StrataGold Corporation

EAGLE GOLD PROJECT

CONSTRUCTION PHASE ENVIRONMENTAL MONITORING PLAN

VERSION 2013-01

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1 INTRODUCTION

1.1 PROJECT SUMMARY

StrataGold Corporation (SGC), a directly held wholly owned subsidiary of Victoria Gold Corp. has proposed to construct, operate, close and reclaim a gold mine in central Yukon. The Eagle Gold Project ('the' Project) is located 85 km from Mayo, Yukon using existing highway and access roads. The Project will involve open pit mining at a production rate of approximately 10 million tonnes per year (Mt/y) ore, an average strip ratio (amount of waste: amount of ore) of 1.45:1.0, and gold extraction using a three stage crushing process, heap leaching, and a carbon adsorption, desorption, and recovery system over a 10 year mine life.

1.2 CONSTRUCTION SCHEDULE

The Project is presently in the permitting stage. YESAB issued a Final Screening Report on February 19, 2013 that recommended that the Project proceed subject to recommended terms and conditions. Yukon Government issued a Decision Document accepting the recommendation of YESAB on April 8, 2013 pursuant to the 123 terms and conditions listed in the Final Screening Report. The Government of Canada issued a coordinated Decision Document on April 19, 2013 that accepted the recommendation of YESAB. The completion of the Final Screening Report and Decision Documents represents a key milestone by allowing for application for and issuance of licences and permits required to construct and operate the Project. A Quartz Mining Licence (QML) is the key regulatory requirement for permitting a quartz mine. The licence serves as a regulatory and decision making framework that delineates how a company will develop and manage the mine over the life of the project. The *Quartz Mining Act* allows for phased licensing where initial development plans may be submitted as a "Part 1 Application" which provides companies with permission to proceed with initial site construction activities that do not require a Water Use Licence; and a "Part 2 Application" which enables proponents to proceed with mine construction and operation after the issuance of the Type A Water Use Licence (WUL).

It is understood that a phased Quartz Mining Licence is possible to permit initial construction activities prior to issuance of the Type A Water Use Licence.

To support the phased licensing of the Project, construction has been planned in two stages. Stage 1 construction will be carried out pending approval of a "Part 1" Quartz Mining Licence and prior to receipt of the Type A Water Use Licence. Stage 2 construction will be carried out upon receipt of the Type A Water Use Licence. In general, Stage 1 represents construction activities that are "non-water" related and do not require a Type A Water Use Licence or other authorizations issued by Federal Departments pursuant to the *Fisheries Act* and *Navigable Waters Protection Act.* Stage 2 construction includes all remaining construction of infrastructure and facilities that involves the use of water, alteration of watercourses and/or discharge of a waste to waters. Project Development and

Operational plans will be submitted to Yukon Government for review via an updated General Site Plan concomitant with the application for a Type A Water Use Licence to the Yukon Water Board.

Stage 1 Construction will begin in 2013 pending receipt of the Quartz Mining Licence and will continue throughout 2014 until receipt of the Type A Water Use Licence. For planning purposes, SGC anticipates receipt of the Type A Water Use Licence in mid-2014. Stage 2 construction will commence upon receipt of a Type A Water Use Licence and updated Quartz Mining Licence to enable additional construction activities and operations.

Construction activities planned for Stage 1 include site clearing and grubbing, road upgrades, civil earthworks, concrete foundations, building erection, Dublin Gulch Diversion Channel (dry work), pit pre-stripping and camp expansion. The remaining construction activities will take place over the following year or as soon as a Type A Water Use License for a Quartz Undertaking (WUL) is granted.

1.3 SCOPE AND OBJECTIVES

SGC has developed this Construction Phase Environmental Monitoring Plan in support of an application for a Quartz Mining License. The plan includes environmental monitoring objectives, work completed to date, and methods for a variety of technical disciplines throughout the construction phase of the Project. The scope of this plan is limited to monitoring during construction and accounts for the transition from environmental baseline data collection to monitoring of potential construction related effects. The two primary objectives of this plan are:

1. To collect data to detect potential Project related effects to the environment during construction.
2. To collect continuous environmental data to augment the existing baseline characterization data set to inform the need and method of adaptive management if required.

Maintaining collection of environmental baseline data prior to and throughout the Project life will provide a continuous dataset that can be used to identify temporal trends, minimize potential uncertainties associated with missing temporal segments, and ensure the variability of baseline is well understood prior to and during the period of compliance monitoring.

Due to the characteristic and idiosyncratic nature of delineating a study area for each discipline, Local Study Area (LSA) delineations may not be the same across all the disciplines; thus the physical study areas as measured in square kilometers and reported below are generally unique to each discipline.

This construction monitoring plan will be expanded to a comprehensive Environmental Monitoring and Surveillance Plan and submitted as application for Type A Water Use and Quartz Mining Licenses required prior to operations, closure and reclamation, and the post-closure Project phases.

2 WATER MONITORING PROGRAM

This section describes the objectives and methods for the monitoring of hydrology, surface water quality, groundwater quality and groundwater quantity during the construction phase of the Project.

2.1 SURFACE WATER HYDROLOGY

2.1.1 Introduction and Objectives

The objective of the hydrology data collection program is to maintain streamflow records in the Project area to support water management design, refinements to water balance and water quality modeling studies, as well as to facilitate reporting of flow data associated with Water Use License criteria. The hydrology data collection has been developed in accordance with accepted standardized practices and procedures, as outlined by the British Columbia Resource and Inventory Standards Committee (RISC) (2009).

2.1.2 Previous Work

Historically, baseline hydrology information has been collected in the Project area for two periods: from 1993 to 1996 and 2007 to present.

The more recent baseline hydrology data collection was established in August 2007 with the installation of automated and manual hydrology stations in the Dublin Gulch, Haggart Creek and Lynx Creek basins. Field methods and data summaries are provided in Stantec (2010a, 2011a and 2012a) and Knight Piesold (2013). The objective of the baseline program was to characterize the seasonal and annual streamflow trends in the Project area prior to Project development. The automated station installations included a pressure transducer and datalogger to continuously measure water level during the open water season, whereas the manual stations included only point discharge measurements taken over a range of flows throughout the season.

The locations of the existing automated stations are summarized in the Table 2.1-1 and shown on Figure 2.1-1. These stations are typically removed at the end of each open water season (end of October or early November) and re-installed prior to the freshet in the following year. Discharge measurements at both the automated and manual stations were generally conducted using either the velocity-area method using a current flow meter or salt dilution method (during freeze-up or under ice conditions) using a conductivity probe.

Table 2.1-1: Baseline Hydrology Automated Station Locations

Site	Location Description	Coordinates		
		Zone	North	East
W1	Dublin Gulch above Stewart Gulch	8V	7101545	460249
W4	Haggart Creek below Dublin Gulch	8V	7101223	458144
W5	Haggart Creek above Lynx Creek	8V	7095888	457814
W6	Lynx Creek above Haggart Creek	8V	7095964	458099
W22	Haggart Creek above Dublin Gulch	8V	7101378	458319
W26	Stewart Gulch	8V	7101443	460331
W27	Eagle Creek near camp	8V	7100997	458235
W29	Haggart Creek below Eagle Creek	8V	7099583	458225

2.1.3 Methods

The hydrology monitoring program during the construction phase will focus on collecting continuous streamflow data in the watersheds of Dublin Gulch and Haggart Creek. This will be achieved by maintaining six of the eight existing automated hydrology stations and manual stage and discharge measurements. Automated stations that will continue to be monitored during the first year of construction include W1, W4, W22, W26, W27 and W29.

During Stage 1 Construction, the automated station at W5 will be decommissioned and a new automated station installed at existing manual station W23. In the second year of construction, some of the monitoring locations will change, be deleted and/or new stations will be added to account for projected changes to watercourses. In addition, two automated stations will be added at the Fish Habitat Compensation channels to be constructed in 2014 (W22-OC and W45). Also, the existing automated stations W1, W26 and W27 will be decommissioned. A new automated station (W1A) will be installed downstream of W1 on Dublin Gulch below Stewart Gulch and directly upstream of the Dublin Gulch Diversion Channel (DGDC).

2.1.3.1 General

For the hydrology data collection program, water level will be recorded continuously with a pressure transducer and datalogger at each automated station location, with discharge measurements conducted at a range of flows during scheduled site visits. Continuous data are preferable to characterize seasonal and inter-annual patterns. Regular site visits to the stations will be conducted by a technician to ensure the instrumentation is in good working order and to perform discharge measurements.

During each visit, the technician will undertake the following general tasks:

- Perform routine maintenance on the instrumentation, and verify that no damage has occurred to the installation. All instrumentation will be in good working order, including datalogger batteries and desiccant.

- Download stage data from datalogger, checking for any signs of erratic behaviour.
- Select a suitable location to conduct a discharge measurement based on current flow conditions.
- Perform a minimum of two high accuracy discharge measurements.
- Record gauge height during site visit with estimated uncertainty based on confidence.
- Record observations of any change in hydraulic control at the stream gauge site.
- Bench mark surveying will be conducted at each station on as-needed basis to verify staff gauge elevations and calibrate gauging instrumentation.
- Document all activities of the visit with concise field notes and photos of all relevant observations.

2.1.3.2 Current Meter Discharge Measurements

Discharge measurements at the automated stations will be performed using the velocity-area method using a current meter. Guidelines that will be followed for obtaining good quality discharge measurements are as follows:

- The entire measurement section will be broken into a minimum of 20 sub-sections.
- These sub-sections will be selected based on the velocity distribution in the stream, and are not required to be equidistant.
- The primary goal is to measure 5% of the total flow in each sub-section, with preferably no more than 10% in each sub-section.

For example, if the wetted stream width is six metres wide with the majority of the flow in the middle 4 metres of the channel, the measurement interval will be approximately 0.25 metres in the flowing segment, and 0.5 metres in the slower sections. This distribution will have the majority of the flow measured in the centre 16 sections with the remainder in the other four closest to the stream banks.

2.1.4 Locations

The station locations for the hydrology data collection program for the construction phase of the Project are shown in Figure 2.1-2 and summarized in Table 2.1-2. The stations in Haggart Creek were chosen to coincide with future compliance point monitoring locations for water quality. The relocated station (W1A) in Dublin Gulch will help to characterize the total flow entering the Dublin Gulch Diversion Channel upstream of the Project facilities.

Table 2.1-2: Project Automated Hydrology Stations during Construction

Station	Location Description	Year -2	Year -1	Coordinates		
				Zone	North	East
W1	Dublin Gulch above Stewart	X		8V	7101545	460249
W1A	Dublin Gulch above Dublin Gulch Diversion Channel		X	8V	7101447	460118
W4	Haggart Creek below Dublin	X	X	8V	7101223	458144
W22	Haggart Creek above Project Influence	X	X	8V	7101378	458319
W5	Haggart Creek above Lynx Creek	X	X	8V	7095888	457814
W6	Lynx Creek above Haggart Creek	X	X	8V	7095964	458099
W23	Haggart Creek below Lynx Creek	X	X	8V	7095683	457790
W26	Stewart Gulch	X		8V	7101443	460331
W27	Eagle Creek near Camp	X		8V	7100997	458235
W29	Haggart Creek below Eagle Creek and Platinum Gulch	X	X	8V	7099583	458225
W45	Eagle Greek above Haggart Creek		X	8V	7099684	458243

2.1.5 Frequency

The hydrology stations are subject to winter freeze and therefore will only be operated during mostly ice-free portions of the hydrologic year. The ice-free period varies year over year but is assumed to be May to November for the purposes of this Plan. A minimum of 3-4 site visits per year per station will be completed during ice-free periods to ensure quality data are collected, and to perform routine maintenance and discharge measurements; however, if the existing rating curves require additional quality points to establish a relationship between stage and discharge, more sampling visits will be added.

Site visits will be made during and immediately after freshet, a minimum of three times during summer and at the onset of freeze up. The objective will be to observe a range in flows when the stage is unaffected by ice, which will support continued development of stage-discharge ratings. It is expected that a more continuous onsite presence will enable technicians to select more opportune periods that are reflective of the range of discharges.

Discharge measurements that are to be used for rating curve development will be conducted at times when the hydrologic control is unaffected by ice or snow.

During snow and ice-affected periods hydrology data will be collected at each station with the following frequency:

- Spring snowmelt period (freshet): weekly discharge measurements until the dataloggers in continuous stations are installed.

- Bi-monthly winter low flow measurements will be collected, if flow is measureable, to characterize baseflow conditions.

Once water level dataloggers are deployed at ice off (late April/May), data collection will be continuous.

2.1.6 Data Analysis and Reporting

During every site visit the available recorded water level and discharge measurement data will be complied and reviewed to ensure quality data collection and enable proactive solutions to causes of anomalous recorded water level or discharge readings. Following the end of the open water season, thorough quality assurance and quality control (QA/QC) will be completed with the goal of producing a meaningful and scientifically credible streamflow record.

To develop good quality measured streamflow records for each station, stage-discharge rating curves will be periodically reviewed and revised, as required due to changing channel bed and/or bank conditions. The rating curves for each station will be applied to the corrected continuous stage data to produce a continuous flow record for the open water season. The winter discharge measurements will be used to infill gaps (interpolate) in the flow record during the periods when the transducer sensors are not installed.

The following data will be included for each station in a summary report following each data collection year:

- corrected water level records;
- discharge measurements;
- rating curves;
- calculated maximum, minimum and mean monthly and annual flows; and
- hydrographs of daily streamflow records.

This data will be used to meet water use license criteria, and inform operational water management during operations and post closure of mine facilities.

2.2 SURFACE WATER QUALITY

2.2.1 Introduction and Objectives

The surface water quality monitoring program during construction includes monitoring of water quality of watercourses within the Project area at strategic locations. The water quality monitoring plan has been designed to meet the following objectives:

- Continue to collect water quality data in the receiving environment as the Project transitions from environmental baseline characterization and into construction at stations upstream and downstream of Project influences.
- Collect water quality data to verify compliance with Type A Water Use License criteria once the license is issued.
- Provide a continuous water quality database to support adaptive management strategies to meet water quality compliance criteria and protect aquatic life.

Surface water quality monitoring has two main focuses: compliance monitoring and environmental effects. Environmental effects monitoring will focus on the following key Project watersheds, namely:

- Haggart Creek from below the confluence of Fisher Gulch to immediately downstream of the confluence of Lynx Creek;
- Dublin Gulch from Bawn Boy Gulch to its confluence with Haggart Creek;
- Eagle Creek;
- Lynx Creek; and
- South McQuesten River at the confluence of Haggart Creek

Compliance monitoring will target specific stream locations in the receiving environment. The water quality monitoring program will not be a static program; stations will be added or removed according to the conditions and adaptive management as required.

2.2.2 Previous Work

Historic surface water quality monitoring in the Project area commenced in 1993 and continued until 1996. More continuous monitoring was initiated again in 2007 and has continued to the present to establish a robust baseline water quality dataset. Water quality data collected since 2007 has focused on the monitoring of seasonal water quality in streams and rivers of the Project area using methodology consistent with environmental assessment standards under Yukon and federal legislation. Prior to 2011, generally monthly sampling occurred but was limited to the ice-free period of April to October; however, beginning in 2011, winter sampling commenced in January. Since January 2011 and continuing to the present sampling was conducted each month, except for July 2011, and January and February 2012. Previous work is described in JWA (2008), Stantec (2011b), Stantec (2012b) and Lorax (2013).

The existing baseline water quality monitoring program targets Project watersheds that have the potential to be affected by Project activities and includes the Haggart Creek, Dublin Gulch and Eagle Creek drainages. Water quality monitoring stations in each of these basins were established to monitor seasonal water quality upstream and downstream of the Project activities. In addition, water quality monitoring stations were established in Lynx Creek, a pristine drainage basin to the immediate south of the local Project area, and selected as reference stations recognizing that Lynx

Creek will not be affected by Project activities. Two sites were added in late 2011 at the confluence of Haggart Creek with the South McQuesten River to establish baseline conditions 20 km downstream in far field areas.

Table 2.2-1 provides details of the existing baseline water quality monitoring program including the location, rationale and number of samples collected for the period of 2007 to October 2012 for each station. Figure 2.2-1 illustrates the existing baseline surface water quality monitoring station locations; this monitoring network was used as a basis for the proposed monitoring stations during the construction phase.

Table 2.2-1: Baseline Water Quality Site Locations, Rationale and Number of Sampling Dates, 2007–2012

Site	Location Description	Coordinates		Rationale	No. of Samples
		Northing	Easting		2007 to 2012
Haggart Creek Drainage Basin					
W22	Haggart above Dublin Gulch	7101377	458319	Above Project influence	42
W4	Haggart below Dublin Gulch	7101223	458144	Below Project influence	34
W29	Haggart below Eagle Creek	7099583	458225	Below Project influence	38
W5	Haggart above Lynx Creek	7095887	457815	Below Project influence	27
W23	Haggart below Lynx Creek	7095682	457790	Below Project influence	29
W39	Haggart above S. McQuesten River	7086504	449780	Far field Below Project	5
Dublin Gulch Drainage Basin					
W20	Bawn Boy Gulch	7101961	461945	Above Project influence	9
W1	Dublin Gulch above Stewart Gulch	7101545	460249	Above Project influence	46
W26	Stewart Gulch	7101443	460331	Above Project influence	23
W21	Dublin Gulch above Haggart Creek	7101261	458359	Below Project influence	42
Eagle Creek Drainage Basin					
W9	Eagle Pup	7101052	459630	Below Project influence	33
W10	Suttles Gulch	7100841	459161	Below Project influence	9
W61	Eagle Creek below Suttles Gulch	7100895	459139	Below Project influence	12
W27	Eagle Creek midway	7100997	458235	Below Project influence	42
W61	Platinum Gulch at road	7099624	458896	Below Project influence	2
W45	Eagle Creek above Haggart Creek	7099684	458243	Below Project influence	10
Lynx Creek Drainage Basin					
W13	Lynx Creek above Ray Creek	7098295	464770	No Project influence	4
W6	Lynx Creek above Haggart Creek	7095964	458099	No Project influence	22

Site	Location Description	Coordinates		Rationale	No. of Samples
		Northing	Easting		2007 to 2012
South McQuesten Drainage Basin					
W49	S. McQuesten below Haggart Creek	7085495	449221	Far field below Project	12

2.2.3 Methods

2.2.3.1 Field Sampling and Protocols

The surface water quality monitoring program will continue to use the sampling methods and analyses established during baseline characterization programs. Specifically, water samples will be collected using the methods outlined in the BC Freshwater Biological Sampling Manual (BC Ministry of Water, Land Air Protection 2003). For stream sampling, water samples will be collected in mid-stream from below the surface film and facing upstream while wearing powderless vinyl gloves.

Samples will be collected in narrow mouth, clean plastic containers; each container will be rinsed three times with sample water with the rinse contents disposed of downstream of the sampler. Sample bottles for cyanide analysis will not be rinsed prior to complete filling as each bottle contains NaOH preservative from the laboratory. After collection, sample bottles will be kept cool and in the dark for transport to the laboratory (in a cooler). Both dissolved metals and nutrient samples will be filtered within a few hours of collection, either in the field, if conditions permit, or indoors on a clean lab surface. Cyanide and total metals samples will be left unfiltered and preserved with NaOH and concentrated HNO_3, respectively. Physical/anion samples will be unfiltered and unpreserved and these bottles will be filled to capacity to minimize headspace and degassing. Total organic carbon and dissolved organic carbon samples will be collected in clean glass amber jars and preserved with HCl. All samples and blanks (both laboratory and field) will be kept in coolers with ice packs until arrival at the laboratory.

Table 2.2-2 provides a summary of the bottle volumes, sample handling (including preservative and filtration), and parameters for each sample collected as part of Eagle Gold water quality monitoring program.

Table 2.2-2: Summary of Eagle Gold Project Water Quality Samples, Treatment Protocols and Parameter List

Bottle Volume	Preservative	Filter	Parameter(s)
1 L	None	NO	Physical (conductivity, hardness, pH, TSS, TDS, Turbidity) + Anions (Alkalinity, Br, Cl, F, SO4)
125 mL	HCl (glass amber)	YES	Total Organic Carbon, dissolved Organic Carbon
250 mL	None	YES	Nutrients (NH3-N, NO3-N, NO2-N, TKN, Total N, dissolved orth-PO4, total diss. PO4, Total PO4)

250 mL	HNO3	NO	Total Metals
250 mL	HNO3	YES	Dissolved Metals

2.2.3.2 Water Quality Parameter List and Detection Limits

The suite of water quality parameters to be monitored during construction for the Eagle Gold Project is essentially the same as used for baseline monitoring program. As the project proceeds from baseline, through construction and into operations, the Water Use License will establish compliance criteria that consider the Project stage. Initially during Stage 1 construction there will be no permitted discharges, so no compliance parameters are expected. During the Stage 2 construction after receipt of the Water Use License, criteria will be established and it is expected that the primary criteria will be TSS given the scope of activities during this Project stage. Additional parameters are expected to be added for compliance criteria for the operations and closure stages of the Project. Although the list of compliance parameters varies through the project stages, the construction environmental monitoring program includes the analysis of physical parameters (pH, conductivity, turbidity, TSS, TDS and hardness); field parameters (pH, conductivity, temperature, dissolved oxygen); total and dissolved organic carbon; major anions and nutrients (alkalinity, total nitrogen, total Kjeldahl nitrogen (TKN), ammonia-N, nitrate-N, nitrite-N, total dissolved phosphate-P, ortho-phosphate-P, total phosphate-P, sulphate, bromide, chloride, fluoride); and, total and dissolved metals (Al, Sb, As, Ba, Be, Bi, B, Cd, Ca, Cr, Co, Cu, Fe, Pb, Li, Mg, Mn, Mo, Hg, Ni, P, K, Se, Si, Ag, Na, Sr, Tl, Sn, Ti, U, V, Zn).

The analytical detection limit for each parameter is summarized in Table 2.2-3. The sampling, handling, preservation, parameter list and analytical detection limits are applicable to all monitoring phases.

Table 2.2-3: Water Quality Parameters and Detection Limits

Parameter		Units	Detection Limit	Parameter		Units	Detection Limit
Physical Parameters	Conductivity	µS/cm	2.0	Total and Dissolved Metals	Barium	mg/L	0.00005
	Hardness (as $CaCO_3$)	mg/L	0.5		Beryllium	mg/L	0.0005
	pH	—	0.1		Bismuth	mg/L	0.0005
	TSS	mg/L	3.0		Boron	mg/L	0.01
	TDS	mg/L	10		Cadmium	mg/L	0.000017
	Turbidity	NTU	0.1		Calcium	mg/L	0.05
Organic/ Inorganic Carbon	DOC	mg/L	0.5		Chromium	mg/L	0.0005
	TOC	mg/L	0.5		Cobalt	mg/L	0.0001

Parameter		Units	Detection Limit	Parameter		Units	Detection Limit
Major Anions and Nutrients	Alkalinity, Total (as $CaCO_3$)	mg/L	2		Copper	mg/L	0.0005
	Ammonia as N	mg/L	0.005		Iron	mg/L	0.03
	Bromide	mg/L	0.05		Lead	mg/L	0.00005
	Chloride	mg/L	0.5		Lithium	mg/L	0.005
	Fluoride	mg/L	0.02		Magnesium	mg/L	0.1
	Nitrate (as N)	mg/L	0.005		Manganese	mg/L	0.00005
	Nitrite (as N)	mg/L	0.001		Mercury	mg/L	0.00001
	TKN	mg/L	0.05		Molybdenum	mg/L	0.00005
	Total Nitrogen	mg/L	0.0025		Nickel	mg/L	0.0005
	Ortho Phosphate as P	mg/L	0.001		Phosphorus - Total	mg/L	0.3
	Total Dissolved Phosphate as P	mg/L	0.002		Potassium	mg/L	2
	Total Phosphate as P	mg/L	0.002		Selenium	mg/L	0.001
	Sulphate	mg/L	0.5		Silicon	mg/L	0.05
Cyanide	Cyanide, Weak Acid Dissociable	mg/L	0.005		Silver	mg/L	0.00001
	Cyanide, Total	mg/L	0.005		Sodium	mg/L	2
Field Parameters	pH	—	0.01		Strontium	mg/L	0.0001
	Temperature	°C	0.1		Thallium	mg/L	0.0001
	Conductivity	µS/cm	1		Tin	mg/L	0.0001
	Dissolved Oxygen	mg/L	0.01		Titanium	mg/L	0.01
Total and Dissolved Metals	Aluminum	mg/L	0.003		Uranium	mg/L	0.00001
	Antimony	mg/L	0.0001		Vanadium	mg/L	0.001
	Arsenic	mg/L	0.0001		Zinc	mg/L	0.003

2.2.3.3 Sampling Quality Assurance/Quality Control

The quality assurance/quality control (QA/QC) program involves the analysis of field blanks and duplicates, filter blanks, laboratory replicates, and certified reference materials. All blank samples will be composed of distilled de-ionized water, of known composition, supplied by the analytical laboratory. Field blanks will be exposed to the same conditions and treatment as the water samples collected, and are intended to monitor any contamination that may occur in the field. Field replicates will be obtained by collecting two samples at the same time from a single station for the purpose of monitoring natural variability. Blanks will be processed through filters used in the preparation of dissolved metals samples collected to detect any contamination potentially introduced during the filtration process.

