiries and concerns in the meeting, and recorded and followed up on outstanding items from the meeting via email. Follow up items included coordinating meetings with TH and TH citizens in Dawson. Based on views presented in this meeting regarding the Proponent's current exploration activities, the Proponent includes this information in the February 14 Chief and Council meeting. |
| **February 3, 2017:** Discuss and confirm meeting dates in person during WRSF Alternatives Assessment workshop | February 14, 2017 | 11 days to prepare views based on meeting topics discussed at the time of meeting confirmation | **TH Chief and Council Meeting**<br>(location: Dawson) | The Proponent and TH meet to discuss a Project update and the Proponent's exploration activities in 2016 and planned for 2017. This is an opportunity for TH to present views on the Project and information presented during the meeting. Views presented included, but were not limited to the following topics:<br>• Current job posting process per the Exploration Communication Agreement<br>• Reclamation and closure | Further details can be found in Appendix 3-A (3A-2085).<br>The Proponent responds to TH's inquiries and concerns in the meeting, and recorded and followed up on outstanding items from the meeting via email. Based on views presented in this meeting, follow up items included coordinating a meeting with TH's Executive Director to discuss contracting and employment opportunities for TH citizens in the upcoming 2017 exploration field season. This meeting occurred on February 23, 2017 in Whitehorse. |
| **February 7, 2017:** Meeting date confirmed with TH (3A-2070)<br>**February 13, 2017:** Flyers posted physically throughout Dawson by TH | February 15, 2017 | 2 days' notice on the meeting topic provided to TH citizens | **TH Citizens Open House**<br>(location: Dawson) | The Proponent holds an open house in Dawson at the TH Hall to provide a Project update and Project information to TH citizens. This is an opportunity for TH citizens to present views on the Project. Hard copies of Project information were available to all attendees. Views presented included, but were not limited to the following topics:<br>• Reclamation and closure<br>• Employment of TH citizens at the Project<br>• NAR and wildlife | Further details can be found in Appendix 3-A (3A-2095).<br>Answers to inquiries from TH citizens were provided by the Proponent during the meeting. No inquiries from attendees in this meeting required additional follow-up. Comments and inquiries were documented. Contact information for the Proponent was provided in the case that attendees wished to follow up with the Proponent. The Community Feedback Protocol and response mechanism was also communicated to TH citizens at the event. |
| **February 15, 2017:** Meeting date decided upon by TH, communicated in person<br>**February 17, 2017:** Invitation sent to TH (3A-2119) | February 22, 2017 | 21 days to prepare views based on Batch 1 documents provided on January 31 | **TH Batch 1 Workshop**<br>(location Whitehorse) | The Proponent and their technical consultants and TH and their technical consultants meet to discuss Batch 1 information provided on January 31. This is an opportunity for TH to present views on the information provided in advance as well as in the meeting. Views presented included, but were not limited to the following topics:<br>• Traditional Land and Resource Use<br>• Water quality and geochemistry of the site<br>• Climate change<br>• Wildlife mitigation measures associated with the Heap Leach | Further details can be found in Appendix 3-A (3A-2136).<br>The Proponent and their technical consultants respond to TH's inquiries and concerns in the meeting, and recorded and followed up on outstanding items from the meeting via email. As a result of the views presented in this meeting regarding definitions of "Traditional Land and Resource Use", the Proponent revises wording within the Land and Resource Use VC Report. As a result of views presented in this meeting, a separate workshop to review the HHRA and HIA is set for March 8, 2017. As a result of views presented in this meeting, the Proponent also agrees to further discussions on water quality, water balance modeling, and geochemistry, and teleconferences on February 27 and 28 are set to discuss these topics. |

| Notice in Sufficient Form and Detail (provided via email unless otherwise specified) | Date of Related Meeting or Event | Time to Prepare Views | Description of Meeting /Event / Opportunity to Present Views | Meeting / Event Purpose and Views Presented by TH | Consideration of Views by the Proponent |
|---|---|---|---|---|---|
| **(Document Sharing)** | February 23, 2017 | Written feedback timelines are summarized in **Table 3.2-7.** The Proponent requested 13 days for TH to provide written feedback (views) on the Batch 2 documents for the Project. TH presented views in written form after 13 days. | **Provide Batch 2 information to TH** | The Proponent provides all Batch 2 VC and IC reports, management plans, and Project Proposal sections for review and feedback prior to workshop on March 9, 2017. This is an opportunity for TH to present views on the information shared for the Project via written feedback. Written feedback timelines are summarized in **Table 3.2-7** and the written feedback process is described in **3.2.3**. | The Proponent considers written views from TH in the preparation of the Project Proposal. The Proponent responds to feedback from TH in writing; however these responses were provided after March 31, 2017. |
| **February 22:** Need for meeting identified in person during Batch 1 workshop<br>**February 26:** Invitation sent to TH (3A-2179) | February 27, 2017 | Views were prepared in advance and provided via letter on February 9th from TH | **TH Technical Meeting** (location: teleconference) | The Proponent and TH meet to discuss water quality as it relates to issues raised in the February 9th letter from Chief Joseph to Buddy Crill. This is an opportunity for TH to present views on water quality and views presented in the February 9th letter. Views presented included, but were not limited to the following topcis:<br>• Site specific water quality objectives<br>• Toxicology work done for the Project | Further details can be found in Appendix 3-A (3A-2180).<br>The Proponent and their technical consultants respond to TH's inquiries and concerns in the meeting, and recorded and followed up on outstanding items from the meeting via email. As a result of the views presented in this meeting regarding site specific water quality objectives, the Proponent has committed to working with TH and their technical consultants on engagement throughout the process of setting site specific water quality objectives. As a result of the views presented in this meeting regarding toxicology work done for the Project, the Proponent has committed to further toxicological studies being done, and provided the upcoming toxicology study methodology for TH's review and input (3A-2223). |
| **February 22:** Need for meeting identified in person during Batch 1 workshop<br>**February 27:** Invitation sent to TH (3A-2185) | February 28, 2017 | 6 days to prepare views based on meeting topic communicated at time of meeting confirmation | **TH Technical Meeting** (location: teleconference) | The Proponent and TH meet to discuss geochemistry and groundwater modeling based on interests from the February 22 workshop. This is an opportunity for TH to present views related to geochemistry and groundwater modeling. Views presented included, but were not limited to the following topcis:<br>• Groundwater modeling views presented in written form on February 22, 2017 | Further details can be found in Appendix 3-A (3A 2189).<br>The Proponent and their technical consultants respond to TH's inquiries and concerns in the meeting, and recorded and followed up on outstanding items from the meeting via email. Action items are iterated in Appendix 3-A (3A-2189). |
| **February 22:** Need for meeting identified in person during Batch 1 workshop<br>**February 28:** Date for meeting confirmed during teleconference | March 7, 2017 | Continuation of views prepared for February 28 teleconference | **TH Technical Meeting** (location: teleconference) | The Proponent and TH meet to follow up from a request for further discussion on geochemistry as a result of February 22 Batch 1 workshop with TH and February 28 teleconference. This is an opportunity for TH to present views related to geochemistry information provided in advance. Views presented included, but were not limited to the following topics:<br>• Geochemistry views presented in written form on February 22, 2017 | Further details can be found in Appendix 3-A (3A-2241).<br>The Proponent and their technical consultants respond to TH's inquiries and concerns in the meeting, and recorded and followed up on outstanding items from the meeting via email. Action items are iterated in Appendix 3-A (3A-2241). |

| Notice in Sufficient Form and Detail (provided via email unless otherwise specified) | Date of Related Meeting or Event | Time to Prepare Views | Description of Meeting /Event / Opportunity to Present Views | Meeting / Event Purpose and Views Presented by TH | Consideration of Views by the Proponent |
|---|---|---|---|---|---|
| **February 22:** Date for meeting confirmed in person during Batch 1 workshop | March 8, 2017 | HHRA provided to TH on January 6; HIA provided to TH on January 27 | **TH Technical Meeting** (location: Whitehorse) | The Proponent and their technical consultants and TH and their technical consultants meet to discuss the Human Health Risk Assessment (HHRA) and Health Impact Assessment (HIA) upon request of the TH technical team. This work shop is a result of views presented on February 22, 2017 regarding the need for a specific session for TH to present views on the HHRA and HIA. Views presented included, but were not limited to the following topics:<br>• Heap Leach and cyanide management<br>• Current and traditional use of TH's traditional territory<br>• HHRA and HIA assessment methodology | Further details can be found in Appendix 3-A (3A-2246).<br>The Proponent and their technical consultants respond to TH's inquiries and concerns in the meeting, and recorded and followed up on outstanding items from the meeting via email. Action items are iterated in Appendix 3-A (3A-2247). As a result of the views presented in this meeting, the Proponent modified the Community Health and Well-being VC Report to reflect feedback from TH. |
| **February 22, 2017:** Date for meeting confirmed in person during Batch 1 workshop | March 9, 2017 | 14 days to prepare views based on information provided on February 23 | **TH Technical Team Meeting** (location: Whitehorse) | The Proponent and their technical consultants and TH and their technical consultants meet to discuss information provided in Batch 2 on February 23. This is an opportunity for TH to present views on the information provided on February 23, 2017. Views presented included, but were not limited to the following topics:<br>• Wildlife habitat modeling<br>• Effects assessment methodology<br>• NAR and wildlife<br>• Heap Leach design and water balance<br>• Cultural awareness training for employees | Further details can be found in Appendix 3-A (3A-2250).<br>The Proponent and their technical consultants respond to TH's inquiries and concerns in the meeting, and recorded and followed up on outstanding items from the meeting via email. Action items are iterated in Appendix 3-A (2250). As a result of the views presented during the meeting, the Proponent will engage TH on the development of the cultural awareness training program for the Project. |
| **February 22, 2017:** Goldcorp invited to present at TH General Assembly in person during Batch 1 workshop<br>**March 2, 2017:** Goldcorp provides agenda for TH input (3A-2224)<br>**March 6, 2017:** Goldcorp follows up on agenda (3A-2240) | March 11, 2017 | | **TH General Assembly** | The Proponent presents Project information and information on the current exploration program to TH citizens. This is an opportunity for TH citizens to present views on the Project. Hard copies of Project information were available to all attendees. Views presented included, but were not limited to the following topics:<br>• Procurement, training, and employment opportunities for TH citizens. | The Proponent responded to TH citizens' comments and inquiries during the meeting. Due to the time slot allowed for the General Assembly presentation, there was a limited number of views presented by TH citizens. Information on the Community Feedback Protocol and contact information for the Proponent were available to all attendees. The Proponent emphasized the open house on March 13, 2017 for citizens to present views based on the information provided. |
| **March 3, 2017:** TH and Goldcorp confirm open house<br>Open House advertised by TH via flyers posted physically throughout Dawson | March 13, 2017 | Open house topic communicated at TH General Assembly; 2 days' notice provided to TH citizens | **TH Citizen's Open House** | The Proponent holds an open house in Dawson at the TH Hall to provide a Project update and Project information to TH citizens, as well as answer questions based on information presented at the TH General Assembly. Hard copies of information presented were available to all attendees. This is an opportunity for TH citizens to present views on the Project. Views presented included, but were not limited to the following topics:<br>• Reclamation and closure<br>• NAR management and wildlife | The Proponent responded to TH citizens' comments and inquiries during the open house. No comments or inquiries from citizens required follow up. Information on the Community Feedback Protocol and contact information for the Proponent were available to all attendees. TH Elders are interested in attending a site tour when TH leadership receives a tour, which is planned for summer 2017. |

| Notice in Sufficient Form and Detail (provided via email unless otherwise specified) | Date of Related Meeting or Event | Time to Prepare Views | Description of Meeting /Event / Opportunity to Present Views | Meeting / Event Purpose and Views Presented by TH | Consideration of Views by the Proponent |
|---|---|---|---|---|---|
| **March 9, 2017:** TH and Goldcorp confirm and coordinate meeting during Batch 2 workshop | March 14, 2017 | Meeting and meeting topic requested by TH | **TH Technical Meeting** (Location: Whitehorse) | The Proponent and TH meet to discuss detailed information on NAR route selection. This meeting is a result of views presented during the Batch 2 workshop on March 9, 2017, and is an opportunity for TH to present views on the NAR route design and management. Views presented included, but were not limited to the following topics:<br>• NAR management<br>• Potential effects of the NAR on fish and wildlife<br>• NAR construction | Further details can be found in Appendix 3-A (3A-2276)<br>The Proponent and their technical consultants respond to TH's inquiries and concerns in the meeting, and recorded and followed up on outstanding items from the meeting via email. Based on views presented during the meeting, an additional meeting to follow up on the NAR discussion, which is to be scheduled after March 31, 2017. |
| **February 22, 2017:** Date for meeting confirmed during Batch 1 workshop | March 27/28, 2017 | 34 days to prepare views based on meeting topic communicated at time of meeting coordination | **TH meeting** | The Proponent and TH meet to discuss an update on the Project Proposal. This is an opportunity for TH to present views on the Project. | Meeting minutes are confidential. |

**Table 3.3-4 Summary of Selkirk First Nation Consultation**

| Notice in Sufficient Form and Detail (provided via email unless otherwise specified | Date of Related Meeting or Event | Time to Prepare Views | Description of Meeting / Event / Opportunity to Present Views | Meeting/Event Purpose and Views Presented by SFN | Consideration of Views by the Proponent |
|---|---|---|---|---|---|
| **February 2013 to November 2014:** Series of emails and letters between SFN leadership and the Proponent attempting to set up a meeting to discuss the Project. Further details can be found in Appendix 3-A (3A-8 through 3A-520 for SFN)<br>**August 18, 2015**: Sent meeting invitation (3A-742)<br>**September 16, 2015:** Confirm meeting date and time (3A-760)<br>**October 1, 2015:** Sent presentation package (3A-771) | October 7, 2015 | 21 days to prepare views based on meeting topic communicated at time of meeting confirmation<br>6 days to prepare views based on meeting materials provided in advance | **SFN Meeting**<br>(location: Pelly Crossing) | The Proponent and SFN meet to discuss the relationship between the Proponent and SFN, provide a Project update, and discuss the NAR. This is an opportunity for SFN to present views on the topics noted above and information presented in the meeting. Views presented included, but were not limited to the following topics:<br>• Water quality<br>• NAR and wildlife<br>• Consultation to date and moving forward; preferred engagement process<br>• Importance of Coffee Creek to SFN | Further details can be found in Appendix 3-A (3A-780).<br>The Proponent responded to SFN's inquiries and comments during the meeting. Comments and action items were recorded and followed up via email. Follow up items included the Proponent providing a copy of the collaborative heritage study performed by TH and WRFN, which SFN originally was a part of but discontinued participation before completion. |
| **May 12, 2016:** Sent letter explaining Kaminak and Goldcorp transaction, requests a meeting (3A-1582)<br>**June 9, 2016:** SFN confirms meeting date and time (3A-1615) | June 16, 2016 | 7 days to prepare views based on meeting topic communicated at time of meeting confirmation | **SFN Meeting**<br>(location: Pelly Crossing) | The Proponent and SFN meet to discuss Project updates. This is an opportunity for SFN to present views on the Project and on the information presented in the meeting. Views presented included, but were not limited to the following topics:<br>• Importance of Coffee Creek to SFN<br>• NAR route and potential effects<br>• TLUS work for the Project | Further details can be found in Appendix 3-A (3A-1625).<br>The Proponent responded to SFN's inquiries and comments during the meeting. Comments and action items were recorded and followed up via email. Follow up items included the Proponent providing a copy of the collaborative heritage study performed by TH and WRFN, which SFN originally was a part of but discontinued participation before completion again. This was originally provided in October 2015 as well. |
| **October 24, 2016:** Invitation sent to SFN<br>**November 22, 2016:** Meeting materials sent to SFN (3A-1784) | November 21, 2016 | 26 days to prepare views based on meeting topic communicated at time of meting confirmation | **SFN Meeting**<br>(location: Whitehorse) | The Proponent and SFN meet to introduce Goldcorp, discuss consultation moving forward and previous engagement with SFN. This is an opportunity for SFN to present views on the Project. Views presented included, but were not limited to the following topics:<br>• Cumulative effects<br>• Consultation to date and moving forward<br>• Project information sharing and technical review | Further details can be found in Appendix 3-A (3A-1773).<br>The Proponent responded to SFN's inquiries and comments during the meeting. Comments and action items were recorded and followed up via email. Follow up items included providing electronic copies of meeting materials and maps, and coordinating a meeting with SFN's technical team for December 1, 2016. |
| **November 23, 2016**: Invitation sent to SFN (3A-1792) | December 1, 2016 | 7 days to prepare views based on meeting topic communicated in meeting invitation and Project information provided in the November 21, 2016 meeting | **SFN Technical Meeting**<br>(location: Whitehorse) | The Proponent and SFN meet to review baseline information and the Project in detail; baseline and road documentation provided (USB). This is an opportunity for SFN and their technical consultants to present views on the Project. Views presented included, but were not limited to the following topics:<br>• Water quality and baseline data collection methods<br>• NAR design and management<br>• Klaza caribou herd | Further details can be found in Appendix 3-A (3A-1821).<br>The Proponent responded to SFN's inquiries and comments during the meeting. Comments and action items were recorded and followed up via email. Action items are iterated in Appendix 3-A (3A-1828) |
| **(Document Sharing)** | December 2, 2016 | Written feedback timelines are summarized in **Table 3.2-2**. The Proponent requested 45 days for SFN to provide written feedback (views) on the baseline studies for the Project. | **Provide Baseline Studies to SFN** | The Proponent provides all baseline studies for the Project to SFN for review and feedback. This is an opportunity for SFN to present views on the baseline studies for the Project via written feedback. Written feedback timelines are summarized in **Table 3.2-2** and the written feedback process is described in **3.2.3**. | As communicated via telephone on January 25, 2017 and in the Waste Rock Storage Facility Alternatives Assessment workshop on February 2, SFN prefers a meeting/workshop format to present views, and elects to not participate in presenting views in the written feedback process. Opportunities for SFN to present views on the baseline information shared occur on February 2, March 3, and March 15, 2017. |

| Notice in Sufficient Form and Detail (provided via email unless otherwise specified | Date of Related Meeting or Event | Time to Prepare Views | Description of Meeting / Event / Opportunity to Present Views | Meeting/Event Purpose and Views Presented by SFN | Consideration of Views by the Proponent |
|---|---|---|---|---|---|
| **(Document Sharing)** | January 13, 2017 | Written feedback timelines are summarized in **Table 3.2-4** The Proponent requested 15 days for SFN to provide written feedback (views) on the Waste Rock Storage Facilities Alternatives Assessment documents for the Project. | **Provide Waste Rock Storage Facility Alternatives Assessment information and Document Sharing and Feedback Plan to SFN** | The Proponent provides all Waste Rock Storage Facilities Alternatives Assessment information for review and feedback prior to workshop on February 3, 2017. This is an opportunity for SFN to present views on the information shared for the Project via written feedback. Written feedback timelines are summarized in **Table 3.2-4** and the written feedback process is described in **3.2.3**. | As communicated via telephone on January 25, 2017 and in the Waste Rock Storage Facility Alternatives Assessment workshop on February 2, SFN prefers a meeting/workshop format to present views, and elects to not participate in presenting views in the written feedback process. SFN has an opportunity to present views on the information provided in the workshop on February 2, 2017. |
| | January 25, 2017 | | **SFN Meeting**<br>(location: teleconference) | The Proponent and SFN meet to discuss SFN's preferred engagement methods and timeline for TLUS with SFN. This is an opportunity for SFN to present views on the Project and topics noted above. Views presented included, but were not limited to the following topics:<br>• NAR management<br>• Preferred engagement method regarding technical information (workshops) | Further details can be found in Appendix 3-A (3A-1998).<br>The Proponent responded to SFN's inquiries and comments during the meeting. Comments and action items were recorded and followed up via email. Action items include following up with SFN regarding a scope of work for TLUS for the Project. |
| **(Document Sharing)** | January 31, 2017 | Written feedback timelines are summarized in **Table 3.2-5** The Proponent requested 20 days for SFN to provide written feedback (views) on the Batch 1 documents for the Project. | **Provide Batch 1 information to SFN** | The Proponent provides all Batch 1 VC and IC reports as scheduled for review and feedback prior to workshop on March 3, 2017. This is an opportunity for SFN to present views on the information shared for the Project via written feedback. Written feedback timelines are summarized in **Table 3.2-4** and the written feedback process is described in **3.2.3**. | As communicated via telephone on January 25, 2017 and in the Waste Rock Storage Facility Alternatives Assessment workshop on February 2, SFN prefers a meeting/workshop format to present views, and elects to not participate in presenting views in the written feedback process. The opportunity for SFN to present views on the baseline information shared occurred March 3, 2017 in the Batch 1 workshop.<br>The Proponent considered the views presented in the February 2 workshop and February 23 letter in the decision-making process for the change to mine plan to use the alpha WRSF. |
| **January 20, 2017:** Invitation sent to SFN (3A-1990)<br>**February 3, 2017:** Sent meeting materials (3A-2071) | February 2, 2017 | 19 days to prepare views based on information provided on January 13, 2017 | **SFN Waste Rock Storage Facility Alternatives Assessment Workshop**<br>(location: Whitehorse) | The Proponent and SFN meet to discuss the WRSF alternatives information provided January 13. This is an opportunity for SFN to present views based on the information provided on January 13 and the information presented in the meeting. Views presented included, but were not limited to the following topics:<br>• Water quality<br>• Reclamation and closure<br>• WRSF slope stability | Further details can be found in Appendix 3-A (3A-2038).<br>The Proponent responded to SFN's inquiries and comments during the meeting. Comments and action items were recorded and followed up via email. |
| | February 16, 2017 | | **SFN Meeting** (location: Teleconference) | The Proponent and SFN meet to discuss the development of a capacity funding agreement. | Meeting minutes are confidential. |
| | February 20. 2017 | | **SFN Meeting**<br>(location: Teleconference) | The Proponent and SFN meet to discuss the development of a capacity funding agreement. | Meeting minutes are confidential. |
| **February 14, 2017**: Invitation sent to SFN (3A-2091) | February 22, 2017 | 8 days to prepare views based on meeting topic communicated in meeting invitation | **SFN Meeting**<br>(location: Whitehorse) | The Proponent and SFN meet to discuss the TLUS progress, socio-economic considerations for the Project. This is an opportunity for SFN to present views on the topics noted above. | The Proponent responded to SFN's comments and inquiries during the meeting. Follow up items include further discussions on the TLUS work for the Project and SFN to consider providing previously collected socio-economic data to the Proponent for inclusion in the Project Proposal. |

| Notice in Sufficient Form and Detail (provided via email unless otherwise specified | Date of Related Meeting or Event | Time to Prepare Views | Description of Meeting / Event / Opportunity to Present Views | Meeting/Event Purpose and Views Presented by SFN | Consideration of Views by the Proponent |
|---|---|---|---|---|---|
| **(Document Sharing)** | February 23, 2017 | Written feedback timelines are summarized in **Table 3.2-7.** The Proponent requested 13 days for SFN to provide written feedback (views) on the Batch 2 documents for the Project. | **Provide Batch 2 information to SFN** | The Proponent provides all Batch 2 VC and IC reports, management plans, and Project Proposal sections for review and feedback prior to workshop on March 15, 2017. This is an opportunity for SFN to present views on the information shared for the Project via written feedback. Written feedback timelines are summarized in **Table 3.2-7** and the written feedback process is described in **3.2.3**. | As communicated via telephone on January 25, 2017 and in the Waste Rock Storage Facility Alternatives Assessment workshop on February 2, SFN prefers a meeting/workshop format to present views, and elects to not participate in presenting views in the written feedback process. The opportunity for SFN to present views on the baseline information shared occurred March 15, 2017 in the Batch 2 workshop. |
| **February 2, 2017:** Date confirmed by SFN during WRSF alternatives assessment workshop<br>**February 23, 2017**: Goldcorp provides flyer to SFN for posting in Pelly Crossing (3A-2173) | March 1, 2017 | **7 days' notice of meeting topic provided to SFN citizens** | **SFN Citizens Meeting** (location: Pelly Crossing) | The Proponent presents Project information to introduce Goldcorp and the Project to SFN citizens. This is an opportunity for SFN citizens to present views on the Project. Hard copies of Project information were made available to all attendees. Views presented included, but were not limited to the following topics:<br>• Potential effects of the NAR on wildlife<br>• Employment and procurement opportunities for SFN citizens<br>• Water quality and potential effects to fish | Further details can be found in Appendix 3-A (3A-2204).<br>Answers to the comments and inquiries from SFN citizens were provided by the Proponent during the meeting. Information on the Community Feedback Protocol and contact information for the Proponent were available to all attendees. Follow up items from the meeting include the Proponent engaging with the Selkirk Renewable Resource Council, which is an ongoing action. |
| **February 20, 2017:** Date confirmed by SFN during teleconference | March 3, 2017 | 30 days to prepare views based on information shared on January 31, 2017 | **SFN Technical Meeting** (location: Whitehorse) | The Proponent and SFN meet to discuss Batch 1 information provided on January 31. This is an opportunity for SFN to present views on the information provided in advance as well as the information provided in the meeting. Views presented included, but were not limited to the following topics:<br>• Management of invasive plants<br>• NAR management<br>• Water quality | Further details can be found in Appendix 3-A (3A-2225).<br>The Proponent responded to SFN's comments and inquiries during the meeting. Comments and action items were recorded and followed up via email. As a result of the views presented in this meeting, the Proponent commits to adding a water quality monitoring station on Coffee Creek associated with the SFN Category B Land parcel at the mouth of Coffee Creek. |
| **March 3, 2017:** Date confirmed by SFN during the workshop<br>**March 8, 2017:** Invitation sent to SFN | March 15, 2017 | 22 days to prepare views based on information shared on February 23, 2017 | **SFN Technical Meeting** (location: Whitehorse) | The Proponent and SFN meet to discuss Batch 2 information provided on February 23. This is an opportunity for SFN to present views based on the information provided in advance and during the meeting. Views presented included, but were not limited to the following topics:<br>• SFN TK inclusion in the Project Proposal<br>• NAR and potential effects to wildlife and fish<br>• Water quality | Further details can be found in Appendix 3-A (3A-2302).<br>The Proponent responded to SFN's comments and inquiries during the meeting. Comments and action items were recorded and followed up via email. As a result of views presented in this meeting, the Proponent will hold a site tour with SFN representatives in summer 2017. |

**Table 3.3-5 Summary of First Nation of Na-cho Nyäk Dun Consultation**

| Notice in Sufficient Form and Detail (provided via email unless otherwise specified) | Date of Related Meeting or Event | Time to Prepare Views | Description of Meeting/Event/Opportunity to Present Views | Meeting/Event Purpose and Views Presented by FNNND | Consideration of Views by the Proponent |
|---|---|---|---|---|---|
| **July 13, 2015:** Introduction and request for meeting sent via letter (3A-723)<br>**October 23, 2015:** Sent meeting invitation (3A-831)<br>**October 26, 2015:** Confirm meeting date and time (3A-835)<br>**November 2, 2015:** Sent presentation package (3A-844) | November 3, 2015 | 10 days to prepare views based on meeting topic communicated in meeting invitation | **FNNND Meeting** (location: Mayo) | The Proponent and FNNND meet to introduce the Project. This is an opportunity for FNNND to present views on the Project. Views presented included, but were not limited to the following topics:<br>• Future studies regarding the NAR and FNNND's involvement<br>• Engagement process moving forward | Further details can be found in Appendix 3-A (3A-846).<br>The Proponent responds to FNNND's comments and inquiries during the meeting. Contact information for the Proponent is provided in the case that questions or comments arise after the meeting. |
| **May 12, 2016:** Sent letter explaining acquisition of the Proponent by Goldcorp, request a meeting (3A-1579)<br>**June 2, 2016:** FNNND confirms meeting date and time (3A-1610) | June 16, 2016 | 14 days to prepare views based on meeting topic communicated at time of meeting confirmation | **FNNND Meeting** (location: Mayo) | The Proponent and FNNND meet to discuss Project updates. This is an opportunity for FNNND to present views on the Project. Views presented included, but were not limited to the following topics:<br>• Employment and procurement opportunities for FNNND citizens<br>• NAR construction | Further details can be found in Appendix 3-A (3A-1630).<br>The Proponent responds to FNNND's comments and inquiries during the meeting. Contact information for the Proponent is provided in the case that questions or comments arise after the meeting. |
| **June 17, 2016:** FNNND and Kaminak confirm presentation at FNNND General Assembly (3A-1634) | June 24, 2016 | | **FNNND General Assembly** (location: Mayo) | The Proponent attends the General Assembly to provide a Project Overview to FNNND citizens. | The Proponent responds to FNNND's comments and inquiries during the meeting. Contact information for the Proponent is provided in the case that questions or comments arise after the meeting. |
| **November 23, 2016:** Agenda sent for input (3A-1794)<br>**January 6, 2017**: Invitation sent (3A-1934) | January 31, 2017 | 67 days to prepare views based on agenda provided in advance | **FNNND Council Meeting** (location: Mayo) | The Proponent and FNNND meet to discuss the Project and introduce Goldcorp. This is an opportunity for FNNND to present views on the Project. Views presented included, but were not limited to the following topics:<br>• NAR management and potential effects to wildlife<br>• FNNND territory interaction with the NAR | Further details can be found in Appendix 3-A (3A-2026).<br>The Proponent responds to FNNND's comments and inquiries during the meeting. Action items included a follow-up meeting to discuss engagement moving forward and the Proponent to consider attending the FNNND career fair. |
| **March 20, 2017:** Meeting and meeting topics confirmed via email | April 26, 2017 | 36 days to prepare views based on meeting topics communicated at time of meeting confirmation | **FNNND Council Meeting** (location: Mayo) | The Proponent and FNNND meet to discuss the Project and to engage in a detailed review of the NAR. This is an opportunity for FNNND to present views on the topics noted above. Views presented included, but were not limited to the following topics:<br>• NAR management and baseline data collected for the NAR<br>• Employment opportunities for FNNND citizens<br>• Heap leach and cyanide transportation | Further details can be found in Appendix 3-A (3A-2360)<br>The Proponent responds to FNNND's comments and inquiries during the meeting. Action items included inviting FNNND to the Proponent's online sharing platform, Open Text Core. |

| Notice in Sufficient Form and Detail (provided via email unless otherwise specified) | Date of Related Meeting or Event | Time to Prepare Views | Description of Meeting/Event/Opportunity to Present Views | Meeting/Event Purpose and Views Presented by FNNND | Consideration of Views by the Proponent |
|---|---|---|---|---|---|
| **April 19, 2017:** Flyer posted physically throughout Mayo | April 26, 2017 | 7 day's notice of meeting topic provided to citizens | **FNNND Citizens Open House** (location: Mayo) | The Proponent presents Project information to FNNND citizens. This is an opportunity for citizens to present views on the Project. Hard copies of information presented were available to all attendees. Views presented included, but were not limited to the following topics:<br>• Water quality<br>• Heap leach and cyanide transportation<br>• Employment and procurement opportunities for FNNND citizens | Further details can be found in Appendix 3-A (3A-2335)<br>The Proponent responds to FNNND's comments and inquiries during the meeting. Comments and inquiries were recorded. No inquiries from this meeting required follow up. Contact information for the Proponent was provided in the case that questions arise after the meeting. The Community Feedback Protocol and response process were also communicated during this meeting to citizens. |

**Table 3.3-6 Summary of White River First Nation Consultation**

| Notice in Sufficient Form and Detail (provided via email unless otherwise specified) | Date of Related Meeting or Event | Time to Prepare Views | Description of Meeting/Event/Opportunity to Present Views | Meeting/Event Purpose and Views Presented by WRFN | Consideration of Views by the Proponent |
|---|---|---|---|---|---|
| | September 2015 | | **WRFN Site Tour** | The Proponent provides a tour of the proposed site and the current camp | |
| **September 22, 2016:** Meeting date set (3A-766)<br>**September 28, 2016:** Meeting date changed (3A-769)<br>**October 15, 2016:** Meeting date confirmed (3A-812) | October 29, 2015 | 14 days to prepare views based on meeting topic communicated at time of meeting confirmation | **WRFN Meeting**<br>(location: Vancouver) | The Proponent and WRFN meet to discuss the WRFN career database being developed in collaboration with the Proponent. This is an opportunity for WRFN to present views on the Project and ongoing collaborations with the Proponent. | The Proponent responds to WRFN's comments and inquiries during the meeting. |
| **February 16, 2016:** Sent meeting invitation (3A-1076)<br>**February 18, 2016:** Sent presentation (3A-1081)<br>**March 14, 2016:** Sent meeting notes (3A-1176) | February 25, 2016 | 7 days to prepare views based on meeting materials provided in advance | **WRFN Technical Meeting**<br>(location: Vancouver) | The Proponent and WRFN meet to discuss a Project overview, water quality baseline, and discuss the WRFN consultation plan. This is an opportunity for WRFN to present views on the above noted topics. Views presented included, but were not limited to the following topics:<br>• Water quality<br>• Ore processing and Heap Leach design<br>• Wildlife | Further details can be found in Appendix 3-A (3A-1097).<br>The Proponent responds to WRFN's comments and inquiries during the meeting. Comments and action items were recorded and followed up via email. Action items are iterated in Appendix 3-A (3A-1330). |
| **March 23, 2016:** Meeting date confirmed (3A-1222) | March 29, 2016 | 6 days to prepare views based on meeting topic communicated at time of meeting confirmation | **WRFN Meeting**<br>(location: Whitehorse) | The Proponent and WRFN meet to discuss upcoming consultation events with WRFN. This is an opportunity for WRFN to present views on the above noted topic. | Further details can be found in Appendix 3-A (3A-1241). |
| Advertised by WRFN, coordinated advertising with the Proponent on **March 23, 2016** | April 13, 2016 | | **WRFN Community Meeting**<br>(location: Beaver Creek) | The Proponent presents a Project Overview to WRFN members. This is an opportunity for WRFN members to present views on the Project. Hard copies of Project information were available to all attendees. Views presented included, but were not limited to the following topics:<br>• Heap Leach<br>• Training and employment of WRFN members<br>• Interaction between the Project and WRFN territory | Further details can be found in Appendix 3-A (3A-1359).<br>The Proponent responds to the comments and inquiries of WRFN members during the meeting. Contact information for the Proponent is provided to attendees should questions or comments arise after the meeting. |
| Advertised by WRFN, coordinated advertising with the Proponent on **March 23, 2016** | April 14, 2016 | | **WRFN Open House**<br>(location: Beaver Creek) | The Proponent presents a Project Overview to WRFN members. This is an opportunity for WRFN members to present views on the Project. Hard copies of Project information were available to all attendees. Views presented were related to training and employment of WRFN members at the Project. | Further details can be found in Appendix 3-A (3A-1380).<br>The Proponent responds to the comments and inquiries of WRFN members during the meeting. Contact information for the Proponent is provided to attendees should questions or comments arise after the meeting. |
| **September 6, 2016:** Site tour date confirmed (3A-1665) | September 29, 2016 | 23 days' notice provided to the site tour attendees | **WRFN Site Tour**<br>(location: Coffee Site) | The Proponent provides a site tour for WRFN Lands Department and WRFN Elders. This is an opportunity for WRFN members and elders to present views on the Project. | Comments and inquiries from site tour attendees are responded to during the site tour by the Proponent. Action items resulting from the site tour include initiating a TLUS with WRFN regarding the NAR. |

| Notice in Sufficient Form and Detail (provided via email unless otherwise specified) | Date of Related Meeting or Event | Time to Prepare Views | Description of Meeting/Event/Opportunity to Present Views | Meeting/Event Purpose and Views Presented by WRFN | Consideration of Views by the Proponent |
|---|---|---|---|---|---|
| **September 14, 2016:** Meeting date confirmed (3A-1677) | September 30, 2016 | 16 days to prepare views based on meeting topic communicated at time of meeting confirmation | **WRFN Meeting** (location: Whitehorse) | The Proponent and WRFN meet to discuss an additional TLUS, as well as WRFN review of Project documents, and a capacity funding agreement. This is an opportunity for WRFN to present views on the Project and the topics noted above. | Further details can be found in Appendix 3-A (3A-1690).<br>The Proponent responds to comments and inquiries from WRFN during the meeting. Action items include following up on a scope for the NAR TLUS and information on the current Water Use License at the site. |
| **September 28, 2016:** Meeting date confirmed (3A-1688) | October 24, 2016 | 26 days to prepare views based on meeting topic communicated at time of meeting confirmation | **WRFN Meeting** (location: Goldcorp Vancouver) | The Proponent and WRFN meet to discuss additional TLUS for the NAR, community capacity, and the current agreement. This is an opportunity for WRFN to present views on the topics noted above. | Further details can be found in Appendix 3-A (3A-1706).<br>The Proponent responds to comments and inquiries from WRFN during the meeting. Action items include scheduling subsequent teleconferences and meetings to discuss ongoing engagement. |
| **(Document Sharing)** | November 3, 2016 | Written feedback timelines are summarized in **Table 3.2-2**. The Proponent requested 30 days for WRFN to provide written feedback (views) on the baseline studies for the Project. WRFN presented views in written form 84 days after receiving the information on January 26, 2017. | **Provide Baseline Studies to WRFN** | The Proponent provides all baseline studies for the Project to WRFN for review and feedback. This is an opportunity for WRFN to present views on the baseline studies for the Project via written feedback. Written feedback timelines are summarized in **Table 3.2-2** and the written feedback process is described in **3.2.3**. | The Proponent considers and responds to feedback from WRFN in writing; responses to feedback from WRFN provided via email on February 10, 14, and 15, 2017. WRFN's feedback (186 views presented) and the Proponent's consideration and responses (186 responses) are documented in Appendix 3-A (3A-2082, 3A-2094, 3A-2102). |
| **November 10, 2016:** Meeting date proposed<br>**November 16, 2016:** Meeting date confirmed (3A-1755) | November 22, 2016 | 6 days to prepare views based on meeting topic communicated at time of meeting confirmation | **WRFN Meeting** (location: teleconference) | The Proponent and WRFN meet to discuss current agreement and upcoming meeting dates, including the November 30th meeting in Beaver Creek. This is an opportunity for WRFN to present views on the above topics. | Further details can be found in Appendix 3-A (3A-1786).<br>The Proponent responds to comments and inquiries from WRFN during the meeting. |
| **November 3, 2016:** Flyer sent to WRFN | November 30, 2016 | | **WRFN Members Meeting** (location: Beaver Creek) | The Proponent presents Project information to WRFN members to introduce Goldcorp and provide a Project update. This is an opportunity for WRFN members to present views on the Project. Hard copies of Project information were available to all attendees. Views presented included, but were not limited to the following topics:<br>• Training and employment of WRFN members at the Project | Further details can be found in Appendix 3-A (3A-1816).<br>The Proponent responds to comments and inquiries from WRFN members during the meeting. Contact information for the Proponent is provided to attendees in the case that they wish to follow up with the Proponent. The Community Feedback Protocol is communicated at this meeting as well. |
| **November 10, 2016:** Meeting date confirmed (3A-1744) | December 16, 2016 | 36 days to prepare views based on meeting topic communicated at time of meeting confirmation | **WRFN Meeting** (location: Goldcorp Vancouver) | The Proponent and WRFN meet to discuss the meeting in Beaver Creek with WRFN members and the status of the TLUS. This is an opportunity for WRFN to present views on the Project and the topics noted above. | Further details can be found in Appendix 3-A (3A-1906).<br>The Proponent responds to comments and inquiries from WRFN during the meeting. As a result of views presented during this meeting, the Proponent will present on more technical information at future WRFN members meetings |
| **(Document Sharing)** | January 13, 2017 | Written feedback timelines are summarized in **Table 3.2-4** The Proponent requested 15 days for WRFN to provide written feedback (views) on the Waste Rock Storage Facilities Alternatives Assessment documents for the Project. | **Provide waste rock storage facilities alternatives assessment information and Document Sharing and Feedback Plan to WRFN** | The Proponent provides all Waste Rock Storage Facilities Alternatives Assessment information for review and feedback prior to workshop on February 2, 2017. This is an opportunity for WRFN to present views on the information shared for the Project via written feedback. Written feedback timelines are summarized in **Table 3.2-4** and the written feedback process is described in **3.2.3**. | As communicated in a letter on February 3, 2017 WRFN elects to not participate in presenting views in the written feedback process. WRFN has an opportunity to present views on the information provided in the workshop on February 2, 2017.<br>The Proponent considered the views presented in the February 2 workshop in the decision-making process for the change to mine plan to use the alpha WRSF. |

| Notice in Sufficient Form and Detail (provided via email unless otherwise specified) | Date of Related Meeting or Event | Time to Prepare Views | Description of Meeting/Event/Opportunity to Present Views | Meeting/Event Purpose and Views Presented by WRFN | Consideration of Views by the Proponent |
|---|---|---|---|---|---|
| **December 12, 2016:** Invitation sent to WRFN (3A-1884) | January 25, 2017 | 43 days to present views based on meeting topic communicated in meeting invitation | **WRFN Meeting**<br>(location: Vancouver) | The Proponent and WRFN meet to discuss updated submission timeline and upcoming meetings. This is an opportunity for WRFN to present views on the Project and the topics noted above. | Further details can be found in Appendix 3-A (3A-2004).<br>The Proponent responds to WRFN comments and inquiries during the meeting. Follow up items include setting dates for WRFN members meetings. |
| **(Document Sharing)** | January 31, 2017 | Written feedback timelines are summarized in **Table 3.2-5** The Proponent requested 20 days for WRFN to provide written feedback (views) on the Batch 1 documents for the Project. | **Provide Batch 1 information to WRFN** | The Proponent provides all Batch 1 VC and IC reports as scheduled for review and feedback prior to a proposed workshop. This is an opportunity for WRFN to present views on the information shared for the Project via written feedback. Written feedback timelines are summarized in **Table 3.2-4** and the written feedback process is described in **3.2.3**. | As communicated in a letter on February 3, 2017 WRFN elects to not participate in presenting views in the written feedback process. The Proponent offers a workshop to provide an opportunity for WRFN to present views on the information provided. |
| **January 20, 2017:** Invitation sent to WRFN (3A-1992)<br>**February 3, 2017:** Sent meeting materials | February 2, 2017 | 19 days to prepare views based on information provided in advance of the meeting | **WRFN Waste Rock Storage Facility Alternatives Assessment Workshop**<br>(location: Whitehorse) | The Proponent and WRFN meet to discuss the WRSF alternatives information provided January 13. This is an opportunity for WRFN to present views on the information provided in advance and the information presented in the Workshop. Views presented included, but were not limited to the following topics:<br>• Water quality<br>• Cumulative effects<br>• Engagement moving forward | Further details can be found in Appendix 3-A (3A-2047).<br>The Proponent responded to inquiries and comments from WRFN during the meeting. |
| **January 25, 2017:** Dates proposed to WRFN in person during a meeting<br>**February 1, 2017:** Date confirmed via telephone | February 9, 2017 | 8 days to prepare views based on meeting topic communicated at time of meeting confirmation | **WRFN Meeting**<br>(location: Vancouver) | The Proponent and WRFN meet to discuss the WRFN Human Resources database and upcoming meetings. This is an opportunity for WRFN to present views on the topics above. | Further details can be found in Appendix 3-A (3A-2080).<br>Based on views presented by WRFN during this meeting, the Proponent suggests additional meetings to address concerns regarding ongoing engagement. |
| **(Document Sharing)** | February 23, 2017 | Written feedback timelines are summarized in **Table 3.2-7.** The Proponent requested 13 days for WRFN to provide written feedback (views) on the Batch 2 documents for the Project. | **Provide Batch 2 information to WRFN** | The Proponent provides all Batch 2 VC and IC reports, management plans, and Project Proposal sections for review and feedback prior to prior to a proposed workshop. This is an opportunity for WRFN to present views on the information shared for the Project via written feedback. Written feedback timelines are summarized in **Table 3.2-7** and the written feedback process is described in **3.2.3**. | As communicated in a letter on February 3, 2017 WRFN elects to not participate in presenting views in the written feedback process. The Proponent offers a workshop to provide an opportunity for WRFN to present views on the information provided. |
| **March 2, 2017:** Goldcorp confirms date and time of teleconference | March 14, 2017 | | **WRFN Meeting** (location: teleconference) | The Proponent and WRFN meet to discuss submission and upcoming meetings. This is an opportunity for WRFN to present views on the above noted Project | Meeting minutes are confidential. |

In addition to in-person consultation events, the Proponent shared information about the Project more broadly through three newsletter mail-drops. The first newsletter was mailed in the Dawson area at the end of November 2015, since Dawson is the locally affected community and the administrative centre for TH. The second newsletter was sent to the Dawson area, as well as Pelly Crossing, Beaver Creek, and Mayo in April 2016, as these are the administrative centres for the potentially affected First Nations. The third newsletter was set to the Dawson area, Pelly Crossing, Beaver Creek, and Mayo in November 2016. These newsletters contained general Project information and updates, a schedule of community consultation events, and other relevant information. Newsletters were also available at community meetings and open houses.

#### *3.3.2.1 Tr'ondëk Hwëch'in Technical Working Group Meetings*

The Project is located entirely within TH Traditional Territory, and the Proponent's consultation with TH included regular meetings with the TH Advisory Committee and scheduled themed meetings with the TH TWG. Meeting themes and format were developed by the TH TWG, and TH community meetings and open houses followed this themed approach. The Proponent also held separate meetings with the TH Advisory Committee and with TH Chief and Council. Key informant interviews with various TH Government representatives were held as part of the Project's Socio Economic Effects Assessment. The purpose of the TH TWG was to collaborate on the development of the Project Proposal through themed discussions that included the detailed review of Project design and Project baseline studies, and to work together on determining the assessment scope for the Project, including selection of VCs and ICs.

The initial meeting in December 2015 of the TH TWG for the Project discussed how TH preferred to be consulted with over the course of the Project baseline programs and Project Proposal development. The TH TWG developed a themed approach for TH meetings per the TH TWG's preferred consultation process. The themes can be found below represented in figures **Figure 3.3-1 through 3.3-5**. These figures include labels such as "V1, V2… etc", which refer to the volumes of the Project Proposal that the themes proposed by TH loosely refer to. Meeting scheduling, agenda items, and format are determined collaboratively between the TH TWG and the Proponent to ensure that as many TH TWG members as possible are able to attend the meetings. Tr'ondëk Hwëch'in TWG meetings took place from December 2015 until May 2016, and included multi-day in-person meetings one week per month in Dawson from December 2015 (with the exception of January 2016) to April 2016, and teleconferences in May 2016.

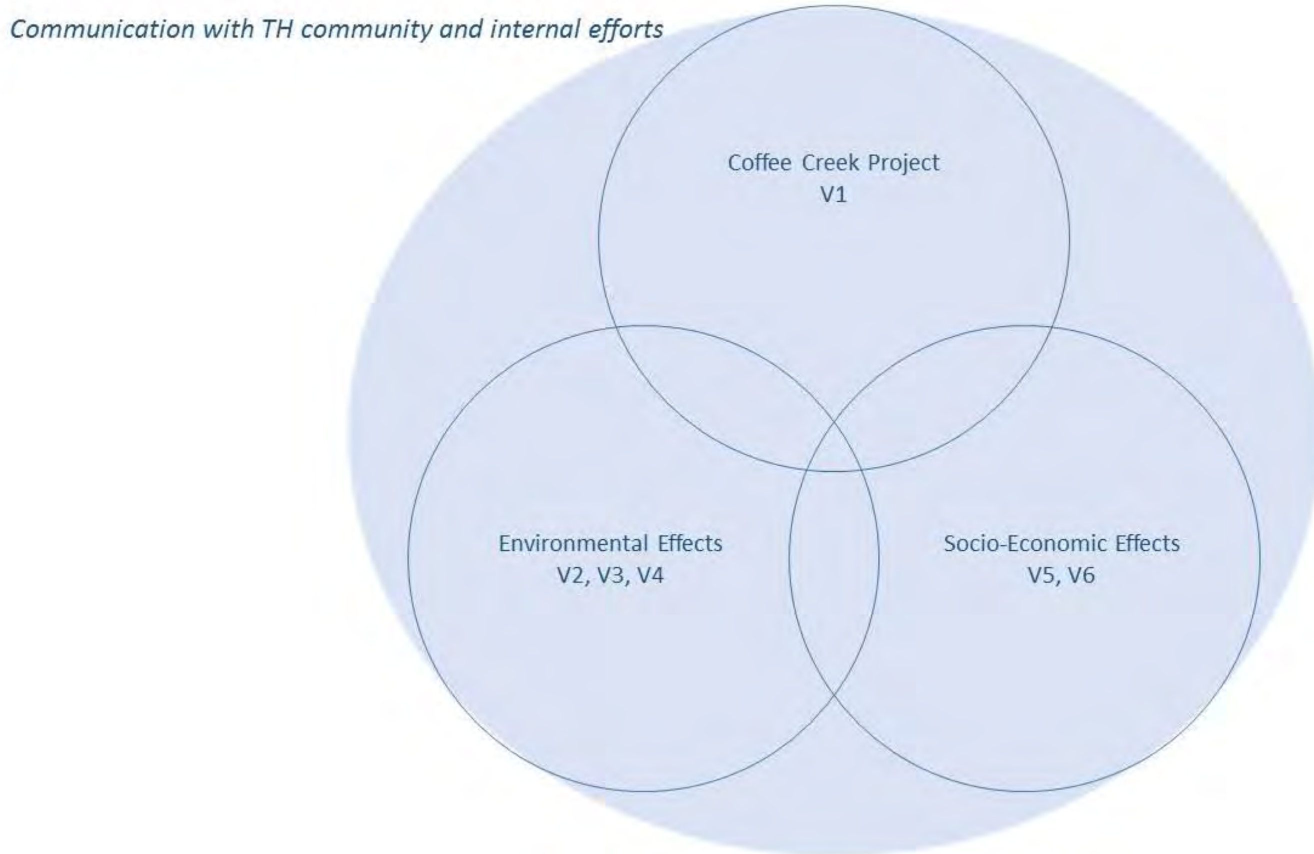


**Figure 3.3-1 Technical Working Group Themes Overview**


**Figure 3.3-2 Communications Theme**

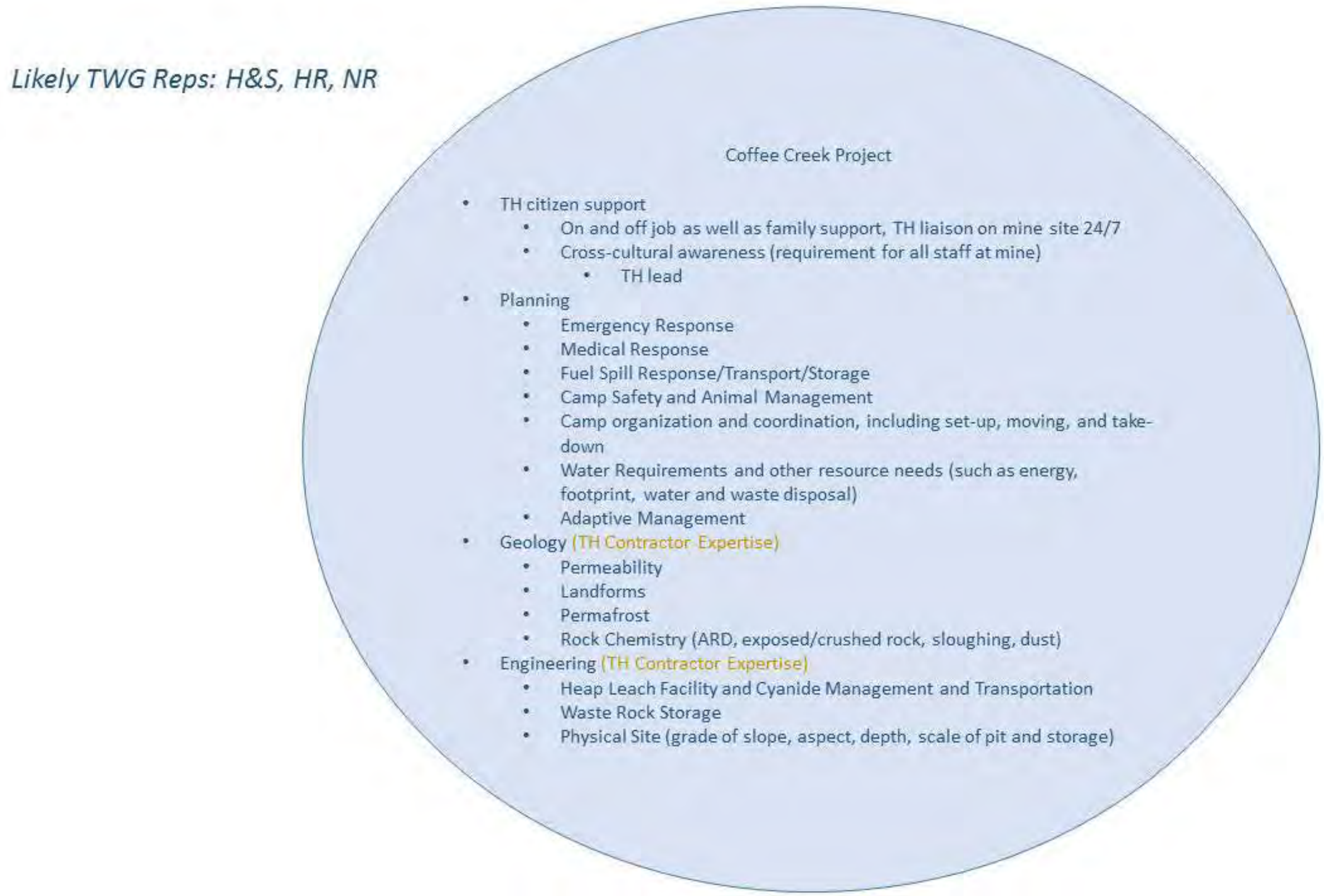


**Figure 3.3-3 Coffee Creek Project**


**Figure 3.3-4 Socio-economic Effects**

*Likely TWG Reps: NR, Heritage*

Biophysical Effects and Cumulative Effects

- Baseline Research and Monitoring
  - Fish, wildlife, water, vegetation, soils, permafrost, heritage resources (land-based heritage sites), traditional uses of the area (such as hunting, fishing and trapping), **access** routes, permafrost
- Effects/Cumulative Effects on the Baseline and Mitigations (ex: offsetting)
- Reclamation and Closure (TH Contractor Expertise)
  - Plans
  - Progressive
  - Filling of pits
  - Financial Security
  - Re-vegetation
  - Desired end land use (land stewardship)
  - Monitoring
- Climate Change
  - Emissions (transportation, operations, facilities)
  - Alternate scenarios and modelling

**Figure 3.3-5 Biophysical and Cumulative Effects**

Tr'ondëk Hwëch'in TWG meetings have followed an established process in which the Proponent provides draft agendas one week in advance for the TH TWG's review and input. The Proponent also provides the TH TWG with the presentation(s) to be given at the meeting and any supporting documentation one week prior to the date of the meeting(s). The schedule for the themed TH TWG meetings, including dates and topics, was determined in early January 2016 and remained relatively unchanged throughout the consultation and engagement program. Notes have been taken at each TH TWG, and action items and issues raised from meetings with the TH TWG are recorded and tracked carefully, and followed up in subsequent meetings or correspondence (see **Appendix 3-A Potentially Affected First Nations Consultation**). As requested by the TH TWG, meeting notes have been provided within one week following the meeting for TH's records and distribution to TH representatives and citizens as TH has seen fit.

#### *3.3.2.2 Tr'ondëk Hwëch'in Document Review and Workshops*

Following Goldcorp's acquisition of Kaminak, TH leadership informed the Proponent in October 2016 that the TWG format no longer aligned with TH's engagement preferences, and TH engaged a new technical consulting team to contribute to TH's review of Project information and provide feedback to Goldcorp. In response to this new engagement preference, Goldcorp provided Project Proposal documents from November 2016 through March 2017 for TH and their technical team to review and provide input on in written form. Documents and the written feedback process are summarized in **Section 3.2.3 Methods**, and a detailed schedule of document sharing can be found in **Table 3.2-2** through **Table 3.2-8**. A letter was received by Goldcorp from TH on December 16, 2016 regarding missing information in the documents provided to date and outstanding questions from the TH technical review. To address the outstanding information, Goldcorp and their technical consultants participated in teleconferences, written responses as part of the written feedback portion of the documentation sharing process, and meetings with TH and their technical team in the weeks and months following receipt of the letter. Based on the TH's engagement preferences, Goldcorp and TH have participated in workshops once per month beginning in January 2017 through March 2017 and teleconferences multiple times per month beginning in December 2016 through March 2017 to discuss the Project Proposal documents and information provided. Workshops and teleconferences occurred in addition to the written feedback and response process. Notes were taken during each workshop and teleconference, and action items were tracked and addressed in subsequent meetings, teleconferences, and correspondence. Further details can be found in **Appendix 3-A Potentially Affected First Nations Consultation Records and Materials**. Goldcorp has incorporated the input and feedback from TH and their technical team into the Project Proposal, and will continue to work to respond to and work with TH on their written and verbal feedback on the Project Proposal after submission.

#### *3.3.2.3 Tr'ondëk Hwëch'in Citizens Meetings*

The Proponent began participating in TH citizens meetings for the Project in June 2015, and the Project team has continued to participate at varying levels of frequency to date. Tr'ondëk Hwëch'in citizen meetings have typically been advertised approximately two weeks in advance of the meeting. Advertisement media used have been in newsprint ad form (Whitehorse Star, Yukon News), radio announcements (CRKW, CHON FM), flyers in the community, and, where possible, TV rolling ad displays in the community (Dawson Rolling Ads). Once hired by TH in January 2016, the TH Coffee Gold liaison officer also informed TH citizens of events through personal communications in the community. Following the acquisition, TH preferred to solely advertise citizens meetings by posting their own flyers in the community.

The Proponent structured TH citizens meetings to include various learning and feedback styles, including an open house portion, typically for the first hour of the event, followed by a formal presentation . At the request of TH leadership, Goldcorp moved to an open house format for TH citizens meetings in February and March 2017. Questions and discussion were encouraged throughout the events and during presentations; TH citizens meetings were key events for the Proponent to hear input and feedback from TH citizens on the Project. An information package including a hard copy of the presentation being delivered at the event, a copy of the most recent newsletter, and a comment sheet were available and provided to attendees at each community meeting and open house. Comment sheets were not commonly used, and beginning in October 2016, the Proponent moved from the comment sheet process to providing information on the Community Feedback Protocol, a more formalized feedback and response protocol.

Tr'ondëk Hwëch'in citizens meetings also included information posters displayed throughout the venue at nearly all events. Where possible, the Proponent ensured that the appropriate technical consultants for the Project were present at TH citizens meetings to answer detailed questions from the community. The Proponent and their technical consultants were available throughout the event and following the presentation to answer questions and hear feedback from TH citizens. Contact information for Goldcorp representatives and consultants was made available at all consultation events, and follow-up inquiries from the attendees were encouraged through multiple avenues, including direct contact with Goldcorp Coffee Team members and drop-ins to the Dawson and Whitehorse offices.

Tr'ondëk Hwëch'in citizens meetings were generally well attended, with approximately 15 to 30 attendees per event.

**Figure 3.3-6 Tr’ondëk Hwëch’in Citizens Meeting – February 2016**

#### *3.3.2.4 Capacity Building*

Recognizing that education in key in building capacity within potentially affected First Nations, the Proponent has partnered with TH and Yukon College to create an Environmental Monitor module course program. This program was delivered in condensed two-week modules, taught at the Project site, and included TH Elders. The combination of hands-on learning in the field and being able to spend time with Elders has resulted in the module courses having full attendance and course completion by students, and helped build skills to be for an Environmental Monitor role with the Proponent or potentially with other projects. This partnership with TH has also helped the Proponent and TH work together to envision the Project site once closed and reclaimed. This has included walking the Project site with TH Elders to identify the local plant species that TH would like the Proponent to use in reclamation of the site. The Proponent's collaboration with TH and Yukon College for the module courses has also resulted in research projects such as the TH local plant seed mapping and the TH greenhouse projects, which map and grow local plant species for use in Reclamation and Closure. .

#### *3.3.2.5 Selkirk First Nation, White River First Nation, and First Nation of Na-cho Nyäk Dun Meetings*

Agendas for meetings with other potentially affected First Nations governments (SFN, WRFN, and FNNND) were created in collaboration with the respective governments, and meeting agendas were provided in advance for review and input, where possible. Notes were taken at each meeting, and any action items and outstanding issues were carefully tracked and addressed in subsequent emails and telephone conversations.

***Selkirk First Nation***

The Proponent has participated in meetings with SFN leadership to discuss the Project and engagement moving forward. Selkirk First Nation and Goldcorp participated in technical meetings with government representatives and the technical teams of SFN beginning in December 2016. Discussion topics include Project Proposal documents and information shared as per the document sharing process outlined in **Section 3.2.3** and the WRSF alternatives assessment undertook by Goldcorp.

Goldcorp and SFN participated in workshops to discuss SFN's feedback on the Project information that had been previously provided. A letter was received by Goldcorp from SFN on February 23, 2017, outlining SFN's feedback on the WRSF Alternatives Assessment information and highlighting key concerns of SFN, including water quality, effects to fish, and WRSF stability. Goldcorp responded to the concerns in this letter via email, committing to continued engagement and to work with SFN on addressing these concerns. Selkirk First Nation invited Goldcorp to Pelly Crossing to introduce Goldcorp and the Project to SFN citizens, a meeting that was organized and advertised by SFN per their request. The event on March 1, 2017 involved a presentation conducted in an interactive format, and questions and comments were encouraged throughout. An information package including a hard copy of the presentation being delivered at the event as well as information on the Community Feedback Protocol, was provided to attendees.

Engagement with SFN is ongoing, and Goldcorp notes the SFN Category B Land at the mouth of Coffee Creek is of particular interest to SFN. Goldcorp and SFN are currently coordinating meetings with SFN Elders and youth councils, family heads, and SFN citizens. Citizens from SFN are interested in heap leach design and safety, and this will be a topic of discussion in upcoming citizens meetings. A meeting with the Selkirk Renewable Resources Council has also been scheduled for April 2017.

***White River First Nation***

Project-specific information sharing has been ongoing with WRFN and their technical team, with the first baseline information shared in February 2016. White River First Nation and their technical team were engaged throughout spring 2016 regarding the Socio-economic baseline for the Project, and continued to participate in the Project information sharing and feedback process through November 2016 into February 2017, providing written feedback to the baseline studies provided in November 2016 and participating in the February 2017 WRSF alternatives assessment workshop. In a letter dated February 3, 2017, WRFN communicated to Goldcorp that it is their preference to provide written feedback on the Project Proposal the YESAB assessment process.

Goldcorp has continued to share information per the Project information sharing process as outlined in **Section 3.2.3**, and continued to offer meetings and workshops to discuss the information shared. Goldcorp also shared Project information with WRFN members through multiple community meetings and open houses. The WRFN community meetings featured an open house component, where WRFN members had an opportunity to view the Project information posters displayed throughout the venue and engage with Goldcorp in discussions. The open house component was followed by a presentation that was conducted in an interactive format, and questions and comments were encouraged throughout. The WRFN open house provided a more informal opportunity for WRFN members to engage with Goldcorp in one-on-one discussions on topics of their choice. An information package including a hard copy of the presentation being delivered at the event, a copy of the most recent newsletter, and a comment sheet were available and provided to attendees at each community meeting and open house. Comment sheets were also collected at the end of events. Beginning in October 2016, Goldcorp moved from the comment sheet process to providing information on the Community Feedback Protocol, a more formalized feedback and response protocol. Goldcorp and WRFN continue to work on developing an information sharing and feedback process that accommodates the needs of both parties.

***First Nation of Na-cho Nyäk Dun***

The interest of FNNND to meet with the Proponent, to date has been limited. Recently, Goldcorp travelled to Mayo to deliver an open house and provide citizens with Project information and to provide a detailed review of the Northern Access Route with FNNND council. Access management was raised as a key interest for FNNND citizens and leadership during these meetings. Prior to this, the topics of highest interest to FNNND leadership were related to employment and training opportunities. Goldcorp continues to work with FNNND on an engagement process for the Project.

### 3.3.3 Consideration of Comments, Input, and Commitments

Through Goldcorp consultation and engagement with potentially affected First Nations to date (2009 to Q1 2017), a number of interests and topics have been raised by event participants. Of these, six key topics and interests have been identified as common amongst potentially affected First Nations, potentially affected communities and governments. These key interests identified by potentially affected First Nations and the Proponent's consideration of them are summarized below in **Table 3.3-7**.

**Table 3.3-7 Summary of Key Issues Identified by Potentially Affected First Nations and Resulting Project Modifications and Mitigation Measures**

| Key Issue | Project Modifications / Mitigation Measures / Enhancements | See Project Proposal Section No. |
|---|---|---|
| **Temporary Closure:**<br>As a result of Yukon's recent and distant history with temporary closure of mining projects, often evolving into permanent closure, nearly every consultation event has included a discussion of how Goldcorp intends to address temporary closure of the Project.<br>Identified by TH, WRFN, SFN | Procedures and plans for temporary closure are described in **Section 2.9 Seasonal or Temporary Closure of the Project Proposal** and the **Conceptual Reclamation and Closure Plan** (**Appendix 31-C**). In the case of temporary closure, Goldcorp will ensure the physical and chemical stability and safety of all infrastructure, and will work to mitigate potential environmental effects that may occur during this period. Goldcorp will ensure compliance with all regulatory and licensing requirements.<br>Prior to and during a Temporary Closure, Goldcorp will implement a Workforce Transition Strategy, which includes the following commitments:<br>• Goldcorp will endeavour to use a staged reduction of workforce in the event of a temporary or permanent closure.<br>• Goldcorp will fulfill all conditions for terminations as defined in contracts, including severance payments. The Proponent will offer an Employee Assistance Program to support employees during transition in the event of a temporary or permanent closure.<br>• Goldcorp will communicate the proposed schedule and activities associated with temporary or permanent closure of the mine to employees, potentially affected and local communities, governments and businesses, and appropriate local non-profit and non-governmental organizations, allowing those engaged in indirect and induced employment and businesses to prepare for the transition, and begin to seek other opportunities<br>• Goldcorp will offer on- the-job training to employees, which will support future career transitions.<br>• Goldcorp will identify and provide a local workforce transition contact to respond to questions and concerns regarding temporary or permanent closure status, schedule, and activities. | **Section 20.0 Economic Conditions Assessment**<br>**Appendix 31-C Conceptual Reclamation and Closure Plan**<br>**Section 2.8 Seasonal or Temporary Closure** |

| Key Issue | Project Modifications / Mitigation Measures / Enhancements | See Project Proposal Section No. |
|---|---|---|
| **Wildlife:**<br>Wildlife is of paramount concern to potentially affected First Nations, in particular TH. The Proponent has consistently heard concerns regarding wildlife, particularly the recently rebounded Forty Mile Caribou Herd, and concerns regarding increased hunting access as a result of the NAR at consultation events. Concerns regarding effects to wildlife movement in the Project area and NAR area have also been frequently voiced at consultation events.<br>Identified by TH, WRFN, SFN, FNNND | Goldcorp will commit to the following measures to mitigate effects to wildlife, particularly around increased access and harvesting activities with respect to the NAR:<br>• The NAR route was selected to minimize effects to caribou (see Section 2.10 Project Alternatives and Chosen Approach.)<br>• Goldcorp will control access to barge landings and ice roads; non-Goldcorp-related traffic will not be permitted on the crossings to the extent permitted by Yukon law.<br>• Goldcorp will implement a no hunting and fishing policy at site for all Project employees.<br>• Wildlife will have the right-of–way along all Project roads, including the NAR.<br>• During the Fortymile Caribou spring and fall migration seasons, a phased approach to mitigation will be followed where NAR traffic will be managed in accordance with presence of collared caribou or the observation of large groups of caribou. If necessary and possible, temporary road closures and traffic management measures will be implemented to avoid disturbing caribou.<br>No significant residual effects are predicted for wildlife species as a result of the Project. Wildlife Monitoring during the Construction, Operation, and Reclamation and Closure Phases of the Project will be conducted as described in the Wildlife Protection Plan (**Appendix 31-F**). | **Section 2.10 Project Alternatives and Chosen Approach**<br>**Appendix 16-B Wildlife and Wildlife Habitat Valued Component Assessment**<br>**Appendix 31-F Wildlife Protection Plan** |
| **Access Route:**<br>The proposed NAR is a frequent topic at consultation events. Concerns include increased traffic and opening land to year-round access, disturbance to wildlife along the NAR.<br>Identified by TH, WRFN, SFN, FNNND | Goldcorp understands that the NAR, from its junction with Northern Klondike Highway to the Stewart River, will be shared with multiple user groups, including placer miners, potentially affected First Nations, and recreational users. Improvements of this section of the NAR will improve access for all users. Goldcorp will control access to all barge ramps and ice roads to the extent possible by Yukon law; thus, current access levels are not expected to change south of the Stewart River crossing. Goldcorp is committed to ongoing dialogue with potentially affected First Nations and road users to address concerns and apply appropriate mitigation measures.<br>Potential effects of the NAR on wildlife are addressed through the measures described above. | **Appendix 24-A Land and Resource Use Valued Component Assessment**<br>**Appendix 31-A Access Route Construction Management Plan**<br>**Appendix 31-B Access Route Operational Management Plan**<br>**Wildlife Protection Plan, Appendix 31-F** |

| Key Issue | Project Modifications / Mitigation Measures / Enhancements | See Project Proposal Section No. |
|---|---|---|
| **Jobs, Training, and Contract Opportunities:**<br>There is a high level of interest in jobs, training, and contract opportunities associated with the Project at every consultation event. A key interest raised is ensuring the Project maximizes benefits in Yukon.<br>Identified by TH, WRFN, FNNND | Goldcorp has committed to hiring locally as much as possible, which is a current practice in place for Goldcorp's exploration program at the Coffee Property. Goldcorp will develop a Local Employment Strategy, in accordance with the Sustainability Excellence Management System (SEMS). In addition, Goldcorp has made the following commitments regarding jobs, training, and contract opportunities:<br>• Goldcorp will organize employee pickup points in Dawson and Whitehorse. Other Yukon community pick up points will be considered if employee numbers warrant it.<br>• Goldcorp will have a workforce transition strategy for employees moving out of roles at the end of the Project or in the unlikely case of unplanned closure.<br>• Goldcorp will provide consideration for employment opportunities to qualified locals, including potentially affected First Nations residents with appropriate skills and qualifications.<br>• Goldcorp will collaborate with local education and training organizations and institutions to identify programs or courses necessary for Project employment, to encourage that programs or courses necessary for Project employment are available to local and regional residents.<br>• Goldcorp will make career development opportunities available to encourage retention of employees and further develop the skills of the local labour force.<br>• Goldcorp will implement a Local Procurement Strategy, and will include requirements to contract and procure local goods and services in its primary contracts.<br>• Goldcorp will include local and regional hiring clauses in all Project contracts.<br>• Goldcorp will implement a Community Feedback Protocol to respond to questions and concerns regarding Project contracting and procurement opportunities. | **Section 20.0 Economic Conditions Assessment**<br>**Appendix 20-A Economic Conditions Valued Component Assessment** |

| Key Issue | Project Modifications / Mitigation Measures / Enhancements | See Project Proposal Section No. |
|---|---|---|
| **Heap Leach and Cyanide:**<br>The Proponent exerted a focused effort on communicating the details around the heap leach pad design and use and transportation of cyanide. This communication has resulted in alleviating priority issues of concern; however, it remains important to ensure that heap leach design and cyanide use and transport are carefully considered, planned for, and managed. Some specific concerns heard during consultation events are:<br>• Transportation of cyanide on barge crossings<br>• Heap leach liner system failures<br>• Worker exposure to cyanide<br>• Wildlife exposures to cyanide.<br>Goldcorp continues to discuss heap leach and cyanide topics in consultation with potentially affected First Nations.<br>Identified by TH, WRFN, SFN, FNNND | Goldcorp will engage in dialogue with stakeholders by describing cyanide use and management procedures and providing information on the health and environmental effects of cyanide.<br>The Project will adhere to the International Cyanide Code, which includes undertaking community engagement and compliance audits.<br>In accordance with the *Transportation of Dangerous Goods Act* and regulations, the driver of a truck carrying sodium cyanide will have an Emergency Response Assistance Plan to implement for immediate response. The Emergency Response Assistance Plan will be provided to Goldcorp and will be reviewed by the Occupational Health and Safety and Environment departments.<br>To effectively address concerns regarding the heap leach design and cyanide, the Proponent ensured that consultants working on the heap leach design and cyanide management have been present at multiple consultation events.<br>As a result of feedback obtained through consultation, the Proponent amended heap leach pad design from a valley-fill design to a free draining, ridge-top design in response to concerns regarding internal cyanide solution storage within the heap leach pad<br>In addition, Goldcorp has also committed to the additional following mitigations:<br>• Progressive closure and rinsing of the heap leach pad<br>• Buried drip emitters<br>• A double-liner system, including a linear low-density polyethylene liner as well as a geosynthetic clay liner for underneath the heap leach pad, as well as a wick drain system for leak detection<br>• Performing an electromagnetic scan after placing overliner on top of the heap leach pad liner system to detect leaks as a result of overliner placement<br>• Fencing the Heap Leach Facility. | **Section 2.0 Project Description**<br>**Section 28.0 Accidents and Malfunctions**<br>**Appendix 31-C Conceptual Reclamation and Closure Plan** |

| Key Issue | Project Modifications / Mitigation Measures / Enhancements | See Project Proposal Section No. |
|---|---|---|
| **Water Quality, Effects to Fish:**<br>Concerns with water quality and effects to fish are a consistent topic at consultation events.<br>Identified by TH, WRFN, SFN, FNNND | Goldcorp has implemented several measures into the Project design that will reduce the potential for the Project to adversely affect downstream surface water quality and resulting fish and fish habitat. The Heap Leach Facility is located on a ridgetop in an area above watercourses; waste rock storage will be centralized; and water management infrastructure is proposed to minimize and control water that is influenced by the Mine Site.<br>Upgrades that Goldcorp will be performing on the existing portions of the NAR will improve drainage, sedimentation control, and crossing structures to improve water quality and fish habitat. Goldcorp will also be including an additional water quality sampling location in association with the SFN Category B Land at the mouth of Coffee Creek, and will be including an additional sampling location immediately downstream of the confluence of Latte Creek and Coffee Creek based on the feedback from TH. In addition, Goldcorp will be taking into consideration feedback from potentially affected First Nations regarding use of Independence Creek as a reference site for future water quality monitoring site selection.<br>Additional Chum Salmon spawning surveys will be conducted in the 2017 field season to provide increased certainty regarding the Aquatic Environment Baseline Summary Report findings. | **Section 2.10 Project Alternatives and Chosen Approach**<br>**Section 14.0 Fish and Fish Habitat Assessment**<br>**Appendix 14-B Fish and Fish Habitat Valued Component Assessment** |

Comments and input from potentially affected First Nations were considered in and influenced the Project planning and design stages, informed baseline and effects assessment studies, and influenced mitigation strategies for the Project.

Many citizens and members of potentially affected First Nations consulted by the Proponent have past experience with and existing knowledge of cyanide heap leach gold mining from the Brewery Creek mine, which operated from 1997 to 2001 near Dawson. Citizens may also recall the recent assessment and permitting of the Eagle Gold Project, a valley-fill heap leach proposed near Mayo. This growing familiarity with the process of cyanide gold heap leaching enabled the Proponent to initiate relatively detailed discussions of the Project mine plan, operations, and heap leach design with those interested. In particular, the majority of interests and questions raised regarding the heap leach pad and water quality were addressed directly during the Proponent's consultation events. The Proponent provided detailed information on the heap leach pad use and design, as well as on water quality monitoring and mitigation plans. Concerns regarding wildlife were also commonly voiced during consultation events, specifically concerns with regard to increased harvesting related to the NAR. While Goldcorp has been able to address many comments and concerns in the Project design, the Wildlife Protection Plan includes monitoring and adaptive management protocols for wildlife management.

In the March 2016 TH TWG meetings, TH raised concerns with respect to the wording of the Traditional Economy and Non-Wage Economy VCs, noting concern that the wording is not inclusive of mixed TH and non-TH families' activities. In response to this, the Proponent adjusted the VC to be titled Social Economy to better reflect inclusivity. In the April TH TWG meetings, TH raised the concern that the Vegetation VC did not address traditional and medicinal plants adequately, and the Proponent responded to this by adding Traditional and Medicinal plants as a VC subcomponent in the Vegetation Valued Component Assessment. During the April TWG meetings, TH also raised concerns about facilitated predation, meaning the potential for increased predation along the NAR due to the nature of the linear disturbance associated with new build for the NAR, and indicated that it should be considered in the Project Proposal. The Proponent has committed to considering facilitated predation in the Wildlife and Wildlife Habitat Valued Component Assessment (Appendix 16-B). In the workshop to discuss the Human Health Risk Assessment and Health Impact Assessment (HIA), TH provided feedback that the HIA should be included in the Community Health and Well-being Valued Component Assessment, rather than be a stand-alone document, and this feedback has been incorporated into the Project Proposal.

In response to concerns raised by TH regarding fish baseline studies, the Proponent committed to including maps of overwintering and open lead habitat in the baseline report, including additional sampling sites in Yukon Tributary (YT)-24 and Halfway Creek in sampling events moving forward. Goldcorp's fisheries team also collected gradient data in the 2016 field season to ground-truth the LiDAR data used in the gradient analysis for the fish baseline report, as recommended by the TH TWG. Water quality effects to fish are also of concern for potentially affected First Nations, and in response to specific interests in Chum spawning survey results in the Aquatic Resource Baseline Summary document, Goldcorp has included additional Chum spawning surveys for the 2017 field season. Goldcorp has also committed to developing site-specific water quality objectives in consultation with the TH technical team, as well as additional water quality monitoring stations in response to the interests of SFN and TH.

Other comments received during consultation activities include interests raised by TH specifically regarding the need for support to TH employees in relation to rotational work schedules, mental health and the pursuit of cultural activities. Within the TH community, the Proponent has heard both positive and negative comments regarding the two-week-on, two-week-off rotation schedule, as this schedule may allow for increased time available for citizens to pursue traditional or cultural activities during their two weeks off, or may create conflict between timing of citizens' two weeks working at site and timing of traditional or cultural TH activities. Goldcorp's commitments and adjustments to address these interests are described in the Human Environment Sections (**Section 18.0 Introduction to the Human Environment through Section 26.0 Heritage Resources Assessment**) of this Project Proposal.

## 3.4 Potentially Affected Communities Consultation and Interested Persons Engagement Program

### 3.4.1 Program Overview

The City of Dawson is the closest municipality to the Project and the proposed access point for the NAR. Dawson has a long history with the mining industry, beginning in the late 1800s as the heart of the Klondike Gold Rush. Based on guidance from YESAB, Dawson has been identified as the potentially affected community for the Project, and the Project's consultation and engagement program has involved a focused effort in Dawson, organizing and hosting meetings with the City's Mayor and Council and community meetings with the general community. To ensure consistency of consultation and Project information provided, the Proponent scheduled Dawson community meetings in the same week as TH citizens meetings, and followed the same themes and topics as TH citizens meetings. The Proponent informed attendees at Dawson community meetings about the themes, where applicable, and tentative dates of upcoming meetings. Meetings to date have been documented with a combination of meeting minutes, sign-in sheets, photographs, or comment cards. A selection of this material can be found in **Appendix 3-B Potentially Affected Communities Consultation and Interested Parties Engagement Records and Materials**. Engagement with the public, including Whitehorse, is discussed in section 3.5, and details regarding public engagement can be found in **Appendix 3-C Public Engagement Records and Materials**.

### 3.4.2 CONSULTATION AND ENGAGEMENT UNDERTAKEN TO DATE

Community meetings were advertised approximately two weeks in advance of the meeting. Advertising media used included: newsprint ad form (Whitehorse Star, Yukon News), radio announcements (CRKW), flyers in the community, and, where possible, TV rolling ad displays in the community (Dawson Rolling Ads). An information package, including a hard copy of the presentation being delivered at the event, a copy of the most recent newsletter, and a comment sheet were made available and provided to attendees at each community meeting. Community meetings also included information posters displayed throughout the venue. Community meetings were conducted as an open house for approximately the first hour, allowing attendees to view the posters displayed, ask questions, and discuss the Project with the Proponent and accompanying technical consultants. The open house was followed by a presentation, with questions and comments throughout the presentation, followed by a question-and-answer period at the end. Comment sheets were collected at the end of events, and where possible, the Proponent ensured that the appropriate technical consultants for the Project were present at consultation events to answer detailed questions from the community. Contact information for the Proponent's representatives and consultants were available at all consultation events, and follow-up inquiries were encouraged.

As part of the Proponent's focused consultation and engagement program launched in mid-2015, the Proponent initiated engagement with interested persons as defined in Section 2 of YESAA, where the Umbrella Final Agreement mandated several organizations as interested persons if a proposed project could affect the natural resources, they have a role in managing. The Project's consultation and engagement included the following:

- The Yukon Fish and Wildlife Management Board and Salmon Subcommittee
- Dawson District Renewable Resources Council.

The Proponent contacted the above-listed parties, notifying them of the Project and inviting them to participate in a meeting to provide a Project overview and an opportunity for parties to ask questions and raise concerns. Meetings with the parties summarized below involved a presentation from Proponent, with questions and comments encouraged throughout, and were followed by a formal question-and-answer period. Presentations delivered to parties being consulted on the Project were provided in hard copy at the meeting or provided electronically following the meeting. Minutes were taken at each meeting, and comments and concerns were tracked and considered by Goldcorp in the Project design.

A summary of consultation and engagement events can be found in **Table 3.4-1**.

**Table 3.4-1 Summary of Potentially Affected Communities Consultation and Interested Persons Engagement**

<table>
<tr><th>Notice in Sufficient Form and Detail (provided via email unless otherwise specified)</th><th>Date of Related Meeting or Event</th><th>Time to Prepare Views</th><th>Description of Meeting/Event/Opportunity to Present Views</th><th>Meeting/Event Purpose and Views Presented</th><th>Consideration of Views by the Proponent</th></tr>
<tr><td></td><td>May 14, 2015</td><td></td><td>Dawson District Renewable Resource Council Meeting (DDRRC) (location: Dawson)</td><td>The Proponent and DDRC meet for the Proponent to present an overview of the Project and NAR. This is an opportunity for the DDRRC to present views on the above noted topics.</td><td>Further details found in Appendix 3-B (3B-1 and 2)<br>The Proponent responded to questions and inquiries from attendees during the meeting. Contact information was made available in the case that attendees wished to follow up with the Proponent.</td></tr>
<tr><td></td><td>May 16, 2015</td><td></td><td>City of Dawson Mayor and Council Meeting (location: Dawson)</td><td>The Proponent and City of Dawson Mayor and Council meet for the Proponent to present an overview of the Project and NAR. This is an opportunity for Mayor and Council to present views on the above noted topics. Views presented included, but were not limited to the following topics:<br>• NAR route<br>• Community Engagement<br>• Local employment opportunities</td><td>Further details found in Appendix 3-B (3B-3)<br>The Proponent responded to questions and inquiries from attendees during the meeting. Contact information was made available in the case that attendees wished to follow up with the Proponent.</td></tr>
<tr><td></td><td rowspan="2">June 18, 2015</td><td></td><td>City of Dawson Mayor and Council Meeting (location: Dawson)</td><td>The Proponent and City of Dawson Mayor and Council meet for the Proponent to present an update on the Project and NAR. This is an opportunity for Mayor and Council to present views on the above noted topics. Views presented included, but were not limited to the following topics:<br>• Heap leach process<br>• Accidents and Malfunctions<br>• Mitigation and closure</td><td>Further details found in Appendix 3-B (3B-4 to 3B-9)<br>The Proponent responded to questions and inquiries from attendees during the meeting. Contact information was made available in the case that attendees wished to follow up with the Proponent.</td></tr>
<tr><td></td><td></td><td>Dawson City Community Meeting (location: Dawson</td><td>The Proponent presents Project information and presents on the exploration program and introduce the Project to the Dawson community. This is an opportunity for residents of the Dawson community to present views on the topics noted above. Views presented included, but were not limited to the following topics:<br>• Preferred methods of consultation and communication about the Project<br>• Heap leach</td><td>Further details found in Appendix 3-B (3B-10 to 3B-12).<br>The Proponent responded to questions and inquiries from community members during the meeting. No inquiries from attendees in this meeting required additional follow-up. Comments and inquiries were documented. Contact information for the Proponent was provided in the case that attendees wished to follow up with the Proponent.</td></tr>
<tr><td>November 19, 2015: Sent meeting flyer to Dawson resident to post (3B-17)</td><td>December 1, 2015</td><td>11 days' notice of meeting topic provided to residents of Dawson</td><td>Dawson City Community Meeting (location: Dawson)</td><td>The Proponent presents an overview of the Project and an update on the Project to the Dawson community. This is an opportunity for residents of the Dawson community to present views on the Project. Hard copies of information presented were available to all attendees. Views presented included, but were not limited to the following topics:<br>• Wildlife<br>• NAR access, map and maintenance<br>• Local employment opportunities</td><td>Further details found in Appendix 3-B (3B-18 to 3B-34)<br>The Proponent responded to questions and inquiries from community members during the meeting. No inquiries from attendees in this meeting required additional follow-up. Comments and inquiries were documented. Contact information for the Proponent was provided in the case that attendees wished to follow up with the Proponent.</td></tr>
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| Notice in Sufficient Form and Detail (provided via email unless otherwise specified) | Date of Related Meeting or Event | Time to Prepare Views | Description of Meeting/Event/Opportunity to Present Views | Meeting/Event Purpose and Views Presented | Consideration of Views by the Proponent |
|---|---|---|---|---|---|
| | December 2, 2015 | | **City of Dawson Mayor and Council Meeting** (location: Dawson) | The Proponent and City of Dawson Mayor and Council meet to discuss the Project, NAR, baseline studies, and Project Proposal. This is an opportunity for Mayor and Council to present views on the topics above. Views presented included, but were not limited to the following topics:<br>• Local employment opportunities<br>• Socio-economic and cultural impacts | Further details found in Appendix 3-B (3B-35 to 3B-57)<br>Answers to inquiries from the City of Dawson Mayor and Council were responded to during the meeting by the Proponent. Comments and inquiries were documented.<br>Proponent provided Mayor and Council with feasibility study results press release for the project as a follow-up to this discussion (3B-58) |
| **January 26, 2016:**<br>Sent flyer to be distributed by TH<br>**January 27, 2016:** Coordinated media advertising (news, radio) | February 11, 2016 | 14 days' notice of meeting topic provided to Dawson residents | **Dawson City Community Meeting** (location: Dawson) | The Proponent and select technical consultants present Project information and water quality baseline information to the Dawson community. This is an opportunity for Dawson community members to present views to the Proponent and technical consultants on the project and the water quality baseline. Hard copies of information presented were available to all attendees. Views presented included, but were not limited to the following topics:<br>• Heap Leach<br>• Energy sources at site<br>• NAR access and management | Further details found in Appendix 3-B (3B-74 to 3B-100).<br>The Proponent responded to questions and inquiries from community members during the meeting. No inquiries from attendees in this meeting required additional follow-up. Comments and inquiries were documented. Contact information for the Proponent was provided in the case that attendees wished to follow up with the Proponent. |
| **February 19, 2016:** Coordinated meeting over the phone (3B-103) | February 23, 2016 | 3 days to prepare views on the topic communicated at time of meeting coordination | **Yukon Fish & Wildlife Management Board Salmon Sub Committee (SSC) Meeting** (location: Whitehorse) | The Proponent meets with the SSC to provide an overview of the Project and NAR, and discuss topics of interest to the SSC. Views presented included but were not limited to the following topics:<br>• Potential impacts to fish<br>• First Nations concerns and interests related to the Project<br>• SSC involvement in the YESAB process. | Further details found in Appendix 3-B (3B-106 to 3B-112)<br>The Proponent responded to comments and inquiries from the committee members during the meeting.<br>Copies of the slides from the presentation provided following the meeting as requested.<br>Comments and inquiries were documented. Contact information for the Proponent was provided in the case that attendees wished to follow up with the Proponent. |
| **March 9, 2016:** Sent flyers for TH to distribute, coordinated media advertising (news, rolling TV ad, radio) (3B-129) | March 22, 2016 | 12 days' notice of meeting topic provided to Dawson residents | **Dawson City Community Meeting** (location: Dawson) | The Proponent presents the preliminary Socio-economic Baseline Study findings to the Dawson community. This is an opportunity for Dawson residents to present views on the Project and topic noted above. Hard copies of information presented were available to all attendees. Views presented included, but were not limited to the following topics:<br>• NAR route and management<br>• Local employment opportunities and effect of the Project on the local community<br>• Closure and reclamation procedures for the heap leach | Further details found in Appendix 3-B (3B-136 and 3B-149).<br>Answers to inquiries from community members were provided by the Proponent during the meeting. No inquiries from attendees in this meeting required additional follow-up. Comments and inquiries were documented.<br>Community members encouraged to return for April Community meeting when closure team will be available to respond to closure questions.<br>Contact information for the Proponent was provided in the case that attendees wished to follow up with the Proponent. |

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| | April 11, 2016 | | **Dawson District Renewable Resource Council Meeting** (location: Dawson) | The Proponent and the DDRRC meet to discuss the Project and NAR. This is an opportunity for the DDRRC to present views on the topics noted above. Views presented included, but were not limited to the following topics:<br>• Heap leach<br>• Closure plans<br>• Potential effects to wildlife and fish | Further details found in Appendix 3-B (3B-161 to 3B-169)<br>Answers to inquiries from the committee members provided by the Proponent during the meeting. No inquiries from attendees in this meeting required additional follow-up. Comments and inquiries were documented. Contact information for the Proponent was provided in the case that attendees wished to follow up with the Proponent. |
| **March 30, 2016:** Sent flyers for TH to distribute, coordinated media advertising (news, rolling TV ad, radio) | April 12, 2016 | 12 days' notice of meeting topic provided to Dawson residents | **Dawson City Community Meeting** (location: Dawson) | The Proponent presents Project information and information on the Wildlife and Fish baseline studies to the Dawson community. This is an opportunity for Dawson residents to present views on the topics noted above. Hard copies of information presented were available to all attendees. Views presented included, but were not limited to the following topics:<br>• Wildlife and Vegetation mapping/management<br>• Local employment opportunities<br>• NAR management | Further details found in Appendix 3-B (3B-170 and 3B-178).<br>Answers to inquiries from community members were provided by the Proponent during the meeting. No inquiries from attendees in this meeting required additional follow-up. Comments and inquiries were documented. Contact information for the Proponent was provided in the case that attendees wished to follow up with the Proponent. |
| **April 4, 2016:** Sent meeting invitation (3B-158) | April 14, 2016 | 10 days to prepare views based on meeting topic communicated in meeting invitation | **City of Dawson Mayor and Council Meeting** (location: Dawson) | The Proponent and Dawson City Mayor and council meet to discuss an update on the Project. Views presented include, but are not limited to a comment in support of the NAR; Dawson is looking forward to local employment opportunities | Further details found in Appendix 3-B (3B-186).<br>Answers to inquiries from the City of Dawson Mayor and Council were responded to during the meeting by the Proponent. Comments and inquiries were documented. No follow-up actions identified. |
| **March 30, 2016:** Sent flyers for TH to distribute, coordinated media advertising (news, rolling TV ad, radio) | April 14, 2016 | 14 days' notice of meeting topic provided to Dawson residents | **Dawson City Community Meeting** (location: Dawson) | The Proponent presents a Project update and information on reclamation and closure of the Project to the Dawson Community. This is an opportunity for Dawson residents to present views on the topics noted above. Hard copies of presentations were available to all attendees. Views presented included, but were not limited to the following topics:<br>• Water quality<br>• Reclamation and closure<br>• Operations and the NAR | Further details found in Appendix 3-B (3B-179 and 3B-185).<br>Answers to inquiries from community members were provided by the Proponent during the meeting. No inquiries from attendees in this meeting required additional follow-up. Comments and inquiries were documented. Contact information for the Proponent was provided in the case that attendees wished to follow up with the Proponent. |
| **October 18, 2017:** Meeting scheduled<br>**October 25, 2017**: Meeting rescheduled | October 26, 2016 | 8 days to prepare views based on meeting topic communicated at time of meeting coordination | **City of Dawson Mayor and Council Meeting** (location: Dawson) | The Proponent presents Project information to Dawson Mayor and Council to introduce Goldcorp, re-introduce the Project, and provide a project update. Views presented included, but were not limited to support for project and desire to work with the Proponent expressed, Local employment and training opportunities important to Dawson. | Further details found in Appendix 3-B (3B-194).<br>Consultant for Proponent provided the handout that was provided during this lunch via email (3B-199) |

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| **October 20, 2016:** Flyer provided to TH to post in Dawson alongside the TH citizens meeting flyer | October 29, 2016 | 8 days' notice of meeting topic provided to Dawson residents | **Dawson Community Meeting** (location: Dawson) | The Proponent presents Project information to the Dawson community to introduce Goldcorp, re-introduce the Project, and provide a project update. This is an opportunity for Dawson residents to present views on the Project. Hard copies of information presented were available to all attendees. Views presented included, but were not limited to the following topics:<br>• Proponent's previous experience with heap leach mining<br>• Local employment and training opportunities<br>• Impact of YG's Gateway project. | Further details found in Appendix 3-B (3B-198).<br>Answers to inquiries from community members were provided by the Proponent during the meeting. No inquiries from attendees in this meeting required additional follow-up. Comments and inquiries were documented. Contact information for the Proponent was provided in the case that attendees wished to follow up with the Proponent. |
| **November 3, 2016:** Meeting confirmed (3B-200 and 3B-201) | November 10, 2016 | 6 days to prepare views based on meeting topic communicated at time of meeting confirmation | **Yukon Fish and Wildlife Management Board Executive Director Meeting** (location: Whitehorse) | The Proponent and the YFWMB meet to introduce Goldcorp, re-introduce the Project, and provide a Project update. This is an opportunity for the YFWMB to present views on the Project. Views presented included, but were not limited to the following topics:<br>• Fish<br>• Heap Leach<br>• NAR management | Further details found in Appendix 3-B (3B-204 and 3B-207).<br>Answers to inquiries from board members were provided by the Proponent during the meeting.<br>The board expressed interest in meeting again to discuss Heap Leach details and in having the Proponent present at their board meeting in February. Proponent consultant followed up via email on Nov. 16 (3B-208 to 3B-209). |
| **November 9, 2016:** Meeting confirmed (3B-203) | November 24, 2016 | 14 days to prepare views based on meeting topic communicated at time of meeting confirmation | **Dawson District Renewable Resource Council Meeting** (location: Dawson) | The Proponent and the DDRRC meet to discuss a Project update, Goldcorp's plans for the future, theft along the NAR. This is an opportunity for the DDRRC to present views on the above noted topics. Views presented included, but were not limited to the following topics:<br>• NAR design and management<br>• Project description<br>• Cultural artifacts and theft | Further details found in Appendix 3-B (3B-211 and 3B-222).<br>Answers to inquiries from council members were provided by the Proponent during the meeting.<br>Proponent committed to taking a DDRRC member on a tour of the NAR.<br>Comments and inquiries were documented. Contact information for the Proponent was provided in the case that attendees wished to follow up with the Proponent. |
| **November 25, 2016:** Meeting confirmed (3B-223 to 3B-227) | December 6, 2016 | 10 days to prepare views based on meeting topic communicated at time of meeting confirmation | **Yukon Fish and Wildlife Management Board Meeting Presentation** (location: Whitehorse) | The Proponent presents information on the Project to introduce Goldcorp, and provide general information on fish and wildlife baseline studies. This is an opportunity for attendees to present views on the above noted topics. | Further details found in Appendix 3-B (3B-230).<br>The Proponent responded to comments and inquiries during the meeting. No follow-up actions identified. |
| **February 10, 2017:** Flyers posted | February 15, 2017 | 4 days' notice of meeting topic provided to Dawson residents | **Dawson Community Meeting** (location: Dawson) | The Proponent presented a Project update, an overview of the company and discussed the intended use of the NAR, employment numbers and permitting/construction schedule to the Dawson community. The Proponent also discussed 2016 exploration and upcoming 2017 exploration, provide update on YESAB application. This was an opportunity for Dawson residents to present views on the above noted topics. Hard copies of information presented were available to all attendees. Views presented included, but were not limited to the following topics:<br>• NAR route and management<br>• Project description and operations details<br>• Exploration information and current status of studies | Further details found in Appendix 3-B (3B-232 and 3B-242).<br>Answers to inquiries from community members were provided by the Proponent during the meeting. No inquiries from attendees in this meeting required additional follow-up. Comments and inquiries were documented. Contact information for the Proponent was provided in the case that attendees wished to follow up with the Proponent. |

| Notice in Sufficient Form and Detail (provided via email unless otherwise specified) | Date of Related Meeting or Event | Time to Prepare Views | Description of Meeting/Event/Opportunity to Present Views | Meeting/Event Purpose and Views Presented | Consideration of Views by the Proponent |
|---|---|---|---|---|---|
| **February 14, 2017:** Meeting confirmed | February 16, 2017 | 1 day to prepare views based on meeting topic communicated at time of meeting confirmation | **City of Dawson Deputy Mayor and Council Meeting** (location: Dawson) | The Proponent provided a Project update, an overview of the company and discussed the intended use of the NAR, employment numbers and permitting/construction schedule. The Proponent also discussed 2016 exploration and upcoming 2017 exploration, provide update on YESAB application. This is an opportunity for Dawson Deputy Mayor and Council to present views on the above noted topics. Views presented included, but were not limited to the following topics:<br>• Investment in local employment opportunities and infrastructure<br>• NAR management<br>• Letter of support City of Dawson offers to write | Further details found in Appendix 3-B (3B-245 and 3B-249).<br>Answers to inquiries from Mayor and Council were provided by the Proponent during the meeting. No inquiries from attendees in this meeting required additional follow-up. Comments and inquiries were documented. Contact information for the Proponent was provided in the case that attendees wished to follow up with the Proponent. |
| **March 6, 2017:** Meeting confirmed (3B-250) | March 14, 2017 | 4 days to prepare views based on meeting topic communicated at time of meeting confirmation | **Dawson District Renewable Resource Council Meeting** (location: Dawson) | The Proponent and the DDRRC met to discuss a Project update. This is an opportunity for the DDRRC to present views on the Project. Views presented included, but were not limited to the following topics:<br>• NAR management and potential effects on wildlife<br>• Reclamation and closure<br>• Moose surveys | Further details can be found in Appendix 3-B (3B-251)<br>The Proponent responds to inquiries and comments from the DDRRC during the meeting. Follow up items include scheduling a meeting to discuss moose surveys with YG. |

Consultation events in Dawson were key opportunities for community members to learn about the Project and raise questions and interests with the Proponent and their technical consultants, and were integral to Goldcorp's consultation and engagement program. The themed approach to consultation events provided the community with the ability to attend consultation events that best aligned with individual interests. Goldcorp heard a number of interests and comments from the Dawson community during consultation events, all of which aligned closely with interests and comments heard in the potentially affected First Nations consultation and engagement program.

### 3.4.3 Consideration of Comments, Input, and Resulting Commitments

The Proponent's consultation with potentially affected communities and engagement with interested persons resulted in feedback and interests that have informed the baseline studies and effects assessments for the Project. The feedback received from potentially affected communities and interested persons was similar to, if not the same as, the feedback received through the potentially affected First Nations consultation and engagement program and the public engagement program, with the exception of the interest in Dawson housing availability and effects to community infrastructure and services. The Proponent discussed the issues of housing availability and the capacity of community infrastructure, such as recreational facilities, with the City of Dawson and Dawson community members. The resulting feedback of these discussions was incorporated into both **Appendix 18 A Socio-economic Baseline** and **Section 22.0 Community Infrastructure and Services Assessment** (and associated appendices). Details regarding concerns over the potential effects to housing are also summarized in this section.

The six key issues identified during consultation with potentially affected communities and engagement with interested persons, as well as Goldcorp's consideration of these concerns, are summarized below in **Table 3.4-2**. While consultation is not required with interested persons under YESAA, meetings with the Dawson District Renewable Resources Council (DDRRC) is considered consultation with residents of the potentially affected community, as all members of the DDRRC are considered residents of Dawson. Details of consultation events and feedback can be found in **Appendix 3-B**.

**Table 3.4-2 Summary of Key Issues Identified by Potentially Affected Communities Resulting Project Modifications and Mitigation Measures**

| Key Issue | Project Modifications / Mitigation Measures / Enhancements | See Project Proposal Section No. |
|---|---|---|
| **Jobs, Training, and Contract Opportunities**<br>The most frequently raised interests in the Project through the potentially affected community consultation and public engagement program are jobs, training, and contract opportunities associated with the Project at every consultation event. A key issue raised is ensuring that the Project maximizes employment benefits in Yukon.<br>Issues related to jobs, training, and opportunities have been identified during consultation events with local businesses in Dawson, meetings with Dawson Mayor and Council, and community meetings in Dawson. | Goldcorp has committed to hiring locally as much as possible, which is a current practice in place for Goldcorp's exploration program at the Coffee Property. Goldcorp will develop a Local Employment Strategy, in accordance with the Sustainability Excellence Management System (SEMS). With respect to jobs, training, and contract opportunities, Goldcorp has made the following commitments:<br>• Goldcorp will have employee pickup points in Dawson and Whitehorse.<br>• Goldcorp will have a workforce transition strategy for employees moving out of roles at the end of the Project or in the unlikely case of unplanned closure.<br>• Goldcorp will provide consideration for employment opportunities to qualified locals, including potentially affected First Nations residents with appropriate skills and qualifications.<br>• Goldcorp will partner with local education and training organizations and institutions to identify programs or courses necessary for Project employment.<br>• Career development opportunities will be available to encourage retention of employees and further develop the skills of the local labour force.<br>• Goldcorp will implement a Local Procurement Strategy through its direct contracts, as well as include requirements to contract and procure local goods and services in its primary contracts.<br>• Goldcorp will include local hiring clauses in all Project contracts.<br>Goldcorp will implement a Community Feedback Protocol to respond to questions and concerns regarding Project contracting and procurement opportunities. | **Section 20.0 Economic Conditions Assessment**<br>**Appendix 20-A Economic Conditions Valued Component Assessment** |

| Key Issue | Project Modifications / Mitigation Measures / Enhancements | See Project Proposal Section No. |
|---|---|---|
| **Temporary Closure**<br>As a result of Yukon's recent and distant history with temporary closure of mining projects, often evolving into permanent closure, nearly every consultation event has included a discussion of how the Proponent intends to address temporary closure of the Project.<br>Identified during community meetings in Dawson. | Procedures and plans for temporary closure are described in **Section 2.9 Seasonal or Temporary Closure of the Project Proposal** and the **Conceptual Reclamation and Closure Plan** (**Appendix 31-C**). In the case of temporary closure, Goldcorp will establish the physical and chemical stability and safety of all infrastructure, and will work to mitigate potential environmental effects that may occur during this period. Goldcorp will comply with all regulatory and licensing requirements.<br>Prior to and during a Temporary Closure, Goldcorp will implement a Workforce Transition Strategy, which includes the following commitments:<br>• Goldcorp will endeavour to use a staged reduction of workforce in the event of a temporary or permanent closure.<br>• Goldcorp will fulfill all conditions for terminations as defined in contracts, including severance payments. In addition, Goldcorp will offer an Employee Assistance Program to support employees during transition in the event of a temporary or permanent closure.<br>• Goldcorp will communicate the proposed schedule and activities associated with temporary or permanent closure of the mine to employees, potentially affected and local communities, governments and businesses, and appropriate local non-profit and non-governmental organizations, allowing those engaged in indirect and induced employment and businesses to prepare for the transition, and begin to seek other opportunities<br>• Goldcorp will offer on the job training to employees, which will support them in future career transition.<br>Goldcorp will identify and provide a local workforce transition contact to respond to questions and concerns regarding temporary or permanent closure status, schedule, and activities. | **Section 20.0 Economic Conditions Assessment**<br>**Appendix 31-C Conceptual Reclamation and Closure Plan**<br>**Section 2.8 Seasonal or Temporary Closure** |

| Key Issue | Project Modifications / Mitigation Measures / Enhancements | See Project Proposal Section No. |
|---|---|---|
| **Wildlife**<br>Goldcorp has consistently heard issues regarding wildlife, including those related to the potential effect of increased hunting access with the NAR. Issues regarding potential effects to wildlife movement in the Project area and NAR area have also been frequently identified at consultation events.<br>Wildlife issues have been identified during community meetings in Dawson and meetings with the Dawson District Renewable Resources Council. | Goldcorp will commit to the following measures to mitigate effects to wildlife, particularly around increased access and harvesting activities with respect to the NAR:<br>• The NAR route was selected to minimize effects to caribou (see Section 2.10 Project Alternatives and Chosen Approach).<br>• Goldcorp will control access to barge landings and ice roads to the extent permitted by Yukon law; non-Goldcorp related traffic will not be able to access the NAR south of the Stewart River.<br>• Goldcorp will implement a no hunting and fishing policy at site for all Project employees.<br>• Wildlife will have the right-of–way along all Project roads, including the NAR.<br>• Goldcorp will implement strict speed protocols and signage for Project vehicles to reduce potential effects to wildlife and increase safety along the NAR.<br>• During the Fortymile Caribou spring and fall migration seasons, a phased approach to mitigation will be followed where NAR traffic will be managed in accordance with presence of collared caribou or the observation of large groups of caribou. If necessary and possible, temporary road closures and traffic management measures will be implemented to avoid disturbing caribou.<br>• No significant residual effects are predicted for wildlife species as a result of the Project. Wildlife monitoring during the construction, operation, and reclamation and closure phases of the Project will be conducted as described in the Wildlife Protection Plan (**Appendix 31-F**). | **Section 21 Project Alternatives and Chosen Approach**<br>**Appendix 16-B Wildlife and Wildlife Habitat Valued Component Assessment**<br>**Appendix 31-F Wildlife Protection Plan** |
| **Access Route**<br>The proposed NAR is a frequent topic at consultation events. Specific issues identified include increased traffic, opening land to year-round access, disturbance to wildlife, and theft along the NAR.<br>Access road issues have been identified during community meetings in Dawson, meetings with Dawson Mayor and Council, and meetings with the Dawson District Renewable Resources Council. | Goldcorp understands that the NAR, from its junction with Northern Klondike Highway to the Stewart River, will be shared with multiple user groups, including placer miners, potentially affected First Nations, and recreational users. Improvements of this section of the NAR will improve access for other users. Goldcorp will control access to all barge ramps and ice roads to the extent permitted by Yukon law; thus, current access levels are expected to be maintained south of the Stewart River crossing. Goldcorp is committed to ongoing dialogue with road users.<br>Potential effects of the NAR on wildlife are address through the measures described above. | **Appendix 14-A Land and Resource Use Valued Component Assessment**<br>**Appendix 31-A Access Route Construction Management Plan**<br>**Appendix 31-B Access Route Operational Management Plan**<br>**Appendix 31-F Wildlife Protection Plan** |

| Key Issue | Project Modifications / Mitigation Measures / Enhancements | See Project Proposal Section No. |
|---|---|---|
| **Heap Leach and Cyanide**<br>The Proponent exerted a focused effort on communicating the details around the heap leach pad design and use and transportation of cyanide. This increased information sharing has resulted in alleviating priority issues; however, it remains important to ensure that heap leach design and cyanide use and transport are carefully considered, planned for, and managed. Some specific concerns heard during consultation events are:<br>• Transportation of cyanide on barge crossings<br>• Heap leach liner system failures<br>• Worker exposure to cyanide<br>• Wildlife exposures to cyanide.<br>Goldcorp continues to discuss topics related to heap leach and cyanide in consultation with potentially affected communities and the public.<br><br>Issues related to heap leach and cyanide have been identified during community meetings in Dawson, meetings with Dawson Mayor and Council, and meetings with the Dawson Renewable Resource Council. | Goldcorp will engage in dialogue with stakeholders by describing cyanide use and management procedures, and provide information on the health and environmental effects of cyanide.<br>The Project will adhere to the International Cyanide Code, which includes undertaking community engagement and compliance audits.<br>In accordance with the *Transportation of Dangerous Goods Act* and regulations, the driver of a truck carrying sodium cyanide will have an Emergency Response Assistance Plan to implement for immediate response. The Emergency Response Assistance Plan will be provided to Goldcorp and will be reviewed by the Occupational Health and Safety and Environment departments.<br>To effectively address concerns regarding the heap leach design and cyanide, the Proponent ensured that consultants working on the heap leach design and cyanide management have been present at multiple consultation events.<br>As a result of feedback obtained through consultation, the Proponent amended the heap leach pad design from a valley-fill design to a free draining, ridge-top design in response to concerns regarding internal cyanide solution storage within the heap leach pad.<br>In addition, Goldcorp has also committed to the additional following mitigations:<br>• Progressive closure and rinsing of the heap leach pad<br>• Buried drip emitters<br>• Using a double liner system, including an linear low density polyethylene liner as well as a geosynthetic clay liner for underneath the heap leach pad, as well as a wick drain system for leak detection<br>• Performing an electromagnetic scan after placing overliner on top of the heap leach pad liner system to detect leaks as a result of overliner placement<br>• Fencing the Heap Leach Facility. | **Section 2.0 Project Description**<br>**Section 28.0 Accidents and Malfunctions**<br>**Appendix 31-C Conceptual Reclamation and Closure Plan** |

| Key Issue | Project Modifications / Mitigation Measures / Enhancements | See Project Proposal Section No. |
|---|---|---|
| **Water Quality/Fisheries**<br>Issues related to water quality and potential effects to fish are a consistent topic at consultation events, since the Project drainages directly route to the Yukon River.<br>Water quality and fisheries issues have been identified during community meetings in Dawson, meetings with Dawson Mayor and Council, and meetings with the Dawson City Renewable Resource Council. | Goldcorp has implemented several measures into the Project design that will reduce the potential for the Project to adversely affect downstream surface water quality and resulting fish and fish habitat. The Heap Leach Facility is located on a ridgetop in an area above watercourses, waste rock storage will be centralized, and water management infrastructure is proposed to minimize and control water that is influenced by the Mine Site.<br>Goldcorp will be including additional water quality sampling locations in Coffee Creek as a result of feedback from potentially affected First Nations; this also applies to the interests of potentially affected communities and the public. Upgrades that Goldcorp will be performing on the existing portions of the NAR will improve drainage, sedimentation control, and crossing structures to improve water quality and fish habitat. | **Section 2,10 Project Alternatives and Chosen Approach**<br>**Section 14.0 Fish and Fish Habitat Valued Component Assessment**<br>**Appendix 14-B Fish and Fish Habitat Valued Component Assessment** |

The most frequently raised issue during consultation with potentially affected communities to date is related to local hiring and local contract sourcing. Dawson community members, the City of Dawson Mayor and Council, and Dawson-based organizations commented that Dawson-based hiring and contracting were a top priority for them. Goldcorp has committed to hiring locally where possible for the Project, which includes working with appropriate organizations to prepare local businesses to be able to bid competitively on Project related work. Goldcorp has specifically heard comments from the Dawson community about locally sourcing groceries for the Project in Dawson. Goldcorp has committed to sourcing groceries locally as much as possible, and currently contracts to Chief Isaac Incorporated for camp catering and fuel for the Coffee exploration program.

Questions and comments regarding the NAR were raised at nearly every public consultation event. Comments regarding NAR-related increases in access and hunting were heard from all Dawson-based parties. Specific interests in the NAR differed amongst parties consulted; some residents of Dawson raised concerns regarding effects to wildlife as a result of the NAR, and some residents of Dawson with interests, such as a placer claim, along the NAR raised comments regarding increased access leading to increased theft along the NAR. Specific comments regarding the depth of the Stewart River and the ability to barge across it were raised in Dawson community meetings and during Dawson District Renewable Resource Council meetings. Goldcorp has sought individual consultation with trapping concession holders as they hold specific interests and feedback related to the Project, particularly related to the NAR, and details on this can be found in section **3.5 Public Engagement** as well as in **Appendix 3-C**.

Goldcorp has designed the NAR considering the comments raised by members of potentially affected communities regarding the potential effects of traffic on wildlife, local residents' knowledge of locations of mineral licks, issues related to caribou migration through the area, and existing road stakeholder interactions. Goldcorp will work to manage and address concerns regarding access and potential effects of increased access to the area.

As discussed earlier in this section, housing in Dawson is also a topic of interest for residents in the area. Generally, the community of Dawson recognizes that housing in Dawson has been an issue for many years, and there are various community initiatives underway to address this issue. Dawson is generally supportive of Goldcorp employees relocating to and becoming part of the community, noting that permanent residents with steady, year-round income have a positive effect on the general economy of community. Dawson Mayor and Council noted the need for investment in community infrastructure such as recreational facilities, and Goldcorp has proposed the Community Investment Protocol as an avenue to assist in addressing these interests. Goldcorp continues to engage with the Dawson community and Dawson Mayor and Council on the Project.


**Figure 3.4-1 Dawson Community Meeting – February 2016**

## 3.5 PUBLIC ENGAGEMENT PROGRAM

### 3.5.1 PROGRAM OVERVIEW

Engagement with the public has included various levels of effort and frequency based on the interests, potential for interaction with the Project, and locations of individuals and public parties. For example, consultation with stakeholders along the NAR occurs during the summer months due to the current seasonal access to the road network from Hunker to Maisy May out of the Dawson area. Consultation with trapping concession holders has been more direct and frequent and has focused on effects to wildlife and land and resource use, whereas consultation undertaken with the Whitehorse community has been to provide general information and Project schedule updates. In general, where there was an interest to meet with an individual or with a public party, the Proponent has been pleased to meet and provide information about the Project. Specific feedback from select public parties was sought to support the Socio-economic Baseline (**Appendix 18-A)** and effects assessments (**Section 19.0 Demographic Analysis through Section 25.0 Community Health and Well-being Assessment**). Engagement with the public is ongoing, and engagement with specific parties such as the Dawson City Chamber of Commerce is planned for the near future.

### 3.5.2 CONSULTATION UNDERTAKEN TO DATE

The following is a list of all parties who have received notifications and information about the Project to date:

- Chief Isaac Group
- City of Whitehorse
- Dawson Ambulance
- Dawson City Chamber of Commerce
- Dawson Fire Department
- Dawson City Community Health Centre and Hospital
- Dawson City Royal Canadian Mounted Police
- Dawson Yukon Wildland Fire Management
- Klondike Visitors Association
- Klondike Placer Miners Association
- Local Businesses Stakeholders
- Road Stakeholders (including but not limited to placer claim, quartz claim, land tenure, and water licence holders within 1 km of the NAR)
- Trapping Concession #115
- Trapping Concession #54

- Trapping Concession #57
- Trapping Concession #58
- Trapping Concession #62
- Yukon Conservation Society
- Yukon Energy (Henderson, Wind Energy Location)
- Yukon Fish and Game Association
- Yukon Outfitters Association
- Yukon Quest
- Yukon River Quest
- Yukon Trapping Association
- Yukon Ultra
- Other interested parties.

Public consultation events included open houses, community meetings, and individual or small group meetings with members of the community or community organizations that may be significantly affected by the Project. Public consultation efforts have been focused in Dawson based on its close proximity to the Project, the location of the NAR, and associated potential level of effects the Project might have on Dawson. Goldcorp also held consultation events with Whitehorse-based parties, including open houses and presentations in Whitehorse.

Meetings with individuals and small groups were scheduled in advance and in coordination with the party to be consulted, and included focused discussions about the Project in relation to the parties' specific interests, as well as general discussion about the Project. Goldcorp provided Project information packages at these consultation events, which included information specific to parties' interests; for example, trapping concession holders received maps of the Project and NAR in relation to trapping concession locations, in addition to general Project information. The Proponent held focus groups and key informant interviews as part of the socio-economic baseline and effects assessment, and held consultation meetings with these parties. Information on consultation events is summarized in **Table 3.5-1**.

**Table 3.5-1 Summary of Public Engagement**

| Notification/Communication | Date of Related Meeting or Event | Description of Meeting or Event | Purpose |
|---|---|---|---|
| | February 11, 2016 | **Dawson City Chamber of Commerce Meeting** (location: Dawson City) | Provide an overview of the Project and conduct a key informant interview to support the Socio-economic Baseline and Effects Assessment. |
| | March 21, 2016 | **Dawson First Responders Focus Group** (location: Dawson City) | Provide an overview of the Project and receive feedback and input on the Proponent's Emergency Response Plan. |
| | April 13, 2016 | **Yukon Quest Board of Directors Meeting** (location: Whitehorse) | Discuss the Project and Yukon Quest route scheduling and alternative related to the NAR. |
| **April 4, 2016:** Coordinated meeting | April 20, 2016 | **Yukon Conservation Society (YCS) Meeting** (location: Whitehorse) | Provide an overview of the Project and discuss topics of interest to the YCS. |
| **April 1, 2016:** Coordinated media advertising (news, radio) | April 20, 2016 | **Whitehorse Open House and Presentation** (location: Whitehorse) | Provide an overview of the Project. |
| | February 10, 2016 | **Trapline Stakeholder #115 Meeting** (location: Dawson) | Provide an overview of the Project and develop an understanding of non-traditional and traditional land and resource use. |
| | February 11, 2016 | **Trapline Stakeholder #58 Meeting** (location: Dawson) | Provide an overview of the Project and develop an understanding of non-traditional and traditional land and resource use. |
| | February 11, 2016 | **Dawson City Chamber of Commerce Meeting** (location: Dawson City) | Provide an overview of the Project and conduct a key informant interview to support for the Socio-economic Baseline and Effects Assessment. |
| | February 29, 2016 | **Trapline Stakeholder #54 Meeting** (location: Dawson) | Provide an overview of the Project and develop an understanding of the traditional economy and traditional land and resource use. |
| | March 21, 2016 | **Dawson First Responders Focus Group** (location: Dawson City) | Provide an overview of the Project and receive feedback and input on The Proponent's Emergency Response Plan. |
| | April 13, 2016 | **Yukon Quest Board of Directors Meeting** (location: Whitehorse) | Discuss the Project and Yukon Quest route scheduling and alternative related to the NAR. |
| **April 1, 2016:** Coordinated media advertising (news, radio) | April 20, 2016 | **Whitehorse Open House and Presentation** (location: Whitehorse) | Provide an overview of the Project. |

| Notification/Communication | Date of Related Meeting or Event | Description of Meeting or Event | Purpose |
|---|---|---|---|
| **April 4, 2016:** Coordinated meeting | April 20, 2016 | **Yukon Conservation Society (YCS) Meeting** (location: Whitehorse) | Provide an overview of the Project and discuss topics of interest to the YCS. |
| | April 28, 2016 | **Trapline Stakeholder #62 Meeting** (location: Dawson) | Provide maps and a brief overview of the Project. |
| | May 22, 2016 | **Trapline Stakeholder #62 Meeting** (location: trapline) | Provide a Project overview to Trapline Concession Holder. The Proponent travelled to the trapline location to meet with the stakeholders, and reviewed maps of the road route and the Project. |
| | September 2, 2016 | **Klondike Placer Miners' Association (KPMA) Annual General Meeting** (location: Dawson) | Introduce Goldcorp to the KPMA and iterate the commitment to work collaboratively with placer miners on the NAR. |
| | September 19, 2016 | **KPMA Meeting** (location: teleconference) | Discuss road management for the NAR, road users group. |
| | October 27, 2016 | **Trapline Stakeholder #115 Meeting** (location: Dawson) | Introduce Goldcorp, discuss Project, and concerns, as well as NAR management. |
| | November 9, 2016 | **Yukon Quest Board of Directors Meeting** (location: Whitehorse) | Introduce Goldcorp and provide a Project overview. |
| | November 9, 2016 | **Klondike Placer Miner's Association Meeting** (location: Whitehorse) | Discuss NAR management. |
| | November 10, 2016 | **Yukon Conservation Society Meeting** (location: Whitehorse) | Introduce Goldcorp and provide a Project overview. |
| **November 7, 2016:** Advertising sent | November 18, 2016 | **Whitehorse Open House** (location: Whitehorse) | Introduce Goldcorp and provide a Project overview. |
| **February 7, 2017:** Advertising sent | February 16, 2017 | **Whitehorse Open House** (location: Whitehorse) | Provide a Project update. |
| | March 13, 2017 | **Dawson Chamber of Commerce** (location: Dawson) | Provide a Project update |

### 3.5.3 CONSIDERATION OF COMMENTS, INPUT, AND RESULTING COMMITMENTS

Feedback received through Goldcorp's focused public engagement program has identified a number of issues and topics of interest to the public. While the priority issues vary between public groups, Goldcorp has been able to identify key issues through the public engagement program, all of which directly align with the key issues and interests of various other parties, including potentially affected First Nations. The six key issues identified during consultation with potentially affected communities and engagement with interested persons and the public, as well as Goldcorp's consideration of these concerns, are summarized below in **Table 3.5-2**. Details of consultation events can be found in **Appendix 3-C**.

**Table 3.5-2 Summary of Key Issues Identified by the Public and Resulting Project Modifications and Mitigation Measures**

| Key Issue | Project Modifications / Mitigation Measures / Enhancements | See Project Proposal Section No. |
|---|---|---|
| **Jobs, Training, and Contract Opportunities**<br>The most frequently raised interests in the Project through the potentially affected community consultation and public engagement program are jobs, training, and contract opportunities associated with the Project at every consultation event. A key issue raised is ensuring that the Project maximizes employment benefits in Yukon.<br>Issues related to jobs, training, and opportunities have been identified during consultation events with Local Business Stakeholders, and community meetings in Whitehorse. | Goldcorp has committed to hiring locally as much as possible, which is a current practice in place for Goldcorp's exploration program at the Coffee Property. Goldcorp will develop a Local Employment Strategy, in accordance with the Sustainability Excellence Management System (SEMS). With respect to jobs, training, and contract opportunities, Goldcorp has made the following commitments:<br>• Goldcorp will have employee pickup points in Dawson and Whitehorse.<br>• Goldcorp will have a workforce transition strategy for employees moving out of roles at the end of the Project or in the unlikely case of unplanned closure.<br>• Goldcorp will provide consideration for employment opportunities to qualified locals, including potentially affected First Nations residents with appropriate skills and qualifications.<br>• Goldcorp will partner with local education and training organizations and institutions to identify programs or courses necessary for Project employment.<br>• Career development opportunities will be available to encourage retention of employees and further develop the skills of the local labour force.<br>• Goldcorp will implement a Local Procurement Strategy through its direct contracts, as well as include requirements to contract and procure local goods and services in its primary contracts.<br>• Goldcorp will include local hiring clauses in all Project contracts.<br>Goldcorp will implement a Community Feedback Protocol to respond to questions and concerns regarding Project contracting and procurement opportunities. | **Section 20.0 Economic Conditions Assessment**<br>**Appendix 20-A Economic Conditions Valued Component Assessment** |

| Key Issue | Project Modifications / Mitigation Measures / Enhancements | See Project Proposal Section No. |
|---|---|---|
| **Temporary Closure**<br>As a result of Yukon's recent and distant history with temporary closure of mining projects, often evolving into permanent closure, nearly every consultation event has included a discussion of how the Proponent intends to address temporary closure of the Project.<br>Identified during community meetings in Whitehorse. | Procedures and plans for temporary closure are described in **Section 2.9 Seasonal or Temporary Closure of the Project Proposal** and the **Conceptual Reclamation and Closure Plan** (**Appendix 31-C**). In the case of temporary closure, Goldcorp will establish the physical and chemical stability and safety of all infrastructure, and will work to mitigate potential environmental effects that may occur during this period. Goldcorp will comply with all regulatory and licensing requirements.<br>Prior to and during a Temporary Closure, Goldcorp will implement a Workforce Transition Strategy, which includes the following commitments:<br>• Goldcorp will endeavour to use a staged reduction of workforce in the event of a temporary or permanent closure.<br>• Goldcorp will fulfill all conditions for terminations as defined in contracts, including severance payments. In addition, Goldcorp will offer an Employee Assistance Program to support employees during transition in the event of a temporary or permanent closure.<br>• Goldcorp will communicate the proposed schedule and activities associated with temporary or permanent closure of the mine to employees, potentially affected and local communities, governments and businesses, and appropriate local non-profit and non-governmental organizations, allowing those engaged in indirect and induced employment and businesses to prepare for the transition, and begin to seek other opportunities<br>• Goldcorp will offer on the job training to employees, which will support them in future career transition.<br>Goldcorp will identify and provide a local workforce transition contact to respond to questions and concerns regarding temporary or permanent closure status, schedule, and activities. | **Section 20.0 Economic Conditions Assessment**<br>**Appendix 31-C Conceptual Reclamation and Closure Plan**<br>**Section 2.8 Seasonal or Temporary Closure** |

| Key Issue | Project Modifications / Mitigation Measures / Enhancements | See Project Proposal Section No. |
|---|---|---|
| **Wildlife**<br>Goldcorp has consistently heard issues regarding wildlife, including those related to the potential effect of increased hunting access with the NAR. Issues regarding potential effects to wildlife movement in the Project area and NAR area have also been frequently identified at consultation events.<br>Wildlife issues have been identified during meetings with the Yukon Fish and Wildlife Management Board (YFWMB) and Yukon Salmon Sub Committee (YSSC), in meetings with Trapping Concession Holders, a meeting with the Yukon Conservation Society. | Goldcorp will commit to the following measures to mitigate effects to wildlife, particularly around increased access and harvesting activities with respect to the NAR:<br>• The NAR route was selected to minimize effects to caribou (see Section 2.10 Project Alternatives and Chosen Approach).<br>• Goldcorp will control access to barge landings and ice roads to the extent permitted by Yukon law; non-Goldcorp related traffic will not be able to access the NAR south of the Stewart River.<br>• Goldcorp will implement a no hunting and fishing policy at site for all Project employees.<br>• Wildlife will have the right-of–way along all Project roads, including the NAR.<br>• Goldcorp will implement strict speed protocols and signage for Project vehicles to reduce potential effects to wildlife and increase safety along the NAR.<br>• During the Fortymile Caribou spring and fall migration seasons, a phased approach to mitigation will be followed where NAR traffic will be managed in accordance with presence of collared caribou or the observation of large groups of caribou. If necessary and possible, temporary road closures and traffic management measures will be implemented to avoid disturbing caribou.<br>• No significant residual effects are predicted for wildlife species as a result of the Project. Wildlife monitoring during the construction, operation, and reclamation and closure phases of the Project will be conducted as described in the Wildlife Protection Plan (Appendix **31-F**). | **Section 210 Project Alternatives and Chosen Approach**<br>**Appendix 16-B Wildlife and Wildlife Habitat Valued Component Assessment**<br>**Appendix 31-F Wildlife Protection Plan** |

| Key Issue | Project Modifications / Mitigation Measures / Enhancements | See Project Proposal Section No. |
|---|---|---|
| **Access Route**<br>The proposed NAR is a frequent topic at consultation events. Specific issues identified include increased traffic, opening land to year-round access, disturbance to wildlife, and theft along the NAR.<br>Access road issues have been identified during meetings with the Yukon Fish and Wildlife Management Board (YFWMB) and Yukon Salmon Sub-committee (YSSC), the KPMA, individual and group meetings with Trapping Concession Holders, Road Stakeholders, Yukon Quest, and the Dawson First Responders Focus Group. | Goldcorp understands that the NAR, from its junction with Northern Klondike Highway to the Stewart River, will be shared with multiple user groups, including placer miners, potentially affected First Nations, and recreational users. Improvements of this section of the NAR will improve access for other users. Goldcorp will control access to all barge ramps and ice roads to the extent permitted by Yukon law; thus, current access levels are expected to be maintained south of the Stewart River crossing. Goldcorp is committed to ongoing dialogue with road users.<br>Potential effects of the NAR on wildlife are address through the measures described above. | **Appendix 14-A Land and Resource Use Valued Component Assessment**<br>**Appendix 31-A Access Route Construction Management Plan**<br>**Appendix 31-B Access Route Operational Management Plan**<br>**Appendix 31-F Wildlife Protection Plan** |

| Key Issue | Project Modifications / Mitigation Measures / Enhancements | See Project Proposal Section No. |
|---|---|---|
| **Heap Leach and Cyanide**<br>The Proponent exerted a focused effort on communicating the details around the heap leach pad design and use and transportation of cyanide. This increased information sharing has resulted in alleviating priority issues; however, it remains important to ensure that heap leach design and cyanide use and transport are carefully considered, planned for, and managed. Some specific concerns heard during consultation events are:<br>• Transportation of cyanide on barge crossings<br>• Heap leach liner system failures<br>• Worker exposure to cyanide<br>• Wildlife exposures to cyanide.<br>Goldcorp continues to discuss topics related to heap leach and cyanide in consultation with potentially affected communities and the public.<br><br>Interests related to heap leach and cyanide have been identified during community meetings in Whitehorse, a meeting with the Yukon Quest, and a meeting with the Yukon Conservation Society. | Goldcorp will engage in dialogue with stakeholders by describing cyanide use and management procedures, and provide information on the health and environmental effects of cyanide.<br>The Project will adhere to the International Cyanide Code, which includes undertaking community engagement and compliance audits.<br>In accordance with the *Transportation of Dangerous Goods Act* and regulations, the driver of a truck carrying sodium cyanide will have an Emergency Response Assistance Plan to implement for immediate response. The Emergency Response Assistance Plan will be provided to Goldcorp and will be reviewed by the Occupational Health and Safety and Environment departments.<br>To effectively address concerns regarding the heap leach design and cyanide, the Proponent ensured that consultants working on the heap leach design and cyanide management have been present at multiple consultation events.<br>As a result of feedback obtained through consultation, the Proponent amended the heap leach pad design from a valley-fill design to a free draining, ridge-top design in response to concerns regarding internal cyanide solution storage within the heap leach pad.<br>In addition, Goldcorp has also committed to the additional following mitigations:<br>• Progressive closure and rinsing of the heap leach pad<br>• Buried drip emitters<br>• Using a double liner system, including an linear low density polyethylene liner as well as a geosynthetic clay liner for underneath the heap leach pad, as well as a wick drain system for leak detection<br>• Performing an electromagnetic scan after placing overliner on top of the heap leach pad liner system to detect leaks as a result of overliner placement<br>• Fencing the Heap Leach Facility. | **Section 2.0 Project Description**<br>**Section 28.0 Accidents and Malfunctions**<br>**Appendix 31-C Conceptual Reclamation and Closure Plan** |

| Key Issue | Project Modifications / Mitigation Measures / Enhancements | See Project Proposal Section No. |
|---|---|---|
| **Water Quality/Fisheries**<br>Issues related to water quality and potential effects to fish are a consistent topic at consultation events, since the Project drainages directly route to the Yukon River.<br>Water quality and fisheries issues have been identified during community meetings in Whitehorse, and meetings with the Yukon Fish and Wildlife Management Board (YFWMB) and Yukon Salmon Sub Committee (YSSC). | Goldcorp has implemented several measures into the Project design that will reduce the potential for the Project to adversely affect downstream surface water quality and resulting fish and fish habitat. The Heap Leach Facility is located on a ridgetop in an area above watercourses, waste rock storage will be centralized, and water management infrastructure is proposed to minimize and control water that is influenced by the Mine Site.<br>Goldcorp will be including additional water quality sampling locations in Coffee Creek as a result of feedback from potentially affected First Nations; this also applies to the interests of potentially affected communities and the public. Upgrades that Goldcorp will be performing on the existing portions of the NAR will improve drainage, sedimentation control, and crossing structures to improve water quality and fish habitat. | **Section 2,10 Project Alternatives and Chosen Approach**<br>**Section 14.0 Fish and Fish Habitat Valued Component Assessment**<br>**Appendix 14-B Fish and Fish Habitat Valued Component Assessment** |

The most frequently raised issue during public engagement to date is related to local hiring and local contract sourcing. Whitehorse community members and Whitehorse and Dawson-based organizations commented that Yukon-based hiring and contracting were a top priority for them. Goldcorp has committed to hiring locally where possible for the Project, which includes working with appropriate organizations to prepare local businesses to be able to bid competitively on Project related work.

Questions and comments regarding the NAR were raised at nearly every public engagement event. Comments regarding NAR-related increases in access and hunting were heard from Whitehorse- and Dawson-based parties, including during a meeting with the Yukon Conservation Society. Specific interests in the NAR differed amongst parties consulted; trapping concession holders raised concerns regarding effects to wildlife as a result of the NAR, road stakeholders and first responders raised comments regarding increased access leading to increased theft along the NAR. The Proponent has consulted with each of the trapping concession holders within 1 km of the NAR individually, except the holder of trapping concession #116, who has not signed a release to be contacted. In late January 2017, Goldcorp was informed that the YG has changed its policy regarding release of contact information for trapping concession holders who have not signed a release. Goldcorp has recently acquired the contact information for the holder of trapping concession #116 and has informed the holder of the Project via letter. Goldcorp has sought individual consultation with trapping concession holders as they hold specific interests and feedback related to the Project, particularly related to the NAR.

Goldcorp has designed the NAR considering the comments raised by the public regarding the potential effects of traffic on wildlife, public knowledge of locations of mineral licks, issues related to caribou migration through the area, and existing road stakeholder interactions. Goldcorp will work to manage and address concerns regarding access and potential effects of increased access to the area.

Goldcorp has engaged in specific consultation with Yukon Quest, as the organization currently uses portions of the NAR for the iconic annual dogsled race. Goldcorp has committed to considering suspending truck traffic on the NAR during the Yukon Quest event and/or brushing a trail for the Yukon Quest to use that is parallel to the current route. Goldcorp has committed to further consultation with Yukon Quest, and participated in a field visit with Yukon Quest representatives in summer 2016. This field visit consisted of driving the proposed NAR to explore areas of overlap with the Yukon Quest route and discuss options for how to address interactions between the Yukon Quest route and the NAR.

## 3.6 Yukon Government and Federal Government Engagement Program

### 3.6.1 Program Overview

The Proponent has been engaging territorial and federal agencies since 2013, and established Regulators and Assessors Working Group in early 2016 to facilitate consistent engagement with territorial and federal agencies through the Project design period. The territorial and federal agencies contacted and engaged by the Proponent and their consultants are listed below:

**Government of Yukon**

- YG Community Services
- YG Executive Council Office (Development Assessment Branch (DAB))
- YG Education
- YG Energy, Mines and Resources)
- YG Environment
- YG Economic Development
- YG Health and Social Services
- YG Highways and Public Works (HPW)
- YG Tourism and Culture.

**Assessment and Regulatory Agencies**

- YESAB
- Yukon Water Board.

**Federal Government**

- Canadian Northern Economic Development Agency (CANNOR)
- Environment and Climate Change Canada
- Fisheries and Oceans Canada (DFO)
- Natural Resources Canada
- Transport Canada.

### 3.6.2 ENGAGEMENT UNDERTAKEN TO DATE

The Proponent's government agency engagement included regular meetings and discussions, teleconferences, as well as site visits. Informal working group meetings were well attended, and while invitations to participate in the informal working group meetings were sent to all Yukon departments and federal agencies (through DAB and CANNOR upon occasion), consistent attendance was seen from Yukon departments, DFO, Environment and Climate Change Canada, and Transport Canada. Meetings with regulators and assessors group followed a themed approach.

Meetings with individual government agencies and departments were in-person where possible, and held as teleconferences when meeting in person was not possible. Meetings with the informal regulators and assessors working group were held in Whitehorse at conference venues. Site tours were based out of Whitehorse and offered over multiple dates to accommodate the schedules of attendees as best as possible. Working group meetings and site tours were attended by the Proponent's technical consultants to aid in addressing specific questions and concerns raised by government agencies. Invitations for meetings and site tours with government agencies and departments were sent at least two weeks prior to the date of the meeting. Relevant meeting and site tour documentation was provided electronically in advance of the meeting, and hard copies of the documentation were available at the meeting or site tour. Meetings and site tours were documented with a combination of meeting minutes, photographs, and/or sign-in sheets. A selection of this material can be found in **Appendix 3-D**. A list of events undertaken to date can be found in **Table 3.6-1**.

Meetings with the informal regulators and assessors working group were scheduled in collaboration with the parties involved to maximize attendance. A preliminary schedule was set in January 2016, and was modified to adjust the timing of the meetings in both April 2016 and May 2016 to better accommodate the schedules of the government agencies attending the meetings, as well as to add a Heritage-themed meeting to the schedule. Meeting invitations were sent at least two weeks in advance. Presentations and supporting documents were distributed at least one day in advance of the meeting, and screen sharing and audio conferencing was arranged for each meeting so that those who could not attend the meeting in person could participate remotely. Meetings were documented in meeting minutes or sign-in sheets. Meeting minutes were provided to attendees within three weeks after the meeting for their records for distribution to colleagues as they saw fit.

**Table 3.6-1 Summary of Government Engagement**

| Notification/Communication | Date of Related Meeting or Event | Description of Meeting or Event | Purpose |
|---|---|---|---|
| | April 4, 2014 | **YG Meeting** (location: Whitehorse) | Meeting with YG Environment to discuss data on wildlife and data sharing between the Proponent and YG on wildlife. |
| | May 12, 2014 | **YG Meeting** (location: Whitehorse) | Meeting with YG Environment to discuss Ecological Land Classification Mapping. |
| | September 18, 2014 | **YG Meeting** (location: Whitehorse | Meeting with YG Environment to discuss the Forty Mile Caribou data and upcoming studies. |
| | October 23, 2014 | **Regulators and Assessors Yukon & Federal Agencies** (location: Whitehorse) | Meeting with multiple agencies to provide a Project overview and discuss the regulatory process. |
| | April 30, 2015 | **YG Meeting** (location: Whitehorse) | Meeting with YG Environment to discuss the NAR. |
| | May 14, 2015 | **YG Meeting** (location: Dawson) | Meeting with Energy, Mines and Resources to provide a Project overview. |
| | May 19, 2015 | **YESAB Meeting** (location: Whitehorse) | Meeting with YESAB to discuss the Project and the harmonized approach to the proposal. |
| | July 10, 2015 | **YG Meeting** (location: Whitehorse and Project site) | Site tour with YG Environment to discuss environmental baseline studies. |
| | July 17, 2015 | **YG Meeting** (location: Whitehorse) | Meeting with HPW to provide a Project overview. |
| | August 14, 2015 | **YG Meeting** (location: Whitehorse) | Meeting with YG Environment to review YG's baseline data recommendations. |
| **August 21, 2015:** Sent site tour information package | August 24, 2015 | **Site Tour (Yukon & Federal Agencies)** (location: Whitehorse and Project site) | Meeting to provide attendees with a tour of the Project site and provide a Project update. |
| | September 9, 2015 | **YG Meeting** (location: Whitehorse) | Meeting with YG Environment to review Forty Mile Caribou habitat modelling. |

| Notification/Communication | Date of Related Meeting or Event | Description of Meeting or Event | Purpose |
|---|---|---|---|
| **September 4, 2015:** Sent site tour information package | September 10, 2015 | **Site Tour (Yukon & Federal Agencies)** (location: Whitehorse and Project site) | Meeting to provide attendees with a tour of the Project site and provide a Project update. |
| **September 4, 2015:** Sent site tour information package | September 11, 2015 | **Site Tour (Yukon and Federal Agencies)** (location: Whitehorse and Project site) | Meeting to provide attendees with a tour of the Project site and provide a Project update. |
| **September 18, 2015:** Sent meeting invitation<br>**September 30, 2015:** Sends meeting agenda | September 30, 2015 | **YESAB Meeting** (location: Whitehorse) | Meeting with YESAB to review the Project and discuss candidate Valued Components, consultation record. |
| | October 1, 2016 | **YG Meeting** (location: Whitehorse) | Meeting with YG Environment to provide updates on Forty Mile Caribou habitat modelling, wildlife baseline studies. |
| **October 29, 2015:** Sent meeting invitation | November 10, 2015 | **YG Meeting** (location: Whitehorse) | Meeting with multiple departments to discuss the Project and present baseline studies of the site and the NAR. |
| **October 2, 2015:** Discussion of meeting date<br>**October 14, 2015:** Confirmation of meeting date | November 12, 2015 | **YESAB Meeting** (location: Whitehorse) | Meeting with YESAB to discuss the regulatory process. |
| | November 16, 2015 | **YG Meeting** (location: Whitehorse) | Meeting with HPW to discuss placer miner use of the NAR and YG's current maintenance responsibilities on the route. |
| **November 18, 2015:** Sent meeting invitation<br>**November 24, 2015:** Sent meeting agenda<br>**November 25, 2016:** Sent Project map, meeting Power Point, and supporting documentation (annotate framework) | November 25, 2015 | **Federal Regulators Meeting** (location: Whitehorse) | Meeting with multiple federal agencies to provide a Project overview and discuss the Project submission timeline. |
| | December 15, 2015 | YG Meeting (location: Whitehorse) | Meeting with Environment and Climate Change Canada to discuss the Project and wildlife baseline study findings. |
| **January 12, 2016:** Sent meeting invitation | January 20, 2016 | **YG Meeting** (location: Whitehorse) | Meeting with YG Community Services to discuss the Proponent's consultation with potentially affected First Nations to date. |

| Notification/Communication | Date of Related Meeting or Event | Description of Meeting or Event | Purpose |
|---|---|---|---|
| **January 13, 2016**: Sent meeting invitation to YG attendees<br>**January 18, 2016**: Sent meeting invitation to Federal attendees<br>**January 20, 2016**: Sent meeting agenda, Power Point | January 21, 2016 | **Regulators and Assessors Yukon and Federal Agencies**<br>(location: Whitehorse) | Meeting with YG to provide the results of the feasibility study. |
| **January 13, 2016**: Sent meeting invitation<br>**January 20, 2016**: Sent meeting agenda, Power Point | January 22, 2016 | **YESAB Meeting**<br>(location: Whitehorse) | Meeting with YESAB to provide the results of the feasibility study. |
| **January 27, 2016**: Sent meeting agenda, supporting documents | February 4, 2016 | **YESAB Meeting**<br>(location: Whitehorse) | Meeting with YESAB to review the candidate VCs for the socio-economic effects assessment, discuss the Proposal format. |
| **January 29, 2016**: Sent original meeting invitation<br>**February 8, 2016**: Sent draft meeting agenda, Power Point<br>**February 12, 2016**: Sent updated meeting agenda<br>**February 14, 2016**: Sent updated meeting Power Point | February 15, 2016 | **Regulators and Assessors Working Group (Yukon and Federal Agencies)**<br>(location: Whitehorse) | Meeting with multiple agencies to provide a detailed overview of the Heap Leach Facility. |
| **January 29, 2016**: Sent original meeting invitation<br>**February 18, 2016**: Sent updated meeting invitation<br>**February 19, 2016**: Sent working agenda<br>**February 28, 2016**: Sent meeting Power Point | March 4, 2016 | **Regulators and Assessors Working Group (Yukon and Federal Agencies)**<br>(location: Whitehorse) | Meeting with multiple agencies to provide a detailed overview of the Project's feasibility study and discuss water quality baseline studies. |
| **January 29, 2016**: Sent original meeting invitation<br>**March 17, 2016**: Sent updated meeting invitation<br>**March 21, 2016**: Sent meeting agenda, supporting documents<br>**April 20, 2016**: Sent meeting notes, Power Point included | March 24, 2016 | **Regulators and Assessors Working Group (Yukon and Federal Agencies)**<br>(location: Whitehorse) | Meeting with multiple agencies to review the socio-economic baseline study and effects assessment. |

| Notification/Communication | Date of Related Meeting or Event | Description of Meeting or Event | Purpose |
|---|---|---|---|
| | April 5, 2016 | **YG Meeting**<br>(location: Whitehorse) | Meeting with Yukon Health and Social Services to review the Health Impact Assessment. |
| | April 18, 2016 | **YG and TH Meeting**<br>(location: Whitehorse) | Meeting with YG Environment and TH to discuss key issues related to wildlife for the Project Mine Site and NAR. |
| **January 29, 2016**: Sent original meeting invitation<br>**April 11, 2016**: Sent working agenda<br>**April 16, 2016**: Sent updated meeting invitation<br>**April 18, 2016**: Sent meeting agenda, Power Point<br>**May 17, 2016**: Sent meeting notes, Power Point included | April 19, 2016 | **Regulators and Assessors Working Group (Yukon and Federal Agencies)**<br>(location: Whitehorse) | Meeting with multiple agencies to review the wildlife and fish baseline studies and effects assessments, as well as potential cumulative effects. |
| | April 21, 2016 | **YESAB Meeting**<br>(location: Whitehorse) | Meeting with YESAB to discuss candidate VCs. |
| | May 10, 2016 | **YESAB Meeting**<br>(location: Whitehorse) | Meeting with YESAB to discuss Traditional Land Use |
| **January 29, 2016**: Sent original meeting invitation<br>**May 3, 2016**: Sent updated meeting invitation and agenda<br>**May 10, 2016**: Sent meeting Power Point, supporting documents | May 11, 2016 | **Regulators and Assessors Working Group (Yukon and Federal Agencies)**<br>(location: Whitehorse) | Meeting with multiple agencies to review the NAR design in detail and to discuss fish and wildlife mitigations associated with it. |
| **January 29, 2016**: Sent original meeting invitation<br>**May 3, 2016**: Sent updated meeting invitation<br>**May 25, 2016**: Sent meeting agenda (no Power Point delivered at this meeting) | May 26, 2015 | **YG Meeting**<br>(location: Whitehorse) | Meeting with YG to discuss heritage as it relates to the Project and the Proponent's Heritage Protection Plan. |
| **January 29, 2016**: Sent original meeting invite<br>**April 25, 2016**: Sent updated meeting invitation<br>**June 7, 2016**: Sent meeting Power Point, agenda | June 8, 2016 | **Regulators and Assessors Working Group (Yukon and Federal Agencies)**<br>(location: Whitehorse) | Meeting with multiple agencies to review the reclamation and closure schedule, plans, and costs for the Project. |

| Notification/Communication | Date of Related Meeting or Event | Description of Meeting or Event | Purpose |
|---|---|---|---|
| **April 25, 2016**: Sent meeting invitation | June 9, 2016 | **Regulators and Assessors Working Group (Yukon and Federal Agencies)**<br>(location: Whitehorse) | Meeting with Yukon agencies to provide an opportunity to address outstanding questions from the reclamation and closure meeting on June 8, 2016.<br>Note: Yukon and Federal Regulators and Assessors invited, only Yukon agencies attended. |
| | September 14, 2016 | **YG Meeting**<br>(location: Whitehorse) | Meeting with DAB to introduce Goldcorp and discus a Project update. |
| | September 15, 2016 | **Yukon Water Board Meeting**<br>(location: Whitehorse) | Meeting to discuss water license submission plans. |
| | September 15, 2016 | **Federal Regulators Meeting**<br>(location: Whitehorse) | Meeting with CANNOR to introduce Goldcorp and provide a Project update. |
| | September 15, 2016 | **YESAB Meeting**<br>(location: Whitehorse) | Meeting to discuss road users group and how it relates to the YG Gateway project, Project Proposal engagement moving forward. |
| | November 9, 2016 | **YESAB Meeting**<br>(location: Whitehorse) | Meeting to provide a Project update, discuss upcoming meetings. |
| | November 10, 2016 | **YG Meeting**<br>(location: Whitehorse) | Meeting with DAB to provide a Project update, discuss road users group. |
| | November 22, 2016 | **Federal Regulators Meeting**<br>(location: Whitehorse) | Meeting with CANNOR to discuss consultation with potentially affected First Nations. |
| | November 23, 2016 | **YG Meeting**<br>(location: Whitehorse) | Meeting with YG Gateway Project Team to discuss NAR and management, road users group. |
| | January 19, 2017 | **YG Meeting**<br>(location: Dawson) | Meeting with conservation officer to discuss trapper cabin locations along NAR. |
| | January 23, 2017 | **Federal Regulators Meeting**<br>(location: Vancouver) | Meeting with CANNOR to discuss a Project update. |
| | February 3, 2017 | **YG Meeting**<br>(location: Dawson) | Meeting with DAB to provide update on Project Proposal submission date and Project update. |
| | February 8, 2017 | **YG Meeting**<br>(location: teleconference) | Meeting to discuss NAR management. |

| Notification/Communication | Date of Related Meeting or Event | Description of Meeting or Event | Purpose |
|---|---|---|---|
| | February 9, 2017 | **YESAB Meeting** (location: teleconference) | Meeting to provide update on Project Proposal submission date and Project update. |
| | March 2, 2017 | **Regulators and Assessors Working Group (Yukon & Federal Agencies)** (location: Whitehorse) | Meeting to provide an overview of the Project Proposal and Project update, as well as an update on consultation. |
| | March 10 | **DAB, YG Department of Tourism & Culture** | To discuss the Heritage Resources research conducted along the NAR |

Questions and comments raised during engagement with government agencies were addressed as thoroughly as possible during the meeting. Goldcorp carefully tracked action items, concerns, and outstanding questions, and addressed these in follow up emails, phone calls, and subsequent meetings.

Issues raised by Yukon departments were often related to the NAR, wildlife, and socio-economic effects of the Project. The Proponent and its team of technical consultants have been working closely with YG Environment to address wildlife-related topics and concerns. The NAR is a topic of interest to most Yukon departments due to the inter-connected nature of the issues raised regarding the route, particularly regarding increased access. There has also been a detailed discussion with Yukon and Federal agencies regarding management of the NAR. Federal agencies also raised questions and concerns about the NAR. In addition, DFO raised specific questions with respect to fish baseline studies and future monitoring programs, which were addressed during meetings.

### 3.6.3 Consideration of Comments, Input, and Resulting Commitments

Engagement events with government agencies were generally well attended and were key opportunities for government agencies to discuss the Project and raise questions and concerns with Goldcorp. Feedback from government agencies influenced the Project design, mitigation efforts, and baseline studies where possible. Details of engagement with government agencies can be found in **Appendix 3-D Government Agency Engagement Records and Materials**. Government agencies raised many topics and issues during engagement events, six of which have been identified as key topics. These are summarized in **Table 3.6-2**.

**Table 3.6-2 Summary of Key Issues Identified by Government Agencies and Resulting Project Modifications and Mitigation Measures**

| Key Issue | Project Modifications / Mitigation Measures / Enhancements | See Project Proposal Section No. |
|---|---|---|
| **Wildlife**<br>Issues regarding wildlife interacting with the Project Mine Site and with the NAR have been consistently raised at engagement events with government agencies. | The Proponent have been working closely with YG Environment to mitigate effects to wildlife. This includes collaborating on baseline studies, determining the NAR alignment that will minimize effects to wildlife, and creating mitigation measures that will minimize effects to wildlife, such as Goldcorp's commitment to alter timing of mine-related traffic during Sharptailed Grouse lekking seasons. | **Section 2.10 Project Alternatives and Chosen Approach**<br>**Appendix 16-B Wildlife and Wildlife Habitat Valued Component Assessment**<br>**Appendix 31-F Wildlife Protection Plan** |
| **Access Route**<br>The proposed NAR is a topic consistently raised at engagement events. Interests in the NAR are broad, ranging from maintenance responsibilities to effects to fish and wildlife and access control. | The Proponent held a specific Road and Transportation Meeting with the informal regulators and assessors working group, and Goldcorp is discussing the details of NAR management with YG. The wildlife mitigation measures along the NAR have been developed as a result of ongoing discussion with YG Environment. As stated above, the alignment of the NAR has also been designed in part as a result of discussions with YG. Access control on the NAR is an ongoing discussion with YG. | **Appendix 24-A Land and Resource Use Valued Component Assessment**<br>**Appendix 31-A Access Route Construction Management Plan**<br>**Appendix 31-B Access Route Operational Management Plan**<br>**Appendix 31-F Wildlife Protection Plan** |
| **Jobs, Employment, Contracting**<br>Given the high interest of this topic during consultation with potentially affected First Nations and the public, there is a common interest in jobs, employment, and contracting during multiple engagement events with government agencies. | Goldcorp's commitment to hiring locally where possible has been a topic of discussion at multiple meetings with the informal regulators and assessors working group. Goldcorp's commitments to local hiring and contracting have been well received by YG, and Goldcorp has received positive feedback for training initiatives that are currently implemented. | **Section 20.0 Economic Conditions Assessment**<br>**Appendix 20-A Economic Conditions Valued Component Assessment** |
| **Emergency Response**<br>Emergency response has been a topic of interest during multiple engagement events with government agencies, specifically related to spill response and emergency response along the NAR. There has also been interest in the level of medical treatment available at site. | The Proponent addressed these issues during the meetings in a number of ways including committing to working with Dawson's first responders on the Project's emergency response plan and ensuring all Project-related traffic vehicles will have spill response kits. The Proponent also created a road monitor role, which will aid in reporting and addressing spills on the access road that are not related to Project traffic. With respect to the level of medical treatment available at site, this has been flagged as a topic of further discussion when Goldcorp has more detail on this topic. | **Appendix 22-A Community Infrastructure and Services Valued Component Assessment**<br>**Appendix 25-A Community Health and Wellbeing Valued Component Assessment** |

| Key Issue | Project Modifications / Mitigation Measures / Enhancements | See Project Proposal Section No. |
|---|---|---|
| **Heap Leach and Cyanide**<br>Discussions of the heap leach and cyanide during engagement with government agencies are generally focused on gaining a better understanding of the design and details of operations of the Heap Leach Facility. Issues raised are related to the heap leach liner functionality and temporary closure of the heap leach. | Questions regarding installment of Goldcorp's proposed liners and wick drain system under the heap leach pad were raised frequently during engagement events with Yukon agencies, particularly related to potential leaks. Goldcorp will be installing the wick drain system to detect leaks, and will be performing electromagnetic scanning once the overliner is placed during construction of the heap leach in order to detect and address potential leaks before the heap leach is in operation. Goldcorp has addressed concerns regarding water quality during possible temporary closure of the heap leach, stating that the water treatment facility that is scheduled to be constructed in Year 9 can be constructed on demand if a temporary closure situation requires it. | **Section 2.0 Project Description**<br>**Appendix 31-C Conceptual Reclamation and Closure Plan** |
| **Water Quality/Fish**<br>Issues related to water quality and potential effects on fish raised during engagement with government agencies were specific to NAR upgrades and construction. | The DFO raised concerns regarding increased sedimentation in streams and the Yukon and Stewart Rivers as a result of road construction upgrades, and the potential effects of this to fish. The Proponent addressed these concerns during meetings, as upgrades along the existing road route will work to improve fish habitat and access. Best management practices for erosion and sediment control will be implemented during installation or removal of culverts and bridges to prevent sediment from entering the streams.<br>Goldcorp has also planned to conduct barge landing activities during times of the year that will have the least effects to fish, in particular migrating and spawning salmon. | **Section 14.0 Fish and Fish Habitat Assessment**<br>**Appendix 14-B Fish and Fish Habitat Valued Component Assessment**<br>**Appendix 31-A Access Route Construction Management Plan** |

Throughout the consultation and engagement program, the Proponent has been engaging with government agencies on the format of the Project Proposal, Project design, and baseline and effects assessment studies. Engagement events with government agencies were key opportunities to receive feedback on the Project and incorporate this feedback into the Project where possible.

With respect to baseline studies, the Proponent has been collaborating with YG Environment on the wildlife baseline study and effects assessment throughout the Project Proposal, including collaborating with YG on multiple Sharptailed Grouse and Forty Mile Caribou studies. These collaborations have been integral to the Proponent's wildlife baseline study and effects assessment. Engagement with YG Environment has also influenced the NAR design, as Goldcorp works to mitigate effects to wildlife through design as much as possible. The NAR avoids Sharptailed Grouse lekking sites as much as possible, which is a wildlife consideration resulting from engagement with YG Environment. Goldcorp is also ensuring that the Project Proposal considers wetlands specifically, based on interests raised during engagement events with YG, influencing both baseline studies and effects assessments.

Based on feedback received from federal agencies during regulators and assessors working group meetings, the Proponent has committed to additional sampling locations in the Stewart River Back Channel, beginning in the 2016 field season as recommended by the DFO. Goldcorp's fisheries team also collected gradient data in the 2016 field season to ground-truth the LiDAR data used in the gradient analysis for the fish baseline report based on concerns raised by the DFO during engagement.

Goldcorp is working closely with government agencies regarding the NAR. Discussions regarding Goldcorp's ability to control access to various points on the NAR are ongoing; Goldcorp is considering the detailed feedback received during the regulators and assessors working group meeting held on May 11, 2016. In addition, Goldcorp will continue to engage with government agencies on the NAR design and management.

### 3.7 FUTURE CONSULTATION, ENGAGEMENT, AND CORPORATE SOCIAL RESPONSIBILITY

Consultation and engagement with potentially affected First Nations, potentially affected communities, interested persons, regulators and assessors, and stakeholders regarding the Project is ongoing. Goldcorp is committed to continuing to share information, address issues, and build relationships throughout the YESAB review and permitting processes. In particular, Goldcorp continues to address issues raised in the document sharing and feedback process with potentially affected First Nations prior to submitting the Project Proposal, as well as participating in ongoing meetings with potentially affected First Nations citizens and members to create a deeper understanding of the Project and inform Project management, monitoring, and mitigation measures in preparation for Project construction and operation. Both TH and SFN are entering into an election cycle in April 2017. As such, engagement and consultation preferences of TH and SFN may change if new leadership is elected. A summary of upcoming meetings with potentially affected First Nations is summarized below in **Table 3.7-1**.

**Table 3.7-1 Upcoming Meetings with Potentially Affected First Nations**

| First Nation | Proposed Meeting Topic |
|---|---|
| Tr'ondëk Hwëch'in | • Meetings to discuss water quality results, site specific water quality objectives<br>• Meetings with (possibly newly elected) Chief and Council and Citizens to increase Project understanding. |
| Selkirk First Nation | • Meetings to determine a more formalized feedback and engagement process<br>• Meetings with Selkirk Renewable Resources Council (April 2017)<br>• Meetings with Elders Council and Family Heads<br>• Meetings with newly elected Chief and Council and Citizens to increase Project understanding. |
| White River First Nation | • Meetings with members to increase Project understanding. |
| First Nation of Na-cho Nyäk Dun | • Meetings with Chief and Council and citizens to increase Project understanding (April 2017)<br>• Meetings to determine a more formalized feedback and engagement process. |

With a strong focus on Corporate Social Responsibility, Goldcorp is committed to supporting communities through local contracting, hiring, and creating capacity within communities through training opportunities. Beyond consultation for the Project, Goldcorp has and will partner with potentially affected First Nations on developing training programs and career databases to create capacity within potentially affected First Nations to prepare citizens for employment related to the Project and the resource industry overall. Succession training is another way that Goldcorp is working to train citizens into future higher-level roles with the Project.

Proactive community outreach and developing education and training plans and initiatives are ways that Goldcorp can ensure that as many local qualified people as possible are hired for the Project. Goldcorp also invests in healthy community initiatives through volunteering time at community events, as well as providing event sponsorships and education scholarships through Goldcorp's community investment program. Examples of sponsored events and initiatives are listed below:

- Adäka Cultural Festival
- Yukon Hospital Foundation – Alkan Air Grand Ball
- Dawson City Gold Show
- Dawson City Music Festival
- Yukon Geoscience Forum and Trade Show
- Association of Mineral Exploration British Columbia Roundup
- Special Olympics Yukon
- Students On Ice, 2014 University Antarctic Expedition
- Tr'ondëk Hwëch'in Moosehide Gathering

- Yukon College – Kaminak Mineral Awards Program
- Yukon First Nations Resource Conference
- Yukon Geoscience Conference
- Yukon Hospital Foundation
- Yukon Imagination Library
- Yukon Mining and Geology Week
- Yukon Mining Procurement Forum
- Yukon Quest
- Yukon River Quest
- Yukon Women in Mining.

# 4.0 PROJECT SETTING

This section presents an introduction to the existing environmental and social setting of the proposed Coffee Gold Mine (Project) area, and includes an overview of land tenure, as well as land and resource uses.

## 4.1 INTRODUCTION

Kaminak Gold Corporation, a wholly owned subsidiary of Goldcorp Inc. (Goldcorp or Proponent) proposes to develop the Project in west-central Yukon, approximately 130 kilometres (km) south of the City of Dawson and 330 km northwest of Whitehorse. The Project is situated within the Yukon Plateau North Ecoregion, in the Klondike Plateau subzone of the Boreal Cordillera Ecozone. Geography in the ecozone is characterized by rolling uplands leading into large U-shaped valleys (Smith et al. 2004). The topography of the Project area (as defined in **Section 2.0 Project Description**) is consistent with the characteristics of unglaciated ecozones, and is characterized by deep soil weathering and strong erosional patterns linked to precipitation and snowmelt (Grods et al. 2012). The long periods of exposure to weathering of granite and schists has created tors, large weathered rock structures, on the ridgetops in the vicinity of the Project.

The ecoregion's climate is characterized by cool summers and cold winters (i.e., ranging from 15 degrees Celsius (° C) in summer to –30° C in winter) (Grods et al. 2012). The highest levels of precipitation occur in July and August, and the driest months extend from December through May (Grods et al. 2012). Long periods of cold temperatures and elevational variability in temperature have led to a discontinuous pattern of permafrost distribution in the vicinity of the Mine Site. The spatial extent of permafrost is dependent on a number of microclimatic factors including elevation and sun exposure (Grods et al. 2012). Detailed information regarding the climate and permafrost distribution in the vicinity of the Mine Site is provided in **Section 9.0 Air Quality and Greenhouse Gas Emissions Analysis** and **Section 11.0 Surficial Geology, Terrain, and Soils Assessment**, respectively.

The Coffee Property (approximately 50 km long by 12 km wide), located within the White Gold Mining District, comprises 3,021 contiguous Yukon quartz claims held by the Proponent. The property is located on National Topographic System (1:50 000 scale) map sheets 115J-13, 115J-14, and 115J-15, centered on the geographical coordinates shown in **Table 4.1-1**. Further information regarding the Coffee Property is provided in **Section 4.1.1**.

**Table 4.1-1 Geographic Location**

| Project Component | UTM Coordinates (Zone 7 NAD 83) | Latitude | Longitude |
|---|---|---|---|
| Coffee Property | 6,974,000 N 584,000 E | 62°53’10.70” N | 139°20’52.55” W |
| NAR at Klondike Highway | 7,101,785 N 589,437 E | 64°1’52.63” N | 139°10’9.26” W |
| NAR at Airstrip | 6,976,547 N 601,317 E | 62°54’17.12” N | 139°0’21.66” W |

**Note:** E - east; N - north; NAD - North American datum; UTM - Universal Transverse Mercator; W – west

The Coffee Property encompasses an area of partially tree-covered hills. The lower creek drainages and hillslopes are covered by a mature pine forest, interspersed with deciduous aspen and birch, as well as thick moss groundcover (detailed information on vegetation is provided in **Section 15.0 Vegetation Assessment**). The ridgetops and hill crests are dominated by low-lying native shrubs and grasses. Ecosystems in the vicinity of the Project support a diversity of wildlife species, including seasonal migrants and permanent residents (detailed information on fish, wildlife, and birds is provided in **Section 14.0 Fish and Fish Habitat Assessment**, **Section 16.0 Wildlife and Wildlife Habitat Assessment**, and **Section 17.0 Birds and Bird Habitat Assessment**).

The Project is located in west-central Yukon within the Coffee Creek, YT-24 and Halfway Creek drainages of the South Yukon River Watershed (**Figure 1.1-1**). Latte Creek, a tributary to Coffee Creek, flows west to east, south of the Mine Site. The Project’s four Open Pits, Waste Rock Storage Facilities, Heap Leach Facility, process plant, and work camp will be located at the height of land, 1,180 metres (m) above sea level and above Latte and Halfway creeks. The main mineralized zone of the Project is located approximately 6 km south of the Yukon River. The Mine Site will be accessed by a 214-km-long single-lane Northern Access Route (NAR) from the Northern Klondike Highway east of the City of Dawson (Dawson).

With a population of 2,202, Dawson is the closest large community to the Project (130 km due north). The community of Beaver Creek, population 113, is located 95 km southwest of the Mine Site, and the community of Pelly Crossing (population 393) is located 140 km southwest of the Mine Site. The City of Whitehorse, the capital of Yukon with a population of 29,529, is located 330 km southeast of the Project (refer to **Section 19.0 Demographics Analysis** for additional information). The Project site is currently accessed by air transportation or boat/barge.

Air transportation via Dawson and Whitehorse will be the primary means of transportation for Mine Site personnel and incidental freight. An all-weather airstrip will be located approximately 7 km east of the Project’s Camp Site. Air transport will also be used to ship gold doré off-site for further processing. The NAR, including barge crossings of the Stewart and Yukon rivers, will provide vehicle access for resupply of freight and fuel (see **Figure 4.1-1**).

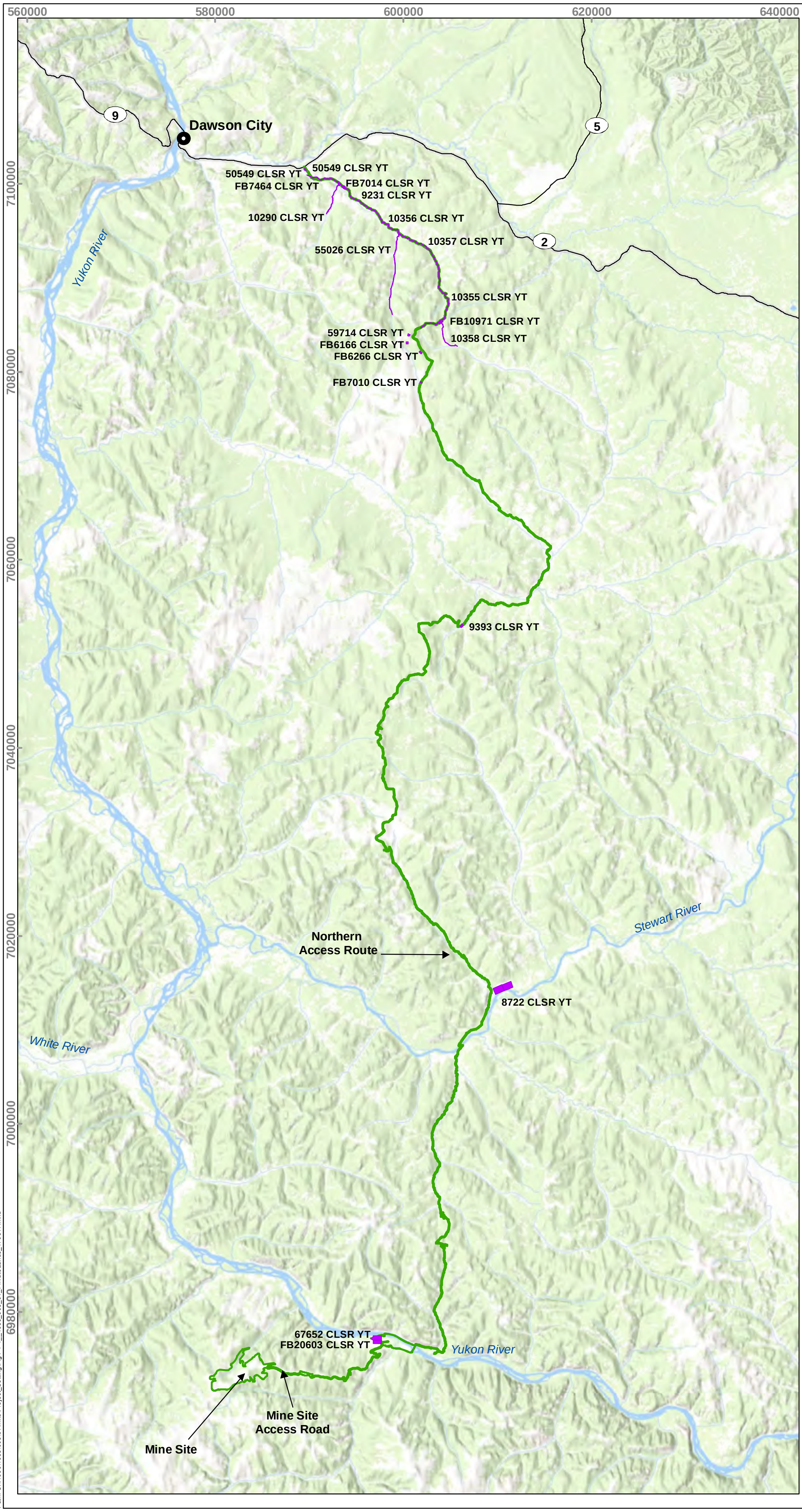
### 4.1.1 LAND TENURE

The Project is primarily located on Crown land, with the exception of two fee simple parcels owned by the Proponent in the vicinity of the existing exploration camp near the Yukon River and several surveyed parcels along the NAR (see **Table 4.1-2** and **Figure 4.1-1**).

**Table 4.1-2 Private Lands Located near the Project**

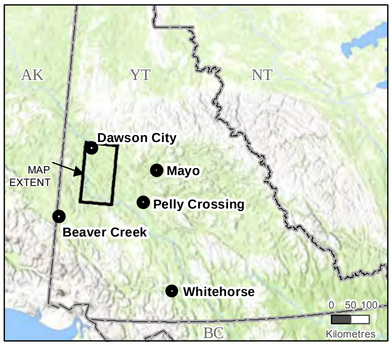
| Parcel Designator | CLSR Plan | LTO Plan | State | Location |
|---|---|---|---|---|
| Lot 576 Group 1052 | 50549 CLSR YT | 24317 LTO YT | Active | Within 1 km of the Project Footprint |
| Access Road | 50549 CLSR YT | 24317 LTO YT | Active | Within 1 km of the Project Footprint |
| Hunker Road | 10356 CLSR YT | - | Active | Overlaps with the NAR |
| Transmission Line License | 91636 CLSR YT | - | Active | Overlaps with the NAR |
| Lot 261 Group 2 | FB7464 CLSR YT | 7464 LTO YT | Active | Within 1 km of the Project Footprint |
| Lot 229 Group 2 | FB7014 CLSR YT | 7014 LTO YT | Active | Within 1 km of the Project Footprint |
| Lot 145 Group 2 | 9231 CLSR YT | - | Active | Overlaps with the NAR |
| Lot 144 Group 2 | 9231 CLSR YT | - | Active | Within 1 km of the Project Footprint |
| Last Chance Road | 10290 CLSR YT | - | Active | Within 1 km of the Project Footprint |
| Goldbottom Road | 55026 CLSR YT | - | Active | Within 1 km of the Project Footprint |
| Hunker Road | 10357 CLSR YT | - | Active | Overlaps with the NAR |
| Hunker Road | 10355 CLSR YT | - | Active | Overlaps with the NAR |
| Lot 469 Group 2 | FB10971 CLSR YT | - | Active | Within 1 km of the Project Footprint |
| Lot 470 Group 2 | FB10971 CLSR YT | - | Active | Within 1 km of the Project Footprint |
| Hunker Road & Ridge Road | 10358 CLSR YT | - | Active | Overlaps with the NAR |
| Lot 594 Group 1052 | 59714 CLSR YT | 42515 LTO YT | Active | Within 1 km of the Project Footprint |
| Lot 47 Group 2 | FB166 CLSR YT | - | Active | Within 1 km of the Project Footprint |
| Lot 50 Group 2 | FB6266 CLSR YT | 6266 LTO YT | Active | Within 1 km of the Project Footprint |
| Lot 263 Group 2 | FB7010 CLSR YT | 7010 LTO YT | Active | Overlaps with the NAR |
| Lot 264 Group 2 | FB7010 CLSR YT | 7010 LTO YT | Active | Within 1 km of the Project Footprint |
| Lot 18 Group 3 | 9393 CLSR YT | - | Active | Overlaps with the NAR |
| Lot 17 Group 3 | 9393 CLSR YT | - | Active | Within 1 km of the Project Footprint |
| Lot 19 Group 3 | 9393 CLSR YT | - | Active | Within 1 km of the Project Footprint |
| Lot 7 Group 3 | 8722 CLSR YT | - | Active | Within 1 km of the Project Footprint |
| Lot 8 Group 3 | 8722 CLSR YT | - | Active | Within 1 km of the Project Footprint |
| Lot 6 Group 3 | 8722 CLSR YT | - | Active | Within 1 km of the Project Footprint |
| Lot 1 Group 952 | FB20603 CLSR YT | - | Active | Private land parcel held by the Proponent |
| Lot 1000 QUAD 115J/14 | 67652 CLSR YT | 63812 LTO YT | Active | Private land parcel held by the Proponent |

**Note:** CLSR – Canada Lands Survey Records, LTO YT – Land Titles Office Yukon Territory




# COFFEE GOLD MINE

## Private Lands Located Near the Project




## Legend

- Highway
- Project Footprint
- Land Parcels

## Notes

1. This map is not intended to be a "stand-alone" document, but a visual aid of the information contained within the referenced Report. It is intended to be used in conjunction with the scope of services and limitations described therein.
2. Map Sources: ESRI Topo Base, Geomatics Yukon

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| Figure 4.1-1 | Date: Mar 17, 2017 | Drawn by: JS | Reviewed: DP |
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The Mine Site is located within the Tr'ondëk Hwëch'in (TH) First Nation Traditional Territory. The Mine Site is also located within the asserted territory of White River First Nation (WRFN). The NAR alignment is located within the Traditional Territory of TH, portions of which are located within the Traditional Territories of the Selkirk First Nation (SFN) and the First Nation of Na-cho Nyäk Dun (FNNND) and the asserted territory of the WRFN (**Figure 1.1-1**).

As described in **Section 4.1**, the Coffee Property consists of quartz claims issued by the Yukon government (**Figure 4.1-2**). Yukon is divided into four mining districts, which provide staking guidelines, assistance, and information on ground that is open for mineral claim staking (EMR 2015a). The Proponent is currently operating under the authority of a Class 4 Exploration Program Approval (LQ00312b) issued pursuant to the *Quartz Mining Act*, SY 2003, c.14, and Quartz Mining Land Use Regulation (OIC 2003/64). Recently, the approval was amended to extend the expiry date until July 11, 2021. The approval provides for access to and use of the property for mineral exploration, in compliance with the Operating Conditions contained in Schedule 1 of the Regulation, and in accordance with identified reporting requirements and terms and conditions. As described in **Section 4.3.2**, the exploration camp and program are also operating under a Type-B municipal water licence, and other water licence approvals.

With the exception of three sections of new road (totalling 37 km) the alignment of the NAR follows an existing network of gravel roads connecting the abundant placer mining operations south of Dawson. The existing portions of the NAR are regulated and managed by the Yukon Department of Highways and Public Works under the *Highways Act*, RSY 2002, c.108. The Proponent will work with the Government of Yukon to obtain appropriate tenures for the upgrades to the NAR, including staging and barge landings at the Stewart and Yukon Rivers.

### 4.1.2 First Nations Lands

The Umbrella Final Agreement between the Government of Canada, the Council for Yukon First Nations, and the Government of Yukon provides a framework within which Yukon First Nation Final Agreements are to be negotiated and concluded (CYFN 2013). Settlement lands are divided into categories in the Umbrella Final Agreement:

- On Category A Settlement Land, a Yukon First Nation has complete ownership of the surface and subsurface land (i.e., rights equivalent to fee simple to the surface of the lands and full fee simple title to the subsurface) (Government of Canada et al. 1993).
- On Category B Settlement Land, a Yukon First Nation has complete ownership of only the surface or top of the land (i.e., rights equivalent to fee simple to the surface only). Subsurface rights, including mineral resources, are retained by the Government of Yukon (Government of Canada et al. 1993).
- Fee Simple Settlement Land is defined as Settlement Land owned under the same form of fee simple title as is commonly held by individuals who own land.
- Non-settlement Land includes all land other than that covered within the above-described categories.

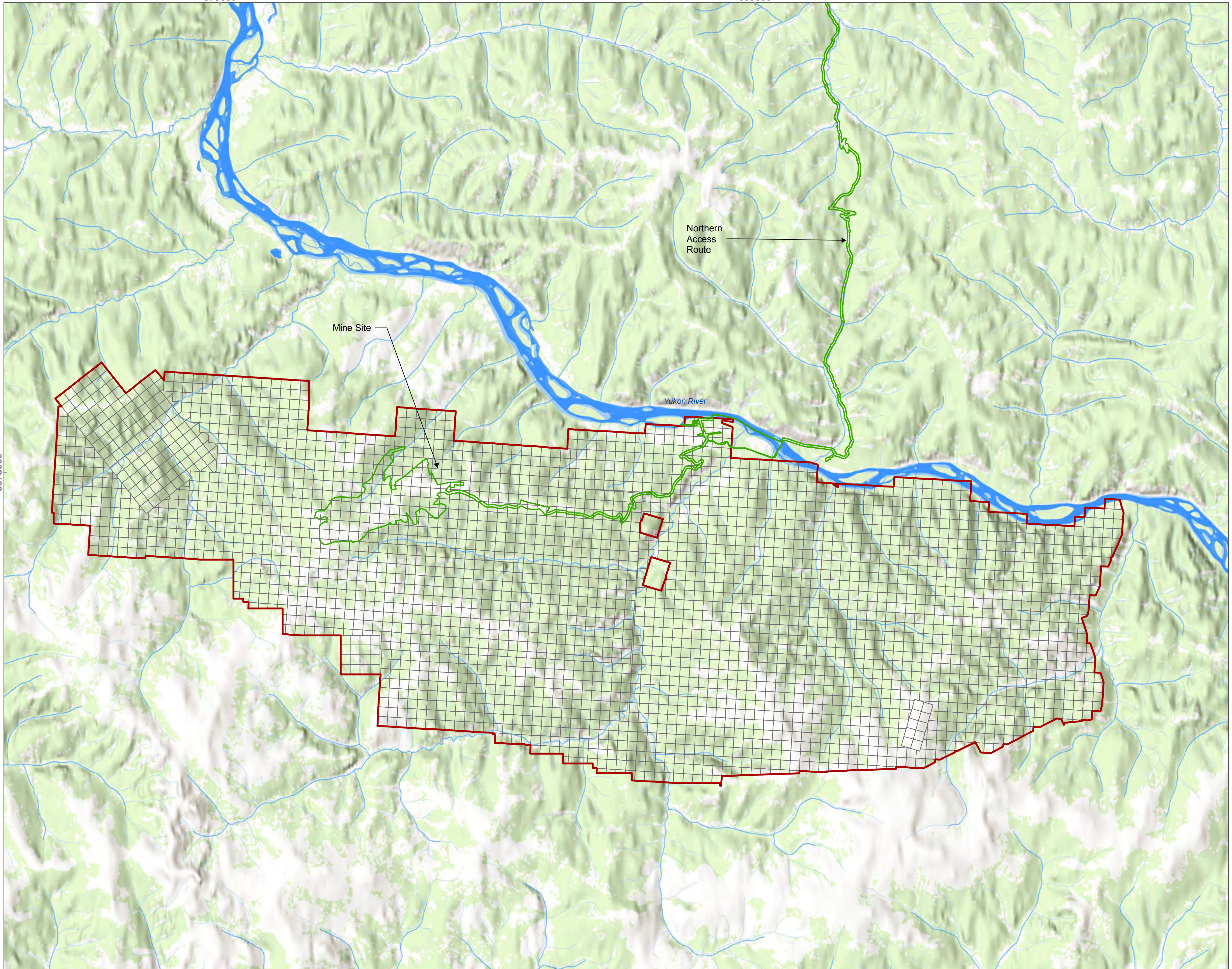
The Project footprint (as defined in **Section 2.0 Project Description**) does not overlap with any First Nation Category A or B Settlement Lands. The proposed NAR parallels a TH parcel of Category A Settlement Land that is located north of the Yukon River, east of Ballarat Creek. Settlement Lands located within 5 km of the Project footprint are shown on **Figure 1.1-1** and listed in **Table 4.1-3**.

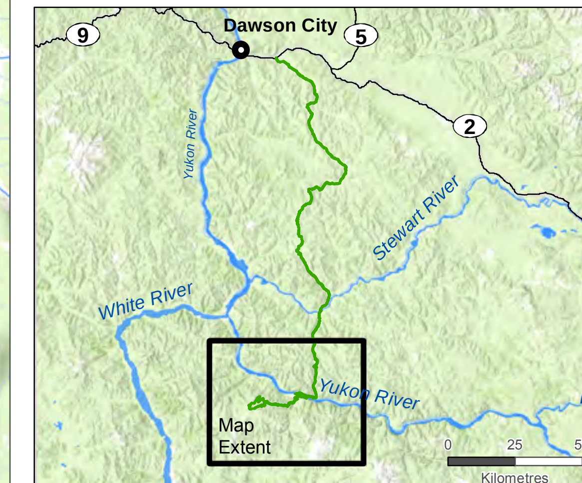
**Table 4.1-3 First Nations Settlement Lands Located near the Project**

| Settlement Land ID | First Nation | Category | Distance from the Project | Settlement Land Location Description |
|---|---|---|---|---|
| SFN 15B1 | SFN | B | 0.1 km | Upstream of and adjacent to the barge landing site on the Yukon River at Coffee Creek |
| TH S-83A1 | TH | A | 0.1 km | Adjacent to NAR on approach to the Yukon River barge landing site at Ballarat Creek |
| TH R-82A | TH | A | 0.1 km | Adjacent to NAR along Maisy May Creek on approach to the Stewart River |
| TH R-18A | TH | A | 2.6 km | East of NAR along Maisy May Creek on approach to the Stewart River |
| TH S-93B | TH | B | 0.3 km | West of NAR near Indian River |
| TH S-126B1 | TH | B | 0.4 km | East of junction of NAR and Klondike Highway |
| TH C-7B | TH | B | 0.7 km | East of junction of NAR and Klondike Highway |
| TH S-153B1 | TH | B | 1.5 km | West of junction of NAR and Klondike Highway |
| TH S-122B1 | TH | B | 4.0 km | East of junction of NAR and Klondike Highway |
| TH C-14B | TH | B | 4.2 km | West of junction of NAR and Klondike Highway |

COFFEE GOLD MINE

**Coffee Property Claim Block**




## Legend

- Watercourse
- Project Footprint
- Property Claims Boundary
- Individual Claims on Coffee Property

## Notes

1. This map is not intended to be a "stand-alone" document, but a visual aid of the information contained within the referenced Report. It is intended to be used in conjunction with the scope of services and limitations described therein.
2. Map Sources: ESRI Topo Base, Geomatics Yukon

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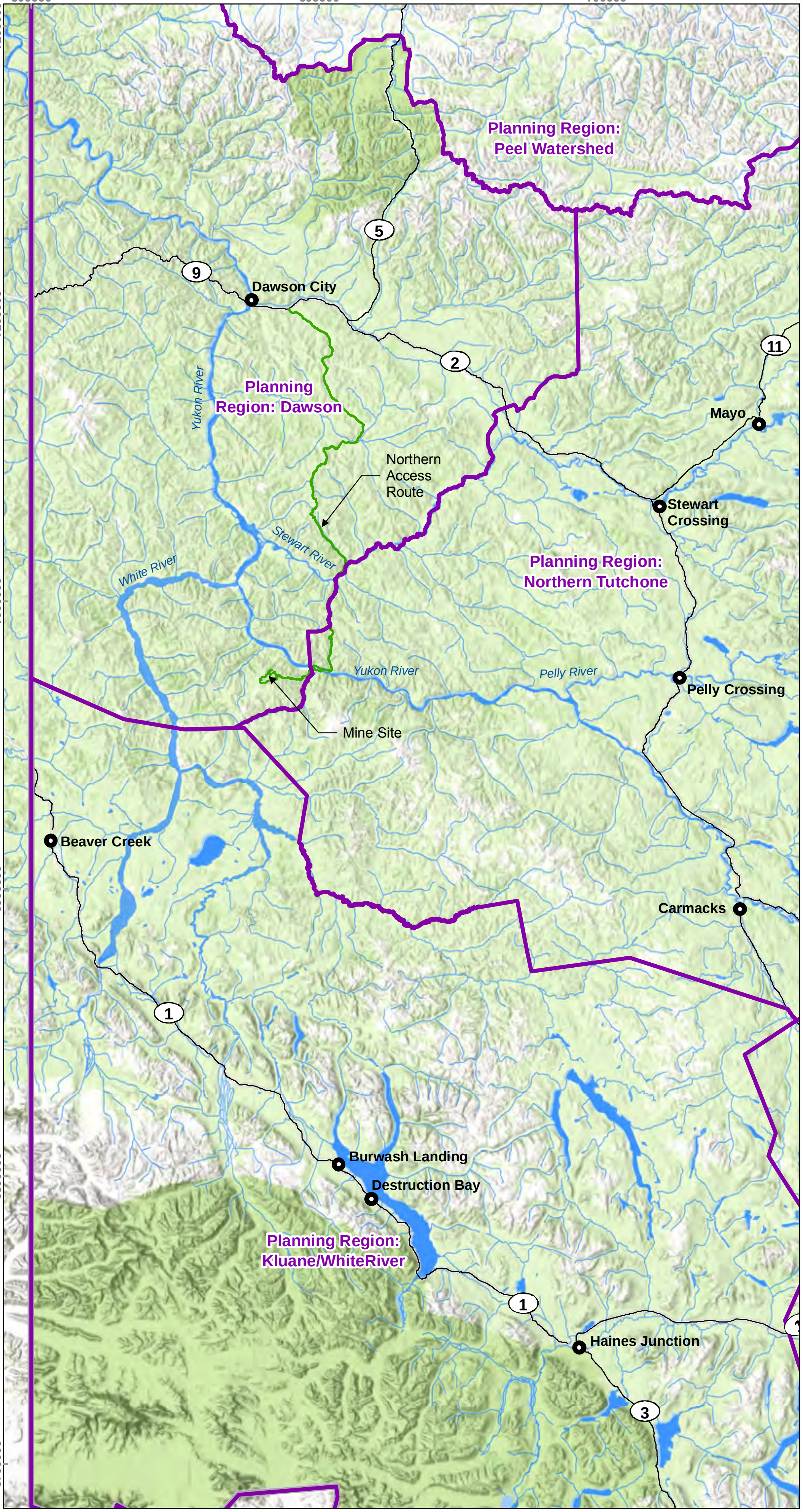
## 4.2 YUKON LAND USE PLANNING

This section provides information on the Yukon land use planning processes in place in the vicinity of the Project. The Project's location within established regional land use planning areas is described, along with the alignment of the Project's design and development with the stated objectives of the community plans and mandates.

### 4.2.1 REGIONAL LAND USE PLANNING

Most of the Mine Site is located within the Dawson Land Use Planning Region (**Figure 4.2-1**).The barge landing on the south side of the Yukon River and a small section of the mine access road are located within the Northern Tutchone Land Use Planning Region (**Figure 4.2-1**). The NAR is also predominantly located within the Dawson Land Use Planning Region, with sections of the route extending into the Northern Tutchone Land Use Planning Region.

Neither the Dawson nor the Northern Tutchone Land Use Planning Region currently has a Regional Land Use Plan (Yukon Land Use Planning Council 2015a, 2015b). While the Dawson Regional Planning Commission has gathered information and feedback on issues and interests, its planning process is temporarily suspended (Yukon Land Use Planning Council 2015a). The Northern Tutchone Regional Planning Commission is yet to be established, although several workshops and meetings have been held to determine boundaries and establish terms of reference for the planning region (Yukon Land Use Planning Council 2015b).




