# Coffee Gold Mine

# YESAB Project Proposal

# Appendix 10-A Noise Intermediate Component Analysis Report

# VOLUME II

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# ACRONYMS AND ABBREVIATIONS

| Acronym / Abbreviation | Definition |
|---|---|
| BC | British Columbia |
| DO | Designated Office |
| EA | Environmental and socio-economic assessment |
| GMA | Game Management Area |
| GMZ | Game Management Zone |
| IC | Intermediate Component |
| ISO | International Organization for Standardization |
| Kaminak | Kaminak Gold Corporation |
| LSA | Local Study Area |
| OBCF | Octave Band Center Frequency |
| OGC | Oil and Gas Commission |
| Project | Coffee Gold Mine Project |
| PSL | Permissible Sound Level |
| RISC | Resource Inventory Standards Committee |
| ROM | Run-of-mine |
| RSA | Regional Study Area |
| TK | Traditional Knowledge |
| VC | Valued Environmental Component or Valued Socio-economic Component |
| WRSF | Waste Rock Storage Facility |
| YESAB | Yukon Environmental and Socio-economic Assessment Board |

# SYMBOLS AND MEASUREMENTS

| Symbol / Measurement | Definition |
|---|---|
| µPa | Micropascal |
| °C | Degree Celsius |
| dB | Decibel |
| dBA | A-weighted Decibel |
| dBL | Linear or Unweighted Decibel |
| ft. | Foot (feet) |
| G | Ground Absorption Coefficient |
| Hz | Hertz |
| kg | Kilogram |
| km | Kilometre |
| $L_{eq}$ | Equivalent Sound Level |
| $L_{max}$ | Maximum Sound Level |
| $L_{n}$ | Statistical Sound Level |
| $L_{P}$ | Sound Pressure Level |
| $L_{peak}$ | Unweighted Peak Noise Level |
| $L_{W}$ | Sound Power Level |
| m | Metre |
| Moz | Million ounces |
| Mtpa | Million tonnes per annum |
| tpd | Tonnes per day |
| W | Watt |

# 1.0 INTRODUCTION

The Coffee Gold Mine (Project) is a proposed gold development project in west-central Yukon, approximately 130 kilometres (km) south of Dawson City. The Project is located on Crown Land within the traditional territory of Tr'ondëk Hwëch'in and the asserted area of White River First Nation. A portion of Kaminak's claim block is located in Selkirk First Nation's traditional territory. The Project is scoped as an open pit gold mine using a cyanide heap leach process to extract ore. It would consist of an 18-month construction period, followed by a 12-year mine life with an average operation rate of five million tonnes per annum of heap leach feed, producing.

Kaminak Gold Corporation, a wholly owned subsidiary of Goldcorp Inc. (Proponent or Goldcorp), has retained Tetra Tech EBA Inc. (Tetra Tech) to undertake an analysis of Noise Intermediate Component (IC). The information provided in this analysis report supports the Project Proposal to be submitted to the Yukon Environmental and Socio-economic Assessment Board (YESAB) Executive Committee for screening under the *Yukon Environmental and Socio-Economic Assessment Act* (YESAA), and applications to be submitted for a Quartz Mining Licence from Yukon Government and a Type A Water Licence from the Yukon Water Board, among other permits and licences.

The Project, comprising four Open Pits called Latte, Double Double, Supremo and Kona, is proposed to be mined at an average rate of 5 million tonnes per annum (Mtpa) of heap leach feed by conventional shovel and truck methods. The ore will be crushed and placed onto a Heap Leach Facility by truck for nine months of the year. During the three coldest months of winter, run-of-mine (ROM) ore will be stockpiled. Gold will be extracted from pregnant leach solution by a 5 tonnes per day (tpd) Absorption, Desorption, and Refining (ADR) carbon plant with mercury retorting to produce a final gold doré product. A total of 1.9 million ounces (Moz) of gold is planned to be recovered, including the pre-production period, over an 11 ½-year mine life.

Project construction and operations will generate noise largely due to the heavy vehicles and equipment needed for mining activities. This report will detail all aspects of the Project noise analysis including:

- Scope of analysis – issues scoping, description of the IC selection process and outcome, and the establishment of spatial and temporal analysis boundaries.
- Provide an overview of noise-related terms and concepts.
- Description of existing baseline sound conditions.
- Analysis of potential Project noise impacts and noise mitigation measures, if necessary.
- A discussion of potential cumulative noise impacts in conjunction with other past, present, and future developments and activities in the vicinity of the Project.

### 1.1 ISSUES SCOPING

The YESAB defines Valued Environmental and Socio-economic Components (VCs) as elements of the environmental and/or socio-economic systems valued for environmental, scientific, social, aesthetic, or cultural reasons. An IC is defined as a component in an intermediate position along a pathway of effects leading to one or more receptors or VCs.

Noise was selected as an IC early during the Project permitting process. Scoping activities primarily consisted of consultation with YESAB, First Nations, and the public. YESAB discusses noise in their publication, *Proponent's Guide to Information Requirements for Executive Committee Project Proposal Submission*, (YESAB 2005), stating the following:

> *"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."*

Traditional knowledge (TK) was also collected from First Nations and influenced the selection of noise as an IC. The following subsections describe the process used to select noise as an IC, identifies and justifies spatial and temporal boundaries for the analysis, and identifies and describes the indicators used to evaluate potential adverse changes related to noise on the surrounding environment.

### 1.2 SELECTION OF NOISE

Valued Environmental and Socio-economic Components are broad components of the biophysical, ecosystem, and human environments that, if altered by the Project, would be of concern to First Nation citizens, regulatory agencies, resource managers, scientists, and members of the general public. The VC selection process set out in **Section 5.1.2 Assessment Methodology, Selection of Valued Environmental and Socio-economic Components** of the Project Proposal was followed and it was determined that noise was most appropriately identified as an IC. Noise was chosen as an IC because airborne sound can potentially affect human and wildlife health and well-being. Noise levels are important to individuals and wildlife for several reasons such as sleep disturbance, annoyance, habitat avoidance, and stress.

**Table 5.3 Intermediate Component and Valued Component Linkages**, included in **Section 5.0 Assessment Methodology** of the Project Proposal includes a brief description of linkages between the Project, Noise, other ICs, and/or selected VCs in the context of each effects pathway. Further information about other VCs potentially impacted by changes to noise are presented in the following Sections and Appendices of the Project Proposal:

- Wildlife and Wildlife Habitat; **Section 16.0, Appendix 16-A**
- Birds and Bird Habitat; **Section 17.0, Appendix 17-A**
- Community Health and Well-being, **Section 25.0, Appendix 25-B**
- Social Economy, **Section 21.0, Appendix 21**
- Land and Resource Use, **Section 24.0, Appendix 24**.

### 1.2.1 CANDIDATE ICS

Noise was identified as an IC through the regulatory framework and through input from First Nations. Yukon does not have any noise-related requirements; however, guidance provided by British Columbia (BC) has been used to support previous permitting applications to Yukon and is referred to for the current Project (BC OGC 2009). Traditional knowledge was also obtained from First Nations, mainly from the White River First Nation (WRFN) Knowledge and Use Study and the Coffee Creek Traditional Knowledge Survey, Final Report. **Table 1.2-1** details quotes and references from those studies, which assisted in IC selection process. The First Nations have concerns regarding the tranquility of the area surrounding the Project being disturbed. There were also concerns raised regarding disturbance to animals and recreational areas where camping and cultural gatherings would typically take place.

**Table 1.2-1 Traditional Knowledge Noise Quotes and References**

| Relevance | Topic | TK Quote | Reference | Applicable Component |
|---|---|---|---|---|
| Evidence to support the argument that the area should be treated as a sensitive receptor and the importance of mitigation measures to minimize impacts. | Cultural / Spiritual<br>Potential Project Interactions - Noise | "WRFN participants therefore expressed concerns about the impacts that ongoing visual and sound pollution from project operations would have on their sense of connection to the landscape, and to the site at the mouth of Coffee Creek in particular. Large numbers of workers being present in the area, traffic, other sources of disturbance and fears of contamination associated with a large industrial project, will also all serve to diminish the sense of tranquility and spirituality that WRFN members associate with the site. WRFN members report dismay at what has already taken place at the site, including excavation and the construction of a road.<br>*But, you know, the impact of — once you open a road, it's just going to keep going further, you know? Like, they opened this one [a different gold mine] … But you go up there and — first couple years I went up there, were just — people are just mining it. And then didn't go up there for three years. So one day, we said, "Yeah, we'd better fly around up there." We flew up there. … You drive up and that road is up on the hill. And then all of a sudden, you come in this area, all of a sudden there's an airport. Roads going all over the damn place here. … And all of a sudden, it was just like that. Was just people all over the frickin' place. Road all over the damn place. They fly vehicles in, you know? On the airport. And now you've got vehicles running around all over the damn place, you know*? W05 19-Aug-2014" p.46 | 2014. Bates, P., DeRoy, S., The Firelight Group, with White River First Nation. White River First Nation Knowledge and Use Study (For Kaminak Gold Corporation) | Air and Noise |
| Evidence to support the argument that the area should be treated as a sensitive receptor and the importance of mitigation measures to minimize impacts. | Potential Project Interactions- Cultural /Spiritual | In summary, potential project interactions from the Coffee Gold Project with WRFN intangible cultural heritage and cultural continuity include:<br>The potential disturbance and loss of an important cultural, historical and spiritual site due to visual and noise pollution from mine activities and an increase in people in the area<br>Reduced opportunities for teaching WRFN culture and passing on WRFN oral history due to loss of and alienation from an important site where that history and knowledge is based, reduced opportunities for travelling on the land, and reduced traditional harvesting activities due to local reductions in quality and quantity of game, fish and plants.<br>A potential reduction in the connection WRFN members feel toward the landscape in general due to changes in the character and feel of the landscape, due to visual pollution, increased noise and disturbance from traffic, increased numbers of people, and fears over contamination." p. 47 | 2014. Bates, P., DeRoy, S., The Firelight Group, with White River First Nation. White River First Nation Knowledge and Use Study (For Kaminak Gold Corporation) | Air and Noise |

| Relevance | Topic | TK Quote | Reference | Applicable Component |
|---|---|---|---|---|
| Evidence to support the argument that the area should be treated as a sensitive receptor and the importance of mitigation measures to minimize impacts. | Potential Project Interactions- Cultural Integrity | "A potential reduction in the connection WRFN members feel toward the landscape in general due to changes in the character and feel of the landscape, due to visual pollution, increased noise and disturbance from traffic, increased numbers of people, and fears over contamination" p.6 | 2014. Bates, P., DeRoy, S., The Firelight Group, with White River First Nation. White River First Nation Knowledge and Use Study (For Kaminak Gold Corporation) | Air and Noise |
| Evidence to support the argument that the area should be treated as a sensitive receptor and the importance of mitigation measures to minimize impacts. | Potential Project Interactions- Noise | "Potential visual and noise pollution from the mine and its traffic, increasing numbers of people and the presence of a work camp deterring WRFN members from camping, constructing cabins or holding gatherings at the culturally important Coffee Creek site, and reducing its spiritual significance" p.6 | 2014. Bates, P., DeRoy, S., The Firelight Group, with White River First Nation. White River First Nation Knowledge and Use Study (For Kaminak Gold Corporation) | Noise |
| Evidence of pristine conditions as baseline | Environment | "...the value of the Coffee Creek region transcends these particular sites and encompasses all of the plants, water, land and wildlife that inhabit or travel through the area. One animal, plant, or heritage site cannot be valued over another, nor can they be viewed in isolation. The Coffee Creek region must be seen as an interconnected whole, which is in turn, part of the larger Tr'ondëk Hwëch'in traditional territory. It is essential that anyone working in the region considers this worldview when evaluating the impacts of their actions on the Coffee Creek region" p.39 | 2012. Tr'ondëk Hwëch'in. Coffee Creek Traditional Knowledge Survey, Final Report (December 2012) | Air and Noise |

Noise was selected as an IC since it will be generated by Project activities and have the potential to interact with other Project components like wildlife and community health and well-being. For this analysis, noise has been both measured and modeled to determine existing conditions and potential future conditions, respectively. **Table 1.2-2** summarizes the IC selection process for noise.

During scoping and consultation with First Nations, the subject of vibration was also raised as a potential IC. However, due to the large separation distance between the Mine site and the closest sensitive receptors, perceivable vibration impacts are not expected. For this reason, it was determined that a vibration assessment would not be required and vibration was not selected as an IC.

**Table 1.2-2 Candidate Intermediate Components – Evaluation Summary**

| Candidate IC | Project Interaction | | | Third Party Input | | Supports the Analysis / Assessment of Which Other IC or VC? | Selected as an IC? | Decision Rationale |
|---|---|---|---|---|---|---|---|---|
| | Interaction? | Project Phase / Project Component / Project Activity | Nature of Interaction | Source | Input | | | |
| Noise | Human Receptors<br>Wildlife Receptors | Construction<br>Operation<br>Construction<br>Operation | The nature of the interaction for both human and wildlife receptors is similar. There is the potential for them to experience received sound levels from the Project | YESAB<br>First Nations | Consultation<br>Proponent's Guide to Information Requirements for Executive Committee Project Proposal Submission<br>Feedback from Traditional Knowledge Surveys | Wildlife/ and Wildlife Habitat<br>Bird and Bird Habitat<br>Community Health and Well-being<br>Land and Resource Use<br>Social Economy | Yes: Noise | Potential for disturbance or loss of wildlife and/or bird habitat due to noise from Project activities.<br>Potential impacts to human receptors both within and outside of the Project site.<br>Potential for impacts to recreational areas where human receptors might be. Impacts could potential deter use of plant/berry collection sites, hunting areas, and other such recreational areas. |

### 1.2.2 SELECTED IC

Airborne sound is described as the rapid fluctuation or oscillation of air pressure above and below atmospheric pressure, creating a sound wave. Sound is characterized by properties of waves, which are frequency, wavelength, period, amplitude, and velocity. Noise is defined as unwanted sound. Additional noise-related concepts and metrics will be described further in **Section 2.0** of this report.

## 1.3 INDICATORS

Indicators for noise are based on the applicable unit of sound/noise, which is the decibel (dB) level. A dB is defined as the ratio between a measured value and a reference value usually corresponding to the lower threshold of human hearing defined as 20 micropascals (µPa). Broadband sound includes sound energy summed across the frequency spectrum. In addition to broadband sound pressure levels, analysis of the various frequency components of the sound spectrum is often completed to determine tonal characteristics. The unit of frequency is Hertz (Hz), which corresponds to the rate in cycles per second that sound pressure waves are generated. Typically, a sound frequency analysis examines 11 octave (or 33 1/3 octave) bands ranging from 20 Hz (low) to 20,000 Hz (high). This range encompasses the entire human audible frequency range. Since the human ear does not perceive every frequency with equal loudness, spectrally varying sounds are often adjusted with a weighting filter. The A-weighted filter is applied to compensate for the frequency response of the human auditory system. Sound exposure in acoustic assessments is commonly measured and calculated as A-weighted dB (dBA). Unweighted sound levels are referred to as linear. Linear dB are used to determine a sound's tonality and to engineer solutions to reduce or control noise as techniques are different for low and high frequency noise. In this report, linear sound levels are presented as dBL.

A change to Project-related noise has occurred when there is a change in the noise level, expressed in dBA and/or dBL. The potential impacts of those changes will be reviewed relative to the regulatory context applied to the Project (**Section 4.1**). **Table 1.3-1** summarizes the indicators for noise.

**Table 1.3-1 Indicators for Noise**

| Indicator | Rationale for Selection |
|---|---|
| Noise Levels (dBA, dBL) | The dB is the universal unit and indicator to describe measured and/or modeled sound levels. The A-weighted sound level (dBA) is primarily used in the report to describe baseline sound survey result and potential noise impacts at receptors. Linear decibels (dBL) are used to express sound levels generated by blasting. |

### 1.4 Establishment of Analysis Boundaries

Analysis boundaries define the maximum limit within which the change analysis and supporting studies (e.g., predictive models) are conducted. Boundaries encompass where and when the Project is expected to interact with the ICs; any political, social, and economic constraints; and limitations in predicting or measuring changes. Boundaries relevant to noise are described below.

#### 1.4.1 Spatial Boundaries

When referring to the spatial boundaries for the noise analysis, there is the Local Study Area (LSA) and Regional Study Area (RSA; **Table 1.4-1** and **Figure 1-4**). The spatial boundaries define the estimated extents of where and when the Project is expected to interact with the VCs; any political, social, and economic constraints; and limitations in predicting or measuring changes.

The LSA for the noise analysis consists of the area within a distance of 3 km from the Mine Site (Project), to largely capture sound attenuation in the vicinity of the Project, as well as 1 km from either side of the Northern Access Route (NAR). In addition, within the LSA lies the 1.5 km point of compliance identified in the regulatory context referenced in **Section 4.1**. The LSA is extended beyond 1.5 km to encompass other receptors that have been identified through Traditional Knowledge and other consultations such as specific points near the Yukon River and Ballarat Creek identified as locations relevant to wildlife and recreational land uses.

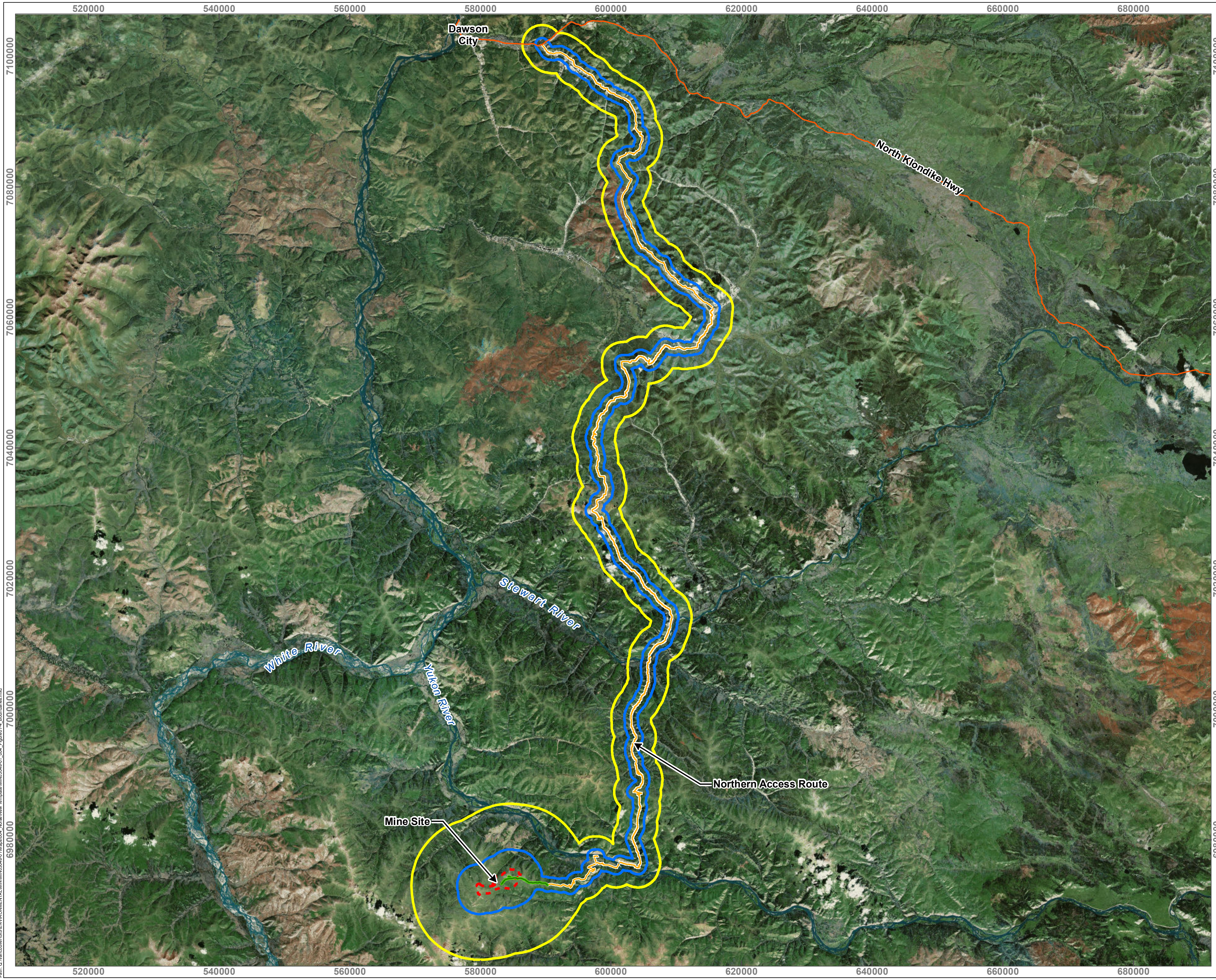
The RSA, which encompasses the LSA, is established to provide a regional context for the analysis of Project-related changes. The RSA also encompasses the area within which residual changes due to the Project are likely to interact with the residual effects of other past, present, or future projects or activities to result in a cumulative change or changes. As a result, the RSA defines the boundaries of the cumulative change analysis. The RSA for the noise analysis extends approximately 10 km from the Mine Site and 3 km from either side of the NAR.

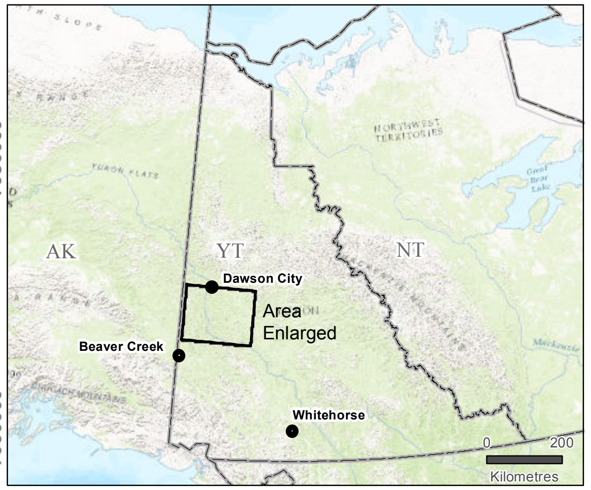
**Table 1.4-1 Spatial Boundary Definitions for Groundwater**

| Spatial Boundary | Description of Assessment Area |
|---|---|
| Local Study Area | The LSA includes an area, which 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 impact analysis was consistent with the extents of the RSA. |

COFFEE GOLD MINE

**Noise Spatial Boundaries**




## 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).
Road from CanVec 1:50,000.

N

1:560,000

0 10 20 30

Kilometres

NAD 1983 UTM Zone 7N

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|---|---|---|---|

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### 1.4.2 TEMPORAL BOUNDARIES

The temporal boundaries of the Noise analysis will span the life of the Project. Noise will vary by and within each Project phase since activities and equipment will vary across phases. Noise propagation and attenuation is also influenced by seasonal meteorological conditions. Baseline data collection occurred during both summer and wintertime periods (**Section 4.3**) and meteorological conditions are considered in the acoustic modeling analysis.

### 1.4.3 ADMINISTRATIVE BOUNDARIES

There are no administrative boundaries relevant to the analysis of Project-related changes to noise.

### 1.4.4 TECHNICAL BOUNDARIES

The noise analysis is conducted with a sophisticated model and the best information available for input to the model. The modeling program, CadnaA, conforms to International Organization for Standardization (ISO) standard ISO 9613-2, *Attenuation of Sound during Propagation Outdoors* and is frequently used in assessing noise; however, like any modeling analysis there is potential for uncertainty. That uncertainty is mainly associated with the assumptions and inputs to the model (e.g., sound source levels, meteorology, ground absorption, etc.), which are derived using the best available knowledge but may differ from actual conditions. Nevertheless, previous experience with CadnaA and ISO-9613-2 methodology has shown that there is a high degree of correlation between the predicted results and field measurements.

# 2.0 ANALYSIS METHODS

## 2.1 ACOUSTIC METRICS AND TERMINOLOGY

Some discussion was provided in **Section 1.3** pertaining to dB, the unit used to measure and model noise. **Section 2.1** provides additional information on noise-related concepts and terminology, which is discussed and referred to throughout this report.

### 2.1.1 NOISE FUNDAMENTALS

Model input includes sound sources; for example, mining equipment such as vibratory screens and heavy-duty vehicles. A sound source is defined by a sound power level ($L_W$), which is independent of any external factors. The acoustic sound power is the rate at which acoustical energy is radiated outward and is expressed in units of watts (W). Sound energy travels in the form of a wave, a rapid fluctuation or oscillation of air pressure above and below atmospheric pressure. A sound pressure level ($L_P$) is a measure of this fluctuation and can be directly determined with a microphone or calculated from information about the source sound power level and the surrounding environment through predictive acoustic modeling. While the sound power of a source is strictly a function of the total amount of acoustic energy being radiated by the source, the sound pressure levels produced by a source are a function of the distance from the source and the effective radiating area or physical size of the source. In general, the magnitude of a source's sound power level is always considerably higher than the observed sound pressure level near a source due to the fact that the acoustic energy is being radiated in various directions.

Sound levels may change from moment to moment. Some are sharp impulses lasting one second or less, while others rise and fall over much longer periods of time. There are various measures of sound pressure designed for different purposes including the following:

- $L_{eq}$: 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, which has the same acoustic energy as the actual varying sound levels over the specified period.
- $L_n$: The statistical sound levels ($L_n$) provide the sound level exceeded for that percentage of time over the given measurement period. For example, the $L_{10}$ level is often referred to as the intrusive noise level and is the sound level that is exceeded for 10% of the measurement period.
- $L_{max}$: The maximum A-weighted sound level as determined during a specified measurement period. It can also be described as the maximum instantaneous sound pressure level generated by a piece of equipment or during a construction activity.
- $L_{peak}$: The maximum value reached by the sound pressure. The $L_{peak}$ can sometimes be confused with the $L_{max}$; however, the $L_{max}$ is the maximum root mean square (RMS) sound level with time constant applied (fast or slow). The $L_{peak}$ has not time constant applied and the signal has not passed through an RMS circuit.

Of the metrics described above, the Project analysis will mainly focus on the $L_{eq}$ metric when describing baseline sound levels and the $L_{max}$ metric when referencing equipment sound power levels. The $L_{eq}$ metric was selected for direct comparison with the BC Oil and Gas Commission (BC OGC) noise guideline (**Section 3.1.1**). The $L_{max}$ metric was selected to represent equipment sound power as a conservative approach because using a lower value could result in underpredictions in received sound levels at receptors.

### 2.1.2 NOISE BACKGROUND AND HUMAN PERCEPTION

An inherent property of the logarithmic decibel scale is that the sound pressure levels of two separate sources are not directly additive. For example, if a sound level of 50 dBA is added to another sound level of 50 dBA, the result is a 3-decibel increase (or 53 dBA), not an arithmetic doubling to 100 dBA. With respect to how the human ear perceives changes in sound pressure level relative to changes in "loudness", scientific research demonstrates the following general relationships between sound level and human perception for two sound levels with the same or very similar frequency characteristics:

- One dBA is the practical limit of accuracy for sound measurement systems and corresponds to an approximate 10 percent variation in the sound pressure level. A 1 dBA increase or decrease is a non-perceptible change in sound.
- Three dBA increase or decrease is a doubling (or halving) of acoustic pressure level and it corresponds to the threshold of change in loudness perceptible in a laboratory environment. In practice, the average person is not able to distinguish a 3 dBA difference in environmental sound outdoors (FHWA 2011).
- Five dBA increase or decrease is described as a perceptible change in sound level and is a discernible change in an outdoor environment.
- Ten dBA increase or decrease is a tenfold increase or decrease in acoustic pressure level but is perceived as a doubling or halving in loudness (i.e., the average person will judge a 10 dBA change in sound level to be twice or half as loud).

Estimates of common noise sources and outdoor acoustic environments, and the comparison of relative loudness are presented in **Table 2.1-1**.

**Table 2.1-1 Sound Pressure Levels (LP) 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 m; 50 ft) | 140 | Threshold of pain | 64 times as loud |
| 50-hp 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 | |

### 2.1.3 DEFINITIONS

Although some of these terms have been discussed above, **Table 2.1-2** provides additional reference information in the way of definitions.

**Table 2.1-2 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 negative effects on people are known to occur. |
| Sound Pressure Level (LP) | Pressure fluctuations in a medium. Sound pressure is measured in decibels referenced to 20 microPascals, the approximate threshold of human perception to sound at 1,000 Hz. |
| Sound Power Level (LW) | 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 as 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-weighting filter is commonly used for describing environmental sound levels. Sound levels that are A-weighted are presented as dBA in this report. |
| Unweighted Decibels (dBL) | Unweighted sound levels are referred to as linear. Linear decibels are used to determine a sound's tonality and to engineer solutions to reduce or control noise as techniques are different for low and high frequency noise. Sound levels that are linear are presented as dBL in this report |
| 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. |
| Octave Bands | The audible range of humans spans from 20 to 20,000 Hz and is typically divided into center frequencies ranging from 31 to 8,000 Hz for noise modeling evaluations. |
| Broadband Sound | Noise which covers a wide range of frequencies within the audible spectrum, i.e., 200 to 2,000 Hz. |
| Masking | Interference in the perception of one sound by the presence of another sound. At elevated wind speeds, leaf rustle and noise made by the wind itself can mask other sources of sound. |
| Frequency (Hz) | The rate of oscillation of a sound, measured in units of Hz or kilohertz (kHz). One hundred Hz is a rate of one hundred times (or cycles) per second. 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. |

## 2.2 NOISE MODELING PROGRAM

The Project noise analysis consists of the baseline sound measurement program to assess existing conditions and the acoustic modeling analysis to predict potential noise impacts related to construction and operation. The baseline data collection methodology is further discussed in **Section 3.2.3**.

The acoustic modeling analysis was conducted using the most recent version of DataKustic GmbH's computer-aided noise abatement program or CadnaA (v 4.6.153). CadnaA is a comprehensive 3-Dimensional acoustic software model that conforms to the International Organization for Standardization (ISO) standard ISO 9613-2, *Attenuation of Sound during Propagation Outdoors*, which is described further in **Section 3.1.3**.

CadnaA allows for three types of sound sources to be introduced into the model: point, line, and area sources. Each noise-radiating element was modeled based on its noise emission pattern. Point sources were programmed for concentrated sound sources that radiate sound hemispherically like graders or dozers. Line sources are used for linear-shaped sources such as conveyor belts. Larger dimensional sources can be modeled as area sources. On-site buildings, equipment enclosures, and plant equipment were modeled as solid structures since diffracted paths around and over structures tend to reduce computed noise levels.