Laboratory replicates, comprising sample splits, will be analyzed to determine precision of the analytical techniques used. Method blanks will be analyzed to detect any contamination that may have been introduced due to the analytical equipment. Finally, certified reference materials will be analyzed to determine the accuracy of the analytical techniques and equipment used.

The criterion used to determine the quality of duplicate QA/QC data is the relative percent difference (RPD), calculated as:

$$RPD = \left| 2 * \left(\frac{A - B}{A + B} \right) \right| * 100$$

Where A and B are duplicate samples. RPD values are generally considered valid if they are less than 25%. However, RPD values of up to 100% are considered acceptable at concentrations less than five times the detection limit.

2.2.4 Construction Phase

Stage 1 Construction will begin in 2013 pending receipt of the Quartz Mining Licence and will continue throughout 2014 until receipt of the Type A Water Use Licence. For planning purposes, SGC anticipates receipt of the Type A Water Use Licence in mid-2014. Stage 2 construction will commence upon receipt of a Type A Water Use Licence and updated Quartz Mining Licence to enable additional construction activities and operations.

Construction activities planned for Stage 1 include site clearing and grubbing, road upgrades, civil earthworks, concrete foundations, building erection, Dublin Gulch Diversion Channel (dry work), pit pre-stripping and camp expansion. The remaining construction activities will take place over the following year or as soon as a Type A Water Use License for a Quartz Undertaking (WUL) is granted.

Locations and Frequency

The surface water quality monitoring program for the first year of the construction phase will be on a bi-monthly basis for many of the monitoring stations previously established as part of the baseline monitoring program. The surface water quality monitoring program for the second year of the construction phase will focus on environmental effects monitoring and compliance monitoring associated with the WUL.

In the second year of construction, water quality compliance monitoring stations will be added below each of the proposed waste rock storage facilities when construction of the starter embankment and rock drain is scheduled. These include the outflows from the Eagle Pup pond (station EP) and the Platinum Gulch pond (station PG).

Figure 2.2-2 illustrates the construction phase surface water quality monitoring locations. Table 2.2-4 provides a summary of each monitoring station, location, coordinates, rationale and monitoring frequency for the approximate 2-year construction period.

The majority of the surface water quality monitoring stations will be monitored on a bi-monthly basis during construction. Only the far-field monitoring stations W39 and W49, adjacent to the confluence of Haggart Creek with the South McQuesten River, will be monitored on a quarterly basis.

Table 2.2-4: Surface Water Quality Monitoring Locations and Frequency – Construction

Site	Location Description			Coordinates		Rationale	Frequency of Sampling
		Year -2	Year -1	Northing	Easting		
	Haggart Creek Drainage Basin						
W22	Haggart above Dublin Gulch	X	X	7101377	458319	Above Project influence	monthly
W4	Haggart below Dublin Gulch	X	X	7101223	458144	Below Project influence	monthly
W29	Haggart below Eagle Creek	X	X	7099583	458225	Below Project influence	monthly
W5	Haggart above Lynx Creek	X	X	7095887	457815	Below Project influence	monthly
W23	Haggart below Lynx Creek	X	X	7095682	457790	Below Project influence	monthly
W39	Haggart above S. McQuesten River	X	X	7086504	449780	Far field below Project	quarterly
	Dublin Gulch Drainage Basin						
W20	Bawn Boy Gulch	X	X	7101961	461945	Above Project influence	monthly
W1	Dublin Gulch above Stewart Gulch	X		7101545	460249	Above Project influence	monthly prior to station decommissioning
W1A	Dublin Gulch below Stewart Gulch and above DGDC		X	TBD	TBD	Above Project Influence	monthly after station commissioning
W26	Stewart Gulch	X		7101443	460331	Above Project influence	monthly prior to station decommissioning
	Eagle Creek Drainage Basin						
EP	Eagle Pup Pond		X	7101052	459630	Below Project influence	monthly after commissioning; daily when discharging [1]

Site	Location Description			Coordinates		Rationale	Frequency of Sampling
		Year -2	Year -1	Northing	Easting		
LDSP	Lower Dublin South Pond flow into Eagle Creek		X	TBD	TBD	Below Project influence	monthly after commissioning; daily when discharging [1]
W27	Eagle Creek	X		7100997	458235	Below Project influence	monthly in year one only until DGDC commissioned and station W27A is established
W27A	Within Fish Habitat Compensation Area in new Eagle Creek Compensation Channel		X	TBD	TBD	Below Project influence	monthly after DGDC is operational
PP	Platinum Gulch Pond		X	7099624	458896	Below Project influence	monthly after PG Pond commissioned; daily when discharging [1]
W45	Eagle Creek above Haggart Creek		X	7099684	458243	Below Project influence	monthly
	Lynx Creek Drainage Basin						
W6	Lynx Creek above Haggart Creek	X	X	7095964	458099	No Project influence	quarterly
	South McQuesten Drainage Basin						
W49	S. McQuesten below Haggart Creek	X	X	7085495	449221	Far field below Project	quarterly

1 –full parameter list on a monthly basis; turbidity only on a daily basis when discharging during construction

2 – TBD indicates new stations to be active during construction; final UTM coordinates to be determined after site selection

Data Analysis and Reporting

Surface water quality data collected during the construction phase of the Eagle Gold Project will be compared to two key benchmarks:

- baseline water quality; and
- surface water quality criteria established by the Yukon Water Board.

Data will be managed in a water quality database and updated on a monthly basis following receipt of the final analytical reports from the laboratory. Data will be tabulated and compared to existing baseline water quality for each Project receiving stream and any WUL criteria for the construction phase. For stations that have no existing baseline data (e.g. EP and PG), these results will be compared to relevant Project water quality criteria.

Surface water quality monitoring QA/QC results for field blanks, filter blanks, field replicates, laboratory replicates, and certified reference materials will be reported for each month of the sampling program. Statistical analysis will be performed on the monitoring data and compared directly to the baseline results to determine if any statistically significant changes have occurred to the receiving environment water quality.

If required, data will be used to prepare a construction phase water quality monitoring report covering monitoring results and analysis for both years of construction.

2.3 GROUNDWATER QUANTITY

2.3.1 Introduction and Objectives

The objectives of the groundwater quantity monitoring program are to provide a continuous baseline dataset and to monitor Project effects on the occurrence and quantity of groundwater as the Project transitions from baseline characterization through construction.

The majority of the Project will be situated within the Dublin Gulch basin, which is part of the Haggart Creek basin (Figure 2.3-1). To characterize the baseline groundwater for the Project, the site was divided into hydrogeologic zones (Stantec 2010, 2011, and 2012b). The zones have been named according to the primary watercourse draining each sub-catchment. The hydrogeologic zones used to characterize groundwater in the Project area include Eagle Pup and the Ann, Suttles, Olive, Bawn Boy, Platinum and Dublin Gulches. The groundwater monitoring program that will be adopted during construction will emphasize the spatial zones where facilities will be constructed to monitor Project effects on the groundwater flow system. The construction zones requiring groundwater monitoring are depicted in Figure 2.3-1 and include:

- the proposed Heap Leach Facility (HLF) area
- the proposed Eagle Pup Waste Rock Storage Area (EP WRSA) and Eagle Pup Pond (EP)

- the proposed Platinum Gulch Waste Rock Storage Area (PG WRSA) and Platinum Gulch Pond (PP)
- the proposed Events Ponds
- the proposed Truck Shop area
- Treatment Plant Holding Pond (TPHP)

2.3.2 Previous Work

Historically, baseline hydrogeology data and information has been collected in the Project area for two periods: from 1995 to 1996 and 2009 to present. The more recent baseline hydrogeology data collection began in May 2009 with the installation of new monitoring wells in addition to identifying and then using historical wells that were established during the 1995-1996 period. The objective of the baseline programs was to characterize subsurface conditions, groundwater occurrence (including seasonal variability) and hydraulic properties. Hydrogeologic baseline data from previous site investigation programs are documented in Stantec (2010b, 2011c, 2012a, 2012b and 2012c) and BGC (2012a, 2012b, 2013a and 2013b).

2.3.2.1 Existing Monitoring Program

Currently, there are approximately 99 monitoring wells, standpipe piezometers, vibrating wire piezometers and aquifer test wells installed throughout the Project area (Figure 2.3-1). This total includes 10 nested well pairs (i.e. 20 of the 99 wells), 13 vibrating wire piezometer installations (with between one and three pressure transducers installed at each location), four pumping test wells and 62 standpipe piezometers/monitoring wells. Of these, 20 (including four nested pairs – or eight wells) were completed in Stewart, Bawn Boy and Olive Gulches up gradient from the immediate proposed Project area (Figure 2.3-1). Potable water supply wells (current and historic) used to supply the exploration program and the existing camp are not included in this total.

Monitoring wells that were used to collect the 2011 and 2012 baseline water level data are summarized in Table 2.3-1, indexed by catchment area, proposed major mine facility and sampling record. These wells are highlighted in green (manual monitoring) and yellow (datalogger and pressure transducer) in Figure 2.3-1.

Groundwater quantity data and information have been described in Stantec (2010b, 2011c and 2012c) and BGC (2013). Continuous water level measurements were collected across the site at nine monitoring wells equipped with dataloggers and pressure transducers as indicated in Table 2.3-1 and Figure 2.3-1. Four of the dataloggers were installed in 2010, and five additional dataloggers were installed in 2011. Instantaneous water levels were also collected periodically from many other wells in 1995, 1996, and from 2009 until 2012.

Table 2.3-1: Existing Groundwater Monitoring Well Network Used for Baseline Data Collection

Instrument ID	Catchment	Facility	Data Logger Installation Date	Apr-11	May-11	Jun-11	Aug-11	Oct-11	Jan-12	Mar-12	May-12	Aug-12	Oct-12	Nov-12
MW10-AG3a	Ann Gulch	Heap Leach	*31-May-10*	-	X	X	X	X	X	X	X	X	X	X
MW10-AG5	Ann Gulch	Heap Leach	-	-	X	X	X	X	X	X	X	X	X	-
MW10-AG6	Ann Gulch	Heap Leach	-	-	X	X	X	X	X	X	X	X	X	-
DH95-152	Dublin Gulch	100 Day Storage	-	-	X	X	X	X	X	X	X	-	-	-
MW09-DG1	Dublin Gulch	Heap Leach	*16-May-10*	X	X	X	X	X	X	X	X	-	-	-
MW09-DG2	Dublin Gulch	Event Ponds	-	-	X	X	X	X	X	X	X	X	X	-
MW09-DG4	Dublin Gulch	Mine Site	1-Apr-11	X	X	X	X	X	X	X	X	X	X	X
MW09-DG5	Dublin Gulch	Mine Site	-	X	X	X	X	X	X	X	X	-	-	-
MW10-DG6	Dublin Gulch	Heap Leach	1-Apr-11	X	X	X	X	X	X	X	X	X	X	-
MW10-OBS1	Dublin Gulch	Mine Site	-	X	X	X	X	X	X	X	X	-	-	-
MW10-OBS2	Dublin Gulch	Mine Site	-	X	X	X	X	X	X	X	X	-	-	-
MW96-23	Platinum Gulch	PG WRSA	-	-	X	X	X	X	X	X	X	X	-	-
MW10-PG1	Platinum Gulch	PG Pond	19-May-11	-	X	X	X	X	X	X	X	X	X	-
MW96-19	Suttles Gulch	Open Pit	*27-May-10*	-	X	X	X	X	X	X	X	-	X	-
MW09-Stu2	Suttles Gulch	100 Day Storage	-	-	X	X	X	X	X	X	X	X	X	-
MW96-12a	Eagle Pup	EP WRSA	-	-	X	X	X	X	X	X	X	-	-	-
MW96-12b	Eagle Pup	EP WRSA	-	-	X	X	X	X	X	X	X	-	-	-
MW96-13a	Eagle Pup	EP WRSA	19-May-11	-	X	X	X	X	X	X	X	X	X	X

Instrument ID	Catchment	Facility	Data Logger Installation Date	Apr-11	May-11	Jun-11	Aug-11	Oct-11	Jan-12	Mar-12	May-12	Aug-12	Oct-12	Nov-12
MW96-13b	Eagle Pup	EP WRSA	19-May-11	-	X	X	X	X	X	X	X	X	X	X
MW96-8	Bawn Boy Gulch	Background	-	-	X	X	X	X	X	X	X	-	-	-
MW96-9a	Bawn Boy Gulch	Background	-	-	X	X	X	X	X	X	X	-	-	-
MW96-9b	Bawn Boy Gulch	Background	*27-May-10*	-	X	X	X	X	X	X	X	X	X	-
DH95-150	Stewart Gulch	Background	-	-	X	X	X	X	X	X	X	-	-	-
MW09-OG3	Olive Gulch	Background	-	-	X	X	X	X	X	X	X	-	-	-

NOTES:

X represent water level measurement taken, italics indicates that there is a break in the continuous dataset

Existing monitoring network is shown on Figure 2.3-1

Nested ground water wells are indicated by a and b distinction

Sources: Stantec (2012) Eagle Gold Project, Environmental Baseline Data Report: Hydrogeology 2011-2012 Update; BGC (2013) Eagle Gold Project, 2012 Groundwater Data Report.

2.3.3 Methods

2.3.3.1 Overview

The proposed operations and closure/post closure monitoring programs will use primarily nested or couplet monitoring well pairs to measure groundwater levels in the saturated materials at the site. Vibrating wire piezometers (VWPs) will be used where only groundwater level information is required. The monitoring wells will also be used to collect groundwater quality samples (as per Section 2.4) for comparison against baseline conditions as well as the applicable water quality criteria to be identified in the Type A Water Use License.

Groundwater level measurements will be used to indirectly monitor changes in groundwater occurrence and quantity from baseline conditions. Groundwater levels (from wells) and pressure measurements (from VWPs) can be used, as necessary, to help estimate horizontal and vertical hydraulic gradients and potential changes in groundwater flow direction due to the construction or development of Project facilities.

The proposed monitoring program for the Project is presented in three main phases as follows:

- Construction Phase
- Operations Phase
- Closure and Post Closure Phases

2.3.3.2 Locations, Frequency, and Rationale for Monitoring During Construction

Due to construction activities, many of the existing monitoring wells will be excavated or abandoned (following standard practices, as required) therefore additional wells may need to be drilled and installed in key locations prior to operations. During construction, groundwater level monitoring will occur at specified locations for the given rationale at the frequency as summarized in Table 2.3-2.

Based on the existing baseline database, although there is some variability, groundwater quality does not vary substantially from quarter to quarter, Thus, quarterly sampling during the construction phase, will be sufficient for the construction period to determine changes. However, groundwater quantity typically shows systematic changes associated with break-up (recharging causes levels to increase relatively rapidly), followed by a slower and longer period of decreasing water levels throughout the year. Depending on site location and rock type, this observed pattern will vary somewhat. Thus, continuous monitoring (using transducers that are downloaded on a quarterly basis) will provide sufficient temporal coverage to characterize baseline trends, as well as the potential effects of construction on groundwater levels.

Table 2.3-2: Groundwater Monitoring Well Network – Construction

Instrument ID	Facility	Datalogger [1]	Groundwater Level Sample Frequency [2]	Groundwater Quality Sample Frequency	Rationale	Construction Impacts to Well
MW09-DG1	Heap Leach	Equipped	Downloaded monthly until decommissioned during construction	Quarterly	Evaluate seasonal flow in HLF embankment area until disturbed	Will be excavated during construction
MW10-AG3A	Heap Leach	Equipped	Downloaded monthly until decommissioned during construction	Quarterly	Evaluate seasonal water level variability and infiltration rates in the Ann Gulch basin (HLF area) above the Phase 1 footprint	Will not be excavated during Stage 1 construction and will remain in place as operations monitoring well until Phase 2 of HLF construction.
MW10-AG3B	Heap Leach	None	Monthly	Quarterly	Evaluate depth to the water table in the Ann Gulch basin (HLF area) above the Phase 1 footprint	Will not be excavated during Stage 1 construction and will remain in place as operations monitoring well until Phase 2 of HLF construction.
MW10-DG6	Heap Leach	Equipped	Downloaded monthly until decommissioned during construction	No	Evaluate seasonal water level variability in the Ann Gulch basin (HLF area) during construction	Will be excavated during construction
MW96-15A	EP Pond	None	Quarterly until decommissioned during construction	Quarterly	Evaluate vertical and seasonal flow in EP Pond area during construction	Will be excavated during construction
MW96-15B	EP Pond	None	Quarterly until decommissioned during construction	Quarterly	Evaluate vertical and seasonal flow in EP Pond area during	Will be excavated during construction

Instrument ID	Facility	Datalogger [1]	Groundwater Level Sample Frequency [2]	Groundwater Quality Sample Frequency	Rationale	Construction Impacts to Well
					construction	
MW96-13A	EP WRSA	Equipped	Downloaded monthly until decommissioned during construction	Quarterly	Evaluate vertical and seasonal flow in the EP WRSA area during construction	Will be excavated during construction or covered during operations
MW96-13B	EP WRSA	Equipped	Downloaded monthly until decommissioned during construction	Quarterly	Evaluate vertical and seasonal flow in EP WRSA area during construction	Will be excavated during construction
MW96-14A	EP WRSA	None	Quarterly until decommissioned during construction	No	Evaluate vertical and seasonal flow in EP WRSA area	Will be excavated during construction
MW96-14B	EP WRSA	None	Quarterly until decommissioned during construction	No	Evaluate seasonal flow and vertical gradients in EP WRSA area	Will be excavated during construction
MW09-DG2	DGDC	None	Quarterly until decommissioned during construction	No	Will likely be excavated during construction; evaluate seasonal water level variability along DGDC during construction	Will be excavated during construction
MW96-17A	Open Pit	None	Monthly until decommissioned during construction	No	Evaluate seasonal water level patterns in the Open Pit during initial depressurization	Will be excavated during open pit pre-stripping activities
MW96-17B	Open Pit	None	Monthly until decommissioned during construction	No	evaluate seasonal water level patterns in the Open Pit during initial depressurization	Will be excavated during open pit pre-stripping activities

Instrument ID	Facility	Datalogger [1]	Groundwater Level Sample Frequency [2]	Groundwater Quality Sample Frequency	Rationale	Construction Impacts to Well
09-BGC-GTH2a	Open Pit	Equipped	Downloaded monthly until decommissioned during construction	No	Measure deep water pressures in pit walls during depressurization	Will be excavated during open pit pre-stripping activities
10-BGC-GTH-05	Open Pit	Equipped	Downloaded monthly or as pre-stripping conditions dictate	No	Measure deep water pressures in pit walls during depressurization	Will be excavated during open pit pre-stripping activities
10-BGC-GTH-06	Open Pit	Equipped	Downloaded monthly or as pre-stripping conditions dictate	No	Measure deep water pressures in pit walls during depressurization	Will be excavated during open pit pre-stripping activities
10-BGC-GTH-07	Open Pit	Equipped	Downloaded monthly or as pre-stripping conditions dictate	No	Measure deep water pressures in pit walls during depressurization	Will be excavated during open pit pre-stripping activities
10-BGC-GTH-08	Open Pit	Equipped	Downloaded monthly or as pre-stripping conditions dictate	No	Measure deep water pressures in pit walls during depressurization	Will be excavated during open pit pre-stripping activities
10-BGC-GTH-10	Open Pit	Equipped	Downloaded monthly or as pre-stripping conditions dictate	No	Measure deep water pressures and vertical gradients in pit during depressurization	Will be excavated during open pit pre-stripping activities
10-BGC-GTH-11	Open Pit	Equipped	Downloaded monthly or as pre-stripping conditions dictate	No	Measure deep water pressures in pit walls during depressurization	Will be excavated during open pit pre-stripping activities
BH-BGC11-74	Lower Dublin Gulch	Equipped	Downloaded monthly	No	Evaluate flow near Haggart Creek and long term change in water table	Will not be excavated during construction – will remain throughout operations and post-closure

Instrument ID	Facility	Datalogger [1]	Groundwater Level Sample Frequency [2]	Groundwater Quality Sample Frequency	Rationale	Construction Impacts to Well
MW10-PG1	PG Pond	Equipped	Downloaded monthly	No	Consistency with ongoing baseline and evaluate flow downgradient from PG WRSA/Pond and Open Pit	Will not be excavated during construction – will remain throughout operations and post-closure
MW96-23	PG WRSA	None	Quarterly	Quarterly	Consistency with ongoing baseline and to evaluate seasonal flow down gradient of the PG WRSA and the Open Pit during construction	Will be excavated during construction or covered by waste rock during operations
BH-BGC11-72	Lower Dublin Gulch	Install	Downloaded monthly or as construction conditions dictate	No	Evaluate flow near Haggart Creek and evaluate long term change in water table	Will not be excavated during construction – will remain throughout operations and post-closure

1 Dataloggers: column indicates wells that currently have dataloggers installed, wells that do not have loggers installed but will be in 2013 and wells that will not have loggers installed.

2 Frequency: for wells that will be excavated as a result of construction this column provides the monitoring frequency as stated until well excavation

Data Analysis and Reporting

Groundwater levels for each monitored instrument will be compiled, corrected for elevation and or barometric pressure fluctuations (as needed depending on instrument type) and plotted versus time and climate data (precipitation and temperature). These hydrographs will be added to and compared with the existing baseline data set to assess potential changes associated with construction activities. If required by licensing conditions, a data summary report will be prepared post construction that will provide input to the groundwater monitoring program required for operations.

2.4 GROUNDWATER QUALITY

2.4.1 Introduction and Objectives

The objectives of the groundwater quality monitoring program are to provide a continuous baseline dataset and monitor Project effects on the quality of groundwater as the Project transitions from baseline conditions through construction. As with the baseline characterization program, the groundwater *quality* monitoring program will be integrated with the groundwater *quantity* monitoring program, and will utilize the wells described in Section 2.3.

2.4.2 Previous Work

Previous work used as a basis to develop the groundwater monitoring plan for groundwater levels and quality are summarized in Section 2.3. Groundwater quality monitoring stations sampled during 2011 and 2012 are summarized in Table 2.4-1.

Table 2.4-1: Groundwater Quality Monitoring Program (2012)

Drainage Sub-basin	MWID	Continuous Data logger deployed	Water Level Measurement & Water Quality Sampling Events										
			Apr-11	May-11	Jun-11	Aug-11	Oct-11	Jan-12	Feb-12	Mar-12	May-12	Aug-12	Oct-12
Ann Gulch	MW10-AG3a	Yes	--	●	●	●	●	--	--	●	●	●	●
	MW10-AG5	No	--	●	●	●	●	--	--	●	●	●	●
	MW10-AG6	No	--	●	●	●	●	--	--	●	●	●	●
Dublin Gulch	DH95-152	No	--	○	○	○	○	--	--	--	--	--	--
	MW09-DG1	Yes	○	○	○	○	○	--	○	○	--	--	--
	MW09-DG2	No	--	●	●	●	●	●	--	●	●	●	●
	MW09-DG4	Yes	○	●	●	●	●	●	--	●	●	●	●
	MW09-DG5	No	○	○	○	○	○	--	--	--	--	--	--
	MW09-DG6	Yes	○	●	●	●	●	●	--	●	-F-	●	●
	MW10-OBS1	No	○	○	○	○	○	--	--	--	--	--	--
	MW10-OBS2	No	○	○	○	○	○	--	--	--	--	--	--
Platinum Gulch	MW96-23	No	--	●	○	○	○	--	--	●	--	--	--
	MW10-PG1	Yes	--	○	●	●	●	--	●	●	●	●	●
Suttles Gulch	MW96-19	Yes	--	○	○	○	○	○	--	○	○	--	○
	MW09-STU2	No	--	●	●	●	●	-F-	--	-F-	-F-	●	-F-
Eagle Pup	MW96-12a	No	--	●	○	○	○	--	--	--	--	--	--
	MW96-12b	No	--	○	○	○	○	--	--	--	--	--	--
	MW96-13a	Yes	--	●	●	●	●	●	--	●	●	●	●
	MW96-13b	Yes	--	○	○	○	○	--	--	●	●	●	●
Bawn Boy Gulch	MW96-8	No	--	○	○	○	○	--	--	--	--	--	--

Drainage Sub-basin	MWID	Continuous Data logger deployed	Water Level Measurement & Water Quality Sampling Events										
			Apr-11	May-11	Jun-11	Aug-11	Oct-11	Jan-12	Feb-12	Mar-12	May-12	Aug-12	Oct-12
	MW96-9a	Yes	--	○	○	○	○	--	--	○	○	○	○
	MW96-9b	Yes	--	○	○	○	○	○	--	○	○	○	○
Stewart Gulch	DH95-150	No	--	○	○	○	○	--	--	--	--	--	--
Olive Gulch	MW09-OG3	No	--	○	○	○	○	--	--	--	--	--	--

○ only manual groundwater level measurement collected
● manual measurement and groundwater quality sample collected
-- no measurements or groundwater quality samples collected
-F- frozen

Groundwater quality parameters that were monitored during baseline characterization and that will continue to be monitored during this program are summarized in Table 2.4-2.

