VICTORIA GOLD CORP
TSX | VGCX

December 2, 2020

Mr. Todd Powell, Director
Mineral Resources Branch
Yukon Government Department of Energy, Mines and Resources
#400 - 211 Main Street, Box 2703
Whitehorse, Yukon Y1A 2C6

Dear Mr. Powell,

RE: Eagle Gold Mine QML-0011 Environmental Audit

As required by Clause 12.1 of the Quartz Mining License QML-0011 for the Eagle Gold Mine, please find enclosed an audit undertaken by Stantec Consulting Ltd. (Stantec) of the environmental protection plans and regulatory controls set out in QML-0011.

Stantec, in their capacity as the approved independent contractor for this audit, were tasked with the review of the management, operations and practices of Victoria Gold (Yukon) Corp. that are intended to ensure environmental protection during production and development of the Eagle Gold Mine. Stantec's key findings are provided within the report and Stantec has stated in the audit report:

> *"Reports and data reviewed do not indicate that indicators of environmental quality (water quality and quantity, aquatic resources (sediment, benthic invertebrates, fish and fish habitat) air quality, soils, vegetation, wildlife and wildlife habitat, stability of physical structures and waste management) are degraded or degrading."*

Also enclosed is Victoria's report detailing the remedial actions that we will undertake in response to the audit.

If you have any questions, please do not hesitate to contact our office.

Sincerely,

Hugh Coyle
Lands & Permitting Manager

Eagle Gold Mine 2020 Environmental Audit Report

November 30, 2020

Prepared for:

Victoria Gold Corporation

Prepared by:

Stantec Consulting Ltd.

Project Number: 123221646

Revision: 1

Executive Summary

The Eagle Gold Mine (the Project), is owned and operated by Victoria Gold (Yukon) Corp (VGC) and is located within the Mayo mining district of Yukon Territory, Canada. The mine is situated approximately 85 km north of Mayo and 400 km north of Whitehorse. The Project is an open pit mine, in-valley heap leach with three stage crush and gold recovery plant.

VGC received a quartz mining license to build the open pit mine in September 2013. A Comprehensive Cooperation Benefits Agreement was signed with the First Nation of Na-Cho Nyak Dun in 2011. Preliminary construction works began in August 2017 and full construction works commenced in March 2018. The Project poured its first gold Q3, 2019 and achieved commercial production on July 1, 2020. In full production, the mine will produce 210,000 ounces per year and the mine life is ten plus years.

Clause 12.0 of Quartz Mine License 0011 (QML-0011) requires the undertaking of an environmental audit every two years, by an independent contractor acceptable to the Director of the Mineral Resources Branch of EMR. Stantec Consulting Ltd. (Stantec) was contracted by VGC to complete an Environmental Audit for the Project in accordance with the conditions of QML-0011. The period of this audit report is inclusive of monitoring and surveillance activities at the Project site from July 1, 2018 to June 30, 2020. This report will be the first audit for the mine, and this audit spans the construction phase and into the first year of mine operations.

The audit scope involved an evaluation of compliance with the following approved plans:

- Environmental Monitoring, Surveillance and Adaptive Management Plan (EMSAMP) Version 2018-01, 2019-01 and 2020-01
- Construction and Operations Water Management Plan Version 2017-01,
- Water Management Plan Version 2020-01,
- Solid Waste and Hazardous Materials Management Plan Version 2017-02,
- Spill Response Plan Version 2017-02,
- Wildlife Protection Plan Version 2017-01.

The auditors reviewed the following regulatory reporting submissions:

- Water License QZ14-041-01 / Quartz Mining License QML-0011 2018 Annual Report and relevant appendices,
- Water License QZ14-041-01 / Quartz Mining License QML-0011 2019 Annual Report and relevant appendices,
- Monthly reports covering climate, air quality, hydrology, groundwater quality and quantity, surface water quality, geochemistry, soils, vegetation, and physical structures monitoring from January to June 2020 and relevant appendices,

- Annual Physical Stability Assessment Report dated December 20, 2018,
- Annual Physical Stability Assessment Report dated October 29, 2019,
- Quarterly Wildlife Reports from September 2018 to June 1, 2020.

Additional records and documents that were reviewed, but not listed above, are listed in the discipline sections under sub-sections titled ‘Documents Reviewed’.

The audit evaluated:

- Compliance and adequate implementation of the plans and associated monitoring programs,
- Confirming the water monitoring (surface water quality and quantity, groundwater, and aquatic, habitat), terrestrial environment and physical stability assessments were completed to the specifications in the approved plans.

The following general steps were taken to conduct the audit:

1. Identification of documents to be reviewed to fulfill the audit objectives and requirements
2. Comparison of monitoring activities at all sites against the execution described in the. EMSAMP for frequency, methods, and results,
3. Review of data quality assurance and quality control procedures,
4. Confirmation that AMP thresholds are being monitored in conformance with the EMSAMP,
5. Confirmation that AMP responses follow what is outlined in the EMSAMP and were reported, appropriately,
6. Provision of an audit adequacy statement regarding conformance with plans within the audit scope,
7. Provision of a summary table of identified gaps and/or recommendations for the monitoring programs

Key findings of the audit are provided in section 8.0 of the report. Overall, the implementation of VGC’s environmental management system has been adequate and has demonstrated continual improvement throughout the audit period. Reports and data reviewed do not indicate that indicators of environmental quality (water quality and quantity, aquatic resources (sediment, benthic invertebrates, fish and fish habitat) air quality, soils, vegetation, wildlife and wildlife habitat, stability of physical structures and waste management) are degraded or degrading.

Stantec noted that there were some common deficiencies across several monitoring programs and associated recommendations (Table ES 1).

Table ES 1 Global Audit Themes and Corrective Actions

Global Audit Deficiency	Recommendation
Reporting monitoring activities and results without sufficient supporting data and information (e.g., validated datasets, statistical analyses, results compared against relevant standards or guidelines)	All reports (monthly, quarterly, annual) should provide validated data sets, supporting data QA/QC documentation, and data analyses and interpretation specified in the project Environmental Monitoring and Surveillance and Adaptive Management Plan
Inconsistent implementation and/or documentation of QA/QC programs	Standard Operating Procedures and/or checklist QA/QC checklist should be developed for all monitoring programs
Equipment malfunction resulting in gaps in datasets (i.e. climate, hydrology)	Regularly inspect equipment and data sensors/loggers to prevent prolonged periods of data loss. Maintain an Equipment Maintenance Log for monitoring equipment and maintain equipment on a regular schedule and/or as required
Missing rationale in reports for gaps in implementation of monitoring schedules	Provide rationale for gaps in quarterly, monthly, and annual reporting, and any corrective action taken to address gaps
For monitoring programs with numerical threshold standards or objectives, statistical analyses were not performed to determine if statistically significant changes occurred to the receiving environment (i.e. air quality, hydrology, surface water quality, groundwater, soils, vegetation)	Develop discipline-appropriate statistical tests and report on trend analysis relative to baseline data
Lack of adaptive management responses or rationale for not implementing adaptive management measures.	Provide reasoning for implementing and not implementing adaptive management measures in quarterly, monthly, and annual reporting

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Abbreviations

ADR	Adsorption Desorption Recovery
AMP	Adaptive Management Plan
AMT	Adaptive Management Threshold
AQC	Air Quality Criteria
AQMP	Air Quality Monitoring Plan
BMP	Best Management Practices
CAAQS	Canadian Ambient Air Quality Standards
CCME	Canadian Council of Ministers of the Environment
DQO	Data Quality Objective
EBAM	Beta-Attenuation Particulate Monitors
EC	Environment Canada
EMR	Department of Energy, Mines and Resources
EMSAMP	Environmental Monitoring and Surveillance Plan
EOR	Engineer of Record
EP	Eagle Pup
EPCM	Engineering Procurement Construction Management
EQS	Effluent Quality Standards
ESC	Erosion Sediment Control
EVP	Event Pond
FNNND	First Nation of Na-Cho Nyak Dun
FOS	Factor of Safety
FT	Mine Water Treatment Plant Finishing Tank
HLF	Heap Leach Facility
HLFUMV	Heap Leach Facility Underdrain Monitoring Vault
IFC	Issued for Construction

ISQG	Interim Sediment Quality Guideline
LDSP	Lower Dublin South Pond
LDSPI	Lower Dublin South Pond Inflow
LDSPO	Lower Dublin South Pond Outflow
LDSP-UND	LDSP Undertrain Outflow
MDMER	Metal and Diamond Mine Effluent Regulations
MWTP	Mine Water Treatment Plant
NH_3	Ammonia
NO_2	Nitrogen Dioxide
OAQC	Ontario Air Quality Criteria
OPP	Open Pit Pond
OPPO	Open Pit Pond Overflow
PASS	Passive Air Sampling Systems
PDI	Platinum Gulch Ditch
PEL	Probable Effects Level
PG	Platinum Gulch
PGS	Platinum Gulch WRSA Seepage
PM_{10}	Particulate Matter 10 (microns)
$PM_{2.5}$	Particulate Matter 2.5 (microns)
PS	Open Pit Sump
QA	Quality Assurance
QC	Quality Control
QML	Quartz Mine License
SGC	StrataGold Corporation
SO_2	Sulphur Dioxide
SOP	Standard Operating Procedure
TDR	Time-domain Reflectometer
TSP	Total Suspended Particulate

TSS	Total Suspended Sediment
VGC	Victoria Gold (Yukon) Corp.
WL	Water Licence
WMP	Water Management Plan
WPP	Wildlife Protection Plan
WQO	Water Quality Objective
WRSA	Waste Rock Storage Area
YAAQO	Yukon Ambient Air Quality Objectives
YESAA	Yukon Environmental and Socio-Economic Act

1.0 INTRODUCTION

Stantec Consulting Ltd. (Stantec) was retained by Victoria Gold (Yukon) Corporation (VGC) in August 2020 to carry out an audit of the Eagle Gold Mine (the Project) in accordance with the conditions of the Quartz Mine License QML-0011 (QML). The objective of this audit was to assess whether the environmental management plans and regulatory controls set out in the QML are implemented in and about the mine and that the environmental management systems and controls are functioning as intended.

1.1 BACKGROUND

The Eagle Gold Mine is owned and operated by VGC and is located within the Mayo mining district of Yukon Territory, Canada. The Project is situated approximately 85 km north of Mayo and 400 km north of Whitehorse. The Project is an open pit mine, in-valley heap leach with three stage crush and gold recovery plant.

VGC completed the Environmental Assessment process under the *Yukon Environmental and Socio-economic Assessment Act* (YESAA) and received Decision Documents from the Yukon Government and federal regulatory agencies in April 2013. An initial quartz mining license was received in September 2013, followed by a Water Use License in Dec 2015. Preliminary construction began in August 2017 and full construction works commenced in March 2018. A Comprehensive Cooperation Benefits Agreement was signed with the First Nation of Na-Cho Nyak Dun in 2011.

In 2017, construction activities began with camp expansion, access road upgrades, site road construction, diversions and ditching, pond construction, clearing and grubbing, civil earthworks, septic system upgrade, and borrow source development. In March 2018, after a winter hiatus, activities resumed and included construction of Phase I of the Heap Leach Facility (HLF), Events Pond, Crushing and Screening Plants, Overland Conveying System and coarse ore transfer areas, Cement and Lime Silos, Adsorption, Desorption and Recovery Plant and Reagent Storage Buildings, Metallurgical Laboratories, Administration Office, mine offices, ANFO and Detonator Storage, Water Distribution Systems, pre-stripping of the Eagle pit and initial development of the Platinum Gulch Waste Rock Storage Area, and construction of 90-day Ore Stockpile.

Commissioning of the built facilities began in Q2 2019. On February 16, 2019, VGC notified responsible authorities of their intent to enter the Production Phase (defined in the regulatory approvals as the relocation of waste rock from the Eagle Pit to a waste rock storage area) on March 17, 2019.
Ore production commenced on July 1, 2019 and VGC poured its first gold Q3, 2019. The mine achieved commercial production on July 1, 2020. In full production, the mine will produce 210,000 ounces per year and the mine life is ten plus years.

1.2 REGULATORY SETTING

The operation of the Project is governed by various regulatory approvals and non-discretionary Territorial and Federal legislation. A key regulatory approval for the Project is the Quartz Mining Licence QML-0011 issued pursuant to section 141(2)(a) of the Quartz Mining Act by the Department of Energy, Mines and Resources (EMR).

Clause 12.0 of QML-0011 requires the undertaking of an environmental audit every two years, by an independent contractor acceptable to the Director of the Mineral Resources Branch of EMR.

The period of this audit report is inclusive of monitoring and surveillance activities that occurred at the mine site from July 1, 2018 through to June 30, 2020. This report documents the first audit and spans the end of construction activities and into the first year of mine operations.

Three approved versions of the Project Environmental Monitoring and Surveillance and Adaptive Management Plan (EMSAMP) [versions 2018-01, 2019-01, 2020-01] and two versions of the Water Management Plan (WMP) [versions 2017-02 and 2020-01] were effective for specific timeframes during the audit period. The Solid Waste and Hazardous Waste Management Plan (version 2017-02), Spill Response Plan (version 2017-02) and Wildlife Protection Plan (2017-01) were in effect for the entire audit period. Table 1 shows the effective periods of the plans approved during construction and operations.

Table 1 Effective Time Periods of Management Plans

Audit Period	Plans / Effective Period	Project Phase
Audit Period (July 1, 2018–June 30, 2020)	EMSAMP 2018-01 (Beginning of Audit Period: July 1, 2018–June 18, 2019)	**Construction** (August 18, 2017–March 16, 2019) **Operations/Production Phase** (commencement of operations — March 17, 2019–present)
	EMSAMP 2019 -01 (June 19, 2019–May 18, 2020)	End of Construction, Beginning of Operations
	EMSAMP 2020-01 (May 19, 2020–June 30, 2020, End of Audit Period)	Operations
	Construction and Operations Water Management Plan 2017-02 – (Beginning of Audit Period, July 1 2018 to January 2020)	Construction and Beginning of Operations
	Water Management Plan 2020-01 – January 2020 to June 30, 2020 End of Audit Period	Operations

Monitoring activities and results specified by these plans (reported in annual and monthly reports) were audited to the requirements of these plans, during their effective period.

1.3 APPROACH

The scope and objectives of the audit were approved by the Yukon Government Department of Energy, Mines and Resources (EMR). The audit for 2020 was a desk top exercise due to Covid-19 precautions.

The audit scope involved an evaluation of compliance with the following approved plans:

- Environmental Monitoring, Surveillance and Adaptive Management Plan (EMSAMP) Version 2018-01, 2019-01 and 2020-01
- Construction and Operations Water Management Plan Version 2017-01,
- Water Management Plan Version 2020-01,
- Solid Waste and Hazardous Materials Management Plan Version 2017-02,
- Spill Response Plan Version 2017-02,
- Wildlife Protection Plan Version 2017-01.

The auditors reviewed the following regulatory reporting submissions:

- Water License QZ14-041-01 / Quartz Mining License QML-0011 2018 Annual Report and relevant appendices,
- Water License QZ14-041-01 / Quartz Mining License QML-0011 2019 Annual Report and relevant appendices,
- Monthly reports covering climate, air quality, hydrology, groundwater quality and quantity, surface water quality, geochemistry, soils, vegetation and physical structures monitoring from January to June 2020 and relevant appendices,
- Annual Physical Stability Assessment Report dated December 20, 2018,
- Annual Physical Stability Assessment Report dated October 29, 2019,
- Quarterly Wildlife Reports from September 2018 to June 1, 2020.

The audit evaluated:

- Compliance and adequate implementation of the plans and associated monitoring programs,
- Confirming the monitoring (surface water quality and quantity, groundwater, and aquatics and fish and fish habitat), terrestrial environment and physical stability assessments were completed to the specifications in the approved plans and licences.

The following general steps were taken to conduct the audit:

1. Identification of documents to be reviewed to fulfill the audit objectives and requirements,
2. Comparison of monitoring activities at all sites against the execution described in the EMSAMP for frequency, methods, and results,
3. Review of data quality assurance and quality control procedures,
4. Confirmation that AMP thresholds are being monitored in conformance with the EMSAMP,
5. Confirmation that AMP responses follow what is outlined in the EMSAMP and were reported appropriately,
6. Provision of an audit adequacy statement regarding conformance with plans within the audit scope, and
7. Provision of a summary table of identified gaps and/or recommendations for the monitoring programs.

The evaluated disciplines were meteorological and atmospheric environment, water resources (which included surface quantity and quality, groundwater quantity and quality, geochemistry and the aquatic environment), the terrestrial environment (which included reclamation, vegetation, soils, and wildlife) and geotechnical stability (which included permafrost monitoring, open pits, material storage and stockpiles and the heap leach and process facilities). The audit also covered a review of the solid waste and hazardous materials handling and spill response.

In accordance with VGC commitments during the YESAA process ongoing noise monitoring is not required. VGC has committed to monitoring sound levels related to significant changes in mining activity or if complaints are made. VGC conducted monitoring of noise levels during blasting in July 2018 and again in May and June 2019. Noise levels were below thresholds set out in the EMSAMP (below 120 dB) therefore continued monitoring was not necessary. VGC has committed to recording any noise complaints received and including them in reporting required by the regulatory approvals for the Project. Additional mitigation measures, or adaptive management strategies will be identified and implemented as required.

2.0 ATMOSPHERIC ENVIRONMENT

This section presents an audit of the climate and air quality monitoring programs as specified in the applicable EMSAMP documents, compared to the data and information reported in supporting annual and monthly reports. The intent is to determine if ongoing monitoring and data collection meets the commitments outlined in the EMSAMP.

2.1 CLIMATE

2.1.1 Documents Reviewed

Documents shown in Table 2 were reviewed for the climate monitoring section of the audit:

Table 2 Climate Monitoring Program Documents Reviewed

Document	Version Reviewed	Sections Applicable during Construction Phase	Sections Applicable to Mine Operations Phase
EMSAMP	2018-01	10.0 – Climate	N/A
EMSAMP	2019-01	10.0 – Climate	N/A
EMSAMP	2020-01	N/A	10.0 - Climate
Water Licence QZ14-041 Quartz Mining License QML-0011 2018 Annual Report	N/A	3.7.1 – Climate Monitoring; Appendix M Climate Data	N/A
Water Licence QZ14-041 Quartz Mining License QML-0011 2019 Annual Report	N/A	3.8.1 – Climate Monitoring; Appendix R Climate Data	N/A
Type A Water Use License QZ14-041-1 Monthly Report, Reporting Period: January 2020 to June 2020	N/A	N/A	Section 6.1 of monthly reports
Standard Operating Procedures/QA/QC Program	Not developed	Not developed	VGC SOP ENV 17 Weather and Climate Stations

2.1.2 Monitoring Program Implementation and Data QA/QC

Two solar powered automated climate stations are currently operating in the Project area. The Potato Hills station (elevation 1,420 m) was installed in 2007 and the Camp station (elevation 782 m) in 2009. The climate stations continuously collect data for the following parameters:

- Air temperature
- Precipitation
- Wind speed and direction
- Barometric pressure,
- Solar radiation
- Snow depth, and
- Relative Humidity

Snow depth information is also collected during winter with monthly manual snow course surveys near both climate stations and in the vicinity of the Heap Leach Facility (in Ann Gulch). During the audit period, the 2018 manual snow survey location in Ann Gulch was discontinued due to construction activity (HLF Phase 1 construction). The new survey location was established in 2019 upgradient of the HLF.

Climate data for each station is collected and submitted in full as excel data and also summarized in annual and monthly reports for the following frequencies:

- Monthly and annual recorded mean, minimum and maximum air 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
- Monthly and annual recorded mean, minimum and maximum net solar radiation
- Estimates of monthly sublimation and evaporation/evapotranspiration

Data retrieval frequencies require monthly station visits during the open water season concurrent with hydrology data collection, and in the winter concurrent with collection of the manual snow course surveys.

Climate monitoring parameters, frequencies and reporting requirements have remained the same throughout construction and operations phases.

Table 3 summarizes compliance with the construction and operations EMSAMPs climate data collection programs for the audit period. Note that the data record is considered incomplete for a month when there are less than 25 days of data available for that month.

Table 3 Climate Monitoring Program Implementation

Monitoring Method	EMSAMP Version 2018-01 Compliance	EMSAMP Version 2019-01 Compliance	EMSAMP Version 2020-01 Compliance	Data QA/QC	Reporting
Climate Station: Potato Hills	• Data record incomplete[1] for: – Air temperature – Wind speed and direction[2] – Relative humidity – Barometric pressure – Solar radiation – Snow depth[3] • Station replaced on Sept. 22, 2018, but malfunctioned Dec. 2018	• Data record incomplete for: – Air temperature[5] – Wind speed and direction[5] – Relative humidity[6] – Barometric pressure[6] – Wind direction[2] – Snow depth[7] – Precipitation[8] – Solar radiation[9] • Station decommissioned in Oct. 2019. To be replaced in 2020	• Data record incomplete[11] for: – Wind speed and direction – Relative humidity – Barometric pressure – Wind direction – Snow depth – Precipitation – Solar radiation • Station replaced March 13, 2020. Data was not recorded during May due to technical malfunction. Servicing completed in May 2020 to correct malfunction.	Data set was incomplete for the audit period, but improved consistently in monthly data collection during 2020	• Annual reports are adequate • Monthly reports should present summary statistics of raw data for snow depth, wind direction and solar radiation, similar to summary statistics presented for temperature, barometric pressure, relative humidity, wind speed and precipitation.
Climate Station: Camp	Data record complete	• Data record incomplete for: – Precipitation[10]	• Data record incomplete for: – Precipitation[12] • Station received general maintenance and a replacement of the existing precipitation gauge with a Geonor all-weather precipitation monitor March 11, 2020. Data complete to end of April. Data was not recorded throughout May due to technical malfunction. Servicing completed in May 2020 to correct malfunction. Data complete from May 28–June 30, 2020	Incomplete for the audit period, but improved significantly during 2020	
Manual Snow Course Survey: Potato Hills	Data record complete	Data record complete	Data record complete	Complete	Annual and monthly reporting is adequate
Manual Snow Course Survey: Camp	Data record complete	Data record complete	Data record complete	Complete	
Manual Snow Course Survey: Ann Gulch	Data record incomplete[4]	• Discontinued due to construction • Re-established at HLF (in Ann Gulch upgradient from HLF Phase 1 construction)	N/A	Complete	
Manual Snow Course Survey: Heap Leach Facility (HLF)	N/A	Data record complete	Data record complete	Complete	

Table 3 Climate Monitoring Program Implementation

NOTES:

[1] Air temperature, wind speed, relative humidity and barometric pressure data were not recorded to the central datalogger at Potato Hills for the following time periods in 2018: April 28 to May 16; June 7 to June 29; July 3 to July 13; August 5 to September 22; and December 2 to December 16.

[2] Potato Hills wind direction sensor was disabled in October 2018 due to power drain on other station sensors.

[3] The snow depth sensor installed at the Potato Hills climate station did not return usable data for the period January 2017 to December 2018.

[4] The Ann Gulch survey location was not available in 2018 due to construction activities in the area. A new survey location was established in 2019 uphill from the active HLF pad.

[5] Potato Hills air temperature and wind speed data were not recorded to the central datalogger for the following time periods in 2019: February 1 to February 28; May 10 to June 1; August 17 to August 24; and September 4 to October 7. No wind direction data was available from the Potato Hills climate station in 2019.

[6] Potato Hills barometric pressure and relative humidity data were not recorded for the following time periods in 2019: February 1 to February 28; May 10 to June 1; August 17 to October 7.

[7] Potato Hills snow depth sensor installed returned minimally usable data for the periods of March 1 to April 16 and May 2 to May 9, 2019.

[8] The Potato Hills climate precipitation sensor did not return usable data from March to June 2019 and from August to October 2019.

[9] The Potato Hills solar radiation sensor did not return usable data for 2019.

[10] The Camp climate station precipitation sensor did not return usable data from January 2019 to December 2019.

[11] Audit of 2020 climate data collection program was based solely on monthly summary data reports. Data gaps are considered preliminary until data validation is performed for the purposes of annual reporting.

[12] The Camp climate station precipitation gauge malfunctioned in January 2020. Precipitation data was incomplete to the end of May 2020.

2.1.3 Reporting Adequacy, Compliance and Recommendations

Data gaps in the implementation of the climate monitoring program during the construction and operations phase of the audit period were due to malfunction of climate station sensors and deficiency in the implementation of QA/QC procedures during this time. Stantec notes that VGC has taken steps to rectify this deficiency in the spring of 2020, by replacing the Potato Hills climate station, which had exceeded its expected lifetime, servicing the Camp Station (which included replacing certain sensors) and retaining a qualified professional (QP) to perform annual calibrations and data validation.

Due to the sensitive nature of climate station sensors, and regulatory requirements to maintain complete climate datasets, Stantec recommends that VGC consider maintaining a spare climate station sensors on site that may be easily deployed should sensors fail or when gaps are noted during monthly review of data records.

Table 4 summarizes compliance gaps and/or deficiencies for the climate monitoring program and provides recommendations for corrective action.

Table 4 Climate Monitoring Program Compliance and Recommendations

Compliance Gaps and/or Deficiencies	Recommendation/Corrective Action
Incomplete climate data recorded between 2018–2020 during the construction phase and portions of the operations phase of mining	• Keep spare climate station sensors on-site for rapid deployment should sensors/equipment begin to fail or data gaps are noted. • Append annual QP climate stations' calibration report/records to annual report.