Topographical information was imported into the acoustic model to accurately represent terrain in three dimensions. Terrain conditions, vegetation type, ground cover, and the density and height of foliage can also influence the absorption that takes place when sound waves travel over land. The ISO 9613-2 Standard accounts for ground absorption rates by assigning a numerical coefficient of G=0 for acoustically hard, reflective surfaces and G=1 for absorptive surfaces and soft ground. If the ground is hard-packed dirt, typically found in industrial complexes, pavement, bare rock or for sound traveling over water, the absorption coefficient is defined as G=0 to account for reduced sound attenuation and higher reflectivity. In contrast, ground covered in vegetation, including suburban lawns, livestock and agricultural fields (both fallow with bare soil and planted with crops), will be acoustically absorptive and aid in sound attenuation (i.e., G=1.0). For the Project acoustic modeling analysis, a reflective ground factor (G=0) was used within the active mining sites and a mixed (semi-reflective) ground factor of G=0.5 was used throughout the rest of the Project study area. In addition to geometrical divergence, attenuation factors include topographical features, terrain coverage, and/or other natural or anthropogenic obstacles that can affect sound attenuation and result in acoustical screening. To be conservative, sound attenuation through foliage and diffraction around and over existing anthropogenic structures such as buildings was not included in the model.

Sound attenuation by the atmosphere is not strongly dependent on temperature and humidity; however, the temperature of 10ºCelsius (50ºFahrenheit) and 70 percent relative humidity parameters were selected as reasonably representative of conditions favorable to sound propagation. Atmospheric absorption depends on temperature and humidity and is most important at higher frequencies. Over short distances, the effects of atmospheric absorption are minimal. The ISO 9613-2 Standard calculates attenuation for meteorological conditions favorable to propagation, i.e., downwind sound propagation or what might occur typically during a moderate atmospheric ground level inversion. In addition, the acoustic modeling algorithms essentially assume laminar atmospheric conditions, in which neighboring layers of air do not mix. This conservative assumption does not take into consideration turbulent eddies and micrometeorological variations that may form when winds change speed or direction, which can interfere with the sound wave propagation path and increase attenuation effects.

# 3.0 EXISTING CONDITIONS

This section describes the existing conditions as they relate to noise, including the regulatory context, TK-based information, scientific and other information, and baseline studies conducted during the Project's Feasibility Program.

## 3.1 REGULATORY CONTEXT

At the federal level, Environment Canada (EC) provides noise guidance within its Environmental Code of Practice for Metal Mines, described further below. Yukon does not have any noise-related requirements so guidance provided by BC was selected to assess Project compliance. BC guidance is based on Alberta Utilities Commission Rule 012, Noise Control, and has been used to support previous permitting applications to Yukon and accepted by YESAB. In addition, as mentioned previously the model used to analyze noise conforms to the ISO 9613-2 Standard, which describes a detailed procedure to calculate sound levels generated by defined sound sources.

The acoustic analysis conducted in support of the Project is limited to evaluating potential noise levels at sensitive off-site receptors. Impacts to on-site receptors (i.e., mine staff) are not analyzed or discussed within this report as they are not part of environmental assessment and permitting. Review of on-site noise exposure is covered under separate legislation pertaining to occupational health and safety.

### 3.1.1 ENVIRONMENT CANADA ENVIRONMENTAL CODE OF PRACTICE FOR METAL MINES

The Environmental Code of Practices for Metal Mines was developed by EC for use by mine owners, operators, regulatory agencies and the public to provide information about the activities associated with the life cycle of a mine and recommendations to minimize environmental impacts from mining activities. The Code is not a federal regulation. It may be adopted on a voluntary basis by mining companies; however, it does not eliminate obligations set forth by other municipal, Aboriginal, provincial, territorial and federal legal requirements.

In section 4.4.7 of the Code guidance is provided for noise including recommendations on measures to minimize noise and monitoring those measures to assess effectiveness. In residential areas adjacent to mine sites, the Code prescribes a daytime limit of 55 dBA $L_{eq}$ and a nighttime limit of 45 dBA $L_{eq}$. The Code also suggests that for mines in areas where blast noise isn't regulated, blasts should be designed to not exceed the following criteria at or beyond the mine property:

- Concussion noise of a maximum of 128 dB.

Lastly, if blasting is conducted in or adjacent to fish-bearing waterbodies, it should be done in accordance with the Guidelines for the Use of Explosives in or near Canadian Fisheries Waters, prepared by the Department of Fisheries and Oceans.

### 3.1.2 BC OIL AND GAS COMMISSION NOISE CONTROL BEST PRACTICES GUIDELINE

Noise control guidelines for oil and gas activities in BC are specified in the BC Oil and Gas Commission (BC OGC) Noise Control Best Practices Guideline (BC OGC 2009). The guideline is a receptor-oriented regulation, which specifies permissible sound levels at designated receptor points (including residences). The BC OGC is complaint-driven, which means that response to noise emissions depends on public feedback on noise levels. Noise impacts to workers are regulated under the Yukon Occupational Health and Safety Regulation, assessed in the Community Health and Well-being VC Report, **Section 25.0, Appendix 25-B**.

The BC OGC noise guideline does not have a noise limit for construction and decommissioning activities. However, the guideline requires that reasonable measures be implemented to limit noise effects from construction and decommissioning activities. The focus of the BC OGC noise guidelines is on the operations phase of the Project.

As noted above, the BC OGC noise guideline is receptor based. In the guideline, a receptor is referred to as a dwelling unit, which can be any permanently or seasonally occupied residence with the exception of an employee residence or construction camp located within an industrial plant boundary. In accordance 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 km of the project mine site boundary. The determination of daytime and nighttime PSL at a receptor is a function of the time of day, type of noise (e.g., impulse or continuous), residential density, and proximity to other noise sources (e.g., highways). In cases where there is no receptor within 1.5 km from the project mine site boundary, the daytime PSL is 50 dBA $L_{eq}$ and nighttime PSL is 40 dBA $L_{eq}$ at 1.5 km from the mine site boundary.

As stated above, Yukon does not have any noise-related requirements but YESAB has accepted the use of the BC OGC noise guideline in previous permitting applications. For that reason, and since the limits prescribed in the BC guidance are more stringent than the limits given in EC's Environmental Code of Practice for Metal Mines, the BC OGC noise guideline is considered the controlling noise criteria for this assessment.

### 3.1.3 ISO 9613-2: ATTENUATION OF SOUND DURING PROPAGATION OUTDOORS

ISO 9613-2, Attenuation of Sound during Propagation Outdoors, specified an engineering method for calculating the attenuation of sound during propagation outdoors in order to predict the levels of environmental noise at a distance from a variety of sources. The method described in this standard calculates sound attenuation under weather conditions that are favorable for sound propagation, such as for downwind propagation or atmospheric inversion, conditions which are typically considered worst-case. The calculation of sound propagation from source to receiver locations consists of full-octave band sound frequency algorithms, which incorporate the following physical effects:

- Geometric spreading wave divergence
- Reflection from surfaces
- Atmospheric absorption at 10°C and 70 percent relative humidity
- Screening by topography and obstacles
- The effects of terrain features including relative elevations of noise sources
- Sound power levels from stationary and mobile sources
- The locations of noise-sensitive land use types
- Intervening objects including buildings and barrier walls
- Ground effects due to areas of pavement and unpaved ground
- Sound power at multiple frequencies
- Source directivity factors
- Multiple noise sources and source type (point, area, and/or line), and
- Averaging predicted sound levels over a given time period.

The standard can be applied to many types of noise sources and environments such as road or rail traffic, industrial noise sources, construction and many other ground-based noise sources.

## 3.2 Background Information and Studies

### 3.2.1 Traditional Knowledge

This section is to demonstrate awareness of TK and how it was considered in the noise assessment. **Table 3.2-1** describes the noise-related TK quotes and references.

**Table 3.2-1 Traditional Knowledge Noise Quotes and References**

| Relevance | Topic | TK Quote | Reference | Applicable Component |
|---|---|---|---|---|
| Evidence to support the argument that the area should be treated as a sensitive receptor and the importance of mitigation measures to minimize impacts. | Potential Project Interactions-Noise | "Potential disturbance of animals due to noise and traffic during project operation, causing them to move away from the area or change movement patterns" p.6 | 2014. Bates, P., DeRoy, S., The Firelight Group, with White River First Nation. White River First Nation Knowledge and Use Study (For Kaminak Gold Corporation) | Noise |
| Evidence to support the argument that the area should be treated as a sensitive receptor and the importance of mitigation measures to minimize impacts. | Potential Project Interactions-Noise | "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.<br>*Part of it is the noise, yeah, it would be the noise. It would be, like — there are some areas where there's a lot of moose calvings, there's certain areas where they have the little ones, and they likely ... say you have a quiet area, and then they have the presence of noise, that would affect it. What would you do? You would move. You would move to another area, where it's nice and quiet. That would apply to that, similar to that*. WO4 18-Aug-2014" p.42 | 2014. Bates, P., DeRoy, S., The Firelight Group, with White River First Nation. White River First Nation Knowledge and Use Study (For Kaminak Gold Corporation) | Noise |
| Evidence of pristine conditions as baseline | Environment | "WRFN participants report that the lands and waters around them remain relatively unspoiled by industrial activity, with the exception of some local disturbance by other mining activities, for example around Dawson City. They also report that in general the animals and plants around them remain plentiful and uncontaminated. There are however some exceptions. Moose, while still plentiful in the area around Beaver Creek, are declining in numbers in the area to the south around Burwash Landing. This is leading to an increasing awareness among WRFN members that moose populations need to be conserved" p.41 | 2014. Bates, P., DeRoy, S., The Firelight Group, with White River First Nation. White River First Nation Knowledge and Use Study (For Kaminak Gold Corporation) | Air and Noise |

### 3.2.2 Scientific and Other Information

Other sources of information were used in developing the Project noise analysis. First and foremost, the *Feasibility Study Technical Report for the Coffee Gold Project* was reviewed for relevant Project information (JDS Energy & Mining Inc. 2016). Previous environmental and socio-economic assessments (EAs) were also consulted as sources of information (e.g., assessment approach, comparison of sound source levels, noise mitigation measure options, etc.) including EAs for the Kerr-Sulphurets-Mitchell (KSM; Seabridge Gold 2013) and Harper Creek Mining (Yellowhead Mining 2015) Projects in BC, and the Casino Project in Yukon (Casino Mining Corporation 2014). Guidance from YESAB and First Nations was also considered for the noise analysis. YESAB recommends describing existing acoustic conditions, outlining existing sources and seasonal variation. In addition, YESAB states that noise is not a VC but noise levels may be and should be considered if sensitive communities or wildlife are nearby (YESAB 2005). First Nations concerns were taken into account by analyzing all Project-related noise sources including those specifically mentioned by First Nations such as traffic and helicopter use. Lastly, Tetra Tech reviewed its internal database of engineering guidelines and scientific literature to develop the appropriate approach and noise source inventory to use as inputs to the modeling analysis.

### 3.2.3 Baseline Studies Conducted during the Project's Feasibility Program

During the Project's Feasibility Program a baseline sound survey was conducted and documented within Appendix 9-A: Air Quality, Noise, and Greenhouse Gas Emissions Baseline Study Report. As indicated in Table 3.2-2, the study was conducted in March and June 2015 and the purpose was to document the existing ambient acoustic environment prior to Project construction, looking at both seasonal and diurnal variation. Additional details pertaining to the baseline sound survey are given in Section 4.3.

**Table 3.2-2 Summary of Desktop and Field Studies Related to Noise**

| Study Name | Study Purpose, Duration and Spatial Boundaries |
|---|---|
| Baseline Air Quality and Noise at the Coffee Gold Project 2015 | The study was conducted to collect ambient sound data to describe pre-construction sound levels in the vicinity of the Mine Site. Measurements were collected in March and June of 2015 at accessible locations in and outside of the RSA representing locations that will also be effective as post-construction monitoring locations. |

## 3.3 Description of Existing Conditions

In late March 2015 and late June 2015, a baseline sound survey was conducted by Tetra Tech in support of permitting the Project within the confines of the Coffee Property to capture wintertime and summertime conditions (**Appendix 9-A**). A Casella CEL-633 Type 2 sound level meter was used to collect data continuously for a period of 24-hours at four monitoring positions. The four baseline sound monitoring locations are summarized in **Table 3.3-1**, below. The baseline noise monitoring locations are also displayed in Figure 3-1. Monitoring was not conducted along the NAR due to changes in mine design. It is expected that existing ambient sound levels along the NAR would be relatively consistent with data collected near the Mine Site since population density, land use and terrain conditions appear to be similar.

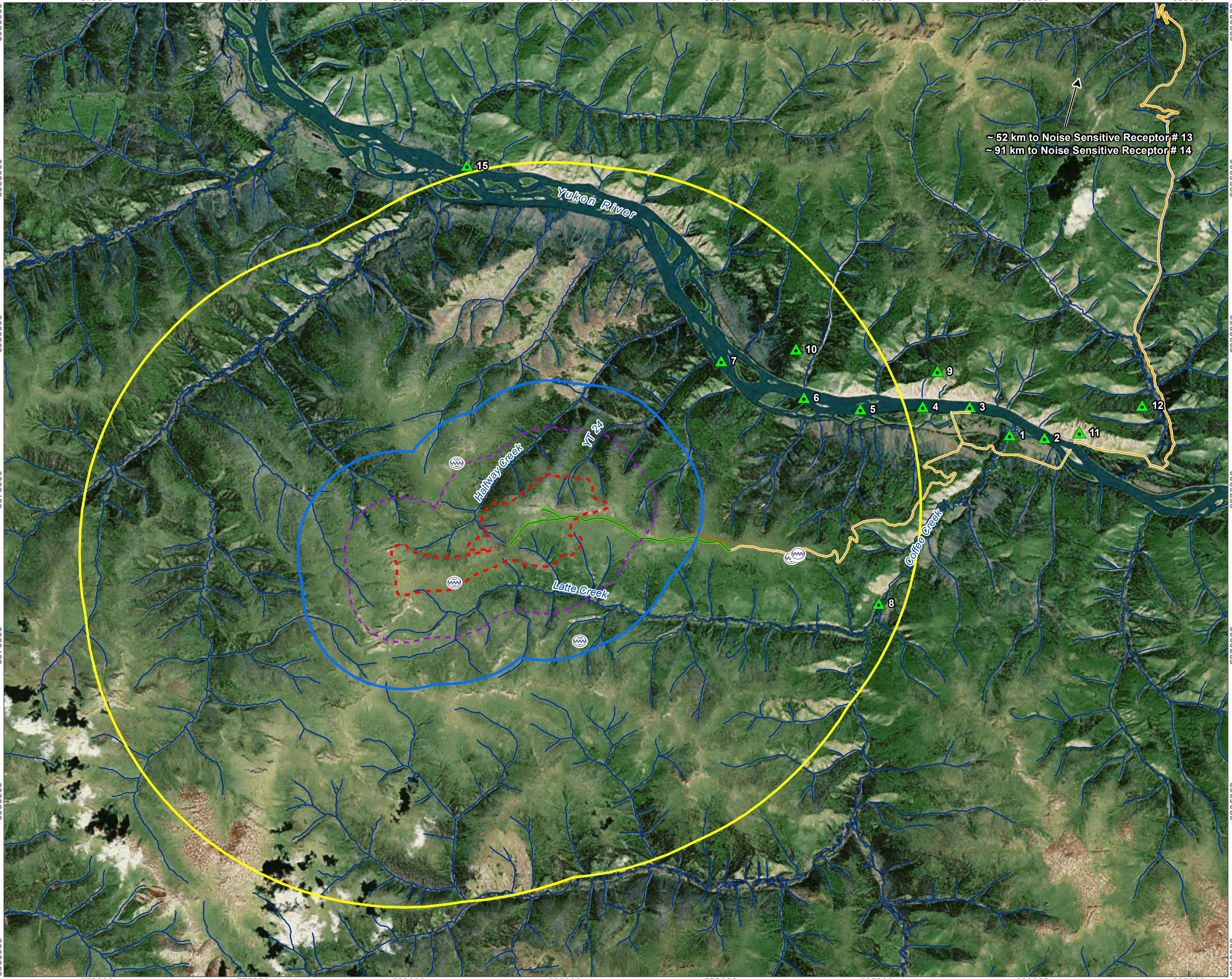
**Table 3.3-1 Baseline Noise Monitoring Locations**

| Monitoring Location | Abbreviation | Coordinates | |
|---|---|---|---|
| | | Latitude | Longitude |
| Meteorological Station | MET | 62.873595°<br>62.874461°<br>62.874853° | -139.185917°<br>-139.181990°<br>-139.181769° |
| ROM | ROM | 62.869182° | -139.398867° |
| Helipad 1 (NW Ridge) | H1 | 62.903516° | -139.395301° |
| Helipad 4 (S Ridge) | H4 | 62.851395° | -139.320814° |

The baseline noise monitoring locations in **Table 3.3-1** are further described in the following bullets, which provide additional details regarding their surroundings and why they were selected to characterize existing conditions within the Coffee Property:

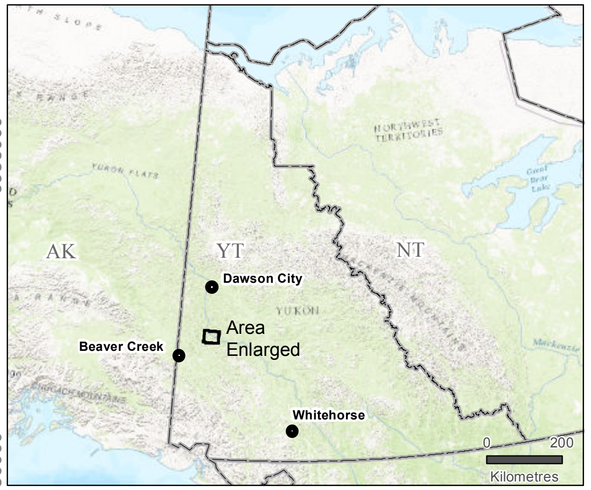
- Monitoring location MET is located in the vicinity of the installed Coffee Creek meteorological station, along the northern ridge of the Latte Creek valley. This location is approximately 7 km east of the proposed pit infrastructure. The site was selected due to ease of access, co-location with the meteorological station, the observed wind pattern, and location relative to the NAR.
- Monitoring location ROM, in the vicinity of the proposed mining plant infrastructure, was selected to provide baseline conditions and acts as an ongoing monitoring location in the vicinity of the run-of-mine and crushed ore stockpiles and the processing plant. The only limitation of this site is that it is inaccessible during wintertime.
- Monitoring location H1 is situated 30 m downslope - on the eastern aspect - from the peak of the ridge (helicopter pad) running between Dan Man Creek and Halfway Creek, north of the proposed pit areas. The location is one of the highest points on the property, at an approximate elevation of 1190 m above sea level (the elevation of the ridge top is 1220 m).
- Monitoring location H4 was selected in consultation with Project wildlife biologists as a noise sensitive location for caribou.

The sound level meter has an operating range of 20 to 140 dBA and was housed within an environmental enclosure to protect the instrument from adverse weather conditions. During the measurements, the microphone was fitted with a windscreen and set upon a tripod at a height of approximately 1.5 m above ground, and located out of the influence of any vertical reflecting surfaces. Measurements were completed during weather conditions conducive to accurate data collection.




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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|---|---|---|---|

GOLDCORP

Data post-processing was accomplished using Casella Insight software. The dataset was analyzed for daytime and nighttime conditions during both the summer and winter periods. To the extent practicable extraneous sound was extracted from the dataset. Extraneous sounds included noise from helicopters, vehicles, and disturbance when field staff were attending to the monitors. During winter, daytime equivalent sound levels ($L_{eq}$) 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. A review of the data in the absence of thunderstorms showed that ambient nighttime sound levels were relatively consistent with sound levels documented at other monitoring locations, with decibel levels in the mid to high 20s.

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 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. Site-specific variations are due to exposure differences (wind, sound-attenuating obstacles) and nearby exploration activity, such as the drilling program occurring in March nearby H4.

# 4.0 FUTURE CONDITIONS WITH THE PROJECT

## 4.1 OVERVIEW

The development of the proposed Project will result in a change in noise levels within the vicinity of the Project. This section identifies and describes potential noise generated from the Project activities during Construction, Operation, Reclamation and Closure, and Post-Closure. This section further evaluates the potential for adverse Project-related changes to noise associated with the Project activities.

As discussed in **Section 2.0**, the noise levels for the construction and operations of the two identified scenarios were predicted using the Cadna-A® computer software developed by DataKustik GmbH. The model incorporated the physical features of the facility and the surrounding area topography. The acoustic analysis focuses on two periods (Year -1 Construction and Year 6 Operation) that would result in the greatest Project-related change, which are expected to be the periods with the highest volume of activity with the most equipment in use at any given time.

Potential interactions between Project activities and noise are screened and discussed in **Section 4.2**. **Sections 4.3, 4.4, 4.5, 4.6, and 4.7** screens and discusses potential Project interactions associated with Project construction, Project operation, NAR activities, blasting activities, and the airstrip, respectively.. **Sections 4.8** discusses potential mitigation measures and residual changes between the Mine Site and the Noise IC. A summary of residual changes that are predicted to result from the Project are discussed in **Section 4.9**.

## 4.2 SCREENING OF POTENTIAL PROJECT INTERACTIONS WITH NOISE

It was assumed for modeling purposes that equipment and activities would take place simultaneously in order to predict the maximum sound levels. A summary of each modeled activity for both the construction and operational phases as well as the potential Project interaction is summarized in **Table 4.2-1**. The full matrix of potential Project interactions with noise is provided in **Appendix 10-A-1**.

**Table 4.2-1 Identification of Potential Project Interactions with Noise**

| Project Component | Project Activity | | Interaction Rating | Nature of Interaction and Potential Effect |
|---|---|---|---|---|
| | # | Description | | |
| **Construction Phase** | | | | |
| Overall Mine Site | C-1 | Mobilization of mobile equipment and construction materials | Potential Interaction | Changes to noise would be generated from the vehicles, equipment and activities but they would be expected to be localized to the surrounding Project area. |
| | C-2 | Clearing, grubbing, and grading of areas to be developed within the mine site | Potential Interaction | Changes to noise would be generated from the vehicles, equipment and activities but they would be expected to be localized to the surrounding Project area. |
| | C-3 | Material handling | Potential Interaction | Changes to noise would be generated from the vehicles, equipment and activities but they would be expected to be localized to the surrounding Project area. |
| Open Pits | C-4 | Development of Latte pit and Double Double pit | Potential Interaction | Changes to noise would be generated from the vehicles, equipment and activities but they would be expected to be localized to the surrounding Project area. |
| Waste Rock Storage Facilities (WRSFs) | C-6 | Development and use of Alpha WRSF | Potential Interaction | Changes to noise would be generated from the vehicles, equipment and activities but they would be expected to be localized to the surrounding Project area. |
| Stockpiles | C-7 | Development and use of temporary organics stockpile for vegetation and topsoil | Potential Interaction | Changes to noise would be generated from the vehicles, equipment and activities but they would be expected to be localized to the surrounding Project area. |
| | C-8 | Development and use of frozen soils storage area | Potential Interaction | Changes to noise would be generated from the vehicles, equipment and activities but they would be expected to be localized to the surrounding Project area. |
| | C-9 | Development and use of run-of-mine (ROM) stockpile for temporary storage of ROM ore | Potential Interaction | Changes to noise would be generated from the vehicles, equipment and activities but they would be expected to be localized to the surrounding Project area. |
| Crusher System | C-10 | Construction and operation of crushing circuit | Potential Interaction | Changes to noise would be generated from the vehicles, equipment and activities but they would be expected to be localized to the surrounding Project area. |
| | C-11 | Construction and operation of crushed ore stockpile | Potential Interaction | Changes to noise would be generated from the vehicles, equipment and activities but they would be expected to be localized to the surrounding Project area. |

| Project Component | Project Activity | | Interaction Rating | Nature of Interaction and Potential Effect |
|---|---|---|---|---|
| | # | Description | | |
| Heap Leach Facility | C-12 | Staged heap leach facility (HLF) construction, including associated event ponds, rainwater pond, piping, and water management infrastructure | Potential Interaction | Changes to noise would be generated from the vehicles, equipment and activities but they would be expected to be localized to the surrounding Project area. |
| | C-13 | Heap leach pad loading | Potential Interaction | Changes to noise would be generated from the vehicles, equipment and activities but they would be expected to be localized to the surrounding Project area. |
| Plant Site | C-14 | Construction and operation of process plant | Potential Interaction | Changes to noise would be generated from the vehicles, equipment and activities but they would be expected to be localized to the surrounding Project area. |
| | C-15 | Construction and operation of reagent storage area and on-site use of processing reagents | Potential Interaction | Changes to noise would be generated from the vehicles, equipment and activities but they would be expected to be localized to the surrounding Project area. |
| | C-16 | Construction and operation of laboratory, truck shop, and warehouse building | Potential Interaction | Changes to noise would be generated from the vehicles, equipment and activities but they would be expected to be localized to the surrounding Project area. |
| | C-17 | Construction and operation of power plant | Potential Interaction | Changes to noise would be generated from the vehicles, equipment and activities but they would be expected to be localized to the surrounding Project area. |
| | C-18 | Construction and operation of bulk fuel/LNG storage and on-site use of diesel fuel or LNG | Potential Interaction | Changes to noise would be generated from the vehicles, equipment and activities but they would be expected to be localized to the surrounding Project area. |
| Camp Site | C-19 | 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 | Potential Interaction | Changes to noise would be generated from the vehicles, equipment and activities but they would be expected to be localized to the surrounding Project area. |
| | C-20 | Construction and operation of waste management building and waste management area | Potential Interaction | Changes to noise would be generated from the vehicles, equipment and activities but they would be expected to be localized to the surrounding Project area. |
| Bulk Explosive Storage Area | C-21 | Construction of storage facilities for explosives components and on-site use of explosives | Potential Interaction | Changes to noise would be generated from the vehicles, equipment and activities but they would be expected to be localized to the surrounding Project area. |

| Project Component | Project Activity | | Interaction Rating | Nature of Interaction and Potential Effect |
|---|---|---|---|---|
| | # | Description | | |
| Mine Site and Haul Roads | C-22 | Upgrade, construction, and maintenance of mine site service roads and haul roads | Potential Interaction | Changes to noise would be generated from vehicular movements along roadways and within the Project site but they would be expected to be localized to the surrounding Project area. |
| Site Water Management Infrastructure | C-23 | Development and use of sedimentation ponds and conveyance structures, including discharge of compliant water | Potential Interaction | Changes to noise would be generated from the vehicles, equipment and activities but they would be expected to be localized to the surrounding Project area. |
| Ancillary Components | C-26 | Upgrade of existing road sections for Northern Access Route (NAR), including installation of culverts and bridges | Potential Interaction | Changes to noise would be generated from the vehicles, equipment and activities but they would be expected to be localized to the surrounding Project area. |
| | C-27 | Construction of new road sections for NAR, including installation of culverts and bridges | Potential Interaction | Changes to noise would be generated from the vehicles, equipment and activities but they would be expected to be localized to the surrounding Project area. |
| | C-28 | Development, operation, and maintenance of temporary work camps along road route | Potential Interaction | Changes to noise would be generated from the vehicles, equipment and activities but they would be expected to be localized to the surrounding Project area. |
| | C-29 | Vehicle traffic, including mobilization and re-supply of freight and consumables | Potential Interaction | Changes to noise would be generated from vehicular movements along roadways and within the Project but they would be expected to be localized to the surrounding Project area. |
| | C-30 | Development, operation, and maintenance of barge landing sites on Yukon River and Stewart River | Potential Interaction | Changes to noise would be generated from the vehicles, equipment and activities but they would be expected to be localized to the surrounding Project area. |
| | C-32 | Annual construction, operation, maintenance, and removal of Stewart River and Yukon River ice roads | Potential Interaction | Changes to noise would be generated from the vehicles, equipment and activities but they would be expected to be localized to the surrounding Project area. |
| | C-33 | Annual construction and operation of winter road on the south side of the Yukon River | Potential Interaction | Changes to noise would be generated from the vehicles, equipment and activities but they would be expected to be localized to the surrounding Project area. |
| | C-34 | Construction, operation, and maintenance of permanent bridge over Coffee Creek | Potential Interaction | Changes to noise would be generated from the vehicles, equipment and activities but they would be expected to be localized to the surrounding Project area. |

| Project Component | Project Activity | | Interaction Rating | Nature of Interaction and Potential Effect |
|---|---|---|---|---|
| | # | Description | | |
| | C-35 | Construction and maintenance of gravel airstrips | Potential Interaction | Changes to noise would be generated from the vehicles, equipment and activities but they would be expected to be localized to the surrounding Project area. |
| | C-36 | Air traffic | Potential Interaction | Changes to noise would be generated from the movement from airplanes and/or helicopters. |
| **Operation Phase** | | | | |
| Overall Mine Site | O-1 | Material handling | Potential Interaction | Changes to noise would be generated from the vehicles, equipment and activities but they would be expected to be localized to the surrounding Project area. |
| | O-2 | Excavation of contaminated soils followed by on-site treatment or temporary storage and off-site disposal | Potential Interaction | Changes to noise would be generated from the vehicles, equipment and activities but they would be expected to be localized to the surrounding Project area. |
| | O-3 | Progressive reclamation of disturbed areas within mine site footprint | Potential Interaction | Changes to noise would be generated from vehicular movements along roadways and within the Project site but they would be expected to be localized to the surrounding Project area. |
| Open Pits | O-4 | Development of Kona pit and Supremo pit and continued development of Double Double pit and Latte pit | Potential Interaction | Changes to noise would be generated from the vehicles, equipment and activities but they would be expected to be localized to the surrounding Project area. |
| | O-6 | Partial backfill of Latte pit and Supremo pit | Potential Interaction | Changes to noise would be generated from the vehicles, equipment and activities but they would be expected to be localized to the surrounding Project area. |
| | O-7 | Backfill of Double Double pit and Kona pit | Potential Interaction | Changes to noise would be generated from the vehicles, equipment and activities but they would be expected to be localized to the surrounding Project area. |
| | O-8 | Dewatering of pits (as required) | Potential Interaction | Changes to noise would be generated from the vehicles, equipment and activities but they would be expected to be localized to the surrounding Project area. |