COFFEE GOLD MINE

**Yukon Regional Land Use Planning Areas**


## Legend

- Highway
- Watercourse
- National/International Border
- Project Footprint
- Yukon Planning Region

## Notes

1. This map is not intended to be a "stand-alone" document, but a visual aid of the information contained within the referenced Report. It is intended to be used in conjunction with the scope of services and limitations described therein.
2. Planning areas from geomaticsyukon.ca, 2016.

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### 4.2.2 COMMUNITY PLANS AND MANDATES

A number of other plans and mandates were considered with reference to Project design and development, including:

- Tr'ondëk Hwëch'in Mining Mandate (November 2011) (TH 2011a)
- Dawson Forest Resource Management Plan (EMR 2013)
- Regional Economic Development Plan for the Tr'ondëk Hwëch'in Territory (TH 2011b)
- After the Gold Rush: The Integrated Community Sustainability Plan (City of Dawson and TH n.d.)
- Official Community Plan, City of Dawson (City of Dawson 2012)
- Selkirk First Nation / Pelly Crossing Integrated Community Sustainability Plan (Inukshuk Planning & Development 2007).

Based on plan review and consultation with TH, the Proponent considers the Project to be consistent with the stated goals of each of these plans, and predicts that the Project will contribute to the successful attainment of economic development, employment, training, and education objectives. Further information regarding the identified plans and the Project's compatibility with those plans is provided in **Section 24.0 Land and Resource Use Assessment**.

## 4.3 LAND AND RESOURCE USE

In this section, land and resource use in the vicinity of the Project is described, including mineral and water rights; management areas, parks, and protected areas; trapping and guide-outfitting operations; forestry operations; and outdoor recreation and wilderness activities.

### 4.3.1 MINERAL RIGHTS

The White Gold District of west-central Yukon was heavily explored by placer miners following the discovery of gold and the subsequent Klondike Gold Rush in the late 1890s to early 1900s. More than a century later, placer mining remains a large contributor to the Yukon economy. Existing placer mining claims providing exclusive mineral rights to the holder are situated along most of the District's creeks, many of which are crossed by the NAR. Following major gold discoveries in the District, the northern mining sector is showing resurgence with a focus on hard rock mining of gold deposits. As a result, the Proponent's quartz claims are bordered on all sides by quartz claims held by other parties. Between the junction of NAR and the Klondike Highway and the southernmost point of the Mine Site, the Project is located adjacent to or overlaps with mining claims held by 164 stakeholders (32 quartz and 132 placer claim holders).

#### 4.3.2 WATER RIGHTS

For the purpose of exploration, the Proponent currently holds a Municipal Type B water licence (MN16-034) to withdraw and store water from the Yukon River, operate a wastewater treatment and disposal system, and construct and manage a wastewater lagoon for an 80-person camp. The water licence expires on July 11, 2026 and allows for the withdrawal of 20 cubic metres per day from either the Yukon River or its adjacent well. No other water users hold water rights in the area that overlaps with the Mine Site; however, the NAR crosses lands where owners of placer mining operations hold a total of 37 other water licences.

Further information regarding land tenure and resource rights is provided in **Section 3.0 Consultation** and **Section 24.0 Land and Resource Use Assessment**.

In Yukon, a First Nation has the exclusive right to use water that is either located on or flowing through its Settlement Lands. This right is protected from substantial alterations to water quantity, rate of flow, or water quality. As per the TH and SFN Final Agreements, the Project assessment considers potential changes to or effects on water quantity and rate of flow, and on water quality on Settlement Land parcels located downstream of the Project (see **Section 8.0 Surface Hydrology Analysis** and **Section 12.0 Surface Water Quality Assessment**, respectively).

#### 4.3.3 MANAGEMENT AREAS, PARKS, AND PROTECTED AREAS

Game management zones (GMZs) and subzones are legal boundaries that define an area with specific management objectives for big game species, such as grizzly bears, caribou, deer, and elk. Game management zones establish specific hunting licence requirements, restrictions, and limits for their respective area (Environment Yukon 2015a). The Mine Site is located entirely within Zone 5, subzone 03 (GMZ 5-03) (**Figure 4.3-1**). Other GMZs near the Mine Site include: GMZ 5-09, located adjacent to Coffee Creek to the southeast, and GMZ 5-02, located to the northwest, bounded by Independence Creek. North of the Yukon River, the GMZ changes to zone 3, subzones 313, and GMZ 314, which are divided by Ballarat Creek. The NAR is located entirely within zone 3, and traverses through subzones 307, 308, 310, 311, 312, and 313 (**Figure 4.3-1**). District Conservation Officers who provide services within the Project footprint and the immediately surrounding area are located in Dawson and Mayo.

Habitat Protection and Special Management Areas have been established to conserve important features of the natural and cultural environment (Environment Yukon 2015b). The Project footprint is not located within any Special Management Area or Habitat Protection Area (**Figure 4.3-2**). The Project is located more than 30 km from the nearest territorial park, Tombstone Territorial Park, and 120 km north of the nearest National Park, Kluane National Park. The Mine Site is located approximately 171 km south of Tombstone Territorial Park, and 150 km west of Ddhaw Ghro Territorial Park (**Figure 4.3-2**). Further detail on management areas, parks, and other protected areas are provided in **Section 24.0 Land and Resource Use Assessment.**

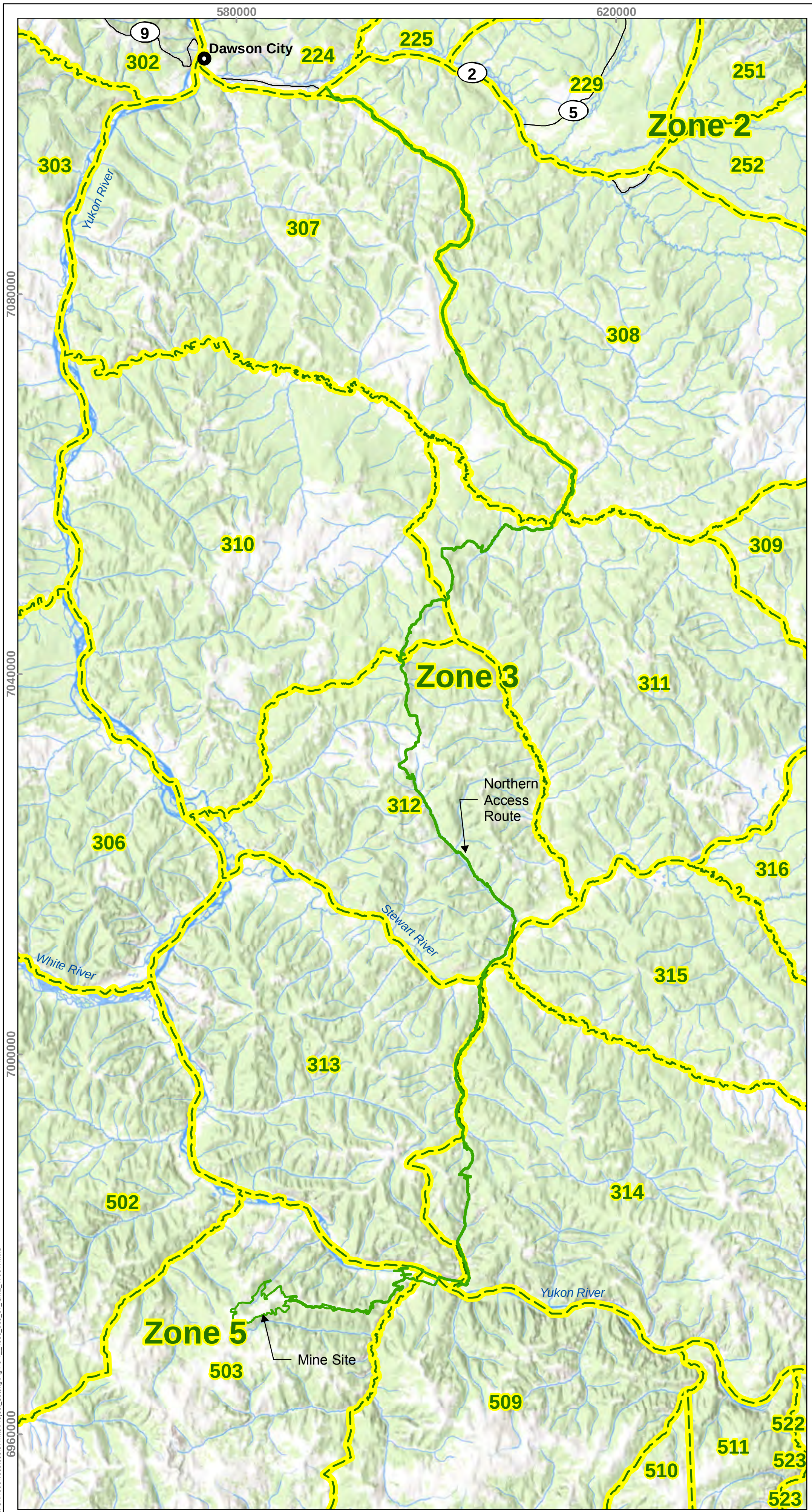
The Department of Tourism and Culture has identified several archaeological sites within the Coffee Property at the Mine Site and near Dawson as heritage resources under the *Historic Resources Act*, RSY 2002, c.109. Additionally, the Klondike Region is pursuing a World Heritage Site designation from the United Nations Educational, Scientific and Cultural Organization. These heritage resources are described in **Section 26.0 Heritage Resources Assessment**.

#### 4.3.4 TRAPPING AND GUIDE OUTFITTING

The *Wildlife Act*, RSY 2002, c. 229, regulates trapline and guide outfitter concession areas that provide exclusive rights to concession holders for the harvest of furbearers and for guided hunts, respectively. Trapline and outfitting concession areas are legally defined, and were established by the Government of Yukon in 1950s. More than 400 trapping licences and 22 outfitting licences are held by Yukon residents (Environment Yukon 2015c). Trapping and guiding provide Yukon residents with opportunities for self-employment in the outdoors and remote areas of the territory (Environment Yukon 2015c, Yukon Outfitters Association 2015).

Two trapline concession areas (IDs 115 and 116) overlap with the Mine Site, and seven trapline concession areas (IDs: 54, 57, 58, 61, 62, 115, and 116) overlap with the NAR from the junction with the Klondike Highway to the Mine Site (**Figure 4.3-3**) (EMR 2015b). The Mine Site does not overlap with any guide outfitter concession areas. The NAR, however, overlaps with guide outfitter concession area ID 11 at the barge crossing of the Yukon River and the winter ice road between the Yukon River and Coffee Creek (**Figure 4.3-3**).

Detailed discussions of trapline and guide outfitter concession areas in relation to the Project are provided in **Section 24.0 Land and Resource Use Assessment** and consultation with these stakeholders is summarized in **Section 3.0 Consultation**.




# COFFEE GOLD MINE

## Game Management Zones


### Legend

- Highway
- Watercourse
- Project Footprint
- Game Management Zone

### Notes

1. This map is not intended to be a “stand-alone” document, but a visual aid of the information contained within the referenced Report. It is intended to be used in conjunction with the scope of services and limitations described therein.
2. Trapline data from geomaticsyukon.ca, 2016.

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# COFFEE GOLD MINE

## Management Areas, Parks and Protected Areas


Legend

- Highway
- Watercourse
- National/International Border
- Project Footprint
- Management Areas, Parks and Protected Areas

Notes

1. This map is not intended to be a "stand-alone" document, but a visual aid of the information contained within the referenced Report. It is intended to be used in conjunction with the scope of services and limitations described therein.
2. Parks and protected areas from geomaticsyukon.ca, 2016.

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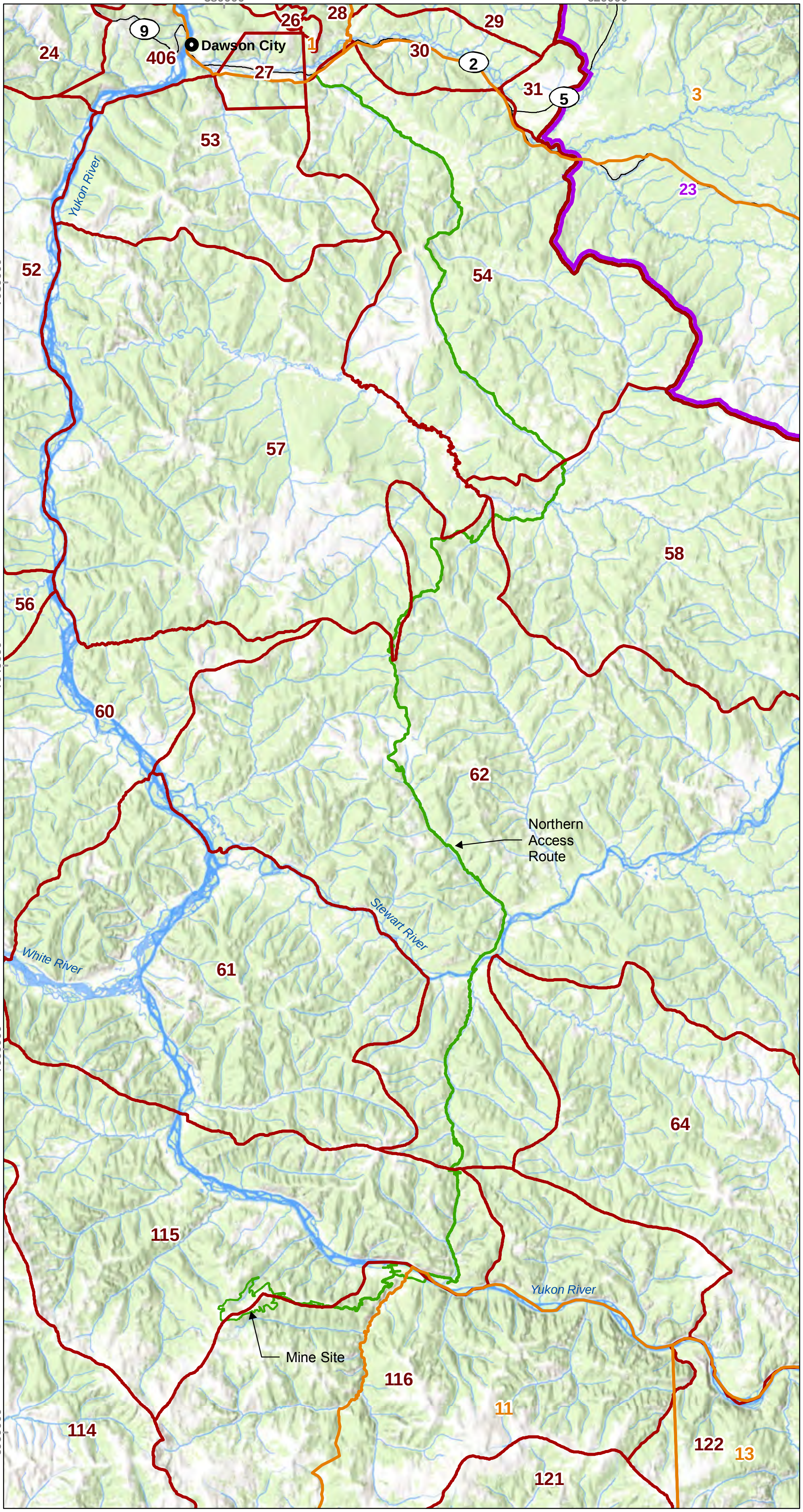


# COFFEE GOLD MINE

## Trapline Concession Areas and Guide Outfitter Areas


### Legend

- Highway
- Watercourse
- Project Footprint
- Outfitting Concessions
- Single Trapline
- Group Trapline

### Notes

1. This map is not intended to be a “stand-alone” document, but a visual aid of the information contained within the referenced Report. It is intended to be used in conjunction with the scope of services and limitations described therein.
2. Parks and protected areas from geomaticsyukon.ca, 2016.

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### 4.3.5 FORESTRY

The forestry industry in Yukon is regulated by the *Forest Resources Act*, SY 2008, c.15, which is currently under review by the Department of Energy, Mines and Resources, with opportunities for amendments to address changing needs of First Nations, industry, and communities, as well as the continued health of Yukon forests. The Project is located within the Yukon River South, Stewart River, and Gold Fields landscape units of the Dawson Forest Resources Management Plan (**Figure 4.3-4**) (EMR 2013). The Project does not overlap with any active forest-tenured area.

### 4.3.6 OUTDOOR RECREATION AND WILDERNESS TOURISM

Tourism is an expanding industry in Yukon, as the Territory's wilderness and numerous outdoor recreation attractions draw visitors interested in experiencing the North. Surrounding Dawson, wilderness and backcountry access is available in all seasons via the Klondike and Dempster Highways and the extensive gravel road network that connects with placer mines.

Due to the Project's remote location and isolation from existing roads, current access to the surrounding backcountry is limited. Access to the Mine Site will be controlled at certain locations which will assist in protecting the health and safety of employees and the public. There are no Government of Yukon campgrounds in the vicinity of the Mine Site or the NAR. A wilderness retreat, located approximately 20 km downstream on the Yukon River from the barge landing site at Coffee Creek, has three cabins that are used by owners of registered group trapline 115, as well as a camping area that can support approximately 200 people. The establishment is the host site for various retreats, and is used as a stop-over during the Yukon River Quest. Every year, hundreds of people paddle along the Yukon River in guided canoe trips, race in the Yukon River Quest, and participate in personal leisure activities and traditional journeys. For further detail on recreation and tourism in the vicinity of the Project, see **Section 24.0 Land and Resource Use Assessment.** Information regarding visual aesthetics and viewpoints from the Yukon River is presented in **Appendix 24-B Visual Analysis**.


# COFFEE GOLD MINE

## Dawson Forest Management Plan Areas


**Legend**

- Highway
- Watercourse
- National/International Border
- Project Footprint
- Forest Resources Management Plans

**Notes**

1. This map is not intended to be a “stand-alone” document, but a visual aid of the information contained within the referenced Report. It is intended to be used in conjunction with the scope of services and limitations described therein.
2. Parks and protected areas from geomaticsyukon.ca, 2016.

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# 5.0 ASSESSMENT METHODOLOGY

This section of the Project Proposal describes the methodology used to identify and assess potential environmental and socio-economic effects of the proposed Coffee Gold Mine (Project). The methodology follows recommended guidelines and legislated requirements, pursuant to the *Yukon Environmental and Socio-economic Assessment Act*, SC 2003, c. 7 (YESAA).

The methodology outlined in this section provides a structured framework that is consistently applied to all assessment topics. The following guidance documents were considered when developing the Project's effects assessment methodology:

- *Proponent's Guide to Information Requirements for Executive Committee Project Proposal Submissions* (YESAB 2005)
- Proposal Checklist for Executive Committee Screenings (YESAB 2015)
- *Guideline for the Selection of Valued Components and Assessment of Potential Effects* (BC EAO 2013).

This methodology makes use of assessment terms Valued Components (VCs), Intermediate Components (ICs), subcomponents, and indicators. Definitions for these terms are included in **Table 5-1**.

**Table 5-1 Assessment Terminology**

| Term | Definition |
|---|---|
| Valued Component | Element of the environmental and socio-economic systems valued for environmental, scientific, social, aesthetic, or cultural reasons. |
| Intermediate Component | An environmental or socio-economic component that is part of a larger effects pathway leading to a VC. |
| Subcomponent | Identified to further structure and focus the assessment into logical cohorts. |
| Indicator | Metrics identified for each VC, IC, or subcomponent to quantitatively or qualitatively evaluate existing conditions and trends, and assess potential Project-related changes and effects. |

The assessment methodology for VCs follows the main steps described below:

- Issues scoping
- Establishing baseline conditions
- Assessing potential effects
- Assessing cumulative effects
- Identifying effects monitoring and adaptive management.

The IC analyses involve most of the methodological steps described above for VC assessments, with the exception of determination of significance and likelihood for both Project-related change and the Project's contribution to cumulative change.

## 5.1 SCOPE OF THE EFFECTS ASSESSMENT

Scoping is designed to focus the Application on the issues with the greatest potential to cause significant adverse effects on the selected VCs and ICs. Each VC effects assessment or IC change analysis section includes a description of the issues scoping process used to identify the VC or IC selected for assessment or analysis, including the indicators used to evaluate the effects or analyze change, and the rationale for their selection. Assessment or change analysis sections also describe the process and rationale used to select assessment and change analysis boundaries.

### 5.1.1 SELECTING INTERMEDIATE COMPONENTS AND VALUED COMPONENTS

During initial issues scoping, Kaminak Gold Corporation, a wholly owned subsidiary of Goldcorp Inc. (Goldcorp or Proponent) compiled a list of candidate ICs and VCs based on Project relevance and importance to First Nations, government agencies, and stakeholders, as identified during the Project's consultation and engagement activities. Key factors considered in the evaluation of candidate ICs and VCs included:

- Ability to measure and monitor potential Project-related changes or effects to the IC or VC
- Ability of the IC or VC to represent potential changes or effects on other candidate ICs or VCs
- Position of the IC or VC along one or more pathways of effects
- Whether the IC or VC is protected through a legal instrument (e.g., territorial or federal legislation).

Valued components, ICs, subcomponents, and indicators selected for assessment are identified in **Table 5.1-1**, and **Table 5.1-2**. Detailed descriptions of the rationale for the selection of each IC and VC are provided in the relevant IC analysis and VC assessment reports.

### Table 5.1-1 Intermediate Components, Subcomponents, and Indicators

| Selected Intermediate Component | Subcomponents | Indicators Used for the Analysis |
|---|---|---|
| Groundwater | Groundwater Quantity | • Groundwater levels<br>• Surface water low flows |
| | Groundwater Quality | • Predicted / observed pit lake water quality<br>• Predicted / observed waste rock seepage quality<br>• Baseflow and observation well water quality |
| Surface Hydrology | N/A | • Annual runoff<br>• Monthly runoff distribution<br>• Low flows<br>• Peak flows<br>• Duration and frequency of flow |
| Air Quality and Greenhouse Gas Emissions | N/A | • Total suspended particulate<br>• Particulate matter <10 µm in diameter<br>• Particulate matter <2.5 µm in diameter<br>• Dust fallout and mineral content<br>• Nitrogen oxides<br>• Sulphur dioxide<br>• Carbon monoxide<br>• Greenhouse gases |
| Noise | N/A | • Noise levels |
| Demographics | N/A | • Population size and growth<br>• Age distribution<br>• Gender distribution<br>• Mobility |

**Note:** µm -micrometre

### Table 5.1-2 Valued Components, Subcomponents, and Indicators

| Selected Valued Component | Subcomponents | Indicators Used for the Assessment |
|---|---|---|
| Surficial Geology, Terrain, and Soils | Terrain Stability | • Change in terrain stability class<br>• Change in terrain stability as a result of permafrost disturbance |
| | Unique Landforms | • Disturbance of unique landforms |
| | Soil Quality | • Soil disturbance<br>• Soil degradation<br>• Soil salvage and handling |
| Surface Water Quality | N/A | • TSS and turbidity concentration<br>• Physical parameters<br>• Cyanide species<br>• Nutrient concentrations<br>• Biological oxygen demand and chemical oxygen demand<br>• Total and dissolved metals concentrations |

| Selected Valued Component | Subcomponents | Indicators Used for the Assessment |
|---|---|---|
| Fish and Fish Habitat | Arctic Grayling | • Habitat suitability<br>• Habitat accessibility<br>• Contaminant toxicity<br>• Stream productivity<br>• Fish mortality |
| | Chinook Salmon | • Habitat suitability<br>• Habitat accessibility<br>• Contaminant toxicity<br>• Stream productivity<br>• Fish mortality |
| | Chum Salmon | • Habitat suitability<br>• Fish mortality |
| Vegetation | Ecological Communities | • Area of ecological communities that will be lost |
| | Wetland Habitats | • Area of wetland habitats that will be lost |
| | Traditional and Medicinal Plants | • Area of berry producing ecological communities that will be lost |
| | Rare Plants | • Area of potential rare plant habitat that will be lost |
| | Vegetation Health | • Risk of increased concentration of trace metals in selected indicator species |
| Wildlife and Wildlife Habitat | Fortymile Caribou | • Habitat availability<br>• Mortality risk<br>• Movement patterns |
| | Klaza Caribou | • Habitat availability |
| | Moose | • Habitat availability<br>• Mortality risk |
| | Thinhorn Sheep | • Habitat availability<br>• Movement patterns |
| | Grizzly Bear | • Individual den sites / den habitat quantity<br>• Habitat availability<br>• Mortality risk |
| | Wolverine | • Individual den sites / den habitat quantity<br>• Mortality risk |
| | Little Brown Myotis | • Roost habitat availability |
| Birds and Bird Habitat | Sharp-tailed Grouse | • Number of available lek sites |
| | Cliff-nesting Raptors | • Number of available nest sites |
| | Passerines | • Amount of high-suitability habitat |
| | Upland-associated Species at Risk | • Amount of high suitability habitat |
| | Wetland-associated Species at Risk | • Amount of high-suitability habitat |
| | Bank Swallow | • Number of available colony sites |
| Economic Conditions | N/A | • Income and income distribution<br>• Labour market<br>• Sustainable economic development |

| Selected Valued Component | Subcomponents | Indicators Used for the Assessment |
|---|---|---|
| Social Economy | Non-wage Economy | • Type and diversity of non-profit and non-governmental organizations<br>• Type and level of engagement in voluntary sector<br>• Type and level of engagement in informal social economic activities<br>• Subsistence activities |
| | Traditional Economy | • Quality and diversity of the traditional economy<br>• Level of engagement in the traditional economy<br>• Value of the traditional economy |
| Community Infrastructure and Services | Housing and Accommodation | • Housing availability<br>• Housing development<br>• Housing cost<br>• Non-permanent accommodation characteristics |
| | Physical Infrastructure | • Physical infrastructure |
| | Community Services | • Community services |
| | Transportation | • Air traffic<br>• Road traffic<br>• Road network |
| Education Services | Primary, Secondary, and Post-secondary Education Services | • Enrollment trends<br>• Educational attainment |
| | Industry-specific Community-based Training | • Opportunities<br>• Linkages to industry needs |
| Land and Resource Use | Non-traditional Land and Resource Use | • Change in access to land and resources<br>• Change in sensory conditions during current use<br>• Direct change in the availability of land and resources<br>• Change in the quality of land and resources |
| | Current Traditional Land and Resource Use | • Change in access to land and resources<br>• Change in sensory conditions during current use<br>• Direct change in the availability of land and resources<br>• Change in the quality of resources |
| Community Health and Well-being | Environmental Quality | • Air quality<br>• Noise and vibration<br>• Country food quality |
| | Socio-economic Factors | • Social determinants of health<br>• Health-related behaviours<br>• Food security<br>• Accidental injuries<br>• Infectious disease<br>• Non-infectious disease<br>• Mental health and wellness<br>• Health services structure and capacity |
| Heritage Resources | Archaeological and Historical Resources | • Number<br>• Integrity |
| | Paleontological Resources | • Number<br>• Integrity |

**Note:** TSS - total suspended solids

### 5.1.2 ESTABLISHING ASSESSMENT BOUNDARIES

Assessment boundaries define the maximum limit of the change analysis and effects assessment. Boundaries encompass areas within and times when the Project is expected to interact with the ICs and VCs, as well as any constraints due to political, social, and economic realities, and limitations in predicting or measuring changes. Each change analysis and effects assessment section of the Project Proposal describes spatial and temporal boundaries and the rationale for their selection, as well as any applicable administrative and technical boundaries.

#### *5.1.2.1 Spatial Boundaries*

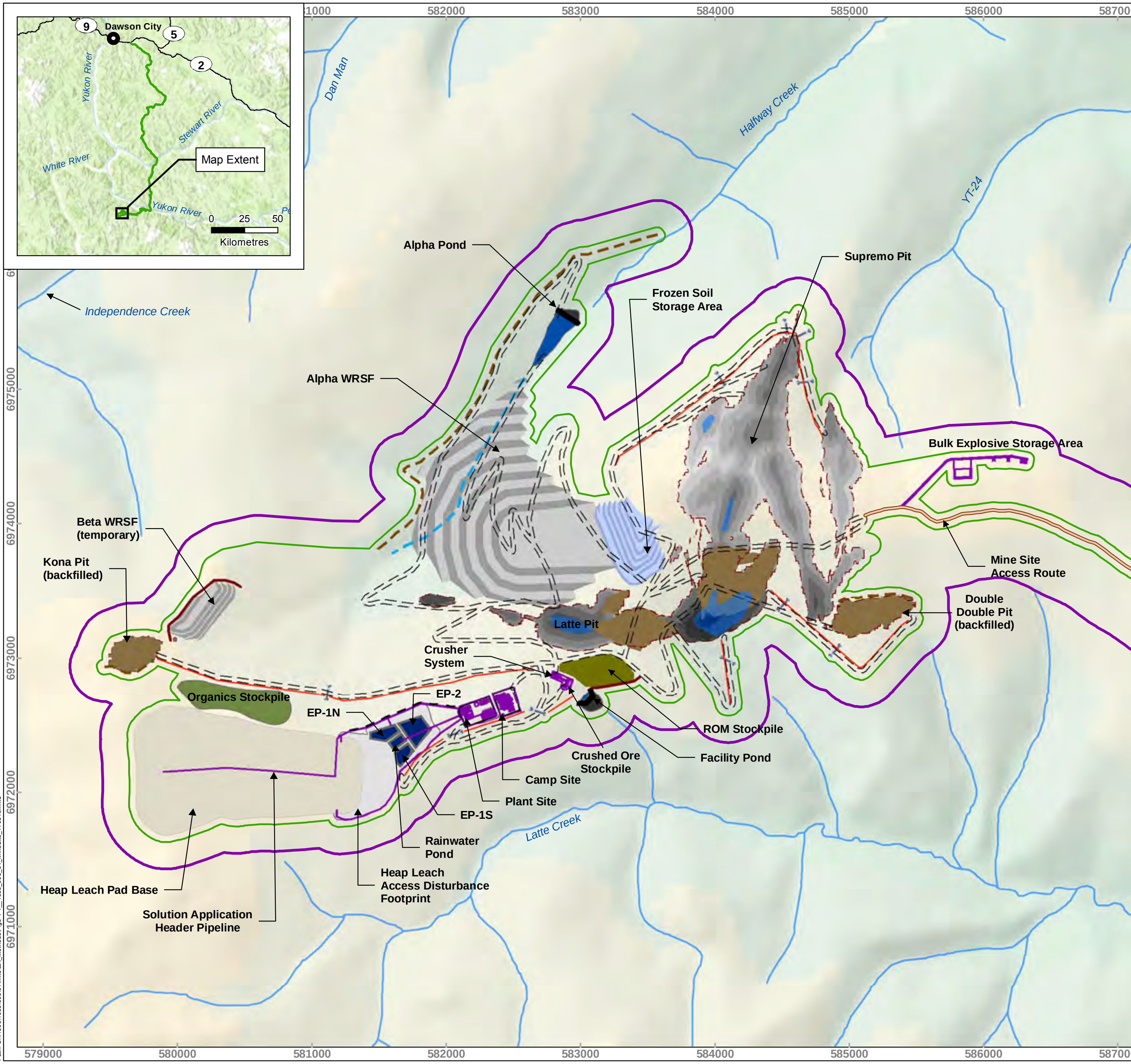
Spatial assessment boundaries were identified for each VC based on the spatial characteristics of the Project and the VC, and the areas where Project–VC interactions and effects are expected to occur. The same process was followed when identifying study area boundaries for each IC.

In determining these spatial boundaries, the Project team considered Traditional Knowledge (TK), scientific and other information, including pertinent ecological, social, and cultural values, as identified through baseline studies and input received from First Nations, government agencies, local communities, the public, and other interested parties. The types of spatial boundaries established for the assessment of potential Project-related changes to individual ICs, and Project-related effects to individual VCs are defined in **Table 5.1-3**.

**Table 5.1-3 Spatial Boundary Definitions for Intermediate Component Analyses and Valued Component Assessments**

| Spatial Boundary | Description of Assessment Area |
|---|---|
| Project footprint | Area in which Project-related physical disturbance will occur, plus a 50-m buffer, as shown in **Figure 5.1-1** and **Figure 5.1-2**. The Project footprint includes a total of 3,402 hectares. |
| Project area | Area encompassing the mine site and airstrip, plus a 250-m buffer (**Figure 5.1-1**).<br>Area encompassing the footprint of the access road between the Mine Site and airstrip, and the footprint of the Northern Access Route footprint, plus a 500-m buffer on either side of the centreline (**Figure 5.1-1** and **Figure 5.1-2**). The Project area includes a total of 22,006 hectares. |
| **Intermediate Component** | |
| Local Study Area | Encompasses the area within which the Project is expected to interact with and potentially result in changes to the IC or subcomponent |
| Regional Study Area | Provides the regional context for the analysis of potential Project-related changes within the LSA; unless otherwise indicated, the RSA will also encompass the area where residual Project-related changes to the IC or subcomponent are likely to combine with the residual changes of other projects and activities to result in a cumulative change to the IC or subcomponent. |
| **Valued Component** | |
| Local Assessment Area | Encompasses the area where the Project is expected to interact with and potentially affect the VC or subcomponent |
| Regional Assessment Area | Provides the regional context for the assessment of potential Project-related effects within the LAA; unless otherwise indicated, the RAA will also encompass the area within which Project-related residual effects on the VC or subcomponent are likely to combine with the residual effects of other projects and activities to result in a cumulative effect on the VC or subcomponent. |

**Notes:** LAA - Local Assessment Area; LSA - Local Study Area; m - metre; RAA - Regional Assessment Area; RSA - Regional Study Area




COFFEE GOLD MINE

**Spatial Boundaries for the Assessment - Mine Site**

## Legend

- Watercourse
- Project Footprint
- Project Area
- Total Pit Outline
- Backfill
- Pit Lake
- Organics Stockpile
- ROM Stockpile
- Heap Leach Access Disturbance Footprint
- Heap Leach Pad Base
- Support Infrastructure
- Mine Site Access Route
- Haul Roads
- Culverts
- Pond Berm
- Diversion Channel
- Road Drainage Ditch
- Rock Drain
- Collection Channel
- Event Pond
- Event Pond Slope
- Sedimentation Pond Dam
- Sedimentation Pond
- Waste Slope
- Bench

## Notes

1. This map is not intended to be a "stand-alone" document, but a visual aid of the information contained within the referenced Report. It is intended to be used in conjunction with the scope of services and limitations described therein.
2. This is a cumulative disturbance figure showing the maximum extent of all mine site components for the duration of the mine life.

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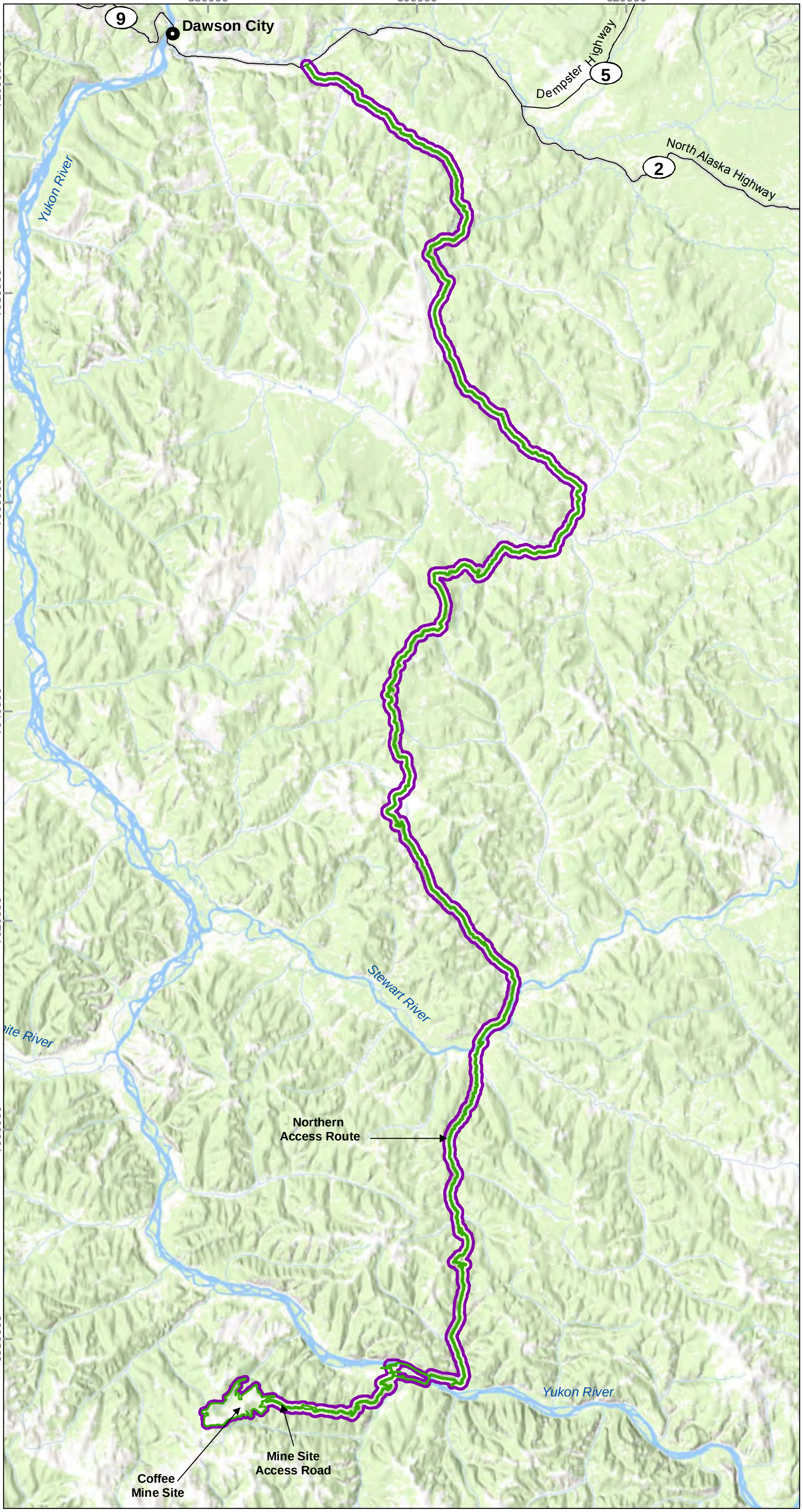


# COFFEE GOLD MINE

## Spatial Boundaries for the Assessment - Northern Access Route


## Legend

- Highway
- Project Footprint
- Project Area

## Notes

1. This map is not intended to be a "stand-alone" document, but a visual aid of the information contained within the referenced Report. It is intended to be used in conjunction with the scope of services and limitations described therein.

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#### *5.1.2.2 Temporal Boundaries*

The temporal boundaries identified for IC analyses and VC assessments encompass periods when the Project is expected to affect ICs and VCs. These boundaries were determined based on the timing and duration of the Project. Potential effects will be considered for each phase of the Project as described in **Table 5.1-4**. Temporal characteristics of the VCs relevant to the effects assessment will also be documented.

**Table 5.1-4 Temporal Boundaries for the Change Analyses and Effects Assessments**

| Spatial Boundary | Project Year | Length of Phase | Description of Activities |
|---|---|---|---|
| Construction | –3 to –1 | 30 months | Construction of Northern Access Route and Mine Site<br>Pre-production activities |
| Operation | 1 to 12 | 12 years | Mining activities<br>Operational closure activities |
| Reclamation and Closure | 13 to 23 | 11 years | Post-mining Closure Stage from Year 13 to Year 17: ore processing continues, but no active mining<br>Active Closure Stage from Year 18 to Year 23: water treatment and reclamation and closure activities at Northern Access Route and Mine Site |
| Post-closure | 24 onwards | as determined to be required | Ongoing monitoring |

#### *5.1.2.3 Administrative and Technical Boundaries*

Administrative boundaries arise when political, economic, or social issues, as well as fiscal or other resourcing issues constrain the environmental assessment. Administrative boundaries do not apply to every assessment, but where identified, the nature of the administrative boundaries and their effect on the assessment is documented.

Technical boundaries arise when there is a limit in the ability to predict a project's effects. This may occur when sampling is constrained by legal restrictions, when large geographical settings limit the ability of proper sampling, or when modelling constraints impose limitations on the analysis. Technical boundaries do not apply to every assessment, but in cases where technical boundaries have been identified, the nature of the technical boundaries and their effect on the assessment are documented.

## 5.2 DESCRIBING EXISTING CONDITIONS

The existing conditions section for each IC and VC section of the Project Proposal establishes the setting for the assessment of Project-related changes or effects on each IC and VC, respectively. The information is provided at an overview level for the regional areas, including the Regional Study Area (RSA) and the Regional Assessment Area (RAA), and in more detail for the local areas, including the Local Study Area (LSA) and the Local Assessment Area (LAA). The level of detail provided for the local areas is sufficient to enable potential Project–IC and VC interactions to be identified and understood.

Existing conditions are described in each IC and VC section based on available information, including the following:

- Federal, territorial, First Nation, and local government jurisdictions, mandates, agreements, and interests of specific relevance to the IC or VC;
- Baseline report describing desktop and field studies conducted for the Project;
- Available TK of specific relevance to the particular IC or VC, subject to any confidentiality constraints that may apply; and
- Scientific and other information, such as published literature, databases, remote sensing imagery and data, monitoring programs, and previous environmental assessments or associated technical reports.

The quality and reliability of the baseline data and their applicability for the purpose used, including any uncertainty or gaps, are discussed in the relevant IC and VC sections.

## 5.3 ASSESSING PROJECT-RELATED EFFECTS OR CHANGES

Each IC and VC section includes an assessment of Project-related effects or changes by: identifying potential Project interactions; evaluating potential Project-specific changes or effects, respectively; and describing proposed mitigation measures. Based on the anticipated effectiveness of these measures, residual changes to ICs and residual effects to VCs are characterized. For VCs, the significance and likelihood of each predicted residual effect is also determined. These steps are described below.

### 5.3.1 IDENTIFYING POTENTIAL EFFECTS AND CHANGES

To determine how ICs may be changed and VCs may be affected by the Project, the Project team has completed a high-level overview of the types of potential effects of the Project on each VC and IC, and has included this overview in each assessment section. The following questions have been posed for each VC and IC:

- What are the types of effects that result from the interaction of the Project's components and activities with the VCs over different Project phases?
- Which interactions have the greatest potential to cause adverse residual effects or are of particular concern to government, First Nations, stakeholders, or the public?

Answering these questions allows the assessment to be focused on Project–VC interactions with the greatest risk.

The Project team compiled a master list of Project activities, organized by Project component, for consideration of potential IC and VC interactions with the Project. This Project Interaction Matrix is included in **Appendix 5-A**, and each IC change analysis or VC assessment section identifies and rates potential interactions with ICs and VCs using the following criteria:

- **No interaction**: The Project activity is not predicted to interact with the VC, IC, or subcomponent. The interaction is not considered further in the assessment.
- **Negligible interaction**: The Project activity is predicted to interact with the VC, IC, or subcomponent; however, effects or changes are predicted to be either not measurable or detectable. The interaction is not considered further in the assessment.
- **Potential interaction**: The Project activity is predicted to interact with the VC, IC, or subcomponent. Changes or effects are predicted to be measurable and detectable, and are described. The interaction is carried forward in the assessment.

Following this screening, the identified potential Project changes and effects are summarized in each Project Proposal section. All Project components/activities that will not interact with a VC will not result in potential effect and are not considered further in the assessment. Where a potential interaction is predicted, a potential effect or change is identified and carried forward in the assessment.

### 5.3.2 MITIGATION MEASURES

Section 2 of YESAA defines mitigation as measures to eliminate, reduce, or control adverse environmental or socio-economic effects. For projects subject to YESAB Executive Committee screening, the Act also requires that mitigation measures incorporated in the Proposal consider:

> (g) the need to protect the rights of Yukon Indian persons under final agreements, the special relationship between Yukon Indian persons and the wilderness environment of Yukon, and the cultures, traditions, health and lifestyles of Yukon Indian persons and other residents of Yukon;
>
> (g.1) the interests of first nations;
>
> (h) the interest of residents of Yukon and of Canadian residents outside Yukon. (YESAA, section 50 (2))

Consistent with direction provided in YESAA, each IC change analysis and VC assessment section includes descriptions of mitigation measures of relevance to the particular VC to eliminate, reduce, or control adverse Project-related effects and changes, including mitigation measures incorporated into Project planning and design (see **Section 2.0 Project Description**), and measures contained in industry codes and standards. A summary of mitigation measures and commitments is provided in **Section 32.0 Project Design Measures and Commitments**, this summary table will be used to track mitigations and commitments throughout the assessment and into subsequent management programs and licencing processes.

### 5.3.3 Characterizing Residual Effects and Determining Significance

The residual changes described in the IC analyses and the residual effects described in the VC assessments represent the best prediction of what is likely to occur based on knowledge of the Project components and activities, the predicted pathways of effects, and the proposed mitigation. No residual changes are characterized for ICs.

#### *5.3.3.1 Residual Effects Characterization*

Residual effects have been characterized using the following criteria: direction, magnitude, geographic extent, timing, frequency, duration, reversibility, and probability of occurrence. General definitions for these characteristics are presented in **Table 5.3-1**. Each VC assessment section provides specific VC or subcomponent definitions for these characteristics and ratings. A narrative description of the relevant context is also provided for each VC or subcomponent (i.e., the extent to which the VC has been affected by past and present environmental and socio-economic processes and conditions, its potential sensitivity to the Project-related residual effect, and its ability to recover from that effect). If residual effect was characterized as potentially being both positive and adverse, typically only the adverse effect was assessed.

**Table 5.3-1 Residual Effect Characteristics**

| Residual Effect Characteristic | General Definition | General Rating |
|---|---|---|
| Direction | Identifies whether the residual effect will be adverse or positive | • Adverse<br>• Positive |
| Magnitude | Size or severity of the residual effect relative to the existing condition of the VC, generally measured in terms of the proportion of the VC affected within the LAA, relative to the range of natural variation (or historic variation in the case of human environment VCs) | • Low<br>• Moderate<br>• High |
| Geographic Extent | Geographic area where the residual effect is likely to occur | • An area within the Project footprint (e.g., Mine Site – Supremo open pit; Northern Access Route – Yukon River south barge landing)<br>• Project footprint<br>• Local (limited to LAA)<br>• Regional (limited to RAA)<br>• Territorial |
| Timing | Occurrence of the residual effect with respect to a temporal attribute important to the VC (e.g., time of day, season, stage in life cycle, etc.) | • VC-specific |
| Frequency | How often the residual effect is likely to occur, taking into account VC-specific temporal characteristics | • Infrequent<br>• Frequent<br>• Continuous |
| Duration | Length of time the residual effect to the VC is likely to persist, taking into account VC-specific temporal characteristics | • Short-term<br>• Long-term<br>• Permanent |

| Residual Effect Characteristic | General Definition | General Rating |
|---|---|---|
| Reversibility | Degree to which the residual effect can be reversed once the causal factors cease; irreversible effects are considered to be permanent | • Fully reversible<br>• Partially reversible<br>• Irreversible |
| Probability of occurrence | Likelihood that the residual effect will occur, taking into account how probable it is that a disturbance will actually be caused by the Project or that a specific mitigation will be successful | • Likely<br>• Unlikely |

Definitions for each residual effect characteristic and rating were derived according to the following hierarchy:

1. A published regulatory or industry standard or criterion that establishes a threshold
2. A range of values or standards that, while not regulated, are widely recognized and accepted
3. Professional judgment based on a review of literature, precedents, TK, scientific, and other information provided by learned persons, panels, etc. that support establishment of a threshold.

Clear definitions for each residual effect characteristic and rating, accompanied by supporting rationales, are provided in each VC assessment section.

#### *5.3.3.2 Level of Confidence in Residual Effects Assessments*

Each VC assessment section describes the level of confidence associated with each residual effects assessment. Level of confidence (i.e., low, moderate, high) is typically based on expert judgement and characterizes the level of uncertainty associated with both the likelihood (i.e., probability of occurrence) and significance determinations (see **Section 5.3.3.1)**. In establishing level of confidence, considerations include:

- Scientific certainty relative to the quantification of the effect, including the quality or quantity of data and the understanding of effect mechanisms
- Scientific certainty relative to the effectiveness of the proposed mitigation
- Professional judgment based on prior experience in assessing effects and the known effectiveness of proven mitigation measures.

#### *5.3.3.3 Determination of Significance*

In determining the significance of residual adverse effects, each VC assessment considers the nature of each residual effect and the context within which the effect would occur. The existing condition of the VC is compared with the future conditions assessed to result from the Project. The anticipated future condition of each VC with the Project is compared to significance criteria defined for that specific VC. The threshold of significance is the point beyond which the integrity of the VC may be compromised and the residual effect is considered to be significant.

The rationale for the determination of significance is provided for each VC. In defining the significance threshold, preference is given to the use of criteria or standards established by government through regulation or widely accepted by industry.

Each VC section indicates whether the level of each residual effect has been rated as Not Significant or Significant. Each VC section also indicates how or whether a consideration of likelihood (i.e., probability of occurrence) (see **Table 5.3-1)** influenced the determination of significance, as well as the level of confidence in both the significance and likelihood determinations. In addition, the nature and source of any uncertainty that lowers the level of confidence in the residual effects assessment is described.

## 5.4 CUMULATIVE EFFECTS ASSESSMENT METHODOLOGY

All residual effects or changes remaining after the implementation of mitigation measures are considered in a cumulative effects assessment or change analysis.

The consideration of cumulative effects is defined in YESAA as follows:

> (d) the significance of any adverse cumulative environmental or socio-economic effects that have occurred or might occur in connection with the project or existing project in combination with the effects of other projects for which proposals have been submitted under subsection 50(1) or any activities that have been carried out, are being carried out or are likely to be carried out in or outside Yukon (section 42(1)).

The *Assessor's Guide to the Assessment of Cumulative Effects* (YESAB 2006) described cumulative effects as:

> Changes to environmental or socio-economic components caused by an activity (related to a project being assessed) in combination with other past, present, and future activities (YESAB 2006).

### 5.4.1 SCOPE OF THE CUMULATIVE EFFECTS ASSESSMENT

As set out in YESAB guidance (YESAB 2006), cumulative effects assessments focus on VCs or subcomponents that, despite the implementation of mitigation measures, are likely to experience Project-related adverse residual effects, whether significant or not significant. Cumulative changes are also characterized for residual changes remaining to ICs after the implementation of mitigation measures. The cumulative effects assessment examines how the residual adverse effects of the Project may interact spatially and temporally with the residual effects of other past, present, or future projects.

In most cases, the assessment of cumulative effects has been conducted within the boundaries of the RAA identified for the VC (see **Table 5.1-3**). For certain VCs, however, the cumulative effects assessment boundaries differed from those of the RAA. In all cases, the rationale supporting the selection of spatial boundaries for the analysis of cumulative changes to an IC or the assessment of cumulative effects to a VC is provided in the corresponding section.

Each IC analysis and VC assessment section includes detailed consideration of potential cumulative effects, including the rationale for inclusion or exclusion of each residual change or residual effect and the spatial and temporal assessment boundaries.

### 5.4.2 IDENTIFYING OTHER PROJECTS AND ACTIVITIES

A master list of other past, present, and future projects and activities with residual adverse effects that may interact spatially or temporally with those of the Project to result in cumulative effects is presented in **Appendix 5-B Project and Activities Inclusion List.** This appendix includes a description for general groups of projects and activities (e.g., placer mines) as well as the list of individual projects and activities. In this list, past projects and activities are defined as projects and land use activities that occurred in the past and are no longer active. Present projects and activities are defined as existing and active projects and land use activities. Future projects and activities are defined as reasonably foreseeable projects or land use activities for which proposals have been submitted under YESAA (subsection 50(1)), or have entered into a formal project approval or permitting process.

The Project and Activities Inclusion List has been developed based on consultation and engagement with government agencies, affected First Nations and local communities, and stakeholders, and review of publicly available information sources including:

- Yukon Environmental and Socio-economic Assessment Board
  - YESAB Online Registry database
- Yukon Government websites:
  - Energy, Mines and Resources
  - Environment Yukon
  - Geomatics Yukon
- Yukon Land Use Planning Council
- Yukon Outfitters Association website
- First Nations' websites.

Each of the projects and activities identified in the master Project and Activities Inclusion List has been screened for each VC and IC using the following criteria:

- Availability of quantitative and qualitative information to support spatial and temporal characterization and identification of potential or actual residual adverse effect(s)
- Spatial overlap between the residual effects of the other project or activity and the residual changes or effects of the Project
- Temporal overlap between the residual effects of the project or activity and the residual changes or effects of the Project.

Projects and activities that meet all three criteria are considered in the analysis of cumulative changes to ICs and the assessment of cumulative effects to VCs. More detailed criteria for screening the other projects and activities are provided in the respective IC or VC section, which also contains an overview description of each project and activity considered in the particular cumulative effects assessment, focusing on its relevant residual effect(s). Where reasonable to assist the assessment, other projects and activities are grouped into larger similar use categories.

### 5.4.3 Identifying Potential Interactions and Cumulative Changes and Effects

Potential interactions between Project-related residual changes or effects on the IC or VC, and the actual or potential residual effects of other projects or activities, are identified and described.

When an interaction is determined as likely to occur but is not be likely to result in a cumulative change to the IC or a cumulative effect on the VC, or if the cumulative change or effect is likely to be negligible, it is not considered further. A clear description of all such interactions and the associated decision rationale are provided.

If an interaction is likely to occur and is likely to result in a demonstrable or measurable cumulative change to the IC or effect on the VC, it is described, along with the rationale for the decision to carry it forward to the next step of the assessment.

### 5.4.4 Mitigation Measures for Cumulative Changes and Effects

Each IC cumulative change analysis and VC cumulative effects assessment considers Project design changes, management plans, and technically and economically feasible measures to eliminate, reduce, or control the identified adverse cumulative effects. Consideration is given to measures to be implemented by Goldcorp, as well as measures to be undertaken by other parties (e.g., Yukon Government, proponents of other projects). Each assessment includes consideration of existing or proposed regional cumulative effects monitoring and management initiatives specific to the VC to which Goldcorp is contributing or will contribute. Further, each assessment section includes descriptions of policies or programs relevant to the IC or VC, or commitments made by Goldcorp to enhance or promote expected positive or beneficial cumulative effects to the IC or VC.

Assumptions or uncertainties concerning the implementation of a particular mitigation measure or its ability to effectively eliminate, reduce, or control the adverse cumulative effect(s) to the IC or VC are discussed in each assessment. Cross-references are provided to specific environmental and socio-economic management plans, presented in **Appendix 31.0 Environmental and Socio-economic Management Program**, which include additional details regarding the particular mitigation measure. In cases where no additional measures are proposed to reduce the identified adverse cumulative changes to the IC or adverse cumulative effects on the VC, a rationale is provided.

### 5.4.5 CHARACTERIZING RESIDUAL CUMULATIVE EFFECTS AND DETERMINING SIGNIFICANCE

Residual cumulative effects to VCs that are likely to remain following the implementation of mitigation measures are evaluated according to the process described in **Section 5.3.3**, using the effects characteristic definitions and ratings and context descriptions developed for the VC. Also discussed in **Section 5.3.3** are any additional aspects of regional context considered relevant to the cumulative effects assessment that are not described in relation to Project-related effects on the VC.

The Project's contribution to each assessed residual cumulative effect to the VC is described. Residual cumulative changes and the Project's contribution to residual cumulative changes are presented for ICs.

The determination of significance for each residual cumulative effect includes consideration of the future condition of the VC, including the residual effects of the Project in combination with the residual effects of other projects and activities, as well as the effects of known physical processes (e.g., climate change) relative to the significance threshold previously defined for the VC (see **Section 5.3.3.3**). The nature of the assessed effect and the context in which it is likely to occur are used to support the significance determination. The influence of probability of effect occurrence (i.e., likelihood) on the determination of significance is discussed, and if it is a key factor, clearly explained.

The level of confidence associated with each significance determination is described, following the methodology set out in **Section 5.3.3.2**. The nature and source of any uncertainty that lowers the level of confidence are also described.

Each VC section provides a brief summary of the potential residual cumulative effects to the VC or VC subcomponents, including in-text references to tables summarizing: 1) residual adverse cumulative effects and 2) the determination of significance of these residual adverse cumulative effects on the VC.

## 5.5 EFFECTS MONITORING AND ADAPTIVE MANAGEMENT

Each IC analysis and VC assessment section describes whether or not monitoring will be required during Project implementation to verify effect assessments, compliance with regulatory requirements and Project approval conditions, and the effectiveness of mitigation measures. Any gaps in knowledge or understanding related to assessment findings will also be addressed. Each section includes cross-references to particular management plans, to be presented in **Appendix 31.0 Environmental and Socio-economic Management Program**, which describe IC- and VC-specific monitoring, surveillance, and follow-up activities.

When uncertainty exists regarding, for example, the effectiveness of a particular mitigation measure, the IC or VC section may describe a follow-up strategy. Key components of such a strategy include identification of alternate technically and economically feasible mitigation measures, design of an appropriate monitoring and evaluation approach, and development of procedures for implementation of the alternate measures and continued effectiveness monitoring, evaluation, and adjustment.

## 5.6 REFERENCES

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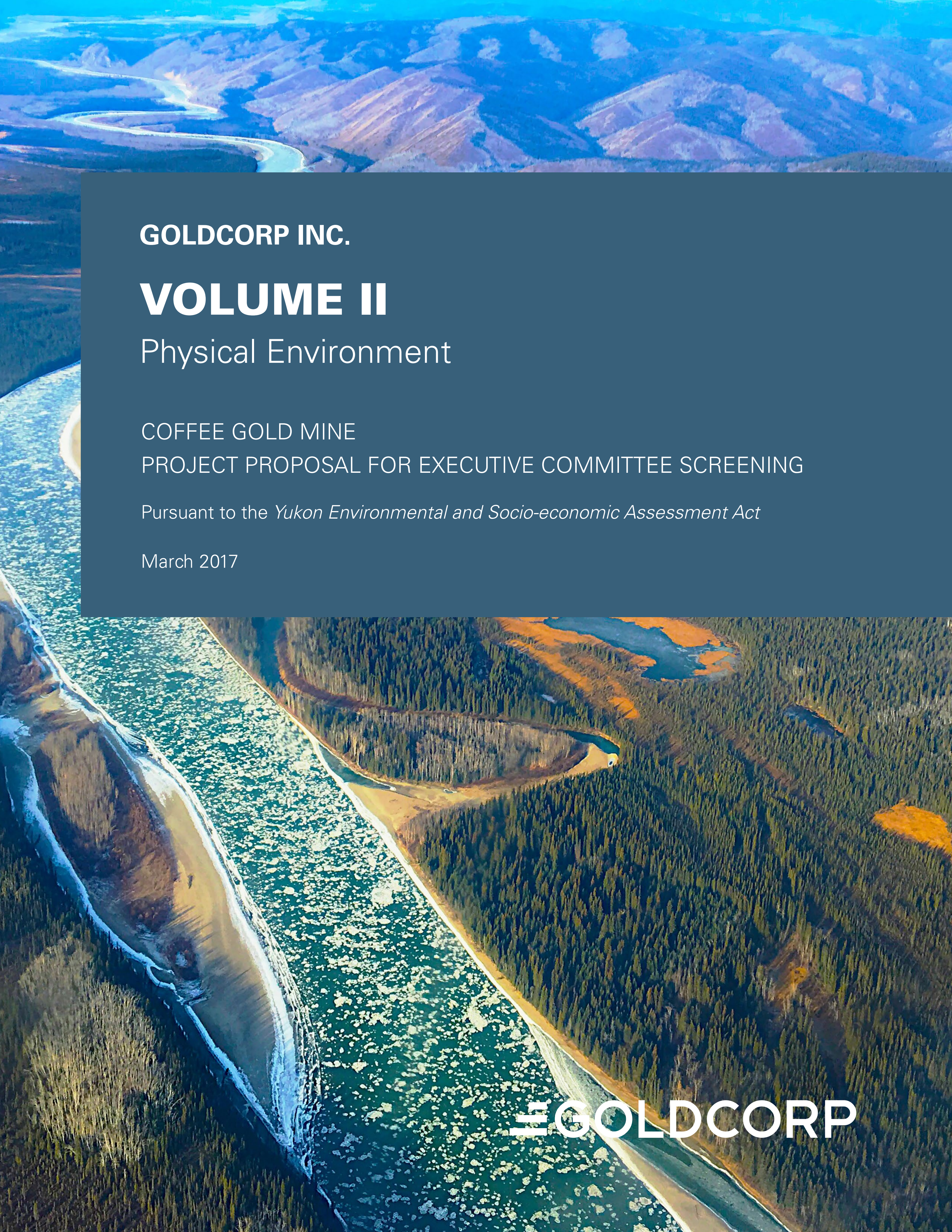


**GOLDCORP INC.**

# VOLUME II

## Physical Environment

COFFEE GOLD MINE
PROJECT PROPOSAL FOR EXECUTIVE COMMITTEE SCREENING

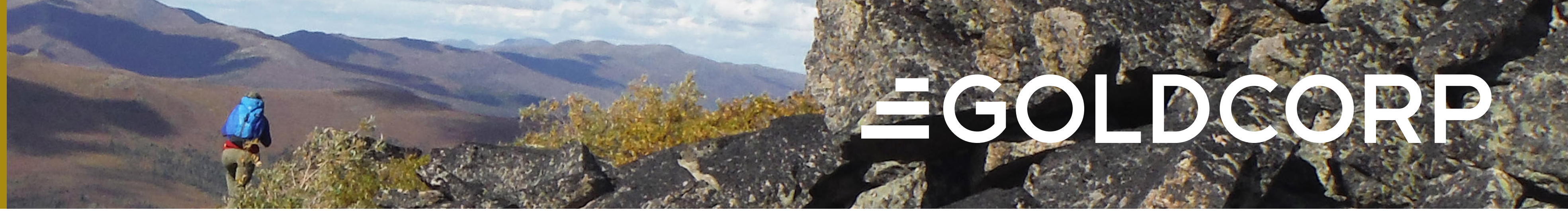
Pursuant to the *Yukon Environmental and Socio-economic Assessment Act*

March 2017

GOLDCORP

## Document Map

# COFFEE GOLD MINE
# YESAB PROJECT PROPOSAL

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# VOLUME II

# PHYSICAL ENVIRONMENT

# Coffee Gold Mine
# YESAB Project Proposal

# VOLUME II – PHYSICAL ENVIRONMENT
# Sections 6.0 to 12.0

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| Acronym / Abbreviation | Definition |
|---|---|
| 3D | three-dimensional |
| AAQO | Ambient Air Quality Objectives |
| AAQS | Ambient Air Quality Standards |
| ADR | adsorption, desorption, and recovery |
| AFN | Assembly of First Nations |
| Ag | silver |
| Al | aluminum |
| AN | ammonium nitrate |
| ANFO | Ammonium Nitrate/Fuel Oil |
| APS | Aboriginal Persons Survey |
| ARD | acid rock drainage |
| As | arsenic |
| ATV | all-terrain vehicle |
| Au | gold |
| AWOS | Automated Weather Observation System |
| BC | British Columbia |
| BEM | Broad Ecosystem Mapping |
| BMP | best management practice |
| BNOISE2 | Blast Noise Version 2 |
| C | carbon |
| CAC | criterion air contaminant |
| $CACO_3$ | calcium carbonate |
| CAD | Canadian dollars |
| CAPEX | capital expenditure |
| CBPR | community-based participatory research |
| CCL | compacted clay liner |
| CCME | Canadian Council of Ministers of the Environment |
| Cd | cadmium |
| CEA | Cumulative Effects Assessment |
| CEO | Chief Executive Officer |
| CEPA 1999 | *Canadian Environmental Protection Act, 1999* |
| CESA | Cumulative Effects Study Area |
| CFO | Chief Financial Officer |
| $CH_4$ | methane |

| Acronym / Abbreviation | Definition |
|---|---|
| CIC | carbon-in-carbon |
| CIM | Canadian Institute of Mining |
| CMHC | Canada Mortgage and Housing Corporation |
| CNIM | Centre for Northern Innovation in Mining |
| Co | cobalt |
| CO | carbon monoxide |
| $CO_2$ | carbon dioxide |
| $CO_2e$ | carbon dioxide equivalent |
| $CO_2e$/yr | carbon dioxide equivalent per year |
| Code | Environmental Code of Practice for Metal Mines |
| Coffee Property | The total property owned by Goldcorp, consisting of all 3.021 contiguous claims in the Coffee Claim Block |
| COPC | contaminant (or chemical) of potential concern |
| COSEWIC | Committee on the Status of Endangered Wildlife in Canada |
| CPI | Consumer Price Index |
| Cr | chromium |
| CRA | Canada Revenue Agency |
| CRC | Consolidated Regulations of Canada |
| CSI | Crime Severity Index |
| Cu | copper |
| CWD | Canadian Wildlife Service |
| Cyanide Code | International Cyanide Management Code |
| CYFN | Council of Yukon First Nations |
| Dawson | City of Dawson |
| DFO | Fisheries and Oceans Canada |
| DNA | deoxyribonucleic acid |
| DO | dissolved oxygen |
| e-DNA | Environmental DNA |
| EASR | Environmental Activity and Sector Registry |
| ECA | Exploration Cooperation Agreement |
| ECCA | Exploration Communication and Cooperation Agreement |
| EEM | effluent effects monitoring |
| ECCC | Environment and Climate Change Canada |
| ELC | Ecological and Landscape Class |
| EMP | Environmental Management Plan |
| EMR | Energy, Mines and Resources |
| EMS | emergency medical services |
| EP-1N | north event pond |

| Acronym / Abbreviation | Definition |
|---|---|
| EP-1S | south event pond |
| EP-2 | event pond 2 |
| EPCM | Engineering, Procurement, and Construction Management |
| ERP | Emergency Response Plan |
| ERT | emergency response team |
| FCASP | Federal Contaminated Sites Action Plan |
| Fe | iron |
| $Fe^{2+}$ | iron II |
| FC-RAA | Fortymile Caribou Regional Assessment Area |
| FIFO | fly in / fly out |
| FMCH | Fortymile Caribou herd |
| FNNND | First Nation of Na-cho Nyäk Dun |
| FRMP | Forest Resources Management Plan |
| FTA | Federal Transport Authorite (U.S.) |
| FTE | full-time equivalent |
| GCL | geosynthetic clay liner |
| GDP | gross domestic product |
| GHG | greenhouse gas |
| GIS | geographic information system |
| g | gravity |
| GMA | Game Management Area |
| GMZ | Game Management Zone |
| Goldcorp | Kaminak Gold Corporation, a wholly owned subsidiary of Goldcorp Inc. |
| GPS | geographic (or global) positioning system |
| HAP | Health Action Plan |
| HCN | hydrogen cyanide |
| H:V | horizontal to vertical |
| HDPE | high-density polyethylene |
| Hg | mercury |
| HHRA | Human Health Risk Assessment |
| HIA | Health Impact Assessment |
| HIV | human immunodeficiency virus |
| HLF | Heap Leach Facility |
| HR | human resources |
| HRIA | Heritage Resources Impact Assessment |
| HROA | Heritage Resources Overview Assessment |
| HRPP | Heritage Resources Protection Plan |

| Acronym / Abbreviation | Definition |
|---|---|
| HSS | Health and Social Services |
| HVAC | heating ,ventilation, and air conditioning |
| IBA | Impact Benefit Agreement |
| IC | Intermediate Component |
| ICSP | Integrated Community Sustainability Plan |
| IFR | Instrument Flight Rules |
| IMS | ice mapping system |
| IO | input-output |
| IPCC | Intergovernmental Panel on Climate Changte |
| IR | Information Request |
| IRR | Internal Rate of Return |
| ITP | inspection and test plan |
| K | Kindergarten |
| Kaminak | Kaminak Gold Corporation |
| KC-RAA | Klaza Caribou Regional Assessment Area |
| KCH | Klaza Caribou herd |
| KCS | Klondike Conservation Society |
| KDO | Klondike Development Organization. |
| LAA | Local Assessment Area |
| LD50 | amount of an ingested substance that causes 50% fatality |
| LLDPE | linear low-density polyethylene |
| LMB | Land Management Branch |
| LMU | Land Management Unit |
| LNG | liquefied natural gas |
| LOM | life-of-mine |
| LSA | Local Study Area |
| LSCFN | Little Salmon / Carmacks First Nation |
| LTECF | Livingstone Trail Environmental Control Facility |
| M | million |
| MAD | mean annual discharge |
| MBCA | *Migratory Birds Convention Act, 1994* |
| MBR | membrane bioreactor |
| MCC | motor control centre |
| MED | marine emergency duties |
| MIHR | Mining Industry Human Resources (Council) |
| ML | metals leaching |
| ML/ARD | metals leaching/acid rock drainage |

| Acronym / Abbreviation | Definition |
|---|---|
| MMER | Metal Mining Effluent Regulations |
| Mn | manganese |
| $Mn^{2+}$ | manganese II |
| Mo | molybdenum |
| MOE | Ministry of Environment |
| MRT | Mine Rescue Team |
| MT | Middle Transitional |
| N | north |
| $N_2O$ | nitrous oxide |
| NaCN | sodium cyanide |
| NAG | non-acid generating |
| NAICS | North American Industrial Classification System |
| NAR | Northern Access Route |
| NBCC | National Building Code of Canada |
| NE | northeast |
| NFPA | National Fire Protection Association |
| $NH_3$ | ammonia |
| NHS | National Household Survey |
| Ni | nickel |
| $NO_2$ | nitrogen dioxide |
| $NO_3$ | inorganic nitrate |
| $NO_x$ | nitrogen oxides |
| NOC | National Occupational Classification |
| NPAG | non-potentially acid generating |
| NPI | National Pollution Inventory |
| NPISH | Non-profit Institutions Serving Households |
| NPRI | National Pollutant Release Inventory |
| NPV | net present value |
| NRCan | Natural Resources Canada |
| NTS | National Topographic System |
| NW | northwest |
| NWP | Navigable Protection Program |
| NWT | Northwest Territories |
| OCP | Official Community Plan |
| ODALS | Omni-directional Approach Lighting System |
| OGC | Oil and Gas Commission |
| OIC | Order-in-Council |

| Acronym / Abbreviation | Definition |
|---|---|
| OPEX | operational expenditures |
| OX | oxide |
| PAG | potentially acid generating |
| Pb | lead |
| PGA | peak ground acceleration |
| PEA | preliminary economic assessment |
| PGS | peak ground acceleration |
| PHA | Permit Hunt Authorization |
| PLC | programmable logic controller |
| PM | particulate matter |
| $PM_{2.5}$ | fine particulate matter of 2.5 microns or less |
| $PM_{10}$ | fine particulate matter of 10 microns or less |
| PMP | probable maximum precipitation |
| PPE | personal protective equipment |
| Project | proposed Coffee Gold Mine |
| Proponent | Kaminak Gold Corporation, a wholly owned subsidiary of Goldcorp Inc. |
| PSL | permissible sound level |
| PWGSC | Public Works and Government Services Canada |
| PYLL | potential years of life lost |
| Q1 | first quarter |
| Q2 | second quarter |
| Q3 | third quarter |
| Q4 | fourth quarter |
| QA/QC | quality assurance / quality control |
| QMA | *Quartz Mining Act* |
| QML | Quartz Mining Licence |
| QMS | quality management system |
| RAA | Regional Assessment Area |
| RCMP | Royal Canadian Mounted Police |
| ROM | run-of-mine |
| RISC | Resource Inventory Standards Committee |
| RPP | Registered Professional Planner |
| RSA | Regional Study Area |
| RSS | Robert Service School |
| RSY | Revised Statutes of Yukon |
| RTC | Registered Trapping Concession |
| S | south |

| Acronym / Abbreviation | Definition |
|---|---|
| $S^{2-}$ | sulfide |
| SARA | *Species at Risk Act* |
| Sb | antimony |
| SDR | systematic data recovery |
| SE | southeast |
| Se | selenium |
| SEEA | socio-economic effects assessment |
| Sea Can | 20-foot shipping container |
| SEMS | Sustainability Excellence Management System |
| SFN | Selkirk First Nation |
| SGA | Self Governing Agreement |
| SLRA | Screening-level Risk Assessment |
| SI | International System of Units |
| SNAP | Scenarios Network for Alaska and Arctic Planning |
| $SO_2$ | sulphur dioxide |
| $SO_4$ | sulfate |
| SOR | Statutory Orders and Regulations |
| SOVA | School of Visual Arts |
| STI | sexually transmitted infection |
| STP | sewage treatment plant |
| SW | southwest |
| SY | Statutes of Yukon |
| SU1 | Supremo Phase 1 |
| SU2 | Supremo Phase 2 |
| SU3 | Supremo Phase 3 |
| SU3N | Supremo Phase 3 North |
| SU4N | Supremo Phase 4 North |
| SU4S | Supremo Phase 4 South |
| SU5N | Supremo Phase 5 North |
| SU5S | Supremo Phase 5 South |
| T-Cd | Total cadmium |
| T-Cr | Total |
| TB | tuberculosis |
| TDGA | *Transportation of Dangerous Goods Act* |
| TH | Tr'ondëk Hwëch'in |
| TIA | tailings impoundment area |
| TLUS | Traditional Land Use Study |

| Acronym / Abbreviation | Definition |
|---|---|
| TK | Traditional Knowledge |
| TR | technical report |
| TS-RAA | Thinhorn Sheep Regional Assessment Area |
| TSP | total suspended particulate |
| TSS | total suspended solids |
| TWG | Technical Working Group |
| U | uranium |
| UFA | Umbrella Final Agreement |
| UNESCO | United Nations Educational, Scientific, and Cultural Organization |
| U.S. | United States |
| USGS | United States Geological Survey |
| UT | Upper Transitional |
| UTM | Universal Transverse Mercator |
| UV | ultraviolet |
| VBY | Volunteer Bénévoles Yukon |
| VC | Valued Component |
| VKT | vehicle kilometres travelled |
| VLP | valley leach pad |
| VOC | volatile organic compound |
| VP | Vice President |
| WBM | water balance model |
| WGH | Whitehorse General Hospital |
| WHO | World Health Organization |
| WQG | water quality guidelines |
| WRFN | White River First Nation |
| WRSF | Waste Rock Storage Facility |
| WSC | Water Survey of Canada |
| WUL | Water Use Licence |
| YBS | Yukon Bureau of Statistics |
| YDA | Dawson City Airport |
| YEC | Yukon Energy Corporation |
| YESAA | *Yukon Environmental and Socio-economic Assessment Act* |
| YESAB | Yukon Environmental and Socio-economic Assessment Board |
| YG | Government of Yukon |
| YGED | Yukon Government Economic Development |
| YHC | Yukon Housing Corporation |
| YOMS | Yukon Occupational Modelling System |

| Acronym / Abbreviation | Definition |
|---|---|
| YT-24 | Yukon Tributary 24 (unnamed tributary) |
| YWB | Yukon Water Board |
| YWCHSB | Yukon Workers Compensation Health and Safety Board |
| YXY | Eric Nielsen Whitehorse Airport |
| Zn | zinc |

## SYMBOLS, AND MEASUREMENTS

| Symbol/Unit of Measure | Definition |
|---|---|
| µ | microgram |
| µg/g ww | micrograms per gram wet weight |
| µg/L | micrograms per litre |
| µS/cm | micro Siemens per centimetre |
| dB | decibel |
| dBA | A-weighted decibel |
| dBL | linear (unweighted) decibel |
| ft. | feet |
| g | gram |
| g/L | grams per litre |
| g/t | grams per tonne |
| ha | hectare |
| hr | hour |
| Hz | Herz |
| kg | kilogram |
| km | kilometre |
| km/hr | kilometres per hour |
| $km^2$ | square kilometres |
| kPA | kilopascal |
| kt | kilotonne |
| kW | kilowatt |
| L | litre |
| $L_{eq}$ | energy-averaged, A-weighted sound level for a complete time period |
| $L_P$ | Sound pressure level |
| $L_{peak}$ | maximum value reached by the sound pressure |
| L/s | litres per second |
| $L/s/km^2$ | litres per second per square kilometre |
| $L_W$ | sound power level |

| Symbol/Unit of Measure | Definition |
|---|---|
| m | metre |
| $m^2$ | square metre |
| $m^3$ | cubic metre |
| $m^3$/day | cubic metres per day |
| $m^3$/hr | cubic metres per hour |
| $m^3$/s | cubic metres per second |
| M | million |
| masl | metres above sea level |
| mg | milligram |
| mg/km | milligrams per kilometre |
| mg/L | milligrams per litre |
| ML | million litres |
| mm | millimetre |
| mm/yr | millimetres per year |
| $Mm^3$ | million cubic metres |
| M oz. | million ounces |
| Mt | million tonnes |
| Mt/a | million tonnes per annum |
| MW | megawatt |
| No. | number |
| oz. | ounce |
| ppb | parts per billion |
| ppm | parts per million |
| s | second |
| sq. mil. | square mile |
| t | tonnes |
| tpd | tonnes per day |
| V | volt |

# 6.0 INTRODUCTION TO PHYSICAL ENVIRONMENT

**Volume II** Physical Environment presents the change analysis of the physical environment Intermediate Components (ICs), and the effects assessments conducted for the physical environment Valued Components (VCs). This section provides an overview of the process for the selection of the ICs and VCs representing the physical environment of the proposed Coffee Gold Mine (Project).

## 6.1 ISSUES SCOPING

Information and issues regarding the physical components in the Project area were identified based on input provided during consultation and engagement, reviews of technical literature, and baseline studies conducted for the Project. Kaminak Gold Corporation, a wholly owned subsidiary of Goldcorp Inc. (Goldcorp or Proponent) has undertaken an engagement and consultation process, as defined under section 50 (3) of the *Yukon Environmental and Socio-economic Assessment Act*, SC 2003, c. 7 (YESAA), to support issues scoping for the Project (Refer to **Section 3.0 Consultation** for detail on the Project's consultation program).

### 6.1.1 FIRST NATIONS

A review of available Traditional Knowledge (TK) for the Project area was central to the issues scoping process. The Project footprint overlaps with the asserted area or established traditional territories of the following First Nations:

- Tr'ondëk Hwëch'in (TH)
- Selkirk First Nation (SFN)
- First Nation of Na-cho Nyäk Dun (FNNND)
- White River First Nation (WRFN).

For all First Nations, the following key issues were raised:

- Temporary and unplanned closure of the mine
- Increased traffic along the Northern Access Route (NAR)
- Cyanide usage and heap leaching.

Specific issues and species raised by each First Nation are listed below.

#### *6.1.1.1 Tr'ondëk Hwëch'in*

The following physical values have been noted for importance to TH during consultation and engagement activities (see **Section 3.0 Consultation** for the full consultation record):

- Air quality is important for the assessment of Project interactions and changes.
- Surficial geology and soil are important features due to the linkages to other VC/IC components.
- Terrain is important with respect to natural hazards, the use of landscape features, and contribution to the safe and effective planning of mine infrastructure.
- Unique landforms represent features on the landscape that are distinctive and may be included in the types of landscape features that were used.
- Coffee Creek valley has historical cultural value and is has continued cultural and spiritual importance (TH 2012b).
- Surface water quality is important, given that if water quality is impacted it has the potential to harm fish.

#### *6.1.1.2 White River First Nation*

The following physical values have been noted for importance to WRFN during consultation and engagement activities (see **Section 3.0 Consultation** for the full consultation record):

- Through consumption of fish, groundwater presents a pathway of effects to the Community Health and Well-being, Land and Resource Use, and Social Economy VCs.
- Potential contamination of water may deter WRFN members from harvesting resources.
- The mouth of Coffee Creek is an important habitation and fishing area where WRFN ancestors are known to have lived and gathered. It was also used as an important place that people would come to trade, and was a transport route.
- Coffee Creek area was historically used by WRFN to hunt moose and caribou as well as for trapping.
- The cultural significance of the Coffee Creek area to WRFN is reflected by all of the site-specific values associated with this area. In addition to such previously described values related to habitation, transportation, and subsistence, Coffee Creek is also culturally valued because of other cultural activities which are known to have taken place here.
- Coffee Creek remains an important area for its habitation value, and is an area that WRFN members have expressed interest in potentially using in the future.
- The Yukon River was an important component of water routes mapped by WRFN members.
- Potential disturbance and loss of an important cultural, historical, and spiritual site may occur due to noise pollution from mine activities and an increase in people in the area.

- There may be a potential reduction in the connection that WRFN members feel toward the landscape in general due to changes in the character and feel of the landscape, as a result of increased noise and disturbance from traffic, increased numbers of people, and fears over contamination.
- Potential noise pollution from the mine and its traffic, as well as increasing numbers of people and the presence of a work camp may deter WRFN members from camping, constructing cabins, or holding gatherings at the culturally important Coffee Creek site; these activities may reduce its spiritual significance.
- Potential disturbance of animals due to noise and traffic during Project Operation may cause them to move away from the area or change movement patterns.
- Noise from the mine workings and the road, boat, and helicopter traffic that the mine will bring into the area may also serve to scare animals such as moose and caribou away from the area.

#### *6.1.1.3 First Nation of Na-cho Nyäk Dun*

The following physical values have been noted for importance to FNNND during consultation and engagement activities (see **Section 3.0 Consultation** for the full consultation record):

- Coffee Creek was an important gathering place where ancestors of FNNND would historically stop during their seasonal round.
- The Stewart River is a waterway that has and is still used by generations of FNNND families for fish camps.

#### *6.1.1.4 Selkirk First Nation*

The following physical values have been noted for importance to SFN during consultation and engagement activities (see **Section 3.0 Consultation** for the full consultation record):

- Coffee Creek was historically an important place where SFN ancestors would gather, live, fish, and trade.
- Coffee Creek was an area historically known for moose hunting, and in the higher elevation areas around Coffee Creek for caribou hunting.
- Selkirk people used to gather and conduct such important cultural and spiritual activities as potlaches at Coffee Creek.

### 6.1.2 AFFECTED COMMUNITIES, INTERESTED PARTIES, AND THE PUBLIC

During consultation with affected communities, interested parties, and the public, the following key issues were raised:

- Increased traffic related to the upgrade of the NAR
- Temporary and unplanned closure of the mine
- Cyanide usage and heap leaching.

Concerns about the proposed NAR are related to increased traffic. Concerns about temporary and unplanned closure of the mine are related to the previous temporary closures of other mining projects in Yukon that turned into permanent closures. Additionally, the use of a heap leach pad and transportation of cyanide have been prioritized as issues of concern. Concerns related to the physical environment include the transport of cyanide via barge crossings as well as a potential failure of the heap leach liner system.

### 6.1.3 GOVERNMENT AGENCIES

With respect to the components of the physical environment that should be included in an assessment, the Yukon Environment and Socio-economic Assessment Board (YESAB) provides the following guidance:

> The potential to affect water resources should be thoroughly evaluated by the proponent prior to initiating any activities that may affect these resources. Because of the high level of importance typically afforded to water resources, this component should be given consideration as a potential VC whenever a project is in the vicinity and has the potential to affect water bodies, watercourses, and groundwater (YESAB 2005; p. 32).
>
> While noise itself is not valued component, noise levels may be. Noise can produce both environmental and socio-economic effects. Where applicable, the proponent should select noise levels as VCs, especially if communities or sensitive wildlife are within the area of influence (YESAB 2005; p. 33).
>
> Air quality impacts resulting from the project (e.g. smoke, dust) can pose a significant concern to residents, and may affect wildlife. If there is a likely potential for the project to adversely affect air quality, this component should be given consideration as a VC (YESAB 2005; p. 34).

While not expressly identified in the YESAB guidance document, it is evident from the review of past submissions to YESAB and other regulatory agencies that surficial geology, terrain, and soils are sufficiently important to government agencies, affected First Nations, local communities, the public, and other interested parties, as well as to other biophysical components of the environment to warrant full consideration in the assessment.

During consultation with government agencies, the following key issues were raised:

- Northern Access Route interests are broad-ranging from maintenance responsibilities to and access control.
- Cyanide usage and heap leaching.

In addition, the regulatory framework applicable to the Project also contributed to issues scoping. This framework is described at a high-level below.

#### *6.1.3.1 Regulatory Context*

The *Canada Water Act,* RSC 1985, c. C-11, provides for the sustainability and ongoing productivity of commercial, recreational, and Aboriginal fisheries, and regulates activities that may affect fish or fish habitat, including modification of flows, alteration or destruction of habitat, and deposition of deleterious substances. The *Canadian Environmental Protection Act, 1999*, SC 1999, c. 33, regulates the definition of hazardous wastes, and directs how and where they are stored and transported.

Environment and Climate Change Canada provides noise guidance within its *Environmental Code of Practice for Metal Mines* (Code) (Environment Canada 2009). The Code prescribes a daytime equivalent sound level ($L_{eq}$) limit of 55 A-weighted decibels (dBA) and a nighttime $L_{eq}$ limit of 45 dBA for residential areas adjacent to mine sites.

The management, use, and discharge of water from a mine site is governed by several pieces of federal and territorial legislation. At the federal level, the discharge of mine effluent is governed under the *Fisheries Act*, RSC 1985, c. F-14 (specifically by the Metal Mining Effluent Regulations (SOR/2002-222)) and the Canada *Water Act*, RSC 1985, c. C-11. SY 2003, c. 19*.* The primary relevant territorial acts are the Yukon *Quartz Mining Act*, SY 2003, c. 14, and the Yukon *Waters Act*, SY 2003, c. 19.

Yukon regulates air quality under the *Environment Act* (RSY 2002, c.76) and the Air Emission Regulations (OIC 1998/207). Specific air quality standards for individual indicators are published under Yukon Environment's Ambient Air Quality Standards and the BC Ambient Air Quality Objectives published by the BC Ministry of the Environment, Environmental Standards Branch (Yukon Environment 2010, BC MOE 2016). Currently, there are no air quality standards or emission limitations for greenhouse gases in Yukon or BC. Yukon is adopting a voluntary emission reporting protocol for large industrial facilities.

The regulation and management of Surficial Geology, Terrain, and Soils is largely through the reclamation policies and guidelines developed for hard rock (quartz) mines in Yukon. Mining projects will likely require a Quartz Mining Licence, which is regulated by the *Quartz Mining Act*, SY 2003, c.14, and issued by the Department of Energy, Mines, and Resources.

## 6.2 SELECTION OF VALUED AND INTERMEDIATE COMPONENTS

The study team used the information provided during issues scoping to identify candidate VCs and ICs based on their presence in the study area, their potential to interact with and be affected by the Project, and their importance to government, First Nations, local communities, interested parties, and the public.

### 6.2.1 GROUNDWATER

Groundwater was identified as a candidate IC given its regulation by several pieces of legislation, including, Final Agreements that Yukon First Nations have with the federal and territorial governments. These Final Agreements guarantee protection of water on Settlement Lands, and use of water in Yukon for trapping, non-commercial harvesting, and traditional heritage, cultural, and spiritual purposes.

The Groundwater IC comprises two sub-components: Groundwater Quantity and Groundwater Quality. Groundwater Quantity refers to the distribution of groundwater and related volumetric fluxes; Groundwater Quality refers to its chemical composition.

Groundwater is a key component of the hydrologic system, biophysical environment, and operational water balance for the Project. Recharge to the groundwater systems occurs when the amount of precipitation that infiltrates soil exceeds losses from evapotranspiration. Prime recharge areas typically occur in upland areas while discharge typically occurs in low-lying areas where groundwater flow paths converge, supplying base flow to creeks, rivers, and lakes. Changes to ground cover and runoff patterns influence recharge to the groundwater system. Likewise, changes in groundwater discharge areas can affect terrain stability. Groundwater carries the signature of minerals and chemicals it encounters along its flow path, and as such is a vector for transporting chemical loads from the Project to the receiving environment.

The analysis of change on Groundwater has linkages along the effects pathways in the assessments of Surface Hydrology (**Section 8.0**), Surficial Geology, Terrain, and Soils (**Section 11.0**), Surface Water Quality (**Section 12.0**), and Fish and Fish Habitat (**Section 14.0**). In addition, Surface Hydrology and Surface Water Quality inform the Groundwater IC, specifically in the loss of some reaches of creeks and streams.

Through consumption of fish, groundwater presents a pathway of effects to the Community Health and Well-being (**Section 25.0**), Land and Resource Use (**Section 24.0**), and Social Economy (**Section 21.0**) VCs.

### 6.2.2 SURFACE HYDROLOGY

Surface Hydrology was identified as a candidate IC, and TK confirmation of the importance of surface hydrology to First Nations was a motivating factor for its selection of Surface Hydrology IC, specifically, the importance of local watercourses to First Nations. Coffee Creek is historically and currently an important fishing spot to FNs, while TH citizens have camps close to the Creek. Members of WRFN and SFN have also used Coffee Creek as a trade location and transport route, and all First Nations consider Coffee Creek a culturally significant area. In addition, YESAB identified the potential for effects to water resources, and requested water resources be thoroughly evaluated prior to initiating any activities that may affect these resources.

The analysis of change on Surface Hydrology has linkages as a receptor VC to the assessments of Groundwater (**Section 7.0**), Surficial Geology, Terrain, and Soils (**Section 11.0**), Surface Water Quality (**Section 12.0**); and as a pathway VC to Fish and Fish Habitat (**Section 14.0**). Surface Hydrology presents a pathway of effects to Community Health and Well-being (**Section 25.0**), Land and Resource Use (**Section 24.0**), and Social Economy (**Section 21.0**) VCs as a result of the consumption of fish.

### 6.2.3 AIR QUALITY AND GREENHOUSE GAS EMISSIONS

Air Quality and Greenhouse Gas Emissions were identified as a candidate IC because TK identified the importance of air quality as part of a holistic assessment of Project interactions and changes. In addition, YESAB identified air quality impacts resulting from the Project (e.g. smoke, dust) as posing a significant concern to residents, and may affect wildlife, and thus would need to be assessed. In addition, air quality can directly affect the health of the surrounding environment through the generation and spread of combustion emissions and particulate matter. The current air quality in the area is characteristic of a pristine natural environment, so changes in these conditions may result in adverse changes to plants, animals, and humans that respire the atmosphere, but also to receptors that can be affected by fallout from airborne contaminants (e.g., acid rain, metal contamination of soils). In addition, a key theme of interest identified through the Project's consultation activities and reviews of other information was road traffic, which can lead to increased dust and decreased air quality.

The analysis of change on Air Quality and Greenhouse Gas Emissions has linkages as a receptor VC to the assessments of Surficial Geology, Terrain and Soils (**Section 11.0**); and as a pathway VC to Surface Water Quality (**Section 12.0**), Fish and Fish Habitat (**Section 14.0**), Vegetation (**Section 15.0**), Wildlife and Wildlife Habitat (**Section 16.0**) and Birds and Bird Habitat (**Section 17.0**), as well as Community Health and Well-being (**Section 25.0**).

In addition, air quality presents a pathway of effects to Community Health and Well-being (**Section 25.0**), Land and Resource Use (**Section 24.0**), and Social Economy (**Section 21.0**) VCs through consumption of fish.

### 6.2.4 NOISE

Identified as unwanted sound, Noise was identified as a candidate IC through a review of the regulatory framework and through input from First Nations. Noise was selected as an IC because airborne sound can potentially affect human and wildlife health and well-being. Noise levels are important to people and wildlife for several reasons such as sleep disturbance, annoyance, habitat avoidance, and stress.

Airborne sound is described as the rapid fluctuation or oscillation of air pressure above and below atmospheric pressure, creating a sound wave. Noise levels are important to individuals and wildlife for several reasons such as sleep disturbance, annoyance, habitat avoidance, and stress.

The analysis of change on Noise has pathway linkages to the assessments of Wildlife and Wildlife Habitat (**Section 16.0**), Birds and Bird Habitat (**Section 17.0**), Social Economy (**Section 21.0**), Land and Resource Use (**Section 24.0**), and Community Health and Well-being (**Section 25.0**).

### 6.2.5 SURFICIAL GEOLOGY, TERRAIN, AND SOILS

Project activities may directly disturb Surficial Geology, Terrain, and Soils, so this component has been included as a VC for the Project. Surficial Geology, Terrain, and Soils contribute to the supporting structure of landscapes and ecosystems, which in turn support various functions and values that range from biological to cultural. To simplify and focus the assessment, three subcomponents are identified for the component; terrain stability, unique landforms, and soil quality.

Terrain stability contributes to the safe and effective planning of mine infrastructure. Unique landforms represent features on the landscape (in this instance, tors and pingos) that are distinctive and may be included in the types of landscape features mentioned in TK that were used as lookouts (TH 2012). In addition, unique landforms may provide particular habitat qualities for plants and wildlife. Soil quality is also integral to the maintenance of overall ecological health and for reclamation planning.

Although surficial geology and soil are not specifically mentioned in the TK data collected to date for the Project, the importance of these features in maintaining the integrity of other components (e.g., plants, ecosystems, wildlife habitat) is inferred through views that have been expressed about traditional ways of life being tied to “healthy and intact ecosystems” (Bates, et al. 2014) and being “key to the overall health of the land” (TH 2012). The importance of terrain in terms of TK has been identified with respect to the avoidance of natural hazards and the use of landscape features as lookouts as well as for travel corridors, and the establishment of hunting and camping sites (Dobrowolsky 2014; TH 2012).

The effects assessment on Surficial Geology, Terrain, and Soils is a pathway VC to the assessments of Groundwater (**Section 7.0**), Hydrology (**Section 8.0**), Air Quality and Greenhouse Gas Emissions (**Section 9.0**), Surface Water Quality (**Section 12.0**), and Vegetation (**Section 15.0**).

### 6.2.6 SURFACE WATER QUALITY

Surface Water Quality was identified as the sole candidate VC in this analysis, and constitutes the physical, chemical, biological, and aesthetic characteristics of water, which are influenced by a variety of regional and local factors including rock weathering, surface transport, biological activity, and anthropogenic influences.

Effect pathways between surface water quality and other ICs and VCs are also noted in TK. Linkages between surface water quality and fish are well-noted (“If we pollute the water it hurts the fish” (TH 2012)), as well as linkages with vegetation, wildlife and wildlife habitat, and birds and bird habitat (“It was noted that contamination of water leads in turn to contamination of plants, fish and animals that drink or live around the water." (Bates and DeRoy 2014). This is further linked with potential community health and well-being effects for the WRFN. Several First Nations individuals and resources also emphasized the importance of the Coffee Creek corridor for its salmon runs, the wildlife and vegetation it supports, as well as its traditional usage for travel.

The effects assessment on Surface Water Quality is a receptor VC to the assessments of Groundwater (**Section 7.0**), Hydrology (**Section 8.0**), Air Quality and Greenhouse Gas Emissions (**Section 9.0**), Surficial Geology, Terrain, and Soils (**Section 11.0**). Surface Water Quality is also a pathway VC for Fish and Fish Habitat (**Section 14.0**), Vegetation (**Section 15.0**), Wildlife and Wildlife Habitat (**Section 16.0**) and Birds and Bird Habitat (**Section 17.0**), as well as for Community Health and Well-being (**Section 25.0**).

### 6.2.7 SUMMARY

All of the candidate VCs and ICs listed for consultation for the physical environment were selected for inclusion in the assessment. A summary of the VCs and ICs for the physical environment volume is shown in **Table 6.2-1.**

**Table 6.2-1 Summary of Physical Environment Valued Components, Intermediate Components, and Subcomponents**

| Valued Component and Intermediate Component | Subcomponent | Representative of | Selection Rationale |
|---|---|---|---|
| **Intermediate Component** | | | |
| Groundwater | • Groundwater quality<br>• Groundwater quantity | N/A | • Groundwater was selected as an IC due to its strong linkages with other ICs and VCs, and the potential for Project-related activities to alter groundwater quality and groundwater fluxes.<br>• Consultation with First Nations also revealed that the Coffee Creek area hosts an important fishery which is a linked component. |
| Hydrology | N/A | N/A | • Hydrology was selected as an IC due to its importance to stakeholders, strong linkages with other ICs and VCs, and the potential for Project-related activities to alter the existing streamflow regime in the Project area.<br>• The importance of local watercourses to First Nations also played a role in the selection of this IC. |
| Air Quality and Greenhouse Gas Emissions | N/A | N/A | • Project activities are likely to increase levels of air quality indicators, having a potential effect on air quality. The air quality in the study area is characteristic of a pristine environment.<br>• Regulatory requirements must be assessed and compliance demonstrated.<br>• As highlighted by the TK consultation, air quality is an important aspect of the natural environment, and must be a part of any holistic assessment of Project interactions. |
| Noise | N/A | N/A | • Human and wildlife receptors may experience sound levels from the Project.<br>• Changes may occur to recreational areas where human receptors might be located, which may deter use of plant/berry collection sites, hunting areas, and other such recreational areas.<br>• Project activities may disturb wildlife or result in the loss of wildlife habitat due to noise. |

| Valued Component and Intermediate Component | Subcomponent | Representative of | Selection Rationale |
|---|---|---|---|
| **Valued Component** | | | |
| Surficial Geology, Terrain, and Soils | Terrain stability | • Change in terrain stability class<br>• Change in terrain stability as a result of permafrost disturbance | • Land clearing and other site activities may disturb surficial geology, terrain, and soils.<br>• Assessment of surficial geology, terrain, and soils also informs closure and reclamation planning. |
| | Unique landforms | • Disturbance of unique landforms | |
| | Soil quality | • Soil disturbance (for in situ soils)<br>• Soil degradation (for in situ soils)<br>• Soil salvage and handling (for salvaged and stockpiled soils) | |
| Surface Water Quality | N/A | N/A | • Surface Water Quality was selected as a VC due to its strong linkages with other ICs and VCs, and the potential for Project-related activities to affect water quality in receiving creeks in the Project area.<br>• In addition to professional knowledge and judgement, the selection process involves consideration of available TK, scientific and other information, input provided during the Project's consultation and engagement program, and discussions with other members of the Project team. |

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### 6.3.1 PERSONAL COMMUNICATION REFERENCES

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# 7.0 GROUNDWATER ANALYSIS

This section presents a high-level summary of the change analysis for the Groundwater Intermediate Component (IC). The full change analysis is presented in **Appendix 7-B Groundwater Intermediate Component Analysis**.

## 7.1 ANALYSIS SCOPE

Two sub-components were selected to focus the groundwater analysis: groundwater quantity and groundwater quality. Groundwater quantity refers to the distribution of groundwater and related volumetric fluxes; groundwater quality refers to its chemical composition.

Two indicators for groundwater quantity have been identified: groundwater levels and surface water low flows (**Table 7.1-1)**. Groundwater levels are used to calculate hydraulic gradients and water table maps, from which flow directions and quantities can be estimated. Surface water low flows are a direct measure of groundwater discharge.

**Table 7.1-1 Indicators for Groundwater Quantity**

| Indicator | Rationale for Selection |
|---|---|
| Groundwater levels | Pit dewatering, collection of atmospheric water in pits shells, or enhanced recharge in disturbed areas may manifest as changes in groundwater levels. Water levels are easy to measure and can be used to determine groundwater flow directions and fluxes. |
| Surface water low flows | Alteration to groundwater recharge patterns resulting from the Project may result in changes to groundwater volume discharging at creeks. Surface water low flows are included as an indicator of the Surface Hydrology IC. |

Three indicators for groundwater quality have been identified: predicted or observed pit lake water quality, predicted or observed waste rock seepage quality, and baseflow and observation well water quality (**Table 7.1-2)**. These indicators provide water quality parameters that are routinely analyzed in groundwater samples using well-established laboratory methods. Water quality parameters included as indicators for groundwater quality include: field parameters (e.g., pH and temperature), anions, nitrogen species including cyanide, and total and dissolved metals.

### Table 7.1-2 Indicators for Groundwater Quality

| Indicator | Rationale for Selection |
|---|---|
| Predicted / observed pit lake water quality | Water that accumulates in open pits represents the integrated change of pit development and, where applicable, waste rock backfills. Pit water may also serve to recharge groundwater flow paths, and/or may discharge to surface water receptors. As a result, pit lake water quality serves as a key indicator of Project changes on groundwater quality.<br>Disturbed materials, when exposed to the atmosphere, can oxidize and release metals into solution.<br>The presence of certain metals in solution can indicate redox conditions (i.e., reduction-oxidation reaction), which can impart controls of metal mobility in groundwater. |
| Predicted / observed waste rock seepage quality (Double Double) | Minerals in excavated material may oxidize when exposed to the atmosphere, and/or may leachate constituents (e.g., sulfate and metals) when flushed with incident precipitation. In addition, waste rock is likely to contain finite quantities of explosive residues that will leach nitrogen (e.g., nitrate). The backfilled Double Double pit is the only facility where waste rock is anticipated to interact with groundwater, therefore, Double Double waste rock seepage is proposed as an indicator for potential Project-related changes to groundwater quality.<br>In broad terms, key WRSF seepage parameters include total and dissolved metals, anions, nitrogen species and field parameters (pH and temperature). |
| Baseflow and observation well water quality | Baseflow in surface streams is an expression of groundwater discharge, and therefore an indicator of groundwater quality.<br>Groundwater quality from observation wells is a direct measurement of groundwater quality.<br>Both of these groundwater quality indicators function to establish baseline conditions from which Project-related changes are compared. Changes in these indicators may also be used to verify and/or validate predicted changes on groundwater quality and associated linkages to surface water systems, as described above. |

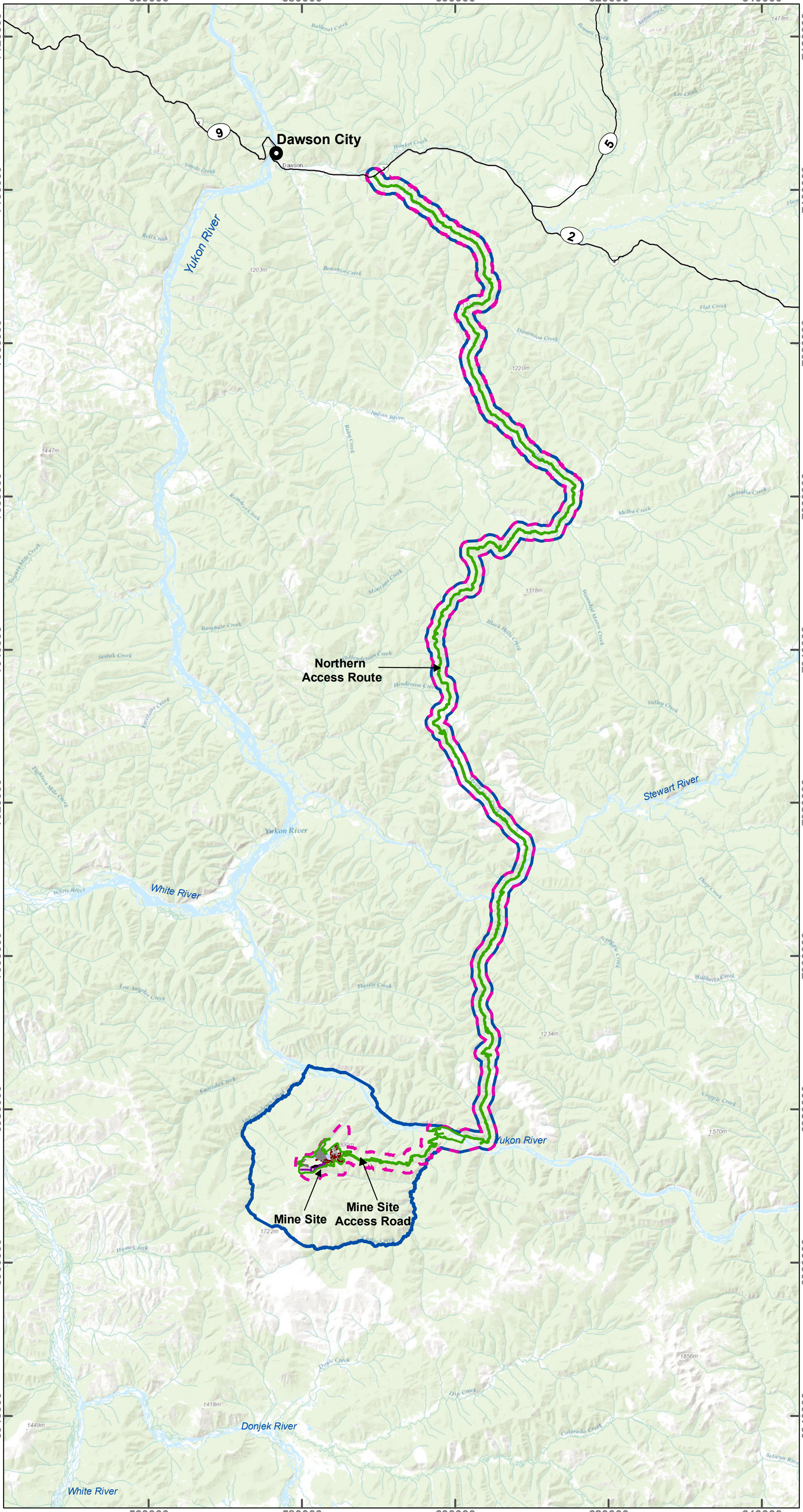
## 7.2 ANALYSIS BOUNDARIES

**Table 7.2-1** below identifies the spatial, temporal, and technical boundaries established for the groundwater analysis (see also **Figure 7.2-1**). There are no administrative boundaries relevant to the groundwater analysis.

### Table 7.2-1 Spatial, Temporal, and Technical Boundaries for Groundwater Analysis

| Boundary | | Description of Boundary |
|---|---|---|
| Spatial | Local Study Area | Area surrounding the major mine units (pits, waste rock facilities, heap leach). Includes immediately downgradient reaches of Halfway Creek (to lineament), YT-24 headwaters, and Latte Creek to the confluence with the Latte Tributary. The LSA also includes the alignment of the proposed Northern Access Route. |
| | Regional Study Area | The span of the Yukon River between Coffee Creek and Independence Creek and the area defined by drainage traces of Independence Creek and Coffee Creek and the intervening height of land between the headwaters of these two drainages. |
| | Cumulative Change Study Area | Coincides with RSA south of the Yukon River. The Northern Access Route is scoped out of the Cumulative Change Study Area. |
| Temporal | | The specifics pertaining to the Project's Construction (Q2 Year –3 to end of Year –1 (30 months)), Operation (Year 1 to Year 12), Reclamation and Closure (Year 13-23), and Post-closure phases (Year 24 onwards) are described in the Project Proposal (**Section 2.0 Project Description**). The Reclamation and Closure Phase consists of Post-Mining Closure (Year 13 to Year 18) and Active Closure (Year 19 to Year 23). The Post-Closure phase coincides with Year 24 onward and consists of monitoring. |
| Technical | | Collection of groundwater quality samples for the Project requires large amounts of heavy equipment to accommodate the different instrumentation types installed on site. Methods are also dictated by physical aspects of the groundwater system (i.e. shallow versus deep water levels, fast versus slow water level recovery, whether the water column partially freezes, etc.). Some of the required groundwater sampling equipment is temperature sensitive and cannot be used in sub-zero conditions. In addition, some wells require several hours to sample. These factors limit the amount of data that can be practicably collected outside of the operating period of the exploration camp (which closed between September 2015 and May 2016) when the window of daylight is small, and temperatures are below freezing. For this reason, groundwater wells were only sampled between May and September of 2015. As a result, the full cycle of the well hydrographs could not be captured in the water quality data. However, these limitations do not pose restrictions on the assessment of groundwater changes. Given that groundwater baseline data collection (including sampling) will be ongoing during permitting, there will be an ongoing effort to establish, evaluate, and demonstrate background groundwater elevations and quality |

**Note:** km - kilometre; LSA – Local Study Area; WRSF - Waste Rock Storage Facility




# COFFEE GOLD MINE

## Groundwater IC Local and Regional Study Areas


**Legend**

- Municipality
- Highway
- Project Footprint
- Local Study Area
- Regional Study Area

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## 7.3 ANALYSIS METHODS

Given the potential for Project interaction at and downstream of mine footprints, a detailed groundwater numerical model was constructed and calibrated using MODFLOW-2005, which was operated using the Groundwater Vistas pre-/post-processing software. The Groundwater Model enabled quantification of groundwater quantity residual changes.

A semi-quantitative approach has been used to assess Project-related changes to groundwater quality. This approach entails a comparison between measured groundwater quality and estimates of future pit lake quality and Waste Rock Storage Facility (WRSF) drainage water quality computed using the combined Water Balance/Water Quality Model developed in GoldSim. The comparison flags parameters that may become elevated in Project groundwater due to the influence of mine contact water.

The Groundwater Model presented in this analysis does not incorporate changes to recharge quantity or distribution of permafrost arising from climate change. Ultimately, climate change has been incorporated into the GoldSim Water Balance Model. The lake levels produced in the GoldSim model take into account projected trends in precipitation and evaporation, and are informed by pit leakage rates estimated from the Groundwater Model.

### 7.3.1 REGULATORY FRAMEWORK

At a federal level, The *Canada Water Act,* RSC 1985, c. C-11, provides for the sustainability and ongoing productivity of commercial, recreational, and Aboriginal fisheries, and regulates activities that may affect fish or fish habitat, including modification of flows, alteration or destruction of habitat, and deposition of deleterious substances.

At the territorial level, the *Public Health and Safety Act*, RSY 2002, c. 176, Camp Sanitation (CO 1961/38), Drinking Water Regulation (OIC 2007/139), and Sewage Disposal Systems Regulation (OIC 1989/82) provides legal framework for protection of public health including creation of health officers; stipulates camp drainage to prevent pollution of any water supply, lake, stream, or watercourse; and regulates location, testing, and general assessment of drinking water systems including those derived from groundwater. Also, the *Waters Act*, SY 2003, c. 19, establishes the Yukon Water Board, issuer of water use licenses, to ensure that appurtenant uses of water or deposits of waste do not adversely affect other users. The Waters Regulation (OIC 2003/58) defines water management areas, classification of undertakings, and licensing criteria for mines.

## 7.4 EXISTING CONDITIONS

### 7.4.1 GROUNDWATER QUANTITY

A continuous water level record is available from most instruments on site from June 2015 onwards, with spot measurements available as early as the fall of 2013. In general, water levels are very deep (from 130 metres (m) to over 220 m below ground surface) in ridge areas, but artesian conditions are encountered even at moderate to high elevations in the drainages. Water level hydrographs indicate variable response to seasonal recharge patterns, with fluctuations ranging from several metres to over 30 m. Nested instrumentation reveals both upward and downward vertical hydraulic gradients in both upland and low-lying areas. In some instances, horizontal hydraulic gradients exceed topographic gradients. Overall, the physical hydrogeological data reveal a complex groundwater system influenced by both discontinuous permafrost and a well-developed fracture system.

Groundwater flows from high elevation (recharge areas) to low elevation, discharging along major drainages. A deeper groundwater flow path ultimately flows toward the Yukon River, and deflects northwest toward a regional topographic low point. Groundwater flowpaths converge along major drainage traces, forcing groundwater to come to the surface and discharge; this is evidenced by seepage at surface and upward artesian groundwater pressures registered at piezometers along drainage traces.

Baseflow is typically understood to constitute the portion of streamflow that is derived from groundwater discharge, and is often considered to be equal to the minimum winter low flow, or the minimum summer flow following an extended dry period (Smakhtin 2001). Baseflow is considered to be at its lowest during winter periods. Winter low flows are expected to range from 0 litres per second per square kilometre ($L/s/km^2$) to 0.7 $L/s/km^2$.

### 7.4.2 GROUNDWATER QUALITY

Groundwater is predominantly circum-neutral (pH 6 to 8), with most samples characterized by pH 7 to 8. Groundwater wells show variable influence from weathering of sulphide minerals or dissolution of sulfate minerals, either from the deposits or other disseminated mineralization across the Project area. This is evidenced by low to substantial sulfate ($SO_4$) concentrations, which range from 12 milligrams per litre (mg/L) to 954 mg/L and variable salinity with specific conductance ranging from 28 micro Siemens per centimetre (µS/cm) to 2269 µS/cm.

Near the Supremo pit, groundwater-screened hydrothermal breccia is oxic or oxygenated, with very low to negligible concentrations of reduced species. Groundwater screened in gneiss is mildly to moderately suboxic or containing less oxygen. Ammonia ($NH_3$), manganese II ($Mn^{2+}$), and iron II ($Fe^{2+}$) are consistently measured in samples in gneiss-originating groundwater.

Groundwater sampled downstream of the Alpha WRSF is oxic to mildly suboxic with inorganic nitrate ($NO_3^-$), nitrogen dioxide ($NO_2$-), ammonia ($NH_3$), and dissolved manganese (Mn) routinely measured. Groundwater sampled downgradient of the lineament in the Halfway Creek drainage, as well as in the YT-24 drainage, is suboxic and mildly to moderately reducing. Groundwater sampled at these two locations are also the most saline of all samples measured in the Local Study Area (LSA).

Groundwater redox conditions at monitoring wells screened in granite are mildly to strongly anoxic (total oxygen depletion). Monitoring wells in the Kona pit area had measurable concentrations of dissolved Mn, iron (Fe), and sulfide ($S^{2-}$), indicating moderately to strongly reducing conditions. The groundwater sampled downstream of the Heap Leach Facility (HLF) had measurable concentrations of dissolved Mn and Fe, but no measurable $S^{2-}$.

Monitoring wells screened in schist span the entire range of redox conditions from oxic to strongly reducing. The well pair adjacent to the proposed Latte pit screened anoxic and moderately to strongly reducing groundwater. The deeper well (MW14-03A) is more strongly reducing with very elevated Fe, but dissolved Fe, Mn, and $S^{2-}$ are consistently measured at both wells.

In the Latte Tributary, the groundwater sampled had measurable concentrations of $NO_3^-$ and low levels of dissolved Fe, Mn, and $S^{2-}$.

Dissolved arsenic (As) is measurable in a number of monitoring wells at the site. The highest As concentrations in the Project area were observed in the granitic bedrock beneath the Kona pit. It is also notable that granite material at the Kona pit has the highest solid-phase As concentrations measured in the Project area.

Dissolved cadmium (Cd) measured in overburden and bedrock groundwater is predominantly in the 0.006 micrograms per litre (µg/L) to 0.06 µg/L range. The highest concentration of Cd (0.125 µg/L) was measured at Latte Tributary downstream of the Project, screening overburden; however non-detect levels have also been recorded at this well.

Concentrations of dissolved copper (Cu) are generally higher in overburden groundwater (0.95 µg/L to 2.0 µg/L); however, the highest concentrations are measured in bedrock. Both MW14-05B, screening granite, and MW15-04WB, screening gneiss, have recorded dissolved Cu concentrations exceeding 2.0 µg/L.

Dissolved mercury (Hg) concentrations are below the method detection limit in the majority of overburden and bedrock groundwater samples. Monitoring wells with measurable dissolved Hg were characterized by concentrations of less than 0.01 µg/L, except in the north Supremo pit area where the highest concentrations were detected (0.02 µg/L to 0.10 µg/L).

Dissolved selenium (Se) was generally low in overburden and bedrock groundwater, with concentrations ranging from below detection limit (0.04 µg/L) to 0.5 µg/L. Samples collected at the monitoring well at Latte Tributary downstream of the Project, were consistently between 0.16 µg/Land 0.20 µg/L, with one sample presenting the highest Se concentration measured in the LSA (1.1 µg/L).

Dissolved uranium (U) is generally elevated (greater than 15 µg/L) across the LSA. Dissolved U concentrations are highest at YT-24 downstream of the Project, in gneiss (530 µg/L to 589 µg/L). Notably, the concentrations of dissolved U are lower (less than 10 µg/L) downgradient of the lineament in Halfway Creek, which screens gneiss. The overburden well downstream of the Alpha WRSF has higher concentrations of dissolved U (17 to 35 µg/L) than the bedrock well at this location.

Dissolved zinc (Zn) was consistently measured across the Project area with higher and more variable concentrations measured in Westbay installations screened in the bedrock. Dissolved Zn levels were lowest in the overburden and bedrock groundwater collected from conventional wells, with concentrations ranging between 0.27 µg/L and 16.5 µg/L. In contrast, the groundwater concentrations at MW15-06WB (the north Supremo area), ranged between 20.9 µg/L and 253 µg/L.

## 7.5 PROJECT INTERACTIONS, POTENTIAL CHANGES, AND MITIGATION MEASURES

### 7.5.1 POTENTIAL PROJECT-RELATED INTERACTIONS

Activities associated with a particular Project phase and their potential effect on groundwater are described in **Table 7.5-1.**

**Table 7.5-1 Potential Interactions**

| Phase | Types of Changes | Causes of Interactions |
|---|---|---|
| Construction Phase | • Changes to groundwater quality<br>• Changes to groundwater quantity | • Construction of HLF<br>• Use of explosives |
| Operation Phase | • Changes to groundwater quality<br>• Changes to groundwater quantity | • Construction and use of lined HLF and associated ponds<br>• Development of Latte, Supremo and Double Double pits<br>• Cessation of mining of Latte, Supremo, Double Double pits<br>• Partial backfill of Double Double pit<br>• Partial backfill of Latte pit and Supremo pits<br>• Seasonal dewatering of the Open Pits<br>• Use of explosives |
| Reclamation and Closure Phase | • Changes to groundwater quality<br>• Changes to groundwater quantity | • Reclamation of Double Double, Latte and Supremo pits<br>• Decommissioning and removal of HLF water treatment plant |
| Post-closure Phase | • Negligible | • Negligible |
| Northern Access Route | • Negligible | • Negligible |

### 7.5.2 Potential Adverse Changes

The main drivers of groundwater quantity changes are pit development and implementation of large, lined areas (i.e. under the HLF and associated facilities). Removal or ponding of water that discharges to and/or collects in pits can increase or decrease recharge to the groundwater system and this may manifest as changes in water levels and creek baseflows. Changes that occur in one pit complex may enhance or diminish changes resulting from development of another pit complex. These changes are further confounded by diminished recharge under mine waste and HLF facilities. The activities span the Construction Phase through the Reclamation and Closure Phase.

The primary mechanisms for potential Project changes to groundwater quality include open pit development and storage of mine waste. Potential Project changes to groundwater quality commence during the Construction Phase and continue through Reclamation and Closure and Post-Closure Phases.

### 7.5.3 Mitigation, Management, and Monitoring

Due to the inherent linkages in the water balance between groundwater and surface water flows, the mitigation measures that are relevant to the Groundwater IC are also relevant to Surface Hydrology and Surface Water Quality. These measures have been built into the Project design and include a combination of Project phasing and development schedules, waste handling options, and water management infrastructure and planning commitments. The mitigation measures proposed for the Project, and relevant to the Groundwater IC, Surface Hydrology IC, and Surface Water Quality Valued Component are outlined below:

- Phased Mine Development and Progressive Reclamation
- Waste Rock Storage Facility Site Selection and Stability
- Backfilling of Open Pits
- Surface Water Protection and Management
- Groundwater Protection and Management
- Heap Leach Facility Design to Facilitate Progressive Closure
- Heap Leach Facility Liner System
- Heap Leach Facility Water Balance
- Management of Non-Contact Water
- Heap Leach Facility Event Ponds
- Heap Leach Facility Rainwater Storage Pond
- Rock Drains and Diversion Channels
- Sediment Pond Design, Capacity, and Discharge

## 7.6 RESIDUAL CHANGES

### 7.6.1 GROUNDWATER QUANTITY

The Groundwater Model was run in steady-state mode for two snapshots in time: end of Operation Phase (Year 12) and Post-closure Phase. By running the model in steady-state for these two time periods, it conservatively estimates the maximum extent of Project changes to groundwater.

#### *7.6.1.1 Operation (Year 12)*

***Potential Changes to Groundwater Levels***

Development of the lined HLF and associated infrastructure is predicted to result in a decrease in groundwater levels of up to approximately 50 m at the eastern margin of the HLF. A depression of the water table occurs under the HLF (and associated event ponds), Supremo Phase 1 (SU1) pit and, Supremo Phase 4 North (SU4N) pit. The drawdown in these areas is due to advancement of pits below the water table and removal of groundwater recharge due to the presence of liners in the HLF footprint

The decline in recharge causes groundwater levels in Kona and upper Latte Creek to decline in the order of 14 m to 19 m. The Kona pit is advanced in permafrost tens of metres above the pre-mine water table. Due to both permafrost and winter placement of waste rock backfill, it is assumed that any recharge that does infiltrate the backfilled waste rock will freeze at the base of the pit; therefore, no recharge is expected through the Kona pit.

Appreciable groundwater mounding (20 meters or higher) occurs under several of the pit lakes, including, Latte, Supremo Phase 3 North and West pits (SU3N, SU3W) and Supremo Phase 5 North (SU5N) (**Figure 7.6-1**). This mounding results from accumulation of meteoric water and diversion of mine contact water that will cause pit lakes to form above the elevation that would otherwise be dictated by the water table alone. By the end of the Operation Phase, shallow pit lakes will have formed as follows:

- Latte Pit (998 m asl) will be approximately 25 m higher than the pre-mining water level.
- SU1 pit lake level will be up to 40 m below the baseline groundwater levels (**Figure 7.6 2**).
- SU2 pit will be 19 m lower than the pre-mine water table. (**Figure 7.6-3**).

The Supremo Phase 3 North (SU3N) pit water levels at the end of Operational Phase will be up to 70 m higher than baseline under the SU3N pit (**Figure 7.6-4**). The Supremo Phase 3 West pit also contributes to mounding in the area.

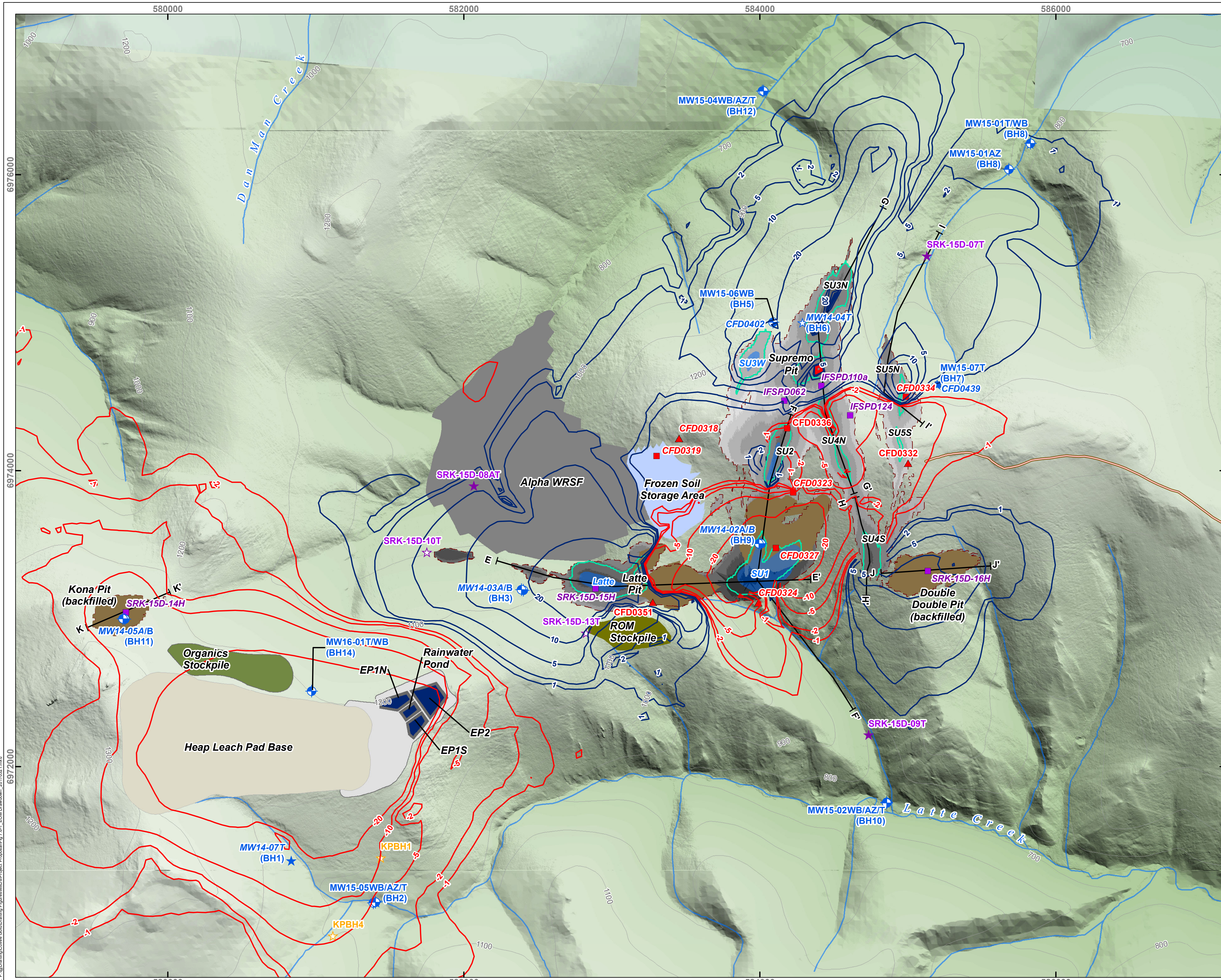
The SU2 pit lake is predicted to lose a minimal (0.03 L/s) amount of seepage to the Halfway Creek drainage, otherwise, a small net inflow of groundwater is anticipated for the HLF. The SU1 pit lake is at its spill point by the end of Operation Phase and this controls water levels downgradient of the facility. Water levels at SRK15D-09T and MW15-02T are essentially unchanged.

The Supremo Phase 4 North (SU4N) pit is largely excavated below the base of permafrost, and intercepts the pre-mining water table. Groundwater discharge to SU4N is minor (less than 0.1 L/s) and a very small seepage loss (0.02 L/s) to Halfway Creek is predicted.

The Supremo Phase 4 South (SU4S) pit is advanced in unfrozen ground up to 15 m below the pre-mine water table (**Figure 7.6-5**). The pit lake that forms in SU4S is below the pre-mine water table at the north end of the pit, but is above the pre-mine water table at the south end. Some groundwater (~0.2 L/s) is expected to report to the pit, but there remains a seepage loss from the pit towards Latte Creek on the order of 0.5 L/s.

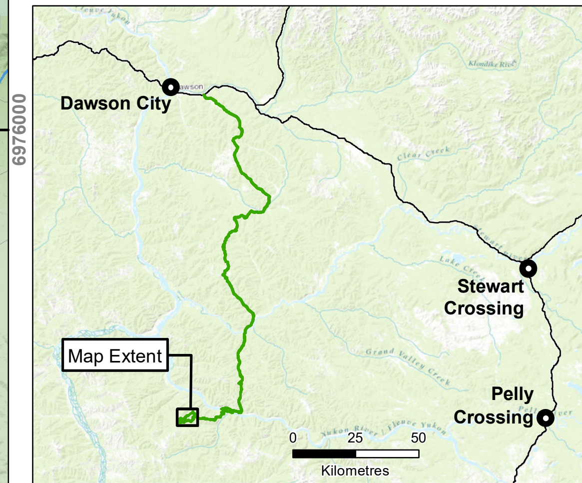
The Supremo Phase 5 pits (SU5N and SU5S) are in permafrost (**Figure 7.6-6**). Both the SU5N and SU5S pits are small and are expected to reach their spill point by the end of Operation Phase. Despite reaching their spill point, interaction between these pits and the groundwater system is low, with less than 0.01 L/s of seepage reporting to the YT-24 and Halfway Creek drainages. A small increase in water levels is predicted at MW15-07T (2 m), due east of the SU5N pit. Father downgradient in the YT-24 drainage, a larger increase in groundwater levels is predicted (~4 m) which is partly due to influence from the SU3N pit. At the most downgradient installation in YT-24, MW15-01T, groundwater levels are only slightly above background (~1 m).

The Double Double pit will be advanced in unfrozen ground below the pre-mine water table (**Figure 7.6-7**). At the end the Operation Phase, the Double Double pit will be completely backfilled with no active management of the water table. Water table mounding on the order of 10 m is expected in the footprint of this facility which is caused by enhanced infiltration through the backfilled mine waste (35% of MAP vs 15% on natural, unfrozen ground). This enhanced infiltration through the pit reports to Latte Creek at a rate of 0.7 L/s.




COFFEE GOLD MINE

**Simulated Groundwater Drawdown and Mounding at the End of Operation Phase**




## Legend

- Monitoring Well — AZ = active zone, WB = Westbay, A = deep conventional (200+m), B = shallow conventional (150+m), T = thermistor/VWP, BH = original drillpad name
- Thermistor (Lorax 2014)
- Thermistor (KP 2014)
- Thermistor (SRK 2015)
- Thermistor/VWP (Lorax 2015)
- Thermistor/VWP (SRK 2015)
- Vibrating Well Piezometer (VWP) (EBA 2013)
- Packer Tests (EBA 2013)
- Packer/Slug Tests (Lorax 2014)
- Packer Tests (SRK 2015)

**End of Operation Phase Drawdown Contours**

- <0m
- >0m
- Transects
- Project Footprint
- Municipality
- Highway
- Waterbody
- Watercourse

**Proposed Infrastructure**

- WRSF
- Backfill
- Total Pit Outline
- ROM Stockpile
- Organics Stockpile
- Frozen Soil Storage Area
- Event Pond
- Heap Leach Access Disturbance Footprint
- Heap Leach Pad Base
- Post-Closure Pit Lake

N

1:25,000

0 250 500 750

Meters

NAD 1983 UTM Zone 7N

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| Figure 7.6-1 | Date: Mar 21, 2017 | Drawn by: GM | Reviewed: JS/LF |
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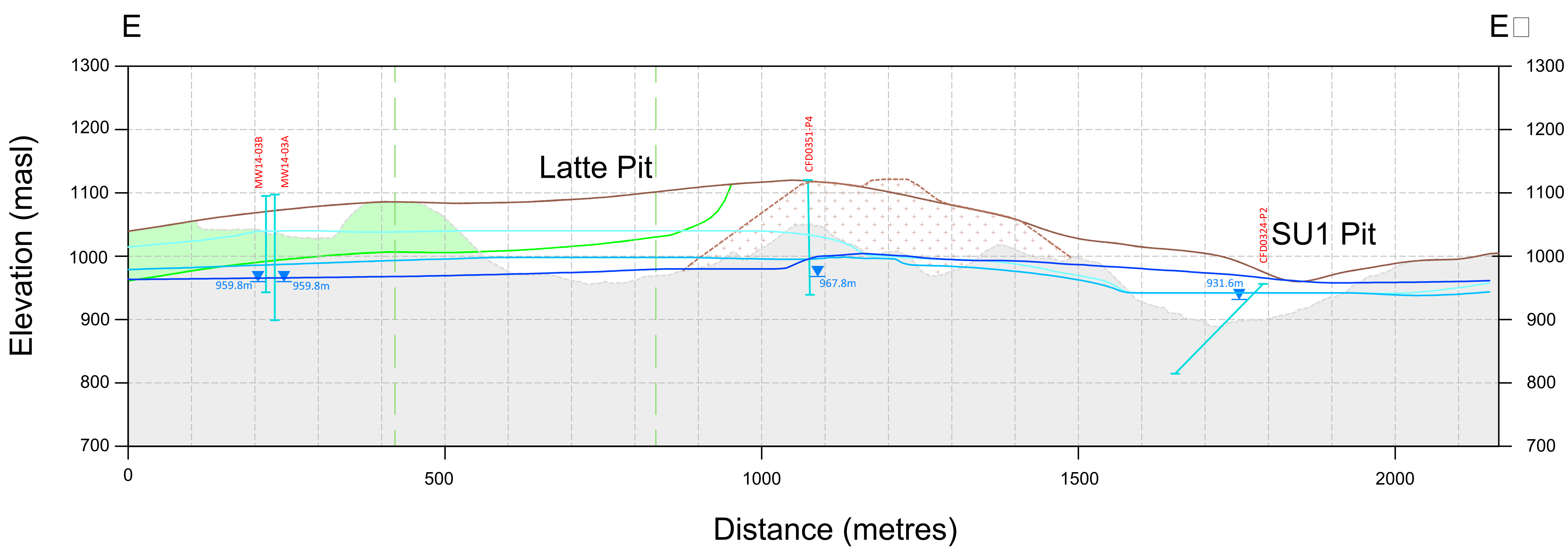


COFFEE GOLD MINE

**Hydrogeological Cross-Section**
**E-E' through Latte Pit & SU1**

Legend

- Pre-mine topography
- Bedrock
- Waste Rock
- Pit
- Permafrost
- Pre-mine GW
- End of Operation GW
- Post-Closure GW
- Inflection Point
- Drillholes
- Water Level (obs)

| Figure 7.6-2 | Date: Mar 21, 2017 | Drawn by: SSS | Reviewed: S |
|---|---|---|---|

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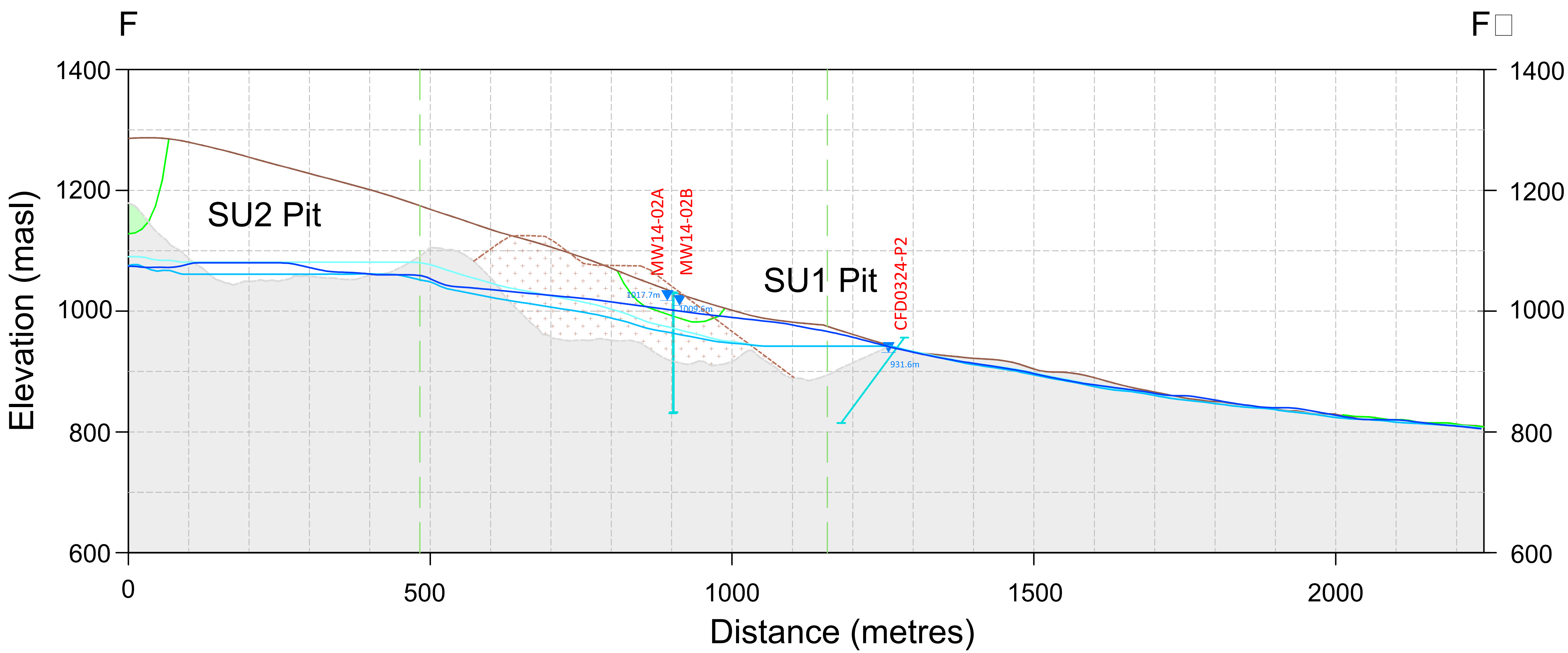


COFFEE GOLD MINE

**Hydrogeological Cross-Section F-F' through Supremo Pit Lake SU1 & SU2**

Legend

- Pre-mine topography
- Bedrock
- Waste Rock
- Pit
- Permafrost
- Pre-mine GW
- End of Operation GW
- Post-Closure GW
- Inflection Point
- Drillholes
- Water Level (obs)

□.E. □1□

| Figure 7.6-3 | Date: Mar 21, 2017 | Drawn by: SSS | Reviewed: □S |
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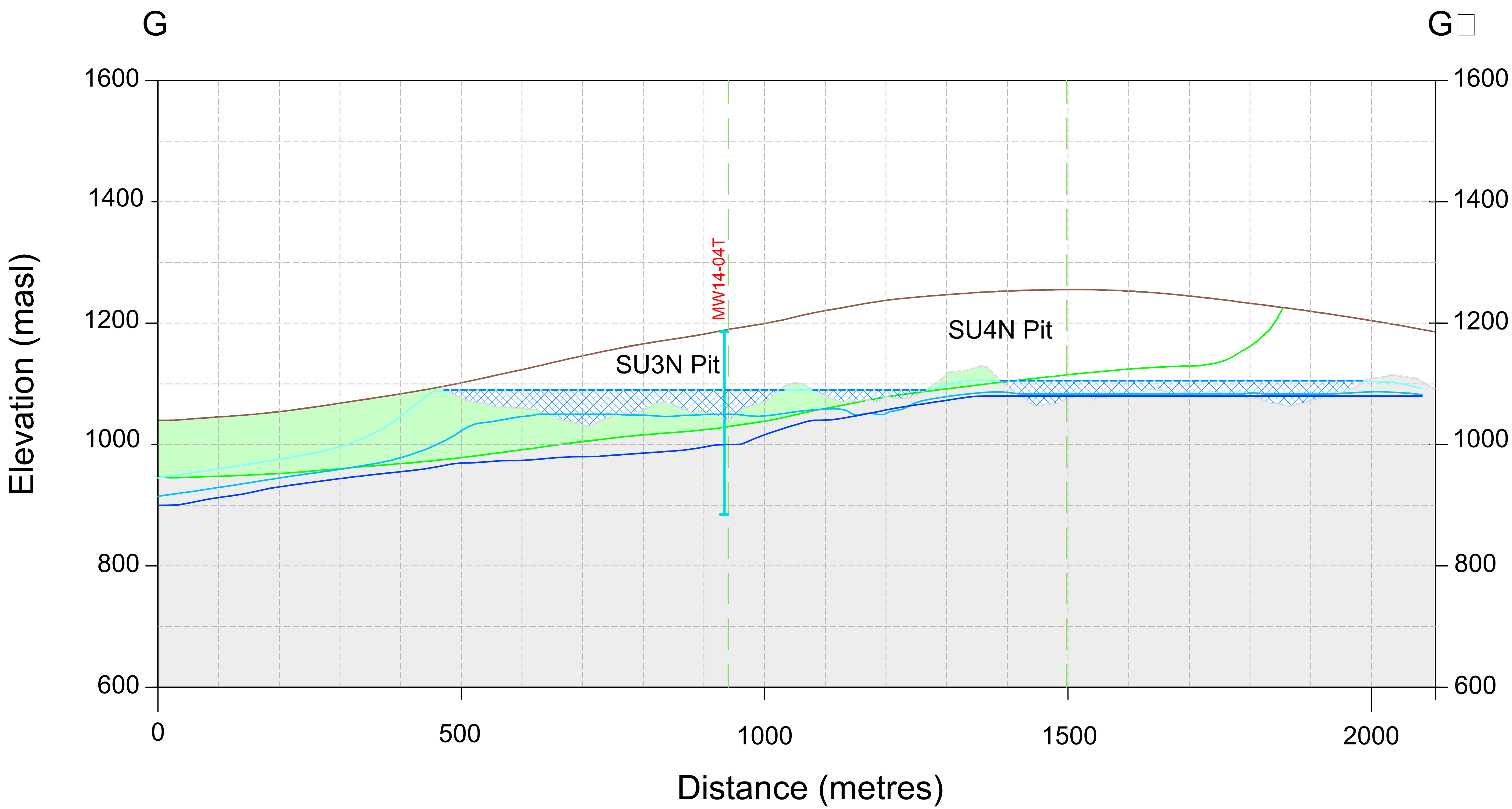


COFFEE GOLD MINE

**Hydrogeological Cross-Section G-G' through Supremo Pit Lake SU3N & SU4N**

| Figure 7.6-4 | Date: Mar 21, 2017 | Drawn by: SSS | Reviewed: S |
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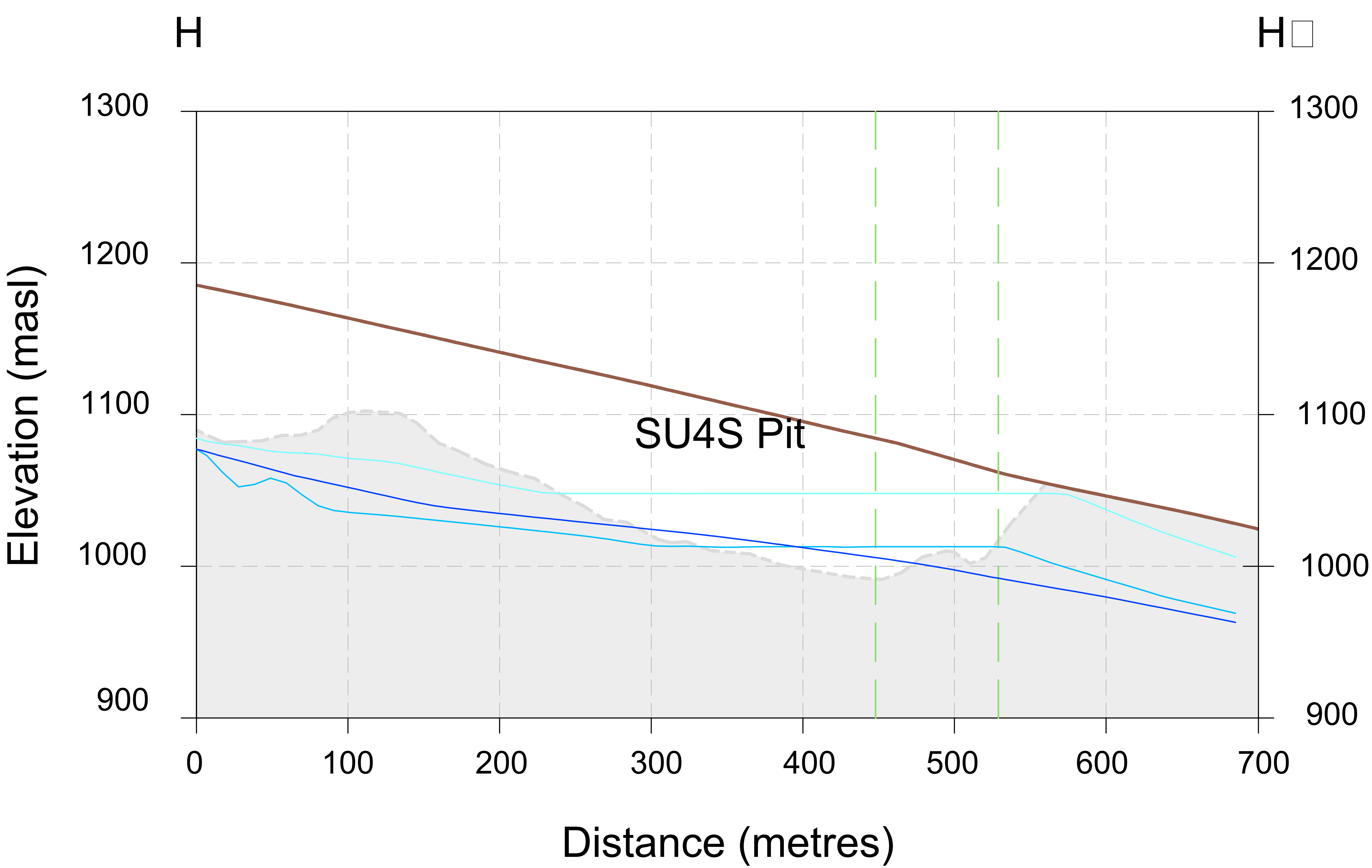


COFFEE GOLD MINE

**Hydrogeological Cross-Section H-H' through Supremo Pit Lake SU4S**

Legend

- Pre-mine topography
- Bedrock
- Pit
- Pre-mine GW
- End of Operation GW
- Post-Closure GW
- Inflection Point

| Figure 7.6-5 | Date: Mar 21, 2017 | Drawn by: SSS | Reviewed: S |
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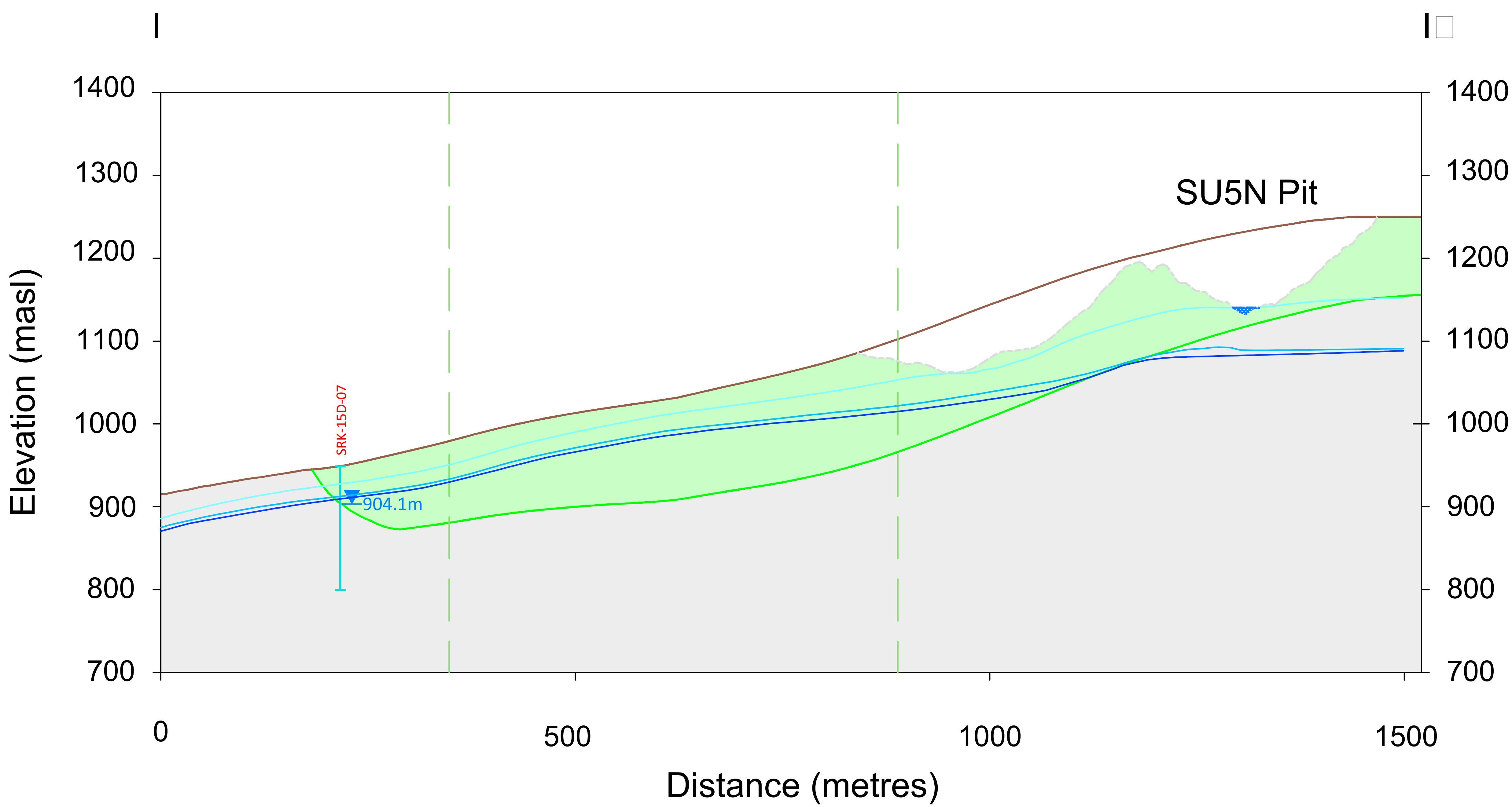
COFFEE GOLD MINE

**Hydrogeological Cross-Section I-I'
through Supremo Pit Lake SU5N & SU5S**




Legend

- Pre-mine topography
- Bedrock
- Pits
- Permafrost
- Pre-mine GW
- End of Operation GW
- Post-Closure GW
- Perched Water Table (Closure)
- Inflection Point
- Drillholes
- Water Level (obs)

V.E. 1:1

| Figure 7.6-6 | Date: Mar 21, 2017 | Drawn by: SSS | Reviewed: S |
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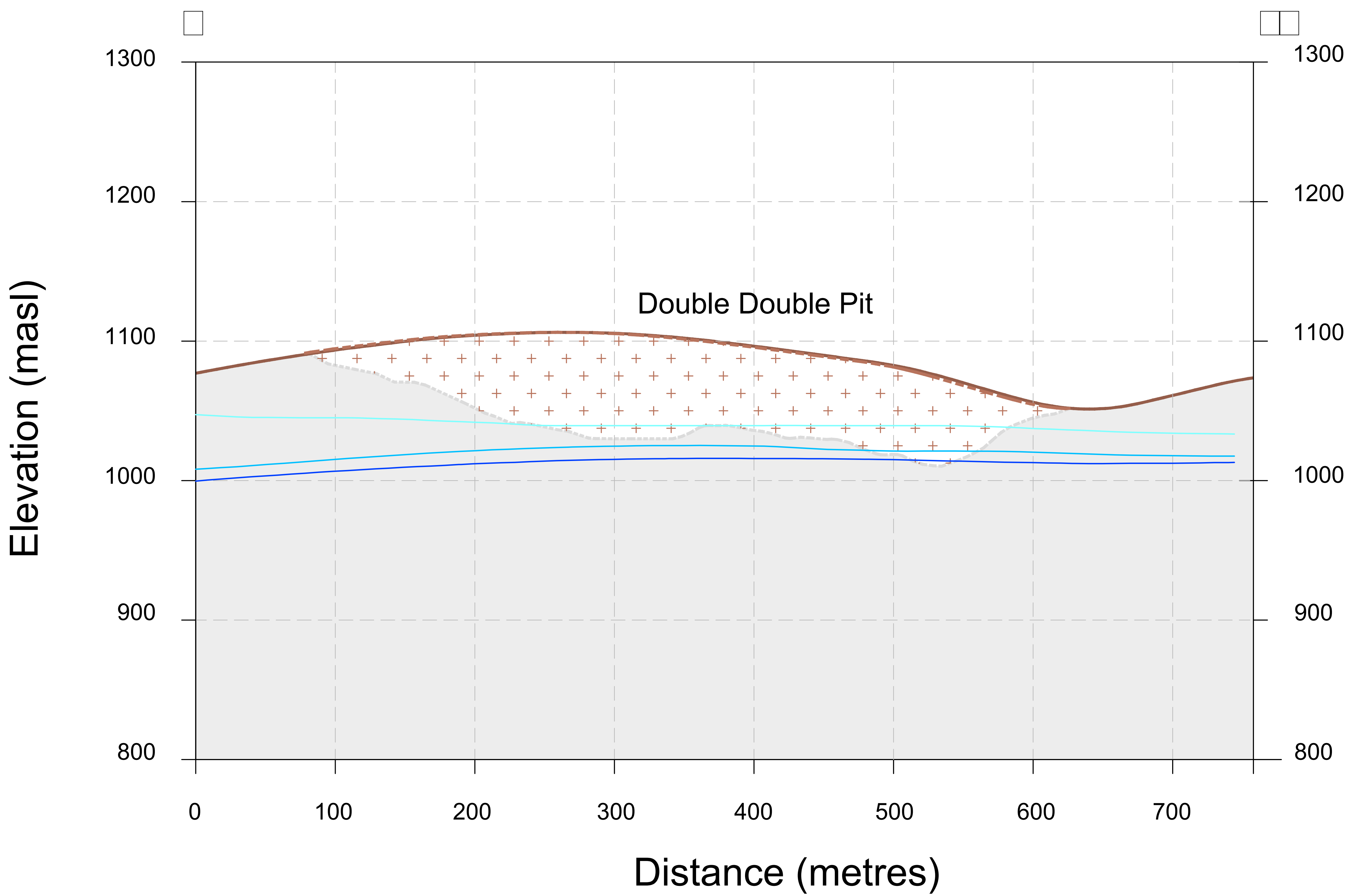


COFFEE GOLD MINE

**Hydrogeological Cross-Section J-J' through Double Double Pit**

Legend

- Pre-mine topography
- Bedrock
- Waste Rock
- Pit
- Pre-mine GW
- End of Operation GW
- Post-Closure GW

V.E. 1:1

| Figure 7.6-7 | Date: Mar 21, 2017 | Drawn by: SSS | Reviewed: S |
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***Potential Changes to Creek Baseflows***

Despite there being large changes to groundwater levels in the Project footprint area (see preceding discussion), changes in local creek baseflows are small due to generally tight bedrock conditions that limit pit/groundwater interactions. When end of Operation Phase baseflows are compared to simulated baseline baseflows, the differences are generally less than 5% of baseline levels and are well within the range of uncertainty associated with the measurement.

#### *7.6.1.2 Post-closure*

***Potential Changes to Groundwater Levels***

Overall combined seepage losses from the pits to Latte Creek (including Latte Tributary), Halfway Creek, and YT-24 are 4 L/s, 3 L/s and 0.5 L/s. Downgradient of the HLF, in the headwaters of Latte Creek, water levels will remain consistent between Operation Phase and Reclamation and Closure Phase, with an approximately 15 m and 5 m decline anticipated due to the loss of recharge over the HLF footprint. Water levels further down the drainage are expected to remain at baseline levels.

Water levels in the SU1 pit lake will remain up to 40 m below pre-mine levels (**Figure 7.6-2**). The SU2 pit lake is 20 m higher than the end of Operation Phase pit lake, but the associated groundwater mound is limited in its southern extent by the drawdown created by the SU1 pit.

Water levels in the SU3N and SU4N pit lakes are 40 m and 20 m higher, respectively, in the Post-closure Phase relative to end of Operation Phase (**Figure 7.6-4**). Seepage losses from the SU3N pit lake are small, with less than 0.5 L/s reporting to Halfway Creek and an even smaller amount (0.1 L/s) reporting to YT-24. SU4N contributes minimal seepage (<0.1 L/s) to the SU1 and SU2 pits, and provides negligible (0.01 L/s) direct seepage to Halfway Creek. Altogether, mounding in the Halfway Creek drainage is more pronounced.

The elevation of the SU4S pit lake increases over 35 m during to reach its spill point Post-closure (**Figure 7.6-6**) compounding groundwater mounding caused by the Double Double pit. The SU4S pit loses a small amount of seepage (0.1 L/s) to the SU1 pit, but predominantly seeps towards Latte Creek at a rate of 1.7 L/s.

A large increase in the mounding of water levels is observed around the SU5S/N pit complex (**Figure 7.6-7**). While the pits are at their spill point as of end of Operation Phase, the formation of through taliks (and associated implementation of constant heads) forces the water table to rise up to the level of pit lakes, whereas they were perched above the water table when permafrost was present (at end of Operation Phase). This causes water levels at MW15-07T to increase by over 40 m over Operation Phase. As a result of the changes, the fluxes out of the highest pit lake, SU5N, are much higher in Post-closure (6.3 L/s versus 0.01 L/s at end of Operation Phase), but nearly all of the seepage reports in an even split to the SU4N, SU4S and SU5N pits. SU5S loses about 0.4 L/s to Latte Creek and 0.3 L/s to YT-24. SU5N in turn, loses only a minor amount of seepage (0.06 L/s) to YT-24. The combined influence of the SU5 and SU3N pits enhances groundwater mounding downgradient in the YT-24 drainage.

***Potential Changes to Creek Baseflows***

An overall increase in seepage losses from the pit facilities contributes to enhanced baseflow in some drainages. Halfway Creek, which experienced a minimal (<5%) increase in baseflow at the end of Operation Phase, now experiences baseflow increases of 22% at HC-2.5 and 11% at downstream HC-5.0. Most of this increase is due to an increase of seepage losses from the Latte Pit, and to a lesser extent SU3N and SU3W. The absolute change in baseflows in this drainage is 1.9 L/s over the base case and remains within the uncertainty of baseflow targets. YT-24 experiences a more modest increase in baseflows of 4% (0.3 L/s), largely due to enhanced seepage from the SU5 pit complex.

Latte Creek and its tributary (CC-1.0) experienced an overall decrease in baseflow at the end of operations due to drawdown associated with the SU1 pit and HLF liner system. While these influences remain at closure, higher pit seepage rates essentially offset the reductions as of station CC-1.5. CC-6.0 (downgradient of the HLF) and CC-1.0 (downgradient of SU1) record baseflow reductions of 5% or less, which is within the uncertainty of the targets. Overall, baseflow is shown to increase at the most down-gradient station, CC-3.5 (Latte Creek upstream of Coffee Creek), by only 3%. The largest contributors of seepage to Latte Creek include SU4S, Latte Pit and Double Double

### 7.6.2 GROUNDWATER QUALITY

To assess potential changes to groundwater quality from mine activities, background groundwater quality data are compared to pit lake water quality computed by the Water Balance/Water Quality Model and source terms developed for waste rock stored in the Double Double pit.

The estimates of water quality are summarized in **Table 7.6-1** and **Table 7.6-2** for pit lakes and Double Double WRSF seepage, respectively. The summary tables are maximum monthly (Base Case) estimates through mine life and include the Post-closure Phase. Maximum estimates are compared to mean baseline. Concentrations of pollutants of concern (POC) that are above mean background groundwater quality are highlighted in grey.

**Table 7.6-1 Predicted Maximum Monthly Pit Lake Water Quality (All Mine Phases) Screened Against Measured Mean Baseline Groundwater Quality by Lithology**

| | | Pit Lake | | | | | | | | Waste Rock |
|---|---|---|---|---|---|---|---|---|---|---|
| Mine Facility | | S3W | SU3N | SU4S | SU5N | SU5S | SU2 | SU1 | Latte | Double Double |
| Underlying Lithology | | Gneiss | Gneiss | Gneiss | Gneiss | Gneiss | Gneiss | Gneiss | Schist | Gneiss |
| Nitrate (N) | mg/L | 0.0 | 0.0 | 0.10 | 0.0 | 0.0 | 0.0 | 6.6 | 4.2 | 30 |
| **Metals** | | | | | | | | | | |
| Dissolved Aluminum (Al) | ug/L | 7.3 | 7.2 | 137 | 7.2 | 7.2 | 7.0 | 65 | 62 | 7.9 |
| Total Arsenic (As) | ug/L | 27 | 26 | 19 | 23 | 23 | 20 | 13 | 33 | 7.0 |
| Total Chromium (Cr) | ug/L | 0.4 | 0.4 | 0.6 | 0.4 | 0.4 | 0.4 | 0.6 | 4.3 | 1.5 |
| Total Copper (Cu) | ug/L | 1.0 | 1.0 | 1.8 | 1.0 | 1.0 | 1.0 | 1.3 | 2.1 | 2.0 |
| Total Uranium (U) | ug/L | 64 | 64 | 46 | 64 | 64 | 60 | 102 | 42 | 376 |
| Total Zinc (Zn) | ug/L | 10.3 | 10.2 | 10.9 | 10.4 | 10.4 | 9.9 | 13.5 | 14.2 | 41 |

**Note**: shaded values are greater than mean observed baseline by lithology (Appendix 7-B, Table 4.4-7).

Al - aluminum; mg/L – milligrams per litre; NA - not applicable; Sb - antimony; $SO_4$ - sulfate; WAD-CN - weak acid dissociable cyanide

**Table 7.6-2 Predicted Maximum Monthly Waste Rock Storage Facility Source Terms (All Mine Phases) Screened Against Measured Mean Baseline Groundwater Quality by Lithology**

| | | Predicted Pit Lake Maximum Base Case Monthly Water Quality | | | | | | | | Waste Rock |
|---|---|---|---|---|---|---|---|---|---|---|
| Mine Facility | | S3W | SU3N | SU4S | SU5N | SU5S | SU2 | SU1 | Latte | Double Double |
| Underlying Lithology | | Gneiss | Gneiss | Gneiss | Gneiss | Gneiss | Gneiss | Gneiss | Schist | Gneiss |
| Nitrate (N) | mg/L | - | - | (1.4)x | - | - | - | (91)x | (112)x | (410)x |
| **Metals** | | | | | | | | | | |
| Dissolved Aluminum (Al) | ug/L | (0.5)x | (0.5)x | (9.5)x | (0.5)x | (0.5)x | (0.5)x | (4.5)x | (6.4)x | (0.6)x |
| Total Arsenic (As) | ug/L | (1.1)x | (1.1)x | (0.8)x | (1.0)x | (1.0)x | (0.8)x | (0.6)x | (1.2)x | (0.3)x |
| Total Chromium (Cr) | ug/L | (0.6)x | (0.6)x | (0.9)x | (0.6)x | (0.6)x | (0.6)x | (0.9)x | (11)x | (2.3)x |
| Total Copper (Cu) | ug/L | (1.3)x | (1.3)x | (2.3)x | (1.3)x | (1.3)x | (1.3)x | (1.7)x | (1.4)x | (2.7)x |
| Total Uranium (U) | ug/L | (0.4)x | (0.4)x | (0.3)x | (0.4)x | (0.4)x | (0.3)x | (0.6)x | (0.8)x | (2.2)x |
| Total Zinc (Zn) | ug/L | (0.1)x | (0.1)x | (0.1)x | (0.1)x | (0.1)x | (0.1)x | (0.2)x | (1.6)x | (0.5)x |

**Note**: Shaded values are greater than mean observed baseline by lithology (Appendix 7-B Groundwater Intermediate Component Analysis, Table 4.4-5).

In general, metal concentrations are within two times background levels for most of the pit lakes, save Latte. The exceptions are dissolved aluminum at SU4 and SU1, which are elevated 10-fold and 5-fold in pit water, respectively. Nitrate, associated with blasting residues, is elevated in pit lakes in contact with backfilled mine waste, i.e. Latte, SU1, and SU4S (to a smaller extent). These parameters are most elevated over background at Latte Pit (110-fold, respectively).

Besides blasting residues, Latte pit water quality is associated with the most exceedances of metal concentrations over background, with dissolved chromium and total aluminum the most elevated at 11-fold and 6-fold, respectively. Post-draindown seepage from the HLF is directed to the Latte pit during active closure and this results in water quality trends that are markedly different at this facility compared to others. For some POCs, including aluminum, arsenic and zinc, the addition of HLF draindown water causes concentrations to drop markedly in Year 21. Other POCs experience a marked increase upon HLF routing, including cyanide decay products (nitrate), copper and chromium.

Double Double WRSF seepage water quality is elevated over background for several POCs. Changes arising from blasting and associated nitrogen leaching are evident. Metals leaching is manifested in elevated chromium, copper, and uranium. Metal behaviour associated with WRSF seepage differs from pit lake water quality in that waste rock storage facilities are highly-oxidizing environments and exhibit different mineral solubility controls than pit wall runoff. These characteristics help to explain the disparate behaviour of arsenic and uranium in these depositional environments.

### 7.7 CUMULATIVE CHANGE ANALYSIS

Residual changes to groundwater quantity and quality that may occur as a result of Project activities are generally small, and are predicted to occur at the local scale without affecting the larger, much deeper regional groundwater system. **Section 7.6** has also indicated that there are no residual changes on the Groundwater IC associated with the Northern Access Route through all Project phases, nor are there changes predicted at the boundaries of the Groundwater Model. For this reason, the spatial boundary for the Cumulative Changes Study Area has been selected to coincide with the Groundwater Model boundary, which is equivalent to the Groundwater RSA boundary south of the Yukon River

Several active quartz mineral claims exist within the Cumulative Changes Study Area. No other activities were identified that overlap spatially or temporally with the Project-related residual changes. The business website for Independence Gold Corp. provides specific details on recent exploration activities at the Boulevard project. The Dan Man project, to the north of the Project, owned by Archer, Cathro and Associates, has reported exploration activities as recent as 2011, but specific plans for future exploration have not been cited. Likewise, no specific details are available on planned exploration activities for the remaining quartz projects.

Overall, the activities associated with exploration drilling are likely to result in minimal changes to groundwater quantity and quality. These changes, if measurable, would be either short-lived or localized to the shallow aquifer system specific to the drainage in which the activity occurs. For this reason, none of the quartz exploration activities associated with leases in the southwest portion of the Cumulative Changes Study Area are likely to confound Project changes to groundwater.

Even if exploration activities associated with the Dan Man project occur within YT-24 or Halfway Creek drainages (overlapping the groundwater LSA), it is not likely that there would be confounding interactions between these activities and the Project on groundwater quantity or quality. Given that an exploration program is orders of magnitude smaller in scope than an open pit mine, it is not likely that exploration, even if it occurs in coincident drainages as the Project, would produce residual changes that would confound Project interactions.

Based on the rationale provided above and summarized in **Appendix 7B Groundwater Intermediate Component Analysis**, there are no projects or activities likely to interact with the Project to produce cumulative changes in the Groundwater IC.

## 7.8 REFERENCES

Smakhtin, V.U. 2001. Low flow hydrology: a review. Journal of Hydrology. 240:147-168.

# 8.0 SURFACE HYDROLOGY ANALYSIS

This section presents a high-level summary of the change analysis for Surface Hydrology Intermediate Component (IC). The full change analysis is presented in **Appendix 8-B Surface Hydrology Intermediate Component Analysis**.

## 8.1 ANALYSIS SCOPE

This section describes the scope of the analysis for the Surface Hydrology IC, including the indicators used to measure and evaluate change resulting from the proposed Coffee Gold Mine (Project) and the spatial, temporal, and technical boundaries of the analysis.

### 8.1.1 SURFACE HYDROLOGY INDICATORS

The indicators chosen for the analysis of Surface Hydrology IC (see **Table 8.1-1**) include standard metrics that are typically used to measure and monitor streamflow. The indicators also include an additional metric: the duration and frequency of instantaneous daily flows that are less than 30 percent (%) of the mean annual discharge (MAD). This value is strongly correlated to basin size, and serves as a cut-off limit for flow reductions during low-flow periods (DFO 2013).

**Table 8.1-1 Indicators for Surface Hydrology**

| Indicator | Rationale for Selection |
|---|---|
| Annual Runoff | Project activities (e.g., pit dewatering, water diversions, water use) may change the proportion of precipitation that becomes surface runoff on an annual basis. |
| Monthly Runoff Distribution | Water management ponds, Open Pits, pit lakes, and WRSFs may alter (e.g., attenuate, enhance) the runoff signatures of mine-affected catchments on a monthly and seasonal basis. |
| Low Flows | Alterations to the existing groundwater regime and shallow interflow may result from Project development (e.g., pit development, waste rock placement). |
| Peak Flows | Alteration of the land surface and diversion of water via ditches may increase peak flows in the vicinity of the Project. Conversely, reductions in basin area may reduce peak flows via reduction in contributing areas. |
| Duration | Flow alterations resulting in instantaneous flows less than 30% of the MAD increase the risk of effects to ecosystems that support fisheries. |

**Note**: WRSF – Waste Rock Management Facility

## 8.2 ANALYSIS BOUNDARIES

**Table 8.2-1** below identifies the spatial, temporal, and technical boundaries established for the analysis of Project-related changes to hydrology (see also **Figure 8.2-1**). There are no administrative boundaries relevant to the hydrology analysis.

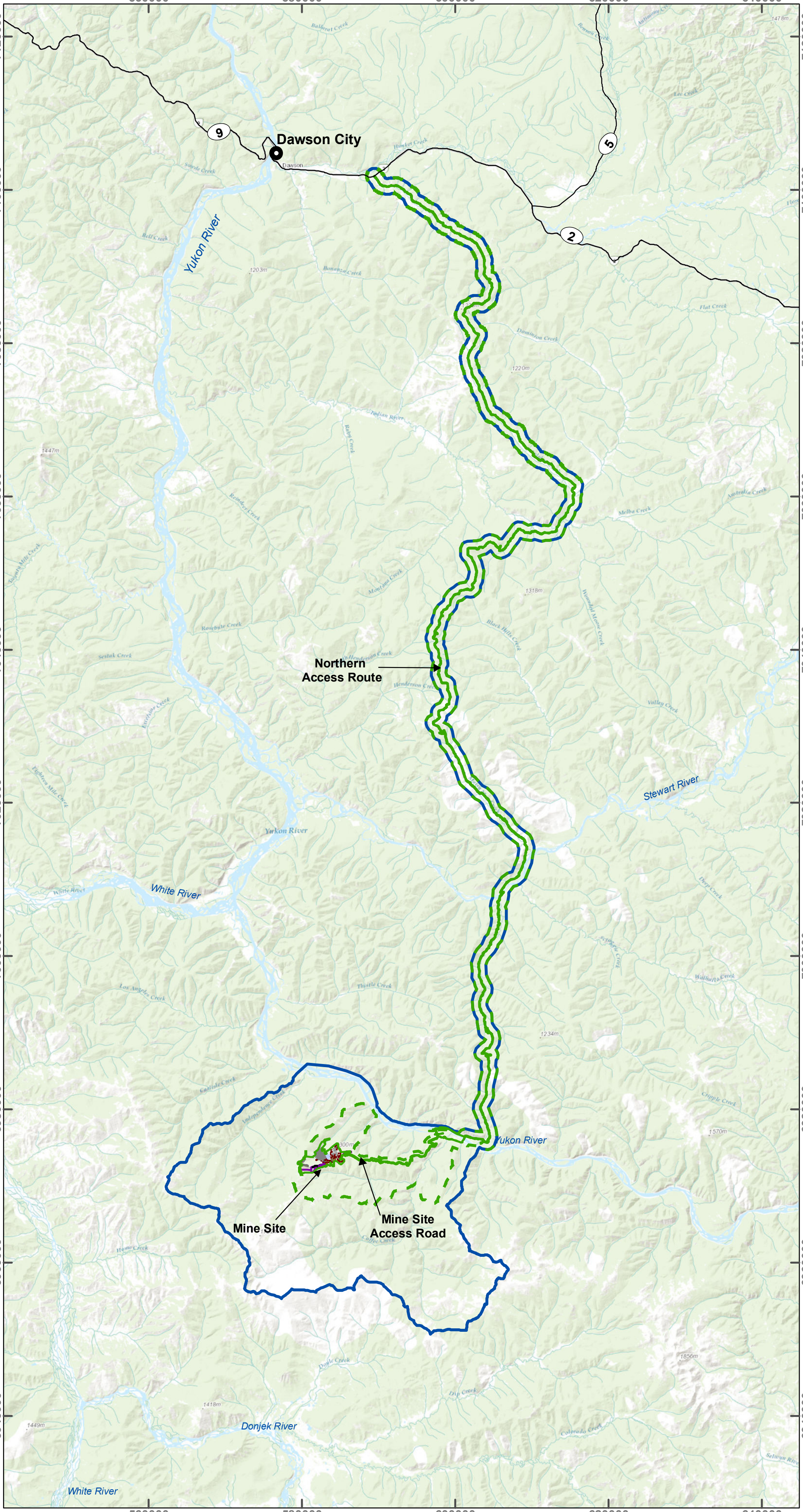
**Table 8.2-1 Spatial, Temporal, and Technical Boundaries for the Hydrology Analysis**

| Boundary | | Description of Boundary |
|---|---|---|
| Spatial | Local Study Area | The Halfway Creek and Yukon Tributary watersheds, Latte Creek, and Coffee Creek downstream of the confluence with Latte Creek to the Yukon River. The LSA also includes the alignment of the proposed Northern Access Route (including barge crossings) from the Mine Site to the North Klondike Highway junction, east of the City of Dawson. |
| | Regional Study Area | The entirety of the LSA, the Coffee Creek watershed (including the portion upstream of the confluence with Latte Creek), Independence Creek, and the section of the Yukon River that spans the confluences with Independence and Coffee Creeks, with a 100-m buffer. |
| | Cumulative Change Boundary | Includes the extent of the RSA south of the Yukon River, as well as a local drainage on the north side of the Yukon River that extends from Ballarat Creek to Kirkman Creek. |
| Temporal | | Construction, Operation, Reclamation and Closure, and Post-closure Phases, which are described in **Section 2.0 Project Description**. |
| Technical | | Given the robust relationship between water quality and quantity for the winter season, as well as the higher uncertainty in the winter discharge measurements, water balance and water quality model calibration focused on replicating the water quality signature during this period. |

**Notes:** LSA – Local Study Area; RSA – Regional Study Area

COFFEE PROJECT

**Surface Hydrology IC Local and Regional Study Areas**





Legend

- Municipality
- Highway
- Project Footprint
- Local Study Area
- Regional Study Area

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## 8.3 ANALYSIS METHODS

Throughout the different phases of the Project, various activities may result in an change to Surface Hydrology. Potential Project interactions with surface hydrology may have an influence on the short- or long-term integrity of this IC, potential changes arising from the interactions are characterized relative to existing conditions, and mitigation measures proposed to minimize potential changes are outlined (**Section 8.5.3**). The water balance model (**Section 8.3.1**) incorporates the site-wide mitigation strategies developed for the Project, in the sense that intended mitigation has been considered in deriving source terms for specific mine components.

### 8.3.1 WATER BALANCE MODEL OVERVIEW

A critical component of both the environmental assessment and licensing process is the prediction of potential changes to water quantity resulting from mine development and reclamation and closure. These predictions inform the mine development and operations plan and water management strategies, and form inputs into the fish and fish habitat VC assessments as well. A site-wide water balance model (WBM) was developed using background climate and hydrology data for the Mine Site. The WBM includes each of the three watersheds that will contain mine infrastructure (Latte Creek and Coffee Creek, Yukon Tributary (YT) 24, Halfway Creek). The WBM calculates the magnitude of predicted flow changes attributable to the Project (Base Case, With Project) by comparing Base Case flows to a baseline (or pre-development) flow record.

Overall, daily temperature and precipitation data are used to drive the WBM, with meteoric water being converted to runoff using assumptions and coefficients specific to the land surface type represented in each sub-catchment. All sub-catchments are assembled in hierarchical order, with runoff tracked and aggregated across the Mine Site and downstream into the receiving environment.

Baseline and Base Case flow data are the main outputs of the site-wide WBM, with outputs provided on a monthly basis for all phases of the Project.

### 8.3.2 REGULATORY FRAMEWORK

The management, use and discharge of water from a mine site is governed by territorial and federal legislation. The primary relevant territorial acts are the Yukon *Quartz Mining Act*, SY 2003, c. 14, and the Yukon *Waters Act*, SY 2003, c. 19. The application information requirements for a licence under both acts overlap substantially, and the regulation of mining activities is integrated across all environmental disciplines.

At the federal level, the assessment of Project-related changes is informed by the *Yukon Environmental and Socio-economic Assessment Act*, SC 2003, c. 7, which co-ordinates the assessment of major projects under a single review that is jointly administered by both the federal and territorial governments.

The discharge of mine effluent is governed under the *Fisheries Act* RSC 1985, c. F-14, and specifically by the Metal Mining Effluent Regulations (SOR-2002-222), which impose limits on the discharge of deleterious substances for any mine that exceeds a discharge rate of 50 cubic metres ($m^3$) per day (from all final discharge points). As the management of mine water discharge often focuses primarily on the effluent water quality, the effluent discharge rates (thus the potential changes to Surface Hydrology) are determined based on a combination of the effluent discharge limits, and the resultant water quality in the receiving streams. The *Navigation Protection Act*, RSC 1985, c. N-22, regulates activities that may affect the navigability of those water bodies listed in the Schedule of Navigable Waters, including dewatering (s.23). The Yukon River is listed in this Schedule, and thus is subject to the provisions of the Act.

## 8.4 EXISTING CONDITIONS

### *8.4.1.1 Annual Runoff*

Error! Reference source not found. presents the annual runoff data for both the measured period of record (2011 to 2015) and the synthetic record (1982 to 2015).

Mean annual runoff estimates vary between catchment basins. For example, the runoff generated by YT-24 is low and approximately 60 millimetres (mm), based on measurements recorded in 2014 and 2015 (**Appendix 8-A**). In contrast, runoff generated in the headwaters of Latte Creek are comparatively high and estimated to be 160 mm based on the 2014 and 2015 measurements. 2014 was an abnormally dry year, and the average runoff values from stations with shorter records will be skewed as a result.

The reconstructed annual runoff values shown in **Table 8.4-1** represent a longer record (33 years) and therefore a wider range of wet and dry years. Consequently, the reconstructed average annual runoff values tend to be higher than the average runoff calculated from the measured data. This reconstructed series was used to calibrate the site-wide WBM, and to ensure that the model represented the inter-annual runoff variability faithfully, and by extension, provided a robust estimate of the likely changes of Project development on the existing streamflow regime.

**Table 8.4-1 Mean Annual Runoff for Coffee Gold Mine Project Gauged Watersheds**

| Station ID | Measured Annual Runoff (mm) | | | | | | Reconstructed Annual Runoff (mm) | | |
|---|---|---|---|---|---|---|---|---|---|
| | 2011 | 2012 | 2013 | 2014 | 2015 | Average | Minimum | Average | Maximum |
| CC-0.5 | | -- | -- | 99 | 236 | 167 | 74 | 231 | 446 |
| CC-1.0 | | -- | -- | 9 | 110 | 60 | 27 | 76 | 147 |
| CC-1.5 | | -- | -- | 123 | 210 | 166 | 120 | 272 | 494 |
| CC-3.5 | 134 | 132 | 168 | 70 | 156 | 132 | 56 | 126 | 232 |
| CC-6.0 | | -- | -- | 148 | 264 | 206 | 196 | 382 | 670 |
| HC-2.5 | | -- | -- | 81 | 127 | 104 | 98 | 191 | 326 |
| HC-5.0 | 183 | 155 | 131 | 97 | 133 | 140 | 54 | 141 | 263 |
| IC-1.5 | | -- | -- | 114 | 207 | 160 | 100 | 240 | 444 |
| IC-2.5 | | -- | -- | 74 | 135 | 104 | 60 | 153 | 276 |
| IC-4.5 | 253 | 200 | 255 | 156 | 216 | 216 | 70 | 179 | 342 |
| YT-24 | | -- | -- | 23 | 97 | 60 | 26 | 92 | 180 |
| Average | | 162 | 185 | 90 | 172 | 136 | 80 | 189 | 347 |

#### *8.4.1.2 Monthly runoff distribution*

Most runoff during the open water season is generated by spring snowmelt (May and June) and frequent intense convective rainfall events (June through September). During the open water season, flows often decrease rapidly following the peak flows associated with a large rain event. Low-flow conditions can occur intermittently during the summer and early autumn, with unit yields during early summer often approaching those measured during the winter months.

**Table 8.2-1** presents the standard runoff, discharge, and unit yield metrics. For reference, MAD and 30% MAD metrics are presented for each station, and the months in which streamflows naturally drop below this threshold are highlighted. A key finding for the Project area is that flows from November through March are less than the 30% MAD threshold, while flows from April through October exceed the 30% MAD threshold at each monitoring location shown. Channel icing is extensive in the Local Study Area during the winter, limiting or excluding fish during this period. This information serves to focus the Surface Hydrology change analysis on the open water season, as the winter months currently experience severe flow reductions as a result of natural freezing processes.

**Table 8.4-2 Monthly Streamflow Metrics for the Coffee Gold Mine Site Area**

| Station | Area (km²) | Units | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | MAD | 30% |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CC-1.5 | 23.1 | mm | 0.70 | 0.74 | 1.39 | 23.45 | 77.92 | 32.20 | 35.36 | 27.13 | 23.34 | 11.71 | 2.47 | 1.39 | | |
| | | $m^3/s$ | 0.01 | 0.01 | 0.01 | 0.21 | 0.67 | 0.29 | 0.31 | 0.23 | 0.21 | 0.10 | 0.02 | 0.01 | 0.17 | 0.06 |
| | | $L/s/km^2$ | 0.26 | 0.30 | 0.52 | 9.05 | 29.09 | 12.42 | 13.20 | 10.13 | 9.00 | 4.37 | 0.95 | 0.52 | | |
| | | % annual | 0% | 0% | 1% | 9% | 31% | 14% | 16% | 12% | 10% | 5% | 1% | 1% | | |
| CC-3.5 | 69.8 | mm | 0.65 | 0.64 | 1.10 | 17.24 | 44.56 | 20.28 | 22.23 | 16.48 | 14.19 | 6.32 | 1.47 | 0.99 | | |
| | | $m^3/s$ | 0.02 | 0.02 | 0.03 | 0.46 | 1.16 | 0.55 | 0.58 | 0.43 | 0.38 | 0.16 | 0.04 | 0.03 | 0.32 | 0.10 |
| | | $L/s/km^2$ | 0.24 | 0.26 | 0.41 | 6.65 | 16.64 | 7.82 | 8.30 | 6.15 | 5.47 | 2.36 | 0.57 | 0.37 | | |
| | | % annual | 0% | 0% | 1% | 11% | 29% | 14% | 16% | 12% | 10% | 5% | 1% | 1% | | |
| CC-4.5 | 484 | mm | 0.04 | 0.16 | 0.81 | 31.92 | 57.30 | 19.10 | 26.86 | 20.74 | 17.97 | 6.35 | 0.33 | 0.16 | 2.77 | 0.83 |
| | | $m^3/s$ | 0.01 | 0.03 | 0.15 | 5.96 | 10.35 | 3.57 | 4.85 | 3.75 | 3.35 | 1.15 | 0.06 | 0.03 | | |
| | | $L/s/km^2$ | 0.01 | 0.07 | 0.30 | 12.31 | 21.39 | 7.37 | 10.03 | 7.74 | 6.93 | 2.37 | 0.13 | 0.06 | | |
| | | % annual | 0% | 0% | 1% | 15% | 24% | 13% | 17% | 12% | 11% | 5% | 1% | 1% | | |
| YT-24 | 11.8 | mm | 0.23 | 0.21 | 0.45 | 24.82 | 21.79 | 10.32 | 12.94 | 10.21 | 9.23 | 2.50 | 0.44 | 0.23 | | |
| | | $m^3/s$ | 0.00 | 0.00 | 0.00 | 0.11 | 0.10 | 0.05 | 0.06 | 0.05 | 0.04 | 0.01 | 0.00 | 0.00 | 0.03 | 0.01 |
| | | $L/s/km^2$ | 0.08 | 0.08 | 0.17 | 9.58 | 8.14 | 3.98 | 4.83 | 3.81 | 3.56 | 0.93 | 0.17 | 0.08 | | |
| | | % annual | 0% | 0% | 1% | 25% | 22% | 12% | 15% | 12% | 11% | 3% | 0% | 0% | | |
| HC-2.5 | 14.8 | mm | 1.27 | 0.99 | 1.45 | 12.78 | 51.58 | 25.04 | 26.78 | 21.72 | 19.62 | 10.68 | 3.50 | 2.17 | | |
| | | $m^3/s$ | 0.01 | 0.01 | 0.01 | 0.07 | 0.29 | 0.14 | 0.15 | 0.12 | 0.11 | 0.06 | 0.02 | 0.01 | 0.08 | 0.03 |
| | | $L/s/km^2$ | 0.47 | 0.41 | 0.54 | 4.93 | 19.26 | 9.66 | 10.00 | 8.11 | 7.57 | 3.99 | 1.35 | 0.81 | | |
| | | % annual | 1% | 1% | 1% | 7% | 28% | 14% | 16% | 12% | 11% | 6% | 2% | 1% | | |
| HC-5.0 | 27.0 | mm | 0.53 | 0.43 | 0.76 | 14.08 | 46.63 | 21.95 | 24.50 | 19.72 | 17.86 | 8.15 | 1.94 | 0.97 | | |
| | | $m^3/s$ | 0.01 | 0.00 | 0.01 | 0.15 | 0.47 | 0.23 | 0.25 | 0.20 | 0.19 | 0.08 | 0.02 | 0.01 | 0.13 | 0.04 |
| | | $L/s/km^2$ | 0.20 | 0.18 | 0.29 | 5.43 | 17.41 | 8.47 | 9.15 | 7.36 | 6.89 | 3.04 | 0.75 | 0.36 | | |
| | | % annual | 0% | 0% | 0% | 8% | 29% | 14% | 16% | 13% | 12% | 5% | 1% | 1% | | |

**Notes:** Months when average discharge falls below the 30% of mean annual discharge threshold are highlighted for reference.
$L/s/km^2$ – litres per second per square kilometre; $m^3/s$ - cubic metres per second

#### *8.4.1.3 Peak flows*

Peak flows in the vicinity of the Mine Site are primarily driven by the intense convective rainfall events during the summer months, with secondary peaks occurring in late May as a result of the melting snowpack. Instantaneous peak flows (as unit yields) are typically between 120 litres per second per square kilometre (L/s/km$^2$) and 200 L/s/km$^2$, although some drainages have recorded peak flows that are much lower (i.e., in the 60 L/s/km$^2$ range). Peak flows recorded in Upper Latte Creek (e.g., CC-6.0 and CC-1.5) are much larger in magnitude (i.e., 300 L/s/km$^2$ to 400 L/s/km$^2$).

A regional peak flow analysis was conducted using data collected from the regional hydrometric network (**Appendix 8-A**). The results of this analysis were used to estimate the corresponding peak flow for all Mine Site drainages, as shown in **Table 8.4-3**.

**Table 8.4-3 Instantaneous Peak Yield Recurrence Interval Estimates for Project Basins Derived from Regional Analysis (L/s/km$^2$)**

| Station | Drainage Area (km$^2$) | 1:2 year | 1:5 year | 1:10 year | 1:25 year | 1:50 year | 1:100 year | 1:200 year | Measured Maximum Peak Yields |
|---|---|---|---|---|---|---|---|---|---|
| CC-0.5 | 385.6 | 118 | 195 | 288 | 398 | 462 | 570 | 639 | 192 |
| CC-1.0 | 3.4 | 241 | 489 | 805 | 1,261 | 1,597 | 2,132 | 2,579 | 50 |
| CC-1.5 | 23.1 | 181 | 337 | 531 | 790 | 966 | 1,249 | 1,465 | 396 |
| CC-3.5 | 69.8 | 153 | 272 | 418 | 603 | 723 | 918 | 1,057 | 141 |
| CC-6.0 | 9.6 | 206 | 400 | 643 | 979 | 1,216 | 1,596 | 1,899 | 310 |
| HC-2.5 | 14.8 | 193 | 368 | 585 | 881 | 1,086 | 1,415 | 1,671 | 81 |
| HC-5.0 | 27 | 176 | 327 | 514 | 761 | 928 | 1,196 | 1,399 | 118 |
| IC-1.5 | 81.1 | 149 | 264 | 405 | 582 | 695 | 880 | 1,012 | 161 |
| IC-2.5 | 17.3 | 189 | 357 | 566 | 848 | 1,042 | 1,354 | 1,596 | 66 |
| IC-4.5 | 222.3 | 128 | 217 | 325 | 455 | 534 | 664 | 751 | 147 |
| YT-24 | 11.8 | 200 | 384 | 615 | 931 | 1,152 | 1,507 | 1,786 | 127 |

#### *8.4.1.4 Low Flows*

As the summer progresses, baseflows are enhanced by active layer melt and soil moisture recharge. By November, unit yields drop to 0.5 L/s/km$^2$ to 1.5 L/s/km$^2$ in all Project drainages. Zero-flow conditions become widespread by late January, and are accompanied by extensive formation of aufeis, which is defined as a sheet-like mass of layered ice that forms from successive flows of groundwater during freezing temperatures. Aufeis is pervasive in creeks and streams at the Mine Site and melts during the freshet but may persist into the early summer (mid to late June).