2.2 AIR QUALITY

2.2.1 Documents Reviewed

Documents shown in Table 5 were reviewed for the audit of air quality:

Table 5 Air Quality Monitoring Program Documents Reviewed

Document	Version Reviewed	Sections Applicable during Construction Phase	Sections Applicable to Operations Phase
EMSAMP	2018-01	11.0 – Air Quality	N/A
EMSAMP	2019-01	11.0 – Air Quality	N/A
EMSAMP	2020-01	N/A	11.0 – Air Quality
Air Quality Monitoring Plan	N/A	N/A	All sections
Air Emissions Permit No. 60-060	N/A	N/A	All conditions
Water Licence QZ14-041 Quartz Mining License QML-0011 2018 Annual Report	N/A	3.7.2 – Air Quality Monitoring and Appendix N – Air Quality Data	N/A
Water Licence QZ14-041 Quartz Mining License QML-0011 2019 Annual Report	N/A	3.8.2 – Air Quality Monitoring (Air quality data appendix not included in 2019 Annual Report)	3.8.2 – Air Quality Monitoring (Air quality data appendix not included in 2019 Annual Report)
Type A Water Use License QZ14-041-1 Monthly Report, Reporting Period: January 2020 to June 2020	N/A	N/A	6.2 – Air Quality Data Collection in available monthly reports for audit period
Dustfall Monitoring Procedure	All sections	All sections	All sections
High Volume Air Sampling Procedure	N/A	N/A	All sections
MetOne EBAM Particulate Monitor Procedure	All sections	All sections	All sections
Passive Monitoring Procedure	N/A	N/A	All sections

2.2.2 Monitoring Program Implementation and Data QA/QC

The air quality monitoring program began in 2018 and will continue throughout operations.

Prior to and during the mine construction phase, air quality monitoring was conducted in accordance with approved EMSAMPs (versions 2018-01 and 2019-01). Early in the construction phase, VGC installed and operated three (environment) Beta-Attenuation Particulate Monitors (EBAMs) capable of continuous measurement of Total Suspended Particulate (TSP), Coarse Particulate Matter (PM_{10}) and Fine Particulate Matter ($PM_{2.5}$). These monitors were and continue to be located near the Camp climate station. EBAM sampling began August 22, 2018. Four dustfall sampling stations were also established on August 23, 2018 alongside four permanent vegetation sampling plots. Dustfall samples were and continue to be collected and submitted for laboratory analysis monthly. The main change between construction and start-up of operations of the mine was the addition of the Passive Air Sampling System (PASS) stations and Hi-Volume Partisol Air Sampler.

Monitoring during operations is conducted for the following parameters: TSP, $PM_{2.5}$, PM_{10}, Nitrogen Dioxide (NO_2), Sulphur Dioxide (SO_2) and Ammonia (NH_3). PASSs for NO_2, SO_2 and NH_3 was initiated in January 2020, in accordance with the conditions of the mine Air Emissions Permit #60-060.

VGC currently employs the following methods to collect air quality data:

1. Three continuous EBAM monitors for TSP, PM_{10}, and $PM_{2.5}$
2. Five dustfall stations collect samples for analysis of total particulates and total metals deposition (flux)
3. Five PASS samplers collect samples for analysis of NO_2, SO_2 and NH_3
4. One Hi-Volume Partisol sampler collects samples for analysis of TSP and metals

EBAMs monitors are located near the Camp climate station, west of the existing camp and within the Haggart Creek valley. Dustfall and PASS samplers are located at various locations south, west and east of the mine facilities, adjacent to soil and vegetation monitoring plots. The Hi-Volume sampler is co-located with the EBAM monitors near the camp station.

TSP, $PM_{2.5}$, and PM_{10} concentrations in ambient air are monitored continuously, and recorded each hour, 24-hours per day. Total dustfall, NO_2, SO_2, and NH_3 samples are collected monthly for laboratory analysis. Metals deposition samples are collected monthly for laboratory analysis and Hi-Volume TSP samples are collected weekly for laboratory analysis.

Monitoring results are compared to air quality criteria set out in the Project Air Emissions Permit No. 60-060 (effective as of December 2019 and amended September 2020). The Project Air Quality Criteria (AQC) are the most stringent criteria referenced in Yukon Ambient Air Quality Objectives (YAAQO), Canadian Ambient Air Quality Standards (CAAQS) and Ontario Air Quality Criteria (OAQC) for metals and NH_3. Collectively, the AQCs define the maximum allowable limits during mine operations for the above-described parameters. Monitoring results are reported monthly and annually as part of EMSAMP reporting, and quarterly, in compliance with the Air Emissions Permit. Quarterly reporting began in Q1 of 2020.

Data reliability and integrity is maintained through implementation of an air quality data QA/QC program. The QA/QC program is described in the project Air Quality Monitoring Plan (AQMP) and relies primarily on:

- Weekly EBAM operational inspections,
- Monthly EBAM Leak/Flow Audits,
- Bi-annual EBAM calibration and maintenance,
- Standard Operating Procedure for PASS samplers
- Quarterly calibration of Hi-Volume Partisol sampler
- All sample laboratory analysis completed by external accredited laboratories
- Chain of custody are used to send samples to the external accredited laboratories

Data validation criteria defined in the AQMP are:

24-hour samples (TSP/$PM_{2.5}$/Metals):

- valid only if within ±10% of the required sample period;
- valid only if the sampled air volume is within ±10% of the target flow;
- valid only if filter material (High volume sampler only) is intact upon retrieval, and not damaged during removal, storage or shipping.

Annual means:

- Annual arithmetic or geometric means are valid only if at least 75% of the possible samples under the relevant sample frequency are valid.

Passive samplers (SO_2, NO_2, NH_3):

- Valid only if the targeted 30-day sampling period is met within ±2 days.

Dustfall (Total Particulate and metals)

- Valid only if the targeted 30-day sampling period is met within ±2 days.

Quantitative air quality management triggers are defined in the EMSAMP and require corrective actions to reduce or bring emissions into compliance with the Project AQC. The management triggers are as follows:

- If air quality concentrations are within 80% of YAAQOs, actions will be taken to minimize the emissions
- If TSP concentrations exceed 100 µg/m^3 24-hour average, or 50 µg/m^3 as an annual geometric mean, additional dust control mitigation measures will be implemented. Additional measures are specified in versions of the EMSAMP and in the Air Emissions Permit.

Table 6 below summarizes compliance with the construction and operations EMSAMPs air quality data collection programs and Air Emissions Permit for the audit period.

Table 6 Air Quality Monitoring Program Implementation

Monitoring Method	EMSAMP Version 2018-01 Compliance	EMSAMP Version 2019-01 /Air Emission Permit[a] Compliance	EMSAMP Version 2020-01/Air Emission Permit Compliance	Data QA/QC	Reporting
EBAMs (stations installed August 22, 2018 adjacent to the Camp climate station)	• Compliant with the exception of: – 9 instances when the TSP 24 hr average concentration was greater than the Yukon Ambient Air Quality Standards – 5 instances when the PM_{10} 24 hr average concentration was greater than the Yukon Ambient Air Quality Standards	• Compliant with the exception of – 2 instances when the TSP 24 hr average concentration was greater than the AQC – 5 instances when the $PM_{2.5}$ 24 hr average concentration was greater than the AQC – 4 instances when the PM_{10} 24 hr average concentration was greater than the AQC	Compliant	• EBAMs inspections, audits, calibration and maintenance adequate • Operations carried out according to SOP • Data validation adequate	• 2018 annual reporting adequate. Supporting air quality data provided in appendix. • 2019 annual reporting inadequate due to missing air quality data appendix and an error in Table 3.8-2. This table was copied without alteration from the 2018 report. • Q1 quarterly report adequate • Q2 quarterly report adequate
Dustfall (stations installed Aug 23, 2018 adjacent to vegetation plots)	Compliant with respect to monthly laboratory sample analysis and reporting	Compliant with respect to monthly laboratory sample analysis and reporting	Compliant with respect to monthly laboratory sample analysis and reporting	• Laboratory QA/QC procedure report and results are provided with analytical results. • Operations carried out according to SOP	• 2018 monthly reporting adequate, but should show comparison to AQC • 2019 monthly reporting adequate, but should show comparison to AQC • Results not discussed in 2018 or 2019 annual reports • Q1 quarterly report adequate • Q2 quarterly report adequate
Passive Air Sampling System (PASS) (stations installed Jan 1, 2020 adjacent to dustfall stations)	Not in use for this period	Compliant with respect to monthly laboratory sample analysis and reporting	Compliant with respect to monthly laboratory sample analysis and reporting	• Laboratory QA/QC procedure report and results are provided with analytical results. • Operations carried out according to SOP	• January-March 2020 reporting adequate • Q1 quarterly report adequate • Q2 quarterly report adequate
Hi-Volume Partisol Air Sampler (installed May 21, 2020 adjacent to EBAMs)	Not in use for this period	Not in use for this period	Compliant with respect to monthly laboratory sample analysis and reporting	• Laboratory QA/QC procedure report and results are provided with analytical results. • Operations carried out according to SOP	Q2 quarterly report adequate

NOTE:
[a] Air Emissions Permit No. 60-060 effective as of December 2019 and amended in September 2020.

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2.2.3 Reporting Adequacy, Compliance and Recommendations

The implementation of the Eagle Gold Mine air quality monitoring program was adequate during the audit period. Performance data indicated that measured concentrations were greater than the 24-hour AQC for TSP, $PM_{10,}$ and $PM_{2.5}$ some days during the construction phase. Management responses set out in the construction phase EMSAMPs were implemented appropriately and described adequately in the 2018 and 2019 annual reports. Reports reviewed for the operations phase of the audit period indicate that the frequency of exceedances decreased compared to the construction period.

Stantec noted reporting inconsistencies during the audit period such as omitting to provide validated datasets to support discussion of results, and reporting results of sampling without showing comparison to the AQC. Implementation of the monitoring program going forward should involve improvements in reporting monitoring results.

Table 7 summarizes compliance gaps and/or deficiencies for the air quality monitoring program and provides recommendations for corrective action.

Table 7 Air Quality Monitoring Program Compliance and Recommendations

Compliance Gaps and/or Deficiencies	Recommendation/Corrective Action
Inconsistency in data reporting	Submit validated datasets with all annual and quarterly reports, and compare monitoring results to AQC

3.0 WATER RESOURCES

This section presents an audit of the water resources monitoring programs as specified in the applicable EMSAMP documents, compared to the data and information reported in supporting annual and monthly reports. The intent is to determine if ongoing monitoring and data collection meets the commitments outlined in the EMSAMP. This audit is specific to the following areas:

- Surface Water Hydrology
- Surface Water Quality
- Groundwater Quantity and Quality
- Geochemical Monitoring
- Stream Sediment
- Benthic Macroinvertebrates
- Fish and Fish Habitat

The scope of this water resources audit is limited to those monitoring methods as specified in the three versions of the EMSAMPs effective during the audit period.

3.1 SURFACE WATER HYDROLOGY

3.1.1 Documents Reviewed

Documents shown in Table 8 were reviewed for the surface water hydrology section of the audit:

Table 8 Surface Water Hydrology Documents Reviewed

Document	Version Reviewed	Sections Applicable during Construction Phase	Sections Applicable to Operations Phase
EMSAMP	2018-01	2.0 – Surface Water Hydrology	N/A
EMSAMP	2019-01	2.0 – Surface Water Hydrology	2.0 – Surface Water Hydrology
EMSAMP	2020-01	2.0 – Surface Water Hydrology	2.0 – Surface Water Hydrology
Water Licence QZ14-041 Quartz Mining License QML-0011 2018 Annual Report	N/A	3.1 – Surface Water Hydrology	N/A
Water Licence QZ14-041 Quartz Mining License QML-0011 2019 Annual Report	N/A	3.1 – Surface Water Hydrology	3.1 – Surface Water Hydrology

Table 8 Surface Water Hydrology Documents Reviewed

Document	Version Reviewed	Sections Applicable during Construction Phase	Sections Applicable to Operations Phase
Type A Water Use License QZ14-041-1 Monthly Report, Reporting Period: January 2020 to June 2020	N/A	N/A	2.2 – Surface Water Hydrology
Construction and Operations Water Management Plan	2017-01	All	All
Water Management Plan	2020-01	All	All

3.1.2 Monitoring Program Implementation and Data QA/QC

Table 9 summarizes the compliance requirement categories for surface water hydrology.

Table 9 Surface Water Hydrology Compliance Requirements

Category	Compliance Criteria	Description of Compliance Requirement
1. Field Program	1A: Frequency	Monitoring was performed at the prescribed frequency (station-specific).
	1B: Tasks	Required tasks were completed at each site visit (e.g., collect data, perform routine maintenance, obtain discharge measurement)
2. Analysis	2A: Rating Curve	For automated stations, a rating curve has been (or is being) developed in accordance with standard industry practices and applicable EMSAMP.
	2B: Streamflow Record	For automated stations, a continuous streamflow record has been generated using continuous stage record and rating curve or other method. For manual stations, discharges and/or water levels have been summarized.
	2C: QA/QC	QA/QC has been performed in accordance with standard industry practices and applicable EMSAMP.
3. Reporting and Adaptive Management	3A: Reporting	Reporting covering/discussing the station was submitted at the prescribed frequency.
	3B: Exceedance Check/Comment	The results were compared to the applicable exceedance thresholds and an evaluation was formally made.
	3C: Response to Exceedance(s)	If an exceedance occurred, the appropriate adaptive management response was performed.

The specifics (e.g., applicable sites, monitoring frequency, required data) of the compliance requirements in Table 9 varied between the three EMSAMP versions (i.e., EMSAMP 2018-01, EMSAMP 2019-01, EMSAMP 2020-01). Therefore, a surface water hydrology audit was performed separately for each of the three EMSAMP versions.

The two WMP versions did not differ to a significant enough degree as to require separate sections. Therefore, WMP compliance was evaluated considering both WMP's simultaneously.

3.1.2.1 EMSAMP 2018-01

EMSAMP2018-01 was applicable from July 1, 2018 to June 18, 2019. The stations and corresponding monitoring requirements for this phase are summarized in Table 2.3.1 within Section 2 of EMSAMP 2018-01. The 2018 and 2019 annual reports were reviewed for compliance with EMSAMP2018-01 requirements for construction from July 1, 2018 to March 16, 2019 and for operations from March 17, 2019 to June 18, 2019. VGC monthly reports completed for the applicable period were not reviewed.

Table 10 summarizes the compliance performance for EMSAMP 2018-01.

3.1.2.2 EMSAMP 2019-01

EMSAMP 2019-01 was applicable from June 19, 2019 to May 18, 2020. The stations and corresponding monitoring requirements are summarized in Table 2.3-1 and 2.3-2 within Section 2 of EMSAMP 2019-01. The 2019 annual report and the January – May 2020 monthly reports were reviewed for compliance with operations phase requirements of the EMSAMP 2019-01.

Table 11 summarizes the compliance performance for EMSAMP 2019-01.

3.1.2.3 EMSAMP 2020-01

EMSAMP2020-01 was applicable from May 19, 2020 to June 30, 2020. During this time, the mine was in the operations phase. The stations and corresponding monitoring requirements are summarized in Table 2.3-2 within Section 2 of EMSAMP 2020-01. The May and June 2020 monthly reports were reviewed for compliance with EMSAMP 2020-01.

Table 12 summarizes the compliance performance for EMSAMP 2020-01.

Table 10 Surface Water Hydrology Monitoring Program Compliance – EMSAMP 2018-01

Station	Monitoring Required		Location Description	Compliance Requirements							
				1. Field Program		2. Analysis			3. Reporting and Adaptive Management		
	Construction	Operations		1A: Frequency	1B: Tasks	2A: Rating Curve	2B: Streamflow Record	2C: QA/QC	3A: Reporting Frequency	3B: Check for Threshold Event	3C: Response to Threshold Event
W1 [a]	a	a	Dublin Gulch above Stewart	Partial compliance. Winter frequency ok. Freshet frequency not completed [2]. Loggers installed during open water.	Partial compliance. Flows obtained. Monitoring visit tasks outlined in EMSAMP 2018-01 Section 2.3.1 not documented.	Compliant. Rating curve developed.	Compliant. Flow record from open water logger data/rating curve and manual winter measurement interpolation. Freshet measurements required to improve continuous record.	Partial compliance. Field visit QA/QC tasks discussed but not documented. Equipment calibration not documented. Rating curve/flow record QA/QC demonstrated.	Compliant. Station covered in annual reports.	Compliant. Evaluation of flows compared to qualitative triggers for adaptive management was made.	N/A. Adaptive management measures not applicable, as the qualitative triggers for adaptive management were considered to be not met.
W4 [a]	a	a	Haggart Creek below Dublin	Partial compliance. Winter frequency ok. Freshet frequency not completed [2]. Loggers installed during open water.	Partial compliance. Flows obtained. Monitoring visit tasks outlined in EMSAMP 2018-01 Section 2.3.1 not documented.	Compliant. Rating curve developed.	Compliant. Flow record from open water logger data/rating curve and manual winter measurement interpolation. Freshet measurements required to improve continuous record.	Partial compliance. Field visit QA/QC tasks discussed but not documented. Equipment calibration not documented. Rating curve/flow record QA/QC demonstrated.	Compliant. Station covered in annual reports.	Compliant. Evaluation of flows compared to qualitative triggers for adaptive management was made.	N/A. Adaptive management measures not applicable, as the qualitative triggers for adaptive management were considered to be not met.
W5 [a]	a	a	Haggart Creek above Lynx Creek	Partial compliance. Winter frequency ok. Freshet frequency not completed [2]. Loggers installed during open water.	Partial compliance. Flows obtained. Monitoring visit tasks outlined in EMSAMP 2018-01 Section 2.3.1 not documented.	Compliant. Rating curve developed.	Compliant. Flow record from open water logger data/rating curve and manual winter measurement interpolation. Freshet measurements required to improve continuous record.	Partial compliance. Field visit QA/QC tasks discussed but not documented. Equipment calibration not documented. Rating curve/flow record QA/QC demonstrated.	Compliant. Station covered in annual reports.	Compliant. Evaluation of flows compared to qualitative triggers for adaptive management was made.	N/A. Adaptive management measures not applicable, as the qualitative triggers for adaptive management were considered to be not met.
W6 [a]	a	a	Lynx Creek above Haggart Creek	Partial compliance. Winter frequency ok. Freshet frequency not completed [2]. Loggers installed during open water.	Partial compliance. Flows obtained. Monitoring visit tasks outlined in EMSAMP 2018-01 Section 2.3.1 not documented.	Compliant. Rating curve developed.	Compliant. Flow record from open water logger data/rating curve and manual winter measurement interpolation. Freshet measurements required to improve continuous record.	Partial compliance. Field visit QA/QC tasks discussed but not documented. Equipment calibration not documented. Rating curve/flow record QA/QC demonstrated.	Compliant. Station covered in annual reports.	Compliant. Evaluation of flows compared to qualitative triggers for adaptive management was made.	N/A. Adaptive management measures not applicable, as the qualitative triggers for adaptive management were considered to be not met.

Table 10 Surface Water Hydrology Monitoring Program Compliance – EMSAMP 2018-01

Station	Monitoring Required		Location Description	Compliance Requirements							
				1. Field Program		2. Analysis			3. Reporting and Adaptive Management		
	Construction	Operations		1A: Frequency	1B: Tasks	2A: Rating Curve	2B: Streamflow Record	2C: QA/QC	3A: Reporting Frequency	3B: Check for Threshold Event	3C: Response to Threshold Event
W20 [b]	b	b	Bawn Boy Gulch	Partial compliance. Manual measurement frequency ok for 2018. No data for 2019. Future monitoring plan not communicated.	Partial compliance. Flows partially obtained. Monitoring visit tasks outlined in EMSAMP 2018-01 Section 2.3.1 not documented.	N/A. Rating curve not required for manual measurement stations.	Partial compliance. Manual flow measurements reported for 2018, but not 2019.	Partial compliance. Field visit QA/QC tasks discussed but not documented. Equipment calibration not documented.	Compliant. Station covered in annual reports.	Not compliant. Data not provided; check for whether threshold triggered.	Not compliant. Data not provided; check for check for whether threshold triggered and response performed.
W21 [d]	d	g	Dublin Gulch at Mouth	Partial compliance. Winter frequency ok. Freshet frequency not completed [2]. Loggers installed during open water.	Partial compliance. Flows obtained. Monitoring visit tasks outlined in EMSAMP 2018-01 Section 2.3.1 not documented.	Compliant. Rating curve being developed.	Partial compliance. Winter interpolation not completed. Flow record from open water logger data/rating curve.	Partial compliance. Field visit QA/QC tasks discussed but not documented. Equipment calibration not documented. Rating curve/flow record QA/QC demonstrated.	Compliant. Station covered in annual reports.	Partial compliance. Evaluation of flows compared to qualitative triggers for adaptive management was made for other automated stations, but not this station.	Partial compliance. Unknown if adaptive management measurements are required as evaluation for triggers for adaptive management not completed for this site.
W22 [a]	a	a	Haggart Creek above Project Influence	Partial compliance. Winter frequency ok. Freshet frequency not completed [2]. Loggers installed during open water.	Partial compliance. Flows obtained. Monitoring visit tasks outlined in EMSAMP 2018-01 Section 2.3.1 not documented.	Compliant. Rating curve developed.	Compliant. Flow record from open water logger data/rating curve and manual winter measurement interpolation. Freshet measurements required to improve continuous record.	Partial compliance. Field visit QA/QC tasks discussed but not documented. Equipment calibration not documented. Rating curve/flow record QA/QC demonstrated.	Compliant. Station covered in annual reports.	Compliant. Evaluation of flows compared to qualitative triggers for adaptive management was made.	N/A. Adaptive management measures not applicable, as the qualitative triggers for adaptive management were considered to be not met.
W23 [b]	b	b	Haggart Creek below Lynx Creek	Not compliant. 2019 annual report suggest no data collected since 2011. No future monitoring plan communicated.	Not compliant. Monitoring visit tasks outlined in EMSAMP 2018-01 Section 2.3.1 not documented.	N/A. Rating curve not required for manual measurement stations.	Not compliant. No manual flow measurements provided.	Partial compliance. Field visit QA/QC tasks discussed but not documented. Equipment calibration not documented.	Partial compliance. Mention of W23 in 2019 annual report only.	Partial compliance. Evaluation of flows compared to qualitative triggers for adaptive management was made for other automated stations, but not this station.	Partial compliance. Unknown if adaptive management measurements are required as evaluation for triggers for adaptive management not completed for this site .

Table 10 Surface Water Hydrology Monitoring Program Compliance – EMSAMP 2018-01

Station	Monitoring Required		Location Description	Compliance Requirements							
				1. Field Program		2. Analysis			3. Reporting and Adaptive Management		
	Construction	Operations		1A: Frequency	1B: Tasks	2A: Rating Curve	2B: Streamflow Record	2C: QA/QC	3A: Reporting Frequency	3B: Check for Threshold Event	3C: Response to Threshold Event
W26 [a]	a	a	Stewart Gulch	Partial compliance. Winter measurements not completed. Freshet frequency not completed [2]. Loggers installed during open water.	Partial compliance. Flows obtained. Monitoring visit tasks outlined in EMSAMP 2018-01 Section 2.3.1 not documented.	N/A. Parshall flume installed.	Partial compliance. Flow record from open water logger data and parshall flume provided. Winter measurement interpolation not completed. Freshet measurements required to improve continuous record...	Partial compliance. Field visit QA/QC tasks discussed but not documented. Equipment calibration not documented. Flow record QA/QC demonstrated.	Compliant. Station covered in annual reports.	Partial compliance. Evaluation of flows compared to qualitative triggers for adaptive management was made for other automated stations, but not this station.	Partial compliance. Unknown if adaptive management measurements are required as evaluation for triggers for adaptive management not completed for this site.
W27 [a]	a	N/A	Eagle Creek near Camp below Eagle Creek Pond	Partial compliance. Winter measurements not completed. Freshet frequency not completed [2]. Loggers installed during open water.	Partial compliance. Flows obtained. Monitoring visit tasks outlined in EMSAMP 2018-01 Section 2.3.1 not documented.	N/A. Parshall flume installed.	Partial compliance. Incomplete flow record from open water logger data due to logger malfunction. Winter measurement interpolation not completed. Freshet measurements required to improve continuous record.	Partial compliance. Field visit QA/QC tasks discussed but not documented. Equipment calibration not documented. Flow record QA/QC demonstrated.	Compliant. Station covered in annual reports.	Partial compliance. Evaluation of flows compared to qualitative triggers for adaptive management was made for other automated stations, but not this station.	Partial compliance. Unknown if adaptive management measurements are required as evaluation for triggers for adaptive management not completed for this site.
W29 / W99 [a]	a	a	Haggart Creek below Eagle Creek and Platinum Gulch	Partial compliance. Winter frequency ok. Freshet frequency not completed [2]. Loggers installed during open water.	Partial compliance. Flows obtained. Monitoring visit tasks outlined in EMSAMP 2018-01 Section 2.3.1 not documented.	Compliant. Rating curve developed at W29. Rating curve being developed at W99.	Partial compliance. Flow record not provided at W29 due to logger malfunction and station damage. Flow record provided at W99 for open water season; winter interpolation not completed.	Partial compliance. Field visit QA/QC tasks discussed but not documented. Equipment calibration not documented. Rating curve/flow record QA/QC demonstrated.	Compliant. Station covered in annual reports.	Partial compliance. Evaluation of flows compared to qualitative triggers for adaptive management was made for other automated stations, but not this station.	Partial compliance. Unknown if adaptive management measurements are required as evaluation for triggers for adaptive management not completed for this site.
W39 [c]	c	c	Haggart Creek above South McQuesten River	Partial compliance. Manual measurements obtained, but not on consistent or quarterly schedule.	Partial compliance. Flows obtained. Monitoring visit tasks outlined in EMSAMP 2018-01 Section 2.3.1 not documented.	N/A. Rating curve not required for manual measurement stations.	Partial compliance. Manual measurements reported, but not on consistent or quarterly schedule.	Partial compliance. Field visit QA/QC tasks discussed but not documented. Equipment calibration not documented.	Compliant. Station covered in annual reports.	Partial compliance. Evaluation of flows compared to qualitative triggers for adaptive management was made for other automated stations, but not this station.	Partial compliance. Unknown if adaptive management measurements are required as evaluation for triggers for adaptive management not completed for this site.