Table 2.4-2: Groundwater Quality - Monitored Parameters

Parameter Set	Comment
Field parameters	temperature, pH, conductivity, turbidity
Laboratory physical parameters	temperature, conductivity, turbidity, TDS, TSS, pH
Anions	Cl, SO4, NO_3, NO, Total Alkalinity
Nutrients	TKN, NH_3, T-Nitrogen, Total-PO_4, Dissolved-PO_4 ,Ortho-PO_4
Carbon	Dissolved Organic Carbon, Total Organic Carbon
Total Metals	ICPOES/MS + mercury, trace metals (Al, Sb, As, Ba, Be, B, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Mo, Ni, P, K, Se, Si, Ag, Na, Sr, Tl, V, U, Zn)
Dissolved Metals	ICPOES/MS + mercury, trace metals (Al, Sb, As, Ba, Be, B, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Mo, Ni, P, K, Se, Si, Ag, Na, Sr, Tl, V, U, Zn)

Previous work on groundwater quality monitoring is documented in the reports listed in Section 2.3.2.

2.4.3 Methods

Field methods

Groundwater quality sampling will be conducted according to the methods currently in use at the site[1], which are consistent with industry standard practice and ASTM D4448-01 Standard Guide for Sampling Ground-Water Monitoring Wells (Environment Yukon, 2011). The use of field preservatives, as needed, (including the strength and the type of preservative to be used) will be dictated by the analytical laboratory responsible for completing the analyses.

Quality Control / Quality Assurance

Groundwater sampling will be conducted on an approximate quarterly basis, subject to access constraints and inclement weather limitations typical in northern mining sites. Groundwater samples will be collected by appropriately trained environmental staff or subcontractors and be submitted to an independent, Canadian Association of Environmental Analytical Laboratories (CAEAL) accredited environmental laboratory in chilled coolers (ice-packs) using laboratory specified bottles and chain-of-custody forms.

Trip blanks (one per cooler per major analysis type), field blanks (one per analysis type per technician per sampling event) and blind field duplicates (random at a ratio of one for every ten samples collected, minimum one blind per analysis type per sampling event) will be submitted for

[1] well development and purging three well volumes using disposable inertial lift pumps (e.g. Waterra tubing and foot valve) followed by sample collection using disposable bailers, with field filtering as required by parameter/analysis type.

every sampling event to evaluate the potential for sampling, transport or analytical biases in the results. These sample results will be used together with the laboratories internal quality assurance / quality control program to evaluate the confidence in the groundwater quality results and to identify outliers and false positives in the results.

Data Analysis

Results, when available from the laboratory (typically 10 to 14 days after sample receipt by the laboratory), will be reviewed against baseline groundwater quality data for each hydrogeologic zone, or facilities area and QA/QC criteria to identify and eliminate false positives/negatives. Subsequently, results will be compared to the Contaminated Sites Regulation Schedule 3 Generic Numerical Water Standards for the Protection of Freshwater Aquatic Life (AW) under the Yukon *Environment Act* (O.I.C. 2002/171) and any applicable permit discharge or monitoring criteria that may be required for specific facilities areas.

Chemical constituent concentrations for each sampled location will be maintained in an on-site database, and concentrations of regulated constituents and key indicator parameters will be plotted versus time to help identify temporal concentration trends. In general, these plots will show applicable standards and baseline concentrations for each regulated chemical constituent. Groundwater quality data will be submitted for regulator review together with groundwater quantity data on an annual basis or in accordance with permit requirements.

Locations and Frequency

During Stage 1 and 2 Construction, groundwater sampling will continue to occur on a quarterly basis at the locations provided in Table 2.3-2. The addition of the wells in Table 2.3-3 sometime prior to operation will replace some of the excavated or abandoned wells due to construction. The parameter set that will be analyzed is summarized in Table 2.4-2. Well locations are shown in Figures 2.3-1.

2.5 REFERENCES

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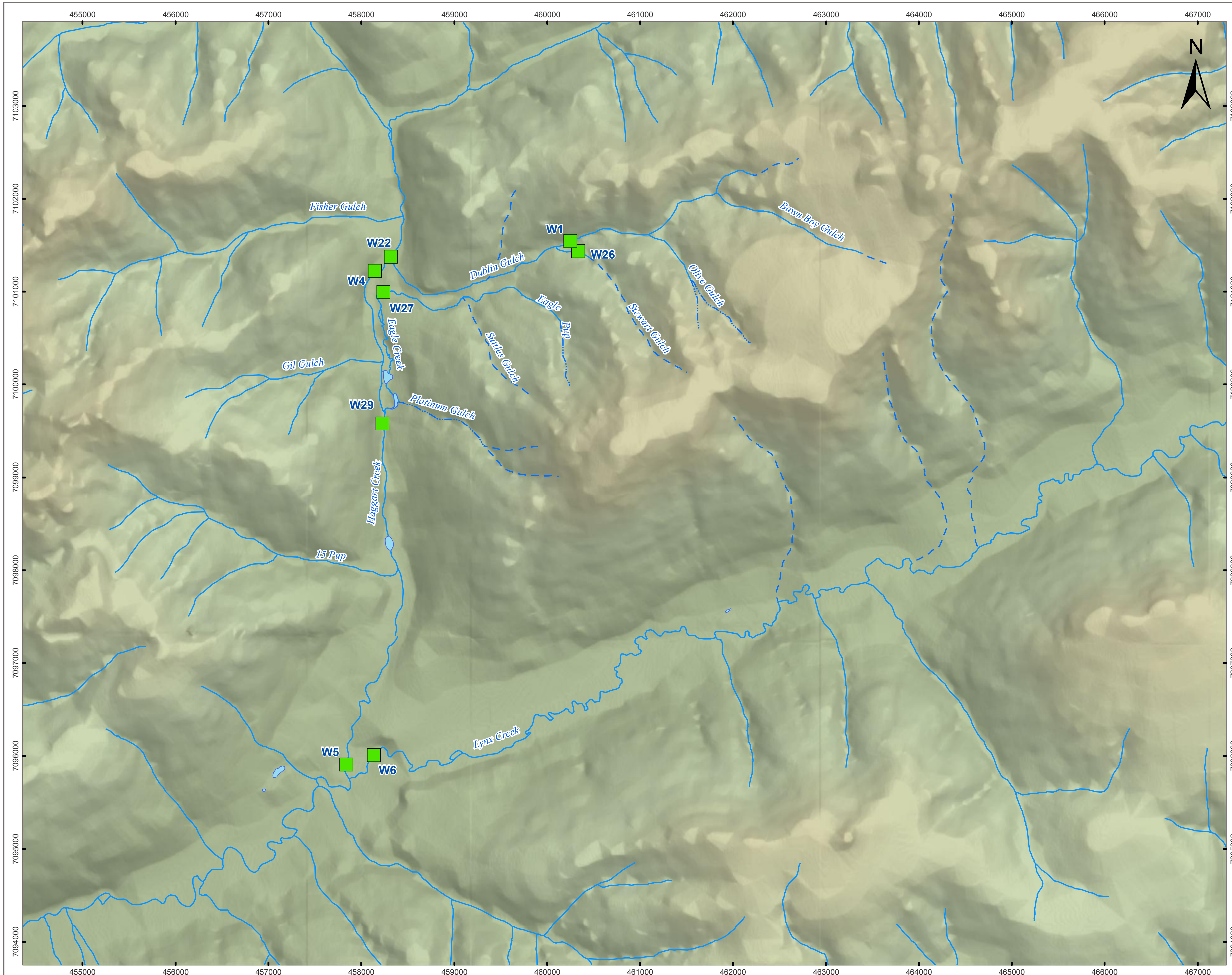
Stantec (2012c) Eagle Gold Project Environmental Baseline Data Report: Water Quality 2011-2012 Update, report prepared for Victoria Gold Corp., June 2012

Stantec (2012d) Eagle Gold Project Environmental Baseline Data Report: Hydrogeology 2011-2012 Update, report prepared for Victoria Gold Corp., June 2012



LEGEND

- Automated Hydrometric Station
- Watercourse (perennial)
- Watercourse (ephemeral)
- Watercourse (intermittent)

NOTES
Base data source:

STATUS
FOR INTERNAL USE ONLY

EAGLE GOLD PROJECT
YUKON TERRITORY

Existing Automated Hydrometric Monitoring Stations

PROJECTION	DATUM	CLIENT
Transverse Mercator UTM Zone 8	NAD83	Victoria Gold Corp

Scale: 1:40,000
400 200 0 400
Metres

FILE NO.

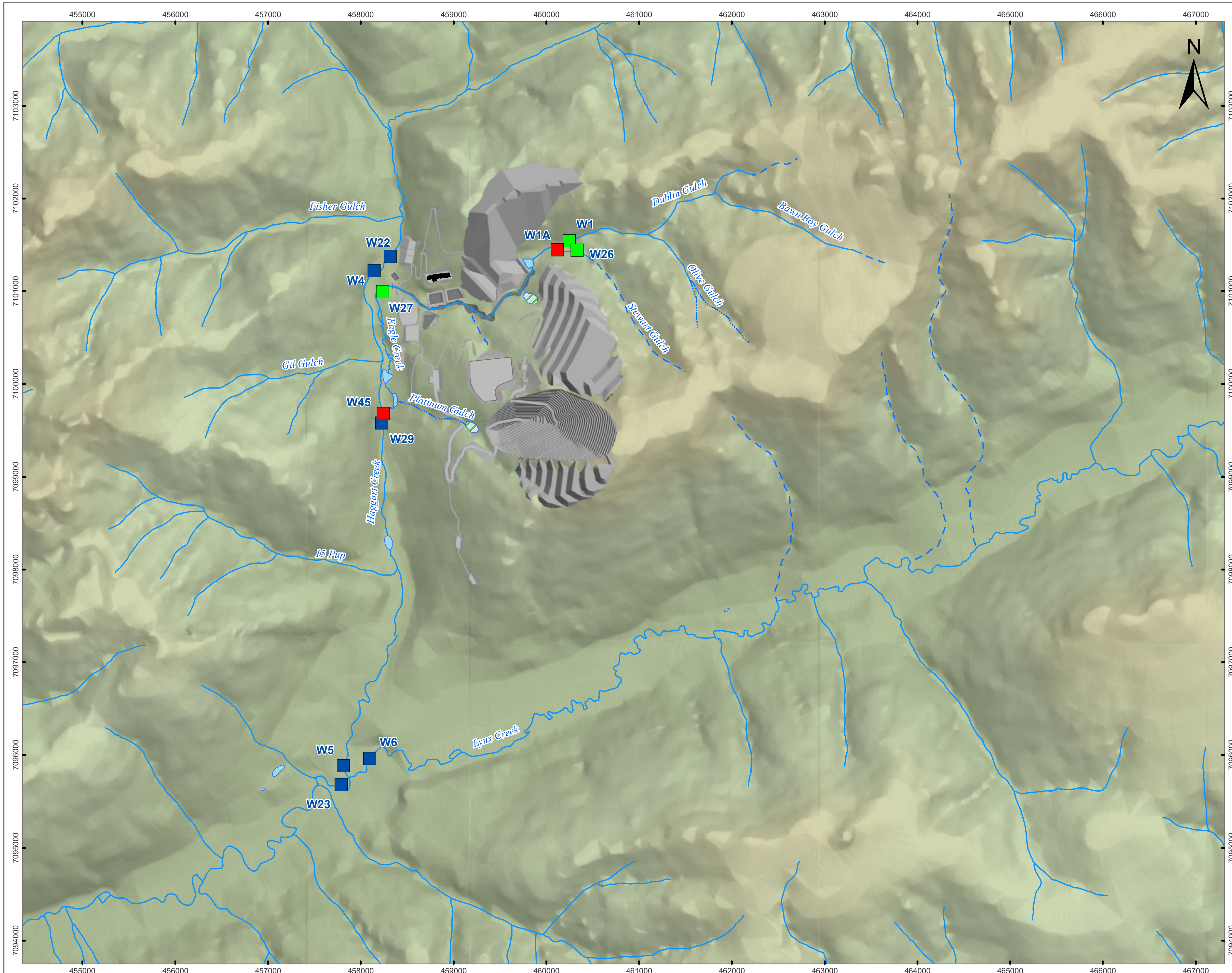
Lorax Environmental

PROJECT	DWN	CKD	APVD	REV
Eagle Gold	VV	DHF	DHF	1

OFFICE	DATE
	December 11, 2012

Figure 2.1-1

Path: P:\U996 (Victoria Gold Eagle Gold Project)\Drafting\MXDs\May2013 edits\Fig2.1-1_Existing Hydrometric Stations_for David F_13May2013.mxd



LEGEND

Automated Hydrometric Stations

- Year - 2 only
- Year - 1 and operations
- Year - 2, -1 and operations
- Project Infrastructure (end of mine life)
- Watercourse (perennial)
- Watercourse (ephemeral)
- Watercourse (intermittent)

NOTES
Base data source:

STATUS
FOR INTERNAL USE ONLY

EAGLE GOLD PROJECT
YUKON TERRITORY

Automated Hydrometric Stations – Construction

PROJECTION	DATUM	CLIENT
Transverse Mercator UTM Zone 8	NAD83	Victoria Gold Corp

Scale: 1:40,000
400 200 0 400
Metres

FILE NO.

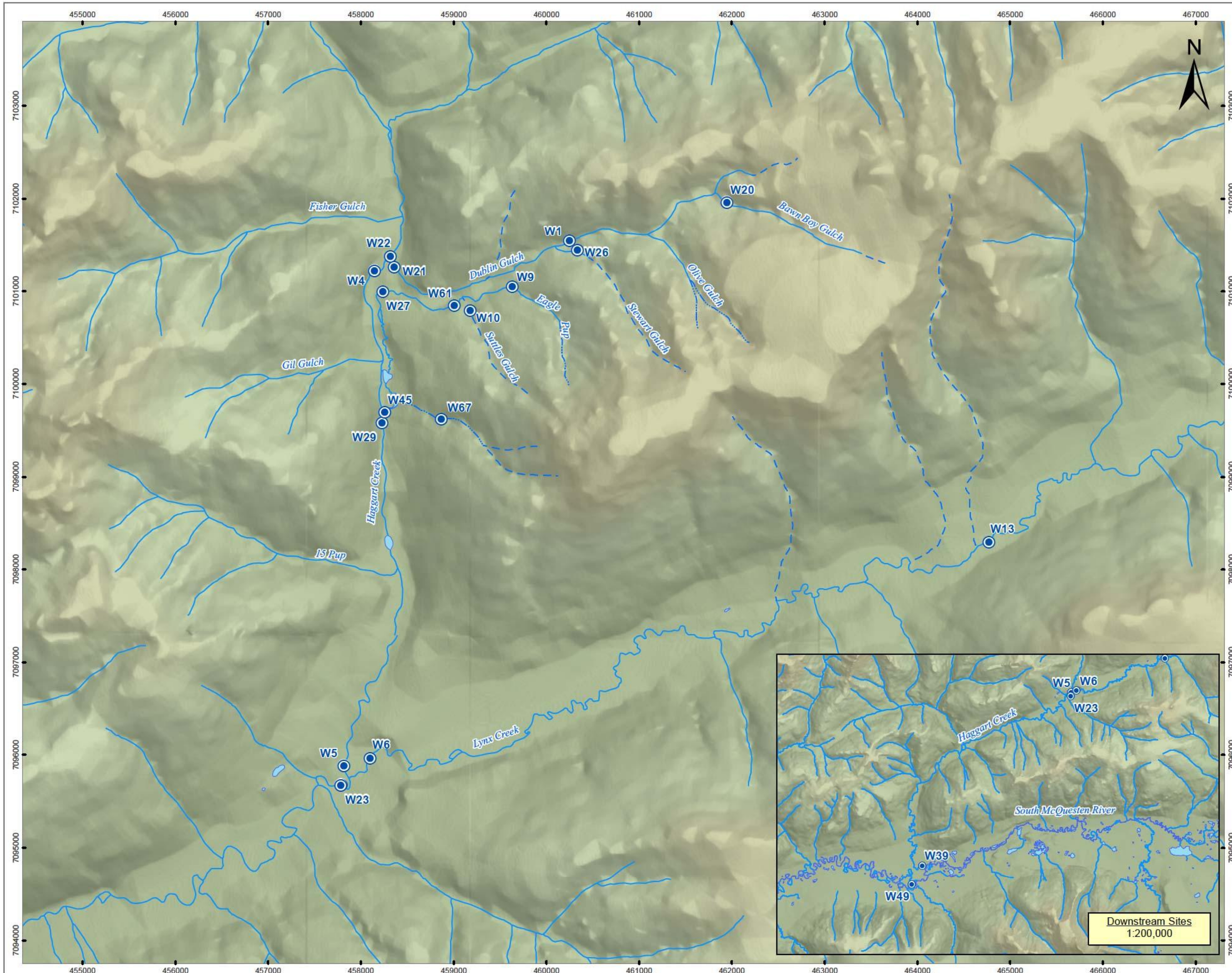
PROJECT	DWN	CKD	APVD	REV
Eagle Gold	VV	DHF	DHF	1

OFFICE
DATE
December 11, 2012

Lorax Environmental

Figure 2.1-2

Path: P:\J996 (Victoria Gold Eagle Gold Project)\Drafting\MXDs\May2013 edits\Fig2.1-x_Automated Hydrometric Stations Construction_for David F_13May2013.mxd



LEGEND

- Water Quality Samples
- Watercourse (perennial)
- Watercourse (ephemeral)
- Watercourse (intermittent)

NOTES
Base data source:

STATUS
FOR INTERNAL USE ONLY

EAGLE GOLD PROJECT
YUKON TERRITORY

Existing Surface Water Quality Monitoring Stations

PROJECTION	DATUM	CLIENT
Transverse Mercator UTM Zone 8	NAD83	StrataGold Corporation

Scale: 1:40,000
400 200 0 400
Metres

FILE NO.

LORAX ENVIRONMENTAL

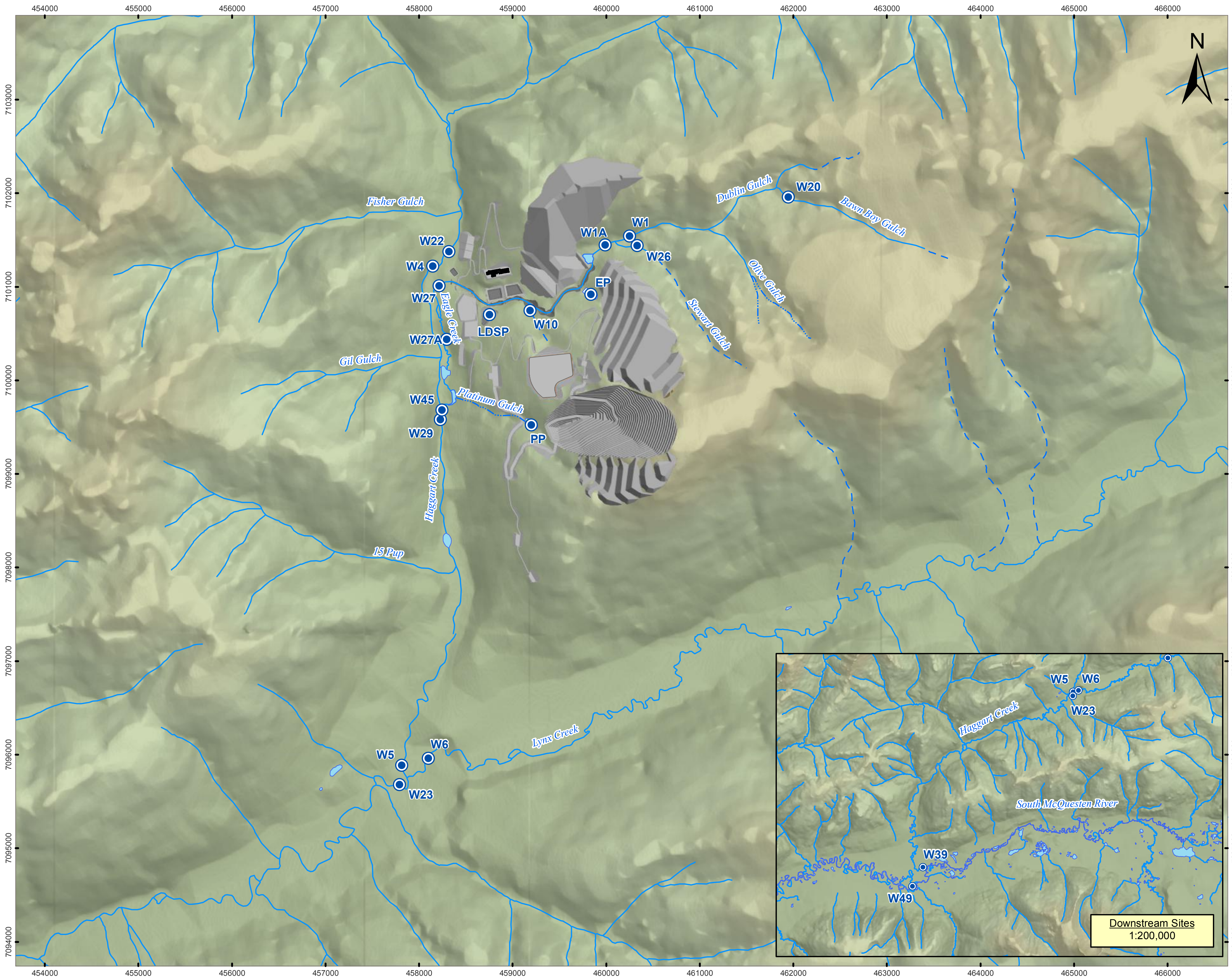
PROJECT	DWN	CKD	APVD	REV
Eagle Gold	VV	DHF	DHF	1

OFFICE

DATE
December 11, 2012

Figure 2.2-1

Path: P:\ U996 (Victoria Gold Eagle Gold Project)\Drafting\MXDs\28Feb2013 edits\Fig2.2-1_Regional Mine area prior to construction_for David F_10Dec2012_11x17.mxd



LEGEND

- Water Quality Stations
- Project Infrastructure (end of mine life)
- Watercourse (perennial)
- Watercourse (ephemeral)
- Watercourse (intermittent)

NOTES
Base data source:

STATUS
FOR INTERNAL USE ONLY

EAGLE GOLD PROJECT
YUKON TERRITORY

Surface Water Quality Monitoring Stations - Construction

PROJECTION	DATUM	CLIENT
Transverse Mercator UTM Zone 8	NAD83	Victoria Gold Corp

Scale: 1:40,000
400 200 0 400
Metres

FILE NO.