| Project Component | Project Activity | | Interaction Rating | Nature of Interaction and Potential Effect |
|---|---|---|---|---|
| | # | Description | | |
| Waste Rock Storage Facilities | O-9 | Continued development and use of Alpha WRSF | Potential Interaction | Changes to noise would be generated from the vehicles, equipment and activities but they would be expected to be localized to the surrounding Project area. |
| | O-10 | Development and use of Beta WRSF | Potential Interaction | Changes to noise would be generated from the vehicles, equipment and activities but they would be expected to be localized to the surrounding Project area. |
| Crushing System | O-14 | Crusher operation | Potential Interaction | Changes to noise would be generated from crusher operation but they would be expected to be localized to the surrounding Project area. |
| Heap Leach Facility | O-16 | Continued staged HLF construction, including related water management structures and year-round operation | Potential Interaction | Changes to noise would be generated from the vehicles, equipment and activities but they would be expected to be localized to the surrounding Project area. |
| | O-17 | Progressive closure and reclamation of HLF | Potential Interaction | Changes to noise would be generated from the vehicles, equipment and activities but they would be expected to be localized to the surrounding Project area. |
| Plant Site | O-18 | Process plant operation | Potential Interaction | Changes to noise would be generated from process plant operation but they would be expected to be localized to the surrounding Project area. |
| | O-19 | Continued on-site use of processing reagents | Potential Interaction | Changes to noise would be generated from vehicular movements along roadways and within the Project site but they would be expected to be localized to the surrounding Project area. |
| | O-20 | Continued on-site use of diesel fuel or LNG | Potential Interaction | Changes to noise would be generated from the vehicles, equipment and activities but they would be expected to be localized to the surrounding Project area. |
| Bulk Explosive Storage Area | O-22 | Continued on-site use of explosives | Potential Interaction | Changes to noise would be generated from the vehicles, equipment and activities but they would be expected to be localized to the surrounding Project area. |
| Mine Site and Haul Roads | O-23 | Use and maintenance of mine site service roads and haul roads | Potential Interaction | Changes to noise would be generated from vehicular movements along roadways and within the Project but they would be expected to be localized to the surrounding Project area. |
| Site Water Management Infrastructure | O-24 | Continued use of sedimentation ponds conveyance structures | Potential Interaction | Changes to noise would be generated from the vehicles, equipment and activities but they would be expected to be localized to the surrounding Project area. |

| Project Component | Project Activity | | Interaction Rating | Nature of Interaction and Potential Effect |
|---|---|---|---|---|
| | # | Description | | |
| Ancillary Components | O-27 | NAR road maintenance (e.g., aggregate re-surfacing, sanding, snow removal) | Potential Interaction | Changes to noise would be generated from the vehicles, equipment and activities but they would be expected to be localized to the surrounding Project area. |
| | O-28 | NAR vehicle traffic, including mobilization and re-supply of freight and consumables | Potential Interaction | Changes to noise would be generated from vehicular movements along roadways and within the Project but they would be expected to be localized to the surrounding Project area. |
| | O-31 | Annual construction, operation, maintenance, and removal of Stewart River and Yukon River ice roads | Potential Interaction | Changes to noise would be generated from the vehicles, equipment and activities but they would be expected to be localized to the surrounding Project area. |
| | O-32 | Annual construction and operation of winter road on the south side of the Yukon River | Potential Interaction | Changes to noise would be generated from the vehicles, equipment and activities but they would be expected to be localized to the surrounding Project area. |
| | O-33 | Operation and maintenance of gravel air strips | Potential Interaction | Changes to noise would be generated from the vehicles, equipment and activities but they would be expected to be localized to the surrounding Project area. |
| | O-34 | Air traffic | Potential Interaction | Changes to noise would be generated from the movement from airplanes and/or helicopters. |
| **Reclamation and Closure Phase** | | | | |
| Overall Mine Site | R-2 | Excavation of contaminated soils followed by on-site treatment or temporary storage and off-site disposal | Potential Interaction | Changes to noise would be generated from the vehicles, equipment and activities but they would be expected to be localized to the surrounding Project area. |
| Crusher System | R-7 | Dismantling and removal of crusher facility and stockpile | Potential Interaction | Changes to noise would be generated from the vehicles, equipment and activities but they would be expected to be localized to the surrounding Project area. |
| Site Water Management Infrastructure | R-14 | Operation and maintenance of HLF water treatment facility | Potential Interaction | Changes to noise would be generated from the vehicles, equipment and activities but they would be expected to be localized to the surrounding Project area. |

| Project Component | Project Activity | | Interaction Rating | Nature of Interaction and Potential Effect |
|---|---|---|---|---|
| | # | Description | | |
| Ancillary Components | R-16 | NAR road maintenance (e.g., aggregate re-surfacing, sanding, snow removal) | Potential Interaction | Changes to noise would be generated from the vehicles, equipment and activities but they would be expected to be localized to the surrounding Project area. |
| | R-17 | NAR vehicle traffic | Potential Interaction | Changes to noise would be generated from vehicular movements along roadways and within the Project site but they would be expected to be localized to the surrounding Project area. |
| | R-20 | Annual construction, maintenance, and decommissioning of Stewart River and Yukon River ice roads | Potential Interaction | Changes to noise would be generated from the vehicles, equipment and activities but they would be expected to be localized to the surrounding Project area. |
| | R-22 | Air traffic | Potential Interaction | Changes to noise would be generated from air traffic but they would be expected to be localized to the surrounding Project area. |

## 4.3 CONSTRUCTION PHASE

The start of construction has the potential to have the greatest change in noise because it is the first substantial amount of noise created at the Mine Site and thus represents the scenario with the largest noise increase from the previous condition.

### 4.3.1 POTENTIAL CHANGE IN NOISE FROM CONSTRUCTION ACTIVITIES

The following subsections discuss the assumptions of the Project acoustic modeling analysis during the Construction Phase. In addition, the results of that acoustic modeling analysis and compliance assessment relative to the BC OGC noise guidelines are given at the identified noise sensitive receptors.

#### *4.3.1.1 Construction Noise Modeling Scenario*

The worst-case construction Year -1 scenario was developed using the Project schedule. The construction noise predictions were carried out using expected noise emissions from the following Project components and activities derived from preliminary construction schedule at Year-1, which are summarized below:

- Clearing, grubbing, and grading of areas to be developed within the mine site
- Hauling
- Development of Latte pit and Double Double pit, and
- Development and use of WRSFs.

The make and model of the equipment as well as the quantity was provided by Goldcorp. The octave band sound power levels were obtained from Tetra Tech's database based on similar types of equipment. **Table 4.3-1** lists the sound power level for each noise source by Octave Band Center Frequency (OBCF) used in the acoustic model. Noise generated from blasting activity and from the on-site airstrip is also discussed in **Sections 4.5** and **4.6**, respectively.

**Table 4.3-1 Sound Power Levels for Construction Year –1 Major Pieces of Project Equipment**

| Sound Source | Quantity | Sound Power Level ($L_P$) by Octave Band Frequency | | | | | | | | | Broadband Level |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 31.5 | 63 | 125 | 250 | 500 | 1k | 2k | 4k | 8k | dBA |
| **Heavy Equipment** | | | | | | | | | | | |
| 209 kW Motor Grader | 3 | 122 | 118 | 114 | 120 | 112 | 108 | 102 | 92 | 84 | 115 |
| Track Dozer | 5 | 124 | 120 | 126 | 122 | 114 | 110 | 104 | 94 | 86 | 117 |
| 250 ton Backhoe | 3 | 122 | 118 | 124 | 120 | 112 | 108 | 102 | 92 | 84 | 115 |
| 370 kW Backhoe Excavator | 2 | 111 | 107 | 113 | 109 | 101 | 97 | 91 | 81 | 73 | 104 |
| Loader | 3 | 111 | 107 | 113 | 109 | 101 | 97 | 91 | 81 | 73 | 105 |
| Wheel Dozer | 2 | 122 | 118 | 124 | 120 | 112 | 108 | 102 | 92 | 84 | 115 |

| Sound Source | Quantity | Sound Power Level ($L_P$) by Octave Band Frequency | | | | | | | | | Broadband Level |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 31.5 | 63 | 125 | 250 | 500 | 1k | 2k | 4k | 8k | dBA |
| 6-9” Rotary Blasthole Drill | 7 | 109 | 118 | 124 | 125 | 125 | 121 | 117 | 118 | 118 | 127 |
| 3-5” Rotary Blasthole Drill | 1 | 104 | 113 | 119 | 120 | 120 | 116 | 112 | 113 | 113 | 122 |
| Water Truck | 2 | 123 | 119 | 125 | 121 | 113 | 109 | 103 | 93 | 85 | 117 |
| Haul Truck | 18 | 106 | 114 | 110 | 107 | 109 | 107 | 105 | 98 | 88 | 112 |
| Water Pump | 1 | 38 | 52 | 64 | 73 | 78 | 85 | 83 | 79 | 71 | 88 |
| Stationary Equipment | | | | | | | | | | | |
| Power Plant* | 1 | 53 | 65 | 69 | 68 | 68 | 65 | 63 | 60 | 53 | 71 |
| Conveyor | 1 | 105 | 105 | 105 | 103 | 101 | 100 | 98 | 92 | 85 | 105 |
| Primary Crusher | 1 | 108 | 109 | 112 | 113 | 110 | 108 | 105 | 100 | 93 | 113 |
| Secondary Crusher | 1 | 109 | 110 | 113 | 114 | 111 | 109 | 106 | 101 | 94 | 114 |
| Vibrating Screens | 1 | 108 | 109 | 112 | 113 | 110 | 108 | 105 | 100 | 93 | 113 |

**Note:** *Per unit area

### 4.3.2 CONSTRUCTION NOISE LEVELS

Noise modeling for the construction Year -1 scenario was completed for the 2016 Feasibility Study mine site plan layout and the results of that analysis are presented in **Appendix 10-A-2 Acoustic Assessment Report**. The results of the previous analysis presented in the **Acoustic Assessment Report (Appendix 10-A-2)** demonstrate that noise levels evaluated at the BC OGC specified distance of 1.5 km from the Mine site will range from 23 dBA to 45 dBA. In addition, highest predicted sound level at an identified noise sensitive receptor is 22 dBA 10 km downriver from the Coffee Creek mouth, which is well below the BC OGC guidelines.

Since the 2016 Feasibility Study, the Mine Site has been revised as described in the Project Description (see **Section 2.0** of the Project Proposal, **Project Description**). Goldcorp advised that the construction equipment types and quantities, which were used as model inputs, are expected to remain the same as those analyzed to support the 2016 Feasibility Study. In addition, Goldcorp advised that the noise sensitive receptor locations identified for the 2016 Feasibility Study have remain unchanged.

However, while the Project location has not changed, 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 site and activities will occur, and were modeled, would be 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.

Changes to the Mine Site Plan may affect potential noise impacts at noise sensitive receptors due to adjustments in distance between sources and receiver and factors like terrain or structures that would shield or attenuate Project sound differently than what was modeled previously. Conversely, the separation distance (10 km or more) between the site and noise sensitive receptors is such that potential noise impacts associated with Project construction are not expected to significantly change from the previous analysis. Received sound levels at the identified noise sensitive receptors is still expected to remain well below the BC OGC guideline limits.

#### 4.3.3 Construction Noise Mitigation Measures

Based on the results of the Project acoustic modeling analysis, beyond best management practices (BMPs) and regular maintenance, no specific noise mitigation measures are being recommended for the Project.

BMPs for noise are provided in the Noise Management Plan, which will be developed for Project licensing that details the relevant noise impact assessment criteria, compliance procedures and controls relating to mining activities. This Plan will demonstrate how appropriate management techniques will reduce the potential for noise-related adverse impacts to employee and public health or the environment and describe the measures that will be undertaken to control noise generated by the Project.

The Noise Management Plan includes noise mitigation strategies for mobile and stationary sound sources as well as blasting. For example, for use of heavy equipment the following measures were recommended:

- Consider noise ratings when selecting equipment.
- Properly maintaining equipment to minimize noise, including lubrication and replacement of worn parts, inclusive of exhaust systems.
- Optimizing the operation of equipment to minimize noise, e.g., reducing vehicle speeds.
- Where practical, optimizing the site layout to minimize noise impact, e.g., through use of natural screens such as buildings, locating doors away from noise sources and facing away from relevant receptors .
- Maximizing the distance between roads servicing heavy equipment and worker camps.
- Optimizing site procedures to minimize the noise impact, e.g., keeping doors closed.
- Conducting loud procedures (e.g., material loading/unloading transfer, etc.) indoors, where possible.

Reducing the drop height hen loading haul trucks.

- Optimizing hours of operation for loud procedures to minimize noise impact and/or restricting operation to specific hours so that workers know when to expect particularly annoying noise events during sleeping hours, and
- Turning off equipment when not in use to avoid unnecessary idling.

For stationary sources like crushing, milling, feeders and conveyors a separate set of noise mitigation measures were recommended. For instance, for feeders and conveyers the following measures were given:

- Reducing impact noise by keeping some material in bins and hoppers when operating
- Reducing the drop height
- Using stone baffles and chute linings, and
- Maintaining the conveyor idlers to minimize squeal.

### 4.3.4 Potential Residual Change on Noise, Construction

Residual effects are those that remain after mitigation measures have been applied. No specific noise mitigation measures, beyond the standard BMPS and Project design measures are recommended. Further discussion about effects of noise on wildlife, birds and human health are discussed in Sections 16, 17 and 27 of the Project Proposal.

## 4.4 Operation Phase

As discussed above, there have been Project changes since the 2016 Feasibility Study including that 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, which will generate noise are given in Table 4.4-1. The annual progression of infrastructure development and operational closure (e.g., pit backfilling, progressive reclamation of the heap leach pad) from Year 2 through Year 11 are described further in Section 2.0 of the Project Proposal (Project Description) as well as additional details regarding the equipment fleet.

Operational noise impacts are analyzed by using the year anticipated to have the maximum quantity of equipment on-site. For the 2016 Feasibility Study that year was Year 6; however, with the Project changes since that time, Year 9 would not be considered the period when the maximum quantity of equipment, and

### 4.4.1 Potential Change in Noise from Operations Activities

The following subsections discuss the assumptions of the Project acoustic modeling analysis during the operations phase. In addition, the results of that acoustic modeling analysis and compliance assessment relative to the BC OGC noise guidelines are given at the identified noise sensitive receptors.

#### *4.4.1.1 Operational Noise Modeling Scenario*

The worst-case construction Year 6 scenario was developed using the 2016 Feasibility Study Project schedule. Worst case operational Year 6 noise predictions were carried out using expected noise emission levels from the following Project components and activities:

- Hauling
- Development of Supremo Pit

- Partial backfill of Supremo Pit
- Use of engineered stockpiles for temporary storage of ROM ore and crushed ore
- Crusher operation
- Operation of on-site service roads and haul roads, and
- On-site power generation and distribution, including installation of fourth genset.

The noise modeling methodology used to analyze Mine Site operations was the same as that used for the construction scenario. **Table 4.4-1** lists the sound power level for each noise source by OBCF used in the operational Year 6 acoustic model. Noise generated from the NAR, blasting activity and from the on-site airstrip is also discussed in Sections 4.4 4.5 and 4.6, respectively.

**Table 4.4-1 Sound Power Levels for Operational Year 6 Major Pieces of Project Equipment**

| Sound Source | Quantity | Sound Power Level (LP) by Octave Band Frequency | | | | | | | | | Broadband Level |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 31. | 63 | 125 | 250 | 500 | 1k | 2k | 4k | 8k | dBA |
| **Heavy Equipment** | | | | | | | | | | | |
| 209 kW Motor Grader | 3 | 122 | 118 | 114 | 120 | 112 | 108 | 102 | 92 | 84 | 115 |
| Track Dozer | 5 | 124 | 120 | 126 | 122 | 114 | 110 | 104 | 94 | 86 | 117 |
| 250 ton Backhoe | 3 | 122 | 118 | 124 | 120 | 112 | 108 | 102 | 92 | 84 | 115 |
| 370 kW Backhoe | 2 | 111 | 107 | 113 | 109 | 101 | 97 | 91 | 81 | 73 | 104 |
| Loader | 3 | 111 | 107 | 113 | 109 | 101 | 97 | 91 | 81 | 73 | 105 |
| Wheel Dozer | 2 | 122 | 118 | 124 | 120 | 112 | 108 | 102 | 92 | 84 | 115 |
| 6-9" Rotary Blasthole | 7 | 109 | 118 | 124 | 125 | 125 | 121 | 117 | 118 | 11 | 127 |
| 3-5" Rotary Blasthole | 1 | 104 | 113 | 119 | 120 | 120 | 116 | 112 | 113 | 11 | 122 |
| Water Truck | 2 | 123 | 119 | 125 | 121 | 113 | 109 | 103 | 93 | 85 | 117 |
| Haul Truck | 18 | 106 | 114 | 110 | 107 | 109 | 107 | 105 | 98 | 88 | 112 |
| Water Pump | 1 | 38 | 52 | 64 | 73 | 78 | 85 | 83 | 79 | 71 | 88 |
| **Stationary Equipment** | | | | | | | | | | | |
| Power Plant* | 1 | 53 | 65 | 69 | 68 | 68 | 65 | 63 | 60 | 53 | 71 |
| Conveyor | 1 | 105 | 105 | 105 | 103 | 101 | 100 | 98 | 92 | 85 | 105 |
| Primary Crusher | 1 | 108 | 109 | 112 | 113 | 110 | 108 | 105 | 100 | 93 | 113 |
| Secondary Crusher | 1 | 109 | 110 | 113 | 114 | 111 | 109 | 106 | 101 | 94 | 114 |
| Vibrating Screens | 1 | 108 | 109 | 112 | 113 | 110 | 108 | 105 | 100 | 93 | 113 |

**Note:** *Per unit area

#### 4.4.2 OPERATIONAL NOISE LEVELS

Noise modeling for the operational Year 6 scenario was completed for the 2016 Feasibility Study mine site plan layout and the results of that analysis are presented in **Appendix 10-A-2 Acoustic Assessment Report**. The results of the previous analysis presented in the Acoustic Assessment report demonstrate that noise levels evaluated at the BC OGC specified distance of 1.5 km from the Mine site 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, which is well below the BC OGC guidelines.

Since the 2016 Feasibility Study, the Mine Site has been revised as described in the Project Description (see **Section 2.0** of the Project Proposal, **Project Description**). As mentioned above, Year 9, not Year 6, is the period when the maximum quantity of equipment is expected on-site. Goldcorp advised that the operation equipment types, which were used as model inputs, are expected to remain the same as those analyzed to support the 2016 Feasibility Study. In addition, Goldcorp advised that the noise sensitive receptor locations identified for the 2016 Feasibility Study have remain unchanged.

However, while the Project location has not changed, 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 site and activities will occur, and were modeled, would be 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, Goldcorp advised that the equipment fleet during the operational phase would change, specifically the number of haul trucks would increase to 24, as opposed to 18 in the previous analysis.

Changes to the Mine Site Plan may affect potential noise impacts at noise sensitive receptors due to adjustments in distance between sources and receiver and factors like terrain or structures that would shield or attenuate Project sound differently than what was modeled previously. Also, noise levels would be expected 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 noise impacts associated with Project operation are not expected to significantly change from the previous analysis. Received sound levels at the identified noise sensitive receptors is still expected to remain well below the BC OGC guideline limits.

#### 4.4.3 OPERATIONAL NOISE MITIGATION MEASURES

Based on the results of the Project acoustic modeling analysis, beyond best management practices (BMPs) and regular maintenance, no specific noise mitigation measures are being recommended for the Project. BMPs are provided in the Noise Management Plan, which is described in Section 4.3.3.

#### 4.4.4 POTENTIAL RESIDUAL CHANGE ON NOISE, OPERATION

Residual effects are those that remain after mitigation measures have been applied. No specific noise mitigation measures, beyond the standard BMPS and Project design measures are recommended. Further discussion about effects of noise on wildlife, birds and human health are discussed in Sections 16, 17 and 27 of the Project Proposal.

### 4.5 NORTHERN ACCESS ROUTE

An all-weather access road will be utilized for providing equipment, fuel and other supplies during the construction and operations. The NAR will be located between Dawson and the Mine Site with Forestry-road type construction starting in Year -3 with completion prior to the start of the site construction in Year –2.

The NAR will cross the Stewart River and the Yukon River. During periods of open flow, barges will be utilized to move transport trucks across each river. During the winter months when the rivers are frozen ice roads will be constructed to allow access across the rivers. No river access will be possible during the spring that and fall freeze-up periods each year. Logistics and storage of fuel and consumable materials during these periods has been considered with incorporating storage and laydown areas.

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. 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.

#### 4.5.1 NAR NOISE LEVELS

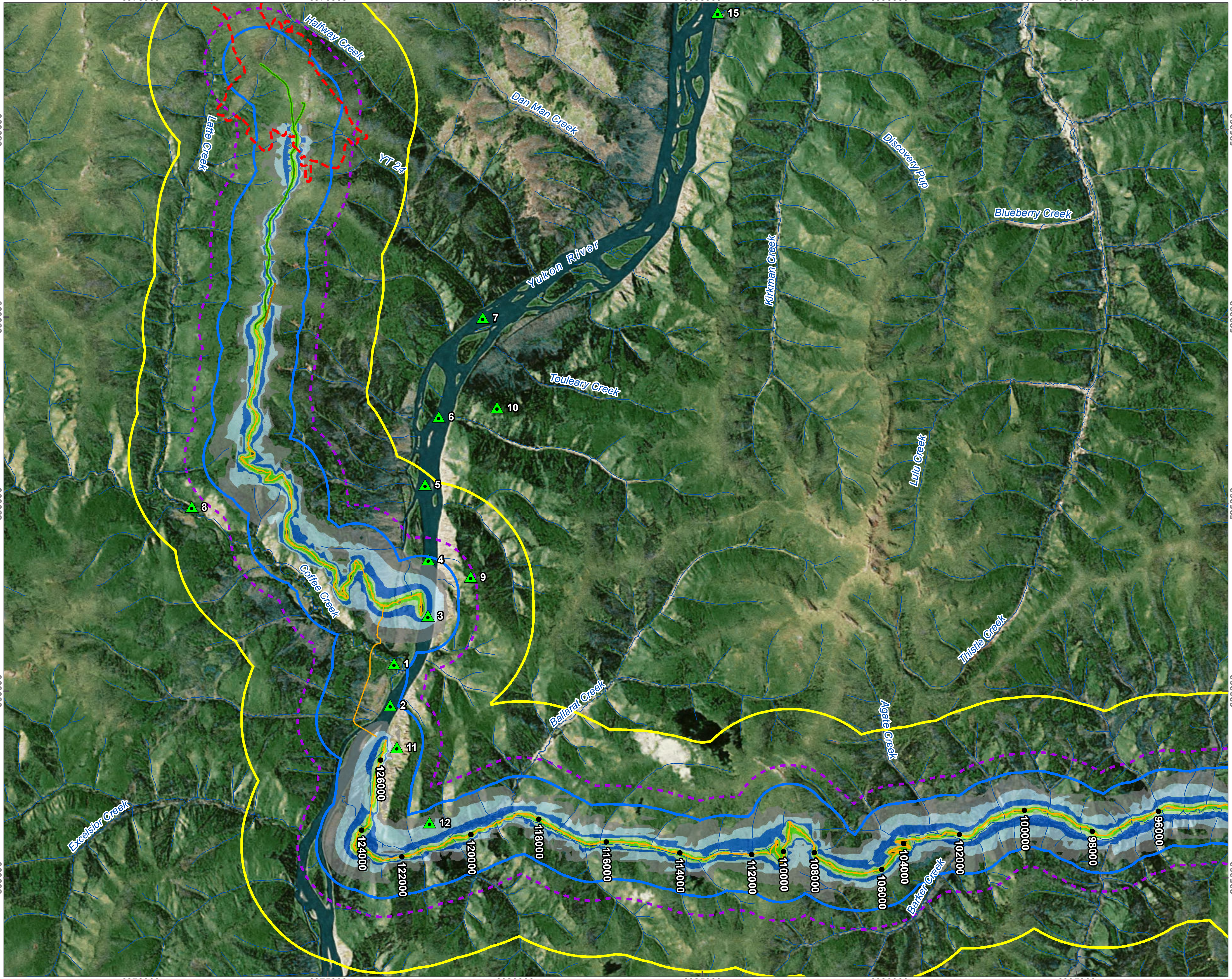
While the Mine site plan has changed since the 2016 Feasibility Study mine site plan, the NAR and assumptions relative to the vehicle activity along the route have not changed; therefore, the previous analysis conducted remains valid and is presented here as well as in **Appendix 10-A-2 Acoustic Assessment Report**.

The NAR was also modeled using the CadnaA noise modeling software and a methodology consistent with the construction and operations analyses. The noise model assumed unpaved roadways with a speed limit of 40 km/hr, which is the average speed limit permitted on the NAR. Based on the Project feasibility study the NAR will have a maximum traffic volume of eight trucks per day, which occurs between years 5 and 7. This maximum daily truck volume was inputted into the noise model during the daytime period only. The NAR will not be used during nightshift hours.

The noise contour distances from the centerline of the NAR are as follows:

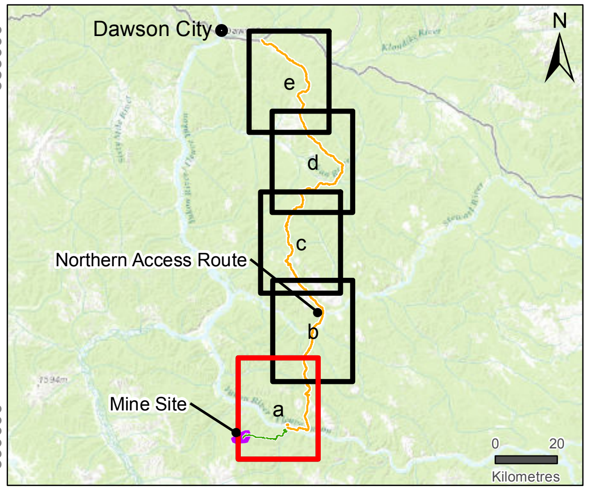
- 50 dBA at 68 m
- 45 dBA at 145 m
- 40 dBA at 307 m
- 35 dBA at 515 m

The received sound levels produced by traffic on the NAR reach the BC OGC 50 dBA daytime guideline at an approximate distance of 68 m from either side of the road centerline. The noise contour distances described may vary slightly due to changes in topography or bends and turns in the road. The noise contours for the NAR operations are presented in **Figure 4-3a** through **4-3e**.




# COFFEE GOLD MINE

## Northern Access Route Operational (Year 6) Noise Contours




**Legend**

- Noise Sensitive Receptor
- Local Study Area
- Regional Study Area
- Mine Site - Project Footprint
- OGC 50 dBA Daytime PSL Point of Compliance
- Northern Access Route
- Mine Site Access Road
- Proposed Airstrip
- Watercourse

**Sound Level Contour Ranges (dBA)**

- 30 - 35
- 35 - 40
- 40 - 45
- 45 - 50
- 50 - 55
- 55 - 60

**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 Kaminak. Additional imagery from ESRI; Earthstar Geographics (1999).

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NAD 1983 UTM Zone 7N

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| Figure 4-3a | Date: Jan 27, 2017 | Drawn by: SL | Reviewed: KG |
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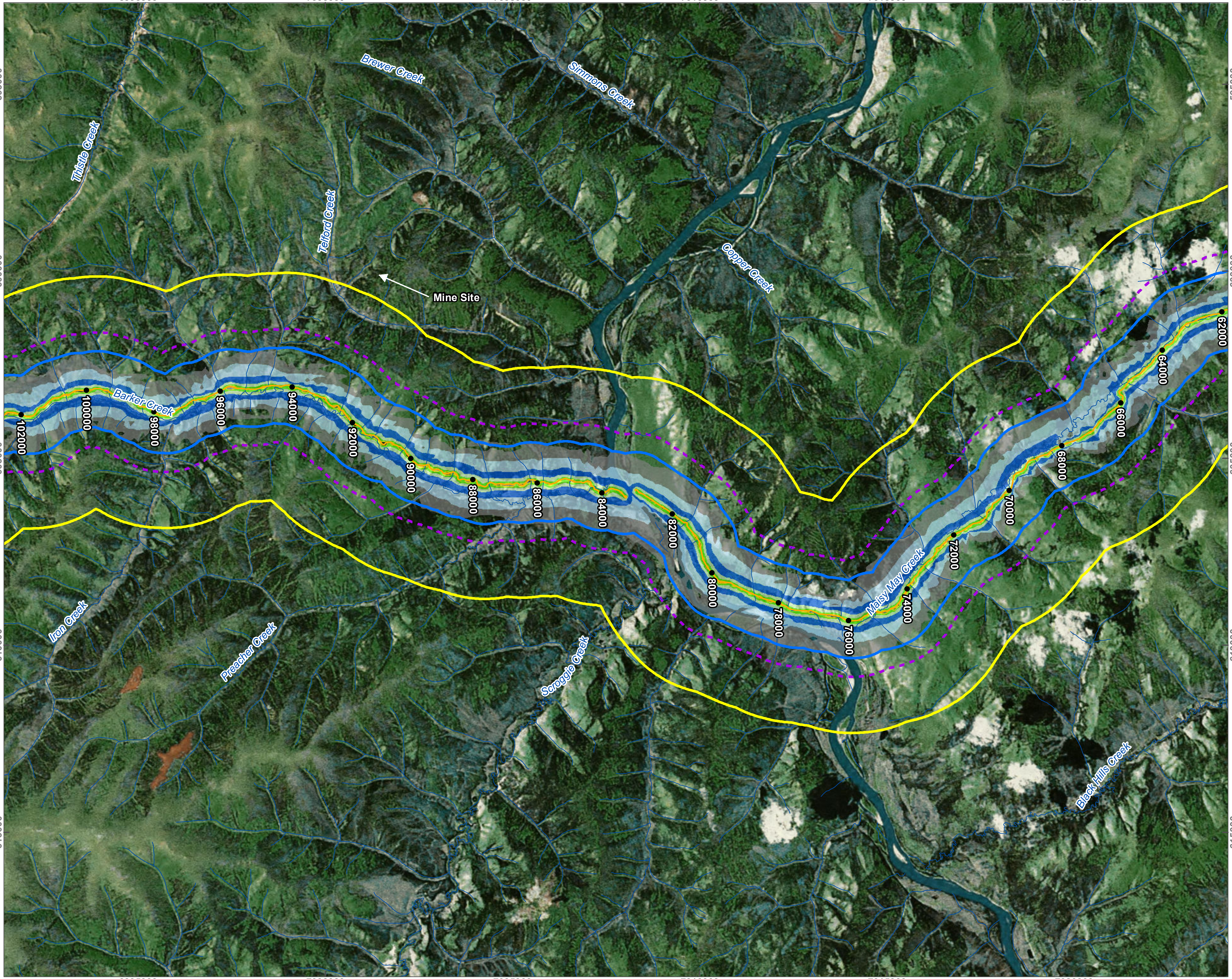
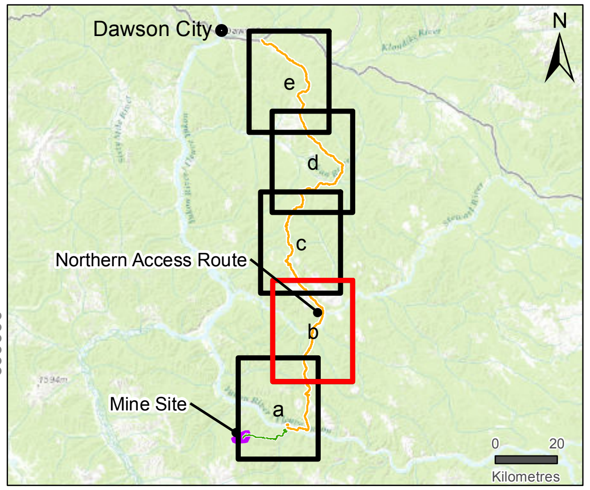
GOLDCORP




COFFEE GOLD MINE

**Northern Access Route**
**Operational (Year 6) Noise Contours**




## Legend

- Noise Sensitive Receptor
- Local Study Area
- Regional Study Area
- OGC 50 dBA Daytime PSL Point of Compliance
- Northern Access Route
- Mine Site Access Road
- Watercourse

**Sound Level Contour Ranges (dBA)**

- 30 - 35
- 35 - 40
- 40 - 45
- 45 - 50
- 50 - 55
- 55 - 60

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 Kaminak. Additional imagery from ESRI; Earthstar Geographics (1999).