Table 10 Surface Water Hydrology Monitoring Program Compliance – EMSAMP 2018-01

Station	Monitoring Required		Location Description	Compliance Requirements							
				1. Field Program		2. Analysis			3. Reporting and Adaptive Management		
	Construction	Operations		1A: Frequency	1B: Tasks	2A: Rating Curve	2B: Streamflow Record	2C: QA/QC	3A: Reporting Frequency	3B: Check for Threshold Event	3C: Response to Threshold Event
W45 [a]	a	N/A	Eagle Creek above Haggart Creek	Partial compliance. Winter frequency ok. Freshet frequency not completed [2]. Loggers installed during open water.	Partial compliance. Flows obtained. Monitoring visit tasks outlined in EMSAMP 2018-01 Section 2.3.1 not documented.	Compliant. Rating curve being developed.	Compliant. Flow record not provided as rating curve is in development. Water level record for open water season provided.	Partial compliance. Field visit QA/QC tasks discussed but not documented. Equipment calibration not documented. Rating curve/flow record QA/QC demonstrated.	Compliant. Station covered in annual reports.	Partial compliance. Evaluation of flows compared to qualitative triggers for adaptive management was made for other automated stations, but not this station.	Partial compliance. Unknown if adaptive management measurements are required as evaluation for triggers for adaptive management not completed for this site.
W49 [c]	c	c	South McQuesten River below Haggart Creek	Partial compliance. Manual measurements obtained, but not on consistent or quarterly schedule.	Partial compliance. Flows obtained. Monitoring visit tasks outlined in EMSAMP 2018-01 Section 2.3.1 not documented.	N/A. Rating curve not required for manual measurement stations.	Partial compliance. Manual measurements reported, but not on consistent or quarterly schedule.	Partial compliance. Field visit QA/QC tasks discussed but not documented. Equipment calibration not documented. documented.	Compliant. Station covered in annual reports.	Partial compliance. Evaluation of flows compared to qualitative triggers for adaptive management was made for other automated stations, but not this station.	Partial compliance. Unknown if adaptive management measurements are required as evaluation for triggers for adaptive management not completed for this site.
CS-01 [d]	d	N/A	Sediment Basin - below lower Process Access Road	Reports reviewed do not address/discuss this station. Compliance cannot be determined using reports. VGC communication outside of reporting (personal communication, October 29, 2020), indicated the site was not constructed and is inactive, suggesting EMSAMP requirements not applicable.							
CS-02 [d]	d	N/A	Sediment Basin - below Truck Shop	Reports reviewed do not address/discuss this station. Compliance cannot be determined using reports. VGC communication outside of reporting (personal communication, October 29, 2020), indicated the site was not constructed and is inactive, suggesting EMSAMP requirements not applicable.							
CS-03 [d]	d	N/A	Sediment Basin - below AN/Emulsion access and storage area	Reports reviewed do not address/discuss this station. Compliance cannot be determined using reports. VGC communication outside of reporting (personal communication, October 29, 2020), indicated the site was not constructed and is inactive, suggesting EMSAMP requirements not applicable.							
CS-04 [d]	d	d	Sediment Basin - below Ice Rich Storage Area	Reports reviewed do not address/discuss this station. Compliance cannot be determined using reports. VGC communication outside of reporting (personal communication, October 29, 2020), indicated the site was not constructed and is inactive, suggesting EMSAMP requirements not applicable.							
EPS [d]	d	d	Eagle Pup WRSA Seepage	Reports reviewed do not address/discuss this station. Compliance cannot be determined using reports. VGC communication outside of reporting (personal communication, October 29, 2020), indicated the site was not constructed and is inactive, suggesting EMSAMP requirements not applicable.							
LDSPI [d]	d	e	Lower Dublin South Pond Inflow	Reports reviewed do not address/discuss this station directly; only make indirect reference to upstream diversions to accommodate work in and around LDSP (suggests not constructed yet). Compliance cannot be determined using reports. VGC communication outside of reporting (personal communication, 29 October 2020) indicated discharging to LDSP did not occur, making EMSAMP requirements not applicable.							
LDSPO [d]	d	e	Lower Dublin South Pond Outflow	Reports reviewed do not address/discuss this station directly; only make indirect reference to upstream diversions to accommodate work in and around LDSP (suggests not constructed yet). Compliance cannot be determined using reports. VGC communication outside of reporting (personal communication, 29 October 2020) indicated discharging from LDSP did not occur, making EMSAMP requirements not applicable.							

Table 10 Surface Water Hydrology Monitoring Program Compliance – EMSAMP 2018-01

Station	Monitoring Required		Location Description	Compliance Requirements							
				1. Field Program		2. Analysis			3. Reporting and Adaptive Management		
	Construction	Operations		1A: Frequency	1B: Tasks	2A: Rating Curve	2B: Streamflow Record	2C: QA/QC	3A: Reporting Frequency	3B: Check for Threshold Event	3C: Response to Threshold Event
PDI [d]	d	N/A	Platinum Gulch Ditch	Reports reviewed do not address/discuss this station. Compliance cannot be determined using reviewed reports. VGC communication outside of reporting (personal communication, October 29, 2020), indicated the site was not constructed and is inactive, suggesting EMSAMP requirements not applicable.							
PGS	N/A	d	Platinum Gulch WRSA Seepage	Reports reviewed do not address/discuss this station. Compliance cannot be determined using reviewed reports. VGC communication outside of reporting (personal communication, October 29, 2020), indicated the site was not active, suggesting EMSAMP requirements not applicable.							
PDI & PGS PTS	N/A	g	Platinum Gulch Ditch into Lower Dublin South Pond	Reports reviewed do not address/discuss this station. Compliance cannot be determined using reviewed reports. VGC communication outside of reporting (personal communication, October 29, 2020), indicated the site was not active, suggesting EMSAMP requirements not applicable.							
PS	N/A	f	Open Pit Sump	Reports reviewed do not address/discuss this station. Compliance cannot be determined using reviewed reports. VGC communication outside of reporting (personal communication, October 29, 2020), indicated the site was not active, suggesting EMSAMP requirements not applicable.							
MWTP	N/A	d	Mine Water Treatment Plant	Reports reviewed do not address/discuss this station. Compliance cannot be determined using reviewed reports. VGC communication outside of reporting (personal communication, October 29, 2020), indicated the site was not active, suggesting EMSAMP requirements not applicable.							
FT	N/A	d	Mine Water Treatment Plant Finishing Tank	Reports reviewed do not address/discuss this station. Compliance cannot be determined using reviewed reports. VGC communication outside of reporting (personal communication, October 29, 2020), indicated the site was not active, suggesting EMSAMP requirements not applicable.							
OPP	N/A	g	Open Pit Pond	No open pit pond. EMSAMP requirements not applicable.							
OPPO	N/A	b	Open Pit Pond Overflow	No open pit pond. EMSAMP requirements not applicable.							

NOTES:
[1] N/A if manual monitoring protocol is performed. If automated monitoring protocol is performed, rating curve must be developed.
[2] VGC communication outside of reporting (personal communication, 29 October 2020) indicated certain freshet measurements not obtained due to unsafe ice or flow conditions.
[a] Automated monitoring. Manual monitoring weekly during freshet until loggers installed and twice a month during winter.
[b] Manual monitoring on a monthly basis.
[c] Manual monitoring on a quarterly basis.
[d] Station may be either manual or automatic. Measurements taken weekly when discharging if manual measurements only.
[e] Automated monitoring when discharging.
[f] Automated monitoring when dewatering
[g] Manual measurement of water level

Table 11 Surface Water Hydrology Monitoring Program Compliance – EMSAMP 2019-01

Station	Location Description	Compliance Requirements							
		1. Field Program		2. Analysis [1]			3. Reporting and Adaptive Management [1]		
		1A: Frequency	1B: Tasks	2A: Rating Curve	2B: Streamflow Record	2C: QA/QC	3A: Reporting	3B: Check for Threshold Event	3C: Response to Threshold Event
W1	Dublin Gulch above Stewart Gulch inflow	Partial compliance. Winter frequency not sufficient. Freshet frequency insufficient[3]. Loggers installed during open water.	Partial compliance. Monitoring visit tasks outlined in EMSAMP 2019-01 Section 2.3.1 not documented.	Compliant. Rating curve developed. 2020 data not incorporated yet.	Partial compliance. Winter interpolation compliance unknown. No open water season data due to logger malfunction.	Partial compliance. Field visit QA/QC tasks discussed but not documented. Equipment calibration not documented. Rating curve/flow record QA/QC demonstrated.	Compliant. Station in 2019 annual report, 2020 monthly reports.	N/A. Not listed as requiring adaptive management check in EMSAMP 2019-01.	N/A. Not listed as requiring adaptive management check in EMSAMP 2019-01.
W4	Haggart Creek below Dublin Gulch	Partial compliance. Winter frequency not sufficient. Freshet frequency sufficient. Loggers installed during open water.	Partial compliance. Flows obtained. Monitoring visit tasks outlined in EMSAMP 2019-01 Section 2.3.1 not documented.	Compliant. Rating curve developed. 2020 data not incorporated yet.	Compliant. Flow record from open water logger data/rating curve. Winter interpolation compliance unknown. Freshet measurements required to improve data record.	Partial compliance. Field visit QA/QC tasks discussed but not documented. Equipment calibration not documented. Rating curve/flow record QA/QC demonstrated.	Compliant. Station in 2019 annual report, 2020 monthly reports.	Partial compliance. Average monthly variance computed (instead of median). Comparison to quantitative performance thresholds not completed.	Not compliant. Performance thresholds exceeded but adaptive management responses were not performed/documented, nor were they documented as not applicable with a rationale.
W5	Haggart Creek above Lynx Creek	Partial compliance. Winter frequency not sufficient. Freshet frequency not sufficient[3]. Loggers installed during open water.	Partial compliance. Flows obtained. Monitoring visit tasks outlined in EMSAMP 2019-01 Section 2.3.1 not documented.	Compliant. Rating curve developed. 2020 data not incorporated yet.	Compliant. Flow record from open water logger data/rating curve. Winter interpolation compliance unknown. Freshet measurements required to improve data record.	Partial compliance. Field visit QA/QC tasks discussed but not documented. Equipment calibration not documented. Rating curve/flow record QA/QC demonstrated.	Compliant. Station in 2019 annual report, 2020 monthly reports.	N/A. Not listed as requiring adaptive management check in EMSAMP 2019-01.	N/A. Not listed as requiring adaptive management check in EMSAMP 2019-01.
W6	Lynx Creek above Haggart Creek	Partial compliance. Winter frequency not sufficient. Freshet frequency not sufficient[3]. Loggers installed during open water.	Partial compliance. Flows obtained. Monitoring visit tasks outlined in EMSAMP 2019-01 Section 2.3.1 not documented.	Compliant. Rating curve developed. 2020 data not incorporated yet.	Compliant. Flow record from open water logger data/rating curve. Winter interpolation compliance unknown. Freshet measurements required to improve data record.	Partial compliance. Field visit QA/QC tasks discussed but not documented. Equipment calibration not documented. Rating curve/flow record QA/QC demonstrated.	Compliant. Station in 2019 annual report, 2020 monthly reports.	N/A. Not listed as requiring adaptive management check in EMSAMP 2019-01.	N/A. Not listed as requiring adaptive management check in EMSAMP 2019-01.
W20	Bawn Boy Gulch	Partial compliance. No data for 2019. 2020 monthly reports indicate monitoring re-started. Unsafe winter conditions noted.	Partial compliance. Flow measurements attempted in 2020. Monitoring visit tasks outlined in EMSAMP 2019-01 Section 2.3.1 not documented.	N/A. Rating curve not required for manual measurement stations.	Not compliant. Water level records not provided.	Partial compliance. Field visit QA/QC tasks discussed but not documented. Equipment calibration not documented.	Partial compliance. Not in 2019 annual report. Station included in 2020 monthly reports.	N/A. Not listed as requiring adaptive management check in EMSAMP 2019-01.	N/A. Not listed as requiring adaptive management check in EMSAMP 2019-01.
W21	Dublin Gulch above confluence with Haggart Creek	Unknown. Required frequency not specified in EMSAMP.	Partial compliance. Flows/water levels attempted. Monitoring visit tasks outlined in EMSAMP 2019-01 Section 2.3.1 not documented.	N/A. Compliance requires water levels only; rating curve not required. Noted that rating curve was actively being developed.	Not compliant. No manual water level measurements provided; no automated water levels provided as logger malfunctioned in 2019.	Partial compliance. Field visit QA/QC tasks discussed but not documented. Equipment calibration not documented.	Compliant. Station in 2019 annual report, 2020 monthly reports.	N/A. Performance thresholds for water level not provided in EMSAMP2019-01.	N/A. Performance thresholds for water level not provided in EMSAMP2019-01.

Table 11 Surface Water Hydrology Monitoring Program Compliance – EMSAMP 2019-01

Station	Location Description	Compliance Requirements							
		1. Field Program		2. Analysis [1]			3. Reporting and Adaptive Management [1]		
		1A: Frequency	1B: Tasks	2A: Rating Curve	2B: Streamflow Record	2C: QA/QC	3A: Reporting	3B: Check for Threshold Event	3C: Response to Threshold Event
W22	Haggart Creek above Project Influence	Partial compliance. Winter frequency not sufficient. Freshet frequency likely not sufficient[3]. Loggers installed during open water.	Partial compliance. Flows obtained. Monitoring visit tasks outlined in EMSAMP 2019-01 Section 2.3.1 not documented.	Compliant. Rating curve developed. 2020 data not incorporated yet.	Compliant. Flow record from open water logger data/rating curve. Winter interpolation compliance unknown. Freshet measurements required to improve data record.	Partial compliance. Field visit QA/QC tasks discussed but not documented. Equipment calibration not documented. Rating curve/flow record QA/QC demonstrated.	Compliant. Station in 2019 annual report, 2020 monthly reports.	N/A. Not listed as requiring adaptive management check in EMSAMP 2019-01.	N/A. Not listed as requiring adaptive management check in EMSAMP 2019-01.
W23	Haggart Creek below Lynx Creek	Partial compliance. No data in 2019. 2020 monthly reports indicate monitoring re-started.	Partial compliance. Flow measurements attempted/obtained in 2020. Monitoring visit tasks outlined in EMSAMP 2019-01 Section 2.3.1 not documented.	N/A. Rating curve not required for manual measurement stations.	Not compliant. No manual flow measurements provided.	Partial compliance. Field visit QA/QC tasks discussed but not documented. Equipment calibration not documented.	Partial compliance. Not in 2019 annual report. Station included in 2020 monthly reports.	N/A. Not listed as requiring adaptive management check in EMSAMP 2019-01.	N/A. Not listed as requiring adaptive management check in EMSAMP 2019-01.
W26	Stewart Gulch	Partial compliance. Winter frequency not sufficient. Freshet frequency not sufficient[3]. Loggers installed during open water.	Partial compliance. Flows obtained. Monitoring visit tasks outlined in EMSAMP 2019-01 Section 2.3.1 not documented.	N/A. Parshall flume installed.	Compliant. Flow record from open water logger data/parshall flume. Winter interpolation compliance unknown. Freshet measurements required to improve data record.	Partial compliance. Field visit QA/QC tasks discussed but not documented. Equipment calibration not documented. Parshall flume/flow record QA/QC demonstrated.	Compliant. Station in 2019 annual report, 2020 monthly reports.	N/A. Not listed as requiring adaptive management check in EMSAMP 2019-01.	N/A. Not listed as requiring adaptive management check in EMSAMP 2019-01.
W27	Eagle Creek near Camp below Eagle Creek Pond	Partial compliance. Winter frequency not sufficient. Freshet frequency not sufficient[3]. Loggers installed during open water.	Partial compliance. Flows obtained. Monitoring visit tasks outlined in EMSAMP 2019-01 Section 2.3.1 not documented.	N/A. Parshall flume installed.	Compliant. Flow record from open water logger data/parshall flume. Winter interpolation compliance unknown. Freshet measurements required to improve data record.	Partial compliance. Field visit QA/QC tasks discussed but not documented. Equipment calibration not documented. Flow record QA/QC demonstrated.	Compliant. Station in 2019 annual report, 2020 monthly reports.	N/A. Not listed as requiring adaptive management check in EMSAMP 2019-01.	N/A. Not listed as requiring adaptive management check in EMSAMP 2019-01.
W29	Haggart Creek below Eagle Creek and Platinum Gulch	Partial compliance. Winter frequency not sufficient. Freshet frequency sufficient. Loggers installed during open water.	Partial compliance. Flows obtained. Monitoring visit tasks outlined in EMSAMP 2019-01 Section 2.3.1 not documented.	Compliant. Rating curve developed. 2020 data not incorporated yet.	Partial compliance. Winter interpolation compliance unknown. No open water season automated data due to logger malfunction, however it is noted that data records for W29 have been replaced by W99.	Partial compliance. Field visit QA/QC tasks discussed but not documented. Equipment calibration not documented. Rating curve/flow record QA/QC demonstrated.	Compliant. Station in 2019 annual report, 2020 monthly reports.	Not compliant. Flow records not compared to performance thresholds.	Not compliant. Performance thresholds exceeded but adaptive management responses were not performed/ documented, nor were they documented as not applicable with a rationale.

Table 11 Surface Water Hydrology Monitoring Program Compliance – EMSAMP 2019-01

Station	Location Description	Compliance Requirements							
		1. Field Program		2. Analysis [1]			3. Reporting and Adaptive Management [1]		
		1A: Frequency	1B: Tasks	2A: Rating Curve	2B: Streamflow Record	2C: QA/QC	3A: Reporting	3B: Check for Threshold Event	3C: Response to Threshold Event
W39	Haggart Creek above South McQuesten River	Partial compliance. Manual measurements obtained, but not on consistent or quarterly schedule.	Partial compliance. Flows obtained. Monitoring visit tasks outlined in EMSAMP 2019-01 Section 2.3.1 not documented.	N/A. Rating curve not required for manual measurement stations.	Partial compliance. Manual measurements reported, but not on consistent or quarterly schedule.	Partial compliance. Field visit QA/QC tasks discussed but not documented. Equipment calibration not documented.	Compliant. Station in 2019 annual report, 2020 monthly reports.	N/A. Not listed as requiring adaptive management check in EMSAMP 2019-01.	N/A. Not listed as requiring adaptive management check in EMSAMP 2019-01.
W45	Eagle Creek above Haggart Creek	Partial compliance. Winter frequency not sufficient. Freshet frequency not sufficient[3]. Loggers installed during open water.	Partial compliance. Flows obtained. Monitoring visit tasks outlined in EMSAMP 2019-01 Section 2.3.1 not documented.	Compliant. Rating curve being developed. 2020 data not incorporated yet.	Partial compliance. Winter interpolation compliance unknown but manual measurements not shown. Water level records provided in lieu of discharge as rating curve still being developed.	Partial compliance. Field visit QA/QC tasks discussed but not documented. Equipment calibration not documented. Rating curve/flow record QA/QC demonstrated.	Compliant. Station in 2019 annual report, 2020 monthly reports.	N/A. Not listed as requiring adaptive management check in EMSAMP 2019-01.	N/A. Not listed as requiring adaptive management check in EMSAMP 2019-01.
W49	South McQuesten River below Haggart Creek	Partial compliance. Manual measurements obtained, but not on consistent or quarterly schedule.	Partial compliance. Flows obtained. Monitoring visit tasks outlined in EMSAMP 2019-01 Section 2.3.1 not documented.	N/A. Rating curve not required for manual measurement stations.	Partial compliance. Manual measurements reported, but not on consistent or quarterly schedule.	Partial compliance. Field visit QA/QC tasks discussed but not documented. Equipment calibration not documented.	Compliant. Station in 2019 annual report, 2020 monthly reports.	N/A. Not listed as requiring adaptive management check in EMSAMP 2019-01.	N/A. Not listed as requiring adaptive management check in EMSAMP 2019-01.
W99	Haggart Creek above 15 Pup	Partial compliance. Winter frequency not sufficient. Freshet frequency not sufficient[3]. Loggers installed during open water.	Partial compliance. Flows obtained. Monitoring visit tasks outlined in EMSAMP 2019-01 Section 2.3.1 not documented.	Compliant. Rating curve being developed. 2020 data not incorporated yet.	Compliant. Winter interpolation compliance unknown. Freshet measurements required to improve data record.	Partial compliance. Field visit QA/QC tasks discussed but not documented. Equipment calibration not documented. Rating curve/flow record QA/QC demonstrated.	Compliant. Station in 2019 annual report, 2020 monthly reports.	N/A. Not listed as requiring adaptive management check in EMSAMP 2019-01.	N/A. Not listed as requiring adaptive management check in EMSAMP 2019-01.
CS-01	Sediment Basin - below lower Process Access Road	These stations are not constructed. Station is not active.							
CS-03	Sediment Basin - below Truck Shop	These stations are not constructed. Station is not active.							
CS-06	Sediment Basin - below AN/Emulsion access and storage area	These stations are not constructed. Station is not active.							
CS-07	Sediment Basin - below Ice Rich Storage Area	These stations are not constructed. Station is not active.							
EPS	Eagle Pup WRSA Seepage	These stations are not constructed. Station is not active.							
FT	Mine Water Treatment Plant Finishing Tank	These stations are not constructed. Station is not active.							

Table 11 Surface Water Hydrology Monitoring Program Compliance – EMSAMP 2019-01

Station	Location Description	Compliance Requirements							
		1. Field Program		2. Analysis [1]			3. Reporting and Adaptive Management [1]		
		1A: Frequency	1B: Tasks	2A: Rating Curve	2B: Streamflow Record	2C: QA/QC	3A: Reporting	3B: Check for Threshold Event	3C: Response to Threshold Event
HLFUMV	Heap Leach Facility Underdrain Monitoring Vault	Partial compliance. No data in 2019. 2020 monthly reports indicate site not active until May 2020.	Partial compliance. No data in 2019.	Partial compliance. No data in 2019.	Partial compliance. No data in 2019.	Partial compliance. No data in 2019.	Partial compliance. Not in 2019 annual report. Station included in 2020 monthly reports.	N/A. Not listed as requiring adaptive management check in EMSAMP 2019-01.	N/A. Not listed as requiring adaptive management check in EMSAMP 2019-01.
LDSPI	Lower Dublin South Pond Inflow	Partial compliance. No data in 2019. 2020 monthly reports indicate site not active.	Partial compliance. No data in 2019.	Partial compliance. No data in 2019.	Partial compliance. No data in 2019.	Partial compliance. No data in 2019.	Partial compliance. Not in 2019 annual report. Station included in 2020 monthly reports.	N/A. Not listed as requiring adaptive management check in EMSAMP 2019-01.	N/A. Not listed as requiring adaptive management check in EMSAMP 2019-01.
LDSP	Lower Dublin South Pond Outflow	Partial compliance. No data in 2019. 2020 monthly reports indicate site not active.	Partial compliance. No data in 2019.	Partial compliance. No data in 2019.	Partial compliance. No data in 2019.	Partial compliance. No data in 2019.	Partial compliance. Not in 2019 annual report. Station included in 2020 monthly reports.	N/A. Not listed as requiring adaptive management check in EMSAMP 2019-01.	N/A. Not listed as requiring adaptive management check in EMSAMP 2019-01.
MWTP	Mine Water Treatment Plant	2019 annual report reviewed do not address/discuss this station. 2020 monthly reports indicate station not active. Compliance cannot be fully determined using reports. VGC communication outside of reporting (personal communication, 29 October 2020), indicated the site was not constructed and is inactive, suggesting EMSAMP requirements not applicable.							
OPP	Open Pit Pond	2019 annual report reviewed do not address/discuss this station. 2020 monthly reports indicate station not active. Compliance cannot be fully determined using reports. VGC communication outside of reporting (personal communication, 29 October 2020), indicated the site was not constructed and is inactive, suggesting EMSAMP requirements not applicable .							
OPPO	Open Pit Pond Overflow	2019 annual report reviewed do not address/discuss this station. 2020 monthly reports indicate station not active. Compliance cannot be fully determined using reports. VGC communication outside of reporting (personal communication, 29 October 2020), indicated the site was not constructed and is inactive, suggesting EMSAMP requirements not applicable.							
PGS	Platinum Gulch WRSA Seepage	Partial compliance. No data in 2019. 2020 monthly reports indicate site not active.	Partial compliance. Flow conditions (no flow/frozen/flow measurement) obtained in 2020. Monitoring visit tasks outlined in EMSAMP 2019-01 Section 2.3.1 not documented.	N/A. Rating curve not required for manual measurement stations.	Not compliant. No streamflow record demonstrated.	Partial compliance. Field visit QA/QC tasks discussed but not documented. Equipment calibration not documented.	Partial compliance. Not in 2019 annual report. Station included in 2020 monthly reports.	N/A. Not listed as requiring adaptive management check in EMSAMP 2019-01.	N/A. Not listed as requiring adaptive management check in EMSAMP 2019-01.
PDI	Platinum Gulch Ditch	Partial compliance. No data in 2019. 2020 monthly reports indicate site not active.	Partial compliance. Flow conditions (no flow/frozen/flow measurement) obtained in 2020. Monitoring visit tasks outlined in EMSAMP 2019-01 Section 2.3.1 not documented.	N/A. Rating curve not required for manual measurement stations.	Not compliant. No streamflow record demonstrated.	Partial compliance. Field visit QA/QC tasks discussed but not documented. Equipment calibration not documented.	Partial compliance. Not in 2019 annual report. Station included in 2020 monthly reports.	N/A. Not listed as requiring adaptive management check in EMSAMP 2019-01.	N/A. Not listed as requiring adaptive management check in EMSAMP 2019-01.
PS	Open Pit Sump	2019 annual report reviewed do not address/discuss this station. 2020 monthly reports indicate station not active. Compliance cannot be fully determined using reports. VGC communication outside of reporting (personal communication, 29 October 2020), indicated the site was not constructed and is inactive, suggesting EMSAMP requirements not applicable.							