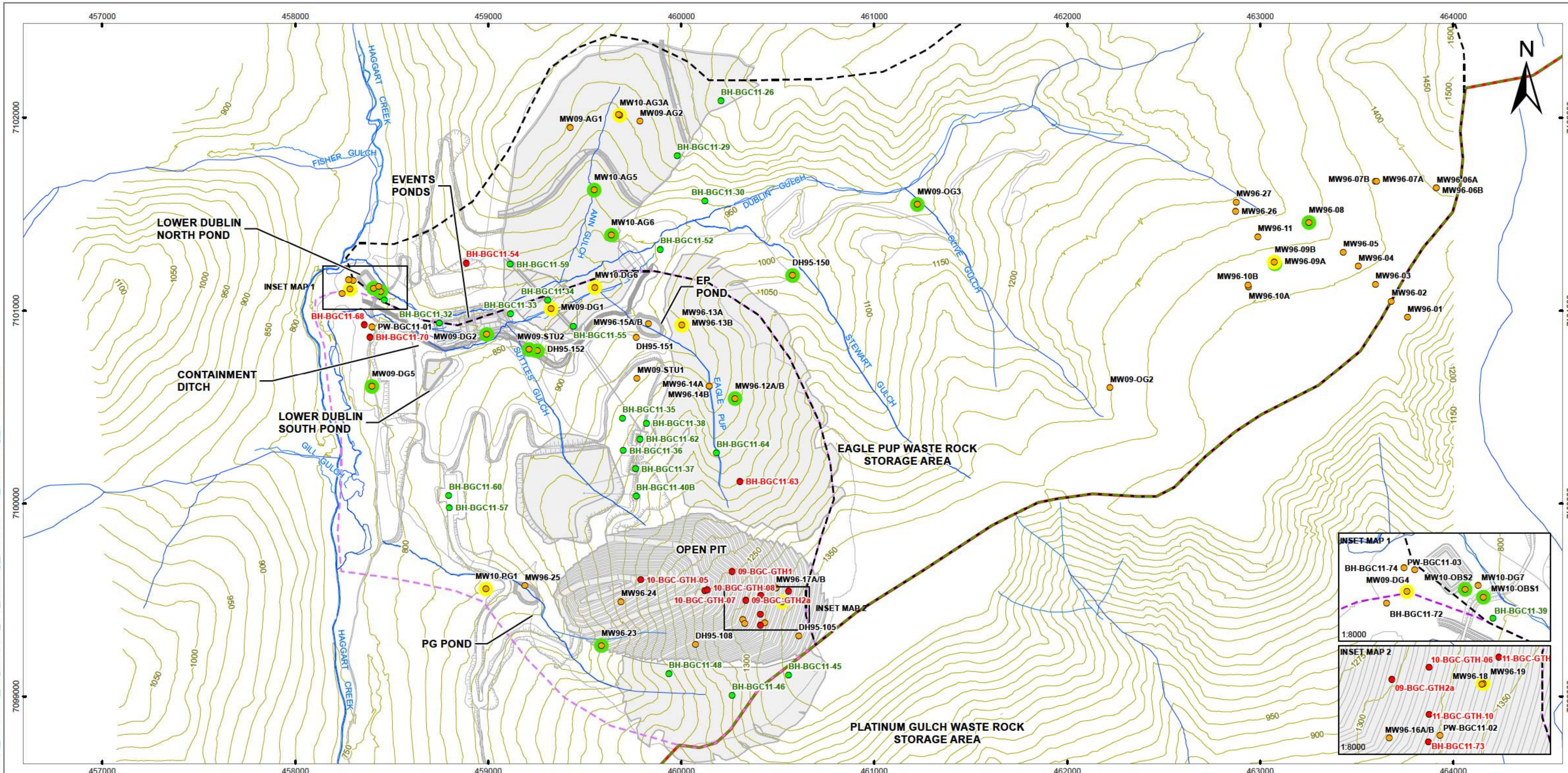
LORAX ENVIRONMENTAL

PROJECT	DWN	CKD	APVD	REV
Eagle Gold	VV	DHF	DHF	1

OFFICE	DATE
	December 11, 2012

Figure 2.2-2

Path: P:\U996 (Victoria Gold Eagle Gold Project)\Drafting\MXDs\May2013 edits\Fig2.2-2_Regional Mine area construction_for David F_13May2013.mxd



X:\Projects\0792 Victoria Gold\008\Workspace\20130124_REPORT_EagleGold\2_3-1_Existing_Groundwater_Monitoring_Network.mxd

LEGEND

- GROUNDWATER MONITORING WELL
- GROUNDWATER MONITORING WELL - DATA LOGGER
- GROUNDWATER MONITORING WELL - MANUAL READ
- BGC VIBRATING WIRE
- BGC STANDPIPE PIEZOMETER
- INFRASTRUCTURE FOOTPRINT
- HYDROLOGY LOCAL STUDY AREA
- DUBLIN GULCH BASIN BOUNDARY
- EAGLE CREEK BASIN AREA
- UPPER HAGGART CREEK BASIN BOUNDARY
- STREAM
- 25 M CONTOUR

NOTES

1. Proposed infrastructure layout received from Wardrop March 28, 2012.

STATUS
FOR INTERNAL USE ONLY

EAGLE GOLD PROJECT YUKON TERRITORY

Existing Groundwater Monitoring Network

PROJECTION	DATUM	CLIENT
UTM Zone 8	NAD83	StrataGold Corporation

Scale: 1:20,000
200 100 0 200 400
Metres

FILE NO.

PROJECT	DWN	CKD	APVD	REV
Eagle Gold	DM	DW		A

OFFICE

DATE
FEBRUARY 2013

Figure 2.3-1

3 GEOCHEMICAL MONITORING

3.1 INTRODUCTION AND OBJECTIVES

The geochemical monitoring program is intended to provide on-going characterization of rock excavated during the construction process and to confirm the results of the assessment of the potential for acid rock drainage and metal leaching and resulting effects on contact water quality as mining progresses from that work developed in support of the Project as reported in SRK 2010, SRK 2012a and SRK 2012b.

The geochemical monitoring program for construction rock has been designed to:

- Assess the potential for metal leaching and acidic drainage from excavated rock;
- Verify geochemical predictions made during the mine planning phase;
- Assess the level of weathering-driven reaction products and their potential to migrate; and
- Evaluate the effectiveness of measures that have been implemented to prevent and control metal leaching and acidic drainage (if applicable).

3.2 PREVIOUS WORK

Geochemical characterization completed prior to mining indicates that the majority of the waste rock and ore from this site has a low sulphur content (typically less than 0.5%), and is predominantly non-acid generating. Additionally, the geochemical characteristics of the rock were relatively uniform, implying that a relatively moderate frequency of monitoring would be appropriate. Results of these evaluations have been provided in SRK (2010 and 2012b) and will be submitted in an updated form with the Water Use License application.

Characterization of potential construction materials has also been completed (SRK, 2012b) and the report and methods to characterize construction materials are provided in an Appendix of the Quartz Mining Licence application. Key findings of this work are:

- Seventy-two samples were collected from site roads, placer tailings and future excavation areas (surficial materials and rock). The majority of samples representing surficial materials (i.e. soil, colluvium and placer tailings) were not potentially acid generating. Although a small proportion of this material was potentially acid generating, sulphide concentrations were generally low, and, given that the particle surfaces have already been exposed to air and water, it was reasonable to assume that the sulphides were encapsulated within larger particles, and would therefore not result in any additional oxidation of sulphides or release of metals if used for construction.

- Two samples representing metasedimentary rock had a total sulphur content greater than 0.02% and a NP/AP or TIC/AP ratio less than 1 and so were classified as either potentially acid generating, or had an uncertain potential for ARD, indicating that some additional characterization and monitoring of metasedimentary rock used for construction is warranted.

3.3 METHODS

3.3.1 Construction Rock

A number of potential borrow sources have been identified to support construction efforts for the Project as reported in BGC (2011). These include primarily placer tailings in the Dublin Gulch and Haggart Creek valleys (over 2.7 million m^3) and silt borrow sites near the existing camp and near the confluence of Platinum Gulch and Haggart Creek (less than 300,000 m^3). Potential durable rock sources include about 4 million m^3 from the open pit pre-strip area, and a large bedrock knob (i.e., up to 900,000 m^3 from the Ann Gulch central knob) to be cut and excavated during the first phase of the heap leach pad subgrade development. In addition, there will be some degree of cut and fill to support road construction on the site.

Previous geochemical characterization work to date indicates that it is reasonable to assume that rock sourced from pre-stripping of the open pit will not result in any metal leaching or acid rock drainage (ML/ARD) if used for construction (SRK 2011). Additionally, the placer tailings and other surficial materials proposed for use as borrow material or in cut and fill areas present a low risk for ML/ARD and are suitable for construction (SRK 2013). The only exception to this are potential excavations within metasedimentary rock that are outside of the open pit limits, in which two out of five samples were identified as potentially acid generating. To address this uncertainty, further investigations may need to be undertaken within these 'other' metasedimentary areas to evaluate their suitability for construction purposes if these areas are designated as potential construction rock sources. Geochemical monitoring will be undertaken to verify these conclusions and to ensure that the characteristics of the construction materials are adequately documented.

The geochemical monitoring of surficial materials will consist of the following:

- Visual inspection of the blasted rock to ensure that anomalously high concentrations of sulphide are not present.
- Grab samples representing each major excavation, with a separate bulk sample collected in each distinct geological formation encountered and/or from every 200,000 m^3 material moved.

The geochemical monitoring of bedrock materials will consist of the following:

- Grab samples representing each major excavation, with a separate sample collected in each distinct geological formation encountered and/or from every 50,000 m^3 material moved. An exception is proposed for bedrock excavated from the open pit, which has been subject to extensive characterization demonstrating a low potential for ARD. Material excavated for use in construction will be sampled at a rate of one per every 100,000 m^3 of material moved.

- Samples will be sieved to obtain subsamples representing specific grain size distributions as follows:
    - Bulk sample
    - <2 mm fraction

Other aspects of the sampling and analysis will be the same for surficial materials and bedrock samples:

- The samples will be reduced to 1-2 kg in size using a riffle splitter prior to shipping to an accredited analytical laboratory for testing.
- Test methods will include the following as recommended in MEND (2009) and summarized in Table 3.3-2:
    - Rinse pH and EC on the <2 mm fraction
    - Modified Acid Base Accounting on the bulk sample and the <2 mm fraction
    - Metal analysis by ICP-MS following aqua regia digestion on the bulk sample and the <2 mm fraction
    - Leach extraction tests will be completed on every 5th sample using a 3:1 water to solid ratio on the <1 cm sample fraction

Table 3.3-2: Construction Rock Monitoring Test Methods and Detection Limits

Test	Parameter	Unit	Method Code [a]	Detection Limit
Modified Acid Base Accounting	Paste pH	Standard Units	Sobek	0.20
	Total Inorganic Carbon	%	SCB02V	0.01
	Equivalent $CaCO_3$	kg $CaCO_3$/t	Calculated	
	Total Sulphur	%S	CSA06V	0.01
	Sulphate Sulphur	%S	CSA07V	0.01
	Sulphide Sulphur	%S	Calculated	
	Acid Potential (AP)	kg $CaCO_3$/t	Calculated	
	Modified Neutralization Potential (NP)	kg $CaCO_3$/t	Modified NP	0.5
	Net NP	kg $CaCO_3$/t	Calculated	
	NP/AP	Ratio	Calculated	
	Fizz Test	Visual	Sobek	
Low-Level Metals by	Ag, Al, As, Au, B, Ba, Bi, Ca, Cd,	ppm	IF-01	

Test	Parameter	Unit	Method Code [a]	Detection Limit
Aqua Regia Digestion with ICP-MS Finish	Co, Cr, Cu, Fe, Ga, Hg, K, La, Mg, Mn, Mo, Na, Ni, P, Pb, S, Sb, Sc, Se, Sr, Te, Th, Ti, Tl, U, V, W, Zn			
Rinse pH and EC	pH	Standard Units		
	EC	µS/cm		
Shake Flask Extraction (3:1 water to solid ratio)	Ag, Al, As, Au, B, Ba, Bi, Ca, Cd, Co, Cr, Cu, Fe, Ga, Hg, K, La, Mg, Mn, Mo, Na, Ni, P, Pb, S, Sb, Sc, Se, Sr, Te, Th, Ti, Tl, U, V, W, Zn	ppm	IF-01	

[a] Method codes provided are those from SGS where baseline testing was completed.

3.3.2 Additional Waste Rock Characterization

Additional characterization of waste rock contact water is currently being evaluated in the form of a field barrel monitoring program as described in a Geochemical Characterization Report for Waste and Ore that will be submitted as part of the application for a Type A Water Use License and Development and Operations Plans for the Waste Rock Storage Facilities as required by the Quartz Mining Act.

- Field barrel monitoring is currently being conducted on a monthly basis, and will continue during ice-free construction season to provide input to refining the geochemical characterization of waste rock prior to developing the geochemical monitoring program to be implemented during operations.
- Analysis includes hardness, pH, anions (acidity, alkalinity, chloride, fluoride, nitrate, nitrite and sulfate), nutrients, and dissolved metals (Table 3.3-3).
- Replicate analyses are completed on one sample for each sampling campaign with relative percent differences calculated and reported with lab results.

Table 3.3-3 Geochemical Water Monitoring Parameters and Corresponding Detection Limits

Physical Parameters	Detection Limit(mg/L)	Total and Dissolved Metals		Detection Limit (mg/L)
Temperature	1	Aluminum	(Al)	0.0002
Conductivity	1	Antimony	(Sb)	0.00002
Hardness	0.5	Arsenic	(As)	0.00002
Total Suspended Solids	4	Cadmium	(Cd)	0.000005
Total Dissolved Solids	10	Calcium	(Ca)	0.05
pH	0	Chromium	(Cr)	0.0001
Turbidity	0.1	Cobalt	(Co)	0.000005

Physical Parameters	Detection Limit(mg/L)	Total and Dissolved Metals		Detection Limit (mg/L)
DOC	0.5	Cobalt	(Co)	0.000005
Major Anions		Copper	(Cu)	0.00005
Alkalinity-Total	0.5	Copper	(Cu)	0.00005
Acidity-Total	0.5	Iron	(Fe)	0.001
Bromide	0.1	Iron	(Fe)	0.001
Chloride	0.5	Lead	(Pb)	0.000005
Fluoride	0.01	Magnesium	(Mg)	0.05
Sulphate	0.5	Manganese	(Mn)	0.00005
Nutrients		Mercury	(Hg)	0.00001
Ammonia Nitrogen	0.005	Molybdenum	(Mo)	0.00005
Nitrate Nitrogen	0.002	Nickel	(Ni)	0.00002
Nitrite Nitrogen	0.002	Phosphorus	(P)	0.002
Dissolved Ortho-Phosphate	0.001	Potassium	(K)	0.05
Total Phosphate	0.005	Selenium	(Se)	0.00004
		Silicon	(Si)	0.1
		Silver	(Ag)	0.000005
		Sodium	(Na)	0.05
		Strontium	(Sr)	0.00005
		Thallium	(Tl)	0.000002
		Vanadium	(V)	0.0002
		Zinc	(Zn)	0.0001

3.4 REPORTING

Results from the geochemical monitoring will be input to an environmental database. Annual review and reporting will be prepared by a professional geoscientist at which time the monitoring program will be reviewed and amendments proposed as required.

3.5 REFERENCES

BGC Engineering Inc. (2011). Eagle Gold Project, Dublin Gulch, Yukon, 2011 Geotechnical Investigation for Mine Site Infrastructure Foundation Report. Report prepared for Victoria Gold Corporation, December 13, 2011.

MEND (2009). Prediction Manual for Drainage Chemistry from Sulphidic Geologic Materials. MEND Report 1.20.1, December 2009.

SRK (2010). Geochemical Characterization and Water Quality Predictions, Eagle Gold Project. Report prepared by SRK Consulting (Canada) Inc. for Stantec Ltd., November 2010. .

SRK (2012a). Narrative on expected effects of Feasibility Study changes to the Project design on the predicted source term concentrations; Technical Memorandum prepared by SRK Consulting (Canada) Inc. for Victoria Gold, March 2012.

SRK (2012b). Geochemical Characterization of Proposed Excavation Areas and Borrow Sources from the Eagle Gold Project, Yukon. Report prepared by SRK Consulting (Canada) Inc. for Victoria Gold Corp., December 2012, *Appendix F In: Quartz Mining Licence Part 1: Construction Site Plan, Eagle Gold Project Construction Management Plan.*

4 AQUATIC ENVIRONMENTAL MONITORING

This section describes the monitoring of stream sediments, benthic macroinvertebrates and fisheries. The following sections describe the objectives and methods for the monitoring of the aquatic environment during the baseline transition and construction phase of the Project.

4.1 STREAM SEDIMENTS

4.1.1 Introduction and Objectives

The stream sediments monitoring program has been designed to provide data on pH and metal levels in the fine fraction of the stream sediments in watercourses of the study area. These parameters are relevant to toxicity and physical habitat requirements for benthos, fish eggs and juvenile fish. The objectives of the sediment monitoring program are to:

- Obtain data on sediment quality that can be used to evaluate changes related to the construction phase of the Project
- Provide ongoing data to support the refinement of future monitoring programs

Sediment quality monitoring will focus on the following key Project watersheds, namely:

- Haggart Creek from below the confluence of Fisher Gulch to immediately downstream of the confluence of Lynx Creek;
- Dublin Gulch;
- Lower Eagle Creek; and
- Lynx Creek

4.1.2 Previous Work

Sites sampled for sediment were selected based on geological and hydrological characteristics relative to proposed Project activities. A total of 26 sites were sampled between 1976 and 2010: ten in Haggart Creek, eight in Dublin Gulch, three in Eagle Creek, and five in Lynx Creek drainage basins. The September 2009 campaign sampled six previously monitored stations and one new station established at W29. Sampling in August 2010 was conducted at a total of eight stations, four of which were newly established at W72, W73, W74 and W75 in Haggart and Eagle Creek drainages.

Stream sediment sample locations for the previous work completed to date are shown in Figure 4.1-1 and details of the stations are summarized in Table 4.1-1. Generally, sediment samples were co-located at water quality monitoring sites, while six stations did not coincide with water quality monitoring (e.g. stations 51, 62, 63, 64, 72 through 75). The number of sites sampled in a given year varied, as did the number of replicates. The GSC collected samples from 11 of the 26 sites in the watershed in 1976 and 1977 and re-analyzed them for a broad range of metals in 1989 and 1990 under the Canada Yukon Economic Development Program.

First Dynasty Mining Ltd. collected six replicate samples from four sites on Haggart Creek and one site on Dublin Gulch in 1993 and 1995 (Knight Piésold 1996). Eleven sites in the four drainages were sampled for the Eagle Gold Project in September 2007 (JWA 2008). Seven additional sites were sampled in 2009 and 2010 to provide either confirmatory data for sites considered most relevant to proposed mine activities or new data for ponds on Haggart and Eagle Creeks that provide depositional habitat on those drainages (higher potential for sediment accumulation).

Table 4.1-1: Baseline Site Locations, Rationale, and Number of Stream Sediment Sampling Dates, 1976 – 2010

Site	Location Description	Coordinates		Rationale	No. of Samples 1976 to 2010
		Northing	Easting		
Haggart Creek Drainage Basin					
W2	Above Iron Rust Creek	7102902	458442	Above Project influence	2
W3	Lower Iron Rust Creek	7102895	458173	Above Project influence	1
W7	Above Fisher Gulch	7102608	458302	Below Project influence	1
W22	Haggart above Dublin Gulch	7101377	458319	Above Project influence	4
W4	Haggart below Dublin Gulch	7101223	458144	Below Project influence	4
W29	Haggart below Eagle Creek	7099583	458225	Below Project influence	2
W5	Haggart above Lynx Creek	7095887	457815	Below Project influence	4
W23	Haggart below Lynx Creek	7095682	457790	Below Project influence	1
Dublin Gulch Drainage Basin					
W20	Bawn Boy Gulch	7101961	461945	Above Project influence	2
W30	Lower Cascallen Gulch	7102209	461877	Above Project influence	1
W51	Below Bawn Boy Gulch	7102039	461638	Above Project influence	1
W8	Below Olive Gulch	7101619	461122	Above Project influence	2
W1	Dublin Gulch above Stewart Gulch	7101545	460249	Above Project influence	3
W36	Upper Stewart Gulch	7101346	460485	Above Project influence	1
W26	Stewart Gulch	7101443	460331	Above Project influence	2
W21	Dublin Gulch above Haggart Creek	7101261	458359	Below Project influence	3
W74	Inlet Pond Haggart Creek	7098330	458287	Below Project influence	1
W75	Outlet Pond Haggart Creek	7098200	458312	Below Project influence	1
Eagle Creek Drainage Basin					
W27	Eagle Creek midway	7100997	458235	Below Project influence	3
W72	Inlet Pond Eagle Creek	7099890	458361	Below Project influence	1

Site	Location Description	Coordinates		Rationale	No. of Samples 1976 to 2010
		Northing	Easting		
W73	Outlet Pond Eagle Creek	7099730	458312	Below Project influence	1
Lynx Creek Drainage Basin					
W62	Lynx Creek above Skate Creek	7101138	468945	No Project influence	1
W63	Lynx Creek below Skate Creek	709958	467310	No Project influence	1
W13	Lynx Creek above Ray Creek	7098295	464770	No Project influence	1
W64	Lynx Creek below Ski Creek	7097774	462796	No Project influence	1
W6	Lynx Creek above Haggart Creek	7095964	458099	No Project influence	1

Mean metal concentrations are summarized by site in Table 4.1-2 for the 2007 – 2010 data. High levels of arsenic were reported at all sites sampled (higher than the CCME Probable Effects Level). Sediment levels were highest in Dublin Gulch (particularly near the confluence with Haggart Creek). Lynx Creek basin also had elevated arsenic concentrations despite being in an undisturbed basin, indicating that arsenic levels in the Project area are naturally elevated. Arsenic concentrations in sediments were lowest in Haggart Creek upstream of the confluence with Dublin Gulch and higher downstream of the Dublin-Haggart confluence than at other sites in that stream. Nickel concentrations were higher than the BC Interim Sediment Quality Guidelines at all sites sampled (there is no CCME guideline). Cadmium, chromium, copper, lead, mercury, and zinc were higher than their sediment quality guidelines at some sites.

There were no significant differences in cadmium, lead, nickel, and zinc concentrations among drainages. Concentrations of antimony, beryllium, molybdenum, thallium, and tin were at or close to the detection limit in all samples analyzed. Barium, cobalt, molybdenum, and vanadium were present at detectable levels; there is no Canadian SQG available for these metals. Cadmium, lead, and selenium were at or close to the detection limit in all samples analyzed and were below the ISQG.

Table 4.1-2: Stream Sediment Metal Concentrations (mean values, N=3 to 11), 2007 – 2010

Parameter	Guideline 1		Haggart Basin					Dublin Basin				Eagle Cr	Lynx Basin	
	ISQG	PEL	W22	W4	W29	W5	W23	W20	W1	W26	W21	W27	W13	W6
No. samples			**6**	**8**	**8**	**6**	**3**	**3**	**11**	**6**	**6**	**11**	**3**	**3**
Antimony			< 10	< 10	10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10
Arsenic	5.9	17	**84.6**	**127**	**113**	**106**	**96.4**	**566**	**315**	**215**	**200**	**130**	**139**	**65.9**
Barium			158	154	62.8	139	219	219	165	115	129	163	228	194
Beryllium			< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	1.23	0.68	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
Cadmium	0.6	3.5	< 0.50	< 0.50	< 0.50	<0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
Chromium	37.3	90	14.5	17.1	14.3	19.7	23.0	21.7	30.8	16.8	18.4	14.3	23.2	20.2
Cobalt			13.6	14.9	12.5	11.6	12.7	8.4	12.2	6.9	8.6	9.5	10.9	10.1
Copper	35.7	197	21.7	23.7	23.8	26.1	29.0	12.3	20.0	12.9	21.3	27.4	23.8	22.8
Lead	35	91	< 30	< 30	33	< 30	< 30	< 30	< 30	< 30	32	< 30	< 30	< 30
Mercury	0.17	0.486	0.0721	0.0486	0.0284	0.0507	0.0574	0.0681	0.0366	0.0341	0.0311	0.0337	0.0547	0.0388
Molybdenum			< 4.0	< 4.0	< 4.0	< 4.0	< 4.0	6.4	< 4.0	< 4.0	< 4.0	< 4.0	< 4.0	< 4.0
Nickel[2]	16	75	**26.2**	**29.2**	**25.6**	**26.2**	**28.8**	**21.9**	**39.3**	**16.4**	**21.0**	**22.1**	**25.4**	**23.6**
Selenium	5	–	< 2.0	< 2.0	< 2.0	< 2	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0
Silver	0.5	–	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0
Thallium			< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Tin			< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0.	< 5.0
Vanadium			22.8	24.8	13.6	23.9	36.0	36.3	33.8	26.0	26.2	22.8	37.9	33.4
Zinc	123	315	88.0	94.5	102	90.9	112	84.6	87.9	55.4	66.7	66.1	116	103

NOTE:

Bold numbers exceed ISQG, Shaded and bold numbers exceed PEL

1 Derived from CCME (2002), except for nickel, selenium and silver (based on BC SQG as per Nagpal et al. 2006) because there are no CCME SQG for these parameters

2 for nickel, BC SQG are for Lowest Effect Level and Severe Effect Level – BCSQG

4.1.3 Methods

4.1.3.1 Field Collection

The stream sediment quality monitoring program described herein will continue to use the sampling methods and analyses established during baseline characterization programs. Specifically, sampling methods will be compatible with those described in the British Columbia Field Sampling Manual (2003) and includes input provided by Environment Canada – Yukon Branch on methods used in the Yukon. Stream sediment samples will be collected downstream of riffle habitat in depositional environments (e.g. pools) to obtain fine-grained sediment samples.

At each station, a minimum of five (5) samples will be collected and composited into a single sample. Replicate samples (i.e., additional sets of five or more) will also be collected from each site, with the first composite sample located at a downstream position and the others located consecutively upstream to avoid sampling downstream from disturbed substrate. Fine sediment will be collected using methods that consider site conditions and water depth (e.g. 2" Lexan core tube, stainless steel trowel, glass jars, and gloved hands). Samples will be placed into acid-washed glass sediment sample bottles and kept cool prior to delivery to the analytical laboratory.

4.1.3.2 Laboratory Methods

Sediment samples will be sieved in the laboratory for analysis of total metals of the fine fraction (< 63 µm). For elemental abundance, sediments samples will be fire dried and then digested in a nitric aqua regia cocktail (HCl and HNO_3) at 90^oC for 3-hours according to the BC Strong Acid-Leachable Metals (SALM) protocol to provide a measure of sediment components. Metals in the digest will then be measured using inductively coupled plasma mass spectrophotometry (ICP-MS) or optical emission spectrophotometry ICP-OES), as appropriate. Mercury will be analyzed by cold vapour atomic fluorescence spectrophotometry (CVAFS).

4.1.3.3 Parameter List and Detection Limits

The suite of sediment parameters to be monitored for the Eagle Gold Project has been established as part of the existing baseline monitoring program. The program includes the analysis of pH and total metals including Sb, As, Ba, Be, Cd, Cr, Co, Cu, Pb, Mo, Hg, Ni, Se, Ag, Tl, Sn, U, V, Zn. The analytical detection limits for each parameter are summarized in Table 4.1-3. The sampling, handling, preservation, parameter list and analytical detection limits are applicable to all monitoring phases.