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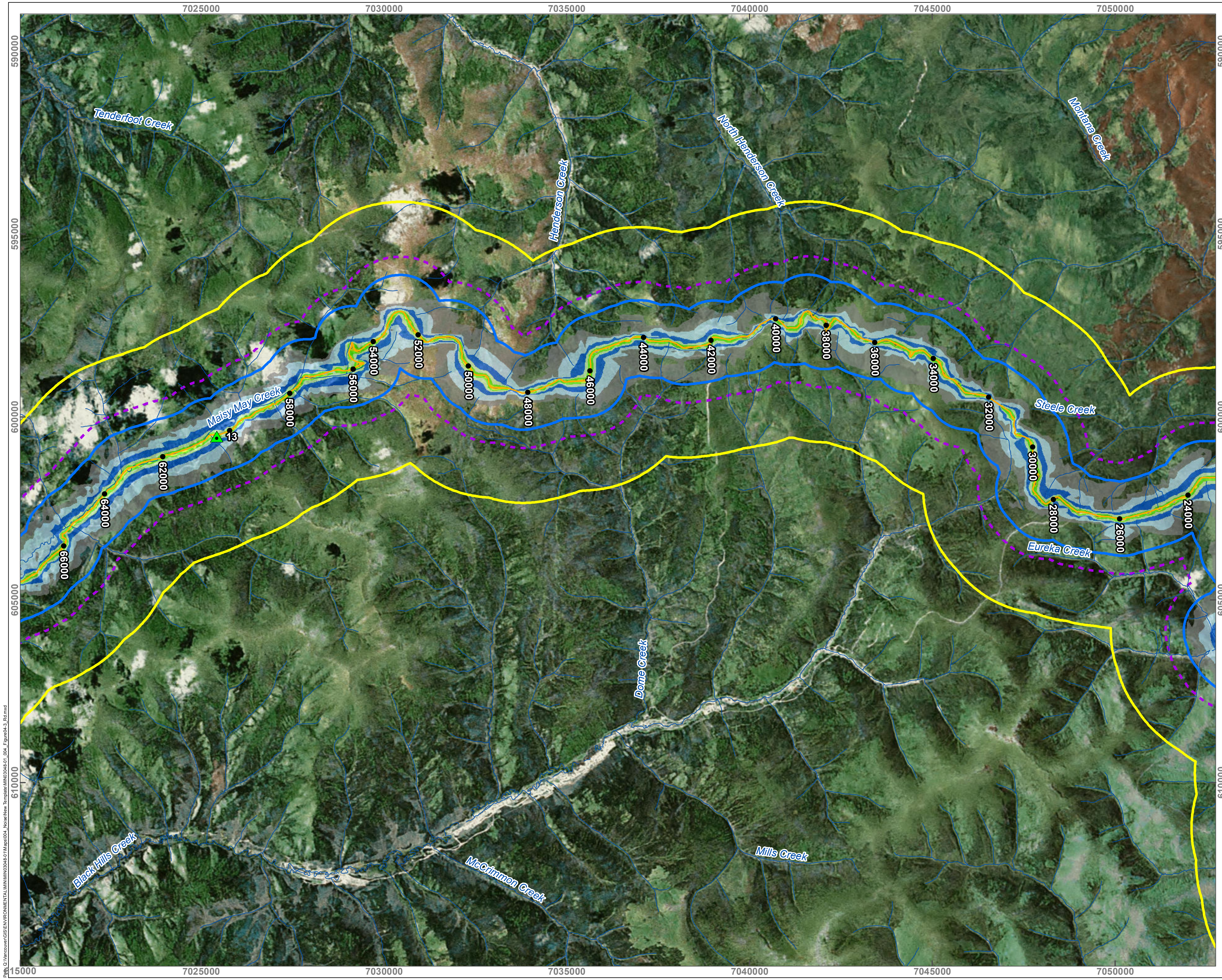
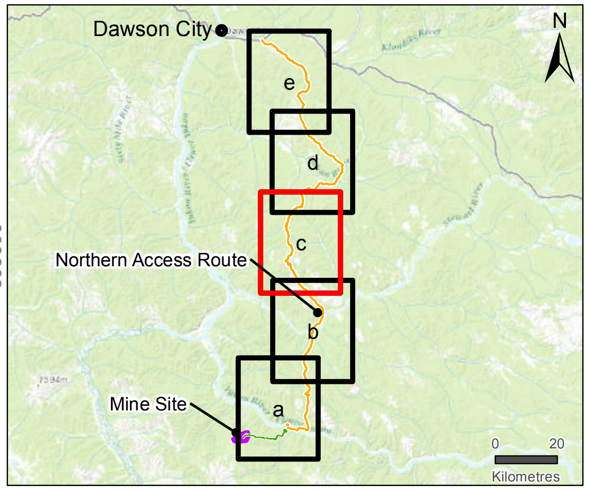
| Figure 4-3b | Date: Jan 27, 2017 | Drawn by: SL | Reviewed: KG |
|---|---|---|---|




COFFEE GOLD MINE

**Northern Access Route**
**Operational (Year 6) Noise Contours**




## Legend

- Noise Sensitive Receptor
- Local Study Area
- Regional Study Area
- OGC 50 dBA Daytime PSL Point of Compliance
- Northern Access Route
- Mine Site Access Road
- Watercourse

**Sound Level Contour Ranges (dBA)**

- 30 - 35
- 35 - 40
- 40 - 45
- 45 - 50
- 50 - 55
- 55 - 60

## 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 Kaminak. Additional imagery from ESRI; Earthstar Geographics (1999).

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| Figure 4-3c | Date: Jan 27, 2017 | Drawn by: SL | Reviewed: KG |
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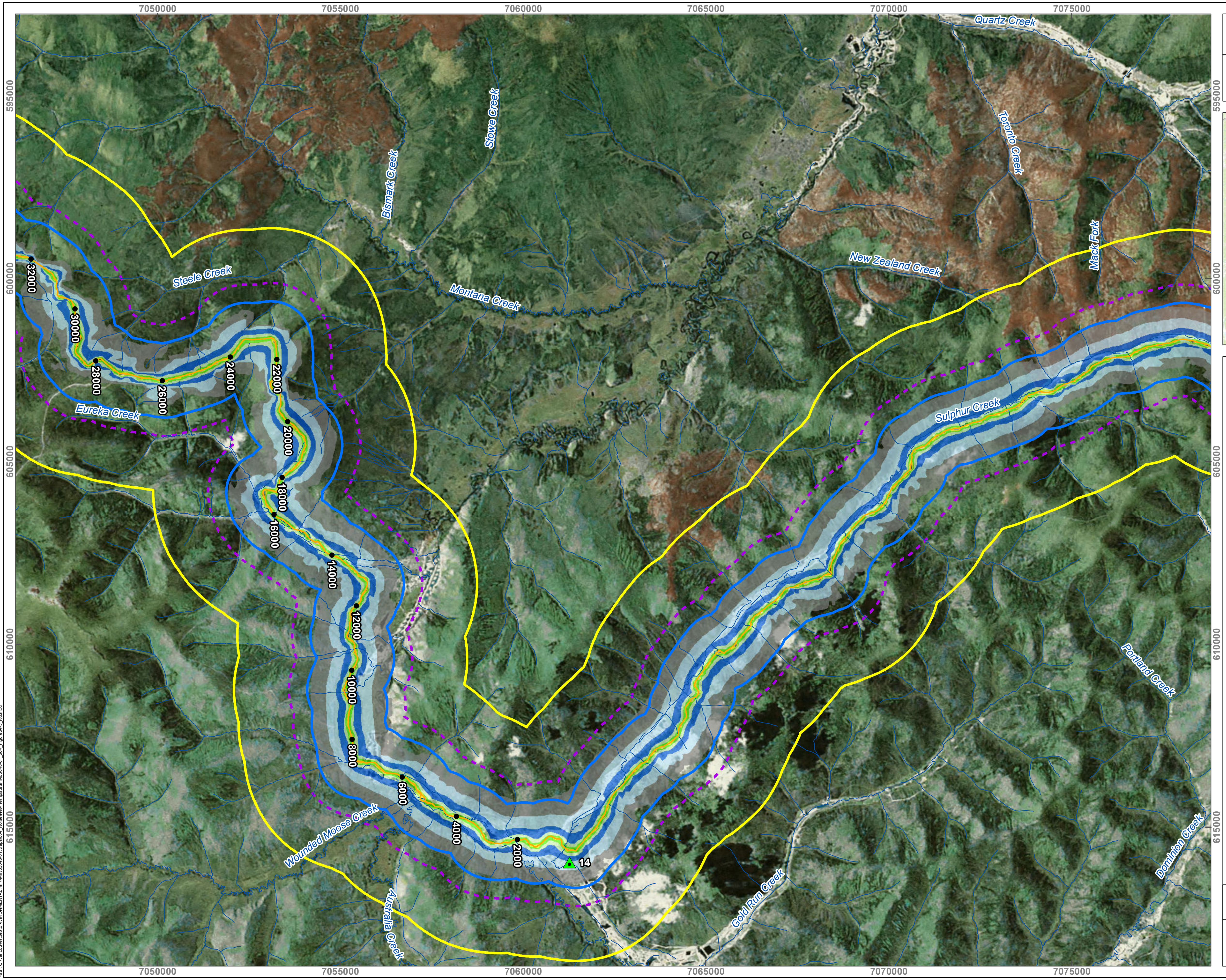
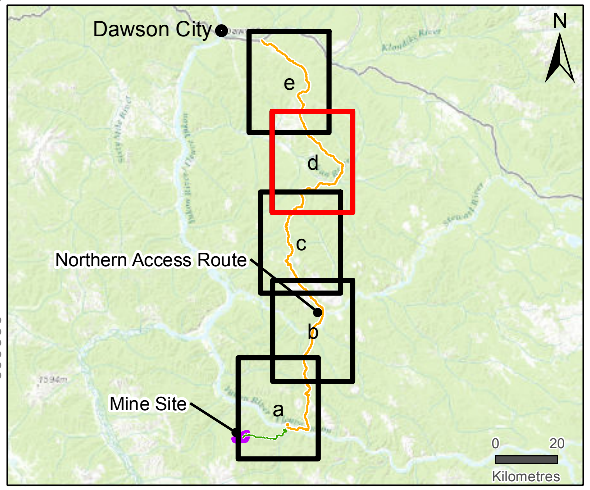
GOLDCORP

# COFFEE GOLD MINE

## Northern Access Route
## Operational (Year 6) Noise Contours




### Legend

- Noise Sensitive Receptor
- Local Study Area
- Regional Study Area
- OGC 50 dBA Daytime PSL Point of Compliance
- Northern Access Route
- Mine Site Access Road
- Watercourse

**Sound Level Contour Ranges (dBA)**

- 30 - 35
- 35 - 40
- 40 - 45
- 45 - 50
- 50 - 55
- 55 - 60

### 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 Kaminak. Additional imagery from ESRI; Earthstar Geographics (1999).

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NAD 1983 UTM Zone 7N

Page Size: 11" x 17"

| Figure 4-3d | Date: Jan 27, 2017 | Drawn by: SL | Reviewed: KG |
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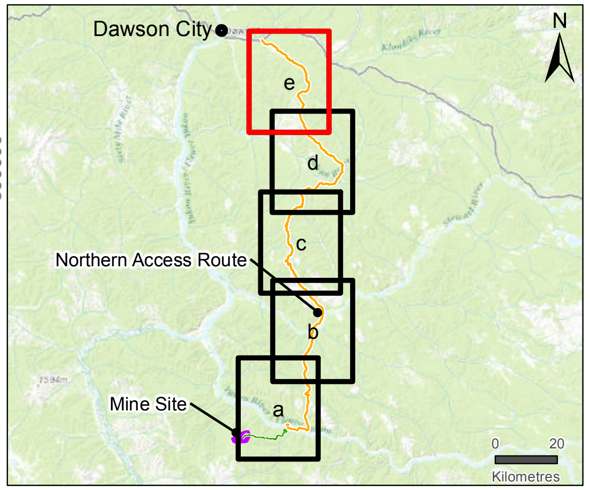
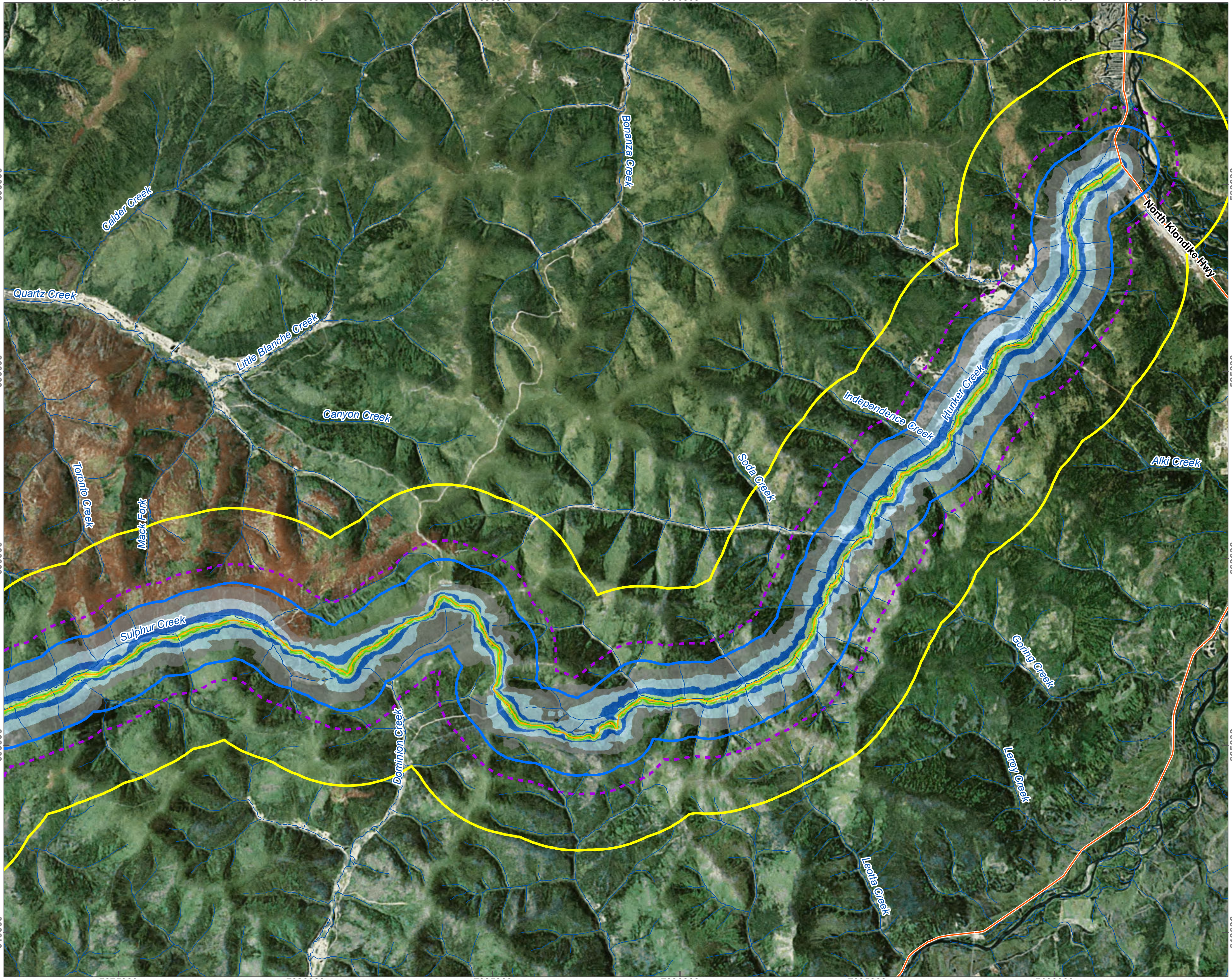
GOLDCORP

COFFEE GOLD MINE

**Northern Access Route**
**Operational (Year 6) Noise Contours**




## Legend

- Noise Sensitive Receptor
- Local Study Area
- Regional Study Area
- OGC 50 dBA Daytime PSL Point of Compliance
- Northern Access Route
- Mine Site Access Road
- Klondike Highway
- Watercourse

**Sound Level Contour Ranges (dBA)**

- 30 - 35
- 35 - 40
- 40 - 45
- 45 - 50
- 50 - 55
- 55 - 60

## Notes

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2. - Imagery from Kaminak. Additional imagery from ESRI; Earthstar Geographics (1999).

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| Figure 4-3e | Date: Jan 27, 2017 | Drawn by: SL | Reviewed: KG |
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GOLDCORP

### 4.5.2 NORTHERN ACCESS ROUTE NOISE MITIGATION MEASURES

Based on the results of the Project acoustic modeling analysis, beyond best management practices (BMPs) and regular maintenance, no specific noise mitigation measures are being recommended for the Project. BMPs are provided in the Noise Management Plan, which is described in Section 4.3.3.

### 4.5.3 POTENTIAL RESIDUAL CHANGE ON NOISE, NORTHERN ACCESS ROUTE

Residual effects are those that remain after mitigation measures have been applied. No specific noise mitigation measures, beyond the standard BMPS and Project design measures are recommended. Further discussion about effects of noise on wildlife, birds and human health are discussed in Sections 16, 17 and 27 of the Project Proposal.

## 4.6 BLASTING OPERATIONS

The construction and operations of the Project will require blasting. Blasting is a short duration event as compared to rock removal methods, such as using track rig drills, rock breakers, jack hammers, rotary percussion drills, core barrels, and/or rotary rock drills. Proposed blasting techniques include the electronically controlled ignition of multiple small-explosive charges in an area of rock 8/1,000 of a second apart, resulting in a total event duration of approximately 3/10 of a second. The detonations are timed so the energy from individual detonations destructively interferes with each other, referred to as wave canceling. As a result, very little of the kinetic energy generated during the detonations is wasted as audible noise.

The Project will use an average charge weight ranging from 287 kilograms (kg) that will be buried. The blasthole depth will be 11.6 m incorporating a 10 m bench height plus 1.6 sub-drill. The blastholes will be loaded with 7.9 m of explosives leaving a 3.7 m collar that will be backfilled with drill cuttings. 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).

Blasting was modeled at a single blast site for Year -1 and Year 6 using the 2016 Feasibility Study mine site plan; however, the Project schedule and Mine site plan have subsequently changed

The 2016 Feasibility Study mine site plan analysis was conducted using BNOISE2 software and the results of that analysis are presented in **Appendix 10-A-2 Acoustic Assessment Report**. The results of the analysis presented in the Acoustic Assessment report demonstrate that noise levels could reach up to 130 dB $L_{peak}$ in the vicinity of the blast. At a distance of 1.5 km the maximum noise level from the blasting operations would range from 60 to 74 dB $L_{peak}$.

Considering that the blasting charge weight and relative locations have not changed in the revised mine plan, the potential noise impacts associated with blasting activity are expected to remain relatively consistent to what was previously modeled.

#### 4.6.1 BLASTING NOISE MITIGATION MEASURES

To minimize the interaction from the blast noise the blasting operations, a plan will be developed. Blasting plans, including incorporation of potential noise reduction measures, will be prepared by the contracted blasting specialist that demonstrate compliance with all applicable blasting regulations including the use of properly licensed personnel and obtaining all necessary authorizations.

#### 4.6.2 POTENTIAL RESIDUAL CHANGE ON NOISE, BLASTING

Residual effects are those that remain after mitigation measures have been applied. No specific noise mitigation measures, beyond the standard BMPS and Project design measures are recommended. Further discussion about effects of noise on wildlife, birds and human health are discussed in Sections 16, 17 and 27 of the Project Proposal.

### 4.7 AIRSTRIP OPERATIONS

The Project will include an all-weather airstrip located east of the mining operations. The dimensions of the airstrip will be 1,220 m in length and 35 m wide. Noise generated at the airstrip will be related to the aircraft or its components, during various phases of a flight; on the ground while parking and using auxiliary power units, while taxiing, on run-up from propeller and jet exhaust, during takeoff, underneath and lateral to departure and arrival paths, over-flying when enroute, or during landing. The Coffee airstrip is designed to handle turboprop passenger aircraft (Hawker Siddeley 748) and is also sufficiently sized to handle cargo aircraft up to a de Havilland DHC-5A Buffalo. In addition, the airstrip will accommodate helicopter (e.g., Bell 206 and the Eurocopter AS350) operations, which will be used to transport drill core and chip samples to the process plant. The helicopters will also be used to complete monthly surveys to remote monitoring sites that are not accessible by mine roads.

Activity at the airstrip was modeled using the 2016 Feasibility Study mine site plan assuming the highest volume of flights would occur in Year 6, which would consist of 9 freight aircraft flights, 179 passenger aircraft flights, and 24 helicopter flights total for the year..

The previous analysis was conducted using BaseOps noise modeling software and the results of that analysis are presented in **Appendix 10-A-2 Acoustic Assessment Report**. The results of the previous analysis presented in the Acoustic Assessment Report demonstrate that there are no identified human noise sensitive receptors that would have a received sound level greater than 50 dBA.

Considering that the volume of flights is not expected to change and that noise sensitive receptors are still located fairly at the same distance from the airstrip, the potential noise impacts associated with airstrip activity are expected to remain relatively consistent to what was previously modeled.

#### 4.7.1 AIRSTRIP NOISE MITIGATION MEASURES

Based on the results of the Project acoustic modeling analysis, beyond best management practices (BMPs) and regular maintenance, no specific noise mitigation measures are being recommended for the Project. BMPs are provided in the Noise Management Plan, which is described in Section 4.3.3.

#### 4.7.2 POTENTIAL RESIDUAL CHANGE ON NOISE, AIRSTRIP

Residual effects are those that remain after mitigation measures have been applied. No specific noise mitigation measures, beyond the standard BMPS and Project design measures are recommended. Further discussion about effects of noise on wildlife, birds and human health are discussed in Sections 16, 17 and 27 of the Project Proposal.

### 4.8 SUMMARY OF FUTURE CONDITIONS WITH THE PROJECT

Sound generated during Project Construction and Operation Phase will fluctuate depending on the Project activity, equipment type, and separation distances between source and receiver. The variation in power and usage imposes additional complexity in characterizing noise levels. The analysis conservatively assumes all equipment and vehicles will operate simultaneously under a given scenario; however, equipment and vehicles may not be operated simultaneously and/or continuously.

On-site activity and equipment use is expected to decrease prior to and during the course of reclamation and closure. It is expected that the noise levels generated from the reclamation and closure phase will be less than the noise generated by construction Year -1 scenario. During the post-closure phase it is assumed that there will be no Project-related equipment or activities. The noise levels during the post-closure phase will be similar to the noise levels documented before the Project activities start.

The Project will generate sound levels that exceed the ambient sound levels and has the potential to cause a temporary, short-term, localized disturbance from time to time. However, the Project is anticipated to comply with the applicable BC OGC noise guideline and will include a Best Management Practice to maintain compliance. The Project will take reasonable efforts to minimize noise changes to the extent practicable.

# 5.0 FUTURE CONDITIONS WITH THE PROJECT AND OTHER PAST, PRESENT, AND FUTURE PROJECTS AND ACTIVITIES

This section presents a preliminary analysis of potential cumulative changes to Noise and the Project's contribution to these changes. These have been included based upon concerns raised by First Nations. Cumulative changes are a result from interactions between the Project's related changes and incremental effects from other past, present, and future projects and activities.

## 5.1 SPATIAL AND TEMPORAL SCOPE OF THE CUMULATIVE CHANGE ANALYSIS

As described in **Section 1.4.1**, the spatial boundaries of the cumulative change analysis for Noise are defined by a 10 km radius from the Mine site and 3 km from either side of the NAR, which are consistent with the extents of the RSA. Projects located outside of those extents will not result in a cumulative change in noise. The temporal boundaries within which cumulative changes are considered will encompass the life of the Project, including its post-closure phase.

## 5.2 CHANGES DUE TO OTHER PAST, PRESENT, AND FUTURE PROJECTS AND ACTIVITIES

Past, present, and future projects located in the RSA include three quartz exploration projects, the Dan Man, Boulevard, and Coffee, Cream and Kirkman properties. The Dan Man property is located approximately 5 km to the north of the Project site. The Boulevard property is located 9.8 km to the southwest of the Project site and the Coffee, Cream and Kirkman properties are located 7.3 km to the southeast of the Project site. There are no other projects are located within the 10 km radius.

In 2009, Silver Quest Resources Ltd. acquired the Boulevard property. Gold mineralization at Boulevard is associated with quartz-carbonate veins in chlorite-biotite schist. In 2010 and 2011, field activities have included geochemical soil sampling, backhoe trenching and diamond drilling. The status of current and future field activities is unknown. The Boulevard is currently owned by Independence Gold and undergoing active exploration activities.

The Dan Man property is comprised of 578 mineral claims and is operated by ARCUS Development Group Inc. (ARCUS). In 2011, ARCUS conducted an exploration campaign focused on the southern portion of the block claim. To date only exploration activities have been conducted within the Dan Man property. Based on information by ARCUS present activities include additional exploration campaigns; however, future activities for the Dan Man project may include mining operations.

The Coffee, Cream and Kirkman properties are owned the Proponent. The primary target on all three properties is a near surface, bulk tonnage gold deposit. Through an exploration campaign it showed that the Coffee property delivered the anticipated deposits. The status of current and future field activities at all three properties is unknown.

The noise generated at these properties, if developed and fully operational, is expected to be similar to or lower than noise levels generated by the proposed Project. Due to the separation distance between the Project and the three abovementioned developments, cumulative noise impacts are not anticipated at the nearest sensitive receptors

In addition to the abovementioned projects, there is the potential for cumulative changes to noise related 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 a quantitative assessment is not possible; however, since there are no nearby residential land uses near the NAR cumulative impacts are not anticipated. A summary of the projects and activities considered in the cumulative effects analysis is given in **Table 5.2-1**.

**Table 5.2-1 Other Projects and Activities Considered in the Analysis of Cumulative Change on Noise**

| Other Project / Activity | Description | Potential Residual Effects | Potential for Interaction Resulting in Cumulative Change (see Notes) and Rationale |
|---|---|---|---|
| **Project Name** | | | |
| Boulevard | In 2009 Silver Quest Resources Ltd. acquired the Boulevard property. Gold mineralization at Boulevard is associated with quartz-carbonate veins in chlorite-biotite schist. In 2010 and 2011 field activities have included geochemical soil sampling, backhoe trenching and diamond drilling. The status of current and future field activities is unknown. | The mining activities and noise generated are expected to be similar to or lower than noise levels generated by the proposed Project. Due to the separation distance between the Project and the Boulevard property, cumulative noise impacts are not anticipated at the nearest sensitive receptor locations. | Yes, the addition of a noise source that is similar to or lower than the Project noise source may result in an interaction, but not a perceptible additive change. |
| Dan Man | To date only exploration activities have been conducted within the Dan Man property. Based on information by ARCUS present activities include additional exploration campaigns. However, future activities for the Dan Man project may include mining operations. | The mining activities and noise generated are expected to be similar to or lower than noise levels generated by the proposed Project. Due to the separation distance between the Project and the Dan Man property, cumulative noise impacts are not anticipated at the nearest sensitive receptor locations. | Yes, the addition of a noise source that is similar to or lower than the Project noise source may result in an interaction, but not a perceptible additive change. |
| Coffee, Cream, and Kirkman | The three properties are owned by Goldcorp. The primary target on all three properties is a near surface, bulk tonnage gold deposit. Through an exploration campaign it showed that the Coffee property delivered the anticipated deposits. The status of current and future field activities at all three properties is unknown. | The mining activities and noise generated are expected to be similar to or lower than noise levels generated by the proposed Project. Due to the separation distance between the Project and the Coffee, Cream, and Kirkman properties, cumulative noise impacts are not anticipated at the nearest sensitive receptor locations. | Yes, the addition of a noise source that is similar to or lower than the Project noise source may result in an interaction, but not a perceptible additive change. |
| **Activity Name** | | | |
| Other Quartz, Placer, Forestry and Utility Projects using the NAR | Vehicles travel the NAR for additional projects than outlined elsewhere in this table. All generate changes to noise through the operation of the vehicles. | Since a detailed traffic study has not been conducted to evaluate the potential incremental increases a quantitative assessment is not possible; however, since there are no nearby residential land uses near the NAR cumulative impacts are not anticipated. | Yes, the addition of traffic may result in an interaction but impacts are expected to be low given proximity to sensitive receptors |

**Note:** **No:** no interaction or not likely to interact cumulatively; **Yes:** potential for cumulative change

### 5.3 Potential Cumulative Changes

This section describes each potential adverse cumulative change to noise resulting from interactions with the other projects and activities identified in **Table 5.2-1**.