A robust characterization of the low flow regime is required to inform potential water quality sensitivities, as well as the potential for shortfalls in water required for the Project (e.g., as process makeup water or for dust control). Recurrence interval estimates for the summer period (June to September) were derived from the synthetic discharge records (**Table 8.4-4**). Due to limited site data available for the winter period, and the extensive aufeis conditions documented in Project area basins, all available spot flow measurements for the winter are presented in **Appendix 8-A** for the site stations. This data provides an indication of the expected annual low flow condition.

**Table 8.4-4 June–September Minimum Seven-day Low Flow Recurrence Interval Estimates from Synthetic Site Records**

| Exceedance Probability | Return Period | CC-0.5 | CC-1.0 | CC-1.5 | CC-3.5 | CC-6.0 | HC-2.5 | HC-5.0 | IC-1.5 | IC-2.5 | IC-4.5 | YT-24 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.5 | 1:2 (median) | 1.79 | 0.00 | 2.49 | 0.80 | 2.55 | 2.83 | 1.72 | 1.94 | 0.75 | 1.64 | 0.89 |
| 0.2 | 1:5 | 0.99 | 0.00 | 1.89 | 0.48 | 1.51 | 2.05 | 0.88 | 1.13 | 0.45 | 0.63 | 0.77 |
| 0.1 | 1:10 | 0.72 | 0.00 | 1.69 | 0.38 | 1.15 | 1.74 | 0.62 | 0.87 | 0.34 | 0.34 | 0.71 |
| 0.05 | 1:20 | 0.55 | 0.00 | 1.57 | 0.33 | 0.91 | 1.52 | 0.46 | 0.71 | 0.28 | 0.19 | 0.67 |

**Note:** Interval estimates generated from synthetic site records. Values are unit yields (L/s/km$^2$).

An important component of the winter flow regime at the Mine Site is the extensive icing of the local channels due to aufeis. This ice impedes flow, forcing it to the top of the existing ice sheet, where it freezes. This process repeats continuously throughout the winter, and results in laminated ice sheets that can approach 2 metres (m) in thickness and more than 50 m in width in Project-area channels. The aufeis process also acts as a storage reservoir for winter baseflows, and can store up to one-third of the cumulative annual baseflow in sub-Arctic watersheds (Yoshikawa et al. 2007).

Aufeis often far exceeds the natural stream channel width in the smaller tributaries, and because ice melts significantly slower than the snowpack, much of the freshet occurs while extensive aufeis is still present. This makes accurate measurement of streamflows challenging or impossible during the winter season at most hydrometric stations, and potentially dangerous during the initiation of freshet. Aufeis may also influence the distribution of annual streamflow, since the baseflow stored in aufeis during the winter months is released during the freshet and early summer periods. Further information on this process, including examples and an aufeis distribution map for the Mine Site area are presented in **Appendix 8-A Hydro-meteorology Baseline Study Report**.

#### *8.4.1.1 Yukon River*

As described in **Appendix 8-B Surface Hydrology Intermediate Component Analysis** (Section 2.2.2), contact waters associated with the Project will report passively to Halfway Creek, YT-24 (unnamed tributary), or Latte Creek – a headwater tributary of Coffee Creek. Ultimately, these three creeks flow into the Yukon River; therefore, an understanding of the Yukon River flow regime is valuable to this analysis.

Average, minimum, and maximum discharge data (period of record, daily) for winter flows in the Yukon River are typically 400 cubic metres per second ($m^3/s$) to 500 $m^3/s$, but may reach winter maximums of approximately 250 $m^3/s$ on occasion. Flows for the months May through November can reasonably be expected to range between 1,000 $m^3/s$ and 3,000 $m^3/s$ at the Project site, with peak flows in summer months reaching periods of record maximums of approximately 2,000 $m^3/s$ to 8,000 $m^3/s$.

### 8.4.2 NORTHERN ACCESS ROUTE

While the **Hydro-meteorology Baseline Study Report** (**Appendix 8-A**) placed emphasis on flow reconstructions for the Mine Site, the analyses completed for that study are directly applicable to the Northern Access Route (NAR).

## 8.5 PROJECT INTERACTIONS, POTENTIAL CHANGES, AND MITIGATION MEASURES

### 8.5.1 POTENTIAL PROJECT-RELATED INTERACTIONS

The analysis focuses on Project interactions with the potential to result in adverse changes to surface hydrology that are measureable and detectable using the indicators identified in **Section 8.1.1**.

#### *8.5.1.1 Mine Site – Construction Phase*

Activities involving large-scale land surface changes within the Project footprint, including clearing and grubbing, and the development Alpha Waste Rock Storage Facility (WRSF), Stockpiles, Open Pits, and Water Management Structures (e.g., diversions, settling ponds) will alter local runoff patterns and affect the existing evapotranspiration regime. Stripping, grubbing, compaction, road construction, and pit development will increase the impervious portion of each mine-affected catchment. The increase in impervious area may reduce infiltration to the shallow (and subsequently deep) groundwater systems, which may result in changes to annual runoff volumes and the distribution of monthly runoff, as well as reduce baseflows, and increase peak flows.

Removal of water from nearby creeks for initial supply to the Heap Leach Facility (HLF) and wetting of the ore will lower flows and alter monthly flow distributions. Because the HLF is a closed system, any water that enters the uncovered HLF footprint will remain there, including precipitation, and any moisture contained in the ore will be loaded onto the HLF. Abstractions of water for use in the HLF may reduce annual runoff volumes, low flows, and high flows, and alter the monthly distribution of flow in local creeks.

#### *8.5.1.2 Mine Site – Operation Phase*

As the Open Pits are developed, the non-contact area within the mine catchments will decrease and the contact areas will increase. Runoff coefficients (i.e., the amount of precipitation that appears as surface runoff) will increase as the pit walls are likely to be largely impervious or non-penetrable, which may increase annual runoff. Low flows may be affected in the watersheds that contain pits that intersect the groundwater table. Later in the mine life, Open Pits may become temporary groundwater sinks as they start to fill, which may reduce annual runoff volumes, alter the monthly distribution of flows (increased winter flows and reduced summer flows), and dampen peak flow magnitudes to some degree. To allow for re-establishment of the permafrost, the Kona pit will be backfilled in winter when the waste rock is frozen. Once the permafrost has been re-established, surface runoff from rainfall and snow melt will discharge to the receiving environment. Once backfilling has been completed, no measurable changes in streamflow from the baseline conditions in the vicinity of Kona pit are likely.

As anticipated during the Construction Phase, the large-scale land surface changes associated with continued use of the Alpha WRSF and development of the Beta WRSF will change local runoff regimes. Placement of waste rock will serve to attenuate flows within mine basins, and has the potential to alter the monthly runoff regime and increase low flows and moderate peak flows in some months (e.g., late summer, fall). The installation of rock drains at the base of the WRSFs will allow up-gradient water to pass freely. Increased residence time of infiltration within the WRSFs may increase baseflows downstream of the WRSFs.

The development of additional water management structures, external to the HLF, and operation and management of existing water management structures will alter local drainage patterns, resulting in higher runoff coefficients than for natural ground. In HLF sections covered by raincoats (i.e., exposed geomembranes), all precipitation will be converted to surface runoff and directed to the rainwater collection pond. The release of this water from the pond to the receiving environment will also contribute to localized increases in runoff coefficients.

Peak flows will be locally moderated by the accumulation of water in the Open Pits, particularly during the spring freshet. In turn, seasonal dewatering of the pits may increase flows during the remaining months of the open water season.

Ongoing staged construction, ore loading, and use of contact water at the HLF will continue to remove runoff within the uncovered HLF footprint, reducing annual runoff and altering monthly flow distributions in area streams. Beginning in Year 12, when the HLF is no longer in service, local streamflows will increase due to discharge of treated HLF rinse water from the water treatment plant.

When mining ceases, meteoric water abstracted to the Open Pits will reduce runoff available to receiving streams, potentially reducing annual runoff and altering the monthly runoff regime, peak flows, and low flows.

#### *8.5.1.3 Mine Site – Reclamation and Closure Phase*

As the Reclamation and Closure Phase commences and progresses, the surface runoff regime in the Mine Site area will begin to return to its natural state.

An exception to this will occur in the vicinity of the Open Pits. Over time, as these pits fill, water will be retained that would otherwise leave the Mine Site as runoff and be available to receiving streams. As a result, annual runoff will be reduced and monthly runoff regimes, peak flows, and low flows will be altered. When backfilling of Double Double pit and Kona pit is complete, water will no longer accumulate in those pits. In the partially backfilled Supremo pit and Latte pit; however, pit lakes are likely to form and persist into the Post-closure Phase. When the pit lakes have filled with water and are spilling, they will serve as water reservoirs, and will have a moderating influence on local streamflows.

#### *8.5.1.4 Mine Site - Post-closure Phase*

During Post-closure when monitoring is the only on-site activity, no interactions with the Project and surface hydrology are likely to occur; however, changes to Mine Site drainages that occur in earlier phases are likely to persist through the Post-closure Phase.

#### *8.5.1.5 Northern Access Route*

Potential changes changes to surface hydrology along the NAR during the Project's Construction, Operation, and Reclamation and Closure Phases include the following:

- Compacted road surfaces, including soil/rock cuts, fill, and adjacent ditching may limit infiltration and alter pre-development surface and groundwater flow paths (Pike et al. 2010).
- Road sections that intersect or re-direct shallow groundwater flow paths may alter local streamflow regimes (e.g., increase annual surface runoff to a minor degree) or alter groundwater-controlled environments (such as springs or seepage areas) down-gradient of the road section (Hancock 2002).
- Runoff from a section of road may flow into a local watercourse directly, potentially increasing peak flows at the point of discharge. Alternatively, local road runoff may be conveyed by ditches and culverts to an adjacent drainage. When this occurs, flows may be reduced in the tributary down-gradient of the road section and increased in the adjacent drainage (Pike et al. 2010).
- Standing waters attributable to a blocked culvert (due to accumulation of debris, beaver activity, or icing) may alter local groundwater flow paths, increasing baseflow to a local tributary. Episodic discharge of standing water may increase peak flows in an adjacent watercourse if the release coincides with a runoff event. Alternatively, discharge of standing water may enhance baseflow conditions in the local watercourse, if it occurs out of sync with the local hydrograph.

No interactions between barge or vehicle traffic along the NAR and surface hydrology are likely; consequently, these Project activities are not considered further in this analysis.

### 8.5.2 POTENTIAL CHANGES

The Construction, Operation, Reclamation and Closure, and Post-closure Phases of the Project may alter the extent of watershed boundaries as water from various mine components will be routed to central management locations (e.g., Open Pits, sediment control ponds). In addition, ground surface characteristics will change as pits are developed, ore is stockpiled and placed on the HLF, waste rock is deposited in WRSFs, and Water Management Infrastructure is constructed and operated.

These alterations within the Project drainages may change flow conditions in local creeks and streams from their baseline condition. Open Pits will store water and reduce runoff while the pits are filling, whereas surface water diversions may remove flow from one drainage and increase flow in an adjacent watershed. The HLF will operate as a closed loop for most of the Operation Phase, and will remove runoff from the headwaters of both Latte and Halfway Creeks. Sediment ponds located down-gradient of the Project infrastructure will collect runoff and may attenuate peak flows (i.e., delay runoff response and moderate peak flows). Finally, the WRSFs are likely to store and release water differently from the natural areas they once were (e.g., attenuate the snowmelt freshet signature and enhance summer low flows).

Upgrades to the NAR and construction activities can lead to a number of potential changes in surface hydrology including compaction and flow path alterations.

### 8.5.3 MITIGATION, MANAGEMENT, AND MONITORING

The mitigation measures proposed to be used to eliminate or reduce Project-related changes to surface hydrology are inherent in the Project design and are related to:

- Phased mine development and progressive reclamation
- WRSF site selection
- Backfilling pits
- Surface water protection and management
- HLF water balance
- Management of non-contact water
- HLF design to facilitate progressive closure
- HLF event ponds
- HLF rainwater storage pond
- Drainage channels
- Sediment pond design, capacity, and discharge
- Rock drains.

## 8.6 Residual Changes

### 8.6.1 Mine Site

The GoldSim WBM was used to predict residual changes during the Project's Construction, Operation, Reclamation and Closure, and Post-closure Phases. The WBM assumes that all the design mitigation measures described in **Section 8.5.3** will be effectively implemented. Further information regarding the WBM, including model setup, parameters, and calibration is provided in **Appendix 12-C Water Balance and Water Quality Model Report**.

The WBM predicts that residual changes to the existing hydrologic regime will occur during the Operation Phase (i.e., the worst-case scenario) when the Mine Site footprint is at its maximum and ore is being actively mined and processed. Predicted changes during other Project phases are consistently of lower magnitude, with the mean values (of all WBM runs) often less than the +/-5% change from baseline that was selected as the analysis threshold. The indicators examined in the residual change analysis for each drainage include annual runoff, monthly flow distribution, low flows, and high flows.

As summarized in **Table 8.6-1**, the changes during the Operation Phase are predicted to occur at three stations (nodes) within the Latte Creek / Coffee Creek watershed (i.e., three stations in the Coffee Creek watershed (CC-15 (23.2 $km^2$), CC-3.5 (69.8 $km^2$), CC-4.5 (484 $km^2$), a single station in the YT-24 watershed (11.8 $km^2$), and two stations in the Halfway Creek watershed (HC-2.5 (14.8 $km^2$) and HC-5.0 (27 $km^2$)). Flow changes and ratings at CC-1.5 and HC-2.5 are predicted to improve with distance downstream and to be minor.

**Table 8.6-1 Summary of Potential Project-related Residual Changes to Surface Hydrology**

| Drainage Name | Potential Change | Mitigation Measures | Potential Residual Change |
|---|---|---|---|
| **Mine Site** | | | |
| Latte Creek (CC-1.5) | Potential changes include:<br>• Reductions in runoff due to storage in HLF, pits, and WRSFs<br>• Increases in runoff due to clearing and stripping activities, pit development, etc.<br>• Alteration of monthly streamflow distributions due to land surface alterations, attenuated runoff through WRSFs, and pond storage and release | • Progressive reclamation and backfilling of pits<br>• WRSF site selection and inclusion of rock drains<br>• HLF operated as closed system for first part of Operation Phase and progressive reclaimed, beginning in Year 4<br>• Management of non-contact water<br>• Sediment pond, event pond, and raincoat pond design. | Moderate changes (reductions) in annual runoff, monthly distribution, low flows, and high flows. |
| Latte Creek (CC-3.5) | | | Low changes (reductions) in annual runoff and high flows, and moderate changes in monthly flow distribution and low flows. |
| Coffee Creek (CC-4.5) | | | No residual adverse changes are likely. |
| YT-24 | | | High-magnitude changes (increases) in annual runoff, monthly flow distribution, low flows, and high flows. |

| Drainage Name | Potential Change | Mitigation Measures | Potential Residual Change |
|---|---|---|---|
| Halfway Creek (HC-2.5) | • Reductions in runoff due to operation of HLF as closed system for most of Operation Phase. | | High magnitude changes (increases) in annual runoff, monthly distribution, low flows and high flows. |
| Halfway Creek (HC-5.0) | | | Moderate/high changes (increases) in annual runoff monthly distribution, low flows and high flows. |
| **Northern Access Route** | | | |
| All | • Increased sediment production and transport<br>• Increased flooding due to blocked culverts, increased runoff from road surfaces and ditches<br>• Reduced infiltration through road surfaces<br>• Altered shallow groundwater flow paths. | Implementation of best practices in management plans:<br>• Access Route Construction Management Plan (**Appendix 31-A**)<br>• Access Route Operational Management Plan (**Appendix 31-B**)<br>• Conceptual Reclamation and Closure Plan (**Appendix 31-C**)<br>• Dust Management Plan (summarized in **Section 31.0 Environmental and Socio-economic Management Program**)<br>• Erosion and Sediment Control Plan (summarized in **Section 31.0 Environmental and Socio-economic Management Program**). | No residual adverse changes are likely. |

At CC-1.5 the greatest changes are predicted during the Operation Phase when actively mined pits are being dewatered. By comparison, in Closure and Post-Closure open pits passively fill and eventually spill and thus the proportion of exposed pit wall is reduced in these later Project Phases. At CC-1.5, the Low flow indicator for the magnitude residual change characteristic returns a consistent high rating for each Project Phase, whereas as other indicators for change characteristics consistently return ratings that are low/moderate or associated with negligible or no change.

CC-3.5 is the next node located downstream of the Project. As a result, any Project related change discernible at CC-1.5 becomes substantially reduced at this node further downstream. The same activities that serve to alter streamflows at CC-1.5 have a similar effect at CC-3.5, though they are muted by the larger watershed. For example, the low flow indicator for the magnitude residual change characteristic returns a consistent moderate rating for each Project Phase at CC-3.5, whereas as other indicators for change characteristics consistently return ratings that are low or associated with negligible or no change.

At CC-4.5 (which represents a watershed area 21 times larger than the CC-1.5 station), model runs did not predict a measurable change in the existing streamflow regime. This station represents Coffee Creek just upstream of its confluence with the Yukon River, and is a site of cultural and historical importance with a long history of use by First Nations.

At YT-24, the magnitude of the predicted residual changes is rated as either moderate or high for all indicators (i.e., direction, magnitude, timing) and all phases of the Project. Exposed pit walls are assumed to generate pit wall runoff more efficiently than natural drainage area and additional runoff from these areas has the potential to enhance future low flow regimes compared to the baseline condition. This is apparent at YT-24, with magnitude (low flow) ratings being high for Operation, Closure and Post-closure Phases. The magnitude (high flow) residual change screenings confirm increased basin productivity following mine development with rating being high for the Operation Phase and moderate for Closure and Post-closure Phases. The higher rating for the Operation Phase occurs as actively mined pits are being dewatered during this phase, rather than passively filling and/or spilling later in the Project timeline. The Project-related residual changes for YT-24 are predicted to be continuous, irreversible (permanent) and the probability of occurrence is rated as likely.

At HC-2.5, the magnitude of predicted flow alterations is high for all four indicators (annual runoff, monthly distribution, low flows and high flows), in all phases. The timing of streamflows in Halfway Creek are predicted to change as the Alpha WRSF is expected to both attenuate streamflows (lagged) and increase the runoff coefficient above the background condition (particularly during wet-years). The changes are predicted to occur continuously, will be irreversible (permanent) and the probability of occurrence is rated as likely.

At HC-5.0, which represents the entire Halfway Creek watershed at its confluence with the Yukon River, the magnitude of predicted flow alterations is low for the annual runoff and high-flow indicators in all Project phases. The magnitude of predicted flow alterations is high for the annual runoff, monthly distribution and low flows indicators, and moderate for the high flows indicator in all phases. As for HC-2.5, the timing of streamflows is expected to change due to the Operation and Closure of the Project. The changes are predicted to occur continuously, be irreversible (permanent) and the probability of occurrence is rated as likely.

### 8.6.2 NORTHERN ACCESS ROUTE

No residual adverse changes to the Surface Hydrology IC are considered likely during the upgrade of existing NAR road sections, construction and decommissioning of new NAR sections, and Project-related operation and maintenance of the NAR.

## 8.7 CUMULATIVE CHANGE ANALYSIS

The Cumulative Change Analysis examined potential interactions between the proposed Project, and other nearby past, present and reasonably foreseeable future projects. A total of two recent (within the last 5 years) active mineral exploration projects, and no known placer projects are located within the portion of the LSA defined for the Surface Hydrology IC that sits south of the Yukon River. Potential exploration activity at these sites in the future is assumed to require very small water abstractions (e.g., for drilling), and therefore future exploration activities are not anticipated to result in measurable incremental changes to the Surface Hydrology IC within local watercourses such as Halfway Creek and YT-24 Creek.

Within the larger CCB, there is the potential for future mineral exploration to interact with the proposed Projects residual changes. The areas where this activity has the potential to occur are the mainstem of Coffee Creek and Independence Creek. However, the residual changes that may result from these potential activities are of low magnitude, duration, extent, and therefore not predicted to result in detectable cumulative changes to the Surface Hydrology IC. The residual changes likely to be realized are attributable mainly to the Project.

## 8.8 REFERENCES

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# 9.0 AIR QUALITY AND GREENHOUSE GAS EMISSIONS ANALYSIS

This section presents a high-level summary of the change analysis for the Air Quality and Greenhouse Gas Emissions Intermediate Component (IC) for the proposed Coffee Gold Mine (Project). The full assessment is presented in **Appendix 9-B Air Quality and Greenhouse Gas Emissions Intermediate Component Analysis Report**.

## 9.1 ASSESSMENT SCOPE

Air quality is quantitatively assessed by comparing the concentrations of contaminants of concern against regulated standards (i.e., Yukon Environment's Ambient Air Quality Standards (AAQS) and British Columbia Ambient Air Quality Objectives (BC AAQO)).

**Table 9.1-1** describes the contaminants of concern that have been selected as indicators, as they are typically associated with mining activities and have relevant regulatory standards for comparison.

**Table 9.1-1 Indicators for Air Quality**

| Indicator | Rationale for Selection |
|---|---|
| ***Airborne Particulate Matter*** | |
| Total Suspended Particulate Matter | • Regulated under Yukon AAQS<br>• Mining operations have the potential to elevate local airborne TSP levels<br>• Major sources include wind erosion, road dust, earth-moving operations<br>• May cause visual changes |
| $PM_{10}$ | • Monitored using BC AAQO<br>• Mining operations have the potential to elevate the local airborne $PM_{10}$ levels<br>• Has the potential to cause health effects |
| $PM_{2.5}$ | • Regulated under Yukon AAQS<br>• Can be transported for kilometres from the emission source<br>• Mining operations have the potential to elevate local airborne $PM_{2.5}$ levels.<br>• Diesel-powered vehicle and generator emissions contain small-fraction $PM_{2.5}$ |
| Dust Fallout and Mineral / Metallic Content | • Monitored using BC AAQO<br>• Dust fallout may have a deleterious effect on vegetation and the subsequent food chain<br>• The mineral / metallic fraction of TSP that falls out as dust can contribute to elevated metal concentrations in soil and water<br>• As mining activities commence, the fraction of TSP that is mineral / metallic in nature will increase |
| ***Combustion By-Products*** | |
| Nitrogen Oxides | • Regulated under Yukon AAQS<br>• $NO_x$ can contribute to TSP (nitrates) formation and/or acid rain fallout<br>• $NO_x$ is generated as a by-product of fuel combustion, when $N_2$ combusts to form NO and $NO_2$, which together are known as $NO_x$<br>• The proposed mining operations will elevate $NO_x$ in the local atmosphere |

| Indicator | Rationale for Selection |
|---|---|
| Sulphur Dioxide | • Regulated under Yukon AAQS<br>• $SO_2$ can contribute to TSP (sulphates) formation and, or acid rain fallout<br>• $SO_2$ is generated as a by-product of diesel fuel combustion, when sulphur (S) in the fuel combusts to form $SO_2$.<br>• The proposed mining operations will elevate $SO_2$ in the local atmosphere |
| Carbon Monoxide | • Regulated under Yukon AAQS<br>• CO causes oxygen displacement within the hemoglobin in the red blood cells within an organisms' blood stream and has the capacity to cause health effects in high concentrations<br>• CO is generated as a by-product of incomplete fuel combustion. Some carbon (C) in the fuel partially combusts to form CO instead of $CO_2$<br>• The proposed mining operations will elevate CO in the local atmosphere |
| Greenhouse Gases:<br>$CO_2$<br>$CH_4$<br>$N_2O$ | • GHGs in the atmosphere contribute to global climate change<br>• The proposed mining operations will contribute GHGs to the atmosphere<br>• $CO_2$ is generated as a product of combustion when the majority of the carbon in fuel combusts to form $CO_2$<br>• $CO_2$ is the primary GHG of concern related to mining activities generated as a product of partial fuel combustion much like CO<br>• $CH_4$ is a GHG with a global warming potential of approximately 25 times that of $CO_2$ generated as a by-product of fuel combustion much like NOx<br>• $N_2O$ is a GHG with a global warming potential of approximately 298 times that of $CO_2$ |

**Source**: **Appendix 9-B Air Quality and Greenhouse Gas Emissions Intermediate Component Analysis Report**

## 9.2 Assessment Boundaries

**Table 9.2-1** below identifies the spatial, temporal, and technical boundaries established for the assessment of Project-related changes to air quality (see also **Figure 9.2-1**). There are no administrative boundaries relevant to the analysis of air quality and greenhouse gas emissions.

**Table 9.2-1 Spatial, Temporal, and Technical Boundaries for the Air Quality Analysis**

| Boundary | | Description of Boundary |
|---|---|---|
| Spatial | Local Study Area | Area surrounding the Project footprint + 1-km radius of the NAR centreline |
| | Regional Study Area and Cumulative Effects Study Area | 44 km x 28 km centred around Mine Site + 2-km radius of the NAR centreline |
| Temporal | | The detailed temporal characteristics of the Project's Construction, Operation, Reclamation and Closure, and Post-closure Phases are described in **Section 2.0 Project Description**. The temporal boundaries established for the analysis of Project changes to air quality encompass these Project phases. |
| Technical | | The air dispersion model boundaries were established in consideration of the anticipated distance from the site that material changes would be predicted, the resolution of the wind field that would provide accurate predictions in the near-field, and limitations of the model (maximum number of grid cells). The model domain was 44 km (E-W) x 28 km, centred near the proposed pit areas, extending to include a 1-km-wide corridor along a partial alignment of the NAR. |

**Note:** E - east; km - kilometre; W - west; NAR - Northern Access Route

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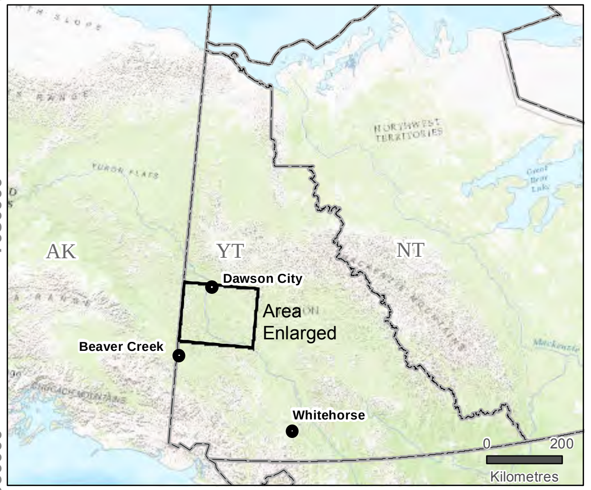
**Local and Regional Study Areas**


Legend

- Northern Access Route
- Mine Site Access Road
- North Klondike Highway
- Mine Footprint
- Local Study Area
- Regional Study Area

Notes

1. This map is not intended to be a "stand-alone" document, but a visual aid of the information contained within the referenced Report. It is intended to be used in conjunction with the scope of services and limitations described therein.
2. Imagery from ESRI; Earthstar Geographics (1999)

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## 9.3 ANALYSIS METHODS

The analysis of Project-related changes and cumulative changes to the ambient airborne particulate matter concentrations and combustion by-products within the spatial and temporal bounds of the Project was carried out based on the modelled and measured ground level concentrations at representative locations on the Mine Site and based on modelled ground level concentrations along the Northern Access Route (NAR).

CALMET preliminary diagnostic meteorological modelling and screening air dispersion model was used with CALPUFF, which identified general areas on the property with the highest predicted air quality effects.

### 9.3.1 REGULATORY FRAMEWORK

Yukon regulates air quality under the *Environment Act* (RSY 2002, c.76) and the Air Emission Regulations (OIC 1998/207). Specific air quality standards for individual indicators are published under Yukon Environment's AAQS and the BC AAQO published by the BC Ministry of the Environment, Environmental Standards Branch (Yukon Environment 2010, BC MOE 2016). Currently, there are no air quality standards or emission limitations for greenhouse gases (GHGs) in Yukon or BC. Yukon is adopting a voluntary emission reporting protocol for large industrial facilities.

Traditional knowledge related to air quality was obtained directly from potentially-affected First Nations (Bates and DeRoy 2014, TH 2012a, TH 2012b, Mishler and Simeone 2004). The analysis of existing air quality conditions in the Project area involved reviews of scientific and other information sources, as well as field studies documented in **Appendix 9-A Baseline Air Quality and Noise at the Coffee Gold Project 2015**.

### 9.3.2 RELEVANT STANDARDS

Data and results from the modelling and monitoring of Project-related activities was compared against the standards in the AAQS and BCAAQO identified in **Table 9.3-1** (Yukon Environment 2010, BC MOE 2016).

**Table 9.3-1 Relevant Particulate Matter Standards**

| Parameter | Standard | Source |
|---|---|---|
| TSP: 24-hour average<br>Annual geometric mean | 120 µg/m$^3$<br>60 µg/m$^3$ | AAQS 2010 |
| $PM_{10}$: 24-hour average | 50 µg/m$^3$ | AAQO 2016 |
| $PM_{2.5}$: 24-hour average | 28 µg/m$^3$ | AAQS 2010 |
| Dust Deposition: 1-month averaged[2] | 1.7 mg/(dm$^2$-day) – lower level<br>2.9 mg/(dm$^2$-day) – upper level | BC AAQO 2016 |

| Parameter | | Standard | Source |
|---|---|---|---|
| $NO_X$: | 1-hour average[3]<br>24-hour average<br>Annual arithmetic mean | 213 ppbv (432 µg/m$^3$)<br>106 ppbv (215 µg/m$^3$)<br>32 ppbv (65 µg/m$^3$) | AAQS 2010 |
| $SO_2$: | 1-hour average[4]<br>24-hour average<br>Annual arithmetic mean | 172 ppbv (485 µg/m$^3$)<br>57 ppbv (161 µg/m$^3$)<br>11 ppbv (31 µg/m$^3$) | AAQS 2010 |
| CO: | 1 hour average<br>8 hour average | 13 ppm (16,000 µg/m$^3$)<br>5 ppm (6,170 µg/m$^3$) | AAQS 2010 |

**Source:** Yukon Environment 2010, BC MOE 2016

**Notes:** [1]Achievement based on annual 98th percentile of daily average, over one year

[2]BC dustfall objectives developed under Pollution Control Objectives were rescinded in 2006 and retained for reference purposes. Their effectiveness for determining impacts on human or environmental health is limited.

[3]Achievement based on annual 98th percentile of daily maximum, over one year.

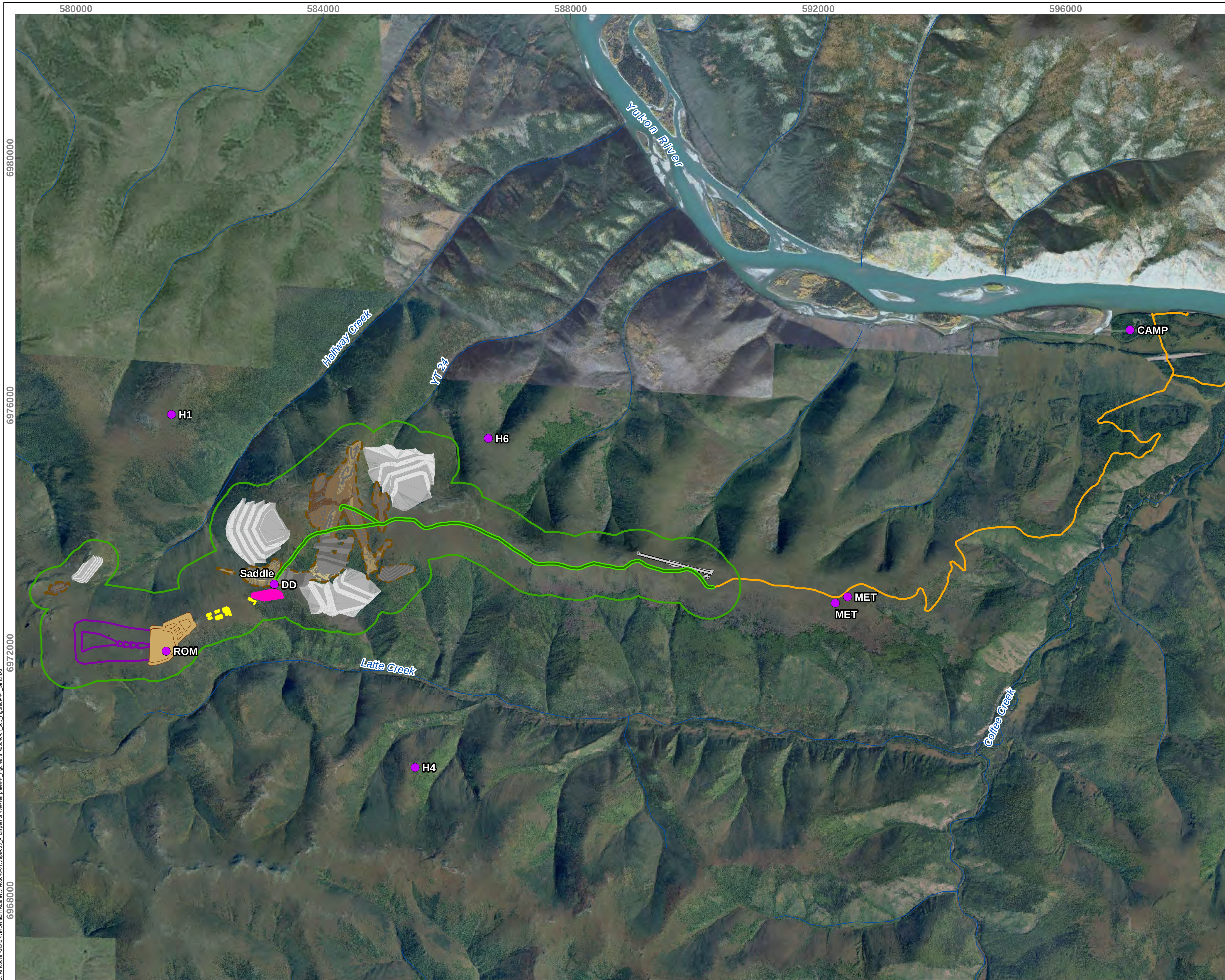
[4]Achievement based on annual 99th percentile of daily maximum, over one year.

## 9.4 Existing Conditions

### 9.4.1 Baseline Air Quality Monitoring

Baseline air quality surveys were conducted according to industry-standard monitoring protocols[1] relevant to Yukon and the mining industry. Monitoring locations were selected according to the siting requirements published in the Canadian Council of Ministers of the Environment (CCME) National Air Pollution Surveillance Program (CCME 2011) and in consideration of several factors including the spatial description of the proposed mine infrastructure (see **Appendix 9-B Air Quality and Greenhouse Gas Emissions Intermediate Component Analysis Report** for the list of factors). Monitoring was not conducted along the NAR. Baseline conditions were extrapolated from existing and regional monitoring sites to the NAR. The selected monitoring sites and those that will be maintained for ongoing monitoring during the life of the Project are shown in **Figure 9.4-1.**

[1] TSP and $PM_{2.5}$ Monitoring: Canadian Council of Ministers of the Environment (CCME) Ambient Air Monitoring Protocol for $PM_{2.5}$ and Ozone – Canada-wide Standards for Particulate Matter and Ozone (CCME 2011).
Dust Fallout Monitoring: (Summer) American Society for Testing and Materials' (ASTM) Standard Test Method for Collection and Measurement of Dustfall (Settleable Particulate Matter) (ASTM 2010) (Early Spring / Winter) BCMOE Snow Survey Sampling Guide (BCMOE 1981).




# COFFEE GOLD MINE

## Air Quality Monitoring Stations


### Legend

- Air Quality Monitoring Station
- Project Footprint - Mine Site
- Northern Access Route
- Mine Site Access Road
- Plant
- Leach Pad
- Event Pond
- Airstrip
- Pit Outline

**Pit Backfill**
- 0 m
- 1 m - 1250 m

**Pit Surface**
- 0 m
- 1 m - 1000 m
- 1000 m - 1100 m
- 1100 m - 1200 m
- 1200 m - 1300 m

- Stockpile

**Waste Rock Storage Facilities**
- 0 m
- 1 m - 1250 m

### Notes

1. This map is not intended to be a "stand-alone" document, but a visual aid of the information contained within the referenced Report. It is intended to be used in conjunction with the scope of services and limitations described therein.
2. Project Footprint provided by Hemerra (March 17, 2017).
Imagery for mine site provided by Kaminak (August 2011).
Imagery for surrounding area provided by Google; DigitalGlobe; Landsat (2010/2013).

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#### *9.4.1.1 Airborne Particulate Matter*

The airborne particulate matter related air quality in the Project area is representative of a pristine environment as it is far from any existing industrial or urban areas and has remained unaffected by development. The pristine natural environment is one that undergoes natural variation such as transient forest fire smoke which is part of the ambient air quality.

Volumetric ambient air quality monitoring of total suspended particulate matter (TSP), $PM_{10}$ (particulate matter of 10 microns or less), $PM_{2.5}$ (particulate matter of 2.5 microns or less) at the Project site during winter recorded very low levels of TSP, $PM_{10}$, and $PM_{2.5}$ concentrations mainly due to snow cover eliminating open sources of particulate matter and organic sources which release pollens are relatively dormant. The summer months showed elevated concentrations due to the influence of migrating forest fire smoke upwind of the Project site. The conditions are not typical of the region during dry summer months which are also conducive to high pollen and mold spore counts which can elevate $PM_{2.5}$ concentrations. **Table 9.4-1** provides a summary of the ambient monitoring results

**Table 9.4-1 Summary of Airborne Particulate Matter – Existing Conditions**

| Parameter | AAQS (µg/m$^3$) | Season | Minimum Ground-Level Concentration (µg/m$^3$) | Maximum Ground-Level Concentration (µg/m$^3$) | Average Ground-Level Concentration (µg/m$^3$) |
|---|---|---|---|---|---|
| TSP | 120 | Winter | 1 | 65 | 2 |
| | | Summer | <1 | 200 | 41 |
| $PM_{2.5}$ | 50 | Winter | 1 | 34 | 2 |
| | | Summer | <1 | 177 | 40 |
| $PM_{10}$ | 25 | Winter | 1 | 61 | 2 |
| | | Summer | <1 | 193 | 40 |

**Notes**: ppb - parts per billion; ppm - parts per million

Dust fallout rates were measured on site using Passive Dust fall monitoring samplers during the summer and through analysis of particulate matter contained in snow cores during the winter. The results are presented in **Table 9.4-2.** The measured quantities are indicative of a relatively pristine environment.

**Table 9.4-2 Dust Deposition – Existing Conditions**

| Constituent | Average Dust Fallout Rate (mg/dm$^2$/day) | |
|---|---|---|
| | Winter | Summer |
| Dust Deposition: 1-month averaged | 0.17 | 0.5 |

**Note:** mg/dm$^2$/day – milligrams per square decimetres per day

Dust samples were also analyzed by ALS Environmental Ltd to determine the constituents of the dust. Organic matter was the primary constituent of the dust deposition, which suggests the Project area under existing conditions is organic in nature (i.e., pollen, mold spores, soot, smoke, etc.).

Existing combustion by product results have been sourced from third parties such as the Casino Mining Corporations Air Quality Baseline 2013, Casino Project Proposal for Executive Committee Review (Casino Mining Corporation 2014), Environment and Climate Change Canada's National Air Pollution Surveillance Program (NAPS) monitoring station in Whitehorse, and the US Environment Protection Agency (EPA) National Oceanic & Atmospheric Administration (NOAA). The results are summarized in **Table 9.4-3**. The measured quantities are indicative of a relatively pristine environment.

**Table 9.4-3 Summary of Combustion By-products – Existing Conditions**

| Combustion By-Product: | Average Concentration |
|---|---|
| NOx | 0.15 ppb[1] |
| $SO_2$ | <0.1 ppb[1] |
| CO | 1 hour = 2.2 ppm; 8 hour = 1.4 ppm[2] |
| $CO_2$ | 400 ppm[3] |

**Source:** [1]Casino Mining Corporation 2014
[2]NAPS
[3]NOAA
**Notes**: ppb - parts per billion; ppm - parts per million

## 9.5 PROJECT INTERACTIONS, POTENTIAL CHANGES, AND MITIGATION MEASURES

### 9.5.1 POTENTIAL PROJECT-RELATED INTERACTIONS

Activities associated with a particular Project Phase and their potential change to air quality and GHG emissions are described in **Table 9.5-1**.

**Table 9.5-1 Potential Interactions**

| Phase | Types of Changes | Causes of Interactions |
|---|---|---|
| Construction Phase | • Generation of airborne particulate matter and combustion by-products may result in adverse air quality. | • Activities involving physical disturbance<br>• Development and use of the Latte and Double Double Open Pits, engineered Stockpiles, Heap Leach Facility, WRSFs, and Waste Management Facilities<br>• Installation of Project facilities, air traffic, support infrastructure, and road use and maintenance<br>• Construction of NAR |

| Phase | Types of Changes | Causes of Interactions |
|---|---|---|
| Operation Phase | • Generation of airborne particulate matter and combustion by-products may result in adverse air quality<br>• Release of measurable quantities of indicator substances | • Activities associated with physical disturbance within the Project footprint<br>• Development, use, closure, and backfill of Open Pits<br>• Development and use of WRSFs<br>• Use of engineered Stockpiles, Project facilities, support infrastructure, Heap Leach Facility, WRSFs, waste management facilities, and disposal areas<br>• All traffic-related activities, barge traffic, hauling of ore, excavation and transport of contaminated soils, trucking of fuel, explosives, hazardous materials and water, and re-supply of freight and consumables<br>• Use and maintenance of NAR |
| Reclamation and Closure Phase | • Generation of airborne particulate matter and combustion by-products<br>• Release of measurable quantities of indicator substances | • Activities involving physical disturbance and closure of pits<br>• Dismantling and decommissioning of Stockpiles, Haul Roads, Project facilities, and support infrastructure<br>• Operation and maintenance of Site Water Management Infrastructure, fuel storage farm, Yukon River exploration camp, air strip, WRSF landfill, and engineered land farm<br>• All traffic-related activities<br>• Use and maintenance of NAR |
| Post-closure Phase | • Negligible | • Negligible |

**Note:** WRSF - Waste Rock Storage Facility

### 9.5.2 POTENTIAL CHANGES

Project-related emissions of air quality indicators have been modelled based on the projected worst-case scenario occurring in Year 6 of the Operation Phase from the 2016 Feasibility Study mine plan. This scenario takes into account the maximum projected activity rates for all Project component interactions with air quality as described in **Section 9.5.2.2**. Emissions during the Construction Phase, as well as those during the Reclamation and Closure Phase, described in **Section 9.5.2.3**, are projected to be much lower in intensity and duration relative to the Year 6 worst-case scenario.

Since the 2016 Feasibility Study was completed for the Project, the Mine Site has been revised as described in the Project Description (**Section 2.0 Project Description**). A number of changes have been incorporated into the current Project Description since the 2016 Feasibility Study. The changes with respect to Project emissions are largely based on increased haul distances to the Alpha WRSF and a larger mine haul truck fleet to ensure production targets can be met. The mine plan change also results in Year 9 of the Operation Phase becoming the projected worst case scenario in terms of air emissions.

The incremental changes to particulate matter emissions are shown in **Table 9.5-2.**

**Table 9.5-2 Comparison of Peak Annual Particulate Matter Emissions – 2016 Feasibility Study vs Revised Mine Design**

| | Peak Year | Extraction (Million Tonnes) | Total Haulage Distance (km) | Peak Annual Emissions (Tonnes) | | |
|---|---|---|---|---|---|---|
| | | | | TSP | $PM_{10}$ | $PM_{2.5}$ |
| 2016 Feasibility Study | Year 6 | 39.1 | 1,040,447 | 2,277 | 811 | 196 |
| Revised Mine Design | Year 9 | 34.0 | 1,824,000 | 2,948 | 977 | 239 |
| **% Change** | **-** | **-13%** | **+75%** | **+30%** | **+20%** | **+22%** |

The revised mine design contains 13% less material extraction in the peak emissions year. As a result, the quantity of rock displaced per blast is lower resulting in lower particulate matter emissions. The total haulage distance has increased by approximately 3 km due to the relocation and expansion of the Alpha WRSF and subsequent expansion of the Haul Road network.

The increase in kilometres travelled by haul trucks results in an increase in TSP, $PM_{10}$ and $PM_{2.5}$ emissions. The most significant changes in airborne particulate matter concentrations would be observed within tens of metres from roads as coarse particles. The overall increase in Haul Road emissions would likely not result in a large difference in the extent of the area where air quality changes are predicted to occur. The increase in peak annual combustion emissions are presented in **Table 9.5-3** below.

**Table 9.5-3 Comparison of Peak Annual Combustion Emissions – 2016 Feasibility Study vs Revised Mine Design**

| | Peak Year | Average Annual Emissions (Tonnes) | | | | | |
|---|---|---|---|---|---|---|---|
| | | CO | $NO_x$ | $SO_2$ | VOC | $PM_{10}$ | $PM_{2.5}$ |
| 2016 Feasibility Study | Year 6 | 1,022 | 1,700 | 12 | 101 | 109 | 101 |
| Revised Mine Design | Year 9 | 1,026 | 1,611 | 15 | 99 | 97 | 90 |
| **% Change** | **-** | **-0.3%** | **+5%** | **-20%** | **+2%** | **+12%** | **+12%** |

The differences in combustion emissions between the 2016 Feasibility Study and revised mine design are not substantial. The predicted concentrations of these CACs are well below the AAQO and slight increases in emissions would not result in substantive changes than what is presented in the modelling results.

The analysis and results expressed above show that there is not likely to be a material difference between the 2016 Feasibility Study and the current Project Description due to the incremental changes that would result from the revised plan. Therefore, the results presented below are representative of the likely worst-case air quality scenarios during Construction and Operation of the Project.

#### *9.5.2.1 Construction*

Project-related interactions with air quality indicators during the Construction Phase include adverse changes to all air quality indicator levels due to the activities described in Section 4.2.1 of **Appendix 9-B**, **Air Quality and Greenhouse Gas Emissions Intermediate Component Analysis Report**). The activities assessed include using mining equipment, as well as earth-moving equipment and vehicles; constructing and maintaining the airstrip; drilling and blasting; using the waste incinerator; and constructing stockpiles.

Releases of particulate matter and diesel combustion from Project-related activities during the Construction Phase will result in an adverse change on the air quality within the Regional Study Area (RSA) by increasing the concentrations of indicator metrics including ground-level TSP, $PM_{10}$, $PM_{2.5}$, dust deposition, nitrogen oxides ($NO_x$), sulphur dioxide ($SO_2$), and carbon monoxide (CO). These changes are likely to be comparable to or less than those presented for the worst-case Year 6 modelling results. Projected changes in the concentrations of combustion by-product from Project-related activities (**Table 9.5-4**) are likely to dissipate within less than 24 hours after the cessation of those activities.

**Table 9.5-4 Summary of Combustion By-products (Greenhouse Gas Emissions) during Construction Phase**

| Year | Annual GHG Total (Tonnes $CO_2e$) |
|---|---|
| Year -3 | 9,069 |
| Year -1 | 26,277 |
| **Total** | **48,949** |

#### *9.5.2.2 Operation*

Project-related interactions with air quality indicators during the Operation Phase may result in adverse changes to all air quality indicator levels from using vehicles, moving earth, building and using stockpiles, drilling, blasting, and crushing. The activities assessed include those described above in **Section 9.5.2.1** as well as crushing and screening ore (i.e., creating dust and airborne particles from pulverized rock, soil, and silt).

Releases of particulate matter and diesel combustion from Project-related activities during the Operation Phase will have an adverse change on air quality within the RSA by increasing the concentrations of indicator metrics, including ground level TSP, $PM_{10}$, $PM_{2.5}$, dust deposition, NOx, $SO_2$, and CO. Projected changes in the concentrations of combustion by-product from Project-related activities (**Table 9.5-5**) are likely to dissipate within less than 24 hours after the cessation of those activities.

**Table 9.5-5 Summary of Greenhouse Gas Emissions during Operation Phase**

| Year | Annual GHG Total (Tonnes $CO_2e$) |
|---|---|
| Year 1 | 81,896 |
| Year 2 | 92,368 |
| Year 3 | 94,041 |
| Year 4 | 102,187 |
| Year 5 | 103,174 |
| Year 6 | 98,671 |
| Year 7 | 94,707 |
| Year 8 | 100,564 |
| Year 9 | 105,973 |
| Year 10 | 86,414 |
| Year 11 | 50,907 |
| Year 12 | 5,196 |
| **Total** | **1,016,098** |

#### *9.5.2.3 Reclamation and Closure, and Post Closure*

Project-related interactions with air quality indicators during the Reclamation and Closure Phase may result in adverse changes to all air quality indicator levels from mining equipment, earth-moving equipment and vehicles, drilling and blasting activities, crushing and screening activities, and stockpiling.

Releases of particulate matter and diesel combustion from Project-related activities during the Reclamation and Closure Phase will have an adverse change on the air quality within the RSA by increasing the concentrations of indicator metrics including ground level TSP, $PM_{10}$, $PM_{2.5}$, dust deposition, NOx, $SO_2$, and CO. Projected changes in particulate matter and combustion by-product indicators from Project-related activities are likely to dissipate within less than 24 hours after the cessation of activities.

Changes to air quality in the RSA during the Post-closure Phase are not likely, and no interactions between Project activities and air quality will occur in the Post-closure Phase.

### 9.5.3 MITIGATION, MANAGEMENT, AND MONITORING

Mitigation measures to eliminate, reduce, or control adverse changes to air quality are summarized below and described in detail in **Appendix 9-B Air Quality and Greenhouse Gas Emissions Intermediate Component Analysis Report**. Mine designs (e.g., covered facilities, high-efficiency vehicles), are not identified as specific mitigations, as they are already part of the Project description to reduce changes in air quality, including GHGs. Mitigation measures include:

- Project Design Measures – Mitigation measures are included in the Project Description that reduce changes to air quality, and include minimizing haul distances and maximizing fuel efficiency using high-efficiency vehicles. Facilities will be covered where possible.

- Minimizing Vehicle Traffic
- Dust Management Plan
- Progressive Reclamation
- Backfilling Pits
- Using Fugitive Waste Heat

Kaminak Gold Corporation, a wholly owned subsidiary of Goldcorp Inc. (Goldcorp or Proponent) will conduct ongoing ambient air quality monitoring of the Project area to monitor air quality indicators, assess the effectiveness of control measures, and ensure Project compliance with applicable air quality standards. Further details on monitoring and adaptive management can be found in **Appendix 9-B Air Quality and Greenhouse Gas Emissions Intermediate Component Analysis Report.**

### 9.6 Residual Changes

Implementation of the mitigation measures summarized above is likely to reduce adverse changes in air quality in the RSA. Residual changes to airborne particulate matter indicators from the various Project-related interactions described above are likely to persist throughout the Project's Construction, Operation, and Reclamation and Closure phases. Due to the short-lived nature of these indicators in the atmosphere, residual changes are likely to dissipate within 24 hours upon cessation of activity.

There were no modelled exceedances of regulated standards or guidelines outside of the RSA. In general, the dispersion modelling and predictions as modelled using the 2016 Feasibility Study, indicate that the Project will comply with relevant air quality objectives and guidelines within 500 m of the Mine footprint. A summary of the results is presented in **Table 9.6-1.**

**Table 9.6-1 Summary of Predictions of Air Quality Changes**

| Contaminant | Averaging Period | Air Quality Objective / Guideline | Predicted Air Quality | |
|---|---|---|---|---|
| | | | Mine Site | Northern Access Route |
| TSP | 24 hour | 120 µg/m$^3$ | Exceedance predicted throughout Mine Site and 500 m beyond Mine Site footprint. | No exceedances predicted |
| | Annual | 60 µg/m$^3$ | Exceedance predicted throughout Mine Site. | No exceedances predicted |
| $PM_{10}$ | 24 hour | 50 µg/m$^3$ | Exceedance predicted throughout Mine Site and 500 m beyond Mine Site footprint. | No exceedances predicted |
| $PM_{2.5}$ | 24 hour | 25 µg/m$^3$ | Exceedance predicted throughout Mine Site. | No exceedances predicted |
| | Annual | 8 µg/m$^3$ | Exceedance predicted throughout Mine Site. | No exceedances predicted |

| Contaminant | Averaging Period | Air Quality Objective / Guideline | Predicted Air Quality | |
|---|---|---|---|---|
| | | | Mine Site | Northern Access Route |
| Dust fall | 1 month | 1.7 mg/dm²·d (lower)<br>2.9 mg/dm²·d (upper) | Exceedance predicted in vicinity of dust-producing sources throughout Mine Site. | No exceedances predicted |
| $SO_2$ | 1 hour | 1 485 µg/m³ | No exceedances predicted. | No exceedances predicted |
| | 24 hour | 1 161 µg/m³ | Exceedance predicted within pit area. | No exceedances predicted |
| | Annual | 1 31 µg/m³ | No exceedances predicted. | No exceedances predicted |
| $NO_2$ | 1 hour | 1 432 µg/m³ | Exceedance predicted throughout Mine Site, particularly active pit areas. | No exceedances predicted |
| | 24 hour | 1 215 µg/m³ | Exceedance predicted throughout Mine Site, particularly active pit areas. | No exceedances predicted |
| | Annual | 1 64 µg/m³ | Exceedance predicted within active pit areas. | No exceedances predicted |
| CO | 1 hour | 1 16,000 µg/m³ | Exceedance predicted within active pit areas. | No exceedances predicted |
| | 8 hour | 1 6,170 µg/m³ | Exceedance predicted within active pit areas. | No exceedances predicted |

**Source**: **Appendix 9-B Air Quality and Greenhouse Gas Emissions Intermediate Component Analysis Report**
N**otes**: [1] Converted from ppm/ppv at 0˚C
µg/m³ – microns per cubic metre; dm² - square decimeters

Residual changes to combustion by-product indicators from the various Project-related interactions described above are likely to persist throughout the Project Construction, Operation, and Reclamation and Closure phases. Due to the short-lived nature of these indicators in the atmosphere, residual changes are likely to dissipate within 24 hours upon cessation of the activity in question.

GHG emissions are also the residue of combustion by-products. The total GHG contribution through the life of the Project is likely to be approximately 1,065,0476 tonnes $CO_2e$.

Changes to air quality as a result of vehicular traffic on the NAR have been modelled to be limited to within 1 km of the roadway beyond which the changes to air quality indicators are likely to return to background concentrations.

## 9.7 CUMULATIVE CHANGE ASSESSMENT

Other relevant projects and activities that have or may result in residual adverse changes that could interact with adverse Project-related changes to air quality within the spatial and temporal scope of the Cumulative Effects Study Area (CESA) are include placer mining operations, quart mines, and forestry activities.

The spatial boundaries of the cumulative change analysis for air quality are defined as the area where changes from Project activities are likely to become negligible (i.e., comparable to average baseline concentrations described in **Section 9.4** above). Based on the modelling results described in **Section 9.6**, this area is contained within the RSA (for all indicators except for GHGs). The spatial boundaries of the cumulative change analysis for GHGs is global.

Dispersion modelling results indicate that Project-related changes to air quality will dissipate to background concentration levels within the RSA for all air quality indicators with the exception of GHGs, which will contribute to global increases in GHG concentrations.

Cumulative interactions are likely to result in cumulative changes to airborne particulate matter indicators of air quality. Increased TSP, $PM_{10}$, and $PM_{2.5}$ ambient ground level concentrations and dustfall rates are likely to occur within the CESA. These cumulative changes are not likely to result in exceedances of any regulatory air quality standards or guidelines; however, as Project-related changes are likely to return to levels comparable to baseline concentrations within the RSA.

The GHG emissions generated by the Project are estimated to be 81 kilotonnes (KT) of carbon dioxide equivalent per year ($CO_2$e/yr). The total cumulative changes by the Coffee, Minto, and Casino projects are estimated to be 660 KT of $CO_2$e/yr. The Project accounts for 12% of the total cumulative changes due to interactions with the other two projects.

Project-related GHG emissions in relation to the cumulative GHG inventories of Yukon and Canada, are presented in **Table 9.7-1**, and show that the Project will be an inconsequential addition to Canada's GHG emissions while in Yukon it will comprise a minor portion of the Territory's overall GHG emissions.

**Table 9.7-1 National and Yukon Greenhouse Gas Emissions**

| Reporting Year | Canada GHG Emissions (KT $CO_2e$/yr) | Project (% of Canada Total) | Yukon GHG Emissions (KT $CO_2e$/yr) | Project (% of Yukon Total) |
|---|---|---|---|---|
| 1990 | 613,000 | 0.01% | 540 | 15.17% |
| 2000 | 744,000 | 0.01% | 505 | 16.22% |
| 2005 | 747,000 | 0.01% | 459 | 17.85% |
| 2010 | 706,000 | 0.01% | 344 | 23.82% |
| 2011 | 710,000 | 0.01% | 384 | 21.34% |
| 2012 | 718,000 | 0.01% | 393 | 20.85% |
| 2013 | 731,000 | 0.01% | 351 | 23.34% |
| 2014 | 732,000 | 0.01% | 268 | 30.57% |

**Source**: Environment and Climate Change Canada 2016.

**Note**: % calculation is based on Coffee Project Direct Emissions of 81.927 KT $CO_2e$/yr. It is the annual average direct GHG emissions in the Construction, Operation and Reclamation and Closure Phases.

Since the cumulative changes to Air Quality indicators within the CESA are not likely to result in exceedances of any applicable regulatory standards (i.e., AAQS), no additional mitigation measure(s) will likely be necessary to eliminate, reduce, or control the Project's contribution to cumulative changes.

## 9.8 REFERENCES

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# 10.0 NOISE ANALYSIS

This section presents a high-level summary of the change analysis for the Noise Intermediate Component (IC) of the proposed Coffee Gold Mine (Project). The full change analysis is presented in **Appendix 10-A Noise Intermediate Component Analysis**.

## 10.1 INTRODUCTION

Sound exposure is commonly measured and calculated as A-weighted decibel[2] (dBA). Unweighted sound levels are referred to as linear, which are presented as dBL. For context, **Table 10.1-1** provides common acoustic terms and definitions while **Table 10.1-2** provides an overview of common noise sources and their relative loudness.

**Table 10.1-1 Acoustic Terms and Definitions**

| Term | Definition |
|---|---|
| **Noise** | Typically defined as unwanted sound. This word adds the subjective response of humans to the physical phenomenon of sound. It is commonly used when adverse sound-related changes to people are known to occur. |
| **Sound Pressure Level** ($L_P$) | Sound pressure is measured in decibels referenced to 20 microPascals, the approximate threshold of human perception to sound at 1,000 Herz (Hz). |
| **Sound Power Level ($L_W$)** | The total acoustic power of a noise source measured in decibels referenced to picowatts (one trillionth of a watt). Noise specifications are provided by equipment manufacturers as sound power, since it is independent of the environment in which it is located. A sound level meter does not directly measure sound power. |
| **A-Weighted Decibel** (**dBA**) | Environmental sound is typically composed of acoustic energy across all frequencies. To compensate for the auditory frequency response of the human ear, an A-weighted filter is commonly used for describing environmental sound levels. Sound levels that are A-weighted are presented as dBA. |
| **Unweighted Decibels** (**dBL**) | Unweighted sound levels are referred to as linear. Linear decibels are used to determine a sound's tonality, and engineer solutions to reduce or control noise, since techniques are different for low- and high-frequency noise. Sound levels that are linear are presented as dBL. |
| **Propagation and Attenuation** | Propagation is the decrease in amplitude of an acoustic signal due to geometric spreading losses with increased distance from the source. Additional sound attenuation factors include air absorption, terrain effects, sound interaction with the ground, diffraction of sound around objects and topographical features, foliage, and meteorological conditions including wind velocity, temperature, humidity, and atmospheric conditions. |
| **$L_{eq}$** | Conventionally expressed in dBA, the $L_{eq}$ is the energy-averaged, A-weighted sound level for the complete time period. It is defined as the steady, continuous sound level over a specified time. |
| **$L_{peak}$** | The maximum value reached by the sound pressure. |
| **Frequency** (**Hz**) | The frequency of a sound is the property perceived as pitch: a low-frequency sound (such as a bass note) oscillates at a relatively slow rate, and a high-frequency sound (such as a treble note) oscillates at a relatively high rate. For comparative purposes, the lowest note on a full range piano is approximately 32 Hz and middle C is 261 Hz. |

**Source**: Noise Intermediate Component Analysis Report (**Appendix 10-A**)

2 A decibel (dB) is the unit used to measure and model noise, defined as the ratio between a measured value and a reference value usually corresponding to the lower threshold of human hearing.

**Table 10.1-2 Sound Pressure Levels and Relative Loudness of Common Noise Sources and Soundscapes**

| Noise Source or Activity | Sound Level (dBA) | Subjective Impression | Relative Loudness (Perception of Different Sound Levels) |
|---|---|---|---|
| Jet aircraft takeoff from carrier (15 metres (m); 50 feet (ft.)) | 140 | Threshold of pain | 64 times as loud |
| 50 horse power siren (30 m; 100 ft.) | 130 | | 32 times as loud |
| Loud rock concert near stage<br>Jet takeoff (61 m; 200 ft.) | 120 | Uncomfortably loud | 16 times as loud |
| Float plane takeoff (30 m; 100 ft.) | 110 | | 8 times as loud |
| Jet takeoff (610 m; 2,000 ft.) | 100 | Very loud | 4 times as loud |
| Heavy truck or motorcycle (8 m; 25 ft.) | 90 | | 2 times as loud |
| Garbage disposal<br>Food blender (0.5 m; 2 ft.)<br>Pneumatic drill (15 m; 50 ft.) | 80 | Loud | Reference loudness |
| Vacuum cleaner (3 m; 10 ft.) | 70 | Moderate | 1/2 as loud |
| Passenger car at 65 mph (8 m; 25 ft.) | 65 | | |
| Large store air-conditioning unit (6 m; 20 ft.) | 60 | | 1/4 as loud |
| Light auto traffic (30 m; 100 ft.) | 50 | Quiet | 1/8 as loud |
| Quiet rural residential area with no activity | 45 | | |
| Bedroom or quiet living room<br>Bird calls | 40 | Faint | 1/16 as loud |
| Typical wilderness area | 35 | | |
| Quiet library, soft whisper (4.5 m; 15 ft.) | 30 | Very quiet | 1/32 as loud |
| Wilderness with no wind or animal activity | 25 | Extremely quiet | |
| High-quality recording studio | 20 | | 1/64 as loud |
| Acoustic test chamber | 10 | Just audible | |
| | 0 | Threshold of hearing | |

**Source**: Noise Intermediate Component Analysis Report (**Appendix 10-A**)

## 10.2 CHANGE ANALYSIS

Intermediate component indicators for noise are based on their decibel level. A change to Project-related noise occurs when there is a change in the noise level, expressed in dBA or dBL (**Table 10.2-1**).

**Table 10.2-1 Indicators for Noise**

| Indicator | Rationale for Selection |
|---|---|
| Noise Levels (dBA, dBL) | The dB is the universal unit and indicator to describe measured and/or modelled sound levels. The A-weighted sound level (dBA) is primarily used in the report to describe baseline sound survey result and potential noise changes at receptors. Linear decibels (dBL) are used to express sound levels generated by blasting. |

### 10.2.1 ANALYSIS BOUNDARIES

**Table 10.2-2** identifies the spatial, temporal, and technical boundaries established for the analysis of Project-related changes to noise (see also **Figure 10.2-1**). There are no administrative boundaries relevant to the analysis of noise.

**Table 10.2-2 Spatial, Temporal, and Technical Boundaries for the Noise Analysis**

| Boundary | | Description of Boundary |
|---|---|---|
| Spatial | Local Study Area | The LSA includes an area that extends 3 km from the Mine Site and 1 km from either side of the NAR; however, additional discrete receptors that have been identified by First Nations and other consultations have also been included in the LSA. |
| | Regional Study Area | The RSA includes the LSA and covers an area extending 10 km from the Mine Site and 3 km from either side of the NAR. |
| | Cumulative Changes Study Area | The study area for the cumulative change analysis is consistent with the extents of the RSA. |
| Temporal | | The temporal boundaries of the Project consist of Construction, Operation, Reclamation and Closure, and Post-closure Phases, which are described in **Section 2.0 Project Description**. |
| Technical | | Technical boundaries for the Noise analysis involve uncertainty that is inherent in modelling exercises. Uncertainty in relation to the noise modelling program is mainly associated with the assumptions and inputs to the model. Assumptions were derived using the best available knowledge but may differ from actual conditions. Nevertheless, previous experience with the model and ISO-9613-2 methodology indicates that there is a high degree of correlation between the potential results and actual field measurements. |

**Notes:** km - kilometre; LSA - Local Study Area; NAR - Northern Access Route; RSA - Regional Study Area

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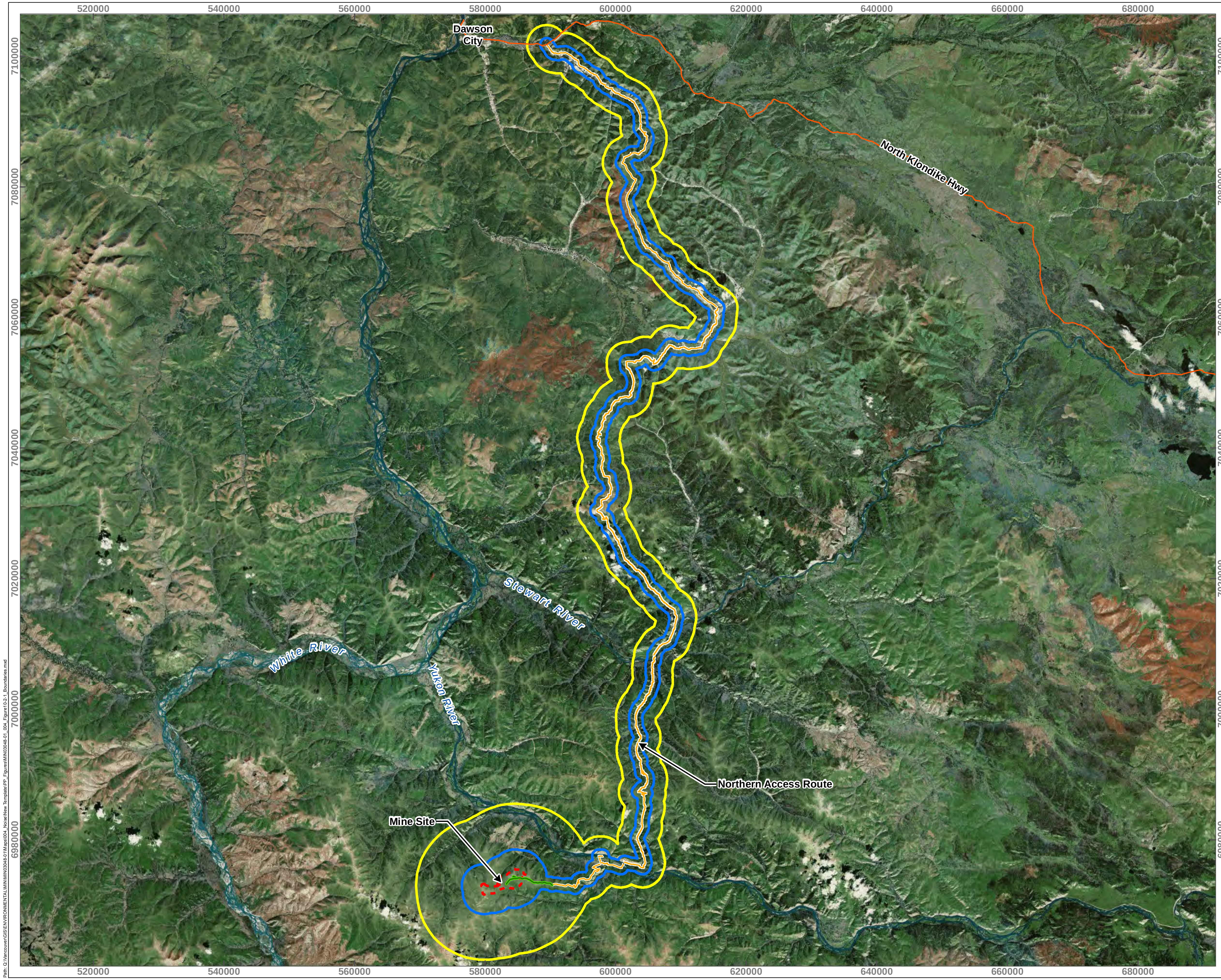
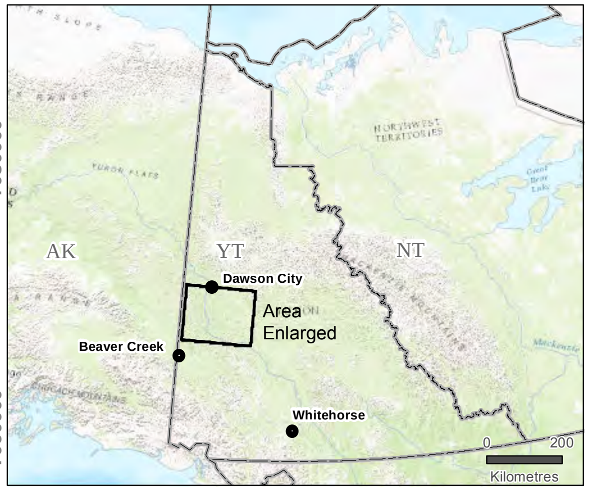
**Project Study Area**




Legend

- Mine Site – Project Footprint
- Local Study Area
- Regional Study Area
- Mine Site Access Road
- Northern Access Route
- Klondike Highway

Notes

1. This map is not intended to be a "stand-alone" document, but a visual aid of the information contained within the referenced Report. It is intended to be used in conjunction with the scope of services and limitations described therein.
2. Imagery from ESRI; Earthstar Geographics (1999).
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## 10.3 ANALYSIS METHODS

Both a measured and modelled noise analysis was used to determine existing conditions and potential future conditions, respectively. Acoustic modelling was conducted using CadnaA to predict potential noise changes related to Construction and Operation. Blast Noise Version 2 (BNOISE2)[3] noise impact software was used in conjunction with CadnaA to calculate noise generated from blasting operations. Noise emissions from the use of the airstrip were modelled using the BaseOps[4] noise modelling software.

### 10.3.1 REGULATORY FRAMEWORK

At the federal level, Environment and Climate Change Canada provides noise guidance within its *Environmental Code of Practice for Metal Mines* (Code) (ECCC 2009). The Code prescribes a daytime limit of 55 dBA of the energy-averaged A-weighted sound level ($L_{eq}$) and a nighttime limit of 45 dBA $L_{eq}$ for residential areas adjacent to mine sites.

Yukon does not have any noise-related requirements so guidance provided by British Columbia (BC)[5] was selected to assess Project compliance.

Noise control guidelines for oil and gas activities in BC are specified in the BC Oil and Gas Commission (OGC) *Noise Control Best Practices Guideline* (BC OGC 2009). The guideline is a receptor-oriented regulation that specifies permissible sound levels at designated receptor points (including residences). In ccordance with the BC noise guideline, all new facilities, when operational, must meet a daytime (7:00 a.m. to 10:00 p.m.) and nighttime (10:00 p.m. to 7:00 a.m.) permissible sound level (PSL) at all receptors within 1.5 kilometres (km) of the Project Mine Site boundary. Given there are no receptors within 1.5 km of the Project boundary, the guideline states that a daytime PSL of 50 dBA $L_{eq}$ and nighttime PSL of 40 dBA $L_{eq}$ needs to be achieved 1.5 km from the Mine Site boundary. The BC OGC noise guideline does not provide a noise limit on construction and decommissioning activities.

## 10.4 EXISTING CONDITIONS

Baseline sound surveys were conducted within the confines of the Coffee Property in late March 2015 and late June 2015 to capture wintertime and summertime conditions. Baseline sound monitoring locations are shown in **Figure 10.4-1**. Monitoring was not conducted along the Northern Access Route (NAR); however, baseline noise conditions recorded at the Mine Site should be consistent with those along the NAR.

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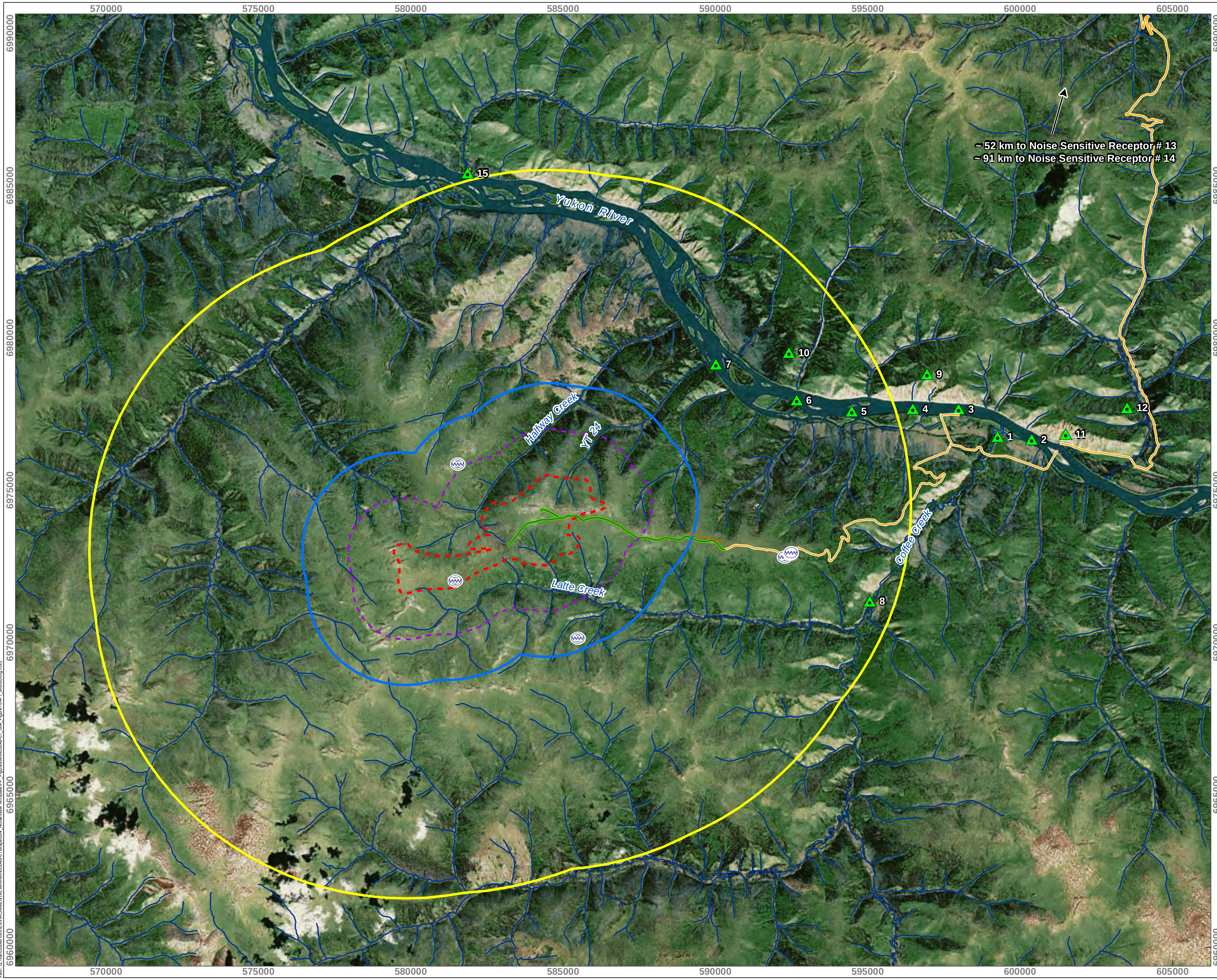
3 Blast Noise Version 2 (BNOISE2™) enables assessment of high-energy impulsive noise effects via calculation and display of noise contours for large arms, including explosive charges.

4 BaseOps software is an approved suite of tools to assess noise effects in accordance with the United States Air Force Environmental Impact Analysis Process (32 CFR 989 in USC 1999).

5 BC guidance is based on Alberta Utilities Commission Rule 012, Noise Control, which has been used to support previous permitting applications in Yukon.




COFFEE GOLD MINE

**Baseline Sound Monitoring Locations**


## Legend

- Baseline Sound Monitoring Location
- Noise Sensitive Receptor
- Northern Access Route
- Mine Site Access Road
- Proposed Airstrip
- Watercourse
- Mine Site – Project Footprint
- OGC 40 dBA Nighttime PSL Point of Compliance
- Local Study Area
- Regional Study Area

## Notes

1. This map is not intended to be a "stand-alone" document, but a visual aid of the information contained within the referenced Report. It is intended to be used in conjunction with the scope of services and limitations described therein.
2. Imagery from ESRI; Earthstar Geographics (1999).

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| Figure 10.4-1 | Date: Mar 23, 2017 | Drawn by: SL | Reviewed: KG |
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During winter, the daytime $L_{eq}$ ranged from approximately 25 dBA to 31 dBA, while nighttime levels ranged from approximately 22 dBA to 26 dBA. During summer, daytime $L_{eq}$ sound levels ranged from approximately 33 dBA to 37 dBA, while nighttime sound levels ranged from approximately 27 dBA to 57 dBA. Elevated ambient nighttime sound levels were recorded at monitoring location H4 due to thunderstorms occurring during the measurement period.

Background levels recorded at Coffee Property are typical for a remote mountainous site. As described in BC OGC noise guideline, average daytime noise levels are typically 5 dBA to 10 dBA higher than at night. Noise levels recorded during the summer were slightly elevated due to the prevalence of thunderstorms throughout the survey, which is typical for the region.

Existing ambient sound levels along the NAR will likely be relatively consistent with data collected near the Mine Site since population density, land use, and terrain conditions are similar.

## 10.5 Project Interactions, Potential Changes, and Mitigation Measures

### 10.5.1 Potential Project-related Interactions

Activities associated with the Project Phases and their potential change to noise are described in **Table 10.5-1**.

**Table 10.5-1 Potential Interactions**

| Phase | Types of Changes | Causes of Interactions |
|---|---|---|
| Construction Phase | Changes to noise | • Activities involving physical disturbance<br>• Mobilization, hauling and material handling<br>• Construction of Project components and infrastructure<br>• Blasting<br>• Vehicle and air traffic |
| Operation Phase | Changes to noise | • Activities involving physical disturbance<br>• Hauling and material handling<br>• Material handling<br>• Operation of Crusher System<br>• Operation and maintenance of Project components and infrastructure<br>• Blasting<br>• Vehicle and air traffic |
| Reclamation and Closure Phase | Changes to noise | • Activities involving physical disturbance<br>• Activities involving vehicle traffic,<br>• Equipment use,<br>• Dismantling of Project components<br>• Vehicle and air traffic |
| Post-closure Phase | Negligible | • Negligible |

### 10.5.2 Potential Changes

Since the 2016 Feasibility Study was completed for the Project, the Mine Site has been revised as described in the Project Description (**Section 2.0 Project Description**). A number of changes have been incorporated into the current Project Description since the 2016 Feasibility Study.

During Construction, the development of the footprints associated with the four Open Pits (Latte, Double Double, Supremo, and Kona) has been revised. The locations where both noise-generating equipment and activities occur, and were modelled, have been revised. Construction activities largely consist of development of the Open Pits, WRSFs, Stockpiles, and construction of facilities including but not limited to the Crusher System, Heap Leach Facility, Plant Site, Camp Site, Bulk Explosive Storage Area, and other ancillary components. The construction equipment types and quantities remain the same as those analyzed to support the 2016 Feasibility Study. In addition, the noise-sensitive receptor locations remain unchanged.

During Operation, the worst-case scenario has moved from Year 6 to Year 9. The development of the footprints associated with the four Open Pits (Latte, Double Double, Supremo, and Kona) has been revised. This means that locations where both noise-generating equipment and activities will occur, and were modelled, have been revised. In addition, there will now be the progressive development of the Alpha WRSF over the Operation Phase. The Alpha WRSF, designed with an ultimate capacity of approximately 246 Mt and a 150-hectare (ha) footprint, will be located north of the Latte Pit and west of the Supremo Pit. Additional activity associated with this WRSF was not considered in the previous analysis. Lastly, the equipment fleet during the Operation Phase would change, specifically the number of haul trucks would increase from the number assumed in the previous analysis. However, the operation equipment types, which were used as model inputs, remain the same as those analyzed to support the 2016 Feasibility Study. In addition, the noise sensitive receptor locations identified for the 2016 remain unchanged.

Changes to the Mine Site plan may affect potential noise changes at noise-sensitive receptors due to adjustments in distance between sources and receiver and factors such as terrain or structures that would shield or attenuate Project sound differently than what was modelled previously. Also, noise levels would be likely to increase due to increased activity related to the Alpha WRSF and haul trucks. Conversely, the separation distance (10 km or more) between the site and noise-sensitive receptors is such that potential changes to noise associated with Project construction and operation are not likely to significantly change from the previous analysis. Received sound levels at the identified noise-sensitive receptors is still likely to remain well below the BC OGC guideline limits.

The analysis and results expressed below, although related to the 2016 Feasibility Study, are not likely to be materially different for the current Project Description. As such, these results represent the likely worst-case noise scenarios during the Construction and Operation Phases of the Project.

#### *10.5.2.1 Construction*

The noise predictions for the construction Year –1 scenario calculated noise levels at 1.5 km from the Mine Site show that the maximum noise levels will range from 23 dBA to 45 dBA. In addition, the highest predicted sound level at an identified noise sensitive receptor is 22 dBA 10 km downriver from the Coffee Creek mouth. These predictions show that during the daytime period, the Project construction noise will be below the BC OGC daytime PSL of 50 dBA (BC OGC 2009). During nighttime hours, there is the potential for an exceedance of the BC OGC nighttime threshold; however, no identified human receptors are located in the vicinity of this area northeast of the Mine Site, so it is not likely that noise mitigation would be required.

#### *10.5.2.2 Operation*

Noise modelling completed for the operational Year 6 scenario (2016 Feasibility Study) calculated noise levels at 1.5 km from the Mine Site show that the maximum noise levels will range from 31 dBA to 42 dBA. In addition, highest predicted sound level at an identified noise sensitive receptor is 28 dBA 10 km downriver from the Coffee Creek mouth. These modelled noise levels show that during the daytime period, the Project operational noise will be below the BC OGC daytime threshold. During nighttime hours, there is the potential for an exceedance of the BC OGC nighttime threshold; however, no human receptors are located in the vicinity of this area northeast of the Mine Site so noise mitigation will not likely be required.

#### *10.5.2.3 Northern Access Route Noise Levels*

The received sound levels produced by traffic on the NAR reach the BC OGC daytime guideline of 50 dBA at an approximate distance of 68 m from either side of the road centerline. The noise contours for operation of the NAR are presented in Figure 4-3 through Figure 4-7 of **Appendix 10-A Noise Intermediate Component Analysis**.

#### *10.5.2.4 Blasting Operations*

At a distance of 1.5 km, the maximum noise level from the blasting operations may range from 60 dB $L_{peak}$ to 74 dB $L_{peak}$[6]. Noise contours for dB $L_{peak}$ are provided for both Year –1 and Year 6 in Figure 4-8 and Figure 4-9 of **Appendix 10-A Noise Intermediate Component Analysis**.

#### *10.5.2.5 Airstrip Operations*

The airstrip was modelled to incorporate proposed flight paths, Year 6 aircraft operations, and yearly anticipated helicopter operations. The noise levels from the airport are not likely to result in an adverse changes to noise-sensitive areas.

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6 $L_{peak}$: instantaneous blasting noise is described as unweighted peak levels ($L_{peak}$), which is the maximum exposure due to blasting. Peak noise levels ranging from 120 dB to 128 dB have been identified as physiologically harmful to humans (Ontario Ministry of Environment 1985).

#### *10.5.2.6 Reclamation, Closure, and Post Closure Phases*

The Reclamation and Closure Phase will incorporate equipment similar to the construction Year –1 scenario; therefore, noise levels generated from the Reclamation and Closure Phase will likely be less than the noise generated by construction Year –1 scenario.

### 10.5.3 PROPOSED MITIGATION, MANAGEMENT, AND MONITORING

A Noise Management Plan will be developed for Project licensing, which will detail the relevant assessment criteria for changes to noise, compliance procedures, and controls relating to mining activities. This Plan will demonstrate how appropriate management techniques will reduce the potential for noise-related adverse changes to employee and public health or the environment, as well as describe the measures that will be undertaken to control noise generated by the Project.

The Noise Management Plan will include noise mitigation strategies for mobile and stationary sound sources as well as blasting.

### 10.5.4 RESIDUAL CHANGES

The modelling exercise described in **Section 10.5.2** demonstrated that Project as designed and described in **Section 2.0 Project Description** is anticipated to comply with the applicable BC OGC noise guideline, and no additional mitigation measures were determined to be necessary. Thus, the residual changes to noise are as described in **Section 10.5.2.**

### 10.5.5 CUMULATIVE CHANGE ANALYSIS

Past, present, and future projects that may interact with Project noise changes are located in the RSA and include three quartz exploration projects, the Dan Man, Boulevard, and Coffee, Cream, and Kirkman properties. The Dan Man property is located approximately 5 km north of the Project site; the Boulevard property is located 9.8 km southwest of the Project site, and the Coffee, Cream, and Kirkman properties are located 7.3 km southeast of the Project site. There are no other projects located within the 10-km radius. The noise generated at those properties is likely to be similar to or lower than noise levels generated by the Project. Due to the separation distance between the Project and those three developments, cumulative changes on the Noise IC are not likely to be experienced at the nearest sensitive receptors.

In addition to the above-mentioned projects, cumulative changes on noise may also occur due to Project traffic in conjunction with other traffic along the NAR. Since a detailed traffic study has not been conducted to evaluate the potential incremental increases in sound, a quantitative analysis is not possible; however, since there are no nearby residential land uses near the NAR, cumulative changes are not likely.

## 10.6 REFERENCES

British Columbia Oil and Gas Commission (BC OGC). 2009. British Columbia Noise Control Best Practices Guideline. Available at https://www.bcogc.ca/node/8152/download. Accessed May 2016.

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Ontario Ministry of the Environment. 1985. Guidelines on Information Required for Assessment of Blasting Noise and Vibration. Available at https://www.ontario.ca/page/environmental-noise-guideline-stationary-and-transportation-sources-approval-and-planning. Accessed February 2017.

United States Congress (USC). 1999. 32 CFR 989, Code of Federal Regulations, Title 32: National Defense, Environmental Impact Analysis Process (EIAP), U.S. Department of Defense, U.S. Air Force. Available at https://www.gpo.gov/fdsys/granule/CFR-2011-title32-vol6/CFR-2011-title32-vol6-part989. Accessed February 2017.

# 11.0 SURFICIAL GEOLOGY, TERRAIN, AND SOILS ASSESSMENT

This section presents a high-level summary of the effects assessment for the Surficial Geology, Terrain, and Soils Valued Component (VC). The full effects assessment is presented in **Appendix 11-B Surficial Geology, Terrain, and Soils Valued Component Assessment**.

## 11.1 ASSESSMENT SCOPE

Following a review of past submissions to Yukon Environmental and Socio-economic Assessment Board (e.g., Casino Project 2014, Eagle Gold Project 2011) and other regulatory agencies (e.g., British Columbia Environmental Assessment Office, Mackenzie Valley Environmental Impact Review Board), it is clear that Surficial Geology, Terrain, and Soils are sufficiently important to government agencies, potentially affected First Nations, affected local communities, the public, and other interested parties to warrant full consideration in the effects assessment for the proposed Coffee Gold Mine (Project). There is also a direct pathway of effects between Surficial Geology, Terrain, and Soils and other biophysical components of the environment. To simplify and focus the assessment, three subcomponents are identified for the surficial geology, terrain, and soils VC: terrain stability, unique landforms, and soil quality. A rationale for the selection of these subcomponents is provided in **Table 11.1-1**.

**Table 11.1-1 Subcomponents for Surficial Geology, Terrain, and Soils**

| Subcomponent | Rationale for Selection |
|---|---|
| Terrain Stability | Terrain stability is fundamental to the planning and placement of mine and access infrastructure. Identifying areas of potential instability can improve engineering design and decision-making, and helps to avoid exacerbating potential high risk (e.g., mass movement) events. |
| Unique Landforms | Several unique landforms (specifically tors and pingos) have been identified within the area, and may have served as navigational aids to First Nations and provide particular habitat qualities for plants and wildlife. |
| Soil Quality | Soil quality is central to the maintenance of ecosystem integrity (for soils left in situ) and reclamation planning (for soils that will be salvaged and stockpiled). |

Indicators for the terrain and soils (including permafrost) subcomponents were selected to focus the assessment of Project-related effects on the overarching VC. Changes in terrain stability, unique landforms, and soil quality are characterized by the indicators listed in **Table 11.1-2**.

**Table 11.1-2 Indicators for Surficial Geology, Terrain, and Soils**

| Valued Component | Subcomponent | Indicator |
|---|---|---|
| Surficial Geology, Terrain, and Soils | Terrain Stability | Change in terrain stability class<br>Change in terrain stability as a result of permafrost disturbance<br>Potential disturbance of unique landforms |
| | Unique Landforms | Disturbance of unique landforms |
| | Soil Quality | Soil disturbance (for in situ soils)<br>Soil degradation (for in situ soils)<br>Soil salvage and handling (for salvaged and stockpiled soils) |

### 11.1.1 Assessment Boundaries

**Table 11.1-3** below identifies the spatial, temporal, and technical boundaries established for the assessment of Project-related effects and cumulative effects on the Surficial Geology, Terrain, and Soils VC and subcomponents (see also **Figure 11.1-1**). There are no administrative boundaries relevant to the Surficial Geology, Terrain and Soils Assessment.

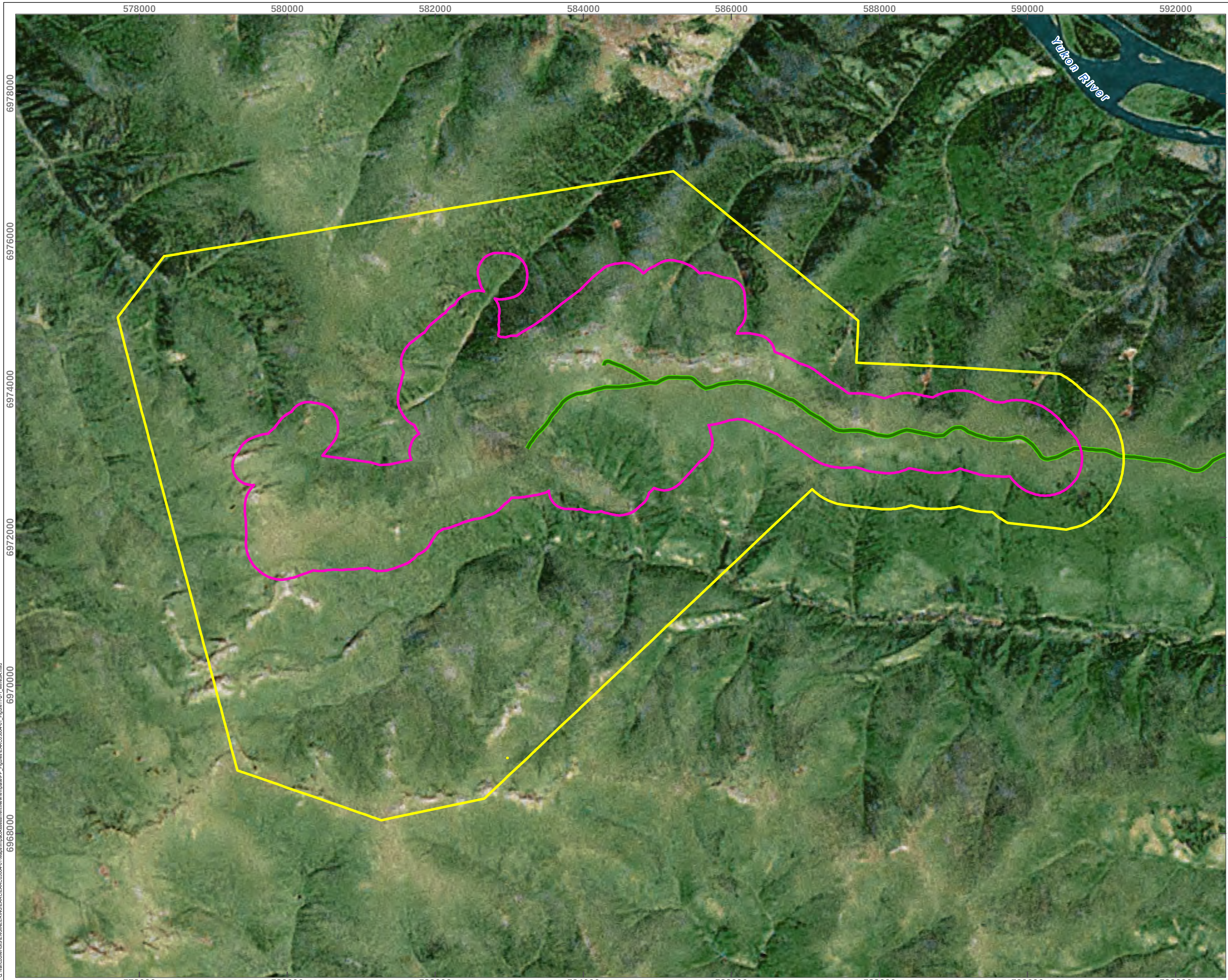
**Table 11.1-3 Spatial Boundary Definitions for Surficial Geology, Terrain and Soils Assessment**

| Boundary | | Description of Boundary |
|---|---|---|
| Spatial | Local Assessment Area | The Mine Site consists of a 250-m buffer around mine infrastructure and a 500 m buffer around the centreline of the access route to airstrip facilities (1,837 ha)<br>For the NAR, consists of a 500-m buffer around the route centreline (19,773 ha) |
| | Regional Assessment Area and Cumulative Effects Assessment Area | Full extent of terrain hazard mapping for the Mine Site and mine access route to the airstrip facilities (6,689 ha)<br>Full extent of terrain hazard mapping for the NAR (which includes a minimum 1 km buffer around the route centreline) (45,897 ha) |
| Temporal | | The temporal boundaries of the Project consist of construction, operation, closure and reclamation, and post-closure phases, which are described in **Section 2.0 Project Description** of the Project Proposal. |
| Technical | | The anticipated extent of Project disturbance (Project Footprint) has been overestimated through the application of a 50 m buffer around the outer boundaries of Project infrastructure. |

**Notes:** ha - hectare; km - kilometer; m – metre; NAR - Northern Access Route

COFFEE GOLD MINE

**Local and Regional Assessment Areas for Surficial Geology, Terrain, and Soils within the Mine Site Area**





## Legend

- Mine Site Access Road
- Local Assessment Area
- Regional Assessment Area

## Notes

1. This map is not intended to be a "stand-alone" document, but a visual aid of the information contained within the referenced Report. It is intended to be used in conjunction with the scope of services and limitations described therein.
2. Imagery from ESRI; Earthstar Geographics (1999)

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| Figure 11.1-1 | Date: Mar 23, 2017 | Drawn by: MEZ | Reviewed: TP |
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GOLDCORP

## 11.2 ASSESSMENT METHODS

Input to the assessment included data collected from field survey programs; terrain and terrain stability mapping; permafrost mapping; ecological land classification mapping; soils mapping (including soil salvage and reclamation suitability); results from the air quality model (dust fall in particular); and consultation and engagement with government agencies, potentially affected First Nations, and the public. Map products were developed at a scale of 1:20,000. The potential effects to soils as a result of possible alterations to groundwater (e.g., as presented by localized increases or decreases in relative soil moisture) from Project activities were also considered. The groundwater model revealed that the water table is sufficiently deep as to limit the interaction with soil (defined here as the top 0.5 metres (m) of material). As such, this potential linkage is not considered further in the assessment.

Changes in terrain stability were determined quantitatively and qualitatively using geographic information system (GIS) to overlay the Project footprint onto the various maps produced. Areas that were considered as being particularly sensitive to disturbance were then identified.

Changes in soil quality were also determined quantitatively and qualitatively using a similar approach to that described for changes in terrain stability class. The Project footprint was overlain onto the soils map (which includes the identification of areas suitable for reclamation) to identify likely disturbance areas.

### 11.2.1 REGULATORY FRAMEWORK

The regulation and management of Surficial Geology, Terrain, and Soils is largely through the reclamation policies and guidelines developed for hard rock (quartz) mines in Yukon. Mining projects will likely require a Quartz Mining Licence, which is regulated by the *Quartz Mining Act*, SY 2003, c.14, and issued by the Department of Energy, Mines, and Resources, as well as a Water Licence, which is regulated by the *Waters Act*, SY 2003, c.19, and issued by the Yukon Water Board. Both licences have reclamation and closure requirements; however, the expectations for reclamation and closure present themselves much earlier in the initial approval stages of a project (e.g., at the Project Proposal stage). These expectations have guided the assessment of potential Project-related effects, as well as the mitigation measures, for the Surficial Geology, Terrain, and Soils VC.

## 11.3 EXISTING CONDITIONS

### 11.3.1 TERRAIN STABILITY

The majority of the Mine Site, including 85 percent (%) of the Local Assessment Area (LAA) and 79% of the Regional Assessment Area (RAA), is considered to be ‘relatively stable’ (i.e., with terrain stability classes of 0 to II). When combined with areas that are considered to be ‘generally stable with minor potential for instability’ (class III), this classification increases to approximately 97% and 93% of the LAA and RAA, respectively. These conditions are reflective of the gentle to moderate slopes that predominate on lower valley sides and in uplands. **Table 11.3-1** presents additional details on terrain stability within the LAA and RAA of the Mine Site and Northern Access Route (NAR).

**Table 11.3-1 Distribution of Terrain Stability Classes within the Local and Regional Assessment Areas of the Mine Site and Northern Access Route**

| Existing Terrain Stability Class[1] | Terrain Stability Class Description | Mine Site | | | | Northern Access Route | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | LAA (ha) | LAA (%) | RAA (ha) | RAA (%) | LAA (ha) | LAA (%) | RAA (ha) | RAA (%) |
| 0 | N/A, Anthropogenic | - | - | - | - | 2,823 | 14 | 3,765 | 8 |
| I | Stable | - | - | - | - | 509 | 3 | 1,182 | 3 |
| II | Generally Stable | 1,688 | 83 | 5,267 | 79 | 12,422 | 63 | 31,356 | 68 |
| III | Generally Stable with Minor Potential for Instability | 306 | 15 | 967 | 14 | 2,621 | 13 | 6,105 | 13 |
| IV | Potentially Unstable | 8 | <1 | 81 | 1 | 199 | 1 | 498 | 1 |
| V | Unstable | 42 | 2 | 374 | 6 | 1,199 | 6 | 2,992 | 7 |
| **Total** | | **2,044** | **100** | **6,689** | **100** | **19,773** | **100** | **45,897** | **100** |

**Source: Appendix 11-A Surficial Geology, Permafrost, and Terrain Stability**

**Notes:** ha – hectares

Classes: 0 – not applicable, anthropogenic, I – stable, II – generally stable, III – generally stable with minor potential for instability, IV – potentially unstable, and V – unstable.

### 11.3.2 PERMAFROST

Within the Mine Site, approximately 65% of the LAA and 56% of the RAA are likely underlain by permafrost (**Table 11.3-2**). Permafrost distribution within the Mine Site appears to be influenced by aspect and vegetation cover. Shallow permafrost is typically present on northeast-facing slopes that support sparse, stunted black spruce and a thick moss layer, while southwest-facing slopes with virtually pure stands of trembling aspen (which require warmer air temperatures and deeper root penetration) are generally free of permafrost.

Along the NAR (including areas requiring new construction), it is estimated that approximately 56% of the LAA and 59% of the RAA is influenced by permafrost (**Table 11.3-2**).

**Table 11.3-2 Distribution of Permafrost within the Local and Regional Assessment Areas of the Mine Site and Northern Access Route**

| Permafrost Type[1] | Mine Site | | | | Northern Access Route | | | |
|---|---|---|---|---|---|---|---|---|
| | LAA (ha) | LAA (%) | RAA (ha) | RAA (%) | LAA (ha) | LAA (%) | RAA (ha) | RAA (%) |
| Frozen, no visible ice (Fn) | 895 | 44 | 2,153 | 32 | 5,646 | 29 | 15,326 | 33 |
| Frozen, visible ice (Fv) | 407 | 20 | 1,585 | 24 | 3,146 | 16 | 7,495 | 16 |
| Frozen, ice-rich (Fi) | - | - | 25 | 0 | 2,350 | 12 | 4,104 | 9 |
| Unfrozen | 742 | 36 | 2,925 | 44 | 8,630 | 44 | 18,972 | 41 |
| **Total** | **2,044** | **100** | **6,689** | **100** | **19,773** | **100** | **45,897** | **100** |

**Source:** [1]Permafrost types and distributions are compiled from studies conducted by Tetra Tech EBA and PECG (refer to **Appendix 11-A Surficial Geology, Permafrost, and Terrain Stability**).

### 11.3.3 Unique Landforms

Landforms that are relatively unique in the area include tors and collapsed and intact open-system pingos. Tors are erosional remnants of a higher plateau level, and are located along ridgetops, primarily in the central and western parts of the Mine Site and along the NAR north of the Stewart River. The tors form towers above otherwise smooth, rounded ridges underlain by granitic bedrock, and are surrounded by either thick colluvium (unconsolidated sediments that gather at the foot of a steep slope) or weathered bedrock.

Pingos are perennial frost mounds that consist of a core of massive ice, and are covered by soil and vegetation (Harris et al. 1988). Open-system pingos result when the water forming the dome of frozen ground is supplied by groundwater moving downslope. Collapsed pingos are indicative of the former presence of massive ground ice and ice-rich permafrost that has since thawed, leaving behind a low, circular ridge of material as a result of the sides of the pingo slumping, and a depression, which in this case is filled with water. A total of six pingos (two collapsed and four intact) were identified within the RAA.

### 11.3.4 Soil Quality

The Mine Site falls within the portion of Yukon that remained unglaciated during the Pliocene to early Pleistocene epochs (3 million to 1.8 million years ago); however, glaciers were present within the Stewart River valley to the north as well as to the west and east of the Mine Site (Duk-Rodkin 1999). This lack of glaciation exposed surficial geology to an extensive period of weathering, resulting in surficial deposits primarily composed of weathered bedrock, colluvium derived from weathered bedrock and loess (very fine grained silt or clay formed through glaciation and deposited by the wind), and fluvial (river-based) materials. At high elevations and along valley slopes, colluvium is likely to be coarse grained, whereas ice-rich re-sedimented loess and peat form colluvial aprons on lower slopes, and fluvial deposits are found in valley bottoms. These deposits may be subject to gullying, cryoturbation (mixing of materials from various soil horizons due to freezing and thawing), solifluction (gradual mass wasting slope process related to freeze-thaw activity), permafrost processes, periglacial processes (geomorphic processes from seasonal thawing in permafrost areas), landslides, and snow avalanches.

Soils at the Mine Site are predominantly Cryosols (permafrost soils), and represent 63% of the LAA and 67% of the RAA. Unfrozen soils are represented primarily by Brunisols (one of three soil orders for forested soils in Canada). Parent materials are largely colluvium, which cover 97% of the LAA and 95% of the RAA. The dominant soil parent material along the NAR (which includes portions that require new construction) is colluvium, which covers 67% to 74% of the LAA and RAA, respectively. Anthropogenic materials are fairly widespread in the LAA due to the original geological materials having been heavily modified by human activities such as placer mining.

Approximately 42% of the soils within the LAA are considered suitable for reclamation compared to 30% within the RAA. The dominance of colluvium is likely a factor limiting the quality of soils available for reclamation. Estimated topsoil depths range from a minimum of 10 cm in frozen fluvial soils to a maximum of 32 cm in frozen fluvial and frozen colluvial soil types.

## 11.4 Project Interactions, Potential Effects, and Mitigation Measures

### 11.4.1 Potential Project-related Interactions

Project Activities associated with Project Phases that will potentially interact with surficial geology, terrain, and soils are described in **Table 11.41**

**Table 11.4-1 Potential Interactions**

| Phase | Types of Effects | Causes of Interactions |
|---|---|---|
| Construction Phase | • Potential to alter local terrain stability, unique landforms, and soil quality<br>• Change the overall stability of terrain<br>• Removal of unique landforms<br>• Potentially to reduce soil quality within the Project footprint | • Large-scale land surface changes within the Project footprint<br>• Construction of Project components.<br>• Stripping, Open Pit, WRSF, and HLF development.<br>• Upgrade, construction and maintenance of Mine Site, service roads and Haul Roads |
| Operation Phase | • Stability, unique landforms, and soil quality<br>• Change the overall stability of terrain<br>• Removal of unique landforms<br>• Potentially to reduce soil quality within the Project footprint | • Large-scale land surface changes within the Project footprint<br>• Stripping, Open Pit, WRSF, and HLF development.<br>• Maintenance of Mine Site, service roads and Haul Roads |
| Reclamation and Closure Phase | Negligible | Negligible |
| Post-closure Phase | Negligible | Negligible |

**Notes:** HLF - Heap Leach Facility; WRSF - Waste Rock Storage Facility

### 11.4.2 Potential Effects

Activities during the Construction and Operation Phases of the Project have the potential to alter the terrain stability in the Project footprint as the development of various mine components will require stripping, permafrost removal, and extensive excavations.

Unique landforms will be affected since the locations of multiple tors lie in the Mine Site footprint, and will be removed prior to the development of Mine Site components.

In addition, soil quality may change as pits are developed, ore is stockpiled and placed on the HLF, waste rock is deposited in Waste Rock Storage Facilities, and organic and overburden materials are stockpiled. This potential change is due to admixing (where soil is inadvertently mixed with subsoil, spoil, or waste material), which can reduce soil quality by altering the texture, structure, or organic matter content (Powter 2002). Also, general activities taking place can results in spills leading to soil contamination.

### 11.4.3 MITIGATION, MANAGEMENT, AND MONITORING

The mitigation measures proposed to be used to eliminate or reduce Project-related changes to surficial geology, terrain, and soils are inherent in the Project design, and are related to:

- Project design – elements that have been incorporated into Project design that will reduce the potential effects to surficial geology, terrain, and soils and mitigate terrain hazards in permafrost areas
- Hazard avoidance
- Terrain hazard mitigation
- Unique landform mitigation
- Soil quality mitigation.

In additional to the mitigation measures described above, adherence to the management plans presented in **Section 31.0 Environmental and Socio-economic Management Program** will further mitigate potential effects to surficial geology, terrain and soils:

## 11.5 RESIDUAL EFFECTS

Following the implementation of mitigation measures, residual effects are likely to remain for the terrain stability, unique landforms, and soil quality subcomponents due to Project components and the resource being in a fixed location with little opportunity to move to a more suitable area. As discussed below, all of these residual effects are likely to be not significant.

### 11.5.1 TERRAIN STABILITY

#### *11.5.1.1 Change in Terrain Stability Due to Project Activities*

Residual effects of the Project on terrain stability are adverse, of high magnitude, and are restricted to the Project footprint both within the Mine Site and along the NAR. The residual effect will occur once as part of construction activities but is likely to persist into the long-term (potentially beyond the Reclamation and Closure Phase). Residual effects are partially reversible in that original terrain stability levels may not be replicated, but similar, stable terrain conditions will be reproduced as part of the Reclamation and Closure Phase. The residual effect is considered unlikely to occur as infrastructure that may be located in unstable terrain (either existing or induced through construction activities) will be designed, constructed, and operated in a manner that is safe and appropriate for the conditions. Additionally, the mitigation measures are engineered solutions tailored specifically to terrain stability and are effective when implemented correctly. Because the residual effects are restricted to the Project footprint, will not be permanent, are partially reversible, and are unlikely to occur, they are likely to not be significant. This assessment has a moderate level of confidence, partly because terrain stability in this context (e.g., a change in terrain stability class due to the addition of a disturbance) is not well documented, thus limiting the opportunity for comparison to other similar circumstances.

#### *11.5.1.2 Change in Terrain Stability Due to Permafrost Disturbance*

Residual effects of the Project on terrain stability resulting from disturbance to permafrost are adverse, of high magnitude, and are restricted to the Project footprint. The residual effect will occur once as part of construction activities, but is likely to persist into the long-term (potentially beyond the Reclamation and Closure Phase). Residual effects are partially reversible in that permafrost aggradation may occur under certain conditions; however, the length of time under which this process would occur is likely considerable and is countered by global climatic modeling considerations and the ensuing long-term degradation of permafrost due to global warming. The residual effect is considered unlikely to occur as infrastructure that may be located in areas underlain by ice-rich (frozen, visible ice or Fv; frozen, ice-rich or Fi) permafrost will be designed, constructed, and operated in a manner that has successfully incorporated the mitigation measures presented in **Section 11.4.3**. Because the residual effects are restricted to the Project footprint, are not permanent, are partially reversible, and are unlikely to occur, they are likely to not be significant. This assessment has a moderate level of confidence, partly because of the possibility that the implementation of the proposed mitigation measures may be reliant on a third party (e.g., a construction contractor) not fully versed in the intricacies of building on permafrost.

### 11.5.2 UNIQUE LANDFORMS

Residual effects of the Project from disturbance to unique landforms are adverse, of high magnitude, and are restricted to the Project footprint within the Mine Site. The residual effect occurs once as part of construction activities, and is considered to be permanent and irreversible. In addition, the residual effect is considered likely to occur because there is little opportunity to move infrastructure to a more suitable location to avoid these landform features. Despite the effects being of high magnitude, permanent, irreversible, and likely to occur, the potential effects and residual effects to unique landforms are considered to be not significant, since they will be restricted to the Project footprint, and do not represent the elimination of unique landforms from the RAA. There are other unique landforms in the LAA and RAA that will remain undisturbed by Project activities, and this is primarily why the effects are thought to be not significant. This assessment has a high level of confidence.

### 11.5.3 CHANGE IN SOIL QUALITY

#### *11.5.3.1 Soil Disturbance*

Residual effects of the Project on soil quality from soil disturbance are adverse, of moderate magnitude, and are restricted to the Project footprint both within the Mine Site and along the NAR. The residual effect will occur once as part of construction activities, but may persist into the long term (potentially beyond the Reclamation and Closure Phase). Residual effects are partially reversible in that soil replacement may not replicate pre-disturbance conditions, but the re-establishment of productive areas is included as part of Reclamation and Closure Phase activities. In addition, the residual effect is likely to occur as soil disturbance is unavoidable with Project construction, though the mitigation measures are likely to be effective if implemented accordingly. This assessment has a high level of confidence.

## 11.6 CUMULATIVE EFFECTS ASSESSMENT

A total of 24 projects (23 currently in operation and one planned for future) overlap with the same terrain stability polygons as the NAR alignment, and fall within sections of the existing road alignment. No projects fall within the portions of the NAR that require new construction. The majority (21) of these projects are associated with placer mining; the remaining three projects include one quartz exploration project and two settlement developments, all of which are considered existing. The likely interactions between these projects and the Coffee Gold Mine arise from the possibility of the projects collectively changing the terrain stability or soil quality in the area as part of project activities.

The projects that have the potential to interact cumulatively with the Project's NAR to the extent they may adversely affect terrain stability were considered as part of the terrain stability assessment. As such, no potential cumulative effects are likely or would not be detectable beyond the effects already described for the Project.

No projects fall within sections of the NAR requiring new construction. As such, there is no interaction with Project activities that may result in further disturbance to soils and no potential for cumulative effects.

Following the application of mitigation measures and the implementation of the management plans developed for the Project (**Section 31.0 Environmental and Socio-economic Management Program**), no residual cumulative effects are likely for Surficial Geology, Terrain, and Soils. As such, an assessment of residual cumulative effects and subsequent determination of east have not been conducted as they are not required.

## 11.7 REFERENCES

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# 12.0 SURFACE WATER QUALITY ASSESSMENT

This section presents a high-level summary of the effects assessment for the Surface Water Quality Valued Component (VC) of the proposed Coffee Gold Mine (Project). The full effects assessment is presented in **Appendix 12-B Surface Water Quality Valued Component Assessment**.

## 12.1 ASSESSMENT SCOPE

As a result of the VC selection process, surface water quality was selected as a VC as water quality in lakes and streams in the region is highly valued by WRFN, FNNND, SFN, TH Nation, local people, as well as the territorial and federal governments. Water quality refers to the biological, chemical, and physical characteristics of water. No subcomponents were defined for the Surface Water Quality VC; the indicators used to describe and evaluate potential effects on the Surface Water Quality VC and the rationale supporting the selection of these indicators are identified in **Table 12.1-1.**

**Table 12.1-1 Indicators for Surface Water Quality**

| Indicator | Rationale for Selection |
|---|---|
| TSS and turbidity concentration | A measurable increase from baseline conditions will identify Project-related effects from:<br>• **Erosion and sedimentation** – associated with surface disturbance and/or elevated suspended sediments in mine effluent discharges.<br>• **Atmospheric deposition** – associated with surface disturbance, roadway traffic, and particulate emissions from Plant Site. |
| Physical parameters (conductivity, pH, hardness, TDS) | A measurable change from baseline conditions will identify Project-related effects from:<br>• **Leaching of disturbed mine materials/waste** – associated with contact water from waste rock storage facilities, ore stockpiles, surface disturbances, or exposed pit surfaces.<br>• **Groundwater and surface water interactions and seepage** – associated with seepage and groundwater (higher in major ions) recharging to surface waters (lower in major ions). |
| Cyanide species (CNWAD, CNT) | A measurable increase from background will identify Project-related effects from:<br>• **Leaching of HLF residues** – associated with application of cyanide for gold extraction at the HLF. |
| Nutrient (TP, $NH_3$, $NO_2$, $NO_3$) concentrations | A measurable increase from background will identify Project-related effects from:<br>• Leaching of nitrogen residues generated from blasting – associated with nitrogen based explosive use.<br>• **Leaching of HLF residues** – associated with application of cyanide for gold extraction at the HLF.<br>• **Discharge of Camp Site waste water** – associated with effluent from the Camp Site. |
| Biological oxygen demand (BOD) and chemical oxygen demand (COD) | A measurable increase from background will identify Project-related effects from:<br>• **Discharge of treated Camp Site waste water** – associated with effluent from the Camp Site. |

| Indicator | Rationale for Selection |
|---|---|
| Total and dissolved metals concentrations (e.g., Al, As, Sb, Co, Cr, Fe, Pb, Hg, Ni, Se, U, and Zn.) | A measurable increase from background levels will identify Project-related effects from:<br>• **Erosion and sedimentation** – with increase total (not dissolved) metal fraction only, associated with surface disturbance and/or elevated suspended sediments in effluent discharged from Project ponds.<br>• **Atmospheric deposition** – associated with surface disturbance, roadway traffic, particulate, or soluble emissions from Plant Site.<br>• **Leaching of disturbed mine materials/waste** – associated with contact water from WRSFs, ore stockpiles, exposed pit surfaces, or surface disturbances.<br>• **Leaching of HLF residues** – associated with application of cyanide for gold extraction at the HLF.<br>• **Groundwater and surface water interactions and seepage** – associated with seepage and groundwater (higher in certain trace elements) recharging to surface waters (lower in certain trace elements). |

**Notes:** Al - aluminum; As - arsenic; BOD - biological oxygen demand; Co - cobalt; COD - chemical oxygen demand; CNT - total cyanide; CNWAD - weak acid dissociable cyanide; Cr - chromium; Fe - iron; Hg – mercury; HLF - Heap Leach Facility; $NH_3$ - ammonia; Ni - nickel; $NO_2$ - nitrogen dioxide; $NO_3$ - nitrate; Sb - antimony; Se - selenium; Pb - lead; TDS - total dissolved solids; TP - total phosphorous; TSS - total suspended solids; U - uranium; Zn - zinc

## 12.2 Assessment Boundaries

**Table 12.2-1** identifies the spatial, temporal, and technical boundaries established for the assessment of Project-related changes to surface water quality (see also **Figure 12.2-1**). There are no administrative boundaries relevant to the analysis of surface water quality.

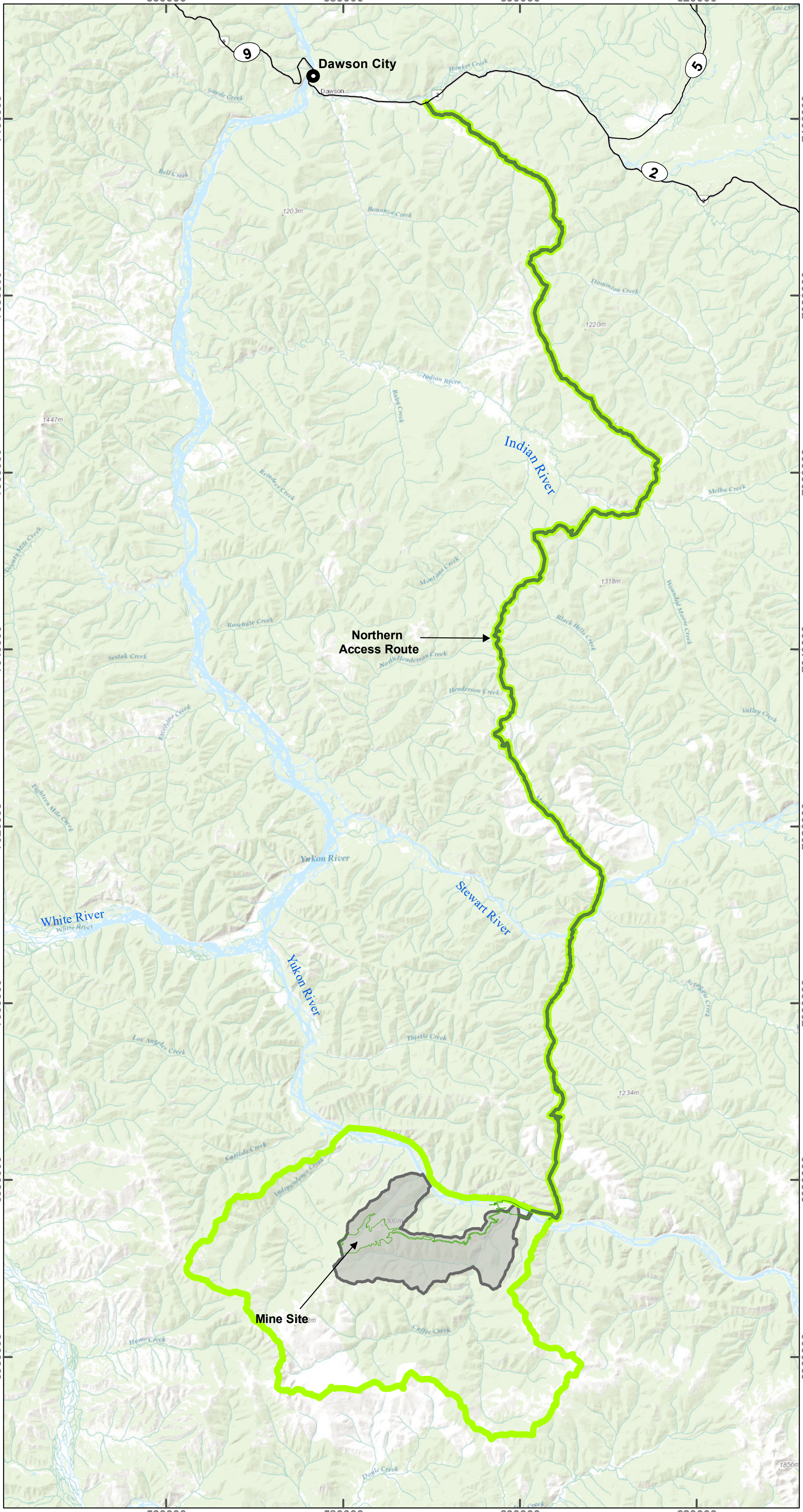
**Table 12.2-1 Spatial, Temporal, and Technical Boundaries for the Surface Water Quality Analysis**

| Boundary | | Description of Assessment Area |
|---|---|---|
| Spatial | Local Assessment Area | The Halfway Creek and Yukon Tributary watersheds, Latte Creek, and Coffee Creek downstream of the confluence with Latte Creek to the Yukon River. The LAA also includes the alignment of the proposed Northern Access Route. |
| | Regional Assessment Area | The entirety of the LAA, the Coffee Creek watershed (including the portion upstream of the confluence with Latte Creek), Independence Creek, and the section of the Yukon River that spans the confluences with Independence and Latte Creeks, with a 100-m buffer. |
| | Cumulative Effects Assessment Area | Not applicable. |
| Temporal | | The temporal boundaries of the Surface Water Quality effects assessment span the entire Project life, beginning with the Construction Phase (Year –3) and ending with the Post-closure Phase (Year 24 onwards as determined to be required). |
| Technical | | No technical boundaries were identified during the assessment of potential Project-related effects to surface water quality; however, technical limitations were encountered during water quality sampling in stream catchments during winter months as part of the baseline water quality monitoring program. Due to freezing, the water quality relationship established for modelling purposes for March to November was used to reasonably estimate background water quality in these catchments during low flow months in lieu of winter samples. |

**Notes:** km - kilometre; LAA - Local Assessment Area; m - metre; RAA - Regional Assessment Area

# COFFEE GOLD MINE

## Local and Regional Assessment Areas for Surface Water Quality





Legend

- Municipality
- Highway
- Local Assessment Area
- Regional Assessment Area
- Project Footprint

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## 12.3 ASSESSMENT METHODS

### 12.3.1 MODEL

The assessment of Project-related effects on this VC included a surface water quality model and water balance model.

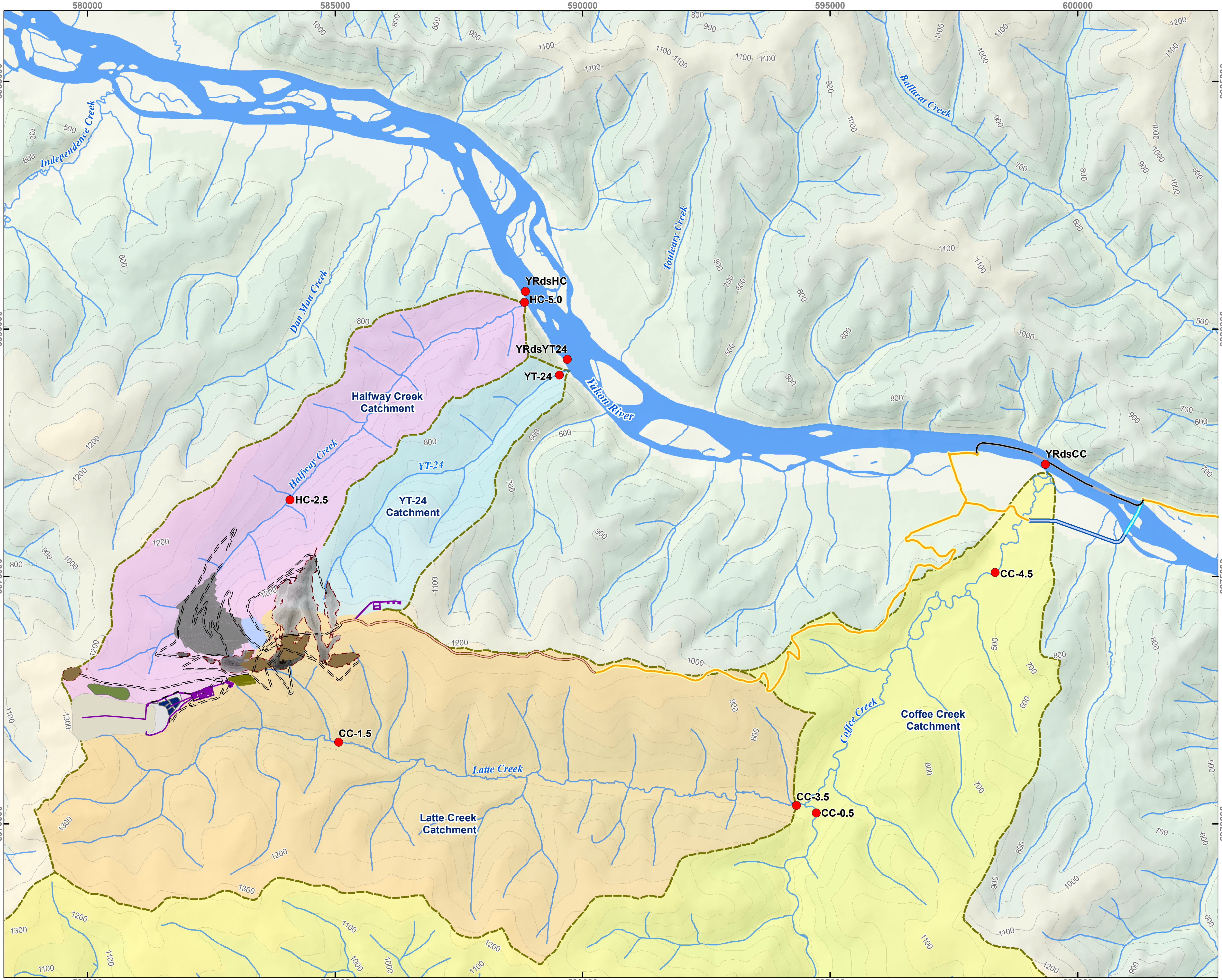
#### *12.3.1.1 Surface Water Quality Model*

The water balance model developed for the Project predicts water quality for key locations (**Figure 12.3-1**) within the receiving environment throughout all phases of the Project. The model generally employs a mass balance approach that combines the loadings associated with background flows and mine-affected flows for a series of climate realizations (i.e., climate scenarios that were developed based on a 28-year climate record, and described more fully in **Appendix 12-C Water Balance and Water Quality Model Report**). The model was developed in GoldSim, and accounts for background water quality, runoff volumes reporting from undisturbed portions of watersheds, and regional groundwater, as well as chemical loads emanating from mine-related facilities (e.g., Open Pits and Waste Rock Management Facilities) and Site Water Management Infrastructure (e.g., contact water ponds and ditches).

The water quality model incorporates the site-wide mitigation strategies developed for the Project, in the sense that intended mitigation has been considered in deriving source terms for specific mine components.

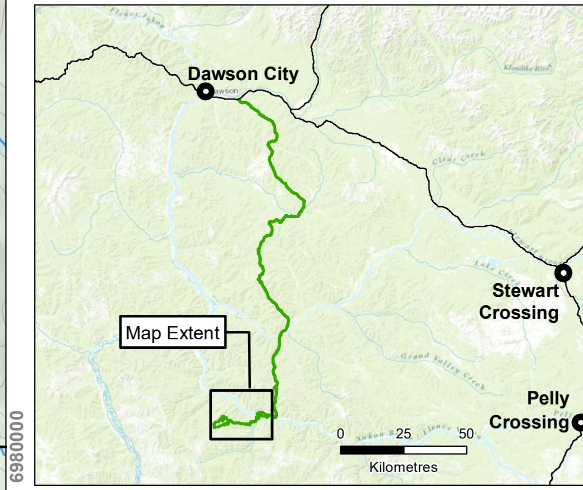
The model accounts for mine-related activities associated with four distinct phases of the Project: Construction, Operation, Reclamation and Closure, and Post-closure. Mine-related activities and facilities that have the potential to alter surface water quality are highlighted in **Section 12.5.1**.

It is assumed that the mine will be fully reclaimed with no active treatment or mitigation required during the Post-closure Phase (commencing Year 24 onwards as determined to be required). The modelled Post-closure Phase incorporates the effect of a conservative climate change scenario as defined by the Intergovernmental Panel on Climate Change.




COFFEE GOLD MINE

**Water Quality Model Nodes and Project Catchment Areas**




Legend

- Water Quality Model Node
- Municipality
- Project Footprint
- Catchment Boundary
- Waterbody
- Watercourse
- Elevation Contours (100m)
- Yukon River Barge Route
- Yukon River Ice Road
- Winter Road
- Mine Site Access Route
- Northern Access Route

**Pre-Mine Catchment Area**

- Halfway Creek
- Latte Creek
- YT-24 Creek
- Coffee Creek

**Proposed Infrastructure**

- WRSF
- Backfill
- Total Pit Outline
- ROM Stockpile
- Organics Stockpile
- Frozen Soil Storage Area
- Event Pond
- Heap Leach Access Disturbance Footprint
- Heap Leach Pad Base
- Haul Road
- Support Infrastructure

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#### *12.3.1.2 Water Balance Model*

The water balance model is a detailed interpretation of the mine and water management plans, with consideration of baseline climate, hydrometric, and hydrogeological data collected for the Project. The water balance model was developed in GoldSim, and is the foundation upon which the water quality model has been developed, in the sense that water quality is assigned to each flow condition included in the water balance model. A full description of the inputs and assumptions employed in the model is provided in **Appendix 12-C Water Balance and Water Quality Model Report** and **Appendix 12-D Geochemical Characterization Report**.

### 12.3.2 REGULATORY FRAMEWORK

The management, use, and discharge of water from a mine site is governed by several pieces of federal and territorial legislation. At the federal level, the discharge of mine effluent is governed under the *Fisheries Act*, RSC 1985, c. F-14 (specifically by the Metal Mining Effluent Regulations (SOR/2002-222)), the Canada *Water Act*, RSC 1985, c. C-11, the Yukon *Quartz Mining Act*, SY, 2003, c. 14, and the Yukon *Waters Act*, SY 2003, c. 19*.* Several guidance documents informed the Project assessment process: the Water and Air Baseline Monitoring Guidance Document for Mine Proponents and Operators (BC MOE 2012) and the *Plan Requirement Guidance for Quartz Mining Projects* (YWB 2013). Potential effects to water quality parameters were determined through comparison against Canadian Council of Ministers of the Environment (CCME) *Water Quality Guidelines for the Protection of Aquatic Life* (2004) and British Columbia Working and Approved *Water Quality Guidelines for the Protection of Aquatic Life* (BC MOE 2015a, b). **Table 12.3-1** outlines the surface water criteria. The CCME water quality guidelines (WQGs) were used as the default standards against which predictions were screened, unless the British Columbia (BC) WQG for the corresponding parameter was more appropriate. Detailed discussion on relevant reason for selecting each parameter criteria is outlined in **Appendix 12-B Surface Water Quality Valued Component Assessment**.

**Table 12.3-1 Water Quality Guidelines for the Assessment of Surface Water Quality**

| Parameter | Unit | Regulatory Source for Guideline | Proposed Water Quality Objectives | | | | |
|---|---|---|---|---|---|---|---|
| | | | Latte Creek | YT-24 | Halfway Creek | Coffee Creek (CC-4.5)[a] | Yukon River (YUK-5.0)[a] |
| $NH_3$-N | mg/L | BC | 1.63[b] | 1.91[b] | 1.91[b] | 0.04 | 0.03 |
| $NO_2$-N | mg/L | BC | 0.02[c] | 0.02[c] | 0.02[c] | 0.05 | 0.05 |
| $NO_3$-N | mg/L | BC | 3 | 3 | 3 | 0.6 | 0.2 |
| P | mg/L | CCME | 0.1[d] | 0.1[d] | 0.1[d] | – | – |
| $SO_4$ | mg/L | BC | 309[e] | 218[e] | 218[e] | 77 | 25 |
| WAD-CN | mg/L | BC | 0.005 | 0.005 | 0.005 | Non-detectable | Non-detectable |
| **Total Metals and Metalloids** | | | | | | | |
| Ag | mg/L | CCME | 0.00025[e] | 0.00025[e] | 0.00025[e] | 0.000007 | 0.00002 |
| As | mg/L | CCME | 0.005 | 0.005 | 0.005 | 0.0006 | 0.0013 |
| Cd | mg/L | CCME | 0.00013[e] | 0.0001[e] | 0.00011[e] | 0.00005 | 0.00021 |
| Cr | mg/L | CCME | 0.001[f] | 0.001[f] | 0.001[f] | – | – |
| Cu | mg/L | CCME | **0.003** | **0.0034** | **0.003** | 0.0042[g] | 0.0055[g] |
| Fe | mg/L | CCME | 1 | 1 | 1 | 0.349 | 2.066[g] |
| Hg | mg/L | CCME | 0.000026 | 0.000026 | 0.000026 | 0.00001 | 0.00001 |
| Mn | mg/L | BC | 0.89[e] | 0.97[e] | 0.86[e] | – | – |
| Mo | mg/L | CCME | 0.073 | 0.073 | 0.073 | 0.00074 | 0.0013 |
| Ni | mg/L | CCME | 0.082[e] | 0.061[e] | 0.069[e] | 0.0015 | 0.0046 |
| Pb | mg/L | CCME | 0.0025[e] | 0.0015[e] | 0.0018[e] | 0.00021 | 0.0011 |
| Sb | mg/L | BC | 0.009 | 0.009 | 0.009 | 0.00014 | 0.0002 |
| Se | mg/L | BC | 0.002 | 0.002 | 0.002 | 0.0001 | 0.00056 |
| Tl | mg/L | BC | 0.0008 | 0.0008 | 0.0008 | – | – |
| U | mg/L | CCME | **0.031** | 0.015 | **0.086** | 0.0036 | 0.001 |
| Zn | mg/L | CCME (draft) | 0.015[e] | 0.011[e] | 0.013[e] | 0.0052 | 0.0017[g] |

| Parameter | Unit | Regulatory Source for Guideline | Proposed Water Quality Objectives | | | | |
|---|---|---|---|---|---|---|---|
| | | | Latte Creek | YT-24 | Halfway Creek | Coffee Creek (CC-4.5)[a] | Yukon River (YUK-5.0)[a] |
| Dissolved Metals and Metalloids | | | | | | | |
| Ag | mg/L | – | – | – | – | 0.000005 | 0.000005 |
| Al | mg/L | BC | **0.351** | **0.205** | **0.403** | 0.263[g] | 0.045 |
| As | mg/L | – | – | – | – | 0.00049 | 0.00054 |
| Cd | mg/L | – | – | – | – | 0.000031 | 0.00006 |
| Cu | mg/L | – | – | – | – | 0.0033 | 0.0017 |
| Fe | mg/L | BC | 0.35 | 0.35 | 0.35 | 0.203 | 0.059 |
| Hg | mg/L | – | – | – | – | 0.00001 | 0.00001 |
| Mo | mg/L | – | – | – | – | 0.00068 | 0.00125 |
| Ni | mg/L | – | – | – | – | 0.0013 | 0.0017 |
| Pb | mg/L | – | – | – | – | 0.000055 | 0.00006 |
| Sb | mg/L | – | – | – | – | 0.00012 | 0.00012 |
| Se | mg/L | – | – | – | – | 0.00012 | 0.0005 |
| U | mg/L | – | – | – | – | 0.0038 | 0.001 |
| Zn | mg/L | – | – | – | – | 0.0022 | 0.0028 |

**Notes:** > - greater than; Ag - silver; As - arsenic; Ca - calcium; $CaCO_3$ - calcium carbonate; Cd - cadmium; CL - chlorine; Cr - chromium; Cu - copper; D-Al - dissolved aluminum; Fe - iron; $H_3$-N - ammoniacal nitrogen; Hg – mercury; Mg - magnesium; mg/L - milligrams per litre; Mn - manganese; Mo - molybdenum; Ni - nickel; $NO_2$-N – nitrate nitrogen; $NO_3$-N – nitrate nitrogen; P - phosphorous; Pb - lead; Sb - antimony; Se - selenium; $SO_4$ - sulfate; TDS - total dissolved solids; TI - titanium; TP - total phosphorous; TSS - total suspended solids; U - uranium; WAD-CN - weak acid dissociable cyanide; Zn - zinc

CCME = Canadian Council of Ministers of the Environment (CCME 2014); BC = British Columbia Ministry of Environment (B.C MOE 2015a,b); dash (–) indicates not proposed.

Values in bold font represent Proposed Site Specific Water Quality Objective (SSWQO). Other values are either based on the generic water quality guidelines (BC or CCME) or non-degradation objectives.

a. Non-degradation objective; all values calculated as 90th percentile of corresponding baseline dataset unless otherwise noted.
b. Guidelines calculated using assumed temperature of 7°C and 25th percentile pH from corresponding baseline dataset.
c. Chloride dependent; value shown assumes Cl > 2 mg/L.
d. Proposed seasonal limit based on CCME trophic trigger range; applied during months of open water (April to October).
e. Hardness-dependent; values shown assume 25th percentile hardness from corresponding baseline dataset.
f. CCME water quality guideline for Cr(VI).
g. 95th percentile from baseline dataset.

To evaluate total phosphorus, CCME (2004) trigger ranges for Canadian lakes and rivers were used to identify changes in predicted total phosphorus levels that could alter the trophic status of assessed creeks. Potential effects from elevated total phosphorus will generally relate to system eutrophication rather that toxicity; therefore, CCME (2004) outlines a tiered approach to evaluating phosphorus effects to water bodies by relating their trophic status to predefined ‘trigger ranges’ (measured as total phosphorus concentration (**Table 12.3-2**).

**Table 12.3-2 Total Phosphorus Trigger Ranges for Canadian Lakes and Rivers**

| Trophic Status | Trigger Ranges for Total Phosphorus (ug/L) |
|---|---|
| Ultra-oligotrophic | < 4 |
| Oligotrophic | 4 – 10 |
| Mesotrophic | 10 – 20 |
| Meso-eutrophic | 20 – 35 |
| Eutrophic | 35 – 100 |
| Hyper-eutrophic | > 100 |

**Source:** CCME 2004
**Notes:** ug/L - micrograms per litre

## 12.4 EXISTING CONDITIONS

### 12.4.1 BASELINE CONDITIONS

A multi-year baseline water quality monitoring program was undertaken in the Project area to characterize existing conditions. The program included all of the drainages potentially affected by the Project, including:

- Latte Creek
- Coffee Creek
- YT-24
- Halfway Creek
- Yukon River.

In addition, Independence Creek was included in the surface water quality monitoring program as a reference site.

A total of 18 water quality stations were established as part of the baseline water quality program. The locations of these stations are shown in **Figure 12.3-1**, and station coordinates; station type (e.g., reference or potential exposure), the date that monthly sampling began, and the rationale for including stations are given in **Appendix 12-A Baseline Water Quality Report** and **Appendix 12-B Surface Water Quality Valued Component Assessment**.

#### *12.4.1.1 Latte Creek and Coffee Creek*

Water chemistry in the Latte Creek and lower Coffee Creek drainages is influenced by varying proportions of snowmelt-driven surface runoff and groundwater inputs to surface flow, based on the seasonal water balance. This seasonality in water chemistry is more pronounced higher in the catchment.

Surface water quality higher in the Latte Creek/Coffee Creek catchment is characterized by soft water that is low in major ions during freshet periods, and hard to very hard waters, with high levels of major ions during winter low-flow periods. Lower in the Latte Creek catchment water chemistry shows a similar seasonality, though annual minimum and maximum amounts are less pronounced. Coffee Creek is characterized by soft to moderately soft waters with lower levels of dissolved major ions during the open water period of May to September. During low-flow periods, water chemistry is dominated by hard to very hard waters with high levels of dissolved solids. In contrast, pH remains relatively uniform throughout the Latte Creek and Coffee Creek drainages on an annual basis (7.0 to 8.0).

Peak summer flows typically coincide with annual maximum amounts of total suspended solids (TSS), dissolved organic carbon, dissolved aluminum, total iron (Fe), and particulate-bound metals; however, mean monthly concentrations of total and dissolved trace elements are generally low. In Latte Creek, dissolved aluminum (Al), Fe, and total copper (Cu) regularly exceed their corresponding CCME long-term water quality guidelines during the open water season, with total cadmium (T-Cd) and total chromium (T-Cr) commonly approaching or exceeding guidelines as well. During winter low-flow periods, the total uranium (U) concentration is consistently well above its CCME long-term guideline on an annual basis. Total arsenic (As) and total selenium (Se) are typically below their WQGs year-round, although sporadic increases are observed in association with high-TSS events.

#### *12.4.1.2 Yukon Tributary 24*

Unlike the Coffee Creek catchment, baseflow in Yukon Tributary 24 (YT-24) is not strongly associated with groundwater recharge. More specifically, when environmental conditions support surface flow, it is characterized by moderately soft, low-ionic-strength waters, with a circumneutral pH (i.e., having a pH between 6.5 and 7.5). Measured TSS concentrations are typically low, although peak flow events are associated with elevated TSS. Consistent with the dominant contribution of snowmelt-driven surface runoff to stream flow, water chemistry commonly shows elevated levels of dissolved organic carbon, dissolved Al, total Fe, and particulate-bound metals, although monthly mean concentrations of most trace elements (e.g., As, antimony (Sb), cobalt (Co), chromium (Cr), lead (Pb), mercury (Hg), nickel (Ni), Se, uranium (U), and zinc (Zn)) are low.

Certain parameters naturally exceed their corresponding CCME or BC WQGs, including dissolved Al and total Cu. Total Cd occasionally occurs near its CCME guideline as well.

#### *12.4.1.3 Halfway Creek*

Similar to the Coffee Creek catchment, water chemistry in Halfway Creek is driven by varying proportions of melt water surface runoff and groundwater inputs. Halfway Creek is characterized by soft water and low levels of major ions during freshet periods. During winter low-flow periods, no flow is evident at station HC-5.0, while station HC-2.5 is characterized by hard to very hard waters with high levels of major ions. Halfway Creek pH remains relatively uniform at the two stations in the drainage on an annual basis, typically ranging between 7.0 and 8.0.

Parameters and their seasonal variations are consistent with Latte Creek/Coffee Creek, with maximum annual TSS, dissolved organic carbon, dissolved AL, total Fe and particulate bond materials occurring in summer. Despite seasonal peaks, mean monthly concentrations of total and dissolved trace elements are typically low; however, as with Latte Creek, several parameters are naturally elevated throughout the Halfway Creek catchment and exceed their CCME or BC WQGs on an annual basis.

#### *12.4.1.4 Independence Creek*

Similar to the Coffee Creek catchment, water chemistry in Independence Creek is driven by varying proportions of melt water surface runoff and groundwater inputs. Independence Creek is characterized by soft water and low levels of major ions during freshet periods, followed by hard to very hard waters with high levels of major ions during winter periods. Measurements of pH remain relatively uniform throughout the drainage on an annual basis, ranging between 7.0 and 8.0.

Parameters and their seasonal variations are consistent with Latte Creek/Coffee Creek, with maximum annual TSS, dissolved organic carbon, dissolved AL, total Fe, and particulate bond materials occurring in summer. Despite seasonal peaks, mean monthly concentrations of total and dissolved trace elements are typically low; however, as with Latte Creek, several parameters are naturally elevated throughout the Halfway Creek catchment and exceed their CCME or BC WQGs on an annual basis.

#### *12.4.1.5 Yukon River*

Yukon River is characterized by consistently hard waters with low to moderate levels of major ions. Measurements for pH are generally circumneutral to slightly basic. The strong seasonal water quality signature is largely absent from the Yukon River, presumably due to its large catchment.

The Yukon River shows concentration peaks for certain organic parameters during summer high flows. Mean monthly total As concentrations are typically well below 1.0 microgram per litre (µg/L) for most flow periods of the year, with maximum values coincident with elevated TSS. Total U and dissolved Al concentrations are also low; but commonly exceed the BC 30-day WQG during summer flows.

Concentrations of total Cu in the Yukon River routinely exceed the CCME guideline. Mean monthly total Cu concentrations at both Yukon River stations indicate that elevated total Cu concentrations are associated with the peak flow months of May and June. Similar to Cu, total Cd concentrations typically slightly exceed the CCME long-term guideline during peak flow periods. Despite annual concentration peaks for certain parameters during summer high flows, mean monthly concentrations of total and dissolved trace elements and most notably for U, are typically low, falling below CCME and BC long-term guidelines.

## 12.5 Project Interactions, Potential Effects, and Mitigation Measures

### 12.5.1 Potential Project-related Interactions

The potential for interactions between Project activities and surface water quality are considered and summarised in **Table 12.5-1**.

**Table 12.5-1 Potential Interactions**

| Phase | Type of Effects | Cause of Interactions |
|---|---|---|
| **Construction** | | |
| Mine Site | • Increased erosion, sedimentation and atmospheric deposition (dust fall), TSS and turbidity concentrations, and associated increases in total and dissolved metals in surface water<br>• Changes to surface water quality parameters including nutrients loading and total and dissolved metals<br>• Reduced annual runoff volumes, low flows, high flows, and change in groundwater/surface water interactions | • Large-scale land surface changes within the Project footprint and installation of ancillary infrastructure<br>• Blasting activities<br>• Removal of water from natural cycles to supply HLF and wetting ore |
| Northern Access Route | • Erosion and sedimentation, atmospheric deposition (dust fall), leaching of nitrogen residues, elevated TSS and turbidity, physical parameters, nutrients, and/or total and dissolved metals | • Upgrade of existing road conditions, construction of new sections, development of borrow pits and quarries, blasting, crushing, and installation of culverts and bridges |
| **Operation** | | |
| Mine Site | • Groundwater and surface water interactions, seepage, erosion, sedimentation and atmospheric deposition, leaching of nitrogen residues, elevated TSS and turbidity concentrations, nutrients, and total and dissolved metals | • Development of major Project infrastructure<br>• Leaching from disturbed mine materials/waste<br>• Blasting<br>• Operation and maintenance of on-site service roads, Haul Roads, and Camp Site. |
| NAR | • Erosion and sedimentation, atmospheric deposition (dust fall), elevated TSS / turbidity, physical parameters, nutrients, and/or total and dissolved metals | • Construction of NAR and upgrading of existing road sections<br>• Development and use of quarries/borrow pits, blasting, crushing, and installation of culverts and bridges |

| Phase | Type of Effects | Cause of Interactions |
|---|---|---|
| **Reclamation and closure** | | |
| Project | • Erosion and sedimentation, atmospheric deposition (dust fall), leaching materials/waste, groundwater and surface water interactions and seepage, elevated TSS and turbidity concentrations and associated total and dissolved metals and elevated cyanide species | • Excavation of soils, backfilling of Open Pits, redistribution of the organics stockpile, and dismantling of Project infrastructure, decommissioning of sediment and event ponds and operation of the HLF water treatment facility |
| **Post-closure** | | |
| Project | • Erosion and sedimentation, leaching of mine materials/waste, nitrogen blasting residues and HLF residues<br>• Groundwater and surface water interactions and seepage may result in elevated TSS, physical parameters, nutrients, and total and dissolved metals | • Continued effects from previous Project activities |

**Notes:** HLF – Heap Leach Facility; NAR – Northern Access Route

### 12.5.2 Potential Effects

The purpose of this section is to focus the assessment on those interactions of greatest potential consequence to surface water quality. To achieve this objective, the potential for interactions between Project activities and surface water quality are considered.

#### *12.5.2.1 Erosion and Sedimentation*

Erosion and sedimentation associated with surface disturbances may result in potential Project-related adverse effects to surface water quality during all Project phases. The geographic extent of effects from erosion and sedimentation events may range from localized to far-reaching, depending on the amount and type of particulate materials introduced into the aquatic receiving environment, and the nature of the erosion source.

#### *12.5.2.2 Leaching from Disturbed Mine Materials / Waste*

Leaching from disturbed mine materials/waste is likely to occur as a consequence of Project development through the disturbance, excavation, crushing, and storing of geologic materials (e.g., bedrock). An assessment of the potential for acid rock drainage resulting from the Project indicates that most rock types have little or no potential for acid generation, with the exception of ore from the Kona pit. Most leachate chemistry will reflect weathering associated neutral rock drainage.

The geographic extent of effects resulting from mine materials/waste leachate depends on several factors, including the nature and type of geologic material, the loading rate of leachate products to contact water, the discharge rate of contact water to the receiving environment, and the background concentration of the same products in receiving streams. Lower levels of geologic leaching are likely in association with NAR development compared to the Mine Site area, given the small relative fraction of bedrock that will be disturbed to upgrade and develop roadways. For example, a total of 300 Mt of waste rock and 60.1 Mt of ore will be excavated from Open Pits at the Mine Site and stored in the Heap Leach Facility or in waste rock storage facilities. In contrast, borrow material requirements for road construction that will be sourced along the road alignment are estimated at approximately 0.56 Mt. Given that the mass of rock disturbed at the Mine Site is more than 500 times greater than disturbances associated with the NAR road alignment, the potential effects associated with the excavation of geologic material are primarily associated with the Mine Site area.

#### *12.5.2.3 Nitrogen Leaching from Blasting Residues*

Residues from nitrogen-based explosive use (blasting) will remain on the surfaces of newly blasted materials, including waste rock, exposed bedrock, pit walls, and unprocessed ore. The mass of nitrogen residues accumulated on these surfaces will vary depending on nitrogen management practices, blasting conditions (e.g., wet vs. dry), and the volume and type of explosives used. Because these residues are highly soluble, they will readily dissolve and elevate levels of nitrogen species ammonia, nitrite, and nitrate in contact waters.

The geographic extent of effects from blasting residues depends largely on the loading rate to the receiving environment. In addition to nitrogen management practices, the loading rate to the environment will depend on the degree to which blasting is required to support the development of mine infrastructure, facilities, and the NAR. Lower nitrogen loading is likely in association with NAR development compared to development in the Mine Site area, given the relatively small amount of blasting required during NAR construction.

#### *12.5.2.4 Heap Leach Facility Residue Leaching*

Residues leached from the HLF and the associated water treatment facility may include cyanide, nutrients and total and dissolved metals. Most cyanide used through mine life will be captured and/or treated (degraded) as specified in the mine plan and HLF design. Some residues may remain on HLF materials and subsequently leach to the receiving environment following decommissioning of the HLF and water treatment facility. In addition, nitrogen-based nutrients may result from the degradation of cyanide, occurring as ammonia, nitrite, and chiefly nitrate, while total P may be associated with leachate and/or discharge from the HLF water treatment facility. HLF contact waters are also likely to contain elevated levels of certain metals associated with cyanide, which are subsequently dissociated once cyanide breakdown occurs.

The geographic extent of potential effects from HLF residues will depend on the loading rate to the receiving environment and the effectiveness of HLF water treatment facility during the Reclamation and Closure phase.

No Project-related sources of HLF residues are identified for the Construction phase. During the Operations and Reclamation and Closure phases, the operation of HLF water treatment facility has the potential to affect surface water quality.

#### *12.5.2.5 Groundwater and Surface Water Interactions and Seepage*

Project activities have the potential to alter groundwater and surface water hydrological regimes, thereby potentially altering surface water quality. The baseline surface water quality dataset shows that the interaction between groundwater and surface water plays an important role in determining natural water chemistry. For example, the annual concentration signature for several parameters (most notably U) in certain Project area creeks is driven by the groundwater baseflow, which dominates the hydrograph during winter low flow months.

Potential Project-related interactions between groundwater and surface water during the Construction phase include development and use of Alpha WRSF, and sedimentation ponds and conveyance structures, and dewatering of pits (as required).

#### *12.5.2.6 Atmospheric Deposition*

Air-borne dust is likely to be generated from surface disturbance, blasting, vehicle traffic, earthworks, culvert and bridge installation along the NAR, and other mining activities. Deposition of dust in receiving environments has the potential to affect surface water quality during all mine phases.

### 12.5.3 MITIGATION, MANAGEMENT, AND MONITORING

The mitigation measures proposed to be used to eliminate or reduce Project-related effects to surface water quality are inherent in the Project design and are related to:

- Phased mine development and progressive reclamation
- Management of explosive use and blasting
- Waste Rock management
- Management of potential acid rock drainage
- Processing facilities mitigation and water management
- Surface water and groundwater protection and management
- Mine Site area water management
- Erosion and sediment control
- Dust management
- Monitoring and adaptive management.

## 12.6 Residual Effects

An overview of the Base Case water quality modelling results in support of the determination of residual Project-related effects is presented in this section.

Overall, the following Project-related effects are predicted to cause residual effects to surface water quality in the Mine Site area:

- Leaching from disturbed mine materials and waste
- Discharge of Camp Site water
- Leaching of nitrogen residues generated from blasting
- Leaching of Heap Leach Facility residues
- Groundwater and surface water interactions and seepage.

Residual effects to surface water quality are not likely to occur along the NAR, or due to erosion and sedimentation, or atmospheric deposition.

Water quality predictions for all modelled scenarios through all phases of the Project are presented in full in **Appendix 12-C Water Balance and Water Quality Model Report**. For the purpose of identifying indicators of residual Project-related effects, predicted maximum monthly values for all parameters at each receiving environment node are presented in **Table 12.6-1** for Project-area creek stations and **Table 12.6-2** for Yukon River stations. Values are compared to the relevant CCME or BC WQG (or trigger range upper limit in the case of phosphorus) and to the Natural (no Project) case. Maximum monthly values for all mine phases are shown (as opposed to the mean or another statistic) to identify all parameters that are predicted to exceed their WQG at any point in the Project's life cycle.

**Table 12.6-1 Summary of Potential Residual Effects for Surface Water Quality**

| | | CC1.5 | | CC3.5 | | Screening Level | CC4.5 | | | HC2.5 | | HC5.0 | | Screening Level | YT24 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Parameter | Unit | Maximum Monthly Concentrations | | Maximum Monthly Concentrations | | | Maximum Monthly Concentrations | | Screening Level | Maximum Monthly Concentrations | | Maximum Monthly Concentrations | | | Maximum Monthly Concentrations | | Screening Level |
| | | Base Case | Natural | Base Case | Natural | WQG | Base Case | Natural | WQG | Base Case | Natural | Base Case | Natural | WQG | Base Case | Natural | WQG |
| Ammonia | mg/L | 0.0342 | 0.0344 | 0.0338 | 0.0343 | 1.63 | 0.0363 | 0.0365 | 1.90 | 0.0432 | 0.0384 | 0.0399 | 0.0399 | 1.91 | 0.030 | 0.030 | 1.91 |
| NO3 | mg/L | 1.04 | 0.35 | 0.810 | 0.567 | 3 | 0.793 | 0.792 | 3 | 4.32 | 0.698 | 2.87 | 0.694 | 3 | 0.699 | 0.700 | 3 |
| NO2 | mg/L | 0.00729 | 0.00500 | 0.0064 | 0.0050 | 0.02 | 0.00521 | 0.00500 | 0.02 | 0.0214 | 0.0050 | 0.0153 | 0.0050 | 0.02 | 0.0050 | 0.0050 | 0.02 |
| SO4 | mg/L | 249 | 249 | 171 | 175 | 309 | 89.0 | 89.0 | 218 | 201 | 100 | 131 | 29.2 | 218 | 39.9 | 40.0 | 218 |
| P | mg/L | 0.0155 | 0.0139 | 0.0151 | 0.0144 | 0.1 | 0.0173 | 0.0173 | 0.1 | 0.0355 | 0.0158 | 0.0247 | 0.0163 | 0.1 | 0.0164 | 0.0147 | 0.1 |
| WADCN | mg/L | 0.00011 | 0.00001 | 0.00008 | 0.00001 | 0.005 | 0.000018 | 0.000010 | 0.005 | 0.00158 | 0.00001 | 0.0010 | 0.0000 | 0.005 | 0.000010 | 0.000010 | 0.005 |
| D-Al | mg/L | 0.261 | 0.265 | 0.256 | 0.270 | 0.05 | 0.312 | 0.315 | 0.05 | 0.268 | 0.282 | 0.281 | 0.291 | 0.05 | 0.0534 | 0.0554 | 0.05 |
| Ag | mg/L | 0.000012 | 0.000012 | 0.000011 | 0.000011 | 0.00025 | 0.0000149 | 0.0000149 | 0.00025 | 0.000018 | 0.000012 | 0.000013 | 0.000006 | 0.00025 | 0.000013 | 0.000012 | 0.00025 |
| As | mg/L | 0.00269 | 0.00180 | 0.00148 | 0.00124 | 0.005 | 0.000717 | 0.000636 | 0.005 | 0.0035 | 0.0016 | 0.00256 | 0.00162 | 0.005 | 0.00634 | 0.00067 | 0.005 |
| Ca | mg/L | 140 | 140 | 93.0 | 95.2 | - | 39.6 | 39.6 | - | 59.8 | 59.8 | 48.5 | 41.9 | - | 40.4 | 30.0 | - |
| Cd | mg/L | 0.000040 | 0.000041 | 0.000040 | 0.000041 | 0.00013 | 0.000040 | 0.000040 | 0.000119 | 0.000027 | 0.000028 | 0.000028 | 0.000029 | 0.00011 | 0.000015 | 0.000009 | 0.00010 |
| Cr | mg/L | 0.000751 | 0.000739 | 0.000742 | 0.000739 | 0.001 | 0.000720 | 0.000720 | 0.001 | 0.00134 | 0.00120 | 0.00127 | 0.00121 | 0.001 | 0.0005 | 0.0005 | 0.001 |
| Cu | mg/L | 0.00252 | 0.00254 | 0.00248 | 0.00253 | 0.002 | 0.00331 | 0.00333 | 0.002 | 0.00281 | 0.00294 | 0.00292 | 0.00302 | 0.002 | 0.0026 | 0.0027 | 0.002 |
| Fe | mg/L | 0.287 | 0.290 | 0.282 | 0.291 | 1.0 | 0.388 | 0.391 | 1.0 | 0.726 | 0.785 | 0.758 | 0.808 | 1.0 | 0.140 | 0.140 | 1.0 |
| Hg | mg/L | 0.000011 | 0.000011 | 0.000011 | 0.000011 | 0.000026 | 0.000011 | 0.000011 | 0.000026 | 0.000012 | 0.000011 | 0.000011 | 0.000011 | 0.000026 | 0.000008 | 0.000008 | 0.000026 |
| Mg | mg/L | 43.9 | 43.9 | 29.5 | 30.2 | - | 13.9 | 13.9 | - | 27.4 | 24.9 | 20.8 | 10.1 | - | 13.0 | 10.0 | - |
| Mn | mg/L | 0.0491 | 0.0492 | 0.0501 | 0.0513 | 0.966 | 0.0284 | 0.0283 | 0.917 | 0.0951 | 0.0564 | 0.0751 | 0.0583 | 0.891 | 0.0230 | 0.0050 | 0.856 |
| Mo | mg/L | 0.00525 | 0.00060 | 0.00318 | 0.00057 | 0.073 | 0.00115 | 0.000811 | 0.073 | 0.0269 | 0.0025 | 0.0174 | 0.0007 | 0.073 | 0.0059 | 0.0005 | 0.073 |
| Ni | mg/L | 0.00159 | 0.00160 | 0.0016 | 0.0016 | 0.082 | 0.00147 | 0.00148 | 0.0737 | 0.00176 | 0.00139 | 0.00158 | 0.00142 | 0.0689 | 0.0015 | 0.0015 | 0.061 |
| Pb | mg/L | 0.000293 | 0.000303 | 0.000295 | 0.000310 | 0.00247 | 0.000274 | 0.000275 | 0.00206 | 0.00031 | 0.00033 | 0.000318 | 0.000332 | 0.00184 | 0.00006 | 0.00006 | 0.0015 |
| Sb | mg/L | 0.00115 | 0.00020 | 0.000653 | 0.000153 | 0.009 | 0.000281 | 0.000226 | 0.009 | 0.00432 | 0.00120 | 0.00284 | 0.000451 | 0.009 | 0.00259 | 0.00040 | 0.009 |
| Se | mg/L | 0.000399 | 0.000399 | 0.000275 | 0.000281 | 0.002 | 0.000133 | 0.000129 | 0.002 | 0.00066 | 0.00016 | 0.00046 | 0.00008 | 0.002 | 0.00021 | 0.00012 | 0.002 |
| Tl | mg/L | 0.000033 | 0.000008 | 0.000021 | 0.000007 | 0.0008 | 0.000009 | 0.000007 | 0.0008 | 0.000146 | 0.000009 | 0.000096 | 0.000008 | 0.0008 | 0.00004 | 0.00001 | 0.0008 |
| U | mg/L | 0.0326 | 0.0319 | 0.0209 | 0.0213 | 0.015 | 0.00672 | 0.00638 | 0.015 | 0.0996 | 0.0996 | 0.0375 | 0.0225 | 0.015 | 0.0146 | 0.0010 | 0.015 |
| Zn | mg/L | 0.00543 | 0.00436 | 0.00497 | 0.00441 | 0.015 | 0.00456 | 0.00449 | 0.018 | 0.0156 | 0.0040 | 0.0107 | 0.0041 | 0.013 | 0.0032 | 0.0014 | 0.011 |

**Notes:** D-Al – dissolved aluminum; mg/L - milligrams per litre; TDS - total dissolved solids; TP - total phosphorous; TSS - total suspended solids; WAD-CN - weak acid dissociable cyanide.

Dark-shaded (Base Case) and light-shaded (Natural Case) cells represent concentrations that exceeds WQG

Base Case model-predicted, mine-affected water quality under expected or base case condition

Natural Case model background case (no mine effect); includes climate change effects

WQG BC WQG or CCME WQG

All metals shown as total fraction. Dissolved guideline for Al shown

Hardness- and pH-dependent guidelines calculated using 25th P of baseline dataset for corresponding station'

**Table 12.6-2 Predicted Maximum Monthly Concentrations for Project-area Yukon River Stations for all Mine Phases**

| Parameter | Unit | YRdsCC4.5 Maximum Monthly Concentrations | | YRdsYT24 Maximum Monthly Concentrations | | YRdsHC5.0 Maximum Monthly Concentrations | | Screening Level |
|---|---|---|---|---|---|---|---|---|
| | | Base Case | Natural | Base Case | Natural | Base Case | Natural | WQG |
| Ammonia | mg/L | 0.0293 | 0.0294 | 0.0260 | 0.0260 | 0.0261 | 0.0261 | 1.02 |
| NO3 | mg/L | 0.143 | 0.128 | 0.100 | 0.100 | 0.164 | 0.101 | 3 |
| NO2 | mg/L | 0.0129 | 0.0129 | 0.0135 | 0.0135 | 0.0136 | 0.0135 | 0.02 |
| SO4 | mg/L | 27.7 | 27.8 | 26.9 | 26.9 | 27.0 | 27.0 | 309 |
| P | mg/L | 0.215 | 0.215 | 0.230 | 0.230 | 0.229 | 0.229 | 0.1 |
| WADCN | mg/L | 0.000837 | 0.000837 | 0.00090 | 0.00090 | 0.00090 | 0.00090 | 0.005 |
| D-Al | mg/L | 0.163 | 0.163 | 0.0508 | 0.0508 | 0.0570 | 0.0584 | 0.05 |
| Ag | mg/L | 0.000039 | 0.000039 | 0.000041 | 0.000041 | 0.000041 | 0.000041 | 0.00025 |
| As | mg/L | 0.00232 | 0.00232 | 0.00246 | 0.00245 | 0.00246 | 0.00245 | 0.005 |
| Ca | mg/L | 31.9 | 31.9 | 31.7 | 31.7 | 31.7 | 31.7 | - |
| Cd | mg/L | 0.00048 | 0.00048 | 0.00052 | 0.00052 | 0.00052 | 0.00052 | 0.00014 |
| Cr | mg/L | 0.00263 | 0.00263 | 0.00278 | 0.00278 | 0.00277 | 0.00277 | 0.001 |
| Cu | mg/L | 0.00776 | 0.00776 | 0.00813 | 0.00813 | 0.00809 | 0.00809 | 0.0035 |
| Fe | mg/L | 3.01 | 3.01 | 3.21 | 3.21 | 3.20 | 3.20 | 1.0 |
| Hg | mg/L | 0.000009 | 0.000009 | 0.000007 | 0.000007 | 0.000007 | 0.000007 | 0.000026 |
| Mg | mg/L | 8.79 | 8.80 | 8.71 | 8.70 | 8.73 | 8.73 | - |
| Mn | mg/L | 0.169 | 0.169 | 0.180 | 0.180 | 0.180 | 0.179 | 0.966 |
| Mo | mg/L | 0.00139 | 0.00139 | 0.00139 | 0.00139 | 0.00155 | 0.00139 | 0.073 |
| Ni | mg/L | 0.00934 | 0.00934 | 0.00995 | 0.00995 | 0.00990 | 0.00990 | 0.086 |
| Pb | mg/L | 0.00226 | 0.00226 | 0.00241 | 0.00241 | 0.00240 | 0.00240 | 0.00266 |
| Sb | mg/L | 0.00155 | 0.00154 | 0.00186 | 0.00185 | 0.00185 | 0.00185 | 0.009 |
| Se | mg/L | 0.00048 | 0.00048 | 0.00049 | 0.00049 | 0.00049 | 0.00049 | 0.002 |
| Tl | mg/L | 0.000030 | 0.000030 | 0.000032 | 0.000032 | 0.000033 | 0.000032 | 0.0008 |
| U | mg/L | 0.00188 | 0.00159 | 0.00133 | 0.00125 | 0.00250 | 0.00160 | 0.015 |
| Zn | mg/L | 0.0351 | 0.0351 | 0.0374 | 0.0374 | 0.0373 | 0.0373 | 0.0135 |

**Notes:** D-Al – dissolved aluminum; mg/L - milligrams per litre TDS - total dissolved solids; TP - total phosphorous; TSS - total suspended solids; WAD-CN - weak acid dissociable cyanide.

Dark-shaded (Base Case) and light-shaded (Natural Case) cells represent concentrations that exceeds WQG
Base Case model-predicted, mine-affected water quality under expected or base case condition
Natural Case model background case (no mine effect; includes climate change effects
WQG BC WQG or CCME WQG
All metals shown as total fraction. Dissolved guideline for Al shown
Hardness- and pH-dependent guidelines calculated using 25th P of baseline dataset for corresponding station

Overall, residual Project-related effects are likely in:

- Latte Creek, from total uranium
- YT-24, from total arsenic.
- Halfway Creek, from nitrate, total uranium and total zinc.

No residual effects are predicted to occur in Coffee Creek, or the Yukon River downstream of Coffee Creek, YT-24, or Halfway Creek confluences.

### 12.6.1 LATTE CREEK

Mine-related contact water is predicted to result in Project-related residual effects to total uranium in Latte Creek. Mitigation measures have been incorporated into the project plan and the water quality model, which decrease the predicted effect measurably following application, however, total uranium levels remain elevated above corresponding WQG or the proposed SSWQO by a small margin for select months of the year, over a limited period of time during the project life. Potential Project-related residual effects to Latte Creek are considered not significant. This rating is assigned a high confidence level based on a high level of certainty in the water quality model predictions and the baseline water quality dataset.

### 12.6.2 YUKON TRIBUTARY 24

Mine-related contact water is predicted to result in Project-related residual effects to total arsenic in YT-24. Mitigation measures have been incorporated into the project plan and the water quality model, which decrease the predicted effect measurably, however, total arsenic levels remain elevated above its corresponding WQG by a small margin for select months of the year, over a limited period of time during the project life.

Therefore, Project-related residual effects from total arsenic to YT-24 are rated not significant. This rating is assigned a high confidence level, given the relative level of certainty in the water quality model predictions and the level of understanding of the Project receiving environment.

### 12.6.3 HALFWAY CREEK

Mine-related contact water is predicted to result in Project-related residual effects to nitrate, total uranium, and total zinc in Halfway Creek. Mitigation measures have been incorporated into the Project plan and the water quality model, decreasing the predicted effect measurably although Base Case predictions for these parameters remain elevated above their corresponding WQGs by a small margin for select months of the year, over a limited period of time during the project life.

Project-related residual effects to Halfway Creek associated with nitrate, total uranium, and total zinc in Halfway Creek are rated as not-significant. This rating is assigned a moderate confidence level. Although there is a high level of certainty in the water quality model predictions, there is uncertainty associated with parameter-specific factors relevant to this assessment.

## 12.7 CUMULATIVE EFFECTS ASSESSMENT

The Project is predicted to cause residual effects in Latte Creek, lower Coffee Creek (below the Latte Creek confluence), YT-24 Creek and Halfway Creek. No residual effects are predicted to occur in Yukon River in association with the Project.

The effects of other projects and activities that have been carried out prior to the Project are reflected in background water quality (i.e. the Natural Case). The only project identified that could potentially cause effects that would interact with the Project's residual effects to surface water quality is further mineral exploration on the Archer, Cathro & Associates Ltd. Dan Man Project, on mineral tenure on the lower reaches of YT-24 and Halfway Creeks. It is possible that additional exploration may be undertaken by the present or future owner of this mineral tenure.

Further exploration activity is expected to create negligible changes to surface water quality. Any changes would be of small magnitude, temporary and localized. No cumulative change is expected to occur as a result of this interaction. Consequently, the cumulative effects assessment for surface water quality concludes that other projects and activities will not contribute to the Project-related residual effects to result in residual cumulative effects.

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GOLDCORP INC.

# VOLUME III

## Biophysical Environment

COFFEE GOLD MINE

PROJECT PROPOSAL FOR EXECUTIVE COMMITTEE SCREENING

Pursuant to the *Yukon Environmental and Socio-economic Assessment Act*

March 2017

## Document Map

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# YESAB PROJECT PROPOSAL


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Photo Credit: Brodie Smith, EDI Environmental Dynamics Inc. (spawning Chum salmon in the Yukon River)

# VOLUME III

# BIOPHYSICAL ENVIRONMENT

# (Binder 1 of 2)

# Coffee Gold Mine
# YESAB Project Proposal

# VOLUME III – BIOPHYSICAL ENVIRONMENT
# Sections 13.0 to 17.0

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| Acronym / Abbreviation | Definition |
|---|---|
| 3D | three-dimensional |
| AAQO | Ambient Air Quality Objectives |
| AAQS | Ambient Air Quality Standards |
| ADR | adsorption, desorption, and recovery |
| AFN | Assembly of First Nations |
| Ag | silver |
| Al | aluminum |
| AN | ammonium nitrate |
| ANFO | Ammonium Nitrate/Fuel Oil |
| APS | Aboriginal Persons Survey |
| ARD | acid rock drainage |
| As | arsenic |
| ATV | all-terrain vehicle |
| Au | gold |
| AWOS | Automated Weather Observation System |
| BC | British Columbia |
| BEM | Broad Ecosystem Mapping |
| BMP | best management practice |
| BNOISE2 | Blast Noise Version 2 |
| C | carbon |
| CAC | criterion air contaminant |
| $CACO_3$ | calcium carbonate |
| CAD | Canadian dollars |
| CAPEX | capital expenditure |
| CBPR | community-based participatory research |
| CCL | compacted clay liner |
| CCME | Canadian Council of Ministers of the Environment |
| Cd | cadmium |
| CEA | Cumulative Effects Assessment |
| CEO | Chief Executive Officer |
| CEPA 1999 | *Canadian Environmental Protection Act, 1999* |
| CESA | Cumulative Effects Study Area |
| CFO | Chief Financial Officer |
| $CH_4$ | methane |

| Acronym / Abbreviation | Definition |
|---|---|
| CIC | carbon-in-carbon |
| CIM | Canadian Institute of Mining |
| CMHC | Canada Mortgage and Housing Corporation |
| CNIM | Centre for Northern Innovation in Mining |
| Co | cobalt |
| CO | carbon monoxide |
| $CO_2$ | carbon dioxide |
| $CO_2e$ | carbon dioxide equivalent |
| $CO_2e/yr$ | carbon dioxide equivalent per year |
| Code | Environmental Code of Practice for Metal Mines |
| Coffee Property | The total property owned by Goldcorp, consisting of all 3.021 contiguous claims in the Coffee Claim Block |
| COPC | contaminant (or chemical) of potential concern |
| COSEWIC | Committee on the Status of Endangered Wildlife in Canada |
| CPI | Consumer Price Index |
| Cr | chromium |
| CRA | Canada Revenue Agency |
| CRC | Consolidated Regulations of Canada |
| CSI | Crime Severity Index |
| Cu | copper |
| CWD | Canadian Wildlife Service |
| Cyanide Code | International Cyanide Management Code |
| CYFN | Council of Yukon First Nations |
| Dawson | City of Dawson |
| DFO | Fisheries and Oceans Canada |
| DNA | deoxyribonucleic acid |
| DO | dissolved oxygen |
| e-DNA | Environmental DNA |
| EASR | Environmental Activity and Sector Registry |
| ECA | Exploration Cooperation Agreement |
| ECCA | Exploration Communication and Cooperation Agreement |
| EEM | effluent effects monitoring |
| ECCC | Environment and Climate Change Canada |
| ELC | Ecological and Landscape Class |
| EMP | Environmental Management Plan |
| EMR | Energy, Mines and Resources |
| EMS | emergency medical services |
| EP-1N | north event pond |

| Acronym / Abbreviation | Definition |
|---|---|
| EP-1S | south event pond |
| EP-2 | event pond 2 |
| EPCM | Engineering, Procurement, and Construction Management |
| ERP | Emergency Response Plan |
| ERT | emergency response team |
| FCASP | Federal Contaminated Sites Action Plan |
| Fe | iron |
| $Fe^{2+}$ | iron II |
| FC-RAA | Fortymile Caribou Regional Assessment Area |
| FIFO | fly in / fly out |
| FMCH | Fortymile Caribou herd |
| FNNND | First Nation of Na-cho Nyäk Dun |
| FRMP | Forest Resources Management Plan |
| FTA | Federal Transport Authorite (U.S.) |
| FTE | full-time equivalent |
| GCL | geosynthetic clay liner |
| GDP | gross domestic product |
| GHG | greenhouse gas |
| GIS | geographic information system |
| g | gravity |
| GMA | Game Management Area |
| GMZ | Game Management Zone |
| Goldcorp | Kaminak Gold Corporation, a wholly owned subsidiary of Goldcorp Inc. |
| GPS | geographic (or global) positioning system |
| HAP | Health Action Plan |
| HCN | hydrogen cyanide |
| H:V | horizontal to vertical |
| HDPE | high-density polyethylene |
| Hg | mercury |
| HHRA | Human Health Risk Assessment |
| HIA | Health Impact Assessment |
| HIV | human immunodeficiency virus |
| HLF | Heap Leach Facility |
| HR | human resources |
| HRIA | Heritage Resources Impact Assessment |
| HROA | Heritage Resources Overview Assessment |
| HRPP | Heritage Resources Protection Plan |

| Acronym / Abbreviation | Definition |
|---|---|
| HSS | Health and Social Services |
| HVAC | heating ,ventilation, and air conditioning |
| IBA | Impact Benefit Agreement |
| IC | Intermediate Component |
| ICSP | Integrated Community Sustainability Plan |
| IFR | Instrument Flight Rules |
| IMS | ice mapping system |
| IO | input-output |
| IPCC | Intergovernmental Panel on Climate Changte |
| IR | Information Request |
| IRR | Internal Rate of Return |
| ITP | inspection and test plan |
| K | Kindergarten |
| Kaminak | Kaminak Gold Corporation |
| KC-RAA | Klaza Caribou Regional Assessment Area |
| KCH | Klaza Caribou herd |
| KCS | Klondike Conservation Society |
| KDO | Klondike Development Organization. |
| LAA | Local Assessment Area |
| LD50 | amount of an ingested substance that causes 50% fatality |
| LLDPE | linear low-density polyethylene |
| LMB | Land Management Branch |
| LMU | Land Management Unit |
| LNG | liquefied natural gas |
| LOM | life-of-mine |
| LSA | Local Study Area |
| LSCFN | Little Salmon / Carmacks First Nation |
| LTECF | Livingstone Trail Environmental Control Facility |
| M | million |
| MAD | mean annual discharge |
| MBCA | *Migratory Birds Convention Act, 1994* |
| MBR | membrane bioreactor |
| MCC | motor control centre |
| MED | marine emergency duties |
| MIHR | Mining Industry Human Resources (Council) |
| ML | metals leaching |
| ML/ARD | metals leaching/acid rock drainage |

| Acronym / Abbreviation | Definition |
|---|---|
| MMER | Metal Mining Effluent Regulations |
| Mn | manganese |
| $Mn^{2+}$ | manganese II |
| Mo | molybdenum |
| MOE | Ministry of Environment |
| MRT | Mine Rescue Team |
| MT | Middle Transitional |
| N | north |
| $N_2O$ | nitrous oxide |
| NaCN | sodium cyanide |
| NAG | non-acid generating |
| NAICS | North American Industrial Classification System |
| NAR | Northern Access Route |
| NBCC | National Building Code of Canada |
| NE | northeast |
| NFPA | National Fire Protection Association |
| $NH_3$ | ammonia |
| NHS | National Household Survey |
| Ni | nickel |
| $NO_2$ | nitrogen dioxide |
| $NO_3$ | inorganic nitrate |
| $NO_x$ | nitrogen oxides |
| NOC | National Occupational Classification |
| NPAG | non-potentially acid generating |
| NPI | National Pollution Inventory |
| NPISH | Non-profit Institutions Serving Households |
| NPRI | National Pollutant Release Inventory |
| NPV | net present value |
| NRCan | Natural Resources Canada |
| NTS | National Topographic System |
| NW | northwest |
| NWP | Navigable Protection Program |
| NWT | Northwest Territories |
| OCP | Official Community Plan |
| ODALS | Omni-directional Approach Lighting System |
| OGC | Oil and Gas Commission |
| OIC | Order-in-Council |

| Acronym / Abbreviation | Definition |
|---|---|
| OPEX | operational expenditures |
| OX | oxide |
| PAG | potentially acid generating |
| Pb | lead |
| PGA | peak ground acceleration |
| PEA | preliminary economic assessment |
| PGS | peak ground acceleration |
| PHA | Permit Hunt Authorization |
| PLC | programmable logic controller |
| PM | particulate matter |
| $PM_{2.5}$ | fine particulate matter of 2.5 microns or less |
| $PM_{10}$ | fine particulate matter of 10 microns or less |
| PMP | probable maximum precipitation |
| PPE | personal protective equipment |
| Project | proposed Coffee Gold Mine |
| Proponent | Kaminak Gold Corporation, a wholly owned subsidiary of Goldcorp Inc. |
| PSL | permissible sound level |
| PWGSC | Public Works and Government Services Canada |
| PYLL | potential years of life lost |
| Q1 | first quarter |
| Q2 | second quarter |
| Q3 | third quarter |
| Q4 | fourth quarter |
| QA/QC | quality assurance / quality control |
| QMA | *Quartz Mining Act* |
| QML | Quartz Mining Licence |
| QMS | quality management system |
| RAA | Regional Assessment Area |
| RCMP | Royal Canadian Mounted Police |
| ROM | run-of-mine |
| RISC | Resource Inventory Standards Committee |
| RPP | Registered Professional Planner |
| RSA | Regional Study Area |
| RSS | Robert Service School |
| RSY | Revised Statutes of Yukon |
| RTC | Registered Trapping Concession |
| S | south |

| Acronym / Abbreviation | Definition |
|---|---|
| $S^{2-}$ | sulfide |
| SARA | *Species at Risk Act* |
| Sb | antimony |
| SDR | systematic data recovery |
| SE | southeast |
| Se | selenium |
| SEEA | socio-economic effects assessment |
| Sea Can | 20-foot shipping container |
| SEMS | Sustainability Excellence Management System |
| SFN | Selkirk First Nation |
| SGA | Self Governing Agreement |
| SLRA | Screening-level Risk Assessment |
| SI | International System of Units |
| SNAP | Scenarios Network for Alaska and Arctic Planning |
| $SO_2$ | sulphur dioxide |
| $SO_4$ | sulfate |
| SOR | Statutory Orders and Regulations |
| SOVA | School of Visual Arts |
| STI | sexually transmitted infection |
| STP | sewage treatment plant |
| SW | southwest |
| SY | Statutes of Yukon |
| SU1 | Supremo Phase 1 |
| SU2 | Supremo Phase 2 |
| SU3 | Supremo Phase 3 |
| SU3N | Supremo Phase 3 North |
| SU4N | Supremo Phase 4 North |
| SU4S | Supremo Phase 4 South |
| SU5N | Supremo Phase 5 North |
| SU5S | Supremo Phase 5 South |
| T-Cd | Total cadmium |
| T-Cr | Total |
| TB | tuberculosis |
| TDGA | *Transportation of Dangerous Goods Act* |
| TH | Tr'ondëk Hwëch'in |
| TIA | tailings impoundment area |
| TLUS | Traditional Land Use Study |

| Acronym / Abbreviation | Definition |
|---|---|
| TK | Traditional Knowledge |
| TR | technical report |
| TS-RAA | Thinhorn Sheep Regional Assessment Area |
| TSP | total suspended particulate |
| TSS | total suspended solids |
| TWG | Technical Working Group |
| U | uranium |
| UFA | Umbrella Final Agreement |
| UNESCO | United Nations Educational, Scientific, and Cultural Organization |
| U.S. | United States |
| USGS | United States Geological Survey |
| UT | Upper Transitional |
| UTM | Universal Transverse Mercator |
| UV | ultraviolet |
| VBY | Volunteer Bénévoles Yukon |
| VC | Valued Component |
| VKT | vehicle kilometres travelled |
| VLP | valley leach pad |
| VOC | volatile organic compound |
| VP | Vice President |
| WBM | water balance model |
| WGH | Whitehorse General Hospital |
| WHO | World Health Organization |
| WQG | water quality guidelines |
| WRFN | White River First Nation |
| WRSF | Waste Rock Storage Facility |
| WSC | Water Survey of Canada |
| WUL | Water Use Licence |
| YBS | Yukon Bureau of Statistics |
| YDA | Dawson City Airport |
| YEC | Yukon Energy Corporation |
| YESAA | *Yukon Environmental and Socio-economic Assessment Act* |
| YESAB | Yukon Environmental and Socio-economic Assessment Board |
| YG | Government of Yukon |
| YGED | Yukon Government Economic Development |
| YHC | Yukon Housing Corporation |
| YOMS | Yukon Occupational Modelling System |

| Acronym / Abbreviation | Definition |
|---|---|
| YT-24 | Yukon Tributary 24 (unnamed tributary) |
| YWB | Yukon Water Board |
| YWCHSB | Yukon Workers Compensation Health and Safety Board |
| YXY | Eric Nielsen Whitehorse Airport |
| Zn | zinc |

## SYMBOLS, AND MEASUREMENTS

| Symbol/Unit of Measure | Definition |
|---|---|
| µ | microgram |
| µg/g ww | micrograms per gram wet weight |
| µg/L | micrograms per litre |
| µS/cm | micro Siemens per centimetre |
| dB | decibel |
| dBA | A-weighted decibel |
| dBL | linear (unweighted) decibel |
| ft. | feet |
| g | gram |
| g/L | grams per litre |
| g/t | grams per tonne |
| ha | hectare |
| hr | hour |
| Hz | Herz |
| kg | kilogram |
| km | kilometre |
| km/hr | kilometres per hour |
| $km^2$ | square kilometres |
| kPA | kilopascal |
| kt | kilotonne |
| kW | kilowatt |
| L | litre |
| $L_{eq}$ | energy-averaged, A-weighted sound level for a complete time period |
| $L_P$ | Sound pressure level |
| $L_{peak}$ | maximum value reached by the sound pressure |
| L/s | litres per second |
| $L/s/km^2$ | litres per second per square kilometre |
| $L_W$ | sound power level |

| Symbol/Unit of Measure | Definition |
|---|---|
| m | metre |
| $m^2$ | square metre |
| $m^3$ | cubic metre |
| $m^3$/day | cubic metres per day |
| $m^3$/hr | cubic metres per hour |
| $m^3$/s | cubic metres per second |
| M | million |
| masl | metres above sea level |
| mg | milligram |
| mg/km | milligrams per kilometre |
| mg/L | milligrams per litre |
| ML | million litres |
| mm | millimetre |
| mm/yr | millimetres per year |
| $Mm^3$ | million cubic metres |
| M oz. | million ounces |
| Mt | million tonnes |
| Mt/a | million tonnes per annum |
| MW | megawatt |
| No. | number |
| oz. | ounce |
| ppb | parts per billion |
| ppm | parts per million |
| s | second |
| sq. mil. | square mile |
| t | tonnes |
| tpd | tonnes per day |
| V | volt |

# 13.0 INTRODUCTION TO BIOPHYSICAL ENVIRONMENT

**Volume III** Biophysical Environment presents the detailed analysis of the biophysical environment Intermediate Components (ICs), and the effects assessments conducted for the biophysical environment Valued Components (VCs). This section provides an overview of the process for the selection of the ICs and VCs representing the biophysical environment of the proposed Coffee Gold Mine (Project).

## 13.1 ISSUES SCOPING

Information and issues regarding the biophysical components in the Project area were identified based on input provided during consultation and engagement, reviews of technical literature, and baseline studies conducted for the Project. Kaminak Gold Corporation, a wholly owned subsidiary of Goldcorp Inc. (Goldcorp or Proponent) has undertaken an engagement and consultation process, as defined under section 50 (3) of the *Yukon Environmental and Socio-economic Assessment Act*, SC 2003, c. 7, to support the scoping of issues for the Project (Refer to **Section 3.0 Consultation** for detail on the Project's consultation program).

### 13.1.1 FIRST NATIONS

A review of available Traditional Knowledge (TK) for the Project area was central to the issues scoping process. The Project footprint overlaps with the asserted territory or established traditional territories of the following First Nations:

- Tr'ondëk Hwëch'in (TH)
- Selkirk First Nation (SFN)
- First Nation of Na-cho Nyäk Dun (FNNND)
- White River First Nation (WRFN).

The initial assessment of available TK confirmed the recognition that flora and fauna resources are inextricably linked; furthermore, the maintenance and protection of these resources are highly important to people and biota (fish, wildlife, and plants) alike. The Project area is representative of a relatively pristine environment because it is far from any existing industrial or urban area and has remained relatively untouched by development, with the exception of some previous placer mining activities.

For all First Nations, general concerns have been raised that the contamination of water may in turn lead to the contamination of plants, fish, and animals that drink or live around the water if Project activities result in contamination of surrounding land and waterways (Bates and DeRoy 2014). The watercourses intersecting the Project footprint drain directly to the Yukon River, likely the most important water body in Yukon and a key component of all salmon fisheries in Yukon. Many First Nations people interviewed about the Project have mentioned the importance of the Coffee Creek corridor and the salmon runs that it supports to their people. In particular, concerns have been expressed regarding potential effects to a number of fish species including Chinook Salmon (*Oncorhynchus tshawytscha*), Chum Salmon (*O. keta*), Arctic Grayling (*Thymallus arcticus*), Burbot (*Lota lota*), and other aquatic biota.

Concerns have also been raised regarding disturbance to animals and recreational areas where camping and cultural gatherings typically take place, and reduced traditional harvesting activities due to local reductions in quality and quantity of game, fish, and plants. It was noted that "…all species and habitats play an important role in ecological function…[TH] does have specific concerns about some key species and habitats." (N. Becker, Personal Communications 2016) These concerns include effects to wetland habitats, habitats associated with rare plants, the spread of invasive plant species, and the risk of wildfire. Consultation and engagement activities have also highlighted concerns about potential effects on vegetation health as a result of Project emissions and dust deposition, and stress the importance of considering Project-related effects on traditional and medicinal plants.