Table 4.1-3: Stream Sediment Quality Parameters and Detection Limits

Parameter	Detection Limits
pH	0.1
Antimony, total	10
Arsenic, total	5

Parameter	Detection Limits
Barium, total	1
Beryllium, total	0.5
Cadmium, total	0.5
Chromium, total	2
Cobalt, total	2
Copper, total	1
Lead, total	30
Mercury, total	0.005
Molybdenum, total	4
Nickel, total	5
Selenium, total	2
Silver, total	2
Thallium, total	1
Tin, total	5
Uranium, total	0.05
Vanadium, total	2
Zinc, total	1

4.1.3.4 Quality Assurance/Quality Control

QA/QC protocols comprise standard procedures in the field to avoid sample contamination, review of laboratory QA/QC (certified reference materials [CRM] and laboratory duplicates), and evaluation of the precision of field replicates. Quality assurance in the field will include cleaning the equipment (plastic collection pan, spatulas) with de-ionized water between sites, rinsing thoroughly with ambient water between replicates, and wearing nitrile gloves (clean gloves at each site) while sampling and preparing samples. Acid-washed glass sampling jars will be used for sediment sample collection. Upon collection, filled sample jars will be immediately placed in a clean cooler containing ice packs.

Laboratory QA/QC will include the use of certified reference materials (CRM standard MESS-2, marine sediment CRM for trace elements from National Research Council of Canada) and laboratory replicates. Field replicate samples will also be collected at each station as described above to provide information about the heterogeneity of the sediment within a site.

4.1.4 Construction Phase

As previously described, construction is presently scheduled to begin after receipt of a Quartz Mining License in 2013. Stage 1 Construction activities include site clearing and grubbing, road upgrades, civil earthworks, concrete foundations, Dublin Gulch Diversion Channel excavation, pit pre-stripping and camp expansion. The remaining construction activities will take place over the following year.

Locations and Frequency

The stream sediment quality monitoring program for the construction phase will continue to monitor sediment quality in key drainage basins; however, a more focused monitoring program is planned relative to the baseline program. Figure 4.1-2 illustrates the construction phase sediment quality monitoring locations. Table 4.1-4 provides a summary of each monitoring station, location, coordinates, rationale and monitoring frequency for the approximate 2-year construction period.

The sediment quality monitoring stations will be sampled in the late summer on an annual basis during construction.

Table 4.1-4: Construction Phase Stream Sediment Quality Monitoring Locations and Frequency

Site	Location Description	Coordinates		Rationale	Frequency Of Sampling
		Northing	Easting		
Haggart Creek Drainage Basin					
W22	Haggart above Dublin Gulch	7101377	458319	Above Project influence	annual
W4	Haggart below Dublin Gulch	7101223	458144	Below Project influence	annual
W29	Haggart below Eagle Creek	7099583	458225	Below Project influence	annual
W5	Haggart above Lynx Creek	7095887	457815	Below Project influence	annual
W23	Haggart below Lynx Creek	7095682	457790	Below Project influence	annual
Dublin Gulch Drainage Basin					
W1	Dublin Gulch above Stewart Gulch	7101545	460249	Above Project influence	Stage 1 construction
W1A	Dublin Gulch below Stewart and above DG Diversion Channel	7101545	460249	Above Project Influence	Stage 2 construction
W26	Stewart Gulch	7101443	460331	Above Project influence	Stage 1 construction
Eagle Creek Drainage Basin					
W27	Eagle and Diverted Dublin Gulch	7100997	458235	Below Project influence	Stage 1 construction
W27A	Within Fish Habitat Compensation Area in new Eagle Creek/Dublin Gulch channel	7100997	458235	Below Project influence	Stage 2 construction (after channel construction)
W45	Eagle Creek above Haggart Creek	7099684	458243	Below Project influence	annual
Lynx Creek Drainage Basin					
W6	Lynx Creek above Haggart Creek	7095964	458099	Reference, No Project influence	annual

Data Analysis and Reporting

Sediment quality data collected during the construction phase of the Eagle Gold Project will be compared to two key benchmarks:

- pre-construction baseline sediment quality; and
- BC Interim Sediment Quality Guidelines (ISQG) (Nagpal et al. 2006).

Data will be managed in a sediment quality database and updated on an annual basis following receipt of the final analytical reports from the laboratory. Data will be tabulated and compared to existing baseline sediment quality for each station and ISQGs.

Sediment quality monitoring QA/QC results for field replicates, laboratory replicates, and certified reference materials will be reported annually with the results of the program.

An annual sediment quality monitoring report will be prepared covering monitoring results and analysis for each year of the construction phase; this report will likely be included in the annual water quality monitoring report. Statistical analysis will be performed on the monitoring data and compared directly to the baseline results to determine if any statistically significant changes have occurred to the receiving environment sediment quality.

4.2 BENTHIC MACROINVERTEBRATES

4.2.1 Introduction and Objectives

The objectives of the benthic invertebrate monitoring program are to:

- Characterize community diversity and abundance during the transition from baseline and through construction of the Project
- Determine variation relative to baseline data
- Provide supporting information for fisheries assessments and to comply with future MMER requirements.

Environment Canada recommends that benthic invertebrates be used as the primary indicator organisms for use in monitoring effects on fish habitat (Environment Canada 2002).

4.2.2 Previous Work

Previous benthic invertebrate monitoring occurred during the late summer low flow period in 1995 (11 sites), 2007 (11 sites), 2009 (7 sites), and 2010 (7 sites), at sites shown in Figure 4.2-1 (Stantec (2011). Samples were collected from riffle habitat to target the preferred habitat of the more sensitive benthic invertebrate species (Table 4.2-1). In 1995, a Hess sampler (250 µm mesh; 0.096 m^2 sampling area) was used to collect three replicate samples from riffle habitat at each site (Hallam Knight Piésold 1996). In 2007, 2009, and 2010, a Surber sampler (250 µm mesh size; 0.093 m^2 area) was used to collect five replicate samples from riffle habitat at each site. Five replicate samples at least 15 m apart were collected at each site. Invertebrates were identified to the lowest practical level (genus for most insects including chironomids, family or order for other organisms, species or phylum in some cases). The size fraction analyzed was 500 µm in 2007, 2009, and 2010, rather than 250 µm in 1995.

Table 4.2-1: Benthic Invertebrate Sample Locations, 1995, 2007, 2009, and 2010

Site	Location	Dates Sampled			
		11 – 16 Aug 1995	11 – 20 Sept 2007	14 – 15 Sept 2009	18 – 19 Aug 2010
Haggart Creek Drainage Basin					
W2	Haggart above Ironrust Creek	✓			
W3	Lower Ironrust Creek	✓			
W7	Haggart below Ironrust Creek	✓			
W11	Lower Fisher Gulch	✓			
W22	Haggart above Dublin Gulch		✓	✓	✓
W4	Haggart below Dublin Gulch	✓	✓		
W29	Haggart below Eagle Creek			✓	✓
W5	Haggart above Lynx Creek	✓	✓	✓	✓
W23	Haggart below Lynx Creek		✓		✓
Dublin Gulch Drainage Basin					
W20	Bawn Boy Gulch		✓		
W8	Dublin below Olive Gulch	✓			
W1	Dublin above Stewart Gulch	✓	✓	✓	✓
W26	Stewart Gulch	✓		✓	
W21	Dublin above Haggart Creek		✓	✓	✓
Eagle Creek Drainage Basin					
W9	Eagle Pup	✓	✓		
W10	Suttles Gulch		✓		
W27	Eagle Creek			✓	✓
Lynx Creek Drainage Basin					
W13	Lynx above Ray Creek		✓		
W6	Lynx above Haggart Creek	✓	✓		

Baseline data indicate the presence of viable and diverse benthic invertebrate communities in all the watercourses monitored, including those with elevated arsenic levels. Differences in taxonomic richness and abundance, diversity, and evenness among sites and years were noted, and were related to the range of habitat characteristics, water quality and fish presence (predators) in the watercourses studied.

There was some variability within sites and among years in terms of abundance, less so for other community characteristics. The number of organisms/m^2 tended to be higher at creek sites in Dublin Gulch and Eagle Creek drainage basins than in Haggart or Lynx Creek drainage basins. Taxon richness and diversity tended to be higher in Haggart and Lynx Creeks than the smaller tributaries, commonly noted when comparing larger and smaller streams. Pollution sensitive aquatic insects (Ephemeroptera, Plecoptera and Trichoptera [EPT], or mayflies, stoneflies and caddisflies) were abundant and diverse at all sites except Eagle Creek (W27) in 2010; abundance and diversity of these organisms are considered an indicator of good water quality and of food supply for fish. Numbers of EPT taxa were highest at sites in Haggart Creek and Dublin Gulch.

The predominant taxa were Ephemeroptera in all drainages except Eagle Creek and Plecoptera in all drainages, as well as pollution tolerant organisms (Chironomidae or midges and Oligochaeta or aquatic worms in all drainages). The changes noted for Eagle Creek (W27) between 2009 and 2010 (shift to lower richness, diversity, number of EPT taxa, Plecoptera abundance and increased chironomid abundance) reflect the changes in water chemistry (higher TSS and metals levels) and habitat quality over that period.

4.2.3 Methods

4.2.3.1 Field Collection

Survey methods will be consistent with those recommended in the Metal Mining Guidance Document for Aquatics Effects Monitoring, Environment Canada, June 2002 (EEM Guidance Document). Riffle zones will be sampled using a Hess sampler (0.1 m^2 area, 500 µm mesh size). Sampling will occur along a longitudinal stretch of the stream that includes one pool/riffle sequence. Five replicates will be collected in each area with a minimum separation of three times the bank-full width (measured at the top of the bank) between stations. Three subsamples (i.e. Hess sampler sets) will be composited to make up a replicate.

Samples will be collected in later summer/early fall to allow comparison of results to historical data to aid in the interpretation of results. Field notes will contain the following information and follow protocols as stipulated in the most current Metal Mining Environmental Effects Monitoring (EEM) Technical Guidance Document, including at a minimum:

- Coordinates of each of the five replicates
- Date and time of sample collection
- Field crew members, their affiliations and credentials
- Habitat descriptions including supporting environmental variables
- Type of sampler used including area and mesh size
- Sample IDs, # of jars per sample, preservation

- Any observations that will help in the interpretation of results

The water quality and sediment sampling programs will be coordinated with the benthic invertebrate sampling program as much as possible, so that the samples will be collected within the same time period and stream reach location and as dictated by the proposed sampling frequency for each program. Field measurements of water temperature, dissolved oxygen, pH, and conductivity will be conducted. Morphometric measurements of each sampling area will include bankfull width, wetted width, depth, and gradient. Canopy cover will also be estimated at each sampling area.

MMER *Schedule 5, section 16(a) (iii)* requires that total organic carbon (TOC) and particle size distribution of sediment be reported along with benthic invertebrate metrics if invertebrate sampling is carried out in an area where sediment can be sampled. The benthic invertebrate sampling will take place in riffle zones with mainly cobble and gravel substrate, whereas sediment samples will be collected in pools or other depositional areas; therefore, sediment samples will not be collected during benthic macroinvertebrate sampling as supporting variables. Embeddedness of cobbles will be measured as a supporting variable.

4.2.3.2 Taxonomy, Data Analysis and Reporting

Benthic invertebrates will be enumerated and identified to a minimum taxonomic level of family, and statistical summaries and descriptive metrics will be done on family level data. Taxonomy on baseline samples will be done to the lowest practical level, usually genus. Taxonomic analysis will be carried out by a qualified taxonomic laboratory experienced with identification of invertebrates from northern streams.

Data from the taxonomic laboratory will be in the form of bench sheets and an electronic form (e.g. Excel workbook). Taxonomic references used for identification will be listed in the taxonomy laboratory report. Data for each replicate sample will include the number of organisms identified from each taxonomic category (minimum of Family). The method and level of sub-sampling that will be carried out during sorting and identification will be clearly identified.

Reporting will include the number of individuals counted as well as the conversion to number per sample. The number per sample will be standardized to number per square meter by dividing by the area sampled (e.g. 0.1 m^2 per Hess set x 3 Hess sets per replicate = 0.3 m^2 per replicate). These data will be used to calculate indices of community characteristics, which will be used to determine if there is an effect on benthic communities in receiving environments sampled.

The abundance data will be used to calculate the following endpoints for each area:

- Total invertebrate density for each replicate as well as arithmetic mean, standard deviation, median, minimum and maximum;
- Family density for each replicate as well as arithmetic mean, standard deviation, median, minimum and maximum;
- Family richness

- Simpson's diversity index
- Simpson's evenness index
- Bray Curtis index
- Taxon (i.e., Family) proportion
- Taxon (i.e., Family) presence/absence

Calculation of total invertebrate density will include unidentified individuals. Individuals that cannot be identified to Family level will not be included in calculations of Family density or community descriptors. A large number of benthic invertebrate community descriptors exist. In general these include measures of the number of organisms present (i.e. density or abundance), the number of different taxa present (i.e. richness), and whether or not the community composition is dominated by a few taxa (i.e. diversity).

In addition, indicator taxa (taxa that are known to be sensitive or tolerant of stressors in general, or to a specific stressor such as metals) may be used to identify changes to the benthic invertebrate community. The federal Metal Mining Effluent Regulation (MMER) requires reporting of total invertebrate density, taxon richness, Simpson's diversity index, and the Bray Curtis index (a measure of the similarity of the benthic community at a sample site to a reference site).

Total invertebrate density, Family richness, Simpson's evenness index, and Bray-Curtis index will be statistically analyzed using ANOVA (power of 0.1). If the ANOVA determines that a metric has a significant difference among stations, a multiple comparison test (e.g. Tukey test) will be used to determine if the exposure sites are significantly different from reference sites, which will be defined as an effect. The results of these analyses will be interpreted relative to the other endpoints listed above (e.g. diversity and Family density, proportion, and presence/absence) as well as supporting environmental variables measured at the time of sampling, results of fish surveys, and relative to historical sampling. In addition, the effect of outliers or extreme values, if any, on results will be evaluated.

4.2.4 Construction Phase

Locations and Frequency

The benthic invertebrate monitoring program for the construction phase will monitor key drainage basins; however, a more focused monitoring program is planned relative to the baseline program. Figure 4.2-2 illustrates the construction phase benthic invertebrate monitoring locations. Table 4.2-2 provides a summary of each monitoring station, location, coordinates, rationale and monitoring frequency for the approximate 2-year construction period.

The benthic invertebrate monitoring stations will be monitored on an annual basis during the late summer/early fall during construction.

Table 4.2-2: Construction Phase Benthic Invertebrate Monitoring Locations and Frequency

Site	Location Description	Coordinates		Rationale	Frequency of Sampling
		Northing	Easting		
Haggart Creek Drainage Basin					
W22	Haggart above Dublin Gulch	7101377	458319	Above Project influence	annual
W4	Haggart below Dublin Gulch	7101223	458144	Below Project influence	annual
W29	Haggart below Eagle Creek	7099583	458225	Below Project influence	annual
W5	Haggart above Lynx Creek	7095887	457815	Below Project influence	annual
W23	Haggart below Lynx Creek	7095682	457790	Below Project influence	annual
Dublin Gulch Drainage Basin					
W1	Dublin Gulch above Stewart Gulch	7101545	460249	Above Project influence	Stage 1 construction
W1A	Dublin Gulch below Stewart and above DG Diversion Channel	TBD	TBD	Above Project Influence	Stage 2 construction
W26	Stewart Gulch	7101443	460331	Above Project influence	Stage 1 construction
Eagle Creek Drainage Basin					
W27	Eagle and Diverted Dublin Gulch	7100997	458235	Below Project influence	Stage 1 construction
W27A	Within Fish Habitat Compensation Area in new Eagle Creek/Dublin Gulch channel	TBD	TBD	Below Project influence	Stage 2 construction
W45	Eagle Creek above Haggart Creek	7099684	458243	Below Project influence	annual
Lynx Creek Drainage Basin					
W6	Lynx Creek above Haggart Creek	7095964	458099	Reference, No Project influence	annual

4.3 FISHERIES

4.3.1 Introduction and Objectives

SGC has prepared a preliminary Fish Habitat Compensation Plan (FHCP) to address predicted harmful alteration, disruption or destruction of fish habitat (HADD) losses resulting from development of the Project. The preliminary FHCP was submitted to YESAB as part of the Project Proposal and for which the Federal Decision Document from Fisheries and Oceans Canada (DFO) is based upon.

SGC is currently preparing a detailed FHCP that will be submitted to DFO as application for authorization under Section 35(2) of the *Fisheries Act*. This detailed FHCP will be submitted to DFO in 2013 with the objective of receiving authorization to construct the fish habitat described in the FHCP after peak freshet 2014. Fish habitat compensation area construction will not commence until DFO approval of the request for authorization under the *Fisheries Act*.

This section of the plan summarizes proposed monitoring of construction of the FHCP. Importantly, fish habitat compensation monitoring will be managed through conditions set out in the *Fisheries Act Authorization* for the Project. Therefore, the proposed methods described may be updated as required by DFO.

To determine the effectiveness of the proposed compensation works, SGC has developed a monitoring and reporting program that will be submitted as part of the FHCP to DFO. The program adheres to methods established in the *Monitoring and Assessment of Fish Habitat Compensation and Stewardship Projects: Study Design, Methodology and Example Case Studies* (Pearson et al. 2005) and focus on the biological effectiveness (e.g., seasonal use for Arctic grayling and physical integrity of constructed channel components). The monitoring program includes assessments of water quantity and quality (e.g., temperature, pH - as previously described); habitat structure, attribute integrity and functionality (e.g., riparian revegetation survival); and fish use by Arctic grayling at each life-history stage.

To ensure compensation works are constructed to design specifications, monitoring will be scheduled at regular intervals throughout construction of the various channel components. The construction monitoring schedule will generally follow recommendations described in the *British Columbia Standards and Best Practices for Instream Works* (MWLAP 2004) as Yukon Standards and Best Practices are still currently under development.

4.3.2 Previous Work

Baseline fish and fish habitat information was gathered from existing consultant reports, government databases, and the results of field studies conducted for the Project prior to SGC's claim ownership. Field studies were completed for watercourses located within the local Project area to obtain biophysical habitat data, determine fish presence and abundance, and characterize fish populations (i.e., size, age, and tissue metal concentrations). The fish and fish habitat study area (study area) included:

- All perennial watercourses in the Dublin Gulch watershed and lower Haggart Creek (below Dublin Gulch).
- Reference watercourses that would be uninfluenced by flows from the Dublin Gulch watershed (i.e., Ironrust Creek, Lynx Creek, and upper Haggart Creek [above Dublin Gulch]).
- All perennial watercourses that cross or approach within 30 m of the site access road which parallels Haggart Creek.

4.3.2.1 Fish-bearing Watercourses

Field studies within the study area were completed over four sampling periods (August 2007, October 2007, April 2008, and July 2009) and included 59 sample sites, located on 28 mapped or field identified watercourses. Of the 28 watercourses sampled, 13 are crossed by the access road, 13 are within or immediately downstream of the Project, and two are within reference watercourses. Detailed results from the 2007-2009 Fish and Fish Habitat Baseline Program are provided in *Eagle Gold Project Environmental Baseline Report: Fish and Fish Habitat* (Stantec 2010b).

Sampled watercourses were characterized as non-fish-bearing unless:

- Fish were not captured, despite the application of appropriate capture methods, during at least two different sampling periods, and;
- The watercourse had physical characteristics that could explain fish absence (i.e., gradient >20% or a permanent barrier to upstream fish passage where no perennial fish habitat exists upstream of the barrier).

Fish density per unit area was estimated for fish-bearing sites sampled in Dublin Gulch, Ironrust Creek, Lynx Creek, and a subset of sites in Haggart Creek, using electrofishing via multiple-pass removal methods.

Of the 26 watercourses sampled in the study area, 14 were identified as fish-bearing or potentially fish-bearing and 12 were identified as non-fish-bearing. The 14 fish-bearing watercourses were:

- Three watercourses located within or immediately downstream of the proposed mine site footprint—Haggart Creek, lower reaches of Dublin Gulch, and the lower reaches of Eagle Creek (including a pond created for historic placer mining operations and its tributary stream).
- Two watercourses sampled as reference watercourses—Lynx Creek and Ironrust Creek.
- Nine additional watercourses crossed by the site access road including: North Star, Bighorn, Cadillac, and Swede Creeks; the South McQuesten River, one unnamed tributary of Haggart Creek, and two unnamed tributaries of the South McQuesten River.

A summary of the data collected for all identified fish-bearing watercourses is presented in Stantec 2010b.

The 12 watercourses identified as non-fish-bearing were as follows:

- Two watercourses with barriers to upstream fish passage located within the footprint of the proposed mine site – Upper Dublin Gulch (a gradient barrier located 1.5 km upstream of the confluence with Haggart Creek) and Upper Eagle Creek (a perched culvert located 1.9 km upstream of the confluence with Haggart Creek).

- Seven tributaries to the non-fish-bearing upper reaches of Dublin Gulch and Eagle Creek—Suttles Gulch, Ann Gulch, Bawn Boy Gulch, Stewart Gulch, Olive Gulch, Cascallen Gulch, and Eagle Creek.

Three watercourses with fish passage barriers that were located outside the Dublin Gulch and Eagle Creek watersheds: Platinum Gulch and three un-named watercourses tributary to Haggart Creek and crossed by the access road.

4.3.2.2 Fish Species Distribution

At least 11 fish species are known to occur in the South McQuesten River watershed, including Chinook salmon (*Oncorhynchus tshawytscha*), Arctic grayling (*Thymallus arcticus*), northern pike (*Esox lucius*), longnose sucker (*Catostomus catostomus*), Arctic lamprey (*Lampetra camtschatica*), burbot (*Lota lota*), slimy sculpin (*Cottus cognatus*), round whitefish (*Prosopium cylindraceum*), inconnu (*Stenodus leucichthys*), lake whitefish (*Coregonus clupeaformis*), and rainbow trout (*Oncorhynchus mykiss*).

No freshwater fish species on Schedules 1 or 2 of the Federal *Species at Risk Act* (SARA) were present in the South McQuesten River watershed or the entire Yukon Territory (GoC 2008). Haggart and Lynx creeks are both known to contain five fish species: Chinook salmon, Arctic grayling, round whitefish, burbot, and slimy sculpin (DFO 2010). Ironrust Creek, Dublin Gulch and Eagle Creek are known to be inhabited by Arctic grayling and slimy sculpin (Hallam Knight Piésold 1996, DFO 2010).

The baseline field program for the Project captured five fish species from ten different watercourses. Arctic grayling were captured in nine watercourses and slimy sculpin were captured in seven. Burbot were captured in the South McQuesten River and lower Haggart Creek. Chinook salmon and longnose sucker were observed in the South McQuesten during a July 2009 snorkel survey.

Previous studies reported the presence of Chinook salmon (*Oncorhynchus tshawytscha*) in Haggart and Lynx creeks (Madrone 2006; Hallam Knight Piésold 1995, 1996; DFO 2010). In the 2007 to 2009, Dublin Gulch sampling programs, Chinook salmon were not captured at any of the Haggart and Lynx creek sites. Previous studies also reported the presence of Chinook salmon in the South McQuesten River, which was confirmed by the sighting of juvenile Chinook (est. age 1+) during a snorkel survey of the South McQuesten River at the access road crossing on July 23, 2009.

No adult Chinook spawners or evidence of spawning were observed in the South McQuesten River during the July 2009 survey. However, Chinook spawners were observed in August 2009 adjacent to the South McQuesten River Bridge immediately downstream of the mouth of Haggart Creek by Stantec personnel.

4.3.2.3 Fish Relative Abundance

Arctic grayling and slimy sculpin were the only species caught during multiple-pass depletion surveys completed in Ironrust Creek, Haggart Creek, Lynx Creek, and in Dublin Gulch. Both species were present in low densities in these watercourses. Mean Arctic grayling catch rate for all sites during all three electrofishing sampling programs was 1.6 fish/100 m^2, and mean catch rate for slimy sculpin for all sites was 2.9 fish/100 m^2. Slimy sculpin were caught at higher densities in Haggart Creek (4.3 to 6.0 fish/100 m^2) than in the other three watercourses (0.7 to 1.9 fish/100 m^2). There were no consistent differences in estimated Arctic grayling densities among the waterbodies sampled.

Habitat Usage

The majority of Arctic Grayling in the Project area are thought to overwinter in the South McQuesten River and migrate into Haggart Creek and its tributaries to rear during summer (Pendray 1983). The summer migration into Lynx Creek has been observed to occur during June and early July (Pendray 1983). The timing of outmigration to overwintering areas has not been observed for the Project Area; however, baseline assessment for this Project (Stantec 2010b) demonstrated that densities of Arctic grayling in Dublin Gulch were similar during July, August, and October, even though anchor ice was beginning to form on the stream margins during the October sampling program. This suggests that significant outmigration may not occur from Dublin Gulch until after October.