Table 12 Surface Water Hydrology Monitoring Program Compliance – EMSAMP 2020-01

Station	Location Description	Compliance Requirements							
		1. Field Program		2. Analysis [1]			3. Reporting and Adaptive Management [1]		
		1A: Frequency	1B: Tasks	2A: Rating Curve	2B: Streamflow Record	2C: QA/QC	3A: Reporting	3B: Check for Threshold Event	3C: Response to Threshold Event
W1 [a]	Dublin Gulch above Stewart	Compliant. Manual measurements demonstrated. Logger installations not documented.	Partial compliance. Flows obtained. Monitoring visit tasks outlined in EMSAMP 2020-01 Section 2.3.1 not documented.	N/A. Rating curve information not required in monthly reports.	N/A. Flow records not required in monthly reports	Not compliant. QA/QC procedures not demonstrated.	Compliant. Included in monthly reports.	N/A. Not listed as requiring adaptive management check in EMSAMP 2020-01.	N/A. Not listed as requiring adaptive management check in EMSAMP 2020-01.
W4 [a]	Haggart Creek below Dublin	Compliant. Manual measurements demonstrated. Logger installations not documented.	Partial compliance. Flows obtained. Monitoring visit tasks outlined in EMSAMP 2020-01 Section 2.3.1 not documented.	N/A. Rating curve information not required in monthly reports.	N/A. Flow records not required in monthly reports	Not compliant. QA/QC procedures not demonstrated.	Compliant. Included in monthly reports.	N/A. Performance threshold check or discussion of adaptive management applicability to be completed in annual reporting.	N/A. Performance threshold check to be completed in annual reporting.
W5 [a]	Haggart Creek above Lynx Creek	Compliant. Manual measurements demonstrated. Logger installations not documented.	Partial compliance. Flows obtained. Monitoring visit tasks outlined in EMSAMP 2020-01 Section 2.3.1 not documented.	N/A. Rating curve information not required in monthly reports.	N/A. Flow records not required in monthly reports	Not compliant. QA/QC procedures not demonstrated.	Compliant. Included in monthly reports.	N/A. Not listed as requiring adaptive management check in EMSAMP 2020-01.	N/A. Not listed as requiring adaptive management check in EMSAMP 2020-01.
W6 [a]	Lynx Creek above Haggart Creek	Compliant. Manual measurements demonstrated. Logger installations not documented.	Partial compliance. Flows obtained. Monitoring visit tasks outlined in EMSAMP 2020-01 Section 2.3.1 not documented.	N/A. Rating curve information not required in monthly reports.	N/A. Flow records not required in monthly reports	Not compliant. QA/QC procedures not demonstrated.	Compliant. Included in monthly reports.	N/A. Not listed as requiring adaptive management check in EMSAMP 2020-01.	N/A. Not listed as requiring adaptive management check in EMSAMP 2020-01.
W20 [b]	Bawn Boy Gulch	Compliant. Site visits demonstrated.	Partial compliance. Flows attempted. Monitoring visit tasks outlined in EMSAMP 2020-01 Section 2.3.1 not documented.	N/A. Rating curve information not required for manual measurement stations.	N/A. Flow records not required in monthly reports	Not compliant. QA/QC procedures not demonstrated.	Compliant. Included in monthly reports.	N/A. Not listed as requiring adaptive management check in EMSAMP 2020-01.	N/A. Not listed as requiring adaptive management check in EMSAMP 2020-01.
W21 [a]	Dublin Gulch at Mouth	Compliant. Manual measurements demonstrated. Logger installations not documented.	Partial compliance. Flows obtained. Monitoring visit tasks outlined in EMSAMP 2020-01 Section 2.3.1 not documented.	N/A. Rating curve information not required in monthly reports.	N/A. Flow records not required in monthly reports	Not compliant. QA/QC procedures not demonstrated.	Compliant. Included in monthly reports.	N/A. Not listed as requiring adaptive management check in EMSAMP 2020-01.	N/A. Not listed as requiring adaptive management check in EMSAMP 2020-01.
W22 [a]	Haggart Creek above Project Influence	Compliant. Manual measurements demonstrated. Logger installations not documented.	Partial compliance. Flows obtained. Monitoring visit tasks outlined in EMSAMP 2020-01 Section 2.3.1 not documented.	N/A. Rating curve information not required in monthly reports.	N/A. Flow records not required in monthly reports	Not compliant. QA/QC procedures not demonstrated.	Compliant. Included in monthly reports.	N/A. Not listed as requiring adaptive management check in EMSAMP 2020-01.	N/A. Not listed as requiring adaptive management check in EMSAMP 2020-01.
W23 [b]	Haggart Creek below Lynx Creek	Compliant. Manual measurements demonstrated.	Partial compliance. Flows attempted. Monitoring visit tasks outlined in EMSAMP 2020-01 Section 2.3.1 not documented.	N/A. Rating curve information not required for manual measurement stations.	N/A. Flow records not required in monthly reports	Not compliant. QA/QC procedures not demonstrated.	Compliant. Included in monthly reports.	N/A. Not listed as requiring adaptive management check in EMSAMP 2020-01.	N/A. Not listed as requiring adaptive management check in EMSAMP 2020-01.

Table 12 Surface Water Hydrology Monitoring Program Compliance – EMSAMP 2020-01

Station	Location Description	Compliance Requirements							
		1. Field Program		2. Analysis [1]			3. Reporting and Adaptive Management [1]		
		1A: Frequency	1B: Tasks	2A: Rating Curve	2B: Streamflow Record	2C: QA/QC	3A: Reporting	3B: Check for Threshold Event	3C: Response to Threshold Event
W26 [a]	Stewart Gulch	Compliant. Manual measurements demonstrated. Logger installations not documented.	Partial compliance. Flows obtained. Monitoring visit tasks outlined in EMSAMP 2020-01 Section 2.3.1 not documented.	N/A. Rating curve information not required in monthly reports.	N/A. Flow records not required in monthly reports	Not compliant. QA/QC procedures not demonstrated.	Compliant. Included in monthly reports.	N/A. Not listed as requiring adaptive management check in EMSAMP 2020-01.	N/A. Not listed as requiring adaptive management check in EMSAMP 2020-01.
W27 [a]	Eagle Creek near Camp below Eagle Creek Pond	Compliant. Manual measurements demonstrated. Logger installations not documented.	Partial compliance. Flows obtained. Monitoring visit tasks outlined in EMSAMP 2020-01 Section 2.3.1 not documented.	N/A. Rating curve information not required in monthly reports.	N/A. Flow records not required in monthly reports	Not compliant. QA/QC procedures not demonstrated.	Compliant. Included in monthly reports.	N/A. Not listed as requiring adaptive management check in EMSAMP 2020-01.	N/A. Not listed as requiring adaptive management check in EMSAMP 2020-01.
W29 [b]	Haggart Creek below Eagle Creek and Platinum Gulch	Compliant. Manual measurements demonstrated. Logger installations not documented.	Partial compliance. Flows obtained. Monitoring visit tasks outlined in EMSAMP 2020-01 Section 2.3.1 not documented.	N/A. Rating curve information not required for manual measurement stations.	N/A. Flow records not required in monthly reports	Not compliant. QA/QC procedures not demonstrated.	Compliant. Included in monthly reports.	N/A. Performance threshold check or discussion of adaptive management applicability to be completed in annual reporting.	N/A. Performance threshold check to be completed in annual reporting.
W39 [c]	Haggart Creek above South McQuesten River	Compliant. Manual measurement attempted in May.	Partial compliance. Flows attempted. Monitoring visit tasks outlined in EMSAMP 2020-01 Section 2.3.1 not documented.	N/A. Rating curve information not required for manual measurement stations.	N/A. Flow records not required in monthly reports	Not compliant. QA/QC procedures not demonstrated.	Compliant. Included in monthly reports.	N/A. Not listed as requiring adaptive management check in EMSAMP 2020-01.	N/A. Not listed as requiring adaptive management check in EMSAMP 2020-01.
W45 [a]	Eagle Creek above Haggart Creek	Compliant. Manual measurements demonstrated. Logger installations not documented.	Partial compliance. Flows obtained. Monitoring visit tasks outlined in EMSAMP 2020-01 Section 2.3.1 not documented.	N/A. Rating curve information not required in monthly reports.	N/A. Flow records not required in monthly reports	Not compliant. QA/QC procedures not demonstrated.	Compliant. Included in monthly reports.	N/A. Not listed as requiring adaptive management check in EMSAMP 2020-01.	N/A. Not listed as requiring adaptive management check in EMSAMP 2020-01.
W49 [c]	South McQuesten River below Haggart Creek	Compliant. Manual measurement attempted in May.	Partial compliance. Flows attempted. Monitoring visit tasks outlined in EMSAMP 2020-01 Section 2.3.1 not documented.	N/A. Rating curve information not required for manual measurement stations.	N/A. Flow records not required in monthly reports	Not compliant. QA/QC procedures not demonstrated.	Compliant. Included in monthly reports.	N/A. Not listed as requiring adaptive management check in EMSAMP 2020-01.	N/A. Not listed as requiring adaptive management check in EMSAMP 2020-01.
W99 [a]	Haggart Creek above 15 Pup	Compliant. Manual measurements demonstrated. Logger installations not documented.	Partial compliance. Flows obtained. Monitoring visit tasks outlined in EMSAMP 2020-01 Section 2.3.1 not documented.	N/A. Rating curve information not required in monthly reports.	N/A. Flow records not required in monthly reports	Not compliant. QA/QC procedures not demonstrated.	Compliant. Included in monthly reports.	N/A. Not listed as requiring adaptive management check in EMSAMP 2020-01.	N/A. Not listed as requiring adaptive management check in EMSAMP 2020-01.

Table 12 Surface Water Hydrology Monitoring Program Compliance – EMSAMP 2020-01

Station	Location Description	Compliance Requirements							
		1. Field Program		2. Analysis [1]			3. Reporting and Adaptive Management [1]		
		1A: Frequency	1B: Tasks	2A: Rating Curve	2B: Streamflow Record	2C: QA/QC	3A: Reporting	3B: Check for Threshold Event	3C: Response to Threshold Event
ADR Pad Ditch [h]	ADR Pad Ditch Outlet	N/A. Daily site visits not required as site not active and not discharging. .	N/A. Not required when not discharging or not active..	N/A. Rating curve information not required for manual measurement stations.	N/A. Flow records not required in monthly reports	N/A. Not required when not active.	N/A	N/A. Not listed as requiring adaptive management check in EMSAMP 2020-01.	N/A. Not listed as requiring adaptive management check in EMSAMP 2020-01.
CS-07 [e]	Sediment Basin - below Ice Rich Storage Area	Compliant. Site visit demonstrated but noted as not active.	N/A. Not required when not active	N/A. Rating curve information not required in monthly reports.	N/A. Flow records not required in monthly reports	N/A. Not required when not active.	N/A	N/A. Not listed as requiring adaptive management check in EMSAMP 2020-01.	N/A. Not listed as requiring adaptive management check in EMSAMP 2020-01.
EPS [b]	Eagle Pup WRSA Seepage	Compliant. Site visit demonstrated but noted as not active.	N/A. Not required when not active.	N/A. Rating curve information not required for manual measurement stations.	N/A. Flow records not required in monthly reports	N/A. Not required when not active.	N/A	N/A. Not listed as requiring adaptive management check in EMSAMP 2020-01.	N/A. Not listed as requiring adaptive management check in EMSAMP 2020-01.
FT [e]	Mine Water Treatment Plant Finishing Tank	Compliant. Site visit demonstrated but noted as not active.	N/A. Not required when not active	N/A. Rating curve information not required in monthly reports.	N/A. Flow records not required in monthly reports	N/A. Not required when not active	N/A	N/A. Not listed as requiring adaptive management check in EMSAMP 2020-01.	N/A. Not listed as requiring adaptive management check in EMSAMP 2020-01.
HLFUMV [a]	Heap Leach Facility Underdrain Monitoring Vault	Compliant. Site visits demonstrated. Logger installations not documented.	Partial compliance. Flows obtained. Monitoring visit tasks not demonstrated.	N/A. Rating curve information not required in monthly reports.	N/A. Flow records not required in monthly reports	Not compliant. QA/QC procedures not demonstrated.	Compliant. Included in monthly reports.	N/A. Not listed as requiring adaptive management check in EMSAMP 2020-01.	N/A. Not listed as requiring adaptive management check in EMSAMP 2020-01.
LDSPI [e]	Lower Dublin South Pond Inflow	Compliant. Site visit demonstrated but noted as flow N/A.	N/A. Not required when not active	N/A. Rating curve information not required in monthly reports.	N/A. Flow records not required in monthly reports	N/A. Not required when not active	Compliant. Included in monthly reports.	N/A. Not listed as requiring adaptive management check in EMSAMP 2020-01.	N/A. Not listed as requiring adaptive management check in EMSAMP 2020-01.
LDSPO [e]	Lower Dublin South Pond Outflow	Compliant. Site visits demonstrated (no flow). Logger installations not documented.	N/A. Not required when not active.	N/A. Rating curve information not required in monthly reports.	N/A. Flow records not required in monthly reports	N/A. Not required when not active	Compliant. Included in monthly reports.	N/A. Not listed as requiring adaptive management check in EMSAMP 2020-01.	N/A. Not listed as requiring adaptive management check in EMSAMP 2020-01.

Table 12 Surface Water Hydrology Monitoring Program Compliance – EMSAMP 2020-01

Station	Location Description	Compliance Requirements							
		1. Field Program		2. Analysis [1]			3. Reporting and Adaptive Management [1]		
		1A: Frequency	1B: Tasks	2A: Rating Curve	2B: Streamflow Record	2C: QA/QC	3A: Reporting	3B: Check for Threshold Event	3C: Response to Threshold Event
LDSP-UND [b]	LDSP Undertrain Outflow	Compliant. Manual measurements demonstrated. Logger installations not documented.	Partial compliance. Flows obtained. Monitoring visit tasks not demonstrated.	N/A. Rating curve information not required for manual measurement stations.	N/A. Flow records not required in monthly reports	Not compliant. QA/QC procedures not demonstrated.	Compliant. Included in monthly reports.	N/A. Not listed as requiring adaptive management check in EMSAMP 2020-01.	N/A. Not listed as requiring adaptive management check in EMSAMP 2020-01.
MWTP [e]	Mine Water Treatment Plant	Compliant. Site visit demonstrated but noted as not active.	N/A. Not required when not active	N/A. Rating curve information not required in monthly reports.	N/A. Flow records not required in monthly reports	N/A. Not required when not active.	Compliant. Included in monthly reports.	N/A. Not listed as requiring adaptive management check in EMSAMP 2020-01.	N/A. Not listed as requiring adaptive management check in EMSAMP 2020-01.
OPP [g]	Open Pit Pond	Compliant. Not required during operation. Site visit demonstrated but noted as not active.	N/A. Not required during operation	N/A. Rating curve information not required for manual measurement stations.	N/A. Flow records not required in monthly reports	N/A. Not required when not active.	Compliant. Included in monthly reports.	N/A. Not listed as requiring adaptive management check in EMSAMP 2020-01.	N/A. Not listed as requiring adaptive management check in EMSAMP 2020-01.
OPPO [b]	Open Pit Pond Overflow	Compliant. Site visit demonstrated but noted as not active.	Partial compliance. Site visit performed. Monitoring visit tasks outlined in EMSAMP 2020-01 Section 2.3.1 not documented.	N/A. Rating curve information not required for manual measurement stations.	N/A. Flow records not required in monthly reports	Not compliant. QA/QC procedures not demonstrated.	Compliant. Included in monthly reports.	N/A. Not listed as requiring adaptive management check in EMSAMP 2020-01.	N/A. Not listed as requiring adaptive management check in EMSAMP 2020-01.
PGS [b]	Platinum Gulch WRSA Seepage	Compliant. Manual measurements demonstrated.	Partial compliance. Flows obtained. Monitoring visit tasks outlined in EMSAMP 2020-01 Section 2.3.1 not documented.	N/A. Rating curve information not required for manual measurement stations.	N/A. Flow records not required in monthly reports	Not compliant. QA/QC procedures not demonstrated.	Compliant. Included in monthly reports.	N/A. Not listed as requiring adaptive management check in EMSAMP 2020-01.	N/A. Not listed as requiring adaptive management check in EMSAMP 2020-01.
PDI [b]	Platinum Gulch Ditch	Compliant. Manual measurements demonstrated.	Partial compliance. Flows obtained. Monitoring visit tasks outlined in EMSAMP 2020-01 Section 2.3.1 not documented.	N/A. Rating curve information not required for manual measurement stations.	N/A. Flow records not required in monthly reports	Not compliant. QA/QC procedures not demonstrated.	Compliant. Included in monthly reports.	N/A. Not listed as requiring adaptive management check in EMSAMP 2020-01.	N/A. Not listed as requiring adaptive management check in EMSAMP 2020-01.
PS [f]	Open Pit Sump	Compliant. Site visit demonstrated but noted as not active.	N/A. Not required when not active.	N/A. Rating curve information not required in monthly reports.	N/A. Flow records not required in monthly reports	N/A. Not required when not active	N/A	N/A. Not listed as requiring adaptive management check in EMSAMP 2020-01.	N/A. Not listed as requiring adaptive management check in EMSAMP 2020-01.

Table 12 Surface Water Hydrology Monitoring Program Compliance – EMSAMP 2020-01

Station	Location Description	Compliance Requirements							
		1. Field Program		2. Analysis [1]			3. Reporting and Adaptive Management [1]		
		1A: Frequency	1B: Tasks	2A: Rating Curve	2B: Streamflow Record	2C: QA/QC	3A: Reporting	3B: Check for Threshold Event	3C: Response to Threshold Event

NOTES:
[1] Compliance for analysis and reporting requirements could often not be checked for compliance; 2020 monthly reports do not provide rating curves, flow records, QA/QC, monitoring summaries, or adaptive management checks
[a] Automated monitoring. Manual monitoring weekly during freshet until loggers installed and monthly during winter.
[b] Manual monitoring on a monthly basis.
[c] Manual monitoring on a quarterly basis.
[e] Automated monitoring when discharging.
[f] Automated monitoring when dewatering.
[g] Quarterly manual water level measurements during active closure.
[h] Manual measurement on a daily basis when discharging.

3.1.2.4 Water Management Plan

The Licensee's compliance with WMP 2017-01 and WMP 2020-01 was evaluated concurrently. Both WMP 2017-01 and WMP 2020-01 are approved plans with design components and as-recorded surveys sealed by a professional engineer licensed to practice in the Yukon.

The compliance evaluation for the WMPs checked for completion, and for effectiveness. Compliance with completion occurred if the water management infrastructure item was documented as installed by the required time (e.g., prior to operation). Compliance with effectiveness occurred if water quality did not exceed the Effluent Quality Standards during operations (Table 7.1-1 in WMP 2017-01, Table 6.1-1 in WMP 2020-01), and if regular inspection (as required) was documented for water management infrastructure/measures. Table 13 summarizes the main water management infrastructure, and provides an evaluation of compliance based on the reviewed reporting. Water quality implications are discussed in Section 3.2 (Surface Water Quality).

Table 13 Water Management Plan Implementation

Water Management Infrastructure	Compliance
LDSP	Partial compliance. VGC communication outside of reviewed reporting (personal communication, 29 October 2020) indicated as built report submitted in 2017 annual report. Completion date not documented in reviewed reports. Use of water from LDSP for dust suppression and concrete mentioned in June–October 2018 (2018 annual report) and storage in LDSP mentioned in May–September 2019, suggesting completion to some degree. Completion of specific LDSP components (spillway, embankment, inlet tie-ins, etc.) not documented in reviewed reports.
Ditch A	Partial compliance. VGC communication outside of reviewed reporting (personal communication, 29 October 2020) indicated ditch as built report provided to EMR as appendix to 2019 Annual Report. In reviewed reporting, excavation, rip rap armoring, HDPE pipe fusing documented as completed in 2019. Inlet to LDSP documented as completed in 2019. Month of completion not documented in reviewed reports. Completion prior to beginning of operation (August 31, 2020) not documented in reviewed reports
Ditch B	Partial compliance. VGC communication outside of reporting (personal communication, October 29, 2020) indicated ditch as built report provided to EMR as appendix to 2019 Annual Report. In reviewed reporting, excavation, rip rap armoring began in 2018, scheduled for completion in March 2019. Completion not documented in reviewed reports. Inlet to LDSP documented as completed in 2019 (month of completion not documented). Completion prior to beginning of operation (August 31, 2020) not documented in reviewed reports. Ditch B extension to toe of Eagle Pup documented as planned for 2020.
Ditch C	Compliant. Excavation, rip rap armoring completed in April 2019, prior to beginning of operation (August 31, 2020).
Culverts	Partial compliance. VGC communication outside of reporting (personal communication, October 29, 2020) indicated culvert inventory has been provided to EMR-CMI. In reviewed reporting, installation of numerous culverts throughout 2018 and 2019 documented. Inventory of culvert locations, characteristics, and completion dates not provided in reviewed reports.
Unnamed Ditches	Partial compliance. Installation of numerous conveyance/diversion ditches throughout 2018 and 2019 documented. Inventory of ditch locations, characteristics, and completion dates not provided.

Table 13 Water Management Plan Implementation

Water Management Infrastructure	Compliance
Events Pond	Partial compliance. VGC communication outside of reporting (personal communication, October 29, 2020) indicated as builts provided to YWB as appendix to 2019 Annual Report. In reviewed reporting, documented as completed in 2019. Month of completion not documented. Completion prior to beginning of operation (August 31, 2020) not documented in reviewed reports.
MWTP	N/A. Not required until Phase 2.
Erosion and Sediment Control BMP's	N/A. Reporting requirements are on an annual basis and were not specified as required until the 2020 Water Management Plan (Table 2.3-2); the 2020 annual report was not a reviewed report. Current and planned implementation of ESC BMP's are generally referenced in 2018 and 2019 annual reporting.

3.1.3 Reporting Adequacy, Compliance and Recommendations

Overall, compliance results for the applicable EMSAMPs were a mix of compliant, partial compliance, and not compliant (See Table 10 to Table 12). Several consistent non-compliance or partial compliance themes were observed throughout the audit period. The Licensee's adherence to the applicable EMSAMP has appeared to improve through the audit period. This improvement was gradual through the audit period and was not related to a transition in project phase (e.g., construction to start-up/operation). For example, in the January – June 2020 monthly reports, all of the stations which were listed in EMSAMP 2019-01 and EMSAMP 2020-01 were listed and commented on in the 2020 monthly reports, whereas the 2018 and 2019 annual reports did not cover/discuss all of the stations listed in the EMSAMPs.

Table 14 summarizes the consistent compliance gaps/deficiencies resulting in partial compliance or non-compliance, and provides recommendations/corrective actions for each.

Table 14 Surface Water Hydrology Compliance and Recommendations

Compliance Gap and/or Deficiency	Recommendation/Corrective Action
EMSAMPs reference RISC (2009) as the document which was used to develop hydrology data collection. This document is out of date; Version 2.0 of that document was published in 2018.	The EMSAMP surface water hydrology program should be updated to reflect Version 2 of the hydrometric standards (RISC 2018).
Poor documentation of revised sampling approaches for various stations based on data collection challenges or change in phase (e.g., monitoring frequency, monitoring type).	Explicitly document and provide rationale for changes to station monitoring approach or regime where applicable, and indicate plans for revising applicable EMSAMP sections.
Prior to the 2020 monthly reports, there was insufficient documentation of periods where “discharging” or “dewatering” was occurring; this informs the requirement for monitoring at several station.	Based on review of monthly reports from 2020, it appears that VGC has improved this. The 2020 annual report, and future monthly and annual reports, should continue to document periods of discharging or dewatering at applicable locations throughout site as to inform the need for monitoring at applicable sites.
For automated stations, winter and freshet time periods were not clearly delineated as to allow for demonstration of compliance as outlined in the EMSAMPs.	Recommend one of two changes: 1. Document approximate dates of freshet start and logger deployment each year in the monthly and annual reports to delineate winter, freshet, and open water periods (each of which have different monitoring requirements), or 2. Update the EMSAMP requirements for the freshet period to better acknowledge i) the subjectivity of determining freshet period and/or ii) the difficulty of obtaining flow measurements during freshet flows.
Quarterly manual monitoring stations are not completed at consistent times of the year.	Clarify “quarterly monitoring” schedule, with backup sampling protocols if conditions are unsafe.
Prior to the 2020 Monthly Reports, not all of the monitoring stations outlined in the EMSAMPs are discussed/addressed in the annual reports.	Discuss/address all monitoring stations listed in the applicable EMSAMP, noting the status (e.g., active, not active) of each. Include data for all active monitoring stations (automated, manual) in reporting.
The EMSAMPs list general tasks to be completed at each field visit (Section 2.3.1). Completion of these tasks was discussed in general in annual reports but documentation was not provided per requirements of RISC (2018).	Provide summary information regarding the completion of the tasks associated with each field visit in the annual reports, and/or indicate (in reporting) that these data have been documented internally and are available upon request.
Logger malfunctions resulted in the loss of partial or full open water season datasets at several stations.	As outlined in the general tasks in the EMSAMPs (Section 2.3.1), download logger data either at every monitoring visit, or at an appropriate regular frequency, to minimize data loss and rectify issues.
Sites experienced flows which were too high to safely obtain a flow measurement. The flows experienced in June are part of the seasonal range in flows and should be captured as part of the rating curve development or verification.	If possible considering a reasonable level of effort and resources, safe flow measurement methods and procedures should be developed and implemented to capture high flows which are essential to development of reliable rating curves. If no method is safe considering reasonable levels of effort and resources, it should be stated in the reporting as such (e.g., as was completed in 2020 Monthly Reports) with a rationale, and the rating curves identified as valid below an identified threshold.