Throughout the consultation and engagement process, potential effects to wildlife have been raised as a key concern. One of the most commonly raised concerns about wildlife has focused on potential effects to the Fortymile Caribou (*Rangifer tarandus*) herd, identified as a concern due to the recent population recovery and re-establishment of previously abandoned winter range in the Project area. Another common concern is the possibility that the proposed Northern Access Route (NAR) may contribute to increased harvest in the region, particularly for Moose (*Alces alces*). Other issues and concerns raised in relation to potential effects of the Project on Wildlife include: habitat loss, fragmentation, sensitive timing and locations, increased mortality, and behavioural disturbances. Meetings have included discussions of birds and bird habitat and the inclusion of passerines, Sharp-tailed Grouse (*Tympanuchus phasianellus*), cliff-nesting raptors, and at-risk bird species in the assessment. During these meetings, concerns were also raised about potential Project-related effects to game birds (i.e., waterfowl, grouse, ptarmigan), which are identified as an important part of subsistence harvesting (Mishler and Simeone 2004; TH 2012; Bates and DeRoy 2014).

Specific issues and concerns raised by each First Nation are listed below.

#### *13.1.1.1 Tr'ondëk Hwëch'in*

The following biophysical values (e.g., species and focal areas of importance) have been noted for importance to TH during consultation and engagement activities (see **Section 3.0 Consultation** for the full consultation record):

- Adult salmon and salmon spawning in the vicinity of the Project area, including for Chinook and Chum Salmon was identified as an important value. Arctic Grayling was also identified as an important species.
- Important vegetation species include Blueberries, Kinnikinnick (Bearberry), Crowberry, and Labrador Tea, Blackcurrant, Raspberries, High bush Cranberries, Low Bush Cranberries, and Strawberries and Caribou Moss.
- The use of the Coffee Creek area as an important hunting area for a range of species including Moose, Porcupine, Beaver, Fortymile Woodland Caribou, wolves, bears, Thinhorn Sheep and Ptarmigan.

#### *13.1.1.2 Selkirk First Nation*

The following biophysical values (e.g., species and focal areas of importance) have been noted for importance to SFN during consultation and engagement activities (see **Section 3.0 Consultation** for the full consultation record):

- A range of fish species and fish habitat were identified as important, including Chinook Salmon and Chum salmon, and Arctic Grayling.
- Important vegetation species and resources include Spruce pitch, Labrador Tea and harvest berries.
- The use of the Coffee Creek area was identified as an important hunting area for a range of species including Moose, Caribou, Mountain Sheep, Beaver, and Black Bear.
- Important bird species and groups identified include Waterfowl, Ducks, Geese, Swans, Sandhill Cranes, Ptarmigan, Blue Grouse, Ruffled Grouse and Sharptail Grouse

#### *13.1.1.3 First Nation of Na-cho Nyäk Dun*

The following biophysical values (e.g., species and focal areas of importance) have been noted for importance to FNNND during consultation and engagement activities (see **Section 3.0 Consultation** for the full consultation record):

- A range of fish species and fish habitat were identified as important, including Arctic Grayling, Chinook Salmon, Chum Salmon, Trout, Whitefish, Northern Pike (Esox lucius), and Inconnu (Stenodus nelma); the importance of the Stewart River was noted.
- Important vegetation species and resources include Low-bush Cranberries, Blueberries, Black Currents, Raspberries, Stone Berries, High Bush Cranberries, Yarrow, Spruce, Pine, Balsam, Labrador Tea, Caribou Horn (lichen), Puffballs (fungi), Bear Root, Spruce gum.
- Important wildlife and bird species include Moose, Caribou, Sheep Deer, small game, bear (both Grizzly and Black), Ptarmigan, Grouse, and ducks.

#### *13.1.1.4 White River First Nation*

The following biophysical values (e.g., species and focal areas of importance) have been noted for importance to WRFN during consultation and engagement activities (see **Section 3.0 Consultation** for the full consultation record):

- A range of fish species were identified as important, including Arctic Grayling, Lingcod (also known as Burbot), Northern Pike, Trout, and Whitefish.
- Important vegetation species and resources include Blackberry, Blueberry, High Bush Cranberry, Low Bush Cranberry, Raspberry, Soapberry, Salmonberries, Bear Root, Caribou Horn, Caribou Leaf, Fireweed, Labrador Tea, various Mushrooms, Pineapple Weed, Spruce gum, and Wild Rhubarb.
- Important wildlife and bird species include Beaver, Moose, Porcupine, Rabbit, Thinhorn Sheep, Caribou, bear (both Grizzly and Black), Wolf, Duck, Goose, Grouse, and Ptarmigan.

### 13.1.2 Affected Communities, Interested Parties, and the Public

During consultation with affected communities and interested parties, the following key issue has been raised by stakeholders: increased traffic, increased access, wildlife disturbance, and hunting access related to the upgrade of the NAR

Concerns around the proposed NAR include the increased traffic, opening up of land to year-round access and the resultant potential increase in harvesting activities, and disturbance to wildlife (e.g., directly mortality resulting from vehicle strikes).

### 13.1.3 Government Agencies

With respect to the components of the biophysical environment that should be included in an assessment, the Yukon Environment and Socio-economic Assessment Board provides the following guidance:

> Vegetation is valued for many reasons, including but not limited to aesthetics, wildlife habitat, various uses as a renewable resources, and diverse ecological processes. Where valued, the loss of vegetative cover can be a concern in Yukon regions, since recovery is slow due to short growing seasons and low annual production of nutrients. Vegetation, ecological processes and functions, as well as composition should be considered as potential VCs wherever these may be affected. (YESAB 2005)
>
> Wildlife species are valued as important ecological components, for aesthetic and cultural reasons, and as a food source, among other reasons. The extent to which the proposed project may affect local wildlife, either directly or indirectly, should be thoroughly evaluated by the proponent, due to the high level of value typically associated with these components. Sensitive species and/or habitats especially should be given consideration as VCs. (YESAB 2005)

During consultation with government agencies, Environment Yukon expressed concerns regarding potential Project-related effects on rare plants (M. Suitor, Personal Communications, 2015) and wildlife, particularly moose and caribou. Discussions with Environment Canada outlined concerns related to potential effects on nesting birds, effects on wetlands and wetland-associated species, and effects on bird Species at Risk, bird species identified as priority species, and migratory birds (Environment Canada, Personal Communication, 2015).

During consultation with government agencies, the following key issues were raised:

- Wildlife issues regarding wildlife interacting with the Project Mine Site and with the NAR
- Potential effects to the Fortymile Caribou herd (*Rangifer tarandus grantii*), due to the recent population recovery and re-establishment of previously abandoned winter range in the north and central Yukon
- Broad-ranging interests related to the NAR, from maintenance responsibilities to effects on fish and wildlife, and access control
- Water quality and effects to fish, given the Project drains directly into the Yukon River.

In addition, the regulatory framework applicable to the Project also contributed to issues scoping. This framework is described at a high-level below.

#### *13.1.3.1 Regulatory Framework*

At a federal level, the *Yukon Act* gives authority to the Yukon Legislature to make laws in relation to the conservation of wildlife and its habitat within Yukon, other than in a federal conservation area. The *Yukon Environmental and Socio-economic Assessment Act* gives authority and rules to YESAB to administer the assessment process that applies to all lands within Yukon

The *Species at Risk Act* (SARA) implements in part Canada's obligations under the United Nations Convention of Biological Diversity. It provides for the legal protection of wildlife species and the conservation of their biological diversity. Under SARA, COSEWIC, an independent body of experts, is responsible for identifying and assessing plant and wildlife species considered at risk, which may then qualify for legal protection and recovery under SARA.

The *Canadian Wildlife Act* allows for the creation, management and protection of wildlife areas to preserve habitats, and to permit wildlife research and interpretive activities. There are no such protected areas within the Wildlife and Wildlife Habitat RAAs. Lastly, the Convention on Wetlands (Ramsar Convention, 1971) commits the federal government to maintain the ecological character of wetlands of international importance and to plan for the sustainable use of all wetlands.

Migratory birds are protected under the *Migratory Birds Convention Act, 1994* (MBCA), which aims to protect and conserve migratory birds (as individuals and populations) and their nests. A migratory bird is defined as any bird included in Article I of the MBCA including the sperm, embryos, eggs, tissue cultures, and parts of a bird (ECCC 2016).

There are a number of sections of the Fisheries Act that govern development activities and are applicable to the Project:

- Section 20 – Fishway Passage and Obstruction –outlines the requirement to ensure free passage of fish by ensuring any and all appropriate tools to manage obstructions, and prevent harm to fish that result from the Project.
- Section 35 – Serious Harm to a Fishery –refers to a restriction of any work or activity that may result in serious harm to fish that are part of a commercial, recreational or Aboriginal CRA) fishery, or fish that support such a fishery. This applies to Chinook Salmon, Chum Salmon and Arctic Grayling in the LAA.
- Section 36 – Pollution to Fish Habitat – Refers to restrictions on the deposition of deleterious substances in water frequented by fish.

Territorial legislation of relevance to the Project includes the *Environment Act* (RSY 2002, c.50), which provides for the protection of land, water, and air, including natural resource planning and management, and conservation easements for conserving and enhancing vegetation communities that provide habitat for wildlife.

## 13.2 SELECTION OF VALUED COMPONENTS

The study team used the information provided during the Project's issues scoping process to identify candidate VCs and ICs based on their presence in the study area, their potential to interact with and be affected by the Project, and their importance to government, First Nations, local communities, interested parties, and the public.

### 13.2.1 FISH AND FISH HABITAT

Fish and Fish Habitat, was selected as a candidate VC for social, biological, and environmental assessment best practice procedures. Fish and fish habitat are protected under the *Fisheries Act.* Fish and Fish Habitat are of primary importance to the local First Nations and other local Yukon residents (**Section 13.1**). Fish species, including Arctic Grayling, Chinook Salmon, Chum Salmon, Burbot, Northern Pike, and multiple species of Whitefish are of traditional and cultural importance. These species provide a valued food source, are of recreational value, and, in the case of the two salmon species, also have commercial value. These species in turn rely on the health and integrity of their surrounding environment to grow and thrive. The environmental components important to the health of fish species include habitat, water, and sediment quality, as well as the presence of benthic invertebrate and phytoplankton populations that provide food sources for the fish species.

A number of other candidate VCs were considered for assessment of aquatic features of the biophysical environment including individual fish species, aquatic biota, and fish and fish habitat. There are distinct interactions between the Project activities and the aquatic environment including aquatic biota and ultimately the fish species that use the stream habitats adjacent to (i.e., the NAR) or downstream of Project infrastructure (i.e., the Mine Site). Candidate VCs that were considered but ultimately rejected from the assessment included Slimy Sculpin (*Cottus cognatus*) due to the species having no noted significant cultural or fisheries value; as well, potential pathways are similar to other species selected for assessment, and the assessment of effects for these species should be consistent with any effects to Slimy Sculpin. As well Whitefish, Northern Pike, and Burbot were considered for assessment, but were similarly rejected because potential pathways of effect are similar to other species selected for assessment that are more prevalent in the area.

Aquatic ecosystems are heavily interconnected, and therefore the selection of a broad, more encompassing VC such as fish and fish habitat assumes that effects to other resident aquatic species and components (e.g., benthic invertebrate and periphyton communities) are indirectly considered as part of the pathway of effects to the ultimate receptors of those effects. The selection of Fish and Fish habitat as the VC allows a focused assessment that best addresses the potential effects of Project interactions with key fish species, and properly considers aquatic biota with respect to the overall health of valued fish species and populations. It is also addresses the broad interests of First Nations, regulators, stakeholders and community members that have been expressed during consultation about the Project.

Fish and Fish Habitat was selected as a VC for the Project, with three subcomponents selected to focus the effects assessment on specific effects of likely interactions and issues of interest: Arctic Grayling, Chinook Salmon, and Chum Salmon (**Table 13.2-1**). These species were selected as subcomponents based on regulatory consultation, community engagement, consultation with First Nations, and review of similar environmental assessments.

The assessment of effects on Fish and Fish Habitat has linkages as a receptor VC to the assessments of Groundwater (**Section 7.0**), Surface Hydrology (**Section 8.0**), Air Quality and Greenhouse Gas Emissions (**Section 9.0**), and Surface Water Quality (**Section 12.0**); and as a pathway VC to Social Economy (**Section 21.0**), Land and Resource Use (**Section 24.0**), and Community Health and Well-being (**Section 25.0**).

#### 13.2.2 VEGETATION

Vegetation was identified as a candidate VC because the Project occurs in a vegetated area of Yukon's boreal forest; as well, the Project may result in direct effects to vegetation through clearing, and in indirect effects to vegetation from dust deposition, surface water quality changes in wetland communities, and spread of invasive species. Vegetation forms an importation component of wildlife habitat, and during consultation was identified as important to First Nations, regulators, and to Yukon's Conservation Data Centre. All First Nations indicated concern over effects to multiple traditional and/or medicinal plant species (**Section 13.1**), as well as concern over the effects caused to native plant communities by the spread of invasive species. Vegetation is recommended for inclusion in an environmental assessment by YESAB. Environment Yukon expressed concerns regarding potential Project-related effects on rare plants. Environment Canada also outlined concerns related to potential effects on wetlands and wetland-associated species (**Section 13.1**).

Vegetation was selected as a VC, with five vegetation subcomponents to provide a comprehensive and focused assessment of the Vegetation VC, including: ecological communities, wetland communities, traditional and medicinal plants, rare plants, and vegetation health (**Table 13.2-1**). Potential effects to vegetation concerns associated with plant health and invasive plant species have been assessed within the Vegetation VC assessment (**Appendix 15-B**).

The assessment of effects on Vegetation has linkages as a receptor VC to the assessments of Air Quality and Greenhouse Gas Emissions (**Section 9.0**), Surficial Geology, Terrain and Soils (**Section 11.0**), Surface

Water Quality (**Section 12.0**); and as a pathway VC to Wildlife and Wildlife Habitat (**Section 16.0**), Birds and Bird Habitat (**Section 17.0**), Social Economy (**Section 21.0**), Land and Resource Use (**Section 24.0**), and Community Health and Well-being (**Section 25.0**).

#### 13.2.3 WILDLIFE AND WILDLIFE HABITAT

Wildlife and Wildlife Habitat was identified as a candidate VC due to the presence of multiple wildlife species within the Project area; as well, the Project may result in effects to wildlife and their habitat including habitat loss and reduced habitat effectiveness, sensory disturbance, and alteration of movement. Consultation activities with all First Nations identified the importance of various wildlife species harvested as a food source or for their furs, including Caribou, Moose, Sheep, Bear, Wolf (*Canis lupus*), Wolverine (*Gulo gulo*), Canada lynx (*Lynx canadensis*), Fox, Porcupine (*Erethizon dorsatum*), Marten (*Martes americana*), Mink (*Neovison vison*), Ermine (*Mustela ermine*), Beaver (*Castor canadensis*), Muskrat (*Ondatra zibethicus*), River Otter (*Lontra canadensis*), Snowshoe Hare (*Lepus americanus*), and gopher/ground squirrel (*Spermophilus parryii*). Many of these species are reported to have been previously and/or currently harvested within the Coffee Creek area and other parts of the proposed Project footprint. As well, some wildlife species that have the potential to occur in the Project area are listed under SARA and COSEWIC. Wildlife and wildlife habitat is recommended for inclusion in an environmental assessment by YESAB. Environment Yukon expressed concerns regarding potential Project-related effects on wildlife, particularly moose and caribou (**Section 13.1**).

Multiple candidate VCs were considered but were ultimately rejected for a range of reasons, including the limited nature of Project interactions with the species, abundance of habitat available to the species in the RAA, the absence of any conservation concern for the species, and the effects to the species being considered under the assessment of another. Candidate VCs that were considered but ultimately rejected included:

- Nelchina Caribou herd because if present, Nelchina Caribou are only expected to interact with the Project in the winter infrequently and in low numbers, effects to Nelchina Caribou are considered under those to Fortymile Caribou
- Mule Deer because Project interaction with these habitats is expected to be very limited
- Species at risk because species at risk that are likely to interact with the Project are treated as individual subcomponents, not as a group
- Black Bear because they are relatively common in the area and can be found in a wide range of habitat types throughout the RAA, and effects are mitigated through standard best management practices
- Grey Wolf because Wolves are not considered a Species at Risk and are relatively abundant
- Coyote/ Red Fox/ Canada Lynx because several larger furbearers are present in the Project area, and effects are mitigated through standard best management practices

- American Marten (and other economic furbearing species) because none of these species are considered a Species at Risk, and Project interactions are expected to be minimal
- Aquatic Mammals (Beaver, Muskrat, River Otter) because none of these species are considered Species at Risk and Project interactions are expected to be minimal
- Collared Pika because baseline surveys did not locate Pika within 10 kilometres (km) of the Project footprint, and Project interactions will be minimal
- Other small mammals (Porcupine, Snowshoe Hare, Squirrels, Mice, Voles) because none of these species are considered Species at Risk and effects to these species can be captured through a quantification of general habitat loss
- Amphibians because the only amphibian species expected in the Project area is the Wood Frog (*Lithobates sylvaticus*), which is widespread throughout the Yukon although potential for the Project to interact with their habitat is minimal
- Terrestrial Insects because based on known ranges, no species listed under SARA have potential to be found in the Project area and no concerns have been raised during consultation activities.

Wildlife and Wildlife Habitat was selected as a VC, with seven subcomponents to provide a comprehensive and focused assessment of the Wildlife and Wildlife Habitat VC: Fortymile Caribou, Klaza Caribou, Moose, Thinhorn Sheep, Grizzly Bear, Wolverine, and Little Brown Myotis (**Table 13.2-1**).

An assessment on the effects on Wildlife and Wildlife Habitat has linkages a receptor VC to the assessments of Air Quality and Greenhouse Gas Emissions (**Section 9.0**), Noise (**Section 10.0**), Surface Water Quality (**Section 12.0**), and Vegetation (**Section 15.0**); and as a pathway VC to Social Economy (**Section 21.0**), Land and Resource Use (**Section 24.0**), and Community Health and Well-being (**Section 25.0**).

### 13.2.4 BIRDS AND BIRD HABITAT

Birds and Bird Habitat was selected as a candidate VC because of potential Project-related effects to individuals, populations, and bird habitats; as well, the Project may result in effects to birds and their habitat including habitat loss and reduced habitat effectiveness, mortality risk, contaminant uptake, and damage or destruction to nests. Consultation activities with all First Nations identified the importance of game birds (e.g., ptarmigan, grouse, ducks) as a subsistence and economic resource, and for their intrinsic value as a symbol of wilderness and a healthy ecosystem. Available TK identified the importance of subsistence harvesting for smaller game such as ducks, geese, swans, grouse, and ptarmigan. Birds and their associated habitats are also important because some species have been identified as Species at Risk and must be assessed where potential Project-related effects can occur (SARA, subsection 79). In addition, migratory birds are protected under the *Migratory Birds Convention* Act*, 1994*, SC 1994, c. 22, and associated regulations, which are in place to protect and conserve migratory birds (as individuals and populations), their eggs, and their nests (**Section 13.1**).

Multiple candidate VCs were considered but were ultimately rejected for a range of reasons, including the limited nature of Project interactions with the species, abundance of habitat available to the species in the RAA, the absence of any conservation concern for the species, and the effects to the species being considered under the assessment of another. Candidate VCs that were considered but ultimately rejected included:

- Species at Risk because species at risk cohorts that are likely to interact with the Project are treated as individual subcomponents, not as a group
- Game birds because the range of habitat requirements for game birds is not practical to assess as a VC, cohorts are assessed as individual subcomponents
- Bird Conservation Region 4 Priority Species the range of habitat requirements for game birds is not practical to assess as a VC, cohorts are assessed as individual subcomponents.

Birds and Bird Habitat was selected as a VC, with six subcomponents to provide a comprehensive and focused assessment of the Wildlife and Wildlife Habitat VC: Sharp-tailed Grouse, cliff-nesting raptors, passerines, upland-associated Species at Risk, wetland-associated Species at Risk, and Bank Swallow (*Riparia riparia*) (**Table 13.2-1**). Together, the subcomponents are considered representative of the likely range of species of birds occurring in the Project area.

An assessment on the effects on Birds and Bird Habitat has linkages as a receptor VC to the assessments of Air Quality and Greenhouse Gas Emissions (**Section 9.0**), Noise (**Section 10.0**), Surface Water Quality (**Section 12.0**), and Vegetation (**Section 15.0**); and as pathway VC to Social Economy (**Section 21.0**), Land and Resource Use (**Section 24.0**), and Community Health and Well-being (**Section 25.0**).

### 13.2.5 SUMMARY

A summary of the VCs and ICs for the biophysical environment volume is shown in **Table 13.3-1**

### Table 13.2-1 Summary of Biophysical Valued Components and Subcomponents

| Valued Component | Subcomponent | Representative of | Selection Rationale |
|---|---|---|---|
| Fish and Fish Habitat | Arctic Grayling | Non-salmonid; recreational fish species | Widespread in LAA; important recreational fish species |
| | Chinook Salmon | Salmonids; juvenile and adult | Importance to local First Nations, present as juveniles in LAA, and may return to area to spawn |
| | Chum Salmon | Salmonids; adult | Importance to local First Nations and may return to area to spawn |
| Vegetation | Ecological Communities | Vegetation abundance found in proximity to the Project | Cultural importance, regulator and First Nation interest, potential for interaction with clearing and construction within the Project footprint, and potential changes in plant composition and possible loss of native plant species due to introduction of invasive species |
| | Wetland Communities | Sensitive ecosystems | Regulator and First Nation interest and potential for interaction with clearing and construction within the Project footprint |
| | Traditional and Medicinal Plants | Harvestable plants of cultural importance to First Nations | Goldcorp commitment to TH TWG (**Section 32.0 Project Design Measures and Commitments**) and potential for interaction with clearing and construction within the Project footprint |
| | Rare Plants | Species at Risk or Yukon Watch-list species found in proximity to the Project | Species at Risk, and regulator and First Nation interest |
| | Vegetation Health | Possible response to changes in habitat due to an increase in available trace metals and possible changes in plant community composition due to increase in dust deposition | Potential interaction with Project activities that increase dust deposition on plants in the LAA and RAA, and First Nation interest |
| Wildlife and Wildlife Habitat | Fortymile Caribou | Ungulates, migratory | Migratory ungulate, culturally important species, recovering population, and regulator interest |
| | Klaza Caribou | Ungulates, non-migratory | Species at Risk, culturally important species, non-migratory, and regulator interest |
| | Moose | Ungulates | Important harvest species, culturally important, and regulator interest |
| | Thinhorn Sheep | Mountain ungulate | Culturally important and regulator interest |
| | Grizzly Bear | Omnivore | Culturally important and regulator interest |
| | Wolverine | Furbearer / carnivore | Proposed Species at Risk; regulator interest |
| | Little Brown Myotis | Small mammals | Species at Risk |

| Valued Component | Subcomponent | Representative of | Selection Rationale |
|---|---|---|---|
| Birds and Bird Habitat | Sharp-tailed Grouse | Upland game birds | Considered representative of upland game birds, Project-related activities will interact with their breeding habitats (i.e., leks) and sensitivity to disturbance around leks during the spring breeding period (particularly females) |
| | Cliff-nesting raptors | Cliff-nesting raptors (Peregrine Falcon, Golden Eagle, and Gryfalcon) | Peregrine Falcons, Golden Eagles, and Gyrfalcons were considered representative of cliff-nesting raptors, Peregrine Falcon is a species of Special Concern under SARA and COSEWIC, Peregrine Falcons and Golden Eagles are migratory birds protected under the MBCA 1994.<br>Peregrine Falcons, Golden Eagles, and Gyrfalcons are habitat specialists that have established long-term nest sites in specific habitats (i.e., cliffs) within and near Project infrastructure.<br>Peregrine Falcon and Golden Eagle nest sites have been found in the RAA. |
| | Passerines | Overall songbird diversity potential | Songbirds are migratory birds protected under the MBCA 1994.<br>Passerines were considered representative of overall songbird diversity potential within the Project area. |
| | Upland-associated Species at Risk | All species of upland associated birds (Common Nighthawk, Olive-sided Flycatcher, and Short-eared Owl) | Common Nighthawks and Olive-sided Flycatchers are Threatened Species under SARA and COSEWIC, Short-eared Owl is a species of Special Concern under SARA and COSEWIC, and many species are migratory birds protected under the MBCA 1994. |
| | Wetland-associated Species at Risk | All species of wetland associated birds (focal species: Horned Grebe, Red-necked Phalarope, and Rusty Blackbird) | Horned Grebe and Red-necked Phalarope are species of Special Concern under COSEWIC, Rusty Blackbird is a species of Special Concern under SARA and COSEWIC, and many species are migratory birds protected under the MBCA. |
| | Bank Swallow | | Threatened species under COSEWIC, migratory bird protected under the MBCA 1994 and a habitat specialist that has established long-term nest sites in specific habitats (i.e., steep bluffs or embankments comprised of friable soils) within and near Project infrastructure. |

**Notes:** COSEWIC - Committee on the Status of Endangered Wildlife in Canada; LAA - Local Assessment Area; MBCA 1994 - *Migratory Birds Convention Act, 1994*; RAA - Regional Assessment Area; TH TWG – Tr'ondëk Hwëch'in Technical Working Group

### 13.3 REFERENCES

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Yukon Environmental and Socio-economic Assessment Board (YESAB). 2005. Proponent's Guide to Information Requirements for Executive Committee Project Proposal Submissions. Yukon Environmental and Socio-economic Assessment Board, Whitehorse, YT. Accessed December 2015.

#### 13.3.1 PERSONAL COMMUNICATIONS

Becker, N. 2016. Natural Resources and Heritage Analyst – Coffee Gold Project. Memo to EDI titled TH Initial Input on Wildlife and Wildlife Habitat Management Plan. Dated April 1, 2016.

Environment Canada. 2015. Meeting between Nathalie Lowry, Pam Sinclair, Margaret Campbell (Environment Canada) and Anne MacLeod, Ben Schonewille (EDI Environmental Dynamics Inc.), Whitehorse, Yukon. December 15, 2015.

Suitor, M. 2014–2016. North Yukon Regional Biologist, Environment Yukon. Multiple phone and email conversations with A. MacLeod, EDI Environmental Dynamics Inc. April 2014 – June 2016.

# 14.0 FISH AND FISH HABITAT ASSESSMENT

This section presents a high-level summary of the effects assessment for the Fish and Fish Habitat Valued Component (VC). The full effects assessment is presented in **Appendix 14-B Fish and Fish Habitat Valued Component Assessment**.

## 14.1 ASSESSMENT SCOPE

In order to take a holistic approach, Fish and Fish Habitat has been selected as the Valued Component. Three subcomponents have been identified for the Fish and Fish Habitat VC: Arctic Grayling (*Thymallus arcticus*), Chinook Salmon (*Oncorhynchus tshawytscha*), and Chum Salmon (*O. keta*). A rationale for the selection of these subcomponents is provided in **Table 14.1-1.**

**Table 14.1-1 Fish and Fish Habitat Subcomponents**

| Subcomponent | Representative of | Rationale for Selection |
|---|---|---|
| Arctic Grayling | Non-salmon species; recreational fish species and food species for First Nations. | Widespread in the LAA; important recreational/food fish species. |
| Chinook Salmon | Salmonids; target species for First Nation fishery. Also targeted by recreational and commercial fisheries. | Importance to local First Nations, present as juveniles in LAA. |
| Chum Salmon | Salmonids; important species for First Nation and commercial fisheries. | Importance to local First Nations and return to LAA to spawn (Yukon River). |

**Note:** LAA - Local Assessment Area

The indicators (i.e., quantitative or qualitative metrics) used to describe and evaluate potential effects on Fish and Fish Habitat subcomponents and the rationale supporting the selection of these indicators are identified in **Table 14.1-2**. The selection of indicators was based on the consideration of the potential pathways of effect on these subcomponents and applicable regulatory requirements.

**Table 14.1-2 Indicators for Fish and Fish Habitat**

| Indicator | Rationale for Selection |
|---|---|
| **Arctic Grayling and Chinook Salmon** | |
| Habitat Suitability | Importance to fish population recruitment; consultation with regulators, First Nations; CCME Water Quality Guidelines (CCME 2007a), regulatory requirement of Section 35 of the *Fisheries Act.* |
| Habitat Accessibility | Importance to fish population recruitment; consultation with regulators, First Nations; regulatory requirement of Section 20 and Section 35 of the *Fisheries Act*. |
| Contaminant Toxicity | Importance to fish population health; consultation with regulators, First Nations; water quality guidelines (CFIA, CCME, U.S. EPA), regulatory requirement of Section 36 of the *Fisheries Act* and Part 2, 7(1) of the Metal Mining Effluent Regulations. |
| Stream Productivity | Importance to fish population recruitment; consultation with regulators, First Nations, regulatory requirement of Part 2, 7(1) of the Metal Mining Effluent Regulations.<br>Importance to fish population recruitment; consultation with regulators, First Nations. |

| Indicator | Rationale for Selection |
|---|---|
| Fish Mortality | Importance to fish population health; consultation with regulators, First Nations; water quality guidelines (CFIA, CCME, U.S. EPA), regulatory requirement of Section 36 of the *Fisheries Act* and Part 2, 7(1) of the Metal Mining Effluent Regulations. |
| **Chum Salmon** | |
| Habitat Suitability | Importance to fish population recruitment; consultation with regulators, First Nations; CCME Water Quality Guidelines (CCME 2007a), regulatory requirement of Section 35 of the *Fisheries Act*. |
| Fish Mortality | Importance to fish population health; consultation with regulators, First Nations; water quality guidelines (CFIA, CCME, U.S. EPA), regulatory requirement of Section 36 of the *Fisheries Act* and Part 2, 7(1) of the Metal Mining Effluent Regulations. |

**Sources:** Appendix 14-B Fish and Fish Habitat Valued Component Assessment; CCME 2007a

**Notes:** CCME - Canadian Council of Ministers of the Environment; CFIA - Canadian Food Inspection Agency; U.S. EPA – United States Environmental Protection Agency

## 14.2 ASSESSMENT BOUNDARIES

**Figure 14.2-1** identifies the spatial, temporal, and technical boundaries established for the fish and fish habitat assessment (see also **Figure 14.2-1**). There are no administrative boundaries relevant to the assessment.

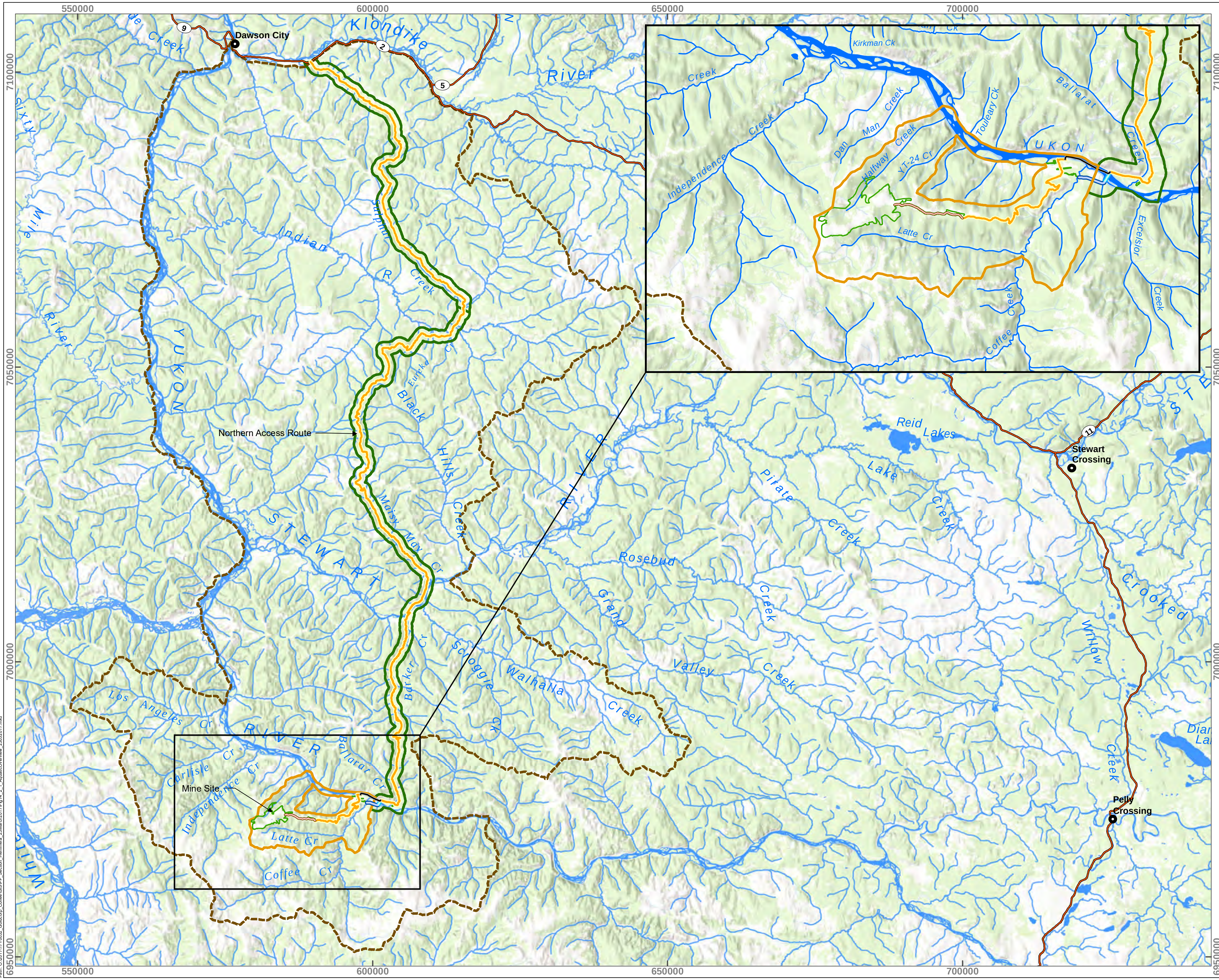
**Table 14.2-1 Spatial, Temporal, and Technical Boundaries for the Fish and Fish Habitat Assessment**

| Boundary | | Description of Assessment Area |
|---|---|---|
| Spatial | Local Assessment Area | • Entire watersheds of Latte Creek, Halfway Creek, and YT-24.<br>• Lower Coffee Creek watershed, from the confluence with the Yukon River extending 10 km upstream.<br>• A 17-km portion of the Yukon River in the vicinity of the Mine Site (includes area of barge operation and ice bridge) and a 9-km portion of the Stewart River in the vicinity of the proposed barge crossing and ice bridge location.<br>• 100 m upstream and downstream of stream crossings along the proposed NAR. |
| | Regional Assessment Area and Cumulative Effects Assessment Area | • Entire watersheds of tributary creeks to the north of the Yukon River, between and including Isaac Creek to east and Los Angeles Creek to the west.<br>• Full watershed extent of any watercourse that is crossed by the NAR, or is within the catchment area for runoff from the NAR.<br>• Yukon River from Ballarat Creek confluence downstream to the City of Dawson (163 km), and Stewart River from upstream of Maisy May Creek confluence downstream to confluence of Yukon and Stewart rivers (51 km). |
| Temporal | | The temporal characteristics of the Project's Construction, Operation, Reclamation and Closure, and Post-closure phases (i.e., the Project Schedule) are described in **Section 2.0 Project Description**. |
| Technical | | The low number of fish in many creeks and ice cover within the Project area limit robust statistical assessments of various fish health metrics in several creeks within the LAA and RAA. For the purposes of this assessment, conservative approaches were used in terms of predicting fish distributions. |

**Note:** km - kilometre; LAA - Local Assessment Area; m - metre; NAR - Northern Access Route; RAA – Regional Assessment Area

COFFEE GOLD MINE

## Fish and Fish Habitat Assessment Boundaries





### Legend

- Stewart River Ice and Barge Crossings
- Yukon River Barge Route
- Yukon River Ice Road
- Winter Road
- Mine Site Access Route
- Northern Access Route
- Project Footprint
- Regional Assessment Area
- Local Assessment Area (mine)
- Local Assessment Area (NAR)

### Notes

1. This map is not intended to be a "stand-alone" document, but a visual aid of the information contained within the referenced Report. It is intended to be used in conjunction with the scope of services and limitations described therein.

### Sources

1. Sources: Esri, HERE, DeLorme, increment P Corp., NPS, NRCan, Ordnance Survey, © OpenStreetMap contributors, USGS, NGA, NASA, CGIAR, N Robinson, NCEAS, NLS, OS, NMA, Geodatastyrelsen, Rijkswaterstaat, GSA, Geoland, FEMA, Intermap and the GIS user community
2. Project access and infrastructure provided by Goldcorp Inc. (2017).
3. Aquatic study areas developed by EDI Environmental Dynamics Inc. (2016).

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| Figure 14.2-1 | Date: Mar 23, 2017 | Drawn by: HG/MP | Reviewed: MAS/PT |
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## 14.3 ASSESSMENT METHODS

The assessment of potential effects on Fish and Fish Habitat from the proposed Coffee Gold Mine (Project) was divided by major Project area: the Mine Site, which encompasses all mine infrastructure and receiving drainages, and the Northern Access Route (NAR). This division in the assessment was conducted because relevant management plans are separate for the Mine Site and the NAR, and because Project activities differ between the two sections, so dividing the sections enabled more detailed description of potential effects.

The habitat suitability assessment at the Mine Site focused on the downstream effects on Fish and Fish Habitat. Flow predictions from the Project's Water Balance Model (**Appendix 8-B**) were used to assess the effects of potential flow changes to Fish and Fish Habitat during each Project phase. In the absence of any Yukon guidelines, resources from nearby jurisdictions were utilized (i.e., *Environmental Flow Assessment Methods for Application to Northeastern British Columbia* (Hatfield et al. 2013)). The NAR footprint interacts with fish habitat and thus required a quantitative and qualitative assessment of the habitat that will be modified or lost.

The Project's potential effects on habitat accessibility were evaluated by considering the effects of Project infrastructure on fish movement and distribution. This component focused on the NAR given there is no fish within the proposed Mine Site infrastructure. In the absence of any Yukon guidelines, information in literature on stream crossing structures and fish passage criteria from nearby jurisdictions was reviewed as necessary (e.g., *Fish Stream Crossing Guidebook* (BC FLNRO 2012).

Potential Project-related effects on Fish and Fish Habitat were evaluated with respect to predicted changes in water quality (**Appendix 12-B Surface Water Quality Valued Component Assessment**). Predicted increases to contaminant concentrations in the Mine Site were screened against Canadian Council of Ministers of the Environment (CCME) and British Columbia Water Quality Guidelines for the Protection of Freshwater Aquatic Life and Proposed Site-Specific Water Quality Objectives (PSSWQO). For the NAR, potential effects of increases in contaminant concentrations associated with sediment mobilization to streams were considered in light of proposed Project activities.

The potential Project-related effects of change in stream productivity on Fish and Fish Habitat were assessed for streams where nutrient levels were predicted to change (**Appendix 12-B**; relevant to Mine Site only). For the NAR, potential Project-related effects of changes to stream productivity (nutrients and total suspended solids) associated with sediment mobilization to streams were considered. Changes to habitat as well as the potential for sediment inputs were also evaluated to determine the potential for fish mortality as a result of Project activities.

### 14.3.1 Regulatory Framework

Management of Fish and Fish Habitat in Yukon is shared between Fisheries and Oceans Canada, the Yukon Government, and local First Nations through a combination of federal legislation, territorial, and First Nation administration and policy. Agreements in place that define both federal and territorial responsibilities include the Canada-Yukon Freshwater Fisheries Agreement, YOIC 1989/060, and the Canada-Yukon Memorandum of Understanding on Aquaculture Development, OIC 2010/070. Through these agreements, Environment Yukon has been delegated authority for management of freshwater fisheries in Yukon, whereas Fisheries and Oceans Canada is responsible for management of anadromous species (e.g., various types of Pacific salmon) and fish habitat.

The *Fisheries Act* is the primary federal legislation for regulating the management of Fish and Fish Habitat in Yukon. Sections of the *Fisheries Act* that govern development activities and are applicable to the Project include Section 20 (Fishway Passage and Obstruction), Section 35 (Serious Harm to Fish), and Section 36 (Pollution to Fish Habitat).

Pursuant and annexed to the *Fisheries Act*, the Metal Mining Effluent Regulations (SOR/2002-222) establishes metal mining discharge criteria. It also outlines the requirements for monitoring mine water effluent, aquatic biota, and fish health in the vicinity of the proposed Mine Site.

Within the Fish and Fish Habitat Local Assessment Area (LAA) and Regional Assessment Area (RAA) there are no aquatic species listed under the federal *Species at Risk Act*, SC 2002, c.29 or under territorial listing. In addition, there are no established protected, special management, or conservation areas relevant to Fish and Fish Habitat within the Fish and Fish Habitat LAA and RAA.

Environmental quality guidelines published by the CCME of particular relevance to Fish and Fish Habitat include:

- Water Quality Guidelines for the Protection of Aquatic Life (CCME 2007a)
- Sediment Quality Guidelines for the Protection of Aquatic Life (CCME 2007b)
- Tissue Residue Quality Guidelines for the Protection of Wildlife Consumers of Aquatic Biota (CCME 2007c).

## 14.4 EXISTING CONDITIONS

### 14.4.1 ARCTIC GRAYLING

Arctic Grayling have been captured in Coffee Creek and in the lower reaches of Halfway and Latte Creeks. While Grayling have not been captured in YT-24, there is potential summer rearing habitat present in the lower 400 metres (m). Within the portion of the LAA along the proposed NAR, Arctic Grayling have been captured in Maisy May, Ballarat, and Barker Creeks, and are known to reside in the Stewart, Yukon and Indian Rivers and historically in Sulphur Creek. Smaller tributary streams along the NAR may also provide summer rearing habitat for Arctic Grayling.

The temporal characteristics of Arctic Grayling life history include seasonal migrations between overwintering, spawning, and summer rearing habitats with the largest individuals often being found the furthest upstream during the summer months (McPhail 2007). Spawning typically occurs during the spring shortly after ice-out, and typically takes place in larger creeks or small rivers over substrates dominated by gravels and cobbles (McPhail 2007). Eggs incubate in the gravel for less than a month before hatching. In terms of sensitivities, deposition of fine sediments over the spawning grounds can result in habitat alteration, covering, or smothering of eggs (mortality) during the incubation period.

During the baseline studies, young-of-the-year Arctic Grayling were only captured in the lower reaches of Black Hills and Independence Creeks, both of which are located outside the LAA. There was no evidence of Arctic Grayling spawning within the LAA, however, spawning cannot be ruled out in the larger creeks along the NAR.

Summer rearing habitat for Arctic Grayling is typically widespread and includes the use of clear-water creeks and rivers including small tributary streams for summer feeding and rearing (Hughes and Reynolds 1994). Summer rearing by Grayling in the LAA was documented in several small streams without overwintering habitat (including Latte and Halfway) and mid-sized streams with overwintering potential (Coffee and Maisy May). Arctic Grayling use the streams within the LAA primarily for summer rearing. This species has been found during summer season sampling in streams downstream of the Mine Site and in watercourse crossings along the NAR No fish have been documented in the portions of the stream within the Project footprint including the upper reaches of YT-24, Halfway, or Latte Creeks (including Latte Creek Tributary C).

Arctic Grayling typically overwinter in larger streams or areas with groundwater inputs. Winter 2016 fish and environmental deoxyribonucleic acid (eDNA) sampling in creeks in the vicinity of the proposed Mine Site confirmed Arctic Grayling overwintering in Coffee Creek and the Yukon River, but not in any other streams within the vicinity of the Mine Site (EDI 2017). Overwintering on the NAR was not investigated; however, it is likely limited to the larger streams (e.g., Maisy May Creek and the Indian River).

Analysis of Arctic Grayling tissue metal concentrations was conducted on samples collected in the vicinity of the proposed Mine Site in the summer of 2014 and 2015. Throughout streams in the vicinity of the proposed Mine Site, Arctic Grayling muscle tissue samples contained estimated baseline concentrations of methylmercury that exceeded CCME guidelines for the protection of piscivorous wildlife (0.033 micrograms per gram wet weight (µg/g ww), (CCME 2007c). Total mercury concentrations in Arctic Grayling tissues did not exceed the Canadian Food Inspection Agency guideline for human consumption in any stream within the LAA (0.5 µg/g ww) (CFIA 2011). Selenium concentrations in Arctic grayling muscle tissue did not exceed the EPA's interim guideline for fish muscle tissue (11.3 µg/g dw; US EPA 2016), however, nearly all samples from all sites, with the exception of five Arctic grayling from Latte Creek exceeded the BC tissue and whole body guidelines for selenium (which are both set at 4 µg/g dw, BC MOE 2014).

#### 14.4.2 CHINOOK SALMON

Chinook Salmon populations in the Yukon River watershed have been experiencing a general trend of declining returns in the number of adults that return to the spawning grounds in the Canadian portion of the Yukon River (JTC 2015), as well as a decreasing trend in the ratio of recruits to spawners (i.e., for each fish that successfully spawns, the number of fish returning in the subsequent generation). This trend is generally understood to relate to fishing pressures and external environmental pressures outside the RAA. If this trend persists, it will generally result in an adverse effect on the number of Chinook Salmon within the Project's RAA.

No Chinook Salmon spawning has been documented in the Yukon or Stewart Rivers within the LAA, and the closest known Chinook Salmon spawning areas on both rivers are located more than 100 kilometres (km) upstream. The Yukon River in the vicinity of Coffee Creek has long been an important salmon fishing location for First Nations, (TH 2012), many documented Chinook spawning areas are located in the Yukon River watershed upstream of the LAA. Traditional Knowledge (TH 2012) has referenced adult Chinook in Coffee Creek; however, Chinook Salmon spawning has not been observed in any of the creeks in the vicinity of the proposed Mine Site during baseline aerial spawning surveys (Sparling 2001, Laberge and White Mountain 2002, AEG 2014, EDI 2017). Habitat quality is generally poor for Chinook Salmon spawning in the vicinity of watercourse crossings along the proposed NAR, and no Chinook spawning has been documented in any portion of the LAA in the vicinity of the NAR.

Juvenile Chinook Salmon use the larger streams in the LAA as non-natal rearing habitat. They were captured during the summer months in Coffee Creek, in the lower portion of Halfway Creek (on one occasion) and in lower Maisy May Creek in the vicinity of the NAR. Potential rearing habitat was inferred by Palmer Environmental Consulting Group based on suitable habitat in portions of Maisy May, Barker, and Ballarat Creeks in the vicinity of the proposed NAR. Year-round use by juvenile Chinook Salmon has been confirmed in Coffee Creek during winter through direct fish capture (minnow trapping) and via eDNA sampling in March 2016. Juvenile Chinook were captured in the lower 200 m of Halfway Creek on one occasion (August 2016, despite being sampled multiple times); however, this stream does not provide overwintering habitat.

Analysis of metal concentrations in juvenile Chinook Salmon tissue was conducted on samples collected in March and August 2016. Juvenile Chinook Salmon tissue samples had estimated baseline concentrations of methylmercury that exceeded CCME guidelines for the protection of piscivorous wildlife (0.033 µg/g ww) (CCME 2007c). However, all samples collected from Halfway Creek were below the guideline; samples from Halfway Creek had a mean methylmercury concentration of 0.024 µg/g. The Canadian Food Inspection Agency tissue concentration guideline for total mercury does not apply to juvenile Chinook Salmon because they are not consumed by humans. Selenium concentrations in juvenile Chinook salmon muscle tissue in Coffee Creek did not exceed the EPA guideline for muscle tissue at any sampled stations. Only one sample from Halfway Creek exceeded the BC selenium tissue guideline.

### 14.4.3 CHUM SALMON

Chum Salmon in the Yukon River watershed have been experiencing a general trend of declining returns in the number of adults that return to the spawning grounds in the Canadian portion of the Yukon River (JTC 2015), as well as a decreasing trend in the ratio of recruits to spawners (i.e., for each fish that successfully spawns, the number of fish returning in the subsequent generation). This trend is generally understood to relate to fishing pressures and external environmental pressures outside of the RAA. If this trend persists, it will generally have an adverse effect on the number of Chum Salmon in the Project's RAA.

Chum Salmon life history characteristics restrict the Chum Salmon's use of the LAA and RAA to adult spawning and egg or alevin development only. Chum Salmon emerge after completing the alevin life stage, and swim directly downstream to the ocean as fry, and therefore do not rear in Yukon freshwater environments.

Chum Salmon spawning has been documented in the Yukon River within the LAA on multiple occasions (AEG 2014, EDI 2017), with confirmed spawning locations generally located on the south side of the Yukon River, in small side channels and sloughs that appear to be groundwater fed, which is consistent with the preferred spawning areas for this species in the Yukon River watershed. Chum spawning has been documented in similar groundwater-fed side channels approximately 10 and 18 km downstream of the LAA (EDI 2017 and Rivest, Personal Communication, 2016). Chum Salmon also migrate through the portions of the Yukon and Stewart Rivers in the LAA to reach spawning areas further upstream. No Chum Salmon spawning has been documented in any of the smaller creeks (or near these stream mouths) within the LAA, nor has any spawning been documented in the immediate vicinity of the proposed barge crossing locations or barge landing areas on the Yukon and Stewart Rivers. Sensitivities for Chum Salmon include changes to spawning habitat suitability (i.e., via increases in sediment) and physical covering of incubating eggs (mortality). Since this species is only present in large rivers where contaminant levels will not be affected by the Project, there is no pathway to changes in contaminant toxicology for Chum Salmon.

## 14.5 Project Interactions, Potential Effects, and Mitigation Measures

### 14.5.1 Potential Project-related Interactions

Activities associated with a particular Project Phase and their potential effect on Fish and Fish habitat are described in **Table 14.5-1**.

**Table 14.5-1 Potential Interactions**

| Phase | Types of Effects | Causes of Interactions |
|---|---|---|
| Construction Phase | Contaminant toxicity<br>Stream productivity<br>Fish mortality<br>Habitat suitability (<br>changes in surface water hydrology and loss of habitat along the NAR)<br>Habitat Accessibility (potential to change fish passage at existing crossings). | Overall Mine Site activities, ground disturbance, mobilization of equipment, and material handling.<br>Development and dewatering of pits, development of Waste Rock Storage Facility (WRSF), Stockpiles and Site Water Management Infrastructure.<br>Construction of Crusher System, Heap Leach Facility (HLF), Plant Site and facilities, Camp Site, Bulk Explosives Storage Area, and ancillary components.<br>Construction and maintenance of roads including NAR. |
| Operation Phase | Contaminant toxicity<br>Stream productivity,<br>Fish mortality<br>Habitat suitability (due to changes in surface water hydrology) | Overall Mine Site activities, ground disturbance, material handling, and progressive reclamation.<br>Development, dewatering, cessation of mining and backfill of pits, development of WRSFs, stockpiles and site water management infrastructure.<br>Operation of Crusher System, HLF, Plant Site and facilities and ancillary components.<br>Use and maintenance of roads. |
| Reclamation and Closure Phase | Contaminant toxicity<br>Stream productivity,<br>Fish mortality<br>Habitat suitability (due to changes in surface water hydrology) | Reclamation of disturbed areas such as pits, WRSFs and stockpiles.<br>Ground disturbance, dismantling of Project facilities, decommissioning of roads, and Site Water Management Infrastructure and removal of HLF water treatment plant.<br>Continued road maintenance and some ancillary components. |
| Post-closure Phase | Contaminant toxicity<br>Stream productivity,<br>Habitat suitability (due to changes in surface water hydrology) | Carry overs from above activities. |

### 14.5.2 Potential Effects

Project-related interactions have the potential to result in effects to Fish and Fish Habitat. The potential effects are described below as they relate to each Fish and Fish Habitat VC subcomponent: Habitat suitability, Habitat Accessibility, Contaminant Toxicity, Stream Productivity and Fish Mortality. Based on the timing and nature of the interactions, consideration was given to the following effects that could occur on Fish and Fish habitat resources:

- Habitat Suitability - including flow changes in Latte, Halfway and YT-24 creeks, changes to habitat from sediment deposition in streams throughout the Project area and habitat alteration from Project infrastructure (specific to NAR only).
- Habitat Accessibility – includes changes in accessibility associated with NAR infrastructure during the Construction Phase.
- Contaminant Toxicity – includes changes in water quality resulting from Project activities (predicted changes to Latte, Halfway and YT-24 creeks and potential changes associated with NAR).
- Stream Productivity – includes changes in nutrient inputs (including predicted changes to Latte, Halfway and YT-24 creeks) and potential changes to suspended sediment concentrations associated with NAR.
- Fish Mortality - from habitat infilling, blasting or high suspended sediment concentrations and/or long durations or sediment deposition over incubating eggs.

### 14.5.3 Mitigation, Management, and Monitoring

A number of mitigation measures are proposed, some of which are general and apply to all Project phases and all Fish and Fish habitat subcomponents, and some that are phase or subcomponent specific. The applicable mitigation measures are listed below:

- Mitigate through Project design
- Water Management Plan
- Erosion and sediment control
- Best management strategies for working around water
- Water quality guidelines and standards
- Progressive reclamation and closure plan
- Blasting mitigation
- Metal Leaching / acid rock drainage management and monitoring plan

## 14.6 Residual Effects and Their Significance

Following the implementation of mitigation measures, residual effects likely remain for Arctic Grayling and Chinook Salmon as a result of changes to habitat suitability (Mine Site and NAR), stream productivity and contaminant toxicity. Residual effects likely remain for Chum Salmon due to changes in habitat suitability along the NAR.

As discussed below, all of the adverse residual effects are assessed to be not significant. A significant positive residual effect is predicted for improvements to habitat accessibility along the NAR for Arctic Grayling,

### 14.6.1 ARCTIC GRAYLING

The assessment of alteration to Arctic Grayling habitat suitability indicated that flow changes may occur downstream of the Mine Site during all Project phases, and habitat alteration may occur along the NAR during the Construction Phase. The only residual adverse effects predicted for habitat suitability were low in magnitude (less than 10%) for Latte Creek (magnitude for Halfway and YT-24 creeks was neutral to high but positive in direction). The measureable residual effects will be focused in headwater streams that provide limited rearing habitat for Arctic Grayling rather than more sensitive spawning or overwintering habitats. Based on these considerations, the residual effects of the Project on habitat suitability are not likely to result in any permanent adverse effects on the ability of Arctic Grayling to carry out their life processes, and are therefore assessed as not significant.

Habitat alteration during the Construction Phase along the NAR is limited to small portions of marginal habitat along the Yukon River and tributary streams where embedded culverts will be installed. The limited amount of area affected and the limited quality of habitat are not likely to limit Arctic Grayling in the LAA, and were assessed as not significant.

The assessment of the accessibility of fish habitat indicated that replacement and upgrading of the crossing structures to Project design standards will have a positive effect on the accessibility of fish habitat in the LAA along the NAR. These upgrades will improve fish habitat accessibility at three of the stream crossings. Application of the design standards to the other fish stream crossings will reduce the risk that fish barriers will develop during the operational life of the road. Arctic Grayling will be the main beneficiary of increased habitat accessibility. Since accessibility improvements will occur to a considerable amount of stream habitat, the potential residual effects are considered significant.

The assessment of contaminant toxicity indicated that following the implementation of mitigation measures, residual effects to contaminant toxicity are predicted for Arctic Grayling in the Latte, Halfway and YT-24 creek watersheds.. Arctic Grayling are widespread through the LAA, including summer rearing use of Latte and Halfway (lower portion) creeks, and the potentially the lower portion of YT-24. Therefore, there is an anticipated effect to Arctic Grayling associated with elevated uranium, nitrate and arsenic concentrations in the LAA. However, given magnitude of anticipated change to the concentrations of these contaminants in water, combined with the limited, seasonal fish use of upper Latte, lower Halfway and YT-24 creeks, this residual effect is deemed not significant and confidence in this prediction is high.

The assessment of stream productivity indicated that anticipated changes to nutrient enrichment in Halfway Creek may have a residual effect on stream productivity for Arctic Grayling. The residual effects related to stream productivity, including effects to benthic algae and invertebrate communities, are assessed to be adverse, low to moderate in magnitude, frequent (but expressed seasonally), and will occur through all

Project phases (long-term). The effect has a moderate likelihood of occurring and will be partially reversible when discharge ceases.

There are no predicted residual effects to Arctic Grayling mortality following the implementation of all appropriate mitigation measures.

### 14.6.2 Chinook Salmon

Residual effects to Chinook Salmon habitat suitability from flow-level changes downstream of the Mine Site are limited to the lower 350 m Halfway Creek. Flow changes in lower Halfway Creek are predicted to be low to moderate in magnitude, and positive in direction (increase in overall flows), making the habitat suitability effects a predominantly positive one.). This stream also provides occasional summer rearing habitat for Chinook rather than more sensitive spawning or overwintering habitats. Based on these considerations, the residual effects of the Mine Site on habitat suitability are not likely to result in any permanent adverse effects on the ability of Chinook to carry out their life processes, and are therefore assessed as not significant.

Habitat alteration during the Construction Phase along the NAR will be limited to small portions of marginal habitat along the Yukon River and tributary streams where embedded culverts will be installed. The limited amount of area affected and the limited quality of habitat are not likely to limit Chinook Salmon in the LAA, and were assessed as not significant.

The assessment of contaminant toxicity indicated after the application of mitigation measures, residual effects to contaminant toxicity are predicted for juvenile Chinook Salmon in the Halfway Creek watershed. However, given the limited use of this watershed by juvenile Chinook Salmon, combined with the magnitude of change of the concentrations of these contaminants in water, this residual effect is deemed not significant. The assessment of stream productivity indicated that the anticipated changes to nutrient enrichments in Halfway Creek may have a residual effect on stream productivity for Chinook. Residual effects associated with stream productivity, including effects to benthic algae and invertebrate communities, are assessed to be adverse, low to moderate in magnitude frequent (but expressed seasonally), and will occur through all Project phases (long-term). The effect has a moderate likelihood of occurring (given the conservative approach) and will be partially reversible when discharge ceases.

### 14.6.3 Chum Salmon

Chum salmon are limited to the Yukon and Stewart Rivers in the LAA, and as such, few residual effects were identified and assessed. There are no anticipated residual effects to Chum Salmon habitat suitability from flow changes downstream of the Mine Site as they are not present in the Latte, Halfway, or YT-24 Creeks.

Habitat alteration during the Construction Phase along NAR is limited to small portions of marginal habitat along the Yukon and Stewart Rivers where the Project will encroach on the river (barge landings and side channel encroachment). The limited amount of area affected and the limited quality of habitat is not likely to limit Chum Salmon within the LAA, and was assessed as not significant.

Chum Salmon have not been documented in the vicinity of the NAR crossings where fish passage will be restored; therefore, effects will be neutral to their habitat accessibility. In addition, there are no predicted residual effects associated with contaminant toxicity or stream productivity to Chum Salmon as they are not present in Halfway Creek.

## 14.7 CUMULATIVE EFFECTS ASSESSMENT

Potential interactions between Project-related residual effects on Fish and Fish Habitat and those of other projects such as the Casino Project, Quartz Projects, and Placer Projects as well as potential adverse cumulative effects are considered below. All potential cumulative adverse effects on Fish and Fish Habitat have been carried forward for assessment. No additional mitigation measures are proposed beyond those commitments already made by the Proponent.

There are few Project components that will likely have a cumulative effect on Fish and Fish Habitat with other activities currently under way in the Fish and Fish Habitat RAA or likely to occur before the Project reaches the Post-closure stage. The upgrades to the NAR have the greatest likelihood to resulting in a cumulative effect on fish habitat. Most road-related effects to fish habitat can be readily mitigated with known technology and BMPs. The adoption of existing Yukon guidelines for working around water and the standards proposed by the Project to other resources road and trail development would mitigate cumulative effects of increasing road construction in the RAA and along the road corridor. Therefore, there residual cumulative effects associated with Fish and Fish Habitat in the RAA are reversible.

## 14.8 REFERENCES


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### 14.8.1 Personal Communications

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# 15.0 VEGETATION ASSESSMENT

This section presents a high-level summary of the effects assessment for the Vegetation Valued Component (VC). The full effects assessment is presented in Appendix 15-B Vegetation Valued Component Assessment. Vegetation was identified as a VC because the proposed Coffee Gold Mine (Project) occurs in a vegetated area of Yukon's boreal forest region. Vegetation is a component of biodiversity, is a key component of wildlife habitat, and is valued by First Nations and other local people who may rely on certain species as a subsistence and economic resource.

## 15.1 ASSESSMENT SCOPE

To simplify and focus the assessment, five subcomponents were chosen for their ability to represent other species or groups that are similar in nature, found in similar habitats, occupy similar ecological niches, or could be similarly affected by Project activities: ecological communities, wetland habitats, traditional and medicinal plants, rare plants, and vegetation health. A rationale for the selection of these subcomponents is provided in **Table 15.1-1**.

**Table 15.1-1 Vegetation Subcomponents**

| Subcomponent | Representative of | Rationale for Selection |
|---|---|---|
| Ecological communities | Vegetation abundance found in proximity to the Project. | • Culturally important, Regulator and First Nation Interest<br>• Potential for interaction with clearing and construction within the Project footprint<br>• Potential changes in plant composition and possible loss of native plant species due to introduction of invasive species |
| Wetland habitats | Wetlands are often considered sensitive ecosystems; this subcomponent is representative of sensitive ecosystems. | • Regulator and First Nation Interest<br>• Potential for interaction with clearing and construction within the Project footprint |
| Traditional and medicinal plants | Traditional and medicinal plants are plants that are considered culturally important to First Nations as they are considered harvestable. | • Proponent commitment to TH TWG<br>• Potential for interaction with clearing and construction within the Project footprint |
| Rare plants | Rare plants include species at risk or Yukon Watch List species found in proximity to the Project. | • Species at risk (SARA), Regulator and First Nation Interest |
| Vegetation health | A possible response may occur to change in trace metal concentrations in indicator plant species due to Project-related activities (dust deposition). | • Potential for interaction with Project activities that increase dust deposition on plants, First Nation interest |

**Notes:** SARA - *Species at Risk Act*; TH TWG – Tr'ondëk Hwëch'in Technical Working Group

Indicators are quantitative or qualitative measures that can be compared against baseline values or conditions to evaluate potential Project-related effects and cumulative effects on Vegetation. The indicators identified for each Vegetation subcomponent and the rationales supporting the selection of these indicators are summarized in **Table 15.1-2**.

**Table 15.1-2 Indicators for Vegetation and Subcomponents**

| Indicator | Rationale for Selection |
|---|---|
| **Ecological Communities** | |
| Area (ha) of ecological communities that will be lost and calculated as a percent loss | Provides a measure of the loss of each ecological community due to the Project activities (habitat loss). |
| **Wetland Habitat** | |
| Area (ha) of wetland habitats that will be lost and calculated as a percent loss | Provides a measure of the loss of each wetland type due to the Project; wetlands are known to contain rare plant communities and are sensitive to hydrological changes (change in habitat and possible loss of habitat). |
| **Traditional and Medicinal Plants** | |
| Area (ha) of berry-producing ecological communities that will be lost and calculated as a percent loss | Provides a measure of the loss of berry-producing ecological communities, ranked by berry-producing potential, due to the Project; berry-producing species are important traditional and medicinal plant species harvested in the Coffee Creek area. |
| **Rare Plants** | |
| Area (ha) of potential rare plant habitat based on ecological community classes (potential occurrence) that will be lost and calculated as a percent loss | Provides a measure of the potential loss of rare plants, protected under federal legislation under *Species at Risk Act* (for listed species) and addresses information needs of Yukon CDC. |
| **Vegetation Health** | |
| Risk of increased concentration of trace metals in selected plant species due to dust deposition and other emissions | An increase in trace metals in selected plant species in habitat adjacent to the Project is representative of potential Vegetation health effects from dust and other emissions. |

**Notes:** CDC - Conservation Data Centre; ha - hectare

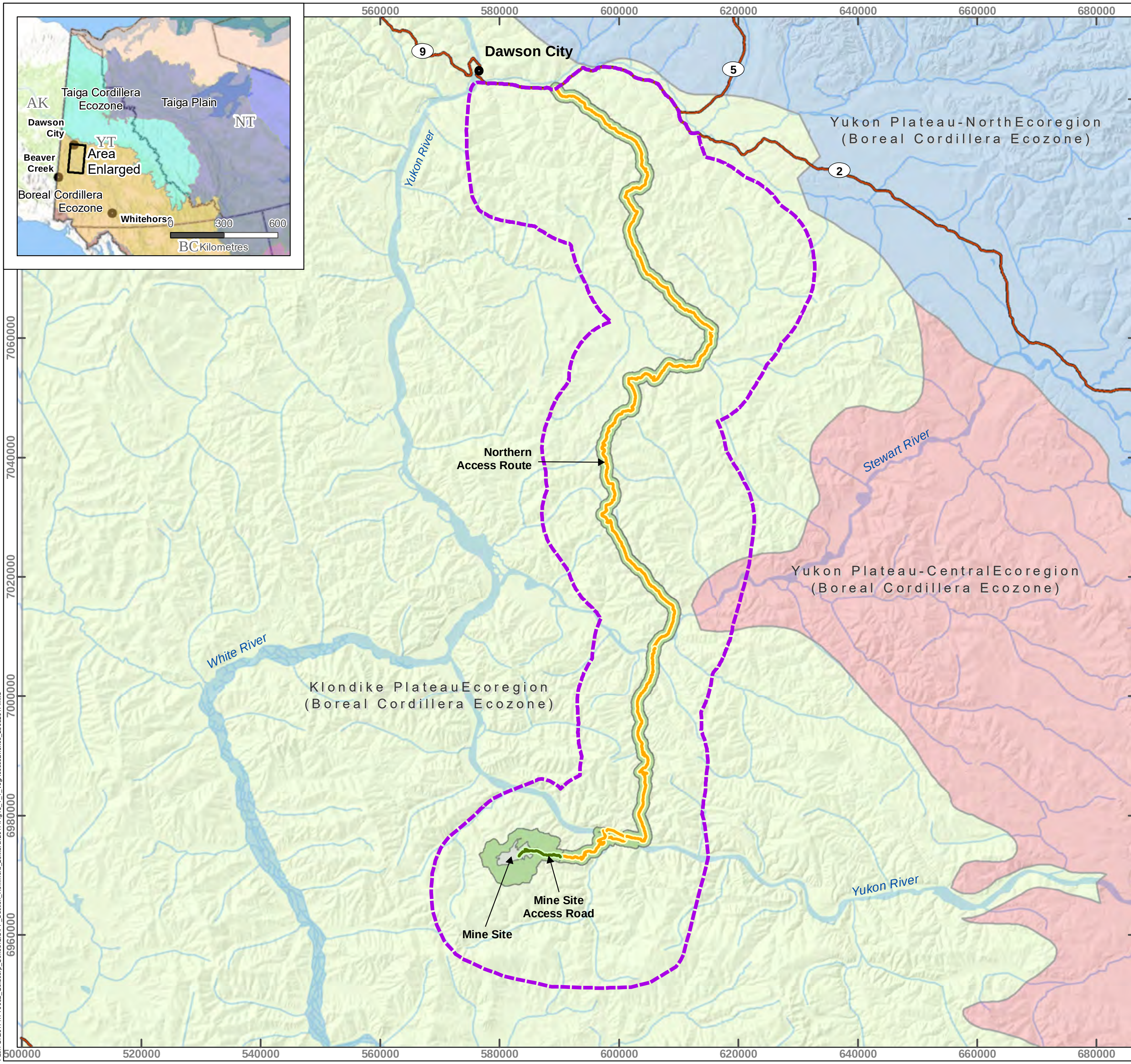
### 15.1.1 Assessment Boundaries

**Table 15.1-3** below identifies the spatial, temporal, and technical boundaries established for the assessment of Project-related changes to vegetation (see also **Figure 15.1-1**). There are no administrative boundaries that are relevant to the vegetation assessment.

**Table 15.1-3 Spatial, Temporal, and Technical Boundaries for the Vegetation Assessment**

<table>
<tr><th colspan="2">Boundary</th><th>Description of Boundary</th></tr>
<tr><td rowspan="2">Spatial</td><td>Local Assessment Area</td><td>Proposed Project Area with a minimum 1-km buffer plus slightly more around the Mine Site area (in general to height of land).</td></tr>
<tr><td>Regional Assessment Area and Cumulative Effects Assessment Area</td><td>The majority of the RAA and CEAA follows an approximate 10-km buffer of the proposed access route and Mine Site footprint. The RAA and CEAA encompass the following drainages:<br>• Coffee Creek, Bonanza Creek, Maisy May Creek, Ballarat Creek, Black Hills Creek, Eureka Creek, Hunker Creek, Sulphur Creek, and Barker Creek.<br>Parts of the following drainages are found within the RAA and CEAA:<br>• Henderson Creek, Indian River, Dominion Creek, and Doyle Creek. A portion of the Independence Creek valley is also found within the RAA and CEAA.</td></tr>
<tr><td colspan="2">Temporal</td><td>The temporal boundaries of the Project consist of the Construction, Operation, Reclamation and Closure, and Post-closure Phases, which are described in Section 2.0 Project Description.</td></tr>
<tr><td colspan="2">Technical</td><td>Rare plant surveys were completed in areas considered to have a high potential of rare plant occurrences, but were not completed throughout the whole LAA. There is a possibility that a rare plant or a Watch List plant may still be found within the Project footprint.<br>Ecological classification for the region is only defined to the subzone level and not to the ecological community (ecosites and Vegetation association) level due to map information limitations.</td></tr>
</table>

**Notes:** CEAA – Cumulative Effects Assessment Area; km – kilometre; LAA – Local Assessment Area; RAA - Regional Assessment Area




# COFFEE GOLD MINE

## Vegetation Assessment Boundaries

### Legend

- Highway
- Mine Site Access Route
- Northern Access Route
- Mine Site Footprint
- Vegetation Local Assessment Area
- Vegetation Regional Assessment Area

**Ecoregions in Vicinity to or Overlapping the Vegetation RSA**

- Klondike Plateau Ecoregion
- Yukon Plateau-Central Ecoregion
- Yukon Plateau-North Ecoregion

### Notes

1. This map is not intended to be a "stand-alone" document, but a visual aid of the information contained within the referenced Report. It is intended to be used in conjunction with the scope of services and limitations described therein.

### Sources

- Canadian Council on Ecological Areas. <2010>. Conservation Areas Reporting and Tracking System. Digital database developed by Environment Canada, Gatineau

- Inset Basemap: ESRI World Topographic Map

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| Figure 15.1-1 | Date: Mar 23, 2017 | Drawn by: MP | Reviewed: MAS |
|---|---|---|---|

GOLDCORP

## 15.2 ASSESSMENT METHODS

The assessment of Project-related effects on Ecological Communities used Ecological and Landscape Classification (ELC) and Broad Ecosystem Mapping (BEM) units developed for the Vegetation Baseline Report (**Appendix 15-A**). Detailed ELC mapping was completed around the proposed Mine Site and along new sections of the Northern Access Route (NAR). General BEM mapping was completed along the proposed NAR in areas that that were described as existing road.

This assessment focuses on the Project-related effects on the Vegetation VCs within the Project footprint, including ecological communities, wetland habitats, and potential rare and traditional and medicinal plant habitat, in the context of habitat availability regionally. Ecological communities contain rare, and traditional and medicinal plants, thus all ecological communities were rated for berry-producing potential (traditional and medicinal plants) and rare plant potential. The Project's potential effects on Vegetation health were assessed by considering the potential for metals uptake from fugitive dust deposition and other emissions.

### 15.2.1 REGULATORY REQUIREMENTS

Federal legislation of relevance to the assessment of Vegetation includes the *Species at Risk Act*, SC 2002, c.29. The Committee on the Status of Endangered Wildlife in Canada (COSEWIC), an independent body of experts, is responsible for identifying and assessing plant and wildlife species considered at risk, which may then qualify for legal protection and recovery under SARA. There are no SARA-listed or COSEWIC-assessed species at risk known to exist in the assessment areas.

Although the Federal Policy on Wetland Conservation (1991) was initially considered in scoping, there are no wetlands of territorial importance, as defined by the Yukon Wetland Technical Committee (Yukon Department of Renewable Resources 2000) within the assessment areas.

Territorial legislation of relevance to the Project includes the *Environment Act*, RSY 2002, c.50, which provides for the protection of land, water, and air, including natural resource planning and management, and conservation easements for conserving and enhancing Vegetation communities that provide habitat for wildlife. The Yukon Conservation Data Center provides information on species at risk in Yukon, and maintains a list of all plants known to occur in Yukon with their corresponding conservation ranks at the global, national, and territorial levels. The Yukon Invasive Species Council is a registered non-profit society formed to prevent the introduction and manage the spread of invasive species in Yukon.

## 15.3 EXISTING CONDITIONS

Detailed information on data quality and reliability, including any uncertainty or gaps in knowledge associated with the existing Vegetation conditions, are described in the Vegetation Baseline Study Report (**Appendix 15-A Vegetation Baseline Report**).

### 15.3.1 ECOLOGICAL COMMUNITIES

The Local Assessment Area (LAA) is located within the Klondike Plateau Ecoregion, and the Regional Assessment Area (RAA) also includes a small portion of the Yukon Plateau-Central Ecoregion, both of which are within the Boreal Cordillera Ecozone. The baseline plant surveys documented 411 different plant species, including seven tree, 60 shrub, 188 forb, 63 grass, 18 fern / horsetail / clubmoss, 2 aquatic, 36 moss / liverwort, and 37 lichen.

Within the ELC mapping extent in the LAA, the most abundant Boreal Bioclimate Zone ecosite mapped is the 01 (approximately 34% of the LAA). Wildfire is a common natural disturbance in the region, and this is well depicted by the proportions of Vegetation associations mapped within ecosite 01. Shrub-dominated early successional-stage zonal communities and mixed-wood stands are the most abundant zonal Vegetation associations, with each comprising approximately 30% of the ecosite total. Coniferous-dominated and deciduous-dominated zonal stands each represent about 20% of the ecosite. The second most abundant boreal ecosystem mapped in the ELC survey extent is ecosite 32, which comprises approximately 5% of the overall LAA. Riparian ecosystems with the ELC survey extent, including low, mid and high-bench floodplains, account for less than 3% of the LAA. Grasslands within the ELC survey extent are restricted to moderate to steep, dry, southerly slopes, and account for less than 2% of the overall area. These areas are very dry during the summer and because of their position on steep slopes, are susceptible to erosion. The broad subalpine ridges within the LAA are dominated by the ecosite 01, which accounts for approximately 4% of the LAA, but 50% of the subalpine area. This ecosite typically supports a dense shrub layer and has a medium moisture and nutrient regime. Also common in the subalpine, but of low overall abundance within the LAA, is the sparely forested ecosite 31 and the cool, sloping, permafrost-influenced ecosite 32.

The LAA contains the Boreal and Subalpine Bioclimate Zones. Approximately 92% of the LAA occurs in the Boreal Bioclimate zones, while the remaining 8% occurs within Subalpine Bioclimate zone. The LAA does not extend into the Alpine Bioclimate Zone and does not contain any alpine ecological communities.

### 15.3.2 WETLAND HABITAT

Wetlands are found scattered across the region but no detailed wetland mapping or classification is available regionally. The most common wetland type found within the LAA is fens (approximately 926 hectares (ha) scattered across the LAA in pockets of various sizes), and swamps (approximately 230 ha of willow-dominated (*Salix spp.*) swamps were mapped within the LAA). No bogs were mapped within the LAA, and few small marshes were mapped throughout the LAA.

### 15.3.3 TRADITIONAL MEDICINAL PLANTS

The occurrence of plants deemed important for traditional and medicinal use was quantified for both the ELC and BEM Vegetation community classification mapping, and for sites likely to contain important berry-producing plants. Edible berry-producing species, including Bog Blueberries (*Vaccinium uliginosum*), Lowbush Cranberries (*V. vitis-idaea*), Crowberries (*Empetrum nigrum*), Bog Cranberries (*V. oxycoccos*), High-bush Cranberries (*Viburnum edule*), Cloudberries (*Rubus chamaemorus*), Currants and Gooseberries (*Ribes* spp.), and Soapberries (*Shepherdia canadensis*), were commonly found throughout the LAA during baseline studies. The majority of ecosystems identified within the LAA support at minimum one berry-producing species, and commonly support multiple species. All identified ecosystems in the LAA were rated for berry-producing potential using five categories (high, medium, low, very low, and nil potential).

### 15.3.4 RARE PLANTS

No COSEWIC- or *SARA*-listed plant species were observed during rare plant surveys; however, populations of four territorial Watch List plant species were found:

- Coffee Creek Scorpionweed (*Phacelia mollis*; S3S4)
- Spotted Lady's Slipper (*Cypripedium guttatum*; S2S3)
- Small Enchanter's Nightshade (*Circaea alpina ssp. alpina*; S2S3)
- Dry-spike Sedge (*Carex siccata*; S2S3).

Coffee Creek Scorpionweed has been found at a number of locations in western Yukon; however, the global population of this species is found only within Yukon and Alaska. Within the LAA, the species was found growing in undisturbed open, Trembling Aspen (*Populus tremuloides*) to mixed forest areas, as well as disturbed exposed soil areas.

Spotted Lady's Slipper has been found at several sites within central and northern Yukon. In the LAA, the species was found on south-facing, moderate slopes, with the exception of one site where a small population was found growing along the existing road on a south-facing slope. The combination of species composition, slope, and aspect appear to play a strong role in dictating suitable habitat for Spotted Lady's Slipper.

Previous to rare plant surveys conducted in 2015, Small Enchanter's Nightshade was only known from southeast Yukon. Although this species is circumpolar from Newfoundland to Alaska and in the northern United States, it is likely that Yukon is at the edge of this species' range. In the LAA, Small Enchanter's-nightshade was found growing in transitional habitat between upland and sedge meadow.

Dry-spike Sedge is listed as S2S3 in Yukon which indicates uncertainty whether this species is considered Imperiled or Vulnerable in the territory. Prior to rare plant surveys in 2016, Dry-spike Sedge was only known from four sites in Yukon. This finding represents the fifth collection in Yukon and provides important information on the overall distribution of Dry-spike Sedge at present. Discussions with the Yukon Conservation Data Centre determined that all known sites in Yukon are widely distributed and threats to occurrences are currently low. This finding also represents the most northern site of Dry-spike Sedge known in Yukon. Dry-spike Sedge is typically found in open, sandy pine forests, but a variety of upland sites have also been recorded including open, dry willow dominated, black spruce, white spruce, and aspen forests

### 15.3.5 VEGETATION HEALTH

As a baseline assessment of Vegetation health, soil and plants were sampled for trace metal levels, with a focus on four plant species or species groups: Willow, Lowbush Cranberry, Horsetail (*Equisetum* spp.), and Reindeer Lichen (*Cladina mitis*, *Cladonia rangiferina*). Vegetation and soil sample collection sites were based on variable distance from the Project footprint: Adjacent (100 metres (m)), Near (1,000 m), and Far (5.5 to 7.5 kilometres (km)). From 2014 to 2016, 89 sites were sampled in the Project area, and included 77 soil, 61 Lowbush Cranberry, 22 Horsetail, 61 Lichen and 68 Willow samples. The soil and vegetation samples were analyzed using Atomic Spectroscopy for the presence and concentration of a large range of metals, but the analysis of trace metals on vegetation health includes arsenic, cadmium, chromium, copper, mercury, lead, selenium, uranium, and zinc.

The baseline samples were separated into two parts for analysis: the Coffee Area (which includes the proposed Mine Site, Mine Site access road, existing Coffee Camp and proposed Casino Connector (no longer considered), and the proposed NAR. Trace metal concentrations in soil were low, with the exception of arsenic and chromium. Arsenic and chromium concentrations were above CCME soil quality guidelines in 24 (27%) and 4 (4%) samples, respectively. These high background levels could be due to the presence of arsenic associated with complex ores, mined primarily for their copper, lead, zinc, silver, and gold content (CCME 1997), which may be present in the Coffee Area. Chromium samples above CCME guidelines were found at near (1,000 m) and control sites (greater than or equal to 15 km) relative to the proposed Project footprint. Chromium rarely occurs naturally, and is often introduced to the environment through anthropogenic sources (CCME 1999). All other trace metals consistently showed concentrations in soil well below the CCME guidelines. Relatively few soil samples reported mercury and selenium above the laboratory reporting detection limit, and pH was below the recommended range in 71 (79%) samples at various distances from the proposed Project footprint.

Soil samples collected along the NAR contained low concentrations of all but two of the targeted trace metals – the concentration of arsenic was higher than CCME guidelines in 2 out of 12 sites sampled, and zinc was found in concentrations higher than CCME guidelines in 2 out of 12 sites sampled. All sites are near areas with existing anthropogenic disturbances. All other trace metals were consistently present at concentrations well below the CCME guidelines.

## 15.4 PROJECT INTERACTIONS, POTENTIAL EFFECTS, AND MITIGATION MEASURES

### 15.4.1 POTENTIAL PROJECT-RELATED INTERACTIONS

Activities associated with a particular Project Phase and their potential effect on Vegetation are described in **Table 15.4-1.**

**Table 15.4-1 Potential Interactions**

| Phase | Types of Effects | Causes of Interactions |
|---|---|---|
| Construction Phase | • Loss of habitat<br>• Changes to vegetation health in adjacent areas<br>• Introduction and spread of invasive species<br>• Positive effects from storage of growth medium for reclamation activities | • Overall Mine Site activities, ground disturbance and mobilization of equipment<br>• Development and dewatering of pits, development of Waste Rock Storage Facility, Stockpiles, and Site Water Management Infrastructure<br>• Construction of Crusher System, Heap Leach Facility, Plant Site and facilities, Bulk Explosives Area, and ancillary components<br>• Construction and maintenance of roads, including the NAR |
| Operation Phase | • Loss of habitat<br>• Changes to vegetation health in adjacent areas<br>• Positive effects include reestablishment of vegetation in reclaimed areas<br>• Positive effects from storage of growth medium for reclamation activities<br>• Introduction and spread of invasive species | • Overall Mine Site activities, ground disturbance, material handling, and progressive reclamation<br>• Development, cessation of mining and backfill of pits, development of WRSFs, Stockpiles, and Site Water Management Infrastructure<br>• Operation of Crusher System, Heap Leach Facility, Plant Site and facilities, Bulk Explosives Area, and ancillary infrastructure<br>• Use and maintenance of roads, including the NAR |
| Reclamation and Closure Phase | • Changes to vegetation health in adjacent areas<br>• Positive effects from storage of growth medium for reclamation activities | • Reclamation of disturbed areas such as pits, Waste Rock Storage Facilities, and Stockpiles<br>• Ground disturbance, dismantling of Project facilities, decommissioning of roads, and water management infrastructure and removal of Heap Leach Facility water treatment plant<br>• Continued road maintenance and some ancillary components |
| Post-closure Phase | • Negligible | • Negligible |

### 15.4.2 Potential Effects

Project-related interactions may result in effects to Vegetation. The potential effects are described below as they relate to each Vegetation VC subcomponent, including ecological communities, wetland habitat, rare plants, traditional and medicinal plants, and vegetation health. Based on the timing and nature of the interactions, consideration was given to the following effects that may occur to Vegetation resources:

- Habitat loss – includes loss of existing areas of vegetated habitat/ecological communities, wetland communities, and areas that could provide suitable conditions for traditional, medicinal and rare plants.
- Change in vegetation health due to dust deposition – includes changes related to potential increase in emissions such as dust, which could result in a change in trace metal concentrations in plants and potentially affect vegetation health.
- Risk of introduction and spread of invasive plant species – includes the introduction or spread of non-native plant species that could displace native vegetation.

### 15.4.3 Mitigation, Management and Monitoring

The Proponent has committed to a number of mitigation actions, some of which are general and apply to all Project phases and all Vegetation subcomponents, and some that are phase or subcomponent specific. The applicable mitigation measures are listed below:

- Mitigate through Project design
- Minimize habitat loss
- Limit activities to the Project footprint
- Minimize dust and emissions
- Reduce fire hazards to adjacent vegetation
- Protect rare plants
- Minimize risk of introduction and spread of invasive plants
- Awareness training for Project personnel.

## 15.5 Residual Effects

Following the implementation of mitigation measures, residual effects are expected to remain for ecological communities, wetland habitat, traditional and medicinal plants, and rare plants due to habitat loss. Vegetation health will have a potential residual effect due to dust deposition from Project emissions, possibly increasing trace metal concentrations.

As discussed below, all of these residual effects are predicted to be not significant.

Invasive plants are a nationally recognized concern with guidelines developed federally, provincially, and territorially. The Proponent recognizes the risk of the introduction and spread of invasive plants, which is a risk within Yukon (i.e., not a Project-specific adverse effect). No attempt is made in this effects assessment to further characterize the magnitude or significance of potential Project-specific residual effects related to the risk of the introduction and spread of invasive plants. The risk of introduction and spread of invasive plants is addressed specifically as a mitigation measure.

### 15.5.1 Ecological Communities

Habitat loss of ecological communities during the Construction phase is likely to be as a residual effect for the Project because it is expected that mitigation efforts will not return the area of ecological communities to baseline levels after closure. Clearing and grubbing will remove approximately 2,718 ha of existing ecological communities (excluding wetlands and anthropogenic features) from the LAA, including 717 ha of subalpine communities, 1,070 ha of boreal communities and 931 ha of broad ecological communities. Overall, approximately 4% of mapped boreal and subalpine ecological communities will be lost from the total LAA area due to activities within the Project footprint. Approximately 2% of mapped BEM ecological communities will be loss from the total LAA area due to the clearing and grubbing associated with the construction of the NAR.

The residual effect of habitat loss for ecological communities is considered not significant. In general, the magnitude of habitat loss is low, the geographic extent is limited to the Project footprint, none of the communities are rare, and they are likely available and distributed throughout the RAA. The effect is considered to be partially reversible with reclamation activities. In consideration of the uncertainty regarding the coarse-scale approach to assessing habitat for ecological communities (i.e., comparable habitat baseline is not available for the larger region) and how individual ecological communities will be affected by habitat loss, confidence in the predictions for habitat loss is rated as moderate.

### 15.5.2 Wetland Habitat

Habitat loss of wetland habitats during the Construction phase is likely to be a residual effect as it is expected that mitigation efforts will not return the weltand habitat extent to baseline levels. The Project could result in a total loss of approximately 70 ha of mapped wetland communities that exist within Project footprint. Overall, 2% of the total Project footprint affects wetland communities. The maximum possible wetland habitat loss within the NAR footprint for each wetland community will range from no loss to a 12% loss (Spruce – Red Bearberry – Brown Moss Fen) of mapped wetlands. The greatest loss to clearing and grubbing by percent of mapped wetland community loss to the Project footprint occurs in the following ecological communities: marsh (13%), Spruce – Red Bearberry – Brown Moss Fen (12%), Willow – Horsetail Swamp (11%) and Swamp (10%). This equates to an overall 0.1% of mapped wetland community habitat loss from the total LAA. No bog communities were mapped within the LAA.

The residual effect of habitat loss for wetland habitats is considered not significant. In general, the magnitude of habitat loss is low, the geographic extent is limited to the Project footprint, and the context is that none of the wetland communities are rare and they are likely available and distributed throughout the RAA. In consideration of the uncertainty regarding the coarse-scale approach to assessing habitat for wetland communities (i.e., comparable habitat baseline is not available for the larger region) and how individual wetland communities will be affected by habitat loss, confidence in the predictions for habitat loss is rated as moderate.

### 15.5.3 Traditional and Medicinal Plants

The loss of traditional and medicinal plant habitat during the Construction phase is likely to be a residual effect for the Project because it is expected that mitigation efforts will not return the amount (area) of ecological communities and by association the amount of traditional and medicinal plants, especially berry producers, to baseline levels after closure. High and moderate potential berry-producing habitat is commonly found throughout the LAA. The Project footprint contains approximately 1,079 ha of high potential berry-producing habitat and 1,384 ha of moderate potential berry-producing habitat. Clearing and grubbing will remove approximately 44% of the high and 14.5% of the moderate available mapped berry habitat, respectively. Overall, clearing in the Project footprint will result in a 2% loss of high potential berry habitat in the total LAA and 3% of moderate potential berry habitat.

The residual effect of habitat loss for traditional and medicinal plants is considered not significant. In general, the magnitude of habitat loss is low, the geographic extent is limited to the Project footprint, none of the assessed traditional and medicinal plants are rare, and they are likely available and distributed throughout the RAA. In consideration of the uncertainty regarding the coarse-scale approach to assessing habitat for traditional and medicinal plants (i.e., comparable habitat baseline is not available for the larger region) and how individual traditional and medicinal plant communities will be affected by habitat loss, confidence in the predictions for habitat loss is rated as moderate.

### 15.5.4 Rare Plants

Clearing the land during construction will result in the removal of potential rare plant habitat, resulting in a residual effect. While no SARA, COSEWIC or Yukon Track-listed plants were found during surveys, Yukon Watch-listed species may occur in the LAA. Four Yukon Watch-list species were recorded in various areas within the LAA. Coffee Creek Scorpionweed was observed adjacent to the existing Mine Site access road at four different locations and observed approximately 160 m east of a tributary along the proposed route option between Barker and Ballarat Creeks. Spotted Lady's-slipper was observed on the east side of the existing Mine Site access road and on a slope above the Ballarat Creek floodplain area, north of the Yukon River. Small Enchanter's Nightshade was observed within the Coffee Creek riparian area just north of the area where the proposed winter road section of the NAR crosses Coffee Creek. Dry-spike Sedge was observed at the base of a south-facing slope above the lower Ballarat Creek floodplain area, north of the Yukon River.

Within the Project footprint, subalpine ecosites 12 and 13 provide potential habitat for approximately six rare plants. These two ecosites cover approximately 90 ha and 190 ha respectively throughout the LAA. The Project footprint will remove approximately 8% of ecosite 12 and 34% of ecosite 13.

The NAR portion of the Project footprint follows valley bottoms or lower slopes for much of its length, where wetland and riparian ecosystems are common. Consequently there are more ecosystems within the NAR section of the Project footprint that have potential for rare plants. Approximately 7% of the ELC and BEM-mapped footprint consist of riparian or wetland ecosystems, including ponds, gravel bars, and floodplains, with potential for at least one Track-listed species. Dry, warm, aspen stands with Purple Reedgrass (ecosite 21) and warm, moderate sloping grasslands (ecosite 20-Capu) also have the potential for rare plants. These two ecosites cover approximately 1,080 ha and 125 ha respectively throughout the NAR area. The Project footprint will remove approximately 4% of ecosite 21 and 2% of ecosite 20-Capu of those available ecological communities in the LAA.

The residual effect of habitat loss for rare plants is considered not significant. In general, the magnitude of habitat loss is low and there is a low probability of any rare plants or Watch List species being located within the Project footprint. In consideration of the uncertainty regarding how individual rare plants will be affected by habitat loss, confidence in the predictions for habitat loss is rated as moderate.

#### 15.5.5 VEGETATION HEALTH

Various Project activities during Construction, Operations, and Reclamation and Closure phases could potentially increase the amount of dust deposition which could increase the amount of available trace metals uptake in plants, resulting in an effect on Vegetation health. Management and mitigation measures described previously will help to minimize the effects to Vegetation health; however, direct and indirect effects will not be fully mitigated, and thus a residual effect is anticipated for to the Vegetation health subcomponent.

The residual effect on Vegetation health is assessed as not significant because the limited spatial extent where the effect may occur does not pose a risk to the long-term persistence and viability of healthy vegetation within the LAA or RAA. The implementation of mitigation and monitoring measures reduces the risk of this effect and the residual effects should be localized to areas immediately adjacent to roads. In consideration of the uncertainty regarding individual species difference in metal uptake, confidence in the predictions for Vegetation health is rated as moderate.

## 15.6 CUMULATIVE EFFECTS ASSESSMENT

This Cumulative Effects Assessment is conducted at the VC level rather than at the subcomponent level because residual cumulative effects are expected to be similar for all vegetation subcomponents. Of the Project-related residual effects, only habitat loss was included in the Cumulative Effects Assessment, given that combined habitat loss from multiple projects and activities could have an adverse cumulative effect on Vegetation.

This residual effects was screened against the residual effects for quartz mining in the future, quartz exploration currently permitted, and placer projects. No additional mitigation measures are proposed beyond those proposed for Project-specific mitigation (**Section 15.4.3**).

Although there will be a cumulative loss of vegetated habitat within the RAA via direct habitat loss, this loss can be partially reversed following successful reclamation of disturbed areas. Based on current known past, present, and future projects within the RAA, it is unlikely that there will be enough simultaneously occurring, large-scale anthropogenic disturbances to reduce the amount of vegetation as a result of direct habitat loss. Considering mitigation and the low likelihood of simultaneously occurring, large-scale anthropogenic disturbances in this landscape, the cumulative effect of habitat loss on the Project's Vegetation VC is assessed as not significant. In consideration of uncertainty regarding the lack of vegetation mapping, and the lack of precise spatial data regarding the size of past, present, and future projects and activities, the confidence in this prediction is moderate.

## 15.7 REFERENCES

Canadian Council of Ministers of the Environment (CCME). 1997. A Protocol for the Derivation of Environmental and Human Health Soil Quality Guidelines: Arsenic. Canadian Council of Ministers of the Environment, Winnipeg, MB, Canada.

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# 16.0 WILDLIFE AND WILDLIFE HABITAT ASSESSMENT

This section presents a high-level summary of the effects assessment for the Wildlife and Wildlife Habitat Valued Component (VC) for the proposed Coffee Gold Mine (Project). The full effects assessment is presented in **Appendix 16-B Wildlife** and **Wildlife Habitat Valued Component Assessment**.

## 16.1 ASSESSMENT SCOPE

Wildlife and Wildlife Habitat is a Project VC as per the Yukon Environmental and Socio-economic Assessment Board (YESAB) guidelines, which considers wildlife to be as a candidate VC, since: "Wildlife are valued as important ecological components, for aesthetic and cultural reasons, and as a food source, among other reasons … Sensitive species and/or habitats especially should be given consideration as VCs…" (YESAB 2005). During Project consultation, concerns about wildlife were frequently raised by regulators, First Nations, and Yukon residents, supporting the identification of this VC.

Seven subcomponents were selected for the Wildlife and Wildlife Habitat VC based on species- or population-specific analyses, including habitat requirements, movement patterns, mortality risks, and sensitivity to disturbance (**Table 16.1-1**). The indicators used to describe and evaluate potential Project-related effects on the Wildlife and Wildlife Habitat VC and its subcomponents, and the rationales supporting the selection of these indicators, are identified in **Table 16.1-2**.

**Table 16.1-1 Wildlife and Wildlife Habitat Subcomponents**

| Subcomponent | Rationale |
|---|---|
| Fortymile Caribou | The Fortymile Caribou herd is a migratory Caribou herd, recently returned to the Project area after decades of recovery from a population low that caused the herd to abandon its Yukon range. Historically the herd was a very important source of food and clothing for local First Nations; however, in recent decades the herd has been the target of international recovery efforts including a closure of Yukon licensed harvest, and a voluntary harvest closure by the Tr'ondëk Hwëch'in. During Project consultation, the continued recovery of the Fortymile Caribou herd was identified as a key concern by both Tr'ondëk Hwëch'in (Becker, c 2016; TH TWG, Pers. Comm. 2016) and Environment Yukon (Suitor 2015). Since the fall of 2013, the Fortymile Caribou herd has been seasonally present in the baseline regional study area in substantial numbers for two of three winters indicating the potential for Project interaction. |
| Klaza Caribou | The Klaza Caribou herd is a resident herd of Woodland Caribou whose annual range overlaps the southern-most sections of the proposed Project. The Klaza Caribou are members of the northern mountain population of Woodland Caribou and are considered a Species at Risk (Special Concern) and listed on Schedule 1 of SARA (2016). Potential Project-related effects to Klaza Caribou were raised as a concern during Project consultation (Hegel, Pers. Comm. 2016), although it was noted that the Project is located outside of the herd's late winter range. |
| Moose | Moose were one of the key species identified during engagement meetings as a concern for the Project. Moose are the primary harvest species in the region for both First Nations (Calliou Group 2012; Becker, Pers. Comm. 2016) and non-First Nations residents (Suitor 2015; Meister, Pers. Comm. 2016), and the ability to harvest Moose is believed to be essential to preserving the health of First Nations people, as well as the "traditional lifestyles and identities of individual TH citizens and the community as a whole" (TH 2012b). Present mortality rates (mostly as a result of hunting) are considered at or near the sustainable limit for parts of the RAA (Suitor 2015) leading to concerns about increased harvest as a result of the Project, as well as other potential Project–related effects on habitat and mortality. |

| Subcomponent | Rationale |
|---|---|
| Thinhorn Sheep | A small number of Thinhorn Sheep have been identified using the steep rocky bluffs along the Yukon River. Thinhorn Sheep are not considered to be a Species at Risk either federally or territorially; however, during Project consultation, concerns were expressed by both Environment Yukon (Suitor 2015; Hegel, Pers. Comm. 2016) and Tr'ondëk Hwëch'in (Ayoub, Pers. Comm. 2016) about potential Project-related effects on Thinhorn Sheep, given the small numbers observed in the Project area. The proposed Northern Access Route may transect Thinhorn Sheep movement corridors along the north side of the Yukon River. |
| Grizzly Bear | Baseline studies documented Grizzly Bear in low densities throughout the Project area. Grizzly Bear are considered a Species at Risk (Special Concern; COSEWIC 2012) but are not listed on Schedule 1 of SARA (2016). Grizzly bears are often sensitive to human presence, and anthropogenic mortality can have important influences on occupancy and functional habitat loss (COSEWIC 2012). Grizzly Bear harvest does occur in the RAA; although in relatively low numbers. During Project consultation, concerns about Project-related effects on Grizzly Bear were raised by Environment Yukon, mostly in relation to increased mortality — the Project area overlaps a region with a history of adverse human-bear interactions. Additional concerns about effects to habitat, particularly denning habitat, were also raised (Suitor 2015; Maraj, Pers. Comm. 2016). |
| Wolverine | Wolverine is considered a Species at Risk (Special Concern; COSEWIC 2014), although is not listed under Schedule 1 of SARA (2016). The species is currently trapped within the RAA (Interview 15, Pers. Comm. 2016; Meister, Pers. Comm. 2016) and according to TK has been harvested in the area for decades (TH 2012a; Bates and DeRoy 2014). Project baseline surveys documented Wolverine on several occasions. During the baseline data collection period, Environment Yukon expressed concerns about potential Project-related effects on Wolverine (Suitor 2015) and information requests made during other YESAB ExComm submissions suggest concerns about Wolverine denning habitat (e.g., YESAB 2015). |
| Little Brown Myotis | Little Brown Myotis is a Species at Risk and is listed under Schedule 1 of SARA (Endangered; SARA 2016). Project baseline surveys indicated presence at lower elevations along the proposed NAR. |

**Note:** NAR - Northern Access Route

**Table 16.1-2 Indicators for Wildlife and Wildlife Subcomponents**

| Indicator | Rationale for Selection |
|---|---|
| **Fortymile Caribou** | |
| Habitat | The Project area is within the known/suspected winter range of the expanding Fortymile Caribou herd population's range. The Project's footprint and sensory disturbances will likely have adverse effects on habitat. Habitat loss due to the Project footprint and reduced habitat effectiveness due to sensory disturbance are quantified in km² or ha. The sum of these two effects is characterized for importance for each subcomponent. |
| Mortality Risk | The Project will likely facilitate increased harvester access through a portion of the herd's winter range, as well increase as the potential for Project-related collisions. Additive mortality can affect population recovery and growth. |
| Movement Patterns | Migratory Caribou herd attempt to access portions of historical winter range. |
| **Klaza Caribou** | |
| Habitat | The Project's sensory disturbances may have adverse effects on habitat used year-round. Habitat loss due to the Project footprint and reduced habitat effectiveness due to sensory disturbance are quantified in km² or ha. The sum is of these two effects is characterized for importance for each subcomponent. |

| Indicator | Rationale for Selection |
|---|---|
| **Moose** | |
| Habitat | The Project area is within known Moose habitat. The Project's footprint and sensory disturbances will likely have adverse effects on habitat. Habitat loss due to the Project footprint and reduced habitat effectiveness due to sensory disturbance are quantified in ha or km². The sum is of these two effects is characterized for importance for each subcomponent. |
| Mortality Risk | The Project will likely facilitate increased harvester access into a portion of the herd's winter range, and increase the potential for Project-related collisions. Additive mortality can affect population dynamics. |
| **Thinhorn Sheep** | |
| Habitat | The NAR traverses between sites known to be used by Thinhorn Sheep. The Project footprint may result in adverse effects on habitat. Habitat loss due to the Project footprint and reduced habitat effectiveness due to sensory disturbance are quantified in km² or ha. The sum is of these two effects is characterized for importance for each subcomponent. |
| Risk to Movement Corridor | The NAR traverses between sites known to be used by Thinhorn Sheep. Sensory disturbances and resulting individual responses may have adverse effects on movement between habitat patches. |
| **Grizzly Bear** | |
| Individual Den Sites/Den Habitat Quantity | Regulator concern – The Project's footprint may overlap with and have adverse effects on individual den sites. Habitat loss due to the Project footprint and reduced habitat effectiveness due to sensory disturbance are quantified in km² or ha. The sum is of these two effects is characterized for importance for each subcomponent. |
| Habitat Availability | Cumulative human presence, including the Project, may adversely affect core security, linkage, and foraging habitat. |
| Mortality Risk | Increased human presence may lead to encounters and problem bear kills beyond sustainable population limits. |
| **Wolverine** | |
| Individual Den Sites/Den Habitat Quantity | Regulator concern – The Project's footprint may overlap with and have adverse effects on individual den sites. Habitat loss due to the Project footprint and reduced habitat effectiveness due to sensory disturbance are quantified in km² or ha. The sum is of these two effects is characterized for importance for each subcomponent. |
| Mortality Risk | Increased human presence may lead to encounters and problem bear kills beyond sustainable population limits. |
| **Little Brown Myotis** | |
| Roose Habitat Availability | The Project's potential disturbance to roost habitat is likely the only interaction the Project has with the potential for adverse effects. Habitat loss due to the Project footprint and reduced habitat effectiveness due to sensory disturbance are quantified in km² or ha. The sum is of these two effects is characterized for importance for each subcomponent. |

**Note:** NAR - Northern Access Route

## 16.2 ASSESSMENT BOUNDARIES

**Table 16.2-1** identifies the spatial, temporal, and technical boundaries established for the Wildlife and Wildlife Habitat VC Assessment (see also **Figure 16.2-1**).

The Yukon-Alaska border is an administrative border that has relevance to this assessment, particularly for the Fortymile Caribou herd. Project-related effects are assessed only within Yukon; therefore no transboundary effects are assessed.

There are several Zones of Influence (ZOI) that are used to assess the effect of reduced habitat effectiveness due to sensory disturbance for most wildlife subcomponents. The ZOI is the area where the effectiveness of habitat may be reduced and does not result in lost or inaccessible habitat, but reduced probability of use of a habitat patch while the influence (i.e. activity) remains.

The Regional Study Area (RSA) was used for baseline studies to assess the abundance and distribution of most large wildlife species, including Caribou, Moose, Thinhorn Sheep, Mule Deer, Grizzly Bear, Black Bear, Wolf, Wolverine, and other furbearers, in the Project area. The RSA was delineated to include any game management subzone (GMS) that intersects or proximal to the Project footprint, including the Northern Access Route (NAR).

There are several Regional Assessment Areas (RAAs) used for the Wildlife and Wildlife Habitat effects assessment. These RAAs were based on areas biologically relevant to the species or species group being assessed. The RAAs used for the Wildlife and Wildlife Habitat VC Assessment include the Fortymile Caribou RAA (FC-RAA), Klaza Caribou RAA (KC-RAA), Thinhorn Sheep RAA (TS-RAA), and Wildlife RAA. The Wildlife RAA was used for Moose, Grizzly Bear, Wolverine, and Little Brown Myotis.

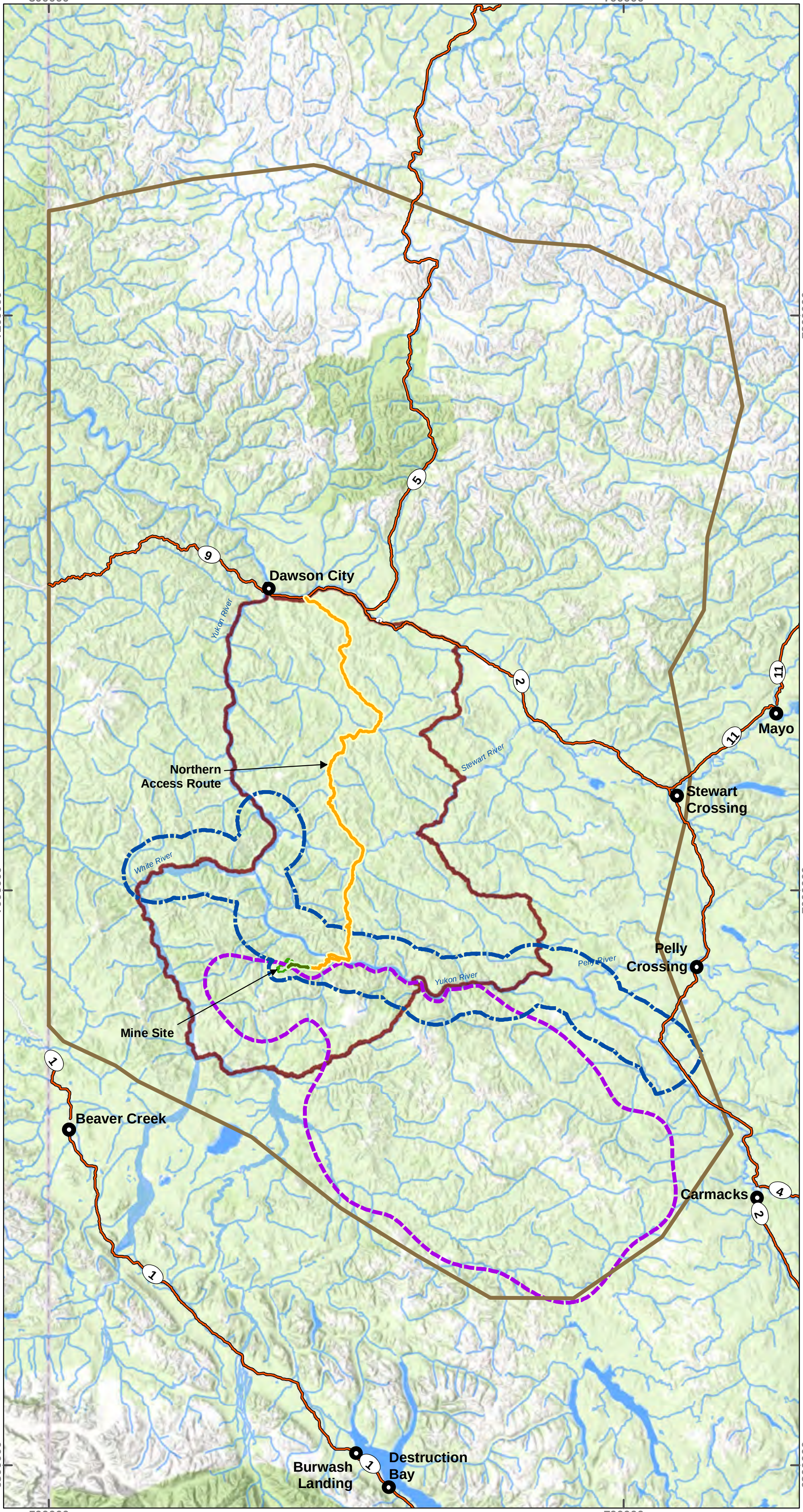
### Table 16.2-1 Assessment Boundary Definitions for Wildlife Assessment

| Boundary | Description of Assessment Area |
|---|---|
| **Spatial Boundary** | |
| **Fortymile Caribou** | |
| Regional Assessment Area / Cumulative Effects Assessment Area | Equivalent to Fortymile Caribou Study Area in **Appendix 16-A Wildlife Baseline Report**. The Fortymile Caribou RAA was chosen because of uncertainty in Fortymile Caribou distribution in Yukon, and has been identified by the Yukon Government as an area where caribou management is a priority. |
| **Klaza Caribou** | |
| Regional Assessment Area / Cumulative Effects Assessment Area | Annual herd range. |
| **Moose, Grizzly Bear, and Wolverine** | |
| Regional Assessment Area / Cumulative Effects Assessment Area | Equivalent to Wildlife RSA. |
| **Thinhorn Sheep** | |
| Regional Assessment Area / Cumulative Effects Assessment Area | A 10-km buffer on either side of the Yukon River. |
| **Little Brown Myotis** | |
| Regional Assessment Area | Equivalent to the LAA used in the Vegetation Assessment. |
| **Temporal Boundary** | |
| Fortymile Caribou | October through April. Typically, the Fortymile Caribou only occupy Yukon during winter. |
| Grizzly Bear denning | September 15 to June 15 – The main denning season for Grizzly Bears in Yukon is from October through April or May, but denning can begin as early as mid-September and extend until as late as mid-June if snow conditions are suitable. |
| Wolverine denning | February through May, which is the typical denning season for Wolverine (Magoun and Copeland 1998). |
| **Technical Boundary** | |
| Several constraints were identified that may impose limitations in identifying or measuring potential effects to Wildlife and Wildlife Habitat within the RAAs due to the potential Project-related interactions. These constraints include the following:<br>• Information on unlicensed harvest is not available.<br>• Accurate population density estimates unavailable.<br>• Seasonal and annual distribution information for many species is lacking.<br>• For Thinhorn Sheep, there is very little information available on the distribution.<br>• A comparison of habitat affected by the Project to the habitat that is available regionally is limited by the lack of region-level ecosystem mapping. | |
| Limited information or knowledge regarding species ranges, population numbers, habitat requirements, and responses to disturbance(s) at the species and individual level may lead to uncertainties regarding the extent of potential Project-related effects and the overall implications at the population level<br>Using habitat suitability models may impose constraints on the effects assessment due to data limitations. | |

**Notes**: km - kilometre; LAA - Local Assessment Area; RAA - Regional Assessment Area; RSA - Regional Study Area

# COFFEE GOLD MINE

## Wildlife and Wildlife Habitat Assessment Boundaries




## Notes

1. This map is not intended to be a "stand-alone" document, but a visual aid of the information contained within the referenced Report. It is intended to be used in conjunction with the scope of services and limitations described therein.

## Sources

1. Sources: Esri, HERE, DeLorme, increment P Corp., NPS, NRCan, Ordnance Survey, © OpenStreetMap contributors, USGS, NGA, NASA, CGIAR, N Robinson, NCEAS, NLS, OS, NMA, Geodatastyrelsen, Rijkswaterstaat, GSA, Geoland, FEMA, Intermap and the GIS user community
2. Study areas developed by EDI Environmental Dynamics Inc. (2014).
3. Project access and infrastructure provided by Goldcorp Inc. (2017).

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## 16.3 ASSESSMENT METHODS

The assessment of Project-related effects on Wildlife and Wildlife Habitat relied on various techniques to quantify or qualify potential effects and cumulative effects on subcomponents. Habitat loss and reduced habitat effectiveness were assessed quantitatively at the regional level for all subcomponents. A regional scale was used to include Yukon game management areas that overlap or are proximal to the Project Footprint, and to utilize a larger area to capture potential population level changes. Mortality risk and alteration to movement were assessed qualitatively at the regional level for corresponding subcomponents. The characteristics of potential residual effects (i.e., those remaining following the application of mitigation measures) are described and their significance and likelihood are determined based on the subcomponent-specific effects criteria and thresholds described in **Appendix 16-B Wildlife and Wildlife Habitat Valued Component Assessment**.

### 16.3.1 REGULATORY FRAMEWORK

At a federal level, the *Yukon Act* gives authority to the Yukon Legislature to make laws in relation to the conservation of wildlife and its habitat within Yukon, other than in a federal conservation area. The *Yukon Environmental and Socio-economic Assessment Act* gives authority and rules to YESAB to administer the assessment process that applies to all lands within Yukon. The *Species at Risk Act* (SARA) implements in part Canada's obligations under the United Nations Convention of Biological Diversity. It provides for the legal protection of wildlife species and the conservation of their biological diversity. Under SARA, COSEWIC, an independent body of experts, is responsible for identifying and assessing plant and wildlife species considered at risk, which may then qualify for legal protection and recovery under SARA. The *Canadian Wildlife Act* allows for the creation, management and protection of wildlife areas to preserve habitats, and to permit wildlife research and interpretive activities. There are no such protected areas within the Wildlife and Wildlife Habitat RAAs. Lastly, the Convention on Wetlands (Ramsar Convention, 1971) commits the federal government to maintain the ecological character of wetlands of international importance and to plan for the sustainable use of all wetlands.

At a territorial level, Yukon's *Environment Act* and regulations provide for the protection of land, water, and air. The Act applies on lands throughout Yukon, including private property, Crown lands, lands within municipal boundaries, and First Nation settlement lands where the First Nation has not developed equivalent laws. The *Wildlife Act* provides rules for hunting and trapping, outfitting and guiding, licensing, enforcement, and habitat protection. It also gives authority to make various regulations.

## 16.4 EXISTING CONDITIONS

### 16.4.1 FORTYMILE CARIBOU

Analysis of satellite collar data and Project survey data found that Fortymile Caribou (*Rangifer tarandus*) are generally using habitats in Yukon and the Project Regional Study Area (RSA) during the winter months, between October and April. The average residency time in the Project footprint and Yukon (FC-RAA) was calculated using collar data from 2013 to 2016 and the maximum and minimum amount of time any one individual Caribou spent in the Project footprint or FC-RAA from the three years of data were used as the maximum and minimum residency times. The average residency time in the Project footprint for all collared Caribou over the three years of data collection was only 0.01 days (range 0 to 0.18 days), whereas the average residency time in the entire FC-RAA was 76 days (range 1 to 183 days). Based on this information, collared Fortymile Caribou have spent a relatively small amount of time during the winter season in the Project footprint area relative to the time spent in the remainder of the FC-RAA (i.e., 0.01 percent (%) of the winter season in the FC-RAA).

Winter habitat selection by Fortymile Caribou was assessed using resource selection function analysis, and habitat selection probabilities were predicted across the study area. Model predictions indicate that 25 % of the habitat within the FC-RAA is rated as high or moderate (use by caribou was greater than the frequency of random points).

At present, licensed caribou harvest is closed year-round in all GMSs that overlap the Project footprint, and Tr'ondëk Hwëch'in has a voluntary no-harvest program in place for the Fortymile Caribou herd (FMCH).

### 16.4.2 KLAZA CARIBOU

The Klaza Caribou Herd (KCH) also seasonally overlaps the southern portions of the Project area. The KCH late winter range encompasses approximately 431,300 hectares (ha) and is located, at the closest, 34 kilometres (km) to the southeast of the Project footprint. Based on Project wildlife observation logs maintained by on-site personnel and incidental observations during baseline studies, approximately 74 suspected Klaza Caribou have been documented within the RSA since 2010. Klaza Caribou have been observed between May and September, typically as one or two individuals, with several observations of larger groups (i.e., 12 to 17 individuals). As such, the Project is only likely to interact with the KCH during non-winter months, and within the larger annual range area.

Caribou are an important subsistence species for some First Nations and other Yukon residents. Harvest records indicate that pressure on the KCH has been relatively low. According to Yukon 2015/2016 regulations (Environment Yukon 2015) Caribou harvest in GMSs that may contain Klaza Caribou within the RSA are closed to Caribou hunting.

### 16.4.3 Moose

Moose (*Alces alces*) are widely distributed across the RSA. Overall, Moose densities in the RSA are close to the Yukon average, with some northern regions possibly containing higher-than-average densities. In the southern sections of the RSA, Moose densities are estimated at 170 per 1,000 km² based on a 2012 survey of the region (O'Donoghue et al. 2013). The northern portions of the RSA were most recently surveyed in 2015, and are based on the preliminary survey results, Moose densities in this area are estimated at 277 per 1,000 km² (Suitor, Personal Communications, 2016). During the 2015 survey of the Dawson Goldfields, the Project team extended the survey along the NAR, resulting in a population estimate within 10 km of the NAR. An estimated 814 Moose are likely to occur within this area at a density of 247 Moose per 1,000 km² (Suitor, Personal Communication, 2016). Analysis of late winter ungulate survey results indicate that several parts of the survey extent show higher concentrations of Moose during the late winter, including the southwestern sections of the RSA along the White River, the upper sections of the Henderson Creek and Black Hills Creek drainages, and just north of the Indian River.

Late winter habitat suitability modelling indicates that 43% of the habitat within the RSA is rated as High or Moderate quality late winter Moose habitat (26% of the RSA rated as High, 17% rated as Moderate). The largest areas of contiguous High-rated late winter habitat occur north of the Stewart River, with smaller patches located north and south of the Yukon River.

Moose are the primary harvest species within the RSA, and are a highly valued species for both First Nations people and licensed hunters. All GMSs in the RSA are open to licensed hunters for bull Moose with an annual bag limit of one. Much of the RSA, particularly the Dawson Goldfields region, is very accessible to hunters due to an abundance of roads and trails. These areas experience relatively high levels of harvest pressure.

### 16.4.4 Thinhorn Sheep

Thinhorn Sheep (*Ovis dalli*) occur in low densities at sporadic, isolated locations within and adjacent to the RSA. There are records of Thinhorn Sheep from two general areas: Mount Maclennan, located approximately 14 km south of the proposed Mine Site, and the steep, south-facing bluffs along the Yukon River. Historically, Mount Maclennan is known to have supported a population of approximately 12 to 15 sheep; however, the area is believed to have been hunted out and no sheep have been observed there since 1990 (Environment Yukon 2016). Along the Yukon River bluffs, three occurrence areas for Thinhorn Sheep have been delineated: one in the RSA (Ballarat Creek occurrence area) and two additional occurrence areas just outside the RSA (one near the confluence of the White and Yukon Rivers, and another between the Pelly River and Minto Landing). Within the Ballarat Creek occurrence area, a maximum of four sheep have been observed during Project surveys, although up to eight sheep have been observed here previously (Russell et al. 2011). Based on the existing survey information, it is believed that there is likely occasional movement of animals among the three occurrence areas.

Assuming Thinhorn Sheep travel among the three known occurrence areas, the most likely movement corridor is along a series of steep hillslopes and ridges that occur on the north side of the Yukon River. Those hillslopes offer good foraging habitat in many locations, and limited escape terrain for travel and stopover habitat; however, during aerial surveys no Sheep were detected outside of the three known occurrence areas.

There is no documented occurrence of Thinhorn Sheep being selected for harvest where they occur along the Yukon River. All three occurrence areas within the TS-RAA are located within Game Management Zone 3, which is close to Sheep hunting.

### 16.4.5 GRIZZLY BEAR

Grizzly Bear (*Ursus arctos*) observations were recorded throughout the RSA on wildlife cameras, during baseline studies in the area, and by Project personnel Grizzly Bear observations were made throughout the RSA including observations in the Dominion Creek valley, Eureka Ridge, Maisy May Creek valley, Barker Creek valley, Ballarat Creek valley and the Coffee Property. Most observations were of individual bears; however, observations of females accompanied by a cub or yearling were made on several occasions. Project observations and harvest records support the observation that Grizzly Bears occur at low densities which is consistent with current estimates by Environment Yukon (2011) for the region.

Baseline Grizzly Bear habitat modelling included habitat effectiveness, security areas, linkage zones, and denning habitat suitability. Modelled habitat effectiveness as a proportion of potential habitat if no disturbance existed in the Wildlife RAA was 92.3% for the green-up period (peak greenness in July) and 91.8% for the green-down period (senescence in September). Modelling of security areas revealed that within the RAA, 94.7% of the area is considered secure and 5.3% is considered not secure. Modelling of linkage zones identified 92.5% of the RAA to be in the minimal danger category with 3.7% as low danger. Moderate and high danger categories occurred over 3.8% and less than 0.1% of the RAA, respectively. The highest danger levels typically occurred in the northern part of the Wildlife RAA between the Indian River and the City of Dawson. Denning habitat suitability modelling identified 22.8% of the Wildlife RAA as not available for denning habitat (i.e., nil), 1.6% was low suitability, 27.1% was low to moderate suitability, 38.9% was moderate suitability, 9.1% was moderate to high suitability, and 0.5% was high suitability.

Den surveys were completed in the spring of 2016 (March 21 to May 6) as part of baseline data collection, in areas considered to be most suitable for Grizzly Bear denning (moderate to high-rated habitat) based on habitat suitability modelling. No Grizzly Bears or their sign were observed during denning surveys, although suspected Black Bear (*Ursus americanus*) denning sites were located on south-aspect slopes.

### 16.4.6 Wolverine

Wolverine (*Gulo gulo*) are known to occur in the Wildlife RAA. Wolverine or their sign were observed during wildlife baseline surveys in 2015 and 2016. In 2015, fresh tracks of one Wolverine were recorded travelling the length of the airstrip. Furthermore, in 2016, 14 occurrences of fresh Wolverine tracks and eight old tracks were encountered within the Coffee Property and along the NAR. In addition, Wolverine tracks were observed more commonly at higher elevations along the NAR (range 470 metres (m) to 1,309 m; average 858 m). Wolverines were captured on wildlife cameras located on Eureka Ridge and Sulphur Creek Road, along the NAR. A Wolverine was also observed within the Coffee Property approximately 7.5 km south of the existing road between the Yukon River and the deposit (i.e., the Java Road).

A Wolverine denning habitat model using remotely sensed snow cover estimates from 2006 to 2015 found that the area likely contains limited high-quality denning habitat.

### 16.4.7 Little Brown Myotis

The Little Brown Myotis (*Myotis lucifugus*) is listed as Endangered under SARA. During acoustic bat surveys conducted for baseline surveys in August 2014, Little Brown Myotis was detected on all four survey nights within the Yukon River valley (Coffee camp location; 430 m elevation), but was not detected at the proposed mine site (Latte location; 1105 m elevation), which was active for six nights. Previous studies in Yukon have found that Little Brown Myotis is generally found below 1,000 m in elevation (Slough and Jung 2008), which is consistent with the lack of detections in the Latte area. No other bat species were detected during the investigations, and based on existing knowledge, no other species are likely within the Wildlife RAA. No other bat species were detected during the investigations, and based on existing knowledge no other species are likely within the Wildlife RAA.

Potential roosting habitat includes tree cavities, rock crevices on cliffs, caves, mines, under the bark of trees, and on man-made structures; therefore, important habitat for Little Brown Myotis roosting includes cliff areas, rock complexes, caves, and old forest. Wetlands, pools, and riparian areas are also important water sources and foraging areas (Holroyd et al. 2016). Anthropogenic features such as camps or homesteads containing buildings as well as rock outcrops and old forest are habitats that are mapped in baseline data, and may have roosting potential for Little Brown Myotis; however, only a small fraction of this area is likely to contain the site-specific features required for roosting. Old forest, especially stands within close proximity to water and foraging habitat, and cliffs with crevices along the Yukon and Stewart Rivers likely provide the greatest potential for bat roosting opportunities in the Project area.

## 16.5 Project Interactions, Potential Effects, and Mitigation Measures

### 16.5.1 Potential Project-related Interactions

Activities associated with a particular Project Phase and their potential effect on Wildlife and Wildlife Habitat are described in **Table 16.5-1**.

**Table 16.5-1 Potential Interactions**

| Phase | Types of Effects | Causes of Interactions |
|---|---|---|
| Construction Phase | Habitat loss<br>Reduced habitat effectiveness<br>Mortality risk<br>Alteration to movement<br>Contaminants uptake | Overall mine site activities, ground disturbance, mobilization of equipment, and material handling.<br>Development of pits, development of Alpha WRSF, stockpiles and site water management infrastructure.<br>Construction of crusher system, heap leach facility, plant site and facilities, bulk explosives area, and ancillary infrastructure.<br>Construction and maintenance of roads. |
| Operation Phase | Habitat loss<br>Reduced habitat effectiveness<br>Mortality risk<br>Alteration to movement<br>Contaminants uptake | Overall mine site activities, ground disturbance, material handling, and progressive reclamation.<br>Development, dewatering, cessation of mining and backfill of pits, development of WRSFs, stockpiles and site water management infrastructure.<br>Operation of crusher system, heap leach facility, plant site and facilities, bulk explosives area, and ancillary infrastructure.<br>Use and maintenance of roads. |
| Reclamation and Closure Phase | Reduced habitat effectiveness<br>Mortality risk<br>Alteration to movement | Reclamation of disturbed areas such as pits, WRSFs and stockpiles.<br>Ground disturbance, dismantling of Project facilities, decommissioning of roads, and water management infrastructure and removal of HLF water treatment plant.<br>Continued road maintenance and some ancillary components. |
| Post-closure Phase | Negligible | Negligible |

### 16.5.2 Potential Effects

Potential adverse effects on Wildlife and Wildlife Habitat were identified overall for the VC based on Project-related interactions. The potential effects are described below as they relate to the subcomponents: Fortymile Caribou, Klaza Caribou, Moose, Thinhorn Sheep, Grizzly Bear, Wolverine, and Little Brown Myotis.

### 16.5.1 Habitat Loss

Habitat loss will result from the ground clearing and vegetation removal required for the Project footprint during the Construction Phase and during the Operation Phase with the continued development of WRSFs. Habitat loss is considered a potential Project-related effect for all Wildlife subcomponents.

### 16.5.2 Reduced Habitat Effectiveness

Reduced habitat effectiveness due to sensory disturbance (e.g., noise, movement, dust, potential emissions, air and barge traffic) may result in avoidance of areas adjacent to the Project footprint or may increase the risk of stress to animals using the habitat. Reduced habitat effectiveness is an anticipated effect for all Wildlife subcomponents, and may occur during Construction, Operation, and Reclamation and Closure Phases when Project activities are occurring. This potential effect is applicable to each subcomponent in a specific way, and the effects assessments were based on habitat suitability modelling for Moose, Thinhorn Sheep, Grizzly Bear, and Wolverine and on literature review and field data for caribou and Little Brown Myotis.

### 16.5.3 Mortality Risk

Mortality risk due to collisions with Project-related vehicles associated with the Project on mine site roads and the NAR was considered a potential Project-related effect for all Wildlife subcomponents since all species may encounter vehicles. Vehicles will be in use for the majority of the Project life; therefore, mortality risk is a potential Project-related effect during the Construction, Operation, and Reclamation and Closure Phases. This potential effect also includes the risk of increased harvest through increased hunter access. In addition, the risk of wildlife entrapment of wildlife in Project facilities such as in Wastewater or Event Ponds or buildings is included in this potential effects.

### 16.5.4 Alteration to Movement

Project infrastructure may present a physical or sensory barrier or filter to natural patterns of animal movement through or to important habitat. The potential effect may occur during the Project's Construction, Operation, and Reclamation and Closure Phases. This effect applies to all subcomponents except Klaza Caribou and Little Brown Myotis. The KCH does not show identified directional movement, particularly not at the periphery of their range where they may interact with the Project, so movement is not considered for that subcomponent. Little Brown Myotis movement patterns are likely to be negligibly altered by Project infrastructure because these features are not likely to interact with localized foraging flights.

### 16.5.5 Contaminants Uptake

Contaminants uptake and risk of illness or mortality from ingesting dust-covered forage is a potential Project-related effect that may occur during the Construction and Operation Phases when these facilities are in use. This potential effect is relevant to plant foraging species such as Fortymile Caribou, Klaza Caribou, Moose, Grizzly Bear, and Thinhorn Sheep.

### 16.5.6 MITIGATION, MANAGEMENT, AND MONITORING

The mitigation measures identified for Wildlife and Wildlife Habitat were informed by a review of mitigation and follow-up programs undertaken for past projects, with emphasis on mining projects in Yukon. Input was received through the Project's consultation and engagement program. Tr'ondëk Hwëch'in provided input (N. Becker, Pers. Comm. 2016) on the Wildlife Protection Plan (**Appendix 31-F**), a key document that will direct mitigation implementation for the Project. Mitigation measures for Wildlife and Wildlife Habitat include the following:

- Implement Project design measures to minimize the overall footprint, avoid sensitive or important wildlife habitat, minimize vehicle traffic, use a Heap Leach Facility to minimize the area required for ore processing, selectively site Waste Rock Storage Facilities, manage attractants, and conduct progressive reclamation and closure activities.
- Deliver wildlife awareness orientation to Project personnel.
- Minimize habitat disturbance.
- Reduce human-wildlife encounters.
- Implement wildlife protection protocols.
- Manage traffic.
- Reduce barriers to movement.
- Manage aircraft operations.
- Prevent wildlife entrapment.

## 16.6 RESIDUAL EFFECTS

Following the implementation of mitigation measures, residual effects are likely to remain for all subcomponents due to one or more of the following Project-related effects: habitat loss, reduced habitat effectiveness, mortality risk, sensory disturbance and alteration to movement. As discussed below, all of these residual effects are predicted to be not significant.

No residual effects are predicted to any Wildlife subcomponent due to contaminant uptake.

### 16.6.1 FORTYMILE CARIBOU

Residual effects on Fortymile Caribou include habitat loss and reduced habitat effectiveness, mortality risk, and alteration to movement. Residual effects on Fortymile Caribou are considered low in magnitude because of the small proportion of Fortymile Caribou habitat likely to be affected by the Project (i.e., 0.6% of the FC-RAA), the very low risk of Caribou-vehicle collisions, and the variability in movement pathways, that, when Caribou do cross through the Project footprint, their movement can occur unhindered. All Project-related residual effects are localized to the Project footprint and ZOI, and occur during the winter months when the FMCH is present in the FC-RAA. Habitat loss will occur primarily during the Construction Phase, whereas reduced habitat effectiveness, mortality risk, and alteration to movement will likely occur during the Construction, Operation, and Reclamation and Closure Phases.

The context for all residual effects is high as the FMCH has shown continuous growth since the population low in the 1970s, the herd is not a listed species, and there is currently no hunting of the FMCH, thereby reducing population stresses on the herd. Based on these considerations, the residual effects of habitat loss, reduced habitat effectiveness, mortality risk, and alteration to movement are not considered to be significant at the regional level. The confidence levels in these significance determinations for habitat loss, reduced habitat effectiveness, and alteration to movement are considered moderate based on the uncertainty of future distribution of Fortymile Caribou in the FC-RAA and interaction with the Project. The level of confidence in the significance determination for mortality risk is considered high for the significance determination for mortality risk, however, based on low traffic volumes, current known movement of Fortymile Caribou near the Project footprint, and predicted effectiveness of mitigation measures to reduce Project-related mortality risk.

### 16.6.2 KLAZA CARIBOU

Residual effects on Klaza Caribou are habitat loss and reduced habitat effectiveness. Project-related residual effects on habitat will likely occur at the edge of the KCH annual range and outside of critical winter habitat during the non-winter months, when Caribou are not limited by habitat availability. Habitat loss will likely be minimal, and will likely only occur during the Construction Phase, whereas reduced habitat effectiveness is likely to occur during the Construction, Operation, and Reclamation and Closure Phases. The effect of the Project on KCH habitat was assessed as low in magnitude due to a limited amount of KCH annual range that may be altered by the Project (i.e., 0.29% of the KC-RAA), As such, the residual effects of habitat loss and reduced habitat effectiveness are considered to be not significant at the scale of the KC-RAA. The level of confidence in these predictions is moderate considering the known occurrence of KCH relative to the Project and the uncertainty of habitat use.

### 16.6.3 MOOSE

Residual effects for Moose include habitat loss due to the Project footprint, reduced habitat effectiveness due to sensory disturbance, and mortality risk due to collisions with vehicles and improved hunting access. While habitat loss is likely to only occur during the Construction Phase, the remaining residual effects are likely to occur during the Construction, Operation, and Reclamation and Closure Phases. The residual effects for Moose were assessed as low in magnitude due to minimal habitat loss and reduced habitat effectiveness (i.e., 0.88% of the W-RAA), low traffic volumes and restricted speed limits on the NAR, and minimal effect on Moose harvest rates in the W-RAA (i.e., an increase of 0.006 Moose per year, and licensed harvest is managed) in the RAA. The context for Moose is high considering Moose are likely resilient to habitat disturbance, preferring younger habitats for foraging, and Moose are likely to be resilient to minimal increases in annual mortality. Based on these considerations, the potential Project-related residual effects on habitat and mortality risk for Moose are considered not significant and should not pose a risk to the long-term persistence and viability of the Moose population at the regional level. The level of confidence in the significance determinations is moderate for habitat effects in consideration of the limited spatial habitat mapping available at the regional level prior to the baseline studies conducted for this Project, whereas the level of confidence in the significance determination for mortality risk was high based on well-defined and understood measurable parameters related to mortality.

### 16.6.4 Thinhorn Sheep

Residual effects for Thinhorn Sheep include habitat loss due to the Project footprint, reduced habitat effectiveness due to ground-based sensory disturbance, and alteration to movement. Habitat loss will be very minimal and is likely to occur during the Construction Phase, whereas reduced habitat effectiveness will be minimal and is likely to occur during the Construction, Operation, and Reclamation and Closure Phases. Both habitat loss and reduced habitat effectiveness are likely to be minimal (i.e., 5.04% of the TS-RAA). Alteration to movement is also likely to be minimal and will likely occur during the Construction, Operation, and Reclamation and Closure Phases. The context for Thinhorn Sheep is considered high because Thinhorn Sheep populations are secure in Yukon (Environment Yukon 2016) and there is no known harvest of Sheep in the TS-RAA. Based on these considerations, the residual habitat effects for Thinhorn Sheep were assessed as low in magnitude, and were therefore considered to be not significant and should not pose a risk to the long-term persistence and viability of the Thinhorn Sheep population at the regional level. The level of confidence in these significance determinations was moderate due to uncertainty and variability in Thinhorn Sheep responses to sensory disturbance and limited information on local Sheep movements.

### 16.6.5 Grizzly Bear

Residual effects for Grizzly Bear include habitat loss due to the Project footprint and reduced habitat effectiveness due to sensory disturbance. Habitat was evaluated using effectiveness, security, and denning models. Habitat loss is likely to occur only during the Construction Phase, while reduced habitat effectiveness is likely to occur throughout the Construction, Operation, and Reclamation and Closure Phases. The residual effects for Grizzly Bear were assessed as low in magnitude and below most identified thresholds for habitat effects. The context for Grizzly Bear is considered moderate. Grizzly Bear is listed as a species of Special Concern (COSEWIC 2012); however, Grizzly Bears have large home ranges and Grizzly Bear density in the W-RAA is considered to be low, and therefore the Project will likely affect a very small portion of an individual bear’s range. Based on these considerations, the residual habitat effects on habitat were considered to be not significant and should not pose a risk to the long-term persistence of Grizzly Bear at the regional level. The level of confidence in these significance determinations was moderate due to knowledge of Grizzly Bears in the region based on literature and uncertainty in the level of activity that poses a threshold level of disturbance to Grizzly Bears.

### 16.6.6 WOLVERINE

Residual effects for Wolverine include habitat loss due to the Project footprint and reduced habitat effectiveness due to sensory disturbance. While habitat loss is likely to only occur during the Construction Phase, reduced habitat effectiveness is likely to occur throughout the Construction, Operation, and Reclamation and Closure Phases. The residual habitat effects for Wolverine were assessed as low in magnitude due to the limited amount of habitat altered from the Project (i.e., 8.52% of potential denning habitat within the W-RAA). The context for Wolverine was considered moderate as Wolverine are a species of Special Concern by COSEWIC (2014); however, Yukon contains a high proportion of Canada's estimated Wolverine population, and densities in Yukon are some of the highest reported in North America. Based on these considerations, the residual effects on potential denning habitat for Wolverine was considered to be not significant and should not pose a risk to the long-term persistence and viability of the Wolverine population at the regional level. The level of confidence in this significance determination is moderate in consideration of the limited spatial habitat mapping available at the regional level prior to the baseline studies conducted for the Project.

### 16.6.7 LITTLE BROWN MYOTIS

Residual effects for Little Brown Myotis include habitat loss due to the Project footprint and reduced habitat effectiveness due to sensory disturbance. While habitat loss is likely to only occur during the Construction Phase, reduced habitat effectiveness is likely to occur throughout the Construction, Operation, and Reclamation and Closure Phases. The residual effects for Little Brown Myotis were assessed as low in magnitude due to the low proportion of potential roosting habitat affected by the Project (i.e., 0.57% of the W-RAA) compared to that available in the W-RAA. The context for Little Brown Myotis is moderate considering the current threat of White-nose Syndrome on bats and their Endangered SARA listing; however, the disease is not believed to have expanded into Yukon bat populations yet (COSEWIC 2013). Based on these considerations, the residual habitat effects are considered not significant and should not pose a risk to the long-term persistence and viability of the Little Brown Myotis population at the regional level. The level of confidence in the significance determination is moderate considering the coarse scale of the habitat mapping performed; however, the areas mapped are only potential roosting habitat and it is unlikely that all of the area mapped will contain the discrete habitat features (e.g., roost trees, rock crevices) to support roosting bats. Potential roosting habitat is therefore likely over-estimated, increasing confidence in the assessment given this conservative approach.

## 16.7 CUMULATIVE EFFECTS ASSESSMENT

The cumulative effects assessment (CEA) was conducted on Wildlife and Wildlife Habitat at the scale of the RAAs used for the effects assessment. Project-related residual effects considered in the CEA for all subcomponents included habitat loss and reduced habitat effectiveness. Mortality risk and/or alteration to movement were considered for select subcomponents (i.e., Fortymile Caribou, Moose, and Thinhorn Sheep). The projects and activities considered in the CEA included quartz projects, placer projects, and existing disturbance including road networks. These projects and activities were selected based on their potential to interact cumulatively with other projects and activities within the RAAs, including the Project. The CEA was completed for each subcomponent using methods consistent with the effects assessment. Habitat loss and reduced habitat effectiveness from anthropogenic disturbances in the FC-RAA and KC-RAA were assessed as low in magnitude (i.e., 5.38% and 5.84%, respectively); however, this was offset by the incorporation of fire disturbance, which has a greater influence on the amount of potential caribou habitat affected (i.e., 26.13% and 19.60%, respectively). Habitat loss and reduced habitat effectiveness were assessed as low for all other subcomponents except Wolverine. The Wolverine denning habitat model uses the presence of late spring snow cover to identify suitable denning habitat; however, the areas mapped are only potential denning habitat and it is unlikely that all of these areas will contain the discrete habitat features necessary to support Wolverine denning sites. Therefore, this approach is conservative and likely over-estimates the amount of potential denning habitat that might be altered by the Project and other projects and activities within the W-RAA. The effects of mortality risk and alteration to movement were assessed as low to moderate for the corresponding subcomponents. Overall, the residual effects considered in the CEA are determined to be not significant at the regional level for all subcomponents and should not pose a risk to the long-term persistence and viability of wildlife subcomponent populations at the regional level.

The CEA predictions are based on several assumptions and represent a conservative approach. It is unlikely that all quartz projects will operate to the same spatial extent as the Project during the life of the Project. The estimated project footprint for each placer footprint (each entire placer claim) is also conservative and may over-represent the area actually affected. Furthermore, the likelihood of these projects occurring consecutively and year-round with the Project is unknown; however, based on mining history in Yukon, consecutive operation is unlikely. Detailed ecosystem mapping is not available for the entire RAA, which was one factor that limited the confidence in the significance determination.

Although there will be a cumulative loss of wildlife habitat within the RAAs via habitat loss and reduced habitat effectiveness, this may be partially reversed following successful reclamation of disturbed areas. The cumulative loss of habitat in areas that cannot be fully reclaimed may be mitigated by the collective actions of individual project proponents, which may include minimizing or otherwise mitigating disturbances to Wildlife and Wildlife Habitat and reclaiming key habitat areas if they are disturbed by project activities.

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# 17.0 BIRDS AND BIRD HABITAT ASSESSMENT

This section presents a high-level summary of the effects assessment for the Birds and Bird Habitat Valued Component (VC). The full effects assessment is presented in **Appendix 17-B Birds and Bird Habitat Valued Component Assessment Report**.

## 17.1 ASSESSMENT SCOPE

Birds and Bird Habitat was selected as a VC due to the potential for the proposed Coffee Gold Mine (Project) to adversely affect individual birds, populations, and habitats. Birds and their habitat are a component of biodiversity and are important because of their value to First Nations and other local people who may rely on certain species as a subsistence and economic resource.

Six subcomponents were selected for the Bird and Bird Habitat VC because they are considered representative of other bird species in the region based on similar habitat requirements (**Table 17.1-1**). The indicators used to describe and evaluate potential Project-related effects on the Birds and Bird Habitat VC and its subcomponents, and the rationales supporting the selection of these indicators, are identified in **Table 17.1-2**.

**Table 17.1-1 Bird and Bird Habitat Subcomponents**

| Subcomponent | Representative of / Focus on | Rationale for Selection |
|---|---|---|
| Sharp-tailed Grouse | Upland game birds | • Potential for interaction with the Project footprint<br>• Sensitive to disturbance around leks during the spring breeding period (particularly females) |
| Cliff-nesting raptors | Peregrine Falcon<br>Golden Eagle<br>Gyrfalcon | • Peregrine Falcon is a species of Special Concern under *the Species at Risk Act*, SC 2002. C. 29 (SARA)<br>• Peregrine Falcon, Golden Eagle, and Gyrfalcon are habitat specialists that have established long-term nest sites in specific habitats (i.e., cliffs) within and near Project infrastructure |
| Passerines (i.e., songbirds) | Overall songbird diversity | • Includes migratory species protected under the *Migratory Birds Convention Act, 1994*, SC 1994, c. 22 (MBCA 1994) |
| Upland-associated species at risk | Focal species:<br>Common Nighthawk<br>Olive-sided Flycatcher<br>Short-eared Owl | • Common Nighthawk and Olive-sided Flycatcher are Threatened species under SARA<br>• Short-eared Owl is a species of Special Concern under SARA<br>• Includes migratory species protected under the MBCA 1994 |
| Wetland-associated species at risk | Focal species:<br>Horned Grebe<br>Red-necked Phalarope<br>Rusty Blackbird | • Horned Grebe and Red-necked Phalarope are species of Special Concern under the Committee on the Status of Wildlife in Canada<br>• Rusty Blackbird is a species of Special Concern under SARA<br>• Includes migratory species protected under the MBCA 1994 |

| Subcomponent | Representative of / Focus on | Rationale for Selection |
|---|---|---|
| Bank Swallow | Not Applicable | • Threatened species under the Committee on the Status of Wildlife in Canada<br>• Migratory species protected under the MBCA 1994<br>• Habitat specialist that has established long-term nesting colonies in specific habitats (i.e., steep bluffs or embankments comprised of friable soils) within and near the Project footprint. |

**Table 17.1-2 Indicators for Birds and Bird Subcomponents**

| Subcomponent | Indicator | Rationale for Selection |
|---|---|---|
| Sharp-tailed Grouse | Number of available lek sites | Potential effect on the availability of breeding habitat if Project infrastructure or activities result in a change to the number of suitable lek sites. |
| Cliff-nesting Raptors | Number of available nest sites | Potential effect on the availability of cliff-nesting raptor habitat if Project infrastructure or activities result in a change to the number of suitable nest sites. |
| Passerines | Amount of high-suitability habitat (hectares (ha)) | Potential effect on habitat suitability for passerines if Project infrastructure or activities result in a change to the amount of high-suitability habitat. |
| Upland-associated Species at Risk | Amount of high-suitability habitat (ha) | Potential effect on habitat suitability for upland-associated birds if Project infrastructure or activities result in a change to the amount of high-suitability habitat. |
| Wetland-associated Species at Risk | Amount of high-suitability habitat (ha) | Potential effect on habitat suitability for wetland-associated birds if Project infrastructure or activities result in a change to the amount of high-suitability habitat. |
| Bank Swallow | Number of available colony sites | Potential effect on the availability of Bank Swallow nesting habitat if Project infrastructure or activities result in a change to the number of suitable colony sites. |

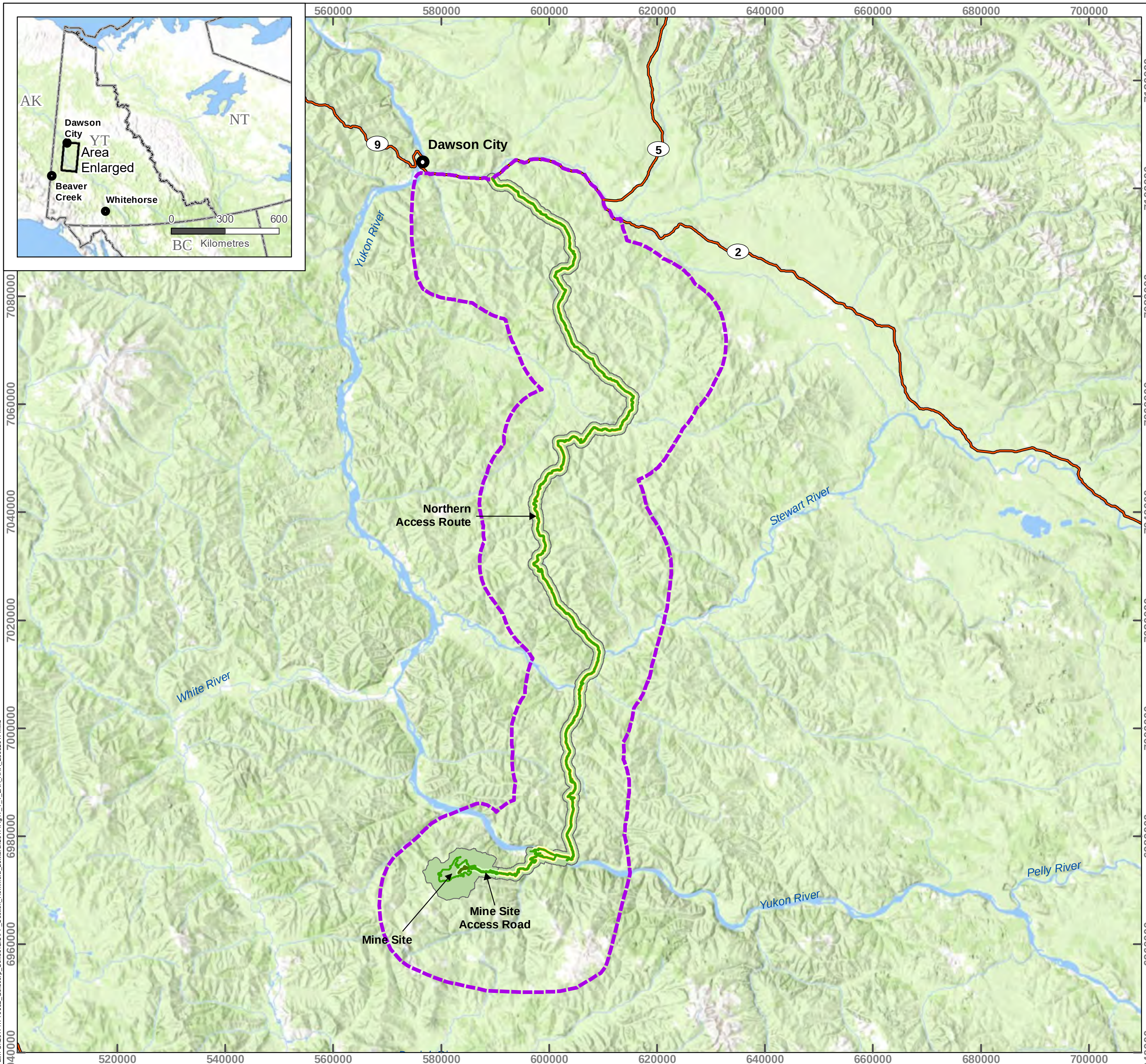
### 17.1.1 Assessment Boundaries

The Local Assessment Area (LAA) is generally defined by the extent of Terrestrial Ecosystem Mapping and encompasses an area of approximately 473 square kilometres ($km^2$) (**Table 17.1-3**). The Regional Assessment Area (RAA) also defines the boundaries of the cumulative effects assessment (CEA) Area for Birds and Bird Habitat. The RAA was delineated using watershed drainage divides and is approximately 5,166 $km^2$ (**Table 17.1-3**). The Project assessment boundaries are presented in **Table 17.1-3**; no administrative boundaries were identified for Birds and Bird Habitat.

**Table 17.1-3 Assessment Boundary Definitions for the Birds and Bird Habitat Assessment**

<table>
<tr><th colspan="2">Boundary</th><th>Description of Boundary</th></tr>
<tr><td rowspan="2">Spatial</td><td>LAA</td><td>Delineated using buffers around the proposed Project:<br>• Around the Mine Site, delineated based on the height of land while encompassing a minimum buffer of 1 kilometre (km) around the Project footprint<br>• Along the NAR, includes a 1-km buffer on either side of the road.</td></tr>
<tr><td>RAA and CEAA</td><td>Delineated using watershed drainage divides, including:<br>• Coffee and Excelsior creek watersheds south of the Yukon River<br>• Entire Ballarat and Barker creek watersheds between the Yukon and Stewart rivers<br>• Entire Maisy May, Black Hills, Eureka, Sulphur, Dominion, Bonanza, and Hunker creek watersheds north of the Stewart River<br>• Portions of the Henderson Dome and Indian River watersheds.</td></tr>
<tr><td colspan="2">Temporal</td><td>The temporal characteristics of the Project’s Construction, Operation, Reclamation and Closure, and Post-closure phases (i.e., the Project Schedule) are described in Section 2.0 Project Description.</td></tr>
<tr><td colspan="2">Technical</td><td>Several constraints were identified that may impose limitations in predicting or measuring potential effects to Birds and Bird Habitat within the RAA. These constraints include the following: limited information on species ranges and population numbers in the region; limited knowledge of habitat requirements for species at risk and species that rarely occur in the region; limited knowledge of species and individual response to disturbance, and unknown implications at the population level; and using habitat suitability models to predict potential Project-related effects for passerines and upland- and wetland-associated species at risk.<br>Habitat suitability mapping for birds is based on ecological land classification mapping. Within the RAA, ecological land classification is defined to the subzone level, rather than the ecological community (e.g., ecosites and vegetation association) level. This technical limitation, combined with the use of non-standardized base mapping for ecosites and vegetation associations, makes it challenging when comparing the amount of suitable habitat available in the context of the RAA.</td></tr>
</table>

**Notes:** CEAA – Cumulative Assessment Area; LAA - Local Assessment Area; NAR – Northern Access Route; RAA – Regional Assessment Area




COFFEE GOLD MINE

**Bird and Bird Habitat Assessment Boundaries**

Legend

- Highway
- Mine Site Access Route
- Northern Access Route
- Project Footprint
- Bird Local Assessment Area
- Bird Regional Assessment Area

Notes

1. This map is not intended to be a "stand-alone" document, but a visual aid of the information contained within the referenced Report. It is intended to be used in conjunction with the scope of services and limitations described therein.

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GOLDCORP

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## 17.1 ASSESSMENT METHODS

The effects assessment places bird habitat potentially affected by the Project footprint in the context of habitat available regionally in the RAA. Fine-scale habitat suitability mapping was completed within the LAA based on Ecological and Landscape Classification and Broad Ecosystem Mapping. Land cover data available for the RAA was not directly comparable with land cover mapping in the LAA. Therefore, to assess change in habitat area, broad-scale habitat components were used as surrogates to represent high-value habitat available in the LAA compared to the RAA. Habitat modelling in the LAA was used to define which habitat components represented high-value habitat.

### 17.1.1 REGULATORY FRAMEWORK

At a federal level, the *Species at Risk Act* (SARA), SC 2002, c.29 implements in part Canada's obligations under the United Nations Convention of Biological Diversity. It provides for the legal protection of plant and wildlife species and the conservation of their biological diversity. Under SARA, the Committee on the Status of Endangered Wildlife in Canada (COSEWIC), an independent body of experts, is responsible for identifying and assessing plant and wildlife species considered at risk, which may then qualify for legal protection and recovery under SARA. Once listed under SARA, species plans are legal requirements to secure the necessary actions for species recovery and management. The schedules of the Act were used to identify SARA listed species in the Project area that are of particular conservation concern, which may require additional levels of protection.

The *Migratory Birds Convention Act* (MBCA)*, SC 1994, c. 22* created in 1917 and updated in 1994, protects and conserves migratory birds (as individuals and populations), their eggs, and their nests through the implementation of the Migratory Birds Regulations and the Migratory Birds Sanctuary Regulations. According to the MBCA, removal of migratory birds, their eggs, or nests from a site is only permissible if the migratory birds are causing or may cause damage to property and equipment (subject to permitting). Deposit of harmful substances to birds in areas or waters frequently visited by migratory birds is prohibited. No migratory bird sanctuaries fall within the region surrounding the Project.

At a territorial level, the *Wildlife Act, R.S.Y. 2002, c.229* defines "wildlife" as any vertebrate animal of any species or type that is wild by nature, and includes wildlife in captivity, but does not include fish. The Act provides rules for hunting and trapping, outfitting and guiding, licensing, enforcement, and habitat protection. It also gives authority to make various regulations. Regulations include prescribing specially protected wildlife and measures to protect, areas to be wildlife sanctuaries and measures for management, methods of hunting and trapping wildlife, licensing and permitting conditions, zoning Yukon to administer the Act, and the submission of harvest information. The Act is typically amended every 10 to 20 years while regulations can be updated annually.

Relevant to Birds and Bird Habitat, the *Wildlife Act* states that a person shall not:

- *"…destroy, take or possess any egg or nest of a bird that belongs to a species that is wild by nature" (Wildlife Act 17[1])*
- *"…damage or interfere with a beaver dam, or the den, lair or nest of any wildlife" (Wildlife Act 91[1])*
- *"…harass any wildlife" (Wildlife Act 91[1]). "A person shall be deemed to harass wildlife if the person operates a vehicle or boat in a manner that might reasonably be expected to harass any wildlife; or attempts to interfere with the movement of any wildlife across any road or watercourse" (Wildlife Act 92[2] c and d).*

## 17.2 EXISTING CONDITIONS

### 17.2.1 SHARP-TAILED GROUSE

Sharp-tailed Grouse are year-round Yukon residents (EC 2015), and inhabit early-successional plant communities dominated by a dense cover of grasses and shrubs (Connelly et al. 1998). In the far north, including Yukon, such habitats are typically created by wildfires and logging activities (EC 2015).

Sharp-tailed Grouse are well-known for their elaborate courtship displays (Connelly et al. 1998). In early spring, multiple males display to attract females at communal sites called leks. Leks, which are generally located on elevated areas with sparse vegetation, can be used year after year. In southwest Yukon, grouse begin to attend lek sites by mid-March when weather conditions are favourable, with the peak of courtship behaviour occurring between the last week of April and first week of May (Mossop et al. 1979). Breeding activity may continue until July. Females generally nest under dense vegetation cover within 0.4 kilometres (km) to 1.8 km of a lek site (Connelly et al. 1998).

Baseline surveys for Sharp-tailed Grouse were conducted in April 2015 and 2016 and were focussed on locating lek sites. The surveys identified six probable lek sites within the RAA; however, no leks were identified in the LAA or within 3 km of Project infrastructure.

### 17.2.2 CLIFF-NESTING RAPTORS

Cliff-nesting raptors potentially found in the Project area include Peregrine Falcon (*Falco peregrinus*), Golden Eagle (*Aquila chrysaetos*), and Gyrfalcon (*Falco rusticolus*). During baseline field studies, 42 nests within 25 nest areas were recorded within the RAA. These included six Golden Eagle nests areas, five Peregrine Falcon nest areas, four Common Raven nest areas, and 10 nest areas where the species was unknown. Sixteen of these nest areas were located along the Yukon River, eight were located along the Stewart River, and one was located in an alpine/subalpine area south of the Yukon River. Four Priority 1 nest areas (i.e., located within 500 metres (m) of Project infrastructure and expected to be most at risk from Project activities) were observed during baseline field studies (**Table 17.2-1**).

**Table 17.2-1 Cliff-nesting Raptor Nest Areas in Regional Assessment Area**

| General Location | Nest Area | Species[1] | No. Nests | Distance to Project Footprint (km) | Project Element |
|---|---|---|---|---|---|
| Yukon River | 009 | Golden Eagle | 3 | 0.3 | NAR, Yukon R. barge crossing, exploration airstrip |
| | 010 | Peregrine Falcon | 1 | 0.4 | NAR, Yukon R. barge crossing, exploration airstrip |
| Stewart River | 103 | Unknown (Golden Eagle) | 3 | 0.1 | NAR along Stewart R. |
| | n/a | Peregrine Falcon | 0 | 0.1 | NAR and Stewart R. barge |

**Notes:**

1 The nest sites provided by Environment Yukon were identified to species previous to the Project surveys. For nests identified by Project biologists, active nests were identified to species; inactive nests were described as ‘Unknown’ species and the suspected species was identified based on nest structure when possible.

Gyrfalcons have not been observed within the LAA or RAA to date (no individuals or nest sites); however, the southern margin of the RAA does overlap a Wildlife Key Area for gyrfalcon and signs of past raptor use (i.e., whitewash and potential perch sites) were observed at a small number of alpine/subalpine sites during baseline field studies.

### 17.2.3 Passerines

Passerines include a wide range of bird species that occupy a variety of habitat types. Fifty-seven passerine species are expected to occur in the Project area, based on baseline field surveys, previous studies in the region, and other background information on bird distributions within Yukon. These species include Flycatchers, Shrikes and Vireos, Jays and Crows, Larks, Swallows, Chickadees, Kinglets, Thrushes, Waxwings, Warblers, Longspurs and Sparrows, Blackbirds, and Finches. During Project baseline studies, systematic point count surveys were conducted over three consecutive years to assess species occurrence, abundance, distribution, and diversity of passerines within the Project area. A total of 48 species were detected during baseline surveys. The most common species detected were Dark-eyed Junco (*Junco hyemalis*), Swainson’s Thrush (*Catharus ustulatus*), and White-crowned Sparrow (*Zonotrichia leucophrys*).

Habitat for breeding birds occurs throughout the LAA, although considerable variation occurs with respect to the density and diversity of birds across habitat types. Habitats that support the highest density of breeding birds include placer-mined areas and old burns (i.e., areas dominated by regenerating vegetation and a large shrub component). Placer-mined areas are located almost exclusively in lowland areas, often in proximity to water (i.e., placer-mined ponds and streams), and contain extensive edge habitat. Notable densities of birds, including habitat specialists (e.g., Townsend’s Warbler (*Setophaga townsendi*)) and species at the northern extent of their breeding range in Yukon (e.g., Warbling Vireo (*Vireo gilvus*) were recorded in upland coniferous and riparian forest (coniferous, deciduous, and mixed). Habitats with the lowest density of breeding birds included subalpine and alpine areas such as felsenmeer (boulder fields), subalpine and alpine shrub, and high-elevation sparse and open forest.

Habitat modelling identified old burns, placer-mined areas, upland coniferous forest, riparian forest, high- and low-elevation shrubby areas, swamps, and marshes as high-quality habitats. For passerine birds, high-quality habitat constituted 49 percent (%) of the total area of the baseline LSA. While these habitats are located throughout the LAA, they are most extensive in the upper Maisy May Creek, Eureka Ridge, Henderson Dome, and the Coffee areas due to the expanse of disturbed habitats (old burns and placer mining) in these areas. The portions of the LAA that cover the Yukon and Stewart River floodplains are also dominated by high-quality habitats, due to the presence of riparian forests and wetlands in these areas.

### 17.2.4 UPLAND-ASSOCIATED SPECIES AT RISK

During Project baseline studies, upland-associated species at risk were detected on point count surveys conducted between 2013 and 2015, and on targeted surveys for Common Nighthawk (*Chordeiles minor*) and Short-eared Owl (*Asio flammeus*) conducted in 2014, 2015 and 2016.

During the Project's baseline bird surveys, 23 Common Nighthawk detections were made, seven within the LAA. Nighthawks were encountered most frequently along the NAR, particularly in the areas near Henderson Dome and Black Hills Creek, as well as lower Dominion Creek. Only one incidental observation was made near south of the Yukon River (i.e., near the existing Coffee Exploration Camp). All detections of territorial boom calls, which indicate proximity to nest sites (Brigham et al. 2011), occurred outside of the LAA. High-quality habitats for Common Nighthawk are extensive in the LAA (13,656 hectares (ha)), making up 29% of the total area.

Thirteen detections of Olive-sided Flycatcher (*Contopus cooperi*) were made during baseline studies, including five detections within the LAA. Habitats rated as high suitability for this species include old burns, fens, stunted coniferous forests, and high-elevation, sparse, or open coniferous forests. Thirty-four percent (15,924 ha) of the LAA is considered high-quality habitat for Olive-sided Flycatchers. This habitat is concentrated in the Coffee and upper Maisy May Creek, Eureka Ridge, and Henderson Dome areas, where there is a prevalence of old burns and stunted coniferous forests.

Short-eared Owl was observed only once during the three years of baseline studies; the observation was made in June 2016 when an owl was observed flying high over the Java Road (i.e. the current exploration road between the Yukon River and the proposed Mine Site), heading southwest. The nature of the flight appeared to be a long-distance movement, and there was no evidence to suggest the owl was actively using the area. Subalpine and alpine shrub areas dominated by dryas or sparse herbs, low or dwarf shrubs, or ground cover were rated as high suitability for this species. Habitat modelling identified only 372 ha of these habitat types within the LAA (1%); this habitat is almost entirely limited to the Coffee Project area in the southern portion of the baseline LSA.

### 17.2.5 Wetland-Associated Species at Risk

Baseline surveys for wetland-associated species at risk included point count surveys conducted in 2013, 2014 and 2015, and ground-based investigations of pond and wetland habitats during 2014 and 2015.

Horned Grebes (*Podiceps auritus*) were detected at two ponds along lower Dominion Creek during baseline studies, including one active nest located on an old placer mining pond and a pair of likely breeders at a natural pond along Dominion Creek. Horned Grebes were not detected within the LAA. During previous surveys in the Indian River Valley, four Horned Grebe breeding pairs were observed on old placer mining ponds (Chevreux 2014). Wetland mapping was used to identify potential breeding habitat for Horned Grebes. Due to the relatively small number of ponds suitable for breeding, all natural and man-made ponds and marshes were assumed to be suitable. On this basis, 35 marshes and small ponds within the LAA, with a total area of 140 ha (less than 1% of LAA), could provide suitable nesting habitat for this species.

Red-necked Phalarope (*Phalaropus lobatus*) were not detected in the Project area during baseline studies. During previous surveys conducted in the Indian River Valley adjacent to the LAA, two pairs of Red-necked Phalaropes, probable breeders, were observed on an unmined pond (Chevreux 2014). The amount of suitable breeding habitat for Red-necked Phalaropes is the same as for Horned Grebes, based on overlapping habitat requirements.

Rusty Blackbirds (*Euphagus carolinus*) were detected eight times during baseline studies. All detections were made outside of the LAA, although there were 5 detections at 2 wetlands along the Stewart River within 2 km of the LAA. During breeding bird surveys along the Indian River during 2014, Chevreux (2014) noted that the species was encountered frequently in both post-mined and unmined habitats, with evidence of probable breeding in both habitat types. Habitats rated as high suitability for Rusty Blackbirds include swamps and marshes with fens. In addition to these habitat ratings, all areas located within 75 m of wetlands and ponds (i.e., marsh, swamp, pond, placer pond) were also rated as high suitability. Habitat mapping identified less than 1% (394 ha) of high-quality habitat for Rusty Blackbird within the LAA.

### 17.2.6 Bank Swallow

During baseline field studies, 12 Bank Swallow colonies were recorded within the RAA, seven of which were also located within the LAA. Of these seven colonies, one was located in natural habitat along a river bank; the remainder were located in embankments created due to roads and placer mining activity. Single birds or small groups of up to four birds were also detected within the LAA and larger RAA during point counts and incidental observations. One observation of more than 10 individuals was made on a point count in an area disturbed by placer mining activity near the Indian River bridge.

Six Priority 1 Bank Swallow colonies (i.e., located within 300 metres (m) of Project infrastructure and expected to be most at risk from Project activities) were observed during baseline studies. Colony site BANS_6, located in a cut bank in an actively mined placer area within 20 m of the existing road centerline, was identified as an inactive colony in 2015. During a field survey in April 2016, this colony could not be found by Project biologists. It is likely it was destroyed by ongoing placer mining activities in the area, and is therefore not considered further in the assessment. **Table 17.2-2** provides a brief summary of the remaining Priority 1 Bank Swallow colonies.

**Table 17.2-2 Bank Swallow Nest Areas in Regional Assessment Area**

| Colony ID | Colony Status | Habitat Type | Distance to Project Infrastructure |
|---|---|---|---|
| BANS_5 | Unknown | Road embankment | 71 m from Project footprint |
| BANS_7 | Active | Cut bank, placer mined area | Within Project footprint |
| BANS_9 | Unknown | Road embankment | Within Project footprint |
| BANS_12 | Unknown | Road embankment | Within Project footprint |
| BANS_13 | Unknown | Road embankment | Within Project footprint |

## 17.3 Project Interactions, Potential Effects, and Mitigation Measures

### 17.3.1 Potential Project-related Interactions

Unless otherwise indicated, because individual subcomponents are expected to respond to a particular interaction in a similar manner, the interactions have been evaluated on a VC-wide basis. Available Traditional Knowledge was incorporated into this assessment. Bates and DeRoy (2014) identified the following as potential Project-related interactions that could be applicable for Birds and Bird Habitat:

- Land clearing for Project operations and road construction potentially causing animal habitat destruction and fragmentation and limiting animal movement across the landscape
- Potential disturbance of animals due to noise and traffic during Project operation, causing them to move away from the area or change movement patterns
- Construction work on the Project bringing more people into the area, and familiarizing them with good hunting locations, which would potentially increase hunting pressure on wildlife populations. (Bates and DeRoy 2014)

Potential Project-related adverse effects on Birds and Bird Habitat were identified based on Project-related interactions (**Table 17.3-1**). Activities associated with a particular effect or combinations of effects have been described together to minimize repetition.

**Table 17.3-1 Potential Interactions**

| Phase | Types of Effects | Causes of Interactions |
|---|---|---|
| Construction Phase | Habitat loss<br>Reduced habitat effectiveness<br>Mortality risk<br>Contaminants uptake<br>Damage or destruction of active nests | Activities involving physical disturbance and material handling within the Project footprint<br>Elevated noise levels from construction activities<br>Mobilization of mobile equipment and construction materials.<br>Development and use of the Latte and Double Double Open Pits, engineered Stockpiles, Site Water Management Infrastructure, Heap Leach Facility, Crusher System, Bulk Explosives Area<br>Installation of Project Site, air traffic, Camp Site, road use and maintenance and ancillary components<br>Development and use of Alpha Waste Rock Storage Facility (WRSF) |
| Operation Phase | Habitat loss<br>Reduced habitat effectiveness<br>Mortality risk<br>Contaminants uptake<br>Damage or destruction of active nests | Activities associated with physical disturbance material handling, and progressive reclamation within the Project footprint<br>Development, use, dewatering and backfill of Kona, Supremo, Latte and Double Double Open Pits, engineered Stockpiles, Site Water Management Infrastructure, Heap Leach Facility, Crusher System, Bulk Explosives Area<br>Development and use of Alpha and Beta WRSF<br>Continued use of Camp Site Facilities, Bulk Storage Area and ancillary infrastructure.<br>All traffic-related activities, hauling of ore, excavation and transport of contaminated soils, trucking of fuel, explosives, hazardous materials and water, and re-supply of freight and consumables<br>Elevated noise levels from Project operations |
| Reclamation and Closure Phase | Reduced habitat effectiveness<br>Mortality risk | Activities involving physical disturbance within the Project footprint, dismantling, removal, closure, decommissioning and elevated noise and emission level |
| Post-closure Phase | Negligible | Negligible |

### 17.3.2 Potential Effects

Potential effects to Birds and Bird Habitat include the following:

- **Habitat loss –** Considered a potential effect for all subcomponents during the Construction and Operation Phases. The assessment focuses on breeding habitat, since this habitat type is likely to be the most limiting habitat with the greatest potential consequence. For cliff-nesting raptors and Bank Swallow, breeding habitat is considered in the context of individual nest sites or colony sites, respectively. For passerines and upland- and wetland-associated species at risk, breeding habitat is considered in the context of breeding habitat suitability, based on habitat suitability modelling.

- **Reduced habitat effectiveness due to sensory disturbance** – Considered a potential effect for all subcomponents during the Construction, Operation, and Reclamation and Closure Phases. This effect may result in avoidance of areas adjacent to the Project footprint, reduced use of such areas for breeding, or increased risk of stress or nest site abandonment. For Cliff-nesting raptors and Bank Swallow, breeding habitat is considered in the context of individual nest sites or colony sites, respectively. For passerines and upland- and wetland-associated species at risk, breeding habitat is considered in the context of breeding habitat suitability, based on habitat suitability modelling.
- **Mortality risk** – Considered a potential effect for all subcomponents during the Construction, Operation, and Reclamation and Closure Phases. Collisions may involve all types of Project-associated vehicles.
- **Contaminants uptake** – Considered a potential effect for Cliff-nesting raptors and wetland-associated species at risk during the Construction and Operation Phases. Risk of illness or mortality may arise for birds represented by these two subcomponents due to scavenging in the Project landfill or foraging in open water ponds. Birds represented by the other three subcomponents do not utilize open water or scavenge.
- **Damage or destruction of active nests** – Considered a potential effect for all subcomponents during the Construction and Operation Phases.

### 17.3.3 MITIGATION MEASURES

The mitigation measures identified for Birds and Bird Habitat were informed by a review of mitigation and follow-up programs undertaken for past projects, with emphasis on mining projects in Yukon. Input was received through the Project's consultation and engagement program (**Section 3.0**). Tr'ondëk Hwëch'in provided input (N. Becker, Pers. Comm. 2016) on the Wildlife Protection Plan (**Appendix 31-F**), a key document that will direct mitigation implementation for the Project. Mitigation measures for Birds and Bird Habitat include the following:

- Implement Project design measures to minimize the overall footprint, avoid sensitive/important bird habitat, minimize vehicle traffic, use a Heap Leach Facility to minimize the area required for ore processing, selectively site WRSFs, manage attractants, and conduct progressive reclamation and closure activities.
- Deliver wildlife awareness orientation to Project personnel.
- Minimize habitat disturbance.
- Avoid disturbance during bird breeding season.
- Protect active and identified nests.
- Manage traffic.

## 17.4 Residual Effects and Determination of Significance

Following the implementation of mitigation measures, residual effects are likely to remain for most subcomponents due to habitat loss and reduced habitat effectiveness. As discussed below, all of these residual effects are likely to be not significant.

Since no probable lek sites were identified within 3 km of the Project, no residual effects are likely for Sharp-tailed Grouse.

### 17.4.1 Cliff-nesting Raptors

All known Raptor cliff-nest sites and the features they are located on are likely to remain intact throughout the life of the Project. Although habitat effectiveness may be reduced for nests located in closer proximity to Project infrastructure, this Project-related effect is not likely to have population-level effects on Cliff-nesting raptors. Nest-specific management plans will be developed for all cliff nests identified within 500 m of the Project footprint to help minimize potential adverse effects on Cliff-nesting raptors. The residual effects of reduced habitat effectiveness on Cliff-nesting raptors are determined to be not significant at the regional level. In consideration of the uncertainty regarding the size and state of the Cliff-nesting raptor population in the region, the confidence in this prediction is moderate.

### 17.4.2 Passerines

The residual effects of habitat loss and reduced habitat effectiveness were assessed as low in magnitude for passerines (i.e., less than 10% of high suitability habitat within the RAA) and are therefore considered to be not significant at the regional level. In consideration of the uncertainty regarding the coarse-scale approach taken to assessing habitat for passerines and how different species and individual birds will be affected by habitat loss and reduced habitat effectiveness, confidence in the predictions for these residual effects is moderate.

### 17.4.3 Upland Species at Risk

Habitat for upland-associated species at risk is widely distributed within the RAA and the broader ecological region. Based on their widely distributed habitat and existing sources of sensory disturbance, it is likely that upland-associated species at risk will be resilient to habitat loss and reduced habitat effectiveness; however, because they are species at risk, a moderate context rating is assigned.

Habitat loss and reduced habitat effectiveness were assessed as low in magnitude for upland-associated species at risk (i.e., less than 10% of high suitability habitat within the RAA) and are therefore considered to be not significant at the regional level. The confidence in these significance determinations is moderate, partly because baseline habitat data is not available throughout the larger region. There is also uncertainty in how habitat for these species will be altered throughout the Project life cycle due to natural disturbance regimes (e.g., fire, climate).

### 17.4.4 Wetland Species at Risk

Due to the level of sensory disturbance associated with the existing road sections and ongoing physical activities (e.g., placer mining), it is assumed that a reduction in the effectiveness of wetland and open-water habitats within the LAA has already occurred. In addition, a limited amount of habitat is actually utilized by wetland-associated species at risk in the LAA. Given the at-risk status of these species and the likelihood that they are less resilient to habitat disturbance, however, the context is considered to be moderate.

The residual effects of habitat loss and reduced habitat effectiveness were assessed as low to moderate in magnitude for wetland-associated species at risk (i.e., less than 15% of high suitability habitat within the RAA) and are therefore considered to be not significant at the regional level. The confidence in these significance determinations is moderate due to the lack of a comparable habitat baseline for the larger region. Uncertainty also exists with respect to how habitat for wetland-associated species at risk will be altered throughout the Project life cycle due to natural disturbance regimes (e.g., fire, climate).

### 17.4.5 Bank Swallows

The five Priority 1 Bank Swallow colonies (excluding Colony BANS_6) located within 300 m of Project infrastructure are likely to remain intact throughout the life of the Project. Although habitat effectiveness may be reduced for colonies located in closer proximity to Project infrastructure, this Project-related effect is not likely to have population-level effects on Bank Swallows. Bank Swallows are known to be relatively insensitive to moderate levels of human disturbance as long as the integrity of their nesting habitat remains intact. Furthermore, habitat suitability is highly ephemeral, and may change during the life of the Project. Colony-specific management plans will be developed for all colonies identified within 300 m of the Project footprint to help minimize potential adverse effects on breeding Bank Swallows. The residual effects of reduced habitat effectiveness for Bank Swallows are considered to be not significant at the regional. Considering uncertainty regarding the exact size and state of the breeding Bank Swallow population in the region, the confidence in this prediction is moderate.

## 17.5 CUMULATIVE EFFECTS ASSESSMENT

This CEA is conducted at the VC level rather than at the subcomponent level because residual cumulative effects are likely to be similar for all birds.

Both residual effects (i.e, habitat loss and reduced habitat effectiveness) are carried forward in the CEA due to the potential for these residual effects to interact cumulatively with other projects and activities. These residual effects were screened against the residual effects for quartz projects, placer projects, and the existing road network. No additional mitigation measures are proposed beyond those proposed for Project-specific mitigation (**Section 17.4.3**).

Following the implementation of mitigation measures, residual cumulative effects are predicted for both habitat loss and reduced habitat effectiveness. Habitat loss was assessed as low in magnitude (i.e., 8.06% of potential bird habitat within the RAA) and is therefore considered to be not significant at the regional level. This 8.06% may include habitat that is rated as high, medium, low, and/or nil suitability for birds; it is unlikely that the entire 8.06% is high suitability habitat. Reduced habitat effectiveness was assessed as moderate in magnitude (i.e., 10.72% of potential bird habitat within the RAA) and is therefore considered to be not significant at the regional level. This 10.72% may include habitat that is rated as high, medium, low, and/or nil suitability for birds; it is unlikely that the entire 10.72% is high suitability habitat. The Project's contribution to this loss will be partially reversed following successful reclamation of disturbed areas. The cumulative loss of habitat in areas that cannot be fully reclaimed can be mitigated by the collective actions of individual Project proponents, which may include minimizing or mitigating disturbances to Birds and Bird Habitat and reclaiming key habitat areas if they are disturbed by Project activities. In addition, based on known past and present projects and reasonably foreseeable future projects within the RAA, it is unlikely that there will be enough large-scale anthropogenic disturbances to reduce population viability as a result of habitat loss and reduced habitat effectiveness. In consideration of uncertainty regarding the exact size and state of the breeding bird population in the region, and the lack of precise spatial data regarding the size of past, present, and reasonably foreseeable future projects and activities within the RAA, the confidence in this prediction is moderate.

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### 17.6.1 PERSONAL COMMUNICATIONS

Becker, N. 2016. Natural Resources and Heritage Analyst – Coffee Gold Project. Memo to EDI titled TH Initial Input on Wildlife and Wildlife Habitat Management Plan. Dated April 1, 2016.

GOLDCORP INC.

# VOLUME IV

## Human Environment

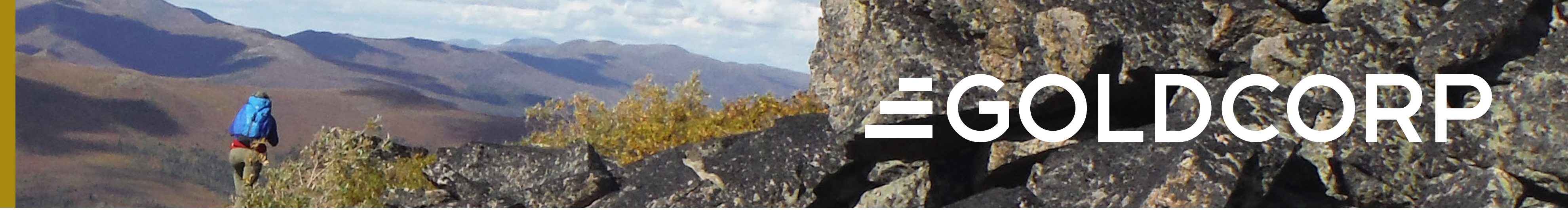
COFFEE GOLD MINE
PROJECT PROPOSAL FOR EXECUTIVE COMMITTEE SCREENING

Pursuant to the *Yukon Environmental and Socio-economic Assessment Act*

March 2017

Document Map

# COFFEE GOLD MINE
# YESAB PROJECT PROPOSAL

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# VOLUME IV

# HUMAN ENVIRONMENT

# Coffee Gold Mine
# YESAB Project Proposal

# VOLUME IV – HUMAN ENVIRONMENT
# Sections 18.0 to 26.0

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| Acronym / Abbreviation | Definition |
|---|---|
| 3D | three-dimensional |
| AAQO | Ambient Air Quality Objectives |
| AAQS | Ambient Air Quality Standards |
| ADR | adsorption, desorption, and recovery |
| AFN | Assembly of First Nations |
| Ag | silver |
| Al | aluminum |
| AN | ammonium nitrate |
| ANFO | Ammonium Nitrate/Fuel Oil |
| APS | Aboriginal Persons Survey |
| ARD | acid rock drainage |
| As | arsenic |
| ATV | all-terrain vehicle |
| Au | gold |
| AWOS | Automated Weather Observation System |
| BC | British Columbia |
| BEM | Broad Ecosystem Mapping |
| BMP | best management practice |
| BNOISE2 | Blast Noise Version 2 |
| C | carbon |
| CAC | criterion air contaminant |
| $CACO_3$ | calcium carbonate |
| CAD | Canadian dollars |
| CAPEX | capital expenditure |
| CBPR | community-based participatory research |
| CCL | compacted clay liner |
| CCME | Canadian Council of Ministers of the Environment |
| Cd | cadmium |
| CEA | Cumulative Effects Assessment |
| CEO | Chief Executive Officer |
| CEPA 1999 | *Canadian Environmental Protection Act, 1999* |
| CESA | Cumulative Effects Study Area |
| CFO | Chief Financial Officer |
| $CH_4$ | methane |

| Acronym / Abbreviation | Definition |
|---|---|
| CIC | carbon-in-carbon |
| CIM | Canadian Institute of Mining |
| CMHC | Canada Mortgage and Housing Corporation |
| CNIM | Centre for Northern Innovation in Mining |
| Co | cobalt |
| CO | carbon monoxide |
| $CO_2$ | carbon dioxide |
| $CO_2e$ | carbon dioxide equivalent |
| $CO_2e/yr$ | carbon dioxide equivalent per year |
| Code | Environmental Code of Practice for Metal Mines |
| Coffee Property | The total property owned by Goldcorp, consisting of all 3.021 contiguous claims in the Coffee Claim Block |
| COPC | contaminant (or chemical) of potential concern |
| COSEWIC | Committee on the Status of Endangered Wildlife in Canada |
| CPI | Consumer Price Index |
| Cr | chromium |
| CRA | Canada Revenue Agency |
| CRC | Consolidated Regulations of Canada |
| CSI | Crime Severity Index |
| Cu | copper |
| CWD | Canadian Wildlife Service |
| Cyanide Code | International Cyanide Management Code |
| CYFN | Council of Yukon First Nations |
| Dawson | City of Dawson |
| DFO | Fisheries and Oceans Canada |
| DNA | deoxyribonucleic acid |
| DO | dissolved oxygen |
| e-DNA | Environmental DNA |
| EASR | Environmental Activity and Sector Registry |
| ECA | Exploration Cooperation Agreement |
| ECCA | Exploration Communication and Cooperation Agreement |
| EEM | effluent effects monitoring |
| ECCC | Environment and Climate Change Canada |

| Acronym / Abbreviation | Definition |
|---|---|
| ELC | Ecological and Landscape Class |
| EMP | Environmental Management Plan |
| EMR | Energy, Mines and Resources |
| EMS | emergency medical services |
| EP-1N | north event pond |
| EP-1S | south event pond |
| EP-2 | event pond 2 |
| EPCM | Engineering, Procurement, and Construction Management |
| ERP | Emergency Response Plan |
| ERT | emergency response team |
| FCASP | Federal Contaminated Sites Action Plan |
| Fe | iron |
| $Fe^{2+}$ | iron II |
| FC-RAA | Fortymile Caribou Regional Assessment Area |
| FIFO | fly in / fly out |
| FMCH | Fortymile Caribou herd |
| FNNND | First Nation of Na-cho Nyäk Dun |
| FRMP | Forest Resources Management Plan |
| FTA | Federal Transport Authorite (U.S.) |
| FTE | full-time equivalent |
| GCL | geosynthetic clay liner |
| GDP | gross domestic product |
| GHG | greenhouse gas |
| GIS | geographic information system |
| g | gravity |
| GMA | Game Management Area |
| GMZ | Game Management Zone |
| Goldcorp | Kaminak Gold Corporation, a wholly owned subsidiary of Goldcorp Inc. |
| GPS | geographic (or global) positioning system |
| HAP | Health Action Plan |
| HCN | hydrogen cyanide |
| H:V | horizontal to vertical |
| HDPE | high-density polyethylene |
| Hg | mercury |
| HHRA | Human Health Risk Assessment |

| Acronym / Abbreviation | Definition |
|---|---|
| HIA | Health Impact Assessment |
| HIV | human immunodeficiency virus |
| HLF | Heap Leach Facility |
| HR | human resources |
| HRIA | Heritage Resources Impact Assessment |
| HROA | Heritage Resources Overview Assessment |
| HRPP | Heritage Resources Protection Plan |
| HSS | Health and Social Services |
| HVAC | heating ,ventilation, and air conditioning |
| IBA | Impact Benefit Agreement |
| IC | Intermediate Component |
| ICSP | Integrated Community Sustainability Plan |
| IFR | Instrument Flight Rules |
| IMS | ice mapping system |
| IO | input-output |
| IPCC | Intergovernmental Panel on Climate Changte |
| IR | Information Request |
| IRR | Internal Rate of Return |
| ITP | inspection and test plan |
| K | Kindergarten |
| Kaminak | Kaminak Gold Corporation |
| KC-RAA | Klaza Caribou Regional Assessment Area |
| KCH | Klaza Caribou herd |
| KCS | Klondike Conservation Society |
| KDO | Klondike Development Organization. |
| LAA | Local Assessment Area |
| LD50 | amount of an ingested substance that causes 50% fatality |
| LLDPE | linear low-density polyethylene |
| LMB | Land Management Branch |
| LMU | Land Management Unit |
| LNG | liquefied natural gas |
| LOM | life-of-mine |
| LSA | Local Study Area |
| LSCFN | Little Salmon / Carmacks First Nation |
| LTECF | Livingstone Trail Environmental Control Facility |
| M | million |
| MAD | mean annual discharge |
| MBCA | *Migratory Birds Convention Act, 1994* |
| MBR | membrane bioreactor |
| MCC | motor control centre |
| MED | marine emergency duties |

| Acronym / Abbreviation | Definition |
|---|---|
| MIHR | Mining Industry Human Resources (Council) |
| ML | metals leaching |
| ML/ARD | metals leaching/acid rock drainage |
| MMER | Metal Mining Effluent Regulations |
| Mn | manganese |
| $Mn^{2+}$ | manganese II |
| Mo | molybdenum |
| MOE | Ministry of Environment |
| MRT | Mine Rescue Team |
| MT | Middle Transitional |
| N | north |
| $N_2O$ | nitrous oxide |
| NaCN | sodium cyanide |
| NAG | non-acid generating |
| NAICS | North American Industrial Classification System |
| NAR | Northern Access Route |
| NBCC | National Building Code of Canada |
| NE | northeast |
| NFPA | |
| $NH_3$ | ammonia |
| NHS | National Household Survey |
| Ni | nickel |
| $NO_2$ | nitrogen dioxide |
| $NO_3$ | inorganic nitrate |
| $NO_x$ | nitrogen oxides |
| NOC | National Occupational Classification |
| NPAG | non-potentially acid generating |
| NPI | National Pollution Inventory |
| NPISH | Non-profit Institutions Serving Households |
| NPRI | National Pollutant Release Inventory |
| NPV | net present value |
| NRCan | Natural Resources Canada |
| NTS | National Topographic System |
| NW | northwest |
| NWP | Navigable Protection Program |
| NWT | Northwest Territories |
| OCP | Official Community Plan |
| ODALS | Omni-directional Approach Lighting System |
| OGC | Oil and Gas Commission |
| OIC | Order-in-Council |
| OPEX | operational expenditures |

| Acronym / Abbreviation | Definition |
|---|---|
| OX | oxide |
| PAG | potentially acid generating |
| Pb | lead |
| PGA | peak ground acceleration |
| PEA | preliminary economic assessment |
| PGS | peak ground acceleration |
| PHA | Permit Hunt Authorization |
| PLC | programmable logic controller |
| PM | particulate matter |
| $PM_{2.5}$ | fine particulate matter of 2.5 microns or less |
| $PM_{10}$ | fine particulate matter of 10 microns or less |
| PMP | probable maximum precipitation |
| PPE | personal protective equipment |
| Project | proposed Coffee Gold Mine |
| Proponent | Kaminak Gold Corporation, a wholly owned subsidiary of Goldcorp Inc. |
| PSL | permissible sound level |
| PWGSC | Public Works and Government Services Canada |
| PYLL | potential years of life lost |
| Q1 | first quarter |
| Q2 | second quarter |
| Q3 | third quarter |
| Q4 | fourth quarter |
| QA/QC | quality assurance / quality control |
| QMA | *Quartz Mining Act* |
| QML | Quartz Mining Licence |
| QMS | quality management system |
| RAA | Regional Assessment Area |
| RCMP | Royal Canadian Mounted Police |
| ROM | run-of-mine |
| RISC | Resource Inventory Standards Committee |
| RPP | Registered Professional Planner |
| RSA | Regional Study Area |
| RSS | Robert Service School |
| RSY | Revised Statutes of Yukon |
| RTC | Registered Trapping Concession |
| S | south |
| $S^{2-}$ | sulfide |
| SARA | *Species at Risk Act* |
| Sb | antimony |
| SDR | systematic data recovery |
| SE | southeast |

| Acronym / Abbreviation | Definition |
|---|---|
| Se | selenium |
| SEEA | socio-economic effects assessment |
| Sea Can | 20-foot shipping container |
| SEMS | Sustainability Excellence Management System |
| SFN | Selkirk First Nation |
| SGA | Self Governing Agreement |
| SLRA | Screening-level Risk Assessment |
| SI | International System of Units |
| SNAP | Scenarios Network for Alaska and Arctic Planning |
| $SO_2$ | sulphur dioxide |
| $SO_4$ | sulfate |
| SOR | Statutory Orders and Regulations |
| SOVA | School of Visual Arts |
| STI | sexually transmitted infection |
| STP | sewage treatment plant |
| SW | southwest |
| SY | Statutes of Yukon |
| SU1 | Supremo Phase 1 |
| SU2 | Supremo Phase 2 |
| SU3 | Supremo Phase 3 |
| SU3N | Supremo Phase 3 North |
| SU4N | Supremo Phase 4 North |
| SU4S | Supremo Phase 4 South |
| SU5N | Supremo Phase 5 North |
| SU5S | Supremo Phase 5 South |
| T-Cd | Total cadmium |
| T-Cr | Total |
| TB | tuberculosis |
| TDGA | *Transportation of Dangerous Goods Act* |
| TH | Tr'ondëk Hwëch'in |
| TIA | tailings impoundment area |
| TLUS | Traditional Land Use Study |
| TK | Traditional Knowledge |
| TR | technical report |
| TS-RAA | Thinhorn Sheep Regional Assessment Area |
| TSP | total suspended particulate |
| TSS | total suspended solids |
| TWG | Technical Working Group |
| U | uranium |
| UFA | Umbrella Final Agreement |
| UNESCO | United Nations Educational, Scientific, and Cultural Organization |

| Acronym / Abbreviation | Definition |
|---|---|
| U.S. | United States |
| USGS | United States Geological Survey |
| UT | Upper Transitional |
| UTM | Universal Transverse Mercator |
| UV | ultraviolet |
| VBY | Volunteer Bénévoles Yukon |
| VC | Valued Component |
| VKT | vehicle kilometres travelled |
| VLP | valley leach pad |
| VOC | volatile organic compound |
| VP | Vice President |
| WBM | water balance model |
| WGH | Whitehorse General Hospital |
| WHO | World Health Organization |
| WQG | water quality guidelines |
| WRFN | White River First Nation |
| WRSF | Waste Rock Storage Facility |
| WSC | Water Survey of Canada |
| WUL | Water Use Licence |
| YBS | Yukon Bureau of Statistics |
| YDA | Dawson City Airport |
| YEC | Yukon Energy Corporation |
| YESAA | *Yukon Environmental and Socio-economic Assessment Act* |
| YESAB | Yukon Environmental and Socio-economic Assessment Board |
| YG | Government of Yukon |
| YGED | Yukon Government Economic Development |
| YHC | Yukon Housing Corporation |
| YOMS | Yukon Occupational Modelling System |
| YT-24 | Yukon Tributary 24 (unnamed tributary) |
| YWB | Yukon Water Board |
| YWCHSB | Yukon Workers Compensation Health and Safety Board |
| YXY | Eric Nielsen Whitehorse Airport |
| Zn | zinc |

## SYMBOLS AND MEASUREMENTS

| Symbol / Unit of Measure | Definition |
|---|---|
| % | percent |
| $ | dollar |
| ° C | degrees Celcius |
| µ | microgram |
| µg/g ww | micrograms per gram wet weight |
| µg/L | micrograms per litre |
| µS/cm | micro Siemens per centimetre |
| dB | decibel |
| dBA | A-weighted decibel |
| dBL | linear (unweighted) decibel |
| ft. | feet |
| g | gram |
| g/L | grams per litre |
| g/t | grams per tonne |
| ha | hectare |
| hr | hour |
| Hz | Herz |
| kg | kilogram |
| km | kilometre |
| km/hr | kilometres per hour |
| $km^2$ | square kilometres |
| kPA | kilopascal |
| kt | kilotonne |
| kW | kilowatt |
| L | litre |
| $L_{eq}$ | energy-averaged, A-weighted sound level for a complete time period |
| $L_P$ | Sound pressure level |
| $L_{peak}$ | maximum value reached by the sound pressure |
| L/s | litres per second |
| L/s/$km^2$ | litres per second per square kilometre |
| $L_W$ | sound power level |
| m | metre |
| $m^2$ | square metre |
| $m^3$ | cubic metre |
| $m^3$/day | cubic metres per day |
| $m^3$/hr | cubic metres per hour |
| $m^3$/s | cubic metres per second |
| M | million |
| masl | metres above sea level |

| Symbol / Unit of Measure | Definition |
|---|---|
| mg | milligram |
| mg/km | milligrams per kilometre |
| mg/L | milligrams per litre |
| ML | million litres |
| mm | millimetre |
| mm/yr | millimetres per year |
| $Mm^3$ | million cubic metres |
| M oz. | million ounces |
| Mt | million tonnes |
| Mt/a | million tonnes per annum |
| MW | megawatt |
| No. | number |
| oz. | ounce |
| ppb | parts per billion |
| ppm | parts per million |
| s | second |
| sq. mil. | square mile |
| t | tonnes |
| tpd | tonnes per day |
| V | volt |

# 18.0 INTRODUCTION TO HUMAN ENVIRONMENT

**Volume IV** Human Environment presents the detailed analysis of the human environment Intermediate Component (IC), and the effects assessments conducted for the human environment Valued Components (VCs). This section provides an overview of the process for the selection of the IC and VCs representing the human environment of the proposed Coffee Gold Mine (Project).