The documented capture of juvenile Arctic grayling in Haggart Creek during May, at a location 19 km upstream from the South McQuesten River (Pendray 1983), suggests that some Arctic grayling may overwinter in the Haggart Creek watershed. The baseline assessment for this Project did indeed document potential overwintering habitat (i.e., with residual pool depth ≥0.8 m) at sample sites in Lynx and Haggart creeks.

Furthermore, a large number of Arctic grayling were captured from a large pool on Haggart Creek in April 2008 (i.e., after freeze up but before breakup) (Stantec 2010b). It is assumed that this unnaturally large pool (1 ha in area and over 10 m deep) was created by placer mining operations and was not present during fish studies conducted in 1996 (Hallam Knight Piésold 1996). This pool created by placer mining and the South McQuesten River likely represent the most important overwintering habitat for Arctic grayling in the study area. The quality of potential overwintering habitat in fish-bearing streams within the mine site footprint (i.e., Dublin Gulch and Eagle Creek) was poor due to residual pool depths ≤0.3 m that most likely freeze to the bottom in winter.

Pendray (1983) observed that spawning by Arctic Grayling in this region occurred predominantly in the South McQuesten River during the last two weeks of May. He also identified a small area at the mouth of Haggart Creek as a probable spawning site. Since spawning occurs in late May, immediately after ice breakup, Arctic grayling that winter in the Haggart Creek watershed might also spawn in the Haggart watershed. The baseline fisheries assessment for this Project identified areas of good to excellent quality potential spawning habitat for Arctic grayling—with modest currents (0.5 – 1.0 m/s), depths of 0.1 – 0.4 m, and 2 – 4 cm diameter gravel (McPhail, 2007)—in Lynx, Haldane, Swede, and Haggart creeks. The quality of potential spawning habitat provided by fish-bearing streams within the mine site footprint (i.e., Dublin Gulch and Eagle Creek) was poor, primarily due to lack of suitable gravel.

As the majority of Arctic grayling in the study area are thought to overwinter and spawn in the South McQuesten River (Pendray 1983), Arctic grayling primarily use study area streams as summer rearing habitat. Good to excellent rearing habitat was present at sample sites in the South McQuesten River, Bighorn Creek, Haggart Creek, Haldane Creek, Lynx Creek, Ironrust Creek, and North Star Creek. These sites had abundant complex cover and availability of pool, riffle, and run habitats. The quality of potential rearing habitat provided by fish-bearing streams within the proposed Project footprint (i.e., Dublin Gulch and Eagle Creek) was moderate, primarily due to lack of cover, high stream gradients, or insufficient channel depths.

4.3.3 Methods

4.3.3.1 Construction Monitoring

Monitoring of fish habitat compensation area construction will be conducted to ensure the FHCP is constructed as designed and approved by DFO. Fish habitat compensation area construction will not commence until DFO approval of the request for authorization under the *Fisheries Act*.

A qualified environmental professional (QEP) will be on-site during start-up, and throughout the construction of the key habitat components (instream features and overwintering pools), and when habitat components are connected to existing fish habitat. Documentation recorded by the QEP or designate during construction works will include the following information:

- Written and photographic accounts of the sequence of events occurring during construction.
- Descriptions of any changes in the design that are necessary to adapt to unanticipated field conditions.
- Documentation of technical issues or problems arising during construction and how they have been addressed.
- Confirmation that habitat area objectives and spatial design requirements have been achieved.
- Confirmation that construction materials used are of the correct size and type as specified in the FHCP (Stantec 2013).
- Confirmation that all habitat and channel stabilization structures are in place and functioning as designed.
- Confirmation that the terms and conditions of the *Fisheries Act* authorization have been met.

4.3.3.2 Effectiveness Monitoring

Effectiveness monitoring will begin in the year following construction of the fish habitat compensation channel and will consist of:

- Biological effectiveness monitoring

- Fish utilization monitoring, and
- Habitat monitoring.

The components of the effectiveness-monitoring plan are intended to evaluate the performance of compensation measures in meeting the quantitative objectives of the FHCP, and comparing various metrics to performance predictions of the FHCP – including the habitat suitability index (HSI) models that were used to quantify habitat productive capacity (Stantec 2013). The monitoring plan will also identify whether specific environmental conditions and physical integrity of habitat elements are present and biological effectiveness of the compensation habitat is persistent.

The effectiveness monitoring program will be developed as required by the *Fisheries Act* authorization and described in a comprehensive environmental monitoring and surveillance plan as required for the operations phase of the Project and will be submitted as part of an updated Quartz Mining License and Type A Water Use License applications.

4.3.4 Reporting

Results of the construction monitoring program will be compiled after channel construction is complete. A summary report will be prepared and submitted to DFO for review if as required by the *Fisheries Act* Authorization.

4.4 REFERENCES

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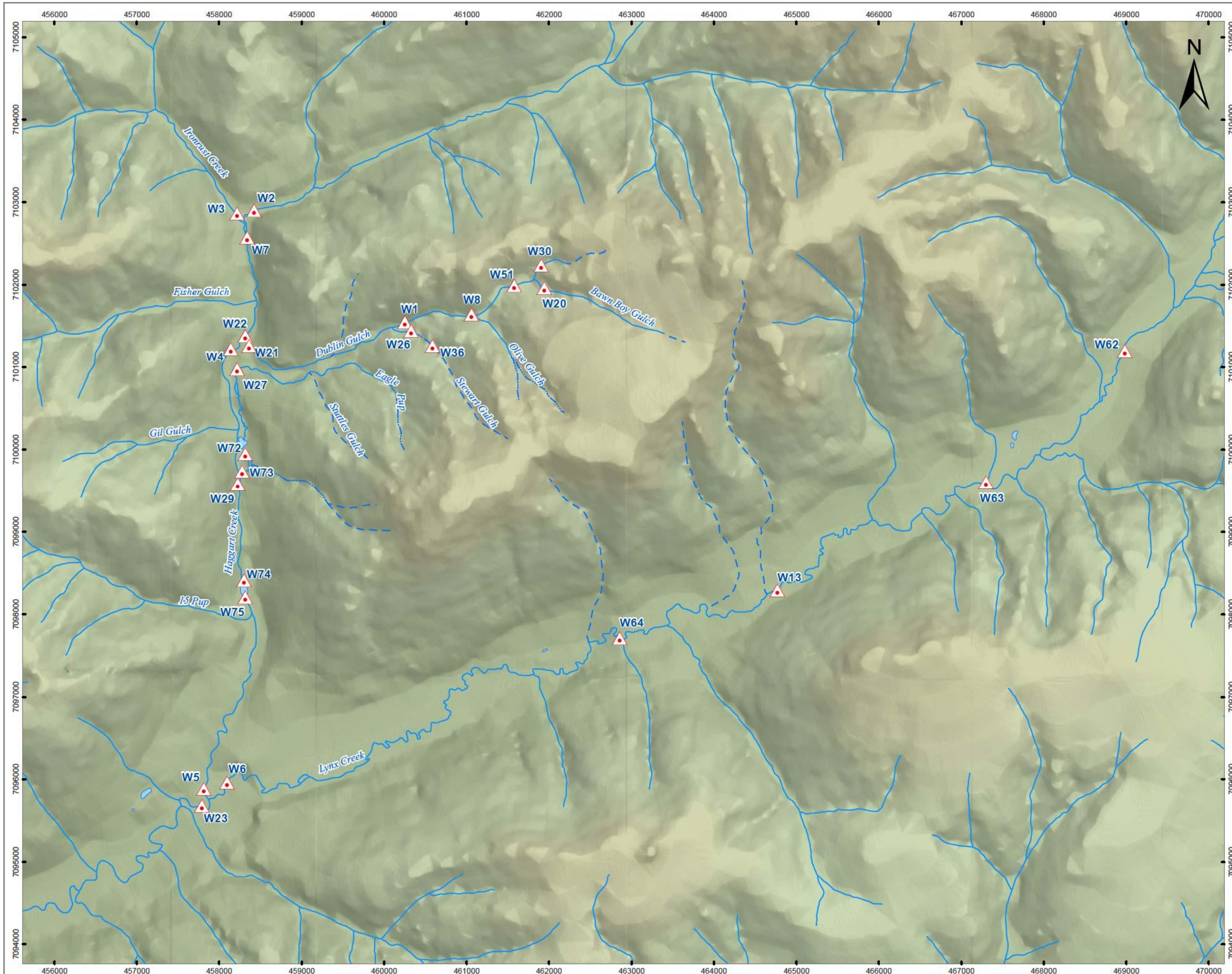


LEGEND

- Sediment Monitoring Stations
- Watercourse (perennial)
- Watercourse (ephemeral)
- Watercourse (intermittent)

NOTES
Base data source:

STATUS
FOR INTERNAL USE ONLY

EAGLE GOLD PROJECT YUKON TERRITORY

Stream Sediment Monitoring Stations Baseline

PROJECTION	DATUM	CLIENT
Transverse Mercator UTM Zone 8	NAD83	StrataGold Corporation

Scale: 1:45,000
800 400 0
Metres

FILE NO.

LORAX ENVIRONMENTAL

PROJECT	DWN	CKD	APVD	REV
Eagle Gold	VV	DHF	DHF	1

OFFICE

DATE
December 11, 2012

Figure 4.1-1

Path: P:\J996 (Victoria Gold Eagle Gold Project)\Drafting\MXDs\28Feb2013 edits\Fig4.1-1_Regional Mine area prior to construction sediment_for David F_09Jan2013_11x17.mxd

LEGEND

- Sediment Monitoring Stations
- Project Infrastructure (end of mine life)
- Watercourse (perennial)
- Watercourse (ephemeral)
- Watercourse (intermittent)

NOTES
Base data source:

STATUS
FOR INTERNAL USE ONLY

EAGLE GOLD PROJECT
YUKON TERRITORY

Steam Sediment Monitoring Stations Construction

PROJECTION	DATUM	CLIENT
Transverse Mercator UTM Zone 8	NAD83	Victoria Gold Corp

Scale: 1:40,000
400 200 0 400
Metres

FILE NO.

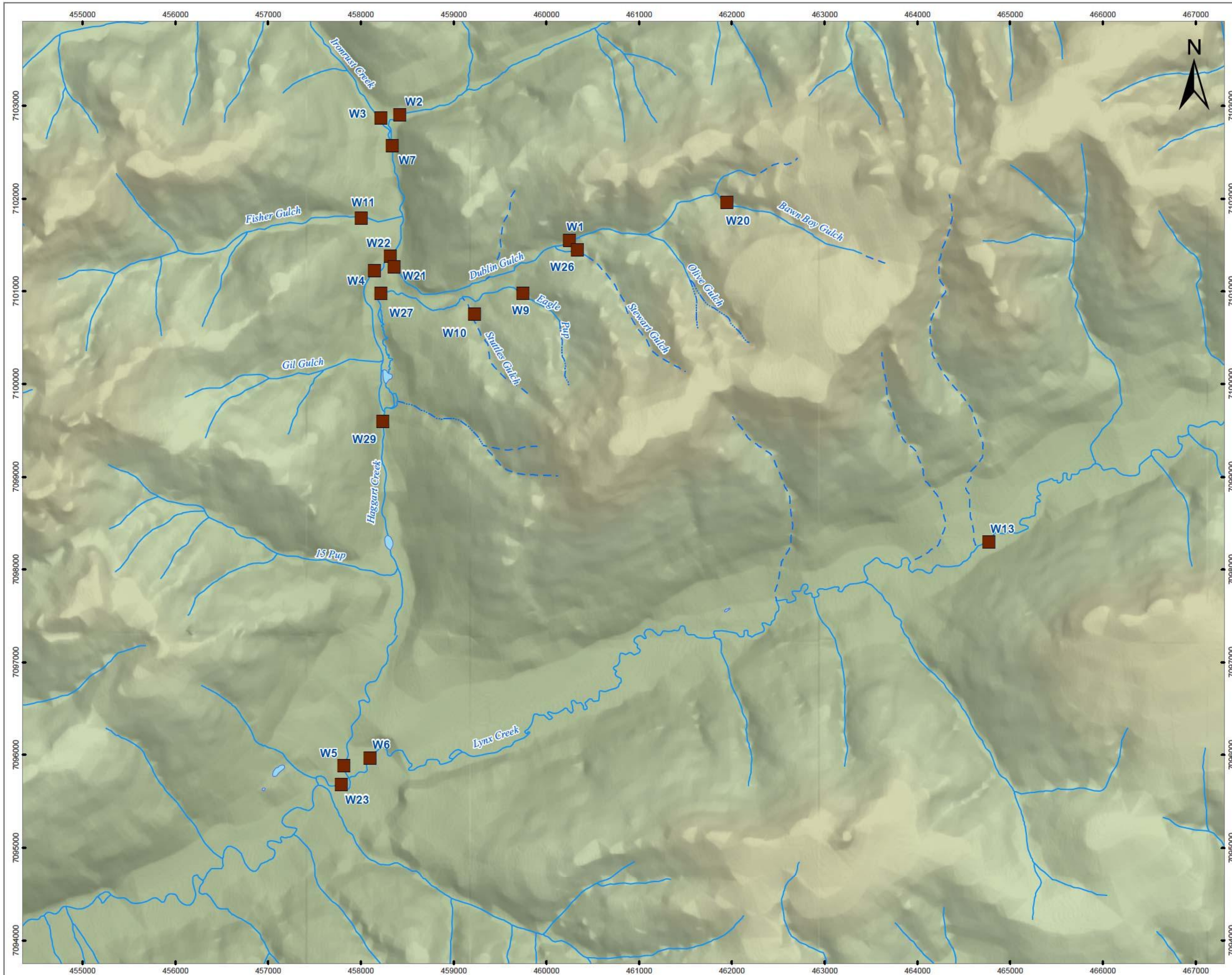
PROJECT	DWN	CKD	APVD	REV
Eagle Gold	VV	DHF	DHF	1

OFFICE
DATE
December 11, 2012

Lorax Environmental

Figure 4.1-2

Path: P:\U996 (Victoria Gold Eagle Gold Project)\Drafting\MXDs\May2013 edits\Fig4.1-2_Regional Mine area construction Sediment_for David F_13May2013.mxd



LEGEND

- Benthic Invertebrate Monitoring Stations
- Watercourse (perennial)
- Watercourse (ephemeral)
- Watercourse (intermittent)

NOTES
Base data source:

STATUS
FOR INTERNAL USE ONLY

EAGLE GOLD PROJECT
YUKON TERRITORY

Benthic Invertebrate Monitoring Stations Baseline

PROJECTION	DATUM	CLIENT
Transverse Mercator UTM Zone 8	NAD83	StrataGold Corporation

Scale: 1:40,000
400 200 0 400
Metres

FILE NO.

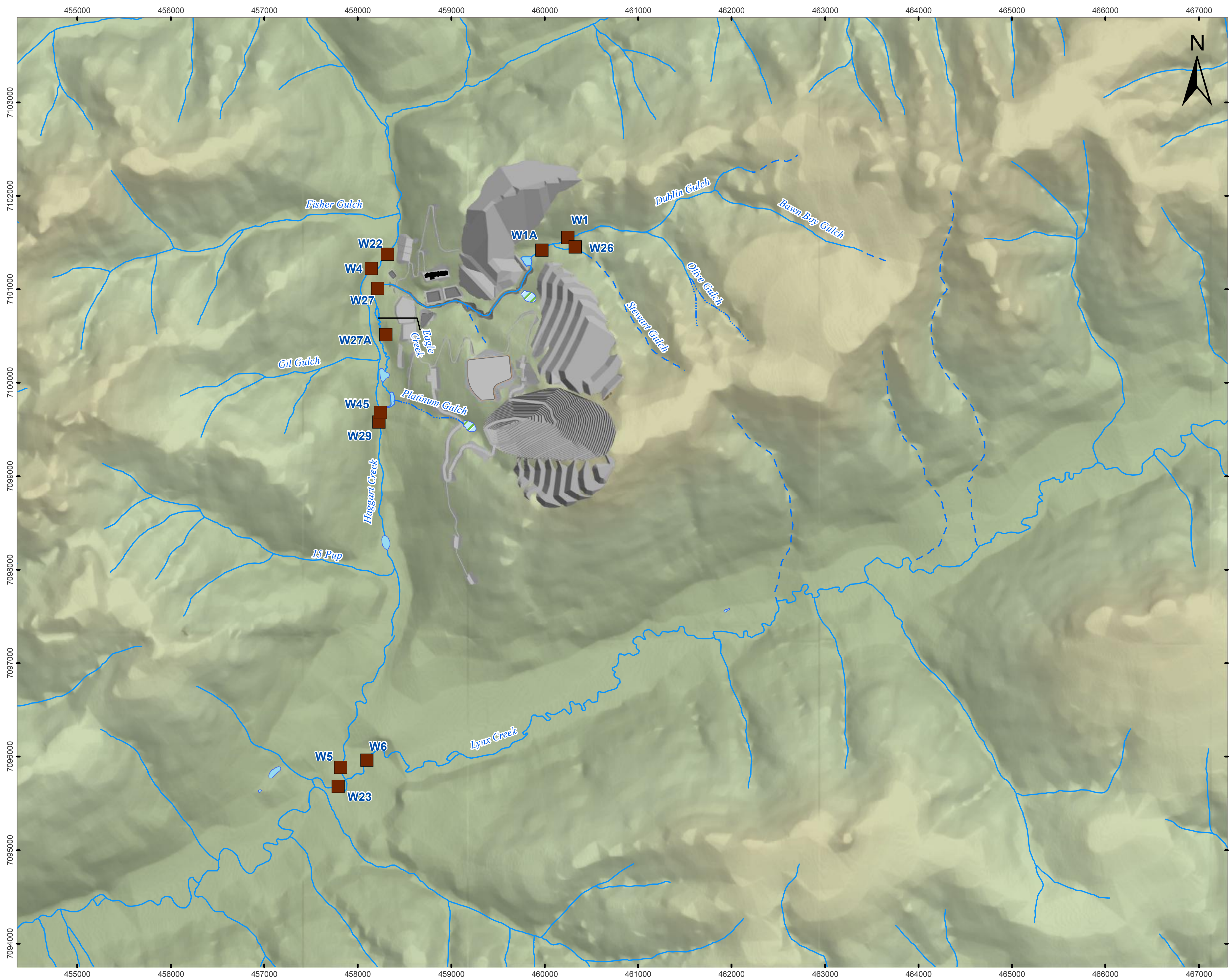
LORAX ENVIRONMENTAL

PROJECT	DWN	CKD	APVD	REV
Eagle Gold	VV	DHF	DHF	1

OFFICE	DATE
	December 11, 2012

Figure 4.2-1

Path: P:\U996 (Victoria Gold Eagle Gold Project)\Drafting\MXDs\28Feb2013 edits\Fig4.2-1_Regional Mine area prior to construction Benthic_for David F_09Jan2013_40.mxd



LEGEND

- Benthic Invertebrate Monitoring Stations
- Project Infrastructure (end of mine life)
- Watercourse (perennial)
- Watercourse (ephemeral)
- Watercourse (intermittent)

NOTES
Base data source:

STATUS
FOR INTERNAL USE ONLY

EAGLE GOLD PROJECT YUKON TERRITORY

Benthic Invertebrate Monitoring Stations Construction

PROJECTION	DATUM	CLIENT
Transverse Mercator UTM Zone 8	NAD83	Victoria Gold Corp

Scale: 1:40,000
400 200 0 400
Metres

FILE NO.

PROJECT	DWN	CKD	APVD	REV
Eagle Gold	VV	DHF	DHF	1

OFFICE

DATE
December 11, 2012

Figure 4.2-2

Path: P:\U996 (Victoria Gold Eagle Gold Project)\Drafting\MXDs\May2013 edits\Fig4.2-2_Regional Mine area construction Benthic Invertebrate_for David F_13May2013.mxd

5 METEOROLOGICAL MONITORING PROGRAM

5.1 CLIMATE

5.1.1 Introduction and Objectives

Two automated climate stations are currently operating in the Project area. The Potato Hills station (elevation 1420 m) was installed in 2007 and the Camp station (elevation 778 m) in 2009. The climate stations collect data for the following parameters:

- Air temperature
- Rainfall (tipping bucket)
- Wind speed and direction
- Barometric pressure,
- Snow depth, and
- Relative Humidity

Snow depth information has also been collected with snow course surveys near both stations during winter.

The objectives of the baseline climate monitoring program are to characterize the local atmospheric environment of the Project area, and to support hydrologic analyses and air quality assessments. The climate monitoring program, through the construction phase of the Project, will include the two existing climate stations, as well as the baseline snow course survey locations.

The objective of the ongoing climate monitoring program will be to calibrate precipitation, snowmelt predictions and runoff patterns used in the water balance and water management design. It will also provide air quality information once Project facilities (e.g. site haul roads, crushing and screening plant, open pit, heap leach facility, refinery and waste rock storage areas, etc.) are in place.

5.1.2 Previous Work

Historical climate data were initially collected intermittently in the area in 1979 to 1980, 1984 and 1993 to 1996. The more recent baseline climate monitoring program was initiated by SGC in August 2007 with the installation of the Potato Hills climate station (elevation 1420 m). This station is an ONSET Hobo operating system and currently records data at a 15-minute interval.

The second climate station, the Camp station was installed in August 2009 (initially at an elevation of 820 m, and then later moved in September 2010 to an elevation of 778 m during camp development activities), as a result of large differences in snow survey information collected in April 2009 near the

Potato Hills station compared to the lower elevation area near the camp. The Camp station is a Campbell Scientific CR800 datalogger, which records data at a 15-minute interval.

Snow course surveys have been conducted during the late winter (generally in April) beginning in 2009 to the present. The snow courses are located near the climate stations and collect snow depth, snow density and snow water equivalent (SWE) data.

Previous work on climate data and information are described in JWA (2008 and 2009), Stantec (2010, 2011 and 2012) and Knight Piesold (2013).

5.1.3 Methods

The current climate stations will continue to collect data at 15-minute intervals for the parameters outlined above.

Snow course surveys will continue to be undertaken following the accepted sampling procedures and techniques used by Yukon Environment and outlined in the Ministry of Environment of British Columbia's document "Snow survey sampling guide" (MOE 1981).

5.1.4 Locations

The locations of the current and ongoing climate stations are shown in Figure 2.1-1 and summarized in Table 5.1-1.

Table 5.1-1: Project Climate Station Locations

Site	Zone	Coordinates		Site Type
		North	East	
Potato Hills	8V	7100800	463550	Automated
Camp	8V	7101000	458200	Automated

5.1.5 Frequency

The climate stations will be visited and data downloaded on a regular basis to ensure that all instrumentation is maintained and functioning properly. During the open water season the stations will be visited at a minimum 3-4 times, concurrent with hydrology data collection. In the winter, the stations will be visited in conjunction with collection of snow course survey data, which will occur on a monthly basis from the beginning of March until the snow is gone by May or June.

5.1.6 Data Analysis and Reporting

The following climate data will be included for each station in the summary annual report following each data collection year:

- Monthly and annual recorded mean, minimum and maximum temperature
- Total monthly and annual precipitation, as well as estimated rainfall and snowfall amounts

- Maximum 24-hour precipitation totals for each month
- Monthly snowpack depth as well as estimated monthly snowmelt distribution
- Monthly average barometric pressure and relative humidity
- Monthly and annual recorded mean, minimum and maximum wind speed and direction

5.2 REFERENCES

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6 ATMOSPHERIC AND TERRESTRIAL MONITORING

6.1 AIR QUALITY

6.1.1 Introduction and Objectives

Atmospheric Criteria Air Contaminants (CAC) will be emitted during the construction phase of the Project. CAC emissions will include fugitive dust emissions, occurring as a result of soil disruption through Project-related activities, most notably clearing, grading, drilling, blasting, loading/unloading, and road traffic and emissions from diesel combustion from heavy vehicles and machinery.

SGC is committed to applying industry standard best management practices to reduce Project emissions. SGC will construct the Project in a way that minimizes the release of PM to the atmosphere and thus minimizes the potential for the ambient standards to be exceeded and adopt a range of design and operational safeguards and procedures for the Project to ensure that emission controls are working effectively.

Yukon Ambient Air Quality Objectives define maximum allowable limits for CACs, including particulate matter, carbon monoxide (CO), sulphur dioxide (SO_2) and nitrogen dioxide (NO_2). Particulate matter can be composed of a variety of materials, and is defined by particle size. Total suspended particulates (TSP) includes all-sized particles suspended in air; typically defined at its upper limit by a cut-off of 300 to 500 µm. $PM_{2.5}$ describes all fine-mode particles up to 2.5 µm. While TSP typically falls out of suspension close to the source, $PM_{2.5}$ can be transported several kilometres, and can settle over soil, vegetation and water, potentially leading to increased metal concentrations in the environment.