Table 14 Surface Water Hydrology Compliance and Recommendations

Compliance Gap and/or Deficiency	Recommendation/Corrective Action
QA/QC related to field and analytical tasks (e.g., benchmark surveys, station condition, field processes, photos, equipment calibration) were not documented.	Recommend that QA/QC processes in accordance with Section 2.3.1 in EMSAMP2018-01, EC 2001, RISC 2018 are documented and provided in reporting.
Flow records are in partial compliance due to lack of winter and freshet measurements and/or logger malfunctions.	Implement monitoring program as outlined in applicable EMSAMP or provide rationale for implementation not being possible in reporting and amend EMSAMP.
For automated stations, it is not clear what the manual monitoring frequency is during the freshet in EMSAMP2020-01.	Clarify this in future EMSAMPs/reporting.
It is not clear in the EMSAMPs if the adaptive management performance thresholds are applicable to manual monitoring stations.	Clarify this in future EMSAMPs/reporting.
Average monthly flows were used instead of median monthly flows (as specified in Table 2.4-1 in EMSAMP2019-01 and EMSAMP2020-01) in evaluation of performance thresholds.	Use median monthly flows in evaluation of performance thresholds as outlined in EMSAMP.
The method of evaluation of performance thresholds for adaptive management was not completed in accordance with quantitative procedure outlined in EMSAMPs.	Apply the quantitative evaluation protocol outlined in the EMSAMPs for performance thresholds for adaptive management at relevant monitoring locations.
The evaluation of performance thresholds for adaptive management was not completed for all automated stations listed in the EMSAMPs.	Perform evaluation of performance thresholds for adaptive management for all relevant automated stations as outlined in the EMSAMP.
Adaptive management responses were not clearly performed following an AMP event of performance thresholds.	Implement and document the adaptive management responses if performance thresholds exceeded at relevant monitoring locations as outlined in EMSAMPs.
Full documentation of completion timelines and dates for key water management infrastructure not documented in reviewed reports.	Include specific completion dates in annual reporting for all key water management components.

3.2 SURFACE WATER QUALITY

3.2.1 Documents Reviewed

Documents shown in Table 15 were reviewed for the surface water quality monitoring section of the audit. In addition, the monitoring program was reviewed with respect to procedures outlined in the British Columbia Field Sampling Manual as per the EMSAMPs (BC ENV 2013), and the Guidance Document for the Sampling and Analysis of Metal Mining Effluents (EC 2001).

Table 15 Surface Water Quality Documents Reviewed

Document	Version Reviewed	Sections Applicable during Construction Phase	Sections Applicable to Operations Phase
EMSAMP	2018-01	3.0 – Surface Water Quality	N/A
EMSAMP	2019-01	3.0 – Surface Water Quality	3.0 – Surface Water Quality
EMSAMP	2020-01	N/A	3.0 – Surface Water Quality
Construction and Operations Water Management Plan	2017-01	3.4.3 – Surface Water Quality	3.4.3 – Surface Water Quality 4.3 – Discharge Protocols 7.0 – Operations Water Management
Water Management Plan	2020-01	N/A	3.4.2 – Surface Water Quality 4.3 – Discharge Protocols 6.0 Water Management Implementation
Water Licence QZ14-041, Quartz Mining License QML-0011 2018 Annual Report	N/A	3.2 – Surface Water Quality	N/A
Water Licence QZ14-041, Quartz Mining License QML-0011 2019 Annual Report	N/A	3.2 – Surface Water Quality	3.2 – Surface Water Quality
Water Licence QZ14-041-01 Monthly reports January 1 to June 30, 2020	N/A	N/A	3.0 – Surface Water Quality
Water Licence QZ14-041-01 (Amendment 1, August 23, 2019)	Amendment 1	Schedule 3 – WQOs	Part F – EQS

3.2.2 Monitoring Program Implementation

The surface water monitoring program was designed to meet the following objectives during construction and operations as described in EMSAMP 2018-01 and EMSAMP 2019-01:

- Continue to collect water quality data in the receiving environment as the Project transitions from construction to operations at stations upstream and downstream of Project influences.
- Collect water quality data to verify compliance with the discharge criteria specified in QZ14-041.
- Provide a continuous water quality database to support adaptive management strategies to meet water quality compliance criteria and protect aquatic life.

The following are key watersheds where the surface water monitoring program focuses on compliance monitoring and environmental effects:

- 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 the confluence with Haggart Creek;
- Eagle Creek;
- Lynx Creek; and
- South McQuesten River at the confluence of Haggart Creek

The surface water monitoring program is implemented according the objectives stated in the EMSAMP versions.

3.2.3 Compliance with EMSAMP

The Construction and Operations Water Management Plan 2017-01 and the Water Management Plan 2020-01 were reviewed for alignment with the applicable EMSAMP. Discharge protocols relating to the adaptive management thresholds (AMTs) and EQS were aligned with the EMSAMP and Water Licence QZ14-041.

For the construction phase, the 2018 and 2019 Annual Reports were reviewed for compliance with surface water quality sections of the EMSAMP 2018-01 and EMSAMP 2019-01. In this review, monitoring stations, sampling frequency, parameters analyzed, and rationale for missing data were checked for compliance with the applicable EMSAMPs. The results of this task are listed in Table 16.
During construction, effluent compliance points and effluent quality standards were not established and no discharge of contact water to the surface water occurred.

For the operational phase, the 2019 Annual Report and applicable 2020 Monthly Reports were reviewed for compliance with EMSAMP 2019-01 and EMSAMP 2020-01. In this review, monitoring stations, sampling frequency, parameters analyzed, and rationale for missing data were checked for compliance with the applicable EMSAMPs. The results of this task are listed in in Table 17. Effluent compliance points, effluent quality standards (EQS), and water quality objectives (WQOs) were described in EMSAMP 2019-01 as per the Water License QZ14-041, Amendment 1, August 23, 2019. Table 18 lists the threshold trigger events for surface water monitoring sites during operations while Table 19 describes the responses and follow up actions completed with auditor's comments on deficiencies.

Table 16 Surface Water Quality Monitoring Program Compliance Table – Construction

Site Name	Site Description	EMSAMP Version	Data and Frequency Required				Compliance Check (Y/N) with Rationale for Missing Data								
			Field Measurements		Laboratory Analysis		Construction Phase (July 1, 2018 - March 17, 2019)								
			Turbidity	pH, Temperature, Dissolved Oxygen, Turbidity and Conductivity	Turbidity and Total Suspended Solids	Full Analytical Suite	Jul-18	Aug-18	Sep-18	Oct-18	Nov-18	Dec-18	Jan-19	Feb-19	Mar-19
W1	Dublin Gulch above Stewart	2018-01	-	M	-	M	Y	Y	Y	Y	Y	Y	Y	Y	Y
W21	Dublin Gulch at mouth	2018-01	-	M	-	M	Y	Y	Y	Y	Y - No Sample	Y	Y	Y	Y - No Sample
W4	Haggart Creek below Dublin	2018-01	-	M	-	M	Y	Y	Y	Y	Y	Y	Y	Y	Y
W22	Haggart Creek above Project Influence	2018-01	-	M	-	M	Y	Y	Y	Y	Y	Y	Y	Y	Y
W5	Haggart Creek above Lynx Creek	2018-01	-	M	-	M	Y	Y	Y	Y	Y	Y	Y	Y	Y
W6	Lynx Creek above Haggart Creek	2018-01	-	Q	-	Q	Y			Y			Y		
W20	Bawn Boy Gulch	2018-01	-	M	-	M	Y	Y	Y	Y	Y	Y	Y	Y	Y
W23	Haggart Creek below Lynx Creek	2018-01	-	M	-	M	Y	Y	Y	Y	Y	Y	Y	Y	Y
W26	Stewart Gulch	2018-01	-	M	-	M	Y	Y	Y	Y	Y	Y - No Sample	Y - No Sample	Y - No Sample	Y - No Sample
W27	Eagle Creek near Camp	2018-01	-	M	-	M	Y	Y	Y	Y	Y - No Sample	Y - No Sample	Y - No Sample	Y - No Sample	Y - No Sample
W29	Haggart Creek below Eagle Creek and Platinum Gulch	2018-01	-	M	-	M	Y	Y	Y	Y	Y	Y	Y	Y	Y
W39	Haggart Creek above South McQuesten River	2018-01	-	Q	-	Q	Y			Y			N	N	Y - No Sample
W45	Eagle Creek above Haggart Creek	2018-01	-	M	-	M	Y	Y	Y	Y	Y	Y	Y	Y - No Sample	Y - No Sample
W49	South McQuesten River below Haggart Creek	2018-01	-	Q	-	Q	Y			Y			Y		
EPS	Eagle Pup WRSA Seepage	2018-01	D	Md	Wd	Md	Y - No Sample	Y - No Sample	Y - No Sample	Y - No Sample	Y - No Sample	Y - No Sample	Y - No Sample	Y - No Sample	Y - No Sample
PDI	Platinum Gulch Ditch into Lower Dublin South Pond	2018-01	D	Md	Wd	Md	Y - No Sample	Y - No Sample	Y - No Sample	Y - No Sample	Y - No Sample	Y - No Sample	Y - No Sample	Y - No Sample	Y - No Sample
LDSPI	Lower Dublin South Pond Inflow	2018-01	D	Md	Wd	Md	Y - No Sample	Y - No Sample	Y - No Sample	Y - No Sample	Y - No Sample	Y - No Sample	Y - No Sample	Y - No Sample	Y - No Sample
LDSPO	Lower Dublin South Pond Outflow	2018-01	D	Md	Wd	Md	Y - No Sample	Y - No Sample	Y - No Sample	Y - No Sample	Y - No Sample	Y - No Sample	Y - No Sample	Y - No Sample	Y - No Sample
CS-01	Sediment Basin - below Lower Process Access Road	2018-01	D	Md	Wd	Md	Y - No Sample	Y - No Sample	Y - No Sample	Y - No Sample	Y - No Sample	Y - No Sample	Y - No Sample	Y - No Sample	Y - No Sample
CS-02	Sediment Basin – below Truck Shop	2018-01	D	Md	Wd	Md	Y - No Sample	Y - No Sample	Y - No Sample	Y - No Sample	Y - No Sample	Y - No Sample	Y - No Sample	Y - No Sample	Y - No Sample

Table 16 Surface Water Quality Monitoring Program Compliance Table – Construction

Site Name	Site Description	EMSAMP Version	Data and Frequency Required				Compliance Check (Y/N) with Rationale for Missing Data								
			Field Measurements		Laboratory Analysis		Construction Phase (July 1, 2018 - March 17, 2019)								
			Turbidity	pH, Temperature, Dissolved Oxygen, Turbidity and Conductivity	Turbidity and Total Suspended Solids	Full Analytical Suite	Jul-18	Aug-18	Sep-18	Oct-18	Nov-18	Dec-18	Jan-19	Feb-19	Mar-19
CS-03	Sediment Basin - below South Infrastructure	2018-01	D	Md	Wd	Md	Y - No Sample	Y - No Sample	Y - No Sample	Y - No Sample	Y - No Sample	Y - No Sample	Y - No Sample	Y - No Sample	Y - No Sample
CS-04	SB-G4 – below Ice Rich Overburden Storage Area	2018-01	D	Md	Wd	Md	Y - No Sample	Y - No Sample	Y - No Sample	Y - No Sample	Y - No Sample	Y - No Sample	Y - No Sample	Y - No Sample	Y - No Sample

NOTES:
Y – No Sample = inactive station, no flow, no discharge, dry conditions, frozen, not active, heavy sediment, or no safe access
D – Daily when discharging; M – Monthly; Md - Monthly when discharging; Q – Quarterly; Wd - Weekly when discharging

Table 17 Surface Water Quality Monitoring Program Compliance Table – Operations

Site	Location Description	Sampling Frequency			Compliance Check (Y/N) with Rationale for Missing Data Operations Phase (April 2019 – June 2020)														
		Field Measurements	Laboratory Analysis																
		pH, Temperature, Dissolved Oxygen and Specific Conductance	Analytical Suite[5]	48-Hour and 96-Hour LT50	Apr-19	May-19	Jun-19	Jul-19	Aug-19	Sep-19	Oct-19	Nov-19	Dec-19	Jan-20	Feb-20	Mar-20	Apr-20	May-20	Jun-20
					EMSAMP 2019-01														EMSAMP 2020-01
W1	Dublin Gulch above Stewart	M	M	-	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
W21	Dublin Gulch below Event Ponds	M	M	-	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
W4	Haggart Creek below Dublin	D, M	D[1], M[1]	-	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
W22	Haggart Creek above Project Influence	M	M[2]	-	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
W5	Haggart Creek above Lynx Creek	M	M[2]	-	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y - No Sample	Y	Y	Y - No Sample	Y	Y
W6	Lynx Creek above Haggart Creek	M	M[2]	-	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y - No Sample	Y	Y	Y	Y	Y
W20	Bawn Boy Gulch	M	M	-	Y	Y	Y	Y	Y	Y	Y	Y - No Sample	Y	Y - No Sample	Y - No Sample	Y - No Sample	Y - No Sample	Y - No Sample	Y
W23	Haggart Creek below Lynx Creek	M	M[2]	-	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
W27	Eagle Creek near Camp below LDSP	M	M	-	Y	Y	Y	Y	Y	Y	Y	Y - No Sample	Y - No Sample	Y - No Sample	Y - No Sample	Y - No Sample	Y - No Sample	Y	Y
W26	Stewart Gulch	M	M	-	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y - No Sample	Y - No Sample	Y - No Sample	Y - No Sample	Y	Y
W29	Haggart Creek below Eagle Creek & Platinum Gulch	D, M	D[1], M[2]	-	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
W39	Haggart Creek above South McQuesten River	Q	Q[2]	-	Y	Y	Y	Y			Y			Y			Y		
W45	Eagle Creek above Haggart Creek	M	M	-	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y - No Sample	Y - No Sample	Y	Y
W49	South McQuesten River below Haggart Creek	Q	Q[2]	-	Y	Y	Y	Y			Y			Y			Y		
W99	Haggart Creek above 15 Pup	M	Q[2]	-	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y

Table 17 Surface Water Quality Monitoring Program Compliance Table – Operations

Site	Location Description	Sampling Frequency			Compliance Check (Y/N) with Rationale for Missing Data Operations Phase (April 2019 – June 2020)														
		Field Measurements	Laboratory Analysis																
		pH, Temperature, Dissolved Oxygen and Specific Conductance	Analytical Suite[5]	48-Hour and 96-Hour LT50	Apr-19	May-19	Jun-19	Jul-19	Aug-19	Sep-19	Oct-19	Nov-19	Dec-19	Jan-20	Feb-20	Mar-20	Apr-20	May-20	Jun-20
EPS	Eagle Pup WRSA Seepage	M	M	-	Y - No Sample	Y - No Sample	Y - No Sample	Y - No Sample	Y - No Sample	Y - No Sample	Y - No Sample	Y - No Sample	Y	Y - No Sample	Y - No Sample	Y - No Sample	Y - No Sample	Y	Y
PDI & PG_PTS[5]	Platinum Gulch Ditch into Lower Dublin South Pond	M	M	-	Y - No Sample	Y - No Sample	Y - No Sample	Y – No Sample	Y - No Sample	Y - documented in Sept 2019 monthly report but station mislabeled as LDSPI (DA4)	Y - No Sample	Y - No Sample	Y - No Sample	Y - No Sample	Y - No Sample	Y - No Sample	Y - No Sample	Y	Y
PGS	Platinum Gulch WRSA Seepage	M	M	-	Y - No Sample	Y - No Sample	Y - No Sample	Y - No Sample	Y - No Sample	Y - documented in Sept 2019 monthly report but station mislabeled as LDSPI (DA4)	Y - No Sample	Y - No Sample	Y - No Sample	Y - No Sample	Y - No Sample	Y - No Sample	Y - No Sample	Y	Y
PS	Open Pit Sump	M	M	-	Y - No Sample	Y - No Sample	Y - No Sample	Y - No Sample	Y - No Sample	Y - No Sample	Y - No Sample	Y - No Sample	Y - No Sample	Y - No Sample	Y - No Sample	Y - No Sample	Y - No Sample	Y - No Sample	Y - No Sample
MWTP	Mine Water Treatment Plant	D	D[2]	-	Y - No Sample	Y - No Sample	Y - No Sample	Y - No Sample	Y - No Sample	Y - No Sample	Y - No Sample	Y - No Sample	Y - No Sample	Y - No Sample	Y - No Sample	Y - No Sample	Y - No Sample	Y - No Sample	Y - No Sample
FT	Mine Water Treatment Plant Finishing Tank	D	D[2]	-	Y - No Sample	Y - No Sample	Y - No Sample	Y - No Sample	Y - No Sample	Y - No Sample	Y - No Sample	Y - No Sample	Y - No Sample	Y - No Sample	Y - No Sample	Y - No Sample	Y - No Sample	Y - No Sample	Y - No Sample
LDSPI	Lower Dublin South Pond Inflow	D, M	D[2], M	M	Y	Y	Y	Y	Y	Y	Y	Y - No Sample	Y - No Sample	Y - No Sample	Y - No Sample	Y - No Sample	Y	N - See note 6	Y
LDSP	Lower Dublin South Pond Outflow	D, W	D[2], W[2,3]	Md	Y	Y - No Sample	Y - No Sample	Y - No Sample	Y - No Sample	Y - No Sample	Y - No Sample	Y - No Sample	Y - No Sample	Y - No Sample	Y - No Sample	Y - No Sample	Y - No Sample	Y - No Sample	Y - No Sample
CS-07	SG-G4 below Ice Rich Overburden Storage Area	Md	Md	-	Y - No Sample	Y - No Sample	Y - No Sample	Y - No Sample	Y - No Sample	Y - No Sample	Y - No Sample	Y - No Sample	Y - No Sample	Y - No Sample	Y - No Sample	Y - No Sample	Y - No Sample	Y - No Sample	Y - No Sample

Table 17 Surface Water Quality Monitoring Program Compliance Table – Operations

Site	Location Description	Sampling Frequency			Compliance Check (Y/N) with Rationale for Missing Data Operations Phase (April 2019 – June 2020)														
		Field Measurements	Laboratory Analysis																
		pH, Temperature, Dissolved Oxygen and Specific Conductance	Analytical Suite[5]	48-Hour and 96-Hour LT50	Apr-19	May-19	Jun-19	Jul-19	Aug-19	Sep-19	Oct-19	Nov-19	Dec-19	Jan-20	Feb-20	Mar-20	Apr-20	May-20	Jun-20
LDSP- UND	LDSP Underdrain Outflow	M	M[3]	-	Y - No Sample	Y - No Sample	Y - No Sample	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
HLFUMV	Heap Leach Facility Underdrain Monitoring Vault	C, D, W	D[4], M[2,3]	M	Y - No Sample	Y - No Sample	Y - No Sample	Y - No Sample	Y - No Sample	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
ADR Pad Ditch	ADR Pad Ditch Outlet	D, M	D[2], W[2,3]		Y - No Sample	Y - No Sample	Y - No Sample	Y - No Sample	Y - No Sample	Y - No Sample	Y - No Sample	Y - No Sample	Y - No Sample	Y - No Sample	Y - No Sample	Y - No Sample	Y - No Sample	Y - No Sample	Y - No Sample

NOTES:

[1] Laboratory analysis includes WAD, Total CN, Thiocyanate and Cyanate.

[2] Laboratory analysis includes WAD and Total CN.

[3] Calculation of un-ionized ammonia

[4] Laboratory analysis only includes WAD and Total CN - no other parameters required.

[5] Laboratory analysis includes physical parameters: pH, Specific Conductance, turbidity, TSS, TDS and hardness as well as total and dissolved organic carbon; cyanide species, major anions and nutrients (alkalinity, total nitrogen, total Kjeldahl nitrogen (TKN), ammonia-N, nitrate-N, nitrite-N, total dissolved phosphate-P, ortho-phosphate-P, sulphate, bromide, chloride, fluoride); and, total and dissolved metals (Al, Sb, As, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Mo, Hg, Ni, , K, Se, Ag, Na, Sr, Tl, S U, Zn).

[6] May 2020 Monthly Report states LDSPI sampled as a combination of all ditch inflows but no analytical data was associated with this Station

C - Continuous monitoring for specific conductance; D - Daily when discharging; W - Weekly when discharging; M - Monthly; Md - Monthly when discharging; Q - Quarterly

Y - No Sample = inactive station, no flow, no discharge, dry conditions, frozen, not active, heavy sediment, or no safe access

Table 18 Surface Water Quality Monitoring Program Exceedance Table – Operations

Site	Site Description	Parameter in Exceedance	Standards						Standards Exceeded																
			WQO (mg/L)	MDMER (mg/L)	EQS (mg/L)	AMT T1 (mg/L)	AMT T2 (mg/L)	AMT T3 (mg/L)	Jan-19	Feb-19	Mar-19	Apr-19	May-19	Jun-19	Jul-19	Aug-19	Sep-19	Oct-19	Nov-19	Dec-19	Jan-20	Feb-20	Mar-20	Apr-20	May-20	Jun-20
									Construction[1]						Operations										
									EMSAMP 2018-01						EMSAMP 2019-01										EMSAMP 2020-01
W1	Dublin Gulch above Stewart																								
W21	Dublin Gulch below Event Ponds																								
W4	Haggart Creek below Dublin	Al (dissolved)	0.1			0.075	0.085	0.1					WQO											WQO, AMT T3	WQO, AMT T2
		As (total)	0.0085			0.0064	0.0072	0.0085				WQO	WQO				WQO[2]							WQO, AMT T3	WQO, AMT T3
		Cd (total)	0.000197			0.000148	0.000167	0.000197																AMT T1	
		Co (total)	0.004			0.003	0.0034	0.004																WQO, AMT T3	
		Fe (total)	1			0.75	0.85	1				WQO	WQO											WQO, AMT T3	WQO, AMT T3	WQO, AMT T2
		Cu (total)	0.005			0.00375	0.00425	0.005																WQO, AMT T3	WQO, AMT T2	
		Pb (total)	0.0077			0.00578	0.00655	0.0077																WQO, AMT T3		
		Hg (total)	0.00002			0.000015	0.000017	0.00002																WQO, AMT T3		
		Zn (total)	0.038			0.0285	0.0323	0.038																AMT T2		
W22	Haggart Creek above Project Influence	Al (dissolved)	0.1			0.075	0.085	0.1																	WQO, AMT T3	
		Fe (total)	1			0.75	0.85	1																	WQO, AMT T3	
W6																										
W20	Bawn Boy Gulch																								
W23	Haggart Creek below Lynx Creek	Al (dissolved)	0.1			0.075	0.085	0.1					WQO												WQO, AMT T2	
		As (total)	0.0085			0.0064	0.0072	0.0085					WQO	WQO										WQO, AMT T3	WQO, AMT T3	
		Cu (total)	0.005			0.00375	0.00425	0.005																	WQO, AMT T3	
		Fe (total)	1										WQO	WQO											WQO, AMT T3	

Table 18 Surface Water Quality Monitoring Program Exceedance Table – Operations

Site	Site Description	Parameter in Exceedance	Standards						Standards Exceeded																
			WQO (mg/L)	MDMER (mg/L)	EQS (mg/L)	AMT T1 (mg/L)	AMT T2 (mg/L)	AMT T3 (mg/L)	Jan-19	Feb-19	Mar-19	Apr-19	May-19	Jun-19	Jul-19	Aug-19	Sep-19	Oct-19	Nov-19	Dec-19	Jan-20	Feb-20	Mar-20	Apr-20	May-20	Jun-20
									Construction[1]						Operations										
									EMSAMP 2018-01						EMSAMP 2019-01										EMSAMP 2020-01
W27	Eagle Creek near Camp below LDSP																								
W26	Stewart Gulch																								
W29	Haggart Creek below Eagle Creek & Platinum Gulch	Al (dissolved)	0.1			0.075	0.085	0.1					WQO											WQO, AMT T3	WQO, AMT T3
		As (total)	0.0085			0.0064	0.0072	0.0085				WQO	WQO										WQO, AMT T3	WQO, AMT T3	WQO, AMT T3
		Cu (total)	0.005			0.00375	0.00425	0.005				WQO	WQO										WQO, AMT T3	WQO, AMT T3	
		Fe (total)	1			0.75	0.85	1				WQO	WQO										WQO, AMT T3	WQO, AMT T3	WQO, AMT T3
		Cd (total)	0.000197			0.000148	0.000167	0.000197															WQO, AMT T3		
		Co (total)	0.004			0.003	0.0034	0.004															WQO, AMT T3		
		Pb (total)	0.0077			0.00578	0.00655	0.0077															WQO, AMT T3		
		Hg (total)	0.00002			0.000015	0.000017	0.00002															WQO, AMT T3	WQO, AMT T2	
		Zn (total)	0.038			0.0285	0.0323	0.038															WQO, AMT T3		
W39	Haggart Creek above South McQuesten River																								
W45	Eagle Creek above Haggart Creek																								
W49	South McQuesten River below Haggart Creek																								

Table 18 Surface Water Quality Monitoring Program Exceedance Table – Operations

Site	Site Description	Parameter in Exceedance	Standards						Standards Exceeded																	
			WQO (mg/L)	MDMER (mg/L)	EQS (mg/L)	AMT T1 (mg/L)	AMT T2 (mg/L)	AMT T3 (mg/L)	Jan-19	Feb-19	Mar-19	Apr-19	May-19	Jun-19	Jul-19	Aug-19	Sep-19	Oct-19	Nov-19	Dec-19	Jan-20	Feb-20	Mar-20	Apr-20	May-20	Jun-20
									Construction[1]						Operations											
									EMSAMP 2018-01						EMSAMP 2019-01											EMSAMP 2020-01
W99	Haggart Creek above 15 Pup	Al (dissolved)	0.1			0.075	0.085	0.1					WQO												WQO, AMT T3	WQO, AMT T3
		As (total)	0.0085			0.0064	0.0072	0.0085				WQO	WQO												WQO, AMT T3	WQO, AMT T3
		Cu (total)	0.005			0.00375	0.00425	0.005																	WQO, AMT T3	
		Fe (total)	1			0.75	0.85	1				WQO	WQO												WQO, AMT T3	WQO, AMT T3
		Hg (total)	0.00002			0.000015	0.000017	0.00002																	WQO, AMT T2	
EPS	Eagle Pup WRSA Seepage																									
PDI & PG_PTS[5]	Platinum Gulch Ditch into Lower Dublin South Pond																									
PGS	Platinum Gulch WRSA Seepage																									
PS	Open Pit Sump																									
MWTP	Mine Water Treatment Plant																									
FT	Mine Water Treatment Plant Finishing Tank																									
LDSPI	Lower Dublin South Pond Inflow																									
LDSP	Lower Dublin South Pond Outflow	As (total)			0.0053							EQS												EQS		
		TSS		30	15							EQS												EQS		
		Fe (total)			6.4																			EQS		
CS-07	SG-G4 below Ice Rich Overburden Storage Area																									
LDSP-UND	LDSP Underdrain Outflow																									
HLFUMV	Heap Leach Facility Underdrain Monitoring Vault																									
ADR Pad Ditch	ADR Pad Ditch Outlet																									