## 18.1 ISSUES SCOPING

Information and issues regarding the human components in the Project area were identified based on input provided during consultation and engagement, reviews of technical literature, and baseline studies conducted for the Project. Kaminak Gold Corporation, a wholly owned subsidiary of Goldcorp Inc. (Goldcorp or Proponent) has undertaken an engagement and consultation process, as defined under section 50 (3) of the *Yukon Environmental and Socio-economic Assessment Act,* SC 2003, c. 7 (YESAA), to support the scoping of issues for the Project (Refer to **Section 3.0 Consultation** for detail on the Project's consultation program).

### 18.1.1 FIRST NATIONS

A review of available Traditional Knowledge for the Project area was central to the issues scoping process. The Project Footprint overlaps with the established or asserted traditional territories of the following First Nations:

- Tr'ondëk Hwëch'in (TH)
- Selkirk First Nation (SFN)
- First Nation of Na-cho Nyäk Dun (FNNND)
- White River First Nation (WRFN).

#### *18.1.1.1 Tr'ondëk Hwëch'in*

Centered in the City of Dawson (Dawson), TH describe themselves as having descended from Aboriginal groups who lived along the Yukon River in the Klondike region since time immemorial. Specifically, this includes the Hän, Gwich'in and Northern Tutchone language groups (TH n.d.a). Tr'ondëk Hwëch'in traditional territory extends from the southern border of the Ni'iinlii Njik (Fishing Branch) Territorial Park in the north, to the Dawson Range Mountains south of the Yukon River, to the Yukon-Alaska border to the west, and to the Clear Creek – McQuesten area to the east. The TH traditional territory also includes the Tombstone mountain range and the Tombstone Territorial Park. Spanning approximately 91,860 square kilometres (km$^2$) across mid-northern Yukon, TH's established traditional territory includes approximately 2,590 km$^2$ of settlement lands (Category A and B) (TH 2014). The diverse and rich landscape which characterizes the TH language, culture, and way of life also characterizes the TH traditional territory. The Hän language is the traditional language of the TH, and The TH speak their own dialect of Hän, known as the Moosehide dialect (CYFN 2016a). The importance of waterways and rivers to the TH and their ancestors is represented in their language, as 'Hän' translates to 'river', and the Hän Gwich'in dialect means 'River People' (Mishler and Simeone 2004).

The entire Project, including the Mine Site and the Northern Access Route (NAR), are located wholly within TH territory. As such, TH's interests identified through the consultation program include the key interests discussed in **Section 18.1.1.5.** Some specific interests of TH include: consideration of TH culture at the Mine Site and in employee training during the mine operations; training and employment opportunities specific to TH citizens; effects of the NAR on resources that TH citizens harvest in their territory such as Moose and traditional and medicinal plants; and habitat and water quality effects to species for which TH has exerted specific conservation efforts including the Fortymile Caribou and Chinook Salmon.

#### *18.1.1.2 Selkirk First Nation*

Selkirk First Nation originally settled in Fort Selkirk, a trading post used during summer months for fish camps (SFN 2016a). Selkirk First Nation relocated to Minto after the construction of the Klondike Highway brought an increase in development. Shortly after this, SFN permanently settled in Pelly Crossing, approximately 285 km northwest of Whitehorse in central Yukon (SFN 2016a). The traditional territory of the SFN extends north of Tatchun Lake to Stewart Crossing, and spans from Wellesley Lake to the headwaters of the Macmillan River (Fred n.d.a). Through their Final Agreement, SFN owns Settlement Land, including approximately 2,408.69 $km^2$ of Category A Land and 2,330.99 $km^2$ of Category B Land, as well as 6.79 $km^2$ of land allocated as per Section 4.3.4 of the Final Agreement (Fred, n.d.a). Selkirk First Nation has also created three Special Management Areas through their Final Agreement, including the Ddhaw Ghro Habitat Protection Area, Lhutsaw Wetland Habitat Protection Area, and Ta'tla Mun Special Management Area (Fred n.d.a). These Special Management Areas are valued for their natural, cultural and recreational considerations, and therefore development is restricted. Selkirk First Nation is part of the Northern Tutchone cultural group (Fred, n.d.a) and were once known as the Hućha Hudän people, meaning 'flatland people' in their traditional language (SFN 2016). This name reflects the landscape around Fort Selkirk, which was flat on either side of the Yukon River (SFN 2016).

A portion of the NAR falls within SFN territory, and this portion is the largest area of new road required for the NAR. Key interests of SFN arising from the consultation program are related to the NAR opening new access to SFN territory that is currently inaccessible by road, and effects to water quality specifically related to SFN Category B land at the mouth of Coffee Creek. Selkirk First Nation is also interested in economic opportunities for SFN citizens through the Project.

#### *18.1.1.3 First Nation of Na-Cho Nyäk Dun*

First Nation of Na-Cho Nyäk Dun is centred in the community of Mayo, in central Yukon. The Taiga Plains, Taiga Cordillera, and Boreal Cordillera are some of the features that characterize their traditional territory. Encompassing approximately 162,456 km$^2$, their traditional territory includes approximately 131,599 km$^2$ in Yukon and approximately 30,857 km$^2$ in the Northwest Territories (FNNND 2008a). Under the FNNND land claims agreement, FNNND was allocated 739.68 km$^2$ of settlement lands in Yukon (FNNND 2016a). The Final Agreement established two Special Management Areas, the Ddhaw Ghro Habitat Protection Area and Horseshoe Slough Habitat Protection Area (Fred n.d.b). The Final Agreement also recognized Lansing townsite, located upstream from Mayo on the Stewart River, as a historic site under the *Historic Resources Act*, RSY 2002, c. 109. First Nation of Na-Cho Nyäk Dun currently has an outstanding claim with the Government of the Northwest Territories, and is involved in discussion with the Federal Government regarding transboundary negotiations (Fred n.d.b). Describing themselves as having used the area around Mayo since time immemorial (FNNND 2008a), citizens of FNNND travel across their territory hunting, fishing and gathering food. These nomadic people moved across the landscape according to the seasonal round. Citizens of FNNND today share Northern Tutchone ancestry, as well as Gwich'in ancestry from the north, and Dene ancestry from the east (CYFN 2016d). First Nation of Na-Cho Nyäk Dun is the most northern First Nation within the Tutchone language and culture group (CYFN 2016d, FNNND 2016a). As part of this group, FNNND remains closely affiliated with the SFN and the Little Salmon / Carmacks First Nation.

FNNND territory overlaps with the northern portion of the NAR. Interests of FNNND in the Project are closely related to the NAR and economic opportunities for FNNND citizens through contracting and employment, as well as training opportunities for citizens.

#### *18.1.1.4 White River First Nation*

White River First Nation is centred in Canada's most western border town of Beaver Creek along the Alaskan Highway. Beaver Creek was originally a surveying camp and served as a Canada Customs post in the 1950s, and became the relocation site for the WRFN people who were relocated from Snag and Scotties Creek after construction of the Alaska Highway (Fred n.d.c).

White River First Nation does not have settled land claims, and is considered to be an Indian Band under the Federal *Indian Act*, RSC 1985, c. I-5. The traditional territory of WRFN that is recognized by the UFA does not align with the area that WRFN asserts. The analyses and assessments within this volume used WRFN's asserted territory with respect to delineating spatial boundaries, though the UFA-recognized traditional territory appears on all figures. White River First Nation's asserted territory consists of 13,000 km$^2$ of land, spanning from the southern tip of Kluane Lake, northwesterly to the Canada – Alaska border (Calliou Group 2012b). White River First Nation's asserted territory includes the drainages of the Donkej and White Rivers, as well as Mount Logan (Calliou Group 2012b).

Traditionally, WRFN people moved around their territory seasonally, hunting, fishing, and trapping. The people of White River also had access to an abundant supply of copper located in streams near the headwaters (YG 2014a). White River First Nation utilized the copper to create spear points, arrowheads, tools, and ornaments (YG 2014a). Their handcrafted items and raw copper nuggets were traded with other First Nation groups within the Yukon interior, who in turn engineered their own items (YG 2014a). Affiliated with both the Upper Tanana people of Alaska and the Northern Tutchone people to the south and east, WRFN is a part of the Athabaskan language family of the Upper Tanana (WRFN n.d.a).

The Mine Site and the southern portion of the NAR, including a large section of new road, fall within the asserted territory of WRFN. White River First Nation's specific interests in the Project include economic opportunities for WRFN, effects to water quality, and effects to wildlife.

#### *18.1.1.5 First Nations Key Interests*

Through Goldcorp's engagement with these four First Nations, key topics and interests have been identified:

- Access: concerns with increased traffic, opening land to year-round access, disturbance to wildlife, and theft along the NAR.
- Available Traditional Knowledge: maintenance and protection of traditional land use and heritage resources.
- Heap leach and cyanide: some specific concerns include transportation of cyanide on barge crossings, heap leach liner system failures, worker exposure to cyanide, and wildlife exposures to cyanide.
- Jobs, training, and contract opportunities: a key concern and interest is how the Project ensures to maximize benefits in Yukon.
- Temporary and unplanned closure: concerns with how Goldcorp intends to address temporary and unplanned closure of the Project.
- Water quality, effects to fish: concerns with water quality and effects to fish, as the Project drainages directly route to the Yukon River.
- Wildlife: specific concerns with the recently rebounded Forty Mile Caribou Herd, increased hunting access as a result of the NAR and effects to wildlife movement in the Project area and NAR area.

TH, SFN, and FNNND have specific interests related to each of their rights as outlined in their respective Final Agreements, and WRFN has specific interests related to their Aboriginal Rights. These interests and concerns, which were raised during the consultation program, generally fall within the key topics listed above.

### 18.1.2 AFFECTED COMMUNITIES, INTERESTED PARTIES, AND THE PUBLIC

The consultation and engagement program indicated that with respect to human environment, local communities are primarily concerned about the economic issues associated with boom and bust cycles, training and employment opportunities, and preservation of traditional land use and cultural values. In Dawson, housing availability and capacity of community infrastructure to accommodate an increase in population are concerns that have also been raised. This list is not intended to be comprehensive, but to inform the selection of human environment components and focus the assessment of potential effects.

The human environment in the Project area is representative of an area that has experienced boom and bust economic cycles associated with resource development, global commodity prices, and seasonal tourism. The major mineral exploration and development activities slowdown in 2013 reinforced the need for local communities to consider local procurement and economic readiness in a broader way, over a longer time period and across multiple industries, rather than having a short-term focus on the mining sector. Primary data collection indicated caution for communities not to become overly reliant on a project, and highlighted the need to ensure that changes occurring throughout the operations of projects are sustainable (Interview 28, Personal Communication 2016).

### 18.1.3 GOVERNMENT AGENCIES

With respect to the components of the human environment that should be included in an assessment, the Yukon Environment and Socio-economic Assessment Board (YESAB) provides the following guidance:

> The Yukon Environmental and Socio-economic Assessment Act (YESAA) requires the consideration of socio-economic components that may be affected by the project. To facilitate this consideration, the Executive Committee submission should provide a description of the economic and social setting within the project area. Information should focus on providing a background on individuals, families, communities, businesses, and/or governments potentially affected as a result of the project activities. (YESAB 2005)
>
> … The following principles can be considered the broad and general rules for what to consider in a socio-economic effects assessment and how to conduct the assessment (YESAB 2006):
>
> - Achieve a broad understanding of the local and regional settings potentially affected by the proposed action
> - Focus assessment on key aspects of the human environment
> - Provide valid and relevant information in use of decision making
> - Identify methods and assumptions and define significance
> - Ensure that effect equity issues are described and analyzed
> - Consider and recommend suitable mitigation and include in the assessment mechanisms to improve the likelihood of mitigation success
> - Determine the best development alternatives rather than merely serving as an arbiter between socio-economic benefit and social cost

…Community and Project Area Information should identify the community/communities potentially affected by the project through direct and indirect environmental and socio-economic changes. Provide general information on the following components of the socio-economic system (YESAB 2006):

- Family and Other Organization
- Culture, Language and History
- Economy - Wage and Subsistence
- Political Structure and Leadership
- Environmental Knowledge Base
- Values, Norms, and Beliefs
- Education and Knowledge Transfer Systems
- Recreation and Leisure
- Spirituality and Religion
- Health and Well-being"

…Land and resource use should provide information on the historic and current land and resource use for traditional purposes by First Nation persons, as well as commercial and recreational use by First Nations and non-First Nations persons, including: recreational activities and routes, registered trapping concession holders, timber harvesting, agriculture, cultural, subsistence and commercial fish harvesting, commercial wilderness activities, mineral exploration and oil and gas activities. (YESAB 2005)

Guidance documents from YESAB and reviews of past submissions to YESAB and other regulatory agencies are clear that human environment components are sufficiently important to government agencies, affected First Nations, affected local communities, the public, and other interested parties, as well as to other components of the environment to warrant consideration in the effects assessment.

Key interests of government agencies include considerations around housing and infrastructure in the City of Dawson, effects to wildlife as it relates to the NAR, and potential for increased harvest in the area, as well as interactions with Fortymile Caribou and the Sharp-tailed Grouse. Management of the NAR is the subject of ongoing discussion between Goldcorp and the Government of Yukon.

## 18.2 SELECTION OF VALUED AND INTERMEDIATE COMPONENTS

The Project study team used the information provided during issues scoping to identify candidate VCs and ICs based on their presence in the study area, their potential to interact with and be affected by the Project, and their importance to government, First Nations, local communities, interested parties, and the public.

### 18.2.1 DEMOGRAPHICS

The Project is located in a northern, remote location. Local communities in remote areas are typically characterized by small populations, which reduces their resiliency to potential socio-economic effects as a result of Project-related changes. The importance of reflecting this value in the analysis was recognized during the VC selection phase when Demographics was identified as a candidate VC. It was determined that Demographics would be more appropriately captured as an IC rather than a VC because a change to demographics as a result of the Project would represent an intermediate step in a pathway of effects on one or more receptors or VCs, rather than functioning as a receptor at the end of a pathway of effects.

The Project may change local community demographics through the creation of new employment and income opportunities, which are likely to attract new residents to local communities. In-migration to these communities has the potential to change demand for local services and opportunities for local residents. The Project-related change in population characteristics will potentially influence a shift in the identity of small communities, resulting in changes to economic conditions (**Section 20.0 Economic Conditions Assessment**), social economy (**Section 21.0 Social Economy Assessment**), community infrastructure and services (**Section 22.0 Community and Infrastructure Assessment**), education services (**Section 23.0 Education Services Assessment**), and community health and wellness (**Section 25.0 Community Health and Well-being Assessment**).

### 18.2.2 ECONOMIC CONDITIONS

The economy was identified as a dimension of sustainability in the Integrated Community Sustainability Plan for the City of Dawson and TH (City of Dawson and TH n.d.a), resulting in the early identification of Economic Conditions as a candidate VC. The subcomponents of the Economic Conditions VC were confirmed through primary and secondary research, as well as consultation and engagement.

The Project has the potential to interact with the Economic Conditions VC through effects to income and income distribution, labour market, and sustainable economic development. The distribution of Project-related economic opportunities and corresponding incomes may be realized differently by different cohorts, genders, and cultural backgrounds of local populations, which may be more pronounced in smaller communities with lower median incomes. The Project may affect the availability of labour for other regional industries and projects as the labour requirements for the Construction and Operation phases of the Project decrease the supply of labour. Project expenditures, contracting and procurement opportunities, and personal spending by Project workers likely drive changes in local economies. The Project will likely result in a range of economic benefits across the region and Canada, including positive effects on employment and local economies, gross output and GDP, and potential effects on government fiscal flows as a result of tax and royalty payments by Goldcorp.

### 18.2.3 Social Economy

In Yukon, the term social economy reflects a cohesive, well-defined VC that represents the values of both First Nation and non-First Nation citizens. Supported by the results of community consultation, the name of this candidate VC evolved from traditional economy and non-wage economy to social economy. This study acknowledges that both First Nation and non-First Nation Yukoners may participate in the mixed economy, although characteristics of their participation may differ.

The Project will increase the needs for goods and services, which may affect current participation in the social economy. The Project will also change current environmental conditions through the construction and operation of the Mine Site and NAR, which directly affect the social economy (including the traditional and non-wage economy) by changing access to lands and resources that are depended on for traditional or non-wage economic activities. Environmental quality of lands and resources may also be affected by the Project, which could change perception of their desirability. Further, Project-related environmental changes may affect intangible aspects of land and resource use including sense of place and cultural and spiritual well-being.

### 18.2.4 Community Infrastructure and Services

Prior experience with resource development projects that involved changes in population associated with employment opportunities led to the identification of the Community Infrastructure and Services VC. Population increase in communities is linked to increased demand for housing as well as pressure on municipal infrastructure and services. Based on previous experience, it was further anticipated that Project-based traffic would be of concern. This was corroborated by community consultation, which found that citizens are concerned about housing, Project-related traffic and changes to road infrastructure. Further, the baseline study of community infrastructure and services found some municipal infrastructure was at or near capacity. These factors supported the inclusion of the Community Infrastructure and Services VC in the Project Proposal.

On-site Project staffing will be through fly-in/fly-out transportation with personnel transfer locations anticipated to be Dawson and Whitehorse. The Project may influence community infrastructure and services in the assessment areas through Project-related population increases. Increased demand for local community services and infrastructure include housing, water, waste management, and emergency services. In addition, Project-related traffic (ground and air) may require expansion and increased maintenance of local transportation infrastructure.

### 18.2.5 EDUCATION SERVICES

Education was recognized as an important value to potentially affected local communities when the initial list of candidate VCs was established. This VC has adopted the term Education Services as it reflects the different indicators described for this value, including primary, secondary and post-secondary education and industry-specific training.

The supply of the Project with labour, goods, and services will create both direct, indirect, and induced employment opportunities, which all have the potential to influence local and regional education services. Providing and supporting locally available training opportunities that accommodate ongoing local culture has been identified as a priority for Goldcorp. Rotational work may have indirect effects on the ability of individuals to effectively participate in cultural education. Primary and secondary enrolment may be affected by potential immigration of workers into the assessment areas as a result of Project-related direct and indirect employment opportunities.

### 18.2.6 LAND AND RESOURCE USE

The Land and Resource Use VC comprises two subcomponents: non-traditional land and resource use and traditional land and resource use.

Non-traditional land and resource use was originally identified as a candidate VC because the designated and undesignated use of lands in the Project area are recognized as being of value for a variety of purposes to a variety of stakeholders. Through consultation and engagement, comments were received from the TH Technical Working Group that suggested a more holistic, inclusive VC is needed that integrates the diverse land and resource use values of the Project area. In response, this candidate VC was reorganized and identified as a subcomponent of the broader Land and Resource Use VC.

Traditional land and resource use was identified through primary and secondary research as important to all First Nations whose established or asserted traditional territory overlaps with the Project footprint. This subcomponent was originally identified as a candidate VC to acknowledge the distinct relationship that First Nations share with the land and resources.

Through consultation with TH it was suggested that traditional land use be considered as a subcomponent of the Land and Resource Use VC to highlight the importance of traditional land and resource use. By considering traditional land and resource use as a subcomponent of the Land and Resource Use VC, this value will still be explicitly described and assessed, and will better reflect TH's perspective on how traditional land and resource use relates to land and resource use in general. Therefore, traditional land and resource use was revised from a candidate VC to a subcomponent.

The Project will affect current environmental conditions through the construction and operation of the Mine Site and NAR. Project activities may directly affect both non-traditional and traditional land and resource uses by changing access to land and resources, as well as changing the quantity, quality, and desirability of land and resources that individuals depend on for non-traditional and/or traditional land and resource purposes. Further, Project-related environmental changes may affect intangible aspects of traditional land and resource use including cultural and spiritual resources.

### 18.2.7 COMMUNITY HEALTH AND WELL-BEING

The selection of Community Health and Well-Being as a VC was informed by the consultation process. The initial scoping process identified health as a potential VC based on prior experience with major resource development projects, as well as YESAA's definition of socio-economic effects, specifically: effects on "economies, health, culture, traditions, lifestyles and heritage resources" (YESAA 2015). A meeting with Yukon's Chief Medical Officer of Health was held, which resulted in the identification of health as an important component of the assessment process. Consultation with assessors and regulators regarding the VCs, including health, and feedback from the Technical Working Group, community members and interview participants supported a broader consideration of health issues in the definition of the VC. Because of limitations of measuring and monitoring health on an individual level, the consideration of health in the broader context of a community includes socio-economic factors including crime, health-related behaviours (e.g., smoking and substance use), food security, accidents and injuries, infectious and non-infectious disease, mental health and wellness, and health services structure and capacity. The candidate Health VC was modified to become the Community Health and Well-Being VC, and includes potential direct effects on health due to Project-related changes in environmental quality (as assessed in the quantitative Human Health Risk Assessment (**Appendix 18-B**), and indirect health effects attributable to interrelated socio-economic factors.

The Project may indirectly and directly affect community and occupational health through direct influences on the work force, effects on environmental quality in the vicinity of the Mine Site and NAR, and Project influences on broader determinants of health. The potential health effects of Project activities include effects on environmental quality from mine activities and increased road traffic including noise, dust, contamination, watershed disturbances, and access to and quality of country foods. Indirect health effects on community health and well-being may include changes to quality of experiences, lifestyle choices, cultural identity, mental health, substance abuse, crime rates, and food security.

### 18.2.8 HERITAGE RESOURCES

The term Heritage Resources is used to refer collectively to archaeological resources, historical resources and paleontological resources because all are considered to be types of heritage resources. The term is specifically defined under YESAA; archaeological and historical resources are the remains of past human activity, whereas paleontological resources are the preserved or fossilized remains of prehistoric plants and/or animals.

Heritage Resources has been selected as a VC due to the potential for the Project to adversely affect archaeological, historical, or paleontological resources. Heritage resources are protected by legislation and are important to First Nations because they demonstrate the long-term use of their traditional territories and provide a physical link to their cultural history.

Project activities involving vegetation clearing and ground disturbance may alter archaeological, historical, or paleontological sites. Alteration could include damage, disturbance, or destruction resulting in an adverse effect to the number or integrity of the heritage resource. Adverse effects to Heritage Resources could result in the permanent loss of valuable information that is fundamental to the understanding of the inter-relationships between individual artifacts and features, spatial distribution, and depositional context of heritage resources.

## 18.3 SUMMARY

All candidate VCs and ICs listed for consultation for the human environment were selected for inclusion in the assessment. A summary of the VCs and ICs for the human environment volume is shown in **Table 18.3-1**.

**Table 18.3-1 Summary of Human Environment Valued Components, Intermediate Components and Subcomponents**

| Valued and Intermediate Component | Subcomponent | Selection Rationale |
|---|---|---|
| **Intermediate Component** | | |
| Demographics | - | Project-related direct, indirect, and induced employment opportunities and service delivery opportunities may cause in-migration of new residents to communities.<br>This potential in-migration of people may cause changes in demographics, which in turn may result in infrastructure and services capacity pressures, and changes to the local labour force, among other factors. |
| **Valued Component** | | |
| Economic Conditions | Income and Income Distribution | Income and income distribution considers individual income, household income, and sources of income (i.e., employment income, government transfers, etc.), and how these may change with direct and indirect Project-related income. |
| | Labour Market | Labour market considers labour force characteristics (i.e., employment rate, unemployment rate, participation rate), employment by occupation and industry, and employment type and tenure. The existing labour force can indicate the extent to which the Project can fill labour requirements locally, and how the Project may influence change in labour market conditions through employment opportunities. |

| Valued and Intermediate Component | Subcomponent | Selection Rationale |
|---|---|---|
| | Sustainable Economic Development | Sustainable economic development considers local economies, gross domestic product, boom and bust economy, local business activities, cost of living, and government revenues. Sustainable economic development can be affected by the Project through changes to these topics. |
| Social Economy | Non-wage Economy | The non-wage economy is a recognized component of Yukon communities' mixed economies. It supports and contributes to the socio-economic well-being of individuals and communities. |
| | Traditional Economy | The traditional economy is a distinct component of the mixed economy, which is unique to First Nation peoples. Similar to the non-wage economy, the traditional economy supports and contributes to the socio-economic well-being of individuals and communities, and contributes to the cultural and spiritual well-being of First Nations.<br>While individual First Nations may have adopted their own unique definition, and understanding of the term traditional economy, this term generally refers to the subsistence-based economy, which is intrinsically linked to the culture, traditions, language, values, and land and resource use of each First Nation. |
| Community Infrastructure and Services | Housing and Accommodation | Housing and accommodation needs have received focused attention in Yukon communities. Project-related population increases may put pressure on existing housing demand. |
| | Physical Infrastructure | Project needs may affect the capacity of existing physical infrastructure. The Project may attract individuals to relocate to communities for direct and/or indirect employment opportunities, which may increase demands on community infrastructure. |
| | Community Services | Project needs may affect the capacity of existing community services, such as health care and social services. The Project may attract individuals to relocate to communities for direct and/or indirect employment opportunities, which may increase demands on community services. |
| | Transportation | The Project will generate traffic directly through supply and resupply of mining consumables and equipment and indirectly through population increases. |
| Education Services | Primary and Secondary Education | Enrollment trends and education attainment provide qualitative data on the success of primary and secondary schools in attracting students and in the student's success at achieving educational milestones. |
| | Industry Specific Community Based Training | Community-based training opportunities to engage in training linked to industry needs are an indicator of an effective training program. |
| Land and Resource Use | Non-Traditional Land Use | The Project footprint is located in an area which has been historically, and is currently, used for numerous non-traditional land and resource purposes. Non-traditional land and resource use refers to the designated and undesignated use of lands and resources for both commercial and personal purposes. |
| | Traditional Land Use | Current traditional land and resource use is an important value of all potentially affected First Nations. Traditional land and resource use supports the socio-economic well-being of First Nations and their respective citizens or members, as well as contributes to their cultural and spiritual well-being. |

<table>
<tr><th>Valued and Intermediate Component</th><th>Subcomponent</th><th>Selection Rationale</th></tr>
<tr><td rowspan="2">Community Health and Well-being</td><td>Environmental Quality</td><td>The subcomponent assesses the possible risk to human health via exposure to hazardous materials from Project-related changes to environmental quality, including changes to air quality, workplace exposure to hazardous materials (e.g., cyanide), contamination of subsistence food, and contamination of drinking water. Additionally, the possible risk to human health from increased Project-related noise is assessed..</td></tr>
<tr><td>Socio-economic Factors</td><td>Socio-economic factors may indirectly affect community health and well-being. These factors include:<br>• Crime and other social determinants of health<br>• Health-related behaviours such as smoking and substance abuse<br>• Food security (availability of nutritious food)<br>• Mental health and wellness<br>• Accidents and injuries<br>• Infectious and non-infectious disease<br>• Health services structure and capacity.<br>This subcomponent assesses how the Project may interact with these factors.</td></tr>
<tr><td rowspan="2">Heritage Resources</td><td>Archaeological and Historical Resources</td><td>Non-renewable resources are susceptible to alteration or disturbance, and are important and valued by the scientific, cultural, public, and First Nations communities.<br>They are also protected by Yukon legislation.</td></tr>
<tr><td>Palaeontological Resources</td><td>Non-renewable resource susceptible to alteration or disturbance as importance and value to the scientific, cultural, public and local communities.<br>They are also protected by Yukon legislation.</td></tr>
</table>

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# 19.0 DEMOGRAPHICS ANALYSIS

This section presents a high-level summary of the change analysis for the Demographics Intermediate Component (IC). The full effects assessment is presented in **Appendix 19-A Demographics Intermediate Component Analysis**.

## 19.1 ASSESSMENT SCOPE

Demographics was nominated, and ultimately selected, as an IC to support the assessment of linked Valued Components (VCs) identified for the proposed Coffee Gold Mine (Project). The IC was refined and shaped through the Project's engagement and consultation process, as defined under Section 50 (3) of the *Yukon Environmental and Socio-economic Assessment Act*, SC 2003, c. 7 (YESAA), to support the Project's issues scoping process. This process included feedback from potentially affected First Nations and communities, government agencies, and interested persons and other stakeholders who may be interested in the Project and its related activities.

Project-related employment may attract new residents to Yukon, in turn changing the size of the population and growth rates, the proportion of the population of certain ages, and the proportion of males to females. Changing demographics in turn may affect other VCs identified for the Project, including Economic Conditions, Social Economy, Education Services, Community Infrastructure and Services, and Community Health and Well-being.

No subcomponents were selected for the analysis of Demographics; indicators and rationale for their selection are listed in **Table 19.1-1**.

**Table 19.1-1 Indicators for Demographics Intermediate Component**

| Indicator | Rationale for Selection |
|---|---|
| • Population size and growth<br>• Age distribution<br>• Gender distribution<br>• Mobility | Indicators are the foundational demographic descriptors and have the potential to interact with the Project. |

### 19.1.1 ASSESSMENT BOUNDARIES

The study areas for the Demographics IC consist of a Local Study Area (LSA) and Regional Study Area (RSA), defined in **Table 19.1-2** and shown in **Figure 19.1-1**. Due to the nature of data availability for the Demographics IC as well as anticipated Project-related changes, the LSA and RSA reflect municipal administrative boundaries for the City of Whitehorse (Whitehorse) and the City of Dawson (Dawson).[1]

[1] Administrative boundaries were not available for Mayo, Pelly Crossing, and Beaver Creek.

**Table 19.1-2 Spatial Boundary Definitions for Demographics**

| Spatial Boundary | Description of Study Area |
|---|---|
| Local Study Area | City of Whitehorse, Dawson, Beaver Creek, Mayo, and Pelly Crossing. The Project footprint has not been included, as changes to Demographics will not likely take place at the Project footprint. |
| Regional Study Area | Yukon Territory |
| Cumulative Changes Study Area | An area inclusive of active and proposed major mine projects, as shown in **Appendix 5-B** |


COFFEE GOLD MINE

**Demographics Spatial Boundaries**

Legend

- Highway
- National/International Border
- Project Footprint
- Local Study Area
- Regional Study Area

Notes

1. This map is not intended to be a "stand-alone" document, but a visual aid of the information contained within the referenced Report. It is intended to be used in conjunction with the scope of services and limitations described therein.

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## 19.1 Analysis Methods

The Demographics analysis, including the analysis of Project-related changes and cumulative changes, was conducted according to the methods set out in **Section 5.0 Assessment Methodology**.

Specifically, demographic changes have been estimated using an input-output model, which estimates the number of direct, indirect, and induced jobs that the Project has the potential to create. The model was based on 2010 Statistics Canada data and February 2017 estimates from Kaminak Gold Corporation, a wholly owned subsidiary of Goldcorp Inc. (Goldcorp or Proponent), of the number of direct Project-related jobs.[2]

The analysis has also been informed by input (e.g., statistical and other information) provided through consultation and engagement with government agencies, potentially affected First Nations, and the public.

### 19.1.1 Regulatory Context

The legislation, community plans, and government-led programs relevant to the Demographics IC include the *Statistics Act*, RSC 1985, c. S-19, the Yukon *Statistics Act*, SY 2003, c.27, the Integrated Community Sustainability Plan of the City of Dawson and Tr'ondëk Hwëch'in (TH) First Nation (City of Dawson and TH n.d.), the Yukon Nominee Program, Temporary Foreign Worker Program, and Foreign Qualifications Recognition.

## 19.2 Existing Conditions

This section describes existing demographic conditions to provide a local and regional context for the assessment of potential Project-related interactions with and changes to this IC. It is based on information presented in **Appendix 18-A Socio-economic Baseline Report**.

### 19.2.1 Population: Size and Growth

#### *19.2.1.1 Regional Study Area*

The Yukon population in September 2016 was 38,200 people, a 1.8% increase from September 2015 and new record high for Yukon (YBS 2016c). Between 2006 and 2011, the population of Yukon changed by 11.6%; this compares to the national average of 5.9% for the same period (Statistics Canada 2011b). The government of Canada cited migration from other jurisdictions as the reason for population growth during the previous census period (CBC News 2012, Waddell 2016). Fertility rates in Yukon are in line with the national average, and the population overall is aging (Waddell 2016).

Yukon is home to approximately 0.1% of Canada's population. Population density in Yukon is 0.1 persons per square kilometer, compared to 3.7 persons per square kilometer nationwide (Statistics Canada 2011b).

[2] 2016 Statistics related to economics and employment were not available at the time this assessment was conducted.

Population information by gender was not available through the 2016 Census as of February 2017, however according to the YBS, approximately 51% of the Territory's total population is male, whereas 49% is female (YBS 2016c). In 2016, most males living in Yukon are between the ages of 25 and 34, with the highest representation of this range aged 30 to 34 (8.3%). For females in Yukon, the majority are between the ages of 25 and 34, with most highly represented between the ages of 30 and 34 (9.1%) (YBS 2016c).

#### *19.2.1.2 Local Study Area*

Whitehorse has the largest population in the LSA at 29,529 people as September 2016, comprising 77% of Yukon's total 2016 population of 38,200 (YBS 2016c). Dawson's 2016 population (2,202) is the next largest. The communities of Beaver Creek, Mayo, and Pelly Crossing each had populations of less than 500 individuals (see **Figure 19.2-1**) (YBS 2016b). The population of Beaver Creek was 113 people as of the 2016 census, 13% more people than at the 2011 census. Mayo had a population of 200 people as of the 2016 census, a decline of 11.5% compared to the 2011 census (Statistics Canada 2016b). Pelly Crossing had a population of 393 as of the 2016 census, a 17.3% increase over the previous census period in 2011.

##### *First Nations Communities*

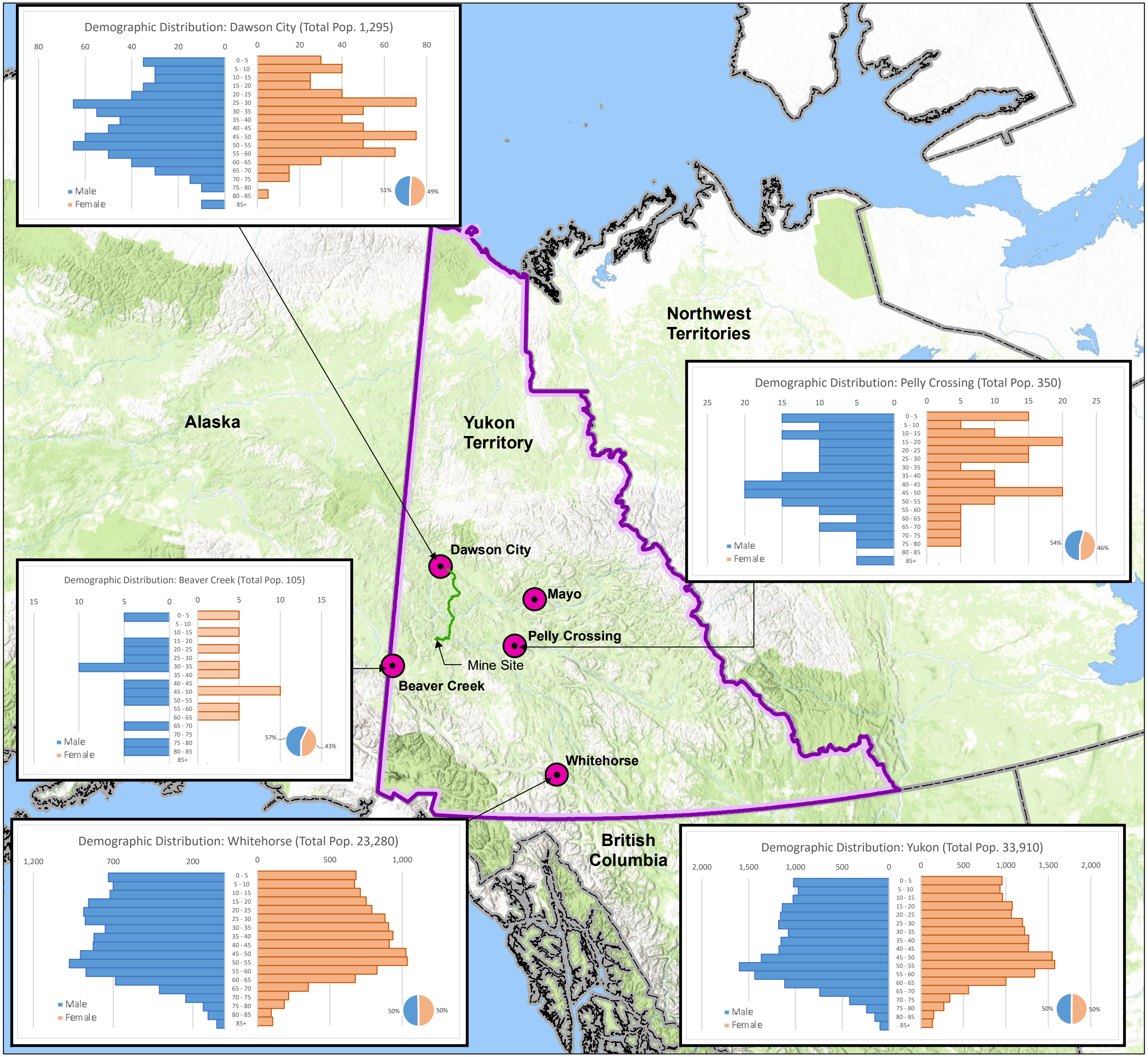
First Nation communities report different population figures from Census data findings: **Table 19.2-1** shows government data on populations of potentially affected First Nations compared with data from First Nations government websites or from other documentation. Registered membership does not indicate residence in the LSA or RSA, and is used here to provide an approximation of First Nation population size. Tr'ondëk Hwëch'in had the most members of the four potentially affected First Nations (TH 2016).

**Table 19.2-1 Summary of First Nation Registered Members**

| First Nation | Registered Population (INAC 2016) as of February 2016 | Number of Registered Members |
|---|---|---|
| Tr'ondëk Hwëch'in | 825 | 1,100 |
| Selkirk First Nation | 637 | N/A |
| First Nation of Na'cho Nyäk Dun | 555 | 602 |
| White River First Nation | 153 | 220[3] |

**Sources:** FNNND 2016; INAC 2016, TH 2016.

[3] Data provided from the 2012 White River – Quartz Exploration Report, provided by WRFN.




# COFFEE GOLD MINE

## Gender and Age Distribution in Regional Study Area and Local Study Area Communities

**Legend**

- Project Footprint
- Local Study Area
- Regional Study Area

**Notes**

1. This map is not intended to be a "stand-alone" document, but a visual aid of the information contained within the referenced Report. It is intended to be used in conjunction with the scope of services and limitations described therein.

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### 19.2.2 POPULATION: GENDER AND AGE DISTRIBUTION

#### *19.2.2.1 Regional Study Area*

According to the YBS, approximately 51% of the Territory's total population is male, whereas 49% is female (YBS 2016c). In 2016, most males living in Yukon are between the ages of 25 and 34, with the highest representation of this range aged 30 to 34 (8.3%). For females in Yukon, the majority are between the ages of 25 and 34, with most highly represented between the ages of 30 and 34 (9.1%) (YBS 2016c).

#### *19.2.2.2 Local Study Area*

Gender and age breakdowns were not available through the 2016 Census for the LSA as of February 2017; Statistics Canada has scheduled these data for release in 2017.

In Whitehorse, 2011, the majority of the male population ranged between the ages of 25 and 34 (16.6%), followed by 44 to 54 (15.1%), and 55 to 64 (14.4%). For females living in Whitehorse in 2011, the majority were aged between 25 and 34 (17.2%), 35 to 44 (15.3%), and 45 to 54 (15.8%) (YG 2013a).

The majority male population in Dawson in 2011 ranged between the ages of 25 and 34 (17.7%), followed by 45 to 54 (16.8%) and 55 to 64 (17%). For females living in Dawson, the majority were aged between 25 and 34 (19%), followed by 35 to 44 (16.2%) and 55 to 64 (16.2%) (YG 2013b).

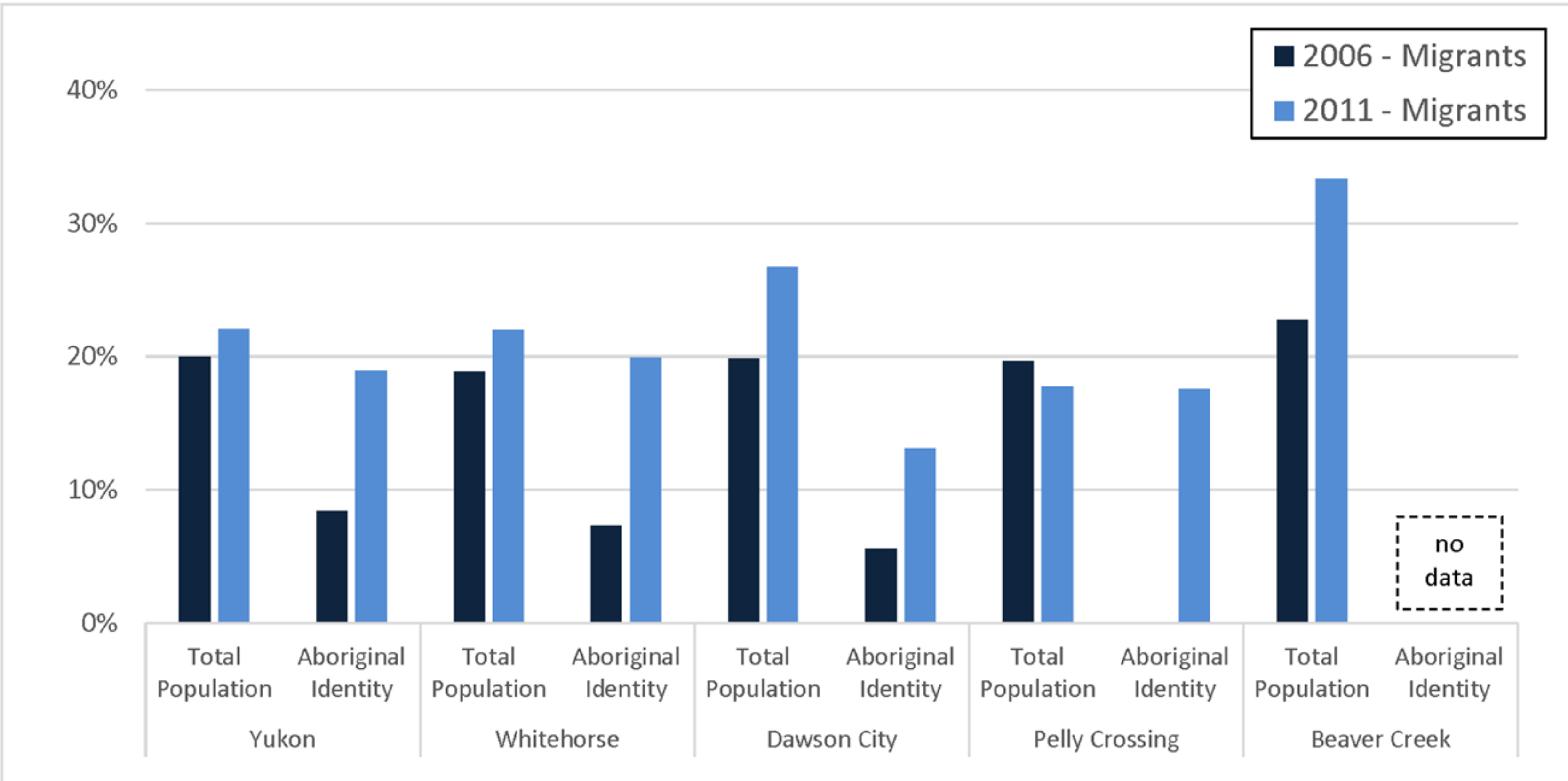
The majority male population in Beaver Creek in 2011 ranged between the ages of 25 and 34 (21%) followed by 45 to 54 (14.5%). For females living in Beaver Creek the majority were aged between 25 and 34 (22%) followed by 55 to 64 (16%) (YG 2013c).

According to 2013 Territory-level data, the majority male population in 2011 Mayo ranged between the ages of 55 and 64 (19.3%) followed by 25 to 34 and 45 to 54 (15.6% respectively). For females living in Mayo, the majority were aged between 25 and34 (19.2%) followed by 45 to 54 (16.2%), and 55 to 64 (15%) (YG 2013d).

The majority male population in Pelly Crossing in 2011 ranged between the ages of 25 and 34 (17.9%) followed by 45 to 54 (16.9%). For females living in Pelly Crossing, the majority were aged between 25 and 34 (16.6%) followed by 15 to 24 (14.9%) (YG 2013e).

### 19.2.3 MOBILITY

Mobility in Yukon in terms of internal migration (intra-territorial and inter-territorial), and external migration (immigration) is primarily driven by economic conditions. According to the YBS (2011a), population change is influenced more by migration in response to economic opportunities than by birth or death rates. A summary of mobility within the LSA and RSA is illustrated in **Figure 19.2-2.**




**Source:** Statistics Canada 2006, 2011a

**Figure 19.2-2 Summary of Local Study Area and Regional Study Area Mobility Status**

### 19.2.4 POPULATION PROJECTIONS

The YBS estimates population changes from 2011 to 2021 independently of future changes in business or government projects. Its three potential growth scenarios are based on births, deaths, immigration and emigration. Under all three scenarios, the number of senior citizens is likely to almost double, and the number of youth is likely to remain relatively steady at about 15% of the population. The working-age population (aged 15 to 64) is likely to be 68.9% to 70.3% of the population, compared to 75.2% in 2011, as Yukon-based baby boomers reach retirement.

The population of Whitehorse is likely to grow faster than Yukon as a whole between 2011 and 2021 under all three scenarios, and is likely to reach between 30,721 and 33,179, depending on the scenario, by 2021, an increase of 6 to14% over the 2016 estimated population. The population of Dawson is projected to be between 2,133 and 2,302 in 2021, which would represent a change of 0.24% to 4.7% over the 2016 estimated population (YBS 2011b).

## 19.3 PROJECT INTERACTIONS, POTENTIAL CHANGES, AND MITIGATION MEASURES

### 19.3.1 POTENTIAL PROJECT-RELATED INTERACTIONS

In the following sections, activities associated with a particular effect or combination of effects are described together to minimize repetition. Potential Project interactions with Demographics are presented in **Table 19.3-1**.

**Table 19.3-1 Identification of Potential Project Interactions with Demographics**

| Phase | Types of Effects | Nature of Interaction |
|---|---|---|
| Construction Phase;<br>Operation Phase; | • Changes to population, age distribution, gender distribution, and mobility. | • Project employment and Project demands for goods and services |
| Reclamation and Closure Phase;<br>Post-closure Phase | • Negligible Interaction | • Negligible Interaction |

### 19.3.2 CHANGES TO DEMOGRAPHIC INDICATORS

#### *19.3.2.1 Changes to Population Size*

The Project has the potential to change population size through increased demand for direct, indirect, and induced jobs, based on an input-output model found in **Appendix 20-A Economic Conditions Valued Component Assessment Report**. Some people will likely relocate to Yukon to take advantage of the employment opportunities. This relocation will likely change population size.

The potential population increases as a result of the Project are summarized in **Table 19.3-2**.

**Table 19.3-2 The Project's Estimated Changes to Population Size**

| Project Phase | Year | Without Project | With Project: In-migration | | | | With Project: Population Size Change (with families) | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | LSA | | | | | |
| | | Yukon Projected Population | Construction (Maximum) | Operation (Potential) | With Families (3 additional) | Total Yukon Pop'n | RSA (Yukon) | Whitehorse, predicted future population | | Whitehorse, 100 % of Future Population | | Dawson (Predicted) | |
| | | *2006 -2011 population patterns)* | *70% of direct, indirect, and induced* | *50% of direct, indirect, and induced* | *(#)* | *(#)* | *% change to Yukon population* | *(%)* | *(#)* | *(%)* | *(#)* | *(%)* | *(#)* |
| Construction | 2018 | 39,861 | 190 | | 762 | 40,623 | 2.5% | 1.9% | 580 | 2.5% | 762 | 1.9% | 41 |
| Construction | 2019 | 40,970 | 331 | | 1,324 | 42,294 | 4.3% | 3.2% | 1,001 | 4.3% | 1,324 | 3.2% | 71 |
| Operation | 2020 | 42,079 | | 176.5 | 706 | 42,785 | 2.2% | 1.7% | 530 | 2.2% | 706 | 1.7% | 37 |
| Operation | 2021 | 43,188 | | 185 | 740 | 43,928 | 2.3% | 1.7% | 552 | 2.3% | 740 | 1.7% | 38 |

**Source:** YBS 2011b, Goldcorp employment estimates 2017

#### *19.3.2.2 Changes in Gender Distribution*

The Project is predicted to increase the estimated proportion of males in the Yukon population by approximately 0.3% to 0.5% in the years 2018 to 2021 (Construction and first years of Operation) (Table 19.3-3**)**. Changes to the gender balance are likely to be negligible, and as a result, will not be carried forward in the analysis. For a more detailed explanation on the current gender balance and predictions of the future gender balance, see **Appendix 19-A Demographics Intermediate Component Analysis.**

**Table 19.3-3 Percentage Change to Population Gender Balance**

| Phase | Year | Total New Male Workers (direct + indirect + induced) (assumed 88% of population) | Number of Accompanying Male Family Members | Total New Males in Yukon as a Result of Project | Total Male Population Size as a Result of Project | Percent Male Population as a Result of Project | Difference in Yukon's Gender Balance (toward male) as a Result of Project |
|---|---|---|---|---|---|---|---|
| Construction | 2018 | 239 | 286 | 525 | 21,037 | 51.79% | 0.33% |
| Construction | 2019 | 416 | 497 | 913 | 22,111 | 52.28% | 0.54% |
| Operation | 2020 | 311 | 265 | 575 | 22,465 | 52.51% | 0.49% |
| Operation | 2021 | 326 | 278 | 603 | 23,190 | 52.79% | 0.49% |

**Notes:** YBS 2011 estimate.
Changes estimated at the Yukon level.
Personal choice will dictate where workers choose to live.
**Sources:** Goldcorp population estimates, YBS 2011b, YGED Personal Communication, 2016

#### *19.3.2.3 Changes in Age Distribution*

The Project may interact with the RSA population by introducing the LSA and RSA additional working-age people, defined by Statistics Canada as those aged 15 to 64. Because of the possibility that working-age people may migrate with children, the Project also has the potential to add young people (aged 0 to 14) to the LSA and RSA.

The YBS estimates that 70% of the Yukon population will be working age by 2021,[4] while 15% will be below-working-age, and the remaining 15% will be 65 or older. As of 2021, the Project will have added 740 new working-age people plus 740 children.[5] No changes are likely to take place to the retired population as a result of the Project. With or without the Project, the working-age population will be approximately 70% (70.3% without the Project, 69.6% with the Project). The below-working-age population in **Table 19.3-4** would rise slightly to 15.8% with the Project, compared to 14.7% without the Project.

**Table 19.3-4 Predicted Percentage Change to Working-age Population**

| Project-related Jobs Created by 2021 (direct, indirect, induced) | Working-age Population (age 15 – 64) without the Project by 2021 (%) | Working-age Population (age 15 – 64) with the Project (%) |
|---|---|---|
| 370 | 70.3% | 69.6% |

**Source:** YBS 2011b, Goldcorp employment estimates 2017.

The change to the working-age population as a result of the Project is negligible, and has not been carried forward for analysis.

#### *19.3.2.4 Changes to Mobility*

In-migrants can be generally classified as returning former residents; Project employees and their immediate families; opportunists; goods and services providers to local communities; goods and services providers to the Project; and entrepreneurs (IFC 2009).

The Project may increase mobility by offering employment, and as a result facilitating the personal decision to move to Yukon.

4 This forecast uses 2006-2011 historic population trends to predict future growth. Population projections for each individual year to 2021 were not available.

5 For this assessment, children are defined as those under age 15.

### 19.3.3 Mitigation and Enhancement Measures

The mitigation measures proposed to be used to eliminate or reduce Project-related changes to demographics are:

- Local Hiring Practices
- Local Hiring Practices
- Local Contracting and Procurement Practices
- Education and Training Activities
- Workforce Transition Strategy

## 19.4 Potential Residual Changes to Demographics

The Project will likely result in a small change to total population size during the Construction and Operation Phases, which will naturally reverse when the Project moves toward Closure and Reclamation, and Post-closure. Changes to gender distribution, age distribution, and mobility are likely to be negligible.

## 19.5 Cumulative Change Assessment

The anticipated major mining projects (Bellekeno, Carmacks Copper, Casino, Eagle Gold, Kudz Ze Kayah, MacTung Tungsten Mine, Minto and the Wolverine Project) are likely to result in additional employment opportunities in the RSA. Over the ten year period from 2018 to 2027, all cumulative projects (other projects including Coffee) are estimated to account 7.5 % to 16.1 % of the total Yukon population. Of this proportion, the Coffee project will account for approximately 2.0% of the anticipated future population size. As with all other projects, the greatest cumulative increase in worker's population will occur from 2020 to 2024 while all projects are in operation. Peak population will occur in 2021 with accumulative workers and dependents accounting for 16.1% (8,316 persons) of the total Yukon population. Workforce demand, and related population estimates will likely drop beyond 2024 as some projects complete operations and move into closure and reclamation phases which do not require the same level of personnel onwards.

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# 20.0 ECONOMIC CONDITIONS ASSESSMENT

This section presents a high-level summary of the effects assessment for the Economic Conditions Valued Component (VC). The full effects assessment is presented in **Appendix 20-A Economic Conditions Valued Component Assessment**.

## 20.1 SCOPE OF ASSESSMENT

Economic Conditions was nominated and ultimately selected as a Valued Component (VC) to support the assessment of the proposed Coffee Gold Mine's (Project's) likely interactions with income and income distribution, the labour market, and sustainable economic development, while reflecting local values and feedback. The Project will increase the need for goods and services, which may influence local and regional economic conditions, including the region's sustainable economic development. Identification of this VC enables the assessment of the Project's potential effects to labour market conditions through changes to employment and income.

No subcomponents were selected for the assessment of Economic Conditions; indicators and rationale for their selection are listed in **Table 20.1-1**.

**Table 20.1-1 Indicators for the Economic Conditions Valued Component**

| Indicator | Rationale for Selection |
|---|---|
| Income and income distribution | Income and income distribution considers individual income, household income, and sources of income (i.e., employment income, government transfers, etc.), and how these may change with direct and indirect Project-related income. |
| Labour market | Labour market considers labour force characteristics (i.e., employment rate, unemployment rate, participation rate), employment by occupation and industry, and employment type and tenure. The existing labour force can indicate the extent to which the Project can fill labour requirements locally, and how the Project may influence change in labour market conditions through employment opportunities. |
| Sustainable economic development | Sustainable economic development considers local economies, gross domestic product, boom and bust economy, local business activities, cost of living, and government revenues. Sustainable economic development can be affected by the Project through changes to these topics. |

## 20.2 ECONOMIC CONDITIONS ASSESSMENT BOUNDARIES

The spatial, temporal, administrative, and technical boundaries established for the assessment of Economic Conditions **Table 20.2-1** (see **Figure 20.2-1**).

**Table 20.2-1 Boundary Definitions for Economic Conditions Assessment**

| Boundary | | Description of Boundary |
|---|---|---|
| Spatial | Local Assessment Area (LAA) | The LAA includes the communities of Dawson[1], Whitehorse[2], Beaver Creek, Mayo, Pelly Crossing, WRFN, SFN, and FNNND. |
| | Regional Assessment Area (RAA) and Cumulative Effects Assessment Area | The RAA includes the LAA and Yukon Territory |
| Temporal | | The temporal boundaries established for the assessment of Project-related effects on Economic Conditions include all phases of the Project, as described in the Project Proposal (**Section 2.0 Project Description**). |
| Administrative | | Due to the nature of data availability and potential Project-related effects related to the Economic Conditions VC, administrative boundaries and centres were selected as the spatial boundaries. Communities may extend outside of the city or census boundary, but the use of the administrative boundary is considered to adequately capture potential Project-related effects.<br>It is acknowledged that these spatial boundaries do not reflect the traditional territories of FNNND, SFN, and WRFN; however, due to the overlapping traditional territories of these communities, their administrative centres were selected as spatial area components. |
| Technical | | Limitations to the accuracy or representation of available data exist with the underlying statistical information. For a detailed discussion of statistical data limitations, refer to **Appendix 18-A Socio-economic Baseline Report**. |

**Notes:** FNNND - First Nation of Na-cho Nyäk Dun; SFN - Selkirk First Nation; WRFN - White River First Nation

1. Dawson corresponds to the Statistics Canada census subdivision and corresponds with Yukon Bureau of Statistics datasets for Dawson.
2. For consistency between Statistics Canada and YBS data sets for Whitehorse, the Statistics Canada Whitehorse Census Agglomeration data is provided, which corresponds with Yukon Bureau of Statistics census data for the Whitehorse Area, rather than the City of Whitehorse.


COFFEE GOLD MINE

**Economic Conditions Spatial Boundaries**

Legend

- Highway
- National/International Border
- Project Footprint
- Local Assessment Area
- Regional Assessment Area

Notes

1. This map is not intended to be a "stand-alone" document, but a visual aid of the information contained within the referenced Report. It is intended to be used in conjunction with the scope of services and limitations described therein.

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### 20.3 Economic Conditions Assessment Methods

The Economic Conditions assessment, including the assessment of Project-related effects and cumulative effects was conducted according to the methods set out in **Section 5.0 Assessment Methodology**. The assessment has been informed by input (e.g., Traditional Knowledge (TK), statistical, and other information) provided through consultation and engagement with government agencies, potentially affected First Nations, and the public.

The assessment of Project-related effects on Economic Conditions also relied on results of input-output modelling, performed by the Government of Yukon Economic Development in 2016, and updated by Hemmera in 2017. The input-output modelling was informed by information provided by Kaminak Gold Corporation, a wholly owned subsidiary of Goldcorp Inc. (Goldcorp or Proponent).

### 20.4 Existing Conditions

This section describes the economic conditions in the Local Assessment Area (LAA) and Regional Assessment Area (RAA) of the Project, with a focus on the following topics: income and income distribution, labour market, and sustainable economic development. It is based on information presented in **Appendix 18-A Socio-economic Baseline Report**.

#### 20.4.1 Income and Income Distribution

There is a variability in income levels and distribution across potentially affected communities in the LAA and RAA, as well as in the context of the broader Territory. For example, of the LAA communities with available data, Whitehorse had the highest median individual income in 2011 ($43,237), although the highest median individual income for those of Aboriginal identity was in the City of Dawson (Dawson) ($31,075) (Statistics Canada 2013a, 2013b). Between 2001 and 2011, all LAA communities experienced overall increases in median individual income, ranging from 12.6 percent (%) in Pelly Crossing to 56.9% in Dawson (Statistics Canada 2003, 2007a, 2007b, 2013a, 2013b).

The greatest incomes for full-time, full year employment were for Whitehorse's total adult population ($61,942) and Dawson's Aboriginal identity population ($61,868). In general, median incomes for males in LAA communities (total population) were approximately $5,000 to $6,000 greater than incomes for females in 2011. Individual total income in 2011 was primarily comprised of employment income in all LAA communities; an average of 70% of income in the LAA was employment income rather from other sources. The greatest proportions in Dawson for both total and Aboriginal populations (85.5% and 83.7%, respectively) (Statistics Canada 2013a, 2013b). Results of the local business survey indicate that average wages paid to employees across various industries in Dawson range from between $15 to more than $25 per hour. Based on the opinion of the majority of survey participants (52%), average wages have increased over the last two years. According to Statistics Canada data (2001 to 2011) and Canada Revenue Agency data (2004 to 2013), the median and average incomes in Dawson have been increasing (Statistics Canada 2003, 2007a, 2007b, 2013a, 2013b, YBS 2016a).

### 20.4.2 LABOUR MARKET

#### *20.4.2.1 Labour Force*

Yukon's total labour force in 2015 was 20,700 (YBS 2016b). In 2011, the total labour force comprised 21,245 workers in Yukon, with 16,520 workers in Whitehorse, 960 workers in Dawson, and 265 workers in the remaining LAA communities (Statistics Canada 2013a, 2013b).

Between 2005 and 2015, Yukon's labour force increased from 18,000 to 20,700 (YBS 2013, 2014a, 2015, 2016b). The Aboriginal labour force comprised 3,700 workers in 2015, representing approximately 18% of the total Yukon labour force (YBS 2016b). The LAA Aboriginal identity labour force comprised approximately 11.2% of the total Aboriginal labour force in the Territory. Dawson's labour force, as identified through various surveys and reports (KDO 2011a, 2013a, 2014a), is seen as a restricting factor in the community's local economic and business development. It is anticipated that Dawson's population will not be able to fill labour force needs related to economic expansion (Kishchuk 2008).

Yukon's 2015 participation rate was 73.7%; though this marked a decrease from the Territory's 2011 participation rate of 77.3%, it was the second highest rate observed in Canada in 2015 (YBS 2016b). The participation rate of Yukon's Aboriginal adult population was 69.8% in 2015, reflecting an increase from 2014, but a minor change from 2011 (70%) (Statistics Canada 2013a, 2013b, YBS 2016b). Generally, consistently low unemployment rates and high participation rates present challenges to the Yukon labour force's ability to fill employer needs.

Yukon's 2015 unemployment rate was 6.3%, an increase since the 4.3% unemployment rate in 2014. The Territory's Aboriginal unemployment rate was 10.8%, an increase over 2014's unemployment rate of 8.8% (YBS 2016b). In 2015, Yukon's unemployment rate was below the national average of 6.9%, reflecting a trend observed between 2006 and 2015 (YBS 2016b, YGED 2015). The consistently low unemployment rate represents a challenge for the Territory to meet skilled labour needs. Herkes et al. (2013) states that that the Yukon labour force will not be able to meet expected skilled labour needs in the mining sector.

Dawson's unemployment rate in 2011 was 10.9%, which represents an improvement from 2006, although still greater than in 2001. The Aboriginal population's unemployment rate has increased each Census year from 15% in 2001 to 28.1% in 2011 (Statistics Canada 2003, 2007a, 2007b, 2013a, 2013b). Yukon's population, labour force, and employment are expected to grow between 2013 and 2021, with interterritorial migration playing a key factor in supplying workers to Yukon (Millier Dickinson Blais 2014).

#### *20.4.2.2 Occupation*

In Yukon, occupations in services, business, and government were predominant for the labour work force in 2015. Through various labour force forecasting analyses in the mining sector, gaps have been identified in terms of available labour to meet industry occupational needs.

In 2015, sales and service occupations employed the most Yukoners (22.9% of the labour force). From 2014 to 2015 there was a 4.5% decrease in the trades, transport, and equipment operators and related occupations (YBS 2016b). In 2015, Yukon's total and Aboriginal labour forces were represented in all 10 National Occupational Classification categories, which can indicate a diverse labour force.

The 2011 National Housing Survey identified sales, trades, and business occupations as the most prevalent for the Yukon labour force. Yukon's 2011 Aboriginal labour force consisted of occupations primarily in trades, transport, and equipment operators and related occupations (Statistics Canada 2013a, 2013b). The balance of occupations for Yukon as a whole was similar for Whitehorse's total and Aboriginal labour force in 2011. The Aboriginal population of Dawson was more strongly represented in fewer occupations, specifically in trades, business, education, law, and government services. The concentration of the LAA labour force in fewer occupations reflects small labour forces, which make it difficult to support a large range of occupations.

In a 2013 survey, trades (mechanics, carpenters, etc.), kitchen and serving staff, office managers, bookkeepers, and highly skilled positions were identified as positions that are difficult to fill (KDO 2013a). In the Dawson area, it was noted that mining-related work in the summer changes from year to year (Interview 23, Personal Communication 2016). As a result of discussions with mine developers and operators, labour force skills, access to housing, and transportation challenges were identified as key concerns in the Dawson region for the mining sector (KDO 2013b).

The Mining Industry Human Resources Council analysis predicted cumulative hiring requirements for 2023, ranging from 1,360 to 4,260 (depending on the economy scenario), and the Yukon Occupational Modelling System analysis predicted 1,400 jobs in the mining sector for 2020 (MIHR 2012, Herkes et al 2013). The largest talent gap was identified for the technologists and technicians occupation category, although negative talent gaps were identified for all occupation categories, both for primary and support sectors. For most occupation categories, the existing talent pool in Yukon does not contain enough workers to meet anticipated industry demands in the mining sector (MIHR 2012).

#### *20.4.2.3 Industry*

Although mining contributes substantially to the Territory's economy, the industry is not considered to be a major employer for the Yukon work force. Between 2009 and 2014, employment increases were focused in the services sector (e.g., retail trade, transportation, professional services, accommodation services), while the goods-producing sector (e.g., forestry, mining, construction) did not perform as well, due to low global mineral commodity prices (Government of Canada 2015b).

The three industry sectors which employed the majority of the total and Aboriginal Yukon labour force in 2011 were public administration, retail trade, and construction (Statistics Canada 2013a, 2013b). Pelly Crossing, Beaver Creek, and Dawson's labour forces were focused in fewer industry sectors (Statistics Canada 2013a, 2013b). Smaller labour forces in fewer industries can make it difficult for a community to support a large range of industries.

High labour demands in the construction industry were experienced in Dawson associated with two major capital projects between 2009 and 2012 (KDO 2013b). In 2013, a slowdown in the mining and exploration industry related to decreasing commodity prices was anticipated to decrease activity levels, and employment needs were scaled back in the sector for the Dawson labour force, a situation that was also experienced in 2015 (KDO 2013b, Interview 23, Personal Communication 2016).

#### *20.4.2.4 Employment Type and Tenure*

Large proportions of the LAA and RAA populations worked full-time in 2010, which is also reflected in more recent (2015) data for the Territory (Statistics Canada 2013a, 2013b, YBS 2016b). Recruitment and retention of employees is a challenge for Yukon, as well as Dawson, particularly in the context of boom and bust-cycle economies reliant on the mining industry (refer to **Section 20.4.3.3**). In Dawson, recruiting labour has consistently been identified as a constraint to local business development. Dawson has a highly seasonal work force, reflecting key industries of mineral exploration and tourism, which exhibit short-tenure labour needs in summer months (KDO 2014a).

***Full-Time and Part-Time Workers***

Approximately 87.6% of employed Yukoners were full-time workers in 2015. Between 2006 and 2015, approximately 13.9% of Yukon's labour force were part-time (YBS 2016b). Through the local business and economic development survey, business owners in Dawson identified that approximately 56.5% of their employees were full-time, and 34.8% were part-time. For several businesses, their employees were a mix of full-time, part-time, and seasonal or temporary.

***Job Tenure***

In 2015, the average job tenure of Yukoners was 91.3 months (approximately 7.6 years), an increase of 4.9% from 2014 (YBS 2016b). Occupations with the longest average job tenures in Yukon were middle management occupations in services- and goods-producing sectors in 2015. Occupations with the shortest average job tenures in Yukon included support occupations in sales, trades, and construction in 2015 (YBS 2016b). This reflects the seasonality of industries, notably the tourism sector (YG 2010a). In comparison to Canada's national average, Yukon had fewer permanent and more temporary workers in 2015 (YBS 2016b).

***Recruitment and Retention***

Findings from research conducted in 2010 identified employee recruitment and retention as a challenge faced by municipalities in Yukon (YG n.d.). Yukon's historic boom and bust cycle is a contributing factor to fluctuations in the Territory's labour market, and is discussed further in **Section 20.4.3.3** (YG 2010a). Strong labour market demands from a short-term upswing in the mining or construction sector can result in employee recruitment and retention challenges over the long term (YG 2010a).

In Dawson, recruiting labour has consistently been identified as a constraint to local business development (KDO 2014a). In Dawson, a lack of affordable housing, qualified workers, competitive wages, and full-time permanent employment were identified as contributors to employee recruitment and retention challenges (KDO 2011a, 2013a, 2014a, Interview 23, Personal Communications 2016, Interview 21, Personal Communications 2016). A 2013 survey of businesses in Dawson stated that 58% of respondents experienced difficulty in recruiting employees, while 63% of respondents experienced difficulty retaining employees (KDO 2013a).

### 20.4.3 SUSTAINABLE ECONOMIC DEVELOPMENT

With territorial and local economies largely reliant on outside events (e.g., global commodity prices, the U.S. dollar, and international tourism trends), pursuing sustainable economic development is an attractive but challenging goal in Yukon. The dominance of the mining industry results in an unstable cyclical economy based on commodity production (Southcott and Walker 2009). The Government of Yukon Economic Development's 2012 to 2017 strategic goals include: attracting investment, growing Yukon's economy, and building Yukon's competitive advantage (YGED 2012).

#### *20.4.3.1 Local Economy*

***Regional Assessment Area***

Yukon's economic sectors include agriculture, energy, film and sound, fishing, forestry, hunting, mining and exploration, tourism, and trapping. The global market for minerals is a key determinant of mineral exploration, development, and production in the Territory, and plays a key role in Yukon's economy (YGED 2015). In 2015, the mining sector in Yukon experienced uncertainty regarding future demand and price performance (YGED 2015). Tourism in Yukon is currently the largest private sector employer, and made up approximately 4% of Yukon's total gross domestic product (GDP) in 2012, contributing to the Territory's economic diversity.

***Local Assessment Area***

Key economic drivers for the City of Whitehorse include government services, tourism, and mining. Government services are predominant as Whitehorse is the Territory's capital city, and tourism largely results from visitors travelling along the Alaska Highway. As a large city, Whitehorse also services mineral exploration companies (City of Whitehorse 2010).

Dawson's local economy is currently driven by placer mining and tourism. This relatively narrow economic focus results in seasonal fluctuations and reliance on outside factors, and is seen as limiting the community's economic development and potential. Sustainable economic development is a key component of the City of Dawson and TH's vision for the community (City of Dawson and TH n.d.). Specifically, the community looks to diversify the local economy through development of heritage, arts, and culture. According to TH, actions to expand and diversify the region's economy include overcoming perceived barriers to economic development, building on existing and unique strengths of the Dawson Region, and remaining open to development activities that are primarily driven by global forces (e.g., non-renewable resources) rather than by local influences (TH 2011).

The development of sustainable local economies in Mayo, Pelly Crossing, and Beaver Creek is challenged by factors such as small populations and lack of capital (FNNND 2016, SFN 2007). As the populations in these communities are strongly represented by First Nations, balancing traditional and modern economies is a focus in sustainable development.

The local economy in Mayo consists of government services from all levels of governments, mining, construction, transportation, energy, and service sectors (YG 2014a). Mining and energy developments provide opportunities for local businesses in Mayo to expand the local economy. The First Nation of Na-cho Nyäk Dun (FNNND) has previously expressed that the community recognizes the importance of balancing resources with economic development and jobs (InterGroup Consultants Ltd. 2009, FNNND 2008). Pelly Crossing's local economy is small and centres on government services, health, and education, with Selkirk First Nation (SFN) as the primary employer. Through its Development Corporation, SFN seeks to develop Pelly Crossing's local economy to ensure stability, local business opportunities related to goods and services provision, and employment opportunities (SFN 2007). Similar to Mayo and Pelly Crossing, Beaver Creek's local economy centres on government services and tourism, with potential for growth associated with mineral exploration activities (YG 2014b).

#### *20.4.3.2 Local Businesses*

Sustaining local businesses is a key component of developing and maintaining a sustainable local economy. Across Yukon, the sectors with the greatest number of businesses included accommodation and food services; retail trade; construction; professional, scientific, and technical services; mining, quarrying, and oil and gas extraction; and transportation and warehousing (YBS 2014b).

Local businesses in Dawson tend to be owned and operated by an older demographic, with concerns expressed regarding succession planning (KDO 2011a). It is acknowledged that portions of the local and regional economy can be expanded, but require additional organized capacity to retain businesses and services in the community (KDO 2011a). Communicating and building awareness of local businesses and services in Dawson with larger regional business operators in the mining sector was identified as an area of focus to ensure local opportunities are realized (KDO 2013a).

A large proportion of businesses (59.4%) in Dawson belong to the mining, tourism, and construction sectors, which reflect the community's local economy (Local Business Focus Group, Personal Communication, 2016). According to a 2016 focus group in Dawson, a majority of respondents (78.3%) believe that the mining industry has positively affected their business operations and activities in the past 5 years, with approximately 82.6% of businesses currently providing goods and / or services to the industry.

#### *20.4.3.3 Boom and Bust Economy*

Yukon's historical boom and bust cycle is a challenge for labour supply, and will likely contribute to future labour market fluctuations (YG 2010a). Yukon has long experienced boom and bust economic cycles associated with resource development and global commodity prices. In the past, economic development planning focused on boom opportunities, ignoring or misunderstanding key characteristics of the Yukon economy that can sustain itself through bust downswings (Staples 1988).

Dawson's local economy sees annual boom and bust cycles associated with seasonality, as well as longer-term boom and bust cycles relating to the mining sector. In 2011 and 2012, employment and local economy diversification were anticipated from increased construction and mineral industry activities (KDO 2013b). Following this period in 2013, however, major mineral exploration and development activities experienced a slowdown, reinforcing the need to consider local procurement and economic readiness in a broader way, over a longer period, and across multiple industries (KDO 2013b). Focusing on broader industries can also lessen Dawson's challenge of cyclical recruitment and retention associated with seasonal boom and bust cycles (KDO 2014b).

The population of Dawson triples each summer, relying on external workers to meet employment needs in mining and tourism (City of Dawson and TH n.d., Vector Research 2008, Interview 28, Personal Communication 2016). In Dawson, the small current permanent population is viewed as the primary barrier to expansion of the local economy. The small population of the area can be attributed to high costs of living, limited access to housing, and availability of year-round services (KDO 2011b, City of Dawson and TH n.d. Interview 21, Personal Communication 2016, Interview 28, Personal Communication 2016). Diversifying economic development into sectors that generate full-time permanent employment opportunities can address employee recruitment and retention issues (KDO 2011a).

#### *20.4.3.4 Cost of Living*

The cost of living in Yukon is generally higher than the cost of living in southern Canada, and even higher for those living in Yukon communities outside of Whitehorse (YG 2014c). Influencing the cost of living is the price of goods and services. Although the Consumer Price Index is not a cost-of-living index, it can be used as an indicator of price changes over time (YBS 2016c). Between 2006 and 2014, the Consumer Price Index for Whitehorse increased annually, but decreased by 0.2% in 2015 (YBS 2016c). In LAA communities, the average regular self-serve fuel prices as well as residential heating costs decreased from March 2015 to March 2016 in most LAA communities (YBS 2016c). High costs of living, in particular fuel and resources costs, were identified as a local challenge for Dawson and TH, particularly in terms of retaining a larger permanent population (City of Dawson and TH n.d.).

#### *20.4.3.5 Gross Domestic Product*

Between 2005 and 2012, Yukon's GDP grew on average 6% per year; however, the growth rate declined to –0.8% in 2014. From 2013 to 2014, Yukon's real GDP contracted by 1.2% to $2.2 billion (in 2007 dollars), largely due to a decline in mineral commodity prices and associated mineral production (Government of Canada 2015b, YBS 2016d, YGED 2015). The mining, quarrying, and oil and gas extraction sector experienced the largest contraction in growth in 2014 (YBS 2016d). Public administration routinely comprises the greatest percentage share of Yukon's GDP, with construction and mining, quarrying, and oil and gas extraction industries demonstrating the greatest fluctuations between years (YBS 2016d). Yukon's GDP in goods-producing industries contracted in 2014, while the services-producing industries increased (YBS 2016d). Generally, slow economic growth was predicted to continue for Yukon in 2017 (Government of Canada 2015a).

#### *20.4.3.6 Government Revenues*

Yukon Government revenues and expenditures are reported annually. Between 2008 and 2014, both revenues and expenditures have increased (Statistics Canada 2016). Other than 2012, which saw a net surplus of $35 million, the territorial government had net deficits between 2008 and 2014 (Statistics Canada 2016). Yukon Government revenue from grants comprised the largest proportion of revenue sources. Rents, including mineral royalties, comprised less than 1% of annual total revenue between 2008 and 2014 (Statistics Canada 2016). The majority of Yukon Government expenditures comprised compensation of employees and use of goods and services.

Yukon Government reports on annual royalties paid associated with three operating mines: Minto, Bellekeno, and Wolverine. Under the *Quartz Mining Act,* SY 2003, c.14 (QMA), Yukon Government receives a royalty or share of profits from mine operators. Between 2007 and 2013, the peak of mine royalties received was almost $6 million in 2009, solely from the Minto Mine. Overall, royalties decreased between 2011 and 2013 due to decreased production, as well as amendments to the QMA Royalty Regulation Guidelines, which caps the annual royalty rate for any profit in excess of $35 million at 12% (YG 2010b).

## 20.5 ASSESSMENT OF PROJECT-RELATED EFFECTS

### 20.5.1 POTENTIAL PROJECT-RELATED INTERACTIONS WITH ECONOMIC CONDITIONS

Potential interactions are likely to occur between Project-related activities and income and income distribution, the labour market, and sustainable economic development during the Construction, Operation, and Reclamation and Closure Phases.

**Table 20.5-1 Identification of Potential Project Interactions with Economic Conditions**

| Phase | Types of Effects | Nature of Interaction |
|---|---|---|
| Construction Phase<br>Operation Phase | • Changes in income and income distribution, labour market, and sustainable economic development | • Potential interaction |
| Reclamation and Closure Phase<br>Post-closure Phase | • Minimal Project employment and expenditures | • Negligible Interaction |

Although employment opportunities associated with the Project will occur during the Reclamation and Closure Phase, the effect is likely to be negligible due to low employment numbers in this Phase. During Reclamation and Closure, the maximum annual labour estimated for the Project is 32, compared to 663 during the Construction Phase and 372 during the Operation Phase. A negligible interaction does not imply that no interaction exists. It is likely that local communities including First Nations will continue to benefit from employment and contracting and procurement opportunities during the Reclamation and Closure Phase of the Project. During the Post-closure Phase, long-term monitoring is the only activity likely to occur. Employment and goods and services expenditures associated with long-term monitoring are not likely; therefore, interactions between Economic Conditions and Post-closure Phase Project activities are likely to be negligible. As a result of negligible interactions, the potential for Project-related effects on economic conditions during Reclamation and Closure, and Post-closure Phases is not carried forward for further assessment.

### 20.5.2 Potential Project-related Effects

#### *20.5.2.1 Increased Direct, Indirect, and Induced Employment Opportunities*

Employment opportunities are likely to occur during Construction and Operation in the LAA and RAA as a result of direct Project employment, as well as indirect and induced employment resulting from Project expenditures and purchases of goods and services.

The Project will require:

- A maximum of 321 pre-production Construction labour positions
- Approximately 132 pre-production and 121 production general and administrative labour positions for all years during Construction and Operation
- 12 labour positions for all years during Construction and Operation
- A maximum of 95 pre-production and a maximum of 103 Process Plant positions
- A maximum of 105 pre-production and a maximum of 136 positions for open pit mining production.

In addition to direct employment opportunities, it is likely that through Project-related goods and service expenditures, as well as expenditures by workers, the LAA and RAA will experience increases in indirect and induced employment opportunities. It is anticipated that the Project will result in:

- Approximately 448 indirect and 110 induced FTE jobs occurring in Yukon during Construction
- Approximately 65 indirect and 48 induced average annual FTE jobs during Operation (YGED, Personal Communication, 2016b).

While it is anticipated that the Project will be required to hire from labour markets in the RAA and beyond to fill labour demands, the LAA, and specifically the nearest community, Dawson is likely to strongly experience the effect of increased direct, indirect, and induced employment opportunities associated with the Project.

#### *20.5.2.2 Increased Income Levels and Changes in Income Distribution Patterns Resulting from Increased Employment Opportunities*

Changes in income patterns during the Project's Construction and Operation Phases are likely to occur across all assessment areas, although it is anticipated that changes in income patterns will be more pronounced in smaller LAA communities, which exhibit lower median incomes. Due to Dawson's geographic location in relation to the Mine Site and Northern Access Route (NAR), it is likely that it will experience a beneficial change in income patterns associated with the Project. For individuals in the labour force engaged in direct, indirect, and induced employment opportunities as a result of the Project, increased incomes are likely to be experienced as a beneficial outcome of the Project.

#### *20.5.2.3 Effects on the Labour Market*

Direct employment opportunities, as well as indirect and induced employment from Project expenditures and purchases of goods and services are likely to result in changes in labour markets. In particular, the Project may reduce the availability of labour for other regional industries or projects. Yukon's labour force has consistently exhibited low unemployment rates and high participation rates, which present challenges to filling employer needs. While it is anticipated that the Project will be able to take advantage of mining sector labour from mines that are planned to be closed at the time of Project Construction and Operation, the Project may also be competing with other major projects for labour (e.g., Casino Mine).

The Proponent's proposed use of fly-in, fly-out rotational labour, as well as an on-site camp for workers may result in more non-local workers seeking employment. Feedback regarding the Project's potential effect on Dawson's local economy and labour force suggested that the Project would influence the local labour market because people will come to Dawson to fill the positions that local people leave in order to work at the mine (Interview 23, Personal Communication, 2016). In conclusion, the Project-related effect of a change in the labour market is likely to be neutral overall. While other industries may experience labour shortages if employees leave for Project opportunities, the potential to recruit and retain individuals and expand the local labour force would be beneficial for LAA communities.

#### *20.5.2.4 Increased Contracting and Procurement Opportunities*

It is likely that businesses in the LAA and RAA will engage in contracts and supply goods and services to the Project. During Construction, it is likely that the primary engineering, procurement, and construction management contract will be awarded to a large firm with specialized experience in open pit gold mining projects similar in scale to the Project; however, local businesses will likely have opportunities to contract directly with the Proponent and the primary engineering, procurement, and construction management contractor. Contract opportunities will also be available throughout the Project's Operation Phase, as well as during Reclamation and Closure. Project expenditures are likely to be focused on procured goods and services such as accommodation, catering, logistics, vehicle maintenance, automotive parts, and hardware. Dawson's proximity to the Project will enable local businesses to take advantage of increased contracting and procurement opportunities. Smaller LAA communities may also be engaged in Project contracting and procurement opportunities; however, the larger and more diverse economy of Whitehorse has the potential to offer a greater range of needed services and materials to the Project. Overall, it is likely that contracting and procurement opportunities will be experienced as a beneficial potential effect of the Project.

#### *20.5.2.5 Change in Local Economies*

The Project will provide a strong source of employment and goods and services spending. The highest potential for effects on local economies is likely in Dawson, due to the community's proximity to the Mine Site and NAR. Overall, the Project has the potential to positively influence Dawson's local sustainable economy through direct employment opportunities and goods and services expenditures, as well as indirect and induced employment and spending. Beaver Creek, Pelly Crossing, and Mayo are also likely to be influenced positively by the Project, but to a lesser extent. It is likely that the Project's potential effects on the LAA will be experienced as both neutral and positive outcomes: neutral because the Project does not present an opportunity for Dawson's desired economic expansion into industries other than mining and tourism, and positive because the Project will provide a strong, year-round source of employment and goods and services spending during its 14-year Construction and Operation Phases.

#### *20.5.2.6 Beneficial Territorial Economic Growth*

The Project is likely to result in a range of economic benefits across the RAA and elsewhere in Canada, including gross output and GDP. For example, during the production phase, it is likely that the average annual contribution to GDP would be $251.1 million occurring in Yukon, and $34.3 million occurring in the rest of Canada (YGED Personal Communication, 2016a, 2016b, 2017). In 2014, Yukon's real GDP was $2.2 billion (in 2007 dollars) (YBS 2016d). Yukon's mining, quarrying, and oil and gas extraction industry accounted for 13.2% of the Territory's real GDP in 2014, and was valued at $437.1 million (YBS 2016d). The influence of the Project's pre-production spending and production output on the Territory's economic growth is likely to be substantial, and a beneficial effect throughout the Construction and Operation Phases of the Project.

#### *20.5.2.7 Change in Government Fiscal Flows*

Tax and royalty payments by the Proponent and the potential for local government expenditures as a result of the Project will result in changes to government fiscal flows. Over the life of the mine, Goldcorp expects to contribute approximately $427.5 million in government revenue in the form of corporate income taxes and Yukon mineral royalties (JDS, Personal Communication 2016b). The net balance of potential Project-related effects on government fiscal flows is likely to be neutral. Although taxes and incomes and royalties comprise a small portion of the Government of Yukon's revenues, they will support the government's ability to deliver services.

### 20.5.3 ENHANCEMENT MEASURES

The potential effects of the Project on Economic Conditions are likely to be beneficial or neutral, and in those cases mitigation is not further considered; however, measures that will be used to enhance potential beneficial effects of the Project are listed below:

- Local hiring practices
- Local contracting and procurement practices
- Education and training activities
- Engagement plan
- Workforce transition strategy.

Refer to the Community Infrastructure and Services Valued Component Assessment (**Appendix 22-A**) for additional enhancement measures.

### 20.5.4 RESIDUAL EFFECTS AND DETERMINATION OF SIGNIFICANCE

This section describes likely Project-related residual effects that may occur due to interactions with the Project's labour needs, goods and services spending, and local economies.

The determination of significance for the potential residual effects on the VC is based on a consideration of the residual effects characteristics and the socio-economic context of Economic Conditions. Context is defined as the extent to which economic conditions have been affected by past processes and conditions, sensitivity to the Project-related residual effect, and economic resilience. The resilience of community economies is defined as the ability of communities to adapt to change, which may be natural, economic, social, or political. Low context refers to a limited ability of community economies to respond to disturbances, while moderate and high context refer to a moderate ability or strong ability of community economies to respond to disturbances, respectively. The level of confidence in the significance determination for all residual effects described for the Economic Conditions VC is moderate, based on an understanding that outcomes may be influenced by external influences, preferences, and choices.

#### *20.5.4.1 Increased Direct, Indirect, and Induced Employment Opportunities during Construction and Operation*

Direct, indirect, and induced employment opportunities are likely to occur during Construction and Operation in the LAA and RAA. While it is likely that the Project will be required to hire from labour markets in the RAA and beyond to fill labour demands, the LAA is likely to strongly experience the effect of direct, indirect, and induced employment opportunities associated with the Project. The effect of increased direct, indirect, and induced employment opportunities during Construction and Operation is positive, moderate to high in magnitude, local to regional in geographic extent, continuous in frequency, long-term in duration, fully reversible, and likely to occur, and in moderate to high context.

#### *20.5.4.2 Increased Income Levels and Changes in Income Distribution Patterns Resulting from Increased Employment Opportunities during Construction and Operation*

Changes in income patterns are likely to occur in the LAA and RAA as a result of direct, indirect, and induced Project-related employment. Although the residual effect is likely to occur across all assessment areas, it is likely that changes in income patterns will be more pronounced in LAA communities with smaller populations and lower median incomes. The effect of increased income levels and changes in income distribution patterns resulting from increased employment opportunities during Construction and Operation is positive, moderate to high in magnitude, local to regional in geographic extent, continuous in frequency, long-term in duration, fully reversible, and likely to occur, in moderate to high context.

#### *20.5.4.3 Effects on the Labour Market during Construction and Operation*

Direct, indirect, and induced employment from Project expenditures and purchases of goods and services are likely to result in changes in labour markets. The capacity of the labour force is dynamic, and will be influenced by the status of other projects in Yukon, particularly in the mining sector. The Project's residual effect on the labour market is likely to be neutral, on balance. While other industries may experience labour shortages if employees leave for Project opportunities, the potential to recruit and retain individuals and expand the local labour force would be beneficial. It is likely that the residual effect will be not significant.

In summary, the effects on the labour market during Construction and Operation is neutral, moderate in magnitude, local to regional in geographic extent, continuous in frequency, long-term in duration, fully reversible, and likely to occur, in moderate to high context.

#### *20.5.4.4 Increased Contracting and Procurement Opportunities during Construction and Operation*

Due to Dawson's proximity to the Project, local businesses will likely be able to take advantage of contracting and procurement opportunities. It is also likely that the other LAA communities (Whitehorse, Beaver Creek, Pelly Crossing, and Mayo) will also be engaged in Project contracting and procurement opportunities; specifically, the larger and more diversified economy of Whitehorse has the potential to offer a greater range of needed services and materials to the Project. Overall, it is likely that contracting and procurement opportunities will be experienced as a beneficial residual effect of the Project. It is likely that the effect will be more strongly felt and therefore significant in Dawson and potentially Beaver Creek, Pelly Crossing, and Mayo due to smaller populations and economies. The effect is likely to be not significant in the RAA. The effect of increased contracting and procurement opportunities during Construction and Operation is positive, moderate to high in magnitude, local to regional in geographic extent, continuous in frequency, long-term in duration, fully reversible, and likely to occur, in moderate to high context.

#### *20.5.4.5 Change in Local Economies during Construction and Operation*

The Project may reduce Dawson's seasonal boom and bust cycle, with year-round needs for labour, goods, and services. Overall, the Project has the potential to strongly influence local economies in the LAA, resulting in a significant effect. It is likely that the Project's residual effects on the local economy will be experienced as both neutral and positive outcomes: neutral because the Project does not present an opportunity for LAA communities' desired economic expansion into industries other than mining and tourism, and positive because the Project will provide a strong source of year-round employment and goods and services spending over its 14-year Construction and Operation Phases. Due to Dawson's geographic location in relation to the Mine Site and NAR, as well as the Proponent's local strategies regarding goods and services expenditures and employment opportunities, it is anticipated that Dawson the residual effect will be experienced more strongly in Dawson. In summary, the effect of in change in local economies during Construction and Operation is high in magnitude, local in geographic extent, continuous in frequency, long-term in duration, fully reversible, and likely to occur, in moderate context.

#### *20.5.4.6 Beneficial Territorial Economic Growth during Construction and Operation*

The influence of the Project's pre-production spending and production output on the Territory's economic growth is likely to be substantial, and will result in a positive residual effect over the Construction and Operation of the Project. It is likely that the decrease in the Project's contribution to territorial economic growth during the Reclamation and Closure Phase of the Project, or in the event of a temporary closure, will be unavoidable, and likely. In summary, the effect of beneficial territorial economic growth during Construction and Operation is positive, high in magnitude, regional in geographic extent, continuous in frequency, long-term in duration, fully reversible, and likely to occur, in high context.

#### *20.5.4.7 Change in Government Fiscal Flows during Construction and Operation*

Royalty payments under the Yukon QMA are expected to average an estimated $11.9 million per year from Year –1 to Year 10, which accounts for less than 1% of the Territory's revenue. Over the life of the mine, Goldcorp expects to contribute approximately $427.5 million in government revenue in the form of corporate income taxes and Yukon mineral royalties. Average annual federal and territorial taxes are expected to be $12.4 million and $12.3 million, respectively, from Year 1 to Year 12. Based on Yukon's 2014 revenues of $1.3 billion, the Project is anticipated to contribute an additional less than 1% to the Territory's revenue during the Operation Phase. Combined with the royalty payments, this represents a moderate magnitude of the residual effect.

The net balance of potential Project-related effects on government fiscal flows is likely to be neutral. Although taxes and incomes and royalties comprise a small portion of YG's revenues, they will support the government's ability to deliver services, provided they are distributed and spent appropriately. In summary, the effect of change in government fiscal flow during Construction and Operation is neutral, moderate in magnitude, local to regional in geographic extent, continuous in frequency, long-term in duration, fully reversible, and likely to occur, in moderate to high context.

## 20.6 SUMMARY OF PROJECT–RELATED RESIDUAL EFFECTS AND SIGNIFICANCE

The Project is not likely to result in residual adverse effects on Economic Conditions, but is likely to result in a number of positive (beneficial) and neutral effects. While most residual effects are likely to extend across both the LAA and RAA, the way in which they materialize in each community will be unique. In many cases, the magnitude of the residual effect is likely to be greater in LAA communities, and in particular Dawson, than in the broader RAA.

## 20.7 CUMULATIVE EFFECTS ASSESSMENT

The Project may result in several potential positive and neutral effects on the Economic Conditions VC. Following implementation of enhancement measures, all potential effects are likely to be positive or neutral in direction, and no residual adverse effects are likely to result from the Project on Economic Conditions; therefore, the assessment is not carried forward to a cumulative effects assessment step for the Economic Conditions VC.

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# 21.0 SOCIAL ECONOMY ASSESSMENT

This section presents a high-level summary of the effects assessment for the Social Economy Valued Component (VC). The full effects assessment is presented in Appendix 21-A Social Economy Valued **Component Assessment**.

## 21.1 ASSESSMENT SCOPE

Social Economy was selected as a VC to address the potential for the proposed Coffee Gold Mine (Project) to result in direct environmental changes, as well as cause an increase in the demand for goods and services, that will potentially influence the social economy by changing the non-wage and traditional economies. The non-wage and traditional economy are valued by First Nations and other local people due to their contributions to the larger socio-economic landscape.

The non-wage economy and the traditional economy were selected as subcomponents for the Social Economy VC because they collectively describe and facilitate the assessment of the role and value of the cash-in-kind component of the mixed economy that characterizes Yukon (**Table 21.1-1**). The indicators used to describe and evaluate potential effects on the Social Economy VC and its subcomponents, and the rationales supporting the selection of these indicators, are identified in **Table 21.1-2**.

**Table 21.1-1 Social Economy Subcomponents**

| Subcomponent | Representative of / Focus on | Rationale for Selection |
|---|---|---|
| Non-wage Economy | • Non-profit and non-governmental organizations[1]<br>• Volunteer sector<br>• Informal social economy activities[2]<br>• Subsistence activities | The non-wage economy is a recognized component of Yukon communities' mixed economies. It supports and contributes to the socio-economic well-being of individuals and communities. |
| Traditional Economy | • Traditional economic activities<br>• Engagement in the traditional economy<br>• Value of the traditional economy | The traditional economy, unique to First Nation peoples, supports and contributes to the socio-economic well-being of individuals and communities, and contributes to the cultural and spiritual well-being of First Nations.<br>This term generally refers to the subsistence-based economy, which is intrinsically linked to the culture, traditions, language, values, and land and resource use of each First Nation. |

**Notes:** Non-profit and non-governmental organizations are included in the assessment because of the contributions they make to the social economy.
Informal social economy activities include bartering and cooperative buying.

**Table 21.1-2 Social Economy Subcomponents and Indicators**

| Subcomponent | Indicator | Rationale for Selection |
|---|---|---|
| Non-wage Economy | Type and diversity of non-profit and non-governmental organizations | The existing condition, quantity, and diversity of non-profit and non-governmental organizations can indicate the extent of an aspect of the non-wage economy that has the potential to be directly and indirectly influenced by Project-related employment. |
| | Type and level of engagement in volunteer sector | The volunteer sector qualitatively describes the role and value that volunteers contribute to the current status of the non-wage economy. Project-related changes to employment and workforce have the potential to influence the volunteer sector through changes to population, income, and availability of local residents. The existing volunteer sector can help to indicate the extent to which the Project is directly and indirectly influencing the non-wage economy through Project-related employment and population change. |
| | Type and level of engagement in Informal social economic activities | Informal social economic activities qualitatively describe the type and level of engagement in these activities, as they are a component of the existing non-wage economy. Informal social economic activities can indicate to the extent to which the Project is directly and indirectly influencing the non-wage economy through Project-related employment and population change. |
| | Subsistence activities | Subsistence activities qualitatively and quantitatively describe the tangible (i.e., monetary equivalent) and intangible value (i.e., quality of life, food security, health, etc.) that subsistence activities contribute to the non-wage economy. These metrics indicate the extent to which the Project is directly and indirectly influencing the non-wage economy through an increased demand for goods and services, as well as through Mine Site development and road activities. |
| Traditional Economy | Quality and diversity | Quality and diversity of the traditional economy qualitatively describes how each First Nation currently describes the traditional economy and the activities involved. These descriptions may differ from First Nation to First Nation in relation to how each defines traditional economy. Existing conditions of traditional economic activities can help to indicate the extent to which the Project is directly and indirectly influencing the traditional economy through increased demand for goods and services from First Nations members, as well as through effects related to development of the Project. |
| | Level of engagement in the traditional economy | Level of engagement qualitatively describes the current level of engagement in the traditional economy for each First Nation, and more specifically the current level of engagement for some of the different activities identified as being a part of the traditional economy by each respective First Nation. The level of engagement can indicate the extent to which the Project is directly and indirectly influencing the traditional economy through Project-related increased demand for goods and services, as well as through effects related to development of the Project. |
| | Value of the traditional economy | Value of the traditional economy qualitatively describes the tangible (i.e., monetary equivalent) and intangible value (i.e., quality of life, cultural and spiritual well-being, health) that subsistence activities contribute to the traditional economy. Having a description of the current value of the traditional economy can help to indicate the extent to which the Project is directly and indirectly influencing the traditional economy through an increased demand for goods and services, as well as through effects related to development of the Project. |

### 21.1.1 Assessment Boundaries

**Table 21.1-3** identifies the spatial, temporal, and technical boundaries established for the assessment of Project-related effects and cumulative effects on the Social Economy VC and subcomponents (see also **Figure 21.1-1** and **Figure 21.1-2**). There are no administrative boundaries relevant to the Social Economy Assessment.

**Table 21.1-3 Spatial Boundary Definitions for the Social Economy Assessment**

| Spatial Boundary | Description of Assessment Area |
|---|---|
| **Non-wage Economy** | |
| LAA | Includes the City of Dawson and a 1-km extent on either side of the Project, inclusive of any land-use designations (for example, trap line concessions, game management areas, or placer claims) that overlap with this area. |
| RAA and CEA Area | Includes the LSA and Yukon Territory. |
| **Traditional Economy** | |
| LAA | The established or asserted Traditional Territory of First Nations located within a 1-km extent of the Project. These First Nations include the TH, SFN, FNNND, and the WRFN. |
| RAA and CEA Area | The area that encompasses the entire established Traditional Territory of the TH, SFN, FNNND, and the entire asserted Traditional Territory of the WRFN. |

**Notes:** CEA Area - Cumulative Effects Assessment Area; FNNND – First Nation of Na-cho Nyäk Dun; LAA - Local Assessment Area; LSA - Local Study Area; RAA - Regional Assessment Area; SFN - Selkirk First Nation; TH - Tr'ondëk Hwëch'in; WRFN - White River First Nation

The temporal characteristics of the Project's Construction, Operation, Reclamation and Closure, and Post-closure Phases are described in **Section 2.0 Project Description**. The temporal boundaries established for the assessment of Project-related effects on the Social Economy encompass these Project phases.


COFFEE GOLD MINE

**Non-Wage Economy Spatial Boundaries**

Legend

- Highway
- Project Footprint
- Local Assessment Area
- Regional Assessment Area
- National/International Border

Notes

1. This map is not intended to be a “stand-alone” document, but a visual aid of the information contained within the referenced Report. It is intended to be used in conjunction with the scope of services and limitations described therein.

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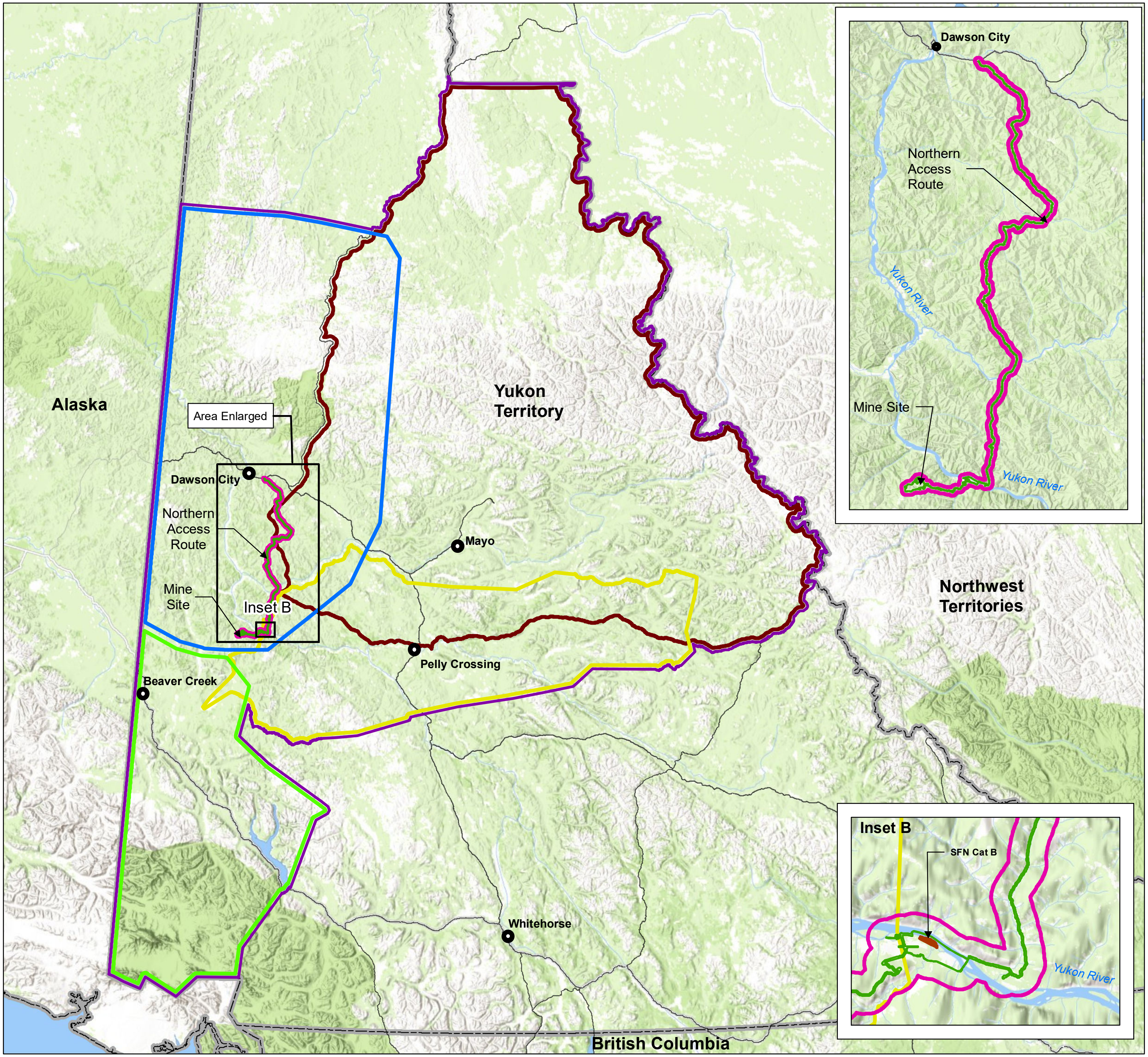
# COFFEE GOLD MINE

## Traditional Economy Spatial Boundaries




### Legend

- Highway
- National/International Border
- Project Footprint
- Local Assessment Area
- Regional Assessment Area
- White River First Nation[2]
- Tr'ondëk Hwëch'in
- Selkirk First Nation
- First Nation of Na-cho Nyäk Dun
- SFN Category B Lands

### Notes

1. This map is not intended to be a "stand-alone" document, but a visual aid of the information contained within the referenced Report. It is intended to be used in conjunction with the scope of services and limitations described therein.
2. The WRFN traditional territory boundary represented in this figure presents the recognized traditional territory under the UFA. This in not the WRFN asserted territory which WRFN recognizes.

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## 21.2 ASSESSMENT METHODS

The methods used to identify and assess potential Project-related and cumulative effects were developed pursuant to assessment requirements identified in Yukon Environmental and Socio-economic Assessment Act, SC 2003, c. 7 and Yukon Environmental and Socio-economic Assessment Board guidance documents (e.g., YESAB 2005). The Social Economy assessment was conducted according to the methods set out in **Section 5.0 Assessment Methodology** of the Project Proposal. The assessment has been informed by Traditional Knowledge, statistics, public sources, and consultation and engagement with government agencies, potentially affected First Nations, and the public. Specific methodologies applied for the assessments in the supporting Intermediate Component and VC reports are presented in those reports.

The following legislation and regulations are relevant to the Project's effects assessment and mitigation and monitoring for the Social Economy VC:

- *Yukon Environmental and Socio-Economic Assessment Act,* SC 2003, c. 7
- Yukon *Economic Development Act,* RSY 2002, c. 60
- Integrated Community Sustainability Plan
- City of Dawson Official Community Plan Bylaw No. 12-23, 2012
- Umbrella Final Agreement.

## 21.3 EXISTING CONDITIONS

This section presents the existing conditions for the non-wage economy and the traditional economy subcomponents within the Social Economy VC.

### 21.3.1 NON-WAGE ECONOMY

The non-wage economy plays an important role in the overall Yukon economy. This existing conditions section for the non-wage economy focuses on subsistence-related activities, as well as other contributing aspects of the non-wage economy, including non-profit and non-governmental organizations, the volunteer sector, and informal social and economic activities.

#### *21.3.1.1 Non-profit and Non-governmental Organizations*

The latest database of Northern Social Economy Organizations identified 591 non-profit organizations operating in Yukon Territory as of March 2012 (SERNNoCa 2012). These organizations are located throughout Yukon in numerous communities, and provide a diverse array of services and activities to Yukoners, from advocacy to sports and recreation.

According to the Government of Yukon (2014), 11 active non-governmental organizations are located in the City of Dawson (Dawson). The services that non-governmental organizations provide to Dawson are diverse, ranging from resource conservation to tourism. In addition to enhancing the quality of life for Klondike Region residents, these organizations provide key services that otherwise would not be locally available.

Project-driven increases to population may increase the demand for services provided by non-profit or non-governmental organizations, although such changes are likely to be minimal. Potential changes to non-profit or non-governmental organizations are therefore not carried forward for detailed assessment.

#### *21.3.1.2 Voluntary Sector*

According to volunteering and participating statistics, Yukon had a 49 percent (%) volunteer rate in 2010 (Statistics Canada 2015). Volunteering is prevalent in the Dawson region (Local Business Focus Group, Personal Communications 2016), and is a strategy the Dawson community uses to address service or funding gaps (KDO 2011). The Klondike Region's seasonal population changes do not affect the availability of volunteers: some volunteers leave the region in winter, but others meet the demand (Interview 11, Personal Communication 2016).

Project-driven increases to population may increase the available pool of volunteers somewhat, although such changes are expected to be minimal and beneficial in nature. Potential changes to volunteering are therefore not carried forward for detailed assessment.

#### *21.3.1.3 Informal Social Economy Activities*

No quantitative data were available to assign a value to informal social economic activities such as bartering and cooperative buying in Yukon. Bartering includes individual-to-individual exchanges of goods and services without money. Bartering[6] is active in the Klondike Region, and contributes to Dawson's social cohesion by promoting individuals to work together (Interview 11, Personal Communication 2016). Some Dawson residents use cooperative buying[7] to decrease the cost of living in the Klondike Region (Interview 11, Personal Communication 2016).

Since data are not available on the value of bartering and cooperative buying, and potential Project-related effects are likely to be beneficial, a detailed assessment has not been conducted.

#### *21.3.1.4 Subsistence Activities*

Subsistence activities are land-based activities that provide goods or services to individuals and communities without the exchange of money; this can include both activities related to gathering wild or country foods, as well as such activities such as gathering firewood and using non-timber forest products. The types of activities considered to be subsistence activities are broad, and are conducted by both First Nation and non-First Nation Yukoners (March TH TWG Meeting, Personal Communications 2016, Usher and Staples 1988). Subsistence activities are an important component of the social economy, and

[6] Examples of bartering include exchanges of livestock for services, and vegetables for equipment (Interview 11, Personal Communication 2016).
[7] Examples of cooperative buying include: buying goods together to reduce and share shipping costs, and buying larger quantities to maximize buying potential (Interview 11, Personal Communication 2016).

contribute significantly to Yukon's economy (Usher and Staples 1988). Further, it is recognized by both public and private institutions that subsistence should contribute to decision-making in Yukon (Usher and Staples 1988). Subsistence activities are closely related to other socio-economic values including culture, health, and wellness.

Subsistence activities constitute one of the strategies that Local Assessment Area (LAA) residents use to provide economic stability during periods of seasonal or market fluctuations (Abele 2009, Usher et al. 2003). Subsistence activities can "act like a sponge" by absorbing and releasing individuals as employment opportunities come and go (Usher et al. 2003).

Wild foods are consumed by over 50% of households in the Dawson area (CKS 2011). More specifically, the proportion of locally produced meat (including hunting and gathering) consumed by Dawson households was 25.2%, and hunting is viewed as the likely source for "many of the consumers with the strongest preference for healthy, local meat products" by First Nation (30% of participants) and non-First Nation consumers alike (CKS 2011). Survey[8] results identified hunting and gathering as the third most commonly used practice by Dawson residents to access local foods (CKS 2011). The value of the local wild meat harvest was roughly estimated[9] to be $285,000 or 19.4% of the total value of meat consumed by Dawson residents (CKS 2011).

### 21.3.2 TRADITIONAL ECONOMY

The traditional economy is a distinct component of the mixed economy, which is unique to First Nation people. Like the non-wage economy, the traditional economy supports and contributes to the socio-economic well-being of individuals and communities, and contributes to the cultural and spiritual well-being of First Nations.

#### *21.3.2.1 Tr'ondëk Hwëch'in Traditional Economy*

The Trondëk Hwëch'in (TH) traditional economy has evolved over thousands of years, and reflects a sophisticated system that has adapted to complex environmental, social, and cultural changes over time (TH 2012). The TH traditional economy plays a central role in supporting all aspects of TH well-being amongst citizens and the community.

***Traditional Economic Activities***

The TH Traditional Territory (**Figure 21.1-1**) has always been and remains the basis for the TH traditional economy (Dobrowolsky and Hammer 2001). In addition to specific activities, the traditional economy involves a complex system of harvesting, processing, production, and technological adaptation (TH 2012). The types of activities (i.e., goods and services) involved in the traditional economy are diverse and varied.

[8] 2011 survey conducted by the Conservation Klondike Society.
[9] Based on averaging and pro-rating of Yukon harvest statistics and store replacement value.

Focus group participants explained that families commonly work together to share goods and materials harvested from the land. Others added that instead of paying with money, TH citizens may give back to those who have shared goods or provided a service by giving them some berries, bannock, or tobacco. Subsistence harvesting activities are also a major component of TH's traditional economy. In addition to selling furs, trapping currently contributes to the traditional economy through the meat and resources that this activity provides. Trapping was an example of a traditional use activity that contributes to family social cohesion as it promotes time spent on the land together with family members conducting traditional pursuits.

***Level of Engagement in the Traditional Economy***

Elders stated that although the traditional economy participation level is decreasing compared to how things were when they were young, key TH principles and values are still actively practiced and demonstrated by citizens. For example, focus group[10] attendees share that when food is hunted or gathered from the land, it is shared with Elders. These findings are consistent with literature that has also found traditional economy engagement is generally decreasing (Southcott and Walker 2009, Mishler and Simeone 2004). Four particular reasons have influenced this decrease: the requirement for children to go to school; regulatory restrictions related to the harvesting of resources (i.e., hunting, fishing, trapping, etc.); the importance of cash income in society today; and the availability of commercial foods (Mishler and Simeone 2004).

***Market Value of the Traditional Economy***

Historically, traditional land and resource use was the basis for the TH traditional economy. Today, traditional land and resources activities continue to contribute to the mixed economy, but are also valued for intrinsic purposes that cannot be assigned a monetary value (TH 2012).

Primary research results indicate that TH citizens do not tend to assign a monetary value to traditional economic activities (TH Traditional Foods and Traditional Economy Survey, 2016). Half the survey respondents indicated that they do not sell goods or services from the land, while 25% estimate that they make between $0 and $500, and 12.5% estimate that they make between $2,001 and $5,000. Focus Group attendees added to this understanding by sharing that they do not give meat or food with the expectation of getting something in return (TH Traditional Foods and Traditional Economy Focus Group, 2016). Though it is understood that the activities and services conducted as part of the traditional economy support the economic well-being of TH citizens, no quantitative value was determined by this study.

### *21.3.2.2 White River First Nation Traditional Economy*

The White River First Nation's (WRFN's) traditional economy reflects the Nation's collective understanding of their sense of place. The WRFN sense of place refers to the intimate and inseparable relationship that the WRFN has with their Traditional Territory (**Figure 21.1-1**).

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10 TH Traditional Foods and Traditional Economy Focus Group (2016).

***Traditional Economic Activities***

Current activities identified as being a part of the WRFN traditional economy include such subsistence-related traditional economic activities as hunting, trapping, fishing, plant gathering, and wood cutting (Dobrowolsky 2014, Calliou Group 2012a). The Yukon Environmental and Socio-economic Assessment Board (2012) reaffirms the importance of wildlife to the WRFN traditional economy by noting that Caribou are important for many different reasons including economic, cultural, and aesthetic. These traditional economic activities contribute to the economic well-being of the WRFN and its members.

***Level of Engagement in the Traditional Economy***

Members of the WRFN continue to actively engage in the traditional economy. With respect to subsistence harvesting activities, a recent community-based study reported high levels of engagement. Over the course of the 13-month study[11], participants reported that 90% hunted, 30% trapped, 95% fished, and 70% conducted gathering activities (Calliou Group 2012b). Over the course of 13 months, a total of 238 harvesting trips were conducted by WRFN members. Of these trips, approximately 68% were one day or less in duration, and almost one-third were multiple days in duration. This finding suggests that the majority of WRFN members engaging in subsistence harvesting activities conduct short-duration trips (i.e., 1 day or less) (Calliou Group 2012b).

***Market Value of the Traditional Economy***

No data were available to describe the current economic value of the overall WRFN traditional economy, aside from identifying some costs associated with undertaking these activities, which at times can be significant[12]. Activities associated with the WRFN's traditional economy are viewed by the WRFN to be Aboriginal rights protected under the Canadian Constitution. Kaminak Gold Corporation, a wholly owned subsidiary of Goldcorp Inc. (Goldcorp or Proponent) acknowledges that the WRFN does not endorse any effort to monetize these rights (WRFN review comments on May 12, 2016 draft of **Appendix 18-A Socio-economic Baseline Report**); however, Yukon First Nations, including the WRFN, have adjusted to changing land uses over time to take advantage of new economic opportunities (Dobrowolsky 2014).

#### *21.3.2.3 Selkirk First Nation Traditional Economy*

The traditional economy is a valued socio-economic component to Selkirk First Nation (SFN) and its citizens (KCB 2013). Traditional economic activities continue to currently contribute to all aspects of SFN well-being (KCB 2013). SFN citizens expressed "…that their ability to depend on the land and its resources is vital to their economic future" (KCB 2013).

11 Twenty WRFN members participated in the study.

12 WRFN members estimated that the majority of subsistence harvesting-related trips cost under $200, one-third cost under $50, and some cost over $1,000 to conduct (Calliou Group 2012b).

***Traditional Economic Activities***

The SFN traditional economy includes such traditional activities as trapping, hunting, fishing, berry picking, and creating goods from materials gathered from the land (KCB 2013). These activities provide income or income in kind, which contributes to the overall well-being of SFN citizens in Pelly Crossing (KCB 2013). One of the activities noted of being of particular importance to SFN's subsistence economy is fishing for salmon and other fish. As stated by Morrell (1991), "…fish and other products of the land provide real income in kind that makes life livable in a cash-poor economy".

***Level of Engagement in the Traditional Economy***

Selkirk First Nation citizens have reported being actively engaged in traditional use activities during all seasons of the year (KCB 2013). The current level of citizens engaged in the traditional economy, however, may not reflect the actual value or importance of the traditional economy.

***Market Value of the Traditional Economy***

No data were available to describe the current economic value of the overall SFN traditional economy; however, previous research found that "…it is estimated that a portion of many of the SFN family's annual income is derived from traditional activities…[t]hese products may be sold, used for subsistence purposes, or traded." (KCB 2013). It was also identified that traditional economic activities provide value to SFN citizens by providing nutritious food.

No data were available to describe the monetary contribution that traditional economic activities make to individual citizens.

#### *21.3.2.4 First Nation of Na-cho Nyäk Dun Traditional Economy*

The First Nation of Na-cho Nyäk Dun (FNNND) traditional economy supports more than just the economic well-being of citizens; it also supports cultural well-being at an individual and community level: "Sharing the harvest is also an important part of Northern Tutchone culture… It is about taking care of each other and sharing the gifts of the land" (DPRA 2010). The culture, traditions, and community cohesion that the traditional economy fosters are an important part of FNNND culture (DPRA 2010).

***Traditional Economic Activities***

Although FNNND citizens currently engage in a mixed economy, they still actively conduct such traditional activities as hunting, fishing, trapping, and gathering. These activities continue to contribute to all aspects of FNNND well-being and community life including economic, culture, diet, and health (DPRA 2010, FNNND 2008a). Specifically, trapping was identified as an important activity since it provides a source of income in the winter (InterGroup Consultants Ltd. 2009).

### *Level of Engagement in the Traditional Economy*

Quantitative data on FNNND's current level of engagement in the traditional economy were not available. A 2008 report states that FNNND (2008b) conducts traditional activities year-round on their Traditional Territory (**Figure 21.1-1**) and that "…proponents should be prepared to encounter harvesters in all seasons throughout the Traditional Territory" (FNNND 2008b).

### *Market Value of the Traditional Economy*

Traditional foods obtained through traditional activities comprise a significant portion of FNNND citizens' diets (DPRA 2010). According to FNNND citizens, traditional foods are important for their nutritional and medicinal value, the linkages that they facilitate with the land culture, and savings compared to store-bought food (DPRA 2010).

## 21.4 PROJECT INTERACTIONS, POTENTIAL EFFECTS, AND MITIGATION MEASURES

### 21.4.1 POTENTIAL PROJECT-RELATED INTERACTIONS

Project Activities associated with Project Phases that will potentially interact with Social Economy are described in **Table 21.4-1**.

**Table 21.4-1 Potential Interactions**

| Phase | Types of Effects | Nature of Interaction |
|---|---|---|
| **Non-wage Economy** | | |
| Construction Phase;<br>Operation Phase;<br>Reclamation and Closure Phase | • Potential effects to subsistence activities (non-wage economy) | • Project-related population increase, demand for goods and services, and development of the Project |
| Post-closure Phase | • No interaction | • No interaction |
| **Traditional Economy** | | |
| Construction Phase;<br>Operation Phase;<br>Reclamation and Closure Phase | • Potential effect to the quantity and diversity of traditional economy activities<br>• Potential effect to the level of engagement in the traditional economy | • The Project may change the socio-environmental setting where traditional economic activities were historically, are currently, or may be conducted. |
| Post-closure Phase | • No interaction | • No interaction |

Project-driven increases to population may increase the demand for services provided by non-profit or non-governmental organizations, although such changes will likely be minimal. Potential changes to non-profit or non-governmental organizations are therefore not carried forward for detailed assessment.

Project-driven increases to population may increase the available pool of volunteers somewhat, although such changes are expected to be minimal and beneficial in nature. Potential changes to volunteering are therefore not carried forward for detailed assessment.

Since data are not available on the value of bartering and cooperative buying, and potential Project-related effects are likely to be beneficial, a detailed assessment has not been conducted.

### 21.4.2 Potential Effects

Potential effects to the social economy include the following:

**Non-wage Economy**

- **Potential effects on ability to conduct subsistence activities (access)** – Changes to how individuals and households are able to access the land and resources may translate into changes to the proportion of households consuming wild foods obtained through subsistence activities, and to the economic value that wild meat (obtained through subsistence activities) contributes to households. The increase in access to lands and resources is assessed in **Appendix 24-A Land and Resource Use**. The change in access to lands and resources, and therefore the ability to conduct subsistence activities, is limited to improvements to the length of the Northern Access Route (NAR) from Stewart River north to the southern end of the existing paved road, and such improvements are considered both adverse and positive.
- **Potential effects on ability to conduct subsistence activities (availability of time)** – The Project will create more and different business and employment opportunities and increase the amount of income available to support non-wage activities, thereby affecting the LAA population's ability to conduct non-wage economic activities. A larger population may increase demand for meat from subsistence sources, depending on the preferences and values of those who relocate to the LAA. The value of wild meat obtained through subsistence activities may also rise with an increase to the LAA population.

**Traditional Economy**

- **Potential Effect to the Quantity and Diversity of Traditional Economic Activities** – The activities that comprise First Nations' traditional economies are diverse and continually evolving. Project activities in the LAA during the Construction, Operation, and Reclamation and Closure Phases may affect the quantity and diversity of traditional economic activities due to changes in sensory or environmental conditions. In addition, changes to employment and business opportunities may compete with or provide people with additional income for subsistence activities. Traditional economic activities may be affected differently depending on the type of activity and time of year that an activity is conducted, the parameters necessary to conduct that activity, and people's individual preference. These potential effects are individually described for each potentially affected First Nation in **Appendix 21-A Social Economy Valued Component Assessment**.
- **Potential Effect to the Level of Engagement in the Traditional Economy** – The collective and individual level of engagement of each First Nation or citizen in the traditional economy may be directly and indirectly affected by Project-related activities in the LAA and Regional Assessment Area (RAA) during the Construction, Operation, and Reclamation and Closure Phases. Traditional economic activities are influenced by several Project-related factors that are connected to the level of engagement in the traditional economy of each respective First Nation; these include such factors as access, sensory conditions, environmental conditions, income, and availability. These potential effects are individually described for each potentially affected First Nation in **Appendix 21-A Social Economy Valued Component Assessment**.

- **Potential Effects to the Value of the Traditional Economy** – The traditional economy of each First Nation reflects tangible (e.g., monetary, goods, materials) and intangible (e.g., sense of place, quality of life, cultural and spiritual well-being) value. The value of the traditional economy may be directly and indirectly affected by Project-related activities in the LAA and RAA during the Construction, Operation, and Reclamation and Closure Phases. Traditional economic activities are influenced by several Project-related factors that are correlated to the value of the traditional economy of each respective First Nation; these factors include environmental and sensory conditions, income, and availability. These potential effects are individually described for each potentially affected First Nation in **Appendix 21-A Social Economy Valued Component Assessment**.

### 21.4.3 Mitigation and Enhancement Measures

The mitigation measures identified for the Social Economy were informed by a review of mitigation and follow-up programs undertaken for past projects, with emphasis on mining projects in Yukon. Input was received through the Project's consultation and engagement program (**Section 3.0**). Mitigation measures for the Social Economy include the following:

- Implement Project design measures to minimize the overall footprint, align the NAR route, use existing roads, avoid sensitive habitats and maintain key habitat features, minimize vehicle traffic, implement phased mine development, and conduct progressive reclamation and closure activities.
- Implement Traditional Economy Enhancement Measures to support the potential benefits that the Project may contribute to the LAA First Nations throughout all phases of the Project.
- Implement measures to minimize effects of the NAR identified in the Access Route Construction Management Plan (**Appendix 31-A**) and the Access Route Operational Management Plan (**Appendix 31-B**).
- Develop and conduct cultural awareness training in cooperation with First Nations during site orientation and periodic refresher training.
- Develop and implement an Engagement Plan to engage with First Nations and communicate the status and schedule of the Project with local communities, residents, organizations, contractors and employees, as well as government.

## 21.5 Residual Effects and Their Significance

Following the implementation of mitigation measures, residual effects are expected to remain for potential effects to subsistence activities (non-wage economy), potential effects to the quantity and diversity of traditional economy activities, and to the level of engagement in the traditional economy. Residual effects are likely to begin in the Construction Phase, and will extend through the Operation and Reclamation and Closure Phases. As discussed below, all of these residual effects are likely to be not significant.

### 21.5.1 Non-wage Economy

This subsection describes the residual effects anticipated for the non-wage economy. The community economic resiliency in the LAA and RAA is generally likely to be similar for each non-wage economy residual effect. The context and resiliency in the LAA and RAA are discussed in **Appendix 21-A Social Economy Valued Component Assessment**.

#### *21.5.1.1 Access-related Residual Effect on Ability to Conduct Subsistence Activities (Non-wage Economy)*

The development of the Project will cause a direct change in access to the lands and resources in the areas surrounding the section of the NAR from Stewart River north to the southern end of the existing road. Increases to the road network and improvement to the overall condition of the road, , represent changes to how individuals and/or households may be able to access the land and resources, which may further translate into changes to the proportion of households consuming wild foods obtained through subsistence activities. The adverse aspects of the residual effect will likely be not significant and will be low to moderate in magnitude, local but pronounced in winter, continuous in frequency, long-term in duration, partially reversible, and likely to occur.

#### *21.5.1.2 Decrease in Availability of Time and Ability to Conduct Subsistence Activities (Non-wage Economy)*

Project-related employment opportunities are likely to result in an increased population in the LAA and RAA, although the precise number of temporary and permanent workers who will reside in either LAA or RAA communities is difficult to determine. It is assumed that a Project-related population increase will therefore increase the amount of people who are available to participate in the LAA non-wage economy. Depending on the preferences and values of those who relocate to the LAA, a change to the proportion of households who consume wild foods obtained through subsistence activities may occur. Project-related increases to local business and employment opportunities may influence such related effects as a reduced availability of the local population to conduct non-wage economic activities, and an increase in the amount of income available to support non-wage activities.

Ultimately, a Project-related change in availability and the ability to conduct subsistence activities related to the non-wage economy are likely to be experienced as an adverse outcome of the Project. The residual effect of a decrease in availability and ability to conduct subsistence activities related to the non-wage economy are likely to be not significant. This effect is rated as negligible to low in magnitude, local but pronounced in winter, continuous in frequency, long-term in duration, fully reversible, and likely to occur.

### 21.5.2 TRADITIONAL ECONOMY

The residual effects to the current traditional economy have been assessed for the Project as a whole, and have not differed between First Nations; however, the Proponent recognizes that the Project is likely to affect First Nations differently, depending on the extent of their Traditional Territory within the Project footprint and assessment areas. An interaction matrix between First Nation traditional lands and the Project Area is provided in **Appendix 21-A Social Economy Valued Component Assessment**.

#### *21.5.2.1 Access-related Decrease in Level of Engagement in the Traditional Economy*

An increase in the road network and improvements to the section of the NAR between Stewart River and the end of the existing road, may result in changes to how people are able to access land and resources, which may further translate into changes to the proportion of households consuming wild foods obtained through traditional economic activities. Ultimately, access-related effects of the Project to conducting traditional economic activities are expected to be experienced as both a beneficial and adverse outcome of the Project.

It is likely that both the positive and adverse aspects of the residual effect will be not significant. The residual effects are likely to be low to moderate in magnitude, focused on the improved portion of the NAR, seasonal, continuous in frequency, long term in duration, partially reversible within communities with a moderate ability to respond to disturbances, and likely to occur.

#### *21.5.2.2 Income-related Decrease in Level of Engagement in the Traditional Economy*

The adverse residual effect of income-related change in the ability to conduct traditional economic activities is likely to begin in the Construction Phase, and extend through the Operation and Reclamation and Closure Phases. The not significant residual effect is likely low to moderate in magnitude, predominantly in the LAA, seasonal, continuous in frequency, long term in duration, fully reversible, and likely, within communities with a moderate ability to respond to disturbances.

## 21.6 CUMULATIVE EFFECTS ASSESSMENT

This section presents the potential interactions between Project-related residual effects on both Social Economy subcomponents and those of other projects and activities. Residual effects are carried forward to the cumulative effects assessment due to the potential for these residual effects to interact cumulatively with other projects and activities. The potential for these residual effects to interact and combine with the residual effects for quartz projects, placer projects, and the existing road network was considered. No additional mitigation measures are proposed beyond those proposed for Project-specific mitigation.

Following the implementation of mitigation measures, the Project is likely to result in cumulative residual adverse effects on non-wage economy (access-related potential cumulative effect on ability to conduct subsistence activities; and decrease in availability of time and potential cumulative effect on ability to conduct subsistence activities), and cumulative adverse residual effects on traditional economy (access-related potential cumulative effect on ability to conduct traditional economic activities; and income-related potential cumulative effects on the ability to engage in traditional economic activities). All cumulative adverse residual effects are likely to extend across both the LAA and RAA; however, the way in which they will materialize for each First Nation and for respective citizens or members will be unique. The Project is not likely to result in significant adverse cumulative effects in any of these four cases; due to a lack of comprehensive data, the level of confidence in these predictions is low.

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### 21.7.1 PERSONAL COMMUNICATIONS

Interview 11. February 10, 2016. President, Vice-President, Board Member, Conservation Klondike Society (CKS), Dawson City, Yukon.

Local Business Focus Group, February 9, 2016. Dawson City Curling Club, Dawson City, Yukon.

Tr’ondëk Hwëch’in (TH) Traditional Foods and Traditional Economy Focus Group, March 1, 2016. TH Community Hall, Dawson City, Yukon.

March TH TWG Meeting, Pers. Comm. 2016.

WRFN review comments on May 12, 2016 draft of Socio-economic Baseline Report.

# 22.0 COMMUNITY INFRASTRUCTURE AND SERVICES ASSESSMENT

This section presents a high-level summary of the effect assessment for Infrastructure and Services Valued Component (VC). The full effects assessment is presented in **Appendix 22-A Community Infrastructure and Services Valued Component Assessment**.

## 22.1 ASSESSMENT SCOPE

Community Infrastructure and Services was identified as a VC because there are distinct interactions between the Project and Community Infrastructure and Services, the proposed Coffee Gold Mine's (Project's) potential effects on Community Infrastructure and Services can be measured, and there are distinct pathways of effects. The Project may result in an in-migration of workers, which may increase demand for local and regional infrastructure and services. The Project will also generate traffic, which may result in a direct effect on community infrastructure. Community Infrastructure and Services was selected as a VC to assess the Project's anticipated interactions with in-migration of Project employees and the resulting increased demand for infrastructure and services, thus reflecting local values; similarly, the feedback received during the Project's consultation process also reflects local values, consultation, and Traditional Knowledge (TK).

The Community Infrastructure and Services VC comprises four subcomponents to focus the assessment on issues raised during the consultation process: housing and accommodation; physical infrastructure; community services; and transportation. Indicators and rationale for their selection are listed in **Table 22.1-1** for each subcomponent

**Table 22.1-1 Indicators for Community Infrastructure and Services Subcomponents**

| Indicator | Rationale for Selection |
|---|---|
| **Housing and accommodations** | |
| Housing availability | This indicator provides information about the current demand for housing, and informs potential effects to housing supply as a result of Project-related increases in population. Increased demand for housing based on in-migration of Project employees may result in a decrease in housing availability. |
| Housing development | This indicator provides information about the addition of new housing units to the market, and informs potential effects on housing availability as a result of Project-related employment and population increases in Yukon communities. |
| Housing cost | This indicator provides information about house prices and median rent to inform housing affordability for residents. Increased demand for housing based on in-migration of Project employees may result in an increase in housing costs. |
| Non-permanent accommodation characteristics | This indicator provides information about non-permanent accommodation available in the community to inform potential effects of the Project-related demand for temporary accommodation that may compete with other needs, such as tourism. |

| Indicator | Rationale for Selection |
|---|---|
| **Physical infrastructure** | |
| Physical infrastructure | This indicator provides information about the condition and status of existing physical community infrastructure, such as water and wastewater facilities, to inform potential effects of increased population as a result of Project activities. |
| **Community services** | |
| Community services | This indicator provides information about the type of community services available and existing demand for services to inform potential effects of the Project to the capacity of community services. |

### 22.1.1 ASSESSMENT BOUNDARIES

Table 22.1-2 identifies the spatial boundaries established for the Community Infrastructure and Services assessment (see also **Figure 22.1-1**). The temporal boundaries established for the assessment of Project-related effects on the VC Community Infrastructure and Services include all phases of the Project, as described in the Project Proposal (**Section 2.0 Project Description**). The temporal characteristics of the Project's Construction, Operation, Reclamation and Closure, and Post-Closure Phases are described in **Section 2.0 Project Description**. Administrative boundaries identified for the Project reflect Yukon Territory and local government administrative boundaries where possible and relevant to the assessment.

**Table 22.1-2 Spatial Boundary Definitions for Community Infrastructure and Services**

| Spatial Boundary | Description of Assessment Area |
|---|---|
| **Housing and accommodation; physical infrastructure; and community services** | |
| Local Assessment Area | The LAA comprises the municipal boundaries of Whitehorse and Dawson, and the communities of Beaver Creek, Pelly Crossing, and Mayo |
| Regional Assessment Area | Yukon |
| Cumulative Effects Assessment area | An area inclusive of active and proposed major mine projects, as shown in **Appendix 5-B** |
| **Transportation** | |
| Local Assessment Area | Dawson and area within 1 km of the NAR (including existing government-maintained roads) and the North Klondike Highway in proximity to Dawson |
| Regional Assessment Area | Yukon |

**Notes:** km - kilometre; NAR - Northern Access Route


# COFFEE GOLD MINE

## Community Infrastructure and Services Spatial Boundaries

### Legend

- Highway
- National/International Border
- Project Footprint
- Local Assessment Area
- Infrastructure and Community Services and Transportation Local Assessment Area
  [1] *The Infrastructure and Community Services Regional Assessment Area is the same as the Infrastructure and Community Services Local Assessment Area.*
- Transportation Regional Assessment Area

### Notes

1. This map is not intended to be a "stand-alone" document, but a visual aid of the information contained within the referenced Report. It is intended to be used in conjunction with the scope of services and limitations described therein.

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Kilometres

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## 22.2 Assessment Methods

The Community Infrastructure and Services assessment, including the assessment of Project-related effects and cumulative effects was conducted according to the methods set out in **Section 5.0 Assessment Methodology**. The assessment has been informed by input (e.g., TK, statistical, and other information) provided through consultation and engagement with government agencies, affected First Nations, and the public.

### 22.2.1 Regulatory Framework

The legislation, regulations, and government-led programs that are relevant to the Community Infrastructure and Services VC include the *Building Standards Act*, RSY 2002, c.19 amended by SY 2013, c.3, and supporting regulations; the *Municipal Act*, RSY 2002, c.154; amended by SY 2003, c.11; SY 2007, c.13; SY 2008, c.18; SY 2012, c.14; SY 2014, c.15; SY 2015, c.12; and Bill No. 89 *Act to Amend the Municipal Act.* The City of Whitehorse is guided by its 2010 Official Community Plan (2013). Transportation is regulated by the federal *Motor Vehicle Transport Act*, RSC 1985, c. 29 with sub-section Commercial Vehicle Drivers Hours of Service Regulations (SOR/2005-313)*;* the Yukon *Highways Act*, RSY 2002, c.108; SY 2013, c.11 and supporting regulations; and the Yukon *Motor Vehicle Act* and general regulations.

## 22.3 Existing Conditions

This section describes the existing conditions of Community Infrastructure and Services, including the regulatory context for the Community Infrastructure and Services VC, based on TK, statistical and other information, and baseline studies conducted during the Project's Feasibility Program.

### 22.3.1 Housing and Accommodation

#### *22.3.1.1 Housing Availability*

The City of Whitehorse's 2010 Official Community Plan (City of Whitehorse 2013) calls for more land for residential development and secondary suites to increase housing stock. Construction for the third phase of the Whistle Bend development is scheduled to take place in the spring of 2017; this neighbourhood is projected to have 3,900 housing units when completed (City of Whitehorse n.d.).

The 2015 Northern Housing Report for Whitehorse indicated that residential construction would decrease from 2014 to 2015, with 95 single-detached starts and 90 multi-family starts expected in 2015. In 2014, there were 212 housing starts (109 single detached and 103 multi-family), which was an increase of 31% from the previous year (Lis 2015).

Housing in the LAA is also available through the Yukon Housing Corporation, the Klondike Development Organization, the Trondëk Hwëch'in, and private sources.

A Statistics Canada 2011 Household Survey found that housing was the primary change recommended to improve the City of Dawson (Dawson) area (24% of respondents); 37% of respondents noted that more available housing would increase the community's ability to attract more year-round residents (Statistics Canada 2013, KDO 2014). Dawson has one of Yukon's largest needs for new housing resulting from natural population growth (Zanasi and Pomeroy 2013). The housing shortage is exacerbated in the summer, when seasonal employment increases requirements for accommodation (YHC 2013). Shortages have also been attributed to mining company rentals removing usual rental housing from the market (KDO 2011).

#### *22.3.1.2 Housing Costs*

Median rent in Whitehorse was $969 per month in October 2015, with a vacancy rate of 3.4%. Median monthly rent for a bachelor apartment was $775, a one-bedroom was $925, a two-bedroom was $1,025, and a three- to four-bedroom was $1,500 (YBS 2015). The median rent of $969 would require a salary of approximately $38,760 per year to meet the affordability standard of 30% of gross income (depending on the cost of heating and other utilities).

As described by Yukon Housing Corporation, "the increasing population has resulted in…tightening in rental vacancy rates, accompanied by rising rents and a very large increase in home prices" (YHC 2013). Because rents are relatively high, it can be difficult for lower-income households to find affordable housing (YHC 2015). A recent report found that over 40% of tenant households were spending more than 30% of their income on rent (YG 2015a).

A 2013 survey found that the average income of all renters in Dawson was $38,800 and the average rent paid was $703 per month, or 22% of their average income" (KDO 2013). Median rent in Dawson was $800 in October 2015, requiring a salary of approximately $32,000 per year to meet the affordability standard of 30% of gross income (depending on the cost of heating and other utilities).

#### *22.3.1.3 Non-permanent Accommodation Characteristics*

Whitehorse offers temporary accommodation through hotels and motels that are open year-round, as well as bed and breakfasts, lodges and cabins, and two hostels, in addition to campgrounds owned privately and by the Yukon Government (YG), which operate seasonally. Rentals are also available from homeowners through online agencies such as Vacation Rental By Owner (VRBO) and Airbnb as of April 20, 2016. The tourism department provides information about vacancies during busy periods to facilitate finding accommodation, but people are generally able to find accommodation in Whitehorse (Saunders, Personal Communication 2016).

Dawson offers accommodation options during the summer months including a rustic hostel (no electricity or running water), two YG campgrounds, and a privately owned RV park, as well as bed and breakfasts, inns, cabins, hotels, and motels. Many facilities close in the winter months, and accommodation is limited at that time.

### 22.3.2 PHYSICAL INFRASTRUCTURE

#### *22.3.2.1 Solid Waste Disposal and Recycling*

Whitehorse is served by a municipal landfill located on the Alaska Highway within the City. Recycling services are provided by the non-profit Raven Recycling Society and the for-profit facility, P&M Recycling.

The Quigley Landfill regional landfill services Dawson, the Klondike Valley, the Dempster Highway, and the North Klondike (City of Dawson 2016a). Located on the Klondike Highway south of Dawson, the landfill is a joint venture between the City of Dawson and the YG.

The landfill is currently approaching maximum capacity, and is estimated to have approximately five years of life remaining using the current waste management approach (Interview 4, Personal Communication 2016). With the implementation of waste diversion, including composting and recycling, the remaining life of the landfill could be extended to 14 years (Interview 4, Personal Communication 2016). Dawson is actively working to identify ways to extend the life of the landfill.

#### *22.3.2.2 Water Supply and Wastewater Treatment*

The water supply for Whitehorse is obtained from the municipal wells located in Riverdale, which is chlorinated, and then transported to residents via a 160-km pipe network (YG 2014a, City of Whitehorse n.d.f). Some pipes and sewer mains have been replaced, and the Selkirk pump house has been replaced with a water station and chlorination facility (YG 2014b).

The Dawson water system includes water supply, storage, treatment, and distribution infrastructure. Four infiltration wells were drilled in July 2014 (City of Dawson 2016b), and provide sufficient water capacity to meet Dawson's current demands as of 2016 (Interview 4, Personal Communication 2016.

Several projects are underway to improve Dawson's physical infrastructure. Although water and sewer lines have been added, some lines are currently at capacity, and a population increase in Dawson would require expansion of water and sewer infrastructure (Interview 7, Personal Communications 2016).

A wastewater treatment facility was completed in 2012, and met testing requirements in February 2015 (YG 2016b). The current capacity of this facility is 4,300 $m^3$/day. In winter, wastewater flows are higher due to the use of a bleeder system to prevent the water lines from freezing and ensure peak flows of approximately 3,100 cubic metres per day ($m^3$/day) are reached, as compared to 2,200 $m^3$/day in the summer (Interview 4, Personal Communication 2016).

### 22.3.3 COMMUNITY SERVICES

#### *22.3.3.1 Health Services*

Whitehorse General Hospital serves the population of Whitehorse and Yukon, providing 24-hour acute care; laboratory and medical imaging services including x-ray, ultrasound, and MRI; and clinics for visiting specialists (Yukon Hospitals 2016). From April 1, 2014 to March 31, 2015, the hospital had a staff of 486 people (Yukon Hospitals 2016) (**Table 22.3-1**). The Whitehorse General Hospital expansion is slated for completion in December 2017.

Hospital occupancy averaged 86% as compared to 80% in the previous fiscal year (Yukon Hospitals 2016). Whitehorse General Hospital receives patients from other Yukon communities for specialist care, births, chemotherapy, and surgeries

**Table 22.3-1 Whitehorse General Hospital Usage**

| | Emergency Visits | Admissions | Medical Imaging Visits | Lab Visits |
|---|---|---|---|---|
| April 1 2014 – March 31 2015 | 32,797 | 3,172 | 17,323 | 26,549 |

**Source:** Yukon Hospitals 2016.

Dawson and surrounding area are served by the Dawson City Community Hospital, which opened at the end of 2013 (**Table 22.3-2**). This medical treatment centre has an emergency room that provides 24-hour acute care, x-ray and laboratory services, and a retail pharmacy. From April 1, 2014 to March 31, 2015, the hospital had a staff of 28 people (Yukon Hospitals 2016). There were six licensed physicians in Dawson for this period (Yukon Medical Council 2015).

**Table 22.3-2 Dawson City Community Hospital Usage**

| | Emergency Visits | Admissions | Medical Imaging Visits | Lab Visits |
|---|---|---|---|---|
| April 1 2014 – March 31 2015 | 2,810 | 92 | 475 | 1,932 |

**Source:** Yukon Hospitals 2016

#### *22.3.3.2 Fire Protection Services*

The City of Whitehorse has two fire halls: one co-located with City Hall at 2121 2nd Ave and one in the Public Safety Building at 305 Range Road (City of Whitehorse n.d.g.). The department's responsibilities include urban and wildland fire suppression, fire prevention, training, fire safety inspections, rescue, and building plan reviews (City of Whitehorse n.d.g.). The department consists of both full-time firefighters and volunteers; there are 6 firefighters on duty at any given time, with 24 staff members supported by approximately 10 to 15 volunteers (City of Whitehorse n.d.h.).

Dawson is served by a volunteer fire department of approximately 25 to 35 members (Interview 4, Personal Communication 2016). The Fire Department responds 24 hours per day to incidents within its jurisdiction, including the area within Dawson's municipal limits, with the exception of an agreement with the YG to provide additional support to neighbouring fire departments, if necessary (Interview 4, Personal Communication 2016). A second department, the Klondike Valley Fire Department, serves the area outside of municipal limits of Dawson, with restrictions. In addition to fire-related services, the fire department also responds to motor vehicle incidents, hazardous materials incidents, utility emergencies, and carbon monoxide alarms, and performs rescue services (Interview 4, Personal Communications 2016).

#### *22.3.3.3 Police Services*

The City of Whitehorse is served by Royal Canadian Mounted Police (RCMP) detachment located at 4100 4th Avenue, headed by a Detachment Commander. The Whitehorse Detachment's jurisdiction extends north along the North Klondike Highway past Lake Laberge, southeast along the Alaska Highway to Tagish, and west along the Alaska Highway to Kusawa Lake.

The Dawson City RCMP detachment provides policing services within its jurisdiction, which include: the Dempster Highway as well as the City of Dawson area, extending from the Northwest Territories border in the north to the Alaska border when the Top of the World Highway is open, and east to the Yukon border (Interview 26, Personal Communication 2016). Their jurisdiction also includes the Goldfields area, including the proposed Northern Access Route (NAR) and Project area. The Dawson City RCMP Detachment currently consists of one sergeant, one corporal, and five constables (Interview 26, Personal Communication 2016).

#### *22.3.3.4 Social Services*

Whitehorse has 26 licensed day cares and 24 licensed family day homes (YG 2016c). With an increase in the number of children born in the city, day care has become more difficult to obtain (CBC 2012). Services for young children are offered through the Child Development Centre, which has a main location in Whitehorse and a satellite office in Dawson; services include physiotherapy and occupational therapy, developmental therapy and psychological services, and speech-language pathological services (YG 2014b).

Dawson is currently experiencing a shortage in child-care availability. In June 2015, the wait list at the Little Blue Early Child Care and Learning Centre was longer than the number of spaces (Windeyer 2015a), and the lack of child care has been adversely affecting people's ability to work (Windeyer 2015b). The Centre has 20 spaces for children. Tr'ondëk Hwëch'in operates a daycare facility, Trinke Zho, which offers care for both First Nation and non-First Nation children, including the Headstart Program. Trinke Zho can accommodate 60 children.

In Whitehorse, seniors are supported through the Seniors' Information Centre, funded by Yukon Health and Social Services, which provides information and assistance to seniors such as pension and housing applications, health issues, and referrals to other agencies and organizations (YG n.d.b.). Assisted living is provided through the 96-bed Copper Ridge Place, 44-bed MacAulay Lodge, and the 29-bed Thompson Centre (YG n.d.c.). A new 150-bed facility is being constructed in Whistle Bend (YG n.d.d.).

### 22.3.4 TRANSPORTATION

#### *22.3.4.1 Air Transportation*

Whitehorse and Yukon are served by the Erik Nielsen Whitehorse Airport (YXY), a controlled international airport operated by the YG that supports commercial traffic, including Air North and Air Canada year-round and Condor and WestJet seasonally. It has two paved runways, with the longest being 9,500 feet (2,900 m) (Acuwick n.d.). In 2015, 271,673 passenger movements and 22,897 aircraft movements were reported at YXY (YG n.d.e.).

Dawson is served by a Transport Canada-certified regional airport, Dawson City Airport (YDA), which is owned and operated by the Aviation Branch of the YG It is an uncontrolled airport with a single unpaved runway approximately 5,000 feet (1,500 metres) long.

Passenger volumes increased steadily at YDA between 2002 and 2012, with 11,285 passengers in 2012, and a corresponding increase in aircraft movements of 8.2% (Aviotec et al. 2013). A business case to pave the runway found that an economic benefit would exceed the cost of construction, with an anticipated 76 jobs being created in the first year of construction; after construction completion, approximately 40 jobs are anticipated to be sustained annually (Peak Solutions 2016).

#### *22.3.4.2 Road Network*

The Yukon highway system has 12 highway routes including core, northern, and remote networks. The highway systems of interest for this Project include the Alaska Highway to the North Klondike Highway and the North Klondike Highway to Dawson.

The Alaska Highway extends from Watson Lake through to Whitehorse, and continues to Haines Junction and on to Alaska. Traffic for the Project will turn north from the Alaska Highway to the North Klondike Highway at the junction just west of Whitehorse. Upgrades to the highway for the section through Whitehorse are currently underway.

The North Klondike highway travels from its junction with the Alaska Highway through the communities of Carmacks, Pelly Crossing, and Stewart Crossing, and turns west north of the Stewart River to the Dempster Highway and Dawson. It is primarily sealed with Bitumous Surface Treatment (YG, 2011).

The existing road network in the LAA, comprising Hunker, Sulphur, Dominion, Black Hills, and Maisey May Roads, extends south from the Klondike Highway, and is used seasonally, with no road clearing in winter. There are 93 existing placer operations using this road system, which has been reported to have had heavy use since 2011, and maintenance from both the YG and the placer miners has not been sufficient to keep up with road use (T. Christie, Personal Communication 2016).

#### *22.3.4.3 Road Traffic*

Between 1992 and 2011, traffic volume on the Alaska Highway at the North Klondike Highway (north side) had the highest average traffic volumes in July (1,727 vehicles per day on average) and lowest average in January (699), amounting to an overall average of 1,119 vehicles per day (YG 2011).

Between 1992 and 2011, traffic volume on the Klondike Highway at the turnoff to the Dempster Highway (north side) had the highest average traffic volumes in the summer, with the highest average of 583 vehicles per day in July and lowest average of 87 vehicles in January, resulting in an overall average of 247 vehicles per day (YG 2011). The Klondike Highway at Dome Road (north side) also had the highest average in July of 3,599 vehicles and the lowest average in January of 992, with an average of 2,097 vehicles per day (YG 2011). For the same period, traffic was measured on Hunker Road at the Klondike Highway for the months of May through September, with an overall average of 231 vehicles per month (maximum 425) (YG 2011). Locations of traffic volume count sites are provided in **Figure 11-12** of **Appendix 18-A Socio-economic Baseline Report**.

## 22.4 PROJECT INTERACTIONS, POTENTIAL EFFECTS, AND MITIGATION MEASURES

### 22.4.1 POTENTIAL PROJECT-RELATED INTERACTIONS

Potential Project interactions with Community Infrastructure and Services are presented in **Table 22.4-1**.

**Table 22.4-1 Project Valued Component Interaction Potential**

| Project Phase | Interaction Rating | Nature of Interaction |
|---|---|---|
| **Construction Phase** | | |
| Overall Construction Phase | Potential Interaction | There is a potential interaction with housing and accommodation, physical community infrastructure, and community services based on potential demand for housing and services due to the temporary in-migration of the Project-related workforce during the Construction Phase. Additionally, there is a potential interaction with transportation as a result of Project-related traffic for construction activities during the Construction Phase. |

| Project Phase | Interaction Rating | Nature of Interaction |
|---|---|---|
| **Operation Phase** | | |
| Overall Operation Phase | Potential Interaction | Increases in demand and use of housing and accommodation; physical community infrastructure; community services; and transportation are likely to occur as a result of an interaction between Community Infrastructure and Services and the overall Operation Phase of the Project. |
| **Reclamation and Closure Phase** | | |
| Overall Reclamation and Closure Phase | Potential Interaction | No measurable changes in housing and accommodation; physical community infrastructure; community services; and transportation are likely as a result of an interaction between community infrastructure and services during the overall Reclamation and Closure Phase. |
| **Post-closure Phase** | | |
| Overall Post-closure Phase | Negligible Interaction | No measurable changes in housing and accommodation; physical community infrastructure; community services; and transportation are likely as a result of an interaction between community infrastructure and services during the overall Post-closure Phase. |

### 22.4.2 Potential Effects

#### *22.4.2.1 Increased Demand for Housing*

Project-related in-migration will likely affect the demand for housing during the Construction and Operation Phases in Whitehorse and Dawson. The increased demand for housing will likely materialize through a decrease in housing availability. It is possible that an increased population will generate demand for housing stock, resulting in new construction.

Kaminak Gold Corporation, a wholly owned subsidiary of Goldcorp Inc. (Goldcorp or Proponent) is perceived to potentially having a positive effect on the community, provided that Project-related housing needs are met and planning and support are adequate (Interview 21, Personal Communication 2016; Interview 23, Personal Communication 2016).

#### *22.4.2.2 Increased Demand on Physical Infrastructure*

Population growth resulting from Project activities during the Construction and Operation Phases will increase the demand on physical infrastructure, including water and wastewater infrastructure, solid waste disposal, and electrical and communications infrastructure in the LAA.

The effect on physical infrastructure will likely be more pronounced in Dawson because existing physical infrastructure, especially water lines, is nearing capacity. Physical infrastructure in Whitehorse such as water and wastewater services can accommodate modest population growth (See **Appendix 18-A Socio-economic Baseline Report**).

#### *22.4.2.3 Increased Demand on Community Services*

Population growth resulting from Project activities during the Construction and Operation Phases will likely increase the demand on community services, including services for families with young children (e.g., day care and family support) and health and social services.

These effects will likely be more pronounced in Dawson because existing resources are nearing or at capacity; however, the new community hospital was designed to accommodate population growth related to a resource development project with sufficient time and resources to increase staffing levels. Dawson currently has six physicians, which represents a population-to-family physician ratio well below the Canadian average of 875 in 2014 (CMA 2016a).

Whitehorse has experienced shortages of family physicians in recent years, although the population-to-family physician ratio in 2014 was 590, which was better than the Canadian average (CMA 2016a). It is likely that a Project-related increase of several hundred people will not affect primary care; however, the territory is currently experiencing shortages in specialist care. Canada has an average of 110 specialists per 100,000 persons, whereas Yukon has 27 (CMA 2016b).

#### *22.4.2.4 Transportation*

***Effect of Increased Vehicle Traffic on Transportation Infrastructure***

Transportation of fuel, equipment and materials, and supplies will increase overall traffic volumes, and may therefore increase the risk of motor vehicle collisions within the LAA. An increase in the number of collisions will affect first responders (ambulance, fire, RCMP) and health services in Dawson and Whitehorse.

During the busiest period for truck traffic, Years 1 through 8 of the Operation Phase, anticipated traffic is approximately 8 trucks per day travelling into the site; an equal number of trucks will be traveling back out of the site each day. Existing roads on the proposed NAR currently experience light use in the summer months (7.6 passes per day on Eureka Ridge, 2.5 passes per day on Henderson, 0.9 passes per day on Maisy May). While the Project traffic represents a large percentage increase in traffic volume, the absolute traffic numbers remain low (See **Appendix 18-A Socio-economic Baseline Report** section 7.4.4, which describes existing traffic conditions).

The proposed NAR may lead to increases in non-Project-related traffic, which will in turn affect RCMP, search and rescue, and other first responders through issues such as lost or stranded drivers; impaired driving; people lost on hunting or hiking trips; as well as motor vehicle collisions (Interview 26, Personal Communication 2016).

***Effect of Increased Air Traffic on Aviation Infrastructure***

Project employees will be transported to the Project site via air, with pick-up and drop-off points, which will likely be Dawson, Whitehorse, and potentially other communities based on where employees reside. Incidental freight and primarily catering supplies will also be transported by air during seasonal road closures. During the Project's Construction and Operation Phases, 117 to 188 flights are expected per year, primarily out of YXY. Crew changes will likely be made using a 40-passenger Hawker Siddeley 748. This increase in air traffic may have effects on air transportation infrastructure, including both physical infrastructure (e.g., increased maintenance for runway and taxiway surfaces) and services (e.g., Air Traffic Control in Whitehorse).

### 22.4.3 Mitigation and Enhancement Measures

The mitigation measures to be used to eliminate, reduce, or control adverse effects to Community Infrastructure and Services include implementation of the following:

- Project design measures to minimize vehicle traffic, Project siting measures and incorporation of on-and off-site mine infrastructure.
- Local hiring practices to reduce potential population increases related to the Project's demand for goods and services, including development of a Local Employment Strategy to encourage the recruitment of local and territorial labourers, in addition to a program for First Nations' employees to encourage work site integration and retention.
- Education and training activities to assist in maximizing direct employment and employment-related incomes of LAA and RAA labour. In addition, develop and implement education and training programs specific to affected First Nations will assist in addressing under-representation by identifying strategies for capacity building and overcoming barriers to employment.
- Engagement Plan for the Project to lead to First Nations and local communities' understanding the Project, and to allow the Proponent to have first-hand knowledge of the concerns and priorities First Nations and local communities about the Project.
- Emergency Response Plan in collaboration with local first responders and health administrators that includes information about on-site personnel, equipment, and services available to address a potential emergency.

  Road safety measures for the NAR in relation to communication protocols, access restriction, driver training, safety policies and signage.

## 22.5 RESIDUAL EFFECTS

Overall, the Project has the potential for adverse residual effects on the housing and accommodation, physical infrastructure, and community services subcomponents during the Construction and Operation Phases. Adverse residual effects are not likely for the transportation subcomponent.

The potential increased demand on housing and accommodation will likely be experienced as an adverse, not significant residual effect of the Project that is moderate in magnitude, local in geographic extent (Dawson), seasonal in timing, continuous in frequency, long-term in duration, fully reversible, and likely to occur.

The potential increased demand on physical infrastructure in Dawson during the Construction and Operation phase will likely be experienced as an adverse, not significant residual effect of the Project that is low in magnitude, local in geographic extent, seasonal in timing, continuous in frequency, long-term in duration, fully reversible, and likely to occur.

The potential increased demand on community services will likely be experienced as an adverse, not significant residual effect of the Project that is low in magnitude, local in geographic extent, seasonal in timing, continuous in frequency, long-term in duration, fully reversible, and likely to occur.

## 22.6 CUMULATIVE EFFECTS ASSESSMENT

Overall, the Project has the potential for adverse cumulative residual effects for increased demand for housing, physical infrastructure and community services from increased populations due to employment for the Project and other mining projects. Residual adverse cumulative effects to Community Infrastructure and Services will be moderated by the mitigation measures for local hiring practices to reduce in-migration, an engagement plan with local communities, and Project measures to provide travel options from both Whitehorse and Dawson, thus distributing population changes. Other mining projects will likely also have commitments that will reduce in-migration, and require engagement and coordination with potentially affected communities. The contribution of the Project to the not significant residual cumulative effect is low (approximately 2% of the driving population increase). The level of confidence in the assessment is low, given the uncertainties with other projects and activities. To address the uncertainties, the Socio-economic Management Program will include a Socio-economic Management Plan (summarized in the Project Proposal in **Section 31.0 Environmental and Socio-economic Management Program**), which will include adaptive management measures to develop and address reasonably foreseeable growth scenarios.

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# 23.0 EDUCATION SERVICES ASSESSMENT

This section presents a high-level summary of the effects assessment for the Education Services Valued Component (VC). The full effects assessment is presented in Appendix 23-A Education Services Valued **Component Assessment Report.**

## 23.1 ASSESSMENT SCOPE

Education Services is an important socio-economic value and was identified as a VC because there are distinct interactions between the proposed Coffee Gold Mine (Project) and Education Services, the Project's potential effects on Education Services can be measured, and there are distinct pathways of effects. The Project may affect economic conditions locally and regionally through induced, indirect employment opportunities and the attraction of speculative workers. Site-based employment will be offered on a two-week-on/two-week-off rotational shift (two-week rotational shift). These potential employment opportunities and the two-week rotational shift may change local and regional demographic characteristics. Further, Kaminak Gold Corporation, a wholly owned subsidiary of Goldcorp Inc. (Goldcorp or Proponent, and local First Nations or local communities anticipate supporting or developing locally available training opportunities. Education Services was identified as a VC to assess Project-induced effects and changes that may affect local and regional education services (targeted at primary and secondary students) and community-based training opportunities (aimed at adult or post-secondary individuals).

The scope of Education Services initially included cultural responsiveness, particularly in view of the potential for rotational work schedules to reduce the ability of parents to participate in student education; however, information on existing parental involvement in student education was not available and these effects could not be assessed.

The Education and Services VC comprises two subcomponents to focus the assessment on issues raised during the consultation process for community services including education (**Table 23.1-1**). Indicators and rationale for their selection are listed in **Table 23.1-2**.

**Table 23.1-1 Subcomponents for the Community Infrastructure and Services Valued Component**

| Subcomponent | Representative of | Rationale for Selection |
|---|---|---|
| Primary, secondary, and post-secondary education services | • Local and regional youth and local and regional families | Identified through primary data collection processes |
| Industry-specific community-based training | • Availability of local, relevant training opportunities | Identified through primary data collection processes |

**Table 23.1-2 Indicators for the Education Services Subcomponents**

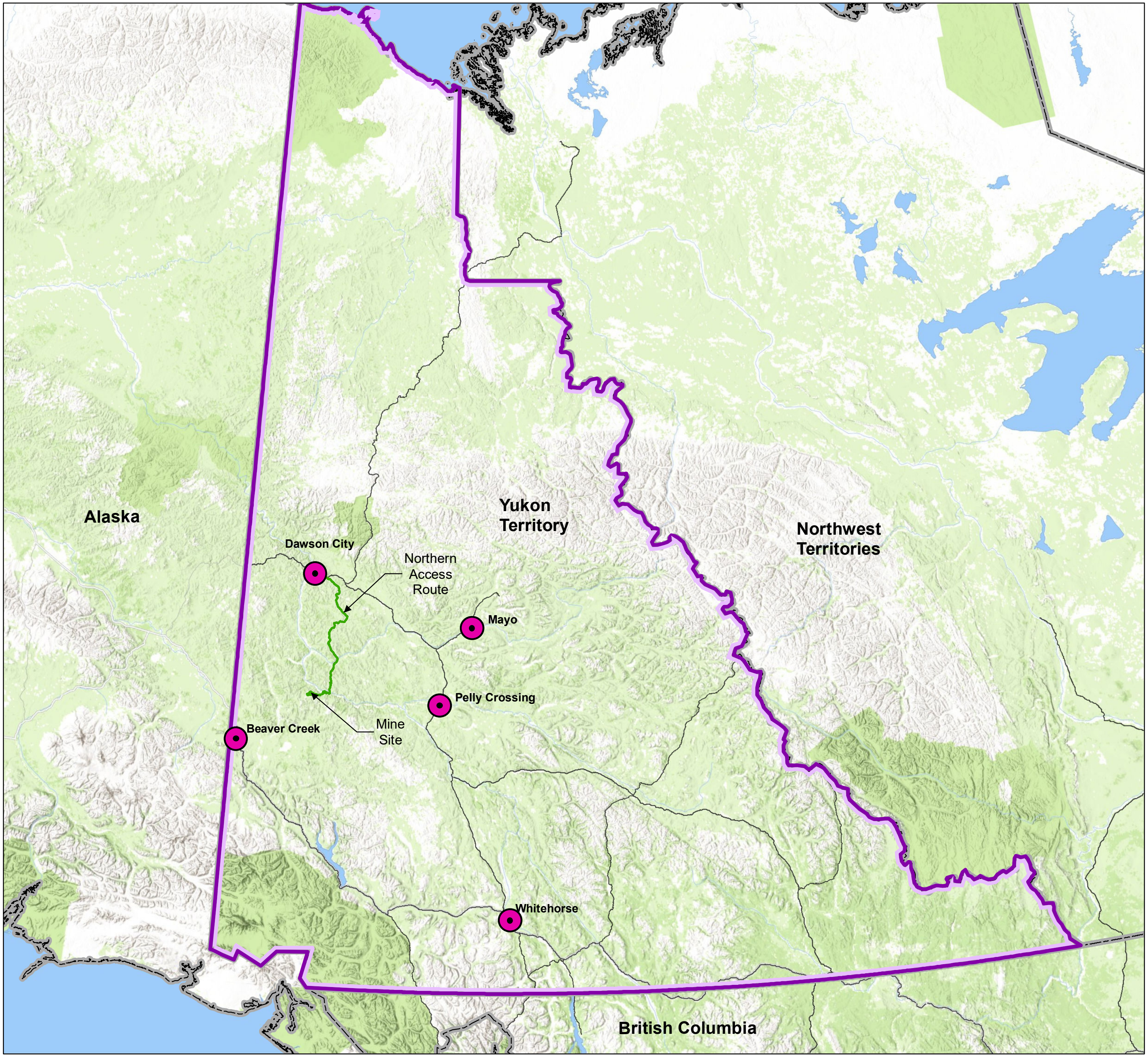
| Subcomponent | Indicators | Rationale for Indicator Selection |
|---|---|---|
| Primary, secondary, and post-secondary education services | Enrollment trends<br>Educational attainment | Enrollment trends and education attainment provide qualitative data on the success of primary and secondary schools at attracting students and in the students' success at achieving the educational requirements. |
| Industry-specific community-based training | Opportunities<br>Linkages to industry needs | Types and number of locally available training opportunities linked to current and anticipated industry needs are an indicator of an effective training program. |

### 23.1.1 Assessment Boundaries

The spatial, temporal, and technical boundaries established for the assessment of Project-related effects and cumulative effects on the Education Services VC are summarized in **Table 23.1-3**, and shown in **Figure 23.1-1**. Due to the nature of data availability as well as anticipated Project-related changes, the LAA reflects municipal administrative boundaries for the City of Whitehorse (Whitehorse) and the City of Dawson (Dawson). The administrative centres of the White River First Nation (WRFN), Selkirk First Nation (SFN), and First Nation of Na-cho Nyäk Dun (FNNND) reflect the availability of demographic and education data at the community scale for the Education Services assessment. The Assessment considers the Project's Construction, Operation, Reclamation and Closure, and Post-Closure phases are described in **Section 2.0 Project Description**. **Table 23.1-3** below describes the technical boundaries for the assessment, which includes the sometimes limited nature of statistical data available to conduct the assessment.

**Table 23.1-3 Spatial, Temporal, and Technical Boundary Definitions for Education Services**

| Boundary | | Description of Assessment Area |
|---|---|---|
| Spatial | Local Assessment Area | City of Whitehorse, City of Dawson, Beaver Creek, Mayo, and Pelly Crossing. The Project footprint has not been included, as changes to Education Services are not expected to take place at the Project footprint. |
| | Regional Assessment Area | Yukon Territory |
| | Cumulative Effects Assessment Area | An area inclusive of active and proposed major mine projects, as shown in **Appendix 5-B Projects and Activities Inclusion List** |
| Temporal | | The temporal characteristics of the Project's Construction, Operation, Reclamation and Closure, and Post-Closure phases are described in **Section 2.0 Project Description**. |
| Technical | | Limitations to statistical data exist. The information provides some of the few available published statistical data at the community level across the RAA, and provides an indication of existing conditions and trends. For a detailed discussion of statistical data limitations, refer to **Appendix 18-A Socio-economic Baseline Report**<br>Information was not available on cultural responsiveness of education services in the LAA, specifically information on existing parental involvement in student education. As a result, assessment of this aspect of education services was not possible. |




COFFEE GOLD MINE

**Education Services Spatial Boundaries**

## Legend

- Highway
- National/International Border
- Project Footprint
- Local Assessment Area
- Regional Assessment Area

## Notes

1. This map is not intended to be a “stand-alone” document, but a visual aid of the information contained within the referenced Report. It is intended to be used in conjunction with the scope of services and limitations described therein.

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## 23.1 ASSESSMENT METHODS

The methods used to identify and assess potential Project-related effects and cumulative effects were developed pursuant to assessment requirements identified in YESAA and Yukon Environmental and Socio-economic Assessment Board (YESAB) guidance documents (e.g., YESAB 2005). The Education Services VC assessment, including the assessment of Project-related effects and cumulative effects was conducted according to the methods set out in **Section 5.0 Assessment Methodology**. The assessment has been informed by input (e.g., TK, statistical, and other information) provided through consultation and engagement with government agencies, affected First Nations, and the public. Primary data collection methods included interviews with key informants and focus groups following a semi-structured group interview format. Specific methodologies applied for the assessments in the supporting Intermediate Component (IC) and VC reports are presented in those reports.

### 23.1.2 REGULATORY CONTEXT

The legislation, regulations, and government-led programs relevant to the Education Services VC are the Yukon *Education Act*, RSY 2002, c.61 (amended by SY 2016 c.5); the *Teaching Profession Act*, RSY 2002, c.215; *Trade Schools Regulation Act*, RSY 2002, c.221; *Apprentice Training Act*, RSY 2002, c.7; *Yukon College Act*, RSY 2002 c.234 (amended SY 2014, c.16); and the *Occupational Training Act*, RSY 2002, c.160.

## 23.2 EXISTING CONDITIONS

### 23.2.1 PRIMARY, SECONDARY, AND POST-SECONDARY EDUCATION

#### *23.2.1.1 Primary and Secondary Education*

There are 16 schools in Whitehorse, 1 in Dawson, and 14 in rural communities.

Student enrollment and teaching staff data, as well as the average student-teacher ratio of the 15 public schools and the Individual Learning Centre in Whitehorse, are represented in **Table 23.2-1.**

**Table 23.2-1 Primary and Secondary Schools in Whitehorse**

| School | Grades | Student Enrollment | Teaching Staff | Average Student-to-Teacher Ratio |
|---|---|---|---|---|
| **Primary and Elementary Schools** | | | | |
| Grey Mountain Primary School | (K-3) | 67 students | 4 teachers | 16.7:1 |
| Elijah Smith Elementary School | (K-7) | 309 students | 20 teachers | 15.4:1 |
| Golden Horn Elementary School | (K-7) | 199 students | 13 teachers | 15.3:1 |
| Hidden Valley School | (K-7) | 80 students | 7 teachers | 11.4:1 |
| Selkirk Elementary School | (K-7) | 225 students[1] | 15 teachers | 15:1 |
| Jack Hulland Elementary School | (K-7) | 325 students | 26 teachers | 12.5:1 |
| Takhini Elementary School[2] | (K-7) | 171 students | -- | - |
| Whitehorse Elementary School | (K-7) | 457 students | 27 teachers | 16.9:1 |
| **French Immersion Schools** | | | | |
| École Emilie-Tremblay | (K-12) | 255 students | 18 teachers | 14.1:1 |
| **Secondary Schools** | | | | |
| F.H Collins Secondary School | (8-12) | 662 students[1] | 61 teachers | 10.8:1 |
| Porter Creek Secondary School | (8-12) | 465 students | 34 teachers | 13.6:1 |
| **Parochial (Catholic) Schools** | | | | |
| Holy Family Elementary School | (K-7) | 171 students | 10 teachers | 17.1:1 |
| Christ the King Elementary School | (K-7) | 345 students | 21 teachers | 16.4:1 |
| Vanier Catholic Secondary School | (8-12) | 376 students | 26 teachers | 14.4:1 |
| **Non-traditional Schools** | | | | |
| Aurora Virtual School | (6-12) | 74 students | 3 teachers | 24.6:1 |
| Individual Learning Centre | (9-12) | 165 students | 5 teachers | 33:1 |

**Source:** YESNET 2016b, 2016c; Yukon Teachers' Association 2016

**Notes**: [1] Includes English and French student enrollment
[2] No publicly available data for Takhini Elementary School teaching staff

The public school in Dawson, the Robert Service School, provides a Kindergarten through Grade 12 curriculum. With a current enrollment of 209 students, 10 elementary teachers, and 8 secondary teachers, there is an average student-teacher ratio of 10:1. While the school is not currently operating at the official capacity of 348 students, it was noted during primary research that some in the community perceive that the school is limited in terms of how many additional students it can accommodate. Enrollment trend data for Robert Service School are relatively consistent in terms of population growth. Enrollment trends are detailed in **Figure 23.2-1**.

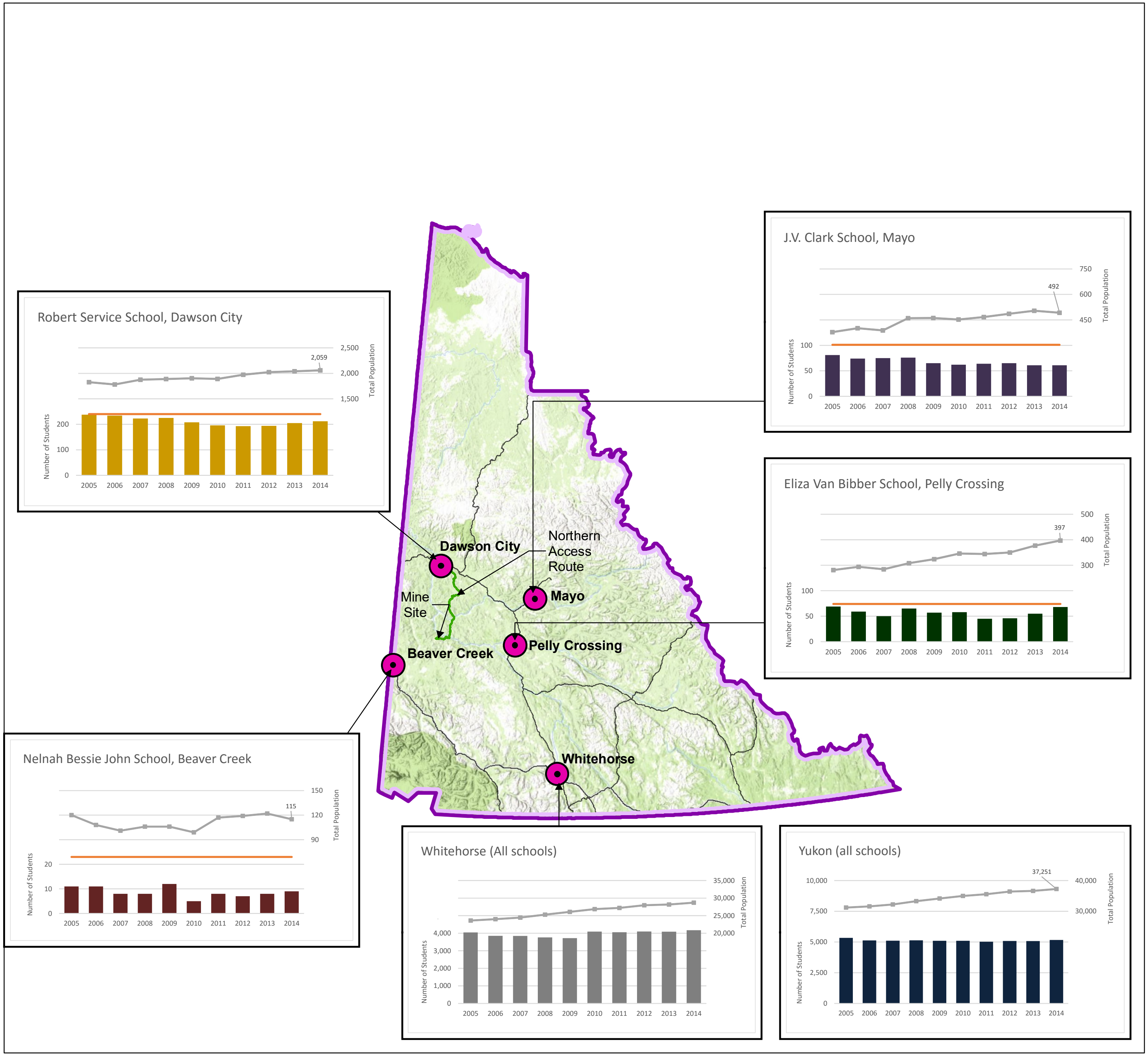
Three additional schools are located in the Local Assessment Area (LAA), two of which provide a K-12 program and one that provides K-9 **(Table 23.2-2**).

**Table 23.2-2 Primary and Secondary Schools in Pelly Crossing, Mayo, and Beaver Creek**

| Community | School | Grades | Student Enrollment | Teaching Staff | Average Student-Teacher Ratio |
|---|---|---|---|---|---|
| Pelly Crossing | Eliza Van Bibber School | (K-12) | 58 students | Nine teachers | 6:1 |
| Mayo | J.V. Clark School | (K-12) | 53 students | 10 teachers | 5:1 |
| Beaver Creek | Nelnah Bessie John School | (K-9) | Six students | One teacher | 6:1 |

**Source:** YESNET 2016c, 2016d, 2016e

Enrollment trend data for these LAA schools are relatively consistent with population fluctuations, as described in **Figure 23.2-1**.




# COFFEE GOLD MINE

## Yukon Territory School Enrollment and Population Statistics

### Legend

- Highway
- Project Footprint
- Local Assessment
- Regional Assessment

### Notes

1. This map is not intended to be a "stand-alone" document, but a visual aid of the information contained within the referenced Report. It is intended to be used in conjunction with the scope of services and limitations described therein.

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#### *23.2.1.2 Post-secondary Education*

The territory has two post-secondary institutions: Yukon College and the Yukon School of Visual Arts. Yukon College has 13 community-based campuses located throughout Yukon. The main campus is located in Whitehorse with an average total enrollment of 5,671 students per year since 2008 (Yukon College 2016). In the LAA, campus locations include Pelly Crossing (Het sedan Ku situated next to Eliza Van Bibber School), Mayo (housed in the JV Clark School), and Dawson. The Yukon School of Visual Arts is located in Dawson. The school receives its accreditation through Yukon College, and is in partnership with the College, Dawson City Arts Society, and TH (Yukon School of Visual Arts n.d.).

Yukon College is made up of 10 schools that offer courses on a variety of study topics, including one-year certificate programs, two-year diploma programs, and degree programs (Yukon College 2012a). These schools include

- The School of Management
- Tourism and Hospitality
- School of Trades
- Technology and Mining
- School of Liberal Arts
- School of Academic and Skill Development
- School of Science
- School of Community Education and Development
- School of Continuing Education and Training
- The School of Health, Education, and Human Services.

Yukon College offers 11 distinct trades certifications to ensure students are adequately trained for existing employment opportunities (Yukon College 2012a). Apprenticeships and certifications are required for nearly 50 different trade-related occupations in the territory. The offered trade certificates include:

- Air Rotary Drilling – Helper Training
- Building Northern Apprentices
- Carpentry
- Electrical
- Heavy Equipment Technician Pre-Apprenticeship (Period 1)
- Introduction to Surface Mining Operations/Heavy Equipment Operations
- Oil Burner Mechanic Apprenticeship
- Pipe Trades
- Underground Mining Operations
- Welding
- Yukon Water and Wastewater Operations.

### 23.2.2 INDUSTRY-SPECIFIC COMMUNITY-BASED TRAINING

Industry-specific community-based training was identified through primary data collection as being key to successful program completion: "…when you take citizens out of their home community to go train, the biggest problem is them being in the city by themselves and changing their culture, and people end up wanting to return home right away." (TWG Meeting, Personal Communication 2016). Currently, Yukon College's goal is to provide as many community-based programs in communities such as Dawson, Beaver Creek, Pelly Crossing, and Mayo as possible (Interview 2, Pers. Comm., 2016). The following support for community-based training or direct, industry-specific training opportunities are available in the LAA **(Table 23.2-3**).

**Table 23.2-3 Summary of Available Training Opportunities in the Local Assessment Area**

| Organization Providing Training Opportunity | Program Description |
|---|---|
| TH Human Resources and Community Education Department | • Provides TH government staffing and training (supports all other departments by helping with recruitment and hiring activities and providing training for employees).<br>• Provides adult education programming.<br>• Administers post-secondary funding for students.<br>• Provides TH citizens with:<br>▫ Funding for training<br>▫ Job search assistance<br>▫ Academic advising<br>▫ Job creation program<br>▫ Career Week, Career Fair, and related activities/workshops<br>▫ Co-op program. |
| Selkirk First Nation | The SFN government provides<br>• Scholarships and post-secondary grants to applicants to meet criteria publicized on the nation's website<br>• Career counselling for qualifying SFN students. |
| First Nation of Na-cho Nyäk Dun | The FNNND government offers post-secondary scholarships and training for qualified members. It facilitates links to external training delivered in person or online for eligible members, and posts opportunities on its website (FNNND 2017). |
| White River First Nation | The WRFN government provides links to external training through Yukon College on its external website (WRFN n.d.). |
| Yukon College | • Provides education and training opportunities in the community, including both locally delivered courses and video conference courses sourced from other campuses.<br>• Delivers the Northern Adult Basic Education Program.<br>The college engages in a number of partnerships with TH, Yukon Government, Parks Canada, Klondike Institute of Art and Culture, and Klondike Region Training Society. |

| Organization Providing Training Opportunity | Program Description |
|---|---|
| Yukon Government, Department of Advanced Education | Supports programs that offer support to employers and/or job seekers, including:<br>• Sector-based training funds<br>• Project-based training funds<br>• The Dawson campus of Yukon College accesses these funds to deliver targeted courses<br>• Student financial assistance<br>• Student employment / trade schools<br>• Apprenticeship and tradesperson certification<br>• Other labour market initiatives (e.g., literacy, Licensed Practical Nurse Program, School of Visual Arts, etc.). |
| Klondike Region Training Fund | Klondike Regional Training Fund provides financial support for training. |
| Klondike Outreach | Provides services to job seekers, employers, and those interested in training. Serves as the local case manager for participants in skills development programs funded by the Government of Yukon Advanced Education:<br>• Skills Development<br>• Self-Employment<br>• Targeted Wage Subsidy<br>• Job Creation Partnership. |
| Klondike Development Organization | Klondike Development Organization provides enterprise and investment facilitation and business advisory services for local businesses and start-up entrepreneurs. |

## 23.3 PROJECT INTERACTIONS, POTENTIAL EFFECTS, AND MITIGATION MEASURES

### 23.3.1 POTENTIAL PROJECT INTERACTIONS

Interactions have the potential to occur between Project-related activities; primary, secondary, and post-secondary education; and community-based training during the Project’s Construction, Operation, and Reclamation and Closure Phases. Interactions are unlikely during the Project’s Post-closure Phase due to the limited nature of Project activities occurring during these phases. Potential Project interactions with Education Services are presented in **Table 23.3-1.**

**Table 23.3-1 Identification of Potential Project Interactions with Education Services**

| Project Component | Interaction Rating | Nature of Interaction and Potential Effect |
|---|---|---|
| **Overall Construction Phase** | | |
| Demand for goods and services, and employment opportunities | Potential Interaction | Economic effects of the Project include employment opportunities and demand for goods and services, which may result in induced and indirect employment. These employment opportunities may interact with the demographic characteristics of the LAA and RAA. Demographic changes may adversely affect primary, secondary, and post-secondary education services. Industry-specific community based training may be positively affected through increased demand for skills acquired during training. |
| **Overall Operation Phase** | | |
| Induced and indirect employment opportunities | Potential Interaction | Potential economic effects of the Project include employment opportunities that may interact with the demographic characteristics of the LAA and RAA. Demographic changes may adversely affect primary, secondary, and post-secondary education services. Industry-specific community-based training may be positively affected through increased demand for skills acquired during training. |
| **Reclamation and Closure Phase** | | |
| Induced and indirect employment opportunities | Negligible Interaction | Minimal Project employment and expenditures associated with Reclamation and Closure-phase activities may interact with Education Services due to local hiring, although these changes are not anticipated to be detectable. |
| **Post-closure Phase** | | |
| Overall Post-closure Phase | No Interaction | N/A |

**Note:** RAA - Regional Assessment

### 23.3.2 Potential Effects

#### *23.3.2.1 Primary, Secondary, and Post-Secondary Education*

Education services may be affected by an increased demand for primary, secondary, and post-secondary education in the LAA during the Project's Construction and Operation Phases. Workers and their families moving to the LAA as a result of Project-related direct, indirect, and induced employment opportunities may affect demographics (MIHR 2013) and in turn education services. The assessment of potential changes to the Demographics IC (**Appendix 19-A**) found that a maximum of 740 children under age 15 have the potential to move to the Regional Study Area with parents who have direct, indirect, or induced employment by 2021.[13]

[13] The Demographics IC section takes a conservative (large) approach to assuming Project-related in-migration to Yukon, and as such estimates are a maximum. **Appendix 19-A** outlines the assumptions taken in estimating potential Project-related in-migration. The number of school-age children was estimated using age 15 as a cut-off point, understanding that people ages 16 and above are legally able to work, and as such have the potential to be Project-related direct, indirect, or induced workers. Project workers and their children will arrive over a period of years. The number of children will likely peak at 740 and remain steady for a number of years.