The air quality baseline data collection program currently implemented is recording TSP, $PM_{2.5}$ and metals for the purpose of establishing pre-disturbed, baseline conditions. As the Project moves into the construction phase, the air quality monitoring plan will consist of two phases:

- Phase 1:
    - Dustfall: install passive dust monitors at four locations
    - TSP: continue monitoring TSP using the existing Partisol Air Sampling unit near the lower camp climate station

- Phase 2:
  - Dustfall: if dustfall levels of 1.75 mg/dm^2/d are exceeded[2], additional dust mitigation measures will be implemented and chemical analyses of TSP will be carried out to determine the chemical composition of dust deposition for potential effects to human and ecological health.
  - TSP: if the Yukon Ambient Air Quality Standard of 120 µg/m^3 24 hour average or 60 µg/m^3 as an annual geometric mean is exceeded, additional dust control mitigation measures will be implemented and chemical analyses of TSP will be carried out to determine the chemical composition of dust deposition for potential effects to human and ecological health.

6.1.2 Previous Work

The air quality baseline monitoring program began in late-August 2012; a Thermo Scientific Partisol 2025i Sequential Ambient Air Sampler was installed near the Camp climate station, in an area away from active exploration activities. The unit samples $PM_{2.5}$ over a continuous 24-hour period (midnight to midnight – Pacific Standard Time) and TSP alternately over a continuous 24 hour period every third day according to protocols established for the National Air Pollution Surveillance (NAPS) program.

6.1.3 Methods

The methods for air quality monitoring described below pertain to the monitoring of TSP and Particulate Matter via ambient air sampling and dust deposition monitoring. For dust deposition, in addition to these methods, SGC will be monitoring metals content in soil and vegetation that will provide data that will be used to determine potential effects from dust deposition. The methods to monitor metal levels in vegetation and soils are described in Sections 6.2 and 6.3 below respectively.

Dispersion modeling results (Stantec 2011) predict that Project emissions of the Criteria Air Contaminants (CACs), except for particulate matter, will not exceed applicable regulatory objectives and standards. Increased dustfall may occur during periods of high ambient TSP concentrations as a result of construction activities. Therefore, dustfall measurements will be the primary means of monitoring ambient particulate conditions near the Project. These measurements will be complemented by ongoing meteorological data collection. A map of the Project area showing existing meteorological stations and proposed dustfall stations is included as Figure 6.1-1.

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[2] Environment Yukon does not have a dustfall objective; therefore, the BC dustfall objective (1.75 mg/dm^2/d) will be applied as the standard

Particulate Matter (PM)

Dustfall monitoring is a simple and cost-effective means of evaluating effects of particulate emissions downwind of the sources. Dustfall is airborne PM that accumulates on a horizontal surface due to gravitational settling and wet deposition. Dustfall monitoring stations will be installed during or prior to the construction phase of the Project. Equipment standards and siting recommendations from ASTM (2010) will be followed to the extent practicable. Four stations will be installed; this will allow for rejected samples and sampling in areas of various distance and direction from the Project disturbance area.

Locations

Dustfall monitoring station locations are shown on Figure 6.1-1. These are preliminary locations, which will be adjusted as needed to satisfy siting recommendations and accessibility considerations. Dustfall collectors will be installed far enough from roads (>100 m) so as to not be dominated by locally generated road dust.

- Dustfall station D1 will be co-located with the Potato Hills meteorological station. Although this station may be downwind of the mine site during certain weather conditions, this station is far enough away from the center of proposed mine activity (approximately 3 to 4 km) to serve as a background reference for the area, as it is beyond the area found to be significantly influenced by TSP from the mine.
- Dustfall station D2 will be located at or near the Camp meteorological station and location of the Partisol Air Quality Sampler. This station will be representative of the Project area boundary.
- Dustfall Station D3 will be located below the hilltop just southeast of the Project area. This corresponds to the area of highest TSP concentrations and dustfall that were predicted by dispersion modeling (Stantec 2011a), i.e., the area of maximum impingement.
- Dustfall Station D4 will be approximately 1.5 km south of the mine camp, to the east of the access road. This location is downwind of prevailing winds at the Camp meteorological station.

If the passive dust monitors indicate exceedance of levels, the current air quality sampler may be moved or other samplers installed on the Property as appropriate.

Frequency

The sampling accumulation period for the dustfall stations will be one calendar month. The dustfall collectors will be changed out monthly and sent to a certified lab for analysis. Sampling procedures will follow those detailed in ASTM (2010).

The 2025i Partisol air quality sampler is set to sample for each particle size and is currently occurring on a 3-day cycle, from midnight to midnight (Pacific Standard Time) but will occur on a 6-day cycle once a baseline is established.

Data Collection and Analysis

Total dustfall will be calculated in $mg/dm^2/d$, averaged over a 30-day period, to determine if the guideline of 1.75 $mg/dm^2/d$ has been exceeded. Analysis of metals content in the dustfall will also be included in laboratory analysis.

The 2025i Partisol holds a filter supply magazine containing 16 filter cassettes. Filters used include a Pallflex TX40 HI20-WW 47 mm filter specified for TSP and PM 2.5 and a 37 mm MCE (mixed cellulose ester) filter specified for metals. Each filter is pre-weighed in triplicate according to procedures in U.S. EPA 2.12 Quality Assurance Handbook, Section 7. The filter weight is recorded along with the filter cassette number and placed into the cassette. Sixteen cassettes are placed into a magazine and shipped to site to be installed in the Partisol.

During a programmed sampling date, the 2025i maintains a temperature- and pressure-compensated flow of 16.67 L/min (1 m^3/hr) through the filter. Following completion of the programmed sampling event (24 hours) the sample filter is automatically transferred into the storage magazine. After 16 sampling events have been completed (8 for TSP and 8 for $PM_{2.5}$), the storage magazine will be shipped to an accredited laboratory for re-weighing.

The re-weighing procedure is similar to that for pre-weighing. The sampled concentration is then determined as the net weight of the filter divided by the total flow volume over the sampling event (24 m^3). Chemical analysis of particulate samples (including but not necessarily limited to ammonia, arsenic, cadmium, chromium, mercury and lead) will also be performed on two samples every second magazine.

In addition to air quality sampling, inspections for fugitive dust generation will be conducted for site roads and all facilities that produce dust to determine the need for additional mitigation measures.

Data management and record keeping will be an integral part of the monitoring program. Dustfall, TSP and PM sampling and reporting will be performed in accordance with the industry standards (ASTM 2010). Data from the monitoring program will be reviewed monthly as dustfall results become available. If exceedance of any of the applicable objectives or standards is detected, SGC will take the following actions:

- Review all applicable air quality and meteorological data as well as metadata (e.g., records of Project activities during the exceedance period, inspection reports, field notes from monthly dustfall station visits, and any other information that may be relevant) to diagnose the conditions that led to the exceedance episode.
- Based on findings from Step 1, modify or add mitigation measures to reduce airborne PM.
- Notify Government of Yukon of the exceedance and any changes to mitigation measures.

Annual reports will be produced which contain the recorded concentrations Dustfall, TSP and $PM_{2.5}$ with comparison to Yukon Ambient Air Quality Objectives. The reports will also contain the sampling QA/QC data recorded in the Partisol Sampler interval file and the results of any chemical lab analyses. High concentrations will be interpreted with respect to prevailing meteorological conditions recorded at the Property.

6.2 VEGETATION

6.2.1 Introduction and Objectives

The vegetation monitoring program has been designed to evaluate changes to vegetation during the construction phase of the Project. The objectives of the vegetation monitoring program include:

- To measure plant metal uptake during construction,
- Establish monitoring sites that will be monitored during future activities, and
- Help identify whether any trends in metal uptake could be attributed to site activities.

6.2.2 Previous Work

A baseline vegetation assessment was completed in 2009 and 2010 (Stantec, 2011a). The baseline assessment includes terrestrial ecosystem mapping, a rare plant survey and foliar sampling for the area of the proposed Project, including the mine site and access road. Vegetation field surveys were undertaken in August 2009 to gather data necessary for the preparation of terrestrial ecosystem mapping and rare plant surveys. Foliar samples of commonly occurring shrubs, grasses or sedges were collected at nine sites for metals analysis. A second rare plant survey was conducted in July 2010 to capture earlier flowering plants.

Terrestrial ecosystem mapping was completed for an area of approximately 7,538 ha surrounding the proposed Project. Ecosystem mapping was also prepared for a 1 km wide corridor along the 44.8 km long access road (4,580 ha). A Project specific ecosystem classification system, based on field data and literature review, was developed for the study areas. A total of 21 vegetated ecosystem units and nine non-vegetated units have been mapped in the study areas.

All foliar samples analyzed in 2009 contained metal concentrations below levels considered toxic for cattle.

Trace Metal Concentrations in Vegetation

Establishment of baseline trace metals was undertaken by conducting foliar analysis of selected plant species at nine locations in and around the local study area. Species sampled included: willow (*Salix* spp.), sedge (*Carex* spp.), bluejoint (*Calamagrostis canadensis*) and northern rough fescue (*Festuca altaica*). All metal levels were analyzed using inductively coupled plasma mass spectrometry (ICP-MS).

The dietary tolerances of wild ungulates for the elements considered are not known due to the difficulties associated with sampling large populations of wild mammals. Consequently, the dietary guidelines established for domestic cattle have been used to predict effects on wild ungulates. All elements were below toxic levels for dietary intake by cattle for all sites and species based on dietary guidelines outlined in Puls (1994).

Barium concentration was high, but not toxic/excessive, in grasses at one site (ELG-10) and willows at another (EGL-50). Phosphorus and potassium concentrations were deficient for all sites and species. Moose are present and forage in the Project study areas, year round, and Caribou are known to be occasionally present (Stantec, 2011b).

6.2.3 Methods

Vegetation monitoring will include the establishment of permanent sample sites and sampling on vegetation monitoring plots. Vegetation monitoring plots will utilize a consistent sample layout (Figure 6.2-1). Each plot will have a center point established and four corner points 10 m from the center point in cardinal directions (half-inch diameter rebar metal rods (50 cm long) will be used to mark center and corner points. At the time of establishment, an ecosystem plot will be implemented which will allow documentation of site conditions, terrain and soil, vegetation and wildlife sign. Data will be recorded on BC MOF (1998) detailed ecosystem field data forms (FS882); information will follow standards in the Field Manual for Describing Terrestrial Ecosystems (BC Ministry of Environment, Lands and Parks and BC Ministry of Forests 1998).

Foliar samples of willow, sedge, bluejoint and northern rough fescue will be collected as available at the center and corner points within a 2 m diameter circle around each point. If those particular species are not available within the 2 m circle, then samples will be taken from the nearest available specimens. Samples will be collected in paper bags and dried on site before being transported to the selected laboratory for analysis.

Locations

Four permanent monitoring plots will be established, one in each Dustfall monitoring quadrant (D1-D4) as described in Section 6.1.3 above. Plot locations will be selected in the field based on identification of pre-established ecosystem criteria (the dominant ecosystems, previously identified). Vegetation monitoring plots will be established on the predominant slope, aspect and drainage position within each dominant vegetation ecosystem unit.

- Vegetation and dustfall monitoring station D1 will be co-located with the Potato Hills meteorological station.
- Vegetation and dustfall monitoring station D2 will be located at or near the Camp meteorological station and location of the Partisol Air Quality Sampler. This station will be representative of the Project area boundary.
- Vegetation and dustfall monitoring station D3 will be located below the hilltop just southeast of the Project area. This corresponds to the area of highest TSP concentrations and dustfall that were predicted by dispersion modeling.

- Vegetation and dustfall monitoring station D4 will be approximately 1.5 km south of the camp, to the east of the access road. This location is downwind of prevailing winds at the Camp meteorological station.

Frequency

All permanent vegetation monitoring plots will be sampled once each construction year during the growing season (July to September). The first sampling event will occur in in late summer of the first year of construction.

Data Analysis

Vegetation species composition will be assessed to determine vegetative assembly and local ecosystem changes over the Project phases. Vegetation samples will be analyzed by an accredited laboratory for metals including mercury using inductively coupled plasma mass spectrometry (ICP-MS). Duplicates of selected vegetation samples and reference standards will also be completed for the purpose of QA/QC of laboratory analytical technique.

6.3 SOILS

6.3.1 Introduction and Objectives

The soils monitoring program has been designed to provide data to determine changes to metal and nutrient levels in soils adjacent to the mine as a result of dust deposition. Soils monitoring will be undertaken in conjunction with the vegetation monitoring program to evaluate if Project activities are resulting in increased trace metal and nutrient levels in soils.

6.3.2 Previous Work

Soil baseline studies were conducted during 2009. The background information, methods, and results for the study are presented in the Surficial Geology, Terrain and Soils Baseline Report (Stantec 2011c). For the purposes of the environmental assessment, the Project area was divided into three study areas defined by the proposed development footprint and by terrain features. The local study area (LSA) encompasses the proposed development area, and is 1,606 hectares in size. The LSA is the Dublin Gulch watershed, with extensions to capture proposed development footprint outside the watershed at the northwestern corner (near Ann Gulch), and north of the confluence of Dublin Gulch and Haggart Creek. The regional study area (RSA) encompasses the 1,606 ha LSA plus an additional 5,932 ha surrounding the LSA, for a total of 7,538 ha. The RSA provides broader context for the LSA, and provides baseline information for the vegetation and wildlife disciplines. The RSA is defined by the heights of land to the west and east of the Dublin Gulch watershed, and by Haggart Creek to the north and Lynx Creek to the south. The road corridor study area (RCSA) encompasses the proposed road upgrade corridor for the South McQuesten Road (SMR) and the Haggart Creek Access Road (HCAR). This corridor is approximately 44.8 km long and 1 km wide (500 m either side of the road centreline), or 4,579 ha.

The soil baseline assessment included:

- Description of soil profiles within the LSA, RSA and RCSA, with a total of 142 plots;
- Sampling of soils at 16 locations in the LSA, with subsequent physical and chemical analysis;
- Description and mapping of soil map units for the RSA;
- Soil metals analysis; and
- Interpretation of soils for soil reclamation suitability.

All soils were described according to the Canadian System of Soil Classification (Soil Classification Working Group 1998). Soil samples were taken at various depths (linked to horizon designation) to a maximum depth of 50 cm. Lab analysis of soils included: particle size (fine [<2 mm] and coarse [>2mm]) and pH. Soil map units were mapped and described to characterize topsoil depths and reclamation suitability.

Areas with known ore bodies often have mineralized soils present; as a result they can have naturally elevated concentrations of some metals. Total recoverable concentrations of 30 elements were determined for 19 surface soil samples. Analytical results were checked for exceedance of the Soil Quality Guidelines of the Canadian Council of Ministers of the Environment (CCME 1999) and the Yukon Contaminated Sites Regulation (YSR 2002).

The results of the baseline soil elemental analyses show arsenic was naturally above all guideline values for this parameter in almost all soil and overburden samples. For the remainder of the analyzed elements, three soil samples, and four overburden samples, had Cd, Cu, Pb, Mo, Ni, or Se concentrations which were equal to or exceeded the lowest of the soil quality guidelines, which was often the CCME agriculture guideline limit. Tables 6.4-1 and 6.4-2 are reproduced from Appendix 6 of the Eagle Gold Project Proposal to provide the soil and overburden baseline data set for samples that exceeded guidelines. Further detail is provided in the Environmental Baseline Report: Surficial Geology, Terrain, and Soils (Stantec 2011c).

Table 6.4-1: Surface Soil Sample Metal Exceedances

Sample	Depth (m)	Element	Concentration (mg/kg)	Guideline Limit (mg/kg)	Guideline
EGL8 NT-1	0 – 0.04	Cd	1.4	1.4	CCME Agriculture
EGL17 NT-1	0 – 0.06	Ni	54	50	CCME Agriculture, Parkland
HL6-8 S1	0.3	Se	1.3	1	CCME Agriculture, Parkland

Table 6.4-2: Overburden Sample Metal Exceedances

Sample	Depth (m)	Element	Concentration (mg/kg)	Guideline Limit (mg/kg)	Guideline
P4 S2	1.8 – 2	Cu	81	63	CCME Agriculture, Parkland
		Se	1	1	CCME Agriculture, Parkland
WR3 S1	2	Mo	5.7	5	CCME and Yukon CSR Agriculture
HL5-7 S3	2.2 – 2.5	Pb	85.8	70	CCME Agriculture
		Mo	7.8	5	CCME and Yukon CSR Agriculture
HL6 -1 S3	5 – 5.5	Ni	57	50	CCME Agriculture, Parkland
WR1 S3	6	Cu	84	63	CCME Agriculture, Parkland
		Se	1.2	1	CCME Agriculture, Parkland

A set of 18 historic soil samples from 1995 were also collected and analyzed for total Cu, Fe, Pb, Zn, Mo, and Hg; and evaluated against the above guidelines (full soil analysis results, see Appendix B). All samples were found to be below guideline limits for the assessed elements.

Arsenic

The soil and overburden of the LSA are naturally enriched with arsenic (As), and most baseline samples collected have arsenic concentrations well above the CCME and Yukon CSR guidelines for Agriculture and Parkland soils. Only two of the soil samples, and none of the overburden samples, had a total arsenic concentration below CCME and Yukon CSR summary guidelines (12 and 15 mg/kg, respectively). The mean concentration of As in soils (0 – 50 cm depth) was 193 mg/kg, with a range of 2.4 to 880 mg/kg. In overburden, the mean As concentration was 320 mg/kg, ranging from 23.7 to 1350 mg/kg.

When compared to the receptor-specific guidelines provided in the Yukon CSR, the natural arsenic content of the soils and overburdens in the footprint are above the values considered to pose a risk to livestock, soil invertebrates, plants, and even humans. More than half of the soil samples collected are above the 50-mg/kg guideline recommended to prevent toxicity to soil invertebrates and plants, and all but one are above the limit recommended to prevent illness in livestock ingesting soil while grazing.

The total As concentration in the soils exceeds the thresholds recommended for the protection of soil biota and vegetation by orders of magnitude. It is important to document these elevated pre-disturbance soil arsenic levels, so that post-closure soils analyses do not erroneously attribute elevated arsenic levels to the effects of Project development. These elevated As levels will also require consideration in planning soil handling for reclamation, and for post-closure assessment of reclamation success.

6.3.3 Methods

Soil Sampling

Soil samples will be collected from the surface soil horizon at depths between 0 and 0.5 m, and carefully transferred from the metal shovel and/or split spoon sampler into clean, pre-labeled jars equipped with Teflon-lined lids. Soils collected will be handled only with disposable gloves or clean stainless steel spoons. Soil remaining in the metal shovel and/or split spoon sampler is used to describe and develop a log of the soil characteristics and site stratigraphy for each sample location. To prevent cross-contamination at each sampling location, new nitrile sampling gloves are worn prior to collecting each soil sample.

Locations

Four permanent soil monitoring sampling locations will be established in conjunction with the permanent vegetation monitoring plots, one in each dustfall monitoring quadrant (D1-D4) as described in Section 6.1.3 above. Plot locations will be selected in the field based on identification of pre-established ecosystem criteria (the dominant ecosystems, previously identified). Vegetation monitoring plots will be established on the predominant slope, aspect and drainage position within each dominant vegetation ecosystem unit.

- Soils, vegetation and dustfall monitoring station D1 will be located adjacent to the Potato Hills meteorological station.
- Soils, vegetation and dustfall monitoring station D2 will be located at or near the Camp meteorological station and location of the Partisol Air Quality Sampler. This station will be representative of the Project area boundary.
- Soils, vegetation and dustfall monitoring station D3 will be located below the hilltop just southeast of the Project area. This corresponds to the area of highest TSP concentrations and dustfall that were predicted by dispersion modeling.
- Soils, vegetation and dustfall monitoring station D4 will be approximately 1.5 km south of the camp, to the east of the access road. This location is downwind of prevailing winds at the Camp meteorological station.

Frequency

Soil samples will be collected in coordination with vegetation monitoring and will be collected once during the growing season (July to September) of the construction phase. The first sampling event will occur in Year 2 of construction.

Data Analysis

Soil samples will be analyzed by an accredited laboratory for metals and nutrients using the methods outlined below. Ten percent of analyzed samples will be blind duplicates, as an assurance on analytical quality and consistency.

Test Method

pH in Soil or Solid – analysis will be performed based on procedures described in the “Manual on Soil sampling and Methods of Analysis” (1993) published by the Canadian Society of Soil Science. The test is performed using a deionized water leach with measurement by pH meter.

Particle Size Analysis – the particle size distribution will be determined in accordance with Methods of Soil Analysis Part 1-Physical and Mineralogical Methods (2nd Ed). UBC Methods Manual for Soil Analysis (1981) and Soil Sampling and Methods of Analysis (1993). The percentage gravel, sand, slit and clay will be determined by a combination of a standard dry sieve, wet sieve and pipetting techniques. Particle size limits used to define size fractions are based according to Canadian Soil Survey Committee (CSSC) and U.S. Department of Agriculture (USDA) classification scheme.

CSSC Textural Category – C Clay, S = Sand, SI Slit, L - Loam, CL Clay Loam, SC = Sandy Clay, SIL = Slit Loam, SIC - Silty Clay. LS = Loamy Sand, SL = Sandy Loam. HC = Heavy Clay, SCL - Sandy Clay Loam, SICL = Silty Clay Loam.

Silver–Inductively, Coupled Plasma Mass Spectrometry (ICP/MS).

Arsenic–Inductively Coupled Plasma Mass Spectrometry (ICP/MS).

Cadmium–Inductively Coupled Plasma Mass Spectrometry (ICP/MS).

Mercury–Cold Vapour Atomic Fluorescence.

Molybdenum–Acid digestion followed by determination using Inductively Coupled Plasma Mass Spectrometry (ICP/MS).

Strong Acid Leachable Metals in Soil –B.C. MOELP Method “Strong Acid Leachable Metals In Soil Version 1.0”. The method involves drying the sample at 60 C, sieving using a 2 mm (10 mesh) sieve and digestion using a mixture of hydrochloric and nitric acids. Analysis is performed using inductively Coupled Argon Plasma Spectroscopy (ICAP) or by specific techniques as described.

Selenium Inductively Coupled Plasma Mass Spectrometry (ICP/MS).

Thallium–Inductively Coupled Plasma Mass Spectrometry (ICP/MS).

Particle Size Analysis - Standard – according to the CSSC and USDA Classification schemes. Soil texture is determined according to CSSC definition of texture. The size fractions that are analyzed are 2.0, 0.250, 0.125, 0.053 and 0.002 mm. The % Sand, % Slit and % Clay are based on the <2 mm fraction of the sample by weight.

Total Nitrogen and Sulfur–combustion analyzer where nitrogen in the reduced nitrous oxide gas is determined using a thermal conductivity detector.

Available NO3 and Available NO2–Available Nitrate and Nitrite will be extracted from the soil sample using a dilute calcium chloride solution. Nitrate will be quantitatively reduced to nitrite by passage of the sample through a copperized Cadmium column. The nitrite (reduced nitrate plus original nitrite) is then determined by diazotizing with sulfanilamide followed by coupling with

N-(1-naphthyl) ethylenediamine dihydrochloride. The resulting water soluble dye has a magenta color which, is measured at colorimetrically at 520 nm.

Available P and Available K - Plant available phosphorus and potassium will be extracted from the soil using Modified Kelowna solution. Phosphorous in the soil extract is determined colorimetrically at 880 nm, while potassium is determined by flame emission at 770 nm. .

6.4 PERMAFROST

6.4.1 Introduction and Objectives

The Project site is located in a region of widespread discontinuous permafrost. Construction, operation and closure of the mine have the potential to disturb permafrost. Permafrost monitoring is required to provide information to update engineering design, adaptively manage construction activities that may require the over-excavation of ice rich material, and minimize thawing and permafrost degradation wherever possible.

The permafrost monitoring plan includes the following:

- Surface water quality monitoring (addressed in Section 2.1);
- Visual inspection;
- Subsurface temperature monitoring; and
- Climate monitoring (addressed in Section 5.0).

Baseline monitoring has included regular observation of subsurface temperatures at existing thermistor strings, as well as routine visual inspections of disturbed areas. Depending on the condition and location of the thermistor after construction, additional thermistor strings may need to be installed at selected facilities. In some cases, decisions on specific monitoring will be made as part of detailed engineering design.

6.4.2 Previous Work

A total of thirteen thermistor strings were installed in test holes around the site between 2009 and 2012, as illustrated in Figure 6.5-1. These have been monitored since their installation (BGC 2012a), and will be monitored on a quarterly basis, twice in summer and twice in winter until mine construction begins.

In addition to thermistor readings, subsurface data from 463 test holes with observations of the presence or absence of late summer frozen ground, which may be taken as a proxy for the probable presence of permafrost, has been compiled (BGC 2012a). The distribution of these observations around the Eagle Gold Project site is shown in Figure 6.5-2. These data provide a basis for inferring the spatial distribution of permafrost. The thermistor strings and other subsurface data show the sporadic presence of relatively warm permafrost (generally warmer than -1ºC) in selected areas of the site, and absence of permafrost elsewhere.