#### 5.3.1 Potential Cumulative Changes to Noise Levels

Based on the known projects including past, present, and future there are only three projects within the 10 km cumulative interaction radius. As discussed above, the Dan Man, Boulevard, and Coffee, Cream and Kirkman properties are the only developments within a 10 km radius that would result in a cumulative interaction in noise. The noise produced at those properties, if developed and fully operational, is expected to be similar to or lower than noise levels generated by the proposed Project. The addition of a noise source that is similar to or lower than the Project noise source may result in an interaction; however, due to the separation distance between the Project and the three quartz developments, cumulative noise impacts are not anticipated at the nearest sensitive receptors.

In addition to those three developments, there is the potential for cumulative changes to noise related 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 a quantitative assessment is not possible. However, since there are no residential land uses near the NAR cumulative impacts are not anticipated.

#### 5.3.2 Mitigation Measures for Cumulative Changes

There is no expected perceptible additive change in noise due to cumulative interactions. Therefore, no mitigation measures have been identified.

#### 5.3.3 Potential Residual Cumulative Changes to Noise

Residual effects are those that remain after mitigation measures have applied. In this case, there is no expected perceptible additive change in noise due to cumulative interactions. No specific noise mitigation measures have been recommended; therefore, an evaluation of residual effects is not applicable.

#### 5.3.4 Summary of Future Conditions with the Project and Other Projects and Activities

This section provides a preliminary analysis of the cumulative changes and the Project's contribution to those cumulative changes to noise. The Dan Man, Boulevard, and Coffee, Cream and Kirkman properties are the only developments within a 10 km radius that would result in a cumulative interaction in noise. The noise generated at those properties is expected to be similar to or lower than noise levels generated by the proposed Project. Due to the separation distance between the Project and those three developments, cumulative noise impacts are not anticipated at the nearest sensitive receptors. Similarly, the NAR is not located in proximity to any identified sensitive receptors; therefore, cumulative noise impacts are not anticipated.

# 6.0 SUMMARY OF ANALYSIS OF CHANGES TO NOISE

Sound generated during Project construction and operation will fluctuate depending on the Project activity, equipment type, and separation distances between source and receiver. The variation in power and usage imposes additional complexity in characterizing noise levels. The analysis conservatively assumes all equipment and vehicles will operate simultaneously under a given scenario; however, equipment and vehicles may not be operated simultaneously and/or continuously.

The Project will generate sound levels that exceed ambient sound levels and that have the potential to cause a temporary, short-term, localized disturbance from time to time. The results of the previous analysis using the 2016 Feasibility Study mine site plan show that the Project is anticipated to comply with the BC OGC noise guideline and no specific noise mitigation measures, beyond Project design measures, including implementing the Noise Management Plan (described in Section 4.3.3.), and BMPs that have been incorporated in all noise models, have been recommended. That being said, the Project will take reasonable efforts to minimize noise impacts to the extent practicable. The Mine site plan and other Project-related details have since been revised; however, we anticipate that potential noise impacts at identified sensitive receptors will not change significantly.

Potential cumulative noise impacts were also assessed and it was determined that the only developments within a 10 km radius were the Dan Man, Boulevard, and Coffee, Cream and Kirkman properties. The noise levels at those developments is expected to be similar to or lower than noise levels generated by the proposed Project. Due to the separation distance between the Project and those three developments, cumulative noise impacts are not anticipated at the nearest sensitive receptors. Cumulative noise impacts are also not expected relative to Project traffic in combination with other traffic; however, if a detailed traffic study is completed further investigation could be conducted.

Uncontrolled explosions have been identified as an accident that could generate noise. Noise from uncontrolled explosions could be audible at over 10 km from the Project site. The noise generated from explosions would be short in duration (less than one second) and would be unexpected. Due to the short durations of the explosions the noise would result in a short-term interaction where changes in noise levels would occur. Because these are uncontrolled explosions the ability to take measures to reduce or eliminate the noise is not feasible. However industry standards should be taken to reduce the potential for uncontrolled explosions.

Further analysis of the noise modeling results and an assessment of their potential changes is described in the human health risk assessment report (**Appendix 18-B - Human Health Risk Assessment Report**), Land and Resource Use, Wildlife and Wildlife Habitat , Birds and Bird Habitat, and Community Health and Well-being sections cited in **Section 1.2**.

# 7.0 CHANGE MONITORING AND ADAPTIVE MANAGEMENT

The Proponent is committed to implementing adaptive management during all phases of the Project. Adaptive management refers to the process of improving environmental management practices based on observed and monitored conditions. The post-construction noise monitoring plan will be described in the Noise Management Plan that will be prepared for Project licensing. If measurement results indicate a potential noise-related issue, specific actions will be taken to achieving the Project's health and safety, environmental objectives and regulatory requirements. **Table 8.1-1** provides examples of potential triggers and possible courses of action to address identifies issues.

## 7.1 Noise Adaptive Management Triggers and Actions

**Table 7.1-1 Noise: Adaptive Management Triggers and Actions**

| Accidents and Malfunctions | Interaction (Yes/No) | Potential Adverse Change to Noise |
|---|---|---|
| **Project Phase** | | |
| Noise | Post-construction noise monitoring indicates received sound levels that are higher than expected; and<br>Receipt of noise complaints related to Project activities. | Expand monitoring to collect noise emission readings in close proximity to each piece of equipment at a standard reference distance of 15 m from the loudest side of the equipment. Field notes should identify the particular piece of equipment under test and describe what activities the equipment is doing while being tested. These equipment noise emission tests need only be performed long enough to capture the equipment going through a few full cycles of typical work (e.g., 5 minutes). Measurement results will be compared to modeled values to ensure that the equipment's mufflers and other noise producing elements are not degrading to any measurable degree.<br>To the extent practicable, relocating noisier equipment to other areas of the site and scheduling of Project activities in consideration of more sensitive periods;<br>Modify maintenance schedules to ensure that frequency is sufficient to address any equipment issues, which could result in additional noise emissions;<br>Re-evaluation of possible noise mitigation options for mobile and stationary equipment/vehicles; and<br>Review of blasting procedures, and implementing noise reduction measures, if practical. |

## 8.0 REFERENCES

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# APPENDIX 10-A-1

## Table of Potential Project Interactions with Noise

| Project Component | Project Activities | | Interaction Rating | Nature of Interaction and Potential Effect |
|---|---|---|---|---|
| | # | Description | | |
| **Construction Phase (Year -2 through Year -1)** | | | | |
| **Overall Construction Phase** | | | | |
| Overall Mine Site | C-0 | Confirmatory geotechnical drilling in select areas at the mine site, as necessary | No Interaction | Negligible changes to Noise are expected from this activity. |
| | C-1 | Mobilization of mobile equipment and construction materials | Potential Interaction | Changes to noise would be generated from the vehicles, equipment and activities but they would be expected to be localized to the surrounding Project area. |
| | C-2 | Clearing, grubbing, and grading of areas to be developed within the mine site | Potential Interaction | Changes to noise would be generated from the vehicles, equipment and activities but they would be expected to be localized to the surrounding Project area. |
| | C-3 | Material handling | Potential Interaction | Changes to noise would be generated from the vehicles, equipment and activities but they would be expected to be localized to the surrounding Project area. |
| Open Pits | C-4 | Development of Latte pit and Double Double pit | Potential Interaction | Changes to noise would be generated from the vehicles, equipment and activities but they would be expected to be localized to the surrounding Project area. |
| | C-5 | Dewatering of pits (as required) | No Interaction | Negligible changes to Noise are expected from this activity. |
| Waste Rock Storage Facilities | C-6 | Development and use of Alpha WRSF | Potential Interaction | Changes to noise would be generated from the vehicles, equipment and activities but they would be expected to be localized to the surrounding Project area. |
| Stockpiles | C-7 | Development and use of temporary organics stockpile for vegetation and topsoil | Potential Interaction | Changes to noise would be generated from the vehicles, equipment and activities but they would be expected to be localized to the surrounding Project area. |
| | C-8 | Development and use of frozen soils storage area | Potential Interaction | Changes to noise would be generated from the vehicles, equipment and activities but they would be expected to be localized to the surrounding Project area. |
| | C-9 | Development and use of run-of-mine (ROM) stockpile for temporary storage of ROM ore | Potential Interaction | Changes to noise would be generated from the vehicles, equipment and activities but they would be expected to be localized to the surrounding Project area. |

| Project Component | Project Activities | | Interaction Rating | Nature of Interaction and Potential Effect |
|---|---|---|---|---|
| | # | Description | | |
| Crusher System | C-10 | Construction and operation of crushing circuit | Potential Interaction | Changes to noise would be generated from the vehicles, equipment and activities but they would be expected to be localized to the surrounding Project area. |
| | C-11 | Construction and operation of crushed ore stockpile | Potential Interaction | Changes to noise would be generated from the vehicles, equipment and activities but they would be expected to be localized to the surrounding Project area. |
| Heap Leach Facility | C-12 | Staged heap leach facility (HLF) construction, including associated event ponds, rainwater pond, piping, and water management infrastructure | Potential Interaction | Changes to noise would be generated from the vehicles, equipment and activities but they would be expected to be localized to the surrounding Project area. |
| | C-13 | Heap leach pad loading | Potential Interaction | Changes to noise would be generated from the vehicles, equipment and activities but they would be expected to be localized to the surrounding Project area. |
| Plant Site | C-14 | Construction and operation of process plant | Potential Interaction | Changes to noise would be generated from the vehicles, equipment and activities but they would be expected to be localized to the surrounding Project area. |
| | C-15 | Construction and operation of reagent storage area and on-site use of processing reagents | Potential Interaction | Changes to noise would be generated from the vehicles, equipment and activities but they would be expected to be localized to the surrounding Project area. |
| | C-16 | Construction and operation of laboratory, truck shop, and warehouse building | Potential Interaction | Changes to noise would be generated from the vehicles, equipment and activities but they would be expected to be localized to the surrounding Project area. |
| | C-17 | Construction and operation of power plant | Potential Interaction | Changes to noise would be generated from the vehicles, equipment and activities but they would be expected to be localized to the surrounding Project area. |
| | C-18 | Construction and operation of bulk fuel/LNG storage and on-site use of diesel fuel or LNG | Potential Interaction | Changes to noise would be generated from the vehicles, equipment and activities but they would be expected to be localized to the surrounding Project area. |

| Project Component | Project Activities | | Interaction Rating | Nature of Interaction and Potential Effect |
|---|---|---|---|---|
| | # | Description | | |
| Camp Site | C-19 | 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 | Potential Interaction | Changes to noise would be generated from the vehicles, equipment and activities but they would be expected to be localized to the surrounding Project area. |
| | C-20 | Construction and operation of waste management building and waste management area | Potential Interaction | Changes to noise would be generated from the vehicles, equipment and activities but they would be expected to be localized to the surrounding Project area. |
| Bulk Explosive Storage Area | C-21 | Construction of storage facilities for explosives components and on-site use of explosives | Potential Interaction | Changes to noise would be generated from the vehicles, equipment and activities but they would be expected to be localized to the surrounding Project area. |
| Mine Site and Haul Roads | C-22 | Upgrade, construction, and maintenance of mine site service roads and haul roads | Potential Interaction | Changes to noise would be generated from vehicular movements along roadways and within the Project site but they would be expected to be localized to the surrounding Project area. |
| Site Water Management Infrastructure | C-23 | Development and use of sedimentation ponds and conveyance structures, including discharge of compliant water | Potential Interaction | Changes to noise would be generated from the vehicles, equipment and activities but they would be expected to be localized to the surrounding Project area. |
| | C-24 | Initial supply of HLF process water | No Interaction | Negligible changes to Noise are expected from this activity. |
| | C-25 | Ongoing use of site contact water (i.e., precipitation, stored rainwater) as HLF process water | No Interaction | Negligible changes to Noise are expected from this activity. |
| Ancillary Components | C-26 | Upgrade of existing road sections for Northern Access Route (NAR), including installation of culverts and bridges | Potential Interaction | Changes to noise would be generated from the vehicles, equipment and activities but they would be expected to be localized to the surrounding Project area. |
| | C-27 | Construction of new road sections for NAR, including installation of culverts and bridges | Potential Interaction | Changes to noise would be generated from the vehicles, equipment and activities but they would be expected to be localized to the surrounding Project area. |

| Project Component | Project Activities | | Interaction Rating | Nature of Interaction and Potential Effect |
|---|---|---|---|---|
| | # | Description | | |
| | C-28 | Development, operation, and maintenance of temporary work camps along road route | Potential Interaction | Changes to noise would be generated from the vehicles, equipment and activities but they would be expected to be localized to the surrounding Project area. |
| | C-29 | Vehicle traffic, including mobilization and re-supply of freight and consumables | Potential Interaction | Changes to noise would be generated from vehicular movements along roadways and within the Project site but they would be expected to be localized to the surrounding Project area. |
| | C-30 | Development, operation, and maintenance of barge landing sites on Yukon River and Stewart River | Potential Interaction | Changes to noise would be generated from the vehicles, equipment and activities but they would be expected to be localized to the surrounding Project area. |
| | C-31 | Barge traffic on Stewart River and Yukon River, including barge mobilization of equipment for NAR construction | No Interaction | No changes to Noise are expected from this activity. |
| | C-32 | Annual construction, operation, maintenance, and removal of Stewart River and Yukon River ice roads | Potential Interaction | Changes to noise would be generated from the vehicles, equipment and activities but they would be expected to be localized to the surrounding Project area. |
| | C-33 | Annual construction and operation of winter road on the south side of the Yukon River | Potential Interaction | Changes to noise would be generated from the vehicles, equipment and activities but they would be expected to be localized to the surrounding Project area. |
| | C-34 | Construction, operation, and maintenance of permanent bridge over Coffee Creek | Potential Interaction | Changes to noise would be generated from the vehicles, equipment and activities but they would be expected to be localized to the surrounding Project area. |
| | C-35 | Construction and maintenance of gravel airstrips | Potential Interaction | Changes to noise would be generated from the vehicles, equipment and activities but they would be expected to be localized to the surrounding Project area. |
| | C-36 | Air traffic | Potential Interaction | Changes to noise would be generated from construction-related air traffic but they would be expected to be localized to the surrounding Project area. |
| | C-37 | Use of all laydown areas | No Interaction | Negligible changes to Noise are expected from this activity.. |
| | C-38 | Use of Coffee Exploration Camp | No Interaction | Negligible changes to Noise are expected from this activity.. |

| Project Component | Project Activities | | Interaction Rating | Nature of Interaction and Potential Effect |
|---|---|---|---|---|
| | # | Description | | |
| **Operation Phase (Year 1 through Year 9)** | | | | |
| **Overall Operation Phase** | | | | |
| Overall Mine Site | O-1 | Material handling | Potential Interaction | Changes to noise would be generated from vehicular movements along roadways and within the Project site but they would be expected to be localized to the surrounding Project area. |
| | O-2 | Excavation of contaminated soils followed by on-site treatment or temporary storage and off-site disposal | Potential Interaction | Changes to noise would be generated from vehicular movements along roadways and within the Project site but they would be expected to be localized to the surrounding Project area. |
| | O-3 | Progressive reclamation of disturbed areas within mine site footprint | Potential Interaction | Changes to noise would be generated from vehicular movements along roadways and within the Project site but they would be expected to be localized to the surrounding Project area. |
| Open PIts | O-4 | Development of Kona pit and Supremo pit and continued development of Double Double pit and Latte pit | Potential Interaction | Changes to noise would be generated from the vehicles, equipment and activities but they would be expected to be localized to the surrounding Project area. |
| | O-5 | Cessation of mining at Double Double pit, Latte pit, Kona pit, and Supremo pit | No Interaction | No changes to Noise are expected from this activity. |
| | O-6 | Partial backfill of Latte pit and Supremo pit | Potential Interaction | Changes to noise would be generated from the vehicles, equipment and activities but they would be expected to be localized to the surrounding Project area. |
| | O-7 | Backfill of Double Double pit and Kona pit | Potential Interaction | Changes to noise would be generated from the vehicles, equipment and activities but they would be expected to be localized to the surrounding Project area. |
| | O-8 | Dewatering of pits (as required) | Potential Interaction | Changes to noise would be generated from the vehicles, equipment and activities but they would be expected to be localized to the surrounding Project area. |
| Waste Rock Storage Facilities | O-9 | Continued development and use of Alpha WRSF | Potential Interaction | Changes to noise would be generated from the vehicles, equipment and activities but they would be expected to be localized to the surrounding Project area. |

| Project Component | Project Activities | | Interaction Rating | Nature of Interaction and Potential Effect |
|---|---|---|---|---|
| | # | Description | | |
| | O-10 | Development and use of Beta WRSF | Potential Interaction | Changes to noise would be generated from the vehicles, equipment and activities but they would be expected to be localized to the surrounding Project area. |
| Stockpiles | O-11 | Continued use of temporary organics stockpile for vegetation and topsoil | Negligible Interaction | Negligible changes to Noise are expected from this activity. |
| | O-12 | Continued use of frozen soils storage area | Negligible Interaction | Negligible changes to Noise are expected from this activity. |
| | O-13 | Continued use of ROM stockpile for temporary storage of ROM ore | Negligible Interaction | Negligible changes to Noise are expected from this activity. |
| Crusher System | O-14 | Crusher operation | Potential Interaction | Changes to noise would be generated from the vehicles, equipment and activities but they would be expected to be localized to the surrounding Project area. |
| | O-15 | Continued use of crushed ore stockpile | Negligible Interaction | Negligible changes to Noise are expected from this activity. |
| Heap Leach Facility | O-16 | Continued staged HLF construction, including related water management structures and year-round operation | Potential Interaction | Changes to noise would be generated from the vehicles, equipment and activities but they would be expected to be localized to the surrounding Project area. |
| | O-17 | Progressive closure and reclamation of HLF | Potential Interaction | Changes to noise would be generated from the vehicles, equipment and activities but they would be expected to be localized to the surrounding Project area. |
| Plant Site | O-18 | Process plant operation | Negligible Interaction | Due to the equipment and noise mitigation planned for the process plant it is expected that negligible changes to noise will be produced from this activity. |
| | O-19 | Continued on-site use of processing reagents | Potential Interaction | Changes to noise would be generated from vehicular movements along roadways and within the Project site but they would be expected to be localized to the surrounding Project area. |
| | O-20 | Continued on-site use of diesel fuel or LNG | Potential Interaction | Changes to noise would be generated from the vehicles, equipment and activities but they would be expected to be localized to the surrounding Project area. |
| Camp Site | O-21 | Continued use of facilities | No Interaction | No changes to Noise are expected from this activity. |

| Project Component | Project Activities | | Interaction Rating | Nature of Interaction and Potential Effect |
|---|---|---|---|---|
| | # | Description | | |
| Bulk Explosive Storage Area | O-22 | Continued on-site use of explosives | Potential Interaction | Changes to noise would be generated from the vehicles, equipment and activities but they would be expected to be localized to the surrounding Project area. |
| Mine Site and Haul Roads | O-23 | Use and maintenance of mine site service roads and haul roads | Potential Interaction | Changes to noise would be generated from vehicular movements along roadways and within the Project site but they would be expected to be localized to the surrounding Project area. |
| Site Water Management Infrastructure | O-24 | Continued use of sedimentation ponds conveyance structures | Potential Interaction | Changes to noise would be generated from the vehicles, equipment and activities but they would be expected to be localized to the surrounding Project area. |
| | O-25 | Ongoing use of site contact water (i.e., precipitation, stored rainwater) as HLF process water | No Interaction | No changes to Noise are expected from this activity. |
| | O-26 | Installation and operation of water treatment facility for HLF rinse water | Negligible Interaction | Negligible changes to Noise are expected from this activity. |
| **Ancillary Components** | O-27 | NAR road maintenance (e.g., aggregate re-surfacing, sanding, snow removal) | Potential Interaction | Changes to noise would be generated from the vehicles, equipment and activities but they would be expected to be localized to the surrounding Project area. |
| | O-28 | NAR vehicle traffic, including mobilization and re-supply of freight and consumables | Potential Interaction | Changes to noise would be generated from vehicular movements along roadways and within the Project site but they would be expected to be localized to the surrounding Project area. |
| | O-29 | Operation and maintenance of barge landing sites on Stewart River and Yukon River | No Interaction | No changes to Noise are expected from this activity. |
| | O-30 | Barge traffic on Stewart River and Yukon River | No Interaction | No changes to Noise are expected from this activity. |
| | O-31 | Annual construction, operation, maintenance, and removal of Stewart River and Yukon River ice roads | Potential Interaction | Changes to noise would be generated from the vehicles, equipment and activities but they would be expected to be localized to the surrounding Project area. |
| | O-32 | Annual construction and operation of winter road on the south side of the Yukon River | Potential Interaction | Changes to noise would be generated from the vehicles, equipment and activities but they would be expected to be localized to the surrounding Project area. |

| Project Component | Project Activities | | Interaction Rating | Nature of Interaction and Potential Effect |
|---|---|---|---|---|
| | # | Description | | |
| | O-33 | Operation and maintenance of gravel air strips | Potential Interaction | Changes to noise would be generated from the vehicles, equipment and activities but they would be expected to be localized to the surrounding Project area. |
| | O-34 | Air traffic | Potential Interaction | Changes to noise would be generated from air traffic but they would be expected to be localized to the surrounding Project area. |
| | O-35 | Use of all laydown areas | No Interaction | No changes to Noise are expected from this activity. |
| **Reclamation and Closure Phase (Year 10 through Year 20)** | | | | |
| **Overall Reclamation and Closure Phase** | | | | |
| Overall Mine Site | R-1 | Reclamation of disturbed areas within mine site footprint | Negligible Interaction | Negligible changes to Noise are expected from this activity. |
| | R-2 | Excavation of contaminated soils followed by on-site treatment or temporary storage and off-site disposal | Potential Interaction | Changes to noise would be generated from the vehicles, equipment and activities but they would be expected to be localized to the surrounding Project area. |
| Open Pits | R-3 | Reclamation of Double Double pit, Latte pit, Supremo pit, and Kona pit | Negligible Interaction | Negligible changes to Noise are expected from this activity. |
| Waste Rock Storage Facilities | R-4 | Reclamation of Alpha WRSF | Negligible Interaction | Negligible changes to Noise are expected from this activity. |
| | R-5 | Reclamation of Beta WRSF | Negligible Interaction | Negligible changes to Noise are expected from this activity. |
| Stockpiles | R-6 | Reclamation of temporary organics stockpile, frozen soils storage area, and ROM stockpile | Negligible Interaction | Negligible changes to Noise are expected from this activity. |
| Crusher System | R-7 | Dismantling and removal of crusher facility and stockpile | Potential Interaction | Changes to noise would be generated from the vehicles, equipment and activities but they would be expected to be localized to the surrounding Project area. |
| Heap Leach Facility | R-8 | Closure of HLF and related water management structures | No Interaction | No changes to Noise are expected from this activity. |
| Plant Site | R-9 | Dismantling and removal of process plant, reagent storage | Negligible Interaction | Negligible changes to Noise are expected from this activity. |

| Project Component | Project Activities | | Interaction Rating | Nature of Interaction and Potential Effect |
|---|---|---|---|---|
| | # | Description | | |
| | | area, laboratory, truck shop and warehouse building, power plant, and bulk fuel storage | | |
| Camp Site | R-10 | 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 | Negligible Interaction | Negligible changes to Noise are expected from this activity. |
| Bulk Explosive Storage Area | R-11 | Dismantling and removal of explosives storage facility | Negligible Interaction | Negligible changes to Noise are expected from this activity. |
| Mine Site and Haul Roads | R-12 | Decommissioning and reclamation of mine site service roads and haul roads | Negligible Interaction | Negligible changes to Noise are expected from this activity. |
| Site Water Management Infrastructure | R-13 | Decommissioning and reclamation of selected water management infrastructure, construction of long-term water management infrastructure, including water deposition to creek systems | Negligible Interaction | Negligible changes to Noise are expected from this activity. |
| | R-14 | Operation and maintenance of HLF water treatment facility | Potential Interaction | Changes to noise would be generated from the vehicles, equipment and activities but they would be expected to be localized to the surrounding Project area. |
| | R-15 | Decommissioning and removal of HLF water treatment plant | Negligible Interaction | Negligible changes to Noise are expected from this activity. |

| Project Component | Project Activities | | Interaction Rating | Nature of Interaction and Potential Effect |
|---|---|---|---|---|
| | # | Description | | |
| Ancillary Components | R-16 | NAR road maintenance (e.g., aggregate re-surfacing, sanding, snow removal) | Potential Interaction | Changes to noise would be generated from the vehicles, equipment and activities but they would be expected to be localized to the surrounding Project area. |
| | R-17 | NAR vehicle traffic | Potential Interaction | Changes to noise would be generated from vehicular movements along roadways and within the Project site but they would be expected to be localized to the surrounding Project area. |
| | R-18 | Operation and maintenance of barge landing sites on Stewart River and Yukon River | Negligible Interaction | Negligible changes to Noise are expected from this activity. |
| | R-19 | Annual resupply of consumables and materials for active closure via barge on the Yukon River | Negligible Interaction | Negligible changes to Noise are expected from this activity. |
| | R-20 | Annual construction, maintenance, and decommissioning of Stewart River and Yukon River ice roads | Potential Interaction | Changes to noise would be generated from the vehicles, equipment and activities but they would be expected to be localized to the surrounding Project area. |
| | R-21 | Decommissioning of new road portions | Negligible Interaction | Negligible changes to Noise are expected from this activity. |
| | R-22 | Air traffic | Potential Interaction | Changes to noise would be generated from air traffic but they would be expected to be localized to the surrounding Project area. |
| | R-23 | Decommissioning and reclamation of airstrip | Negligible Interaction | Negligible changes to Noise are expected from this activity. |
| | R-24 | Re-opening and operation of pre-existing Yukon River exploration camp and airstrip to support post-closure monitoring activities | Negligible Interaction | Negligible changes to Noise are expected from this activity. |
| **Post-closure Phase** | | | | |
| **Overall Post-closure Phase** | | | | |
| Overall Mine Site | P-1 | Long-term monitoring | No Interaction | No changes to Noise are expected from this activity. |

# APPENDIX 10-A-2

## Acoustic Assessment Report

# Coffee Gold Mine
# Acoustic Assessment Report

**March 2017**

**PREPARED FOR:**

GOLDCORP

**PREPARED BY:**

TETRA TECH

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# ACRONYMS AND ABBREVIATIONS

| Acronym / Abbreviation | Definition |
|---|---|
| BC | British Columbia |
| EC | Environment Canada |
| HLF | Heap Leach Facility |
| IC | Intermediate Component |
| ISO | International Organization for Standardization |
| Kaminak | Kaminak Gold Corporation |
| LSA | Local Study Area |
| NAR | Northern Access Route |
| OBCF | Octave Band Center Frequency |
| OGC | Oil and Gas Commission |
| Project | Coffee Gold Mine Project |
| PSL | Permissible Sound Level |
| ROM | Run-of-mine |
| RSA | Regional Study Area |
| WRSF | Waste Rock Storage Facility |
| YESAB | Yukon Environmental and Socio-economic Assessment Board |

# SYMBOLS AND MEASUREMENTS

| Symbol / Measurement | Definition |
|---|---|
| µPa | Micropascal |
| °C | Degree Celsius |
| dB | Decibel |
| dBA | A-weighted Decibel |
| dBL | Linear or Unweighted Decibel |
| ft. | Foot (feet) |
| G | Ground Absorption Coefficient |
| Hz | Hertz |
| kg | Kilogram |
| km | Kilometre |
| $L_{eq}$ | Equivalent Sound Level |
| $L_n$ | Statistical Sound Level |
| $L_P$ | Sound Pressure Level |
| $L_{peak}$ | Unweighted Peak Noise Level |
| $L_W$ | Sound Power Level |
| m | Metre |
| Moz | Million ounces |
| Mtpa | Million tonnes per annum |
| tpd | Tonnes per day |
| W | Watt |

# 1.0 INTRODUCTION

Tetra Tech Canada Inc. (Tetra Tech) was contracted by Goldcorp, formerly Kaminak Gold Corp. in February 2016 to complete modelling and effects assessment of air quality (including greenhouse gases (GHG) and noise. This report provides the noise modelling results from the 2016 mine design included in the Coffee Project Feasibility Study (JDS 2016).

The Coffee Gold Mine (Project) is a proposed gold development project in west-central Yukon, approximately 130 kilometres (km) south of Dawson City. A 214 km all-weather access road with river barge crossings, referred to as the Northern Access Route (NAR), will provide access between 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. Air transportation and the use of airstrips at the Mine Site will provide year- round access, and will be utilised 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. Principal components at the Mine Site include:

- Four Open Pits – Latte, Double Double, Kona, and Supremo
- 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 (HLF) 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 building
- Bulk Explosive Storage Area
- Mine Site and Haul Roads, and
- Site Water Management Infrastructure including sedimentation ponds and conveyance structures.

Noise is expected to be generated during both construction and operational phases of the Project and Tetra Tech has been retained to analyze potential noise impacts at noise sensitive receptors (e.g., residences).The following Acoustic Assessment documents the potential impacts in order to determine compliance with the applicable noise guidelines. The objectives of the Acoustic Assessment were to: (1) identify the Project sound sources and estimate sound propagation characteristics; (2) computer simulate sound levels using internationally accepted calculation standards; and (3) determine the feasibility of the Project to operate consistent with the Project's acoustic design goals and generally accepted environmental noise, health and safety guidelines.

## 1.1 PROJECT STUDY AREA

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 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 with 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 Nyak Dun and the asserted area of White River First Nation.