Table 18 Surface Water Quality Monitoring Program Exceedance Table – Operations

Site	Site Description	Parameter in Exceedance	Standards						Standards Exceeded														
			WQO (mg/L)	MDMER (mg/L)	EQS (mg/L)	AMT T1 (mg/L)	AMT T2 (mg/L)	AMT T3 (mg/L)	Jan-19	Feb-19	Mar-19	Apr-19	May-19	Jun-19	Jul-19	Aug-19	Sep-19	Oct-19	Nov-19	Dec-19	Jan-20	Feb-20	Mar-20	Apr-20	May-20	Jun-20
									Construction[1]						Operations											
									EMSAMP 2018-01						EMSAMP 2019-01											EMSAMP 2020-01

NOTES:
[1] Exceedances are reported for all 2019 data (as per the Quartz Mining Licence QML-0011 2019 Annual Report), although at the time of the sample event, the WQO were not established (part of the EMSAMP 2019-01)
[2] Results from September 11, 2019 is currently considered potentially erroneous as most other measured metals or metalloid parameters were not highly elevated in the W4 September 11, 2019 sample.
WQO = Water Quality Objective (QZ14-041)
MDMER = Metal and Diamond Mining Effluent Regulations, Schedule 4 Authorized Discharge
EQS = Effluent Quality Standard (QZ14-041)
AMT = Adaptive Management Threshold, T1 = Tier 1, T2 = Tier 2, T3 = Tier 3

Table 19 Surface Water Quality Exceedances and Responses

Date	Stations	Standard Exceeded	Response(s)	Follow Up Reporting	Auditor's Comments
April 2019	W4, W29, W99, W23	WQO	• Discharges were ceased when on-site TSS data indicated EQS exceedance	Results included in the 2019 Annual Report. Email notification sent to NND (Na-Cho Nyak Dun) Lands & Resources and the Energy and Mines Resources Compliance Inspector.	As per Section 3.8.3 of the EMSAMP 2018-01, adaptive management measures during operations that will be employed in the event these thresholds are reached include: • MWTP inspection during operations to determine if system is functioning as intended • PTS inspection early and post closure to determine if system is functioning as intended • Repair MWTP components and adjust reagent dosages as necessary • Perform maintenance on passive treatment systems • Verify on site analysis results with accredited laboratory results • Re-sample and analyze after verification water treatment system functioning properly • Consider need for temporary re-routing of contact water to suspend effluent discharge until licensed effluent concentrations are achieved prior to discharge. Examples of operational/ routing changes include: – Recirculation of excess process water within the HLF until repairs and adjustments are made to MWTP to achieve licensed effluent concentrations – Rerouting contact water from Open Pit and Waste Rock Storage Areas from MWTP to the events pond and/or HLF for storage and recirculation temporarily – Suspend Open Pit dewatering operations • Consider capital improvements to augment or replace existing treatment systems The 2019 Annual Report did not include a detailed AMT response following the above stated methods.
April 2020	W23, W29, W99	WQO and AMT T3	• Sample frequency changed from monthly to weekly. • Acute lethality testing was performed on the discharged water on April 21 and yielded results that were non-acutely lethal to rainbow trout or Daphnia Magna. • VGC continued to maintain the Dublin Gulch exploration road to keep snowmelt runoff from mobilizing sediment from the road.	A full report regarding the discharge from April 20–28, 2020 has been provided to the Yukon Water Board via the Waterline registry for QZ14-04-1 on May 19, 2020. A Freshet/High-Volume Management Plan was requested by Energy and Mines Resources in July 2020 to be prepared. VGC submitted this plan on September 30, 2020.	As per Section 3.8 of the EMSAMP 2019-01 notification, review, evaluation, and action for exceeding an AMT were partially completed. Missing: • For WQO and AMT exceedances, compare values to baseline to determine if any significant changes have occurred to the receiving environment water quality, complete a trend analysis and include methods and results in the report. • Detailed AMT response following the EMSAMP methods was not clear.
May 2020	W22, W4, W29, W99, W23	WQO and AMT T2 and T3	• Additional samples were collected mid-May at Stations W22, W4, and W29.	No follow up reporting noted.	As per Section 3.8 of the EMSAMP 2019-01 notification, review, evaluation, and action for exceeding an AMT were not completed. Increased sample frequency (monthly to weekly) as per the Water Management Plan was not completed after the exceedance in early May.
June 2020	W4, W29, W99	WQO and AMT T2 and T3	• Additional samples were collected mid-June following an AMT T2 exceedance at W4	No follow up reporting noted.	As per Section 3.8 of the EMSAMP 2019-01 notification, review, evaluation, and action for exceeding an AMT were not completed. Increased sample frequency (monthly to weekly) as per the Water Management Plan was not completed after the exceedance in mid-June.

3.2.4 Data QA/QC

2018 Annual Report

The methods of the QA/QC program were adequately described, though results (e.g., number of samples collected, duplicate relative percent differences, any failed data quality objectives (DQOs), and corrective action if DQOs fail) were not included in the report body nor were results of the QA/QC samples included in Appendix D and therefore total number of QA/QC samples (e.g., >10% of dataset) could not be determined.

2019 Annual Report

The methods and summary of results of the QA/QC program were adequately described except for the duplicate samples – where summary of results was omitted. However, detailed results (e.g., number of samples collected, duplicate relative percent differences, any failed DQOs were not included in the report body nor were analytical results of the QA/QC samples included in Appendix F; however, this data was available in the 2019 Monthly Reports. A total of 14% of QA/QC samples were collected (30 QA/QC samples per 212 surface water samples) which follows recommendations (>10%) as per BC ENV (2013).

2020 Monthly Reports

Details of the QA/QC program was not included in the monthly reports. For all 2020 monthly reports—in the report body or Appendix A, QA/QC duplicate samples are not identified, but assumed to be the Station number followed by "…01" for duplicates, "…02" for travel blanks, "…03" for travel blanks, and "…04" for equipment blank. From this assumption, 7 duplicate samples, three field blanks, and three travel blanks were collected between January and June 2020 resulting in 9.1% of QA/QC samples to total samples (13 QA/QC samples per 143 surface water samples). BC ENV (2013) recommends >10%.

3.2.5 Reporting Adequacy

The 2018 Annual Report, the 2019 Annual Report, and the 2020 Monthly Reports were reviewed for adequacy and compliance. Overall, the reporting and summarization of data collected for the surface water quality monitoring program is complete and adequate with deviations described below.

2018 Annual Report

The 2018 Annual Report adequately described and reported the construction monitoring program as described in the EMSAMP 2018-01; however, deviations and omissions were noted:

- Rationale for missed sampling events was not provided in relevant sections and was inferred from the TSS table (Table 3.2-2)
- As described in Section 3.2.4, the results of the QA/QC samples were not described or included in Appendix D.

2019 Annual Report

The 2019 Annual Report adequately described and reported the construction and operational monitoring program as described in the EMSAMP 2018-01 and EMSAMP 2019-01; however, some deviations and omissions were noted:

- Tabulated list of the water quality results including QA/QC data, reported from the analytical lab, were absent from the report and appendices. Instead, water quality results were reported in graph form which adequately compared parameters to WQOs and Effluent Quality Standards, as stated in the Water Licence QZ14-041, but does not show the laboratory reported value or full analytical suite.
- As this report does not include the tabulated water quality results, a check for compliance with the EMSAMPs was completed using the 2019 Monthly Reports
- A summary of QA/QC duplicate sample results were not included in the report body.
- In Appendix F, the quality of Figures 2-5, 2-6, 2-9, 2-11, 2-13, 2-14, 2-15, 2-16, and 2-17, was poor, the x axis could not be read.
- In Appendix F, scatter plots of arsenic, aluminum, sulphate, selenium, and uranium were plotted with baseline (2007) to current (2019) data; however, analytes were not statistically compared to baseline values to determine if any significant changes have occurred to the receiving environment water quality nor method or results of trend analysis included.
- Cyanate and thiocyanate were not included in the analytical suite.
- TSS and arsenic exceeded MDMER (TSS) and EQS (arsenic and TSS) during a discharge event at Station LDSP in April 2019. While discharge was ceased due to high field TSS, details of adaptive management measures (as per EMSAMP 2018-01 as this was during construction) were omitted (e.g., inspections, repairs, verification of analyte results, and/or re-run samples).

2020 Monthly Reports

The 2020 Monthly Reports adequately described and reported the operational monitoring program as described in the EMSAMP 2019-01; however, some deviations and omissions were noted:

- In Table 3.3-1 in January 2020 Monthly report, no rationale was provided for missing field parameters for Station W27, rationale was found in Table 2.2-1, part of the hydrology section.
- For all 2020 monthly reports – in the report body or Appendix A, QA/QC duplicate samples are not identified, but assumed to be the Station number followed by "…01 or …02". In addition, duplicate samples should not include the parent sample (i.e., Station number) in the sample name.
- WQO and Adaptive Management Thresholds (AMT) were exceeded in April, May, and June 2020. Exceeded analytes were not statistically compared to baseline values to determine if any significant changes have occurred to the receiving environment water quality nor method or results of trend analysis included. In addition, details of the AMT response were not included.
- Table 3.2-1 in May 2020 Monthly report states that Station LDSPI was sampled as a combination of all ditch flows, but laboratory data was not attached to the report for that station.

- Table 3.2-1 in May 2020 Monthly report states that Station EPS was not active, but Appendix A included laboratory water quality data for Station EPS. VG noted that EPS is active and the discrepancy was a reporting error.

3.2.6 Summary of Deficiencies and Recommendations

Table 20 summarizes compliance gaps and/or deficiencies for the surface water monitoring program and provides recommendations for corrective actions.

Table 20 Surface Water Quality Compliance and Recommendations

Compliance Gap and/or Deficiency	Recommendation/Corrective Action
2018 Annual Report – Rationale for missing sample events	Include a footnote for each table describing missing data rationale (e.g., frozen water)
2018 Annual Report – QA/QC results not described	Include text in the report body describing the results of the QA/QC program (e.g., number of QA/QC samples, summary of results, DQOs, and corrective actions for failed DQOs). Also include these data in the database (Appendix D) or tabulated form.
2019 Annual Report – Water Quality Results	Include a tabulated form of all water quality data including QA/QC samples
2019 Annual Report – QA/QC results not completely described	Include results of duplicate sample results as well as total amount of QA/QC samples collected and summarize data in a tabulated form.
2019 Annual Report – Quality of plots	Improve quality of plots so axes can be read (Appendix F)
2019 Annual Report – Statistical and trend analysis	For WQO exceedances, the EMSAMP commits VGC to compare values to baseline to determine if any significant changes have occurred to the receiving environment water quality, complete a trend analysis, and include methods and results in the report. We recommend an adjustment to this commitment with the goal of an achievable exercise for this project (e.g., complete statistical analysis to determine significance, and/or monitor over x number of sampling events to determine if it is a real change in water quality)
2019 Annual Report – Cyanide species	Include cyanate and thiocyanate in the analytical suite for compliance with EMSAMP 2019-01
2019 Annual Report – AMT Responses	The EMSAMPs requests VGC to describe in detail the response for any AMT exceedances. As per the Water Management Plan, sampling frequency will increase accordingly (next higher order) to better characterize trends.
2020 Monthly Reports – QA/QC	Report on QA/QC samples collected monthly and include results in the report body including laboratory QA/QC results. Frequency of QA/QC samples are to meet >10% ratio of QA/QC samples to total water quality samples. Currently field blanks are being collected are documented in the 2020 monthly report water quality appendices.

Table 20 Surface Water Quality Compliance and Recommendations

Compliance Gap and/or Deficiency	Recommendation/Corrective Action
2020 Monthly Reports – AMT Responses	For WQO and AMT exceedances, the EMSAMP commits VGC to compare values to baseline to determine if any significant changes have occurred to the receiving environment water quality, complete a trend analysis and include methods and results in the report. We recommend an adjustment to this commitment with the goal of an achievable exercise for this project (e.g., complete statistical analysis to determine significance, and/or monitor over x number of sampling events to determine if it is a real change in water quality). We also recommend to include a detailed AMT response. As per the Water Management Plan, sampling frequency should increase accordingly (next higher order) to better characterize trends.

3.3 GROUNDWATER QUANTITY AND QUALITY

3.3.1 Documents Reviewed

Documents in Table 21 were reviewed for the groundwater quantity and quality section of the audit:

Table 21 Groundwater Quantity and Quality Documents Reviewed

Document	Version Reviewed	Sections Applicable to Construction Phase	Sections Applicable to Operations Phase
EMSAMP	2018-01	4.0 Groundwater Quantity 5.0 Groundwater Quality	N/A
EMSAMP	2019-01	4.0 Groundwater Quantity 5.0 Groundwater Quality	4.0 Groundwater Quantity 5.0 Groundwater Quality
EMSAMP	2020-01	N/A	4.0 Groundwater Quantity 5.0 Groundwater Quality
Water Licence QZ14-041 Quartz Mining License QML-0011 2018 Annual Report	2019-01	3.3 Groundwater; Appendix F 2018 Groundwater Hydrographs Appendix G 2018 Groundwater Quality Data	N/A
Water Licence QZ14-041 Quartz Mining License QML-0011 2019 Annual Report	N/A	3.4 Groundwater; Appendix J 2020 Numerical Hydrogeological Model Update Appendix K Eagle Gold 2019 Groundwater Quality Data	3.4 Groundwater; Appendix J 2020 Numerical Hydrogeological Model Update Appendix K Eagle Gold 2019 Groundwater Quality Data
Type A Water Use License QZ14-041-1 Monthly Report, Reporting Period: January 2020 to June 2020	N/A	N/A	4.0 Groundwater Quantity and Quality; Appendix B Lab Results: Groundwater

Table 21 Groundwater Quantity and Quality Documents Reviewed

Document	Version Reviewed	Sections Applicable to Construction Phase	Sections Applicable to Operations Phase
Eagle Gold EMSAMP WRB Concerns on EMSAMP Implementation July 2020	N/A	N/A	N/A
Eagle Gold Project Water Management Plan	2020-01	3.5 Groundwater	3.5 Groundwater 5.5 Groundwater Model

The periods of the groundwater monitoring program audited (January 2018 to June 2020) include the mine's construction phase and operations phase, and a transition period between the two phases. The approved groundwater monitoring program (e.g. well locations, data collection frequency) presented in the EMSAMP are different for each of the phases. The relevant version of the EMSAMP and groundwater monitoring programs used as the basis of the auditing are presented in Table 21.

3.3.2 Monitoring Program Implementation and Data QA/QC

3.3.2.1 Groundwater Quantity

The objective of the groundwater quantity monitoring program presented in the EMSAMP is to provide groundwater level measurement to monitor potential project effects on the occurrence and quantity of groundwater during mine construction and start-up phases. The main components of the groundwater quantity program, as presented in the relevant EMSAMPs, are:

- Field program to install and maintain a network of groundwater monitoring wells at strategic locations and perform continuous and/or manual groundwater level measurement at selected wells in accordance with the monitoring schedule proposed in the EMSAMPs.
- Desktop assessment to compile and calibrate field groundwater level data, plot hydrographs versus time, precipitation, and temperature, and compare the hydrographs to existing baseline data.
- Preparation of data summary report at the completion of construction, annually during operation, and for specific reporting periods as identified in the Reclamation and Closure Plan.

As a part of the audit's effort to evaluate the implementation of the groundwater quantity monitoring program, the groundwater level records presented in the 2018 and 2019 annual reports and 2020 monthly reports were reviewed and compared with the applicable groundwater quantity monitoring requirements in the relevant EMSAMP.

As noted in Section 3.3.1, groundwater quantity monitoring requirements (e.g. well locations, data collection frequency) for the construction and operations phases were different. It is understood that during the transition period from the mine construction phase to operations phase most of the monitoring wells in the construction phase monitoring program (Table 22) were gradually decommissioned and no longer being monitored. At the same time, new wells in the operations phase monitoring network were progressively installed. The audit results of the two phases are presented separately in Table 22 and Table 23. Recommendations on the implementation of the groundwater quantity monitoring program are presented in section 3.3.3.

Table 22 Groundwater Quantity Monitoring Program Implementation – Construction Phase

Well ID	Facility	Datalogger	Groundwater Level Monitoring Frequency[1]	01/2018	02/2018	03/2018	04/2018	05/2018	06/2018	07/2018	08/2018	09/2018	10/2018	11/2018	12/2018	01/2019	02/2019	03/2019	04/2019	05/2019	06/2019	07/2019	08/2019	09/2019	10/2019	11/2019	12/2019	Note
MW10-AG6	HLF	Yes	Downloaded quarterly	L	L	L M	L	L	L M	L	L M	L M	L M		M	M	M	M	M	M	M	M	M		M			Logger deployed in Feb-19 but above water level.
MW10-AG3A	HLF	Yes	Downloaded quarterly	L	L	L M	L	L	L M		M	M			M	M	L M	L M	L M	L M	L M	L M	L M	L M	L	L	L M	Logger failed Jun-18, redeployed Feb-19. Well excavated.
MW10-AG3B	HLF	No	Quarterly			M		M													M	M	M	M			M	Well decommissioned.
BH-BGC11-26	HLF	Yes	Downloaded quarterly						L M	L	L M	L M	L	M	M	M												Logger above water level Nov-2018 to May-2019. Well decommissioned.
MW10-DG6	HLF	Yes	Downloaded quarterly	L	L	L	L	L	L	L M	L M	L	L M		M	M												Well damaged in construction.
MW10-OBS1	Lower Dublin South Pond	Yes	Downloaded quarterly	L	L	L	L	L M	L	L	L M	L M		L M	M	M	L M	L M	L M	L M								Logger removed Nov-18, redeployed Feb-19. Well decommissioned
BH-BGC11-72	Lower Dublin South Pond	Yes	Downloaded quarterly		L	L M	L	L M	L	L M	L	L M	L M		M	L M	L M	L M	L M	L M	M	M	M	L M	L M			Logger removed May-19, re-deployed Sep-19
BH-BGC11-74	Lower Dublin South Pond	Yes	Downloaded quarterly	L	L	L M	L	L	L M	L	L M	L M	L M		M	L M	L M	L M	L M	L M	L M	L M	L M	L M	L M			
MW96-15(B)	EP WRSA	Yes	Downloaded quarterly	L	L	L	L	L	L	L	L	L M	L M	L M	L M	L M				M	M	M	M	M	M			Logger removed in 2019.
MW96-13A	EP WRSA	Yes	Downloaded quarterly	L	L	L M		L M	L	L M	L	L M	L M	L M	L	L M	L M	L	L M	L M	L M	L M	L M	L	L M			
MW96-13B	EP WRSA	Yes	Downloaded quarterly	L	L	L M			L M	L	L	L M	M	M	M	M	L M	L M	L M	L	L M	L M	L M	L M				Logger removed in Oct-18, re-deployed in Feb-19
MW96-14B	EP WRSA	No	Quarterly							M	M	M	M					M	M	M	M	M		M				Location frost jacked
MW96-17A	Open Pit	Yes	Downloaded monthly	L	L	L	L	L	L	L	L	L	L															Decommissioned in Jan-19
MW96-17B	Open Pit	No	Monthly						M	M			M			M												Decommissioned in Jan-19
MW10-PG1	PG WRSA	Yes	Downloaded quarterly	L	L	L M	L	L	L M	L	L M			M	M	M	L M	L M	L M	L M	L M	L M	L M	L M	L			Logger removed Oct-18, re-deployed Feb-19

NOTES:
[1] "M" – manual groundwater level record, "L" – datalogger groundwater level record, the timing of the records shown in the table was visually identified from hydrographs therefore is approximate.

Table 23 Groundwater Quantity Monitoring Program Implementation – Operations Phase

Well ID	Facility	Datalogger[1]	Groundwater Level Monitoring Frequency[2]	05/2019	06/2019	07/2019	08/2019	09/2019	10/2019	11/2019	12/2019	01/2020	02/2020	03/2020	04/2020	05/2020	06/2020	07/2020	Notes
BH-BGC11-73a	Open Pit	Yes	Quarterly	L	L	L	L	L	L	L	L								.
BH-BGC11-73b	Open Pit	Yes	Quarterly	L	L	L	L	L	L	L	L								
BH-BGC11-73c	Open Pit	Yes	Quarterly	L	L	L	L	L	L	L	L								
PW-BGC11-02	Open Pit	No	Quarterly																Documents reviewed do not contain GW level data from this well.
MW19-PGW1a	PG WRSA	Yes	Quarterly												M				Q1 2020 measurement not completed due to COVID-19
MW19-PGW1b	PG WRSA	Yes	Quarterly																Q1 2020 measurement not completed due to COVID-19
MW10-PG1	PG WRSA and Open Pit	Yes	Quarterly	L M	L M	L M	L M	L M	L						M		M		Q1 2020 measurement not completed due to COVID-19
MW96-13A	EP WRSA	Yes	Quarterly	L M	L M	L M	L M	L	L M							M	M		Q1 2020 measurement not completed due to COVID-19
MW96-13B	EP WRSA	Yes	Quarterly	L	L M	L M	L M	L M								M	M		Q1 2020 measurement not completed due to COVID-19
MW96-14B	EP WRSA	No	Quarterly	M	M	M		M								M	M		Q1 2020 measurement not completed due to COVID-19
MW96-15(B)	EP WRSA	No	Quarterly	M	M	M	M	M	M							M	M		Q1 2020 measurement not completed due to COVID-19
MW19-EPW1a	EP WRSA	Yes	Quarterly	L M	L M	L M	L M	L	L M	L				M			M		Q1 2020 measurement not completed due to COVID-19.
MW19-EPW1b	EP WRSA	Yes	Quarterly	M	L M	L	L M	L M	L M	L				M			M		Q1 2020 measurement not completed due to COVID-19.
MW19-HLF1a	HLF	Yes	Quarterly	L	L M	L M	L M	L	L	L				M			M		Q1 2020 measurement not completed due to COVID-19.
MW19-HLF1b	HLF	No	Quarterly	M	M	M	M	M						M			M		Q1 2020 measurement not completed due to COVID-19.
MW10-AG6	HLF	Yes	Quarterly	M	M	M	M		M										Logger deployed in Feb-19 but above water level. Q1 2020 measurement not completed due to COVID-19.
MW19-DG6Ra	HLF	Yes	Quarterly	M	M	L M	L M	L	L M	L M				M		M			Q1 2020 measurement not completed due to COVID-19.
MW19-DG6Rb	HLF	Yes	Quarterly			M	M		M					M		M			Q1 2020 measurement not completed due to COVID-19.

Table 23 Groundwater Quantity Monitoring Program Implementation – Operations Phase

Well ID	Facility	Datalogger[1]	Groundwater Level Monitoring Frequency[2]	05/2019	06/2019	07/2019	08/2019	09/2019	10/2019	11/2019	12/2019	01/2020	02/2020	03/2020	04/2020	05/2020	06/2020	07/2020	Notes
MW19-EVP1a	Events Pond	No	Quarterly			M										M	M		Q1 2020 measurement not completed due to COVID-19.
MW19-EVP1b	Events Pond	No	Quarterly	M	M	M	M	M	M							M	M		Q1 2020 measurement not completed due to COVID-19.
MW19-EVP2a	Events Pond	No	Quarterly	M		M	M								M		M		Q1 2020 measurement not completed due to COVID-19.
MW19-EVP2b	Events Pond	No	Quarterly	M	M	M	M	M	M						M		M		Q1 2020 measurement not completed due to COVID-19.
MW18-DG2R	Lower Dublin South Pond	Yes	Quarterly	L M	L M	L M	L	L	L M	L M					M		M		Q1 2020 measurement not completed due to COVID-19.
MW18-LDSP1	Lower Dublin South Pond	Yes	Quarterly												M		M		Q1 2020 measurement not completed due to COVID-19.
MW19-LDSP2A	Lower Dublin South Pond	Yes	Quarterly	L M	L M	L M	L M	L M	L	L					M		M		Q1 2020 measurement not completed due to COVID-19.
MW19-LDSP2B	Lower Dublin South Pond	Yes	Quarterly	L M	L M	L M	L M	L M	L	L					M		M		Q1 2020 measurement not completed due to COVID-19.
BH-BGC11-72	Lower Dublin Gulch	Yes	Quarterly	L M	M	M	M	L M	L M						M			M	Logger removed May-19, re-deployed Sep-19. Q1 2020 measurement not completed due to COVID-19.
BH-BGC11-74	Lower Dublin Gulch	No	Quarterly	L M	L M	L M	L M	L M	L M						M			M	Q1 2020 measurement not completed due to COVID-19.
MW96-9b	Upper Dublin Gulch	No	Quarterly	L M	L M	L M	L M	L M	L M	L	L	L							Manual data not collected in 2020 due to equipment malfunction or unsafe condition. Q1 2020 measurement not completed due to COVID-19.

NOTES:
[1] The documents reviewed do not contain 2020 datalogger data.
[2] "M" – manual groundwater level record, "L" – datalogger groundwater level record, the timing of the records shown in the table was visually identified from hydrographs therefore is approximate.