Potential population effects to the existing population growth trends in Dawson and Whitehorse were assessed, however population growth in the smaller communities (Beaver Creek, Pelly Crossing, and Mayo) was not predicted due to alternate patterns of growth and decline and lack of a trend. Teacher-to-student ratios in the three smaller communities suggest that there is capacity to absorb additional elementary and secondary student enrollment without affecting the quality of education as expressed by the student-to-teacher ratio (YESNet, 2016c, 2016d, 2016e).

A maximum of an additional 740 children in the Regional Study Area as a result of the Project may affect enrollment patterns and adversely affect the student-teacher ratio and class sizes. According to official statistics, approximately 70% of the Yukon population lives in the City of Whitehorse (YBS 2016a). If Yukon communities continue their projected growth patterns, 75% of the 740 children (555 children) may enroll in schools in Whitehorse. Dawson, which forms 6% of the Yukon population, may receive 33 children under the age of 15 if communities grow in size due to the Project and in proportion to their current growth patterns. It is difficult to predict with certainty what ages the children of Project workers will be. The assessment has assumed that in the absence of reliable information, the number of children of Project-related in-migrants will be evenly spread over the ages of 0 to 15 years. This means that 33.3% of the children of Project-related migrants aged 0 to 15 would be under age 5; the potential Project-related effect based on this assumption may affect enrollment patterns in daycare and preschool, rather than primary and secondary schools. The remaining 66.7% of children (aged 5 to 15) would be enrolled in primary or secondary schools. **Table 23.3-2** shows estimates of the number of school-age children who may move to Yukon, as well as to the LAA communities of Whitehorse and Dawson as a result of the Project (YBS 2011).

**Table 23.3-2 Estimated Number of School-age Children Accompanying Project Workers**

| Age | % of School-age Children | Number of Children Accompanying Project Workers | | | School Enrollment Category Applicable |
|---|---|---|---|---|---|
| | | Yukon (RAA) | Whitehorse (LAA) | Dawson (LAA) | |
| | | 100% of Yukon population | 75% of Yukon population | 6% of Yukon population | |
| 0-1 | 3.3% | 25 | 19 | 1 | None |
| 2-5 | 30.0% | 222 | 166 | 13 | Daycare or preschool |
| 5-10 | 33.3% | 246 | 185 | 15 | Elementary |
| 10-12.5 | 16.7% | 124 | 93 | 7 | Elementary |
| 12.5-15 | 16.7% | 124 | 93 | 7 | Secondary |
| TOTAL | 100% | 740 | 555 | 33 | |

**Sources:** YBS 2016, Project employment data; Hemmera calculations.

Whitehorse may experience an estimated additional 278 elementary students and 93 additional secondary students as a result of the Project. In Dawson, an estimated additional 22 elementary students and 7 secondary students may enter the school system due to the Project.

Whitehorse's student-teacher ratios suggest that the elementary and secondary school systems in that city will be resilient in the face of Project-related change. Student-teacher ratios in Yukon in general are the lowest in the country, and data from Whitehorse schools shows that both the public and parochial school systems can absorb enrollment at the levels that the Project may affect. The effects to elementary and secondary education are assessed as neutral.

The Project's potential effect on enrollment can be viewed as adverse in Dawson. Robert Service School is already at capacity, and primary data collection revealed that increased enrollment would adversely affect the educational environment (Interview 17, Personal Communication, 2016).

Overall, while the Project is likely to adversely increase enrollment in the LAA, the effect is likely to be more strongly experienced in Dawson due to limitations in the Robert Service School's ability to accept new students.

The Project's effects on post-secondary enrollment are likely to be neutral. The Project will require skilled tradespeople, including graduates from the newly established the Centre for Northern Innovation in Mining at Yukon College. Increased enrollment as a result of Project demand for skilled trades is not anticipated to adversely affect the quality of education as expressed by the student-teacher ratio.

#### *23.3.2.2 Industry-specific Community-based Training*

The Project's direct, indirect, and induced employment opportunities may increase demand for community-based training during Construction and Operation as community members in Dawson, Beaver Creek, Mayo, and Pelly Crossing can perceive the potential for training to lead to employment as a result of the Project. Effects to enrollment, and therefore quality of education, may be adverse or beneficial. Effects would be adverse if Project-related enrollment rises to the extent that causes student-teach ratios to rise and the quality of education to subsequently decline. Effects would be positive if Project-related enrollment increases sufficiently enough to contribute to the long-term sustainability of programs due to sustained demand and proven success of graduates attaining employment. The decision to participate in training is personal, and may also be affected by factors that are not connected to the Project (e.g., family commitments, interest in other types of work). The Proponent plans to support relevant industry-specific training opportunities, and will monitor the effectiveness of training.

### 23.3.3 Mitigation and Enhancement Measures

The mitigation measures for Education Services comprise several topics, including local hiring practices, training activities, First Nations mentorship, and development and implementation of an Engagement Plan.

**Table 23.3-3** summarizes the potential effects and mitigation, and whether residual effects are anticipated following the application of mitigation measures.

**Table 23.3-3 Summary of Potential Adverse Effects and Mitigation Measures for Education Services**

<table>
<tr><th>Summary of Potential Effect</th><th>Project Components</th><th>Contributing Project Activities</th><th>Proposed Mitigation Measure</th><th>Detectable / Measurable Residual Effect (Yes / No)</th></tr>
<tr><td colspan="5">Construction and Operation Phases</td></tr>
<tr><td>Increase in primary and secondary enrollment</td><td>Overall Construction and Operation Phases</td><td>Direct and indirect Project-related employment opportunities during the Construction and Operation Phases may result in changes to demographics.</td><td rowspan="2">• Sustainability Excellence Management System<br>• Local Hiring Practices<br>• Education and Training Activities<br>• First Nations Mentoring Program<br>• Engagement Plan</td><td>Yes</td></tr>
<tr><td>Increased demand for community-based training</td><td>Overall Construction and Operation Phases</td><td>Direct and indirect Project-related employment opportunities during the Construction and Operation Phases may result in changes to demographics</td><td>No. Effects may be adverse or positive. Goldcorp will monitor to ascertain potential effects.</td></tr>
</table>

## 23.4 Residual Effects

After the successful implementation of mitigation measures, a residual effect is likely to occur for primary, secondary, and post-secondary education due to increased enrollment.

### 23.4.1 Increase in Primary, Secondary, and Post-Secondary Education

The residual effect to enrollment patterns is likely to begin during the Construction Phase and will extend through the Operation Phase. Though employment opportunities associated with the Project (and subsequent changes in income) will occur during the Reclamation and Closure Phase, the effect is likely to be negligible due to the much lower Project-related employment.

Enrollment pattern effects are anticipated to occur in the LAA as a result of increases in population resulting from direct, indirect, and induced employment related to Project expenditures and purchases of goods and services. Mitigation measures such as local hiring practices and local procurement and contracting may assist in minimizing influx and associated increases in primary, secondary, and post-secondary school enrollment numbers, particularly in Whitehorse, but will not enable the Proponent to meet all of the Project's employment requirements, thus in-migration is likely. Residual adverse effects are likely in Dawson, where primary data indicate that perceived quality of education would be affected through an unfavourable change in the student-to-teacher ratio. Residual effects in Dawson are likely to be moderate in magnitude, local in extent, occurring continuously during the Construction and Operation Phases, and reversible and likely. Effects in Whitehorse are likely to be neutral, moderate, local, continuous, long-term, fully reversible, and likely. Whitehorse has medium resilience to changes in enrollment. While changes to population size in Beaver Creek, Pelly Crossing, and Mayo cannot be reasonably predicted in terms of their direction or magnitude (see **Appendix 19-A Demographics Intermediate Component Analysis**), student-to-teacher ratios demonstrate that primary and secondary education institutions in these communities can accommodate population-driven increases to enrollment.

In summary, there is the potential for a residual adverse effect to primary and secondary education in Dawson during the Construction and Operation Phases, although this effect was found to be not significant as a result of its limited geographic scope.

## 23.5 CUMULATIVE EFFECTS ASSESSMENT

Agricultural, energy, forestry, industrial, placer mine, quartz mine, settlements, transportation, and utility projects may contribute to changes in demographics in the LAA and Regional Assessment Area (RAA) (see **Section 19.0 Demographics Analysis**) and consequently the demand for Education Services. However, employment and population changes from current and future agricultural, energy, forestry, industrial, settlement, transportation, placer mining, and utility projects are included in current population projections, and are not expected to substantially affect employment numbers and subsequently result in significant effects to Education Services in either the LAA or RAA. Major mine projects active and proposed in Yukon may result in substantial additional employment opportunities and consequent population changes, and therefore may affect Education Services in the RAA.

A number of anticipated major mining projects (Carmacks Copper, Casino, Eagle Gold, Kudz Ze Kayah, Mactung and Minto) may result in additional employment opportunities in the LAA and related increases in population. Over the ten year period from 2018 to 2027, cumulative effects from other projects, including the Coffee Gold Mine, are estimated to account 7.5% to 16.1 of the total Yukon population. Of this proportion, the Project will account for approximately 2.0% of the anticipated future population size. As with all other projects, the greatest cumulative increase in worker's population is likely to occur from 2021 to 2024 while all projects are in operation

No additional mitigation measures for adverse cumulative effects are proposed to reduce the Project's contribution to adverse cumulative effects to Education Services, as it is assumed that other projects of similar size and scale will implement appropriate mitigation measures to eliminate, reduce, or control project-specific adverse effects to Education Services. Cumulative effects to Education Services are likely to be not significant. The Proponent will monitor effects to address uncertainties associated with interactions with other mining project effects due to a lack of available information, and engage in adaptive management if needed.

### 23.6 References

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# 24.0 LAND AND RESOURCE USE ASSESSMENT

This section presents a high-level summary of the effects assessment for the Land and Resource Use Valued Component (VC). The full effects assessment is presented in **Appendix 24-A Land and Resource Use Valued Component Assessment**.

## 24.1 ASSESSMENT SCOPE

Land and Resource Use was selected as a VC to assess the proposed Coffee Gold Mine's (Project's) anticipated interactions with non-traditional and current traditional land and resource use, reflecting local values, consultation, and Traditional Knowledge (TK). The Project will potentially cause direct environmental changes as a result of the Mine Site and Northern Access Route (NAR) activities, which may influence various aspects of Land and Resource Use.

The Land and Resource Use VC comprises two subcomponents, Non-traditional Land and Resource Use and Current Traditional Land and Resource Use, to reflect the comments received during consultation and engagement activities (**Table 24.1-1**) conducted for the Project. The indicators used to describe and evaluate potential effects on the Land and Resource Use VC and its subcomponents, and the rationales supporting the selection of these indicators, are identified in **Table 21.1-2**.

**Table 24.1-1 Land and Resource Use Subcomponents**

| Subcomponent | Representative of | Rationale for Selection |
|---|---|---|
| **Non-traditional land and resource use** | • Land use planning<br>• Land use tenures<br>• Water licenses<br>• Game management<br>• Guide outfitting<br>• Trapping<br>• Subsistence harvesting<br>• Parks and protected areas<br>• Placer mining<br>• Recreation and tourism | The Project footprint is located in an area that has been historically and is currently used for numerous non-traditional land and resource purposes. Non-traditional land and resource use refers to the designated and undesignated use of lands and resources for both commercial and personal purposes. |
| **Current Traditional Land and Resource Use** | • Habitation<br>• Transportation<br>• Subsistence activities<br>• Culture and heritage<br>• Environmental values | Current traditional land and resource use is an important value of all potentially affected First Nations. Traditional land and resource use supports the socio-economic well-being of First Nations and their respective citizens or members, and contributes to their cultural and spiritual well-being. |

### Table 24.1-2 Indicators for Land and Resource Use and Subcomponents

| Indicator | Rationale for Selection |
|---|---|
| **Non-traditional Land and Resource Use** | |
| Change in access to land and resources | Project-related changes to access may affect access to the environment and/or resources that are currently used for non- traditional land and resource purposes. Measurement is qualitative in terms of whether potential changes in access to land and resources would be perceived by individuals as a positive or adverse effect. |
| Change in sensory conditions during current use | Project-related changes to sensory conditions may change the appropriateness, desirability, feasibility, and/or possibility of using current areas for non-traditional land and resource purposes. Linked biophysical technical reports that support this indicator include the following ICs: Visual, Noise, and Air Quality. Measurement is qualitative in terms of user perceptions and quantitative in terms of indicators used for ICs. |
| Direct change in the availability of land and resources | Construction and Operation of the Project will require land area that will no longer be available to certain existing uses |
| Change in the quality of land and resources | Project-related changes to environmental conditions may affect the quality (e.g. health, habitat) of the land and resources currently used for non-traditional purposes. Linked biophysical technical reports that support this indicator include the following VCs: Fish and Aquatics, Vegetation, and Wildlife. Measurement is qualitative in terms of changes to other ICs and VCs that make up land and resources used for non-traditional purposes |
| **Current Traditional Land and Resource Use** | |
| Change in access to land and resources | Project-related changes to access may affect the ability of First Nations to access the environment and/or resources they currently use for current traditional land and resource purposes. Measurement is qualitative in terms of whether access to land and resources may be perceived by individuals as a positive or adverse Project-related change. |
| Change in sensory conditions during current use | Project-related changes to sensory conditions may change the appropriateness, desirability, feasibility, and/or possibility of using current areas for traditional land and resource purposes. Linked biophysical technical reports that support this indicator include the following ICs: Visual, Noise, and Air Quality. Measurement is qualitative in terms of user perceptions and quantitative in terms of indicators used for ICs. |
| Direct change in the availability of land and resources | Construction and operation of the Project will require land area that will no longer be available to certain existing uses |
| Change in the quality of resources | Project-related changes to environmental conditions may affect the quality (e.g. health, habitat) of the land and resources currently used for traditional purposes. Linked biophysical technical reports that support this indicator include the following VCs: Fish and Aquatics, Vegetation, and Wildlife. Measurement is qualitative relative to changes to other ICs and VCs that make up land and resources currently used for traditional purposes. |
| Change in quality of intangible cultural resources | Project-related changes to environmental conditions may affect the quality of intangible cultural resources (e.g., connection to the land, sense of place, areas where TK and activities can be taught) used for current traditional land and resource use. Measurement is qualitative and based on changes to environmental values that relate to intangible cultural resources and on primary data collection |

**Note:** IC - Intermediate Component

### 24.1.1 Assessment Boundaries

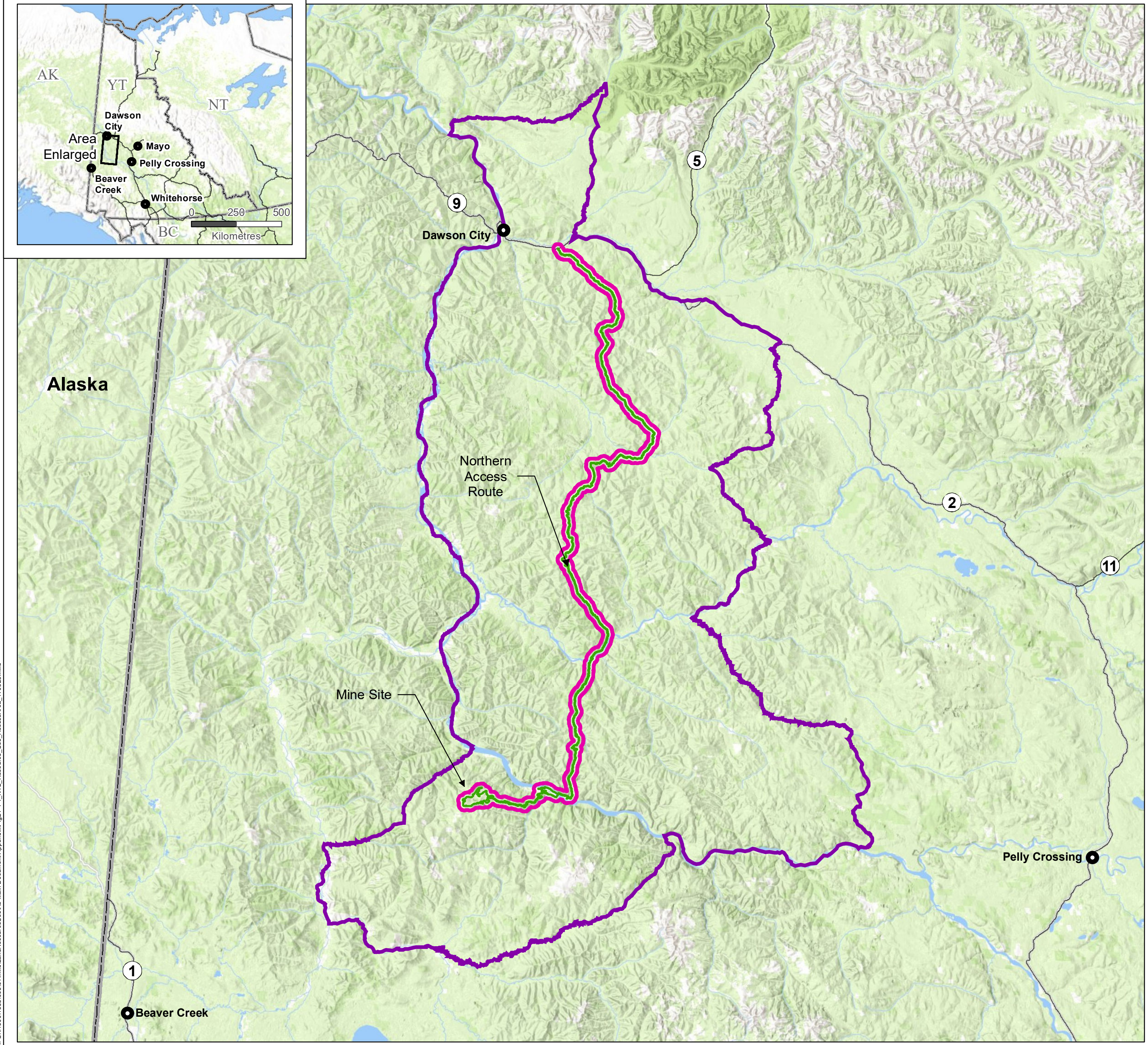
The Local Assessment Area (LAA) for Non-traditional Land and Resource Use is defined as a 1-kilometre (km) buffer from the Project footprint, inclusive of any land use designations (for example, trapline concessions, game management areas, or placer claims) that overlap this area; it includes areas that are most likely to be directly or indirectly affected by the Project. The Regional Assessment Area (RAA), which encompasses the LAA, is established to provide a regional context for the assessment of potential Project-related effects. The RAA was also delineated to support the assessment of the potential residual effects to linked biophysical VCs, and encompasses the Game Management Subzones that overlap the Project footprint (see **Section 24.3.1)**, (YG 2016a). The RAA also encompasses the area where the residual effects of the Project are likely to interact with the residual effects of other past, present, or future projects or activities to result in a cumulative effect.

The LAA for Current Traditional Land and Resource Use is defined as the established or asserted Traditional Territory of the Tr'ondëk Hwëch'in (TH), Selkirk First nation (SFN), First Nation of Na-cho Nyäk Dun (FNNND), and White River First Nation (WRFN), the First Nations that are located within a 1-km area on either side of the Project footprint. Direct Project-related effects to traditional land and resource use are most likely to occur in the LAA. The RAA for Current Traditional Land and Resource Use is defined as the entire Traditional Territory of the TH, SFN, FNNND, and the entire asserted territory of the WRFN, as this area provides context for the local area assessments. The RAA also encompasses the area where the residual effects of the Project are likely to interact with the residual effects of other past, present, or future projects or activities to result in a cumulative effect.

The spatial boundaries for the Land and Resource Use assessment are summarized in **Table 21.1-3** and shown in **Figure 24.1-1** and **Figure 24.1-2**.

**Table 24.1-3 Assessment Boundary Definitions for the Land and Resource Use Assessment**

<table>
<tr><th colspan="2">Boundary</th><th>Description of Assessment Area</th></tr>
<tr><td colspan="3">Non-traditional Land and Resource Use</td></tr>
<tr><td rowspan="2">Spatial</td><td>Local Assessment Area</td><td>1-km buffer either side of the Project footprint.</td></tr>
<tr><td>Regional Assessment Area and Cumulative Effects Assessment Area</td><td>Game Management Subzones overlapping the Project footprint as shown on Figure 24.1-1.</td></tr>
<tr><td colspan="3">Current Traditional Land and Resource Use</td></tr>
<tr><td rowspan="2">Spatial</td><td>Local Assessment Area</td><td>The established or asserted Traditional Territory of each First Nation located within 1 km on either side of the Project footprint. These First Nations include TH, SFN, FNNND, and WRFN.</td></tr>
<tr><td>Regional Assessment Area and Cumulative Effects Assessment Area</td><td>The entire established Traditional Territory of TH, SFN, and FNNND as shown in Error! Reference source not found. Error! Reference source not found..</td></tr>
<tr><td colspan="2">Temporal</td><td>The temporal boundaries for the assessment of Project-related effects on Community Health and Well-Being include all Phases of the Project, as described in Section 2.0 Project Description.</td></tr>
<tr><td colspan="2">Administrative</td><td>Land and Resource subcomponent RAA is based on Environment Yukon Game Management subzones<br>Current Traditional Land and Resource Use subcomponent has been delineated in consideration of and with reference to the established traditional territories of TH, SFN, FNNND, and WRFN</td></tr>
</table>




COFFEE GOLD MINE

**Non-Traditional Land and Resource Use Spatial Boundaries**

Legend

- Highway
- National/International Border
- Project Footprint
- Local Assessment Area
- Regional Assessment Area

Notes

1. This map is not intended to be a "stand-alone" document, but a visual aid of the information contained within the referenced Report. It is intended to be used in conjunction with the scope of services and limitations described therein.
2. Game Management Area Data provided by Govenment of Yukon, 2016 ftp://ftp.geomaticsyukon.ca/GeoYukon/Base/

N

1:1,250,000

0 15 30 45

Kilometres

NAD 1983 UTM Zone 8N

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| Figure 24.1-1 | Date: Mar 23, 2017 | Drawn by: NK | Reviewed: DP |
|---|---|---|---|

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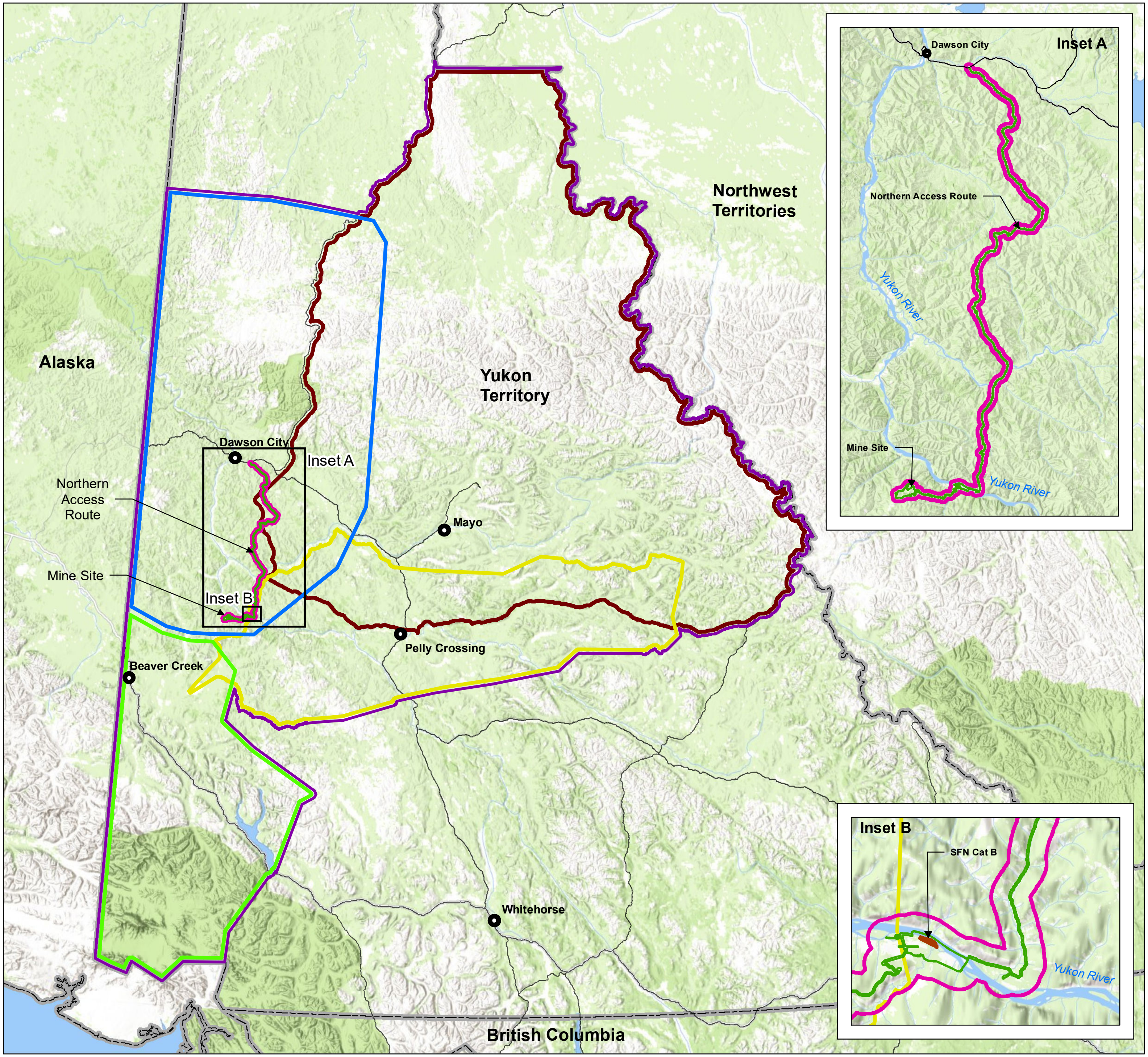


# COFFEE GOLD MINE

## Traditional Land and Resource Use Spatial Boundaries

### Legend

- Highway
- National/International Border
- Project Footprint
- Local Assessment Area
- Regional Assessment Area
- White River First Nation[2]
- Tr'ondëk Hwëch'in
- Selkirk First Nation
- First Nation of Na-cho Nyäk Dun
- SFN Category B Lands

### Notes

1. This map is not intended to be a "stand-alone" document, but a visual aid of the information contained within the referenced Report. It is intended to be used in conjunction with the scope of services and limitations described therein.
2. The WRFN traditional territory boundary represented in this figure presents the recognized traditional territory under the UFA. This is not the WRFN asserted territory which WRFN recognizes.

N

1:4,500,000

0 50 100 150

Kilometres

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| Figure 24.1-2 | Date: Mar 23, 2017 | Drawn by: JS | Reviewed: DP |
|---|---|---|---|

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The temporal characteristics of the Project's Construction, Operation, Reclamation and Closure, and Post-closure Phases are described in **Section 2.0 Project Description**. The temporal boundaries established for the assessment of Project-related effects on Land and Resource Use encompass these Project phases.

Technical boundaries for the Land and Resource Use assessment include the limitations and constraints that have been identified for linked biophysical VC and Intermediate Component (IC) assessments, which have informed the analyses conducted as part of this assessment report. Please refer to each respective VC and IC assessment for a detailed discussion regarding the relevant technical boundaries for each.

## 24.2 Assessment Methods

The Land and Resource Use assessment, including the assessment of Project-related effects and cumulative effects was conducted according to the methods set out in **Section 5.0 Effects Assessment Methodology**. The assessment has been informed by input (e.g., TK, statistical, and other information) provided through consultation and engagement with government agencies, affected First Nations, and the public. Baseline data was also informed through review of online spatial information, and online information about Yukon.

In addition to the *Yukon Environmental and Socio-economic Act*, SC 2003, c. 7 (YESAA), land and resource use in Yukon is guided by legislation for public lands, settlement lands, and municipal lands. The approval process for applications to the Government of Yukon (YG) for authorization for a specific land use or activity varies depending on the applicability of YESAA.

All uses on public land must apply for approval through a Land Application Process. Yukon Land Management Branch (LMB) within the Energy, Mines and Resources Department, administers the following acts and regulations on public land (excluding federal parks):

- *Lands Act*, RSY 2002, c. 132, and Regulations
- *Territorial Lands (Yukon) Act* SY 2003, c. 17, and Regulations.

The LMB manages land applications pursuant to the *Lands Act* Regulations for commercial, industrial, rural residential, and trapping leases. The LMB also manages water lots, quarries and enlargement of existing properties, and land use permitting pursuant to the *Territorial Lands Act* Regulations for a variety of uses, including site clearing or earth works; constructing a new road, trail, or access; clearing or installing a utility right-of way; conducting geo-technical or hydrological studies; and temporarily using or occupying Commissioner's land.

The Yukon Land Planning Branch reviews and makes decisions on applications in accordance with the *Subdivision Act* and *Regulations* and the *Area Development Act* and *Regulations*. It manages local area plans, and zoning regulations and subdivision requests outside of Whitehorse and the City of Dawson (Dawson). Subdivision approvals outside of Dawson and Whitehorse are administered by the Land Planning Branch. Within these municipalities, approval must be obtained from the municipality (YG 2015b).

The Umbrella Final Agreement (UFA) is a policy document that was established between the Government of Canada, YG, and Yukon First Nations as represented by the Council of Yukon First Nations in 1993. This policy document was used by Yukon First Nations to support the negotiation of Final and Self-Government Agreements. The UFA is not a legally enforceable document itself; however, as all of its provisions are included in each First Nation Final Agreement they have lawful effect (YG 2008). The potentially affected First Nations of TH, SFN, and FNNND have each signed a Final and Self-Government Agreement. Each Final Agreement is recognized as a treaty according to section 35 of the *Constitution Act*, *1982*, enacted as Schedule B to the *Canada Act 1982*, 1982, c. 11 (U.K.) (YG 2008).

As signatories to the UFA, TH, SFN, and FNNND are able to draft legislation to manage fish and fish habitat on their Settlement Lands. To date, TH has drafted the Tr’ondëk Hwëch’in *Fish and Wildlife Act*.

White River First Nation has not signed a Final or Self-Government Agreement; therefore, the Aboriginal interests of WRFN are considered as part of common law requirements related to existing Aboriginal interests in Canada according to section 35 of the *Constitution Act, 1982.*

## 24.3 Existing Conditions

### 24.3.1 Non-traditional Land and Resource Use Existing Conditions

The majority of land in the LAA is Yukon public land, with the exceptions of privately held land in the Klondike Valley. Exceptions also include surveyed parcels located in the Project footprint and Project area (see **Section 4.1**). Land use planning takes place at a territorial, regional, and municipal level. The Yukon Land Use Planning Council comprises three members, who, on behalf of the Yukon Land Use Planning Council, “promote an open, fair and public process carried out by all Yukoners, as set out in Yukon First Nation Final Agreement” (YLUPC 2015).

The Dawson and Northern Tutchone Regional Planning Areas overlap with the LAA and RAA. A planning commission is yet to be established for Northern Tutchone. The YG, TH, and the Vuntut Gwitchin Governments have mutually decided to suspend the Dawson Regional Land Use Planning process following the conclusion of the Peel Watershed Land Use Plan court hearing.

In addition to the municipal planning processes for Dawson and Whitehorse, the YG also prepares Local Area Plans. There are no Local Area Plans within the LAA for Non-traditional Land and Resource Use, and a portion of the Klondike Valley District Plan is within the RAA for this subcomponent. Within the RAA for Current Traditional Land and Resource Use, Local Area Plans have been prepared for the Community of West Dawson and Sunnydale, as well as for Beaver Creek, Klondike Valley District, and areas to the north and south of Whitehorse. The Local Area Plans are implemented through the development of zoning regulations (YG, Personal Communication, 2017).

Land tenures on Crown land within the LAA include transportation, utilities, commercial, rural residential, heritage, and environment uses (YG 2011). Most tenures are located in the vicinity of the northern portion of the NAR. Utilities include a transmission line from the NAR to the Klondike Highway. Other roads intersect with the NAR.

Under the Yukon *Waters Act*, SY 2003, c. 19, the Yukon Water Board issues water use licences for various activities for the use of water and the deposit of waste to water. Water licences within the LAA are for the purposes of placer mining, with the exception of the water licence held by Kaminak Gold Corporation, a wholly owned subsidiary of Goldcorp Inc. (Goldcorp or Proponent) near the mouth of Coffee Creek for municipal purposes.

Game Management Areas (GMAs) are defined by Environment Yukon as "legal boundaries that define an area within which big game management objectives can be met through the setting of area specific regulations. In other words, GMAs are used to manage Yukon wildlife species." (YG 2016a) The LAA falls within the Game Management Zone 3 subzones 307, 308, 310, 311, 312, 313, 314 and 315 to the north of the Yukon River, and Game Management Zone 5 subzones 502 and 509 to the south of the Yukon River. GMA 3 overlaps with the NAR north of the Yukon River. Currently, Caribou and Sheep hunting is closed in the GMA 3. Moose are the most popular target animal in the zone. Trapping and small animal hunting is also considered popular within GMA 3 for the following species: Lynx, Marten, Wolf, Wolverine, Mink, Beaver, Otter, and Fox. Coyote, Black Bear, and Grizzly Bear. Bear are not currently popular target species (Interview 13, Personal Communication 2016).

Primary data collection indicates access to GMA 3 is mainly road access and ATV, primarily for moose hunting. During the summer months, the Yukon River is well used; however, tourists using the river are not permitted to hunt for large game without a guide. They are permitted to hunt for small game with a hunting license.

Environment Yukon defines Outfitter Concessions as:

> "…legal boundaries that define an area where the holder of the concession has the exclusive right to outfit non-residents for the purpose of hunting big game animals (excepting special guiding licences). If non-residents wish to hunt in Yukon they must do so accompanied by a Yukon resident – either a private individual who does this for free, or a commercial operator who does this as a business (an outfitter)…" (YG 2016b).

There is no guide outfitting concession within the LAA, with the exception of a small area at the Yukon River. The LAA overlaps with guide outfitter concession area ID 11 at the barge crossing of the Yukon River and the winter ice road between the Yukon River and Coffee Creek.

Subsistence harvesting consists of non-commercial harvesting of wildlife, fish, and edible plants and berries. The harvested small game species include Snowshoe Hare, Arctic Ground Squirrel, Porcupine. Game birds include: Spruce/Ruffed Grouse, Dusky (Blue) Grouse, Sharptailed Grouse, and Ptarmigan.

In Yukon, a valid Yukon hunting licence, and a federal Migratory Game Bird Hunting Permit with a Canadian Wildlife Habitat Conservation Stamp are required to hunt migratory game birds including Ducks, Geese, Rails, Coots, Sandhill Cranes, and Snipe. Anglers must have a valid angling licence to fish, an additional sportfishing licence for means other than angling, and a Yukon Salmon Conservation Catch Care to fish for Salmon. Fishing regulations, including catch limits, are laid out in the Yukon Fishing Regulations Summary annually (YG 2016c).

Placer mining activity is focused in the northern portion of the RAA near Dawson, although placer mining has also taken place throughout the LAA. There are Prospecting Leases with applications for claims along Coffee and Ballarat creeks with the LAA near the Yukon River.

Within Yukon, Minto copper-gold-silver mine is the sole operating hard rock mine. Within the Current Traditional Land and Resource Use RAA, operation at Bellekeno is suspended, Casino and Dublin Gulch/Eagle proposed mines are under assessment, and the remainder of mining licences are for exploration (YGS 2015). Within the LAA, there are four mining licences in the Dawson District.

The Project is located within the forest planning region of the Dawson Forest Resources Management Plan (FRMP) and the Pelly Crossing Annual Limit Region. The Dawson FRMP is a joint effort between TH, the Dawson District Renewable Resource Council, and the YG. This region comprises approximately 34,000 square km (km$^2$), and includes landscapes as forests, tundra, waterbodies, wetlands, exposed rock and human developments (Dawson FRMP 2013). The forest productivity is classified as poor (46 percent (%)), medium (28%), and good (6%). Good sites are usually located in riparian areas and south-facing upland slopes.

The three FRMP Land Management Units which overlap with the Project are the Yukon River South, Stewart River, and Gold Fields. Both the Yukon River South and the Steward River were designated as Hinterland Forest Zones (not included in the timber supply analysis), and as having medium and low planning priority. The Gold Fields in the vicinity of Dawson has a high planning priority, however, and is designated as Forest Resource Management Zone. This provides for a strategic overview including high conservation focus, general forest management activities with specific or special management guidelines for identified wildlife, ecosystem, habitat, and cultural-recreational values (Dawson FRMP 2013).

Recreation in the LAA has been identified as an important economic opportunity for the community by the Klondike Development Organization, stating the “importance of quality and variety of recreation opportunities in attracting and retaining residents as a key part of community economic development” (2011c). The 2011 Klondike Development Organization Household Survey found recreation (18%) was the second priority change recommended to improve the Dawson area, after improved housing (KDO 2011). A full description of current recreation and leisure activities in the LAA and RAA is provided in Community Infrastructure and Services (**Appendix 22-B**) and Community Health and Wellbeing (**Appendix 25-B**).

Tourism plays a key role in community economic development. Yukon Visitor Information Center Statistics indicate that visitors to Dawson vary by year. Between 2012 and 2013 the number of visitors in Dawson increased from 24,060 (2012) to 32,930 (2013). In 2014, the number of visitors decreased to 29,544, and in 2015 increased to 37,569. (Yukon Department of Tourism and Culture 2014).

There are several annual races held within the LAA and RAA, which attract local and international participants. These include:

- Yukon River Quest (summer race): world's longest canoe/paddle race (716 km) from Whitehorse to Dawson City, Yukon
- Yukon Quest Sled Dog (winter race): a 1,600 km sled-dog race from Fairbanks Alaska to Whitehorse, Yukon
- Yukon Arctic Ultra (winter race): Takes place on the Quest Trail from Whitehorse, to Dawson.

Access to and within the RAA is by road, air, water, and non-road access with all-terrain vehicles (ATVs) and snowmobiles. Existing transportation for the RAA and LAA is described in the transportation section in **Appendix 22-A Community Services and Infrastructure Valued Component Assessment**. In winter, within the LAA there is vehicular access on the existing road for approximately 15 km south from the Alaska Hwy (maintained by the YG), and snowmobile access south to the Mine Site, assuming crossing of the frozen Stewart and Yukon rivers and suitable weather conditions. In summer, there is vehicular access on the existing road to within several km from Stewart River, and Yukon River access by boat from the north (Dawson) and the east. During freeze / thaw periods, vehicular access is available on the existing road to Sulphur Creek on sections maintained by the YG, and access on non-maintained roads is limited. No river access is available in this period, and snowmobiles and ATVs have limited access depending on specific weather conditions. There is air access to the Mine Site in all seasons.

### 24.3.2 Traditional Land and Resource Use Existing Conditions

Existing conditions for habitation, transportation, subsistence activities, cultural and spiritual values, and environmental values are summarized below for TH, SFN, FNNND, and WRFN. The descriptions incorporate information gathered through consultation with regulators, First Nations, stakeholders, and community members to inform the identification of issues and guide the assessment process (refer to **Section 3.0 Consultation and Engagement with First Nations, the Public and Yukon and Federal Government** and **Table 3.2-1).** The traditional land and resource uses described should not be considered as an exhaustive description, rather a description based on available and provided information.

#### *24.3.2.1 Tr'ondëk Hwëch'in Traditional Land and Resource Use*

**Habitation**: TH citizens continue to live on the land at different times of the year, in areas which overlap the LAA (Interview 14, Personal Communication 2016, Interview 22, Personal Communication 2016). Coffee Creek was an important gathering place for TH in the past (Yukon River Commercial Fishing

Association and TH 1997). There are cabins (i.e., long-term habitation) and known camps in close proximity to the LAA near the Yukon River (Interview 14, Personal Communication, 2016; Interview 22, Personal Communication, 2016).

**Transportation:** Historically, TH are known to have used the rivers and creeks across their Traditional Territory, including the area along the Yukon River close to Coffee Creek, as well as overland routes to travel in accordance with the season and conduct different subsistence activities (Dobrowolsky and Hammer 2001, TH 2012b). Most contemporary traditional land and resource use tends to occur in accessible areas along roads and rivers (TH 2012b). River corridors, including the Yukon and Stewart, as well as traditional trails, were identified as being of high value.

**Subsistence**: The land and resources across TH's Traditional Territory have been providing for their subsistence needs for thousands of years (Ecofor 2012) through seasonal hunting, trapping (in winter, known in the Coffee Creek area), fishing (also known in the Coffee Creek area), and plant gathering. In the summer and fall, people would work to gather and preserve food for the winter, including fish and berries (Dobrowolsky 2014). Species which are currently hunted in the Coffee Creek area include small game (e.g., porcupine and beaver) (TH 2012b), Fortymile woodland caribou, moose, wolves, bears, thinhorn sheep, and ptarmigan (TH 2012b) (Kristensen and Whalen 2012 in TH 2012b). Species fished by TH citizens in the Yukon River and waterways in the Coffee Creek area include Salmon, Whitefish, Grayling, and Pike (Interview 14, Personal Communication 2016). One of the features in the Yukon River that makes Coffee Creek an attractive area to fish are the eddies located in the area (Interview 14, Personal Communication 2016). Plants are currently used by TH citizens for subsistence, medicinal, and material related purposes (Interview 14, Personal Communication 2016, Interview 22, Personal Communication 2016). Traditional medicines are currently used by TH citizens, and are preferred over western medicines by many Elders (TH 2012b).

**Cultural and Spiritual Values:** Tr'ondëk Hwëch'in citizens shared how the practice of conducting traditional use activities fostered important time spent together as a family. Whether working together to process meat and materials from animals, sharing traditional knowledge with family members, or teaching children traditional skills and values out on the land, traditional land and resources are an integral current cultural value (Interview 14, Personal Communication 2016, Interview 22, Personal Communication 2016). Coffee Creek and the surrounding area continue to be a place of cultural and spiritual importance to TH citizens.

**Environmental Values:** Environmental integrity, and the health and abundance of harvested species, as well as inorganic environmental components are important values. As TH citizens are highly aware of the holistic nature of the environment and the complex relationships that characterize it, they value key habitat areas that support wildlife. Tr'ondëk Hwëch'in view the animals on their Territory as an economic resource that supports their traditional lifestyle and economy (TH 2012b). Harvesting activities have been identified as important components of the "modernized traditional economy" (TH 2012b).

#### *24.3.2.2 White River First Nation Traditional Land and Resource Use*

**Habitation:** The mouth of Coffee Creek is an important permanent and temporary habitation area where WRFN ancestors are known to have lived, gathered, and traded (Bates et al. 2014, Easton et al. 2013, TH 2012b, Yukon River Commercial Fishing Association and TH 1997).

**Transportation:** There is a network of overland and water routes connecting Coffee Creek to important places across the landscape. As WRFN were historically nomadic people, these transportation linkages played a central role in facilitating the seasonal round, as well as other cultural and spiritual activities. Current transportation means include personal vehicles, walking, and combinations of cars, trucks, vans, other motorized vehicles (e.g., ATVs and snowmobiles). A Community Harvest Study conducted in 2012 reported that the majority of subsistence harvesting activities occurred in accessible areas in close proximity (35 km) of Beaver Creek, such as along the Alaska Highway.

**Subsistence**: Subsistence harvesting such as hunting, trapping, and fishing continues to be an important value and contributes to current collective understanding of WRFN's sense of place, as well as food security. (YESAB 2012). Spring and summer seasons are the busiest seasons for WRFN, as this is a time when fishing, gathering, and hunting are conducted, and the fall is also busy while the winter is the quietest, with members primarily focused on trapping during this time (Calliou Group 2012b). WRFN members report hunting in a variety of locations, though the majority of hunting currently occurs within an area 35 km north and 25 km south of Beaver Creek and concentrated along the Alaska Hwy (Calliou Group 2012b).

**Cultural and Spiritual Values:** The land and resources across WRFN's territory facilitate the transmission, practices, and knowledge of integral WRFN values and practices, including the transmission of language, knowledge, stories, traditional values and cultural practices (Bates et el. 2014). The cultural and spiritual importance of the Coffee Creek area to WRFN is reflected by all of the site-specific values associated with this specific area (Bates et al. 2014). The Coffee Creek area is considered by the WRFN to have spiritual value because this was a birth and burial place for some WRFN ancestors, as well as other activities such as marriage and baptism ceremonies (Bates et al. 2014).

**Environmental Values:** White River First Nation values the both the biophysical and inorganic components of the environment, and have specific concerns for water quality (YESAB 2012). The WRFN consider that the Coffee Creek area has environmental value as it is a part of the land base that is inherently linked to all other aspects across the landscape. Specific environmental values related to the Coffee Creek area include Bear habitat on the north side of the Yukon River bank across from Coffee Creek, and Caribou habitat on the ridges surrounding the Project facility (Bates et al. 2014).

#### *24.3.2.3 First Nation of Na-cho Nyäk Dun Traditional Land and Resource Use*

**Habitation**: Coffee Creek was an important gathering place where ancestors of FNNND would historically stop during their seasonal round (TH 2012b).

**Transportation:** Traditionally, FNNND people would travel long distances in accordance with the seasonal round to conduct different subsistence activities (InterGroup Consultants Ltd. 2009), which included following such important food sources as Moose, Caribou and Mountain Sheep (InterGroup Consultants Ltd. 2009).

**Subsistence**: Traditional foods harvested from the land have always maintained a central role in the diet of FNNND citizens, and today, they continue to comprise a substantial portion of FNNND citizen's diet and contribute to FNNND culture (DPRA 2010). Further, subsistence activities support the traditional land and management system of FNNND citizens, since spending time on the land conducting traditional activities contributes to their ability to monitor environmental conditions (DPRA 2010). Moose, Caribou, Sheep, Deer, small game, Black Bear, Grizzly Bear, and birds (e.g., Ptarmigan, Grouse, Ducks) are examples of some of the species that FNNND citizens have historically and presently use for subsistence purposes (DPRA 2010, InterGroup Consultants 2009). Key species that FNNND trap include: Lynx, Marten, Wolf, Wolverine, and Rabbit (InterGroup Consultants Ltd. 2009, Leary 2009). The most commonly fished species on FNNND Traditional Territory include Chinook Salmon, Lake Trout, Lake Whitefish, Northern Pike, Arctic Grayling, and Inconnu (InterGroup Consultants 2009). Plants are used for both food and medicinal purposes. Some of the plants currently harvested for consumption include Lowbush cranberries, Blueberries, Black Currents, Raspberries, Stone Berries, and High-bush Cranberries (InterGroup Consultants 2009).

**Cultural and Spiritual Values:** Traditional use activities conducted across FNNND Traditional Territory support socio-cultural ties through the actual harvesting of traditional foods, as well as the act of sharing and consuming them (DPRA 2010).

**Environmental Values:** Environmental values of FNNND are intrinsically linked to cultural values and practices. First Nation of Na-cho Nyäk Dun citizens share an inseparable connection and relationship with their Traditional Territory, and the lands and resources that characterize it. Maintaining and enhancing the environmental health of their Traditional Territory is an important current environmental value of FNNND. Stewardship and responsible management of the land are two values identified as being important to FNNND (FNNND 2008). According to FNNND reports, traditional forms of land management have evolved and now integrate aspects of contemporary land management as well (FNNND 2008).

#### *24.3.2.4 Selkirk First Nation Traditional Land and Resource Use*

**Habitation**: Historically, SFN ancestors would gather and live at Coffee Creek (Easton et al. 2013, Yukon River Commercial Fishing Association and TH 1997, TH 2012b). A village used to exist in the Coffee Creek area before the highway was constructed (Yukon River Commercial Fishing Association and TH 1997). Selkirk First Nation elders described how many people lived at Coffee Creek in the 1930s, as at the time it was home of an active trading post (TH 2012b).

**Transportation:** Depending on the season, SFN members would travel by water and trails (dogsled), including by boat to the Coffee Creek area. There was an overland route between Fort Selkirk and Coffee Creek (TH 2012b).

**Subsistence**: The SFN traditional land and resource use has historically and currently remains a central component of SFN culture. Selkirk First Nation is known for using a diverse range of plants, animals, and resources across their Traditional Territory. Traditionally, winters were spent trapping, hunting moose, and fishing. Some people settled in groups at specific locations for the winter, whereas others continued to travel across the Territory conducting various traditional use activities. During the spring, people tended to occupy valley and lowland areas as they hunted and trapped. The summer months of July and August were often spent fishing salmon together in groups at rivers, and gathering plants. The fall was known as a time when game were plentiful; thus efforts were focused on these activities (Castillo 2012).

Animal species hunted by SFN include such big game as Moose, Caribou, Mountain Sheep, and Black Bear, as well as such waterfowl as Ducks, Geese, Swans, and Sandhill Cranes (Castillo 2012, Pearse and Weinstein 1988). Small game was also hunted; this includes Ptarmigan, Blue Grouse, Ruffed Grouse, and Sharptail Grouse (Pearse and Weinstein 1988). Coffee Creek was an area historically known for Moose hunting, and in the higher elevation areas around Coffee Creek for Caribou hunting (TH 2012b). Several types of fur bearers are trapped, including Beaver, Lynx, Muskrat, Fox, Wolf, Marten, Mink, Wolverine, Coyote, Red Squirrel, Otter, and Weasel (Pearse and Weinstein 1988). Such small game species may also be trapped as the Snowshoe Hare and the Ground Squirrel or Gopher (Pearse and Weinstein 1988). Fishing provides food security in the absence of hunting success. Species fished include Lake Trout, King Salmon (Chinook Salmon), Dog Salmon (Chum Salmon), Grayling, Inconnu, Whitefish, Pike, Sucker, and Ling Cod (or Burbot) (Castillo 2014, Pearse and Weinstein 1988). Coffee Creek is known for its productive trapping and fishing habitat.

**Cultural and Spiritual Values**: Dooli Law, the sacred and spiritual laws unique to Northern Tutchone peoples, provides guidance on what people should and should not do (Mease 2008), continues to guide and influence contemporary values and activities. Cultural activities such as family meetings, traditional use activities, potlatches, and community events and activities such as the Selkirk Spirit Dancers, community hand game tournaments, and the community garden continue to contribute to the SFN's social cohesion and community well-being. In the past, Selkirk people used to gather and conduct such important cultural and spiritual activities as potlaches at Coffee Creek (Easton et al. 2013, TH 2012b).

**Environmental Values:** The environment is highly valued by SFN and its citizens, and sustaining a healthy environment is of upmost importance (KCB 2013).

## 24.4 PROJECT INTERACTIONS, POTENTIAL EFFECTS, AND MITIGATION MEASURES

### 24.4.1 POTENTIAL PROJECT INTERACTIONS

Potential Project-related effects resulting from the interactions of the Project activities with the Non-traditional Land and Resource Use and Current Traditional Land and Resource Use subcomponents **(Section 4.1**) are described in this section. Potential interactions result from Project activities and work conducted during Construction, Operation, and Reclamation and Closure Phases. Interactions are also linked to the assessments for environmental components affecting sensory conditions and quality of the environment. Potential interactions are described in **Table 24.4-1.**

**Table 24.4-1 Potential Interactions**

| Phase | Types of Effects | Nature of Interaction |
|---|---|---|
| **Non-traditional land and resource use** | | |
| • Construction Phase<br>• Operation Phase<br>• Reclamation and Closure Phase | • Effects to the availability of land for other uses<br>• Effects of increases in access on portions of the NAR<br>• Effects to sensory disturbance<br>• Decreases in the quality of land and resources | • All Project activities and work conducted during Construction, Operation, and Reclamation and Closure |
| • Post-closure Phase | • No interaction | • No interaction |
| **Current traditional land and resource use** | | |
| • Construction Phase<br>• Operation Phase<br>• Reclamation and Closure Phase | • Effects to the availability of land for current traditional uses<br>• Effects of increases in access on portions of the NAR<br>• Effects to sensory disturbance<br>• Decreases in the quality of land and resources<br>• Effects to the quality of intangible cultural and spiritual resources | • All Project activities and work conducted during Construction, Operation, and Reclamation and Closure |
| • Post-closure Phase | • No interaction | • No interaction |

### 24.4.2 Potential Effects

The following potential effects resulting from the interactions during the Construction, Operation, and Reclamation and Closure Phases are addressed. Potential effects to current traditional land and resource use are considered separately for each First Nation.

### 24.4.3 Non-traditional Land and Resource Use

#### *24.4.3.1 Decrease in Availability of Land and Resources*

Project-related land use will adversely affect the amount of land and resources for non-traditional purposes. This direct effect is considered to occur from Construction through to Operation. Some effects will reverse at the completion of the Reclamation and Closure phase. The potential effect is presented for the entire Project footprint, and assessed once, in the Construction phase, when effects are estimated to be the most pronounced.

#### *24.4.3.2 Increase in Access to Lands and Resources:*

Vehicular access to land and resource uses may be increased through upgrades, increased winter maintenance, and increased connectivity of the NAR north of the Stewart River during the winter and summer months. The main improvements will occur between the Stewart River and the southern end of the existing paved road. Only Project-related vehicles will have access to the Stewart River crossings in winter and summer; therefore, access south of the Stewart River will not change. Access from the improved section of the NAR to adjacent areas in the RAA will also improve, generally by facilitation of the ability to transport ATVs to areas of use. Access to and through the mine (via boat on the Yukon River to the NAR) will be controlled for health and safety reasons, so access on the south side of the Yukon River beyond the mine airport will not improve. For the majority of non-traditional users with tenure and other land use permits, the improvements may be considered beneficial; however, some of the existing users for resource harvesting and trapping activities may consider that the improvements are not beneficial. As the length of road with increased access is limited, potential effects due to increased harvesting are not likely; however, hunting would be managed by the YG through its hunting and fishing regulations (see **Section 18 Wildlife and Wildlife Habitat**).

#### *24.4.3.3 Effects to Sensory Conditions*

Sensory conditions include air quality, visual conditions, and noise conditions. A change in sensory conditions may affect the desirability of potentially affected areas for activities related to harvesting and subsistence. Guide outfitters, trappers, placer miners, and recreationists may also consider that changes in these conditions affect the desirability of potential areas for use. Residual adverse changes identified in linked IC reports are summarized below and discussed with respect to effects to sensory conditions:

- **Air quality:** With the implementation of the mitigation measures, human health risks from changes to air quality are low, and sensory disturbance will likely to be negligible for non-traditional uses.

- **Noise:** Potential effects to noise sensitive activities (hunting, trapping, commercial guide outfitting, recreational uses, and subsistence activities) from sensory disturbance caused by noise are predicted to be limited in extent and duration, and will likely cause negligible effects to non-traditional land and resource users.
- **Visual:** Project related changes to visual conditions are not likely to cause adverse effects in other VCs, including the potential effect to sensory conditions for non-traditional land and resource users conducted in the same area as the described viewpoints.

#### *24.4.3.4 Decrease in Quality of Land and Resources:*

Project-related changes to environmental conditions may adversely affect the quality of resources currently used for non-traditional purposes. Residual effects with linked biophysical technical reports that support an assessment of changes in the land quality are summarized below:

- **Groundwater and Surface Water Quality:** The Project will likely affect surface water quality in YT-24 Tributary; however, no licensed uses have been identified.
- **Vegetation:** Residual effects will likely include habitat loss, changes in distribution of invasive plant species, and change in vegetation health as a result of roadside dust, but none of these effects are likely to be significant. No effects to the non-traditional use of vegetation are likely.
- **Fish and Fish Habitat:** Residual effects to the non-traditional use of fish are rated neutral as no significant effects to fish and fish habitat were identified, and not significant residual effects are very localized, and will not likely affect non-traditional fishing activities.
- **Wildlife and Wildlife Habitat and Birds and Bird Habitat:** Project-related effects will be unlikely to pose a risk to the long-term persistence and viability of the wildlife and bird populations at the regional level, and will not likely result in a residual adverse effect to the non-traditional use of wildlife.

### 24.4.4 CURRENT TRADITIONAL LAND AND RESOURCE USE:

Consideration of potential effects to current traditional land and resource use assumes that the entirety of the First Nation Traditional Territory is potentially used. Identification of specific areas of use is not available.

#### *24.4.4.1 Decrease in Availability of Land and Resources*

The Project footprint will have a direct effect on availability of land in traditional territories for current traditional land and resource uses for TH, SFN, and FNNND. While the area within the Project footprint comprises a very small percentage of the asserted and Traditional Territory areas (**Table 24.4-2)**, the loss of landbase availability may affect traditional uses.

**Table 24.4-2 Availability of Land within the Local Assessment Area**

| Traditional Territory | Total Area (ha) | Area in LAA (ha) | Percentage of Territory in the LAA (%) | Area in the Project Footprint (ha) | Percentage of Territory in Project Footprint (%) |
|---|---|---|---|---|---|
| Tr'ondëk Hwëch'in | 6398328 | 45344 | 0.7 | 3294.9 | 0.1 |
| White River First Nation[1] | 3333403 | 0 | 0.0 | 0.0 | 0.0 |
| Selkirk First Nation[2] | 3955083 | 7761 | 0.2 | 307.1 | 0.0 |
| First Nation of Na-cho Nyäk Dun | 13156776 | 13127 | 0.1 | 665.5 | 0.0 |

**Notes:**

1. Area in the Umbrella Agreement
2. The Project footprint avoids Category B lands held by the Selkirk in the vicinity of the Yukon River crossing (Figure 24.1-2).

### *24.4.4.2 Increase in Access to Lands and Resources:*

A change in access may affect land-based current traditional land and resource uses, including such subsistence activities as hunting, trapping, fishing, and plant harvesting, as well as such other current uses as (but not limited to) wood cutting, preparing harvested food from the land, sharing resources harvested from the land, and passing on TK through land-based experiences and teachings. Changes in access are likely to affect different individuals and/or First Nations differently. Project-related changes to access that may affect current traditional land and resource use are due to upgrades, increased winter maintenance, and increased access from connectivity of roads in the portion of the NAR north of the Stewart River. Only Project-related vehicles will have access to the Stewart River crossings in winter and summer; therefore, access south of the Stewart River will not change. The main improvements will occur between the Stewart River and the southern end of the existing paved road. Access from this section of the NAR to adjacent areas in the RAA will also improve, generally by facilitating the ability to transport ATVs to areas of use. Access to and through the mine (via boat on the Yukon River to the NAR) will be controlled for health and safety reasons, so access on the south side of the Yukon River beyond the mine airport will not improve.

The potential effect to current traditional land and resource use in the LAA and RAA during Construction and Operation as a result of a Project-related change in access from the Stewart River north to the existing YG road may be positive (increased options to access land for traditional uses) and adverse (displacement of traditional harvest activities). During the Reclamation and Closure phase, potential effects to current traditional land and resource use will likely be beneficial in the permanently upgraded sections of the NAR. It is recognized that the current traditional uses of each of the First Nations extend beyond their traditional territories. There is a common area of use in the vicinity of the Yukon River and Coffee Creek, however, the Project is not changing access within this area. These potential effects are individually described for each potentially affected First Nation in **Appendix 24-A Land and Resource Use Valued Component Assessment**.

### *24.4.4.3 Effects to Sensory Conditions:*

Sensory conditions include visual resources, noise, and air quality. A change in sensory conditions may affect First Nations and other individuals differently. A change in sensory conditions can affect the desirability of conducting current traditional land and resource uses, including hunting, trapping, fishing, and plant harvesting, as well as wood cutting, preparing harvested food from the land, sharing resources harvested from the land, and passing on TK through land-based experiences and teachings. These potential effects are individually described for each potentially affected First Nation in **Appendix 24-A Land and Resource Use Valued Component Assessment**.

Potential effects to air quality, noise, and visual resources are summarized in their respective sections (**Section 9.0 Air Quality and Greenhouse Gas Emissions Analysis; Section 10.0 Noise Analysis; Appendix 24-B Visual Analysis**, **and Section 25.0 Community Health and Well-being**). The potential for Project-related changes to these linked ICs to influence the locations and activities for current traditional land and resource uses is discussed below.

The potential effect to current traditional land and resource use in the LAA during Construction and Operation as a result of changes to visual conditions will likely be neutral to adverse, depending on the specific area, time of year being considered, and individual perspective. The Visual Analysis (**Appendix 24A**) concludes that no significant adverse effects are likely from the selected viewpoints near the Mine Site from the Yukon River. In this area of the LAA, changes to the visual condition will likely have a neutral effect on current land and resource use. Primary data shows that changes to sensory conditions along the road during winter may be an adverse Project-related effect.

The Project's noise analysis concluded that no adverse residual changes to focus areas are likely; thus, potential effects to current traditional land and resource use in the LAA during Construction and Operation as a result of Project-related changes to noise will likely be neutral. Changes to baseline noise conditions will likely be temporary, short-term, and localized.

The Project will comply with relevant air quality objectives and guidelines beyond the Project footprint, with small areas of potential temporary exceedance of particulate matter indicator concentrations situated mainly within the Project area. A potential effect would be adverse to the extent that current traditional land and resource use overlaps in time with these short-lived, very localized changes.

### *24.4.4.4 Decrease in Quality of Land and Resources:*

The assessment of potential effects to the quality of land and resources included consideration of effects to vegetation, wildlife, birds, fish, and water. Potential effects to biophysical conditions that affect the quality of land and resources are discussed in each respective VC assessment, including Surface Water Quality (**Appendix 12-B**), Fish and Fish Habitat (**Appendix 14-B**), Vegetation (**Appendix 15-B**), Terrestrial Wildlife and Wildlife Habitat (**Appendix 16-A**), and Birds and Bird Habitat (**Appendix 17-A.)**. These potential effects are also individually described for each potentially affected First Nation in **Appendix 24-A Land and Resource Use Valued Component Assessment**.

A change to the quality of resources will likely affect different individuals and First Nations differently. Project-related environmental changes to the amount of resources currently used for traditional purposes may include such potential effects as presence, absence, abundance, and distribution of animals, plants, and fish that First Nations depend on for traditional purposes. Changes to environmental conditions may also affect traditional economic activities such as gathering firewood, transmitting TK on the land, hunting, fishing, trapping, and plant harvesting.

***Vegetation***

Although a residual effect may occur to vegetation resources, the effect is unlikely to pose a risk to the long-term persistence and viability of vegetation, including ecological communities, wetlands, and traditional, medicinal and rare plants at the local and regional level; therefore, Project-related effects will not likely result in a residual adverse effect to the current use of vegetation by First Nations.

***Wildlife and Wildlife Habitat and Birds and Bird Habitat***

Project-related effects to wildlife and wildlife habitat will not likely result in a significant residual adverse effect to the current use of wildlife by TH.

***Fish***

Residual effects to the current use of fish are rated neutral as no significant effects to fish and fish habitat were identified, and not significant residual effects are very localized, and will not likely affect traditional fishing activities.

***Surface Water Quality***

Project-related effects to surface water quality in YT-24 Tributary are likely to result in effects to current use of water to the extent that First Nations currently use water in the YT-24 Tributary; however, information on current use of water in YT-24 by First Nations was not available.

#### *24.4.4.5 Effects to the Quality of Intangible Cultural and Spiritual Resources*

Potential effects to intangible cultural and spiritual resources are related to changing the desirability of the land for an existing or potential future use, changing the connection that First Nations have with the land, and changing the opportunities that First Nations may have to share, teach, and practice traditional knowledge. The assessment of potential adverse effects to cultural and spiritual resources considers the potential for effects to habitation, transportation, and intangible culture and heritage values, which in turn are supported by the assessment of effects to sensory conditions (noise, visual effects, air quality), access, heritage resources, the availability of land, and the quality of land (water, fish, wildlife, birds and habitats).

These potential effects are individually described for each potentially affected First Nation in **Appendix 24-A Land and Resource Use Valued Component Assessment**.

The potential effects to known and tangible First Nation traditional cabins, buildings and habitation sites, and traditional trails are discussed and assessed in **Section 26.0 Heritage Resources Assessment,** which concludes that implementation of identified mitigation measures will likely prevent adverse residual effects to heritage resources.

Changes to the quality of intangible cultural resources may occur during the Construction, Operation, and Reclamation and Closure Phase in the LAA and RAA as a direct result of Project activities. These changes will likely be experienced and characterized differently by different citizens at the community level. Limited site-specific information regarding current use of resources by First Nations in or near the LAA and RAA was provided or available to the study team.

**Habitation:** The potential effect in the LAA during Construction and Operation to habitation-related intangible cultural and spiritual resources will likely be neutral. At a community level, neutral effects may be experienced by those who habituate and gather in the RAA and LAA in areas near the Yukon River. This determination is supported by **Section 10.0 Noise Analysis**, **Appendix 24-B Visual Analysis**, and **Section 9.0 Air Quality and Greenhouse Gas Emissions Analysis**, which all found that no significant adverse effects are likely as a result of Project-related activities during Construction or Operation. At a community level, adverse effects may be experienced by those who consider any change to the existing condition and character of the land to affect their well-being; these potential effects are discussed and assessed in **Section 25.0 Community Health and Well-being Assessment**.

**Transportation**: The potential effect in the LAA and RAA during Construction and Operation to transportation-related intangible cultural and spiritual resources will likely be neutral. At a community level, the trend of the effect is likely to be neither a worsening nor improvement from baseline conditions

**Intangible Culture and Heritage Values**: Project-related effects to intangible culture and heritage values may occur during the Construction and Operation Phases in the LAA and RAA as a direct result of Project activities, which change the ability of a First Nation to conduct traditional land and resource activities. As discussed and assessed in preceding sections of this Project Proposal, no significant adverse residual effects to access, sensory conditions, or the amount or quality of resources will likely result from the Project. These potential effects may collectively contribute to a Project-related effect to the intangible culture and heritage values; therefore, a neutral effect to intangible culture and heritage values is likely. At a community level, the trend of the effect is considered neither a worsening nor improvement from baseline conditions.

### 24.4.5 Mitigation Measures

The mitigation measures identified for Land and Resource Use were informed by a review of mitigation and follow-up programs undertaken for past projects, with emphasis on mining projects in Yukon. Input was received through the Project's consultation and engagement program (**Section 3.0**). Mitigation measures for Land and Resource Use include the following:

- Implement Project design measures to minimize the overall Project footprint; utilize the existing access routes as components of the NAR, implement phased mine development and conduct progressive reclamation and closure activities, and avoid sensitive habitats and maintain key habitat features.
- Minimize effects of the NAR (i.e., minimize traffic) per the Access Route Construction Management Plan (**Appendix 31-A**) and the Access Route Operational Management Plan (**Appendix 31-B**).
- Develop and implement an Engagement Plan to continue to engage with First Nations, and communicate the status and schedule of the Project with local communities, residents, organizations, contractors, and employees, as well as government.
- Implement current traditional land and resource use enhancement measures.

## 24.5 Residual Effects and Determination of Significance

Following the implementation of mitigation measures, residual effects will likely remain for most of the identified potential effects for non-traditional and current traditional land and resource use, with the qualification that changes in the quality of land and resources only considers surface water quality; the effects from other biophysical assessments will not likely affect the quality of land and resource uses. As discussed below, these residual effects are likely to be not significant or positive.

### 24.5.1 Non-traditional Land and Resource Use

Within a historical context of gold and placer mining in Yukon and the region, the existing land users will likely be able to respond and adapt to Project-related changes to land uses and access; therefore, the context for the assessment for non-traditional land and resource uses is considered moderate.

#### *24.5.1.1 Decrease in Availability of Land and Resources*

The potential adverse residual effects from a decrease in available land for non-traditional land and resource uses will likely be low in magnitude, as the area of the Project footprint is less than 0.3 % of the RAA. Where possible, the Proponent has utilized land already withdrawn from land and resource use by existing activities (e.g., placer mining and existing roads). The geographic extent is the LAA (excepting those areas already disturbed), and the effect is continuous, long term, and partially reversible on decommissioning. The residual effect is likely as the Project will require land area. Based on the effects characteristics, the residual effect is considered not significant, with high confidence, in an area with moderate resiliency to disturbance.

#### *24.5.1.2 Effects from Increase in Access to Lands and Resources*

Residual effects will likely be moderate in magnitude, and will extend into the areas of the RAA in proximity to the LAA along the portion of the NAR north of Stewart River to the southern end of the YG road. Effects will vary by season, and will be continuous, long term, and likely. In addition, residual effects will likely be not significant, within a moderately resilient context, since non-traditional users will have the ability to adjust to changes. Confidence in the assessment is considered moderate; the Engagement Plan will likely further clarify user perspectives.

#### *24.5.1.3 Effects to Sensory Conditions*

Based on a review of the residual changes for the linked ICs (Air Quality, Noise, visual effects), residual effects to air quality may affect sensory conditions for non-traditional uses, so only these effects are considered further. The residual adverse effects to sensory conditions from Project-related effects to air quality will likely be low in magnitude, local in extent (in the vicinity of the Mine Site), seasonal as potential uses may change by season, and reversible, since air quality will likely return to baseline conditions. The residual effect to changes in sensory conditions will likely begin in the Construction Phase and extend through Operation and Reclamation and Closure, although the air quality assessment considers the operation year with the greatest potential for effects. The residual effects is considered likely, based on the assessment of the Air Quality VC. The residual effect will likely be not significant based on the effects characteristics, and the moderate to high resiliency of the subcomponent non-traditional land and resource use. Confidence in the assessment is considered moderate: further consultation through the proposed consultation mitigation may clarify non-traditional land and resource uses of the potentially affected areas near the mine.

#### *24.5.1.4 Decrease in Quality of Land and Resources*

Based on a review of the residual effects assessments for the linked VCs (Surface Water Quality, Fish and Fish Habitat, Vegetation, Wildlife and Wildlife Habitat, and Birds and Bird Habitat), the residual effects to surface water quality will likely affect the quality of land for non-traditional uses, and only these effects are considered further.

The residual adverse effect to land quality from Project-related effects to surface water quality will likely be low in magnitude, local in extent as the water resources affected are in the vicinity of the Mine Site, seasonal as the effect is seasonal and potential uses may change by season, and partially reversible as surface water quality in affected watercourses will likely return to close to baseline conditions. The residual effect to changes in land quality will likely begin during the Construction Phase and extend through Operation and Reclamation and Closure. The residual effect is considered likely, based on the assessment of the Surface Water Quality VC. The residual effect will likely be not significant based on the effects characteristics, and the moderate resiliency of the subcomponent current traditional land and resource use. Confidence in the assessment is considered moderate: further consultation through the engagement plan may clarify land and resource uses of the potentially affected areas near the mine.

### 24.5.2 CURRENT TRADITIONAL LAND AND RESOURCE USE

This section presents the residual effects to current traditional use of land and resources. Goldcorp recognizes and respects that each First Nation may identify and interpret the term traditional economy, and the related use of land and resources differently from one another, and each may identify different potential Project interactions. Also, not all aspects of traditional land uses may be represented in this assessment, as comprehensive qualitative and quantitative secondary data specific to each potentially affected First Nation were not readily available or provided to the Project study team, and primary data collection could not be completed with each of the potentially affected First Nations identified in this assessment.

The residual affects to the current use of land and resources have been assessed for the Project as a whole, and have not generally differentiated between First Nations; however, Goldcorp recognizes that the Project is likely to affect First Nations differently, depending on the extent of their Traditional Territory within the Project footprint and assessment areas. An interaction matrix between First Nation traditional lands and the Project Area is provided in **Appendix 24-A Land and Resource Use Valued Component Assessment**.

#### *24.5.2.1 Decrease in Availability of Land and Resources*

The potential adverse residual effects from a decrease in available land to the current use of lands and resources will likely be low in magnitude, as the area of land in the Project footprint is less than 0.03 % of the RAA. Where possible, the Proponent has utilized land already withdrawn from traditional land and resource by existing activities (placer mining and existing roads). The geographic extent is the LAA (excepting those areas already disturbed within the LAA). The effect is continuous, long term, and partially reversible on decommissioning. The residual effect is likely as the Project will require land area (**Table 4.4-9**). Based on the effects characteristics, the residual effect is considered not significant, with high confidence, in an area with moderate resiliency to disturbance.

#### *24.5.2.2 Effects from Increase in Access to Lands and Resources*

Increases in access will likely occur from Stewart River north to the southern end of the existing paved road as a direct result of upgrades, increased winter maintenance, and extensions for the NAR, which may facilitate additional improvements in access in the LAA and adjacent portions of the RAA via ATVs, snowmobiles, or walking. The residual effect will likely affect different cohorts within each potentially affected First Nation differently in both the LAA and RAA. For those First Nations who use the LAA, the Project-related change in access is an opportunity to facilitate current traditional land and resource use; thus, a positive effect is likely. For those First Nations who are displaced from where they are currently conducting or may wish to conduct particular traditional land and resource use activities in the future, an adverse effect is likely.

Residual effects will likely be moderate in magnitude, extend into the areas of the RAA in proximity to the LAA from the Stewart River north to the southern end of the existing YG road, will vary by season, and will be continuous, long term, and likely. The residual effects will likely be not significant, within a moderately resilient context as First Nations will have the ability to adjust to changes. Confidence in the assessment is considered moderate.

#### *24.5.2.3 Effects to Sensory Conditions*

Based on a review of the residual changes for the linked ICs, the residual effects to air quality and visual resources may affect sensory conditions for traditional uses, and only these effects are considered further.

The residual adverse effect to sensory conditions from Project-related effects to air quality will likely be low in magnitude, local in extent (in the vicinity of the Mine Site), seasonal as potential uses may change by season, and reversible as air quality will likely return to baseline conditions. Beginning in the Construction Phase and extending through Operation, the residual effect to changes in sensory conditions is considered likely, based on the assessment of the air quality VCs, and will likely be not significant, based on the effect characteristics, and the moderate to high resiliency of the subcomponent. Confidence in the assessment is considered moderate.

The residual adverse effects to sensory conditions from Project-related effects to visual resources will likely be low in magnitude, local in extent (in the vicinity of the Mine Site and new and upgraded portions of the NAR), seasonal as potential uses may change by season, and partially reversible depending on the rate of return to baseline conditions for those areas that are reclaimed. Beginning in the Construction Phase and extending through Operation and Reclamation and Closure, the residual effect is considered likely, based on the assessment of the visual resources and the primary data from First Nations, and will likely be not significant, based on the effect characteristics, and the moderate to high resiliency of the subcomponent. Confidence in the assessment is considered moderate.

#### *24.5.2.4 Decrease in Quality of Land and Resources*

An effect to the quality of the land may decrease the ability and desirability of First Nations to carry out current traditional activities to the current levels. Residual effects to current use of linked VCs for Fish and Fish Habitat, Vegetation, Wildlife and Wildlife Habitat, and Birds and Bird Habitat were rated neutral, as no significant effects to the VCs were identified, and effects considered not significant are localized or not considered likely to affect the long-term viability of the VC; therefore, effects are not considered likely to affect traditional activities. The potential residual effects to the current use of water are rated as adverse, as there are potential localized residual effects to surface water quality in Yt-24 tributary from nitrate and nitrite, sulphate, and T-U.

Based on this review of the residual effects assessments for the linked VCs, the residual effects to surface water quality may affect the quality of land for traditional uses, and only these effects are considered further.

The residual adverse effect to land quality from Project-related effects to surface water quality will likely be low in magnitude, local in extent as the water resources affected are in the vicinity of the Mine Site, seasonal as the effect is seasonal and potential uses may change by season, and partially reversible as water quality in affected watercourses will likely return closer to baseline conditions over the long term. The residual effect to changes in land quality will likely begin in the Construction phase and extend through Operation, Reclamation and Closure. The residual effect is considered likely, based on the assessment of the residual effects to the Surface Water Quality VC. The residual effect will likely be not significant, based on the effects characteristics, and the moderate resiliency of the subcomponent; confidence in the assessment is considered moderate.

#### *24.5.2.5 Effects to the Quality of Intangible Cultural and Spiritual Resources*

Potential effects to intangible cultural and spiritual resources are related to changing the desirability of the land for an existing or potential future use, changing the connection that First Nations have with the land, and changing the opportunities that First Nations may have to share, teach, and practice traditional knowledge. Assessment of the potential adverse effects to cultural and spiritual resources considers the potential for effects to habitation, transportation, and intangible culture and heritage values, which in turn are supported by the assessment of effects to sensory conditions (noise, visual effects, air quality), access, heritage resources, the availability of land and the quality of land (water, fish, wildlife, birds and habitats). The potential residual effects for Heritage Resources (**Appendix 26-A**), access, sensory conditions, availability of land, and quality of resources are assessed separately (see **Section 22.4.2.2, Section 22.4.2.3 and Section 22.4.2.4**) and therefore not considered further within this effect assessment for intangible resources. Residual effects for these considerations are summarized as follows:

- No residual effects for heritage resources
- Negligible residual effects for sensory conditions
- Negligible or not significant adverse residual effects (localized) for VCs with linkages to the quality of land
- No significant adverse and positive residual effects for access.

The assessment of the quality of intangible cultural resources therefore focuses on the extent to which the Project may influence cultural knowledge and TK. Project support for TK projects and monitoring will enable learning about traditional resources, and will encourage time spent on the land. With the enhancement measures in place, such as encouragement for employees to pursue traditional land and resource uses through the two-week-on, two-week-off schedule, this effect will likely be positive. The residual effects will likely be low in magnitude, local to regional in extent, year-round, continuous, long-term and partially reversible as learning may be passed to future generations.

## 24.6 CUMULATIVE EFFECTS ASSESSMENT

This cumulative effects assessment is conducted at the VC level rather than at the subcomponent level because residual cumulative effects will likely be similar for non-traditional and current traditional land and resource uses. Adverse residual effects are considered in the cumulative effects assessment as there is a potential for these effects to interact cumulatively with other projects and activities. These Project-related adverse residual effects include: increases in access, changes in sensory conditions, decrease in availability of land, and decrease in quality of resources (surface water quality). These residual effects were screened against the residual effects for quartz projects, placer projects, and the existing road network. No additional mitigation measures are proposed beyond those proposed for Project-specific mitigation.

#### *24.6.1.1 Increase in Access*

Settlements and the existing road network have contributed to the existing access conditions with the cumulative assessment areas, and additional related activity is not likely to be perceptible. Quartz mining projects and placer mining projects may increase access in the future, which may be considered an adverse effect by selected users.

Future changes (increases) in access in the vicinity of the Project-related improved access may be expected from quartz mining projects that require vehicular access, including Casino Mine, southeast of the Project and Lonestar Mine, northwest of the NAR. Lonestar Mine is in an area of existing nearby access, and therefore is not likely to interact cumulatively. Increases in access from the Casino Mine will not overlap directly or be connected to the Project-related access. Within the larger traditional use RAA, proposed and existing mines on the west side of the Klondike Highway do not substantially change access from existing conditions.

For those land and resource users for whom access increases are an adverse effect, residual cumulative effects will likely be low in magnitude, regional within the non-traditional use RAA, long term, and continuous, although dependent on the seasonality of various users. The residual effect would commence on completion of improved access for other projects, likely not until later in the Project's Operation Phase, and would extend until decommissioning of the NAR. The effect is at least partially reversible following Reclamation and Closure of the Project, as it is assumed that some improvements to the NAR will remain although new road sections would be decommissioned. The access-related residual cumulative effect is viewed as not significant. The Project has a relatively smaller contribution to the effect on Current Traditional Land and Resource Use than on Non-traditional Land and Resource Use due to the larger size of the RAA. The level of confidence associated with this significance determination is low to moderate, as there is uncertainty with respect to temporal overlaps for future projects.

#### *24.6.1.2 Changes in Sensory Conditions*

Potential cumulative effects from changes in sensory conditions may occur from interactions with future quartz mining, and placer mining projects. Existing disturbances related to settlements and their associated land uses may interact cumulatively with the current land and resource uses; however, future uses will likely be within the same boundaries and not distinguishable from existing activities. Project- related residual effects to sensory disturbance result from air quality and visual effects.

Air quality changes associated with the Mine Site are not likely to overlap spatially with air quality changes of other mine sites, given the distance to the closest proposed mine site (Casino); therefore changes in sensory conditions due to residual air quality effects are not carried forward to the residual cumulative effects assessment.

While future quartz mining projects may also result in residual visual effects given their spatial location, it is not likely that there will be cumulative visual effects, as it will not be possible to see other disturbances from the same viewpoint. Similarly, while there may be visual effects from placer mining along the NAR, there is no information that leads to an expectation that their use would change substantially in magnitude. Existing users may alter their locations but not likely the extent of their activity, and changes in the visual quality along the NAR will likely not change cumulatively. For these reasons, sensory disturbance due to residual effects to visual resources is not carried forward to the residual cumulative effects assessment.

#### *24.6.1.3 Decrease in Availability of Land*

The availability of land may be cumulatively affected by other projects and activities that utilize substantial areas of land, including interactions with future quartz and placer mining. The existing disturbance to the land base from present settlements and the existing road network in combination with the Project and other activities may result in a cumulative effect.

Based on the analysis of potential disturbance within the vegetation RAA (an approximately 10-km buffer from the Project footprint), the cumulative disturbance is 9.5 % of the RAA, and the Project contributes 0.4 % of the disturbance (**Appendix 15-B Vegetation Valued Component Assessment**). The cumulative loss within the land and resource use RAAs will likely be similar in scope. The contribution of the Project to the cumulative effect will likely be negligible, since the percentage will be less than the contribution for vegetation cumulative effects as the RAA is larger; as a result, this potential effect is not carried forward to the cumulative residual effects assessment.

#### *24.6.1.4 Decrease in Quality of Resources*

Adverse Project-related effects to the quality of resources was identified for surface water quality. A scenario of future development of mines upstream of the Project discharging elevated concentrations of surface water quality parameters of interest into the Yukon River during periods of low flow may result in not significant adverse residual cumulative effects of small magnitude in the Yukon River. Effects are considered unlikely (**Appendix 12-B Surface Water Quality Valued Component Assessment**). The potential cumulative effect to the quality of land and resources is therefore considered not likely, and is not carried forward to the residual cumulative effects assessment.

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# 25.0 COMMUNITY HEALTH AND WELL-BEING ASSESSMENT

This section presents a high-level summary of the effects assessment for the Community Health and Well-being Component (VC) in support of the proposed Coffee Gold Mine (Project). The full effects assessment is presented in **Appendix 25-A Community Health and Well-being Valued Component Assessment Report**.

## 25.1 ASSESSMENT SCOPE

The selection of Community Health and Well-Being as a VC was informed by the consultation process that was led by Kaminak Gold Corporation, a wholly owned subsidiary of Goldcorp Inc. (Proponent or Goldcorp). The initial scoping process identified health as a potential VC based on prior experience with major resource development projects, as well as YESAA's definition of socio-economic effects, specifically: effects on "economies, health, culture, traditions, lifestyles and heritage resources" (YESAA 2015). Consultation with assessors and regulators regarding the VCs, including health, and feedback from the Tr'ondëk Hwëch'in (TH) Technical Working Group, community members, and interview participants supported a broader consideration of health issues in the definition of the VC. Because of limitations of measuring and monitoring health on an individual level, the consideration of health in the broader context of a community includes socio-economic factors including crime, health-related behaviours (e.g., smoking and substance use), food security, accidents and injuries, infectious and non-infectious disease, mental health and wellness, and health services structure and capacity. The candidate Health VC was modified to become the Community Health and Well-Being VC, and includes potential direct effects on health due to Project-related changes in environmental quality (as assessed in the quantitative Human Health Risk Assessment (**Appendix 18-C**)), and indirect health effects attributable to interrelated socio-economic factors.

Community Health and Well-being is influenced by social, economic, and environmental conditions, and includes such attributes as safety and the ability for community members to meet their basic needs, as well as the presence of infectious diseases. Two subcomponents were selected for this assessment: Environmental Quality, which includes indicators described in the HHRA, and Socio-economic Factors, which includes socio-economic indicators of individual and community health. Indicators for the Community Health and Well-being VC are listed in **Table 25.1-1**.

### Table 25.1-1 Indicators for Community Health and Well-being Valued Component

| Indicator | Rationale for Selection | Measurable / Descriptive Parameters |
|---|---|---|
| **Environmental Quality Subcomponent** | | |
| **Air Quality** | Possible risk to human health through inhalation of airborne contaminants or via exposures to contamination of soils, water, or country foods associated with mining-related dust fall contamination. | Estimated levels of CACs in air ($NO_2$, $SO_2$, CO, $PM_{2.5}$, $PM_{10}$, TSP)<br>Estimated levels of combustion-related contaminants in air<br>Estimated exposures to trace elements in airborne dust<br>Estimated contaminant concentrations in soil and food/medicinal resources from dust fall or fine particulate / aerosol wet and dry deposition |
| **Noise** | Noise arising from Project activities pose a possible risk to human health through stress and annoyance, sleep disturbance, or interference with the quality of speech, comprehension, and learning. | Stress and annoyance<br>Interference with speech comprehension and cognition<br>Sleep disturbance, per WHO night-time noise guidelines (2010)<br>Annoyance from low-frequency, high impulsive noise (e.g., blasting) |
| **Country Food Quality** | Possible risk to human health through exposures to mining-related contaminants while engaged in the gathering and consumption of edible/medicinal plants and fish/wildlife. | Contaminant uptake into edible/medicinal plants and wildlife resources<br>Contaminant uptake into edible fish tissues |
| **Socio-economic Factors Subcomponent** | | |
| **Social Determinants of Health** | This indicator provides information about personal security and safety and general well-being in a community. The health and well-being of individuals and communities are affected by social issues such as living conditions, economic conditions, family structures and crime; however, these factors influence health in complex ways. | Time off work (average No. days/year)<br>Housing condition (% needing repairs)<br>Census family structure<br>Children in care (%)<br>Crime rates, incidents, crime severity<br>Family violence (reasons for women seeking shelter) |
| **Health-related Behaviours** | Health-related behaviours are of interest for the Project. Fly-in, fly-out (FIFO) workers may be more likely to be current smokers, drink alcohol at risky levels, and be overweight or obese as compared to other employment types. | Smoking rates (%)<br>Heavy drinking rates (%)<br>Physical activities (% moderately active)<br>Nutrition (rates of fruit and vegetable consumption) |

| Indicator | Rationale for Selection | Measurable / Descriptive Parameters |
|---|---|---|
| **Food Security** | Food security may be affected by the Project based on the community's perception of traditional foods being contaminated, which may reduce consumption. High transportation costs and environmental changes affecting traditional food sources are identified as current threats to food security in Dawson and by TH. | Households reporting moderate or severe lack of access to nutritious foods (%, % with children) |
| **Accidental Injuries** | Possible risk to individual health through workplace- and transportation-related injuries. Accidental injuries are ranked as a leading cause of death in Yukon and also have high hospitalization rates. | Overall injuries (% causing limitations, % requiring medical attention, life years lost)<br>Workplace injuries (lost-time rates, No. claims)<br>Transportation-related injuries (No. caused by collisions, aviation) |
| **Infectious Disease** | Possible risk to community health through increased infectious disease rates. Gastrointestinal and respiratory infections can be transmitted easily in crowded living conditions. An increase in sexually transmitted infection rates is common with an influx of young, male workers. | Infectious disease rates (% respiratory, gastrointestinal, sexually transmitted infections) |
| **Non-infectious Disease** | This indicator provides information about rates chronic diseases and cancer in Yukon. Modifiable health-related behaviours may lead to chronic diseases. | Chronic disease rates (% diabetes, % obese)<br>Cancer rates (%) |
| **Mental Health and Wellness** | Possible risk to community health through changes in stress levels, substance use, and rates of mental health disorders. Perceived health, mental health, and life stress levels are important indicators of wellness and quality of life. This indicator provides information about the mental health status of a community or region, including alcohol and drug misuse and stress, which are associated with socio-economic changes. | Perceived health (% excellent, very good, fair, poor)<br>Perceived mental health (% as above)<br>Perceived life stress (%)<br>Sense of community belonging (%)<br>Life satisfaction (% satisfied)<br>Mood disorder (%)<br>Rates of self-harm (rates, cause of death) |
| **Health Services Structure and Capacity** | Possible risk to community health through changes in access to health services. This is an indicator of health system performance, specifically whether care is delivered in a timely way, and whether people are using the health care services that are available. | Access to family physician (%)<br>Influenza immunization (%)<br>Emergency room wait times (hours)<br>Hospital service use (No./year) |

**Notes:** % - percent; CAC - criterion air contaminant; CO - carbon monoxide; FIFO - fly-n, fly-out; $NO_2$ - nitrogen dioxide; $PM_{2.5}$ - fine particulate matter of 2.5 microns or lesp; $PM_{10}$ - fine particulate matter of 10 microns or less; $SO_2$ sulphur dioxide; TSP - total suspended particulate; WHO – World Health Organization

### 25.1.1 Assessment Boundaries

The spatial, temporal, administrative and technical boundaries established for the assessment of Project-related effects on the Socio-economic Factors subcomponent are described in **Table 25.1-2** and **Figure 25.1-1.** Assessment boundaries for the Environmental Quality subcomponent (for the assessment of air quality, noise and country food quality) are provided in **Appendix 18-B HHRA Technical Report.**

**Table 25.1-2 Assessment Boundary Definitions for Socio-economic Component of Community Health and Well-Being**

| Boundary | | Description of Assessment Area |
|---|---|---|
| Spatial | Local Assessment Area | 1 km buffer around Project footprint, communities of Whitehorse, Dawson, Beaver Creek, Mayo, and Pelly Crossing |
| | Regional Assessment Area<br>Cumulative Effects Assessment Area | Yukon Territory |
| Temporal | | The temporal boundaries established for the assessment of Project-related effects on Community Health and Well-Being include all phases of the Project, as described in the Project Proposal (**Section 2.0 Project Description**). |
| Administrative | | Administrative boundaries for the Socio-economic Factors subcomponent are government administrative boundaries for Whitehorse, Dawson, Beaver Creek, Pelly Crossing, and Mayo, where such administrative boundaries are in place.<br>It is acknowledged that these spatial boundaries do not reflect the traditional territories of First Nation of Na-cho Nyäk Dun, Selkirk First Nation, and White River First Nation; however, due to the overlapping traditional territories of these communities, their administrative centres were selected as spatial area components. |
| Technical | | A technical challenge is that no single factor will have a large influence on health and well-being independently of any other factor; many factors will continually interact in often complex ways; and the level of health and wellness of individuals and communities will reflect the cumulative past influences of many experiences and conditions. As such, it is challenging to objectively measure community health and well-being, or to predict the overall influence of one factor or change on the overall community status. |


# COFFEE GOLD MINE

## Community Health and Well-being Spatial Boundaries

### Legend

- Highway
- National/International Border
- Project Footprint
- Local Assessment Area
- Local Assessment Area
- Community Health and Well-being Regional Assessment Area

### Notes

1. This map is not intended to be a "stand-alone" document, but a visual aid of the information contained within the referenced Report. It is intended to be used in conjunction with the scope of services and limitations described therein.

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## 25.2 ASSESSMENT METHODS

The methods used to identify and assess potential Project-related and cumulative effects were developed from assessment requirements identified in YESAA and YESAB guidance documents (e.g., YESAB 2005). The assessment of potential Project-related effects on Community Health and Well-being was informed by two complementary approaches: a quantitative HHRA, which informed the selection of environmental quality indicators, and a qualitative HIA, which informed the socio-economic indicators. The HHRA assessed the direct health implications of exposure to Project-related noise, air emissions, and contaminant exposures associated with the gathering and consumption of country foods. The qualitative HIA methodology assessed the indirect effects on health due to Project-related changes in key socio-economic factors that can indirectly affect community health and well-being.

## 25.3 EXISTING CONDITIONS

A summary of existing regulatory and baseline conditions is provided for local context and to enable the reviewer to identify and understand the potential interactions between the Project and Community Health and Well-being.

### 25.3.1 ENVIRONMENTAL QUALITY

Existing conditions for air quality and noise are described in **Section 9.0 Air Quality and Greenhouse Gas Emissions Analysis and Section 10.0 Noise Analysis** respectively, as well as in **Appendix 9-A Baseline Air Quality and Noise at the Coffee Gold Project 2015**. Sampling was also completed to characterize the chemistry of soil and plant tissue as part of identification of existing conditions in the Project area, as discussed in **Appendix 15-A Vegetation Baseline Report**.

The areas at and around the proposed Mine Site are in a generally natural state. There are no local sources of airborne contaminants, and the soils and plants reflect background regional concentrations, except in the immediate vicinity of areas where there has been substantial disturbance as a result of mining exploration activities. Dust fall in the area reflects natural sources of dust such as tree pollen, as well as deposits during forest fires. Baseline noise measurements are consistent with a quiet environment. Similarly, the areas adjacent to the Northern Access Route (NAR) tend to be largely undeveloped, and can be considered in a generally natural state with regard to air quality, water quality, soil quality, and the quality of country foods, except perhaps in limited locations around active placer mines.

Based on the baseline information collected, natural resources in important harvesting areas such as the mouth of Coffee Creek are good quality, and provide good nutritional, medicinal, and cultural resources, in areas where they are adequately abundant.

### 25.3.1 SOCIO-ECONOMIC FACTORS

Socio-economic Factors include: social indicators of individual and community health (e.g., crime), health-related behaviours (e.g., smoking and substance use), food security, accidents and injuries, infectious and non-infectious disease, mental health and wellness, and health services structure and capacity. Socio-economic health factors are described for the RAA, and for the LAA where available.

#### *25.3.1.1 Social Determinants of Health*

The health and well-being of individuals and communities are affected by social issues such as living conditions, economic conditions, and community and family structures; however, these factors influence health in complex ways. It is important to consider and assess social determinants of health while recognizing that there typically is no direct cause-and-effect relationship between social determinants of health and health outcomes.

***Employment***

Issues relating to employment and economic development are discussed in **Section 4.0** of **Appendix 18-A Socio-Economic Baseline Report**. In 2014, an average of 12.6 days of work were lost per Yukon worker for personal reasons, which is similar to the 12.9 days reported Canada-wide. Occupations in social science, government service, and religion (27.6 days); trades helpers, construction, and transportation labourers and related occupations (27.1 days); and occupations in art, culture, recreation, and sport (26.5 days) had the highest numbers of days lost for personal reasons (YBS 2015b).

***Housing***

Housing issues are an important component of health and well-being, particularly when considering the adequacy, suitability, and affordability of housing. Adequacy considers the condition of a home and whether it needs repairs; having adequate heat is also a consideration. Suitability considers whether a home has enough bedrooms to accommodate all residents. Affordability considers whether the cost of housing exceeds 30 percent (%) of the household's gross income (CMHC 2016).

In 2011, 29% of Yukon First Nations members lived in homes needing major repairs, and 7% lived in crowded homes, with more than one person per room. The corresponding figures for the non-Aboriginal population were 12% and 4% respectively (Arriagada 2016). Overall, housing was frequently mentioned as a concern in the City of Dawson (Dawson), in terms of availability, affordability, and adequacy (Interview 2, Pers. Comm. 2016; Interview 7, Pers. Comm. 2016; Interview 8, Pers. Comm. 2016; Interview 20, Pers. Comm. 2016; Interview 21, Pers. Comm. 2016; Interview 28, Pers. Comm. 2016).

### *Family Structure*

Overall, the structure of Canadian families is becoming more diverse, with a decrease in the number of married two-parent households with children, although this remains the majority family structure (Statistics Canada 2015f). There is a higher percentage of common-law families with children in Yukon (25.1% in 2011), as well as a higher percentage of lone-parent households (20.5% in 2011), as compared to Canada as a whole (16.7% and 16.3%, respectively) (Statistics Canada 2016a).

### *Children in Care*

The Child and Family Services division of Yukon Government Health and Social Services (YGHSS) provides child placement services including adoption, foster care, and child abuse treatment services (YG 2015a). The Child Protection Branch provides programming intended to reduce family violence, child abuse, and neglect, and engages family home workers to provide intensive in-home support (YG 2015b).

A recent Aboriginal Children in Care report specified that 64% of Yukon children in care are Aboriginal, although 33% of the child population is Aboriginal (Aboriginal Children in Care Working Group 2015). Of all Yukon Aboriginal children aged 14 and younger, 4% were in foster care in 2014 (Arriagada 2016). There were 30% fewer Aboriginal children in care in 2013 and 2014, compared to 2007 and 2008 (Aboriginal Children in Care Working Group 2015).

### *Children and Youth*

Child care is often a necessity for working parents, especially when families do not have the support of extended family or for lone-parent households. Access to child care is a challenge throughout Canada, with one estimate suggesting that day care centres only have space for approximately 20% of children needing care. The quality of child care also affects language and cognitive development as well as emotional development (Cohen et al 2004). Early influences on emotional development have long-term consequences on the development of children and youth (Cohen et al. 2004).

The Social Inclusion Survey conducted in 2010 by Government of Yukon reported that 31% of parents had difficulty finding child care, and 28% had difficulty finding affordable child care, particularly for people living outside of Whitehorse. Of the families surveyed with children under 14 living in their households, 45% had a full-time stay-at-home parent (the mother in 72.3% of families), and 30.4% of families included a parent who worked reduced hours to care for children (the mother for 73.3% of families) (HSS 2010).

### *Crime*

Community safety is an important component of a community's well-being. In 2014, the crime rate in Yukon was the third highest in Canada, behind Nunavut and NWT, at 23,919 incidents per 100,000 people (Allen and Perreault 2013). This rate reflected an increase of 0.3% over the 2013 rate and an increase of 7.8% over the 2005 rate (YBS 2015a).

The Crime Severity Index (CSI) is a tool that is weighted to account for the severity of police-reported crime, using the year 2006 in Canada as a reference point of 100. The police-reported Crime Severity Index for the LAA is summarized for each community:

- Dawson had a jump of 137% in its violent CSI from 2013 (90.71) to 2014 (214.90) (Statistics Canada 2016d).
- Whitehorse reported a high of 6,380 total violations in 2014, and a low of 4,354 violations in 2006, reflecting a generally upward trend in recent years (Statistics Canada 2016c). Violent *Criminal Code* violations for Whitehorse were variable for 2004 to 2014, with a peak of 1,070 in 2014 and a low of 671 in 2006 (YBS 2015). Whitehorse showed a 83% increase, from 111.72 in 2013 to 204.05 in 2014 (Statistics Canada 2016c).
- Beaver Creek reported a high of 60 total violations in 2009, and a low of 24 violations in 2014, reflecting a generally downward trend in recent years (Statistics Canada 2016c). Violent Criminal Code violations were variable for 2004 to 2014, with a peak of 16 in 2012 and a low of 4 in 2014 (YBS 2015).
- Pelly Crossing had a range of 135 (2004) to 368 (2010) total violations, with violent Criminal Code violations ranging from 32 in 2005 and 2006 to 74 in 2010 (Statistics Canada 2016c; YBS 2015).
- Mayo had a range of 113 (2010) to 214 (2013) violations for the reported period, with 17 (2008) to 60 (2014) violent Criminal Code violations. The highest reported rates were observed in 2013 and 2014 for both categories (Statistics Canada 2016c; YBS 2015).

***Family Violence***

Yukon recorded a rate of family violence of 911.6 per 100,000 population in 2014, the third highest rate in Canada behind Nunavut and NWT. There was a 20% increase in reported rates of family-related physical assault in Yukon between 2012 and 2013, whereas every other province and territory reported a decrease. Yukon police-reported rates of intimate partner violence were 1,247.0 victims per 100,000, as compared to the national rate of 310.3 victims per 100,000, the third highest rate behind Nunavut and NWT (Statistics Canada 2015e). Violence against women has been mentioned as a concern associated with the proposed Project (Int. 31, Personal Communication 2015).

#### *25.3.1.2 Health-related Behaviours*

Health-related behaviours are individual choices such as not smoking, participating in regular physical activity, and eating nutritiously, which are associated with reducing the incidence of health conditions including diabetes, heart disease, cerebrovascular disease, and certain cancers. Health-related behaviours are of interest for the Project, since fly-in, fly-out (FIFO) workers in Australia were found to be substantially more likely to be current smokers, drink alcohol at risky levels, and be overweight or obese as compared to other employment types (Joyce et al 2013).

***Smoking***

Smoking rates in Yukon have been showing a generally decreasing trend in recent years, with a peak rate of 35.5% reported in 2009. The smoking rate declined to 25.9% in 2013 (Statistics Canada 2014). Yukon has the third highest rates of smoking in Canada, behind Nunavut and NWT, but smoking rates are decreasing more quickly than the rest of Canada, at a rate of 6% per year as compared to 3% for Canada (CBC News 2016b).

***Physical Activity***

Many people in Yukon enjoy participating in a variety of outdoor activities and recreational sports. Mountain biking, hiking, running, skiing, and snowmobiling are popular pursuits, and Yukon has been described as a very active place (Int. 1, Personal Communication 2016). Approximately two-thirds of Yukoners reported being moderately active in their leisure time in 2012 and 2013 (Statistics Canada 2014). Exercise has been identified as being very important for maintaining worker wellness while in camp (Int. 1, Personal Communication 2016).

***Nutrition***

Rates of fruit and vegetable consumption appear to be on a downward trend, with only 32.6% of Yukoners reporting eating five or more fruits and vegetables per day, down from 52.5% in 2010. Potential Project interactions with access to healthy food are discussed in **Appendix-A Section 4.2.5**.

***Substance Use***

Heavy drinking refers to men having five or more drinks, or women who have reported having four or more drinks, on one occasion, at least once per month in the past year. In 2013, the rate of heavy drinking in Yukon was 32.4% higher than the national average, second only to NWT (Statistics Canada 2015a).

#### *25.3.1.3 Food Security*

The City of Dawson Official Community Plan includes food security as a priority, defining it as "…the ability to secure nutritious, affordable and culturally appropriate food through healthy systems" (City of Dawson 2012). Food insecurity is typically measured using surveys with a range of questions designed to assess the ability to obtain nutritious food, by household. Yukon households both with and without children have rates of food insecurity somewhat above the national average, and food security has been mentioned as an issue (Interview 9, Personal Communication 2016).

Tr'ondëk Hwëch'in has launched several initiatives to enhance food security, including a collaborative Teaching and Working Farm in collaboration with Yukon College, with classes beginning in Spring 2016 (TH n.d.a). The Farm School includes both formal classroom instruction and field experience.

A recent community-based study in collaboration with TH found that sharing and trading food remains a common practice that strengthens the community's spiritual development (Institute for Sustainable Food Systems 2015).

***Accidents and Injuries***

Yukon has very high rates of unintentional injuries causing death, and is typically ranked as the third leading cause of death (the second leading in 2009), behind cancer and heart disease (Statistics Canada 2015f). In Canada, unintentional injury is the fifth leading cause of death (Statistics Canada 2015f). In general, the rates of injuries requiring hospitalization are approximately 1.5 to 2 times the national average; this may be partly attributed to the popularity of high-risk recreational opportunities in Yukon, such as snowmobiling (HSS 2013b).

According to the Canadian Community Health Survey, approximately 15% to 20% of Yukoners typically report an injury that has limited their normal activities in the past year, and approximately 11%, on average, looked for medical attention for their injuries (Statistics Canada 2016b).

***Workplace Health and Safety***

Workplace injuries for mining-related industries in Yukon have shown consistently higher rates for lost time as compared to all industries as a whole, from 1997 to present. According to the data reported to Yukon Workers' Compensation Health and Safety Board (YWCHSB), mining-related activities include the following categories: diamond drilling; drilling of gas or oil wells; drilling of water wells; exploration; gravel crushing or stockpiling; mapping; surveying; or prospecting (YWCHSB 2015). Because of the broad categorization of mining activities, these results should be interpreted with caution.

***Transportation-related Injuries***

Motor vehicle collisions accounted for approximately 35% of deaths in Yukon due to accidental injuries based on data collected between 2007 and 2011 (Transport Canada 2012). No fatalities were reported due to collision with an animal from 1999 to 2003 (Transport Canada 2012). In 2011, the rate of traffic fatalities appeared to be higher in Yukon than the rate for Canada as a whole, with a territorial rate of 11.6 fatalities per 100,000, compared to a national fatality rate of 6.5 fatalities per 100,000 (Transport Canada 2012).

***Aviation Incidents***

The Project will be an FIFO operation, and there will be occasional use of helicopters for transportation on site; accordingly, information about aviation accidents and fatalities has been included in this report. In general, the majority of aviation incidents involve private aircraft, rather than commercial aircraft; for example, incidents in Canada in 2012 were comprised of 143 incidents involving private airplanes and 45 incidents involving commercial airplanes (TSB 2014a, 2014b).

Overall, fatality rates for aviation incidents in Yukon are low (Error! Reference source not found.**)** (TSB 2014a, 2014b). In Dawson, it was noted that previous experience with an increase in aviation traffic resulting from mining activity did not result in a local increase in aviation incidents (Interview 33, Personal Communication 2015).

#### *25.3.1.1 Infectious Disease*

Infectious disease incidence such as for respiratory and gastrointestinal (enteric, food, and waterborne) diseases, influenza and sexually transmitted diseases within Yukon are noted below.

Giardiasis was the most commonly reported gastrointestinal infection for the period from 2007 to 2012, with reporting rates of 29.4 to 53.1 per 100,000. Campylobacteriosis, salmonellosis, and cryptosporidiosis have also been observed in Yukon, in addition to *E.Coli* and Hepatitis A (HSS 2013a). In addition, Yukon commonly experiences outbreaks of norovirus (HSS 2016).

Laboratory-confirmed influenza rates reached a high of 497.1 per 100,000 in 2009 for the reporting period 2007 to 2012. Tuberculosis (TB) rates declined in 2012 to 2.9 per 100,000 from a peak of 24.2 cases per 100,000 in 2008 (YG 2013). Most often reported in Yukon First Nations patients, TB affects people living in remote communities who have limited access to timely and consistent TB care, laboratory resources, and available TB expertise and staff (Government of Canada 2012).

Reported chlamydia rates are higher in Yukon than in southern Canada (PHAC 2008), but steadily decreased from 2007 to 2012 (YG 2013). Similarly, hepatitis C rates also decreased in this period. Syphilis was reported in Yukon in 2009 and 2012 (YG 2013).

#### *25.3.1.1 Non-infectious Disease*

Shift work is known to adversely affect health, and may be linked to an increased risk of accidents due to disruption of hormonal rhythms and metabolism (Boivin and Boudreau 2014, Kim et al 2015, Ulhôa et al 2015). Long work hours are associated with poor health outcomes, such as cardiovascular disease, diabetes, anxiety, and depression (van der Hulst 2003, Bannai and Tamakoshi 2014). Working more than 60 hours per week is attributed to substantially worse self-rated health as compared to working a 40-hour week (Song et al 2014).

Based on responses to the Canadian Community Health Survey, Yukon rates of diabetes appear to be lower than the overall Canadian rate in all years since 2003 where data are available, except in 2012 (Statistics Canada 2016b); however, these findings must be interpreted carefully due to the small sample size involved in the data analysis. Obesity rates for Yukon appear to be similar to those for Canada; the average obesity rate from 2003 to 2013 was 17.4% for Canada as a whole, while the rate in Yukon was 19.8% for the same period. Obese adults are more likely to have diabetes (PHAC 2011).

#### *25.3.1.1 Mental Health and Wellness*

Perceived health, mental health, and life stress levels are important indicators of wellness and quality of life. Overall, Yukoners report high rates of community belonging and life satisfaction, although perceived mental health has been decreasing over the past decade. Perceived life stress has remained relatively consistent over the reporting period, varying from 18% (2010) to 22.9% (2008). The vast majority of Yukoners reported having a sense of community belonging, ranging from 70.6% (2005) to 82% (2010). Similarly, life satisfaction rates were high, ranging from 88.2% (2003) to 94.7% (2011) (Statistics Canada 2014).

Reported rates of mood disorders also appear lower in Yukon than Canada as a whole, but these statistics are to be used with caution due to response rate. It is generally understood that about one in five Canadians will experience a mental health issue in any given year (CMHA 2016).

***Workplace Mental Health***

Stress affects health, both directly and indirectly, by contributing to the use of coping mechanisms such as alcohol and drug use (Goh et al 2015). Work-related stress is associated with absenteeism from work, accidents and injuries, and under-performance (Samra et al. 2012). Approximately 20% of Canadians experience mental health problems each year, often having an adverse effect on their work. In addition, workplace bullying has been associated with having poorer health and fewer personal and social resources (MacIntosh et al 2014).

Shift work and FIFO work schedules provide certain advantages for employees, such as facilitating longer periods of time at home; however, prolonged absences can also be stressful for workers and their families. Mobile workers can experience exhaustion, loneliness, stress, and anxiety, and may delay taking care of their mental health while at work (Angel 2014). Fly-in/fly-out work is also associated with mental health issues such as depression and anxiety (Meredith et al. 2014).

#### *25.3.1.2 Health Services Structure and Capacity*

***Access to Medical Care***

For the period of 2005 to 2014, an average of 84.9% of Canadians reported having access to a regular family physician, as compared to 75.9% of people in Yukon. For the same period, 79.6% of Canadians and 79.7% of people in Yukon reported having contact with a medical doctor over the past 12 months. This suggests that despite not having the same access to a regular family physician, Yukoners are receiving care; similar to other parts of Canada. Those without a regular family doctor in Yukon may be using the emergency room or drop-in clinics to fill the gap. As an indication of access to general medical care, an average of 32.4% of people in Yukon, comparable to an average of 30.6% of Canadians, reported receipt of an influenza vaccination from 2005 to 2014.

The average amount of time spent waiting for treatment in emergency waiting areas and rates of hospital admissions are also indicate of access to medical care. Reports of emergency wait times were available for Whitehorse General Hospital. The average wait, based on the 90th percentile, was 1.7 hours as compared to 3.2 hours nationally. Hospital admissions for Whitehorse General Hospital (WGH) increased by approximately 4.6% between 2014 and 2015, while admissions for Dawson City Community Hospital (DCCH) decreased by 13%; note that measures for DCCH are affected by small numbers.

## 25.4 PROJECT INTERACTIONS, POTENTIAL ADVERSE EFFECTS, AND MITIGATION MEASURES

This section describes the potential interactions between Project activities and community health and well-being, potential effects, and mitigation measures to avoid and reduce potential effects to Community Health and Well-being.

### 25.4.1 POTENTIAL PROJECT-RELATED INTERACTIONS

Potential Project-related interactions will likely occur between Project activities and community health and well-being during the Construction, Operation, and Reclamation and Closure Phases. During these phases, the Project is likely to result in changes to:

- Air quality
- Noise
- Country food quality
- Social Determinants of Health
- Health-related Behaviours
- Food Security
- Accidental Injuries
- Infectious Disease
- Mental Health and Wellness
- Health Services Structure and Capacity.

### 25.4.2 POTENTIAL EFFECTS

This subsection describes the nature of potential effects to the Community Health and Well-being VC as a result of the above-described interactions. The potential effects of the Project on Community Health and Well-being are discussed below according to subcomponent.

#### *25.4.2.1 Potential Health Effects Related to Changes in Air Quality*

The Project will likely influence air quality in two possible ways: via the generation of dust as a result of mining activities, and exposure of stripped areas and mine wastes to wind. Dust generation may result in exposures of the public to suspended particulates in air in areas adjacent to the mine. Associated dust fall may also affect trace element concentrations in soil and plants at or around the Mine Site area, which in turn may increase human exposures to those trace elements that occur at atypically high concentrations in Coffee mine ore and waste rock.

The second potential influence on air quality is with emissions from internal combustion engines (gasoline or diesel) used in support of mining as well as garbage incineration. This includes diesel power generation, domestic garbage incineration, and various types of mining and transportation equipment. The primary air quality contaminants of potential concern (COPCs) include CACs for which Yukon Ambient Air Quality Objectives (AQO) exist, including carbon monoxide, nitrogen dioxide ($NO_2$), sulphur dioxide, fine particulate matter, and total suspended particulates. Internal combustion engines also emit a large variety of volatile and semi-volatile organic contaminants such as benzene, 1,3-butadiene, formaldehyde, acetaldehyde, acrolein, naphthalene, and other polycyclic aromatic hydrocarbons such as benzo[a]pyrene.

The major conclusions based on completion of the HHRA for air quality were that none of the CACs are likely to exceed their respective Yukon AAQO for areas where the public might be exposed, and that none of the volatile to semi-volatile organic contaminants that are a priority for health concerns are likely to exceed or approach relevant health-based thresholds of effects. The HHRA indicates that human health risks associated with air quality during the peak Operational period, in areas around the Mine Site where people might focus their activities, will be acceptably low. Since no potential effects to human health are likely to result from changes to air quality, this effect is not considered further in this assessment.

#### *25.4.2.2 Potential Health Effects Related to Noise*

Noise generation will likely occur during Project Construction, Operation, and Reclamation and Closure as a result of mining activities and diesel power generation. There will be no Project-related noise following Reclamation and Closure. Reclamation and closure activities will generate noise; however, the amount of activity and noise generated will likely be less than for the Operation phase. The potential effects for the Operation phase, therefore, will likely adequately predict the effects potential for the Reclamation and Closure Phase.

Noise health risks associated with human noise exposures while on the Mine Site are not assessed in the HHRA since members of the public will generally not be present in these areas for extended periods. Health risks from occupational noise exposures will be managed in compliance with Yukon regulations.

For all focal areas of interest adjacent to (i.e., outside of) the proposed Mine Site, noise levels associated with Construction or Operation activities will likely be lower than the existing measured background noise levels, and thus will not be easily distinguishable from the background wilderness-type noise environment. In addition, noise levels at modelled locations will be far lower than authoritative health effect thresholds relating to sleep disturbance or speech interference. Since no potential effects to human health are identified from changes to noise, this effect is not considered further in the assessment.

#### 25.4.2.3 Potential Health Effects Related to Country Food Quality

Changes in soil and plant quality from mining-related dust may result in increased human exposures to trace elements that occur at much higher concentrations in mining-related dust than generally occur in the existing forested area surface soils. This is particularly important in light of the traditional harvesting of country foods. The baseline assessment did not predict any health risks from dust fall associated with transportation activities along the NAR.

Only arsenic in ore or waste rock has an average concentration greater than background soil concentrations. Dust fall from mining activities was estimated to add only 0.7% to the naturally occurring arsenic concentrations in soil at the Mine Site, and less than or equal to 0.01% of the naturally occurring arsenic concentrations beyond the Mine Site; therefore, there will likely be no detectable changes in arsenic levels in forest soils, plants, fish, and wildlife as a result of dust fall; therefore, there is no potential risk to human health.

Screening-level risk calculations suggest that waste rock arsenic contamination may indirectly pose adverse risk to human health, largely attributed to ingestion of country foods growing on or foraging in uncovered waste rock disposal areas. Waste rock arsenic concentrations may lead to marginally higher exposure levels than acceptable for cancer risk potential based on the observed arsenic concentrations in granite waste rock, but not the other two rock types. Risk management of granitic waste rock will be required and is discussed further in the mitigation **Section 4.3**. No other health risks in relation to arsenic exposure from granitic waste rock are associated with the Project. As a result, only the potential for arsenic effects on country food quality is carried forward for further assessment.

#### 25.4.2.4 Potential Health Effects Related to Social Determinants of Health

This section presents potential effects to social determinants of health, including potential effects on children and youth, and the potential for changes in crime incidents. Potential Project-related effects on community health and well-being that are specifically related to employment, housing and children in care are not identified and are not carried forward for further assessment. However, it is recognized that these socio-economic factors may interact with other factors to contribute to effects on community health and well-being.

***Potential Effects on Children and Youth***

An increase in population and changes in employment patterns due to the shift rotation of the Project are likely to increase demand for resources for children and their families. Families new to town who have not had an opportunity to develop support networks may be more vulnerable (Int. 9, Personal Communication 2016). Previous experience of the Ekati Diamond Mine in NWT found that a large proportion of employees believed their job had an adverse effect on their children, particularly those employees with children under nine years old (Rescan 2012).

Using the largest hypothetical scenario of 15% of the Project workforce relocating to Dawson during the
Using the largest hypothetical scenario of 15% of the Project workforce relocating to Dawson during the highest population prediction trend, a 4% increase in the population of Dawson could occur as a result of the Project. In this scenario, increased demand on services is likely. Given that many current resources are operating at or near capacity, there is the potential for a Project-related effect that families of young children will have a decreased ability to access resources when needed.

***Potential Effects as a Result of Increased Crime***

The assessment considered the potential for an adverse effect on community well-being may occur based on alcohol- and drug-related crimes resulting from an influx of workers. However, previous experience during the exploration boom in Dawson in 2011 did not generate a measurable effect on crime (Int. 26, Pers. Comm. 2016). Additionally, should an increase in call volumes be experienced, the Royal Canadian Mounted Police (RCMP) has the ability to increase staffing in response (Int. 26, Personal Communication 2016).

As a result of the overall analysis of social determinants of health, potential health effects are carried forward for further assessment.

#### *25.4.2.5 Potential Health Effects Related to Health-Related Behaviours*

Camp employees may experience an adverse effect on health-related behaviours while at camp, due to factors including stress and the proposed 12-hour daily shift length. Potential adverse health effects may include an increase in smoking and changes in eating patterns (for example, eating greater quantities of food in a cafeteria than at home). In addition, camp employees may experience reduced activity levels due to physical fatigue and time constraints resulting from long shifts and shift rotations..

***Potential Effects as a Result of Increased Smoking***

Rates of smoking could potentially increase among company staff and their families related to a variety of factors such as stress, isolation, and boredom. An increase in smoking rates would increase the risk of adverse effects both for individuals and for communities due to factors such as secondhand smoke.

***Potential Effects Resulting from Increased Substance Use***

The Project will run a dry camp with a zero-tolerance substance use policy; however, potential adverse effects on health could occur if employees increase their alcohol use during the two weeks they spend at home[14]. Based on input from community members, some workers may increase alcohol consumption as a result of having increased income. Some individuals may use alcohol as a coping mechanism in the

[14] With respect to the Ekati Diamond Mine in Northwest Territories, although almost 92% of employees based in Yellowknife and 71% of employees from small local communities reported drinking alcohol during their time away from the mine, only 7% of Yellowknife employees and no employees from small local communities reported drinking more often (Rescan 2012).

absence of their usual support systems. Further, an increase in substance use also may cause increased incidence of violence against women and family members, which may increase the need for shelter. Responsibility for substance use is held by individuals; however, workplaces can be structured to provide an environment that supports employee health and wellness and therefore reduces the likelihood of substance abuse.

***Potential Effects as a Result of Changes to Nutrition***

There is a potential for adverse effects on employee in terms of reduced nutrition due to changes in eating patterns for workers in camp; for example, eating less nutritious foods or eating larger quantities due to increased food availability.

***Potential Effects Resulting from Reduced Physical activity***

Potential adverse effects may occur due to a reduction in physical activity related to physical fatigue from factors a 12-hour shift length and may also be connected to other factors such as mental health and wellness.

Potential health effects related to health-related behaviours are carried forward for further assessment.

#### *25.4.2.6 Potential Health Effects Related to Food Security*

Food security may be adversely affected based on society's perception of traditional foods being contaminated, which may in turn prevent people from consuming those foods in the Project area. This perception persists in spite of the true health risks associated with contaminants, as discussed in **Section 4.2.3**. Concerns about the integrity of country foods can be an impediment to harvesting and consuming country foods, especially in and around industrialized areas and areas that have experienced intensive human development. However, the area of the proposed Mine Site is not an area relied upon for harvesting due to its relatively remote location and lack of road access, and alternative harvesting areas are available.

Possible adverse effects to food security may also be based on a decrease in community members' ability to buy food or changes in access to traditional food sources or harvesting areas. However, it is considered that the Project will likely have a positive effect on food security by providing increased employment and income, which will subsequently improve the purchasing power of employees and potentially lead to increased food security for employees and their families. Increased spending power may also lead to purchase of more locally produced food, where and when available.

Based on the analysis related to country food quality (**Section 4.2.3**), the potential for arsenic exposure effects from the Project on food security is considered to be adequately addressed by the potential adverse effect carried forward for country foods quality. The potential positive effect on food security is carried forward for further assessment.

#### *25.4.2.7 Potential Health Effects Related to Accidental Injuries*

Potential effects related to accidents and injuries consist of:

- Workplace accidents and injuries for Project employees
- Project related transportation accidents and injuries
- Project workplace safety

There is a potential effect of workplace accidents and injuries based on Project-related activities and Project-related traffic travelling on the NAR during the Construction, Operation, and Reclamation and Closure Phases.

Though possible health effects related to the NAR include an increase in collision-related injuries due to increased commercial truck traffic, collision rates involving commercial traffic are generally lower than overall rates. In addition, Project-related traffic volumes are generally low at approximately eight trucks per day (lower during Construction). Staff will be flown to and from the Project to improve safety, and improvements made during road upgrading, such as improved surfacing and lines of sight, will improve safety.

#### *25.4.2.8 Potential Health Effects Related to Infectious Disease*

The Project may increase infectious disease rates, specifically STIs, in the communities where Project workers live and recreate. An influx of mobile workers can be associated with increased rates of sexually transmitted infections (STIs). For example, the in-migration of young, predominantly male oil and gas workers in northern British Columbia corresponded with increased chlamydia rates, 22% higher than the provincial average rate (Goldenberg et al 2008). An increase in the incidence of gastrointestinal disease outbreaks may also occur, arising from the close living quarters of the Project Camp Site.

Infectious diseases are an important consideration in camps where a large number of people are working in close quarters, as well as to the residents of communities in the Project's Local Study Area. Outbreaks of communicable diseases such as respiratory and gastrointestinal illnesses can have serious consequences for worker health and productivity, and can adversely affect the community as a whole.

Most infections are treatable and short-term, and treatment resources are available. As a result of this analysis, the potential effects of the Project related to infectious disease is carried forward for further assessment.

#### *25.4.2.9 Potential for Increase of Non-Infectious Diseases*

Shift work is linked to increased rates of diabetes due to sleep disruption. Weight gain is also associated with an increased risk of diabetes; the lifestyle in camp may contribute to weight gain for some individuals, depending on diet and activity levels. Potential adverse health effects are considered minor because sleep disruptions will be discontinuous due to the two-week-on, two-week-off rotation; workers will also have opportunities to eat healthy food and exercise, which can mitigate the risk of obesity and diabetes.

Non-infectious diseases can best be addressed through health promotion strategies as outlined in **Section 25.4.3**. As a result of this analysis, the potential for effects as a result of the Project on non-infectious diseases is not carried forward for further assessment.

#### *25.4.2.10 Potential Health Effects on Mental Health and Wellness*

There is a potential adverse effect of the Project on mental health and wellness in potentially affected communities, particularly Dawson, where effects related to stress on workers and their families can increase due to shift rotations and various other changes in lifestyle. There is also a potential adverse effect for on-site workers related to workplace stress, isolation, and shift structure. Potential positive secondary health effects that may result due to the increased availability of time to spend on the land or with friends and family during the two weeks between shifts are addressed in **Appendix 24-A**.

Potential Project-related adverse health effects may occur associated with stressors due to the shift rotation (length of shift, duration of rotation; time away from home) and possible increase in drug and alcohol use in the community. A sense of disconnection from the land has also been raised as a concern, particularly for First Nation workers. As a result the potential for effects as a result of the Project on mental health and wellness is carried forward for further assessment.

#### *25.4.2.11 Potential Effects on Health Services Structure and Capacity*

Possible Project-related adverse effects may occur due to increased demand on the existing health care system, which may consequently contribute to adverse health outcomes. The existing capacity of acute and primary care resources in Dawson is currently considered adequate, and resources can be increased as needed. Given that the potential influx of workers and families to communities within the LAA could place additional pressure beyond service structure and capacity, the potential for an effect from the Project on health services structure and capacity is carried forward for further assessment.

### 25.4.3 MITIGATION AND ENHANCEMENT MEASURES

The mitigation measures proposed to be used to eliminate or reduce Project-related changes adverse effects to Community Health and Well-Being include the following. A complete list of mitigation measures is provided in **Appendix 25-A**:

- Country food quality mitigation measures:
    - Waste rock will be managed such that materials within the upper one metre of deposits will not exhibit an arsenic concentration that is greater than 60 mg/kg on average. If unable to do so, review alternative means of deterring human traffic and prolonged use of facilities in closure (e.g., signage).

    - Borrow materials that contain arsenic will not be used in a manner that could result in human exposure.

- Social Determinants of Health - Children and Youth:
    - An increase in resources to support young families
    - Enhancement measures may include providing meaningful work experiences for young adults, and increasing capacity (e.g., frequency, scope) of community activities and events by providing sponsorship.
- Social Determinants of Health – Increased Crime:
    - Implementation of a drug and alcohol policy
    - Implementation of an Employee Assistance Program
    - Creation of a Visiting Elders program
    - Supporting a campaign to prevent family violence
- Health-Related Behaviours
    - Implementation of a smoking cessation program for company staff and their families
    - implementation of a drug and alcohol policy,
    - provide information to employees on healthy eating, and having an on-site a fitness centre for employee use.
- Food security mitigation measures:
    - Creating a visiting Elders Program.
    - Provide information to employees and their families about strategies to increase food security
- Accident and injury mitigation measures:
    - Transport staff to and from site generally by air to improve safety.
    - Develop road improvement strategies in consultation with First Nations, regulators, and other stakeholders.
    - Adhere to all applicable workplace safety regulations and guidelines, and regularly engage with Yukon Workers' Compensation Health and Safety Board and follow identified best practices.
    - Adhere to industry standards, such as the Mining Association of Canada Towards Sustainable Mining protocols, and the International Cyanide Management Code.
    - Adhere to Proponent's internal health and safety programs and initiatives.
    - Adopt a workplace safety program and foster a culture with leadership from the top that directly engages workers and fosters a culture of safety
- Infectious disease mitigation measures:
    - Ensure that on-site drinking water meets or exceeds applicable drinking water standards.
    - Encourage hand washing
    - Provide clinical services for infectious diseases

  - Coordinate with Yukon Health and Social Services (HSS) to offer on-site influenza vaccination clinics.
  - Monitor for gastroenteritis outbreak, and implement an outbreak management strategy should gastroenteritis cases manifest.
  - Provide free condoms at camp.
- Mental health and wellness mitigation measures include:
  - providing a comfortable environment for Project staff when off-shift,
  - planning shifts in blocks,
  - develop a workplace wellness strategy,
  - implement policies such as workplace harassment,
  - inviting visiting Elders to provide support for First Nations staff, and
  - partnering with local and regional organizations to facilitate mental health support.
- Health services and structural capacity mitigation measures include:
  - Goldcorp will communicate with Yukon HSS regarding anticipated numbers of employees and communities of residence.
  - Goldcorp will develop an Emergency Response Plan.
  - The Proponent will provide on-site health and clinic services for workers with general health concerns.

No health effects have been identified for exposures to noise or air quality; therefore, no additional mitigation strategies, beyond the management approaches in the **Dust Management Plan** and **Noise Management Plan** (summarized in **Section 31.0 Environmental and Socio-economic Management Program**) are proposed.

With the implementation of the mitigation, the residual effects for air quality, noise, country food quality, health-related behaviours, food security, accidental injuries, and non-infectious disease are considered negligible and are not carried forward to the residual effects assessment.

## 25.5 RESIDUAL EFFECTS AND THEIR SIGNIFICANCE

This section describes potential residual effects of the Project (i.e., effects likely to occur subsequently to the application of mitigation measures) to community health and well-being.

### 25.5.1 INCREASE IN CRIME

Despite mitigation measures aimed at supporting employees in reducing harm from substance use, the Project will likely result in a residual adverse effect to crime during Construction and Operation due to an increase in indirect and induced employment in LAA communities and an increase in income for local employees and contractors in LAA communities. Increased access along the NAR may also lead to an increase in property crime.

An increase in crime indicators were observed in NWT in correlation with increased mining activity (GNWT 2015). The mitigation measures identified above, together with the ability of the RCMP to increase staffing in response to an increased number of calls, are proposed to reduce the potential adverse effect on health from increased crime in the LAA or in accessible areas along the NAR. Some uncertainty exists around the degree to which the mitigation can be effective, however.

The residual effect is likely to be low in magnitude as crime rates in Yukon are already among the highest in Canada, and the additional effects from the Project area will likely be relatively low in magnitude. The timing of the effect will likely reflect current crime rates, which peak in the summer. The residual effect will likely be infrequent and short-term due to the isolated nature of incidents of crime, and is fully reversible after completion of the Project Operation Phase. Based on similar experience with other projects (GNWT 2015) and based on the above characterization, this residual adverse effect is not significant as a result of the Project. The confidence is moderate, due to uncertainty in the effectiveness of mitigation measures.

### 25.5.2 Increase in Infectious Disease Rates

Despite mitigation measures aimed at on-site infectious disease management, the Project is likely to result in an increase in infectious disease rates resulting from STIs and other infectious diseases during Construction and Operation due to an influx of workers into LAA communities. This residual effect is likely to be adverse in direction, although low in magnitude as mitigation measures are likely to be effective, and the most common infectious diseases, including STIs, are treatable. The effect would be focused on the Mine Site and Camp Site, where employees will live and work in close proximity, although the effect may extend to all LAA communities. As the effect is tied to the presence of a workforce during Construction and Operation, the effect is likely to be shift-based, continuous, long-term, and fully reversible. The probability of occurrence is likely, based on experience in other jurisdictions (GNWT 2015). Based on this characterization, this effect not significant. The confidence in this assessment is high, based on the effectiveness of mitigation measures and the experience of other jurisdictions. **Appendix 25-A Community Health and Well-being Valued Component Assessment Report** (Table 1.11-4) presents the characteristics of Project-related effects on infectious disease within the LAA.

### 25.5.3 Positive Effect on Food Security

During Construction and Operation, the Project is considered likely to have a positive effect on food security by providing increased employment and income, which will subsequently improve purchasing power to buy nutritious foods. Potential secondary effects from these positive effects are also possible for other indicators, including social determinants of health (e.g., positive effects on children and youth), health-related behaviours (e.g., nutrition) and mental health and wellness. No effects on food security are likely due to changes in access to traditional food sources or harvesting areas. The area of the proposed Mine Site is not an area relied upon for harvesting due to its relatively remote location and lack of road access, and alternative harvesting areas are available.

The magnitude of this effect is low, since the effect may be detectable at the community-wide level. This effect will occur in the LAA, in the communities where employees live, and will be continuous, long-term, and reversible, since it will likely last only through the Construction and Operation Phases. Based on this characterization, the Project is not likely to result in a significant residual effect on food security. Confidence in this assessment is moderate as the actions of Project employees due to increased income largely depends on individual or family preferences and personal situation.

### 25.5.4 Adverse Effects on Mental Health and Wellness

Despite mitigation measures aimed at on-site mental health support, an adverse Project-related residual effect to mental health and wellness is likely to occur during the Construction and Operation phase due to a change in worker lifestyle because of shift work, and from potential increased substance abuse from stress or increased income. While not all workers will experience this, some workers will experience increased stress due to being away from families and community members for an extended period of time. The magnitude of this effect is low, due to the effectiveness of mitigation measures based experience with other Projects. For example, the Proponent will run a dry camp with a zero-tolerance substance use policy.

This effect will occur in the LAA, in the communities where employees live, and will be continuous, long-term, and reversible, since it will likely last only through the Construction and Operation phases.

Based on this characterization, the Project is not likely to result in a significant residual effect on mental health and wellness. This confidence in this assessment is moderate as the number of proportion of employees affected in this way by the Project is unknown.

### 25.5.5 Increased Pressure on Health Services Structure and Capacity

An adverse effect to mental health services in LAA communities during Construction and Operation due to insufficient services available to support the population increase in LAA communities is predicted to occur as a result of the Project. While health services in the larger LAA communities of Dawson and Whitehorse are currently generally sufficient to meet the needs of the existing population, there is concern that mental health services in the smaller LAA communities of Beaver Creek, Mayo, and Pelly Crossing are not (**Section 22.0 Community Services and Infrastructure Assessment)**. The effect is predicted to be of low magnitude, since existing infrastructure may have sufficient capacity to absorb some increased need. The effect will be continuous, long-term, and fully reversible in duration as it is linked to the Project Construction and Operation workforce. The effect is likely to occur.

Consequently, it is likely that the Project will result in a not significant residual adverse effect on health services structure and capacity. The confidence in this assessment is high due to the understanding of the limitations in the mental health service capacity of LAA communities.

## 25.6 CUMULATIVE EFFECTS ASSESSMENT

Project-related residual effects carried forward into the cumulative assessments include increases in the crime rate and infectious disease rates, as well as adverse effects on mental health and wellness and increased pressure on health services structure and capacity. Projects considered to add to these cumulative effects include Bellekeno, Brewery Creek, Carmacks, Casino, Eagle Gold, Kudz Ze Kayah, MacTung Tungsten Mine, Minto, and Wolverine mines.

Overall, cumulative interactions may occur between residual adverse effects of the Project on mental health and wellness and social cohesion and residual adverse effects on the same subcomponents from other present and future quartz mine projects should they proceed to active mining.

The health determinants of interest (crime, infectious disease, mental health and wellness, health service structure and capacity) are all amenable to additional mitigation strategies if the need arises in the future; however, mental health and wellness requires specific mitigation strategies to address anticipated cumulative effects. For all of these subcomponents, a major aspect of any mitigation strategy is adequate resourcing. The Proponent will work with local communities and governments to participate in implementation of mitigation strategies and programs.

Specific projects and initiatives will be determined by local communities and governments in coordination with the Proponent. Further detail on cumulative effects can be found in **Appendix 25-A Community Health and Well-being Valued Component Assessment**.

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Interview 21, February 17, 2016. Realtor, Coldwell Banker Redwood Realty, Dawson City, Yukon.

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# 26.0 HERITAGE RESOURCES ASSESSMENT

This section presents a high-level summary of the effects assessment for the Heritage Resources Assessment Valued Component (VC). The full effects assessment is presented in **Appendix 26-A Heritage Resources Valued Component Assessment**.

## 26.1 ASSESSMENT SCOPE

Heritage resources are nominated and ultimately selected as a VC due to the potential for the proposed Coffee Gold Mine (Project) to adversely affect archaeological, historical, or paleontological resources. Heritage resources are protected by legislation and are important to First Nations because they demonstrate the long-term use of First Nation traditional territories and provide a physical link to their cultural history. For the purposes of this assessment, Heritage Resources is divided into two subcomponents: archaeological and historical resources, and paleontological resources (**Table 26.1-1**).

**Table 26.1-1 Heritage Resources Subcomponents**

| Subcomponent | Represents | Selection Rationale |
|---|---|---|
| Archaeological and Historical Resources | Remains of past human activity, including pre-contact and post-contact sites older or suspected to be older than 45 years | • Non-renewable resource susceptible to alteration or disturbance<br>• Has importance and value to the scientific, cultural, public, and First Nations communities<br>• Protected by Yukon and First Nation legislation. |
| Paleontological Resources | Remains of a fossil or other object that indicates the existence of extinct or prehistoric plants or animals | • Non-renewable resource susceptible to alteration or disturbance<br>• Has importance and value to the scientific, cultural, public, and local communities<br>• Protected by Yukon First Nation legislation |

The indicators used to describe and evaluate potential effects to Heritage Resources and its subcomponents, and the rationales supporting selection of these indicators, are identified in **Table 26.1-2.**

**Table 26.1-2 Indicators for Heritage Resources Subcomponents**

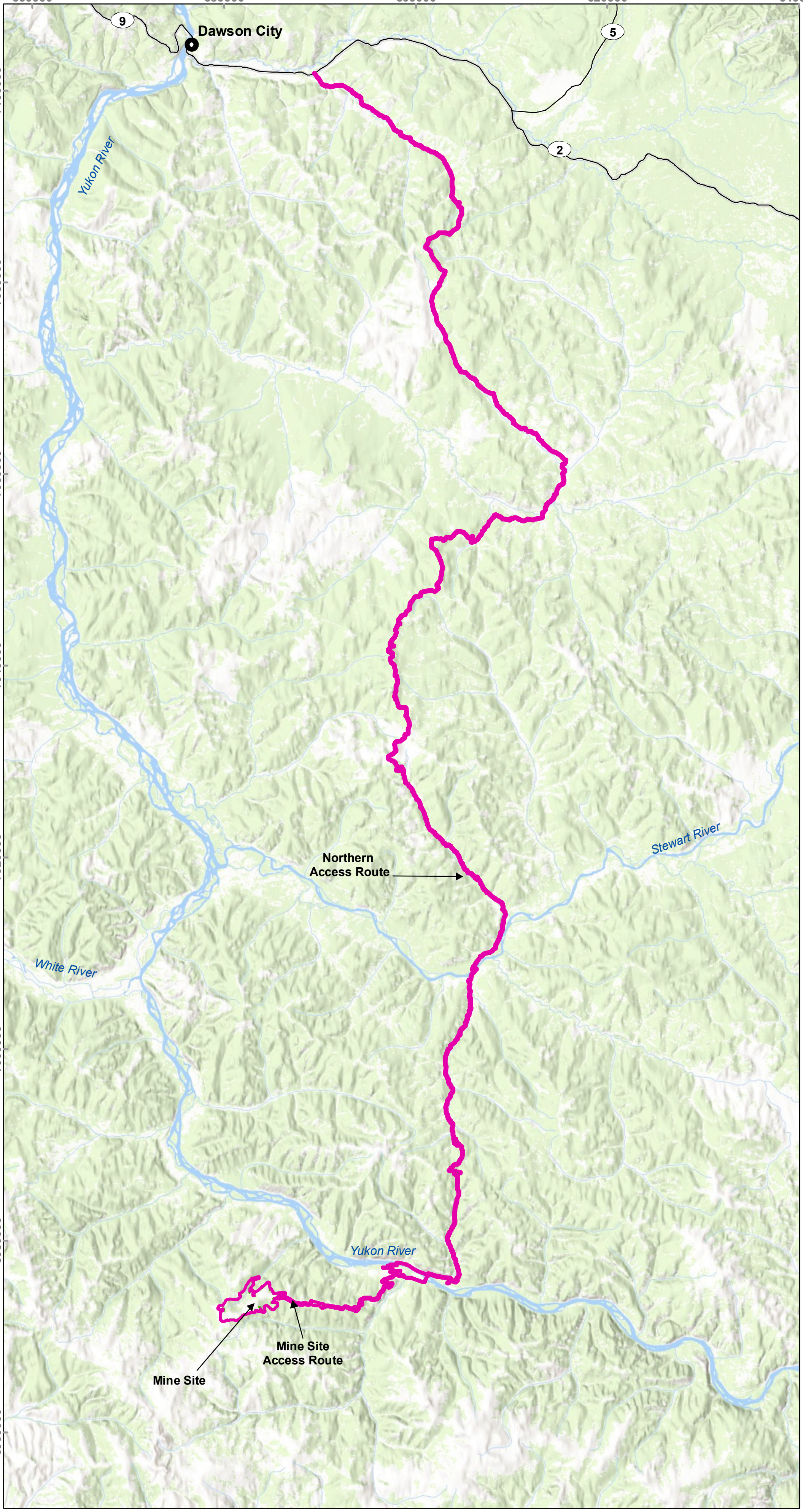
| Indicator | Selection Rationale |
|---|---|
| **Archaeological and Historical Resources** | |
| Number | • Recorded archaeological or historical sites are measurable areas proven to contain archaeological and/or historical objects and features, and are culturally important to First Nations.<br>• Any loss to the number of sites is a measureable adverse effect or change to the VC subcomponent. |
| Integrity | • Recorded archaeological or historical sites are measurable areas proven to contain archaeological and/or historical objects and features, and are culturally important to First Nations.<br>• A loss of the integrity of a site (reduced size, disturbed context, redistribution of material) is a measurable adverse effect or change to the VC subcomponent. |
| **Paleontological Resources** | |
| Number | • Recorded paleontological sites are measurable areas proven to contain paleontological objects and/or features.<br>• Any loss to the number of sites is a measureable adverse effect or change to the VC subcomponent. |
| Integrity | • Recorded paleontological sites are measurable areas proven to contain paleontological objects and/or features.<br>• A loss of the integrity of a site (reduced size, disturbed context, redistribution of material) is a measurable adverse effect or change to the VC subcomponent. |

## 26.2 ASSESSMENT BOUNDARIES

The Local Assessment Area (LAA) is the same as the Project footprint (see **Table 26.2-1** and **Figure 26.2-1**). The Regional Assessment Area (RAA) provides regional context and is considered to be the LAA plus a 200-metre (m) buffer (see **Table 26.2-1** and **Figure 26.2-2**).

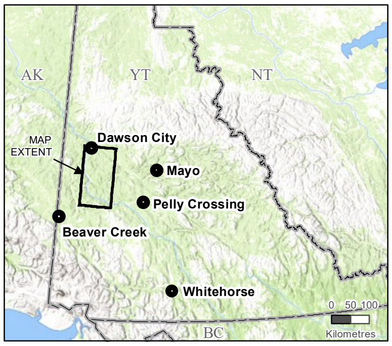
**Table 26.2-1 Assessment Boundary Definitions for Heritage Resources Assessment**

| Spatial Boundary | Description of Assessment Area |
|---|---|
| **Heritage Resources** | |
| Local Assessment Area | The Project footprint: The area in which Project-related ground disturbance and clearing activities will occur, plus a 50-m buffer, including the Mine Site, associated infrastructure, permanent and/or temporary access roads, and the airstrip as shown in Error! Not a valid result for table.. |
| Regional Assessment Area | The RAA is defined as the area encompassing the Project footprint or LAA, as well as a 200 m buffer as shown in **Figure 26.2-2**. |
| Temporal | The temporal characteristics of the Project's Construction, Operation, Closure and Reclamation and Post-closure phases are described in **Section 2.0 Project Description**. The temporal boundaries established for the assessment of Project-related effects on Heritage Resources encompass the Construction and Operation Phases. |




COFFEE GOLD MINE

**Heritage Resources**
**VC Assessment**
**Local Assessment Area**




## Legend

- Highway
- Project Footprint
- Local Assessment Area

## Notes

1. This map is not intended to be a "stand-alone" document, but a visual aid of the information contained within the referenced Report. It is intended to be used in conjunction with the scope of services and limitations described therein.
2. Map Sources: ESRI Topo Base, Geomatics Yukon

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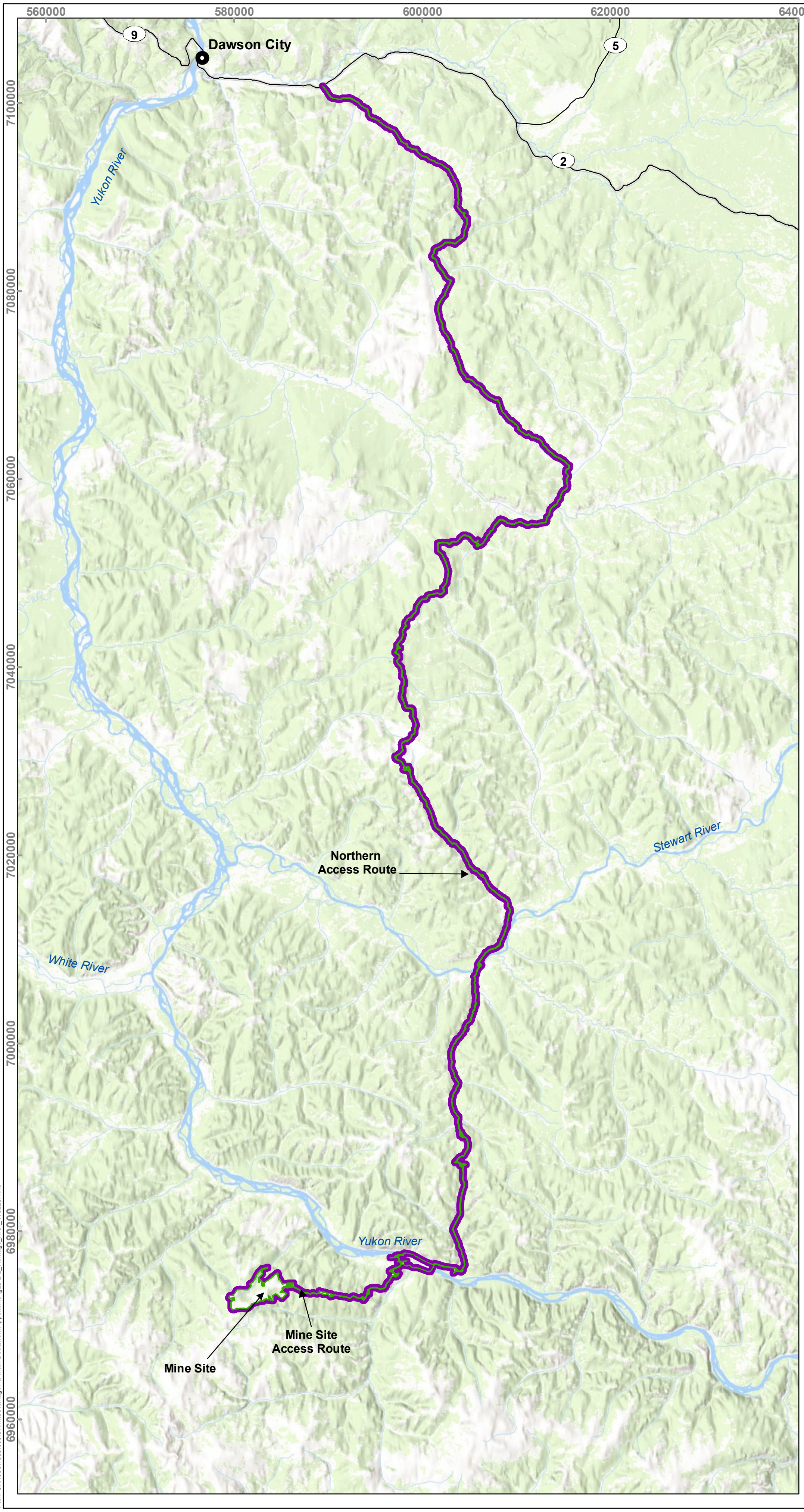
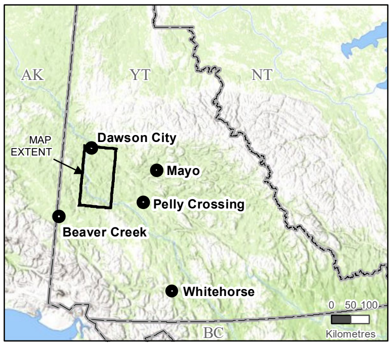
# COFFEE GOLD MINE

## Heritage Resources
## VC Assessment
## Regional Assessment Area




### Legend

- Highway
- Project Footprint
- Regional Assessment Area

### Notes

1. This map is not intended to be a "stand-alone" document, but a visual aid of the information contained within the referenced Report. It is intended to be used in conjunction with the scope of services and limitations described therein.
2. Map Sources: ESRI Topo Base, Geomatics Yukon

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## 26.3 Heritage Resources Assessment Methods

The assessment is based on information presented in **Appendix 26-A Heritage Resources Valued Component Assessment**, **Appendix 26-A1 Heritage Resources Overview Assessment**, **Appendix 26-A2 Heritage Resources Impact Assessment**, **Appendix 26-A3 Heritage Resources Overview Assessment for a Proposed Access Road Corridor**, and the preliminary **Appendix 26-A4 Heritage Resources Impact Assessment for a Proposed Access Road Corridor**. The assessment was informed by available background literature, previous archaeological and historical studies in the area, access to the Yukon Archaeological Sites Database, the Yukon Historic Sites Inventory, and environmental baseline reports for paleontological resource potential.

First Nations Traditional Knowledge (TK) related to the Project area was used to support the identification of areas of archaeological potential to inform the Heritage Resources assessment. The assessment considered the potential for the Project to overlap with or disturb known and potentially unidentified archaeological[15] and paleontological resources.[16]

### 26.3.1 Regulatory Framework

The regulatory context for Heritage Resources includes a number of acts, regulations, and agreements which govern the management and protection of heritage resources in Yukon. Information regarding these laws and agreements is presented in **Appendix 26-A Heritage Resources Valued Component Assessment.**

## 26.4 Existing Conditions

The Project is located within the traditional territories of the Tr'ondëk Hwëch'in First Nation, who are Hän, and the Selkirk First Nation and First Nation of Na-Cho Nyäk Dun who are both Northern Tutchone. In addition, the Project location is within the asserted traditional territory of White River First Nation, who comprise both Northern Tutchone and Upper Tanana people. Related ethnographic and TK sources were reviewed to identify past traditional land uses and historic events that influence the archaeological record (e.g., material culture and seasonal rounds), and provide cultural context for possible archaeological and historic sites in the assessment area. Examination of the ethnography and ethnohistory of the relevant First Nations groups is provided in the Heritage Resources Overview Assessment (HROA) and Heritage Resources Impact Assessment (HRIA) reports (**Appendices 26-A1**, **26-A2**, **26-A3**, and **26-A4**).

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15 Field methods to identify Heritage Resources included aerial survey, pedestrian survey, and subsurface shovel testing. Criteria used to determine potential for Heritage Resources included: proximity to streams and water bodies, known heritage sites, known First Nations or historic trails, topography, vegetation cover, and presence of fish and wildlife habitat as outlined in the Wildlife Key Area maps produced by the Yukon Government Department of Environment.

16 Paleontological resource potential was examined using the Project-specific geology, permafrost, and terrain baseline report (**Appendix 11-A Surficial Geology, Permafrost, and Terrain Stability**).

Previously available information on heritage resources in the LAA is characterized by a lack of detailed ethnographic data, a scarcity of previous heritage studies, as well as a lack of detailed information on environmental and geomorphological processes throughout glacial and post-glacial periods. Records and documents of the archaeology, prehistory, history, ethnology[17], paleoenvironment, and environment of the region (published and unpublished), including a Project-specific TK Database, were reviewed to provide a cultural context for possible archaeological and historical sites in the study area. **Appendix 26-A Heritage Resources Valued Component Assessment** provides a list of studies within or adjacent to the LAA that resulted in the discovery of Heritage Resources (Table 3.2-1) as well as a summary of desktop and field studies related to heritage resources (Table 3.2-2).

### 26.4.1 ARCHAEOLOGICAL AND HISTORICAL RESOURCES

The RAA and LAA possess potential for precontact heritage sites in excess of 10,000 years of age, when the northern portion of the continent was first colonized by people. Some of the earliest known archaeological sites in Yukon are found in the Klondike region. More detail on the natural and cultural histories of the area is provided in the appended HROA and HRIA reports (**Appendices 26-A1**, **26-A2**, **26-A3**, and **26-A4**).

To date, 29 Heritage Resource sites have been identified and recorded within the LAA (**Table 26.2-1**). Five are located within the Mine Site, and were identified during the Preliminary Field Reconnaissance (**Appendix 26-A1**) and the HRIA (**Appendix 26-A2**). These include three prehistoric lithic sites[18], one historical artifact site, and one World War II-era plane wreck. Also, 24 previously recorded archaeological and historical sites, including 6 prehistoric lithic and 18 historical sites, were identified during the 2016 HROA (**Appendix 26-A3**) and preliminary 2016 HRIA (**Appendix 26-A4**) along the Northern Access Route (NAR).

**Table 26.4-1 Known Heritage Resources within the Local Assessment Area**

| Site Number | Project Location | Site Classification[2] | Site Type |
|---|---|---|---|
| KfVj-1 | Mine Site | Historic | Historic artifacts |
| KfVk-1 | Mine Site | Prehistoric | Lithic artifacts |
| KfVk-2 | Mine Site | Prehistoric | Lithic artifacts |
| KfVk-3 | Mine Site | Prehistoric | Lithic artifacts |
| KfVk-4 | Mine Site | Historic | World War II Plane Wreck |
| KfVi-16 | Northern Access Route | Prehistoric | Lithic artifacts and faunal remains |
| KgVi-1 | Northern Access Route | Prehistoric | Lithic artifact |
| KgVj-2 | Northern Access Route | Prehistoric | Lithic artifacts |

17 Anthropological term meaning the study of the characteristics of different peoples and the differences and relationships between them.
18 Location sites showing physical evidence of stone tool production prior to recorded history.

| Site Number | Project Location | Site Classification[2] | Site Type |
|---|---|---|---|
| KjVi-1 | Northern Access Route | Prehistoric | Lithic artifacts and faunal remains |
| KjVj-2 | Northern Access Route | Prehistoric | Lithic artifacts |
| KlVi-6 | Northern Access Route | Prehistoric | Lithic artifacts |
| 115O/02/004 | Northern Access Route | Historic | Building |
| 115O/10/047 | Northern Access Route | Historic | Dredge |
| 115O/10/052 | Northern Access Route | Historic | Cabin |
| 115O/10/053 | Northern Access Route | Historic | Cabin |
| 115O/10/097 | Northern Access Route | Historic | Foundations |
| 115O/10/098 | Northern Access Route | Historic | Collapsed Building |
| 115O/10/099 | Northern Access Route | Historic | Latrines |
| 115O/10/105 | Northern Access Route | Historic | Cabin |
| 115O/10/106 | Northern Access Route | Historic | Cabin |
| 115O/10/108 | Northern Access Route | Historic | Dredge |
| 115O/10/109 | Northern Access Route | Historic | Outhouse |
| 115O/10/110 | Northern Access Route | Historic | Foundation |
| 115O/10/113 | Northern Access Route | Historic | Shed |

**Source**: Appendix 26-A Heritage Resources Valued Component Assessment

[1] The term Historic is used here to be consistent with the Yukon Historic Sites Inventory Site Classification terminology

An additional 13 heritage resources have been identified and previously recorded in the RAA. The majority of these resources (10) consist of industrial structural remains associated with historical placer mining activities, and the remainder are prehistoric lithic sites (3).

Areas of the LAA with moderate to high potential for previously unrecorded heritage sites were inspected through detailed field investigation in the 2011 and 2016 HRIAs described in **Appendix 26-A2** and **Appendix 26-A4**. Previously unrecorded heritage resources (if or where present in the LAA) likely consist of small, short-term camps related to hunting, trapping, or travel activities. Various stages of settlement and use of the Coffee Creek area (Easton et al. 2013, Winton 2012, Bates et al. 2014, Dobrowolsky 2014) by First Nations groups, indicates areas of archaeological and historical potential for associated heritage resources. Further detailed examination of those references and their effect on heritage potential are outlined in the appended HROA and HRIA reports (**Appendices 26-A1**, **26-A2**, **26-A3**, and **26-A4**).

### 26.4.2 PALEONTOLOGICAL RESOURCES

The major creek and river valleys as well as areas of permafrost within the LAA possess potential for the preservation of paleontological resources. While specific Project-related paleontological studies have not been conducted for the Project, approximately 62% of the Mine Site area is underlain by permafrost (**Appendix 11-A Surficial Geology, Permafrost, and Terrain Stability**), and these areas have a higher potential for preservation of Pleistocene-age paleontological resources.

## 26.5 PROJECT INTERACTIONS, POTENTIAL EFFECTS, AND MITIGATION MEASURES

### 26.5.1 POTENTIAL PROJECT INTERACTIONS

Project-related Construction and Operation activities with the potential to alter archaeological, historical, or paleontological resources include clearing and grubbing, site grading, deposition of imported fills, as well as construction-related ground disturbance, including the installation of mine facilities, utilities, support facilities, and access roads (see **Appendix 26-A Heritage Resources Valued Component Assessment**, Table 4.1-2). In each case, the alteration may include damage, disturbance, removal or mixing of sediments, or destruction resulting in an adverse effect to the number or integrity of archaeological, historical, or paleontological resources.

Removal or mixing of sediments containing archaeological or historical deposits during Project Construction and Operation may result in the permanent loss of valuable information that is fundamental to the understanding of these resources, particularly the inter-relationships between individual artifacts and features, their distribution within the landscape, and the context in which they were deposited in the soil.

It is not likely that any of the Project components associated with the Reclamation and Closure or Post-closure Phases will result in further disturbance of heritage resources within the LAA as there will be no additional ground disturbance, clearing, or vegetation removal during these phases. Interactions likely to result in potential effects to heritage resources are discussed further in **Section 26.5.2**.

### 26.5.2 POTENTIAL EFFECTS

The only potential effect to archaeological and historical resources is **alteration**[19] during the Construction and Operation Phases of the Project. The consequence of non-mitigated effects may be permanent loss of heritage resources or changes in the integrity of heritage resources. Specific potential effects include the following:

- The overall Mine Site overlaps with archaeological sites KfVk-1, KfVk-2, and KfVk-3, and historical site KfVk-4 (see **Table 26.4-1**). Consequently, ground-altering activities within the Mine Site footprint may adversely affect the number and integrity of these sites. Due to its location, archaeological site KfVk-1 may also interact with and be adversely affected by staged construction

[19] For the purposes of this assessment, alteration is considered any kind of damage, disturbance, removal, or mixing of sediments, or destruction that affects the number or integrity of any archaeological, historical resource or paleontological resources.

of the Heap Leach Facility (HLF); heap leach pad loading; development and use of Water Management Infrastructure external to the HLF; and ongoing use of Mine Site contact water (i.e., precipitation, stored rainwater) as HLF process water. Construction of the engineered land farm (location to be determined) may also cause adverse effects to Heritage Resources.

- The upgrade, construction, and maintenance of Mine Site service roads and Haul Roads will overlap spatially with two historical sites (KfVj-1, KfVk-4; see **Table 26.4-1**). These sites may be adversely affected as a result of the ground disturbance or clearing associated with these activities.
- The upgrade of existing road sections (177 kilometres (km)) along the NAR will not likely affect existing archaeological site KlVi-6.
- Construction of new road sections (37 km) will overlap with and potentially affect one historical site (KfVj-1) and the following three archaeological sites (see **Table 26.4-1**), which were discovered during the preliminary 2016 HRIA (**Appendix 26-A4**):
    - Site KfVi-16[20] (a Precontact Period First Nations campsite found during shovel testing) – Avoidance of the KfVi-16 site area and 30-m buffer zone is recommended.
    - Site KgVi-1 (a Precontact Period First Nations isolated find of a lithic scraper) – Avoidance of the KgVi-1 site area and 30-m buffer zone is recommended.
    - Site KjVj-2 (a Precontact Period First Nations lithic scatter) – Shovel tests yielded an assemblage of 22 pieces of non-diagnostic lithic debitage[21] (see **Appendix 26-A4**). A 30-m buffer was established around this site, and the proposed road was rerouted into an area of low heritage potential immediately east of the buffered site area. Continued avoidance of the KjVj-2 site area and 30-m buffer zone is recommended.
- The development of quarries for road construction along the NAR will overlap with and potentially affect two archaeological sites (KjVi-1 (prehistoric lithics and faunal remains) and KjVi-2 (prehistoric lithics); see **Table 26.4-1**). Fieldwork in 2017 will revisit these two archaeological sites and confirm whether or not they fall outside the right of way.

#### *26.5.2.1 Paleontological Resources*

The only potential effect to paleontological resources is **alteration**[22] during the Construction and Operation Phases of the Project. Paleontological resources are non-renewable, and are susceptible to alteration by many types of development-related activities. While the effects may occur only once, their duration will be permanent and irreversible. The consequence of non-mitigated effects could be permanent loss of paleontological resources or a change in the integrity of a resource.

Paleontological resource potential was not determined during baseline studies specific to the Project, and there are no known paleontological resources present; however, the potential for development to conflict with as of yet undiscovered paleontological resources must be considered, particularly for any Project-related activities that overlap with areas of permafrost.

20 The site area was flagged in the field with a 30-m avoidance buffer on three accessible sides pending a response from Yukon Heritage.
21 Remains of stone tool production (e.g., stone chips, flakes, and cores).
22 See note 5.

### 26.5.3 MITIGATION MEASURES

Heritage resources are protected from non-permitted alteration by the *Historic Resources Act,* RSY 2002, c. 109, and the Archaeological Sites Regulation (OIC 2003/73). Mitigation measures for heritage resources will be implemented prior to any ground disturbance or clearing activities, following relevant regulatory approvals, Project-specific HRIA reports, and First Nation consultation advice. These mitigation measures are summarized below.

- **Implement Project design measures** to limit the size of the Project footprint; utilize the existing access routes as components of the NAR; reroute the NAR corridor to avoid heritage sites such as Site KjVj-2; and reduce potential alterations to paleontological resources by consolidating the Waste Rock Storage Facilities (WRSFs) at the Alpha WRSF location and using more area that is not perennially frozen.
- **Complete an HRIA** for the NAR and any changes to the final Project footprint, and provide recommendations for site-specific mitigation measures about any newly identified archaeological and historical resources in conflict with proposed ground-disturbing or clearing activities for the Project. Additional field work will be undertaken in 2017 to support preliminary heritage work on the NAR. The scope of this field work will be determined after consultation with the Yukon Heritage Resources Unit, and will include additional stops and shovel testing at areas of archaeological potential and previously disturbed sites.
- **Consult First Nations and regulators** regarding the choice of appropriate mitigation measures for all heritage resource sites that overlap with areas of proposed ground disturbance. This will include consideration of the remaining mitigation measures listed below in order of preference.
- **Avoid known heritage resources** (including archaeological sites KfVk-1, KfVk-2, KfVk-3, KfVi-16, KgVi-1, KjVj-2, and historical site KfVk-4) through Project redesign. Use flagging tape or physical barriers to mark a 30-m buffer around the resources to be avoided. If the site areas and site buffer can be avoided, no further heritage resource assessments are recommended.
- **Conduct systematic data recovery** prior to any potentially ground-altering development activities if heritage resource sites cannot be avoided – conducted under the authority of a *Historic Resources Act* Class 2 permit and in compliance with the *Tr'ondëk Hwëch'in Heritage Act*. A final permit report will be available to First Nations, regulators, and other archaeologists.
- **Implement monitoring plans** during Construction and Operation Phase clearing and ground-disturbance activities, which involve visual inspection by an archaeologist during Construction so that heritage resources can be appropriately managed if encountered. Where monitoring is carried out, final permit reports will be available to First Nations, regulators, and other archaeologists.
- **Implement Project-specific Heritage Resources Protection Plan, including a Chance Find Protocol**, which provides methods for protecting known heritage resources (archaeological, historical, and paleontological), and includes a Chance Find Protocol[23].

[23] The Chance Find Protocol provides those involved in ground-disturbing activities with a framework for identifying cultural materials, and assists in avoiding unforeseen disturbance to heritage resources. The protocol provides descriptive information regarding cultural materials commonly found in the region and those most likely to be encountered in the Project area.

- **Implement site-specific measures for paleontological resources** and follow guidance provided in the *Yukon Mineral Exploration Best Management Practices for Heritage Resources* (Government of Yukon 2010). Refer to **Appendix 26-A Heritage Resources Valued Component Assessment** for a summary of best management practices.

## 26.6 RESIDUAL EFFECTS AND THEIR SIGNIFICANCE

Based on the determination that potential effects to heritage resources will be fully mitigated in accordance with applicable legislation and guidelines, no potential residual or cumulative effects on heritage resources are likely as a result of the Project.

## 26.7 CUMULATIVE EFFECTS ASSESSMENT

Effects on individual heritage resources resulting from the proposed Project will be fully mitigated through avoidance and the application of mitigation procedures following the development of the Heritage Resources Protection Plan, and as required by Yukon legislation such that no residual effects are likely. Other projects in the vicinity of the LAA must also comply with Yukon legislation and relevant First Nations guidance, and must similarly minimize residual effects to Heritage Resources; therefore, the Project is not likely to contribute to residual effects from other projects and activities in a way that would result in adverse cumulative effects, and a cumulative effects assessment is not warranted.

## 26.8 REFERENCES

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Winton, Alexandra. 2012. Coffee Creek Traditional Knowledge Survey - Final Report. Prepared for Tr'ondëk Hwëch'in First Nation.

GOLDCORP INC.

# VOLUME V

## Additional YESAA Requirements

COFFEE GOLD MINE
PROJECT PROPOSAL FOR EXECUTIVE COMMITTEE SCREENING

Pursuant to the *Yukon Environmental and Socio-economic Assessment Act*

March 2017

Document Map

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# ADDITIONAL YESAA REQUIREMENTS

# Coffee Gold Mine
# YESAB Project Proposal

## VOLUME V – ADDITIONAL YESAA REQUIREMENTS
## Sections 27.0 to 34.0

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| Acronym / Abbreviation | Definition |
|---|---|
| 3D | three-dimensional |
| AAQO | Ambient Air Quality Objectives |
| AAQS | Ambient Air Quality Standards |
| ADR | adsorption, desorption, and recovery |
| AFN | Assembly of First Nations |
| Ag | silver |
| Al | aluminum |
| AN | ammonium nitrate |
| ANFO | Ammonium Nitrate/Fuel Oil |
| APS | Aboriginal Persons Survey |
| ARD | acid rock drainage |
| As | arsenic |
| ATV | all-terrain vehicle |
| Au | gold |
| AWOS | Automated Weather Observation System |
| BC | British Columbia |
| BEM | Broad Ecosystem Mapping |
| BMP | best management practice |
| BNOISE2 | Blast Noise Version 2 |
| C | carbon |
| CAC | criterion air contaminant |
| $CACO_3$ | calcium carbonate |
| CAD | Canadian dollars |
| CAPEX | capital expenditure |
| CBPR | community-based participatory research |
| CCL | compacted clay liner |
| CCME | Canadian Council of Ministers of the Environment |
| Cd | cadmium |
| CEA | Cumulative Effects Assessment |
| CEO | Chief Executive Officer |
| CEPA 1999 | *Canadian Environmental Protection Act, 1999* |
| CESA | Cumulative Effects Study Area |
| CFO | Chief Financial Officer |
| $CH_4$ | methane |

| Acronym / Abbreviation | Definition |
|---|---|
| CIC | carbon-in-carbon |
| CIM | Canadian Institute of Mining |
| CMHC | Canada Mortgage and Housing Corporation |
| CNIM | Centre for Northern Innovation in Mining |
| Co | cobalt |
| CO | carbon monoxide |
| $CO_2$ | carbon dioxide |
| $CO_2e$ | carbon dioxide equivalent |
| $CO_2e$/yr | carbon dioxide equivalent per year |
| Code | Environmental Code of Practice for Metal Mines |
| Coffee Property | The total property owned by Goldcorp, consisting of all 3.021 contiguous claims in the Coffee Claim Block |
| COPC | contaminant (or chemical) of potential concern |
| COSEWIC | Committee on the Status of Endangered Wildlife in Canada |
| CPI | Consumer Price Index |
| Cr | chromium |
| CRA | Canada Revenue Agency |
| CRC | Consolidated Regulations of Canada |
| CSI | Crime Severity Index |
| Cu | copper |
| CWD | Canadian Wildlife Service |
| Cyanide Code | International Cyanide Management Code |
| CYFN | Council of Yukon First Nations |
| Dawson | City of Dawson |
| DFO | Fisheries and Oceans Canada |
| DNA | deoxyribonucleic acid |
| DO | dissolved oxygen |
| e-DNA | Environmental DNA |
| EASR | Environmental Activity and Sector Registry |
| ECA | Exploration Cooperation Agreement |
| ECCA | Exploration Communication and Cooperation Agreement |
| EEM | effluent effects monitoring |
| ECCC | Environment and Climate Change Canada |
| ELC | Ecological and Landscape Class |
| EMP | Environmental Management Plan |
| EMR | Energy, Mines and Resources |
| EMS | emergency medical services |
| EP-1N | north event pond |

| Acronym / Abbreviation | Definition |
|---|---|
| EP-1S | south event pond |
| EP-2 | event pond 2 |
| EPCM | Engineering, Procurement, and Construction Management |
| ERP | Emergency Response Plan |
| ERT | emergency response team |
| FCASP | Federal Contaminated Sites Action Plan |
| Fe | iron |
| $Fe^{2+}$ | iron II |
| FC-RAA | Fortymile Caribou Regional Assessment Area |
| FIFO | fly in / fly out |
| FMCH | Fortymile Caribou herd |
| FNNND | First Nation of Na-cho Nyäk Dun |
| FRMP | Forest Resources Management Plan |
| FTA | Federal Transport Authorite (U.S.) |
| FTE | full-time equivalent |
| GCL | geosynthetic clay liner |
| GDP | gross domestic product |
| GHG | greenhouse gas |
| GIS | geographic information system |
| g | gravity |
| GMA | Game Management Area |
| GMZ | Game Management Zone |
| Goldcorp | Kaminak Gold Corporation, a wholly owned subsidiary of Goldcorp Inc. |
| GPS | geographic (or global) positioning system |
| HAP | Health Action Plan |
| HCN | hydrogen cyanide |
| H:V | horizontal to vertical |
| HDPE | high-density polyethylene |
| Hg | mercury |
| HHRA | Human Health Risk Assessment |
| HIA | Health Impact Assessment |
| HIV | human immunodeficiency virus |
| HLF | Heap Leach Facility |
| HR | human resources |
| HRIA | Heritage Resources Impact Assessment |
| HROA | Heritage Resources Overview Assessment |
| HRPP | Heritage Resources Protection Plan |

| Acronym / Abbreviation | Definition |
|---|---|
| HSS | Health and Social Services |
| HVAC | heating ,ventilation, and air conditioning |
| IBA | Impact Benefit Agreement |
| IC | Intermediate Component |
| ICSP | Integrated Community Sustainability Plan |
| IFR | Instrument Flight Rules |
| IMS | ice mapping system |
| IO | input-output |
| IPCC | Intergovernmental Panel on Climate Changte |
| IR | Information Request |
| IRR | Internal Rate of Return |
| ITP | inspection and test plan |
| K | Kindergarten |
| Kaminak | Kaminak Gold Corporation |
| KC-RAA | Klaza Caribou Regional Assessment Area |
| KCH | Klaza Caribou herd |
| KCS | Klondike Conservation Society |
| KDO | Klondike Development Organization. |
| LAA | Local Assessment Area |
| LD50 | amount of an ingested substance that causes 50% fatality |
| LLDPE | linear low-density polyethylene |
| LMB | Land Management Branch |
| LMU | Land Management Unit |
| LNG | liquefied natural gas |
| LOM | life-of-mine |
| LSA | Local Study Area |
| LSCFN | Little Salmon / Carmacks First Nation |
| LTECF | Livingstone Trail Environmental Control Facility |
| M | million |
| MAD | mean annual discharge |
| MBCA | *Migratory Birds Convention Act, 1994* |
| MBR | membrane bioreactor |
| MCC | motor control centre |
| MED | marine emergency duties |
| MIHR | Mining Industry Human Resources (Council) |
| ML | metals leaching |
| ML/ARD | metals leaching/acid rock drainage |

| Acronym / Abbreviation | Definition |
|---|---|
| MMER | Metal Mining Effluent Regulations |
| Mn | manganese |
| $Mn^{2+}$ | manganese II |
| Mo | molybdenum |
| MOE | Ministry of Environment |
| MRT | Mine Rescue Team |
| MT | Middle Transitional |
| N | north |
| $N_2O$ | nitrous oxide |
| NaCN | sodium cyanide |
| NAG | non-acid generating |
| NAICS | North American Industrial Classification System |
| NAR | Northern Access Route |
| NBCC | National Building Code of Canada |
| NE | northeast |
| NFPA | National Fire Protection Association |
| $NH_3$ | ammonia |
| NHS | National Household Survey |
| Ni | nickel |
| $NO_2$ | nitrogen dioxide |
| $NO_3$ | inorganic nitrate |
| $NO_x$ | nitrogen oxides |
| NOC | National Occupational Classification |
| NPAG | non-potentially acid generating |
| NPI | National Pollution Inventory |
| NPISH | Non-profit Institutions Serving Households |
| NPRI | National Pollutant Release Inventory |
| NPV | net present value |
| NRCan | Natural Resources Canada |
| NTS | National Topographic System |
| NW | northwest |
| NWP | Navigable Protection Program |
| NWT | Northwest Territories |
| OCP | Official Community Plan |
| ODALS | Omni-directional Approach Lighting System |
| OGC | Oil and Gas Commission |
| OIC | Order-in-Council |

| Acronym / Abbreviation | Definition |
|---|---|
| OPEX | operational expenditures |
| OX | oxide |
| PAG | potentially acid generating |
| Pb | lead |
| PGA | peak ground acceleration |
| PEA | preliminary economic assessment |
| PGS | peak ground acceleration |
| PHA | Permit Hunt Authorization |
| PLC | programmable logic controller |
| PM | particulate matter |
| $PM_{2.5}$ | fine particulate matter of 2.5 microns or less |
| $PM_{10}$ | fine particulate matter of 10 microns or less |
| PMP | probable maximum precipitation |
| PPE | personal protective equipment |
| Project | proposed Coffee Gold Mine |
| Proponent | Kaminak Gold Corporation, a wholly owned subsidiary of Goldcorp Inc. |
| PSL | permissible sound level |
| PWGSC | Public Works and Government Services Canada |
| PYLL | potential years of life lost |
| Q1 | first quarter |
| Q2 | second quarter |
| Q3 | third quarter |
| Q4 | fourth quarter |
| QA/QC | quality assurance / quality control |
| QMA | *Quartz Mining Act* |
| QML | Quartz Mining Licence |
| QMS | quality management system |
| RAA | Regional Assessment Area |
| RCMP | Royal Canadian Mounted Police |
| ROM | run-of-mine |
| RISC | Resource Inventory Standards Committee |
| RPP | Registered Professional Planner |
| RSA | Regional Study Area |
| RSS | Robert Service School |
| RSY | Revised Statutes of Yukon |
| RTC | Registered Trapping Concession |
| S | south |

| Acronym / Abbreviation | Definition |
|---|---|
| $S^{2-}$ | sulfide |
| SARA | *Species at Risk Act* |
| Sb | antimony |
| SDR | systematic data recovery |
| SE | southeast |
| Se | selenium |
| SEEA | socio-economic effects assessment |
| Sea Can | 20-foot shipping container |
| SEMS | Sustainability Excellence Management System |
| SFN | Selkirk First Nation |
| SGA | Self Governing Agreement |
| SLRA | Screening-level Risk Assessment |
| SI | International System of Units |
| SNAP | Scenarios Network for Alaska and Arctic Planning |
| $SO_2$ | sulphur dioxide |
| $SO_4$ | sulfate |
| SOR | Statutory Orders and Regulations |
| SOVA | School of Visual Arts |
| STI | sexually transmitted infection |
| STP | sewage treatment plant |
| SW | southwest |
| SY | Statutes of Yukon |
| SU1 | Supremo Phase 1 |
| SU2 | Supremo Phase 2 |
| SU3 | Supremo Phase 3 |
| SU3N | Supremo Phase 3 North |
| SU4N | Supremo Phase 4 North |
| SU4S | Supremo Phase 4 South |
| SU5N | Supremo Phase 5 North |
| SU5S | Supremo Phase 5 South |
| T-Cd | Total cadmium |
| T-Cr | Total |
| TB | tuberculosis |
| TDGA | *Transportation of Dangerous Goods Act* |
| TH | Tr’ondëk Hwëch’in |
| TIA | tailings impoundment area |
| TLUS | Traditional Land Use Study |

| Acronym / Abbreviation | Definition |
|---|---|
| TK | Traditional Knowledge |
| TR | technical report |
| TS-RAA | Thinhorn Sheep Regional Assessment Area |
| TSP | total suspended particulate |
| TSS | total suspended solids |
| TWG | Technical Working Group |
| U | uranium |
| UFA | Umbrella Final Agreement |
| UNESCO | United Nations Educational, Scientific, and Cultural Organization |
| U.S. | United States |
| USGS | United States Geological Survey |
| UT | Upper Transitional |
| UTM | Universal Transverse Mercator |
| UV | ultraviolet |
| VBY | Volunteer Bénévoles Yukon |
| VC | Valued Component |
| VKT | vehicle kilometres travelled |
| VLP | valley leach pad |
| VOC | volatile organic compound |
| VP | Vice President |
| WBM | water balance model |
| WGH | Whitehorse General Hospital |
| WHO | World Health Organization |
| WQG | water quality guidelines |
| WRFN | White River First Nation |
| WRSF | Waste Rock Storage Facility |
| WSC | Water Survey of Canada |
| WUL | Water Use Licence |
| YBS | Yukon Bureau of Statistics |
| YDA | Dawson City Airport |
| YEC | Yukon Energy Corporation |
| YESAA | *Yukon Environmental and Socio-economic Assessment Act* |
| YESAB | Yukon Environmental and Socio-economic Assessment Board |
| YG | Government of Yukon |
| YGED | Yukon Government Economic Development |
| YHC | Yukon Housing Corporation |
| YOMS | Yukon Occupational Modelling System |

| Acronym / Abbreviation | Definition |
|---|---|
| YT-24 | Yukon Tributary 24 (unnamed tributary) |
| YWB | Yukon Water Board |
| YWCHSB | Yukon Workers Compensation Health and Safety Board |
| YXY | Eric Nielsen Whitehorse Airport |
| Zn | zinc |

## SYMBOLS, AND MEASUREMENTS

| Symbol/Unit of Measure | Definition |
|---|---|
| µ | microgram |
| µg/g ww | micrograms per gram wet weight |
| µg/L | micrograms per litre |
| µS/cm | micro Siemens per centimetre |
| dB | decibel |
| dBA | A-weighted decibel |
| dBL | linear (unweighted) decibel |
| ft. | feet |
| g | gram |
| g/L | grams per litre |
| g/t | grams per tonne |
| ha | hectare |
| hr | hour |
| Hz | Herz |
| kg | kilogram |
| km | kilometre |
| km/hr | kilometres per hour |
| $km^2$ | square kilometres |
| kPA | kilopascal |
| kt | kilotonne |
| kW | kilowatt |
| L | litre |
| $L_{eq}$ | energy-averaged, A-weighted sound level for a complete time period |
| $L_P$ | Sound pressure level |
| $L_{peak}$ | maximum value reached by the sound pressure |
| L/s | litres per second |
| $L/s/km^2$ | litres per second per square kilometre |
| $L_W$ | sound power level |

| Symbol/Unit of Measure | Definition |
|---|---|
| m | metre |
| $m^2$ | square metre |
| $m^3$ | cubic metre |
| $m^3$/day | cubic metres per day |
| $m^3$/hr | cubic metres per hour |
| $m^3$/s | cubic metres per second |
| M | million |
| masl | metres above sea level |
| mg | milligram |
| mg/km | milligrams per kilometre |
| mg/L | milligrams per litre |
| ML | million litres |
| mm | millimetre |
| mm/yr | millimetres per year |
| $Mm^3$ | million cubic metres |
| M oz. | million ounces |
| Mt | million tonnes |
| Mt/a | million tonnes per annum |
| MW | megawatt |
| No. | number |
| oz. | ounce |
| ppb | parts per billion |
| ppm | parts per million |
| s | second |
| sq. mil. | square mile |
| t | tonnes |
| tpd | tonnes per day |
| V | volt |

# 27.0 EFFECTS OF THE ENVIRONMENT ON THE PROJECT

This section assesses the potential effects of the environment on the proposed Coffee Gold Mine (Project) and the consequences of those environmental conditions on Project components and activities. The assessment includes a description of critical site conditions and operational timing sensitivities, as well as consideration of the relative severity of the potential consequences.

The *Yukon Environment and Socio-economic Assessment Act*, SC 2003, c. 7, requires proponents to consider the significance of any environmental or socio-economic effects of a project that may occur in or outside Yukon. The Yukon Environment and Socio-economic Assessment Board (YESAB) *Proponents Guide to Information Requirements for Executive Committee Project Proposal Submissions* (YESAB 2005) recommends proponents to characterize the potential for effects of the environment on a project, including terrain hazards, terrain instability, seismic activity, inclement weather, and climate change. This guidance also requires a proponent to describe any critical site conditions that may affect the timing of operations, and describe the manner in which environmental conditions may affect this timing.

## 27.1 APPROACH

As part of the early design of the Project, the Project study team considered regulatory standards and physical elements of the environment in the site plan and component design where possible. These considerations led to the development of avoidance, minimization, and mitigation measures that have been incorporated into the Project's design to avoid or minimize potential effects. These measures are included as part of the Project Description (**Section 2.0 Project Description**), and the potential effects of the environment are assessed after the implementation of these design factors. The effects consideration therefore takes into account the environmental protection afforded by each design feature. The proposed mitigation measures are considered after initial conclusions are made following an evaluation of the potential Project-related effects based on the Project's design.

The approach to assessing the potential effects of the environment on the Project is to characterize the environmental conditions with the potential to adversely affect the Project. The following environmental conditions were identified through professional experience and engagement with First Nations and regulatory agencies:

- Extreme weather conditions
- Flood events
- Permafrost
- Terrain and geohazards
- Seismic activity
- Wildfire
- Climate change.

### 27.1.1 Mitigation by Design

Several Project design changes were implemented to avoid or mitigate environmental effects to the Project throughout the Project's planning and feasibility study stages. These changes include trade-off and alternative studies conducted to identify risks associated with the various alternatives considered in Project design (**Section 2.10**). Additional Project design changes are described below. A summary of all the Project design measures committed to by Kaminak Gold Corp., a wholly owned subsidiary of Goldcorp Inc. (Goldcorp or Proponent) is provided in **Section 32.0 Project Design Measures and Commitments**.

As described in **Section 2.10**, the Proponent made the shift from the original design of a valley fill leach pad with a large in-heap impoundment to a conventional free-draining heap leach pad on the ridgetop. This change eliminates the risks associated with a large dam, more complex operations, and closure objectives (e.g., not being amenable to progressive reclamation). As construction of the heap leach pad progresses, the overall volume of precipitation captured in the Heap Leach Facility (HLF) will increase and generate a surplus of water within the heap leach system. To avoid a large surplus of water and the associated need for treatment and discharge, temporary geomembrane covers (or raincoats) will be positioned over the heap in Year 3 (**Section 2.3.5.4 Raincoat Covers**). The deployment of raincoats will reduce the volume of atmospheric water entering the heap leach process.

Other Project Design measures intended to mitigate the effects of the environment on the Project include:

- Heap leach liner system exceeds industry standards and Yukon Government design criteria.
- Selection of sites for major infrastructure will avoid geohazards, terrain, and flooding risk.
- Water management:
  - Watercourse crossings exceed design hydraulic capacity (i.e., 1-in-200-year flood), wherever possible.
  - Diversion channels and drainage ditches are designed for a peak flow rate of a 1-in-100-year, 24-hour precipitation event.
  - Alpha pond is designed for 100-year freshet volume with a pump-back capacity of 5,000 gallon-per-minute, 24-hour storm event runoff volume for up to 48 hours and average daily snowmelt for approximately 12 hours.
  - Facility pond is designed for sediment control and will accommodate the peak flow generated by a 10-year, 24-hour storm event with 48 hours of retention time to allow for TSS reduction.
  - Rock underdrain developed beneath the Alpha WRSF to convey runoff from the upper Halfway Creek catchment, meteoric infiltration and groundwater discharge to the Alpha Pond. The underdrain is designed to accommodate the 100-year, 24-hour storm event, including snowmelt with capacity of up to two times the calculated runoff peak quantity.
  - Emergency spillways are designed to convey the 200-year peak flow generated by a 24-hour storm event with average snowmelt conditions.

- Permafrost management:
  - Building on permafrost will be avoided wherever possible.
  - Permafrost and thaw-unstable soils will be removed wherever necessary from the footprints of all major infrastructure components.
  - The first lift of each Waste Rock Storage Facility (WRSF) will be placed during the winter months so that permafrost soils will remain frozen to provide foundation for the WRSFs.
  - Special geotechnical considerations will be incorporated during design of Northern Access Route (NAR) to prevent erosion and mass wasting due to changes in permafrost.
- Extreme weather management:
  - Operational restrictions include the suspension of crushing and heap leach stacking during periods of adverse cold (typically January through March).
  - At least 3.5 million tonnes of ore will be loaded to the heap leach pad in Year –1 to maintain thermal integrity.
  - HLF design measures include burying drip lines to a depth of at least 1 m before winter, use of geomembrane liners, barren solution heating in the coldest months, and a back-up irrigation area in case the primary irrigation area freezes.
  - Heap leach event ponds are designed to higher criteria than standard practice as to reduce risk associated with storm events. The event ponds are designed to contain the cumulative amount of the probable maximum precipitation event, a 72-hour full-pumping drain-down, and maintain a minimum 1m freeboard.
- Progressive reclamation and closure of key infrastructure including the HLF:
  - Progressive reclamation and closure will begin as soon as mining is completed at the various Open Pits, and will continue throughout the mine life.
  - The heap leach pad will be constructed in three stages, separated into cells and closed progressively as each cell is completed, commencing in Year 4. Final closure design will allow for the heap leach pad to transition to passive management.

### 27.1.2 Environmental and Safety Regulatory Standards

The Project has been designed to withstand potential environmental effects in a manner that is consistent with best available technologies and current regulations, codes, and standards (see **Section 2.0 Project Description** and **Section 2.10**). **Table 27.1-1** lists key design standards and codes that have been incorporated in the Project.

**Table 27.1-1 Key Design Standards, Guidelines, and Codes Incorporated into Project Design**

| Design Standard | Source or Regulating Body | Relevance |
|---|---|---|
| Plan Requirements Guidance for Quartz Mining Projects | Energy, Mines and Resources and Yukon Water Board 2013a | Provides overall guidance for the expectations of the development, operational, and closure plans for a Mine Site in Yukon. |
| Reclamation and Closure Planning for Quartz Mining Projects | Energy, Mines and Resources and Yukon Water Board 2013b | Describes the expectations, principles, and context for mine reclamation and closure planning in Yukon. |
| National Fire Code of Canada | National Research Council Canada 2015a | Establishes the technical provisions related to the design, construction, use, or demolition of buildings or facilities with respect to hazardous and flammable materials. |
| National Fire Protection Association Codes and Standards | National Fire Protection Association 2016 | These codes describe the provisions for the prevention of death, injury, and property or economic loss due to fire, electrical or related hazards. |
| National Building Code of Canada (NBCC) | National Research Council Canada 2015b | Provides technical provisions for the design and construction of new buildings and for changes in use and demolition of existing structures. |
| Canadian Electrical Code | Canadian Standards Association 2016 | Establishes system that is intended to protect installers, regulators, consumers, and their families safe from harm, and provides a set of individual standards for the installation and use of electrical equipment and components. |
| Dam Safety Guidelines 2007 (Revised 2013) | Canadian Dam Association 2013 | Establishes principles, guidance, and good practices for the compliance of dams to ensure long-term safety. |
| BC Mined Rock and Overburden Pile Minimum Factor of Safety Guidelines | BC Mine Waste Rock Pile Research Committee 1991 | Provides guidance for standardized approaches to pre-design investigation and design considerations for development of waste rock and overburden structures. |
| Geosynthetics Institute: GM-3, GM-9, GM-17, GM-19, GCL-5 | Geosynthetics Institute n.d. | Produces guidance documents for the specifications and testing standards for geosynthetic clay liners, linear low-density polyethylene, and geomembranes. |
| US Environmental Protection Agency (EPA): Background Document on Proposed Liner and Leak Detection Rule EPA 530/SW-87-015, Action Leakage Rates for Leak Detection Systems EPA 530-R-92-004,<br>The Electrical Leak Location Method for Geomembranes EPA 600/2-88/035,<br>Final Rule on Liners and Leak Detection Systems EPA 530-SW-91-088 | US EPA 2012 | Provides summary documents of the requirements for liner and leak detection systems. These documents provide descriptions of the factors that may affect the performance of various liner systems and the expected capabilities of liner and leak detection systems to protect the environment. |
| American Society for Testing and Materials (ASTM): D7002, D7007, D7703 (for liner integrity surfaces, also known as electrical leak location surveys to ensured installed quality) | ASTM International 2016 | Provides practical performance-based standards for electrical leak detection systems (puddle method, water lance method) for exposed and covered geomembranes. |

## 27.2 EXTREME WEATHER CONDITIONS

For the purposes of this assessment, extreme weather events are defined as events of unusual, severe, or unseasonal weather at the extremes of the typical historical distribution. The following extreme weather events are discussed in this section:

- Extreme temperatures
- Extreme precipitation (rain and snow)
- Extreme drought.