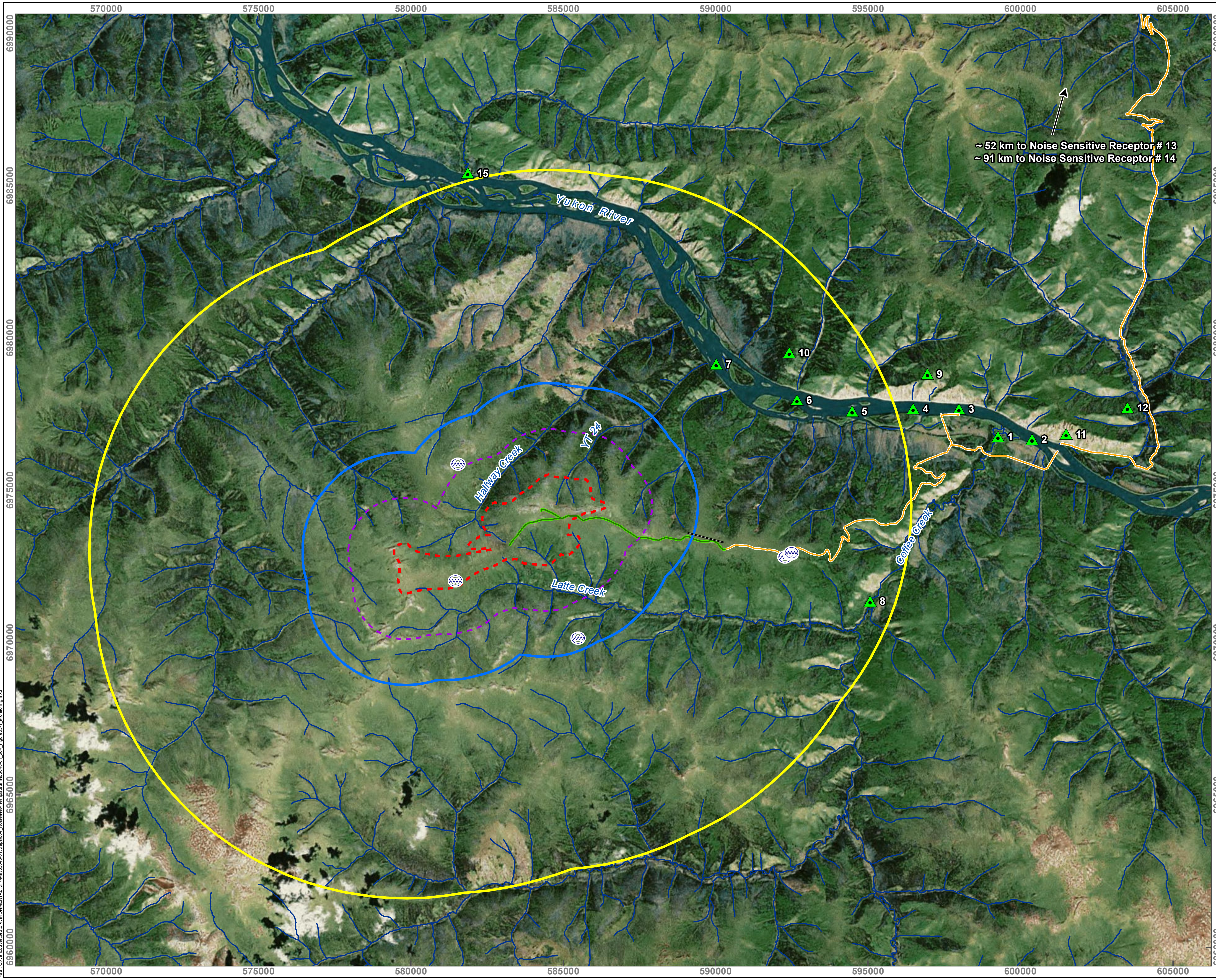
The topography of the Project area is consistent with the characteristics of unglaciated ecozones, and is characterized by deep soil weathering and strong erosional patterns linked to precipitation and snowmelt. The long periods of exposure to weathering of granite and schists has created tors, large weathered rock structures, on the ridgetops in the vicinity of the Project.

Much of the land surrounding the Mine Site is undeveloped and the very sparsely populated with the closest sensitive receptors being located a substantial distance from the Mine site boundary as shown in Figure 1-1.

## 1.2 ACOUSTIC TERMINOLOGY

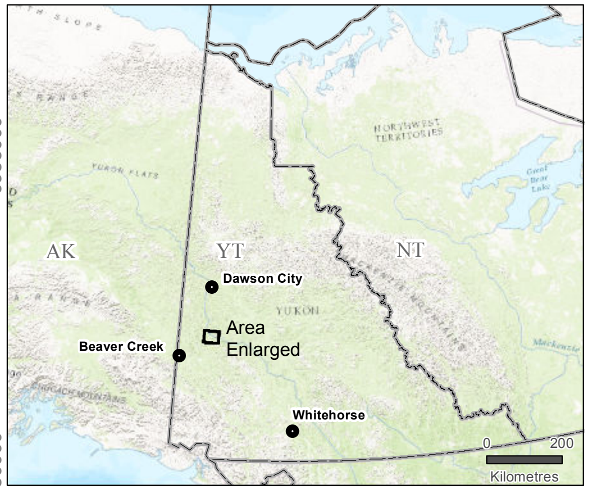
Airborne sound is described as the rapid fluctuation or oscillation of air pressure above and below atmospheric pressure, creating a sound wave. Sound is characterized by properties of the sound waves, which are frequency, wavelength, period, amplitude, and velocity. Noise is defined as unwanted sound. A sound source is defined by a sound power level ($L_W$), which is independent of any external factors. The acoustic sound power is the rate at which acoustical energy is radiated outward and is expressed in units of watts (W). Sound energy travels in the form of a wave, a rapid fluctuation or oscillation of air pressure above and below atmospheric pressure. A sound pressure level ($L_P$) is a measure of this fluctuation and can be directly determined with a microphone or calculated from information about the source sound power level and the surrounding environment through predictive acoustic modeling. While the sound power of a source is strictly a function of the total amount of acoustic energy being radiated by the source, the sound pressure levels produced by a source are a function of the distance from the source and the effective radiating area or physical size of the source. In general, the magnitude of a source's sound power level is always considerably higher than the observed sound pressure level near a source due to the fact that the acoustic energy is being radiated in various directions.

Sound levels are presented on a logarithmic scale to account for the large pressure response range of the human ear, and are expressed in units of decibels (dB). A dB is defined as the ratio between a measured value and a reference value usually corresponding to the lower threshold of human hearing defined as 20 micropascals (μPa). Conversely, sound power is commonly referenced to 1 picowatt (pW), which is one trillionth of a watt. Broadband sound includes sound energy summed across the frequency spectrum. In addition to broadband sound pressure levels, analysis of the various frequency components of the sound spectrum is often completed to determine tonal characteristics. The unit of frequency is Hertz (Hz), which corresponds to the rate in cycles per second that sound pressure waves are generated. Typically, a sound frequency analysis examines 11 octave (or 33 1/3 octave) bands ranging from 20 Hz (low) to 20,000 Hz (high). This range encompasses the entire human audible frequency range. Since the human ear does not perceive every frequency with equal loudness, spectrally varying sounds are often adjusted with a weighting filter. The A-weighted filter is applied to compensate for the frequency response of the human auditory system. Sound exposure in acoustic assessments is commonly measured and calculated as A-weighted dB (dBA). Unweighted sound levels are referred to as linear. Linear dB are used to determine a sound's tonality and to engineer solutions to reduce or control noise as techniques are different for low and high frequency noise. Sound levels that are linear in this report are presented as dBL.




COFFEE GOLD MINE

**Project Study Area**




## 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 1-1 | Date: Jan 12, 2017 | Drawn by: SL | Reviewed: KG |
|---|---|---|---|

GOLDCORP

Sound can be measured, modeled, and presented in various formats, with the most common metric being the equivalent sound level ($L_{eq}$). The equivalent sound level has been shown to provide both an effective and uniform method for comparing time-varying sound levels and is widely used in acoustic assessments. Estimates of noise sources and outdoor acoustic environments, and the comparison of relative loudness are presented in Table 1-1. Table 1-2 provides additional reference information on acoustic terminology.

### Table 1-1 Sound Pressure Levels (LP) 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 m; 50 ft) | 140 | Threshold of pain | 64 times as loud |
| 50-hp siren (30 m; 100 ft) | 130 | | 32 times as loud |
| Loud rock concert near stage<br>Jet takeoff (61m; 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 (8m; 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 | |

## Table 1-2 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 negative effects on people are known to occur. |
| Sound Pressure Level (LP) | Pressure fluctuations in a medium. Sound pressure is measured in decibels referenced to 20 microPascals, the approximate threshold of human perception to sound at 1,000 Hz. |
| Sound Power Level (LW) | 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 as 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-weighting filter is commonly used for describing environmental sound levels. Sound levels that are A-weighted are presented as dBA in this report. |
| Unweighted Decibels (dBL) | Unweighted sound levels are referred to as linear. Linear decibels are used to determine a sound's tonality and to engineer solutions to reduce or control noise as techniques are different for low and high frequency noise. Sound levels that are linear are presented as dBL in this report |
| 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. |
| Octave Bands | The audible range of humans spans from 20 to 20,000 Hz and is typically divided into center frequencies ranging from 31 to 8,000 Hz for noise modeling evaluations. |
| Broadband Sound | Noise which covers a wide range of frequencies within the audible spectrum, i.e., 200 to 2,000 Hz. |
| Masking | Interference in the perception of one sound by the presence of another sound. At elevated wind speeds, leaf rustle and noise made by the wind itself can mask other sources of sound. |
| Frequency (Hz) | The rate of oscillation of a sound, measured in units of Hz or kilohertz (kHz). One hundred Hz is a rate of one hundred times (or cycles) per second. 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. |

# 2.0 NOISE REGULATIONS AND GUIDELINES

At the federal level, Environment Canada (EC) provides noise guidance within its Environmental Code of Practice for Metal Mines, described further below. Yukon does not have any noise-related requirements so guidance provided by BC was selected to assess Project compliance. BC guidance is based on Alberta Utilities Commission Rule 012, Noise Control, and has been used to support previous permitting applications to Yukon and accepted by the Yukon Environmental and Socio-economic Assessment Board (YESAB).

The acoustic analysis conducted in support of the Project is limited to evaluating potential noise levels at sensitive off-site receptors. Impacts to on-site receptors (i.e., mine staff) are not analyzed or discussed within this report as they are not part of environmental assessment and permitting. Review of on-site noise exposure is covered under separate legislation pertaining to occupational health and safety.

## 2.1 ENVIRONMENT CANADA ENVIRONMENTAL CODE OF PRACTICE FOR METAL MINES

The Environmental Code of Practices for Metal Mines was developed by EC for use by mine owners, operators, regulatory agencies and the public to provide information about the activities associated with the life cycle of a mine and recommendations to minimize environmental impacts from mining activities. The Code is not a federal regulation. It may be adopted on a voluntary basis by mining companies; however, it does not eliminate obligations set forth by other municipal, Aboriginal, provincial, territorial and federal legal requirements.

In section 4.4.7 of the Code guidance is provided for noise including recommendations on measures to minimize noise and monitoring those measures to assess effectiveness. In residential areas adjacent to mine sites, the Code prescribes a daytime limit of 55 dBA $L_{eq}$ and a nighttime limit of 45 dBA $L_{eq}$. The Code also suggests that for mines in areas absent of regulations for noise from blasting should design their blasts do not exceed the following criteria at or beyond the mine property:

- Concussion noise of a maximum of 128 dB.

Lastly, if blasting is conducted in or adjacent to fish-bearing waterbodies, it should be done in accordance with the Guidelines for the Use of Explosives in or near Canadian Fisheries Waters, prepared by the Department of Fisheries and Oceans.

BC OIL AND GAS COMMISSION NOISE CONTROL BEST PRACTICES GUIDELINE

Noise control guidelines for oil and gas activities in BC are specified in the BC Oil and Gas Commission (BC OGC) Noise Control Best Practices Guideline (BC OGC 2009). The guideline is a receptor-oriented regulation, which specifies permissible sound levels at designated receptor points (including residences). The BC OGC is complaint-driven, which means that response to noise emissions depends on public feedback on noise levels. Noise impacts to workers are regulated under the Yukon Occupational Health and Safety Regulation, assessed in the Community Health and Well-being VC Report, Section 27.0, Appendix 27-B.

The BC OGC noise guideline does not have a noise limit on construction and decommissioning activities. However, the guideline requires that reasonable measures be implemented to limit noise effects from construction and decommissioning activities. The focus of the BC OGC noise guidelines is on the operations phase of the Project.

As noted above, the BC OGC noise guideline is receptor based. In the guideline, a receptor is referred to as a dwelling unit, which can be any permanently or seasonally occupied residence with the exception of an employee residence or construction camp located within an industrial plant boundary. In accordance 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 km of the project mine site boundary. The determination of daytime and nighttime PSL at a receptor is a function of the time of day, type of noise (e.g., impulse or continuous), residential density, and proximity to other noise sources (e.g., highways). In cases where there is no receptor within 1.5 km from the project Mine site boundary, the daytime PSL is 50 dBA $L_{eq}$ and nighttime PSL is 40 dBA $L_{eq}$ at 1.5 km from the Mine site boundary.

As stated above, Yukon does not have any noise-related requirements but YESAB has accepted the use of the BC OGC noise guideline in previous permitting applications. For that reason, and since the limits prescribed in the BC guidance are more stringent than the limits given in EC's Environmental Code of Practice for Metal Mines, the BC OGC noise guideline is considered the controlling noise criteria for this assessment.

# 3.0 EXISTING CONDITIONS

In late March 2015 and late June 2015, a baseline sound survey was conducted by Tetra Tech in support of permitting the Project within the confines of the Coffee Property to capture wintertime and summertime conditions (Appendix 9-A). A Casella CEL-633 Type 2 sound level meter was used to collect data continuously for a period of 24-hours at four monitoring positions. The four baseline sound monitoring locations are summarized in Table 3-1, below. The baseline noise monitoring locations are also displayed in Figure 1 1. Monitoring was not conducted along the NAR due to changes in mine design. It is expected that existing ambient sound levels along the NAR would be relatively consistent with data collected near the Mine Site since population density, land use and terrain conditions appear to be similar.

### Table 3-1 Baseline Noise Monitoring Locations

| Monitoring Location | Abbreviation | Coordinates | |
|---|---|---|---|
| | | Latitude | Longitude |
| Meteorological Station | MET | 62.873595°<br>62.874461°<br>62.874853° | -139.185917°<br>-139.181990°<br>-139.181769° |
| ROM | ROM | 62.869182° | -139.398867° |
| Helipad 1 (NW Ridge) | H1 | 62.903516° | -139.395301° |
| Helipad 4 (S Ridge) | H4 | 62.851395° | -139.320814° |

The baseline noise monitoring locations in Table 3-1 are further described in the following bullets, which provide additional details regarding their surroundings and why they were selected to characterize existing conditions within the Coffee Property:

- Monitoring location MET is located in the vicinity of the installed Coffee Creek meteorological station, along the northern ridge of the Latte Creek valley. This location is approximately 7 km east of the proposed pit infrastructure. The site was selected due to ease of access, co-location with the meteorological station, the observed wind pattern, and location relative to the NAR.
- Monitoring location ROM, in the vicinity of the proposed mining plant infrastructure, was selected to provide baseline conditions and acts as an ongoing monitoring location in the vicinity of the run-of-mine and crushed ore stockpiles and the processing plant. The only limitation of this site is that it is inaccessible during wintertime.
- Monitoring location H1 is situated 30 m downslope - on the eastern aspect - from the peak of the ridge (helicopter pad) running between Dan Man Creek and Halfway Creek, north of the proposed pit areas. The

location is one of the highest points on the property, at an approximate elevation of 1190 m above sea level (the elevation of the ridge top is 1220 m).

- Monitoring location H4 was selected in consultation with Project wildlife biologists as a noise sensitive location for caribou.

The sound level meter has an operating range of 20 to 140 dBA and was housed within an environmental enclosure to protect the instrument from adverse weather conditions. During the measurements, the microphone was fitted with a windscreen and set upon a tripod at a height of approximately 1.5 m above ground, and located out of the influence of any vertical reflecting surfaces. Measurements were completed during weather conditions conducive to accurate data collection.

Data post-processing was accomplished using Casella Insight software. The dataset was analyzed for daytime and nighttime conditions during both the summer and winter periods. To the extent practicable extraneous sound was extracted from the dataset. Extraneous sounds included noise from helicopters, vehicles, and disturbance when field staff were attending to the monitors. During winter, 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. A review of the data in the absence of thunderstorms showed that ambient nighttime sound levels were relatively consistent with sound levels documented at other monitoring locations, with decibel levels in the mid to high 20s.

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 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. Site-specific variations are due to exposure differences (wind, sound-attenuating obstacles) and nearby exploration activity, such as the drilling program occurring in March nearby H4.

# 4.0 ACOUSTIC MODELING ANALYSIS

Operational modeling was completed for the Project design and equipment configuration information, which was provided by Kaminak in February 2016. Project operational sound was simulated using the latest version of DataKustic GmbH's comprehensive 3-dimensional computer-aided noise abatement program CadnaA® (v 4.6.153) was used for the acoustic modeling analysis. CadnaA's propagation equations are based on the Organization for International Standardization (ISO) standard ISO 9613 "Acoustics – Attenuation of sound during propagation outdoors" which is a widely recognized approach to assessing noise attenuation from known industrial noise sources outdoors (ISO, 1996). The method evaluates A-weighted sound pressure levels under meteorological conditions favorable to propagation from sources of known sound emission. The calculation of sound propagation from source to receiver locations consists of 1/1 full octave band sound frequency algorithms, which incorporate the following physical effects:

- Geometric spreading wave divergence
- Reflection from surfaces
- Atmospheric absorption at 10° C and 70 percent relative humidity
- Screening by topography and obstacles
- The effects of terrain features including relative elevations of noise sources
- Sound power levels from stationary and mobile sources
- The locations of noise-sensitive land use
- Intervening objects including buildings and barrier walls
- Ground effects due to areas of pavement and unpaved ground
- Sound power at multiple frequencies
- Source directivity factors
- Multiple noise sources and source type (point, area, and/or line)
- Height of both sources and receptors (i.e., NSRs)
- Averaging predicted sound levels over a given time period

CadnaA allows for three types of sound sources to be introduced into the model: point, line, and area sources. Each noise-radiating element was modeled based on its noise emission pattern. Point sources were programmed for concentrated sound sources that radiate sound hemispherically like graders or dozers. Line sources are used for linear-shaped sources such as conveyor belts. Larger dimensional sources can be modeled as area sources. On-site buildings, equipment enclosures, and plant equipment were modeled as solid structures since diffracted paths around and over structures tend to reduce computed noise levels.

## 4.1 METEOROLOGY

Meteorological factors, such as temperature, humidity, wind speed and direction, influence sound propagation. The ISO 9613-2 standard calculates received sound pressure levels for meteorological conditions favorable to propagation, i.e., downwind sound propagation or "under a well-developed moderate ground-based temperature inversion." Application of such weather conditions to the model yields conservative estimates of operational noise levels in the surrounding community. The sound level variations caused by wind and temperature gradients are most pronounced for large separation distances. At large distances from a sound source when the influences of wind or temperature gradients are present, atmospheric effects may cause fluctuations in received sound levels over long distances, but may also attenuate noise to levels below those predicted when the NSR is located either cross or upwind. The effects of wind gradients on outdoor sound propagation can also cause variations in the sound levels, but will generally reduce sound levels in the upwind and cross wind directions.

Molecular absorption of energy as the sound waves propagate through the air results in additional attenuation. Atmospheric absorption is a function of frequency, temperature, and relative humidity. The absorption effect increases with frequency. At distances farther from the Project the frequency spectrum will shift towards the lower end of the spectrum as greater attenuation of the high frequency sound component will occur.

## 4.2 TOPOGRAPHY AND GROUND EFFECTS

Terrain conditions, vegetation type, ground cover, the density and height of foliage can also influence the absorption that takes place when sound travels over land. Offsite topography was determined using publically available United States Geological Survey (USGS) digital elevation data to accurately represent terrain in three dimensions. In addition, the ISO 9613-2 standard accounts for ground absorption by assigning a numerical coefficient of G=0 for acoustically hard, reflective surfaces and G=1 for absorptive surfaces and soft ground. If the ground is hard-packed dirt, typically found in industrial complexes, pavement, bare rock or for sound traveling over bodies of water, the absorption coefficient is defined as G=0 to account for reduced sound attenuation. In contrast, ground covered in vegetation, including grasslands, suburban lawns, will be acoustically absorptive and aid in sound attenuation, i.e., G=1.0. The ground attenuation selected was semi-reflective for all offsite areas and hard reflective for all onsite paved areas. For the acoustic modeling analysis, sound attenuation through foliage and diffraction around and over existing anthropogenic structures such as buildings was conservatively ignored.

## 4.3 CONSTRUCTION SOUND SOURCES

The worst-case construction Year -1 scenario was developed using the Project schedule. The construction noise predictions were carried out using expected noise emissions from the following Project components and activities derived from preliminary construction schedule at Year-1, which are summarized below.

- Clearing, grubbing, and grading of areas to be developed within the mine site
- Hauling
- Development of Latte pit and Double Double pit, and
- Development and use of west and south WRSFs.

The make and model of the equipment as well as the quantity was provided by Kaminak. The octave band sound power levels were obtained from Tetra Tech’s database based on similar types of equipment. Table 4 1 lists the sound power level for each noise source by Octave Band Center Frequency (OBCF) used in the acoustic model.

### Table 4-1 Sound Power Levels for Construction Year -1 Major Pieces of Project Equipment

| Sound Source | Quantity | Sound Power Level (LP) by Octave Band Frequency | | | | | | | | | Broadband Level |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 31.5 | 63 | 125 | 250 | 500 | 1k | 2k | 4k | 8k | dBA |
| **Heavy Equipment** | | | | | | | | | | | |
| 209 kW Motor Grader | 3 | 122 | 118 | 114 | 120 | 112 | 108 | 102 | 92 | 84 | 115 |
| Track Dozer | 5 | 124 | 120 | 126 | 122 | 114 | 110 | 104 | 94 | 86 | 117 |
| 250 ton Backhoe | 3 | 122 | 118 | 124 | 120 | 112 | 108 | 102 | 92 | 84 | 115 |
| 370 kW Backhoe Excavator | 2 | 111 | 107 | 113 | 109 | 101 | 97 | 91 | 81 | 73 | 104 |
| Loader | 3 | 111 | 107 | 113 | 109 | 101 | 97 | 91 | 81 | 73 | 105 |
| Wheel Dozer | 2 | 122 | 118 | 124 | 120 | 112 | 108 | 102 | 92 | 84 | 115 |
| 6-9" Rotary Blasthole Drill | 7 | 109 | 118 | 124 | 125 | 125 | 121 | 117 | 118 | 118 | 127 |
| 3-5" Rotary Blasthole Drill | 1 | 104 | 113 | 119 | 120 | 120 | 116 | 112 | 113 | 113 | 122 |
| Water Truck | 2 | 123 | 119 | 125 | 121 | 113 | 109 | 103 | 93 | 85 | 117 |
| Haul Truck | 18 | 106 | 114 | 110 | 107 | 109 | 107 | 105 | 98 | 88 | 112 |
| Water Pump | 1 | 38 | 52 | 64 | 73 | 78 | 85 | 83 | 79 | 71 | 88 |
| **Stationary Equipment** | | | | | | | | | | | |
| Power Plant* | 1 | 53 | 65 | 69 | 68 | 68 | 65 | 63 | 60 | 53 | 71 |
| Conveyor | 1 | 105 | 105 | 105 | 103 | 101 | 100 | 98 | 92 | 85 | 105 |
| Primary Crusher | 1 | 108 | 109 | 112 | 113 | 110 | 108 | 105 | 100 | 93 | 113 |
| Secondary Crusher | 1 | 109 | 110 | 113 | 114 | 111 | 109 | 106 | 101 | 94 | 114 |
| Vibrating Screens | 1 | 108 | 109 | 112 | 113 | 110 | 108 | 105 | 100 | 93 | 113 |

**Note:** *Per unit area

## 4.4 OPERATIONAL SOUND SOURCES

The worst-case operational Year 6 noise predictions were carried out using expected noise emission levels from the following Project components and activities:

- Hauling;
- Development of Supremo Pit;
- Partial backfill of Supremo Pit;
- Use of engineered stockpiles for temporary storage of ROM ore and crushed ore;
- Crusher operation;
- Operation of on-site service roads and haul roads, and

- On-site power generation and distribution, including installation of fourth genset.

The noise modeling methodology used to analyze Mine Site operations was the same as that used for the construction scenario. Table 4.-2 lists the sound power level for each noise source by OBCF used in the operational Year 6 acoustic model.

### Table 4-2 Sound Power Levels for Operational Year 6 Major Pieces of Project Equipment

| Sound Source | Quantity | Sound Power Level (LP) by Octave Band Frequency | | | | | | | | | Broadband Level |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 31.5 | 63 | 125 | 250 | 500 | 1k | 2k | 4k | 8k | dBA |
| **Heavy Equipment** | | | | | | | | | | | |
| 209 kW Motor Grader | 3 | 122 | 118 | 114 | 120 | 112 | 108 | 102 | 92 | 84 | 115 |
| Track Dozer | 5 | 124 | 120 | 126 | 122 | 114 | 110 | 104 | 94 | 86 | 117 |
| 250 ton Backhoe | 3 | 122 | 118 | 124 | 120 | 112 | 108 | 102 | 92 | 84 | 115 |
| 370 kW Backhoe Excavator | 2 | 111 | 107 | 113 | 109 | 101 | 97 | 91 | 81 | 73 | 104 |
| Loader | 3 | 111 | 107 | 113 | 109 | 101 | 97 | 91 | 81 | 73 | 105 |
| Wheel Dozer | 2 | 122 | 118 | 124 | 120 | 112 | 108 | 102 | 92 | 84 | 115 |
| 6-9” Rotary Blasthole Drill | 7 | 109 | 118 | 124 | 125 | 125 | 121 | 117 | 118 | 118 | 127 |
| 3-5” Rotary Blasthole Drill | 1 | 104 | 113 | 119 | 120 | 120 | 116 | 112 | 113 | 113 | 122 |
| Water Truck | 2 | 123 | 119 | 125 | 121 | 113 | 109 | 103 | 93 | 85 | 117 |
| Haul Truck | 18 | 106 | 114 | 110 | 107 | 109 | 107 | 105 | 98 | 88 | 112 |
| Water Pump | 1 | 38 | 52 | 64 | 73 | 78 | 85 | 83 | 79 | 71 | 88 |
| **Stationary Equipment** | | | | | | | | | | | |
| Power Plant* | 1 | 53 | 65 | 69 | 68 | 68 | 65 | 63 | 60 | 53 | 71 |
| Conveyor | 1 | 105 | 105 | 105 | 103 | 101 | 100 | 98 | 92 | 85 | 105 |
| Primary Crusher | 1 | 108 | 109 | 112 | 113 | 110 | 108 | 105 | 100 | 93 | 113 |
| Secondary Crusher | 1 | 109 | 110 | 113 | 114 | 111 | 109 | 106 | 101 | 94 | 114 |
| Vibrating Screens | 1 | 108 | 109 | 112 | 113 | 110 | 108 | 105 | 100 | 93 | 113 |

**Note:** *Per unit area

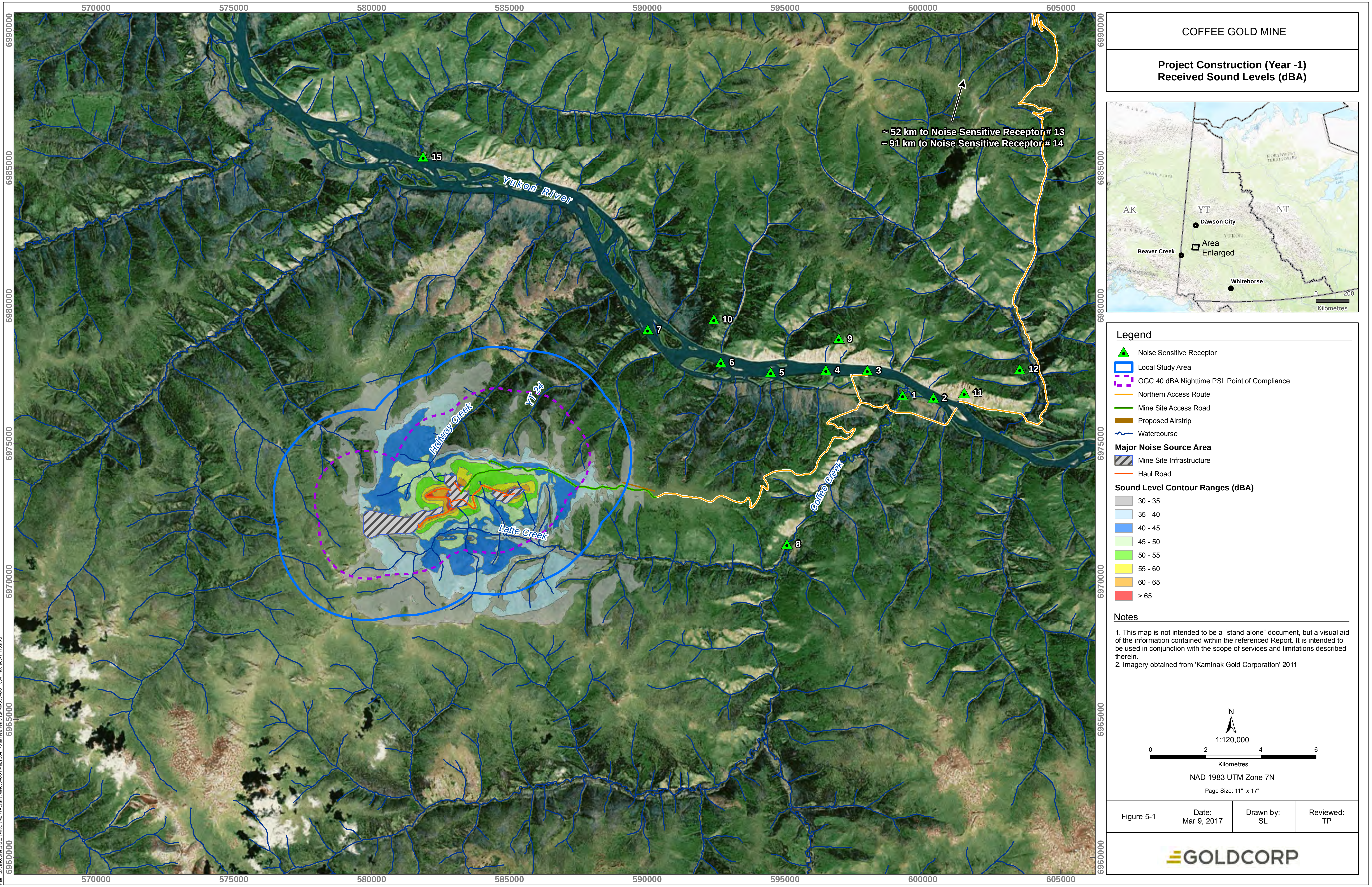
# 5.0 ACOUSTIC MODELING RESULTS AND IMPACT ASSESSMENT

This section presents an assessment of potential noise impacts related to construction and operation of the proposed Project. As with any large, complex project, the information available during the initial engineering phases is only at a conceptual level and does not allow design details to be finalized for specific mitigation measures. Vendor information has been incorporated into the Project's acoustical model when available. Final design will incorporate appropriate mitigation measures to ensure compliance with all applicable regulatory requirements. These measures may include noise mitigation measures not included in the preliminary screening analysis.