3.3.2.2 Groundwater Quality

The objective of the groundwater quality monitoring program is to monitor project effects on the quality of groundwater as the project transitions from baseline conditions through construction and operations. The key components of the groundwater quantity program, as presented in the relevant EMSAMP, are:

- Field program to install and maintain a network of groundwater monitoring wells at strategic locations, and collect groundwater samples from selected wells in accordance with the monitoring schedule, and sampling and transportation protocols presented in the EMSAMP. The groundwater quality monitoring is integrated with the groundwater quantity monitoring program such that groundwater samples are collected from a subset of wells that are monitored for groundwater levels.
- Field QA/QC program including collection of trip blanks, field blanks, and field duplicates samples.
- Field and lab analysis of groundwater samples for the following groundwater quality parameters:
  - Field parameters: temperature, pH, conductivity, turbidity
  - Lab physical parameters: temperature, conductivity, turbidity, TDS, TSS, pH
  - Anion: Cl, SO_4, NO_3, NO, CN_2, Total Alkalinity
  - Nutrients: TKN, NH3, 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)
- Desktop analysis of analytical results and compilation of groundwater quality data, review data against baseline groundwater quality and QA/QC criteria to identify and eliminate false positives and negatives, compare results to applicable permit discharge or monitoring criteria, and plot concentration of regulated constituents and key indicator parameters versus time and applicable standards and baseline concentrations.
- Submission of groundwater quality data for regulatory review.

As a part of this audit's effort to evaluate the implementation of the groundwater quality monitoring program, the groundwater quality data presented in the 2018 and 2019 annual reports and 2020 monthly reports were reviewed and compared to applicable groundwater quality monitoring requirements in the relevant EMSAMP.

As noted in Section 3.3.1, monitoring requirements (e.g. well locations, data collection frequency) for construction phase and operations phase are different. It is understood that during the transition period from the mine construction phase to operations phase , most of the monitoring wells in the construction phase monitoring program (Table 24) were gradually decommissioned and no longer being monitored. At the same time, new wells in the mine operation phase monitoring network were progressively installed. The audit results of the evaluation of the two phases are presented separately in Table 24 and Table 25.

Table 24 Groundwater Quality Monitoring Program Implementation – Construction Phase

Well ID[1]	Facility	Groundwater Sample Frequency	01/2018	02/2018	03/2018	04/2018	05/2018	06/2018	07/2018	08/2018	09/2018	10/2018	11/2018	12/2018	01/2019	02/2019	03/2019	04/2019	05/2019	06/2019	07/2019	08/2019	09/2019	10/2019	11/2019	12/2019	Note
MW10-AG6	HLF	Quarterly			S			S		S			S							S							
MW10-AG3A	HLF	Quarterly			S			S			S	S					S		S				S			S	
BH-BGC11-26	HLF	Quarterly																									Well decommissioned.
MW10-DG6	HLF	Quarterly								S		S															Well decommissioned.
MW10-OBS1	Lower Dublin South Pond	Quarterly			S						S	S							S								
MW96-15(B)	EP WRSA	Quarterly									S	S							S				S	S			
MW96-13A	EP WRSA	Quarterly			S			S			S	S					S		S	S			S				Well decommissioned.
Blank[2]																											
Field Duplicate[2]																											

NOTES:
[1] "S" – Groundwater sample collected.
[2] Groundwater quality lab analysis data included in the 2018 and 2019 annual reports do not contain lab results of blank or duplicate samples.

Table 25 Groundwater Quality Monitoring Program Implementation – Operations Phase

Well ID[1]	Facility	GW Quality Sample Frequency[2]	05/2019	06/2019	07/2019	08/2019	09/2019	10/2019	11/2019	12/2019	01/2020	02/2020	03/2020	04/2020	05/2020	06/2020	07/2020	Note
MW19-PGW1a	PG WRSA	Quarterly														S		Q1 2020 sampling not completed due to COVID-19
MW19-PGW1b	PG WRSA	Quarterly																Q1 2020 sampling not completed due to COVID-19
MW10-PG1	PG WRSA and Open Pit	Quarterly												S		S		Q1 2020 sampling not completed due to COVID-19
MW96-13A	EP WRSA	Quarterly													S			Q1 2020 sampling not completed due to COVID-19
MW96-13B	EP WRSA	Quarterly																Q1 2020 sampling not completed due to COVID-19
MW96-15(B)	EP WRSA	Quarterly													S	S		Q1 2020 sampling not completed due to COVID-19
MW19-EPW1a	EP WRSA	Quarterly												S		S		Q1 2020 sampling not completed due to COVID-19
MW19-EPW1b	EP WRSA	Quarterly												S		S		Q1 2020 sampling not completed due to COVID-19
MW10-AG3A	HLF	Quarterly	S				S			S								Q1 2020 sampling not completed due to COVID-19
MW19-HLF1a	HLF	Quarterly																Q1 2020 sampling not completed due to COVID-19
MW19-HLF1b	HLF	Quarterly		S			S	S						S		S		Q1 2020 sampling not completed due to COVID-19
MW19-DG6Ra	HLF	Quarterly					S	S						S		S		Q1 2020 sampling not completed due to COVID-19
MW19-DG6Rb	HLF	Quarterly												S		S		Q1 2020 sampling not completed due to COVID-19
MW19-EVP1a	Events Pond	Quarterly																Q1 2020 sampling not completed due to COVID-19
MW19-EVP1b	Events Pond	Quarterly																Q1 2020 sampling not completed due to COVID-19
MW19-EVP2a	Events Pond	Quarterly																Q1 2020 sampling not completed due to COVID-19
MW19-EVP2b	Events Pond	Quarterly												S		S		Q1 2020 sampling not completed due to COVID-19
MW18-DG2R	Lower Dublin South Pond	Quarterly												S		S		Q1 2020 sampling not completed due to COVID-19
MW18-LDSP1	Lower Dublin South Pond	Quarterly																Q1 2020 sampling not completed due to COVID-19
MW19-LDSP2A	Lower Dublin South Pond	Quarterly	S				S	S								S		Q1 2020 sampling not completed due to COVID-19

Table 25 Groundwater Quality Monitoring Program Implementation – Operations Phase

Well ID[1]	Facility	GW Quality Sample Frequency[2]	05/2019	06/2019	07/2019	08/2019	09/2019	10/2019	11/2019	12/2019	01/2020	02/2020	03/2020	04/2020	05/2020	06/2020	07/2020	Note
MW19-LDSP2B	Lower Dublin South Pond	Quarterly												S		S		Q1 2020 sampling not completed due to COVID-19
BH-BGC11-72	Lower Dublin Gulch	Quarterly												S				Q1 2020 sampling not completed due to COVID-19
BH-BGC11-74	Lower Dublin Gulch	Quarterly												S			S	Q1 2020 sampling not completed due to COVID-19
Blank[2]														1				
Field Duplicate[2]														1	1	2		

NOTES:
[1] "S" – Groundwater sample collected.
[2] Groundwater quality lab analysis data included in the 2018 and 2019 annual reports do not include results of blank or duplicate samples.

3.3.3 Reporting Adequacy, Compliance and Monitoring

Table 26 summarizes compliance gaps and/or deficiencies for the groundwater quantity and quality monitoring program and provides recommendations for corrective action.

Table 26 Groundwater Quantity and Quality Compliance and Recommendations

Compliance Gaps and/or Deficiencies	Recommendation/Corrective Action
Groundwater quantity and quality monitoring from some wells was performed less frequently than the schedule prescribed in the relevant EMSAMPs.	• A number of factors, including those beyond the control of VGC may result in a scheduled monitoring not being performed (e.g. weather, equipment malfunction, unsafe condition, construction, pandemic). The monthly and annual reporting needs to provide the rationale for missed monitoring in tabular format and if any corrective action will be taken. • The annual and monthly reporting should include the installation and decommission date, and operational status of monitoring wells. • A maintenance log should be maintained for any maintenance or repairs made to logs and reported in the annual report.
EMSAMP (2020-01, S. 4.5) states that groundwater levels will be compared to predicted (modeled) effects due to the loss of recharge in the HLF and WRSA.. However, trends were not quantitatively compared with predicted (modelled) effect in the 2019 Annual Report or 2020 Monthly Reports. It is unclear if the trends are consistent with the predicted thresholds or if the model requires calibration based on field observation.	• Compare measured groundwater levels to predicated effects in assessment in operations phase once dewatering of the pit commences. • Calibrate modeled adaptive management thresholds for groundwater quantity based on field observation.
EMSAMP (2020-01, S. 4.4) states that groundwater hydrographs will be compared with existing baseline data to assess potential change associated with the Project. The 2019 Annual Report in S. 3.4.3.1 presents a qualitative discussion of the observed changes in groundwater quantity associated with the construction and operation of mine. This discussion is not presented in the context of modelled effect or groundwater quantity indicators.	Present further assessment of the change in groundwater quantity associated with the Project. The assessment would be strengthened if a list of groundwater quantity indicators and associated triggers were developed and utilized in the operation stage.
EMSAMP (2020-01, S. 5.2) presents groundwater quality parameters to be analyzed in the monitoring program. Review of groundwater quality records in the 2019 Annual Report suggests some samples were not analyzed for the full suite of parameters.	• Review water licence conditions and lab records to confirm if required parameters were analyzed. • Include all analyzed parameters and lab reports in annual reporting.

Table 26 Groundwater Quantity and Quality Compliance and Recommendations

Compliance Gaps and/or Deficiencies	Recommendation/Corrective Action
• EMSAMP (2020-01, S. 5.3.2 and 5.3.3) describes the field QA/QC program for groundwater quality monitoring, which includes collection and analysis of trip blanks, field blanks and duplicates. • The 2019 Annual Report does not present information on the implementation of the QA/QC program. Appendix K of the 2019 Annual Report (Groundwater Quality Data) does not contain records of the QA/QC samples.	• Present information on the implementation of the field QA/QC program and the results of the QA/QC program in the annual reports.
EMSAMP (2020-01, S. 5.3.3) states that plots of concentrations of regulated constituents and key indicator parameters versus time will also show applicable standards and baseline concentration. Plots in the 2019 Annual Report do not contain the applicable standards and baseline concentration.	Present applicable standards and baseline concentration in the groundwater water sample constituent concentration plots for the annual report.
EMSAMP (2020-01, S. 5.4.1) describes that trends in groundwater quality will be examined to potentially inform management actions. The existing analysis of the water quality trend in the 2019 Annual Report contains discussion of the trend but in some cases does not provide rationale for the observed trends.	• Present groundwater quality trend analysis in monthly and annual reporting to confirm that trends are being monitored appropriately. • Present groundwater quality trend assessment in the context of baseline water quality and predicted effects of the Project. • Provide greater logical link between discussion of observed groundwater quality trend and proposed adaptive management actions (e.g. no action).

3.4 GEOCHEMICAL MONITORING

3.4.1 Documents Reviewed

Documents shown in Table 27 were reviewed for the geochemical section of the audit:

Table 27 Geochemical Monitoring Program Documents Reviewed

Document	Version Reviewed	Sections Applicable during Construction Phase	Sections Applicable to Operations Phase
EMSAMP	2018-01	6.0 - Geochemical Monitoring	N/A
EMSAMP	2019-01	6.0 - Geochemical Monitoring	6.0 Geochemical Monitoring
EMSAMP	2020-01	N/A	6.0 Geochemical Monitoring
Water Licence QZ14-041, Quartz Mining License QML-0011 2018 Annual Report	N/A	3.4 - Geochemical Monitoring	N/A
Water Licence QZ14-041, Quartz Mining License QML-0011 2019 Annual Report	N/A	3.5 - Geochemical Monitoring	3.5 Geochemical Monitoring
Water Licence QZ14-041-01 Monthly reports January 1 to June 30, 2020	N/A	N/A	5.0 Geochemical Monitoring
Quartz Mining Licence QML-0011	N/A	N/A	9.3 and 9.4

3.4.2 Monitoring Program Implementation

During construction, the geochemical monitoring program was designed to meet the following objectives as described in EMSAMP 2018-01, EMSAMP 2019-01, EMSAMP 2020-01:

- Assess the potential for metal leaching and acidic drainage from excavated rock to determine if it is suitable for construction material.
- 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 to prevent and control metal leaching and acidic drainage (if applicable).

During operations, the geochemical monitoring program was designed with the following methods as described in EMSAMP 2018-01, EMSAMP 2019-01, EMSAMP 2020-01:

- Assaying capability will be required once operations commence. Assaying may include a mobile or containerized lab whose equipment would be re-installed in the permanent facilities once constructed, or a program to build a lab utilizing modular or pre-engineered construction that would be extended to provide the additional facilities contemplated.
- The assay lab will use both fire assay and perform atomic absorption assay to support both mining and processing functions. It is estimated that up to 200 blast-hole samples will require gold assays each day using fire assay.
- Crushing equipment to prepare samples for metallurgical testing to be included with all appropriate dust controls.
- Plant ore head samples, process solution samples and carbon samples will require assaying as well as samples from the metallurgical laboratory. The laboratory will include crushers, pulverizers and all associated equipment, including dust collection and environmental safety controls for sample preparation through to fire assaying.
- Analysis will be primarily for gold and silver, however pH, cyanide, total and sulfide sulfur, as well as arsenic will be included.

In addition, waste rock contact water monitoring during operations comprises in EMSAMP 2018-01, EMSAMP 2019-01, EMSAMP 2020-01:

- Monthly water quality sample collection at seeps if detected from the toe of Eagle Pup and Platinum Gulch WSRAs (included as part of the surface water quality audit)
- Flow monitoring every two weeks when flow is occurring and measurable at each seep collection point (included as part of the hydrology audit)
- Field barrel monitoring at least four times per year (during ice-free periods)
- Analysis to include hardness, pH, anions and nutrients (acidity, alkalinity, chloride, fluoride, nitrate, nitrite, and sulfate) and dissolved metals
- One replicate analyses conducted for each sampling event
- Monthly survey of waste facilities during ice-free months to observe developments of new seeps (as per Section 6.3.3 of the EMSAMP 2020-01)

The geochemical monitoring sampling protocol of the EMSAMP was updated in the 2020 version as per requirement in the Water Licence QZ14-041 Amendment 1 (August 23, 2019) to reflect:

5. *i) the collection and analysis of blast-hole chip composite samples of waste rock and ore from each blast round in the open pit;*
6. *ii) each composite sample will represent a maximum of 20% of the total blast holes per blast round;*
7. *iii) composite samples will be analysed for carbon, sulphur and arsenic; and*
8. *iv) results will be geospatially linked to the sample location from the pit, and if possible, to the deposition area within the WRSA and the HLF Pad.*

The geochemical monitoring program is consistent across all three version of the EMSAMPs, with minor variances noted above. The geochemical monitoring program was implemented according the objectives stated in the EMSAMP versions; however, compliance with the EMSAMP is included in the following section.

3.4.3 Compliance with EMSAMP

For the construction phase, the 2018 and 2019 Annual Reports were reviewed for compliance with EMSAMP 2018-01 and EMSAMP 2019-01. For the operations phase, the 2019 Annual Report and the 2020 Monthly Reports were reviewed for compliance with EMSAMP 2019-01 and EMSAMP 2020-01.

The following field and laboratory methods and compliance with sampling frequencies per the EMSAMP were reviewed for each mine phase:

- Construction
  - Surficial material static testing
  - Bedrock material static testing
- Operations
  - Blast-hole static testing
  - Waste rock static testing
  - Field barrel kinetic testing
  - Waste rock contact water (seep) monitoring

The results of this task are listed in Table 28.

Table 28 Geochemical Monitoring Program Compliance Table – Construction and Operations

Phase	Program	Analysis Location	Methods	Required		Conducted		Sample Compliance Check (Y/N) with Rationale	Methods Check (Y/N) with Rationale
				Sampling Quantity	Sampling Frequency	Sampling Quantity	Sampling Frequency		
Construction	Surficial Material Static Testing	Off-Site Analysis	• Visual inspection to determine presence of high concentrations of sulphides. • Bulk grab samples at each major excavation in distinct geological formations encountered and/or from every 200,000 m3 material moved. • 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 6.3-1: – Rinse pH and electrical conductivity (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 Waste rock used for construction or fill purposes must have a pH of at least 5.0, a NP:AP ratio of at least 3:1, and a total sulphide sulphur content of no greater than 0.3% (QML-0011)	Varies	Each major excavation or every 200,000 m^3 material moved	**2018 Annual Report** - 12 Samples	**2018 Annual Report -** Not described, grab samples	**2018 Annual Report** - N Visual inspection not described. No description of volume of material moved or if samples were per distinct geological formation	**2018 Annual Report** - Y

Table 28 Geochemical Monitoring Program Compliance Table – Construction and Operations

Phase	Program	Analysis Location	Methods	Required		Conducted		Sample Compliance Check (Y/N) with Rationale	Methods Check (Y/N) with Rationale
				Sampling Quantity	Sampling Frequency	Sampling Quantity	Sampling Frequency		
Construction	Bedrock Static Testing	Off-Site Analysis	• Grab samples at each major excavation in distinct geological formations encountered and/or from every 100,000 m3 material moved (except for the open pit) • 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 6.3-1: – Rinse pH and electrical conductivity (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 Waste rock used for construction or fill purposes must have a pH of at least 5.0, a NP:AP ratio of at least 3:1, and a total sulphide sulphur content of no greater than 0.3% (QML-0011)	Varies	Each major excavation or every 100,000 m^3 material moved (except for open pit)	**2018 Annual Report -** 15 Samples **2019 Annual Report -** 7 Samples	**2018 Annual Report -** Not described, grab samples **2019 Annual Report -** Not described, grab samples collected on January 25, 2019	**2018 Annual Report** - N No description of volume of material moved or if samples were per distinct geological formation **2019 Annual Report** - N No description of volume of material moved or if samples were per distinct geological formation	**2018 Annual Report** - Y - all bedrock samples met criteria for construction or fill purposes. Y
Operations	Blast-hole Static Testing	On-Site Analysis	• Blast-hole chip composites of waste rock and ore from each blast round in the open pit. Each composite sample will represent a maximum of 20% of the total blast holes per blast round. • Geological logging of blast hole composites. • Analysis for **carbon,** sulphur and arsenic. • Results will be geospatially linked to the sample location from the pit, and if possible, to the area within the waste storage facilities **and the HLF pad** that it is placed.	20% of total blast hole (EMSAMP 2020-01 onwards)	Each blast round	**2019 Annual Report** - 7 samples	**2019 Annual Report** - Not described, samples collected in July and December, 2019	**2019 Annual Report** - N - Details of blast rounds were not included in the annual report Section 3.5; therefore sample compliance could not be completed.	**2019 Annual Report** - N - analysis for carbon, sulfur, and arsenic were still being compiled and not included in the annual report. Geological logs were not included in the annual report. Confirmation of the geo-spatial link of the samples pending.

Table 28 Geochemical Monitoring Program Compliance Table – Construction and Operations

Phase	Program	Analysis Location	Methods	Required		Conducted		Sample Compliance Check (Y/N) with Rationale	Methods Check (Y/N) with Rationale
				Sampling Quantity	Sampling Frequency	Sampling Quantity	Sampling Frequency		
Operations	Blast-hole Static Testing	Off-Site Analysis	• Grab samples collected quarterly representing blasted waste, reduced to 1–2 kg in size using a riffle splitter prior to shipping to an accredited analytical laboratory for testing of the following methods as recommended in MEND, 2009. – Rinse pH and EC – Modified Acid Base Accounting (ABA) including a total sulphur, sulphate sulphur, fizz rating, modified Sobek neutralization potential and total inorganic carbon – Metal analysis by ICP-MS following aqua regia digestion	20% of total blast hole (EMSAMP 2020-01 onwards)	Quarterly	**2019 Annual Report - 7 samples**	**2019 Annual Report** - 7 samples collected in Q3 and Q4	**2019 Annual Report** - Y	**2019 Annual Report** - Y
Operations	Waste Rock Static Testing	Off-Site Analysis	Annual waste sampling from placed waste rock in the storage facilities (Eagle Pup and Platinum Gulch) consisting of collection of grab samples from waste produced in the previous calendar year. The number of samples will vary depending on production. One sample per million tonnes of waste produced be collected.	Varies. 1 sample/million tonnes of waste	Annual	**2019 Annual Report** - N/A**	**2019 Annual Report** - N/A**	2019 Annual Report - N/A**	2019 Annual Report - N/A**
Operations	All Static Testing	Off-Site Analysis	Samples will be sieved to collect samples representing specific grain size distributions as follows: • Bulk sample • <2 mm fraction • <1 cm fraction (including the < 2 mm fraction) • 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 6.3-1: • Rinse pH and EC on the <2 mm size fraction • Modified Acid Base Accounting including a total sulphur, sulphate sulphur, fizz rating, modified Sobek neutralization potential and total inorganic carbon on all three size fractions • Metal analysis by ICP-MS following aqua regia digestion on all four size fractions • Leach extraction analyses using a 3:1 water to solid ratio on the <1 cm sample fraction	N/A	N/A	N/A	N/A	N/A	**2019 Annual Report** - N - All analyses are correct with the exception of conducting the SFE tests on < 1 cm and <2 mm fractions. These details are not included in Appendix I ALS Reports. ALS states a 0.50 g sample is prepared, but does not include size fractions completed in that preparation - only refers to MEND 1.20.1 Predication Manual. The MEND 1.20.1 Prediction Manual methods describe 100 g samples of minus 6.35 mm size fraction.

Table 28 Geochemical Monitoring Program Compliance Table – Construction and Operations

Phase	Program	Analysis Location	Methods	Required		Conducted		Sample Compliance Check (Y/N) with Rationale	Methods Check (Y/N) with Rationale
				Sampling Quantity	Sampling Frequency	Sampling Quantity	Sampling Frequency		
Operations	Field Barrel Kinetic Testing	Off-Site Analysis	Field barrel monitoring is currently being conducted at least four times per year (during ice-free periods), and will continue through initial operations to expand the time trends until actual seepage database is adequate and can be related to the barrel data. Analysis currently includes hardness, pH, anions and nutrients (acidity, alkalinity, chloride, fluoride, nitrate, nitrite and sulfate) and dissolved metals. Replicate analyses are completed on one sample for each sampling campaign.	Four	Per Year	**2019 Annual Report** - field bin dataset was not included, sample frequency could be inferred from figures in Appendix H. Inferred: 7 samples between mid-2018 and October 2019	**2019 Annual Report** -Could not be determined. No attached dataset.	**2019 Annual Report -** Y*	**2019 Annual Report -** N - raw data not attached. No replicate samples reported.
Operations	Waste Rock Contact Water (Seep) Monitoring	Off-Site Analysis	Monthly sample collected as part of the Surface Water Quality Monitoring (included as part of the surface water quality audit) Flow measurements every two weeks when flowing at each seep collection point (included as part of the hydrology audit) Monthly survey of waste facilities during ice-free months to monitor for development of new seeps.	As needed	Monthly Survey	N/A	N/A	N/A	**2019 Annual Report** - N - Monthly seep survey not documented.

3.4.4 Data QA/QC

2018 Annual Report

- A total of 27 samples were collected as part of construction activities. There were no documented duplicate samples collected nor analyzed.

2019 Annual Report

- A total of 14 samples were collected as part of construction (7 samples) and operation (7 samples) activities. There were no documented duplicate samples collected nor analyzed.

2020 Monthly Reports

- In June 2020, two field bins were installed with two samples collected and one duplicate (with the assumption that reference "samples number…01" is a duplicate sample). From this assumption, 50% of total samples were QA/QC samples (half of the samples), compliant with EMSAMP (requiring one duplicate per sampling campaign). In May 2020, one sample of construction material was collected, analyzed, and reported in the June 2020 report. There were no QA/QC samples for the construction material sample. Overall greater than 10% QA/QC samples were collected as required by the EMSAMP.
- Results of the QA/QC samples (i.e., duplicate relative percent differences) were not included in the report body for June 2020.

3.4.5 Reporting Adequacy

The 2018 Annual Report, the 2019 Annual Report, and the 2020 Monthly Reports were reviewed for adequacy and compliance. Overall, the reporting and summarization of data collected for the geochemical monitoring program is complete and adequate with deviations described below.

2018 Annual Report

- Section 3.4.3 reports sulphur content ranging from non-detect at <0.01% to 22%, where it is reported as <0.01% to 0.22% in Table 3.4-1
- In Section 3.4.3, the NP:AP ratio reported in Table 3.4.1 would be better interpreted as the neutralization potential ratio (NPR) which is neutralization potential / acid potential (NP/AP) (e.g., 13.3, instead of 8:0.6 as per Sample VICEAG-GCM-01). This was corrected in the 2019 Annual Report.
- Section 3.4.3, Table 3.4-1 lists 26 samples, but Appendix I list 27 samples collected in 2018. Sample VICEAG-GCM-31 was omitted from Table 3.4-1
- In Section 3.4.3, Table 3.4-1 does not mention the type of material (i.e., surficial or bedrock) nor the rationale for sampling (i.e., distinct geological formation encountered and/or from every 100,000 or 200,000 m^3 material moved as per EMSAMP 2018-01)
- Acid base accounting results, including rinse pH and electrical conductivity, were not included in Appendix I

2019 Annual Report

- Field barrel analytical data was not included in the report or appendices (only figure form in Appendix H); therefore, compliance with sample frequency could not be determined nor compliance for analytical parameters analyzed determined.
- Section 3.5.2, Table 3.5-1 does not mention the type of material (i.e., surficial or bedrock) nor the rationale for sampling (i.e., distinct geological formation encountered and/or from every 100,000 or 200,000 m^3 material moved as per EMSAMP 2019-01)
- Details of blast rounds were not included in the annual report Section 3.5; therefore, sample compliance could not be completed for operations blast hole static testing.
- Geological logs of the blast-hole samples were not included.
- Appendix I did not state whether <1 cm size fraction was used for shake flask extraction tests
- Details of monthly seep survey for development on new seeps were not documented.

2020 Monthly Reports

- Results of the QA/QC samples (i.e., duplicate relative percent differences) were not included in the report body for June 2020. Duplicate samples were not explicitly described as such, the assumption that reference “samples number…01” is a duplicate sample.