The prevailing climate conditions for the Project are typical for central Yukon (**Appendix 8-A Hydro-meteorology Baseline Report**). At the Mine Site, the average annual temperature is – 2.6 degrees Celcius (° C), with average monthly mean air temperatures ranging from –19° C in December to +13° C in July. The minimum temperature recorded at the Coffee Creek meteorological station is –37.6° C (January 28, 2013) and the maximum recorded temperature is 27.2° C (June 25, 2013). Locally, the Mine Site experiences notable temperature inversions during winter months, with ridgetop temperatures being up to 10° C higher than temperatures recorded in valley bottoms. Similar temperatures, representative of regional climate normal, are assumed along the NAR. Existing research suggests that the timing and phase of climate cycles such as La Niña/El Niño, Pacific Decadal Oscillation, and Artic Oscillation have strong influences on climate in central Yukon. As discussed further in **Section 27.8**, the climate model predicts that average temperatures at the Mine Site will likely to increase by 3° C to 5° C by the year 2100.

Mean annual precipitation at the Mine Site (approximately 1,300 m above sea level (masl)) is estimated to be 485 millimetres (mm) with 65 percent (%) of the total precipitation falling as rain from May through September, and the remaining 35% falling as snow from October through April. The months of June, July, and August exhibit the largest one-day-return precipitation events. The maximum precipitation measured at the Mine Site was 101.9 mm in July and the minimum precipitation seen was 13.5 mm in April. Although site-specific data are not available for the NAR, the regional meteorology station located at Coffee Creek is assumed to provide representative regional information for both the Mine Site and the NAR.

At the Mine Site, winter snowfall maximum precipitation depths occurred in the months of January (12.7 mm) and February (11.9 mm). The estimated return intervals and predicted annual precipitation for dry and wet years at the Mine Site are included in **Table 27.2-1**. Further detail is provided in **Appendix 8-A Hydro-meteorology Baseline Report**.

**Table 27.2-1 Annual Precipitation Recurrence Interval**

| Weather Extreme | Recurrence Interval | Annual Precipitation (mm) |
|---|---|---|
| Dry Year | 1:200 | 285 |
| | 1:100 | 300 |
| | 1:50 | 318 |
| | 1:25 | 338 |
| | 1:10 | 372 |
| Median | 1:2 | 479 |
| Wet Year | 1:10 | 613 |
| | 1:25 | 667 |
| | 1:50 | 702 |
| | 1:100 | 734 |
| | 1:200 | 762 |

**Source:** Appendix 8-A Hydro-meteorology Baseline Report

### 27.2.1 Potential Effects of Extreme Weather Conditions

This section presents information on the potential effects on the Project from extreme weather conditions, including extreme temperatures, extreme precipitation, and extreme drought. Measures to mitigate the potential effects from extreme weather conditions are also identified in this section.

#### *27.2.1.1 Extreme Temperatures*

To determine design parameters for Project components under extreme temperatures, the Proponent developed thermodynamic models to factor various temperatures into multiple operational scenarios (**Section 2.11**). The models factored in mean monthly temperatures ranging from –22.5 ° C in the winter to 13.6 ° C in the summer.

Given the climatic setting of the Project area, effects on the Project likely arise primarily from extremely cold air temperatures. These extreme temperatures may affect workers, infrastructure, or machinery. Extremely low air temperatures could adversely affect workers' health, causing frostbite and hypothermia. Workers can also become distracted and prone to accidents under extreme low temperatures. Equipment and machinery is more likely to malfunction or become damaged during extreme low temperatures, increasing the potential for worker-related exposure and accidents. In addition, extreme low temperatures may be accompanied by blowing snow, which could affect surface transport of materials and personnel, and could temporarily slow mine operations. Increased heating requirements on site would result from extreme low temperatures, thus increasing power demand. Extended cold spells could also result in a prolonged winter and increased snow accumulation; therefore, Project infrastructure may require more frequent maintenance. Extreme low temperatures could also increase the risk of pipelines freezing and frost heave forming on pit walls and road cuts.

As discussed in **Section 2.11**, the Proponent has completed extensive modelling and research in selecting a heap leach technology that is best suited to operation in cold northern climates. The Proponent focused the cold weather modelling on the HLF because this component is the most sensitive and most at-risk to freezing in cold northern climates. Thermodynamic modelling of the HLF indicated that it is sensitive to extreme cold temperatures. Freezing in the HLF or portions of the HLF would limit production of gold doré during the entire time the HLF is frozen, and may have implications for solution containment during spring thaw and in subsequent years due to freeze-thaw action on geomembranes. The thermodynamic modelling allowed the identification of risks of cold northern climates to operation activities and identify mitigations to avoid freezing in the HLF.

Extreme warm weather, though unlikely given the climatic setting of the Project, could also affect worker health, infrastructure, and machinery. Extremely high air temperatures may adversely affect workers' health, potentially causing heat exhaustion, dehydration, and heat stroke. Workers can become distracted and more prone to accidents under extreme high temperatures. In addition, with sustained warm air temperatures, more precipitation would fall as rain than as snow, and earlier melting of the snow-pack could cause increases in runoff during the late winter and early spring. Storms where precipitation falls as rain rather than snow could cause more rapid runoff, potentially increasing the erosive capabilities of surface flows (discussed in **Section 27.3**). Extremely high temperatures coinciding with dry periods could increase the likelihood of wildfires occurring in the area (discussed in **Section 27.7**).

The potential effects on the Project associated with extreme temperatures, extreme precipitation, and extreme drought, along with the respective mitigation measures are described in **Table 27.2-2**.

#### *27.2.1.2 Extreme Precipitation*

A detailed analysis of long-term precipitation records available from Environment Canada's regional climate networks and the resulting estimates of frequency-duration storm magnitude were calculated in accordance with the National Ocean and Atmospheric Administration methods for 24-hour, 2-day, 3-day, 10-day, and 30-day maximum precipitation events for the Mine Site (NOAA 2012). Detailed methods and precipitation frequency analysis calculations are provided in **Appendix 8-A Hydro-meteorology Baseline Report**. Two patterns appeared in the data from Environment Canada and National Ocean and Atmospheric Administration: a strong west-east extreme precipitation gradient, where precipitation estimates were high west of the Coffee property and lower east of the property, and a general increase in precipitation with increases in elevation. Similar conditions are assumed to exist at the NAR.

Detailed methods and calculation for the 24-hour probable maximum precipitation events are provided in **Appendix 8-A Hydro-meteorology Baseline Report**. Estimates derived from the regional climate stations were used to predict a probable maximum precipitation of 280 mm in any 24-hour period at the Mine Site. High-magnitude rain and snow events are relatively infrequent in the Project area; however, prolonged wet weather in Project catchments could trigger flooding events, especially if they coincide with periods of peak snowmelt. Prolonged wet weather could result in an increase in erosion near roads and infrastructure and in sediment delivered to streams. Precipitation-related effects could include damage to buildings, site infrastructure, and roads.

Snow, sleet, or hail could also affect infrastructure. Prolonged precipitation in solid forms may damage building roofs and other infrastructure. Similar infrastructure damage could occur during winter warm temperature cycles. These warm temperature cycles can act to increase the density of snow, and therefore increase the force on roofs, anchoring cables, covered walkways, etc. Greater potential for large snowfall amounts during the winter could also result in periods of high snow accumulation on roads. In addition, heavy precipitation events could lead to road damage and/or erosion. Increased maintenance could be required to access various Project locations in winter and maintain road integrity.

During typical rainfall periods, there would be little effect to Project operation (**Table 27.2-3**). If rainfall intensity increases beyond historic norms, there may be increased disruption in Project construction and operation, including reduced speed of traffic along Haul Roads and access roads. Severe rainstorms in the Project could trigger flooding events, especially if they were to coincide with freshet conditions. Thunderstorms may also be accompanied by hail, lightning, and damaging winds. Large hail could damage building infrastructure, cause temporary blockages of diversion channels, and create unsafe working conditions. High-velocity winds related to thunderstorms could damage infrastructure. Lightning could cause forest fires (wildfires are discussed in **Section 27.7**) under dry conditions, or could damage infrastructure. Thunderstorms within the region could also temporarily suspend air traffic, disrupting the mobilization of personnel to and from the Project area. Storms may also cause floods and increase geohazard risk; these effects are discussed in **Section 27.3** and **Section 27.5,** respectively.

#### *27.2.1.3 Extreme Drought*

An extreme lack of precipitation can result in adverse implications for the Project, such as a reduced ability to continue to irrigate the heap, reduced dust suppression, and increased risk of wildfires (**Section 27.7**). The potential effects of drought on the Project and the applicable mitigation measures are provided in **Table 27.2-4**. The potential effects identified below are considered worst-case effects, as the potential effects considered likely are expected to be effectively managed through mitigation by Project design (**Section 2.0 Project Description**, **Section 27.1.1**, and **27.2.2**).

### 27.2.2 EXTREME WEATHER CONDITIONS MITIGATION MEASURES

The Project has been designed to accommodate extreme weather events and prevent potential effects associated with high precipitation and extreme temperatures. Additional mitigation measures with respect to Project components are described above in **Table 27.2-2**, **Table 27.2-3**, and **Table 27.2-4**. In addition to mitigation measures described above, the Proponent will develop and implement an **Erosion and**

**Sediment Control Plan** (**Section 31.0 Environmental and Socio-economic Management Program**) to prevent erosion effects from large precipitation events. To accommodate periods of drought, the Project has been designed to incorporate measures to conserve, store, and recycle process and mine contact water for use during low-precipitation periods. The design of the Project also includes considerations for extreme cold temperatures as described in **Section 2.11**.

To mitigate against damage to infrastructure or personnel because of extreme weather, weather forecasts will be monitored for advanced warning of inclement weather. Health and safety policies will be implemented, and risk assessments will be undertaken before personnel begin working in adverse weather conditions. Staff will be educated through formal training programs to ensure they understand the risks of working under extreme high or low temperatures, and to ensure they have good knowledge of the related procedures. Daily job safety analyses will also be conducted. Personnel will be required to wear appropriate personal protective equipment, including cold-weather gear, while working outside. Radio communication will be maintained with anyone working away from the Project area.

Suitable equipment and design systems will be purchased and implemented for the Project to enable operation under extreme temperatures. Equipment will be maintained to ensure reliable operation. Potentially vulnerable infrastructure will be built to withstand extreme temperatures. To help mitigate the effects on mine infrastructure from any damage caused by high precipitation, building and distribution materials will be stored on site to facilitate timely repairs and reconstruction.

#### 27.2.3 Summary of Effects of Extreme Weather Conditions

As described in **Section 2.7.1** and **Section 2.11** the Project has been designed to accommodate the cold temperatures of the central Yukon, and therefore potential effects are not likely. The likely- and worst-case potential effects on the Project associated with extreme temperatures, extreme precipitation, and extreme drought and the respective mitigation measures are described in **Table 27.2-2**, **Table 27.2-3**, and **Table 27.2-4**, respectively.

**Table 27.2-2 Potential Effects of Extreme Cold on the Project and Mitigation Measures and Management Plans**

| Project Components | Range of Potential Effects | | Project Design and Mitigation Measures | Management Plans* |
|---|---|---|---|---|
| | Likely Scenario | Worst-case Scenario | | |
| Open Pits | N/A | Ice jacking of pit walls | Incorporated into Project design | • **Waste Rock and Overburden Management Plan (Appendix 31-D)** |
| Waste Rock Storage Facilities<br>Stockpiles | Negligible water accumulation in WRSF due to partial freezing of flow-through drains. | Major water and or ice accumulation in WRSF due to flow-through drains and underdrain freezing resulting in a reduction of WRSF stability. | • Project Design: Design of drainage channel capacity to accommodate predicted volumes of spring thaw and freshet. Thermal modeling of flow-through drains. WRSF designed for high permeability and transmissivity throughout the facility to create necessary flow requirement to avoid pore pressure development.<br>• Localized areas of the drain may freeze during the winter as groundwater seeps into the channel, but this ice will melt during freshet flows. The drains are designed to accommodate up to 2 times the 100-year, 24-hour flow and also, due to the perviousness of the waste rock dump, it is unlikely that ice could form and block flow entirely. | |

| Project Components | Range of Potential Effects | | Project Design and Mitigation Measures | Management Plans* |
|---|---|---|---|---|
| | Likely Scenario | Worst-case Scenario | | |
| Heap Leach Facility | Early suspension of HLF stacking. HLF still operational. | Partial or complete freeze of HLF and distribution system. Shutdown of HLF. | • To prevent freezing the pregnant, barren, and rinse pipelines will be buried a minimum of 1 m below grade.<br>• To prevent freezing, barren solution will be heated seasonally prior to irrigation.<br>• Stacking will be suspended seasonally as ambient air temperatures reach critical temperature.<br>• Seasonally stockpiled ore will be stored as coarse run-of-mine ore to allow the ore to be brought up to ambient temperature through handling and crushing during stockpile reclaim.<br>• Drip emitters applying barren solution to the heap will be covered with at least 1 m of ore to reduce freezing potential.<br>• At the end of Year 1, the installed drip area will be doubled before the onset of winter to allow for backup piping if the primary area freezes.<br>• Should zones of freezing develop near the exterior of the heap, a slow and deliberate application of heated barren solution at a rate slow enough to allow thawing without creating ponds on the heap would return the HLF to normal operations.<br>• If the HLF freezes completely, all distribution of solutions to the HLF will be suspended until monitoring after spring thaw demonstrates no loss of integrity of the complete system. Any damage caused by freezing will be repaired prior to re-initializing the HLF.<br>• In a temporary shutdown situation, all reagent and chemical storage would be secured, tanks, pipes and pumps would be drained to prevent freezing. | • **Heap Leach and Process Facilities Plan** |
| Plant Site | Partial freezing of one or more pipes. | Freezing of multiple pipes leading to shutdown. | • Return pipes will be buried and/or insulated. | |

| Project Components | Range of Potential Effects | | Project Design and Mitigation Measures | Management Plans* |
|---|---|---|---|---|
| | Likely Scenario | Worst-case Scenario | | |
| Bulk Explosive Storage Area<br>Camp Site | Cold-related damage to infrastructure and equipment. Freezing or extreme heat conditions for staff. | Cold-related damage to infrastructure and equipment. Freezing or extreme heat conditions for staff. | • Regular maintenance and snow removal.<br>• Adherence to Yukon *Occupational Health and Safety Act*. | • **Mine Development and Operations Plan** |
| Site Roads and Haul Roads<br>Airstrip<br>Northern Access Route | Icing or extended period of snow cover. Delays in transportation of goods, supplies and personnel to, from, and within the Project. | Freeze-thaw damage to roads. Roads become impassable due to snow. Delays in transportation of goods, supplies and personnel to, from, and within the Project. | • Regular monitoring and maintenance of transportation infrastructure, and snow removal.<br>• In the event of severe damage to the NAR requiring temporary closure for repairs, the mine plan accommodates this closure with storage of up to 10 weeks of Mine Site supplies, and supplementary delivery of supplies through air transportation. | • **Access Route Construction Management Plan (Appendix 31-A)**<br>• **Access Route Operational Management Plan (Appendix 31-B)**<br>• **Mine Development and Operations Plan** |

**Note:** * For descriptions of management plans please refer to **Section 31.0 Environmental and Socio-economic Management Program.** Definitions: ice jacking – occurs when water enters a confined space in a structural support or geologic formation, and upon freezing causes structural fractures as the ice expands.

**Table 27.2-3 Potential Effects of Extreme Precipitation Events on the Project, Mitigation Measures, and Management Plans**

| Project Components | Range of Potential Effects | | Project Design and Mitigation Measures | Management Plans* |
|---|---|---|---|---|
| | Likely Scenario | Worst-case Scenario | | |
| Open Pits | Minor erosion of road berms or pit infrastructure due to extreme precipitation events. | Extreme precipitation events can lead to erosion of materials resulting in potential instability. | • Active monitoring of stability.<br>• Diversion channels and drainage ditches designed convey water away from the Open Pits.<br>• Pit dewatering using flood pumps. | • **Mine Development and Operations Plan**<br>• **Erosion and Sediment Control Plan** |
| Waste Rock Storage Facilities<br>Stockpiles | Minor erosion of embankments due to extreme precipitation events. | Extreme precipitation events can lead to increased erosion of materials resulting in deposition of sediments in receiving watercourses and potential instability of WRSFs. | • Diversion channels, and drainage ditches design capacity for peak flow rate following a 100-year, 24-hour precipitation event.<br>• Flow-through drain design capacity for up to four times the flow from a 100-year 24-hour precipitation event.<br>• The underdrain is designed to accommodate the 100-year, 24-hour storm event, including snowmelt with capacity of up to two times the calculated runoff peak quantity. | • **Waste Rock and Overburden Management Plan (Appendix 31-D)**<br>• **Erosion and Sediment Control Plan** |
| Heap Leach Facility | Minor erosion of the heap due to extreme precipitation events. Additional water infiltrating the HLF will be captured in event ponds from Year –1 to Year 3 (installation of raincoat). | Extreme precipitation events can lead to higher volumes of atmospheric water infiltrating the heap and being captured in event ponds. | • Installation of raincoat to reduce precipitation volumes entering the heap<br>• Event ponds capable of storing all contact water produced by multiple, back-to-back, 200-year precipitation events (designed to probable maximum precipitation) and the 72-hour full pumping drain-down of the HLF. | • **Heap Leach and Process Facilities Plan**<br>• **Erosion and Sediment Control Plan** |
| Plant Site<br>Bulk Explosive Storage Area<br>Camp Site | Minor erosion surrounding Process Plant buildings and facilities during extreme precipitation events. Monitoring and mitigation are sufficient to prevent sediment delivery into watercourses and short-term instability. | Extreme precipitation events can lead to higher erosion of sediments surrounding the Process Plant leading to potential instability of facilities. | • Diversion channels, flow-through drains, and drainage ditches design capacity for peak flow rate following a 100-year, 24-hour precipitation event. | • **Mine Development and Operations Plan**<br>• **Erosion and Sediment Control Plan** |

| Project Components | Range of Potential Effects | | Project Design and Mitigation Measures | Management Plans* |
|---|---|---|---|---|
| | Likely Scenario | Worst-case Scenario | | |
| Site Roads and Haul Roads<br>Airstrip | Minor erosion of site roads and airstrip during extreme precipitation events. Monitoring and mitigation are sufficient to prevent sediment delivery into watercourses and short-term instability. | Extreme precipitation events can lead to erosion of sediments supporting the site roads and airstrip, leading to potential instability or loss of function of the Mine Site and airstrip. | • Site roads and airstrip are equipped with culverts with a minimum 500-mm diameter designed to accommodate a 100-year precipitation event, drainage ditches (0.3 m by 0.8 m) to convey water away from road surface, and rip rap armour around river and creek banks to protect bridges and culverts. | • **Mine Development and Operations Plan**<br>• **Erosion and Sediment Control Plan** |
| Northern Access Route | High precipitation events can cause reduced traffic speeds along the NAR or temporary closure due to localized erosion. | Extreme precipitation events can lead to temporary or extended road closures to repair any localized or widespread erosion damage. | • The NAR, including watercourse crossings, has been designed to withstand 1-in-100-year precipitation events.<br>• The NAR is equipped with culverts with a minimum 500-mm diameter, drainage ditches (0.3 m by 0.8 m) to convey water away from road surface, and rip rap armour around river and creek banks to protect bridges and culverts.<br>• In the event of severe damage to the NAR requiring temporary closure for repairs, the mine plan accommodates this closure with storage of up to 10 weeks of Mine Site supplies, and supplementary delivery of supplies through air transportation. | • **Access Route Construction Management Plan (Appendix 31-A)**<br>• **Access Route Operational Management Plan (Appendix 31-B)**<br>• **Mine Development and Operations Plan**<br>• **Erosion and Sediment Control Plan** |

* **Note:** For descriptions of management plans please refer to Section 31.0 Environmental and Socio-economic Management Program

**Table 27.2-4 Potential Effects and Mitigations Measures for Extreme Drought**

| Project Component | Potential Effects | Project Design and Mitigation Measures | Management Plans* |
|---|---|---|---|
| Open Pits | Increased fugitive dust emissions due to drought conditions. | • During periods of drought make-up water for dust suppression will be sourced from the aquifer adjacent to the Yukon River**.<br>• Reduced dust management or use of chemical dust suppressants. | • **Mine Development and Operations Plan**<br>• **Dust Management Plan** |
| Waste Rock Storage Facilities | | | |
| Stockpiles | | | |
| Heap Leach Facility | During droughts, water shortages may cause temporary shutdown of heap leach and processing activities. | • During periods of drought, make-up water for the HLF will be sourced from the aquifer adjacent to the Yukon River**.<br>• Possible cessation of ore stacking on the HLF, and use of the ROM stockpile.<br>• Adaptive management procedures for contact water will be in place for storage and use during low precipitation periods. | • **Mine Development and Operations Plan** |
| Plant Site | | | |
| Bulk Explosive Storage Area | Potential drinking water shortage during drought conditions. | • Potable and fire water will be sourced from the Yukon River. | |
| Camp Site | | | |
| Site Roads and Haul Roads | Increased fugitive dust emissions due to drought conditions. | • During periods of drought make-up water for dust suppression will be sourced from the aquifer adjacent to the Yukon River**.<br>• Reduced dust management or use of chemical dust suppressants. | • **Access Route Operational Management Plan (Appendix 31-B)**<br>• **Dust Management Plan** |
| Airstrip | | | |
| Northern Access Route | | | |

*__Note:__ For descriptions of management plans please see **Section 31.0 Environmental and Socio-economic Management Program**

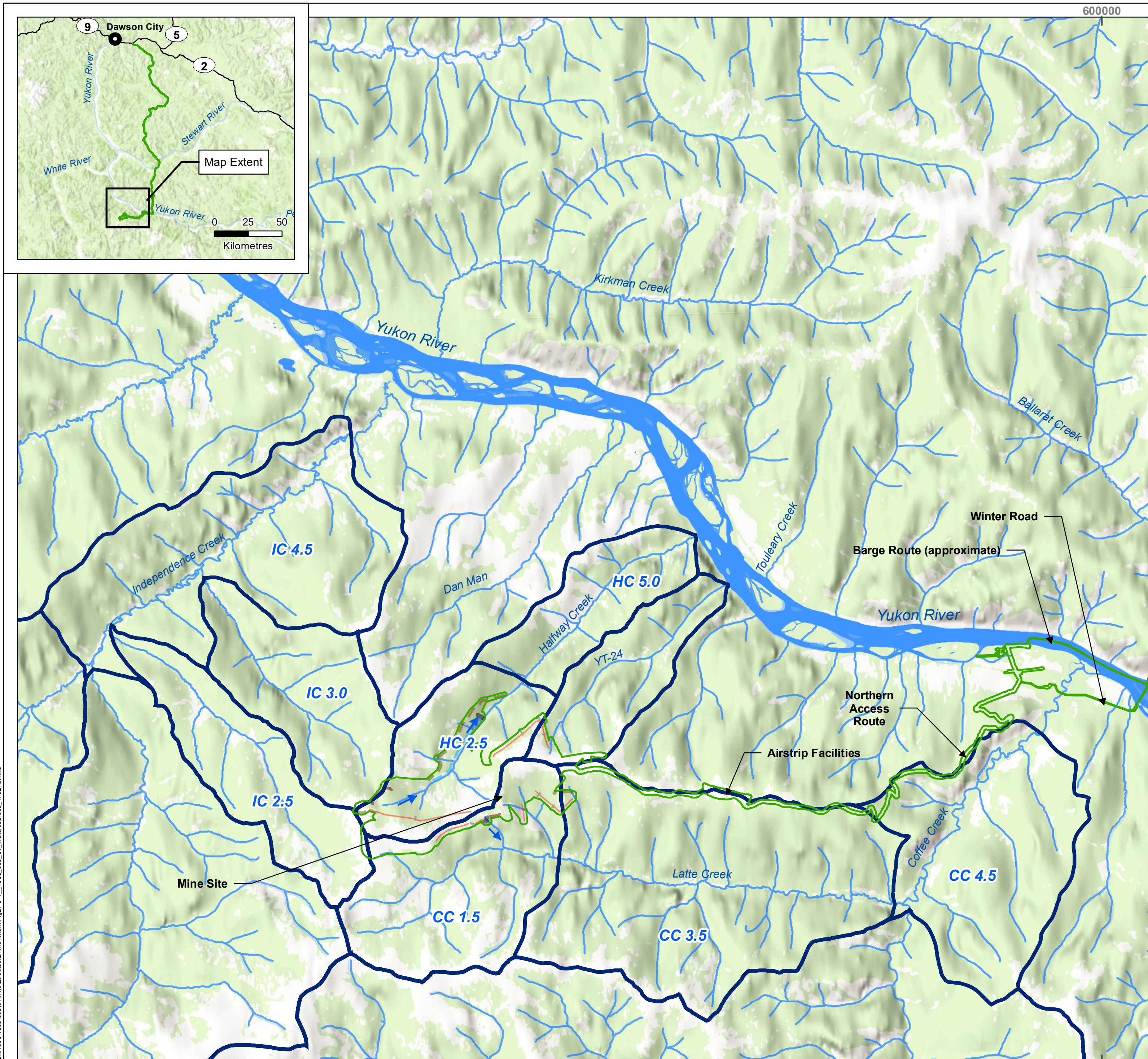
**__Note:__ Extraction of drought make-up water sourced from the aquifer adjacent to the Yukon River will be conducted in compliance with an existing municipal Type B Water Licence (MN16-034) held by the Proponent, and only under extreme conditions.

### 27.3 FLOOD EVENTS

In Yukon, floods are typically the result of high-precipitation events, rapid snowmelt, or a combination of the two. Intense precipitation events are most common in summer months, although they can occur throughout the freshet season. Snowmelt-related floods are most likely to occur in late May during freshet. For a detailed description of climate, precipitation, and flow conditions within the Project area, refer to **Section 8.0 Surface Hydrology Analysis**.

The Mine Site is located at the height of land along a ridge in between Halfway and Latte Creek. Halfway Creek flows directly north into the Yukon River, while Latte Creek flows northeast into Coffee Creek, which flows north into the Yukon River (**Figure 27.3-1**). Local patterns of streamflow in these catchments are dominated by a snowmelt freshet that typically occurs between late April and early June. Following freshet, stream flow is dominated by precipitation-induced runoff events, which occur throughout the summer and autumn months. These high-flow, precipitation-induced events are typically short in duration, persisting over a one- to two-day period. Flows in local creeks and streams typically decrease in October in response to reduced precipitation and freezing temperatures, and several local watercourses experience zero flow conditions throughout the winter (i.e., November through the end of March).

At the Mine Site, peak flows in Latte and Halfway Creeks are highly influenced by rain events from June through August, with secondary peaks occurring in late May resulting from melting snowpack. Generally, wet years are likely to produce up to 10 times more surface runoff than an extreme dry year. In a wet year, soil moisture is likely fully recharged, and would have limited capacity to store additional moisture. Conversely, during a dry year, the soil would have the capacity to store a large proportion of precipitation during a precipitation event before the remainder is converted into runoff. The data from the hydro-meteorology program (**Appendix 8-A Hydro-meteorology Baseline Report**) show that the proportion of annual precipitation converted into runoff increases with the total annual precipitation at the Mine Site. Wet years are predicted to result in up to 10 times the surface runoff than in an extreme (1-in-200 year) dry event. The average runoff for the Mine Site is presented alongside the corresponding annual precipitation estimate for each recurrence interval in **Table 27.3-1**.




COFFEE GOLD MINE

**Figure 27.3-1**
**Watercourses Surrounding the Mine Site**

Legend

- Watercourse
- Highway
- Project Footprint
- Catchment

Notes

1. This map is not intended to be a "stand-alone" document, but a visual aid of the information contained within the referenced Report. It is intended to be used in conjunction with the scope of services and limitations described therein.
2. The numbered labels correspond to water monitoring locations in each catchment, please refer to Section 12.0 Surface Water Quality.

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**Table 27.3-1 Annual Average Runoff Recurrence Interval Estimates**

| Weather Extreme | Recurrence Interval | Annual Precipitation (mm) |
|---|---|---|
| Dry Year | 1:200 | 285 |
| | 1:100 | 300 |
| | 1:50 | 318 |
| | 1:25 | 338 |
| | 1:10 | 372 |
| Median | 1:2 | 479 |
| Wet Year | 1:10 | 613 |
| | 1:25 | 667 |
| | 1:50 | 702 |
| | 1:100 | 734 |
| | 1:200 | 762 |

**Source:** Appendix 8A Hydro-meteorology Baseline Report

The return peak flow analysis for drainages within the Mine Site area are presented in **Table 27.3-2**. These results present the predicted peak yields and maximum recorded discharges from drainages surrounding the Mine Site. The return periods were calculated using data from the hydro-meteorology program (**Appendix 8-A Hydro-meteorology Baseline Report**), beginning in autumn of 2010 and currently ongoing.

**Table 27.3-2 Instantaneous Peak Flow Recurrence for Project Basins**

| Basin | Drainage Area ($km^2$) | Peak Yield ($L/s/km^2$) by Recurrence Interval | | | | | | | Measured Maximum Peak Yield ($L/s/km^2$) | Measured Maximum Discharge ($m^3/s$) |
|---|---|---|---|---|---|---|---|---|---|---|
| | | 1:2 Year | 1:5 Year | 1:10 Year | 1:25 Year | 1:50 Year | 1:100 Year | 1:200 Year | | |
| Upper Latte Creek | 23.1 | 181 | 337 | 531 | 790 | 966 | 1,249 | 1,465 | 396 | 9.15 |
| Latte Creek at Coffee Creek | 69.8 | 153 | 272 | 418 | 603 | 723 | 918 | 1,057 | 141 | 26.14 |
| Coffee Creek | 385.6 | 118 | 195 | 288 | 398 | 462 | 570 | 639 | 192 | 74.21 |
| Upper Halfway Creek | 14.8 | 193 | 368 | 585 | 881 | 1,086 | 1,415 | 1,671 | 81 | 0.84 |
| Upper Independence Creek | 81.1 | 149 | 264 | 405 | 582 | 695 | 880 | 1,012 | 161 | 13.04 |
| Lower YT-24 | 11.8 | 200 | 384 | 615 | 931 | 1152 | 1507 | 1786 | 127 | 1.50 |

**Source:** Appendix 8A Hydro-meteorology Baseline Report

**Notes:** $km^2$ - square kilometres; L/s/km2 - litres per second per square kilometre; m3/s - cubic metre per second

The NAR will intersect with 18 major watercourses that will be crossed either with a clear span bridge or a culvert, in addition to the two major river crossings by barge or ice road. Estimations for peak flow at each of the crossings were initially made using standard methods for estimating peak flow, and were adjusted for localized watershed characteristics such as infiltration rates and precipitation volumes. Initial calculations were compared with secondary United States Geological Survey (USGS) peak flow calculations for a study area that includes the study area identified for the hydro-meteorology baseline. The peak flows were estimated based on initial estimations, USGS peak flow estimations, site observations, existing structures, and historic high-water evidence (**Appendix 8-A Hydro-meteorology Baseline Report**). The design capacity (i.e., 1-in-200-year flood) exceeds the hydraulic capacity of the stream crossings for most the watercourse crossings in the Project, and all crossings are designed to meet the hydraulic capacity of a maximum predicted flood event. The crossings were designed to have larger-than-required capacities to achieve other objectives including reducing stream bank disturbance on fish streams, providing fish passage, as well as accommodating ice and road geometry considerations.

### 27.3.1 POTENTIAL EFFECT OF FLOOD EVENTS

Flooding risk to Project infrastructure at the Mine Site is considered very low due to its location at the height of land along the ridge between Latte Creek and Halfway Creek. Runoff from extreme rainfall and snowmelt events will be diverted away from Mine Site infrastructure, along drainage ditches, diversion channels, collection channels and underdrains and be distributed toward receiving drainages. The primary risk to the Project from floods occurs along the NAR, and at barge crossings. There, floods could result in road and barge closures caused by excess water on the road surface, erosion of the road surface, damage to stream crossings, or debris blocking the roads. Under the most extreme flood events there is the potential for drainage structure washouts (bridges and culverts), which could affect site haulage and operations. The potential effects and mitigations of flood events for individual Project components are listed in **Table 27.3-3.**

### 27.3.2 FLOOD EVENTS MITIGATION MEASURES

At the Mine Site the key mitigation measure for flood events is the location of Project infrastructure on ridge tops. In addition, design mitigation measures that have been integrated into the Project design to minimize the potential effects of a flood are listed in **Table 27.3-3**.

During a flood event, rainwater and sediment ponds may overflow (**Figure 27.3-1**). If a sediment pond (Alpha Pond or Facility Pond, **Figure 2.3-6** in **Section 2.0 Project Description**) were to overflow, it would flow directly into Halfway Creek or Latte Creek and cause short-term, localized increases in peak discharge. Should an event or rainwater pond overflow, the flow would be captured in a diversion channel immediately south of the event and rainwater ponds. This diversion channel would redirect the flow into a sediment pond near the ore stockpile (Facility Pond, **Figure 2.3-6**). Should this pond then overflow, the flow would discharge into a tributary to Latte Creek.

For floods in excess of the design criteria, it is likely that road closures would be required due to the potential for crossings to partially obstruct flows, resulting in elevated upstream water levels that could flow overtopping onto the road surface. Road closures under these conditions would be temporary and the road would re-open once water levels recede and structural checks of the crossings have been made.

Further mitigation measures to minimize the potential effects of a flood that will be implemented throughout the Construction, Operation, and Reclamation and Closure Phases include:

- Monitoring weather forecasts to anticipate and prepare for large precipitation events and freshet
- Continually monitoring and reviewing water collection, diversion, and storage structures as mining progresses, and identifying strategies to maximize effectiveness
- Monitoring watercourse crossings along the NAR during freshet and following large precipitation events.

### 27.3.3 SUMMARY OF EFFECTS OF FLOOD EVENTS

The potential effects on the Project associated with flooding events and the respective mitigation measures are described in **Table 27.3-3** below.

**Table 27.3-3 Potential Effects of Flood Events on the Project and Mitigation Measures and Management Plans**

<table>
<tr><th rowspan="2">Project Component</th><th colspan="2">Range of Potential Effects</th><th rowspan="2">Project Design and Mitigation Measures</th><th rowspan="2">Management Plans*</th></tr>
<tr><th>Likely Scenario</th><th>Worst-case Scenario</th></tr>
<tr><td>Open Pits</td><td colspan="2">The Open Pits are situated on the ridgetops and high elevations along the height of land, and do not overlap with any watercourses. Potential flooding effects are limited to excessive site runoff, potentially resulting in minor erosion of embankments, potential instability, and accumulation of runoff in the Open Pits.</td><td>• Diversion channels, flow-through drains, and drainage ditches direct designed redirect flow of water away from Open Pits. Open Pits will be dewatered seasonally</td><td>• Mine Development and Operations Plan<br>• Erosion and Sediment Control Plan</td></tr>
<tr><td>Waste Rock Storage Facilities</td><td colspan="2" rowspan="2">The WRSFs are in high-elevation headwaters of creeks, and are not likely to be affected by a flood. Worst-case scenarios include erosion of the WRSF materials resulting in deposition of sediments in receiving watercourses and potential instability of structures themselves.</td><td rowspan="2">• Benches slope inwards from WRSF crest. Runoff concentrated along the toe of each bench and prevented from running over the WRSF face by a series of diversion berms (originally safety berms). Runoff diverted to the perimeter of the WRSFs and collected in channels at the WRSF perimeter.<br>• Diversion channels, flow-through drains, and drainage ditches direct designed for peak flow rate following a 100-year, 24-hour precipitation event.<br>• The underdrain is designed to accommodate the 100-year, 24-hour storm event, including snowmelt with capacity of up to two times the calculated runoff peak quantity.</td><td rowspan="2">• Waste Rock and Overburden Management Plan (Appendix 31-D)<br>• Erosion and Sediment Control Plan</td></tr>
<tr><td>Stockpiles</td></tr>
<tr><td>Heap Leach Facility</td><td colspan="2">The HLF is situated on the ridgetop at the height of land, and does not overlap with any watercourses; therefore, is not likely to be affected by a flood.</td><td>• N/A</td><td>• Heap Leach and Process Facilities Plan</td></tr>
</table>

<table>
<tr><th rowspan="2">Project Component</th><th colspan="2">Range of Potential Effects</th><th rowspan="2">Project Design and Mitigation Measures</th><th rowspan="2">Management Plans*</th></tr>
<tr><th>Likely Scenario</th><th>Worst-case Scenario</th></tr>
<tr><td>Plant Site</td><td colspan="2" rowspan="3">The Process Plant, bulk explosive storage, and camp and administration facilities are situated on the ridgetops and high elevations along the height of land, and do not overlap with any watercourses. Potential flooding effects are limited to excessive site runoff, potentially resulting in minor erosion of embankments and potential instability.</td><td rowspan="3">• Diversion channels and drainage ditches designed for peak flow rate following a 100-year, 24-hour precipitation event.</td><td rowspan="5">• Mine Development and Operations Plan<br>• Erosion and Sediment Control Plan</td></tr>
<tr><td>Bulk Explosive Storage Area</td></tr>
<tr><td>Camp Site</td></tr>
<tr><td>Site Roads and Haul Rods</td><td colspan="2" rowspan="2">The site roads and airstrip are situated on the ridgetops and high elevations along the height of land, and do not overlap with any watercourses. Potential flooding effects are limited to excessive site runoff, potentially resulting in minor erosion of transportation infrastructure during extreme flooding, temporary loss or impairment of use.</td><td rowspan="2">• Site roads are equipped with culverts with a minimum 500-mm-diameter designed to accommodate a 100-year precipitation event, and rip rap armour around river and creek banks to protect bridges and culverts;<br>• Drainage ditches (0.3 m x 0.8 m) will convey water away from road surface</td></tr>
<tr><td>Airstrip</td></tr>
<tr><td>Northern Access Route</td><td>Minor erosion of transportation infrastructure during freshet or following high-precipitation events. Temporary loss or impairment of use.</td><td>Damage to watercourse crossings, causing erosion, mass movement of soils and debris, and deposition of sediment. Bridges or culverts may be washed out.<br>Significant damage to the NAR could cause a delay in the delivery of supplies to the Mine Site. A result of an extreme flood is temporary or extended road closures to repair any localized or widespread erosion damage.</td><td>• The NAR is equipped with culverts with a minimum 500-mm diameter, drainage ditches (0.3 m by 0.8 m) to convey water away from road surface, and riprap armour around river and creek banks to protect bridges and culverts.<br>• In the event of severe damage to the NAR requiring temporary closure for repairs, the mine plan accommodates this closure with storage of up to 10 weeks of Mine Site supplies, and supplementary delivery of supplies through air transportation.</td><td>• Access Route Construction Management Plan (Appendix 31-A)<br>• Access Route Operational Management Plan (Appendix 31-B)<br>• Erosion and Sediment Control Plan</td></tr>
</table>

**Note:** * For descriptions of management plans please refer to **Section 31.0 Environmental and Socio-economic Management Program**

### 27.4 PERMAFROST HAZARDS

Permafrost is ground that remains frozen for longer than two consecutive years, and may or may not contain material amounts of ice. In central Yukon, the distribution of permafrost is moderately extensive and primarily discontinuous (Yukon Permafrost Network 2011). The Project is located across varying zones of permafrost. The Mine Site is largely situated in area of discontinuous permafrost, while the NAR crosses areas of limited permafrost to areas of continuous permafrost. Warming of the near-surface permafrost may lead to widespread terrain instability in ice-rich permafrost areas, and may result in a number of thaw-related landscape features and terrain hazards (USGS 2013). Approximately 62% of the Mine Site is underlain by permafrost (**Appendix 11-A Surficial Geology, Permafrost, and Terrain Stability**). Field program data suggest that permafrost extends to greatest depths in ridge areas (135 m), while appearing thinner in lower-elevation areas (30 m). The ice content of the permafrost across the Mine Site is highly variable. Ice-poor permafrost is common in upland settings along ridges, and on moderately steep valley sides with convex or straight slopes. Ice-rich permafrost is more common in areas with higher organic accumulation and silt-rich sediments in fluvial valley bottoms. Approximately 34% of the Mine Site is underlain by ice-poor permafrost, 27% is underlain by permafrost with visible excessive ice, and approximately 1% is underlain by ice-rich permafrost. Permafrost-related processes that are active within the Mine Site include solifluction, active layer detachment, slope creep, frost heave, and thermal erosion. Approximately 21% of the NAR corridor is underlain by ice-rich to very ice-rich permafrost. Sections of the NAR proposed for thaw-sensitive warm permafrost areas, which are sensitive to natural and anthropogenic disturbances, will require special geotechnical considerations to avoid erosion and mass wasting associated with permafrost thaw and thermokarst. For more detailed information regarding descriptions of potential permafrost hazards to terrain stability refer to **Section 11.0 Surficial Geology, Terrain, and Soils Assessment**.

#### 27.4.1 POTENTIAL EFFECTS OF PERMAFROST HAZARDS

Permafrost hazards may affect all Project components and activities if not mitigated. The Project has been designed to avoid thaw unstable soils where possible. A summary of potential effects and applicable mitigations are provided in **Table 27.4-1**.

#### 27.4.2 PERMAFROST MITIGATION MEASURES

Project components have been designed with respect to existing permafrost conditions at the Mine Site and along the NAR. Mitigations for potential effects due to changes in permafrost (**Section 11.0 Surficial Geology, Terrain, and Soils Assessment**) are largely mitigations by design and by avoidance (**Section 27.1.1**). The site selection of Project infrastructure was influenced by the depth and type of permafrost present at design locations; however, permafrost could not be avoided for all Project components. The site selection of most infrastructure focused on areas where overburden was relatively thin, facilitating excavation of permafrost to solid rock below building footprints. Where avoidance of ice-rich permafrost is not possible, locations of infrastructure will have frozen material excavated down to bedrock below the bases of the structures and, if necessary, ice-rich permafrost may be over excavated and replaced with frost stable materials. The water management structures were designed to reduce thermal changes to permafrost. Thermal evaluations during the infrastructure design were optimized to reduce the potential for the depth of thaw to progress further than the natural active layer. To avoid permafrost-related stability and erosion issues in surface water diversions, berms will be used rather than ditches wherever possible. These mitigation measures are described in **Table 27.4-1**. In addition, permafrost conditions will be monitored adjacent to cleared areas for potential changes in conditions that may influence terrain stability for the life of the Project.

### 27.4.3 SUMMARY OF POTENTIAL EFFECTS OF PERMAFROST HAZARDS

The potential effects on the Project associated with permafrost hazards and the respective mitigation measures are described in **Table 27.4-1** below.

**Table 27.4-1 Potential Effects of Permafrost Hazards on the Project and Mitigation Measures and Management Plans**

| Project Component | Range of Potential Effects | | Project Design and Mitigation Measures | Management Plans* |
|---|---|---|---|---|
| | Likely Scenario | Worst Case Scenario | | |
| Open Pits | Minor thaw of permafrost near the Open Pits. Potential for erosion. | Significant thaw of permafrost near the Open Pits. Potential thawing of permafrost may lead to erosion and mass wasting which could lead to stability concerns in the Open Pits. | • The Open Pits are located in areas with deep, largely ice-poor permafrost, with some ice-moderate permafrost areas on the west side of the Latte pit. There are relatively few areas with active rock creep and some evidence of gullied terrain on the south side of the Supremo pit.<br>• Water management structures will be designed to reduce thermal changes to permafrost.<br>• Thermal evaluation during infrastructure design with the objective of reducing the potential for the depth of thaw to progress to depths greater than the normal natural active layer. | • **Frozen Materials Management Plan**<br>• **Mine Development and Operations Plan**<br>• **Erosion and Sediment Control Plan** |
| Waste Rock Storage Facilities | Minor thaw of permafrost near the WRSFs. Potential for erosion. | Significant thaw of permafrost near and under the WRSFs. There is potential for thermokarst development in the valley bottom by the Alpha WRSF. The potential thermokarst may lead to erosion and mass wasting of thawing organic and ice-rich soils, which could lead to stability issues in the WRSF. Potential ice accumulation in the flow-through drains. | • The design of the WRSFs has considered areas of permafrost under the Alpha WRSF (92%).<br>• The vegetative mat will be left in place within WRSF footprints to preserve permafrost conditions, except where foundation soils will require removal to bedrock, near the toes.<br>• WRSFs will be constructed on permafrost soils. Where possible, the first lift (approximately 5 m) of all new WRSF areas will be placed during the winter season to insulate and protect permafrost.<br>• Stability of the waste rock piles will be enhanced by excavation of overburden near the toe of each dump to create key trenches to resist creep. All thaw-unstable soils and weathered bedrock to a 1-m depth will be removed from areas of the WRSF footprint within 15 m of all final and interim WRSF toes.<br>• Stockpiles will be constructed on fill material on top of ice-poor permafrost soils. Stockpiles will be resistant to settlement fluctuations.<br>• Due to the perviousness of the waste rock, the design of the WRSFs, and the flow-through drains, it is unlikely that ice could form to block flow entirely. | • **Frozen Materials Management Plan**<br>• **Mine Development and Operations Plan**<br>• **Erosion and Sediment Control Plan**<br>• **Waste Rock and Overburden Management Plan (Appendix 31-D)** |
| Stockpiles | | | | |

| Project Component | Range of Potential Effects | | Project Design and Mitigation Measures | Management Plans* |
|---|---|---|---|---|
| | Likely Scenario | Worst Case Scenario | | |
| Heap Leach Facility | Minor thaw of permafrost near the HLF. Potential for erosion | There is a small layer of active detachment in the northwest corner of the HLF footprint, which indicates permafrost thaw. Significant thaw of permafrost near the HLF. Solifluction and related rock creep are also noted within the HLF footprint. Potential thawing of permafrost may lead to erosion and mass wasting, which could lead to stability concerns in the HLF. | • Removal of all thaw-unstable soils within 15 m of the HLF footprint.<br>• The HLF is located on a ridge of weathered bedrock with a colluvial veneer. Approximately 68% of the HLF is underlain by ice-poor permafrost and 5% with ice-moderate permafrost, the remaining 27% is estimated to be permafrost-free. | • **Frozen Materials Management Plan**<br>• **Mine Development and Operations Plan**<br>• **Erosion and Sediment Control Plan** |
| Plant Site | Minor thaw of permafrost near Project facilities. Potential for erosion. | Significant thaw of permafrost near Project facilities. Potential thawing of permafrost may lead to erosion and mass wasting which could lead to stability concerns. | • Approximately 85% of the Process Plant, bulk explosive storage facility, and camp and administration facilities areas are located on ice-poor permafrost, with the remaining 15% permafrost free. The area is a broad, relatively flat section of the ridge, it is covered by a colluvial veneer of weathered bedrock and colluvial materials. No stability concerns have been noted in the Process Plant, bulk explosive storage facility, and camp and administration areas.<br>• Critical structures that cannot tolerate fluctuations in settlement (i.e., Process Plant) will be founded on competent bedrock.<br>• Non-critical structures that are able to tolerate minor settlements (e.g., camp and administration facilities) will be designed on fill sections of cut-and-fill pads constructed of free-draining, coarse, granular materials. | • **Frozen Materials Management Plan**<br>• **Mine Development and Operations Plan**<br>• **Erosion and Sediment Control Plan** |
| Bulk Explosive Storage Area | | | | |
| Camp Site | | | | |

| Project Component | Range of Potential Effects | | Project Design and Mitigation Measures | Management Plans* |
|---|---|---|---|---|
| | Likely Scenario | Worst Case Scenario | | |
| Site Roads and Haul Roads<br>Airstrip<br>Northern Access Route | Minor thaw of permafrost near or under transportation infrastructure. Potential for erosion. | Significant thaw of permafrost near or under transportation infrastructure. Potential permafrost degradation may lead to thermokarst development, erosion, and mass wasting, which could lead to stability concerns. | • Avoidance of areas with ice-rich permafrost where possible.<br>• The site roads and airstrip will be constructed using fill material on top of largely ice-poor permafrost soils. The airstrip is designed to be resistant to permafrost changes.<br>• The design of the NAR involves the overland construction method in which a sufficient thermal buffer is provided by the road prism to prevent degradation of the underlying permafrost. The buffer is maintained by avoiding disturbance to the organic mat and overburden through end-dumping and preventing equipment moves beyond the constructed point.<br>• A high-strength, woven geotextile will be laid on undisturbed ground and overlain with fill that will be compacted in lifts to a minimum depth of 1.5 m.<br>• Water management in construction areas is critical to prevent thermokarst from forming in local permafrost. Water management in permafrost areas will utilize sub-grading and cross drains to redirect water away from the rod prism. | • **Frozen Material Management Plan**<br>• **Access Route Construction Management Plan (Appendix 31 A)**<br>• **Access Route Operational Management Plan (Appendix 31-B)**<br>• **Erosion and Sediment Control Plan** |

**Note:** * For descriptions of management plans please refer to **Section 31.0 Environmental and Socio-economic Management Program**. Definitions: mass wasting - quick movement of a large mass of surficial materials; thermokarst - melting of massive ice or thawing of ice-rich permafrost resulting in consolidation and deformation of the soil surface and formation of specific forms of surface relief such as thermokarst lakes, collapsed pingos, sinkholes, and pits; solifluction - slow downslope movement of saturated unfrozen, thawed earth materials across a frozen or otherwise impermeable substrate.

## 27.5 TERRAIN AND GEOHAZARDS

An analysis of potential terrain hazards for the Mine Site is provided in **Appendix 11-A Surficial Geology, Permafrost, and Terrain Stability**. This analysis was used to inform the surficial geology, terrain, and soils Valued Component assessment (**Section 11.0 Surficial Geology, Terrain, and Soils Assessment**). The terrain stability assessment considered terrain and terrain stability mapping, field investigation, and hazard identification of potentially hazardous terrain features. The focus of the terrain stability assessment is on the potential for geohazards such as mass movements, erosion, and avalanches with the potential to affect the Project.

Most of the Mine Site is considered to be relatively stable (terrain stability classes 0 to II). These conditions reflect the gentle to moderate slopes that predominate on lower valley sides and in uplands. Areas that are considered relatively unstable (terrain stability classes IV and V) within the Mine Site study area are minor. Geohazards identified within the Mine Site study area include rock fall, debris slides, rock creep, gullying, slope-wash, and permafrost-related hazards including solifluction, and thermokarst (**Section 27.4**). Areas currently mapped as unstable (class V) are anticipated to remain as such. Facilities to be located at least partially within potentially unstable areas include the Alpha WRSF, HLF, and organics stockpile.

Along the NAR (including areas requiring new construction), most the NAR is considered relatively stable and is mapped as stability classes 0 to II. Terrain stability class III ('generally stable with minor potential for instability') comprises a relatively minor portion of the study area for the NAR. A small portion of the NAR has been classified as relatively unstable (classes IV and V), owing primarily to steep, gullied slopes and areas underlain by permafrost displaying thermokarst activity (**Appendix 11-A Surficial Geology, Permafrost, and Terrain Stability**). Approximately 15% of the NAR study area has no terrain stability rating assigned (class 0) and is associated with anthropogenic disturbances, largely from placer mining activity along the valleys of larger tributaries.

### 27.5.1 POTENTIAL EFFECT OF TERRAIN AND GEOHAZARDS

Field investigations and terrain hazard mapping did not identify any mappable evidence of past avalanche occurrences within the Project's terrain study areas. Avalanches occur on moderate to steep slopes in wind-loaded alpine areas. The slope class of the Project area is considered gentle, with moderate slopes on lower valley sides; therefore, an avalanche is not considered a risk that could not adversely affect the Project.

The geology of the Mine Site largely comprises a ridgetop of weathered bedrock and colluvial veneer or mantle of variable thickness along the slopes, with some areas of thicker colluvial blanket materials. The road geology for most the NAR consists of colluvial veneer or mantle of variable thickness, weathered bedrock, and fluvial and anthropogenic materials. The NAR from the City of Dawson (Dawson) passes through numerous watersheds, as well as ridge tops with thin colluvial materials and exposed, weathered bedrock.

Areas identified through terrain and terrain stability mapping as unstable or potentially unstable were avoided where possible. Where avoidance was not possible, potential instability will be mitigated through design measures. Approximately 284 ha within the Mine Site area footprint and 458 ha of the NAR footprint may become potentially unstable from relatively stable, assuming no mitigation for slope instability or permafrost conditions (**Appendix 11-B Surficial Geology, Terrain, and Soils Assessment**). **Table 27.5-2** identifies and describes the terrain hazards with the potential to affect Project components identified through field investigation programs, as well as using terrain and terrain stability mapping.

### 27.5.2 TERRAIN AND GEOHAZARDS MITIGATION MEASURES

Given the uncertain nature of the extent of terrain hazards, the Proponent has adopted design-based mitigation measures for potentially sensitive structures, and will establish monitoring and response measures prior to construction. Site selection for potentially sensitive components including the HLF, WRSF, and stockpiles were based on engineering assessments that considered geotechnical conditions and investigations and stability analyses for the proposed location of the Project components (**Section 2.0**). With respect to the northern access route, the Proponent has selected the NAR to maximize the use of the existing road network to the greatest practical extent, such that only 37 kilometres (km) of the 213-km route requires new construction. Progressive reclamation will be initiated as the mine plan allows, which will further stabilize disturbed areas.

The design and hazard-specific mitigation measures developed to avoid or reduce potential effects from terrain hazards are provided in **Table 27.2-1**.

As mine design progresses, efforts will continue to avoid exposing infrastructure to upslope or downslope unstable areas (terrain stability class V). Site preparation will also help avoid hazards by eliminating or altering the conditions responsible for the hazard (e.g., excavating ice-rich surficial material prior to construction). In the event that avoidance of the hazard is not possible, site-specific hazard mitigation measures will be developed as necessary. These mitigation measures are provided in **Table 27.5-1.**

**Table 27.5-1 Summary of Mitigation Measures for Terrain and Geohazards**

| Terrain Hazard | Mitigation Measure |
|---|---|
| Slope Failure | Manage surface runoff and groundwater drainage patterns to avoid saturation of surficial materials. Modify slope geometry to reduce risk of slope failure. |
| Meander Migration | In addition to rip-rap, mitigations for meander migration could include in-stream flow “training” such as adding rock veins or stream bards to adjust position of the flow or local channel realignment. |
| Icing | Localized enlargement of culvert entrances, installation of multiple culverts, and local drainage diversions |

An annual geotechnical inspection will be carried out by a qualified geotechnical engineer licensed to practice in Yukon during mine operations until closure has been completed. These inspections will be carried out during the summer months when there is no snow cover. The inspection will encompass the HLF, all WRSFs, Open Pit high walls, all contact and non-contact water storage ponds, water diversion structures, and any other remaining surface infrastructure elements that may affect permafrost. Terrain and geohazard conditions will be monitored adjacent to cleared areas for potential changes in conditions that may influence terrain stability for the life of the Project.

### 27.5.3 Summary of Potential Effects of Terrain and Geohazards

The potential effects on the Project associated with terrain hazards and the respective mitigation measures are described in **Table 27.5-2** below.

**Table 27.5-2 Potential Effects of Terrain and Geohazards on the Project and Mitigation Measures and Management Plans**

| Project Component | Range of Potential Effects | | Project Design and Mitigation Measures | Management Plans* |
|---|---|---|---|---|
| | Likely Scenario | Worst-case Scenario | | |
| Open Pits | Minor rock creep and gullying near the slopes of the Open Pits. | Significant rock creep and/or gullying of slopes of the Open Pits. Potential for erosion and loss of stability, potentially leading to a suspension of activities in affected pit until stability concerns are addressed. | • Expect increased maintenance, and allow for minor settling of rock debris; minimize disturbance to gullied slopes.<br>• Erosion control and monitoring. | • **Mine Development and Operations Plan**<br>• **Erosion and Sediment Control Plan** |
| Waste Rock Storage Facilities | Minor rock creep and gullying near the slopes within the footprints of the WRSFs. | Significant rock creep and/or gullying of soils in the WRSF footprints. Potential for erosion and loss of stability. Potential for highly unstable areas mapped in vicinity of the toes of the Alpha WRSF.<br>Potential for a suspension of activities in affected WRSF until stability concerns are addressed. | • Expect increased maintenance, and allow for minor settling of rock debris; minimize disturbance to gullied slopes; expect increased maintenance due to fine sediment movement.<br>• Erosion control and monitoring.<br>• Progressive reclamation will also be initiated after Year 2 which with further stabilize disturbed areas. | |
| Stockpiles | Minor rock creep and gullying near the slopes within the footprints of the Stockpiles. | Significant rock creep and/or gullying of soils in the stockpile footprints. Potential for erosion and loss of stability, potentially leading to a suspension of activities in affected stockpile until stability concerns are addressed. | • Expect increased maintenance, and allow for minor settling of rock debris; minimize disturbance to gullied slopes; expect increased maintenance due to fine sediment movement. | |
| Heap Leach Facility | N/A | N/A | • Remove unstable soils from HLF footprint; construct HLF in a balanced cut-and-fill pad using rock for a stable structural fill | |

| Project Component | Range of Potential Effects | | Project Design and Mitigation Measures | Management Plans* |
|---|---|---|---|---|
| | Likely Scenario | Worst-case Scenario | | |
| Plant Site | The Process Plant is located on broad, near-level section of the ridge, and covered by a veneer of weathered bedrock and colluvium. There are no stability concerns. | | • No stability concerns are likely for the Process Plant area. Process plant will be built on suitable bedrock, and will be resistant to settlement fluctuations. | • **Mine Development and Operations Plan**<br>• **Erosion and Sediment Control Plan** |
| Bulk Explosive Storage Area | Minor rock creep and gullying near the slopes near Project facilities. | Significant rock creep and/or gullying of soils near the explosive storage facility. Potential for erosion and loss of stability. | • Explosive storage facilities, camp and administration facilities, site and haul roads, and airstrip will be built on constructed fill material and will be resistant to settlement fluctuations.<br>• Erosion Control and Monitoring. | |
| Camp Site | Minor rock creep and gullying near the slopes near the camp and administration facilities. | Significant rock creep and/or gullying of soils near the camp and administration facilities. Potential for erosion and loss of stability. | | |
| Site Roads and Haul Roads | Minor rock creep and gullying near the slopes and the site road footprints. | Significant rock creep and/or gullying of soils near the site road footprints. Potential for erosion and loss of stability. | | |
| Airstrip | The airstrip is located on broad near level section of the ridge. It is covered by a veneer of weathered bedrock and colluvium. There are no stability concerns. | | | |

| Project Component | Range of Potential Effects | | Project Design and Mitigation Measures | Management Plans* |
|---|---|---|---|---|
| | Likely Scenario | Worst-case Scenario | | |
| Northern Access Route | Minor mass movements, rock creep, rock fall, solifluction, and gullying may affect the NAR downslope of potentially unstable areas. Minor effects to the NAR from fluvial processes including erosion at watercourse crossings, meander migration, and icing. | Significant mass movements, rock creep, rock fall, solifluction, and gullying may affect the NAR downslope of potentially unstable areas. Significant effects to the NAR from fluvial processes including erosion at watercourse crossings, meander migration, and icing. Potential for severe erosion and loss of stability. | • The NAR has been designed to accommodate special geotechnical and icing considerations, and will avoid terrain, ice, and geohazards where possible.<br>• Watercourse crossings have been designed to accommodate natural meander migration processes and ice accumulation, persistence, and seepage.<br>• Where possible, setbacks will be maintained, and rock armour (i.e., riprap) used to provide erosion protection for design peak flow in watercourses.<br>• Construction will include scaling of rock face to prevent rock fall, installation of large ditch-line to intercept debris, posting hazard signage, and no blasting into the base of rock bluffs.<br>• These measures will be monitored and repaired throughout the life of the Project as needed to protect the road and water crossings. | • **Access Route Construction Management Plan (Appendix 31-A)**<br>• **Access Route Operational Management Plan (Appendix 31-B)**<br>• **Erosion and Sediment Control Plan** |

**Note:** * For descriptions of management plans please refer to **Section 31.0 Environmental and Socio-economic Management Program**. Definitions: solifluction - slow downslope movement of saturated unfrozen, thawed earth materials across a frozen or otherwise impermeable substrate

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## 27.6 SEISMIC ACTIVITY HAZARDS

The Project is located in an area of relatively low seismic activity in the St. Elias region, which includes southwestern Yukon Territory, northwestern British Columbia, and southeastern Alaska. The Project is located further northeast, between the Denali and Tintina fault systems, where the rates of seismic activity decrease dramatically (NRC 2016a). **Figure 27.6-1** shows the regional tectonic fault lines and historical seismic activity of Yukon with respect to the Project. In the St. Elias Region, the Pacific tectonic plate is being forced underneath the North American tectonic plate through subduction.

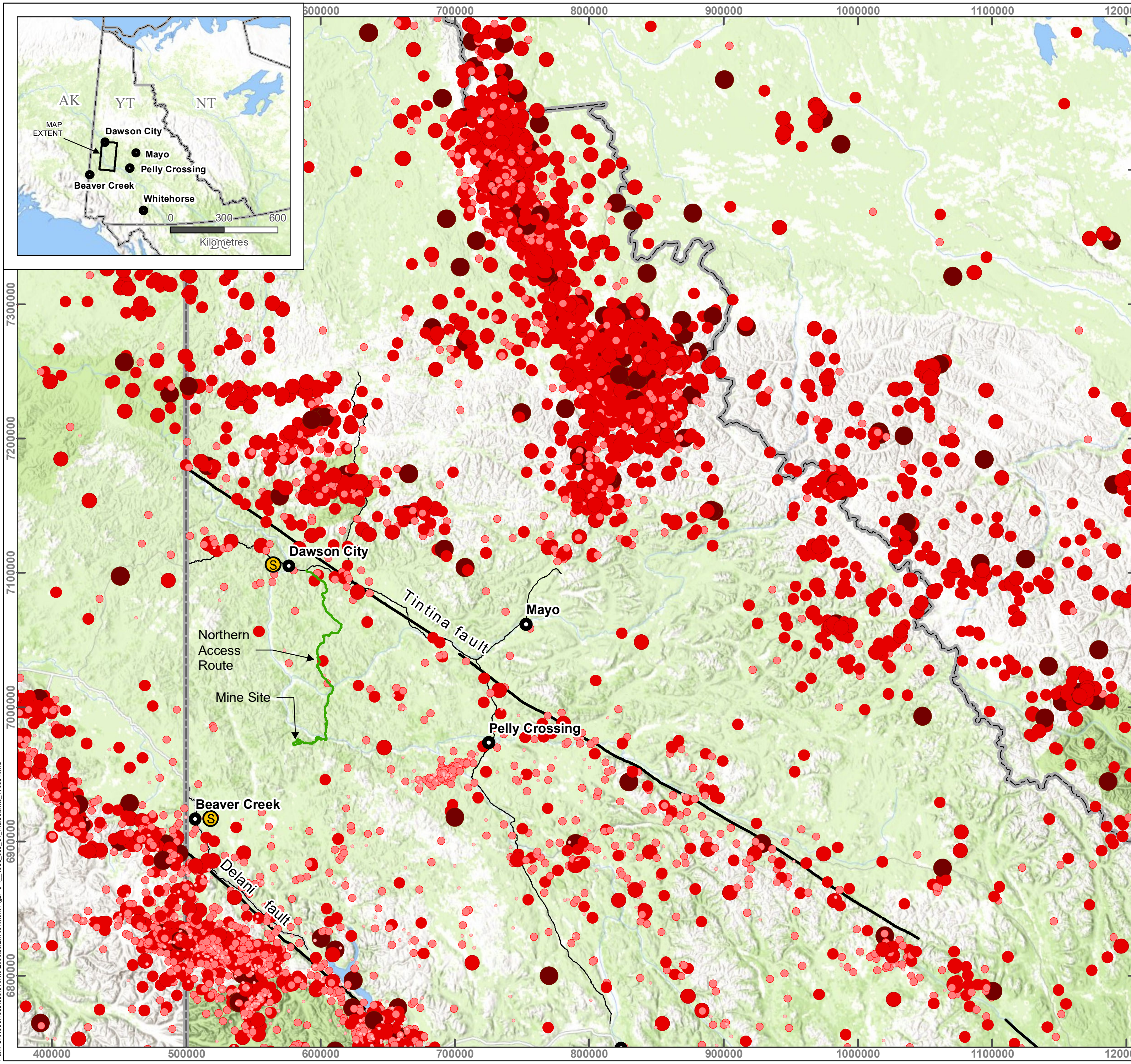
The seismic hazard for the Project area predominantly consists of shallow crustal earthquakes (with magnitudes of up to 7.0 on the Richter Scale) that may occur in the region south of the Project (greater than 100 km) (NRC 2016a). Seismic hazards are influenced by the potential for larger-magnitude earthquakes (with magnitudes from 7.5 to 8.0) occurring further from the Project site (greater than 100 km) on the East Denali fault zone, near the Alaska-Yukon border (NRC 2016a).

The Proponent completed a review of the regional tectonics and historical seismicity in the southwest Yukon region to enable the selection of appropriate design earthquake events for key Project components such as the HLF (JDS 2016). The closest seismograph stations to the Project are located in Dawson and Beaver Creek (NRC 2016b). The closest historical earthquakes have occurred near Beaver Creek, the most recent being a magnitude 4.2 earthquake in 2012, which is characterized as a light earthquake, slightly felt, but during which zero to minimal damage occurs (Belik 2013, NRC 2016c).

An analysis of seismic hazards in the Project area was performed using the 2015 National Building Code of Canada (NBCC) seismic hazard calculator (NRC 2016d). Peak ground acceleration (PGA) is a measure of how hard the earth shakes, and is measured in units of acceleration due to gravity (g)). The PGA was calculated for the Project area for three return periods (**Table 27.6-1**) (USGS 2011, NRC 2016d). Based on the intensity descriptions developed by the USGS, a PGA of 0.025 g is perceived as light, and is not likely to cause structural damage, while a PGA of 0.080 g is perceived as a moderate quake, with very light potential to result in structural damage (USGS 2011).The worst case peak ground acceleration of 0.17 g (potentially occurring every 10,000 years; **Table 27.6-1**) would represent a very strong earthquake with the potential to cause moderate structural damage to buildings and structures.

**Table 27.6-1 Summary of Seismic Hazard Analysis**

| Annual Exceedance Probability | Return Period | Peak Ground Acceleration (g) |
|---|---|---|
| 0.01 | 100 | 0.04 |
| 0.002 | 475 | 0.06 |
| 0.001 | 1,000 | 0.08 |
| 0.0004 | 2,475 | 0.10 |
| 0.0002 | 5,000 | 0.13 |
| 0.0001 | 10,000 | 0.17 |




COFFEE GOLD MINE

**Figure 27.6-1**
**Historical Seismic Activity in the Yukon**

## Legend

- City/Town
- Highway
- National/International Border
- Project Footprint
- Seismic Stations
- Fault

**Seismic Activity Magnitude**

- 0 - 1.9
- 1.9 - 2.6
- 2.6 - 3.3
- 3.3 - 4.2
- 4.2 - 8.0

## Notes

1. This map is not intended to be a “stand-alone” document, but a visual aid of the information contained within the referenced Report. It is intended to be used in conjunction with the scope of services and limitations described therein.
2. Seismic activity data downloaded from the geomatics Yukon website in February 2017.

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#### 27.6.1 POTENTIAL EFFECT OF SEISMIC ACTIVITY

If a seismic event were to occur in an area close to the Project, the damage potential of the seismic event would largely depend on the proximity of the epicentre of the seismic event to the Project. A seismic event has the potential to affect all Project components. Damage to Project infrastructure could occur directly through ground shaking, loss of structural integrity, or slope failure, and indirectly because of induced landslides or cascading events. In addition to structural effects, seismic events could trigger spills from the fuel storage area, or rupture of fuel and solution distribution systems. The potential effects of seismic activity in the likely and worst case scenarios are described in **Table 27.6-2**.

Based on the description of the scenarios described in **Table 27.6-2**, the potential effects of the low and high magnitude earthquake scenarios are likely to be mitigated through Project design and adherence to design standards.

#### 27.6.2 SEISMIC ACTIVITY MITIGATION MEASURES

The Project has been designed to withstand exposure to seismic activity up to criteria consistent with current standards in the NBCC (NRCC 2015), which incorporates technical considerations into building design requirements for buildings to be built based on local seismic conditions. All buildings on site, including the accommodations camp, Process Plant, explosives storage facility, and other support buildings will be designed and built according to NBCC codes and standards. All Project structures are designed to withstand a seismic event meeting or exceeding the 1-in-500 year return period. This is consistent with best practices and industry standards as specified in the NBCC.

A detailed Emergency Response Plan (**Section 31.0 Environmental and Socio-economic Management Program**) will be developed and made operational prior to the initiation of the construction phase. This plan will include training, guidance, and actions for responding to seismic activity.

#### 27.6.3 SUMMARY OF POTENTIAL EFFECTS OF SEISMIC HAZARDS

The potential effects on the Project associated with seismic hazards and the respective mitigation measures are described in **Table 27.6-2** below.

**Table 27.6-2 Potential Effects of Seismic Activity on the Project and Mitigation Measures and Management Plans**

| Project Component | Range of Potential Effects | | Project Design and Mitigation Measures | Management Plans* |
|---|---|---|---|---|
| | Low Magnitude Earthquake | High Magnitude Earthquake | | |
| Open Pits | Small slides and rock falls may occur. No damage to pit integrity. A shutdown of the mine would not occur. | Complete failure of Open Pit. A temporary shutdown of the mine would be required. | • All Mine Site infrastructure is designed to meet or exceed all applicable building standards to withstand an earthquake (BC Mined Rock and Overburden Pile Minimum Factor of Safety Guidelines (BC Mine Waste Rock Pile Research Committee 1991)).<br>• In the event of severe damage to the NAR requiring temporary closure for repairs and if the Mine Site remains operational, the mine plan accommodates this closure with storage of up to 10 weeks of Mine Site supplies; supplementary delivery of supplies would occur via air transportation should the airstrip remain functional.<br>• Special inspections shall be carried out if an unusually large seismic event occurs (ground acceleration greater than 0.8 g). Inspections will be completed as soon as possible following such an event. | • **Emergency Response Plan**<br>• **Mine Development and Operations Plan** |
| Waste Rock Storage Facility | Any damage caused by seismic activity will be minor and would not significantly affect the structure. WRSF would not fail; integrity and stability is maintained. | WRSF failure leading to the release of waste rock into the receiving environment. A temporary shutdown of the mine would be required. | | |
| Stockpiles | Consequences would be limited to the minor displacement of ore and soil from stockpile slopes. A shutdown of the mine would not occur. | Complete failure of stockpiles. A temporary shutdown of the mine would be required. | | |
| Heap Leach Facility | Damage to the heap leach would be minor, causing no loss of containment of processing reagents. A shutdown of the mine would not occur. | HLF failure leading to the displacement of heaped ore and deformation of the heap leach pad. Loss of containment of processing reagents. A temporary shutdown of the mine would be required, and barren solution would be re-directed to the Latte Pit depending on the volume of solution and integrity of the event ponds. | | |
| Plant Site | Damage to the Process Plant would be minor, causing no loss of containment of processing reagents. A shutdown of the mine would not occur. | Structural damage to Process Plant and/or interruption of Process Plant. A temporary shutdown of the mine would be required. | | |
| Bulk Explosive Storage Area | Bulk explosive storage facility would not experience significant damage. A shutdown of the mine would not occur. | Structural damage to the bulk explosive storage facility. A temporary shutdown of the mine would be required. | | |

| Project Component | Range of Potential Effects | | Project Design and Mitigation Measures | Management Plans* |
|---|---|---|---|---|
| | Low Magnitude Earthquake | High Magnitude Earthquake | | |
| Camp Site | Buildings, facilities and Process Plants would not experience significant damage. A shutdown of the mine would not occur. | Structural damage to buildings and facilities, or interruption of Process Plant. A temporary shutdown of the mine would be required. | | |
| Site Roads and Haul Roads | Small debris and rock movement, with no significant damage to the integrity of the site road or water crossings. A shutdown of the mine would not occur. | Failure of site road integrity or water crossing. A shutdown of the mine would not occur. | | |
| Airstrip | Minor damage to airstrip facilities and infrastructure. No interruption of critical services. | Severe damage to the airstrip and facilities. Regularly scheduled flights would be delayed for repairs. | | |
| Northern Access Route | Small debris and rock movement, with no significant damage to the integrity of the road or water crossings. A shutdown of the mine would not occur. | Failure of road integrity or water crossing. A shutdown of the mine would not occur. | | |

**Note**: * For descriptions of management plans, please refer to Section 31.0 Environmental and Socio-economic Management Program

### 27.7 WILDFIRE HAZARDS

Wildfires are a common landscape disturbance throughout boreal cordillera ecosystems, and the forest cover of most of Yukon's forest is a patchwork mosaic resulting from successive forest fires (Smith et al. 2004, Grods et al. 2012). An average of 140 fires burn a total of 117,000 hectares (ha) of land in Yukon each year (Yukon Government 2010). In 2015, 184 fires burned a total of over 177,000 ha in Yukon (NRC 2016e). In 2015, a wildfire burned 465 ha approximately 20 km east of the Mine Site. In 2010, an area of over 15,500 ha overlapping with the proposed NAR south of the Stewart River was burned. Nearly half of all fires are triggered by lightning strikes and the other half are caused by human activity (Yukon Government 2010). Wildfire occurrence and intensity is dependent upon ignition potential, fuel source, weather conditions, and suppression capacity.

Yukon Government's Department of Community Services records and maintains spatial data for wildland fires dating back to 1950; this information is useful for determining wildfire probability. The database includes fire location, date, cause, and spatial extent. A summary of wildfire occurrences in Yukon is provided in **Table 27.1-1** and shown on (**Figure 27.7-1**).

**Table 27.7-1 Wildfire Occurrences by Decade by Cause in Yukon**

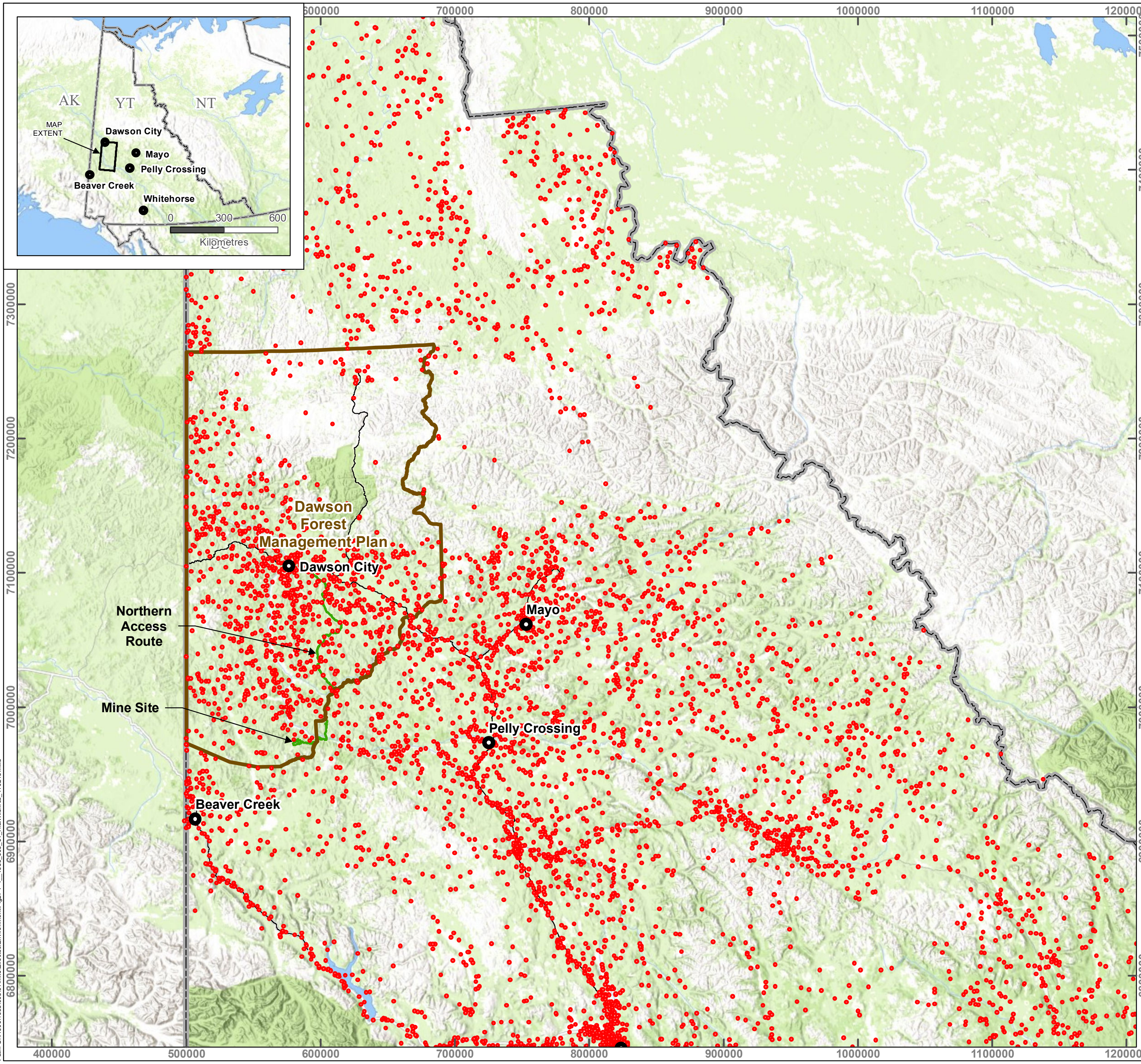
| Decade | Number of Fires by Cause | | Total Hectares (ha) Burned |
|---|---|---|---|
| | Lightning | Human | |
| 1950s | 195 | 428 | 1,789,671 |
| 1960s | 265 | 447 | 1, 047,306 |
| 1970s | 531 | 642 | 795,373 |
| 1980s | 895 | 728 | 1,086,435 |
| 1990s | 936 | 677 | 1,604,334 |
| 2000s[1] | 490 | 222 | 2,049,740 |

**Note:** [1]2000s include fires from 2000 to 2006 only.
**Source:** Yukon Government 2011

The wildfire regime in the Dawson Forest Resources Management Plan (FRMP) region (**Figure 27.7-1**) is characterized by frequent, high-intensity, stand-replacing crown fires (Dawson Forest Management Planning Team 2013). From 1992 to 2010, an average of 25 fires per year burned an average of 33,035 ha of land. Elevation is a strong predictor of forest fire occurrence in the Dawson FRMP region, with virtually all forest fires occurring below 1,200 masl, and the highest fire frequency occurring between 400 masl and 700 masl (Dawson Forest Management Planning Team 2013). This relationship is largely the result of climate, fuel conditions, and the majority of forest occurring below 700 masl. Elevations above 1,200 masl are typically characterized by alpine tundra environments, and largely lack fuels for high-intensity burns. Elevations below 400 masl often encompass river valleys and lower slopes with higher moisture contents, which limit wildfires (Dawson Forest Management Planning Team 2013). The mine has an elevation of

1,300 masl and is located outside of the high frequency fire elevation, while the elevation of the NAR varies across its length from 508 masl to 1,169 masl. The majority of the NAR falls between 500 masl and 1,000 masl, and therefore largely lies in the area where wildfires are most likely to occur.

Seasonality is another dominant factor in characterizing the fire regime in the Dawson FRMP region. Summer storms through the area account for many of fires started by lightning strikes. In contrast, human-caused fires represent a small portion of the wildfires in the Dawson FRMP region.




COFFEE GOLD MINE

**Figure 27.7-1**
**Historical Wildfire Activity in the Yukon**

## Legend

- City/Town
- Highway
- National/International Border
- Project Footprint
- Dawson Forest Resources Management Plans
- Wildfire Occurence (2016 and earlier)

## Notes

1. This map is not intended to be a “stand-alone” document, but a visual aid of the information contained within the referenced Report. It is intended to be used in conjunction with the scope of services and limitations described therein.
2. Wildfire history data downloaded from the Yukon Government website in February 2017

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| Figure 27.7-1 | Date: Mar 21, 2017 | Drawn by: JS | Reviewed: DP |
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### 27.7.1 POTENTIAL EFFECT OF WILDFIRE

Wildfire events may affect limited Project components and activities. The primary Project components at risk from a potential wildfire include administrative, camp, and accessory support buildings; Process Plant; airstrip; and the NAR. A summary of potential effects from wildfires is provided in **Table 27.7-2.**

### 27.7.2 WILDFIRE MITIGATION MEASURES

The Project is located within the Dawson FRMP region, and the closest fire department is in Dawson. Yukon Department of Community Services, Wildland Fire Management Program is responsible for managing wildfires in Yukon. The Wildland Fire Management Program provides support for wildfire suppression, control, and emergency response to areas affected by wildfires. While the Project will have a fire response program (refer to **Section 31.0 Environmental and Socio-economic Management Program**), response to a large wildlife will likely involve support from the Dawson Fire Department.

The Mine Site is located in an area of relatively sparse vegetation, dominated by low lying shrubs and grasses; south-facing aspects have developed thin forest stands dominated by deciduous aspen and tamarack (refer to **Appendix 15-B Valued Component Assessment Report Vegetation**). The Mine Site will be largely cleared of vegetation, which will reduce the risk of wildfires travelling into the Mine Site. Mitigation measures proposed to minimize the potential effects of a wildfire are listed in **Table 27.7-2**. In addition to the mitigation measures above, the Proponent will follow all applicable requirements in the National Fire Code of Canada (NRCC 2015) through all Project phases.

The Project has been designed to be compliant with all building and fire code requirements and with provisions to adapt to potential wildfire events and prevent potential effects associated with wildfires. Should a wildfire threaten the Project or Project activities, the Emergency Response and Health and Safety Plan (summarized in **Section 31.0 Environmental and Socio-economic Management Program**) provides a plan for the temporary shutdown of Project activities to protect the Mine Site (including combustible materials) from the wildfire and evacuation of Project personnel.

### 27.7.3 SUMMARY OF POTENTIAL EFFECTS OF WILDFIRES

The potential effects on the Project associated with wildfire and the respective mitigation measures are described in **Table 27.7-2** below.

**Table 27.7-2 Potential Effects and Mitigation Measures for Wildfires**

<table>
<tr><th rowspan="2">Project Component</th><th colspan="2">Range of Potential Effects</th><th rowspan="2">Project Design and Mitigation Measures</th><th rowspan="2">Management Plans*</th></tr>
<tr><th>Likely Scenario</th><th>Worst-case Scenario*</th></tr>
<tr><td>Open Pits</td><td rowspan="5">No damage to infrastructure; no interruption of mine operations as fire is limited to the established vegetation buffer zone.</td><td rowspan="3">Evacuation of all personnel requiring a temporary shutdown of the mine.</td><td rowspan="5">• Vegetation clearing throughout the Mine Site will reduce fuel sources and fire risk near the Project buildings.<br>• Fire water for suppression will be stored and readily available in a tank near the camp and administration facilities.</td><td rowspan="7">• Emergency Response Plan<br>• Mine Development and Operations Plan</td></tr>
<tr><td>Waste Rock Storage Facility</td></tr>
<tr><td>Stockpiles</td></tr>
<tr><td>Heap Leach Facility</td><td>Complete shutdown of HLF for an extended period requiring draining of HLF to event ponds.</td></tr>
<tr><td>Plant Site</td><td>Process plant completely destroyed. Complete shutdown of HLF for an extended period.</td></tr>
<tr><td>Bulk Explosive Storage Area</td><td>Unintended explosion and/or fire is within the established buffer zone, and does not affect any components of the Mine Site. No interruption of critical services.</td><td>Unintended explosion and/or fire is within the established buffer zone, and does not affect any components of the Mine Site. No interruption of critical services. Project facilities are intentionally located at a distance that will not be affected by a large-scale explosion at the Bulk Explosive Storage Area.</td><td>• Explosives will be stored in approved explosives magazines on separate pads. Each magazine will be surrounded by earthen berms. Fuels tanks will be surrounded by farm bund lined with a high-density polyethylene liner.<br>• Adherence to Explosives Act<br>• Fire water for suppression will be stored and readily available in a tank near the camp and administration facilities.</td></tr>
<tr><td>Camp Site</td><td>Minor or no damage to buildings and structures at the Mine Site. No interruption of critical services.</td><td>Buildings and structures at the Mine Site are severely damaged or destroyed by wildfire. Complete evacuation and shutdown of Project activities and services for an extended period.</td><td>• Vegetation clearing throughout the Mine Site will reduce fuel sources and fire risk near the Project buildings.</td></tr>
</table>

| Project Component | Range of Potential Effects | | Project Design and Mitigation Measures | Management Plans* |
|---|---|---|---|---|
| | Likely Scenario | Worst-case Scenario* | | |
| Site Roads and Haul Roads | Minor damage to culverts, or temporary closure of site road due to obstructions or safety concerns. | Multiple culverts are severely damaged by wildfire, causing an extended temporary closure of the Mine Site road for repairs. | • Fire water for suppression will be stored and readily available in a tank near the camp and administration facilities | |
| Airstrip | Minor damage to airstrip facilities and infrastructure. Minor service interruptions due to smoke. | Severe damage to the airstrip and facilities. Regularly scheduled flights delayed for repairs. | | |
| Northern Access Route | Minor damage to bridges and culverts, or temporary closure of NAR due to obstructions or safety concerns. | Multiple bridges and culverts severely damaged by wildfire causing an extended temporary closure of the NAR for repairs. | • Brushing and clearing along the NAR right-of-way will reduce the risk of wildfires, which will include measures to prevent fires because of Project-related traffic along the NAR. | • **Emergency Response Plan**<br>• **Access Route Operational Management Plan (Appendix 31-B)** |

**Note:** * For descriptions of management plans please refer to **Section 31.0 Environmental and Socio-economic Management Program;** for all infrastructure located at the Mine Site, a worst-case scenario is considered extremely unlikely because of the sparse vegetation occurring at the Mine Site.

### 27.8 Climate Change

Global climate change is projected to have a profound effect on northern regions in Canada. The effects of climate change are already being measured in sub-polar regions, where average annual temperatures have risen, regional snow cover has decreased, permafrost has thawed, and the extent and frequency of wildfires has increased (Environment Yukon 2014). Current climate model projections predict that the nature of seasonal climates will also change materially in the next several decades, with warmer and wetter-than-average winters, and hotter, drier summers (Environment Yukon 2014). Weather extremes are predicted to become more frequent. Associated biological and ecological changes are likely as a result of climate change.

Northern Canada is uniquely vulnerable to the effects of climate change; specifically, Yukon is experiencing significant effects to infrastructure, traditional ways of living, and ecological systems (Environment Yukon 2016). Average temperature in Yukon has increased by 2° C over the past 50 years, which is double the rate experienced in southern Canada (Environment Yukon 2016). These changes are leading to an increase in the frequency and magnitude of extreme events including storms, flash floods, ice jams, and forest fires.

As climate change will have effects on the physical and biological elements across the Coffee Creek region, the existing climate conditions at the Project are unlikely to remain static. The Proponent assessed potential climate change effects for the Project to guide effective long-term Project planning (see **Appendix 8-A Hydro-meteorology Baseline Report**, Appendix D). Modelled historical climate averages and future projections were used to calculate temperature, precipitation, and freeze/thaw date projections for the Project to the year 2100. Additional relevant information is also provided in **Section 9.0 Air Quality and Greenhouse Gas Emissions Analysis** and **Section 29.0 Carbon Management Assessment**.

Overall, the model indicates that warming is anticipated to be particularly pronounced in the summer at Coffee Creek, and this will lead to a later freeze-up in fall and an earlier thaw in spring. In tandem, this yields a growing season that is as much as one month longer by the end of the century, and implies a notably lengthened duration for above zero temperatures and consequent adverse implications for permafrost integrity in the region.

Average annual temperatures are projected to rise significantly in the Coffee Creek region over the course of this century. The current annual average, about –3° C at the Project site (**Appendix 8-A Hydro-meteorology Baseline Report**), is forecast to rise by 3° C to 5 ° C by the end of the century.

Average seasonal temperatures are projected to increase by approximately 3° C to 5 ° C in spring, fall and winter, with a more dramatic rise in summer months. It is estimated that the average temperature for the Project site in June, July, and August at present is +11.3° C. By the end of the century the climate model predicts that the June-July-August average temperature will be between 14.9° C and 16.5° C, an increase of some 3° C to 5°C relative to average conditions today (**Appendix 8-A Hydro-meteorology Baseline Report**).

As with mean temperature, net precipitation in the Coffee Creek region overall is projected to increase over the course of this century. The average precipitation rate for the Project site is currently 485 mm per year (mm/yr), which is slightly higher than the 428 mm/yr to 476 mm/yr at the valley floor. At the valley-floor elevation, average annual precipitation by the year 2100 is projected to increase marginally to between 477 mm/yr and 525 mm/yr, and a similar increase is projected for the Project site. Across the broader region, an increase of up to 20% (574 mm/yr to 670 mm/yr) can be anticipated by the year 2100 given the emissions pathway used in the climate model.

The remainder of this section discusses the potential effects of changing climate on the Project, and the mitigation measures the Project will adopt to minimize or eliminate these effects.

#### 27.8.1 POTENTIAL EFFECT OF CLIMATE CHANGE

The increases in temperature and precipitation associated with climate change are predicted to occur gradually over the course of the next century. The Project has been designed to accommodate current climate extremes; therefore, climate change is not likely to significantly alter the climate beyond Project during the Construction and Operation Phases (approximately the first 15 years). The effects of climate change are likely to interact with the Project during the Reclamation and Closure Phase (15 years and onwards) (see **Section 2.0 Project Description**, Figure 2.4-1 Project Schedule).

The gradual warming over the next century will lead to a later freeze-up in fall and an earlier thaw in spring, according to the climate model results. This will yield a growing season that is up to one month longer by the end of the century. This represents a significantly lengthened duration of above-zero temperatures, which has adverse implications for permafrost integrity in the region. The analysis of permafrost thaw under long term climate conditions suggests that towards the end of this century the active permafrost layer is likely to grow in thickness in the warmer months while the depth of the active permafrost layer to permanently frozen ground will slowly increase (**Appendix 27-A Implications of Long-term Climate Conditions on Permafrost**).

The Reclamation and Closure Phase and the Post-closure Phase of the Project are most likely to experience effects of climate change. The potential implications for these phases of the Project due to climate change include: changes in permafrost regime, risk of wildfire, drought, extreme rainfall events, and flooding.

Climate change may affect limited Project components and activities. A summary of potential effects from climate change is provided in **Table 27.8-1**.

### 27.8.2 Climate Change Mitigation Measures

The Project has been designed to standards that will withstand extreme return periods for temperatures, precipitation, flooding, and permafrost changes that are representative of current climate conditions. Climate change is not likely to significantly alter the current climate regime within the next 15 years. The mine design incorporates considerations for the occurrence of extreme and probable maximums and worst-case scenarios (**Section 27.1.1** and **27.2.1**). Planning for mine closure and reclamation incorporates considerations for potential climate-related changes, and the design specifications for closure and reclamation have incorporated considerations for potential effects linked to climate change; these effects and the appropriate mitigation measures are described in **Section 27.2.1**, **Section 27.3.1**, **Section 27.4.1**, and **Section 27.7.1**.

To accommodate for uncertainties surrounding climate change effects on the Project, the Proponent will follow an adaptive management approach to climate change. This approach will focus on using site-specific climate data to continuously improve policies and practices, and will allow for flexible responses to early signals of climate change when timing and magnitude are uncertain. Implementing an adaptive management approach to respond to the likely effects of climate change may bridge the gap between the climate projections for the Project area and the actual climate change effects that are realized at the Project site. This approach will enable the Proponent to adapt to such effects by formulating proactive mitigation to the extent possible.

### 27.8.3 Summary of Potential Effects of Climate Change

The potential effects on the Project associated with climate change and the respective mitigation measures are described in **Table 27.8-1** below.

**Table 27.8-1 Potential Effects of Climate Change on the Project and Mitigation Measures and Management Plans**

| Project Component | Range of Potential Effects | Project Design and Mitigation Measures | Management Plan* |
|---|---|---|---|
| Open Pits | Extreme precipitation events leading to excessive accumulation of water in remaining Open Pits. | • Spillways will be constructed at the pour point of the pit lakes to direct overflow to natural drainage courses, channels, and rock drains leading to discharge locations as specified in the mine plan. | • **Conceptual Reclamation and Closure Plan (Appendix 31-C)** |
| Waste Rock Storage Facility | Extreme precipitation events leading to erosion and sediment deposition in downstream environments.<br>Climate regime change reduces efficiency of revegetation efforts of the stockpile and temporary WRSF areas. | • Diverting runoff around erosion-prone areas through waste rock toe collection channels, waste rock surface diversion channels, inlet channels, drainage ditches, diversion berms, and waste rock bench diversion ditches.<br>• The Proponent initiated a revegetation and reclamation research program alongside exploration activities to test the effectiveness of various revegetation and reclamation techniques under different site conditions. Natural revegetation will be encouraged according to site-specific testing to be performed during the operating life of the Project. | |
| Stockpiles | | | |
| Heap Leach Facility | Extreme precipitation events leading to erosion and sediment deposition in downstream environments.<br>Climate regime change reducing efficiency of revegetation efforts. | • Pilot programs will be commissioned between Year 4 and 6, and will provide opportunities for optimization and further development with a focus on passive and semi-passive systems.<br>• The slopes and crest of the heap will be graded to route water away from the heap towards armored drainage channels. Flat or minimally sloped surfaces (less than about 6%) of the heap will be compacted and capped with an low permeability infiltration barrier (e.g., geosynthetic clay liner (GCL) or equivalent), followed by a drainage layer (e.g., gravel or equivalent) and finely-graded material (e.g., waste rock, soil, or other suitable material). Slopes of the heap will be compacted then covered with finely-graded material (e.g., waste rock, soil, or other suitable material), due complexities of creating a stable slope with a low-permeability infiltration barrier. Natural revegetation will be encouraged on the capped heap.<br>• The Proponent initiated a revegetation and reclamation research program alongside exploration activities to test the effectiveness of various revegetation and reclamation techniques under different site conditions. Natural revegetation will be encouraged according to site-specific testing to be performed during the operating life of the Project. | |

| Project Component | Range of Potential Effects | Project Design and Mitigation Measures | Management Plan* |
|---|---|---|---|
| Plant Site | Extreme precipitation events leading to erosion and sediment deposition in downstream environments.<br>Climate regime change reduces efficiency of revegetation efforts of the ancillary facility areas, site roads, airstrip, and the NAR. | • The Proponent initiated a revegetation and reclamation research program alongside exploration activities to test the effectiveness of various revegetation and reclamation techniques under different site conditions. Natural revegetation will be encouraged according to site-specific testing to be performed during the operating life of the Project. | |
| Bulk Explosive Storage Area | | | |
| Camp Site | | | |
| Site Roads and Haul Roads | | | |
| Airstrip | | | |
| Northern Access Route | | | |

**Note:** * For descriptions of management plans please refer to Section 31.0 Environmental and Socio-economic Management Program.

## 27.9 SUMMARY OF EFFECTS OF THE ENVIRONMENT

The analysis of potential effects of the environment on the Project has determined that the Project has been designed to withstand severe environmental phenomenon and resist significant damage from extreme events. In the event that the Project experiences significant damage from an extreme environmental event during the Project's lifetime, the implementation of mitigation measures and deployment of the **Emergency Response Plan (Section 31.0 Environmental and Socio-economic Management Program)** are likely to reduce the severity of potential effects and prevent critical damage and loss of life.

To accommodate for uncertainties surrounding the unpredictable nature of potential effects of the environment on the Project, the Proponent will follow an adaptive management approach. This approach will focus on using continuous climate and stability monitoring, and staying tuned to local earthquake and wildfire alerts. The Proponent is committed to developing and implementing policies and practices that will allow for flexible responses to early signals of potential environmental hazards. This adaptive management approach to respond to various environmental conditions will allow the Proponent to respond to the actual environmental conditions and effects that are realized at the Project site.

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# 28.0 ACCIDENTS AND MALFUNCTIONS ASSESSMENT

## 28.1 INTRODUCTION

This section evaluates the potential effects to any accident or malfunction to Intermediate Components (ICs) and Valued Components (VCs) during the Construction, Operation, Reclamation and Closure, and Post-Closure Phases of the proposed Coffee Gold Mine (Project). Pursuant to section 42(1)(c) of the *Yukon Environmental and Socio-Economic Assessment Act*, S.C. 2003, c.7, the assessment of a project must include a consideration of “the significance of any environmental or socio-economic effects of the project that might occur in or outside Yukon, including the effects of malfunction or accidents”. This section identifies the cause, type, nature, likelihood, and predicted consequence of accidents or malfunctions associated with Project components and activities during each Project phase, and the mitigation measures (e.g., design standards, preventative measures, management plans, and emergency response and contingency plans and procedures) to be implemented to manage risk and prevent or reduce the incidence and magnitude of such unplanned events.

For the purposes of this report, accidents and malfunctions are defined as follows:

- **Accident**: an unexpected occurrence or unintended action
- **Malfunction**: failure of a piece of equipment, a device, or a system to function normally.

While the possibility of accidents and malfunctions occurring exists, the objective of Kaminak Gold Corporation, a wholly owned subsidiary of Goldcorp Inc. (Goldcorp or Proponent), is to minimize the probability of such incidents and the associated consequences that may affect people and the environment. The Project will be designed, constructed, and operated according to standard industry best management practices to minimize the risk of an accident or malfunction occurring. Goldcorp will implement best management practices, including appropriate management plans, in addition to developing and following procedures for safe mine operations. In addition, Goldcorp will deliver training to personnel associated with emergency response during all phases of the Project. The training will focus on emergency procedures to manage potential onsite situations. Refer to **Section 31.0 Environmental and Socio-economic Management Program** for more detailed information on operational safety and best management practices).

## 28.2 SCOPE

### 28.2.1 PROJECT DESCRIPTION

The Project is a proposed gold mine in the White Gold District of west-central Yukon, approximately 130 kilometres (km) south of the City of Dawson (Dawson) and 330 km northwest of Whitehorse. The Project contains a substantial oxide resource that will be mined by open pit mining methods and recovered using heap leach processing. The Project will consist of a 30-month Construction Phase, a

12-year Operation Phase, an 11-year Reclamation and Closure Phase, which includes post-mining and active closure stages, in addition to a Post-closure Phase.

A detailed description of the Project can be found in **Section 2.0 Project Description**

### 28.2.2 REGULATORY REQUIREMENTS AND GUIDELINES

Goldcorp must adhere to a number of territorial and federal regulatory requirements that outline mitigations for a potential accident and malfunction as well as measures for reporting and clean-up responses. These regulatory requirements include the following:

- *Environment Act,* RSY 2002, c.76, provides a legislative framework for the protection of the territory's land, water, and air. The *Environment Act* and its regulations apply on land throughout Yukon, including private property, government-owned lands, lands within municipal boundaries and First Nation settlement lands where the First Nation has not developed equivalent laws. Regulated activities under the Act include, among others, fuel storage and handling, solid waste management, hazardous waste management, air emissions and the assessment and clean-up of spills.
- *Occupational Health and Safety Act*, RSY 2002. c. 159**,** promotes and protects worker health and safety in Yukon.
- *Dangerous Goods Transportation Act*, RSY 2002, c.50 is a territorial legislation that applies to the transportation of dangerous goods on a highway.
- *Canadian Environmental Protection Act, 1999,* SC 1999, c.33 (CEPA 1999), is a primary element of the federal legislative framework for protecting the Canadian environment and human health. A key aspect of CEPA 1999 is the prevention and management of risks posed by toxic and other harmful substances. CEPA 1999 also governs the management of environmental and human health effects of vehicle, engine, and equipment emissions, fuels, hazardous wastes, environmental emergencies, and other sources of pollution.
- *Transportation of Dangerous Goods Act, 1992*, SC 1992, c. 34 (TDGA 1992), is the primary federal legislation to promote public safety in the transportation of dangerous goods. The TDGA 1992's Dangerous Goods Regulations (SOR/2001-286) defines classes of materials that are considered to be dangerous goods under TDGA 1992, and defines threshold volume and mass for spill reporting.
- *Fisheries Act,* RSC 1985, c. F-14, is the primary federal legislation to protect fish and fish habitat in Canada. Section 36 of the *Fisheries Act*, the key pollution prevention provision, prohibits the deposit of deleterious substances into waters frequented by fish, unless authorized by regulations under the *Fisheries Act* or other federal legislation. A deleterious substance can be any substance that, if added to any water, would degrade or alter its quality such that it could be harmful to fish, fish habitat, or the use of fish by people..

### 28.2.3 CONSULTATION

The Mine Site (defined in **Section 2.0 Project Description**) as described in **Section 4.0 Project Setting**, the Mine Site is located within the traditional territory of Tr’ondëk Hwëch’in and the asserted territory of White River First Nation. The Northern Access Route (NAR) is located within the traditional territory of Tr'ondëk Hwëch'in, and portions of the access road are located within the shared traditional territories of Selkirk First Nation and the First Nation of Na-cho Nyäk Dun and the asserted territory of White River First Nation. Additional details specific to the Project area (defined in **Section 2.0 Project Description**) pertaining to ecological characteristics, land tenure, regional land use planning, and land and resource use are presented in **Section 4.0 Project Setting**.

Inputs and comments received from Aboriginal groups, stakeholders and the public during the consultation and engagement process were taken into account to identify accidents and malfunctions concerns. This includes:

- Concerns regarding transportation accidents associated with increased traffic along the NAR. This was identified by Tr’ondëk Hwëch’in, White River First Nation, and Selkirk First Nation, and during community meetings in Dawson and Whitehorse. This was also identified as a concern during meetings with Dawson Mayor and Council, individual and group meetings with Trapping Concession Holders, Road Stakeholders, the Yukon Quest, and the Dawson First Responders Focus Group.
- Concerns regarding transportation risks of cyanide on barge crossings, heap leach liner system failures, worker and wildlife exposure to cyanide. These were identified by Tr’ondëk Hwëch’in and White River First Nation. These concerns were also voiced during community meetings in Dawson, meetings with Dawson Mayor and Council, meetings with the Dawson Renewable Resource Council, a meeting with the Yukon Quest, and a meeting with the Yukon Conservation Society.

These Concerns are addressed, by following the methodology described in **Section 28.3**, in **Section 28.7** (Scenario 5) regarding transportation accidents, in **Sections 28.4.3** (Scenario 1C), **28.4.4** (Scenario 1D), regarding cyanide risks to workers and wildlife associated with an accidental cyanide spill and a failure of the Heap Leach Facility (HLF).

## 28.3 METHODOLOGY

Goldcorp followed a three-step process to assess potential Project-related accidents and malfunctions:

- Potential accidents, malfunctions, and unplanned events that might occur during the life of the Project were identified using historical performance data for similar projects and professional judgment. The analysis is focused on events that may result in risks to personnel, the environment (both biophysical and human), infrastructure, and human health (**Section 28.3.1**). From these options, the accident or malfunction with the worst-case credible scenario was selected for further assessment.

- The potential interactions between each event scenario and relevant IC / VC receptors are considered. The IC / VC and the interaction analysis serves as a screening tool to identify potential residual effects of the unplanned event (**Section 28.3.2**). The interactions between each event and the ICs/VCs are analyzed to establish the potential significance and severity of the effects. Mitigation and management measures are considered within this interaction analysis.
- A risk assessment was then conducted using the likelihood and severity of the unplanned event in each scenario (**Section 28.3.3**). The analysis of residual effects is used to establish the severity of the hazard associated with the event scenario and likelihood is derived from experience with past projects, similar projects, and professional judgment.

The scenarios used for the purpose of this environmental assessment are detailed in **Table 28.3-1** and in **Sections 28.4.**

### 28.3.1 SELECTION OF POTENTIAL ACCIDENTS AND MALFUNCTIONS

#### *28.3.1.1 Selecting Accidents and Malfunctions for Evaluation*

Identification of these accidents and malfunctions was carried out by considering the specifics of the Project's design, technology, location, and infrastructure; by using historical performance data for other similar projects; by consultation with First Nations and stakeholders; and by applying professional judgment and experience with similar types of projects and activities.

The screening of these accidents and malfunctions was conducted by considering the following:

- Project phase in which the accidents and malfunctions may occur
- Type of accidents and malfunctions that may occur
- Geographic extent of the potential effects of accidents and malfunctions
- Frequency of potential accidents and malfunctions
- Duration of the potential effects of accidents and malfunctions
- Effects of natural events on potential accidents and malfunctions
- Direct and indirect socio-environmental effects that may result from accidents and malfunctions.

Following their assessment, potential accidents and malfunctions were categorized into specific and distinct types of accidents and malfunctions that may occur on site and during transportation along the NAR. The categories identified are:

- Containment failure
- Earthworks failure
- Power failure
- Fires or explosions
- Transportation accidents.

#### *28.3.1.2 Development of Worst-case Scenarios of Potential Accidents and Malfunctions*

For each category listed above, a suite of potential scenarios from the Project that could lead to effects on Project ICs and VCs was developed. Each scenario development included a consideration of the following:

- Whether the event occurs in isolation of other events. A series of accidents and malfunctions occurring one after the other, or combined with one another, is not considered plausible and therefore not evaluated
- Whether the event represents a worst-case scenario, and whether the focus of the assessment is on the accidents and malfunctions for which the resulting adverse residual environmental effects may potentially be significant.

The worst-case scenarios for each category are presented in **Table 28.3-1,** along with the Project phases in which these accidents or malfunctions may occur.

### Table 28.3-1 Accidents and Malfunctions Worst-case Scenarios and Project Phases

| No. | Potential Accident or Malfunction | | Project Phase C | O | RC | PC | Worst-Case Scenario |
|---|---|---|---|---|---|---|---|
| 1A | Containment Loss | Hazardous material spill in water – diesel fuel | X | X | X | | Entire loss of containment of fuel truck into major watercourse (i.e., Yukon River or Stewart River). The worst-case scenario would be loss of containment during spring or late fall, when dilution capacity in the river is the lowest. |
| 1B | | Hazardous material spill on land – diesel fuel | X | X | X | | Entire loss of containment of fuel truck– 46,500 L of diesel fuel – onto land. The worst-case scenario would be loss of containment during the late summer, when active layer of permafrost is deepest. |
| 1C | | Hazardous material spill in water – cyanide | | X | | | Entire loss of cyanide shipment – 20 tonnes – into major watercourse (i.e., Yukon River or Stewart River). The worst-case scenario would be loss of containment during the spring or late fall, when dilution capacity in the river is the lowest. |
| 1D | | Hazardous material spill on land – cyanide | | X | | | Loss of on-site cyanide containment – 20 tonnes stored at the Mine Site - onto land. The worst-case scenario would be loss of containment during the late summer, when active layer is the deepest and rain could interact with the material. |
| 1E | | Containment Failure of Heap Leach Facility | X | X | | | Containment failure in the HLF; release of contact water into receiving environment. In this scenario, the discharged effluent would be off-specification, and would have higher concentrations of suspended solids, metals, or nutrients than permitted by regulations. The worst-case scenario would be discharge during spring or late fall, when dilution capacity of the receiving waterbodies is the lowest. |
| 1F | | Sediment release into watercourse | X | X | X | | Failure of the Alpha sedimentation pond; release of pond contents into downstream receiving environment; changes to water quality and hydrology including streambed scouring. The worst-case scenario would be discharge during spring or late fall, when dilution capacity in the receiving waterbodies is the lowest. |
| 2 | Earthworks Failure | Failure or slumping of Open Pit walls | X | X | X | X | Failure or slumping of pit wall. |
| 3 | Power Failure | | X | X | X | | Long-term power failure leading to temporary mine shutdown. |
| 4 | Fire or Explosion | Fire or explosion on site | X | X | X | | Fire / explosion of a tank at the bulk fuel storage area |
| 5 | Transportation Accidents | Transportation accident leading to human mortality | X | X | X | X | Vehicle accident resulting in at least one human fatality. |

**Notes:** L - litres; ML - million litres

### 28.3.2 EFFECTS ASSESSMENT

#### *28.3.2.1 Screening and Analyzing Effects from Potential Accidents and Malfunctions*

Potential interactions between the VCs and ICs of the Project and potential accidents and malfunctions were evaluated using the same ranking system that were used for the Project-related effects for the VCs / ICs. Each scenario was screened against the VCs / ICs using a risk-based approach to filter potential effects into low, moderate, or high risk ratings as a result of interactions between the accident or malfunction and the VCs / ICs. The potential interactions were ranked using past experience, guidance documents, and professional judgement for each of the VCs / ICs. All risks interactions evaluated as moderate or high were then carried forward to be assessed in terms of the resultant effect on the receiving environment based on the proposed Project design and mitigation measures.

**Table 28.3-2** summarizes the VCs and ICs that may be affected by potential Project-related accidents and malfunctions.

Note that the worst-case scenario would involve a power failure of up to 72 hours; longer power failures would be mitigated by: redundant systems (backup generators), critical spares on site, and minimum fuel reserves available. In the extremely unlikely event of total generator loss, new generators can be procured in under a week. In the case of a short-term power outage (up to 72 hours), the following mitigation measures would ensure that environmental effects are minimized:

- Event ponds are sized to contain the following cumulative volume: (a) all contact water produced by a PMP storm event; (b) full heap drainage during a power outage or pump failure; and (c) seasonal water accumulation assuming a wet cycle. The PMP storage volume is sufficient to contain the runoff from multiple back-to-back 200-year precipitation events, and may be compared to a 10,000-year event. Full heap drainage has been estimated by applying the full operating pregnant flow rate of 455 cubic metres per hour for a 72-hour period without attenuation. If power or pumping capacity is lost and the irrigation flow ceases, the rate of flow out of the heap will begin to decline rapidly and will approach negligible rates within several days. The power outage would need to persist for months with no other mitigation in order for a release of water to occur.
- Generators will be installed with a minimum n+1 configuration, providing back-up power capabilities.

As no moderate or high-risk interactions were identified for a full power outage at the Mine Site, this scenario is not considered further in this assessment.

**Table 28.3-2 Screening of Plausible Accidents and Malfunctions on Project Intermediate Components and Valued Components**

| No. | Potential Accidents and Malfunctions | | Groundwater | Hydrology | Air Quality and Greenhouse Gas Emissions | Noise | Surficial Geology, Terrain, and Soils | Surface Water Quality | Fish and Fish Habitat | Vegetation | Wildlife and Wildlife Habitat | Birds and Bird Habitat | Demographics | Economic Conditions | Social Economy | Community Infrastructure and Services | Education and Training | Land and Resource Use Assessment | Community Health and Well-Being (Human Health) | Heritage Resources |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1A | Containment Failure | Hazardous material spill in water – diesel fuel | ⚪ | ⚪ | ⚪ | ⚪ | ⚪ | 🔴 | 🟡 | 🟡 | 🟡 | 🟡 | ⚪ | | 🟢 | 🟡 | ⚪ | 🟡 | 🟡 | ⚪ |
| 1B | | Hazardous material spill on land – diesel fuel | 🟡 | ⚪ | ⚪ | ⚪ | 🟢 | ⚪ | ⚪ | 🟢 | 🟢 | 🟢 | ⚪ | ⚪ | 🟢 | 🟡 | ⚪ | 🟢 | 🟡 | ⚪ |
| 1C | | Hazardous material spill in water – cyanide | 🟢 | ⚪ | 🟡 | ⚪ | ⚪ | 🔴 | 🟡 | 🟡 | 🟡 | 🟡 | ⚪ | ⚪ | 🟢 | 🟡 | ⚪ | 🟡 | 🔴 | ⚪ |
| 1D | | Hazardous material spill on land – cyanide | 🟡 | ⚪ | 🟡 | ⚪ | 🟡 | ⚪ | ⚪ | ⚪ | 🟢 | 🟢 | ⚪ | ⚪ | 🟢 | 🟡 | ⚪ | 🟢 | 🔴 | ⚪ |
| 1E | | Containment failure of HLF | 🟢 | ⚪ | ⚪ | ⚪ | ⚪ | 🔴 | 🟡 | 🟢 | 🟢 | 🟢 | ⚪ | ⚪ | 🟢 | 🟡 | ⚪ | 🟢 | 🔴 | ⚪ |
| 1F | | Sediment release into watercourse | ⚪ | 🟡 | ⚪ | ⚪ | ⚪ | 🔴 | 🟡 | 🟡 | 🟢 | 🟢 | ⚪ | ⚪ | 🟢 | 🟢 | ⚪ | 🟢 | 🔴 | ⚪ |
| 2 | Earthworks | Failure or slumping of pit | ⚪ | ⚪ | 🟢 | ⚪ | ⚪ | 🟢 | ⚪ | 🟢 | 🟢 | 🟢 | ⚪ | ⚪ | 🟢 | 🟡 | ⚪ | 🟢 | 🔴 | ⚪ |
| 3 | Power Failure | | ⚪ | ⚪ | ⚪ | ⚪ | ⚪ | ⚪ | ⚪ | ⚪ | ⚪ | ⚪ | ⚪ | ⚪ | ⚪ | ⚪ | ⚪ | ⚪ | ⚪ | ⚪ |
| 4 | Fire or Explosion on Site | | 🟢 | ⚪ | 🟡 | 🟡 | ⚪ | ⚪ | ⚪ | ⚪ | 🟢 | 🟢 | ⚪ | ⚪ | 🟢 | 🟡 | ⚪ | 🟢 | 🔴 | ⚪ |
| 5 | Transportation Accident | | ⚪ | ⚪ | ⚪ | ⚪ | ⚪ | ⚪ | ⚪ | ⚪ | 🟢 | 🟢 | ⚪ | ⚪ | 🟢 | 🟡 | ⚪ | 🟢 | 🔴 | ⚪ |

⚪ – No interaction; no adverse effect could occur; no further consideration warranted
🟢 – Low risk interaction; negligible or minor adverse effect could occur; no further consideration warranted
🟡 – Moderate risk interaction; moderate adverse effect could occur; warrants further consideration
🔴 – High risk interaction; a key interaction resulting in significant major adverse effect; warrants further consideration

#### *28.3.2.2 Potential Effects*

The potential effects are those of greater importance that require preventative or mitigation measures for the effects to be minimized. Potential effects were analyzed using best practice methods to predict the nature and extent of Project-related effects that may result from potential accidents and malfunctions should mitigation measures and contingency plans not be fully effective. The effects were described using the same ranking system used for each individual Project IC or VC. These analyses are described for each category of potential accidents and malfunctions in the sections that follow.

### 28.3.3 RISK ASSESSMENT

Risk is derived from the product of probability and consequences; therefore, the risk assessment of accidents and malfunctions consists of an evaluation of the probability (i.e., the likelihood of occurrence) of a scenario happening, and an evaluation of the consequences (i.e., the severity of occurrence) of the effects of a mishap on the VCs / ICs, assuming that emergency planning and management controls are in place.

The likelihood and severity of an accident and malfunction is determined according to the attributes identified in **Table 28.3-3** and **Table 28.3-4**. These attributes have been developed according to professional judgement and environmental assessment best practice in Yukon and for mining projects. The overall risk assessment result is calculated using **Table 28.3-5** as guidance.

**Table 28.3-3 Definitions for Likelihood of an Event**

| Category | Description |
|---|---|
| Almost Certain | Event is expected to occur in most circumstances and has a history of occurrence. Expected to occur once or more per year. |
| Likely | Event will probably occur in most circumstances. Expected to occur once in one to three years. |
| May | Event could occur at some point. Expected to occur once in every three to five years. |
| Unlikely | Event not likely to occur in normal circumstances. Expected to occur only once during the life of the Project. |
| Rare | Event could occur only in exceptional circumstances. Not expected to occur during the life of the Project. |

### Table 28.3-4 Definitions for Severity of an Event

| Consequence Rating | Description |
|---|---|
| Severe | Biophysical: Resulting in structural and functional changes at the population level to an extent which could potentially result in severe changes at the community and ecosystem levels, or resulting adverse effects occur regionally and will take more than 10 years to reverse.<br>Human Environment: Adverse effects would result in changes beyond historical norms and present a major management challenge. One or more fatalities may occur. |
| Major | Biophysical Environment: Resulting in some structural and functional changes at the population level above natural variation, or resulting adverse effects occur regionally and can be reversed in 10 years or less.<br>Human Environment: Adverse effects would result in changes beyond historical norms and present a moderate management challenge. |
| Moderate | Biophysical Environment: Resulting in lethal and/or sub-lethal effects at the individual level indistinguishable from natural variation or resulting adverse effects are detectable and can be reversed in one year or less.<br>Human Environment: Adverse effects would result in demonstrable change and are possible at the community-wide level, but remain within historic norms and present no or a minor management challenge. |
| Minor | Biophysical Environment: Resulting adverse effects are barely detectable and can be reversed in one month or less.<br>Human Environment: Resulting adverse effects are detectable, but are not likely to be experienced at the community level. |
| Negligible | Resulting adverse effects are barely to not detectable and can be reversed in two days or less.<br>Human Environment: Resulting adverse effects are not detectable, or are in the normal range of variability in the human environment. |

### Table 28.3-5 Risk Matrix

| | | Consequence | | | | |
|---|---|---|---|---|---|---|
| | | Severe | Major | Moderate | Minor | Negligible |
| Likelihood of Event Occurring | Almost Certain | Critical | Very High | High | Medium | Low |
| | Likely | Very High | High | High | Medium | Low |
| | May | High | High | Medium | Low | Very Low |
| | Unlikely | High | Medium | Medium | Low | Very Low |
| | Rare | High | Medium | Low | Very Low | Negligible |

**Source:** Adapted from BC Risk Management Branch and Government Security Office, 2012

The significance of an accident and malfunction scenario (worst-case) is determined based on the risk ranking. Risks assessed as “High”, “Very High” and “Critical” are deemed “Significant”, whereas risks assessed as “Negligible”, “Very Low”, “Low” and “Moderate” are deemed “Not Significant”. This significance categorization was derived based on that “High”, “Very High” and “Critical” risks may trigger re-design or major operational changes, i.e., material changes to the Project Description.

## 28.4 SCENARIOS 1A-1E: CONTAINMENT FAILURE

The Project will use and store a variety of hydrocarbon fuels, lubricants, and process chemicals throughout the Construction, Operation, Reclamation and Closure, and Post-closure Phases. Two hazardous materials have been identified for this scenario due to their potential environmental effects associated with an accidental spill, i.e., diesel fuel and cyanide. Diesel will be transported to site by truck (**Section 2.0 Project Description**). Cyanide will be used in the process plant for ore processing. The transport, storage, and use of these materials have associated risks for the unintended release of these compounds in the environment. Failure modes include vehicle accidents, failures of tanks and containment systems, spills during maintenance or operations, or releases associated with other failures such as fires.

The worst-case spills and leaks scenarios considered in this assessment are:

- Scenario 1A: Hazardous material spill in water – diesel fuel
- Scenario 1B: Hazardous material spill on land – diesel fuel
- Scenario 1C: Hazardous material spill in water – cyanide
- Scenario 1D: Hazardous material spill on land – cyanide
- Scenario 1E: Containment failure of Heap Leach Facility
- Scenario 1F: Sediment release into watercourse.

### 28.4.1 SCENARIO 1A: HAZARDOUS MATERIAL SPILL IN WATER – DIESEL FUEL

Diesel fuel will be transported to site in approved vehicles along the NAR. Inclement weather, a wildlife strike, barge strike, or other serious incidents could result in the loss of containment of the fuel shipment. This scenario evaluates the effects to ICs and VCs in the worst-case scenario where the entire load of diesel fuel (full truck load) is released into a major waterbody such as the Yukon River or Stewart River. The worst-case scenario would be loss of containment during spring or late fall, when the rivers are flowing but dilution capacity in the river is the lowest.

To be conservative, this scenario assumes that all of the spilled fuel enters the freshwater environment. This scenario is applicable during the Construction, Operation, and Reclamation and Closure Phases; no significant fuel transport will occur in the Post-closure Phase.

#### *28.4.1.1 Low Risk Effects*

After consideration of mitigation measures and as per **Table 28.3-2**, a fuel spill in water has no or low risk interaction with Groundwater; Hydrology; Air Quality and Greenhouse Gas Emissions; Noise; Surficial Geology, Terrain and Soils; Demographics; Economic Conditions; Social Economy; Education and Training; and Heritage Resources ICs and VCs. Effects to these ICs and VCs from this potential accident or malfunction are not evaluated further.

#### *28.4.1.2 Mitigation Measures*

The **Access Route Construction Management Plan (Appendix 31-A)** describes the procedures and protocols for construction of the access road, barge crossings and seasonal winter road and the **Access Route Operational Management Plan (Appendix 31-B)** describes procedures and protocols to be followed in the operation of the NAR, barge crossings, and seasonal winter road and ice crossings, along with a description of BMPs used to guide procedures and protocols. **Section 31.0 Environmental and Socioeconomic Management Plans** contains information on the additional plans that Goldcorp will develop and implement that will help to mitigate the potential for a diesel fuel spill in water during all phases of the Project. These plans will include:

- Emergency Response Plan
- Mine Development and Operations Plan
- Spill Contingency Plan
- Waste Management Plan.

The Project will adhere to the federal CEPA 1999, TDGA 1992 and relevant associated regulations. The territorial *Environment Act* and relevant regulations (e.g., Contaminated Sites Regulation, Spills Regulation, Storage Tank Regulations) will also be adhered to.

Specific Project measures that will help to minimize the risk of a diesel fuel spill in water largely surround the safe operation of vehicles and storage. These measures include the following:

- Project site roads will be designed, constructed and maintained so that they are safe for designated uses including a one-lane, two-way radio assisted NAR.
- Vehicles will not park on the travelling surface – to park, vehicles will pull off the road in a safe location such as a pullout.
- Speed limits will be posted in accordance with permit conditions and signage requirements.
- Goldcorp employees and contractors will be educated on road safety rules during safety induction training, which will take place before they first drive the NAR.
- Driving under the influence of alcohol or intoxicating drugs will be prohibited.
- Wildlife will have the right-of-way at all times. Vehicle operators will be vigilant to watch for wildlife near roads and will take reasonable actions to avoid collisions with wildlife.
- Road signage, including both permanent and temporary/movable signage, will be erected to inform users regarding seasonal wildlife issues and high-risk areas for wildlife collisions.
- Each barge will be operated by a Transport Canada-certified captain and have a deck assistant.
- Barge crews will be trained and certified in Marine Emergency Duties A1 and A2.

While this scenario does not explicitly evaluate spills from stationary fuel storage locations, significant substantial volumes of fuel for the barge operations will be stored in 20,000 L double-walled tanks that will be placed a minimum of 30 m from the water, inside of high density polyethylene (HDPE) -lined berms.

One fuel tank will be located at both barge landings on the south side of the Yukon and Stewart rivers. Lined containment berms will be sized to provide 22,000 L of storage, or 110% capacity of the tank. Fuel handling and storage infrastructure and equipment will be regularly inspected and maintained.

***Emergency Response and Cleanup Procedures***

In the event of a spill, the Emergency Response Plan and the Spill Contingency Plan will be triggered. To ensure compliance with Section 36 (3) of the *Fisheries Act* and Section 132 of the *Yukon Environment Act*, all spills of hazardous materials, regardless of quantity, into a waterbody will be considered a major spill. Under the Spills Regulation, any release into a watercourse requires immediate notification of the 24-hour Yukon Spill Report Center line.

In the event of a diesel spill into water, the emergency response team (ERT) will be activated. The ERT will be comprised of individuals trained and responsible for responding to major spills. These team members will attend regular training sessions in emergency and spill response. If safe to do so, the ERT will secure the site to prevent the continued spill or leakage of contaminants into the surrounding environment.

A site-wide communication system will be in place to communicate to all Project staff in the event of a spill. The main on-site radio communication system will be used to alert workers to danger, convey safety information, and maintain site control. Radios or satellite telephones will be used when work teams are away from the main communication systems such as along the NAR. Communication equipment maintained on-site will include radios, telephones, satellite phones, and other wireless communication systems.

Spill cleanup and restoration activities will be as described in the Spill Contingency Plan. Spill response and containment procedures on water will include the following procedures:

- Contain spill as close to release point as possible
- Concentrate slicks using spill containment booms
- Deflect slicks from nearby intakes or other sensitive areas using sorbent booms
- Use appropriate sorbent pads on small spills
- For fast current and turbulent water, only use appropriate spill response measures (i.e standard sorbent booms and pads should not be utilised).
- Intercept moving slicks in quiet areas using sorbent booms.

Containment and cleanup equipment will be stored at appropriate locations. Fuel trucks and the fuel tanks will have spill kits, which will contain containment and cleanup equipment such as personal protective equipment (PPE), sorbent pads, socks and pillows, shovels, fire extinguishers, and granular absorbents. Spill response kits will be available on the barges.

Goldcorp's Environmental Department will undertake monthly spill kit inspections to ensure the kits are fully stocked. In the event that a spill kit is used for spill response, the kit will be replenished after the spill response is completed.

Absorbent materials used in collecting spilled hydrocarbons will be incinerated.

When appropriate, equipment used in the spill recovery will be taken to the truck shop where it will be cleaned using cleaning compounds or materials. These are to be collected for incineration or packed for transportation to an approved disposal facility. Cleaning water that has come into contact with hydrocarbons will be send to the land farm for storage and treatment.

#### *28.4.1.3 Likelihood of Accident or Malfunction*

The risk assessment consists of an evaluation of the probability (i.e., the likelihood of occurrence) of an accidental release of full truck load of diesel fuel from a fuel tanker truck and an evaluation of the consequences (i.e., the severity of occurrence) of the effects on the environment.

The probability ranking is evaluated based on a review of the general industry statistics and Project-specific conditions and facility details. The International Association of Oil & Gas Producers provides accident statistics on land transportation of dangerous goods for risk assessment purposes, suggesting $2.1 \times 10^{-8}$ accidents per loaded vehicle km for product release over 1,500 kilograms (kg) (approximately 2,000 litres (L)) (IAOGP 2010). During Project construction and operation when majority of the fuel usage occurs, the estimated diesel fuel consumption is 287,514,000 L, i.e., 6,183 loaded tanker truck (full truck load capacity) trips totalling 1,323,162 km. Based on these data and assuming all accidents would lead to spill on the Yukon River or Stewart River, there is a likelihood of less than one accidental tanker truck spill over life of the Project. As described in **Section 28.4.1.2**, all Project personnel will adhere to strict rules on speed limits, ensure driver qualifications and training requirements are met, and road use restrictions are implemented during inclement weather conditions. Therefore, the likelihood of major spill as a result of a tanker truck accident is rated as rare.

#### *28.4.1.4 Potential Effects and Risk Assessment*

***Surface Water Quality***

Any spill of diesel fuel near a watercourse, or that leads to diesel fuel being conveyed via roadside ditches into a watercourse, could have effects on surface water quality in terms of total petroleum hydrocarbon concentrations. When petroleum hydrocarbons (e.g., diesel) are released into the environment, four major fate processes will take place: dissolution in water, volatilization, biodegradation, and adsorption.

Diesel spill in surface water initially forms a thin layer on the surface. Some components (especially the isoalkanes, the dicycloalkanes, and cycloalkane monoaromatics) would evaporate and be photodegraded by reaction with ultraviolet light and hydroxyl radicals (CONCAWE 2001). Diesel fuel has low solubility in water (CONCAWE 1996). Aromatic components of diesel fuel would dissolve partially in water, whereas the aliphatic components are not water soluble (Environment Canada and Health Canada 2015). Diesel fuel can form fine dispersions and discrete particles in the water column as a result of mixing in turbulence (Gordon et al. 1973). Once turbulence stops, much of the entrained fuel would return to the surface film, which is positively correlated to water temperature (Gordon et al. 1973). Diesel fuel persistence in water typically ranges from days to weeks (Davis et al. 2004; NRC 2003).

Some diesel fuel would likely come in contact with exposed river bank or river bed during low flow conditions (worst case). Diesel fuel is expected to sorb to soil, and may have limited mobility if the concentration of organic matter in the soil is high and the volume of fuel released is large (Environment Canada and Health Canada 2015). When fuel stranded on marsh substrate, retention potential is considered high due to the oleophillic nature of the vegetation substrate. Weathering rates are likely to be reduced as the result of reduced water flow action and evaporation potential. A small fraction of diesel fuel may persist for over a year in sediments (Environment Canada and Health Canada 2015). For stranded fuel in the substrate, volatilization and biodegradation are two important fate processes (Environment Canada and Health Canada 2015). It has been found that nearly all soils and sediments have bacteria and other organisms that are capable of degrading petroleum hydrocarbons (Pancirov and Brown 1975) and, based on its hydrocarbon components, diesel fuel is inherently biodegradable (CONCAWE 2001). Adsorbed fuel to substrate may potentially enter or re-enter the water column and return to the water surface.

With the implementation of response procedures and mitigation (including clean-up, monitoring and follow-up program), as summarized in **Section 28.4.1.2**, an accidental spill of full truck load of diesel fuel to Yukon River or Stewart River would have a moderate to high (in magnitude), local to regional, short-term, and reversible effect on surface water quality. When considerations are given to generally short persistence of diesel in water and the highly localized nature of stranded fuel in the areas that may require the longer-term recovery (over a year), the consequence of an accidental fuel spill on surface water quality is assessed as moderate. The risk to surface water quality associated with an accidental fuel spill to the Yukon River or Stewart River is therefore assessed as low and deemed not significant.

***Fish and Fish Habitat***

Effects of a diesel (or other petroleum hydrocarbons) spill on fish and fish habitat would vary depending upon its constituents, duration of exposure, and water depth and flow. The dispersal of hydrocarbons into shallow areas and sediments of spawning areas can have an adverse effect on development of fish eggs and larvae (Carls et al. 1999, Heintz et al. 1999). Exposure of salmon eggs to hydrocarbons during larval development can affect juvenile growth rates, which can have a delayed effect on salmon growth and ocean survival (Heintz et al. 2000). Residual polycyclic aromatic hydrocarbons can remain bioavailable following clean-up and dispersa, and can cause a variety of long-term physiological and reproductive effects to exposed fish (Schein et al. 2009).

Introduction of hydrocarbons can also cause a short-term effect to stream benthic invertebrates. Lytle and Peckarsky (2001) found that benthic invertebrate community was affected by a 26,500-L diesel spill in a small stream, up to 5 km downstream of the spill; however, the benthic invertebrate community showed rapid recovery the following year.

A spill in the spring or fall could adversely affect migrating fish in the rivers and streams reaches downstream of where the spill occurs. There are no known salmon spawning areas in the vicinity of the Project area; however, a spill could have an effect on upstream movements of adult salmon and the downstream migration of juveniles.

With the implementation of response procedures and mitigation summarized in **Section 28.5.2**, an accidental spill of full truck load of diesel fuel to Yukon River or Stewart River would have a moderate to high (in magnitude), local to regional, short-term, and reversible effect on fish and fish habitat. Lethal or sub-lethal effects may occur at the individual level in areas where fuel concentrations are high; however, population level effects to aquatic species are not anticipated. The resulting adverse effects on fish and fish habitat are not considered fully recovered until surface water quality and sediment quality have recovered and invertebrate and fish species have recovered, or affected areas have been populated by similar species from neighbouring reaches and tributaries of the river. This process may take months or even over a year in some highly localized areas where stranded fuel concentrations are initially high. When these considerations are included in evaluation, no population level effects are anticipated. Longer-term recovery (over a year) would be highly localized, the consequence of an accidental fuel spill on fish and fish habitat, and is assessed as moderate. The risk to fish and fish habitat associated with an accidental fuel spill to the Yukon River or Stewart River is therefore assessed as low and deemed not significant.

***Vegetation***

Diesel could cause harm to aquatic vegetation via physical contact with above-ground structures and by absorption through root systems (Adam and Duncan 1999). Diesel is phytotoxic to plants even at low concentrations. Below the phytotoxic level, effects of diesel fuel include inhibition of seed germination, reduction of photosynthetic pigments, and reduced nutrient assimilation (Adam and Duncan 1999). A spill during spring may be more likely to adversely affect regenerating vegetation due to effects on germination and growth. Changes in soil properties due to contamination with petroleum-derived substances can lead to water and oxygen deficits as well as to a shortage of available forms of nitrogen and phosphorus (Njoku et al. 2009).

Phytotoxicity of petroleum hydrocarbons depends on the type and amount of contaminant, the species, the extent of coverage, the season of a spill, air temperature and water level at the time of a spill, and substrate composition (Lin et al. 2002; Zhu et al. 2004). Plants may be more vulnerable during the spring growing season than during the winter dormant period. Hot, sunny weather may increase oil toxicity, and tidal elevation at the time of a spill may determine the stranding elevation for any floating contaminants (Zhu et al. 2004).

With the implementation of response procedures and mitigation summarized in **Section 28.4.1.2**, an accidental spill of full truck load of diesel fuel to the Yukon River or Stewart River would have a moderate to high (in magnitude), local to regional, short-term, and reversible effect on vegetation. Lethal or sub-lethal effects may occur at the individual level; however, population-level effects to vegetation species are not anticipated. The consequence of an accidental fuel spill on vegetation is therefore assessed as moderate. In addition, the risk to vegetation associated with an accidental fuel spill to the Yukon River or Stewart River is assessed as low and deemed not significant.

***Wildlife and Wildlife Habitat***

A fuel spill into a major watercourse (i.e., Yukon River or Stewart River) could interact with wildlife through direct contact, change in habitat, and sensory disturbance due to the spill constituents and subsequent clean-up and restoration efforts. The majority of wildlife subcomponents of concern in the event of an accidental spill are highly mobile and would immediately avoid the vicinity of the spill. A fuel spill in water could result in indirect effects to some wildlife subcomponents due to adverse effects on fish, fish habitat, and aquatic resources. For wildlife species feeding on invertebrates (e.g., bats) and fish in these areas, decreases in ecosystem productivity and prey abundance may reduce the availability of food. Grizzly Bears may forage for salmon in the major watercourses in late fall in preparation for winter hibernation. A fuel spill into a watercourse resulting in fish kills would reduce foraging opportunities for Grizzly Bears in the Project area. A decrease in productivity would reduce the availability of flying insects for bats.

Under the worst-case scenario, a diesel fuel spill would occur in the spring or fall when the dilution capacity in rivers is the lowest. This suggests that a spill may not evaporate and disperse as readily as under higher-flow conditions, which could lead to greater adverse effects to wildlife associated with wetland or riverine habitats. Grizzly Bears and bats are highly mobile and would immediately move away from the spill clean-up activities, searching for alternate food sources. Also, in the Project area, vegetation has been identified as the primary food source for Grizzly Bears, largely consisting of grasses and horsetails in the summer and fall, and berries when they become available.

In summary, potential effects to wildlife would likely be primarily associated with food source. Alterative food sources are available in the neighbouring area for the highly mobile wildlife species of concern. With the implementation of response procedures and mitigation summarized in **Section 28.4.1.2**, an accidental spill of a full truck load of diesel fuel to the Yukon River or Stewart River would have a moderate (in magnitude), local to regional, short-term, and reversible effect on wildlife and wildlife habitat. Population level effects to wildlife species are not anticipated. Although the aquatic system would not fully return to baseline conditions until at least surface water quality and sediment quality have returned to the background conditions, which may take months to over a year, potential residual effects on wildlife would likely last a shorter time (i.e., weeks) when considerations are given to the availability of other food sources in the neighbouring area and the highly mobile nature of the wildlife of concern (e.g., bears and bats). The consequence of an accidental fuel spill on wildlife and wildlife habitat is therefore assessed as minor. In addition, the risk to wildlife and wildlife habitat associated with an accidental fuel spill to the Yukon River or Stewart River is assessed as very low and not significant.

***Birds and Bird Habitat***

The worst-case scenario for a diesel fuel spill into water could lead to greater adverse effects to birds associated with wetland and riverine habitats. In addition, a spill in the spring or fall may be more likely to adversely affect migrating birds at stop-over sites if the spill occurred within the immediate vicinity of a staging area or was transported downstream into a staging area.

Diesel can cause harm to birds via physical contact, absorption, inhalation, and ingestion (USDC 2016; USFWS 2004). Physical contact with diesel can adversely affect the insulation value of feathers, the ability of birds to fly, and the buoyancy of birds, which could result in death by hypothermia. Inhalation or ingestion of diesel can occur when birds attempt to clean their feathers, which could result in immediate death under extreme circumstances or long-term/chronic health effects (e.g., skin irritation and ulceration, immune system suppression, organ damage, behavioural changes) that lead to subsequent death. Ingestion of diesel could also occur when birds eat contaminated food sources (e.g., plankton, algae, aquatic plants, aquatic invertebrates, fish). Bird species that use the water surface or nearshore riparian habitats are at greatest risk from oil contamination (USFWS 2004). Adult birds that come in contact with petroleum hydrocarbon may transfer some of the fuel to their eggs (Albers 1980; U.S. EPA 1999). This may be lethal to the eggs and reduce reproductive performance.

The potentially adverse effects of a diesel spill could be compounded if the spill occurs within the immediate vicinity of an area used by birds for nesting, foraging, or staging, or if the spill is transported downstream into an area used by nesting, foraging, or migrating birds (USDC 2016). A diesel fuel spill could also adversely alter bird habitats and decrease prey availability.

With the implementation of response procedures and mitigation (including clean-up, monitoring and follow-up program), as summarized in **Section 28.4.1.2**, an accidental spill of full truck load of diesel fuel to the Yukon River or Stewart River would have a moderate to high (in magnitude), local to regional, short-term, and reversible effect on birds and bird habitat. Lethal or sub-lethal effects may occur at the individual level; however, population level effects to bird species are not anticipated. As aquatic habitat would recover within months with the exception of highly localized areas, the consequence of an accidental fuel spill on birds and bird habitat is assessed as moderate. The risk to birds and bird habitat associated with an accidental fuel spill to the Yukon River or Stewart River is therefore assessed as low and deemed not significant.

***Community Infrastructure and Services***

A full truck load of diesel fuel spill from a tanker truck to the Yukon River or Stewart River would likely require external emergency response resources. If the accident that causes the spill involves injury, this could result in increased strain on community infrastructure and services (e.g., first responders and health services) based in Dawson and Whitehorse. With the implementation of the mitigation measures, as described **Section 28.4.1.2**, an accidental fuel spill would have a moderate (in magnitude), local to regional, short-term, and reversible effect on community infrastructure and services. Resulting effects are possible to be experienced at the community-wide level in terms of expansion and upgrade of existing infrastructure and services. The consequence is therefore assessed as moderate. In addition, the risk to community infrastructure and services associated with an accidental fuel spill is assessed as low and deemed not significant.

***Land and Resource Use***

The exposure of wildlife, fish, and other components of the biophysical environment to a diesel fuel spill could make them inedible to subsistence consumers, or could lead to changes in consumption due to perceived toxicity. This would therefore impede the ability of individuals to engage in subsistence or traditional economic activities. The direct exposure of individuals to diesel fuel could result in incidental soil ingestion, dust inhalation, water ingestion, or absorption through the skin. However, as the effects to vegetation, fish and wildlife are expected to be short-term and fully reversible, the resultant effects to the quality of these resources are expected to be similar. The effects resulting from the perception of resource quality may endure over the long-term, but are still expected to be fully reversible with time. No change or a minor change on land and resource use management is anticipated. The consequence of an accidental diesel fuel spill on land and resource use for components of the biophysical environment used in subsistence and traditional economic activities as well as direct exposure to hazardous materials are therefore assessed as moderate. In addition, the risk to land and resource use associated with an accidental fuel spill is assessed as low and deemed not significant.

***Community Health and Well-being (Human Health)***

In the event of a diesel fuel spill, potential routes of absorption by human includes dermal, oral, or pulmonary exposure. Acute exposure to diesel vapour and ingestion of diesel fuel may lead to intoxication symptoms such as dizziness, headache, nausea, and vomiting. Exposure of skin to diesel may cause dermatitis (Chilcott 2006).

Diesel typically persists in water for a short period of time. When considerations are given to the location of the Project, human contact with the spill would primarily involve the response team. With the implementation of response procedures and mitigation summarized in **Section 28.5.2**, an accidental spill of a full truck load of diesel fuel to the Yukon River or Stewart River would have a low (in magnitude), local to regional, short-term, and reversible effect on human health. It is not likely that human health effects would be experienced at the community level. The consequence is therefore assessed as minor (**Section** 28.4.1.4). The risk to human health associated with an accidental fuel spill on water is assessed as very low and deemed not significant.

### 28.4.2 Scenario 1B: Hazardous Material Spill on Land – Diesel Fuel

Diesel fuel would be transported to site in approved vehicles along the NAR and distributed to various locations on site. Inclement weather, a wildlife strike, or other serious incidents could result in the loss of containment of the fuel shipment. This scenario evaluates the effects to ICs and VCs in the worst-case scenario where the entire load of diesel fuel (full truck load) is released onto the land. The worst-case scenario would be loss of containment during the late summer, when the active permafrost zone, the supra-permafrost layer that seasonally thaws, is greatest.

This scenario is applicable during Construction, Operation, and Reclamation and Closure; no significant fuel transport or storage of fuel onsite would occur during Post-closure.

#### *28.4.2.1 Low-risk Effects*

After consideration of mitigation measures and as per **Table 28.3-2**, a fuel spill onto land is expected to be highly localized and relatively easily managed, and is predicted to have no or low-risk interaction with Hydrology; Air Quality and Greenhouse Gas Emissions; Noise; Surficial Geology, Terrain, and Soils; Surface Water Quality; Fish and Fish Habitat; Vegetation; Wildlife and Wildlife Habitat; Birds and Bird Habitat; Demographics; Economic Conditions; Social Economy; Education and Training; Land and Resource Use; and Heritage Resources ICs and VCs. Effects to these ICs and VCs from this potential accident or malfunction are not evaluated here.

#### *28.4.2.2 Mitigation Measures*

Project design and mitigation measures that will help minimize the risk of a diesel fuel spill in land, and along the NAR, are described in **Section 28.4.1.2**. Additional measures to help minimize the risk of a diesel fuel spill on land at the Mine Site include containment measures for the fuel storage area. The main 4 million-litre (ML) tanks will be single-walled and constructed of welded steel. The fuel tank farm will have berms and will be lined with HDPE, and a spill containment capacity equal to the volume of the largest tank plus 10 percent (%) of the volume of the remaining tanks, or 110% of the volume of the largest tank, whichever is greater. The tanks and storage locations will be designed and constructed to meet the

Canadian Council of Ministers of the Environment (CCME) guidelines for *Aboveground Storage Tank Systems Containing Petroleum and Allied Petroleum Products* (CCME 2003).

The management plans that will mitigate the potential for a diesel fuel spill on land during all phases of the Project are the same as described in **Section 28.4.1.2**.

***Emergency Response and Clean-up Procedures***

In the event of a spill, the Emergency Response Plan and the Spill Contingency Plan will be triggered.

Statutory reporting of spills of more than 200 L of diesel fuel to Yukon Environment is required under the *Environment Act* Spills Regulation. As a precaution, if there is any doubt as to whether the quantity spilled exceeds the minimum reportable thresholds, the spill incident will be reported.

Schedule A of the Spills Regulation specifies spill thresholds where reporting is compulsory for listed substances. For the Project, a major spill is defined as an accidental release of a Schedule A substance into the environment that cannot be handled safely or without the assistance of the ERT, including all events where a person is injured or contaminated.

Spill clean-up and restoration activities are described in detail in the Spill Contingency Plan, which is summarized in **Section 31.0 Environmental and Socio-economic Management Program**. Spill response and containment for land-based spills will include the following:

- If required, block entry into waterways by building a berm or trench down-gradient from and as close as possible to the spill source.
- Construct earth berms or trenches so they accumulate a thick layer of free product in a single area (e.g., U- or V-shaped).
- Place a synthetic liner at the foot of and over the berm to protect underlying soil or other material.
- Capture minor spills with appropriate sorbent pads.
- Recover large spills with pumps or vacuum equipment.
- Use absorbent sheets to soak up residual fuel on water, ground, and on vegetation.

Large volumes of hydrocarbon-contaminated soils, snow, or ice will be stored and treated in a land farm. Small volumes of hydrocarbon-contaminated soils and soils contaminated with other hazardous materials will be placed in appropriately labelled drums for transport to off-site disposal or treatment facilities. The Project will adhere to the requirements under the *Transportation of Dangerous Goods Act* and regulations.

Absorbent materials used in collecting spilled hydrocarbons will either be incinerated or packed for disposal at an approved off-site facility.

#### *28.4.2.3 Likelihood of Accident or Malfunction*

As discussed in **Section 28.4.1.3,** the probability of a diesel fuel spill from a tanker truck accident is rated as rare.

#### *28.4.2.4 Potential Effects and Risk Assessment*

***Groundwater***

The spilled diesel would be expected to begin infiltrating immediately into the soil layer, and subsequently into the active layer and the underlying groundwater system. Where permafrost precludes infiltration into the deeper groundwater system, the spill would likely remain within the shallow groundwater perched above the permafrost. Assuming that there is no use of or interference with (i.e., pumping) this groundwater, the plume would disperse through the shallow groundwater system over time. If the spill occurred closer to surface water at a topographic low (groundwater discharge zone), then the probability that the plume could interact with surface water would be higher. The assessment of a diesel spill's effect on surface water quality is presented in **Section 28.1** and **Section 28.5.4**. Lag times between the spill occurrence and daylighting in a nearby creek would be determined by many factors, including antecedent soil moisture conditions, distance between spill point and surface water, hydraulic gradient. A diesel spill on land would only be expected to have a moderate effect on groundwater quality, and no effect on groundwater quantity.

In the event of a spill of diesel fuel on land, emergency response and clean-up procedures will be followed. Contaminated soils and groundwater will be remediated to meet regulatory requirements. Contaminated soils will be hauled to the land farm for remediation. If needed, groundwater will be likely treated onsite. If a spill occurs in the vicinity of a drinking water well, water quality will be monitored and the well will be shut down until it is confirmed that the Canadian drinking water guidelines are met.

With the implementation of response procedures and mitigation summarized in **Section 28.4.2.2**, an accidental spill of full truck load on land would have a moderate to high (in magnitude), local, short-term, and reversible effect on groundwater. The recovery process of groundwater may take months or even over a year. When considerations are given to the localized nature, the consequence of an on-land fuel spill on groundwater is assessed as moderate. The risk on groundwater is therefore assessed as low and deemed not significant.

***Community Infrastructure and Services***

The potential residual effects of an on-land diesel spill on community infrastructure and services are similar to that of a spill on water (see **Section 28.4.1.4**). The risk to community infrastructure and services is assessed as very low and deemed not significant.

***Community Health and Well-being (Human Health)***

The potential residual effects of an on-land diesel spill on human health are similar to that of a spill on water (see **Section 28.4.1.4**). The risk to community infrastructure and services is assessed as very low and deemed not significant.

### 28.4.3 Scenario 1C: Hazardous Material Spill in Water – Cyanide

Gold extraction will utilize sodium cyanide heap leaching technology. Sodium cyanide briquettes (dry flakes) are a solid product, and will be transported from the point of manufacture to the Mine Site along the NAR. The sodium cyanide briquettes will be shipped in standard 20 tonne ISO containers designed for long-distance shipment of NaCN

This scenario evaluates the effects to ICs and VCs of the worst-case scenario for a 20-t cyanide spill into a watercourse (i.e., the Yukon River or Stewart River) during spring or late fall when dilution capacity in rivers is lowest. To be conservative, this scenario assumes that all the spilled cyanide enters the freshwater environment. This scenario is applicable during the Construction Phase and Operation Phase. No transport of cyanide will occur during the other Project phases.

#### *28.4.3.1 Low-risk Effects*

After consideration of mitigation measures and as per **Table 28.3-2**, a cyanide spill on water has no or low interaction with Groundwater; Hydrology; Noise; Surficial Geology, Terrain, and Soils; Demographics; Economic Conditions; Social Economy; Education and Training; and Heritage Resources ICs and VCs. Effects to these ICs and VCs from this potential accident or malfunction are not carried forward for further evaluation.

#### *28.4.3.2 Mitigation Measures*

***Project Design Measures***

The International Cyanide Management Code (Cyanide Code) is a voluntary industry program for companies involved in the production of gold by the cyanidation process, and focuses on the management of cyanide and cyanide solutions. The Cyanide Code (ICMC 2015) addresses the production of cyanide, its transport from the producer to the mine; its on-site storage and use; decommissioning and financial assurance; worker safety; emergency response; training; stakeholder involvement; and verification of implementation. Goldcorp became a signatory to the Cyanide Code in July 2007, and will ensure the Project is designed and operated within compliance of the Cyanide Code. The Cyanide Code addresses the production of cyanide, its transport from the producer to the mine, its on-site storage and use, decommissioning and financial assurance, worker safety, emergency response, training, stakeholder involvement, and verification of implementation.

***Management Plans***

Goldcorp will develop and implement the following management plans, which will help to mitigate the potential for a cyanide spill on land (refer to **Section 31.0 Environmental and Socio-economic Management Program**):

- Cyanide Management Plan
- Emergency Response Plan
- Spill Contingency Plan.

***Emergency Response and Clean-up Procedures***

In the event of a cyanide spill into water, the emergency response measures outlined in the Emergency Response Plan and the Cyanide Management Plan will be triggered. The ERT will respond to a cyanide spill along the NAR. The driver of the truck carrying the sodium cyanide will also have an Emergency Response Assistance Plan to implement for immediate response. The Emergency Response Assistance Plan will be provided to the Proponent and will be reviewed by the Occupational Health and Safety and Environment departments. A copy of the Emergency Response Assistance Plan will be provided to the ERT, should they need to respond to an incident involving a truck carrying cyanide. The Emergency Response Assistance Plan will outline strategies in the event of an emergency and will include procedures and current contact information for notifying the producer, the Mine Site, regulatory agencies, medical facilities and potentially-affected communities. The truck will carry health and safety equipment and spill response supplies to be used in the event of an accident or loss of product. Safety is a paramount concern and the driver will have training in responding to spills while wearing appropriate PPE.

If a transportation incident were to occur, the driver will contact the producer and the Mine Site, even if sodium cyanide was not spilled. The information to be provided will include the name of the driver, location and nature of the accident, proximity to surface water, the nature of any injuries, amount of material released, if any, weather conditions, and proximity to a populated area.

Reporting of a cyanide spill by Goldcorp will be as described in the Spill Contingency Plan**.** In accordance with the Spills Regulation, any release into a watercourse requires immediate notification of the 24-hour Yukon Spill Report Centre line.

#### *28.4.3.3 Likelihood of Accident or Malfunction*

Similar to a diesel fuel truck accident, as discussed in **Section 28.4.1**, the probability of a cyanide truck accident that involves product spill into a watercourse is rated as rare.

#### *28.4.3.4 Potential Effects and Risk Assessment*

***Air Quality and Greenhouse Gas Emissions***

A cyanide spill into the aquatic environment could lead to cyanide being volatilized and released to the atmosphere. This would result in an adverse change in air quality within the vicinity of the spill.

Cyanide has relatively low persistence in surface waters under normal conditions, and volatilization is the dominant mechanism of fate in the open environment. Volatilization rates depend on several parameters, including temperature, pH, wind speed, and cyanide concentration (US EPA 1981). The volatilization half-life of HCN gas in the open water environment is estimated to be approximately 10 hours (US EPA 1981); thus, the cyanide concentration would decrease to the Canadian water quality guideline for the protection of freshwater aquatic life over the short-term.

Hydrogen cyanide gas, the primary airborne form, is a highly toxic substance that can be absorbed through inhalation (ATSDR 2011). Once airborne, cyanides dissipate quickly with conditions returning to normal within 24 hours following the event. The ERT will be required to use cyanide specific PPE such as self-contained breathing apparatus during the emergency response and clean-up.

With the implementation of response procedures and mitigation summarized in **Section 28.4.3.2**, an accidental spill of cyanide to the Yukon River or Stewart River would have a moderate (in magnitude), local to regional, short-term, and reversible effect on air quality. The consequence of a cyanide spill on air quality is therefore assessed as moderate. In addition, the risk to air quality associated with an accidental cyanide spill to the Yukon River or Stewart River is assessed as low and deemed not significant.

***Surface Water Quality***

As mentioned above, cyanide concentrations in raw water are relatively low (i.e., less than 0.1 milligram per litre) (WHO 1984). Cyanide is miscible with water (CCME 1997). The solubility of sodium cyanide (NaCN) is normally found to be 480 grams per litre (g/L). The Canadian guideline for cyanide concentration is 5 micrograms per litre (µg/L) for the protection of freshwater aquatic life (CCME 1987), while the guideline for drinking water is 200 µg/L in Canada (Health Canada 2008).

Cyanide has relatively low persistence in surface waters under normal conditions. Volatilization is the dominant mechanism for removal of free cyanide from concentrated solutions, and is most effective under conditions of high temperatures and high dissolved oxygen levels, and at increased concentrations of atmospheric carbon dioxide. Loss of cyanides (other than strong complexes, such as ferricyanides and ferrocyanides) within the water column is primarily through sedimentation, microbial degradation, and volatilization.

With the implementation of response procedures and mitigation (including clean-up, monitoring, and follow-up program), as summarized in **Section 28.4.3.2**, an accidental spill of cyanide to the Yukon River or Stewart River would have a moderate to high (in magnitude), local to regional, short-term, and reversible effect on surface water quality. The consequence of a cyanide spill on surface water quality is therefore assessed as moderate. In addition, the risk to surface water quality associated with an accidental cyanide spill to the Yukon River or Stewart River is assessed as low and deemed not significant.

***Fish and Fish Habitat***

Under the worst-case scenario, a cyanide spill would occur in the spring or fall when the dilution capacity in rivers is the lowest. In this scenario, a spill may not disperse as readily as under higher flow conditions with fish being exposed to lethal or sub-lethal concentrations. In addition, a spill in the spring may affect salmon juveniles moving downstream.

Cyanide effects on fish and fish habitat are influenced by the form of cyanide and the concentrations. Free cyanide at concentrations of 5.0 µg/L to 7.2 µg/L reduces swimming performance in fish (including salmon and trout). Concentrations of 20 µg/L to 76 µg/L can be lethal to many fish species, and concentrations greater than 200 µg/L are rapidly toxic. Invertebrates experience sub-lethal effects at 18 µg/L to 43 µg/L, and lethal effects can occur at 30 µg/L to 100 µg/L (Eisler 1991, ICMC 2015).

Long-term exposure (64 days) to concentrations up to 20 µg/L can cause sub-lethal effects such as reduced growth rate in Chinook Salmon (Eisler 1991). Due to the implementation of emergency response procedures, the nature of cyanide to rapidly complex with metals and organic particles, as well the rapid dissipation rate, it is unlikely that lengthy exposure to sub-lethal concentrations would occur. Potential effects of an accidental spill would therefore likely be short-term, lethal responses.

With the implementation of response procedures and mitigation (including clean-up, monitoring, and follow-up program), as summarized in **Section 28.4.3.2**, an accidental spill of cyanide to the Yukon River or Stewart River would have a moderate to high (in magnitude), local to regional, short-term, and reversible effect on fish and fish habitat. Lethal or sub-lethal effects may occur at the individual level; however, population-level effects to aquatic species are not anticipated. The recovery process for fish and fish habitat may take months following the recovery of surface water quality; therefore, the consequence of an accidental cyanide spill on fish and fish habitat is assessed as moderate. The risk to fish and fish habitat associated with an accidental cyanide spill to the Yukon River or Stewart River is therefore assessed as low and deemed not significant.

***Vegetation***

Elevated cyanide concentrations in plants can inhibit respiration and other vital plant processes (Towill et al. 1978). At non-lethal concentrations, cyanide can diminish new growth and can affect the germination of seeds (Solomonson 1981, Eisler and Wiemeyer 2004). Aquatic plants are more tolerant of cyanide than fishes and aquatic invertebrates; therefore, adverse effects of cyanide on aquatic plants are unlikely at concentrations that cause acute effects in aquatic wildlife (US EPA 1980, Eisler and Wiemeyer 2004). In soils, cyanide is not strongly bound by soil particles and is quite mobile. Cyanide is either complexed by trace metals, which can be taken up by plants, microbially metabolized, or lost to the air through volatilization (Eisler and Wiemeyer 2004).

With the implementation of response procedures and mitigation summarized in **Section 28.4.3.2**, an accidental spill of cyanide to the Yukon River or Stewart River would have a minor (in magnitude), local to regional, short-term, and reversible effect on vegetation. Lethal or sub-lethal effects may occur at the individual level; however, population-level effects to vegetation species are not anticipated. The consequence of an accidental cyanide spill on vegetation is therefore assessed as minor. In addition, the risk to vegetation associated with an accidental cyanide spill to the Yukon River or Stewart River is assessed as very low and deemed not significant.

***Wildlife and Wildlife Habitat***

Lethal effects to wildlife can occur from direct consumption of cyanide occurring in ponds and wetlands downstream of the spill. Higher concentrations of cyanide would be expected to collect in the wetlands and riparian areas along slow-moving watercourses. Indirect effects can result from degradation of habitat, availability of prey and forage, and sensory disturbance due to the spill response and subsequent clean-up and restoration efforts. Potential effects from cyanide would be attenuated by natural processes including dispersion and dilution in flowing waters of the Yukon or Stewart Rivers, as well as oxidation and evaporation. Under all circumstances, the potential adverse effects would require active mitigation, management, and follow-up monitoring following the cyanide spill.

The amount of an ingested substance that causes 50% fatality of a test sample (LD50) of cyanide to deer, pig, goat, rabbit, hare, and cattle have been observed to be in the range of 3.5 mg/kg to 5 mg/kg body weight (New Zealand Department of Conservation, n.d.), while the LD50 of cyanide to possums is approximately 8.7 mg/kg body weight (Fisher and Fairweather 2004). The effects on wildlife are anticipated to be local and short-term due to the natural processes of dispersion and volatilization, combined with the containment and clean-up of any accessible cyanide. Exposure to cyanide is expected to be occasional; therefore, chronic effects are not of great relevance. Nevertheless, repeated dietary intake of 135 mg/kg by young domestic chicken was found to result in sub-lethal effects such reduced growth (Eisler 1991).

Cyanide reacts readily in the environment, and is quickly broken down into less toxic chemicals by sunlight and air. Direct effects from the release would be localized and are expected to be reversible through clean-up and reclamation activities. Indirect effects can result from degradation of habitat, availability of prey and forage, sensory disturbance due to the spill constituents, and subsequent clean-up and restoration efforts. These indirect effects are expected to reverse as the ecosystem recovers and available forage increases. In addition, cyanides do not cause cancer, and do not build up (or biomagnify) in the food chain (Mining Facts 2012).

With the implementation of response procedures and mitigation summarized in **Section 28.4.3.2**, an accidental spill of cyanide to the Yukon River or Stewart River would have a moderate (in magnitude), local to regional, short-term, and reversible effect on wildlife and wildlife habitat. Lethal or sub-lethal effects may occur at the individual level; however, population-level effects to wildlife species are not anticipated. The recovery process for wildlife habitat may take weeks to months; therefore, the consequence of an accidental cyanide spill on wildlife and wildlife habitat is assessed as moderate. The risk to wildlife and wildlife habitat associated with an accidental cyanide spill to the Yukon River or Stewart River is therefore assessed as low and deemed not significant.

***Birds and Bird Habitat***

The worst-case scenario for a cyanide spill could lead to adverse effects to birds associated with wetland and/or riverine habitats. A spill in the spring or fall may be more likely to adversely affect migratory birds at stop-over sites if the spill occurred within the immediate vicinity of a staging area or was transported downstream into a staging area. Under the worst-case scenario, it was assumed that there would be no direct effects to the terrestrial environment.

Cyanide is known to be acutely toxic to birds (particularly migratory waterbirds and passerines) at very low concentrations (Friend and Franson 1999; Eisler and Wiemeyer 2004; ICMC 2015). Cyanide poisoning of birds is caused by exposure to cyanide in two forms: inorganic salts and HCN gas. Cyanide interferes with oxygen use from the bloodstream and causes death via lack of oxygen (Friend and Franson 1999). In more sensitive species, symptoms of cyanide poisoning (i.e., panting, eye blinking, salivation, and lethargy) occur within 0.5 minutes to 5 minutes after ingestion; in more resistant species, symptoms occur up to 10 minutes later (ICMC 2015). In all species, death typically occurs within 15 minutes to 30 minutes following ingestion. In some cases, cyanide poisoning can cause delayed mortality when the amount of cyanide-contaminated water initially ingested is sufficiently low, but additional cyanide is later released by stomach acid (Eisler and Wiemeyer 2004; ICMC 2015). Some birds are able to recover from cyanide-poisoning if the initial exposure levels are sufficiently low and the bird survives the first hour of symptoms; this presumably occurs via rapid metabolism of cyanide and subsequent excretion (ICMC 2015). However, birds that are struggling with the symptoms of cyanide-poisoning may be more susceptible to predation (predators in turn could be exposed to cyanide poisoning by consumption of the prey). A cyanide spill could also adversely alter bird habitats and decrease prey availability.

Due to the implementation of emergency response procedures and rapid dissipation rate of cyanide, it is unlikely that lengthy exposure to sub-lethal concentrations would occur; therefore, potential effects of an accidental spill would likely be short-term, lethal responses.

With the implementation of response procedures and mitigation (including clean-up, monitoring, and follow-up program), as summarized in **Section 28.4.3.2**, an accidental spill of cyanide to the Yukon River or Stewart River would have a moderate to high (in magnitude), local to regional, short-term and reversible effect on birds and bird habitat. Lethal or sub-lethal effects may occur at the individual level; however, population-level effects to bird species are not anticipated. As discussed under Surface Water Quality, the cyanide concentration is expected to decrease to 5 µg/L, the Canadian water quality guideline for the protection of freshwater aquatic life, in the order of days to weeks at most. The recovery process for bird habitat may take months following the recovery of surface water quality; therefore, the consequence of an accidental cyanide spill on birds and bird habitat is assessed as moderate (**Section 28.4.3.4**). The risk to birds and bird habitat associated with an accidental cyanide spill to the Yukon River or Stewart River is therefore assessed as low and deemed not significant.

***Community Infrastructure and Services***

In the unlikely event of a major cyanide spill to the Yukon River or Stewart River, it is highly probably that external emergency response resources will be required. If the accident that causes the spill or the spill itself involves injury, and fire, this could result in increased strain on local infrastructure and services (e.g., first responders and health services) based in Dawson and Whitehorse. With the implementation of the mitigation measures summarized in **Section 28.4.3.2**, an accidental cyanide spill to the Yukon River or Stewart River on community infrastructure and services is considered to have a moderate (in magnitude), local to regional, short-term, and reversible effect on community infrastructure and services. Resulting effects may be experienced at the community-wide level in terms of expansion and upgrade of existing infrastructure and services. The consequence is therefore assessed as moderate. The risk to community infrastructure and services associated with a cyanide spill on water is assessed as low and deemed not significant.

***Land and Resource Use***

The exposure of wildlife, fish, and other components of the biophysical environment to cyanide spill could make them inedible to subsistence consumers. This would therefore impede the ability of individuals to engage in subsistence or traditional economic activities.

With the implementation of response procedures and mitigation summarized in **Section 28.4.3.2**, an accidental cyanide spill to the Yukon River or Stewart River would have a moderate (in magnitude), local to regional, short-term, and reversible effect on land and resource use. The consequence, in terms of real or perceived contamination of components of the biophysical environment used in subsistence and traditional economic activities as well as direct exposure to hazardous materials, is assessed as moderate.

The risk to land and resource use associated with an accidental cyanide spill is assessed as low and deemed not significant.

***Community Health and Well-being***

Exposure to cyanide can be by way of inhalation, skin or eye contact, and ingestion. Exposure to small amounts of cyanide can lead to lethal and sub-lethal effects. Cyanide is rapidly distributed to all organs and tissues via the bloodstream. On the other hand, cyanide is rapidly detoxified in the body by conversion to the much less toxic thiocyanate ion (Ellenhorn and Barceloux 1988). Food and drinking water are considered the main sources of cyanide exposure for individuals who are not occupationally exposed to the substance. Inhaling air contaminated with cyanide is the main source for workers. The following health effects associated with cyanide are summarized from the Agency for Toxic Substances & Disease Registry (2006) unless indicated otherwise.

The severity of the harmful effects depends on the form of cyanide (such as HCN gas or cyanide salts), dosage, and time of exposure. Exposure to high levels of cyanide for a short time harms the brain and heart, and can even cause coma and death.

First symptoms of cyanide poisoning may include rapid, deep breathing and shortness of breath, followed by convulsions (seizures) and loss of consciousness. These symptoms can occur rapidly, depending on the amount of intake. The health effects of large amounts of cyanide are similar, whether through injection of food or water, or by inhalation. Cyanide uptake into the body through the skin is slower than other types of exposure, (i.e., ingestion and inhalation). Skin contact with HCN or cyanide salts can cause irritation and sores. Workers who breathed in amounts of HCN as low as 6 parts per million (ppm) to 10 ppm over a period of time developed breathing difficulties, chest pain, vomiting, blood changes, headaches, and enlargement of the thyroid gland.

In the event of an accidental cyanide spill into a watercourse, the response team will use cyanide specific PPE such as self-contained breathing apparatus during the emergency response and clean-up. Non-responders will be restricted to safe locations away from the spill. Immediately, public health authority will be contacted to implement subsistence use closure over a geographic extent including the range of mobile animals. Health warnings will be communicated to local communities.

In the worst-case scenario, a cyanide spill may lead to one or more human fatalities, or serious injury to Project employees. A mortality or serious injury will have severe effects on the affected individuals, as well as major effects on the well-being of family and community members. This effect will be major to severe in magnitude, local to regional, long-term and irreversible. Resulting effects may be experienced at the community level, and may be particularly felt in smaller communities if the affected employees live in these smaller communities. The risk of such an accident or malfunction is rated as rare, the resultant risk to community health and well-being is assessed as high and deemed significant

### 28.4.4 Scenario 1D: Hazardous Material Spill on Land – Cyanide

This scenario evaluates the effects to ICs and VCs in the worst-case scenario for a cyanide spill onto land, .i.e., the entire loss of containment of one cyanide ISO container (20t) is released onto the land during rainy conditions. The worst-case scenario would be loss of containment during the summer, when the active permafrost zone is greatest. This scenario is applicable during the Construction Phase and Operation Phase; no cyanide storage or use will occur during the other Project phases.

#### *28.4.4.1 Low-risk Effects*

After consideration of mitigation measures and as per **Table 28.3-2**, a cyanide spill on land has no or low risk interaction with Hydrology, Noise, Surface Water Quality, Fish and Fish Habitat, Vegetation, Wildlife and Wildlife Habitat, Birds and Bird Habitat, Demographics, Economic Conditions, Social Economy, Education and Training, Land and Resource Use, and Heritage Resources ICs and VCs. Effects to these ICs and VCs from this potential accident or malfunction are not carried forward for further evaluation.

#### *28.4.4.2 Mitigation Measures*

***Project Design Measures***

General Project design measures for cyanide transportation are presented in **Section 28.4.3.2**. At the Mine Site, the Proponent will implement several Project design measures to ensure the safe handling, storage, and use of cyanide at the Mine Site. Key features include:

- All procedures will be developed and executed in compliance with the ICMC.
- Standard operating procedures will be developed for the handling, storage, and use of cyanide.
- The HLF will be lined with a geosynthetic membrane, and gold processing will be a closed-loop system.
- All workers involved in storing, handling and mixing cyanide will be appropriately trained and will wear personal HCN gas monitors and appropriate PPE.

***Management Plans***

Goldcorp will develop and implement the following management plans (refer to **Section 31.0 Environmental and Socio-economic Management Program**), which will help to mitigate the potential for a cyanide spill on land:

- Cyanide Management Plan
- Heap Leach and Process Facilities Plan
- Emergency Response Plan
- Spill Response Plan.

***Emergency Response and Clean-up Procedures***

In the event of a cyanide spill onto land of 20 t, the emergency response measures outlined in the Emergency Response Plan and the Cyanide Management Plan will be triggered. The ERT will respond to a cyanide spill at the Mine Site.

The process plant will have curbs around its complete perimeter, and will not have floor drains so that spilled material or solution remains within the confines of the plant. Spilled solutions within the process plant will divert to a sump and pump, where it will be pumped into the appropriate solutions tank or an event pond. As a result, any spilled cyanide solution or any other liquid spilled inside the process plant will be contained and cannot escape to the receiving environment. A dry spill of sodium cyanide will be swept or shoveled up, collected in a container with a close-fitting lid, and subsequently added to the mix tank. Internal and external emergency communication of cyanide incidents will be sent to Goldcorp's corporate offices and regulatory agencies to communicate the cyanide incident and what was done to manage and rectify it. Reporting of such incidents will be as described in the Spill Contingency Plan**.**

#### *28.4.4.3 Likelihood of Accident or Malfunction*

Similar to a diesel fuel truck accident, as discussed in **Section 28.4.1**, the probability of a loss of containment of cyanide on land is rated as rare.

#### *28.4.4.4 Potential Effects and Risk Assessment*

***Groundwater***

The spilled cyanide would be expected to begin infiltrating immediately into the soil layer, and subsequently into the active layer and the underlying groundwater system. Where permafrost precludes infiltration into the deeper groundwater system, the spill would likely remain within the shallow groundwater perched above the permafrost. Assuming that there is no use of or interference with (i.e., pumping) this groundwater, the plume would disperse through the shallow groundwater system over time. If the spill occurred closer to surface water at a topographic low (groundwater discharge zone), then the probability that the plume could interact with surface water would be higher. Lag times between the spill occurrence and daylighting in a nearby creek would be determined by many factors, including antecedent soil moisture conditions, distance between spill point and surface water, and hydraulic gradient.

In subsurface soil, cyanide at low concentrations would probably biodegrade under both aerobic and anaerobic conditions. In spills where cyanide levels are toxic to micro-organisms the concentrations of water-soluble cyanides may be sufficiently high to leach into groundwater. While cyanide has relatively low persistence in surface water under normal conditions, it may persist for extended periods (i.e., months to years) in groundwater (Way 1981) because volatilization is not an important fate process for cyanide in groundwater. An accidental spill on land may result in elevated level of cyanide in groundwater, in part depending on the amount of water in contact with the spill; however, potential effects would be localized.

With the implementation of response procedures and mitigation (including clean-up, monitoring, and follow-up program), as summarized in **Section 28.4.4.2**, an accidental cyanide spill on land would have a moderate (in magnitude), local, long-term, and reversible effect on groundwater. If a spill occurs in the vicinity of a drinking water well, water quality will be monitored and the well will be shut down until it is confirmed that the Canadian drinking water guidelines for cyanide are met. When considerations are given to the localized nature of the spill on land, the consequence on groundwater is assessed as moderate.

The risk to groundwater associated with an accidental cyanide spill on land is therefore assessed as low and deemed not significant.

***Air Quality and Greenhouse Gas Emissions***

The potential effect of a cyanide spill on land on air quality is similar to that of spill on water (see **Section 28.4.3.4**. The risk to air quality associated with an accidental cyanide spill on land is therefore assessed as low and deemed not significant.

***Surficial Geology, Terrain, and Soils***

In the event of an accidental loss of on-site containment of cyanide in briquette form could result in soil contamination. Any contaminated soil would be isolated and removed as per Goldcorp's environmental management system and that is in adherence to the Cyanide Code.

Following removal of the spilled briquettes, soil contaminated with residual NaCN can be remediated by implementing one of two primary treatment methods: oxidation (using chemicals such as sodium hypochlorite or hydrogen peroxide) or complexation (using ferrous sulfate). Use of either of these treatment methods will result in further soil contamination. Follow-up monitoring will be implemented to characterize the effectiveness of the treatment and remediation efforts.

Excavation of contaminated soil that may be underlain by permafrost will be carried out in accordance with the appropriate mitigation measures for permafrost. Depending on the level and extent of the contamination, soil remediation may take weeks to months. With the implementation of response procedures and mitigation (including clean-up, monitoring, and follow-up program), as described above and summarized in **Section 28.4.4.2**, an accidental cyanide spill on land will have a low (in magnitude), local, short-term, and reversible effect on soils. The consequence of a cyanide spill on soils is therefore assessed as minor. In addition, the risk to soils associated with an accidental cyanide spill on land is assessed as very low and deemed not significant.

***Community Infrastructure and Services***

The potential effects of an on-land cyanide spill on community infrastructure and services is similar to those of a spill on water (**Section 28.4.3.4)**. The risk to community infrastructure and services associated with an accidental cyanide spill on land is therefore assessed as very low and deemed not significant.

***Community Health and Well-being***

The potential effects of an on-land cyanide spill on community health and well-being is similar to those of a spill on water (see **Section 28.4.3.4)**. The consequence of is therefore assessed as severe. The risk to human health associated with a cyanide spill on water is assessed as high and deemed significant.

### 28.4.5 SCENARIO 1E: CONTAINMENT FAILURE OF HEAP LEACH FACILITY

The HLF will use a cyanide-based solution as part of the extraction; therefore, a failure of the HLF and/or associated containment infrastructure would potentially allow dilute cyanide solutions (with high metals concentrations) to escape containment and enter nearby watercourses.

Extreme rain and meltwater event ponds and a conventional rainwater pond will be constructed for the HLF. As storage volume requirements increase due to an increase in the leach pad area, additional event ponds will be constructed. Small embankments will be used to create four ponds: the south event pond 1 (Event Pond (EP), EP-1S), north event pond 1 (EP-1N), event pond 2 (EP-2), and the rainwater pond. Water will be routed from the heap leach pad to the event ponds via the north and south event and rain water channels. The event ponds are designed to contain a combination of upset conditions including:

- Heap draining during an extended power or pumping outage
- Extreme precipitation and freshet events
- Cumulative water storage during wet years or temporary shut-downs.

In the event of surplus water accumulation, each pond is designed to spill into the next pond downstream, until all ponds are full. If a shutdown continued longer than one year, and if that year received the maximum design precipitation, then any further water accumulation would infringe on the probable maximum precipitation (PMP) storage capacity. A water treatment plant will be constructed to treat excess process water (e.g., water produced during rinsing of the heap leach as part of mine closure activities) in the Reclamation and Closure Phase. The treatment process will include oxidizing residual cyanide, precipitating ferric hydroxide to remove arsenic and uranium, and adding flocculent to enhance the settling of precipitates. Treated water from the water treatment plant will initially be used in additional rinsing of the heap leach, and discharged to the environment once the treated water quality meets effluent discharge criteria.

The unplanned event scenario is the discharge of off-specification effluent into the receiving environment from a failure of one of the event ponds. In addition, a physical failure of the HLF would cause a slump and release of dilute cyanide into the receiving environment. Some ore may be move downhill with a slump; however due to the low volumes of water contained within the HLF the physical disturbance would be relatively minimal, and could likely be cleaned up and remediated in the short-term. Thus, no significant effects ICs and VCs are expected from the physical movement of ore. The more substantial effects would occur due to the release of pregnant solution or cyanide into the receiving environment.

In this scenario, the off-specification and has higher concentrations of suspended solids, metals (e.g., arsenic, uranium, and cyanide than permitted. The worst-case scenario would involve off-specification effluent release during the fall, when dilution capacity in receiving waterbodies is lowest. This scenario is applicable during Construction and Operation.

#### *28.4.5.1 Low-risk Effects*

After consideration of mitigation measures and as per **Table 28.3-2**, a release of off-specification effluent has no or low risk interaction with Groundwater; Hydrology; Air Quality and Greenhouse Gas Emissions; Noise; Surficial Geology, Terrain and Soils; Vegetation; Wildlife and Wildlife Habitat; Birds and Bird Habitat; Demographics; Economic Conditions; Social Economy; Education and Training; Land and Resource Use; and Heritage Resources ICs and VCs. Effects to these ICs and VCs from this potential accident or malfunction are not carried forward for further evaluation.

#### *28.4.5.2 Mitigation Measures*

***Project Design Measures***

Goldcorp will construct, operate, and close the Project in accordance with the Cyanide Code.

Considerable measures have been included in the design of the HLF to account for worst-case scenarios. The ridgetop pad design was selected because it is a highly stable configuration (see **Section 2.10 Project Alternatives and Chosen Approach**). Event ponds have been designed to hold the cumulative volume that would result from a 24-hour storm event, the drainage of all solution stored in the heap, and seasonal water accumulation. In addition, event ponds will be constructed with a double liner system, underlain by a geosynthetic clay liner to prevent leakage from occurring to the local groundwater system. A leak detection sump will also be installed in the topographical low of the event ponds. It is expected that the event ponds will rarely be used, and the second event pond will likely never be used. This additional capacity provides a significant buffer for upset conditions, including large storm events that may result in excess contact water requiring management. Additional Project design measures include the following:

- All thaw-unstable soils will be removed from the footprint of leach pad and ponds.
- The leach pad will be constructed in stages, separated into cells, and closed (rinsed) progressively.
- The heap configuration will be designed as a free-draining heap with no solution impoundment, minimizing the total amount of in-heap solution, and minimizing the amount of contaminated liquids available to be discharged in a failure.
- The toe of each lift will be set back from the crest of the lower lift by approximately 10 m to create an overall horizontal to vertical (H:V) slope of 2.5H:1V. The benches will provide heap slope stability, protect the liner system from damage due to sloughing, and provide access to the heap. Build the overall slope to facilitate closure.
- Surface water and rainwater will be kept away from the HLF and process circuit to the maximum extent possible:
    - Install permanent and interim perimeter diversion channels and berms around the outside of heap leach pad.
    - Install a drainage ditch or berm and drainage pipe between each heap leach stage. Between cells within each stage, construct a ditch or berm with a drainage pipe every 100 m. These berms and ditches will allow high-resolution tracking of solution chemistry and aid in progressive closure by allowing rinsing of older portions of the heap leach pad.

  - Beginning in Year 3, place raincoats (i.e., exposed geomembrane covers) over portions of the heap leach pad to minimize infiltration of rainwater and snowmelt into the heap leach pad and process circuit, and increase heat retention in the winter.

- Design provides for gravity drainage from the heap leach pad to the pregnant tank at the process plant (or in the case of an upset, the event ponds) via double-contained, buried pipes. A leak detection system will monitor air pressure in the annular void between the two pipes.
- Barren solution will be pumped from the barren tank in the process plant to the heap leach pad in a double-walled pipeline. A leak detection system, including moisture sensing cable and associated programmable logic controller will be installed and tied into the process plan master programmable logic controller.
- A rainwater storage pond, capable of being converted to an event pond, if necessary, will be built between the HLF and the process plant. The pond, which will receive only clean water, will have two geosynthetic liners: an HDPE liner over a geosynthetic clay liner.
- A water treatment plant will be installed during the Operation Phase to treat surplus water from the HLF.

***Management Plans***

Goldcorp will develop and implement the following management plans (**Section 31.0 Environmental and Socio-economic Management Program**) that will help to mitigate the potential for an off-specification effluent release into a watercourse during the Construction, Operation, and Reclamation and Closure Phases of the Project:

- Cyanide Management Plan
- Emergency Response Plan
- Erosion and Sediment Control Plan
- Heap Leach and Process Facilities Plan
- Mine Development and Operations Plan
- Spill Contingency Plan
- Waste Management Plan (**Appendix 31-E**).
- Water Management Plan.

At the federal level, the discharge of mine effluent is governed under the *Fisheries Act,* and specifically by the Metal Mining Effluent Regulations, which impose limits on the discharge of deleterious substances for any mine that exceeds a discharge rate of 50 cubic metres per day from all final discharge points. The *Canada Water Act*, RSC 1985, c. C-11, provides legislation for the management of water resources in Canada and between federal and provincial/territorial agencies. The primary territorial Acts are the Yukon *Quartz Mining Act*, SY 2003, c. 14, and the *Waters Act*, SY 2003, c. 19.

***Emergency Response and Clean-up Procedures***

In the event of an off-specification effluent release into a watercourse, the Emergency Response Plan and the Spill Contingency Plan will be triggered.

In the event of discharge of off-specification effluent, notifications will be given immediately to appropriate supervisors, the Environment Manager and the Mine Manager. As appropriate, these notifications will be extended to regulatory agencies where required. The emergency response approach for the off-specification effluent discharge will include the following:

- Halt the discharge of effluent to the receiving environment, as soon as feasible.
- Take immediate action to protect the safety of employees, site personnel, and the public.
- Immediately assess the potential effects to the environment.
- Identify and repair the treatment processes failures that have resulted in the off-specification effluent.

If an emergency response is triggered, control of the situation will be transferred to the ERT. The team will be guided by the Emergency Response Plan (**Section 31.0 Environmental and Socio-economic Management Program**). If fish and fish habitat are affected by the event, it would be reported to Fisheries and Oceans Canada.

Monitoring and assessment programs will be initiated to identify any residual effects in the receiving watercourse.

#### *28.4.5.3 Likelihood of Accident or Malfunction*

The risk assessment consists of an evaluation of the probability (i.e., the likelihood of occurrence) of an accidental release of off-specification effluent from the largest event pond and an evaluation of the consequences (i.e., the severity of occurrence) of the effects on the environment.

Event ponds are designed for excess capacity for the events listed above; as such the the likelihood of a containment failure for the event ponds is rated as rare.

#### *28.4.5.4 Potential Effects and Risk Assessment*

The quantity of cyanide from a containment failure associated with the HLF would be much lower than that evaluated in **Section 28.4.3 Hazardous Material Spill in Water – Cyanide**; no significant adverse effects were evaluated for VCs/ICs due to that scenario, other than related to a human fatality. The potential for a human fatality is evaluated for this scenario; otherwise. No significant adverse effects are predicted for the release of cyanide into the receiving environment for a containment failure of the HLF, and the release of cyanide into the receiving environment is not evaluated further here. Additionally, a failure of containment will likely result in the mobilization of sediment into waterbodies. This effects from sediment mobilization would be similar to or lower than those evaluated in **Section 28.4.6 Sediment Release into Watercourse**. No significant effects were assessed in that scenario; and no significant effects due to sediment mobilization are predicted here. This interaction is not evaluated further in this scenario.

***Surface Water Quality***

The accidental release of off-specification effluent would affect water quality in the receiving environment in terms of elevated suspended solids and heavy metals. Effluent would be diluted in the receiving environment and carried downstream and further diluted. During low flow conditions, some residual off-specification effluent would be left on land in flooded areas (such as watercourse banks and riparian areas), which would be geographically limited to the immediate vicinity of the watercourse. Any contaminated sediment that remains would likely be flushed in the following spring freshet and other high flow events such that there would be no long-term effects on surface water quality. With the implementation of response procedures and mitigation (including clean-up, monitoring, and follow-up program), as summarized in **Section 28.4.5.2**, an accidental release of off-specification effluent from the event pond to nearby watercourses will have a moderate (in magnitude), local to regional, short-term, and reversible effect on surface water quality. In addition, the consequence is therefore assessed as moderate. The risk to surface water quality associated with an accidental release of off-specification effluent is assessed as low and deemed not significant.

***Fish and Fish Habitat***

The accidental release of off-specification effluent would affect fish and fish habitat in the receiving environment primarily associated with compromised surface water quality in terms of heavy metals. As discussed above, elevated levels of suspended solids and heavy metals would likely be flushed downstream and would be quickly diluted to background levels. Contaminant uptake by fish would be limited in extent and duration. In addition, a release in the winter may be more likely to adversely affect overwintering fish that are concentrated in overwintering areas (e.g., deep pools) and be less able to avoid a plume of high concentrated effluent.

With the implementation of response procedures and mitigation summarized in **Section 28.4.5.1**, the potential residual effects on fish and fish habitat associated with an accidental release of off-specification effluent is anticipated to be low in magnitude, local, short-term, and reversible. It is not anticipated that there will be permanent alteration of fish habitat or threat to long-term survival of aquatic species. Although surface water quality may take over a year to recover to its background conditions, when considerations are given to that no population level effects are anticipated, the consequence is assessed as minor. The risk to fish and fish habitat associated with an accidental release of off-specification effluent is therefore assessed as low and deemed not significant.

***Community Infrastructure and Services***

The release of off-specification effluent from the largest event pond may result in death or injuries of workers and consequently the involvement of first responders and health services. With the implementation of the mitigation measures summarized in **Section 28.4.5.2**, the potential effects on community infrastructure and services are anticipated to be low (in magnitude), local to regional, short-term, and reversible. Resulting effects are not likely to be experienced at the community level in terms of expansion and upgrade of existing infrastructure and services. The consequence is therefore assessed as minor. In addition, the risk to community infrastructure and services is assessed as very low and deemed not significant.

***Community Health and Well-being***

In the worst-case scenario, release of off-specification of effluent from the largest event pond may result in a fatality or serious injury to Project employees. Cyanide exposure may also result in one or more fatalities. A fatality or serious injury will have severe effects on the affected individuals, as well as major effects on the well-being of family and community members. This effect will be major to severe in magnitude, local to regional, long-term and irreversible. Resulting effects may be experienced at the community level, and may be particularly felt in smaller communities if the affected employees live in these smaller communities. The risk of such an accident or malfunction is rated as rare, the resultant risk to community health and well-being is assessed as high and deemed significant.

### 28.4.6 Scenario 1F: Sediment Release into Watercourse

During the Construction, Operation, and Reclamation and Closure Phases, certain activities will require diversion channels and sediment ponds at strategic locations to prevent sediment-laden water from active zones entering watercourses. Surface runoff within the Mine Site will be directed via conveyance structures to local sumps located throughout the Mine Site, or to the Alpha sedimentation pond.

The Alpha sedimentation pond will consist of an embankment (dam), a storage basin, an outlet, and an emergency spillway. The basin and upstream face of the dam will be lined with an impervious liner, which will be covered by a fine-grained material, and a layer of riprap will also be placed on the upstream face.

This scenario evaluates the effects on ICs and VCs in the worst-case scenario for a sediment release into a watercourse, which is the failure of the Alpha sedimentation pond and release of the full contents (357,500 $m^3$) into the downstream receiving environment during freshet,.

#### *28.4.6.1 Low-risk Effects*

After consideration of mitigation measures and assumptions per **Table 28.3-2**, a release of sediment into a watercourse has no or a low risk interaction with Groundwater; Air Quality and Greenhouse Gas Emissions; Noise; Surficial Geology, Terrain, and Soils; Wildlife and Wildlife Habitat; Birds and Bird Habitat; Demographics; Economic Conditions; Social Economy; Education and Training; Land and Resource Use; and Heritage Resources ICs and VCs. Effects to these ICs and VCs from this potential accident or malfunction are not carried forward for further evaluation.

#### *28.4.6.2 Mitigation Measures*

***Project Design Measures***

Eight types of conveyance structures are included in the Mine Site design, based on the location of the structure and its purpose:

- Waste rock surface diversion channels
- Diversion berm
- Drainage ditches
- Waste rock bench diversion ditches
- Waste rock toe collection channels
- Inlet channels
- Flow-through drains
- Pumping systems.