## 5.1 CONSTRUCTION NOISE LEVELS

Noise modeling completed for the construction Year -1 scenario calculated noise levels at 1.5 km from the Mine site. The noise predictions show that the maximum noise levels at a distance of 1.5 km from the Mine site will range from 23 dBA to 45 dBA. These modeled noise levels 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 so it is not expected that noise mitigation should be required. These results are presented in the form of sound contour plot (Figure 5-1) displaying dBA sound levels presented as color-coded isopleths. The contours are a graphical representation of how the construction Year -1 scenario noise would be distributed over the surrounding area.

The BC OGC approach to assessing compliance is receptor-based or, in the absence of human receptors, compliance is assessed at a distance of 1.5 km distance from the Mine site boundary. In addition, the BC OGC noise guideline does not have a noise limit on construction and decommissioning activities. There are no human receptors within the 1.5 km radius; however, wildlife and bird habitat occur within this area. Further discussion of potential noise impacts on wildlife, birds and their habitat is provided in Sections 16.0 (Appendix 16-A) and 17.0 (Appendix 17-A) of the Project Proposal. The nearest receptor, identified during Project scoping, is located approximately 6 km northeast from the Mine site identified as a location with potentially sensitive wildlife and traditional resource acquisition/cultural/spiritual significance (Figure 5 1).



COFFEE GOLD MINE
Project Construction (Year -1)
Received Sound Levels (dBA)
AK
YT
NT
Dawson City
Beaver Creek
Area Enlarged
Whitehorse
0
200
Kilometres
Legend
Noise Sensitive Receptor
Local Study Area
OGC 40 dBA Nighttime PSL Point of Compliance
Northern Access Route
Mine Site Access Road
Proposed Airstrip
Watercourse
Major Noise Source Area
Mine Site Infrastructure
Haul Road
Sound Level Contour Ranges (dBA)
30 - 35
35 - 40
40 - 45
45 - 50
50 - 55
55 - 60
60 - 65
> 65
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 obtained from 'Kaminak Gold Corporation' 2011
N
1:120,000
0
2
4
6
Kilometres
NAD 1983 UTM Zone 7N
Page Size: 11" x 17"
Figure 5-1
Date: Mar 9, 2017
Drawn by: SL
Reviewed: TP
GOLDCORP
~ 52 km to Noise Sensitive Receptor # 13
~ 91 km to Noise Sensitive Receptor # 14
Yukon River
Halfway Creek
YT 24
Latte Creek
Coffee Creek
1
2
3
4
5
6
7
8
9
10
11
12
15
570000
575000
580000
585000
590000
595000
600000
605000
6960000
6965000
6970000
6975000
6980000
6985000
6990000

For construction, Year -1 scenario, the predicted sound level at that nearest receptor (receptor ID 7) located 10 km downriver from the Coffee Creek mouth is expected to be 22 dBA, which is well below the BC OGC guidelines. In addition, received sound levels during Project construction have been tabulated at other identified potentially sensitive receptors, in Table 5-1, and shown in Figure 5-1.

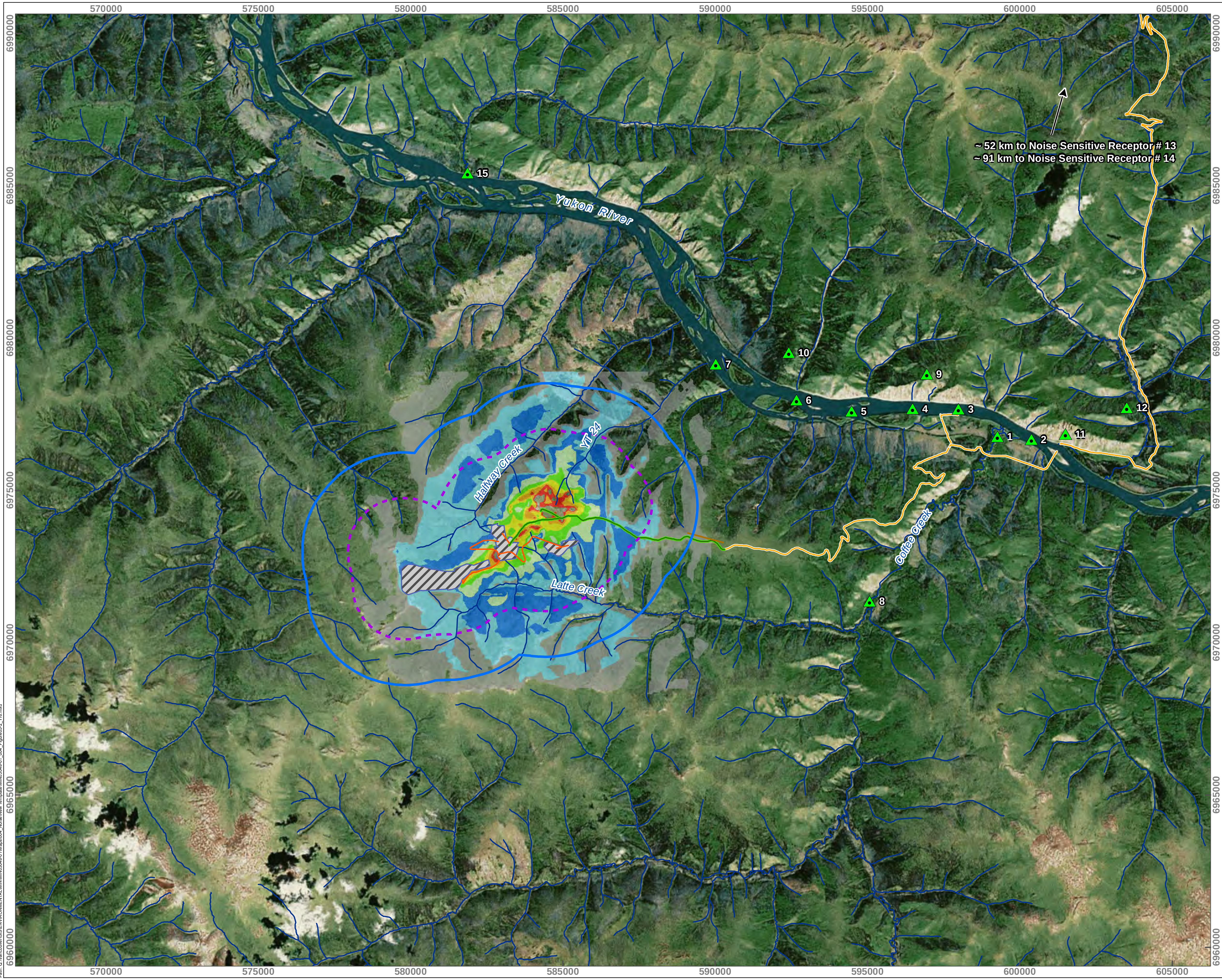
### Table 5-1 Project Construction Received Sound Levels

| Receptor ID | Receptor | Receptor Type | Received Sound Level (dBA) |
|---|---|---|---|
| 1 | Mouth of Coffee Creek | Cultural | <20 |
| 2 | Yukon River , Center Channel, ~1.5 km Upriver from Mouth of Coffee Creek | Cultural | <20 |
| 3 | Yukon River , Center Channel, ~1.5 km Upriver from Mouth of Coffee Creek | Cultural | <20 |
| 4 | Yukon River , Center Channel, ~3.0 km Downriver from Mouth of Coffee Creek | Cultural | <20 |
| 5 | Yukon River , Center Channel, ~5.0 km Downriver from Mouth of Coffee Creek | Cultural | <20 |
| 6 | Yukon River , Center Channel, ~7.0 km Downriver from Mouth of Coffee Creek | Cultural | <20 |
| 7 | Yukon River , Center Channel, ~10.0 km Downriver from Mouth of Coffee Creek | Cultural | 22 |
| 8 | Confluence of Latte and Coffee Creeks | Cultural | 20 |
| 9 | Height of Land Across Yukon River from Coffee Creek | Cultural | <20 |
| 10 | Height of Land Across Yukon River from Mine Site | Cultural | 20 |
| 11 | Height of Land Across Yukon River to East | Wildlife | <20 |
| 12 | Ballarat Creek Area, North of Yukon River | Wildlife | <20 |
| 13 | Placer Miner/Residence | Residence | <20 |
| 14 | M. Dubios Cabin | Residence | <20 |
| 15 | Kirkman Cabins | Residence / Business | <20 |

## 5.2 OPERATIONAL NOISE LEVELS

Noise modeling completed for the operational Year 6 scenario calculated noise levels at 1.5 km from the Mine site. The noise predictions show that the maximum noise levels at a distance of 1.5 km from the Mine site will range from 31 dBA to 42 dBA. These modeled 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 so it is not expected that noise mitigation should be required. These results are presented in the form of sound contour plot (Figure 5-2) displaying dBA sound levels presented as color-coded isopleths. The contours are a graphical representation of how the operational Year 6 scenario noise would be distributed over the surround area.

The BC OGC approach to assessing compliance is receptor-based or, in the absence of human receptors, compliance is assessed at a distance of 1.5 km distance from the Mine site boundary. There are no human receptors within the 1.5 km radius; however, wildlife and bird habitat occur within this area. Further discussion of potential noise impacts on wildlife, birds and their habitat is provided in Sections 16.0 (Appendix 16-A) and 17.0 (Appendix 17-A) of the Project Proposal. The nearest receptor, identified during Project scoping, is located approximately 6 km northeast from the Mine site identified as a location with potentially sensitive wildlife and traditional resource acquisition/cultural/spiritual significance. For the operational Year 6 scenario, the predicted sound level at that nearest receptor (receptor ID 7) located 10 km downriver from the Coffee Creek mouth is expected to be 28 dBA, which is well below the BC OGC guidelines. In addition, received sound levels during Project operation have been tabulated at other identified potentially sensitive receptors, in Table 5-2, and are shown in Figure 5 2.




COFFEE GOLD MINE

**Project Operation (Year 6)**
**Received Sound Levels (dBA)**


## Legend

- Noise Sensitive Receptor
- Local Study Area
- OGC 40 dBA Nighttime PSL Point of Compliance
- Northern Access Route
- Mine Site Access Road
- Proposed Airstrip
- Watercourse

**Major Noise Source Area**

- Mine Site Infrastructure
- Haul Road

**Sound Level Contour Ranges (dBA)**

- 30 - 35
- 35 - 40
- 40 - 45
- 45 - 50
- 50 - 55
- 55 - 60
- 60 - 65
- > 65

## 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 obtained from 'Kaminak Gold Corporation' 2011

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| Figure 5-2 | Date: Mar 9, 2017 | Drawn by: SL | Reviewed: TP |
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### Table 5-2 Project Operation Received Sound Levels

| Receptor ID | Receptor | Receptor Type | Received Sound Level (dBA) |
|---|---|---|---|
| 1 | Mouth of Coffee Creek | Cultural | <20 |
| 2 | Yukon River , Center Channel, ~1.5 km Upriver from Mouth of Coffee Creek | Cultural | <20 |
| 3 | Yukon River , Center Channel, ~1.5 km Upriver from Mouth of Coffee Creek | Cultural | <20 |
| 4 | Yukon River , Center Channel, ~3.0 km Downriver from Mouth of Coffee Creek | Cultural | <20 |
| 5 | Yukon River , Center Channel, ~5.0 km Downriver from Mouth of Coffee Creek | Cultural | 21 |
| 6 | Yukon River , Center Channel, ~7.0 km Downriver from Mouth of Coffee Creek | Cultural | 24 |
| 7 | Yukon River , Center Channel, ~10.0 km Downriver from Mouth of Coffee Creek | Cultural | 28 |
| 8 | Confluence of Latte and Coffee Creeks | Cultural | 21 |
| 9 | Height of Land Across Yukon River from Coffee Creek | Cultural | <20 |
| 10 | Height of Land Across Yukon River from Project Site | Cultural | 24 |
| 11 | Height of Land Across Yukon River to East | Wildlife | <20 |
| 12 | Ballarat Creek Area, North of Yukon River | Wildlife | <20 |
| 13 | Placer Miner/Residence | Residence | <20 |
| 14 | M. Dubios Cabin | Residence | <20 |
| 15 | Kirkman Cabins | Residence / Business | 22 |

## 5.3 NORTHERN ACCESS ROUTE

An all-weather access road will be utilized for providing equipment, fuel and other supplies during the construction and operations. The NAR will be located between Dawson and the Mine Site with Forestry-road type construction starting in Year -3 with completion prior to the start of the site construction in Year 2.

The NAR will cross the Stewart River and the Yukon River. During periods of open flow, barges will be utilized to move transport trucks across each river. During the winter months when the rivers are frozen ice roads will be constructed to allow access across the rivers. No river access will be possible during the spring that and fall freeze-up periods each year. Logistics and storage of fuel and consumable materials during these periods has been considered with incorporating storage and laydown areas.

During the open water season barges are estimated to operate on an average of 158 days per year. Barges will operate Monday through Friday during the dayshift only. During the winter months the ice crossings are estimated to open for haulage an average of 137 days and the NAR will be open to traffic from Monday through Friday during the dayshift only.

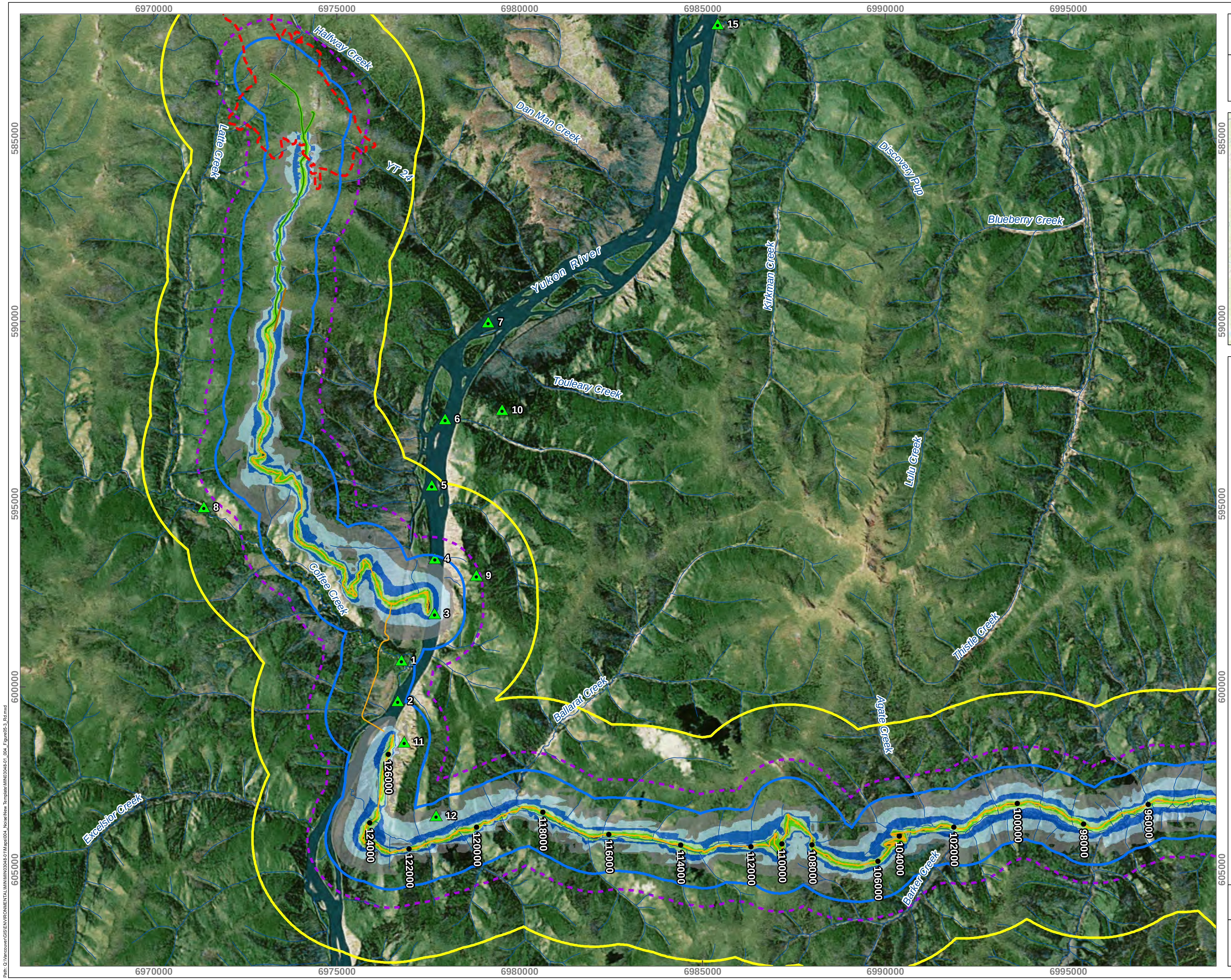
### 5.3.1 NAR NOISE LEVELS

The NAR was modeled using the CadnaA noise modeling software. The noise model assumed unpaved roadways with a speed limit of 40 km/hr, which is the average speed limit permitted on the NAR. Based on the Project feasibility study the NAR will have a maximum traffic volume of eight trucks per day, which occurs between years 5 and 7. This maximum daily truck volume was inputted into the noise model during the daytime period only. The NAR will not be used during nighttime hours.

The noise contour distances from the centerline of the NAR are as follows:

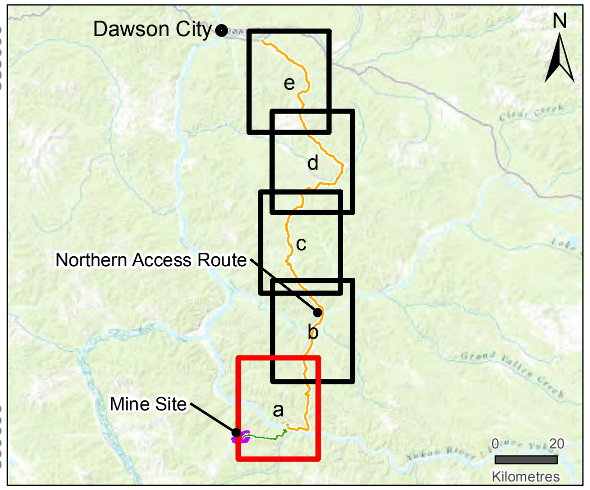
- 50 dBA at 68 m;
- 45 dBA at 145 m;
- 40 dBA at 307 m; and
- 35 dBA at 515 m.

The received sound levels produced by traffic on the NAR reach the BC OGC 50 dBA daytime guideline at an approximate distance of 68 m from either side of the road centerline. The noise contour distances described may vary slightly due to changes in topography or bends and turns in the road. The noise contours for the NAR operations are presented in Figures 5-3a through 5-3e.




COFFEE GOLD MINE

**Northern Access Route**
**Operational (Year 6) Noise Contours**




## Legend

- Noise Sensitive Receptor
- Local Study Area
- Regional Study Area
- Mine Site - Project Footprint
- OGC 50 dBA Daytime PSL Point of Compliance
- Northern Access Route
- Mine Site Access Road
- Proposed Airstrip
- Watercourse

**Sound Level Contour Ranges (dBA)**

- 30 - 35
- 35 - 40
- 40 - 45
- 45 - 50
- 50 - 55
- 55 - 60

## 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 Kaminak. Additional imagery from ESRI; Earthstar Geographics (1999).

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| Figure 5-3a | Date: Mar 9, 2017 | Drawn by: SL | Reviewed: KG |
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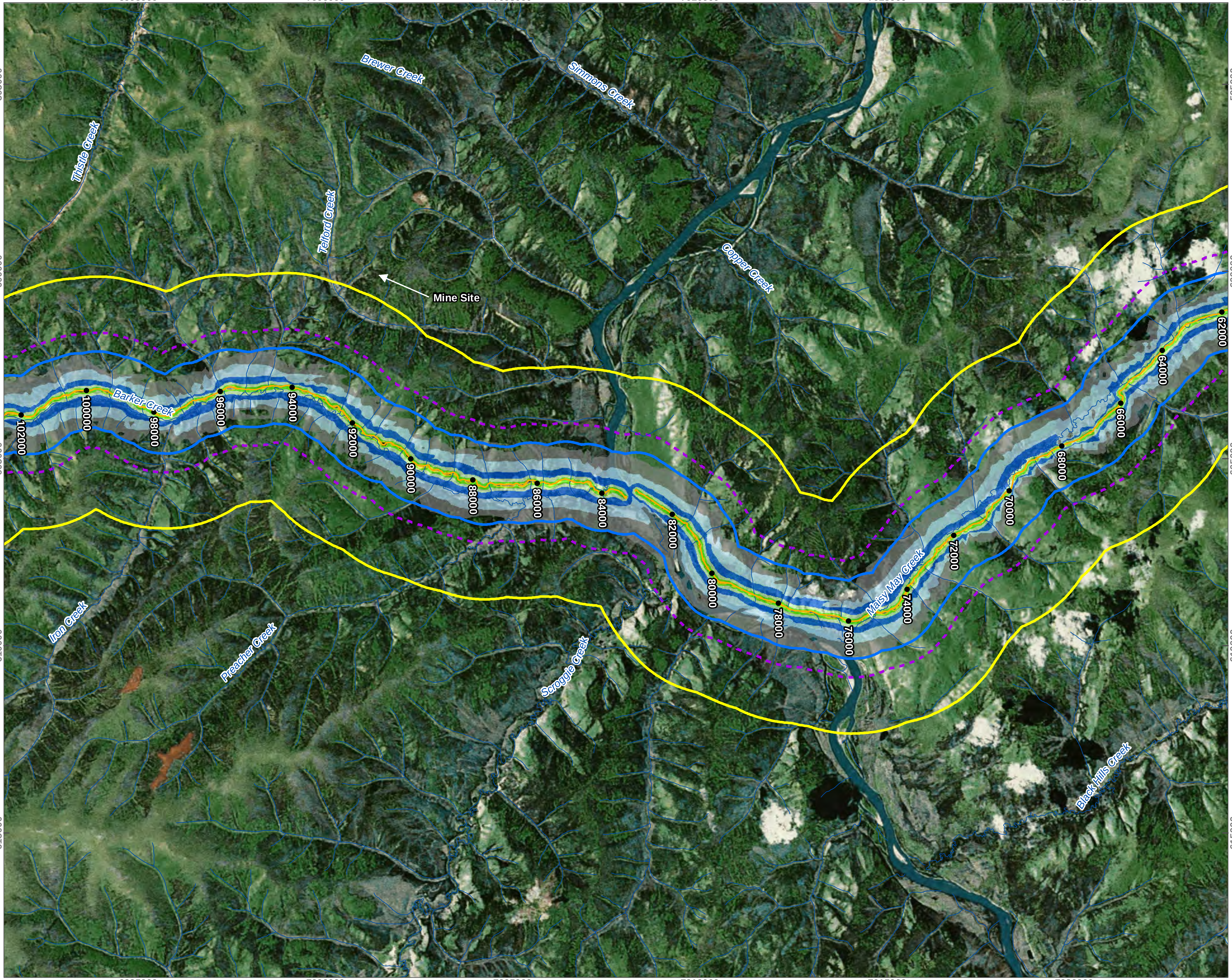
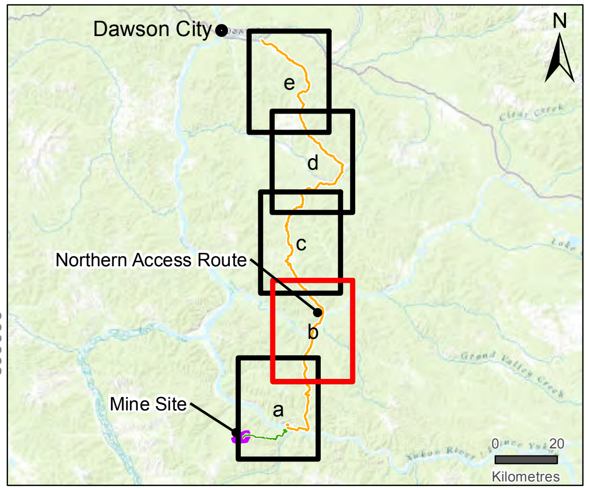



COFFEE GOLD MINE

**Northern Access Route Operational (Year 6) Noise Contours**




## Legend

- Noise Sensitive Receptor
- Local Study Area
- Regional Study Area
- OGC 50 dBA Daytime PSL Point of Compliance
- Northern Access Route
- Mine Site Access Road
- Watercourse

**Sound Level Contour Ranges (dBA)**

- 30 - 35
- 35 - 40
- 40 - 45
- 45 - 50
- 50 - 55
- 55 - 60

## Notes

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2. - Imagery from Kaminak. Additional imagery from ESRI; Earthstar Geographics (1999).

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| Figure 5-3b | Date: Mar 9, 2017 | Drawn by: SL | Reviewed: KG |
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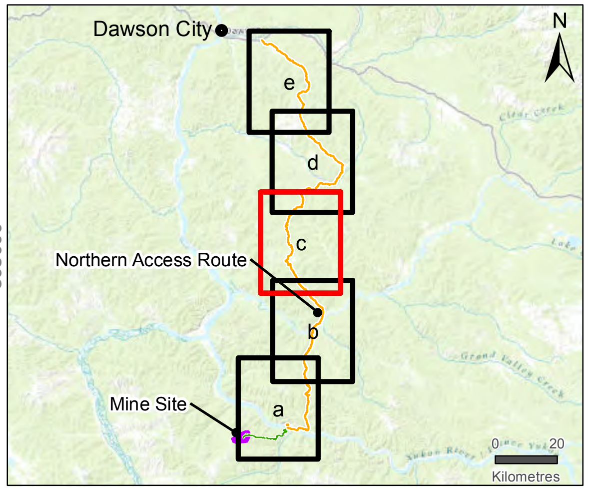
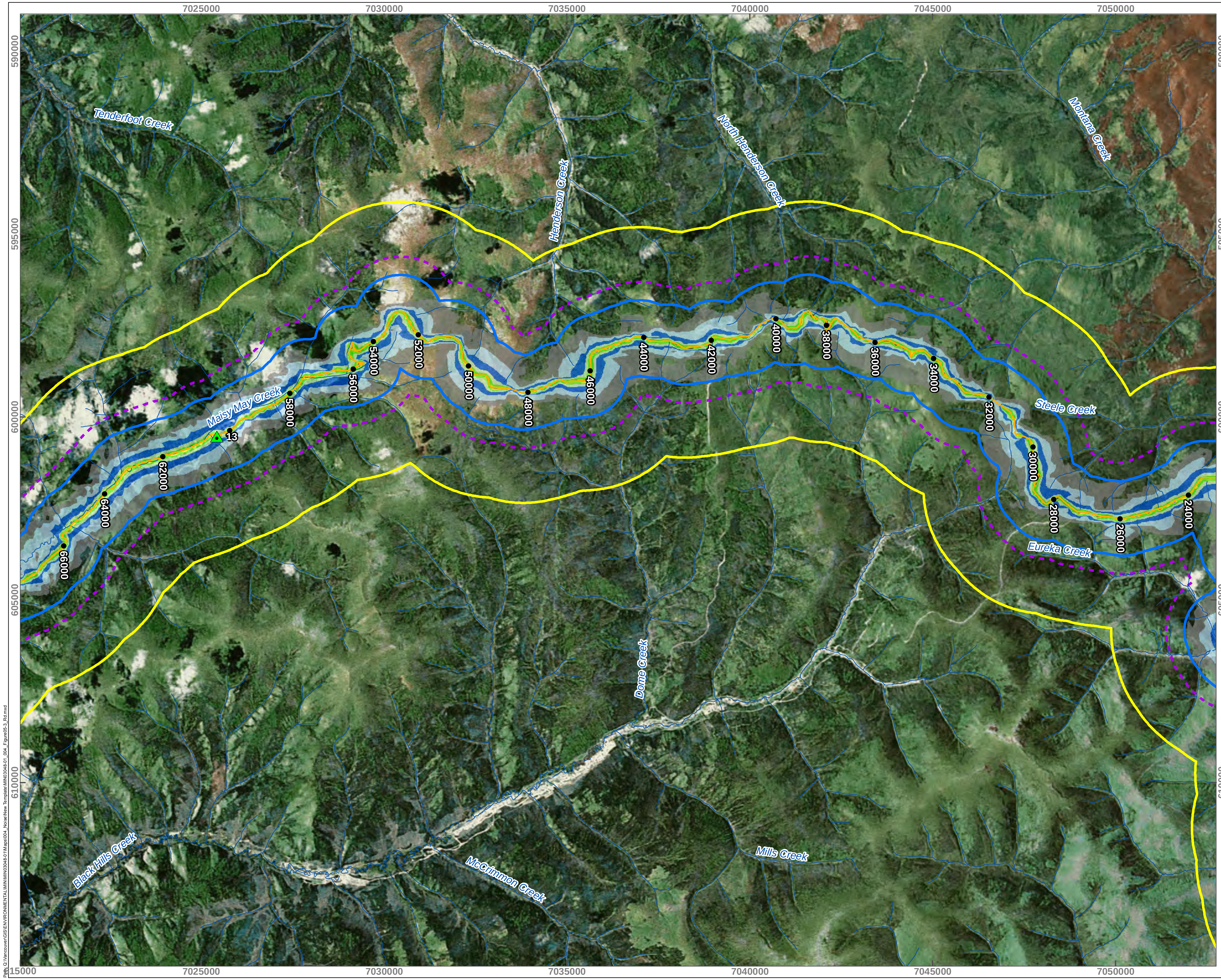
## Northern Access Route Operational (Year 6) Noise Contours




### Legend

- Noise Sensitive Receptor
- Local Study Area
- Regional Study Area
- OGC 50 dBA Daytime PSL Point of Compliance
- Northern Access Route
- Mine Site Access Road
- Watercourse

**Sound Level Contour Ranges (dBA)**

- 30 - 35
- 35 - 40
- 40 - 45
- 45 - 50
- 50 - 55
- 55 - 60

### Notes

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2. - Imagery from Kaminak. Additional imagery from ESRI; Earthstar Geographics (1999).