6.4.3 Monitoring Methods

Permafrost monitoring will involve the following primary components:

- Visual inspection during construction of selected engineered facilities, including cut or fill slopes greater than 3 m in height, will be inspected visually at regular intervals for signs of sloughing, slumping, settlement, tension cracks, rill or gully erosion, seepage or other evidence of permafrost degradation. Locations where water is ponding will also be noted since they represent heat sources that could potentially trigger subsurface thawing and instability. A record will be prepared for every inspection and compared to previous observations to assess ongoing degradation. This information will inform mitigation strategies or design changes as described in the adaptive management program.
- Subsurface temperature monitoring: shallow and deep ground temperatures will be monitored using existing thermistors. The locations of thermistor monitoring correspond to those where visual monitoring is required. Additional thermistors may need to be installed during construction and will be determined based on site observations and on as needed basis as part of finalizing designs.
- Surface water quality monitoring: runoff from engineered facilities will be monitored for Total Suspended Solids (TSS) and turbidity. Changes in runoff water quality can be used as early indication of evolving issues (e.g. unknown ground disturbance associated with permafrost degradation) before they become more acute issues. Areas demonstrating elevated levels in comparison with CCME guidelines will be investigated by field reconnaissance, and may be further monitored through more frequent visual monitoring, if required, following any remedial efforts considered warranted.

Locations

Existing thermistors depicted on Figure 6.5-1 will be used to monitor permafrost conditions. Efforts will be made to protect existing thermistors as much as possible, however it is expected that many of the existing thermistors will be destroyed by construction activities. Where possible, existing thermistors will be maintained to identify changes in thermal trends as response to ground disturbance due to construction of the facilities. Destroyed thermistors may be replaced with new thermistors, as deemed necessary and installed to an approximate 10 m depth, outside but close to the disturbance areas.

For monitoring during construction and operations, new thermistors may be installed at specific locations where visual monitoring may be necessary to inform detailed design specifications and/or to monitor evolving conditions during operations, including for example:

- Dublin Gulch Diversion Channel (channel and cut slopes)

- Heap Leach Facility:
  - Heap Leach Embankment
  - Heap Leach Pad
- Building pad fills
- Ice-rich storage facilities (abutments and foundation), and
- Waste Rock Storage Facilities.

Frequency

Baseline monitoring, prior to mine construction, will involve reading thermistors four times a year to capture the seasonal fluctuations of ground temperatures and to determine the presence of frozen ground and thickness of the active layer.

Quarterly monitoring of thermistors installed in key facilities to assess trends in changes on permafrost. Visual inspections and surface water quality monitoring will also be carried out quarterly.

Review of compiled weather data will be conducted on an annual basis and will include review of total monthly and annual precipitation, mean monthly and annual temperatures, air freezing indices and air thawing indices. The data will be compared with climate normals for the area.

The monitoring methods and frequencies are summarized in Table 6.5-1.

Table 6.5-1 Monitoring Frequencies for Different Methods

Monitoring Frequency	Construction and Operations	Closure
Visual Inspection	4 per year	2 per year
Subsurface Temperature Monitoring	4 per year	2 per year
Surface Water Quality	4 per year	2 per year
Climate Monitoring	continuous	continuous

Data Analysis

Data from thermistor readings will be plotted as profiles of temperature with depth and as profiles of temperature with time at selected depths noting the following:

- Range of ground temperature;
- Temperature of permafrost at depth;
- Thickness of the active layer;
- Identification of differences in ground temperature with respect to distribution of facilities within the site; and
- Identification of any trends within the ground temperatures with depth that could indicate potential warming.

Data from visual inspections will be collected as photo log albums, indicating date, time and personnel responsible for data collection, accompanied by a written description of observations. Compiled records of visual observations will be reviewed for evidence of permafrost degradation warranting either more vigilant monitoring or remedial action.

Data and findings will be presented in an annual data report, with a detailed assessment of subsurface trends and conditions carried out to determine the need for either more frequent monitoring or remedial effort.

6.5 NOISE

6.5.1 Introduction and Objectives

The objective of the noise monitoring program is to ensure that public users of the Haggart Creek Access Road (HCR) adjacent to the Project site are not at risk of exposure to high sound levels associated with blasting. For on-site personnel project design criteria and procurement policy requires that noise levels from any equipment shall not exceed 85 dBa at 1 metre, and noise level for control rooms and offices shall not exceed 60 dBA at 1 m in accordance with the Yukon Occupational Health Regulations.

The loudest source of noise during construction and operations will be from the use of explosives. The maximum peak sound pressure level of 120 dB is the cautionary limit for blasting. Blasting will occur during construction in the development of the open pit, development of infrastructure pads, and quarry development. Blasting will occur in the open pit throughout the operations phase of the Project and will be scheduled to occur once per day at shift change or lunch break. Blasting will occur only during daylight hours.

The predicted peak sound level (PSL) at 500 m from the open pit is 196 dB. At 1.5 km from the open pit, noise from blasting is expected to be 92 dB north; 85 dB east; 82 dB south; and 103 dB west. These numbers are below the cautionary limit of 120 dB.

Within the site boundaries closest to the open pit, noise levels from blasting will likely be higher than 120 dB during blasting. On-site personnel may be potentially affected by noise from blasting without the proper safety measures in place. The health and safety of on-site personnel with respect to exposure to steady state or impact noise will be managed in accordance with the *Yukon Occupational Health and Safety* and *Regulations*.

By restricting access to the mine site at the gate house on the HCR immediately prior to the site entrance, recreational land users will not be present in the vicinity of the mine during blasting operations. However, the HCR is located directly adjacent to the mine site, and at the closest point, it is approximately 1000 m west of the open pit. Sound levels from blasting in the open pit will be between 196 dB and 103 dB. It is possible that noise levels could exceed 120 dB on the HCR closest to the open pit during blasting. Members of the public and uninformed mine personnel may be potentially affected by noise from blasting when traveling on the HCR.

A number of standard mitigation measures have been incorporated into the Project design to minimize noise including:

- Minimize effect of blasting noise on people and applying Yukon Occupational Health Regulations for employees and restrict public access to the mine site
- Limit blasting to the least noise-sensitive times of day (between 7:00 am and 10:00 pm)
- Locate major crushing equipment and other noise-generating equipment (e.g., blowers and air compressors, etc.) inside buildings wherever possible
- Perform regular inspection and maintenance of vehicles and equipment to ensure that they have high quality mufflers installed and worn parts replaced
- Follow posted vehicle speed limits
- Maintain site haul and secondary roads to minimize vehicle noise associated with vibration
- Turn off equipment when not in use and practical to do so
- Restricting access to the mine site so that recreational land users are not present in the vicinity of the mine during blasting operations

6.5.2 Previous Work

A noise assessment was conducted as part of the Project Proposal developed under the *Yukon Environment and Socio Economic Assessment Act* (YESAA) requirements.

Yukon has no specific regulatory guidance that relates to environmental noise effects on the general public. Hence, guidelines widely used in other jurisdictions where no provincial noise assessment regulations exist were considered. Following these guidelines, a study area, encompassing the Project footprint, the physical area occupied by the Project infrastructure, and an extension beyond the footprint boundary (the Project boundary) of approximately 2 km in all directions, was selected for the noise assessment. Baseline ambient sound levels of 35 dBA Leq(9) nighttime and 45 dBA Leq(15) daytime were applied for the assessment. Sound level modeling was conducted using the software CADNA/A Version 4.0 (DataKustik GmbH (DataKustik) 2009) for Project construction, operations, blasting, and decommissioning. Predictions at 1.5 km from the Project boundary were compared to the regulatory noise criteria to evaluate Project compliance.

The construction-related noise limits for residential areas are 65 dBA Leq(12) for daytime, 60 dBA Leq(4) for evening, and 55 dBA Leq(8) for nighttime and all day for Sundays and holidays set by Environment Canada (1989) *Code of Practice*. Because the Project construction equipment will be operating continuously, the focus was to assess the effects of construction noise in relation to the most stringent regulatory criteria (nighttime limit of 55 dBA Leq(8)).

During construction and decommissioning, the maximum predicted nighttime sound level will be 42 dBA Leq(8) and the maximum cumulative predicted nighttime sound level, including ambient baseline sound levels, will be 43 dBA Leq(8). This is less than the Environment Canada (1989) *Code of Practice* nighttime limit of 55 dBA Leq(8) for construction-related noise. Therefore predicted noise levels during the construction phase are well below generally accepted regulatory criteria.

Permissible sound levels (PSLs) are 50 dBA Leq(15) for operations during daytime and 40 dBA Leq(9) for operations during nighttime, respectively. During Project operations, the maximum predicted daytime sound level is 41 dBA Leq(15). The maximum cumulative predicted daytime sound level, including ambient baseline sound levels, is 46 dBA Leq(15), which is less than the daytime PSL of 50 dBA Leq(15). During Project operations, the maximum predicted nighttime sound level associated with the Project alone is 36 dBA Leq(9). The maximum cumulative predicted nighttime sound level, including ambient baseline sound levels, is 39 dBA Leq(9), which is lower than the PSL of 40 dBA Leq(9). Therefore, predicted noise levels during the operation phase are within the generally accepted applicable regulatory criteria in Canada.

The maximum predicted daytime peak (instantaneous) sound level at 1.5 km from the Project boundary during blasting is approximately 104 dBA. All predicted peak sound levels at receptors located 1.5 km from the Project boundary are well below the cautionary limit of 120 dB, as specified by the Ontario MoE (1978) *NPC-119 Blasting*.

Based on the results of the noise assessment, predicted sound levels at 1.5 km from the Project boundary during construction, operation, and decommissioning phases are expected to remain within acceptable limits of the generally accepted criteria for ambient sound quality in Canada.

6.5.3 Methods

In accordance with term and condition #121 of the Decision Document, SGC will monitor sound-levels related to blasting activities along the portion of the HCR that is within the 1.5 km boundary identified in the Noise Assessment Report. Should noise levels on the HCR exceed 120 dB, SGC will use personnel to control and inform traffic on this portion of the HCR during blasting events until such time as the noise monitoring demonstrates blasting noise is consistently below 120 dB.

Prior to scheduled blasting events, a technician will travel to the monitoring locations and record sound levels during blasting. Sound levels will be measured using a Class 1 Sound Level Meter that has a dynamic range of at least 30 - 140 dB.

6.5.4 Location

Monitoring will be completed at several fixed locations on the HCR closest to the open pit. Additionally, SGC will conduct instantaneous monitoring at specific locations to be determined based on blasting locations during construction if outside of the open pit area or, if warranted by a noise complaint.

6.5.5 Frequency

Sound monitoring will be initially undertaken monthly for a minimum of 3 months to determine if the peak sound levels during blasting exceed 120 db. If sound levels do not exceed 120 dB during this period and blasting operations do not vary, monitoring and road restrictions during blasting will be discontinued until warranted by a change in blasting procedures that may increase sound levels in the area or if warranted by a noise complaint. In the event sound levels exceed 120 db during blasting, monitoring will continue during blasting activities to ensure access road restrictions are necessary.

6.5.6 Data Analysis and Reporting

Recorded sound levels will be collected and stored in an electronic database. Data reports will be made available upon request. Any noise complaints received will be recorded and included.

Based on the results of the monitoring additional mitigation measures, or adaptive management strategies will be identified and implemented as required.

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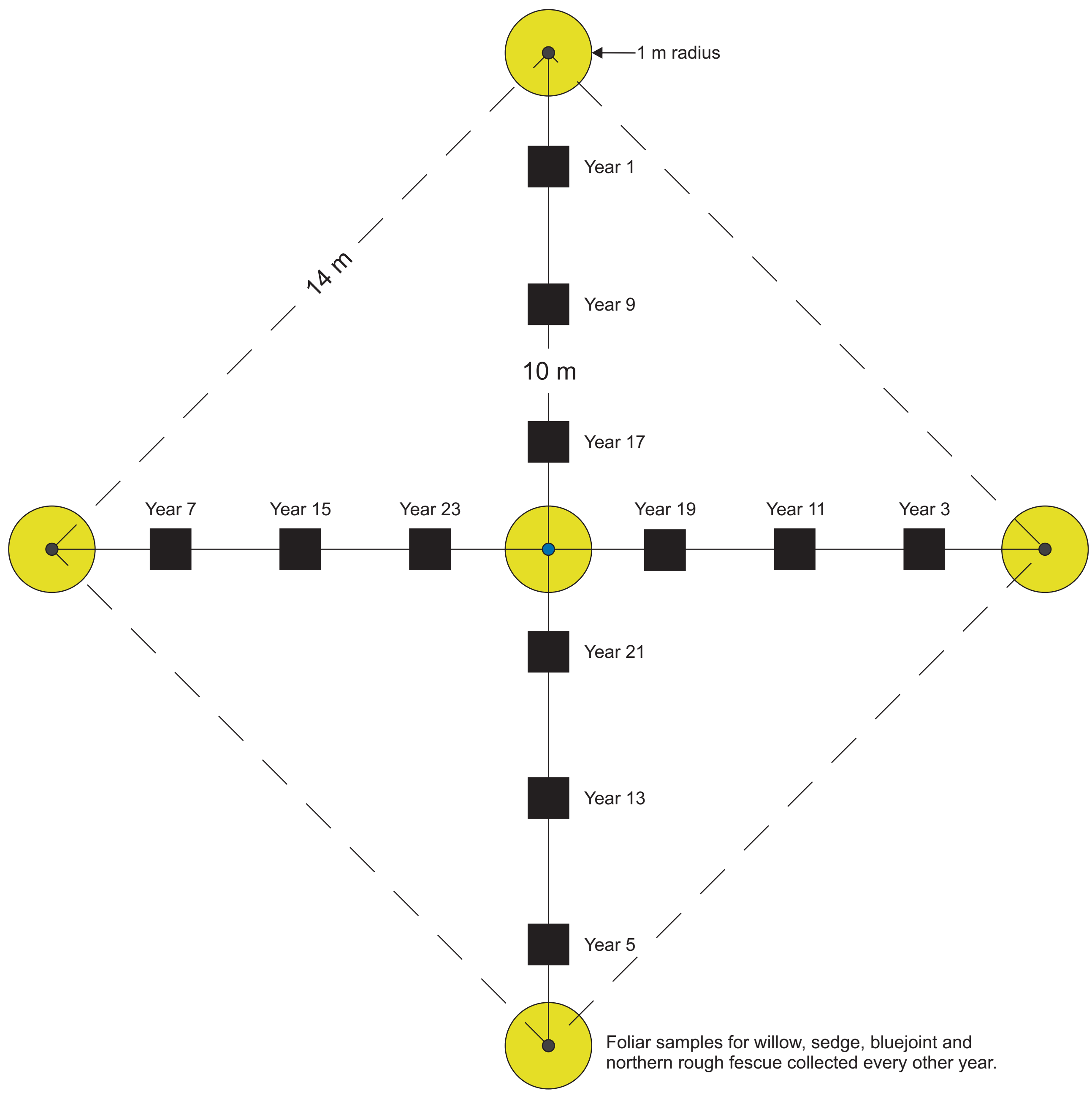


LEGEND

1 m radius

Vegetation sample plot locations; painted ½ inch rebar to locate centre and corner plots; foliar samples collected every other year.

Soil sampling locations, surface horizon between 0 and 0.5 m depths; one sample every other year.

STATUS
ISSUED FOR REVIEW

CLIENT
StrataGold Corporation

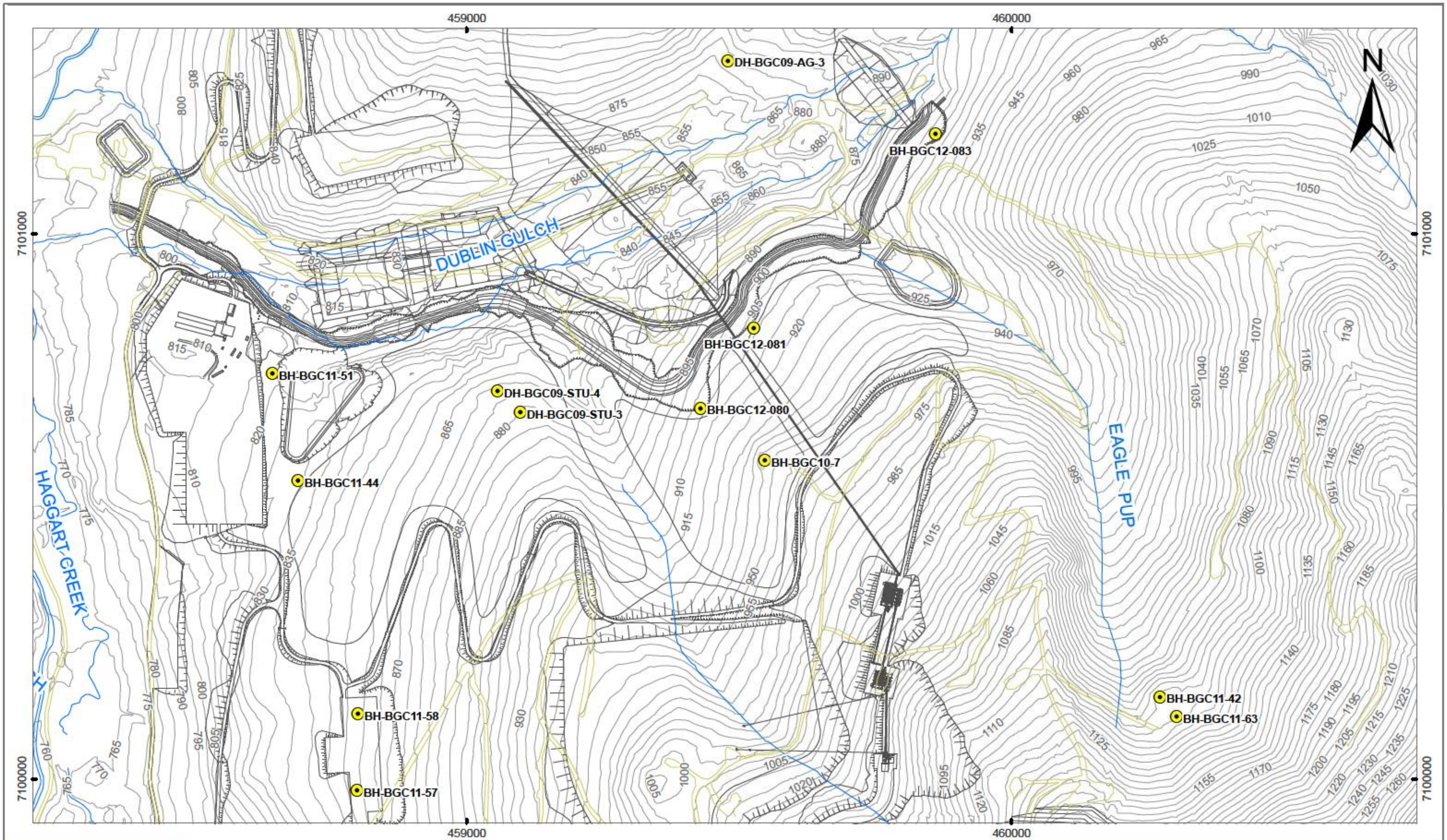
eba
A TETRA TECH COMPANY

EAGLE GOLD PROJECT
YUKON TERRITORY

Vegetation/Soil Permanent Monitoring Plot Layout

FILE NO. CDR001-1_Veg-Soils-PlotLayout.cdr				
PROJECT NO.	DWN	CKD	APVD	REV
Eagle Gold	KW	GC	GC	0
OFFICE	DATE			
VANC	April 16, 2013			

Figure 6.2-1



LEGEND

- BGC THERMISTOR
- PROPOSED INFRASTRUCTURE LAYOUT
- EXISTING ROADS
- STREAM
- 5 m CONTOUR

NOTES

1. Proposed infrastructure layout received from Wardrop March 28, 2012.
2. BH-BGC11-57, BH-BGC12-080 and BH-BGC12-081 contain both standpipe piezometers and thermisters.

STATUS
ISSUED FOR REVIEW

Scale: 1:10,000
190 95 0 190
Metres

PROJECTION	DATUM
UTM Zone 8	NAD83

FILE NO. BGC: X:\Projects\0792 Victoria Gold\008\Workspace\20130108_REPORT_Ice_Rich_Materials_Management_Plan\6_4_1_Thermistors_Installed_by_BGC.mxd

CLIENT StrataGold Corporation — BGC

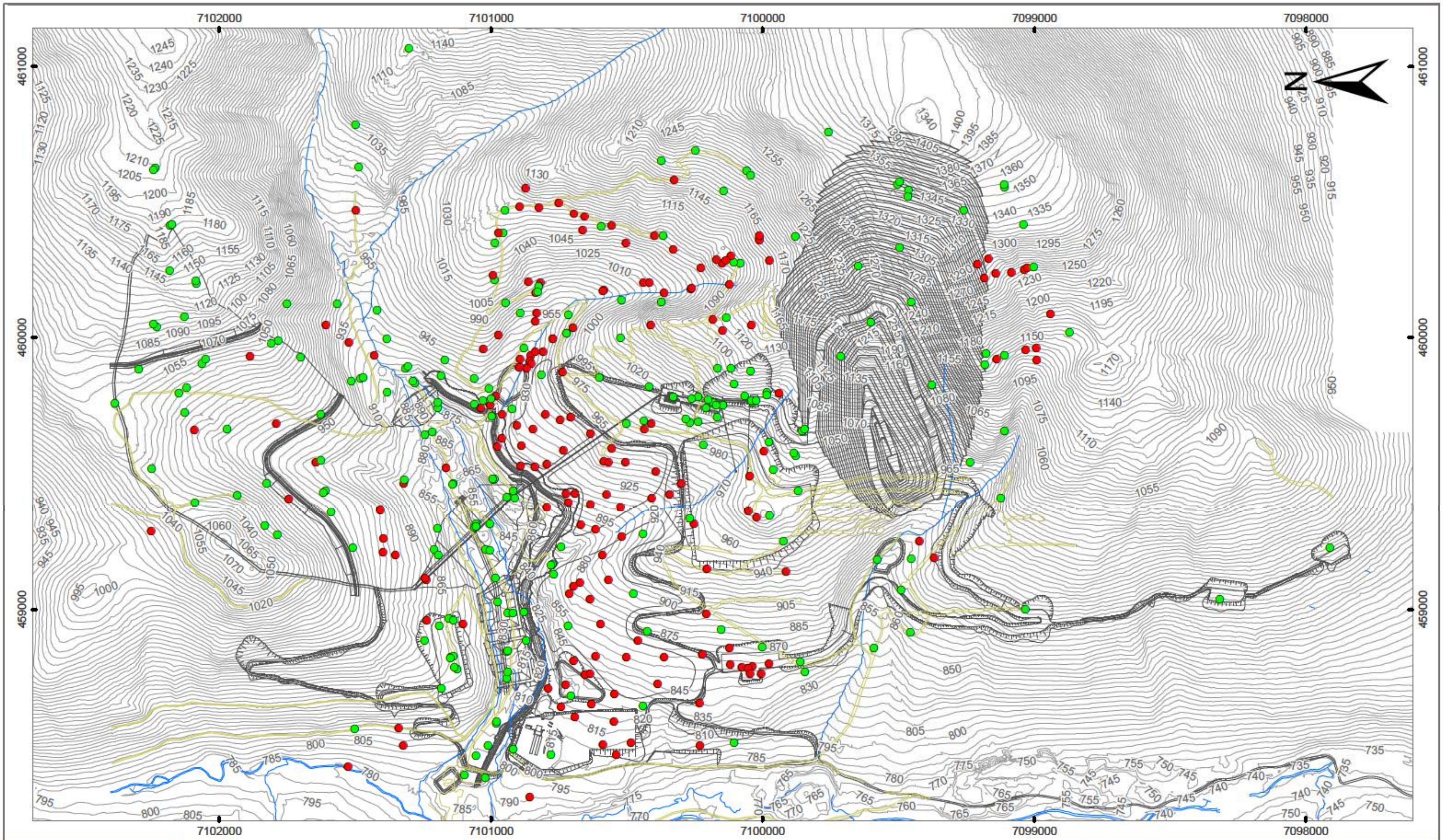
EAGLE GOLD PROJECT YUKON TERRITORY

Thermistors Installed By BGC

PROJECT	DWN	CKD	APVD	REV
Eagle Gold	LL	DW	PQ	0

OFFICE	DATE
	JANUARY 2013

Figure 6.5-1



LEGEND

- FROZEN SOIL
- NO FROZEN SOIL
- PROPOSED INFRASTRUCTURE LAYOUT
- EXISTING ROADS
- STREAM
- 5 m CONTOUR

NOTES

1. Proposed infrastructure layout received from Wardrop March 28, 2012.

STATUS
ISSUED FOR REVIEW

Scale: 1:20,000

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Metres

PROJECTION	DATUM
UTM Zone 8	NAD83

FILE NO. BGC: X:\Projects\0792 Victoria Gold\008\Workspace\20130108_REPORT_Ice_Rich_Materials_Management_Plan\6_4_2_Frozen_Ground_Observations.mxd

CLIENT
StrataGold Corporation
BGC

EAGLE GOLD PROJECT YUKON TERRITORY

Frozen Ground Observations

PROJECT	DWN	CKD	APVD	REV
Eagle Gold	LL	DW	PQ	0

OFFICE

DATE
January 2013

Figure 6.5-2