A description of the conveyance structures and sedimentation pond is provided in **Section 2.0 Project Description**.

***Management Plans***

Goldcorp will develop and implement the following management plans, which will help to mitigate the potential for sediment release into a watercourse during the Construction and Operation Phases of the Project:

- Access Route Construction Management Plan (**Appendix 31-A**)
- Access Route Operations Management Plan (**Appendix 31-B**)
- Emergency Response Plan
- Erosion and Sediment Control Plan

- Fish and Aquatic Habitat Protection Plan
- Mine Development and Operations Plan
- Spill Contingency Plan
- Waste Rock and Overburden Management Plan (**Appendix 31-D**)
- Water Management Plan (**Appendix 31-E**).

Refer to Section 31.0 Environmental and Socio-economic Management Program for plan summaries.

***Emergency Response and Clean-up Procedures***

In the event of a failure of the Alpha sedimentation pond, the Emergency Response Plan will be triggered and the initial emergency response will be as described in **Section 28.4.5.2**.

#### *28.4.6.3 Likelihood of Accident or Malfunction*

The containment structure for the Alpha sedimentation ponds will retain runoff volumes by continuously discharging water to prevent overflow. The pond is adequately sized for settling solids for any flow up to the 1:100 year freshet. Only during events larger than the 1:100 year freshet would water flow over the emergency spillway. The spillway is designed to convey the peak flow from a 1:200 year 24 hour storm. Due to the large influx of runoff during spring freshet, the pond will fill to capacity, and the overflow will discharge through the emergency spillway; thus, the corresponding likelihood of the dam failure is rated as rare.

#### *28.4.6.4 Potential Effects and Risk Assessment*

***Hydrology***

A sedimentation pond failure could release a large volume of water and sediment into a receiving stream..

The sediment released would consist of a proportionately higher quantity of fines, which would remain suspended until the flow energy decreases to the point where the sediment would settle out. This release would potentially alter the channel form and bedload characteristics at that point on the watercourse. A sediment pond release would also include a substantial volume of water; this would increase the peak flow substantially for a short period of time while this pulse of water moves downstream. In the immediate vicinity of the failure, substantial scour of the streambed and bank erosion would likely occur, and would extend downstream to the point where the additional flow formed a lesser proportion of the peak flows that would be expected to be present naturally during a large storm event. The changes resulting from such a failure would be temporary in nature. With the implementation of response procedures and mitigation summarized in **Section 28.4.6.2**, the potential residual effects on hydrology associated with an accidental sediment release from the Alpha pond would be moderate in magnitude, local to regional, short-term, and reversible. The consequence is therefore assessed as moderate. The risk to hydrology associated with an accidental sediment release from the sedimentation pond is assessed as low and deemed not significant.

***Surface Water Quality***

Surface water quality would be affected primarily in terms of suspended solids in concentrations that are anticipated to be further elevated as a result of scouring of the stream channel due to high energy flows of the accidental release. Suspended sediment will be diluted as it is carried downstream, and will settle out as flow energy decreases. Sediment may be disturbed by subsequent freshet or other high flow events, resulting in elevated total suspended solids concentrations.

With the implementation of response procedures and mitigation summarized in **Section 28.4.6.2**, sediment-laden runoff from the sedimentation pond release and associated scouring would have a high in magnitude, local to regional, short-term, and reversible effect on surface water quality. The consequence is therefore assessed as major (**Section 28.4.6.3**). Given the major consequence and the rare likelihood of occurrence of the event, the risk to surface water quality associated with an accidental sediment release from the sedimentation pond is assessed as medium and deemed not significant.

***Fish and Fish Habitat***

Sediment can have a range of sub-lethal to lethal effects on fish, depending on the dose and duration of sediment exposure (Newcombe and Jensen 1996). Increased sediment concentrations can also affect feeding influencing the visual prey detection (Hansen et al. 2013) and changing the benthic community toward burrowing taxa (Suttle et al. 2004). Suspended sediment would be diluted as it is carried downstream, and would settle out as flow energy decreases. In addition, if the volumes of sediment and water released were to cause a debris flow down the stream channel, debris flows could have an adverse effect on riparian and instream habitat, and cause morphological changes to stream channels that can take an extended period of time to recover (Bigelow et al. 2007, Hartman et al. 1996). Debris flows can also have an effect on the benthic invertebrate community that are an important source of food for fish (e.g., Kobayashi et al. 2010). Scouring would decrease as the additional flow generated from the sedimentation pond release forms a lesser proportion of the peak flows that would be expected to be present naturally during a large storm event.

The release of a large volume of sediment and water, particularly during low flow periods, would affect fish and fish habitat in the watercourses downstream of the Project. With the exception of a single Arctic Grayling documented in the upper part of Latte Creek, known fish and fish habitat are kilometres from the Coffee Creek Mine, therefore, direct effects (e.g., burial) are unlikely and fish would likely have the opportunity to respond to increasing total suspended solids concentrations (i.e., avoidance). If immediate actions to contain a large-scale sediment release are not effective, the release could result in changes in substrate composition in lower portions of the tributary streams. This would affect feeding and rearing habitat for the VC sub-component species (Arctic Grayling and juvenile Chinook Salmon).

With the implementation of response procedures and mitigation summarized in **Section 28.4.6.2**, it is not anticipated that sediment release from the sedimentation pond would permanently alter fish habitat of the receiving environments or affect long-term survival of aquatic species. It is also not anticipated that there would be direct mortality to any species such that long-term survival would be threatened. The potential residual effects on fish and fish habitat associated with an accidental sediment release from the largest sedimentation pond is expected to be moderate in magnitude local to regional, short-term, and reversible. The consequence is therefore assessed as moderate. In addition, the risk to fish and fish habitat associated with an accidental sediment release from the sedimentation pond is assessed as low and deemed not significant.

***Vegetation***

Vegetation could be affected by a major sediment release to a watercourse by direct damage or loss of vegetation along watercourse edges due to scouring. Sediment may also smother vegetation, particularly if there is debris associated with the sediment transport. In addition, results of a sedimentation event would introduce fine particles into the water column of affected watercourses that could affect riparian habitat. There are no known rare plant locations along watercourses surrounding the mine site that would be affected by a large release of sediment-laden water. Due to the location of the sediment pond in the Project area, sediment is expected to fall out of solution and be diluted prior to entering wetland communities along the Yukon River, thereby attenuating adverse effects.

Affected vegetation would recover or regenerate after sedimentation and scouring is settled. With the implementation of response procedures and mitigation (including replanting of scoured riparian areas to prevent further erosion, monitoring and follow-up program), as described in **Section 28.4.6.2**, sediment release from the sedimentation pond would not permanently affect any vegetation species such that long-term survival would be threatened. The potential residual effects on vegetation would be moderate, local to regional, short-term, and reversible. The consequence of an accidental release of sediment from the largest sedimentation pond on vegetation is therefore assessed as moderate. In addition, the risk to vegetation associated with an accidental sediment release from the sedimentation pond is assessed as low and deemed not significant.

***Community Infrastructure and Services***

The failure of a sedimentation embankment may result in death or injuries of workers and consequently the involvement of first responders and health services. With the implementation of the mitigation measures summarized in **Section 28.4.5.2**, the potential effects on community infrastructure and services are anticipated to be low in magnitude local to regional, short-term, and reversible. Resulting effects are not likely to be experienced at the community level in terms of expansion and upgrade of existing infrastructure and services. The consequence is therefore assessed as minor. In addition, the risk to community infrastructure and services is assessed as very low and deemed not significant.

***Community Health and Well-being***

In the worst-case scenario, failure of a sedimentation embankment may result in a fatality or serious injury to Project employees. A fatality or serious injury will have severe effects on the affected individuals, as well as major effects on the well-being of family and community members. This effect will be major to severe in magnitude, local to regional, long-term and irreversible. Resulting effects may be experienced at the community level, and may be particularly felt in smaller communities if the affected employees live in these smaller communities. The risk of such an accident or malfunction is rated as rare, the resultant risk to community health and well-being is assessed as high and deemed significant.

## 28.5 SCENARIO 2: EARTHWORKS FAILURE – FAILURE OR SLUMPING OF PIT WALLS

There will be four Open Pits developed for the Project: Double Double, Latte, Supremo, and Kona. This scenario evaluates the effects to ICs and VCs in the worst-case scenario, which would be a failure or slumping of a pit wall. A failure or slumping of a pit wall would result in the deposition of pit wall material into the bottom of the pit. This scenario is applicable during the Construction, Operation, Reclamation and Closure, and Post-closure Phases.

### 28.5.1 LOW-RISK EFFECTS

After consideration of mitigation measures and as per **Table 28.3-2**, failure or slumping of pit walls has no or a low risk interaction with Groundwater; Hydrology; Air Quality and Greenhouse Gas Emissions; Noise; Surficial Geology, Terrain, and Soils; Surface Water Quality; Fish and Fish Habitat; Vegetation; Wildlife and Wildlife Habitat; Birds and Bird Habitat; Demographics; Economic Conditions; Social Economy; Education and Training; Land and Resource Use; Community Health and Well-being; and Heritage Resources ICs and VCs. Effects to these ICs and VCs from this potential accident or malfunction are not carried forward for further evaluation.

### 28.5.2 MITIGATION MEASURES

#### *28.5.2.1* Project ***Design Measures and Management Plans***

The suite of design measures the Project will implement and the ongoing monitoring that will be conducted to ensure the stability of the pit walls will be outlined in detail in the Mine Development and Operations Plan. Key features to minimize the risk of a failure or slumping of pit walls will include:

- A thorough geological and geomechanical bench face mapping program will be undertaken beginning in the early stages of development to verify that the geologic structural conditions encountered are consistent with the assumptions and estimates used in the Feasibility Study Analyses, and identify local variations in structural conditions that might increase the risk of localized instabilities. Bench design will be refined and inter-ramp and overall slope angles will be optimized based on geotechnical database developed during this program.

- Double benching will take place in fresh, competent rock. The double, 20-m-high benching will permit the incorporation of more adequately sized berms for rock-fall control, thereby reducing the number of crests and toes that are subject to potential damage.
- The bench width will be 10 m in all areas.
- Pit walls will be visually monitored to identify apparent physical changes that may indicate future instability and allow the conditions to be mitigated prior to instability occurring. Facility operators will complete routine visual inspections at least weekly (unless otherwise noted), and more frequently when operational conditions dictate.
- Written records of routine inspections will be maintained as a permanent record at the Mine Site. Any deviations from normal or expected conditions will be immediately reported to the geotechnical engineer.

The Project will also adhere to the Yukon Workers Compensation Health and Safety Board guidance as well as the Yukon Water Board and Yukon Government Energy Mines and Resources document entitled *Plan Requirement Guidance for Quartz Mining Projects* (Yukon Water Board and EMR 2013).

#### *28.5.2.2 Emergency Response Procedures*

In the event of a failure or slumping of a pit wall, the Emergency Response Plan will be triggered. The Mine Rescue Team will be the first responders in the event of an emergency associated with the mining operation. The Mine Rescue Team may comprise personnel from the ERT or they may be separate. The first responders will be personnel with formal qualified training.

After the initial emergency response, an event-driven inspection will occur as soon as possible. Event-driven inspections, which require follow-up action, will include a detailed description of such action with timelines and compliance criteria included in a Report of Special Inspection.

### 28.5.3 LIKELIHOOD OF ACCIDENT OR MALFUNCTION

To increase stability and minimize the risk of failure, as described in **Section 28.5.2**, the Proponent will undertake controlled blasting and pro-active geotechnical monitoring over the life of mine operation, implement a thorough geological and geomechanical bench face mapping program, build double-benching in fresh and competent rock (10-m bench width in all areas), and monitor pit walls to identify apparent physical changes. The likelihood of major failure of pit walls is rated as unlikely.

### 28.5.4 POTENTIAL EFFECTS AND RISK ASSESSMENT

#### *28.5.4.1 Community Infrastructure and Services*

Failure of a pit wall may result in death, dismemberment, or other crush injuries of workers and consequently the involvement of first responders and health services in Dawson and Whitehorse. This may result in increased strain on local infrastructure and services (e.g., firefighting and medical services) based in Dawson and Whitehorse. With the implementation of the mitigation measures summarized in **Section**

**28.5.2**, the potential effects associated with failure or slumping of a pit wall on community infrastructure and services are anticipated to be low in magnitude, local to regional, short-term, and reversible. Resulting effects are not likely to be experienced at the community level in terms of expansion and upgrade of existing infrastructure and services. The consequence is therefore assessed as minor. In addition, the risk to community infrastructure and services associated with a failure or slumping of pit walls is assessed as very low and deemed not significant.

#### *28.5.4.2 Community Health and Well-being*

In the worst-case scenario, failure or slumping of pit walls may result in a fatality or serious injury to Project employees. A fatality or serious injury will have severe effects on the affected individuals, as well as major effects on the well-being of family and community members. This effect will be major to severe in magnitude, local to regional, long-term and irreversible. Resulting effects may be experienced at the community level, and may be particularly felt in smaller communities if the affected employees live in these smaller communities. The risk of such an accident or malfunction is rated as rare, the resultant risk to community health and well-being is assessed as high and deemed significant.

## 28.6 SCENARIOS 4: FIRES OR EXPLOSIONS ON SITE

A fire or explosion occurring at the Mine Site is possible as a result of an accident at or near the fuel storage facility, which would cause on-site combustible materials to ignite.

Project components and activities that may cause fires or explosions include:

- Fuel spill
- Blasting resulting in air overpressure or fly rock damage
- Improper storage or handling of processing reagents
- Waste management (waste oil burners, woody debris slash piles)
- Vehicle collision
- Plane crash.

This scenario assumes fire or explosion of a diesel fuel storage tank with a capacity of 4 ML. This scenario is applicable during the Construction, Operation, and Reclamation and Closure Phases.

### 28.6.1 LOW-RISK EFFECTS

After consideration of mitigation measures and as per **Table 28.3-2**, fires and explosions have no or a low risk interaction with Groundwater; Hydrology; Surficial Geology, Terrain, and Soils; Surface Water Quality; Fish and Fish Habitat; Vegetation; Wildlife and Wildlife Habitat; Birds and Bird Habitat; Demographics; Economic Conditions; Social Economy; Education and Training; Land and Resource Use; and Heritage Resources ICs and VCs. Effects to these ICs and VCs from this potential accident or malfunction are not carried forward for further evaluation.

### 28.6.2 MITIGATION MEASURES

***Project Design Measures***

Goldcorp has incorporated the following measures into the Project design to minimize the risk of a fire or explosion on site:

- The Mine Site facilities will be protected, at a minimum, from fire in accordance with applicable codes and standards. All storage tanks will be constructed and operated in accordance with the National Fire Code and in conformity with the *Environmental Code of Practice for Aboveground Storage Tank Systems Containing Petroleum Products* (CCME 2003). The fire alarm system will consist of manual pull stations at building exits and audible and visual notification devices throughout the work areas. All surface mobile equipment will be fitted with fire extinguishers. The fleet of open pit mining equipment will also contain fire suppression systems.
- The design of all explosives storage facilities will meet government regulations and will be located according to required separation distances as regulated by the Explosives Regulatory Division of Natural Resources Canada.
- Bulk ammonium nitrate storage area will be lined with HDPE liner to provide spill containment.
- The fuel tank farm bund will be lined with HDPE for spill containment. Fuel dispensing equipment for mining, plant services, and freight vehicles will be located adjacent to the fuel tank bund, and the fuelling area will drain into the bund.
- The airstrip will be capable of accommodating aircraft with the capacity for a return trip fuel reserve, allowing for immediate turn-around without refuelling.

Project facilities will be protected, at a minimum, from fire in accordance with applicable codes and standards. The fire alarm system will consist of manual pull stations at building exits and audible and visual notification devices throughout work areas. All surface mobile equipment will be fitted with fire extinguishers. The fleet of open pit mining equipment will also contain fire suppression systems.

The firewater main, hydrant, and standpipe system will service the Coffee site facilities by a fire water tank and modularized pump unit. The fire water pump system will include a main pump and jockey pump, which are electrically powered and a diesel-driven standby pump, and will be housed in a modular building. A fire water truck will provide supplemental protection. In addition, all buildings and conveyors will have fire extinguishers and some will have standpipe systems and fire truck connections. There are no sprinkler systems inside the truck shop or the process plant. The power generators are large diesel engines, and therefore will each have a Liquid Vehicle System fitted. The camp, administration offices, and mine dry will be fitted with sprinklers connected to the firewater main.

***Management Plans***

- Explosives Management Plan
- Emergency Response Plan
- Adherence to the *Explosives Act*, RSC 1985, c. E-17, and relevant associated regulations
- Adherence to National Fire Code of Canada 2015 (NRCC 2015).

***Emergency Response Procedures***

In the event of a fire or explosion on site, the Emergency Response Plan will be triggered. Initial response to a fire will be as follows:

- If an identified fire is small enough, then an attempt to extinguish with a fire extinguisher will be attempted.
- If extinguishing the fire is not possible, the Discoverer will activate the nearest fire pull station and advance to the muster point.
- Upon hearing the alarm, all individuals will assess the situation and evacuate the building yelling "fire" and knocking on doors as they are passed.
- The ERT will respond to the scene and all traffic will stop to ensure minimal delay to emergency response vehicles.

### 28.6.3 Likelihood of Accident or Malfunction

The likelihood of a fire occurring of sufficient severity for the Project to affect the biophysical and socio-economic environments is rare. For example, in a worst-case scenario, a fire would occur as a result of operation of a Project fuel tanks. The International Association of Oil & Gas Producers (IAOGP 2010) provides accident statistics on storage tanks for risk assessment purposes, suggesting an accidental rate of $9.0 \times 10^{-5}$ per tank year for fire incidents. Thus, an accidental tank fire is not expected over the life of the Project. To reduce the potential of an accidental tank fire or explosion as described in **Section 28.6.2**, the Project's fuel storage tanks will be constructed and operated in accordance with the National Fire Code and in conformity with the *Environmental Code of Practice for Aboveground Storage Tank Systems Containing Petroleum Products* (CCME 2003).

### 28.6.4 Potential Effects and Risk Assessment

***Air Quality and Greenhouse Gas Emissions***

A fire or explosion from Project activities is expected to result in adverse changes to all air quality indicators within the Project footprint. This change in air quality is expected to be limited in duration based on the quantity of fuel available for combustion, with conditions returning to normal within 24 hours of the end of the event.

With the implementation of response procedures and mitigation summarized in **Section 28.6.2**, a fire or explosion on site will have a moderate (in magnitude), local, short-term and reversible effect on air quality. The consequence is therefore assessed as moderate. In addition, the risk to air quality associated with an accidental fire or explosion of a fuel storage tank is assessed as low and deemed not significant.

***Noise***

Similar to blasting, noise from uncontrolled explosions could be audible at more than 10 km from the Project site. The noise generated from explosions would be very short in duration and would be unexpected. Due to the short duration and explosion, noise would result in a short-term interaction during which changes in noise levels would occur. Because these would be uncontrolled explosions, the ability to take measures to reduce or eliminate the noise is not feasible.

With the implementation of response procedures and mitigation summarized in **Section 28.6.2**, a fire or explosion on site will have a high in magnitude, local to regional, short-term, and reversible effect on noise. The consequence is therefore assessed as moderate. In addition, the risk of noise associated with an explosion is assessed as low and deemed not significant.

***Community Infrastructure and Services***

In the unlikely event of a fire or explosion at the Project site, it is very likely external emergency response resources will be required. The accident may involve death, and injury and fire and could result in increased strain on local infrastructure and services (e.g., firefighting and medical services) based in Dawson and Whitehorse. With the implementation of the mitigation measures summarized in **Section 28.6.2**, the potential effects from an explosion on community infrastructure and services are anticipated to be low in magnitude, local to regional, short-term, and reversible. Resulting effects are not likely to be experienced at the community level in terms of expansion and upgrade of existing infrastructure and services. The consequence is therefore assessed as minor. In addition, the risk to community infrastructure and services associated with a fire or explosion on site is assessed as very low and deemed not significant.

***Community Health and Well-being***

In the worst-case scenario, a fire or explosion at site may lead to one or more human fatalities, or serious injury to one or more Project employees. A fatality or serious injury will have severe effects on the affected individuals, as well as major effects on the well-being of family and community members. This effect will be major to severe in magnitude, local to regional, long-term and irreversible. Resulting effects may be experienced at the community level, and may be particularly felt in smaller communities if the affected employees live in these smaller communities. The risk of such an accident or malfunction is rated as rare, the resultant risk to community health and well-being is assessed as high and deemed significant.

## 28.7 SCENARIO 5: TRANSPORTATION ACCIDENTS

Multiple transport modes will be used to support the Project including: motor vehicle traffic on the NAR; site roads and haul roads; barges across the Yukon and Stewart River; and aircraft. These scenarios could result in human injury or fatality, wildlife injury or mortality, use of essential services (RCMP, fire department, ambulatory care), or a loss of containment of a hazardous substance. The loss of containment resulting from a transportation accident are addressed in other sections (**Section 28.4.1**, **Section 28.4.2**, **Section 28.4.3**, and **Section 28.4.4**).

This scenario evaluates a worst-case transportation accident resulting in a human fatality, which may occur during aircraft takeoff or landing; vehicle operation along the NAR, in-pit haul roads or site roads; or barge operation. Motor vehicle traffic along the NAR is selected for this scenario as motor vehicle traffic on public roads are generally considered to have a higher risk profile that other transportation modes. This scenario is applicable during the Project's Construction, Operation, Reclamation and Closure, and Post-closure Phases.

#### *28.7.1.1 Low-risk Effects*

After consideration of mitigation measures and as per **Table 28.3-2**, transportation accidents have no or a low risk of interaction with Groundwater; Hydrology; Air Quality and Greenhouse Gas Emissions; Noise; Surficial Geology, Terrain, and Soils; Surface Water Quality; Fish and Fish Habitat; Vegetation; Wildlife and Wildlife Habitat; Birds and Bird Habitat; Demographics; Economic Conditions; Social Economy; Education and Training; Land and Resource Use; and Heritage Resources ICs and VCs. Effects to these ICs and VCs from this potential accident or malfunction are not carried forward for further evaluation.

#### *28.7.1.2 Mitigation Measures*

***Project Design Measures***

Goldcorp has incorporated the following measures into the Project design to minimize the risk of a transportation accident:

- Most personnel will operate on a two-week-on/two-week-off-shift rotation on a fly-in/fly-out basis.
- The NAR will be a one-lane, two-way, radio-assist access road. All Goldcorp employees and contractors using the NAR will be equipped with a radio set to the access road frequency, which will be posted on the information sign at Sulphur Creek. Radio communication will be line-of-site only to provide communications between vehicles within close proximity to each other.
- Goldcorp will educate all employees and contractor personnel on the road safety rules during the safety induction training, which will take place before they first drive the NAR.
- Vehicles on the NAR will not park on the travelling surface – to park, vehicles will pull off the road in a safe location such as a pullout (passing pullouts are intervisible along the NAR beginning at Sulphur Creek).
- Speed limits will be posted in accordance with permit conditions and signage requirements; NAR usage by Goldcorp vehicles will be restricted during periods of inclement weather.
- Driving under the influence of alcohol or intoxicating drugs will be prohibited, and will result in immediate dismissal from the Project.

The Project will adhere to the *Yukon Occupational Health and Safety Act* and relevant associated regulations. Project-related vehicles travelling outside of the Project area (e.g., on provincial highways, aircraft) are required to fully comply with all relevant legislation, including the federal *Motor Vehicle Safety Act*, SC 1993, c. 16, Yukon *Motor Vehicles Act*, RSY 2002, c. 153, and regulations, and the Canadian Aviation Regulations (SOR/96-433).

***Management Plans***

Goldcorp will develop and implement the following management plans to mitigate the potential for a transportation accident that would result in the loss of human life:

- Access Route Construction Management Plan (**Appendix 31-A**)
- Access Route Operational Management Plan (**Appendix 31-B**)
- Emergency Response Plan
- Mine Development and Operations Plan.

***Emergency Response Procedures***

The ERT will respond in the event of an incident or accident at the Mine Site or the NAR, and ERT personnel will be tasked with responding to any vehicle accident resulting in personal injury or spillage of harmful material. Goldcorp will initiate extraction and transport to medical assistance at the Mine Site, Dawson, or Whitehorse, depending on the location of the accident and the severity of the injury. In the event of serious injuries, the person or persons will be evacuated to the Dawson City Community Hospital or Whitehorse General Hospital through the most appropriate means (i.e., on-site Mobile Medical Treatment Unit, on-site ambulance or Medevac). Medevac services use specially equipped planes provided by Alkan Air, based in Whitehorse.

### 28.7.2 Likelihood of Accident or Malfunction

Goldcorp will implement strict safety requirements for Project personnel at all times, including during transportation. The Project transportation involves remote travel, and the probability of a transportation accident has conservatively been rated as unlikely.

### 28.7.3 Potential Effects and Risk Assessment

***Community Infrastructure and Services***

Potential effects to Community Infrastructure and Services may occur through fatality and injury associated with motor vehicle accidents involving Project-related traffic on the NAR; accidents involving haul trucks and vehicles performing mining operations; and other transportation-related accidents, including aircraft and barge traffic that would require the involvement of first responders and health services based in Dawson and Whitehorse. With the implementation of the mitigation measures, as described above, potential effects associated with transportation accidents on local infrastructure and services are anticipated to be low in magnitude, local to regional, short-term, and reversible. Resulting effects are not likely to be experienced at the community level in terms of expansion and upgrade of existing infrastructure and services. The consequence is therefore assessed as minor. In addition, the risk to community infrastructure and services associated with transportation accidents is assessed as low and deemed not significant.

***Community Health and Well-being***

In the worst-case scenario, a transportation accident may lead to one or more human fatalities, or serious injury to one or more people, including the public and/or Project employees. A fatality or serious injury will have severe effects on the affected individuals, as well as major effects on the well-being of family and community members. This effect will be major to severe in magnitude, local to regional, long-term and irreversible. Resulting effects may be experienced at the community level, and may be particularly felt in smaller communities if the affected employees live in these smaller communities. The risk of such an accident or malfunction is rated as unlikely, the resultant risk to community health and well-being is assessed as high and deemed significant.

## 28.8 SUMMARY

Based on the probability (likelihood) attributes identified in **Table 28.3-3** and the consequence (severity) attributes identified in **Table 28.3-4,** the risks for the accident and malfunction scenarios were assessed in **Sections 28.4** to **28.7** summarized in **Table 28.8-1**. The majority of risk rankings range from very low to medium and are all assessed as not significant. However, significant effects are expected if an accident or malfunction, e.g., from a transportation or fly rock accident, results in one or more human fatality. To prevent this, Goldcorp will implement stringent safety measures that all employees and contractors must adhere to while on site.

**Table 28.8-1 Summary of Significance Assessment for Assessment of Accidents and Malfunctions**

| Potential Accidents and Malfunctions | | Groundwater | Hydrology | Air Quality and Greenhouse Gas Emissions | Noise | Surficial Geology, Terrain, and Soils | Surface Water Quality | Fish and Fish Habitat | Vegetation | Wildlife and Wildlife Habitat | Birds and Bird Habitat | Demographics | Economic Conditions | Social Economy | Community Infrastructure and Services | Education and Training | Land and Resource Use Assessment | Community Health and Well-Being (Human Health) | Heritage Resources |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Containment Loss | Hazardous material spill in water – diesel fuel | | | | | | NS | NS | NS | NS | NS | | | | NS | | NS | NS | |
| | Hazardous material spill on land – diesel fuel | NS | | | | | | | | | | | | | NS | | | NS | |
| | Hazardous material spill in water – cyanide | | | NS | | | NS | NS | NS | NS | NS | | | | NS | | NS | S | |
| | Hazardous material spill on land – cyanide | NS | | NS | | NS | | | | | | | | | NS | | | S | |
| | Containment failure of Heap Leach Facility | | | | | | NS | NS | NS | NS | NS | | | | NS | | | S | |
| | Sediment release into watercourse | | NS | | | | NS | NS | NS | | | | | | | | | S | |
| Earthworks Failure | Failure or slumping of pit walls | | | | | | | | | | | | | | NS | | | S | |
| Fire or Explosion | | | | NS | NS | | | | | | | | | | NS | | | S | |
| Transportation Accident (leading to human mortality) | | | | | | | | | | | | | | | NS | | | S | |

**Note:** NS – Not significant; S – Significant.

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# 29.0 CARBON MANAGEMENT ASSESSMENT

This section identifies regulations and policies regarding carbon management, and identifies current greenhouse gas (GHG) emissions at both a territorial and federal level. An estimate of the GHG emissions associated with the proposed Coffee Gold Mine (Project) during each Project phase has been provided, along with a discussion of the options available for managing carbon emissions.

Kaminak Gold Corp., a wholly owned subsidiary of Goldcorp Inc. (Goldcorp or Proponent), recognizes that GHG production is a contributor to climate change and an ongoing concern in Yukon, and has committed to working with regulatory agencies to meet the GHG targets contained within territorial and federal management plans.

## 29.1 REGULATORY AND POLICY SETTING

In response to concern over potential effects from GHGs and climate change, the Canadian federal government developed a Regulatory Framework for Air Emissions (Government of Canada 2007). Recently, the Government of Canada committed to the Paris Agreement, which will involve the development of long-term emissions targets for 2025 and 2030 (Government of Canada 2016a, United Nations 2015). Legislation and GHG emissions targets at the federal level are being developed.

The Government of Yukon has developed a comprehensive Climate Change Action Plan (Environment Yukon 2009), which recognizes that climate change is happening now, and that human behaviour is a major contributing factor. A key priority of Yukon Government's Climate Change Action Plan is enabling effective adaptation to changing climate (Environment Yukon 2009) by describing four goals for climate change action:

- Enhance knowledge and understanding of climate change
- Adapt to climate change
- Reduce GHG emissions
- Lead Yukon action in response to climate change.

The Climate Change Action Plan identifies 33 specific commitments that advance the four goals identified above. As of December 2015, the majority of these commitments have been completed or are underway. The most current Progress Report identifies 28 new climate change actions that largely focus on mitigation and adaptation (Environment Yukon 2015). Currently, however, Yukon has not implemented regulations specific to the release of GHG emissions within Yukon.

A detailed discussion of climate change and related elements such as permafrost stability and extreme weather are provided in **Section 27.0 Effects of the Environment on the Project**.

## 29.2 NATIONAL AND TERRITORIAL GHG EMISSIONS

Greenhouse gas emissions, both national totals and broken down by province and territory, are published annually by the Government of Canada. In addition, Canadian GHG emissions are published in the National Inventory Report, the most recent of which served as Canada's inventory submission to the United Nations Framework Convention on Climate Change (ECCC 2016). Greenhouse gas emissions for Yukon and Canada from 1990 to 2014 are summarized in **Table 29.2-1**.

**Table 29.2-1 National and Territorial Greenhouse Gas Emissions**

| Year | Total GHG Emissions in Yukon (kt of $CO_2e$ per year) | Total GHG Emissions in Canada (kt of $CO_2e$ per year) |
|---|---|---|
| 1990 | 540 | 613,000 |
| 2000 | 505 | 744,000 |
| 2005 | 459 | 747,000 |
| 2010 | 344 | 706,000 |
| 2011 | 384 | 710,000 |
| 2012 | 393 | 718,000 |
| 2013 | 351 | 731,000 |
| 2014 | 268 | 732,000 |

**Note:** $CO_2e$ – carbon dioxide equivalent; kt – kilotonne.
**Source**: ECCC 2016

As shown in **Table 29.2-1**, Canadian emissions for 2014 were 20 percent (%) above the total for 1990 (i.e., 732,000 vs 613,000 kilotonnes (kt) of equivalent carbon dioxide ($CO_2e$)). The majority of 2014 emissions were produced by the energy sector, consisting of stationary combustion sources, transport, and fugitive sources (ECCC 2016). In contrast, GHG emissions in Yukon have decreased by approximately 50% from 1990 to 2014 (i.e, 268 kt $CO_2e$ vs. 520 kt $CO_2e$), mainly due to changes in the nature and extent of industrial activity and the cyclical nature of the resource economy (Environment Yukon 2014). Despite low GHG emissions, Yukon continues to experience the effects of climate change more quickly than other regions, which is likely to continue due to increasing global GHG emissions (Environment Yukon 2016).

## 29.3 PROJECT-RELATED GREENHOUSE GAS EMISSIONS

As discussed in **Appendix 9-B2 Greenhouse Gas Emissions Inventory**, Project activities are expected to generate GHG emissions over the life of the Project. The primary sources of these emissions will be fuel consumption during the Construction and Operation Phases, ore processing, wastewater treatment, vegetation removal, the use of explosives, and transportation of materials and employees to and from site. Estimates of GHG emissions over the life of the Project are provided in **Table 29.3-1** and were calculated based on the newly released guidance document entitled *Environment and Climate Change Canada Generic Guidance on Information Related to Mine Fleet Emissions to be Included in Environmental*

*Assessments* (Government of Canada 2016b). The assumptions used to guide these estimates are detailed in **Appendix 9-B2 Greenhouse Gas Emissions Inventory**.

**Table 29.3-1 Greenhouse Gas Emissions Summary for the Project**

| Year | Annual GHG Total (kt of $CO_2e$) |
|---|---|
| Year –3 | 9.069 |
| Year –2 | 13.603 |
| Year –1 | 26.277 |
| Year 1 | 81.896 |
| Year 2 | 92.368 |
| Year 3 | 94.041 |
| Year 4 | 102.187 |
| Year 5 | 103.174 |
| Year 6 | 98.671 |
| Year 7 | 94.707 |
| Year 8 | 100.564 |
| Year 9 | 105.973 |
| Year 10 | 86.414 |
| Year 11 | 50.907 |
| Year 12 | 5.196 |
| **Total** | **1,065.047** |

Based on the estimated GHG emissions provided above, it is likely that the average annual emissions of 88.75 kt $CO_2e$ from the Project will increase Yukon's annual GHG emission total for 2014 by approximately 25%. As Yukon emissions represent approximately 0.03% of Canada's total emissions, however, the Project will have a negligible effect on total Canadian GHG emissions.

As discussed in **Section 2.0 Project Description**, the Proponent has incorporated several mitigation measures into the design of the Project, including measures to reduce GHG emissions by reducing hauling distances and streamlining transportation to and from site. Goldcorp will also adhere to industry-wide best management practices throughout all phases of the Project. In addition, Goldcorp will develop a Greenhouse Gas Management Plan prior to construction, which will outlines commitments to improve energy efficiency, reduce GHG emissions, record energy use, and investigate instances where energy use is found to be in excess of expected amounts. Goldcorp will report annually on the Project's GHG emissions to Environment Yukon and the Department of Energy, Mines, and Resources as a part of its voluntary reporting protocols for large, stationary facilities.

## 29.4 REFERENCES

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# 30.0 CAPACITY OF RENEWABLE RESOURCES

This section presents an assessment of potential effects of the proposed Coffee Gold Mine (Project) on the capacity of renewable resources to meet the needs of present and future generations. An assessment of a Project's effects on the capacity of renewable resources is required under the *Yukon Environment and Socio-economic Assessment Act* SC 2003, c. 7, Section 42(2) (b).

For the purposes of this assessment renewable resources are defined as: those natural resources that can naturally recover from consumption over a period of time, and include resources such as timber and wildlife (Casino 2013, Harper Creek 2015). Capacity to meet present and future needs is defined as the ability for a renewable resource to sustain a reasonable level of use or harvest (Casino 2013, Harper Creek 2015).

**Sections7.0** (**Groundwater Analysis**) through **Section 26.0** (**Heritage Resources Assessment**) of this Project Proposal assess the potential Project-related effects and potential cumulative effects on Valued Components (VCs) and Project-related changes and cumulative changes on Intermediate Components (ICs), many of which can be considered renewable resources from a biological or land use perspective. The VC assessments and IC change analyses are therefore used as the basis for identifying potential Project-related effects to the capacity of renewable resources. For ease of readability, the term VC is used from here forward to refer to both ICs and VCs. Note that residual effects were only identified for VCs, and that only VCs have been identified as a renewable resource in this chapter.

## 30.1 METHODOLOGY

The values identified during the Project's consultation process (**Section 3.0 Consultation**), regulatory requirements, and the identification of VCs are reflected in the components that may be considered renewable resources and have the potential to be adversely changed by Project during the Construction, Operation, and Reclamation and Closure, and Post-closure Phases. These assessments have identified the potential Project-related effects and cumulative effects and the significance of any residual and cumulative effects on VCs and ICs. This assessment of the potential Project-related effects on the capacity of renewable resources is based on the results of VC assessments reported in **Section 7.0 through Section 26.0** and on a review of assessment approaches reported in literature and other Project Proposals. In addition, this assessment uses the methods described in **Section 5.0 Assessment Methodology** as described below:

- Identify the VCs that could act as renewable resources for which not significant or significant potential effects, residual effects, or cumulative adverse effects are predicted because of the Project or cumulatively with other projects and activities.
- Identify the parties that use and value the identified renewable resources in the Local Assessment Area (LAA) and Regional Assessment Area (RAA) currently and who will likely continue to use them in the future.

- Determine whether the sustainable use of the identified renewable resources by identified parties will potentially be impaired by the Project using the significance determinations as a basis for conclusions.
- Conduct a formal effects assessment following the methodology described in **Section 5.0 Assessment Methodology** when a renewable resource may be affected by the Project and when the potential adverse effect is considered significant.

## 30.2 IDENTIFICATION OF RENEWABLE RESOURCES

Renewable resources are those natural resources that are naturally produced over time in a naturally occurring environment, and can recover from consumption over a period of time. The assessment of capacity of renewable resources thus includes the individual assessments on specific VCs, as discussed in the following sections.

### 30.2.1 SCOPING RENEWABLE RESOURCES

This assessment focuses on those renewable resources considered of value for human uses (e.g., commercial, recreational, subsistence, and traditional use). The assessment of land and resource use (**Section 24.0**) includes the current use of renewable resources, including fish, wildlife, and plant resources harvested by the local First Nations. This information was provided to Kaminak Gold Corporation, a wholly owned subsidiary of Goldcorp Inc. (Proponent or Goldcorp), through consultation (**Section 3.0**). A review of the VC assessments used to include the above renewable resources within the scope of the capacity of renewable resources assessment for the reasons described in **Table 30.2-1**.

**Table 30.2-1 Renewable Resource Valued Components**

| Renewable Resource | Renewable Resource Use |
|---|---|
| **Physical Environment** | |
| Surface Water<br>• Quality<br>• Quantity | • Supports wildlife, vegetation, and habitats<br>• Supports aquatic species and habitats<br>• Potential drinking water source |
| **Biophysical Environment** | |
| Fish and Fish Habitat<br>• Chinook Salmon<br>• Chum Salmon<br>• Arctic Grayling | • Recreational fishing<br>• First Nations commercial, subsistence, and cultural harvesting |
| Vegetation<br>• Ecological communities<br>• Wetland habitats<br>• Traditional and medicinal plants | • Supports wildlife, vegetation and habitats<br>• First Nations traditional harvesting<br>• Supports human use |

| Renewable Resource | Renewable Resource Use |
|---|---|
| Wildlife and Wildlife Habitat<br>• Forty-mile Caribou<br>• Klaza Caribou<br>• Moose<br>• Grizzly Bear<br>• Thinhorn Sheep<br>• Wolverine | • Hunting opportunities<br>• First Nation traditional and subsistence use<br>• Guide outfitting opportunities<br>• Commercial and traditional trapping |
| Birds and Bird Habitat<br>• Sharp-tailed Grouse<br>• Upland-associated Species at Risk<br>• Wetland-associated Species at Risk | • Hunting opportunities<br>• First Nation traditional and subsistence hunting<br>• Guide outfitting opportunities |

## 30.3 Current and Future Users of Renewable Resources

### 30.3.1 First Nations

The Project footprint is in the traditional territories of Tr’ondëk Hwëch’in, Selkirk First Nation, First Nation of Na-cho Nyäk Dun and the asserted territory of White River First Nation. Natural resources are the foundation of traditional economies (see **Figure 1.3-2** in **Appendix 24-A Land and Resources Use Valued Component Assessment**). The Umbrella Final Agreement for the Tr’ondëk Hwëch’in, Selkirk First Nation, and First Nation of Na-cho Nyäk Dun all include settlement lands and in Yukon, a First Nation has the exclusive right to use water that is located on or flowing through its Settlement Lands (**Appendix 24-A Land and Resources Use Valued Component Assessment**, **Section 3.1.2**). This right is protected from substantial alterations to water quantity, rate of flow, or water quality. In keeping with the Umbrella Final Agreement, the Project assessment considers potential changes to or effects on water quantity and rate of flow, and on water quality on Settlement Land parcels located downstream of the Project (see **Section 8.0 Surface Hydrology Analysis** and **Section 12.0 Surface Water Quality Assessment**, respectively) (Government of Canada, CYI, and Government of Yukon 1993).

As per the Umbrella Final Agreement, Yukon First Nations people have the right to harvest all species of fish and wildlife for themselves and their families for subsistence or trade within their Traditional Territory and with the consent of another Yukon First Nation in that Yukon First Nation’s traditional territory (Government of Canada, Council of Yukon Indians and Government of Yukon 1993).

The mouth of Coffee Creek is known as an important site for the salmon harvest, and the location drew members of multiple First Nations who travelled many kilometres to participate in the harvest (Dawson Indian Band 1988). First Nations would travel long distances to follow food sources, or arrive at traditional seasonal harvesting locations to harvest resources at their peak so that resources could be stored in caches for periods of lower returns (Easton et al. 2013). The Yukon River watershed supports populations of numerous fish species including: Arctic Grayling (*Thymallus Arcticus*), Chinook Salmon (*Oncorhynchus* *tshawytscha*), and Chum Salmon (*O. keta*). These species are of significant traditional, historical, and cultural importance to First Nations (Mischler and Simeone 2004).

Baseline studies for vegetation have documented 410 different species including; seven trees, 60 shrubs, 188 forbs, 62 grasses, 18 ferns, two aquatics, 36 mosses, and 37 lichens (**Appendix 15-A Vegetation Baseline Report**). Many of these species are currently or were traditionally harvested by local First Nations as sources of food, medicinal, cultural, decorative, or practical purposes. The harvest of berries (Bog Blueberry [*Vaccinium uliginosum*], Lowbush Cranberry [*V. vitis-idaea*], Crowberry [*Empetrum nigrum*], Bog Cranberry [*V. oxycoccos*], Cloudberry [*Rubus chamaemorus]*, Currant [*Ribes spp.*], Gooseberry [R*ibes oxyacanthiodes*], Blackberry [*Rubus spp.*], and Soapberry [*Shepherdia Canadensis*]) and various other edible plants (Labrador Tea [*Rhododendron groenlandicum*], Bear Root [*Ligusticum porter*], Alaska Birch [B*etula neoalaskana*]) have supplemented the meat and fish that are also harvested in the region. The majority of ecosystems identified with the Vegetation LAA support at minimum one berry-producing species, and commonly support multiple species. Labrador Tea, Alaska Birch, and spruce trees were commonly sampled throughout the LAA during other baseline vegetation studies. The Coffee Creek area is noted as an important area for harvesting Blueberries, High- and Lowbush Cranberries, Soap Berries, and Gooseberries (TH 2012a).

The climate and habitat, which are characteristic of the Klondike Plateau subzone of the Boreal Cordillera Ecozone, support a wide variety of wildlife including large ungulates, large predatory mammals, small herbivorous and carnivorous mammals, predatory birds, migratory birds, passerines, game birds, amphibians, and reptiles. The Coffee Creek area is an important hunting area for large game, Moose (*Alces alces*) and Thinhorn Sheep (*Ovis dalli dalli)* in particular, smaller game including American Beaver (*Castor canadensis*), Common Muskrat *(Ondatra zibethicus),* and Snowshoe Hare (*Lepus americanus*), as well as birds such as waterfowl and upland game birds (Bates et al. 2014). The area also supported trapping for furbearing species including Minks (*Neovison vison*), Foxes (*Vulpes vulpes*), Wolverine (*Gulo gulo*), Lynx (*Felis lynx*), American Beaver, Common Muskrat, and Grey Wolves (*Canis lupus*) (TH 2012b). In winter, the Coffee Creek area was an important hunting ground for Woodland Caribou (*Rangifer tarandus*), as the animals would move to higher-elevation habitats surrounding the creeks (TH 2012a).

### 30.3.2 NON-TRADITIONAL USERS

The surface waters of creeks and rivers in the west central Yukon support various activities, including quartz and placer mining, as well as municipal, agricultural, recreational, and hydro-electric uses. Currently there are no water rights held by other users that overlap with the Mine Site. The Northern Access Route (NAR), however, crosses lands where owners of placer mining operations hold a total of 37 other water licences.

Game management zones (GMZs) and subzones are established through the *Wildlife Act*, RSY 2002, c.229, and are legal boundaries that define an area with specific management objectives for big game species. Game management zones establish specific hunting licence requirements, restrictions, and limits for their respective area (Environment Yukon 2015a). The Mine Site is located entirely within Zone 5, subzone 03 (GMZ 5-03), and the NAR is located entirely within zone 3, and traverses through subzones 307, 308, 310, 311, 312, and 313. District Conservation Officers provide services within the Project footprint and the immediately surrounding area are based out of the City of Dawson and Beaver Creek. The *Wildlife Act* regulates trapline and guide outfitter concession areas that provide exclusive rights to concession holders for the harvest of furbearers and for guided hunts, respectively. Trapping and guiding provide Yukon residents with opportunities for self-employment in the outdoors and remote areas of the Territory (Environment Yukon 2016b, Environment Yukon 2016c, Yukon Outfitters Association 2016). The Mine Site does not overlap with any guide outfitter concession areas; however, the NAR overlaps with guide outfitter concession area ID 11 at the barge crossing of the Yukon River and the winter ice road between the Yukon River and Coffee Creek (**Figure 4.3-3**). Two trapline concession areas (IDs 115 and 116) overlap with the Mine Site, and seven trapline concession areas (IDs: 54, 57, 58, 61, 62, 115, and 116) overlap with the NAR from the junction with the Klondike Highway to the Mine Site (**Figure 4.3-3**) (Yukon Government, 2016).

The Project is located within the Yukon River South, Stewart River, and Gold Fields landscape units of the Dawson Forest Resources Management Plan (**Figure 4.3-3**) (Energy, Mines and Resources 2013), and does not overlap with any active forest-tenured area.

### 30.4 ASSESSMENT OF EFFECTS ON RENEWABLE RESOURCES

The assessment of potential effects on the capacity of renewable resources is based on the identification of renewable resources (**Section 30.2**) and uses of renewable resources (**Section 30.3**). Where the individual VC and IC assessments have identified not significant (NS) or significant (S) Project-related effects and cumulative effects they are carried forward and analyzed in this section to identify potential effects of the Project on the capacity of renewable resources **Table 30.4-1**.

**Table 30.4-1 Potential Effects to Valued Components Carried Forward to the Assessment of Capacity of Renewable Resources**

| Renewable Resource | Rationale | Potential Effects | Residual Adverse Effects | |
|---|---|---|---|---|
| | | | Residual | Cumulative |
| **Physical Environment** | | | | |
| Surface Water Quality | Supports plant, fish, wildlife, and human life | • Contamination from contact water and related mine effluents | NS | NS |
| **Biophysical Environment** | | | | |
| Fish and Fish Habitat<br>• Chinook Salmon<br>• Chum Salmon<br>• Arctic Grayling | Recreational fishing and First Nations commercial, subsistence, and cultural harvesting | • Changes in surface water quality in adjacent creeks and Yukon River<br>• Change in accessibility to fish habitat | NS | NS |
| Vegetation<br>• Traditional and Medicinal Plants | First Nations traditional harvesting and supporting wildlife habitats | • Increase in invasive species<br>• Change in species composition and diversity<br>• Loss of traditional use plants | NS | NS |
| Wildlife and Wildlife Habitat<br>• Forty-mile Caribou<br>• Klaza Caribou<br>• Moose<br>• Grizzly Bear<br>• Thinhorn Sheep<br>• Wolverine | Yukon resident hunting opportunities, First Nation traditional and subsistence hunting and trapping, guide outfitting hunting opportunities, commercial and traditional trapping | • Change in availability of high suitability habitats<br>• Population level effects due to increased mortality | NS | NS |
| Birds and Bird Habitat<br>• Sharp-tailed Grouse<br>• Upland-associated Species at Risk<br>• Wetland-associated Species at Risk | Yukon resident hunting opportunities, First Nation traditional and subsistence hunting, Guide outfitting hunting opportunities | • Change in availability of high suitability habitats<br>• Population level effects due to increased mortality | NS | NS |

***Note:** NS – not significant

No significant adverse residual effects were assessed for any potential renewable resources, and no effects are predicted for the capacity of renewable resources as a result of the Project.

### 30.5 CONCLUSION OF POTENTIAL EFFECTS TO RENEWABLE RESOURCES

The assessment of potential effects on the capacity of renewable resources has considered the potential for the Project to result in adverse effects to the following renewable resources that are of value to First Nations community members and other Yukon residents:

- Surface Water Quality VC (**Section 12.0**)
- Fish and Fish Habitat VC (**Section 14.0**)
- Vegetation VC (**Section 15.0**)
- Wildlife and Wildlife Habitat VC (**Section 16.0**)
- Birds and Bird Habitat VC (**Section 17.0**).

Following consideration of Project design and implementation of mitigation measures, the effects assessments for the VCs identified above have determined that the Project will not likely result in significant adverse residual or cumulative effects to the sustainability of these renewable resources.

In addition, the assessment of potential effects to the Land and Resource Use VC (**Section 24.0**) considered potential effects to traditional and non-traditional land uses. The effects assessment for Land and Resource Use determined that with the implementation of mitigation, no significant adverse residual effects are likely. The Project may result in effects resulting from increases in access to land and resources through the development of the NAR; these potential effects will be mitigated by utilizing existing access where available, as well as by developing and implementing the Access Route Construction Management Plan (**Appendix 31-A**) and the Access Route Operation Management Plan (**Appendix 31-B**) to guide and direct Construction and Operation Phase activities

In conclusion, the potential Project-related effects to the capacity of renewable resources to meet of current and future demands are likely to be not significant. This conclusion is supported by the assessment details presented in the Project Proposal's VC assessment and IC analysis sections identified above.

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# 31.0 ENVIRONMENTAL AND SOCIO-ECONOMIC MANAGEMENT PROGRAM

This section presents an overview of the environmental and socio-economic management plans (EMPs) that will be developed for the proposed Coffee Gold Mine (Project), as well as a description of Kaminak Gold Corporation's, a wholly owned subsidiary of Goldcorp Inc. (Goldcorp's or Proponent's), commitment to implementing best management practices (BMPs) to minimize potential adverse effects to the environment, local communities, employee and public health and safety, and overall safety and stability of Project infrastructure and facilities.

Goldcorp is committed to making every reasonable effort to minimize the potential long-term environmental and socio-economic effects of the Project, while ensuring that long-lasting benefits to local communities and economic advantages are generated for employees, local communities, and shareholders. The objective is to design, develop, operate, close, and reclaim the Project in an economically rewarding, environmentally sound, and socially responsible manner, and will do so in close consultation and partnership with First Nations, local communities, and stakeholders. Upon completion of mining at the Project, Goldcorp will implement a technically feasible reclamation and closure program that is environmentally sound while respecting the regulatory regime, as well as laws, traditional land uses, and public interests.

Goldcorp is committed to conducting operations and activities in a safe and environmentally and socially responsible manner that promotes the protection of the natural and social environment and the health and welfare of employees and contractors. Goldcorp is also committed to keeping employees, regulators, First Nations, and the public informed of environmental plans, and will communicate their development and implementation through internal and external programs.

## 31.1 REGULATORY FRAMEWORK

Mining projects in Yukon require a Quartz Mining Licence (QML) under the *Quartz Mining Act*, SY 2003, c. 14, and a Water Use Licence (WUL) under the *Waters Act*, SY 2003, c. 19. As a part of the application for a QML and WUL, proponents are required to submit developmental, operational, and environmental protection plans (EMR 2013b). Typically, these plans are submitted at a conceptual level with the Project Proposal to the Yukon Environmental and Socio-economic Board (YESAB), and are further refined into complete plans following permitting licensing and final design. The EMPs include (and will continue to include) mitigations and measures that have been described in the related assessment documents (VC and IC reports) filed as part of the Project Proposal. Where appropriate, the recommendations of YESAB and associated Decision Documents from the Decision Bodies will be incorporated into the EMPs for Project licensing.

Six of the EMPs have been developed to be regulatory-ready documents to demonstrate to regulators, First Nations, and the public that Goldcorp has a comprehensive plan to construct, operate, decommission, and close the Project. The remaining EMPs will be developed during detailed design and Project permitting.

Goldcorp is committed to the continuous improvement of the EMPs developed in support of the Project, and will update them regularly throughout the assessment and licensing processes and through the life of the mine.

Goldcorp must also adhere to a number of additional territorial and federal regulatory requirements. These regulatory requirements include the following:

***Territorial***

- *Dangerous Goods Transportation Act*, RSY 2002, c.50 is a territorial legislation that applies to the transportation of dangerous goods on a highway.
- *Environment Act*, RSY 2002, c.76; amended by SY 2009, c.9; SY 2009, c.21; SY 2010, c.12; SY 2012, c.14; SY 2014, c.6; SY 2016, c.5, provides a legislative framework for the protection of the Territory's land, water, and air. The *Environment Act* and its regulations apply on land throughout Yukon, including private property, government-owned lands, lands within municipal boundaries, and First Nation settlement lands where the First Nation has not developed equivalent laws. Regulated activities under the Act include, among others, fuel storage and handling, solid waste management, hazardous waste management, air emissions, and the assessment and clean-up of spills.
- *Historic Resources Act*, RSY 2002, c.109, and the Archaeological Sites Regulation (OIC 2003/73) contain legislation that mandates the management and protection of Yukon archaeological, historical, and paleontological resources. This legislation applies to heritage resources on both private and public land and archaeological and historical resources that are older than 45 years. Archaeological, historical, and paleontological resources are protected from unpermitted surveys, disturbances, alterations, or excavations.
- *Occupational Health and Safety Act*, RSY 2002. c.159; amended by SY 2005, c.4; SY 2009, c.21; SY 2010, c. 12, promotes and protects worker health and safety in Yukon.
- *Wildlife Act,* RSY 2002, c.229 provides rules for hunting and trapping, outfitting and guiding, licensing, enforcement, and habitat protection. It also gives authority to make various regulations, which include prescribing specially protected wildlife and measures to protect; prescribing boundaries of wildlife sanctuaries and measures for management; identifying methods of hunting and trapping wildlife; licensing and permitting conditions; zoning Yukon to administer the Act, and the submitting harvest information.

***Federal***

- *Explosives Act*, RSC 1985 c.E-17, provides a legislative framework for the manufacture, testing, acquisition, possession, sale, storage, transportation, importation, and exploration of explosives.
- *Fisheries Act,* RSC 1985, c.F-14, is the primary federal legislation to protect fish and fish habitat in Canada. Section 36 of the Act, the key provision for pollution prevention, prohibits the deposit of deleterious substances into waters frequented by fish, unless authorized by regulations under the *Fisheries Act* or other federal legislation. A deleterious substance can be any substance that, if added to any water, would degrade or alter its quality such that it could be harmful to fish, fish habitat, or the use of fish by people.

- *Migratory Birds Convention Act, 1994*, SC 1994, c. 22, protects and conserves migratory birds (as individuals and populations), their eggs, and their nests through the implementation of the Migratory Birds Regulations (CRC, c. 1035) and the Migratory Birds Sanctuary Regulations (CRC, c. 1036). Per the *Migratory Birds Convention Act, 1994*, removal of migratory birds, their eggs, or nests from a site is only permissible if the migratory birds are causing or may cause damage to property and equipment (subject to permitting). Deposit of harmful substances to birds in areas or waters frequently visited by migratory birds is prohibited. No migratory bird sanctuaries fall within the region surrounding the Project.
- *Species at Risk Act,* SC 2002, c.29 (SARA) and Committee on the Status of Endangered Wildlife in Canada (COSEWIC). The *Species at Risk Act* implements in part Canada's obligations under the United Nations Convention of Biological Diversity. It provides for the legal protection of plant and wildlife species and the conservation of their biological diversity. Under SARA, an independent body of experts – COSEWIC – is responsible for identifying and assessing plant and wildlife species considered at risk, which may then qualify for legal protection and recovery under SARA. Once listed under SARA, species plans are legal requirements to secure the necessary actions for species recovery and management.
- *Transportation of Dangerous Goods Act, 1992,* SC 1992, c.34, is the primary federal legislation to promote public safety in the transportation of dangerous goods. The Act's Transportation of Dangerous Goods Regulations (SOR/2001-286) defines classes of materials that are dangerous goods under the Act, and defines threshold volume and mass limits for reporting spills.

## 31.2 MANAGEMENT AND ORGANIZATIONAL STRUCTURE

Goldcorp will provide over-arching management to meet the objectives of each EMP throughout the mine life. Personnel resources will be allocated to operational, environmental, and socio-economic management throughout the managerial hierarchy. Responsibilities of each EMP may be delegated to those personnel who have greater technical expertise of wider responsibilities; however, ultimate accountability is to the Mine General Manager, who is responsible for ensuring that the site is managed in a way that ensures compliance will all regulatory requirements and internal Goldcorp sustainability objectives.

## 31.3 QUALITY ASSURANCE AND QUALITY CONTROL

All personnel with responsibilities under any EMP will be provided with all the necessary training and accreditation to be effective in performing duties under the EMP program. Quality assurance and quality control (QA / QC) measures will be implemented at the data gathering, data entry and analysis, and evaluation and reporting stages of the EMP program. The QA / QC process will be managed by qualified professionals using a system of field checks and blanks to ensure consistent, reproducible data sets.

Additional QA / QC procedures will include regular audits, external reviews, and consultation with regulators and First Nations. Issues identified via QA / QC processes will be addressed systematically with associated action planning, follow-up monitoring, and reporting.

Discipline specific QA / QC procedures are discussed in detail in individual management plans.

## 31.4 REPORTING

The EMPs will be subject to approval by regulatory bodies under the licenses required to construct and operate the mine, as such, each EMP will include reporting requirements under those authorisations. EMP reports will be provided to the appropriate regulatory authority within the required timelines; reports will also be distributed to First Nations and made publicly available.

## 31.5 PROGRAM OVERVIEW

The EMPs are designed to by dynamic documents with flexibility to be refined throughout the mine life, and will be enhanced with input from regulatory agencies and consultation throughout the assessment, licensing, and permitting processes. The key components of each EMP are:

- Purpose and objectives
- Applicable legislation, regulations, and required authorizations
- Roles, responsibilities, and training
- Detailed instructions and methods for implementation of plan mechanisms
- Monitoring, reporting, and communication procedures.

The EMPs demonstrate Goldcorp's commitment to minimizing potential adverse effects where possible. Summaries of each of the EMPs are provided in Section 31.5.1 through Section 31.5.23.

### 31.5.1 ACCESS ROUTE CONSTRUCTION MANAGEMENT PLAN

The purpose of the Access Route Construction Management Plan is to describe the procedures and protocols for construction of the access route, barge crossings, and seasonal winter road (i.e., the Northern Access Route (NAR)) between the City of Dawson (Dawson) and the Project site. Road construction activities have the potential to affect permafrost, local vegetation, wildlife, among other important environmental considerations,

The NAR has been designed to minimize or eliminate potential adverse environmental effects that may be associated with new road construction and road upgrading. With the implementation of the Project design measures and the Access Route Construction Management Plan, the road can be constructed so that unintended effects or changes to the surrounding environment are minimized or eliminated. The Access Route Construction Management Plan includes, but is not limited to, information pertaining to:

- Clearing practices
- Road construction and surfacing
- Wildlife protection measures
- Water crossings
- Borrow sources (including geochemical considerations).

The Access Route Construction Management Plan incorporates the relevant Project design and mitigation measures outlined in **Appendix 7-B Groundwater Intermediate Component Analysis**, **Appendix 8-B Surface Hydrology Intermediate Component Analysis, Appendix 9-B Air Quality and Greenhouse Gas Emissions Intermediate Component Analysis, Appendix 10-B Noise Intermediate Component Analysis, Appendix 11-B Surficial Geology, Terrain and Soils Valued Component Assessment, Appendix 12-B Surface Water Quality Valued Component Assessment, Appendix 14-B Fish and Fish Habitat Valued Component Assessment, Appendix 15-B Vegetation Valued Component Assessment Report, Appendix 16-B Wildlife and Wildlife Habitat Valued Component Assessment** and **Appendix 17-B Bird and Bird Habitat Valued Component Assessment, Appendix 21-A Social Economy Valued Component Assessment** and **Appendix 25-A Community Health and Well-being Valued Component Assessment**.

The Access Route Construction Management Plan is provided in **Appendix 31-A**.

### 31.5.2 ACCESS ROUTE OPERATIONAL MANAGEMENT PLAN

The purpose of the Access Route Operational Management Plan is to describe the procedures and protocols to be followed in the operation of the NAR, barge crossings, and seasonal winter road and ice crossings, along with providing a description of BMPs used to guide procedures and protocols. The plan provides details about traffic management, road maintenance, inspection, ice road and winter road management, and wildlife management.

The Access Route Operational Management Plan incorporates the relevant Project design and mitigation measures that are outlined in **Appendix 8-B Surface Hydrology Intermediate Component Analysis, Appendix 9-B Air Quality and Greenhouse Gas Emissions Intermediate Component Analysis, Appendix 10-B Noise Intermediate Component Analysis, Appendix 12-B Surface Water Quality Valued Component Assessment, Appendix 14-B Fish and Fish Habitat Valued Component Assessment, Appendix 15-B Vegetation Valued Component Assessment Report, Appendix 16-B Wildlife and Wildlife Habitat Valued Component Assessment, Appendix 17-B Bird and Bird Habitat Valued Component Assessment, Appendix 21-A Social Economy Valued Component Assessment**, **Appendix 22-A Community Infrastructure and Services Valued Component Assessment, Appendix 24-A Land and Resource Use Valued Component Assessment** and **Appendix 25-A Community Health and Well-being Valued Component Assessment**.

The Access Route Operational Management Plan is provided in **Appendix 31-B**.

### 31.5.3 Conceptual Reclamation and Closure Plan

The purpose of the Conceptual Reclamation and Closure Plan is to present details of Goldcorp's proposed approach to decommissioning mine features and other reclamation. It includes closure objectives and a monitoring program that will be conducted until these objectives are achieved. This Plan is conceptual in nature, and has been developed to provide the level of detail necessary for the assessment stage of the Project. A more detailed plan will be included in licensing submissions

The Conceptual Reclamation and Closure Plan has been developed in accordance with industry BMPs and informed by the Yukon regulatory, policy, and guidance requirements described in *Proponent's Guide to Information Requirements for Executive Committee Project Proposal Submissions* (YESAB 2005), *Reclamation and Closure Planning for Quartz Mining Projects* (YWB and EMR 2013), *Yukon Mine Site Reclamation and Closure Policy* (EMR 2006), and *Yukon Mine Site Reclamation and Closure Policy – Financial and Technical Guidelines* (EMR 2013a).

Although the Conceptual Reclamation and Closure Plan outlines measures that will be in effect primarily during the Reclamation and Closure and Post-closure Phases of the Project, Goldcorp has designed the Project with closure in mind. This Project's design approach thus requires progressive reclamation activities to occur during the Construction and Operation Phases of the Project.

As per Goldcorp's Sustainability Excellence Management System, Goldcorp will consult and work with communities for subsequent versions of the reclamation and closure plan, which will include mitigation measures activities related to socio-economic aspects of closure (e.g., community contributions, partnerships).

The Conceptual Reclamation and Closure Plan is provided in **Appendix 31-C**.

### 31.5.4 Waste Rock and Overburden Management Plan

The purpose of the Waste Rock and Overburden Management Plan is to describe the types of waste rock, soil overburden, and run-of-mine stockpiles that will be constructed for the Project and how their materials will be characterized, segregated, and stored to verify long-term chemical and physical stability. This Plan provides details about the design, construction, and operation of each waste rock and overburden storage facility, and summarizes closure strategies considered during the design, construction, and operation of each facility.

The Waste Rock and Overburden Management Plan will satisfy requirements of both *Quartz Mining Act* and the *Occupational Health and Safety Act*, as well as all associated regulations.

The Waste Rock and Overburden Management Plan incorporates the Project design and mitigation measures outlined in **Appendix 7-B Groundwater Intermediate Component Analysis**, **Appendix 8-B Surface Hydrology Intermediate Component Analysis, Appendix 11-B Surficial Geology, Terrain and Soils Valued Component Assessment,** and **Appendix 12-B Surface Water Quality Valued Component Assessment**.The Plan outlines measures that will be in effect during the Construction, Operation, and Reclamation and Closure Phases of the Project. A monitoring program consisting of routine, annual, and event-driven inspections of all waste rock storage facilities, overburden stockpiles, and associated dams and slopes will be in place throughout the life of the Project.

The Waste Rock and Overburden Management Plan is provided in **Appendix 31-D**.

### 31.5.5 Water Management Plan

The objective of the Water Management Plan is to describe the proposed surface water management system that will be used to intercept, convey, and treat mine contact water and divert non-contact water from mine workings at the Project. The operational, maintenance, and monitoring requirements are also discussed. The Water Management Plan incorporates the Project design and mitigation measures outlined in **Appendix 7-B Groundwater Intermediate Component Analysis**, **Appendix 8-B Surface Hydrology Intermediate Component Analysis** and **Appendix 12-B Surface Water Quality Valued Component Assessment**.

Facilities will be developed in phases and will be progressively reclaimed over the mine life. This approach has been incorporated into the mine plan to minimize the disturbed area and volume of contact water that is generated, at any point in time. Water management facilities will consist of a network of surface drainage channels and ponds through the Construction, Operation, and Reclamation and Closure phases.

Water monitoring programs will include the following:

- Precipitation and surface water flows within the Mine Site, to verify that they fall within the expected ranges
- Surface water quality, to verify that performance objectives are being met, and
- Integrity and stability of conveyance structures.

The discharge of contact water from the Mine Site is anticipated to be subject to both the Metal Mine Effluent Regulations (SOR/2002-222), a regulation issued pursuant to the *Fisheries Act*, as well as the conditions established in the QML and WUL that are anticipated to be required for the Project. Water quality monitoring data for creeks in the Project area and Yukon River will be compared to baseline water quality data and relevant guidelines including site-specific water quality objectives.

The Water Management Plan is provided in **Appendix 31-E**.

### 31.5.6 WILDLIFE PROTECTION PLAN

The objective of the Wildlife Protection Plan is to outline the measures that will be used to minimize the effects of the Project's Construction and Operation Phase activities on wildlife and wildlife habitat, monitor the results of mitigation to ensure effectiveness, and adaptively manage for any unanticipated effects from the Project. The Plan is intended to ensure that wildlife continue to use habitat in areas adjacent to the Project footprint and within the broader area while reducing the potential for Project-related injury or mortality to wildlife and accommodating operational requirements and human health and safety requirements.

Wildlife management, monitoring, and protection plans from similar mining projects in Yukon and northern Canada were reviewed to provide details on mitigation measures and monitoring that have been implemented in Yukon. Additionally, federal and territorial legislation, regulations, and guidance documents are used to guide the management and conservation of wildlife, including the *Migratory Birds Convention Act*, *Species at Risk Act*, *Yukon Wildlife Act*, and the Fortymile Caribou Herd Management Plan.

Goldcorp has committed to a number of mitigation measures to reduce or eliminate potential Project-related effects on wildlife (see **Appendix 16-B Wildlife and Wildlife Habitat Valued Component Assessment** and **Appendix 17-B Bird and Bird Habitat Valued Component Assessment**). The wildlife protection measures are supported by a Project-related effects monitoring framework to inform Goldcorp, regulators, First Nations, and stakeholders about mitigation effectiveness and Project-related effects. The Project's wildlife monitoring program will be used to confirm compliance with mitigation practices, discern Project-related effects from natural variability, identify unanticipated Project-related effects so that mitigation actions can be implemented to reduce further harm, and provide information to support adaptive management of the Wildlife Protection Plan.

The Wildlife Protection Plan is provided in **Appendix 31-F**.

### 31.5.7 CYANIDE MANAGEMENT PLAN

The purpose of the Cyanide Management Plan is to describe the measures Goldcorp will implement to minimize the risk to the public, employees, contractors, and the environment from the use of cyanide in the recovery of gold from ore. This plan will focus on the safe management of cyanide throughout all aspects of the Project's life cycle, and will include guidance on the manufacture and transport of cyanide to site, storage on-site, usage in gold extraction, and detoxification of cyanide compounds in processing solutions.

The International Cyanide Management Code (Cyanide Code) is a voluntary industry program for companies involved in the production of gold by the cyanidation process, and focuses on the management of cyanide and cyanide solutions. The Cyanide Code (ICMI 2016) addresses the production of cyanide, its transport from the producer to the mine; its on-site storage and use; decommissioning and financial assurance; worker safety; emergency response; training; stakeholder involvement; and verification of implementation. Goldcorp became a signatory to the Cyanide Code in July 2007 and will ensure the Project is designed and operated within compliance of the Cyanide Code.

Goldcorp will adhere to the requirements of the Cyanide Code, and will implement several Project design measures to ensure the safe handling, storage, and use of cyanide at the Mine Site. Key features include:

- All procedures will be developed and executed in compliance with the Cyanide Code.
- Standard operating procedures will be developed for the handling, storage, and use of cyanide.
- The HLF will be lined with a geosynthetic membrane, and gold processing will be a closed-loop system.
- All workers involved in storing, handling, and mixing cyanide will be appropriately trained and will wear personal hydrogen cyanide gas monitors and appropriate personal protective equipment (PPE).

The primary mitigation measure will be to implement the Cyanide Management Plan. As noted above, the overall objective of the Cyanide Management Plan is to outline the measures that will be put in place to protect the health and safety of workers working with cyanide products and prevent the loss of cyanide products to the environment.

### 31.5.8 DUST MANAGEMENT PLAN

The objective of the Dust Management Plan is to identify and describe appropriate management techniques that will be implemented to reduce the potential for any dust-related adverse effects to human health or the environment, and the measures that will be undertaken to control dust generated by Project activities. Construction and operation of the Project has the potential to generate dust from a variety of activities including earthworks, vehicle and equipment operation, and fugitive road dust.

The Project area is subject to Yukon Environment's Ambient Air Quality Standards (Yukon Environment 2010). These standards provide a quantitative basis for comparison against ambient concentrations of airborne contaminants such as total suspended particulate matter (TSP) and particulate matter less than 2.5 micrometers in diameter ($PM_{2.5}$). The dust (measured using TSP and $PM_{2.5}$) generated from Project-related activities will be maintained at concentrations less than the applicable ambient air quality standards at all off-site locations. The Yukon Department of Environment also requires operators of commercial dust-generating activities that require a permit under Yukon's Air Emissions Regulations (OIC 1998\207 to submit a dust management plan for approval.

Primarily, mitigation measures will be used to control dust generated during Project operations during activities such as bulk materials handling and storage, earth-moving, construction, blasting, and vehicular traffic movements. The Dust Management Plan will identify the action thresholds and triggers that will be used to determine when the primary or contingency measures will be activated. Scheduled site inspections will identify and address any potential new or modified dust emission sources or issues. Records of these inspections will be maintained for the life of the Project, and will be reviewed periodically to identify any trends or long-term issues.

Specific mitigation measures that will be implemented for dust management are included in **Appendix 9-B Air Quality and Greenhouse Gas Emissions Intermediate Component Analysis** and **Appendix 15-B Vegetation Valued Component Assessment Report**.

#### 31.5.9 EMERGENCY RESPONSE PLAN

The overall objective of the Emergency Response Plan is to protect Project employees and members of the public. The Emergency Response Plan will be developed per the guidelines within the Yukon Workers Compensation Health and Safety Board guidance document entitled *Mine Emergency Response Plan – Guidelines for the Mining Industry* (YWCHSB 2011) as well as the Yukon Water Board and Yukon Government Energy Mines and Resources document entitled *Plan Requirement Guidance for Quartz Mining Projects* (YWB and EMR 2013).

An emergency is defined as a serious, unexpected, and often dangerous situation meeting one or more of the following criteria:

- Serious accident of serious injury as defined by the Yukon Occupational Health and Safety Act section 30(1)
- Response to a fire requiring discharge of a fire extinguisher of fire suppression equipment
- Discharge of a hazardous or controlled product where there is a potential to affect persons or environment
- Natural disaster including but not limited to landslides, earthquakes, avalanches, forest fire, or flooding where damage to persons or property has or may have occurred
- Major power failure
- Missing persons
- Motor vehicle accident
- Loss of life.

The Emergency Response Plan will outline measures that will be in effect during the Construction, Operation and Reclamation and Closure Phases of the Project as well as reporting requirements. The safety of Project employees and the public as well as the protection of the environment are integral to the Goldcorp team. As such, the Emergency Response Plan will be a living document, and will undergo regular review to ensure compliance with any changes in industry standards or territorial guidelines.

In the event of an emergency, having an organized team and procedures is integral to a fast and efficient response. Key personnel that will be involved in an emergency response include an Emergency Response Team (ERT), who will mobilize to the location of an emergency call and conduct the initial response of the emergency. The first responders will be personnel who have received formal qualified training. Training for the personnel associated with emergency response will be ongoing for the duration of the Project. The training will focus on emergency procedures to deal with potential on-site situations.

### 31.5.10 EROSION AND SEDIMENT CONTROL PLAN

The objective of the Erosion and Sediment Control Plan is to minimize water erosion and prevent sediment mobilization into the receiving environment, specifically areas with fish and aquatic biota values that can be affected by increased turbidity or sediment deposition. The Erosion and Sediment Control Plan will describe the concepts and general plans for erosion and sediment control based on the designs for the Mine Site. Specific erosion and sediment control measures that will be implemented are outlined in **Appendix 12-B Surface Water Quality Valued Component Assessment, Appendix 14-B Fish and Fish Habitat Valued Component Assessment** and **Appendix 15-B Vegetation Valued Component Assessment Report**.

Several provincial and territorial pieces of legislation pertain to erosion and sediment control with respect to provisions for protecting receiving environments, depositing waste, and altering habitat. There are also several territorial guidance documents available for review that set out goals and expectations as well as provide regionally important information. Relevant legislation includes the *Fisheries Act*, *Quartz Mining Act*, *Waters Act*, as well as *Best Management Practices for Works Affecting Water in Yukon* (Yukon Environment 2011), the *Canadian Environmental Quality Guidelines* (CCME 2014), and the *Yukon Revegetation Manual* (Matheus and Omtzigt 2013).

Mitigation measures that will be outlined in the Erosion and Sediment Control Plan include the following:

- Minimize surface disturbance, including clearing and grubbing, to reduce erosion and hence the need for sediment control.
- Prevent sediment mobilization into the receiving environment by managing runoff from disturbed areas through grading slopes, ditching, and settling ponds.
- Establish vegetation on disturbed areas as soon as practical to prevent long-term erosion.
- Monitor and maintain the erosion and sediment control measures to protect vegetation and watercourses adjacent to the Project footprint.

The approach to erosion and sediment control will use both a risk-based and hierarchical approach to implement erosion and sediment control measures during the Project phases. The first step is to understand the risks and potential consequences of erosion to allocate the appropriate level of erosion and sediment control. This risk assessment is followed by a hierarchical approach to erosion and sediment control by first implementing clean water runoff controls where possible, followed by various erosion control measures.

Sediment controls will also be implemented but will be considered as secondary method, after water management and erosion prevention controls have been implemented.

### 31.5.11 EXPLOSIVES MANAGEMENT PLAN

The purpose of the Explosives Management Plan is to outline the management practices that the Project will employ to ensure the safe storage and use of explosives in mine operations while minimizing the risk to employees, contractors, and the environment. The handling, storage, and use of explosives requires special attention and is regulated at the federal and territorial level to ensure the safety of workers and the environment. The Project will implement operational policies and procedures that meet or exceed the required laws and regulations. Regulations under the federal *Explosives Act* require specific authorizations to be obtained including an Ammonium Nitrate/Fuel Oil (ANFO) Permit, Explosive Magazine Permit, Explosive Transportation Permits, as well as a Factory Licence. A Blaster's Permit is also required under the Yukon Occupational Health and Safety Regulations.

Only trained and certified persons will be permitted to work with explosives, and will undertake formal and on-the-job training to ensure compliance with legislation. Safety training will include the identification of hazards, safety systems required for the handling, transport and manufacture of explosives, and any other specific rules needed to protect workers and facilities (NRCan 2014).

Leaching of nitrogen residues to surface waters from nitrogen-based explosives will be minimized by observing best practices for blasting. Explosives use will follow BMPs, Project management plans, and technical guidance documents to minimize the generation of nitrogen residues and leaching of residues to surface waters, including the *Guidelines for Use of Explosives In or Near Canadian Fisheries Waters* (Wright and Hopky 1998).

Specific mitigation measures related to blasting that will be implemented are outlined in **Appendix 12-B Surface Water Quality Valued Component Assessment** and **Appendix 16-B Wildlife and Wildlife Habitat Valued Component Assessment**.

### 31.5.12 FISH AND AQUATIC HABITAT PROTECTION PLAN

The objective of the Fish and Aquatic Habitat Protection Plan is to provide direction to protect fish and aquatic habitat values downstream of the Mine Site, and will outline and describe the mitigation and monitoring actions that Goldcorp will employ to reduce or eliminate the Project-related residual adverse effects to fish or aquatic environment. This plan will include the mitigation measures that will be implemented to reduce or eliminate Project-related effects outlined in **Appendix 14-B Fish and Fish Habitat Valued Component Assessment**, The federal *Fisheries Act* is the primary legislation in Yukon regulating the management of fish and fish habitat, with Section 35 (serious harm to fish) and Section 36 (pollution of fish habitat) being most relevant to the Project. Responsibility for the management of fish and fish habitat in Yukon is shared between the federal government (Fisheries and Oceans Canada), Yukon Government, and local First Nations. Goldcorp will continue to maintain a dialogue with regulators, governments, and Project stakeholders to further develop the details of the Plan. These parties will include but will not be limited to Yukon Government, Fisheries and Oceans Canada, First Nations, Renewable Resources Councils, and various other land users.

The Fish and Aquatic Habitat Protection Plan will include an Aquatic Effects Monitoring Program to detect Project-related adverse effects on fish and habitat. The long-term monitoring program will outline how fish and aquatic biota will be monitored during all phases of the Project and how this information will be used to confirm the predictions of the environmental assessment or detect unanticipated effects. Monitoring of fish and aquatic habitat resources will be conducted during the Construction, Operation, and Reclamation and Closure Phases of the Project. During the Post-closure Phase, monitoring will only be conducted in the event that site-specific water quality objectives are not maintained during this time. Site-specific water quality objectives are included in the Water Management Plan (**Appendix 31-E**).

### 31.5.13 FROZEN MATERIAL MANAGEMENT PLAN

The objective of the Frozen Material Management Plan is to provide procedures so that that frozen materials are excavated, handled, and stored in a manner that will not lead to unsuitable runoff from either the excavations or the stockpiled materials. The Frozen Material Management Plan will outline measures that will be in effect during the Construction and Operation Phase of the Project, as frozen materials will be excavated for construction of infrastructure and during some pit development.

The Frozen Material Management Plan will describe the four frozen soil classification types that have been developed for the Project area. Type I to IV frozen materials will be segregated and stored in separate areas in the frozen soil storage area. These material classifications will be utilized to determine the potential use and material handling requirements of each of the frozen soils types, as follows:

- Type I – not visible to less than 5% visible ice content. This material will be used as general fill or if excess to a local fill requirement, stored for reclamation. It will be stored in either the temporary organics stockpile or the Type I stockpile in the frozen soil storage area. It will be recognized that material will settle if placed in a frozen state, and are thus not suitable for structural fill.
- Type II – coarse-grained sands and gravels, ice content 5% to 15%, moderate visible ice content. This material will be exposed and readily thawed and drained, and then used as general fill within embankments and pads or stored in the Type II stockpile in the frozen soil storage area. If excess volumes exist over that required for closure, they can be co-disposed of in a WRSF.
- Type III – fine-grained soils, ice content 5 to 15%, moderate visible ice content. This material will be separated and stockpiled in the Type III stockpile in the frozen soil storage area, and will only

be used if absolutely required and only after it has thawed and drained. If excess volumes exist over that required for closure, it can be co-disposed of in a WRSF.

- Type IV – ice content greater than 15% (ice rich). This material will be segregated at the excavation site based on prior field data and information and additional observations during excavations. It will be excavated and hauled to the ice-rich area in the frozen soil storage area.

Field description and classification of frozen materials at the Project will be based on *ASTM 4083 Standard Practice for Description of Frozen Soils (Visual-Manual Procedure*) (ASTM 2016), which is the most recognized description procedure for frozen soils. The ASTM standard was initially based on an older Canadian approach developed by the National Research Council of Canada and presented in *Technical Memorandum 79, Guide to Field Description of Permafrost for Engineering Purposes* (Pihlainen & Johnston 1962), which is typically used by practitioners of permafrost engineering in Canada.

Ongoing inspection of excavation, transport, and stockpiling of frozen materials will be carried out as part of site-wide monitoring of the performance of all civil works during construction. Monitoring will continue through the Operation and Reclamation and Closure Phases.

### 31.5.14 HAZARDOUS MATERIALS MANAGEMENT PLAN

The objective of the Hazardous Materials Management Plan is to describe the responsible handling and storage of hazardous materials and the responsible disposal of hazardous wastes. The plan will highlight safety considerations and training that Goldcorp will provide to employees and contractors to ensure hazardous materials are safely and properly handled. Hazardous materials are products or substances that have the potential to cause harm to people or the environment and are classified as hazardous in the legislation.

The proper handling and storage of hazardous materials and the responsible disposal of hazardous wastes are a legal requirement. Both federal and territorial legislation regulate the management of hazardous materials in Yukon. Several acts, regulations, and guidelines provide specific requirements for the management of different types of hazardous materials at the Project. Legislation includes the *Transportation of Dangerous Goods Act*, *Explosives Act*, *Occupational Health and Safety Act, Dangerous Goods Transportation Act,* and *Environment Act.*

All employees and contractors for the Project will undergo site-specific health and safety training session. The site-specific health and training session will describe the environmental and safety policies of the Project including an overview of mine operations, potential hazards at the site, use of PPE, a description and handout showing the site layout, location of the medical first-aid station, and what to do in the event of an emergency. Hazardous materials will be appropriately identified with placards, and paper copies of material safety data sheets will be available in the workplace.

The Project will use the following types of hazardous materials:

- Petroleum products and lubricants – diesel fuel, oils, greases, anti-freeze, and solvents used for equipment operation and maintenance
- An Adsorption, Desorption, and Recovery (ADR) plant and heap leach consumables – chemicals for gold extraction and recovery
- Water treatment consumables – chemicals
- Explosives – ANFO, emulsion, other explosives and caps used for blasting
- Laboratory consumables and wastes – various chemicals used in the assay laboratory
- Other – batteries, paints, compressed gases, cleaning supplies, etc.

Most reagents used on-site will be used in the ADR plant, and will be stored in the reagent storage area.

The Hazardous Material Management Plan will describe how hazardous waste will be stored, handled and disposed of in compliance with site permits, the *Transportation of Dangerous Goods Act* and other regulations. Petroleum hydrocarbon wastes are likely to be the most common hazardous wastes generated on-site. The waste oil and waste fuel may be used to fuel the incinerator, ADR boiler or for heat generation.

Soil, snow, ice, or water that has been contaminated with hydrocarbons or coolant will be treated in a land farm. Soils and waste rock that have successfully undergone bioremediation and have met site-specific criteria will be removed from the land farm for use as cover material in the landfill or elsewhere on the Mine Site, where acceptable.

#### 31.5.15 Heap Leach and Process Facilities Plan

The objective of the Heap Leach and Process Facilities Plan is to describe the ore processing methods and infrastructure for the Project. Detailed design criteria and operational details for the crusher system, HLF, process plant, and associated infrastructure will be provided. This Plan will also include detailed information on cyanide handling in the ADR plant. The Plan will outline measures that will be in effect during the Construction and Operation Phases of the Project, including the operational procedures and management of the HLF, as well as practices to mitigate potential effects to surface water during operations and temporary closure. Guidance for reclamation and closure of Heap Leach Facilities is addressed in the Conceptual Reclamation and Closure Plan (**Appendix 31-C**).

The Heap Leach and Process Facilities Plan will satisfy requirements of both *Quartz Mining Act* and the *Occupational Health and Safety Act*, as well as all associated regulations.

The Plan will describe the multi-layer leach pad liner system, leak detection measures, and design criteria of the associated event pond structures, and wildlife protection measures.

A monitoring program consisting of routine, annual, and event-driven inspections will be described for all phases of the Project.

### 31.5.16 HERITAGE RESOURCES PROTECTION PLAN

The objective of the Heritage Resources Protection Plan is to provide protection measures to reduce any significant or adverse effects for known (including archaeological sites KfVk-1, KfVk-2, KfVk-3, and historical site KfVk-4) and previously unrecorded heritage resources throughout the life of the Project. Heritage resources are protected under the *Historic Resources Act* and include any work or assembly of works of nature or of human endeavour that is of value for its archaeological, paleontological, pre-historic, historic, scientific, or aesthetic features.

Goldcorp will comply with the *Historic Resources Act* and the Yukon Archaeological Sites Regulation, and will follow any agreements made with affected First Nations. The Heritage Resources Protection Plan will provide details of the mitigation measures that will be used to reduce any significant or adverse effects for known heritage resources throughout the life of the Project. The BMPs that will be employed are described in **Appendix 26-A Heritage Resources Valued Component Assessment**. This Plan will also provide Project personnel with procedures on what to do and who to contact in the event that previously unrecorded heritage resources are inadvertently discovered during the life of the Project, through the use of a Chance Find Procedure. The guidance provided in the *Yukon Mineral Exploration Best Management Practices for Heritage Resources* (YG 2010) will be followed.

### 31.5.17 MINE DEVELOPMENT AND OPERATIONS PLAN

The objective of the Mine Development and Operations Plan is to describe the development, mining methods, infrastructure, and support equipment required for the Project. Detailed design criteria and operational details for major Project infrastructure will be provided, along with overarching information on construction QA / QC methods, monitoring plans, planned inspections, and adaptive management. A geotechnical monitoring program consisting of routine, annual, and event-driven inspections will be in place throughout the life of the Project.

The Mine Development and Operations Plan will satisfy requirements of both *Quartz Mining Act* and the *Occupational Health and Safety Act*, and relevant regulations.

### 31.5.18 METAL LEACHING / ACID ROCK DRAINAGE MANAGEMENT AND MONITORING PLAN

The objective of the Metal Leaching / Acid Rock Drainage Management and Monitoring Plan will be to verify that the ore, waste rock, and overburden generated as part of Project activities are handled in a way that minimizes the potential for acid rock drainage (ARD) generation and metal leaching (ML). The potential for ARD from various geologic materials to be disturbed at the Project site has been assessed by a variety of geochemical test work (refer to **Appendix 12-D Geochemical Characterization Report**). These analyses show that most rock types have little or no potential for acid generation, with the exception of granite ore produced from the Kona pit. Mine rock will be monitored for ML/ARD potential as part of the ongoing effort to characterize mine waste over the Project life.

The ML/ARD monitoring program will provide continuous characterization of the ML/ARD potential of ore, overburden, waste rock, and heap leach tailings as they are produced. The monitoring data gathered as part of this plan will be reported in the Annual Surveillance and Monitoring Report, required under the QML. Potential updates to monitoring and management will be reviewed in the Conceptual Reclamation and Closure Plan (**Appendix 31-C**) updated for the mine, which must be submitted every two years.

The Metal Leaching / Acid Rock Drainage Management and Monitoring Plan will satisfy the requirements of the QML and the Type A WUL. Specific mitigation measures that will be implemented to manage ARD are outlined in **Appendix 12-B Surface Water Quality Valued Component Assessment,**

#### 31.5.19 Noise Management Plan

The objective of the Noise Management Plan is to describe the appropriate management techniques that will reduce the potential for noise-related adverse effects to human health or the environment. The Noise Management Plan will describe relevant noise effects assessment criteria, compliance procedures, and controls relating to Project activities, as well as the noise monitoring plan. The Noise Management Plan will identify the threshold action response that will use results of noise monitoring to determine whether contingency measures are required.

Sound generated during the Project will fluctuate depending on the Project activity, equipment type, and separation distances between source and receiver; however, the Project will generate sound levels that exceed the ambient sound levels and have the potential to cause a temporary, short-term, localized disturbance from time to time. The Noise Management Plan will include noise mitigation strategies for mobile and stationary sound sources as well as blasting, as described in **Appendix 10-B Noise Intermediate Component Analysis**.

The Noise Management Plan will outline measures that will be in effect during the Construction and Operation Phases of the Project. Noise monitoring will be conducted during the Reclamation and Closure, if required. Regardless of Project phase, the objective of monitoring is the same, which is to confirm that noise produced by the Project will remain within acceptable levels.

#### 31.5.20 Socio-economic Management Plan

The purpose of the Socio-economic Management Plan is to mitigate and enhance the socio-economic effects of the Project on potentially affected First Nations and communities. The Socio-economic Management Plan focuses on measures not covered by other management plans developed for the Project, although several other management plans contain measures that will be used to mitigate effects of the Project on the human environment. For example, the Dust Management Plan will be a mitigation measure for air quality.

The Socio-economic Management Plan will describe commitments and policies that Goldcorp will undertake to mitigate adverse effects of the Project, encourage and promote positive socio-economic development, and maximize the Project opportunities for the benefit of First Nations and Yukoners. These opportunities and measures will be implemented during all stages of the Project, consistent with Mining Association of Canada's Towards Sustainable Mining program.

The Socio-economic Management Plan will contain the following key measures:

- Cultural Awareness Training
- Current Traditional Land and Resource Use Enhancement Measures
- Education and Training Activities Engagement Plan
- First Nation Mentoring Program
- Flight Scheduling
- Local Contracting and Procurement Practices
- Local Hiring Practices
- Mitigation and Enhancement Measures for Food Security
- Mitigation Measures Associated with Country Food Quality
- Mitigation Measures for Crime
- Mitigation Measures for Health Services Structure and Capacity
- Mitigation Measures for Infectious Disease
- Mitigation Measures for Mental Health and Wellness
- Non-Wage Economy Enhancement Measures
- Traditional Economy Enhancement Measures
- Workforce Transition Strategy.

Details on the key measures are included in **Appendix 19-A Demographics Intermediate Component**, **Appendix 20-A Economic Conditions Valued Component Assessment**, **Appendix 21-A Social Economy Valued Component Assessment**, **Appendix 22-A Community Infrastructure and Services Valued Component Assessment**, **Appendix 23-A Education Services Valued Component Assessment**, **Appendix 24-A Land and Resource Use Valued Component Assessment** and **Appendix 25-A Community Health and Well-being Valued Component Assessment**.

Goldcorp expects that the Socio-economic Management Plan will be iterative, and will evolve over the course of the environmental assessment, regulatory reviews, and development stages of the Project throughout the life of the Project. As the Project advances through the development stages and as new ways to manage socio-economic effects are identified, the Socio-economic Management Plan will be updated with the new mitigation or enhancement measures.

### 31.5.21 SPILL CONTINGENCY PLAN

The purpose of the Spill Contingency Plan is to minimize the effects of spills through the establishment of pre-determined lines of response and plans of action, and protect the safety of workers and contractors during a spill event. Goldcorp is committed to preventing spills and being prepared to take appropriate action in the event of a spill. The Spill Contingency Plan will outline preventative measures to be undertaken as well as spill response strategies for chemicals and hazardous substances that will be used at the Project. These measures will include applying BMPs, promoting environmental awareness and safety, encouraging prevention and maintenance, training staff and contractors in spill response procedures, and facilitating efficient clean-up of spills, releases, or discharges to land, water, ice, and snow.

To ensure compliance with Section 36 (3) of the *Fisheries Act* and Section 132 of the *Environment Act*, all spills of hazardous materials, regardless of quantity, into a waterbody will be considered a major spill. For the Project, a major spill will be defined as an accidental release of a Spills Regulation Schedule A substance into the environment that cannot be handled safely or without the assistance of the ERT, including all events where a person is injured or contaminated. Under the Spills Regulation, any release into a watercourse will require immediate notification of the 24-hour Yukon Spill Report Centre line.

### 31.5.22 VEGETATION MANAGEMENT PLAN

The purpose of the Vegetation Management Plan is to reduce the effects of Project Construction and Operation Phase activities on vegetation and ecological communities, and monitor the results of mitigation measures to ensure their effectiveness. The Vegetation Management Plan will outline measures to maintain the integrity of vegetation and ecological communities and prevent the introduction and spread of invasive plant species while accounting for operational and human health and safety requirements. The vegetation monitoring program will be used to confirm compliance with mitigation practices, discern Project-related effects from natural variability, identify unanticipated Project-related effects so that mitigation actions can be implemented to reduce further harm, and provide information to support adaptive management programs. Vegetation mitigation and monitoring programs for the Closure and Post-closure Phases of the Project are included in the Conceptual Reclamation and Closure Plan (**Appendix 31-C**).

The Vegetation Management Plan will describe; personnel awareness training and programs, site clearing and stripping protocols, invasive plant management and progressive reclamation guidance. Specific mitigation measures that will be implemented are detailed in **Appendix 15-B Vegetation Valued Component Assessment**.

### 31.5.23 WASTE MANAGEMENT PLAN

The objective of the Waste Management Plan is to describe the various means to manage non-hazardous, hazardous, and special wastes at the Project. Wastes that are not managed properly have the potential to affect the environment in unintended ways including leaching hazardous or non-hazardous materials into the surrounding environment, acting as wildlife attractants, or creating potentially unstable situations if improperly disposed of. The Waste Management Plan will identify the wastes that will be recycled, landfilled, incinerated, land treated, and treated (sewage), and will describe the transport of wastes off-site that cannot be incinerated, treated, reused, or disposed of on-site.

Several authorizations will be required for the management of wastes at the Mine Site, including a Special Waste Permit, Storage Tank Systems Permit, Solid Waste Permit and Air Emissions Permit / Waste Management Permit. The Project will comply with all permits and authorizations required for waste management and waste disposal.

### 31.6 REFERENCES

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# 32.0 PROJECT DESIGN MEASURES AND COMMITMENTS

Goldcorp is committed to protecting lifestyle, heritage, and environment in its areas of operation. Goldcorp's practice is to engage early and work to build strong relationships with First Nations and local communities, recognizing that successful and meaningful engagement must be collaborative and ongoing throughout all Project phases.

*The Coffee Project has incorporated multiple measures into the Project planning and design that will reduce environmental and socio-economic effects during each Project phase (***Table 32-1***). Project design measures include a combination of Project phasing and development schedules, waste handling and water management infrastructure and planning commitments. The design mitigation measures were incorporated into the IC analysis and VC assessments.*

*In addition to Project Design measures, c*onsistent with YESAA, each IC and VC section describes mitigation measures of relevance, contained in industry codes and standards and / or developed by the Project team to eliminate, reduce, or control adverse Project-related effects and changes. The environmental and socio-economic mitigation measures are listed in **Table 32-3.**

While the commitments presented in this section are meant to apply to all site components (unless where specified), there may be times were execution of the commitments cannot be achieved (e.g. an area to be inspected is covered by snow) or is not practical to do so, (e.g presents a safety concern). VC and IC reports should be reviewed for clarification on the commitments in this section and how they should be applied.

As the Project moves through the assessment stage to licensing, and into operation, it is useful for Project Design measures and for mitigations contained in the IC and VC reports to be tracked in such a way that allows for continued reference to commitments made throughout the process. The two aforementioned tables allow for ease of required updates and reference to ensure the consistency of Goldcorp's commitments as the Project is advanced.

**Table 32-1 Summary of Project Design Measures**

| Mitigation Name | Design Mitigation | Project Phase |
|---|---|---|
| **Overall Project including Mine Site and NAR** | | |
| **Project Siting** | The Project has implemented key planning and design considerations in the Project siting, including:<br>• Keep Project footprint as small as possible.<br>• Use existing roads to the extent possible.<br>• Limit Project activities to defined (i.e., surveyed and approved) Project footprint.<br>• Site Project components so as to avoid environmentally sensitive habitats (e.g., wetlands, active nest sites, rare plant localities), to the extent possible.<br>• Maintain key habitat features (e.g., cliff nest sites, sharp-tailed grouse leks, mineral licks, dens, wildlife trees). | C, O, R&C |
| **Minimize Vehicle Traffic** | Most personnel will operate on a two week on, two week off-shift rotation on a fly-in, fly-out basis. | C, O, R&C |
| **Northern Access Route Design** | Potential negative or adverse effects of the NAR on fish habitat suitability and accessibility will be mitigated through the selection of appropriately sized/designed culverts and bridges to prevent constriction of the stream channels and facilitate fish passage. Clear span bridges will be used for crossing moderate and smaller sized fish bearing streams with valuable fish habitat characteristics. | C, O |
| **Overall Mine Site** | | |
| **Phased Mine Development and Progressive Reclamation** | In addition to providing flexibility in the schedule, maximizing ore grade, and allowing the HLF to be maintained at full production capacity, phased development of the mine will reduce pre-stripping requirements in the early years.<br>Progressive reclamation and closure activities will begin as soon as mining is completed and will continue throughout the mine life. | C, O |
| **Open Pits** | | |
| **Geological and Geomechanical Bench Face Mapping** | A thorough geological and geomechanical bench face mapping program will be undertaken beginning in the early stages of development to verify that the geologic structural conditions encountered are consistent with the assumptions and estimates used in the Feasibility Study analyses, and to identify local variations in structural conditions that might increase the risk of localized instabilities. Bench design will be refined and inter-ramp and overall slope angles optimized based on geotechnical database developed during this program. | C |

| Mitigation Name | Design Mitigation | Project Phase |
|---|---|---|
| **Waste Rock Storage Facilities, Stockpiles, and Backfills** | | |
| **WRSF Site Selection** | The WRSF sites were selected to meet geotechnical and mine design criteria and will be engineered to minimize operational and closure costs and reduce long-term environmental effects. Non-Kona Pit waste rock has been concentrated into the Alpha WRSF to minimize the total area of disturbance. Additionally, the design of the Alpha WRSF has been engineered to abut the opposite valley wall to improve stability. | C, O |
| **Backfilling of Pits** | Waste rock will be used to selectively backfill mined out pits at Latte, Supremo, and Double Double, to create causeways that shorten the ore haul distance to the crusher system (compared to having to haul material around the pits), and to minimize contact water catchment area. | O |
| **WRSF Stability** | The WRSFs will be designed to meet or exceed the acceptable design criteria for short-term conditions during operations (FOS 1.3) and long-term closure criteria (FOS 1.5). | C, O |
| **Surface Water Protection and Management** | Waste rock benches will be designed to slope inwards from WRSF crest. Runoff will be concentrated along the toe of each bench and prevented from running over the WRSF face by a series of diversion berms. | C, O, R&C |
| **Groundwater Protection and Management** | Rock drains will be installed in the base of Alpha WRSF to allow water flow through the base. | C, O, R&C |
| **Management of Potential ARD from Kona Pit** | To reduce ARD potential for granite ore to be exposed on Kona pit walls, the pit will be backfilled with non-potentially ARD generating waste rock at closure. | C, O |
| **Management of Potential ARD at HLF** | PAG granite ore will be excluded from the bottom 10m lift on the HLF, and will be placed at least 10m below the final elevation of the HLF and at least 10m away from HLF slope. Excluding granite ore from the bottom lift will ensure that excess NP associated with the gneiss and schist ores will neutralize any acidity generated from granite ore within the HLF. Excluding granite ore from the bottom and top lift and keeping it 10 m away from the HLF slopes will ensure that granite ore is encapsulated at the end of mine life. | C, O |
| **Management of Potential ARD in ROM Stockpile** | To reduce ARD potential for granite ore in the ROM stockpile, ROM pad to be lined and drainage collected throughout mine life. | C, O, R&C |
| **Processing Facilities** | | |
| **HLF Site Selection** | The HLF site was selected to be a ridgetop configuration; non-impounding heap leaches located on relatively flat slopes are by far the safest heap leach facilities to construct, operate, and close. | C, O |
| **HLF Design to Facilitate Progressive Closure** | The heap leach pad will be constructed in 5 stages, separated into cells, and closed progressively. Final closure design will allow for site transition to passive management.<br>Toe of each lift will be set back from crest of lower lift by approximately 10 m to create an overall slope of 2.5H:1V. The benches will provide heap slope stability, protect the liner system from damage due to sloughing, and provide access to the heap. The overall slope will facilitate closure. | All |

| Mitigation Name | Design Mitigation | Project Phase |
|---|---|---|
| **Heap Leach Pad Liner System** | Liner system design will provide for collection of process and rinse solutions and protection of surface and groundwater quality through heap leach pad operation and active closure. Liner system elements include:<br>• Development of a graded subgrade, overlain with a thin plating layer of finer material from the rock or thaw-stable soil, to prevent puncturing of the geosynthetic clay liner (GCL)<br>• Leak detection system consisting of monitoring wells installed away from the heap leach pad, unsaturated or vadose zone monitoring under the leach pad using an adaptation of lysimeter technology (i.e., wick drains), and electrical leak location surveys performed after construction of each stage of the leach pad<br>• Placement of a reinforced GCL<br>• Placement of a primary, low permeability geomembrane liner consisting of 2.0 mm thick linear polyethylene (LLDPE), aggressively textured on its bottom side to allow for a close bond with the GCL<br>• Placement of overliner gravel (crushed ore), 500 mm thick, with drainage pipes, to protect the liner from damage during initial ore stacking and operations, and to drain process and rinse waters out of the system in a manner that minimizes the hydraulic head directly over the liner.<br>The HLF liner system is designed to maximize recovery of pregnant solution by minimizing any losses to the groundwater system. | C, O, R&C |
| **Non-impounding Heap Leach** | Pregnant solution will be fed directly to the process plant and circulated back to the HLF as barren solution, eliminating need for in-heap process solution storage pond, dam, and tailings. | C, O |
| **Pregnant Solution Management** | Design provides for gravity drainage from heap leach pad to the pregnant tank at the process plant (or in the case of an upset, the event ponds) via double-contained, buried pipes. A leak detection system will monitor air pressure in the annular void between the two pipes. | C, O |
| **HLF Water Balance** | HLF water balance will be designed to minimize demand for withdrawal of make-up water from external sources and to avoid need to treat surplus water until near the end of the mine life.<br>Process water for use in heap pad leaching will be sourced from site contact water (i.e., process solution), minimizing the need to withdraw water from area creeks. | C, O, R&C |
| **Management of Non-contact Water** | Surface water and rainwater will be kept away from the HLF and process circuit to the maximum extent possible through:<br>• Installation of permanent and interim perimeter diversion channels and berms around perimeter of heap leach pad<br>• Installation of a drainage ditch or berm and drainage pipe between each heap leach stage, and between cells within each stage by construction of a ditch or berm with a drainage pipe every 100 m. These berms and ditches will allow high-resolution tracking of solution chemistry and aid in progressive closure by allowing rinsing of older portions of the heap leach pad.<br>• Expected to begin in Year 3, placement of raincoats (i.e., exposed geomembrane covers) over portions of the heap leach pad to minimize infiltration of rainwater and snowmelt into the heap leach pad and process circuit, and to increase heat retention in the winter.<br>• Progressive closure of HLF will reduce length of time that HLF is at its maximum footprint size | C, O |

| Mitigation Name | Design Mitigation | Project Phase |
|---|---|---|
| **HLF Event Ponds** | Two event ponds (EP-1S and EP-1N) will be built between the heap leach pad and the process plant prior to commencement of operations (Year -1). These ponds, to be in use over the life of mine, will be capable of containing seasonal water accumulation, full heap drainage, the 24-hour “Probable Maximum Precipitation” (PMP) storm event, and seasonal solution accumulation. Each pond will have 3 synthetic liner layers: a double HDPE geomembrane, separated by a leak detection and collection layer, and underlain by a GCL.<br>A third event pond, EP-2, will be built in an adjacent location and placed in service in Year 6 to accommodate the expanded heap leach pad footprint. The pond will be sized to contain a PMP storm event, complete heap drainage, and maximum seasonal water accumulation, plus additional freeboard, in excess of industry standards and regulatory requirements. It will be used only in response to a PMP event (i.e., highly diluted solution). EP-2 will have 2 geosynthetic liners: an HDPE liner over a GCL. | C, O, R&C |
| **HLF Rainwater Storage Pond** | A rainwater storage pond, capable of being converted to an event pond, if necessary, will be built between the HLF and the process plant. The pond, which will receive only clean water, will have 2 geosynthetic liners: an HDPE liner over a GCL. | O, R&C |
| **Doré Production and Transport** | On-site production of gold doré bars allowing for frequent and secure transfer via air to off-site refineries for further processing. | O |
| **Treatment of Surplus HLF Water** | Installation of water treatment facility to treat surplus water from HLF. | O, R&C |
| **Water Management Facilities** | | |
| **Drainage Channels** | Drainage channels will be capable of conveying a 100-year 24-hour storm event, including average daily snowmelt. | C, O, R&C |
| **Sediment Pond Design** | Runoff from the Mine Site will be routed to the Alpha Pond and Facility Pond. The ponds will serve two purposes: 1) settlement of TSS load prior to discharge, and 2) reduction in peak discharge rate of a storm by attenuating (storing and releasing) runoff and discharging it at a lower peak rate. | C, O, R&C |
| **Sediment Pond Containment Capacity** | The Alpha Pond will be designed to hold the 100-year freshet and will have a capacity of 357,400 $m^3$<br>The Facility Pond will be designed for the 10-year, 24-hour rainfall event, and will have capacity of 9,400 $m^3$ | C, O, R&C |
| **Sediment Pond Discharge Capacity** | The Alpha Pond outlet structure will be capable of discharging the 100-year freshet flow. The Facility Pond outlet structure will be capable of discharging the 10-year, 24-hour rainfall event.<br>Storms up to the 200-year event will discharged from the emergency spillway. | C, O, R&C |
| **Sediment Pond Freeboard** | Height of sediment pond embankments provides for 1 m of freeboard | C, O, R&C |
| **Rock Drains and Conveyance Structures** | The Alpha rock drain is designed to accommodate up to two times the 100-year, 24-hour storm event with average snowmelt runoff. The material used to construct the rock drain will have a D50 of 0.3 m.<br>Conveyance structures will be designed to convey the 100-year, 24-hour peak flows. | C, O, R&C |

| Mitigation Name | Design Mitigation | Project Phase |
|---|---|---|
| **Fuel and Hazardous Materials Storage Facilities** | | |
| **Fuel Tank Farm – Spill Containment** | The fuel tank farm bund will be lined with HDPE for spill containment. | C, O, R&C |
| **Mine Site Support Infrastructure** | | |
| **Use of Modular Structures** | Accommodation and office complex will consist of portable, modular units constructed off-site, thus reducing site disturbance that would be associated with construction and decommissioning. | C, R&C |
| **Permafrost Protection** | The design includes the following measures to protect permafrost:<br>• Water management structures (e.g., diversion channels) will be designed to reduce thermal changes to permafrost. E.g., To avoid permafrost-related stability and erosion issues in surface water diversions, berms will be used rather than ditches wherever practical. | C |
| **Use of Fugitive Waste Heat** | Buildings will be heated primarily by heat recovered from the power plant.<br>Excess heat from the generators, when available, will be used to heat the barren solution. | O |
| **Manage Wildlife Attractants** | Project waste will be managed to minimize the potential for attracting wildlife to the site.<br>• Incineration and waste and recyclable sorting at a designated waste management area.<br>• Food waste will be incinerated, and if composting methods are utilized will be done in a way that will not serve as a wildlife attractant. Only non-hazardous, non-leaching, inorganic garbage will be disposed of in on-site landfill.<br>• Sewage will be treated by a membrane bioreactor (MBR) plant. | C, O, R&C |

**Notes:** Project Phases: C – Construction, O – Operation, R&C –Reclamation and Closure, P-C – Post-closure.

**Table 32-2 Summary of Environmental Mitigation Measures**

| Mitigation Number | Mitigation Name | Proposed Mitigation – Suggested text | Project Phase(s) | Status |
|---|---|---|---|---|
| **1** | **Management Plans** | Goldcorp will develop and implement detailed management plans, as listed below. These management plans will contain the following information, where relevant:<br>• Scope and objectives of the plan<br>• Applicable regulatory requirements, guidelines and management plans, including any relevant authorizations and authorizing bodies<br>• Applicable Goldcorp internal standards and requirements<br>• Reporting requirements and responsibilities<br>• How consultation issues and feedback were incorporated into the plan<br>• How Traditional Knowledge and Traditional Use was incorporated into the plan<br>• Project design and mitigation measures, including but not limited to:<br>▫ Relevant Project design and mitigation measures described throughout this Project Proposal, including those listed in Section 2, and 7 through 28<br>▫ Relevant detail and mitigation measures from Section 31 Environmental and Socio-Economic Management Program of this Project Proposal<br>• A description of detailed monitoring program(s) including objectives, methods, frequency, location, and monitoring indicators, including but not limited to:<br>▫ Relevant monitoring measures described throughout this Project Proposal, including in Sections 7 through 28<br>• Adaptive management thresholds and adaptive management measures, including but not limited to:<br>▫ Relevant adaptive management measures described throughout this Project Proposal, including in Sections 7 through 28<br>These plans will be as follows:<br>• Cyanide Management<br>• Emergency Response Plan<br>• Erosion and Sediment Control Plan<br>• Explosives Management Plan<br>• Fish and Aquatic Management Plan<br>• Frozen Material Management Plan<br>• Hazardous Materials Management Plan<br>• Heap Leach and Process Facilities Plan<br>• Heritage Resources Protection Plan | | |

| Mitigation Number | Mitigation Name | Proposed Mitigation – Suggested text | Project Phase(s) | Status |
|---|---|---|---|---|
| | | • Mine Development and Operations Plan<br>• Metal Leaching / Acid Rock Drainage Management and Monitoring Plan<br>• Noise Management Plan<br>• Spill Contingency Plan<br>• Vegetation Management Plan<br>Waste Management Plan | | |
| 2 | **Access Route Construction Management Plan** | Goldcorp will develop and implement an Access Route Construction Management Plan that contains the following commitments:<br>• Utilize conventional cut and fill construction.<br>• Use best management practices to protect the integrity of areas underlain by undisturbed, shallow, ice-rich permafrost<br>▫ the existing surface material will be left intact, with the road constructed by filling over a geotextile separation layer.<br>▫ Embankment thickness will be a minimum of 1.5 m (ideally 2 m), with material placed on woven geotextile<br>• Avoid high fills and sideslope alignments wherever practical.<br>• Do not exceed 10% on flat horizontal and vertical curves and gradients wherever practical<br>• Minimize clearing widths in areas of riparian vegetation<br>• Situate staging areas at depleted borrow sites, pullouts, spoil sites and previously cleared areas within the road right of way where practical.<br>• Assess the ML/ARD potential of bedrock prior to disturbance, including areas where bedrock may need to be removed along the road alignment, as well as potential quarry and borrow material sites.<br>• Surround with berms and underlay with an impermeable liner fuel storage areas with a volume greater than 4000 L. Storage drums will have secondary containment.<br>• Contain, clean up and report all spills. Train contractors and employees in fuel handling and storage best practices. Locate a copy of the Spill Contingency Plan where bulk fueling occurs. Spill kits will be present in all mobile equipment and at fueling storage areas | C | |

| Mitigation Number | Mitigation Name | Proposed Mitigation – Suggested text | Project Phase(s) | Status |
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| | | • Incorporate standard non-fish stream culverts; embedded culverts in small, low habitat fish value streams; and, all-steel portable bridges over larger water courses or higher value fish habitat as appropriate.<br>• Design stream crossing structures to pass a peak flow event appropriate for the design life of the NAR.<br>• Redirect ditch water away from the stream at stream crossing sites by use of cross drain culverts and off take ditches.<br>• Control drainage to prevent water ponding along the toe of embankments. If runoff water must be collected and channelized, do so at a reasonable distance from the embankment (>10 m).<br>• Install relief culverts if the road approaches require fill on floodplains.<br>• Design all bridge elevations for the 100-year return period flood.<br>• Size bridges so that the abutments will not constrict the bankfull channel width or impinge on the stream channel or floodplain.<br>• Isolate construction areas from stream flows and put in place erosion and sediment control activities when instream works are required. Minimize and complete instream work on all watercourses at times of low flow.<br>• Carry out fish salvage to remove fish from the work areas when site isolation is required for any site containing fish.<br>• Construct wildlife crossings, including trails that traverse the cuts and fills to reduce the grade that animals must climb or descend where road embankments may pose a barrier to wildlife movement. The Site-specific design will incorporate the following:<br>▫ Wildlife crossings will be designed to have a gradual grade (e.g., a 5:1 slope).<br>Crossing surface will be smooth and compacted to allow for solid footing, and constructed of finer fill materials (e.g., crushed rock 100 mm or less in diameter). | | |

| Mitigation Number | Mitigation Name | Proposed Mitigation – Suggested text | Project Phase(s) | Status |
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| 3 | **Access Route Operational Management Plan** | Goldcorp will develop and implement an Access Route Operational Management Plan that contains the following commitments:<br>• Enforce speed limits for Project vehicles, conduct, regular road inspections and grading.<br>• Enforce a maximum speed limit along the NAR of 50 km/h.<br>• Control access at the north entrances of each of the Stewart and Yukon River barge and ice crossings to the extent permitted by Yukon law.<br>• Allow only authorized, mine-related vehicles on Proponent-operated barges and ice bridges on the Stewart and Yukon rivers.<br>• Post signage on Hunker Road at Sulphur Creek and at each barge landing advising the public of the hazards of using the NAR. The signs will also provide safety and emergency contact information including radio call-out procedures and radio frequencies<br>• Conduct weekly inspections of the NAR to verify that the road is maintained for safe travel of personnel, equipment, and supplies.<br>• Follow DFO's Operational Statement for Ice Bridges and Snow Fills (DFO 2007) for water withdrawals required for ice bridges.<br>• Perform all major repairs on the barges prior to launching the barges back into the water at the beginning of the open water season.<br>• Remove the barges at the end of each barging season and store on the southern barge landing area. Winterize barges prior to storage.<br>• Provide additional signage at the access points of the ice roads to notify drivers of the reduced speeds on the ice.<br>• Place temporary emergency shelters at each barge landing, and equip with survival and communication equipment.<br>• Monitor the ice roads for ice structural conditions, thickness and density.<br>• Perform decommissioning tasks once hauling on the winter NAR is complete as outlined in the Access Route Operational Management Plan.<br>• Do not store petroleum hydrocarbons within 30 m of the top of a bank.<br>• Implement best management practices if using gas-powered equipment near water.<br>• Work with appropriate stakeholders, including Yukon Government Highways and Public Works and RCMP, to develop traffic management protocols for the NAR, including speed restrictions.<br>Incorporate additional feasible land use and access-related mitigation measures determined through engagement with First Nations, regulators, and stakeholders in the Access Route Operational Management Plan | C,O, R&C | |

| Mitigation Number | Mitigation Name | Proposed Mitigation – Suggested text | Project Phase(s) | Status |
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| 4 | **Conceptual Reclamation and Closure Plan** | • Goldcorp will develop and implement a Conceptual Reclamation and Closure Plan that contains the following commitments:<br>• Develop a detailed closure Adaptive Management Plan (AMP) to support Project licensing.<br>• Consult and work with communities for subsequent versions of the reclamation and closure plan, which will include mitigation measures activities related to socio-economic aspects of closure (e.g., community contributions, partnerships<br>• Salvage suitable soil material from areas that will be disturbed by the Project footprint where appropriate.<br>• Undertaken progressive reclamation and closure. Revegetate inactive areas as soon as practical.<br>• Implement erosion and sedimentation mitigation associated with reclamation and closure activities.<br>• Ensure that reclaimed ponds and conveyance structures are graded, as required, for proper drainage. Implement a care and maintenance program during seasonal closures or temporary closure.<br>• During temporary closure, conduct regular inspections to confirm compliance with applicable permits and licenses<br>• Maintain an egress point out of Open Pits during Reclamation and Closure and Post-closure phases, to reduce potential wildlife entrapment.<br>• Develop a Revegetation Reclamation Research Program where reclamation protocols will be developed and tested on-site. Apply the most successful treatments more broadly during the reclamation phase.<br>• Decommission and close Project facilities as described in this plan.<br>• Continue the Operation Phase monitoring programs until no longer required, or have been adapted for closure. | C,O,R&C | |

| Mitigation Number | Mitigation Name | Proposed Mitigation – Suggested text | Project Phase(s) | Status |
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| **5** | **Waste Rock and Overburden Management Plan** | Goldcorp will develop and implement a Waste Rock and Overburden Management Plan that contains the following commitments:<br>• Develop a construction QA/QC plan for the WRSFs, frozen soil storage area, temporary organics stockpile and the ROM stockpile prior to the commencement of construction to ensure the parameter assumptions and recommendations developed during the design process are achieved.<br>• Include a plan for overall site clearing and stripping to ensure materials are properly stored for later use in reclamation of the site.<br>• Remove potentially thaw-unstable material and replace with waste rock within 15 m of the toes where seasonal thawing may occur.<br>• Ensure each WRSF and stockpile is constructed to the appropriate geotechnical design criteria.<br>• Construct a rock drain beneath the Alpha WRSF to downstream Alpha Pond.<br>• Construct rock drains in in-pit backfill, where necessary, to promote drainage.<br>• Ensure that overburden soils not suitable for the temporary organics stockpile are not concentrated along the foundation or within the final side slopes of the WRSF.<br>• Segregate frozen soils in the frozen soils storage area by type, defined primarily by ice content and grain size, to permit recovery of materials that will be utilized in reclamation.<br>• If there is not enough waste rock in the Alpha WRSF to contain the earliest frozen soils excavated, construct a small berm on the downslope side of the frozen soil storage area to provide initial containment and filtering.<br>• Ensure flow-through berms for the frozen soils storage area allow for excess pore water from the thaw of ice-rich materials to drain, while containing the file-grained materials that may otherwise be thaw-unstable.<br>• Water from the Alpha WRSF will be routed to the Alpha Pond.<br>• Manage waste rock such that materials within the upper 1 m of deposits do not exhibit an arsenic concentration that is greater than 60 mg/kg, on average. If unable to do so, review alternative means of deterring human traffic and prolonged use of facilities in closure (e.g. signage).<br>• Backfill waste from the Kona Pit into the mined out Kona Pit.<br>• Conduct clearing and stripping in a short of a time period as practical in advance of waste rock, in order to minimize the exposure period of the de-vegetated ground.<br>• Monitor the performance of the WRSFs and stockpiles as outlined in the Waste Rock and Overburden Management Plan. | C,O,R&C | |

| Mitigation Number | Mitigation Name | Proposed Mitigation – Suggested text | Project Phase(s) | Status |
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| **22** | **Water Management Plan** | Goldcorp will develop and implement a Water Management Plan that contains the following commitments:<br>• Construct the water management facilities via a network of conveyance structures and ponds through the Construction, Operations, and Reclamation and Closure phases.<br>• Ensure the quantity and quality of contact water discharged from the Mine Site complies with applicable regulatory requirements<br>• Compare water quality monitoring data for creeks in the Project area and Yukon River to baseline water quality data and relevant guidelines including site-specific water quality objectives. | C,O,R&C | |
| **23** | **Wildlife Protection Plan** | Goldcorp will develop and implement a Wildlife Protection Plan that contains the following commitments:<br>• Time construction activities to avoid sensitive habitats during sensitive times. If construction activities must occur during a sensitive period, implement additional monitoring and mitigation.<br>• Time vegetation clearing and grubbing to occur outside the migratory birds nesting period. If clearing and grubbing must occur during the nest period (May 1 to August 15), conduct a breeding bird nest survey prior to clearing. If nests are discovered with eggs and/or chicks, avoid these areas and establish a no-disturbance buffer around the nest until the young birds have left the nest.<br>• Mark wildlife habitat features and sensitive habitats as sensitive on all construction drawings, and establish appropriate buffers.<br>• Reclaim riparian vegetation in areas affected by barge landing construction (restore shoreline habitat).<br>• Take special care so that road construction and operation through the Thinhorn Sheep Ballarat occurrence area is a minimal hindrance to Sheep crossing the road. Specifically:<br>▫ Avoid tall, steep road banks<br>▫ Conduct snow clearing and piling in a way that will minimize hindrance to Sheep crossing the road<br>• Ensure known cliff-nesting raptor nests remain intact and are not damaged by construction activities. If construction activities overlap the nesting period for these species, check raptor nests within 1 km of the road for occupancy, and develop a construction management plan for working near occupied nests.<br>• When disturbance in the breeding bird season is required for the Project, and near specific nest sites identified during baseline studies, conduct additional mitigation to protect nests as follows: | C, O, R&C | |

| Mitigation Number | Mitigation Name | Proposed Mitigation – Suggested text | Project Phase(s) | Status |
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| | | ▫ Conduct pre-clearing nest surveys.<br>▫ Identify and protect active nests. Establish no disturbance setbacks around active nests.<br>▫ Protect nests of certain species such as raptor nest sites identified during baseline surveys year round, regardless if they are actively being used. Provide protocols that include timing of breeding season, setback distances around active nests, and methods for conducting pre-clearing nest surveys.<br>• Conduct pre-clearing surveys for bat roosts in habitats with high potential to support bat roosts prior to the commencement of construction activities. Leave any identified bat roosts structurally intact and establish a no-disturbance buffer around active roosts.<br>• Establish no-disturbance buffers around identified wildlife habitat features (e.g., mineral licks, dens, and bat roosts) during sensitive periods. Consider project activities, including blasting, for disturbance to nearby wildlife features. If disturbance within the no-disturbance buffer is unavoidable, develop site-specific protection measures in consultation with authorities.<br>• Time road construction to avoid activity near the Yukon River cliffs during the lambing season.<br>• Phase an approach to mitigation to minimize disturbance to migrating caribou, during the Fortymile Caribou Herd spring and fall migration seasons. Implement temporary road controls when large groups of caribou are migrating through the area. Depending on the size of the movements, speed restriction and convoying traffic may be sufficient to allow for continued caribou movement.<br>• Implement wildlife protocols to reduce the potential for wildlife-human interactions in the Project footprint<br>• Prohibit hunting of wildlife at all times for all employees and contractors while present on site (both on and off-shift).<br>• Prohibit feeding and harassment of wildlife.<br>• Post warning signs in areas of frequent wildlife encounters on a seasonal basis or as otherwise required.<br>• Ensure employees report wildlife sightings along the road and near Project facilities.<br>• In the event of bear encounters, employ several types of bear deterrents, including bear spray and air horns. Use firearms only as a last resort in the event of a bear encounter when all other methods of bear deterrents have failed. If animals are killed in defense of life or property, consult Yukon Conservation Services regarding disposal. | | |

| Mitigation Number | Mitigation Name | Proposed Mitigation – Suggested text | Project Phase(s) | Status |
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| | | Right-of-way will be given to Wildlife along all Project roads:<br>▫ Vehicle operators will watch for wildlife near roads, and take all reasonable actions to avoid collisions with wildlife.<br>▫ Traffic will stop as far back as safely possible if wildlife are observed on the road. If after five minutes the animals have not moved off the road, the vehicle may proceed slowly and cautiously (less than 20 km/h).<br>▫ Road signage, both permanent and temporary, will be erected to inform users regarding seasonal wildlife issues along the NAR and Mine Site roads as necessary.<br>▫ Speed limits will be posted along Project roads, including additional speed restrictions for the protection of wildlife along specific sections of road and/or during seasons when wildlife are expected to regularly interact with the road.<br>▫ No-stopping areas will be designated in sensitive wildlife areas as determined by project monitoring and project biologists; no-stopping areas will have signs posted.<br>▫ Drivers will communicate wildlife observations along the road via radio communications to verify other drivers are informed of potential hazards.<br>▫ Implement temporary road closures and/or traffic restrictions (i.e., convoying traffic) as required to minimize effects to wildlife during sensitive periods including moose congregation areas in the post-rut and early winter, and caribou migration.<br>▫ Maintain a wildlife sighting log by on-site personnel through all Project phases. Drivers will be required to document all wildlife observations and wildlife logs will be collected by on a weekly basis.<br>• Provide project personnel wildlife awareness orientation to all workers on the site through all phases of the Project. The objectives of the wildlife awareness orientation with respect to wildlife and wildlife habitat are:<br>▫ Provide workers with knowledge of why interactions with wildlife are important to manage, and an understanding of the course of action to be taken in a variety of circumstances.<br>▫ Emphasize the role of adaptive management in realizing effective mitigation for wildlife and the workers' role in recording their observations on the wildlife sighting log, or as part of the monitoring programs described in the Wildlife Protection Plan.<br>▫ Keep records to document completion of the orientation by all site personnel.<br>• Manage aircraft operations, including both fixed-wing aircraft and helicopters, to limit the potential effects to wildlife. Subject to safety considerations and pilot discretion:<br>• All Project-related aircraft will maintain a minimum cruising altitude of 300 m above ground level; between May 1 and June 31 the minimum cruising altitude will be increased to 600 m above ground level when Caribou have been identified in the area (for the protection of calving Caribou)<br>• Avoid hovering or circling over wildlife. | | |

| Mitigation Number | Mitigation Name | Proposed Mitigation – Suggested text | Project Phase(s) | Status |
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| | | • For the protection of Thinhorn Sheep, aircraft will maintain a cruising altitude of 500 m above ground when flying over the south-facing slopes along the Yukon River, or maintain a horizontal distance of at least 1,000 m from these slopes.<br>• Low-level flights and/or flights along the Yukon River during wildlife surveys will be conducted, as directed by Project biologists in accordance with wildlife research permits.<br>• Fence Heap Leach Facility events ponds during Operation to prevent access by wildlife.<br>• Where safe to do so, place boulders to create berms to prevent access to the edges of the Open Pits, where they could present a hazard to wildlife that is not readily visible to approaching wildlife.<br>• Conduct periodic audits to assess the effectiveness of waste management practices and regular surveillance of Project facilities and waste disposal sites will ensure that wildlife control measures are effective.<br>• Conduct immediate follow-up if any observation of bears or other wildlife acting defensively, showing signs of human habituation, or acting aggressively. If specific wildlife becomes a concern, contact Yukon Conservation Officer Services for advice on appropriate actions.<br>• Where practical, and not a risk to human safety, implement a Stop Work policy when wildlife in the area may be endangered (i.e., risk of physical injury or death) by the work being conducted.<br>• Conduct wildlife monitoring in accordance with the requirements of the Wildlife Protection Plan | | |
| **Socio-economic Monitoring Program** | | | | |
| | **Local Hiring Practices** | Goldcorp will develop and implement the following Local Hiring Practices:<br>• Develop a Local Employment Strategy to encourage the recruitment of local labourers in accordance with the Proponent's internal sustainability management system<br>• Provide consideration for employment opportunities to qualified local, regional, and First Nations residents with appropriate skills and qualifications.<br>• Communicate typical job descriptions, employment requirements (including skills and qualifications), and other information in a timely manner to ensure local residents can prepare and seek any required training / experience in advance of Project Construction and Operation.<br>• Develop a program for First Nations employees to encourage work site integration and retention. | C, O, R&C | |

| Mitigation Number | Mitigation Name | Proposed Mitigation – Suggested text | Project Phase(s) | Status |
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| | | • Advertise employment opportunities with appropriate local organizations and through appropriate venues.<br>• Work with local communities and organizations to identify barriers to employment, and evaluate the implementation of potential solutions.<br>• Track the number of local applicants and employees through socio-economic monitoring.<br>• Implement a Community Feedback Protocol to respond to questions and concerns regarding Project employment opportunities.<br>• Engage with local businesses, industry partners, and organizations if potential concerns are identified related to local or regional labour competition. Work with these groups to identify appropriate means to offset any challenges.<br>• Engage educational bodies in the LAA and RAA to promote opportunities for experiential learning that will allow students to consider potential career paths within the mining industry. | | |
| | **Local Contracting and Procurement Practices** | Goldcorp will develop and implement the following Local Procurement Practices:<br>• Develop a Local Procurement Strategy to encourage the recruitment of local businesses.<br>• Implement the Local Procurement Strategy through its direct contracts, as well as include incentives to contract and procure local goods and services in its primary contracts.<br>• Include local hiring clauses in all Project contracts.<br>• Communicate contracting and procurement opportunities, as well as pre-qualification factors (e.g., safety certifications) and evaluation criteria in a timely manner to ensure local businesses can prepare and seek any required qualifications in advance of Project Construction and Operation.<br>• Advertise contracting and procurement opportunities with appropriate local organizations and through appropriate venues.<br>• Implement a Community Feedback Protocol to respond to questions and concerns regarding Project contracting and procurement opportunities. | C, O, R&C | |
| | **Education and Training Activities** | Goldcorp will develop and implement the following Education and Training Activities Mitigation Measures:<br>• Communicate with local education and training organizations and institutions to identify and encourage availability of programs or courses necessary for Project employment to local residents.<br>• Make available limited on-the-job training for employees who identify a need or who express an interest in furthering their career. | C, O, R&C | |

| Mitigation Number | Mitigation Name | Proposed Mitigation – Suggested text | Project Phase(s) | Status |
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| | | • Make available career development opportunities to encourage retention of employees and further develop the skills of the local labour force.<br>• New employee orientation will include cultural awareness training.<br>• Provide or facilitate training opportunities for under-represented groups in the mining sector, such as First Nations and women.<br>• Offer an Employee Assistance Program (EAP) which provides support for career development. | | |
| | **Workforce Transition Strategy** | Goldcorp will develop and implement a Workforce Transition Strategy that contains the following commitments:<br>• Endeavour to carry out a staged reduction of workforce in the event of a temporary or permanent closure.<br>• Fulfill all conditions for terminations as defined in contracts, including severance payments and grievance procedures. Offer an Employee Assistance Program to support employees during transition in the event of a temporary or permanent closure<br>• Communicate the proposed schedule and activities associated with temporary or permanent closure of the mine to employees, local communities, governments and businesses and appropriate local non-profit and non-governmental organizations, allowing those engaged in indirect and induced employment and businesses to prepare for the transition, and begin to seek other opportunities.<br>• Make available limited on-the-job training for employees who identify a need or who express an interest in furthering their career.<br>• Identify and provide a local workforce transition contact to respond to questions and concerns regarding temporary or permanent closure status, schedule, and activities. | C, O, R&C | |
| | **Engagement Plan** | Goldcorp will develop and implement an Engagement Plan that contains the following commitments:<br>• Continue to communicate the status and schedule of the Project with employees, contractors, local communities, government, and other organizations. Communicate any temporary and seasonal closure.<br>• Implement a Community Response Protocol to respond to questions and concerns regarding Project. The Engagement plan will lay out the strategy and actions required to publicize this protocol through the course of ongoing engagement.<br>• Continue to engage with First Nations, and consider their concerns, interests, and priorities.<br>• Consider the values, needs, and concerns expressed by First Nation and non-First Nation land and resource users in the development of Project plans, procedures, and communications. | C, O, R&C | |

| Mitigation Number | Mitigation Name | Proposed Mitigation – Suggested text | Project Phase(s) | Status |
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| | | • Communicate with representatives from the Yukon Government including Health and Social Services and Community Services, to help inform planning for services based on hiring practices and anticipated in-migration for Project staffing and contracted services<br>• Work with the placer mining claims holders potentially affected by the NAR to develop approaches to road development and access that will avoid or minimize potential interruptions to placer operations where practical. | | |
| | **Traditional Economy Enhancement Measures** | Goldcorp will develop and implement the following Traditional Economy Enhancement Measures:<br>• Implement a cultural awareness training.<br>• Encourage employees to pursue traditional economy activities by providing a 2-week on, 2-week off schedule.<br>• Implement the enhancement measures associated with the traditional economy in conjunction with other human environment mitigation, such as the Engagement Plan and cultural awareness training, among others. | C, O, R&C | |
| | **Cultural Awareness Training** | Goldcorp will develop and implement Cultural Awareness Training. | C, O, R&C | |
| | **Northern Access Route Mitigation and Road Safety Measures** | Goldcorp will develop and implement the following Northern Access Route Mitigation Measures:<br>• Implement access control at river crossings of the Stewart and Yukon Rivers to the extent permitted by Yukon law.<br>• Only permit only Proponent-authorized vehicles to use the Proponent's barges and ice bridges on the Stewart and Yukon Rivers.<br>• Post signage on Hunker Road at Sulphur Creek and at each barge landing advising the public of the hazards of using the NAR. The signs will also provide safety and emergency contact information including radio call-out procedures and radio frequencies.<br>• Prior to opening the road, Proponent will advertise and hold at least one public meeting in Dawson to explain the hazards of using the road. Review safety protocols and considerations.<br>• Develop indicators for monitoring how traffic is affected by the Project and adapt management protocols accordingly.<br>• Develop a NAR Emergency Response Plan, which will include incident prevention and response measures | | |

| Mitigation Number | Mitigation Name | Proposed Mitigation – Suggested text | Project Phase(s) | Status |
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| | | • Develop and communicate traffic management protocols for Project vehicles during the Project's Construction and Operation Phases<br>• All Proponent vehicles using the road will be equipped with a radio set to the NAR frequency.<br>• Work with appropriate stakeholders including the YG's Highways and Public Works and RCMP to develop traffic management protocols for the NAR, including speed restrictions. Speed limits for the NAR will be 50 km per hour (km/h)<br>• Road use by Project vehicles may be limited under poor weather and road conditions<br>• Proponent vehicles, including contractor vehicles, will carry emergency roadside kits and emergency spill kits<br>• Spill kits will be located at barge landings<br>• The Proponent will have safety induction training for all applicable employees and contractor's employees on road safety rules, with training on defensive driving practices, driving in winter conditions and on gravel roads, and spill response. Topics will include the use of seat belts; observing posted speed limits; wildlife protection protocols, and improving visibility for others by wearing reflective clothing at all times<br>• Use of seat belts will be mandatory for all Proponent drivers and passengers.<br>• Driving under the influence of alcohol or intoxicating drugs will be prohibited.<br>• All Proponent drivers will possess a valid driver's licence from a Canadian province or territory for the appropriate class of vehicle.<br>• All Proponent vehicles using the road will have radio contact capabilities, meet vehicle maintenance requirements, and will be familiar with spill response systems<br>• The Proponent will post appropriate signage along the road. Typically, these signs will advise drivers of the posted speed limits, approaching bridges, curves, or areas of low visibility. Signs will be posted to advise drivers of safety rules and road conditions. | | |
| | **Emergency Response Plan** | Goldorp will include the following mitigation measures within the Emergency Response Plan:<br>• Include information about on-site personnel, equipment, and services available to address a potential emergency.<br>• Update as needed and share with the hospitals in Dawson and Whitehorse, as well as with emergency services<br>• Staff will be prohibited from leaving the Project site while on their in-rotation, and will be prohibited from hunting and fishing to reduce potential calls to emergency services for lost and injured parties<br>• Include a zero tolerance policy for alcohol and drug use | | |

| Mitigation Number | Mitigation Name | Proposed Mitigation – Suggested text | Project Phase(s) | Status |
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| | | • Actively promote workplace safety, including transportation safety (speed limits, safe driving practices)<br>• Provide on-site medical services to reduce calls for external medical or emergency response.<br>• The Emergency Response Plan or Spill Contingency Plan will contain contingencies for the following events:<br>▫ Vehicle collisions that may result in personal injury or spillage of potentially harmful materials such as fuel, lubricating fluids, and reagents.<br>▫ Contact between vehicles and wildlife that may result in harm to wildlife, personal injury, or spillage of potentially harmful materials<br>▫ Single-vehicle accidents that may result in personal injury or spillage of potentially harmful materials<br>▫ Spills of harmful materials onto the land or into water courses | | |
| | **Flight Scheduling** | Goldcorp will develop and implement the following Flight Scheduling Mitigation Measures:<br>• Consult local authorities and airline companies regarding routine flight scheduling for crew changes during the Construction and Operation phases and, if needed, adjust flight timing to allow a spread between aircraft to minimize effects on air traffic control and reduce airport and passenger congestion.<br>• Communication Protocols: For uncontrolled airports where flights will operate (e.g., Dawson), communicate schedule information for crew change flights to Community Aerodrome Radio Stations so local users are aware of when to expect traffic. | C, O | |
| | **First Nation Mentoring Program** | Goldcorp will develop and implement a First Nation Mentoring Program that will provide onsite mentorship to First Nation employees. | C, O, R&C | |
| **24-1** | **Current Traditional Land and Resource Use Enhancement Measures** | Goldcorp will develop and implement the following Current Traditional Land and Resource Use Enhancement Measures:<br>• Implement a cultural awareness training;<br>• Encourage employees to pursue traditional land and resource use activities by providing a 2 week on, 2 week off schedule.<br>• Implement the enhancement measures associated with traditional land and resource use in conjunction with other human environment mitigation for potential adverse effects, such as the Project's Engagement plan. | C, O, R&C | |
| **25-125-1** | **Mitigation Measures for** | Goldcorp will develop and implement the following Mitigation Measures for Country Food Quality: | | |

| Mitigation Number | Mitigation Name | Proposed Mitigation – Suggested text | Project Phase(s) | Status |
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| | **County Food Quality** | • waste rock will be managed such that materials within the upper one metre of deposits will not exhibit an arsenic concentration that is greater than 60 mg/kg on average. Where this is not practical, review alternative means of deterring human traffic and prolonged use of facilities in closure (e.g., signage).<br>• Samples collected from candidate borrow sources for the NAR contained a small number of samples of schist that exhibited arsenic concentrations greater than 100 mg/kg (**Appendix 18-B Human Health Risk Assessment**). To mitigate against any human or ecological risks associated with the placement of high-arsenic materials, any borrow material with high arsenic concentrations will not be used in a manner that creates an exposure potential, regardless of their status as non-acid generating | | |
| | **Mitigation and Enhancement Measures Children and Youth** | Goldcorp will develop and implement the following Mitigation and Enhancement Measures to for Children and Youth:<br>• Engagement between the Proponent and the Government of Yukon to discuss the needs of employees and their families, including providing information about the communities of residence of employees<br>• Use the Community Investment Protocol to support programs which contribute to the community's resilience related to Project-related increases in population, such as supporting recreational opportunities for children and youth<br>• Provide meaningful work experiences for young adults, in accordance with applicable laws regulations, such as co-op and summer work programs<br>• Increase capacity of community activities and events by providing sponsorship, such as providing resources to increase recreational opportunities for children and youth | | |
| | **Mitigation Measures for Crime** | Goldcorp will develop and implement the following Mitigation Measures for Crime:<br>• Implement a drug and alcohol policy that prohibits the use of alcohol or drugs while on the Mine Site property or using company vehicles.<br>• Implement an Employee Assistance Program (EAP) that provides additional support to employees experiencing difficulties with alcohol or substance use.<br>• Create a Visiting Elders program, where elders from First Nations provide mentorship and support for First Nations and Non-First Nations employees.<br>• Make space available for people to hold Alcoholics Anonymous or Narcotics Anonymous meetings at site.<br>• Support a campaign to prevent family violence.<br>• Implement policies for behavioural issues such as workplace harassment. | C,O | |
| | **Mitigation Measures for Smoking** | Goldcorp will develop and implement the following Mitigation Measures for Smoking: | | |

| Mitigation Number | Mitigation Name | Proposed Mitigation – Suggested text | Project Phase(s) | Status |
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| | | • Implement a smoking cessation program for employees and their families, to complement the existing program available through Yukon Health and Social Services.<br>• Restrict locations where smoking is permitted, and prohibition of smoking in vehicles | | |
| | **Mitigation Measures for Increased Substance Use** | Goldcorp will develop and implement the following Mitigation Measures for Increased Substance Use:<br>• Implement a drug and alcohol policy that prohibits the use of alcohol or drugs while on the Mine Site property or using company vehicles.<br>• Offering an Employee and Family Assistance Program that provides additional support to employees experiencing difficulties with alcohol or substance use.<br>• Create a Visiting Elders program, where elders from First Nations provide mentorship and support for First Nations and Non-First Nations employees.<br>• Cultivation of a non-drinking environment by providing fun, social environments on site that do not involve drinking, so people can disassociate drinking from socialization.<br>• Making space available for Project staff to create their own recreational opportunities during non-working hours on site.<br>• Making space available for people to hold Alcoholics Anonymous or Narcotics Anonymous meetings at site | | |
| | **Mitigation Measures for Changes in Nutrition** | Goldcorp will develop and implement the following Mitigation Measures for Changes in Nutrition:<br>• Support healthy eating by providing a variety of healthy foods in the Project's cafeteria, including whole grains, fruits, and vegetables, and with fewer fried and processed foods.<br>• Provide information to employees on healthy eating through general awareness campaigns and through information available as part of an Employee and Family Assistance Program.<br>• Support healthier choices by providing scalable portions, making water readily available, and providing spices to replace salt | | |
| | **Mitigation Measures for Reduced Physical Activity** | Goldcorp will develop and implement the following Mitigation Measures for Reduced Physical Activity:<br>• Have an on-site a fitness centre for employee use.<br>• Develop hiking trails that may also be used for cross-country skiing and snowshoeing in the winter, providing the opportunity for year-round activity during daylight hours and in acceptable weather conditions. Appropriate precautions will be taken to safeguard employees from wildlife and other hazards, such as providing bear spray, radios and training. | | |

| Mitigation Number | Mitigation Name | Proposed Mitigation – Suggested text | Project Phase(s) | Status |
|---|---|---|---|---|
| | **Mitigation and Enhancement Measures for Food Security** | Goldcorp will develop and implement Mitigation and Enhancement Measures for Food Security that contains the following commitments:<br>• Create a Visiting Elders program, where Elders from Yukon First Nations to provide mentorship and support for First Nations and Non-First Nations employees.<br>• Providing information to employees and their families about strategies to increase food security. | C, O | |
| | **Mitigation Measures for Accidents and Injuries** | Goldcorp will develop and implement Mitigation Measures for Accidents and Injuries that contains the following commitments:<br>• Transport for staff will generally occur by air to improve safety.<br>• Develop road improvements strategies in consultation with First Nations, regulators, and other stakeholders. Potential NAR improvements include:<br>▫ Improve blind corners to reduce collisions with animals and vehicles<br>▫ Improve problem areas (e.g., locations of frequent flooding or wash-out)<br>▫ Develop communication and traffic management protocols and means of communication for Project drivers<br>▫ Impose speed restrictions.<br>• Implement mine specific mitigation measures, including the following:<br>▫ Adhere to all applicable workplace safety regulations and guidelines, and regularly engagw with YWCHSB to ensure best practices are followed.<br>▫ Adhere to industry standards, such as the Mining Association of Canada *Towards Sustainable Mining* protocols, and the International Cyanide Management Code.<br>▫ Adhere to Proponent's internal health and safety programs and initiative.<br>▫ Adopt a workplace safety program and foster a culture with leadership from the top that directly engages workers and fosters a culture of safety, which may include:<br>- Hold safety meetings at the beginning of each shift<br>- Develop and implement fatigue management guidelines and structuring shifts to minimize fatigue.<br>- Provide training specific to the workplace environment (e.g., fall prevention; helicopter safety; Yukon Mine Rescue Training (Surface)), and utilize the courses that are offered via the Northern Safety Network and private providers. Provide on-site refresher courses as needed.<br>- Require site supervisors to have First Line Supervisor Certificates<br>- Ensure contractors are following a Goldcorp's safety system and procedures.<br>▫ Develop and implementation of an Emergency Response Plan in collaboration with first responders including emergency medical services, fire department, and RCMP. This plan will include strategies to: | C,O, R&C | |

| Mitigation Number | Mitigation Name | Proposed Mitigation – Suggested text | Project Phase(s) | Status |
|---|---|---|---|---|
| | | - Provide on-site medical clinic staffed by a full-time health professional (emergency medical responder, nurse, or nurse practitioner) with an emergency medical responder on site 24 hours a day to provide emergent care.<br>- Provide first-aid stations at various locations on site.<br>- Ensure that first-aid training and refresher courses are provided to all supervisors and, when appropriate, other staff.<br>- Collaboratively develop medical transport and care plans with Yukon health care providers | | |
| | | - Ensure emergency response supplies are appropriate for Yukon operations.<br>- Ensure that one or more medevac-equipped operator is available as a backup should the primary medevac operator be unavailable.<br>▫ Ensure buildings have adequate ventilation, especially when they have changed purposes.<br>▫ Develop Mine Site traffic management protocols.<br>▫ Ensure maintenance is carried out on equipment to prevent injuries and fatalities. | | |
| | **Mitigation Measures for Infectious Disease** | Goldcorp will develop and implement the following Mitigation Measures for Infectious Disease:<br>• Ensure that on-site drinking water meets or exceeds applicable drinking water standards.<br>• Encourage hand washing by posting signs in site washrooms.<br>• Provide clinical services for infectious diseases through on-site medical services.<br>• Coordinate with Yukon Health and Social Services to offer influenza vaccination clinics on site.<br>• Monitor for gastroenteritis outbreak (three or more cases in a four-day period), and implement an outbreak management strategy should gastroenteritis cases manifest<br>• Provide free condoms at camp | C, O, R&C | |
| | **Mitigation Measures for Mental Health and Wellness** | Goldcorp will develop and implement the following Mitigation Measures for Mental Health and Wellness:<br>• Provide a comfortable environment for Project staff when off-shift<br>• Plan shifts in blocks (i.e., a block of daytime shifts followed by a block of night shifts); reducing the number of transitions helps to reduce stress.<br>• Develop a workplace wellness strategy in consultation with employees and health professionals.<br>• Implement policies to mitigate potential behavioural issues such as workplace harassment. | C, O, R&C | |

| Mitigation Number | Mitigation Name | Proposed Mitigation – Suggested text | Project Phase(s) | Status |
|---|---|---|---|---|
| | | • Create a Visiting Elders program, where elders from First Nations provide mentorship and support for First Nations and Non-First Nations employees.<br>• Work with local and regional organizations to facilitate mental health support to Project staff when off-shift on site.<br>• Offer support where feasible to reduce the potential for harm. | | |
| | **Mitigation Measures for Health Services Structure and Capacity** | Goldcorp will develop and implement the following Mitigation Measures for Health Services Structure and Capacity:<br>• Communicate with YGHSS regarding anticipated numbers of employees and communities of residence.<br>• Develop an Emergency Response Plan, which will include about on-site emergency response services. Update this plan as needed and shared with hospitals in Dawson and Whitehorse, as well as with emergency services.<br>• Provide on-site health and clinic services for workers with general health concerns | C, O, R&C | |
| | **Complete Heritage Impact Assessment for Northern Access Route and Changes to the Final Project Footprint** | Prior to the start of Project Construction, Goldcorp will<br>• Complete the HRIA for the NAR and any changes to the final Project footprint<br>• Provide recommendations for site-specific mitigation measures for any newly identified archaeological and historical resources in conflict with proposed ground disturbing or clearing activities for the Project<br>• Undertake additional field work in 2017 to support preliminary heritage work on the NAR. The scope of 2017 field work will be determined after consultation with the Heritage Resources Unit, and will include additional stops and shovel testing at areas of archaeological potential and previously disturbed sites.<br>• Determine the scope of the HRIA in other areas on completion of the final footprint | C, O | |
| | **Consult on Appropriate Mitigation Measures** | Goldcorp will consult with First Nations and regulators regarding the choice of appropriate mitigation measures for all heritage resource sites that overlap with areas of proposed ground disturbance. This will include consideration of the remaining mitigation measures listed below in order of preference | C, O | |
| | **Avoid Known Archaeological and Historical Resources** | Goldcorp will:<br>• Avoid known heritage resources (including archaeological sites KfVk-1, KfVk-2, KfVk-3, and historical site KfVk-4) through Project redesign.<br>• Implement avoidance buffers, using flagging tape or physical barrier, around current and future known heritage sites as described in the VC report and any heritage resource assessments. Buffers will be a minimum of 30 m. If site areas cannot be avoided, appropriate mitigation plans will be developed. | CO O | |

| Mitigation Number | Mitigation Name | Proposed Mitigation – Suggested text | Project Phase(s) | Status |
|---|---|---|---|---|
| | **Systematic Data Recovery** | If the resource sites cannot be avoided, Goldcorp will conduct a systematic data recovery (SDR) prior to any potentially ground-altering development activities. All SDR studies will be conducted under the authority of a Historic Resources Act Class 2 permit and in compliance with the Tr'ondëk Hwëch'in Heritage Act. | C, O | |
| | **Implement Monitoring Plans for Construction and Operation Phase Clearing and Ground Disturbance Activities** | If site avoidance is not feasible or practical, and SDR is not warranted because the heritage site has low scientific value, or SDR has occurred and monitoring is warranted, Goldcorp will mitigate Project interactions through a program of archaeological monitoring carried out during development. | C, O | |
| | **Implement Project-Specific Heritage Resources Protection Plan and Chance Find Protocol** | Goldcorp will develop and implement a Heritage Resources Protection Plan, which will:<br>• Provides methods for protecting known heritage resources (archaeological, historical, and paleontological)<br>• Includes a Chance Find Protocol CFP, which will<br>▫ provide those involved in ground-disturbing activities with a framework for identifying cultural materials, and assists in avoiding unforeseen disturbance to heritage resources.<br>▫ provides descriptive information regarding cultural materials commonly found in the region and those most likely to be encountered in the Project area.<br>- Provide both documents will provide Project personnel with procedures on what to do and who to contact in the event that previously unrecorded heritage resources are inadvertently discovered during Project Construction or Operation | C, O | |
| | **Implement Site-Specific Measures for Paleontological Resources** | Goldcorp will follow the guidance provided in the *Yukon Mineral Exploration Best Management Practices for Heritage Resources* (Government of Yukon 2010). Goldcorp will conduct the following activities:<br>• In the event that bone and tusk is uncovered, collect as much of the animal(s) as can be located and preserved. If possible, verify whether it is a single intact skeleton or whether multiple animals are represented.<br>• In the event that a single intact skeleton is found, or mummified remains that preserve the hide or flesh of the animal, avoid further disturbance by protecting the remains through buffering from Project activities, or removing with intact surrounding sediments and storing.<br>• Advise the Yukon Paleontology office of all findings, and store or protect as advised until they can be collected and conserved by the Yukon Paleontology office. | C, O | |

**Notes:** Project Phases: C – Construction, O – Operation, R&C –Reclamation and Closure, P-C – Post-closure.

# 33.0 CONCLUSION

Goldcorp understands that the purpose of the YESAB Executive Committee screening process in Yukon is to inform planning and decision-making by governments to avoid or minimize significant environmental and socio-economic effects while realizing development objectives. Goldcorp recognizes that the YESAB Executive Committee screening process provides an integrated means of identifying, evaluating, and mitigating a proposed project's potential adverse and cumulative effects. This Proposal is in accordance with the requirements specified in section 50(2) of the *Yukon Environmental and Socio-economic Assessment Act*, SC 2003, c. 7, and more broadly with the matters set out in 42(1,2).

Goldcorp has used alternatives and changes in Project design, applied best management practices, and proposes effects-specific mitigation to avoid or decrease potential effects of the Project. Alternatives for Project activities were evaluated that led to changes in Project design to minimize effects. Where effects assessments indicated that adverse effects could occur to a VC, Goldcorp has applied best practices and technically and economically feasible mitigation measures. The results of the effects assessment on VCs, indicate that all Project-related residual adverse effects are likely to be not significant. Over 10 Project-related positive residual effects have been identified, among which three are likely to be significant, including, improved habitat accessibility for Arctic Grayling along the Northern Access Route, improved local economies and beneficial territorial economic growth. A summary of the residual effects assessment for each VC is provided in **Table 33.1-1**.

All Project-related residual effects were considered for their potential to spatially and/or temporally interact or overlap with the residual impacts of present, and reasonably foreseeable future projects and activities. Residual effects found to have a nil or low risk of interacting with other Projects and activities were scoped out of the cumulative effects assessment for further assessment. Consequently, twenty-five residual effects were carried forward; these were all determined to likely be not significant. A summary of the cumulative effects assessment for the VCs is provided in **Table 33.1-2**.

Goldcorp is committed to meaningful consultation with First Nations and engagement with stakeholders and members of the public. Goldcorp intends to continue to provide opportunities for input and direction as the Coffee Gold Mine proceeds through the assessment and permitting processes and throughout the life of the mine. Consultation has influenced the process of site selection, engineering design, implementation of mitigation measures, adherence to best management practices, and implementation of effective environmental management plans. As a result, Goldcorp believes that it can construct, operate, and decommission the Project in a way that meets Yukon's goal of promoting sustainable development while avoiding or minimizing potential adverse environmental and socio-economic effects.

**Table 33.1-1 Summary of Residual Effects Characterization on Valued Components**

| Potential Residual Effects | Project Phase | Proposed Mitigation (or Enhancement) | Potential Degree of Residual Effect after Mitigation | | | | | | | | Significance of Residual Effect | Confidence in Probability and Significance Determination |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Direction | Magnitude | Geographic Extent | Duration | Timing and Frequency | Reversibility | Context | Probability of Occurrence of Residual Effect | | |
| **Surficial Geology, Terrain and Soils** | | | | | | | | | | | | |
| Change to the overall stability of terrain (including permafrost disturbance) | Construction<br>Operation<br>Reclamation and Closure | Project design<br>Minimize footprint<br>Avoidance of unique landforms<br>Terrain hazard avoidance<br>Limit size of overall footprint area<br>Salvage soils for use in reclamation<br>Implement soil quality mitigation measures including adherence to various management and monitoring plans<br>Terrain hazard mitigation for slope failures<br>Terrain hazard mitigation for meander migration, and icing<br>Terrain hazard mitigation for permafrost considerations | Adverse | High | Project Footprint | Long-term | Timing n/a;<br>Once | Partially-reversible | Low | Unlikely | **Not Significant** | Medium |
| Removal of unique landforms | Construction<br>Operation<br>Reclamation and Closure | | Adverse | High | Project Footprint | Permanent | Timing n/a;<br>Once | Irreversible | Low | Likely | **Not Significant** | High |
| Reduced soil quality | Construction<br>Operation<br>Reclamation and Closure | | Adverse | Moderate | Project Footprint | Long-term | Timing n/a;<br>Once | Partially-reversible | Moderate | Likely | **Not Significant** | High |
| **Surface Water Quality** | | | | | | | | | | | | |
| Surface water quality increases above corresponding WQG or proposed SSWQO (Latte Creek: T-U) | Construction<br>Operation<br>Reclamation and Closure<br>Post-closure | Phased mine development and progressive reclamation<br>Management of explosive use and blasting<br>Waste Rock management<br>Management of potential acid rock drainage<br>Processing facilities mitigation and water management<br>Surface water and groundwater protection and management<br>Mine site area water management | Adverse | Low | Local | Long-term | Year-round; Continuous | Irreversible | Low | Likely | **Not Significant** | High |
| Surface water quality increases above corresponding WQG or proposed SSWQO (YT-24: T-As) | Construction<br>Operation | | Adverse | Low | Local | Long-term | Open-water Period; Multiple Regular Event | Reversible | Low | Likely | **Not Significant** | High |
| Surface water quality increases above corresponding WQG or proposed SSWQO (Halfway Creek: T-U) | Construction<br>Operation | | Adverse | Low | Local | Long-term | Open-water Period; Multiple Regular Event | Irreversible | Low | Likely | **Not Significant** | Medium |
| corresponding WQG or proposed SSWQO (Halfway Creek: nitrate, T-U, T-Zn) | Reclamation and Closure | | Adverse | Moderate | Local | Long-term | Open-water Period; Multiple Regular Event | Irreversible | Low | Likely | **Not Significant** | Medium |

| Potential Residual Effects | Project Phase | Proposed Mitigation (or Enhancement) | Potential Degree of Residual Effect after Mitigation | | | | | | | | Significance of Residual Effect | Confidence in Probability and Significance Determination |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Direction | Magnitude | Geographic Extent | Duration | Timing and Frequency | Reversibility | Context | Probability of Occurrence of Residual Effect | | |
| Surface water quality increases above corresponding WQG or proposed SSWQO (Latte Creek: T-U) | Post-closure | Erosion and sediment control<br>Dust management<br>Monitoring and adaptive management | Adverse | Low | Local | Long-term | Year-round; Continuous | Irreversible | Low | Likely | **Not Significant** | High |
| Surface water quality increases above corresponding WQG or proposed SSWQO (Halfway Creek: nitrate, T-U) | Post-closure | | Adverse | Moderate | Local | Long-term | Open-water Period; Multiple Regular Event | Irreversible | Low | Likely | **Not Significant** | Medium |
| **Fish and Fish Habitat** | | | | | | | | | | | | |
| Change in habitat suitability – Arctic Grayling (Mine Site, Latte Creek) | Construction<br>Operation<br>Reclamation and Closure<br>Post-closure | Project design<br>Water Management Plan<br>Erosion and sediment control<br>Best management strategies for working around water<br>Water quality guidelines and standards<br>Progressive reclamation and closure plan<br>Blasting mitigation<br>Metal Leaching / acid rock drainage management and monitoring plan | Adverse | Low | Local | Long-term to Permanent | Less-sensitive Period;<br>Continuous | Partially-reversible | High | Likely | **Not Significant** | Medium |
| Change in habitat suitability – Arctic Grayling (Mine Site, YT-24) | Construction<br>Operation<br>Reclamation and Closure<br>Post-closure | | Positive | Low – High | Local | Long-term to Permanent | Less-sensitive Period;<br>Continuous | Partially-reversible | High | Likely | **Not Significant** | Medium |
| Change in habitat suitability – Arctic Grayling (Mine Site, Halfway Creek) | Construction<br>Operation<br>Reclamation and Closure<br>Post-closure | | Positive | Low – High | Local | Long-term | Less-sensitive Period;<br>Continuous | Partially-reversible | High | Likely | **Not Significant** | Medium |
| Change in habitat suitability – Arctic Grayling (NAR) | Construction | | Adverse | Negligible | Site-specific | Long-term | Less-sensitive Period;<br>Continuous | Partially-reversible | High | Likely | **Not Significant** | High |
| Change in habitat accessibility – Arctic Grayling (NAR) | Construction | | Positive | Positive | Local | Long-term | Less-sensitive Period;<br>Continuous | Fully-reversible | High | Likely | **Significant** | High |
| Contaminant toxicity – Arctic Grayling | Operation<br>Reclamation and Closure<br>Post-closure | | Adverse | Low | Site-specific | Long-term | Less-sensitive Period;<br>Frequent | Partially-reversible | High | Likely | **Not Significant** | High |
| Change in stream productivity – Arctic Grayling | Operation<br>Reclamation and Closure<br>Post-closure | | Adverse | Moderate | Local | Long-term | Less-sensitive Period;<br>Frequent | Partially-reversible | High | Likely | **Not Significant** | Medium |
| Change in habitat suitability – Chinook Salmon (Mine Site, Halfway Creek) | Construction<br>Operation<br>Post-closure | | Positive | Low – High | Local | Long-term - Permanent | Less-sensitive Period;<br>Continuous | Partially-reversible | High | Likely | **Not Significant** | Medium |

| Potential Residual Effects | Project Phase | Proposed Mitigation (or Enhancement) | Potential Degree of Residual Effect after Mitigation | | | | | | | | Significance of Residual Effect | Confidence in Probability and Significance Determination |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Direction | Magnitude | Geographic Extent | Duration | Timing and Frequency | Reversibility | Context | Probability of Occurrence of Residual Effect | | |
| Change in habitat suitability – Chinook Salmon (Mine Site, Halfway Creek) | Construction | | Adverse | Negligible | Site-specific | Long-term | Less-sensitive Period;<br>Continuous | Partially-reversible | High | Likely | **Not Significant** | High |
| Contaminant toxicity - Chinook Salmon | Operation<br>Reclamation and Closure<br>Post-closure | | Adverse | Low | Site-specific | Long-term | Less-sensitive Period;<br>Frequent | Partially-reversible | High | Likely | **Not Significant** | High |
| Change in stream productivity – Chinook Salmon | Operation<br>Post-closure | | Adverse | Moderate | Local | Long-term | Less-sensitive Period;<br>Frequent | Partially-reversible | High | Likely | **Not Significant** | Medium |
| Change in habitat suitability –<br>Chum Salmon | Construction | | Adverse | Negligible | Site-specific | Long-term | Less sensitive;<br>Continuous | Partially-reversible | High | Likely | **Not significant** | High |
| **Vegetation** | | | | | | | | | | | | |
| Habitat loss Ecological Communities | Construction<br>Operation | Project design<br>Minimize habitat loss<br>Limit activities to the Project footprint<br>Minimize dust and emissions<br>Reduce fire hazards to adjacent vegetation<br>Protect rare plants<br>Minimize risk of introduction and spread of invasive plants<br>Awareness training for Project personnel | Adverse | Low | Project Footprint | Permanent | Timing n/a;<br>Infrequent | Partially-reversible | Moderate | Likely | **Not significant** | Medium |
| Habitat loss Wetland Habitats | Construction<br>Operation | | Adverse | Low | Project Footprint | Permanent | Timing n/a;<br>Infrequent | Partially-reversible | Moderate | Likely | **Not significant** | Medium |
| Habitat loss Traditional and Medicinal Plants | Construction<br>Operation | | Adverse | Low | Project Footprint | Permanent | Timing n/a;<br>Infrequent | Partially-reversible | Moderate | Likely | **Not significant** | Medium |
| Habitat loss Rare Plants | Construction<br>Operation | | Adverse | Low | Project Footprint | Permanent | Growing season;<br>Infrequent | Partially-reversible | Low | Unlikely | **Not significant** | Medium |
| Dust deposition Vegetation Health | Construction<br>Operation<br>Reclamation and Closure | | Adverse | Moderate | Local | Long-term | Growing season;<br>Continuous | Partially-reversible | Moderate | Likely | **Not significant** | Medium |
| **Wildlife and Wildlife Habitat** | | | | | | | | | | | | |
| Habitat loss and reduced habitat effectiveness – Fortymile Caribou | Construction<br>Operation<br>Reclamation and Closure | Project design<br>Project personnel wildlife awareness orientation<br>Minimize habitat disturbance<br>Reduce human-wildlife encounter risk<br>Wildlife protection protocols | Adverse | Low | Local | Long-term | Winter;<br>Continuous | Partially-reversible | High | Likely | **Not Significant** | Medium |
| Mortality risk – Fortymile Caribou | Construction<br>Operation<br>Reclamation and Closure | | Adverse | Low | Project Footprint | Long-term | Winter;<br>Infrequent | Partially-reversible | High | Unlikely | **Not Significant** | High |

| Potential Residual Effects | Project Phase | Proposed Mitigation (or Enhancement) | Potential Degree of Residual Effect after Mitigation | | | | | | | | Significance of Residual Effect | Confidence in Probability and Significance Determination |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Direction | Magnitude | Geographic Extent | Duration | Timing and Frequency | Reversibility | Context | Probability of Occurrence of Residual Effect | | |
| Alteration to movement – Fortymile Caribou | Construction<br>Operation<br>Reclamation and Closure | Manage traffic<br>Reduce barriers to movement<br>Manage aircraft operations<br>Prevent wildlife entrapment | Adverse | Low | Local | Long-term | Winter;<br>Frequent | Partially-reversible | High | Likely | **Not Significant** | Medium |
| Habitat loss and reduced habitat effectiveness – Klaza Caribou | Construction<br>Operation<br>Reclamation and Closure | | Adverse | Low | Local | Long-term | Seasonal (May-September);<br>Continuous | Partially-reversible | High | Likely | **Not Significant** | Medium |
| Habitat loss and reduced habitat effectiveness – Moose | Construction<br>Operation<br>Reclamation and Closure | | Adverse | Low | Local | Long-term | Seasonal (Winter);<br>Continuous | Partially-reversible | High | Likely | **Not Significant** | Medium |
| Mortality risk – Moose | Construction<br>Operation<br>Reclamation and Closure | | Adverse | Low | Project Footprint to Regional | Long-term | Year-round;<br>Continuous | Partially-reversible | High | Likely | **Not Significant** | High |
| Habitat loss and reduced habitat effectiveness – Thinhorn Sheep | Construction<br>Operation<br>Reclamation and Closure | | Adverse | Low | Local | Long-term | Year-round;<br>Continuous | Partially-reversible | High | Likely | **Not Significant** | Medium |
| Alteration to movement – Thinhorn Sheep | Construction<br>Operation<br>Reclamation and Closure | | Adverse | Low | Local | Long-term | Year-round;<br>Infrequent | Partially-reversible | High | Likely | **Not Significant** | Medium |
| Habitat loss and reduced habitat effectiveness – Grizzly Bear | Construction<br>Operation<br>Reclamation and Closure | | Adverse | Low | Local | Long-term | Year-round;<br>Continuous | Partially-reversible | Moderate | Likely | **Not Significant** | Medium |
| Habitat loss and reduced habitat effectiveness – Wolverine | Construction<br>Operation<br>Reclamation and Closure | | Adverse | Low | Local | Long-term | Seasonal (Winter);<br>Continuous | Partially-reversible | Moderate | Likely | **Not Significant** | Medium |
| Habitat loss and reduced habitat effectiveness – Little Brown Myotis | Construction<br>Operation<br>Reclamation and Closure | | Adverse | Low | Local | Long-term | Seasonal (Summer);<br>Continuous | Partially-reversible | Moderate | Likely | **Not Significant** | Medium |

| Potential Residual Effects | Project Phase | Proposed Mitigation (or Enhancement) | Potential Degree of Residual Effect after Mitigation | | | | | | | | Significance of Residual Effect | Confidence in Probability and Significance Determination |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Direction | Magnitude | Geographic Extent | Duration | Timing and Frequency | Reversibility | Context | Probability of Occurrence of Residual Effect | | |
| **Bird and Bird Habitat** | | | | | | | | | | | | |
| Reduced habitat effectiveness – Cliff-nesting Raptors | Construction<br>Operation<br>Reclamation and Closure | Project design<br>Project personnel wildlife awareness orientation<br>Minimize habitat disturbance<br>Avoid disturbance during breeding bird season<br>Protect active and identified nests<br>Manage traffic | Adverse | Low | Local | Long-term | Breeding season;<br>Continuous at mine site; Frequent on NAR | Fully-reversible | Moderate | Likely | **Not Significant** | Medium |
| Habitat loss – Passerines | Construction | | Adverse | Low | Project Footprint | Long-term | Breeding season;<br>Infrequent | Partially-reversible | High | Likely | **Not Significant** | Medium |
| Reduced habitat effectiveness – Passerines | Construction<br>Operation<br>Reclamation and Closure | | Adverse | Low | Local | Long-term | Breeding season;<br>Continuous (mine); Frequent (NAR) | Fully-reversible | High | Likely | **Not Significant** | Medium |
| Habitat loss – Upland-associated Species at Risk | Construction | | Adverse | Low | Project Footprint | Long-term | Breeding season<br>Infrequent | Partially-reversible | Moderate | Likely | **Not Significant** | Medium |
| Reduced habitat effectiveness – Upland-associated Species at Risk | Construction<br>Operation<br>Reclamation and Closure | | Adverse | Low | Local | Long-term | Breeding season;<br>Continuous (mine); Frequent (NAR) | Fully-reversible | Moderate | Likely | **Not Significant** | Medium |
| Habitat loss – Wetland-associated Species at Risk | Construction | | Adverse | Low | Project Footprint | Long-term | Breeding season;<br>Infrequent | Partially-reversible | Moderate | Likely | **Not Significant** | Medium |
| Reduced habitat effectiveness – Wetland-associated Species at Risk | Construction<br>Operation<br>Reclamation and Closure | | Adverse | Low to Moderate | Local (within 300 m of Project Footprint) | Long-term | Breeding season;<br>Continuous (mine) Frequent (NAR) | Fully-reversible | Moderate | Likely | **Not Significant** | Medium |
| Reduced habitat effectiveness – Barn Swallow | Construction<br>Operation<br>Reclamation and Closure | | Adverse | Low | Local | Long-term | Breeding season;<br>Continuous (mine)<br>Frequent (NAR) | Fully-reversible | Moderate | Likely | **Not Significant** | Medium |

| Potential Residual Effects | Project Phase | Proposed Mitigation (or Enhancement) | Potential Degree of Residual Effect after Mitigation | | | | | | | | Significance of Residual Effect | Confidence in Probability and Significance Determination |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Direction | Magnitude | Geographic Extent | Duration | Timing and Frequency | Reversibility | Context | Probability of Occurrence of Residual Effect | | |
| **Economic Conditions** | | | | | | | | | | | | |
| Increased direct, indirect, and induced employment opportunities | Construction<br>Operation | Local hiring practices<br>Local contracting and procurement practices<br>Education and training activities<br>Engagement Plan<br>Workforce transition strategy | Positive | Moderate to High | Local to Regional | Long-term | Timing n/a;<br>Continuous | Fully-reversible | Moderate to High | Likely | **Not Significant to Significant** (varies within and across communities) | Medium |
| Increased income levels and changes in income distribution patterns resulting from increased employment opportunities | Construction<br>Operation | | Positive | Moderate to High | Local to Regional | Long-term | Timing n/a;<br>Continuous | Fully-reversible | Moderate to High | Likely | **Not Significant to Significant** (depending on geographic extent) | Medium |
| Effects on the labour market | Construction<br>Operation | | Neutral | Moderate | Local to Regional | Long-term | Timing n/a;<br>Continuous | Fully-reversible | Moderate to High | Likely | **Not Significant** | Medium |
| Increased contracting and procurement opportunities | Construction<br>Operation | | Positive | Moderate to High | Local to Regional | Long-term | Timing n/a;<br>Continuous | Fully-reversible | Moderate to High | Likely | **Significant** (locally)<br>**Not Significant** (regionally) | Medium |
| Change in local economies | Construction<br>Operation | | Neutral and Positive | High | Local | Long-term | Timing n/a;<br>Continuous | Fully-reversible | Moderate | Likely | **Significant** | Medium |
| Beneficial territorial economic growth | Construction<br>Operation | | Positive | High | Regional | Long-term | Timing n/a;<br>Continuous | Fully-reversible | High | Likely | **Significant** | Medium |
| Change in government fiscal flows | Construction<br>Operation | | Neutral | Moderate | Local to Regional | Long-term | Timing n/a;<br>Continuous | Fully-reversible | Moderate to High | Likely | **Not Significant** | Medium |
| **Social Economy** | | | | | | | | | | | | |
| Access-related change in ability to conduct subsistence activities (non-wage economy) | Construction<br>Operation<br>Reclamation and Closure | Cultural awareness training<br>Northern Access Route mitigation measures<br>Engagement plan<br>Traditional economy enhancement measures | Adverse | Low to Moderate | Local | Long-term | Seasonal;<br>Continuous | Partially-reversible | Moderate | Likely | **Not Significant** | Medium |
| Change in availability of time and ability to conduct subsistence activities (non-wage economy) | Construction<br>Operation<br>Reclamation and Closure | | Adverse | Negligible to Low | Local | Long-term | Seasonal;<br>Continuous | Fully-reversible | Moderate | Likely | **Not Significant** | Medium |
| Access-related change in ability to conduct traditional economic activities | Construction<br>Operation<br>Reclamation and Closure | | Adverse | Low to Moderate | Local to Regional | Long-term | Seasonal;<br>Continuous | Partially-reversible | Moderate | Likely | **Not Significant** | Medium |
| Income-related change in ability to engage in traditional economic activities | Construction<br>Operation<br>Reclamation and Closure | | Adverse | Low to Moderate | Local to Regional | Long-term | Seasonal;<br>Continuous | Fully-reversible | Moderate | Likely | **Not Significant** | Medium |

| Potential Residual Effects | Project Phase | Proposed Mitigation (or Enhancement) | Potential Degree of Residual Effect after Mitigation | | | | | | | | Significance of Residual Effect | Confidence in Probability and Significance Determination |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Direction | Magnitude | Geographic Extent | Duration | Timing and Frequency | Reversibility | Context | Probability of Occurrence of Residual Effect | | |
| **Community Infrastructure and Services** | | | | | | | | | | | | |
| Increased Demand on Housing and Accommodation | Construction<br>Operation | Project design<br>Local hiring practices<br>Education and training activities<br>Engagement Plan<br>Emergency Response Plan<br>Road safety measures<br>Flight scheduling | Adverse | Moderate | Local | Long-term | Seasonal; Continuous | Fully-reversible | Moderate | Likely | **Not Significant** | Medium |
| Increased Demand on Physical Infrastructure | Construction<br>Operation | | Adverse | Low | Local | Long-term | Seasonal; Continuous | Fully-reversible | Moderate | Likely | **Not Significant** | Medium |
| Increased Demand on Community Services | Construction<br>Operation | | Adverse | Low | Local | Long-term | Seasonal; Continuous | Fully-reversible | Moderate | Likely | **Not Significant** | Medium |
| **Education Services** | | | | | | | | | | | | |
| Changes in primary, secondary, and post-secondary enrollment patterns | Construction<br>Operation | Local hiring practices<br>Education and training activities<br>Engagement Plan | Neutral (Whitehorse) | Moderate | Local | Long-term | Timing n/a; Continuous | Fully-reversible | Moderate | Likely | **Not Significant** | Medium |
| | | | Adverse (Dawson) | Moderate | Local | Long-term | Timing n/a; Continuous | Fully-reversible | Moderate | Likely | **Not Significant** | Medium |
| **Land and Resource Use** | | | | | | | | | | | | |
| Decrease in the availability of non-traditional land | Construction<br>Operation<br>Reclamation and Closure | Project design<br>Mitigation measures for relevant valued components or intermediate components<br>Traditional economy enhancement measures<br>Access Route Construction and Operational Management Plans<br>Water Management Plan<br>Engagement Plan<br>Erosion and Sediment Control Plans<br>Fish and Aquatic Habitat Protection Plan<br>Vegetation Management Plan<br>Wildlife Protection Plan<br>Noise Management Plan<br>Heritage Resources Protection Plan | Adverse | Low | Local | Long-term | Timing n/a; Continuous | Partially-reversible | Moderate | Likely | **Not Significant** | Medium |
| Change in access to non-traditional land and resources | Construction<br>Operation<br>Reclamation and Closure | | Adverse | Moderate | Regional | Long-term | Seasonal; Continuous | Partially-reversible | Moderate | Likely | **Not Significant** | Medium |
| Change in sensory conditions on non-traditional land, by way of changed air quality | Construction<br>Operation<br>Reclamation and Closure | | Adverse | Low | Local | Long-term | Seasonal; Continuous | Reversible | Moderate to High | Likely | **Not Significant** | Medium |
| Decrease in quality of non-traditional land and resources (specifically water) | Construction<br>Operation<br>Reclamation and Closure | | Adverse | Low | Local to Regional | Long-term | Seasonal; Continuous | Partially-reversible | Moderate | Likely | **Not Significant** | Medium |
| Decrease in the availability of traditionally-used land | Construction<br>Operation | | Adverse | Low | Local | Long-term | Timing n/a; Continuous | Partially-reversible | Moderate | Likely | **Not Significant** | High |
| Increase in access to traditionally-used land and resources | Construction<br>Operation<br>Reclamation and Closure | | Adverse (Displacement of existing traditional use) | Moderate | Regional | Long-term | Seasonal; Continuous | Partially-reversible | Moderate | Likely | **Not Significant** | Medium |

| Potential Residual Effects | Project Phase | Proposed Mitigation (or Enhancement) | Potential Degree of Residual Effect after Mitigation | | | | | | | | Significance of Residual Effect | Confidence in Probability and Significance Determination |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Direction | Magnitude | Geographic Extent | Duration | Timing and Frequency | Reversibility | Context | Probability of Occurrence of Residual Effect | | |
| | | | Positive (Facilitation of traditional use) | Moderate | Regional | Long-term | Seasonal; Continuous | Partially-reversible | Moderate | Likely | **Not Significant** | Medium |
| Change in sensory conditions on traditionally-used land, by way of changed air quality | Construction Operation Reclamation and Closure | | Adverse | Low | Local | Long-term | Seasonal; Continuous | Reversible | Moderate to High | Likely | **Not Significant** | Medium |
| Change in sensory conditions on traditionally-used land, by way of changed visual aesthetics | Construction Operation Reclamation and Closure | | Adverse | Low | Local | Long-term | Seasonal; Continuous | Partially-reversible | Moderate to High | Likely | **Not Significant** | Medium |
| Decrease in quality of traditionally-used resources (specifically water) | Construction Operation Reclamation and Closure | | Adverse | Low | Local | Long-term | Seasonal; Continuous | Partially-reversible | Moderate | Likely | **Not Significant** | Medium |
| Change in quality of intangible cultural and spiritual resources | Construction Operation Reclamation and Closure | | Positive | Low | Local to Regional | Long-term | Year-round; Continuous | Partially-reversible | Moderate | Likely | **Not Significant** | Medium |
| **Community Health and Well-Being** | | | | | | | | | | | | |
| Increase in crime | Construction Operation | Mitigation measures for Crime Mitigation measures for Country Food Quality Mitigation measures for Accidents and Injuries Mitigation measures for Infectious Diseases Mitigation measures for Mental Health and Wellness Mitigation measures for Health Services Structure and Capacity | Adverse | Low | Local | Short-term | Seasonal; Infrequent | Reversible | Moderate to High | Likely | **Not Significant** | Medium |
| Increase in Infectious Disease rates | Construction Operation | | Adverse | Low | Local | Long-term | Shift-work; Continuous | Reversible | Moderate to High | Likely | **Not Significant** | High |
| Positive effect on food security | Construction Operation | | Positive | Low | Local | Long-term | Project Phase; Continuous | Reversible | Moderate to High | Likely | **Not Significant** | Medium |
| Adverse effects on mental health and wellness | Construction Operation | | Adverse | Low | Local | Long-term | Project Phase; Continuous | Reversible | Moderate to High | Likely | **Not Significant** | Medium |
| Increased pressure on health services structure and capacity | Construction Operation | | Adverse | Low | Local | Long-term | Project Phase; Continuous | Reversible | Moderate to High | Likely | **Not Significant** | High |

**Table 33.1-2 Summary of Residual Cumulataive Effects Characterization on Valued Components**

| Potential Residual Cumulative Effects | Other Projects or Activities | Proposed Mitigation (or Enhancement) | Potential Degree of Residual Cumulative Effect after Mitigation | | | | | | | | Significance of Cumulative Residual Effect | Confidence in Probability and Significance Determination |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Direction | Magnitude | Geographic Extent | Duration | Timing and Frequency | Reversibility | Context | Probability of Occurrence of Residual Cumulative Effect | | |
| **Fish and Fish Habitat** | | | | | | | | | | | | |
| Localized changes in habitat accessibility and water quality and/or quantitiy | Placer Mining<br>Quartz Mining | Project-related mitigation outlined in previous table<br>Existing regulatory project review process<br>Use appropriate stream crossings on fish-bearing streams and best management practices when working around water<br>Adaptive managmenet measures | Neutral | Moderate | Regional | Long-term | Sensitive Period;<br>Frequent | Fully-reversible | High | Unlikely | **Not Significant** | Medium |
| **Vegetation** | | | | | | | | | | | | |
| Direct habitat loss | Placer Mining<br>Quartz Mining<br>Existing road network | Project-related mitigation outlined in previous table<br>Adaptive managmenet measures<br>Existing regulatory project | Adverse | Low | Regional | Long-term | Timing n/a;<br>Infrequent | Partially-reversible | Moderate | Likely | **Not Significant** | Medium |
| **Wildlife and Wildlife Habitat** | | | | | | | | | | | | |
| Habitat loss and reduced habitat effectiveness – Fortymile Caribou | Agriculture<br>Energy<br>Existing road network<br>Forestry<br>Industry<br>Placer Mining<br>Quartz Mining and Exploration<br>Settlements<br>Transporation<br>Utilities<br>Wildlife (hunting and trapping) | Project-related mitigation outlined in previous table<br>Adaptive managmenet measures<br>Existing regulatory project review process | Adverse | Moderate | Regional | Long-term | Seasonal (winter);<br>Continuous | Partially-reversible | High | Likely | **Not Significant** | Medium to High |
| Mortality risk – Fortymile Caribou | | | Adverse | Low | Regional | Long-term | Seasonal (winter);<br>Infrequent | Partially-reversible | High | Unlikely | **Not Significant** | High |
| Alteration to movement – Fortymile Caribou | | | Adverse | Low | Regional | Long-term | Seasonal (winter);<br>Frequent | Partially-reversible | High | Likely | **Not Significant** | Medium |
| Habitat loss and reduced habitat effectiveness – Klaza Caribou | | | Adverse | Moderate | Regional | Long-term | Year-round;<br>Continuous | Partially-reversible | High | Likely | **Not Significant** | Medium |
| Habitat loss and reduced habitat effectiveness – Moose | | | Adverse | Low | Regional | Long-term | Seasonal (winter);<br>Continuous | Partially-reversible | High | Likely | **Not Significant** | Medium |
| Mortality risk – Moose | | | Adverse | Low | Regional | Long-term | Year-round;<br>Infrequent | Partially-reversible | High | Likely | **Not Significant** | Medium |
| Habitat loss and reduced habitat effectiveness – Thinhorn Sheep | | | Adverse | Low | Regional | Long-term | Year-round;<br>Continuous | Partially-reversible | High | Likely | **Not Significant** | Medium |

| Potential Residual Cumulative Effects | Other Projects or Activities | Proposed Mitigation (or Enhancement) | Potential Degree of Residual Cumulative Effect after Mitigation | | | | | | | | Significance of Cumulative Residual Effect | Confidence in Probability and Significance Determination |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Direction | Magnitude | Geographic Extent | Duration | Timing and Frequency | Reversibility | Context | Probability of Occurrence of Residual Cumulative Effect | | |
| Alteration to movement – Thinhorn Sheep | | | Adverse | Moderate | Regional | Long-term | Year-round; Infrequent | Partially-reversible | High | Likely | **Not Significant** | Low |
| Habitat loss and reduced habitat effectiveness – Grizzly Bear | | | Adverse | Low | Regional | Long-term | Year-round; Infrequent | Partially-reversible | High | Likely | **Not Significant** | Medium |
| Habitat loss and reduced habitat effectiveness – Wolverine | | | Adverse | High | Regional | Long-term | Seasonal (winter); Continuous | Partially-reversible | Moderate | Unikely | **Not Significant** | Medium |
| Habitat loss and reduced habitat effectiveness – Little Brown Myotis | | | Adverse | Low | Regional | Long-term | Seasonal (summer); Continuous | Partially-reversible | Moderate | Unlikely | **Not Significant** | Medium |
| **Bird and Bird Habitat** | | | | | | | | | | | | |
| Habitat loss – All bird subgroups | Quartz Mining<br>Quartz Exploration<br>Placer Mining<br>Existing road network<br>General physical disturbance | Project-related mitigation outlined in previous table<br>Adaptive managmenet measures<br>Existing regulatory project review process | Adverse | Low | Regional | Long-term | Year-round; Infrequent | Partially-reversible | Moderate | Likely | **Not Significant** | Medium |
| Reduced habitat effectiveness – All bird subgroups | | | Adverse | Moderate | Regional | Long-term | Year-round; Frequent | Partially-reversible | Moderate | Likely | **Not Significant** | Medium |
| **Social Economy** | | | | | | | | | | | | |
| Access-related change in ability to conduct subsistence activities (non-wage economy) | Placer Mining<br>Quartz Mining and Exploration<br>Settlements<br>Existing road network | Project-related mitigation outlined in previous table<br>Adaptive managmenet measures<br>Existing regulatory project review process | Adverse | Moderate | Local to Regional | Long-term | Seasonal; Continuous | Partially-reversible | Low | Likely | **Not Significant** | Low |
| Change in availability of time and ability to conduct subsistence activities (non-wage economy) | | | Adverse | Low | Local to regional | Long-term | Seasonal; Continuous | Partially-reversible | Low | Liikely | **Not Significant** | Low |
| Access-related change in ability to engage in traditional economic activities | | | Adverse | Moderate | Local to Regional | Long-term | Seasonal; Continuous | Partially-reversible | Low | Likely | **Not Significant** | Low |
| Income-related change in ability to engage in traditional economic activities | | | Adverse | Moderate | Local to Regional | Long-term | Seasonal; Continuous | Partially-reversible | Low | Likely | **Not Significant** | Low |

| Potential Residual Cumulative Effects | Other Projects or Activities | Proposed Mitigation (or Enhancement) | Potential Degree of Residual Cumulative Effect after Mitigation | | | | | | | | Significance of Cumulative Residual Effect | Confidence in Probability and Significance Determination |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Direction | Magnitude | Geographic Extent | Duration | Timing and Frequency | Reversibility | Context | Probability of Occurrence of Residual Cumulative Effect | | |
| **Community Infrastructure and Services** | | | | | | | | | | | | |
| Change in Demand Community and Infrastructure and Services | Placer Mining<br>Quartz Mining and Exploration | Project-related mitigation outlined in previous table<br>Adaptive managmenet measures to address reasonably forseeable growth scenarios<br>Existing regulatory project review process | Adverse | Moderate | Regional | Long-term | Seasonal; Continuous | Reversbile | Moderate | Likely | **Not Significant** | Low |
| **Education Services** | | | | | | | | | | | | |
| Changes in primary, secondary, and post-secondary enrollment patterns | Quartz mining<br>Placer mining | Project-related mitigation outlined in previous table.<br>Adaptive managmenet measures<br>Existing regulatory project review process | Adverse | Moderate | Local | Moderate-term | Timing n/a; Continuous | Fully-reversible | Moderate | Likely | **Not Significant** | Low to Medium |
| **Land and Resource Use** | | | | | | | | | | | | |
| Increase in access to non-traditional land and resources | Quartz mining<br>Placer mining<br>Existing road network | Project-related mitigation outlined in previous table<br>Adaptive managmenet measures<br>Existing regulatory project review process | Adverse | Moderate | Regional | Long-term | Seasonal; Continuous | Partially reversible | Moderate | Likely | **Not Significant** | Medium |
| Increase in access to traditionally-used land and resources | | | Adverse | Moderate | Regional | Long-term | Seasonal; Continuous | Partially reversible | Moderate | Likely | **Not Significant** | Medium |
| **Community Health and Well-Being** | | | | | | | | | | | | |
| Positive effect on food security | Quartz mining | Project-related mitigation outlined in previous table<br>Adequate resourcing<br>Work with local communities and governments to participate in implementation of mitigation strategies and programs<br>Adaptive managmenet measures<br>Existing regulatory project review process | | | | | | | | | | |
| Adverse effects on mental health and wellness | | | Adverse | Low | Local | Long-term | Project Phase; Continuous | Reversible | Moderate to High | Likely | **Not Significant** | Medium |

# 34.0 ACKNOWLEDGEMENT AND CERTIFICATION

The information contained in this Project Proposal is required for conducting an executive committee screening under the *Yukon Environmental and Socio-economic Assessment Act* (YESAA). I acknowledge that pursuant to section 118 of YESAA, a copy of this Project Proposal will be placed on a publicly accessible register.

I understand that misrepresenting or omitting information required for the screening may cause delays in the assessment process.

I certify that the information contained in this Project Proposal is true and correct to the best of my knowledge and belief.

Signature included in secure electronic files and hardcopies

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Date