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| Figure 5-3c | Date: Mar 9, 2017 | Drawn by: SL | Reviewed: KG |
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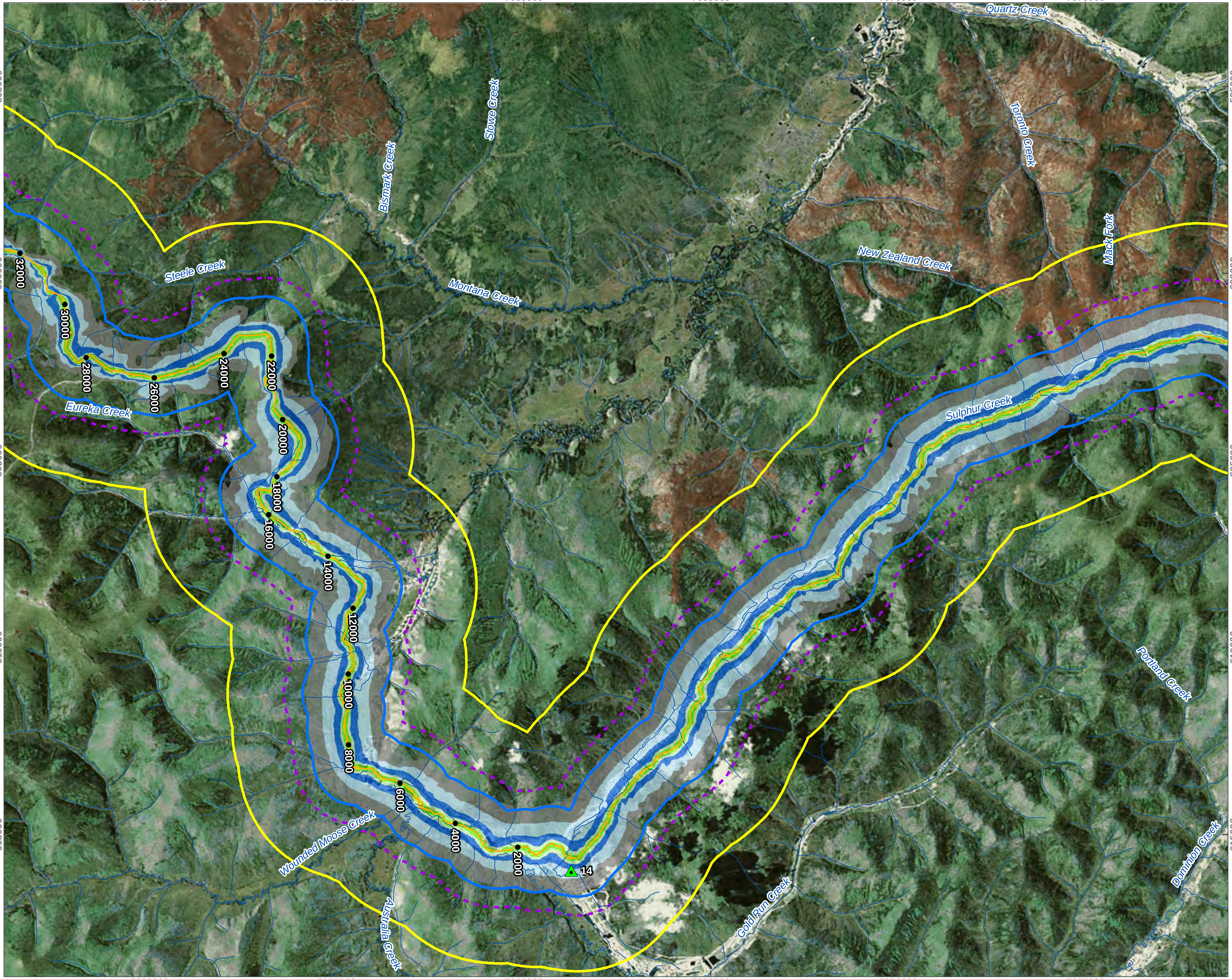
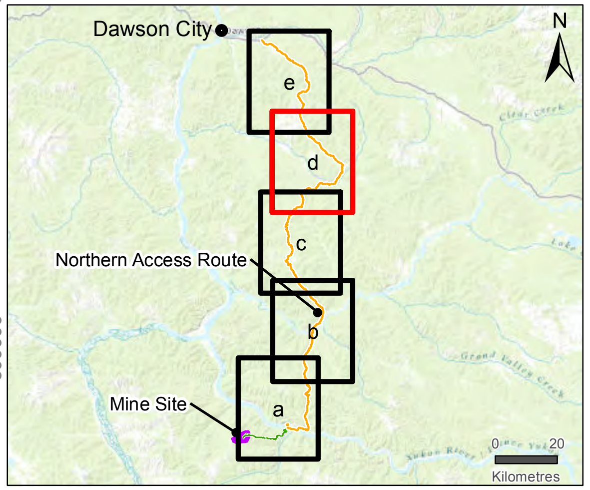
COFFEE GOLD MINE

**Northern Access Route Operational (Year 6) Noise Contours**




## Legend

- Noise Sensitive Receptor
- Local Study Area
- Regional Study Area
- OGC 50 dBA Daytime PSL Point of Compliance
- Northern Access Route
- Mine Site Access Road
- Watercourse

**Sound Level Contour Ranges (dBA)**

- 30 - 35
- 35 - 40
- 40 - 45
- 45 - 50
- 50 - 55
- 55 - 60

## Notes

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2. - Imagery from Kaminak. Additional imagery from ESRI; Earthstar Geographics (1999).

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| Figure 5-3d | Date: Mar 9, 2017 | Drawn by: SL | Reviewed: KG |
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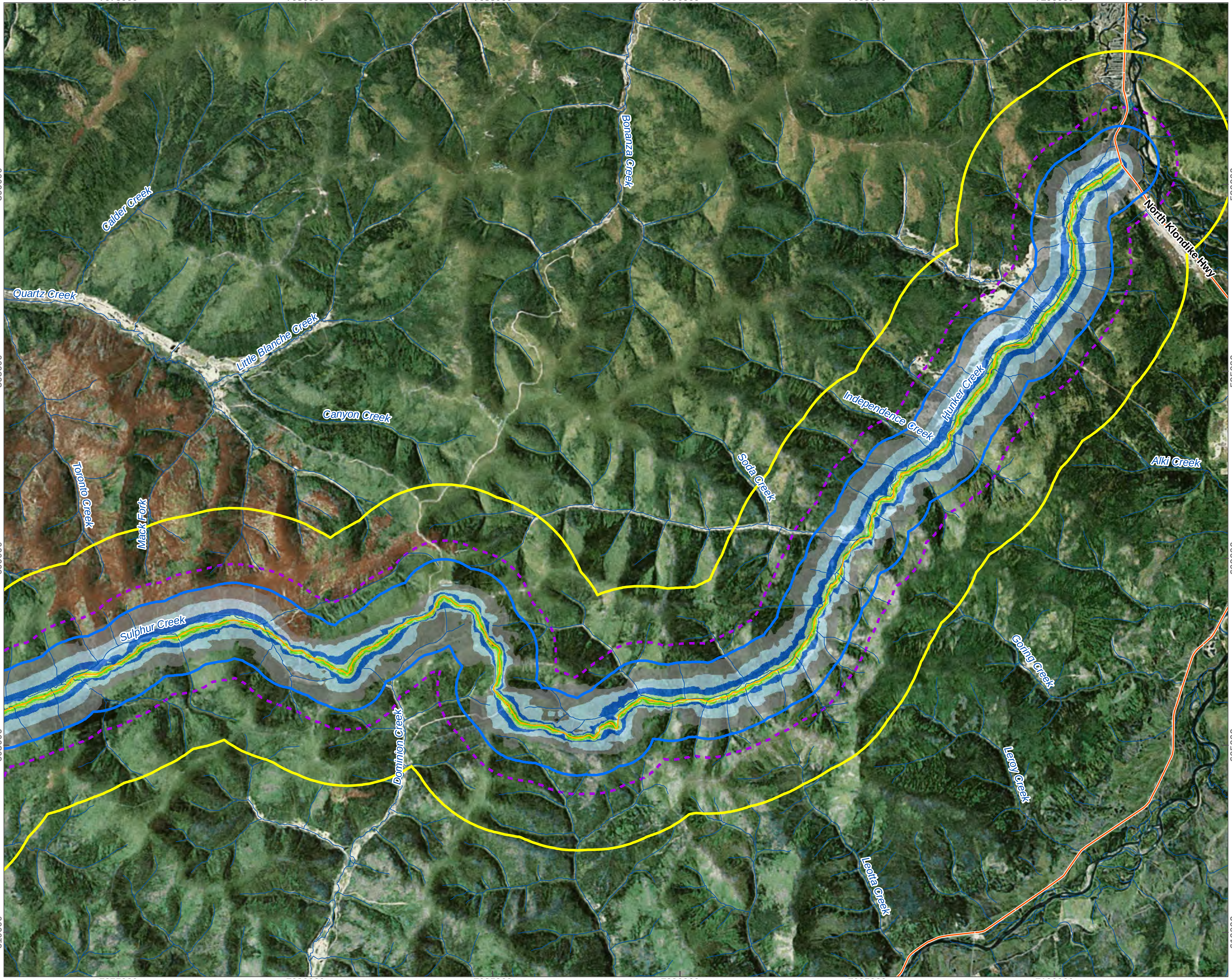
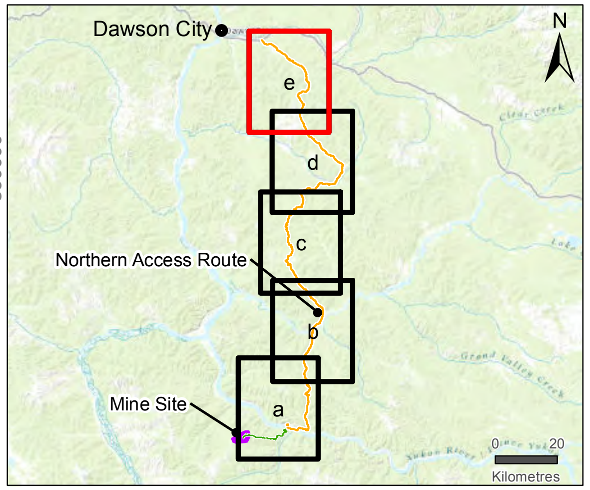
**Northern Access Route**
**Operational (Year 6) Noise Contours**




## Legend

- Noise Sensitive Receptor
- Local Study Area
- Regional Study Area
- OGC 50 dBA Daytime PSL Point of Compliance
- Northern Access Route
- Mine Site Access Road
- Klondike Highway
- Watercourse

**Sound Level Contour Ranges (dBA)**

- 30 - 35
- 35 - 40
- 40 - 45
- 45 - 50
- 50 - 55
- 55 - 60

## Notes

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| Figure 5-3e | Date: Mar 9, 2017 | Drawn by: SL | Reviewed: KG |
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## 5.4 BLASTING OPERATIONS

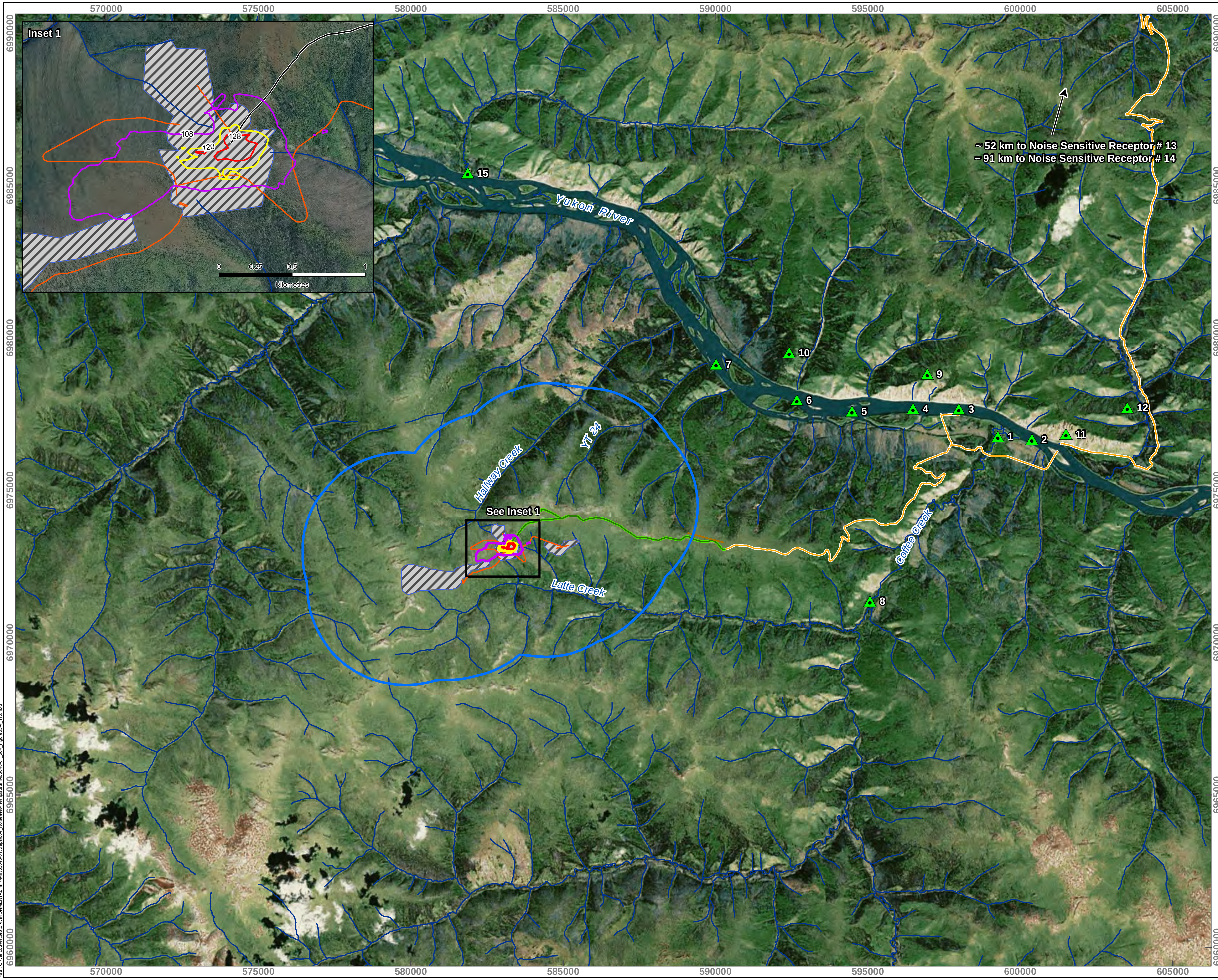
The construction and operations of the Project will require blasting. Blasting is a short duration event as compared to rock removal methods, such as using track rig drills, rock breakers, jack hammers, rotary percussion drills, core barrels, and/or rotary rock drills. Proposed blasting techniques include the electronically controlled ignition of multiple small-explosive charges in an area of rock 8/1,000 of a second apart, resulting in a total event duration of approximately 3/10 of a second. The detonations are timed so the energy from individual detonations destructively interferes with each other, referred to as wave canceling. As a result, very little of the kinetic energy generated during the detonations is wasted as audible noise.

The Project will use an average charge weight ranging from 287 kilograms (kg) that will be buried. The blasthole depth will be 11.6 m incorporating a 10 m bench height plus 1.6 sub-drill. The blastholes will be loaded with 7.9 m of explosives leaving a 3.7 m collar that will be backfilled with drill cuttings. 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).

Blasting was modeled at a single blast site for Year -1 and Year 6. The BNOISE2 software was used to calculate noise generated from blasting operations. The blast noise level at identified receptors is dependent on the distance between the blast location and the receiver, the amount of explosive used, the depth of the charge, and the relevant diffraction over terrain surrounding the Project site. CadnaA was used to calculate terrain effects on the blast noise propagation.

Based on the charge weight of the blasts, the impulsive maximum noise level could reach up to 130 dB $L_{peak}$ in the vicinity of the blast. At a distance of 1.5 km the maximum noise level from the blasting operations would range from 60 to 74 dB $L_{peak}$. The 108, 120, and 128 dB $L_{peak}$ noise contours are provide for both Year -1 and Year 6 in Figure 5 4 and Figure 5 5.

To minimize the interaction from the blast noise the blasting operations, a plan will be developed. Blasting plans, including incorporation of potential noise reduction measures, will be prepared by the contracted blasting specialist that demonstrate compliance with all applicable blasting regulations including the use of properly licensed personnel and obtaining all necessary authorizations.




COFFEE GOLD MINE

**Received Sound Levels:**
**Project Construction (Year -1) Blasting (dB Lpeak)**


## Legend

- Noise Sensitive Receptor
- Local Study Area
- Northern Access Route
- Mine Site Access Road
- Proposed Airstrip
- Watercourse

**Major Noise Source Area**

- Mine Site Infrastructure
- Haul Road

**Contour (dB Lpeak)**

- 108
- 120
- 128

## Notes

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2. Imagery obtained from 'Kaminak Gold Corporation' 2011

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| Figure 5-4 | Date: Mar 9, 2017 | Drawn by: SL | Reviewed: TP |
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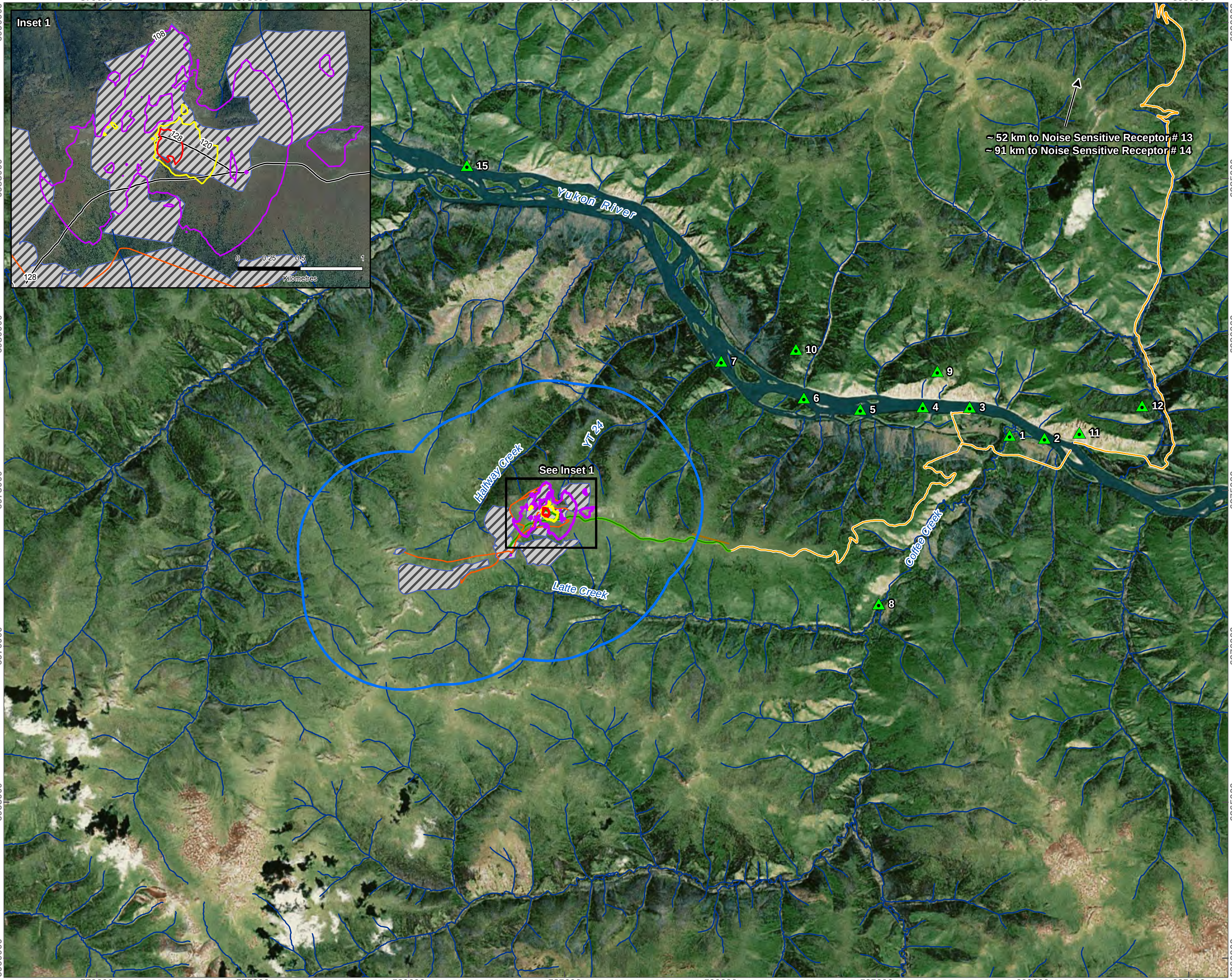
COFFEE GOLD MINE

**Received Sound Levels:**
**Project Operation (Year 6) Blasting (dB Lpeak)**





## Legend

- Noise Sensitive Receptor
- Local Study Area
- Northern Access Route
- Mine Site Access Road
- Proposed Airstrip
- Watercourse

**Major Noise Source Area**

- Mine Site Infrastructure
- Haul Road

**Contour (dB Lpeak)**

- 108
- 120
- 128

## Notes

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2. Imagery obtained from 'Kaminak Gold Corporation' 2011

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| Figure 5-5 | Date: Mar 9, 2017 | Drawn by: SL | Reviewed: TP |
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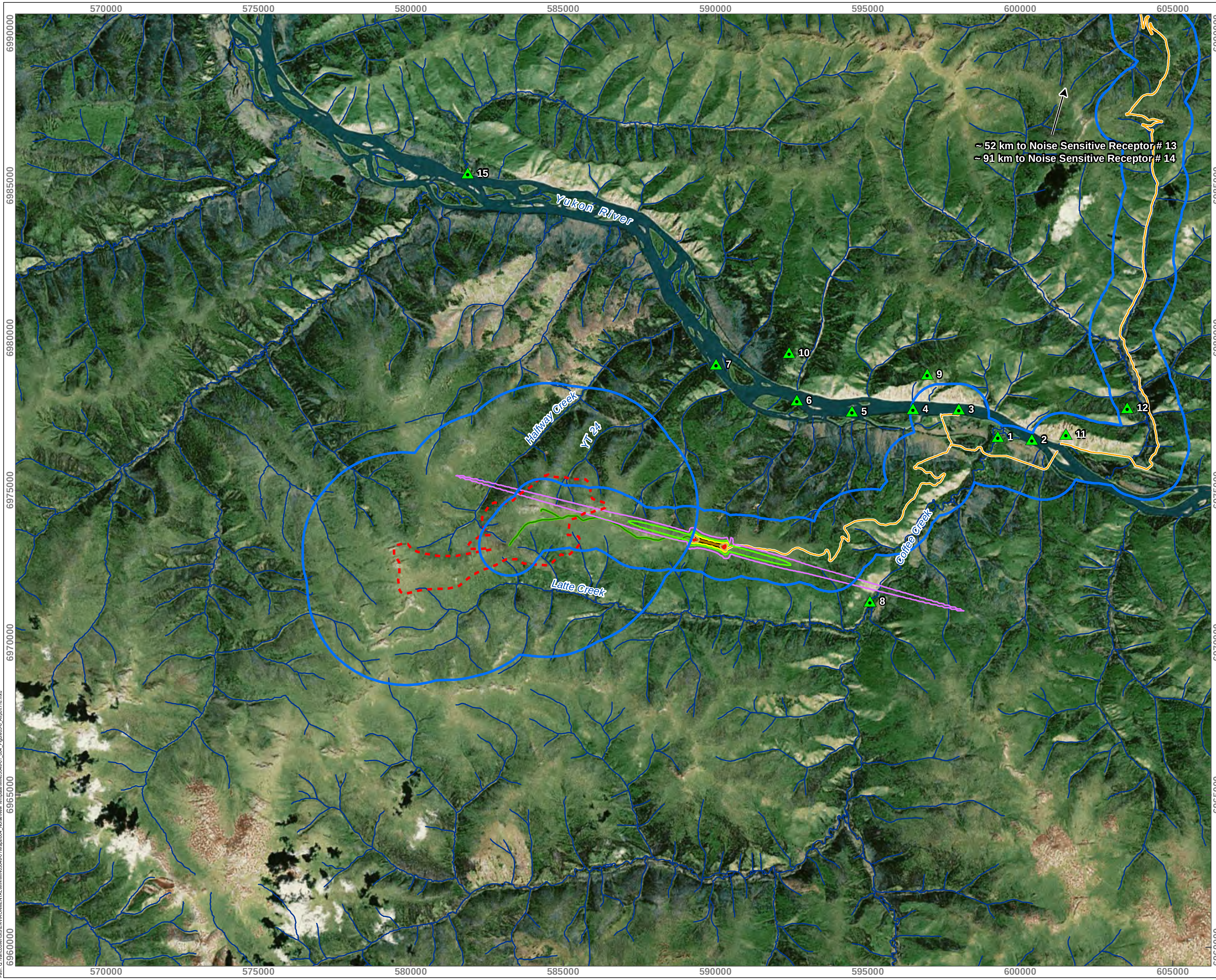
## 5.5 AIRSTRIP OPERATIONS

The Project will include an all-weather airstrip located east of the mining operations. Noise generated at the airstrip with be related to the aircraft or its components, during various phases of a flight; on the ground while parking and using auxiliary power units, while taxiing, on run-up from propeller and jet exhaust, during takeoff, underneath and lateral to departure and arrival paths, over-flying when enroute, or during landing. The Coffee airstrip is designed to handle turboprop passenger aircraft (Hawker Siddeley 748) and is also sufficiently sized to handle cargo aircraft up to a de Havilland DHC-5A Buffalo. The airstrip will be constructed to 1,220 m in length and 35 m wide. The highest airstrip operations will occur in Year 6 and will incorporate 9 freight flights and 179 passenger flights total for the year.

The airstrip will also accommodate helicopter operations, which will be used to transport drill core and chip samples to the process plant. The helicopters will also be used to complete monthly surveys to remote monitoring sites that are not accessible by mine roads. The helicopters planned for use are the Bell 206 and the Eurocopter AS350. A total of 24 helicopter operations will occur per year.

Noise emissions from use of the airstrip was modeled using the BaseOps noise modeling software. The BaseOps software is an approved suite of tools to assess noise impacts in accordance with the United States Air Force Environmental Impact Analysis Process (32 CFR 989; USC 1999). The model predicts airstrip operation noise including airspace activity, airfield activity, and engine run-ups. The airstrip was modeled incorporating proposed flight paths, Year 6 aircraft operations, and yearly anticipated helicopter operations. The noise contours for the Year 6 operations inclusive of helicopter activity are illustrated in Figure 5 6. There are no identified human noise sensitive receptors that are within the 50 dBA $L_{eq}$ noise contours. The noise levels from the airport are not expected to result in an adverse impact to the noise sensitive areas.




COFFEE GOLD MINE

**Received Sound Levels:**
**Project Operation (Year 6) Airport (dBA Leq)**


## Legend

- Noise Sensitive Receptor
- Local Study Area
- Mine Site – Project Footprint
- Runway
- Northern Access Route
- Mine Site Access Road
- Watercourse

**Contour (dBA Leq)**

- 50
- 55
- 60
- 65
- 70

## Notes

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Page Size: 11" x 17"

| Figure 5-6 | Date: Mar 9, 2017 | Drawn by: SL | Reviewed: TP |
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## 5.6 RECLAMATION AND CLOSURE PHASE

The reclamation and closure phase will incorporate equipment similar to the construction Year -1 scenario. On-site activity and equipment use is expected to decrease prior to and during the course of reclamation and closure (e.g., there will be no drilling and blasting after Year 9). Therefore, it is expected that the noise levels generated from the reclamation and closure phase will be less than the noise generated by construction Year -1 scenario.

## 5.7 POST-CLOSURE PHASE

During the post-closure phase, it is assumed that there will be no Project-related equipment or activities. Therefore, the noise levels during the post-closure phase will be similar to the noise levels documented before the Project activities start, which is presented in Section 3 of this report where the results of the baseline sound survey are described.

# 6.0 CONCLUSIONS AND RECOMMENDATIONS

Noise levels associated with Project construction and operation were analyzed relative to the BC OGC guideline, which prescribes a daytime PSL of 50 dBA $L_{eq}$ and a nighttime PSL is 40 dBA $L_{eq}$ at 1.5 km from the mine site boundary.

During construction the noise predictions show that the maximum noise levels at a distance of 1.5 km from the Mine site will range from 23 dBA to 45 dBA. Therefore, received sound levels will be greater than the 40 dBA nighttime PSL applicable at a distance of 1.5 km from the Mine site; however, there are no identified off-site human receptors within the 45 dBA isopleth. The closest sensitive (human and wildlife) receptors are identified in Table 5-1 and the highest predicted sound level expected to be received at these receptors is 28 dBA, occurring at the receptor located 10 km downriver from the Coffee Creek mouth.

During operations, the noise predictions show that the maximum noise levels at a distance of 1.5 km from the Mine site will range from 31 dBA to 42 dBA. Therefore, received sound levels will be greater than the 40 dBA nighttime PSL applicable at a distance of 1.5 km from the Mine Site during operations; however, there are no human receptors nearby. The closest receptors are identified in Table 5-2 and the highest predicted sound level is 28 dBA, occurring at the receptor located 10 km downriver from the Coffee Creek mouth.

When analyzing noise produced by activity on the NAR it was found that noise levels will range from 35 dBA at 515 m for the NAR to 50 dBA at 68 m from the NAR. The received sound levels produced by traffic on the NAR reach the BC OGC 50 dBA daytime guideline at an approximate distance of 68 m from either side of the roadway centerline.

Section 5.5 describes the results of the blasting noise assessment. Based on the charge weight of the blasts, the impulsive maximum noise level could reach up to 130 dB $L_{peak}$ in the vicinity of the blast. At a distance of 1.5 km the maximum noise level from the blasting operations would range from 60 to 74 dB $L_{peak}$. Sound levels would be below the 120 to 128 dB range identified as physiologically harmful to humans (Ontario Ministry of Environment 1985).

The Project airstrip was modeled incorporating proposed flight paths, Year 6 aircraft operations, and yearly anticipated helicopter operations. There are no identified noise sensitive receptors that are within the 50 dBA $L_{eq}$ noise contours. The noise levels from the airport are not expected to result in an adverse impact to the noise sensitive areas.

The Project will generate sound levels that exceed the ambient sound levels and has the potential to cause a temporary, short-term, localized disturbance from time to time. However, the Project is anticipated to comply with the applicable BC OGC noise guideline and will include a Best Management Practice to maintain compliance. The Project will take reasonable efforts to minimize noise changes to the extent practicable.

# 7.0 REFERENCES

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