3.4.6 Summary of Deficiencies and Recommendations

Table 29 summarizes compliance gaps and/or deficiencies for the geochemical monitoring program and provides recommendations for corrective actions.

Table 29 Geochemical Monitoring Compliance and Recommendations

Compliance Gaps and/or Deficiencies	Recommendation/Corrective Action
2018 Annual Report – QA/QC samples	Collect duplicate samples of construction monitoring samples and include discussion of results including relative percent differences in report body and append dataset.
2018 Annual Report – Report NPR values	Report NPR values in addition to NP:AP for better interpretation of results. This was corrected in the 2019 Annual Report.
2018 and 2019 Annual Report – Sample type description	Include details on the material sample collected (i.e., surficial, or bedrock) and why these samples were collected (i.e., 1 per 100,000 m^3 material moved or distinct geological unit).
2018 Annual Report – Appended analytical data	Include all analytical data in appendices. Missing: acid base accounting, rinse pH, and electrical conductivity.
2019 Annual Report – Appended analytical data	Include field barrel analytical data in appendices.

Table 29 Geochemical Monitoring Compliance and Recommendations

Compliance Gaps and/or Deficiencies	Recommendation/Corrective Action
2019 Annual Report – QA/QC samples	Collect duplicate samples of construction and operational monitoring samples, include discussion of result (including relative percent differences) in report body, and append dataset.
2019 Annual Report – Details of blast rounds	Include details of blast rounds so compliance with EMSAMP can be evaluated. Include geological logs of blast holes.
2019 Annual Report – Monthly seep sample survey	Include details of monthly seep sample survey in report.
2019 Annual Report – Shake flask extraction size fraction	Check with off-site laboratory (ALS) if shake flask extraction is conducted on <2 mm and <1 cm size fraction.
2020 Monthly Reports – QA/QC samples	Collect duplicate samples of construction monitoring samples and include discussion in report body and append dataset. For operational samples, include relative percent differences and discuss results in the report body. Consider re-naming duplicate samples to not include parent sample name. Explicitly describe which samples are duplicates of respective parent sample.

3.5 AQUATIC ENVIRONMENT

3.5.1 Stream Sediment

3.5.1.1 Documents Reviewed

Documents shown in Table 30 were reviewed for the stream sediment section of the audit.

Table 30 Stream Sediment Documents Reviewed

Document	Version Reviewed	Sections applicable during construction phase	Sections applicable to mine operations phase
EMSAMP	2018-01	7.0 – Stream Sediment	N/A
EMSAMP	2019-01	N/A	7.0 – Stream Sediment
EMSAMP	2020-01	N/A	7.0 – Stream Sediment
Water Licence QZ14-041 Quartz Mining License QML-0011 2018 Annual Report	N/A	3.5.1 – Stream Sediment Appendix J – Stream Sediment Monitoring Report (Laberge 2018)	N/A
Water Licence QZ14-041 Quartz Mining License QML-0011 2019 Annual Report	N/A	N/A	3.6.1 – Stream Sediment Appendix M – Stream Sediment Monitoring Report (Laberge 2020)

3.5.1.2 Stream Sediment Monitoring Program Design in EMSAMPS

The objectives of the stream sediment monitoring program, in all versions of the EMSAMP (Strata Gold 2018, 2019, Victoria Gold 2020), were to:

- collect data on pH and metal levels in the fine sediment fraction in watercourses in the study area as these parameters are relevant to toxicity and physical habitat requirements for benthos, fish eggs, and juvenile fish
- obtain data on sediment quality that can be used to evaluate changes related to the Project
- provide ongoing data to support refinement of future monitoring programs.

These data were to be collected from:

- five sites in Haggart Creek between the confluence of Fisher Gulch to the confluence of Lynx Creek (one above Project influence and four below Project influence)
- two sites in Dublin Gulch (both above Project influence)
- one site in Lower Eagle Creek (below Project influence)
- one site in Lynx Creek (reference site in unaffected stream)

Field samples were to be collected in depositional habitats (i.e., pools) downstream of riffle habitats using methods compatible with Part D (Soil and Sediment Sampling) of the British Columbia Field Sampling Manual (BC Ministry of Forests and Natural Resource Operations 2013).

Triplicate samples were to be collected from each of nine sites with each sample being comprising of a composite of five individual grabs. Composite samples were to be placed in individual acid-wash glass bottles and kept cool for delivery to the analytical lab.

Quality assurance/quality control (QA/QC) methods to be used in the field included: cleaning equipment with de-ionized water between sites, rinsing equipment with ambient water between replicates, wearing nitrile gloves while sampling and preparing samples, using acid-washed glass sampling jars, and storing samples on ice in a clean cooler. A field replicate was also to be collected at each site.

In the lab, sediment samples were to be sieved to isolate the <63 µm fraction so that analysis of total metal concentrations could be conducted. In 2018 and 2019, the fine fraction was to be analyzed for pH, and total concentrations of 19 metals and metalloids. In 2020, the fine fraction was to be analyzed for particle size distribution, pH, total organic carbon, and a suite of 33 metals and metalloids. In all years, only total concentrations were to be analyzed; no dissolved fractions were required in any of the EMSAMPs. While detection limits for some parameters have remained the same from 2018 to 2020 (e.g., zinc), required detection limits for many parameters are orders of magnitude lower in 2020 than for 2018 and 2019 (e.g., antimony, arsenic, silver) (Table 31).

QA/QC methods to be used in the lab included: use of certified reference materials including CRM standard MESS-2 for trace elements from the National Research Council of Canada and analysis of laboratory replicates. Laboratory replicates were not defined in any of the EMSAMPs.

Results were to be compared to pre-construction baseline values and the BC Interim Sediment Quality Guidelines (ISQG) for arsenic, cadmium, chromium, copper, iron, lead, manganese, mercury, nickel, silver, and zinc (Nagpal et al. 2006). Statistical analyses were to be performed on the monitoring data and compared directly to baseline results (i.e., pre 2018) to determine if any statistically significant change in sediment quality had occurred.

Table 31 Comparison of Stream Sediment Quality Parameters and Detection Limits for each year of the EMSAMP

	EMSAMP year		
Parameter	**2018**	**2019**	**2020**
pH	✓ (0.1)	✓ (0.1)	✓ 0.1
Particle Size Distribution			✓ (%)
Total Organic Carbon			✓ (%)
Aluminum, total			✓ (50.0)
Antimony, total	✓ (10.0)	✓ (10.0)	✓ (0.1)
Arsenic, total	✓ (5.0)	✓ (5.0)	✓ (0.05)
Barium, total	✓ (1.0)	✓ (1.0)	✓ (0.5)
Beryllium, total	✓ (0.5)	✓ (0.5)	✓ (0.1)
Bismuth, total			✓ (0.1)
Boron, total			✓ (10.0)
Cadmium, total	✓ (0.5)	✓ (0.5)	✓ (0.02)
Calcium, total			✓ (50.0)
Chromium, total	✓ (2.0)	✓ (2.0)	✓ (0.5)
Cobalt, total	✓ (2.0)	✓ (2.0)	✓ (0.1)
Copper, total	✓ (1.0)	✓ (1.0)	✓ (0.5)
Iron, total			✓ (50.0)
Lead, total	✓ (30.0)	✓ (30.0)	✓ (0.1)
Lithium, total			✓ (2.0)
Magnesium, total			✓ (10.0)
Manganese, total			✓ (0.2)
Mercury, total	✓ (0.005)	✓ (0.005)	✓ (0.005)
Molybdenum, total	✓ (4.0)	✓ (4.0)	✓ (0.1)
Nickel, total	✓(5.0)	✓(5.0)	✓(0.5)
Phosphorus, total			✓(50.0)
Potassium, total			✓(100.0)
Selenium, total	✓ (2.0)	✓ (2.0)	✓ (0.1)
Silver, total	✓(2.0)	✓(2.0)	✓(0.05)
Sodium, total			✓(50.0)

Table 31 Comparison of Stream Sediment Quality Parameters and Detection Limits for each year of the EMSAMP

	EMSAMP year		
Parameter	**2018**	**2019**	**2020**
Strontium, total			✓(0.1)
Sulfur, total			✓(100.0)
Thallium, total	✓ (1.0)	✓ (1.0)	✓ (0.05)
Tin, total	✓(5.0)	✓(5.0)	✓(0.2)
Titanium, total			✓(1.0)
Uranium, total	✓ (0.05)	✓ (0.05)	✓ (0.05)
Vanadium, total	✓(2.0)	✓(2.0)	✓(0.2)
Zinc, total	✓ (1.0)	✓ (1.0)	✓ (1.0)
NOTES: ✓ = parameter analyzed Values in brackets represent laboratory detection limits in mg/Kg dry weight except for % for particle size distribution and total organic carbon and pH units for pH			

Adaptive management thresholds for sediment monitoring were set at:

- 25% higher than median baseline concentrations for those parameters that currently exceed the Probable Effects Level[1] (PEL) as a baseline condition
- The PEL for those parameters that do not exceed PELs at baseline

If parameter concentrations exceed these thresholds, adaptive management measures specific in EMSMAP will be considered. Because sediment arsenic concentrations naturally exceed the arsenic PEL at most sites, the dominant species of arsenic was to be identified to determine if it was the biologically available form.

Table 32 and Table 33 below provides the audit results of the sediment quality monitoring programs.

[1] The Probable Effects Level is a threshold above which adverse biological effects frequently occur (more than 50% adverse effects occur above the PEL).

Table 32 2018 Stream Sediment Construction Monitoring Program Implementation

Stream	Site	Triplicate Samples collected? (Yes/No)	Field Duplicate Collected? (Yes/No)	Field QA/QC protocols followed? (Yes/No)	Required lab analysis conducted? (Yes/No)	Lab QA/QC protocols followed? (Yes/No)	Lab detection limits met or exceeded? (Yes/No)	Results compared to BC ISWQs? (Yes/No)	Results compared to Baseline Data? (Yes/No)	Required Statistical Analyses performed? (Yes/No)
Haggart Creek	W22	Yes	Yes	Yes	Yes[1]	Yes[2]	Yes	Yes	Yes[3]	No
	W4	Yes	No	Yes	Yes[1]	Yes[2]	Yes	Yes	Yes[3]	No
	W29	Yes	No	Yes	Yes[1]	Yes[2]	Yes	Yes	Yes[3]	No
	W5	Yes	No	Yes	Yes[1]	Yes[2]	Yes	Yes	Yes[3]	No
	W23	Yes	No	Yes	Yes[1]	Yes[2]	Yes	Yes	Yes[3]	No
Dublin Gulch	W1	Yes	No	Yes	Yes[1]	Yes[2]	Yes	Yes	Yes[3]	No
	W26	Yes	No	Yes	Yes[1]	Yes[2]	Yes	Yes	Yes[3]	No
Eagle Creek	W27	Yes	No	Yes	Yes[1]	Yes[2]	Yes	Yes	Yes[3]	No
Lynx Creek	W6	Yes	No	Yes	Yes[1]	Yes[2]	Yes	Yes	Yes[3]	No

NOTES:

[1] particle size distribution and a suite of 32 metals and metalloids were analyzed in 2018 instead of the 19 required by the 2018 EMSAMP; particle size distribution was not prescribed in the 2018 EMSAMP

[2] lab QA/QC included analysis of lab duplicates; standard protocol for Certified Analytical Labs but not prescribed in 2018 EMSAMP

[3] arsenic and nickel only

Table 33 2019 Stream Sediment Operational Monitoring Program Compliance Summary

Stream	Site	Triplicate Samples collected? (Yes/No)	Field Duplicate Collected? (Yes/No)	Field QA/QC protocols followed? (Yes/No)	Required lab analysis conducted? (Yes/No)	Lab QA/QC protocols followed? (Yes/No)	Lab detection limits met or exceeded? (Yes/No)	Results compared to BC ISWQs? (Yes/No)	Results compared to Baseline Data? (Yes/No)	Required Statistical Analyses performed? (Yes/No)
Haggart Creek	W22	Yes	Yes	Yes	Yes[2]	Yes[3]	Yes	Yes	Yes[4]	No
	W4	Yes	No	Yes	Yes[2]	Yes[3]	Yes	Yes	Yes[4]	No
	W29	Yes	No	Yes	Yes[2]	Yes[3]	Yes	Yes	Yes[4]	No
	W5	Yes	No	Yes	Yes[2]	Yes[3]	Yes	Yes	Yes[4]	No
	W23	Yes	No	Yes	Yes[2]	Yes[3]	Yes	Yes	Yes[4]	No
Dublin Gulch	W1	Yes	No	Yes	Yes[2]	Yes[3]	Yes	Yes	Yes[4]	No
	W26	No[1]								
Eagle Creek	W27	Yes	No	Yes	Yes[2]	Yes[3]	Yes	Yes	Yes[4]	No
Lynx Creek	W6	Yes	No	Yes	Yes[2]	Yes[3]	Yes	Yes	Yes[4]	No

NOTES:

[1] Samples could not be collected due to low water and absence of depositional areas

[2] Particle size distribution and a suite of 32 metals and metalloids were analyzed in 2018 instead of the 19 required by the 2019 EMSAMP; particle size distribution was not prescribed in the 2018 EMSAMP

[3] Lab QA/QC included analysis of lab duplicates; standard protocol for Certified Analytical Labs but not prescribed in 2019 EMSAMP

[4] Arsenic and nickel only

3.5.1.3 Compliance with the EMSAMP Stream Sediment Monitoring Program

In 2018, triplicate stream sediment samples were collected at the nine required sites (Table 32). In 2019, triplicate stream sediment samples were collected at only eight of the nine required sites (Table 33). No samples were collected from site W26 in Dublin Gulch in 2019 due to low flow conditions and lack of depositional areas to collect sediment.

All required field QA/QC protocols were followed in 2018 and 2019 with the exception that field duplicates were only collected at one of the nine sites. In the lab, all required analyses were conducted plus the additional analysis of particle size distribution, total organic carbon, and 13 other sediment quality parameters. Detection limits were provided in the laboratory analytical reports and met or exceeded those required in the 2018 and 2019 EMSAMPs. Lab QA/QC protocols included analysis of lab duplicates, which were not prescribed in the 2018 or 2019 EMSAMP but are an industry standard.

Mean concentrations, standard deviations, and coefficients of variation were calculated for the 2018 and 2019 data. Mean concentrations were compared to the appropriate CCME and/or BC ISWGs. However, the author reported a BC Working Sediment Quality Guideline for selenium; there is only an “alert” concentration for selenium in sediment and not an official BC working sediment quality guideline.

Results of the 2018 and 2019 surveys were presented in tabular form for 10 selected sediment quality parameters and not the entire suite; selected parameters were those deemed potential toxic to aquatic ecosystems, likely presence in the mineral deposit near the mine, and existence of environmental guidelines for the protection of freshwater aquatic life. Mean concentrations of arsenic and nickel were presented graphically to show comparison to Interim Sediment Quality Guidelines (ISQGs) and Probably Effects Levels (PELs) and the spatial differences between sites. Mean concentrations of arsenic and nickel were also compared in tables and graphs to mean arsenic and nickel concentrations determined from the 63 µm fraction from the same sites in previous years. These two parameters were selected because they consistently exceeded the PEL or ISWG at each sample site in 2018. Comparison of results for other parameters between years was not provided. Statistical analyses of potential significant differences in mean parameter concentrations, including arsenic and nickel, between 2018 and 2019 and previous years were not conducted.

Arsenic was the only parameter to exceed the CCME and BC WQG PEL for freshwater aquatic life in 2018; mean arsenic concentrations exceeded the PEL at all nine sites in 2018 and at all eight sites in 2019. Although mean arsenic concentrations exceeded the PEL at all sites in all previous years of sampling, including at reference sites and sites upstream of the influence of the Project, there was no mention of whether the 2018 or 2019 mean arsenic concentrations exceeded the adaptive management threshold defined in the 2018 and 2019 EMSAMPs or whether additional mitigation measures to control arsenic concentrations in stream sediments are warranted. Further, arsenic speciation was not conducted although recommended in the EMSAMP if arsenic concentrations in stream sediments exceeded guideline PELs.

3.5.1.4 Summary of Deficiencies and Recommendations

Deficiencies in the 2018 and 2019 annual reports are summarized in Table 34. VGC indicated the identified compliance gaps or deficiencies are being addressed in the Study Design that Victoria Gold is preparing for submission to Environment and Climate Change Canada for its Environmental Effects Monitoring (EEM) plan under Schedule 5 of the MDMER. However, this EEM plan study design was not included in the scope of this audit and, therefore, the gaps and deficiencies are only based on a comparison of the annual monitoring program reports to the requirements of the EMSAMPs.

Table 34 Stream Sediment Monitoring Program Deficiencies and Recommendations

Compliance Gaps and/or Deficiencies	Recommendation/Corrective Action
Field methods – use of stainless-steel trowel to collect samples	Samples collected for analysis of metal concentrations should be collected with plastic utensils to avoid potential contamination
Field methods – out of date field method guidelines	Methods should be consistent with updated BC Field Sampling Manual from 2020 and with BC's "Water and Air Baseline Monitoring Guidance Document for Mine Proponents and Operators" (BC MoE 2016)
Field methods – site documentation	Water depth, sediment texture and color, and presence of debris, biofilms, odours, or sheens should be described at each site. Sites should be photographed showing upstream, downstream, obliques, banks, riparian vegetation, and substrates
Lab methods – screening equipment	Laboratories should be required to screen sediment samples for particle size distribution and <63 µm fraction using non-metallic screens to avoid potential contamination
Reporting – units	Clearly document that guidelines and concentrations are reported as dry or wet weight
Reporting - guidelines	Sediment quality guideline for selenium is only an "alert" concentration and not a working sediment quality guideline
Reporting - guidelines	Clearly indicate whether guidelines for specific parameters are from CCME and/or BC WQG
Reporting – detection limits	Reports should identify results that are below detection limits (e.g., boron and silver)
QA/QC – field methods	Clearly document the field QA/QC procedures followed
QA/QC – field duplicates	Every third or fifth sample should be "field split" to assess sampler and laboratory QA/QC as per BC MoE 2016
QA/QC – laboratory detection limits	Reports should describe instances where laboratory detection limits are not ≤ $1/5^{th}$ of the respective sediment quality guideline or ≤ $1/5^{th}$ of the lowest background concentration
Reporting – lack of statistical analyses	Reports should include statistical comparison of data to pre-construction baseline data as required by EMSAMP
Reporting – lack of discussion of need for adaptive management due to PEL exceedances for arsenic	Conduct statistical analyses comparing contemporary and pre-construction data to identify any significant differences and conduct arsenic speciation analyses on future stream sediment samples

3.5.2 Benthic Invertebrates

Documents shown in Table 35 were reviewed for the benthic invertebrate monitoring section of the audit.

Table 35 Benthic Invertebrate Documents Reviewed

Document	Version Reviewed	Sections applicable during construction phase	Sections applicable to mine operations phase
EMSAMP	2018-01	8.0 – Benthic Macroinvertebrates	N/A
EMSAMP	2019-01	N/A	8.0 – Benthic Macroinvertebrates
EMSAMP	2020-01	N/A	8.0 – Benthic Macroinvertebrates
Water Licence QZ14-041 Quartz Mining License QML-0011 2018 Annual Report	N/A	3.5.2 – Benthic Macroinvertebrates Appendix K – Benthic Invertebrate Monitoring Report	N/A
Water Licence QZ14-041 Quartz Mining License QML-0011 2019 Annual Report	N/A	N/A	3.6.2 – Benthic Macroinvertebrates Appendix N – Benthic Invertebrates Monitoring Report

3.5.2.1 Benthic Invertebrates Monitoring Program Design in EMSAMPS

The objectives of the benthic invertebrate monitoring program, in all versions of the EMSAMP (Strata Gold 2018, 2019, Victoria Gold 2020), were 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

Benthic invertebrate data were to be collected from the same nine sites as the stream sediments:

- five sites in Haggart Creek between the confluence of Fisher Gulch to the confluence of Lynx Creek (one above Project influence and four below Project influence)
- two sites in Dublin Gulch (both above Project influence)
- one site in Lower Eagle Creek (below Project influence)
- one site in Lynx Creek (reference site in unaffected stream)

Benthic macroinvertebrates sampling methods were to be consistent with methods recommended in the Metal Mine Guidance Document for Aquatic Environmental Effects Monitoring (Environmental Canada 2012). Riffle habitat were to be sampled in late summer/fall using a quantifiable bottom sampler (e.g., Surber). Three replicate samples were to be collected at each site with a minimum separation of three times bank-full width between replicates. Field measurements of water temperature, dissolved oxygen concentration, pH, and conductivity, bankfull and wetted width, depth, gradient and canopy cover were to be measured at each site.

Benthic invertebrates were to be identified to lowest practical level (typically genus) and enumerated by a qualified taxonomic laboratory with experience identifying benthic invertebrates from northern environments. The method and level of sub-sampling was to be identified during sorting.

Data analysis as per the EMSAMP is to include total number of individuals per sample, number of organisms per unit area, and the following indices:

- 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 or similar index
- Simpson’s evenness, or similar index
- Bray Curtis index or similar index
- Taxon (i.e., Family) proportion
- Taxon (i.e., Family) presence/absence

Total invertebrate density, Family richness, Simpson’s evenness index, and Bray-Curtis index was to be statistically analyzed using ANOVA (power of 0.1). If the ANOVA determined that a metric had a significant difference among stations, a multiple comparison test (e.g., Tukey test) was to be used to determine if the exposure sites were significantly different from reference sites. Any significant differences were to be interpreted as a Project effect requiring adaptive management measures listed in the EMSAMPs. Results were to be interpreted relative to the other indices as well as to supporting environmental variables measured at the time of sampling, results of fish surveys, and relative to historical sampling. The effect of any outliers on results were to be evaluated.

Table 36 and Table 37 below provides the audit results of the benthic invertebrate monitoring program.

Table 36 2018 Benthic Invertebrate Construction Monitoring Program Compliance Summary

Stream	Site	Triplicate Samples collected? (Yes/No)	Samples collected at appropriate time of year and from appropriate habitat? (Yes/No)	Field QA/QC protocols followed? (Yes/No)	Required lab analysis conducted? (Yes/No)	Lab QA/QC protocols followed? (Yes/No)	Required community indices calculated? (Yes/No)	Required statistical analyses performed? (Yes/No)[4]	Results compared to Baseline Data? (Yes/No)	Adaptive Management Requirements discussed? (Yes/No)
Haggart Creek	W22	Yes	Yes	Yes[1]	Yes[2]	unknown	No	No	Yes[3]	No
	W4	Yes	Yes	Yes[1]	Yes[2]	unknown	No	No	Yes[3]	No
	W29	Yes	Yes	Yes[1]	Yes[2]	unknown	No	No	Yes[3]	No
	W5	Yes	Yes	Yes[1]	Yes[2]	unknown	No	No	Yes[3]	No
	W23	Yes	Yes	Yes[1]	Yes[2]	unknown	No	No	Yes[3]	No
Dublin Gulch	W1	Yes	Yes	Yes[1]	Yes[2]	unknown	No	No	Yes[3]	No
	W26	Yes	Yes	Yes[1]	Yes[2]	unknown	No	No	Yes[3]	No
Eagle Creek	W27	Yes	Yes	Yes[1]	Yes[2]	unknown	No	No	Yes[3]	No
Lynx Creek	W6	Yes	Yes	Yes[1]	Yes[2]	unknown	No	No	Yes[3]	No

NOTES:

[1] All field QA/QC procedures were followed except for the need for *a priori* criteria regarding acceptability of samples collected

[2] All organisms identified to genus or species for all insect larvae

[3] Qualitatively only

[4] VGC to perform statistical analysis as part of EEM study design.

Table 37 2019 Benthic Invertebrate Operations Monitoring Program Compliance Summary

Stream	Site	Triplicate Samples collected? (Yes/No)	Samples collected at appropriate time of year and from appropriate habitat? (Yes/No)	Field QA/QC protocols followed? (Yes/No)	Required lab analysis conducted? (Yes/No)	Lab QA/QC protocols followed? (Yes/No)	Required community indices calculated? (Yes/No)	Required statistical analyses performed? (Yes/No)	Results compared to Baseline Data? (Yes/No)	Adaptive Management Requirements discussed? (Yes/No)
Haggart Creek	W22	Yes	Yes	Yes[1]	Yes[2]	Yes	No	No	Yes[3]	No
	W4	Yes	Yes	Yes[1]	Yes[2]	Yes	No	No	Yes[3]	No
	W29	Yes	Yes	Yes[1]	Yes[2]	Yes	No	No	Yes[3]	No
	W5	Yes	Yes	Yes[1]	Yes[2]	Yes	No	No	Yes[3]	No
	W23	Yes	Yes	Yes[1]	Yes[2]	Yes	No	No	Yes[3]	No
Dublin Gulch	W1	Yes	Yes	Yes[1]	Yes[2]	Yes	No	No	Yes[3]	No
	W26	Yes	Yes	Yes[1]	Yes[2]	Yes	No	No	Yes[3]	No
Eagle Creek	W27	Yes	Yes	Yes[1]	Yes[2]	Yes	No	No	Yes[3]	No
Lynx Creek	W6	Yes	Yes	Yes[1]	Yes[2]	Yes	No	No	Yes[3]	No

NOTES:

[1] All field QA/QC procedures were followed except for the need for *a priori* criteria regarding acceptability of samples collected

[2] All organisms identified to genus or species for all insect larvae

[3] Qualitatively only

3.5.2.2 Compliance with the EMSAMP Stream Benthic Invertebrate Monitoring Program

Benthic invertebrate samples were collected from riffle habitats at all nine sites using a Surber sampler with a 300 micron mesh net in September 2018 (Table 36) and September 2019 (Table 37). Samples were preserved in buffered formalin and transported to the taxonomic lab in Summerland, BC. The required in-situ water quality parameters were collected at each site. Channel measurements (e.g., bankfull width, gradient, canopy cover) were reported in the appendices except for channel gradient. Site photos were provided in an appendix. QA/QC procedures in the field were consistent with those described in the EMSAMP. However, as per EEM QA/QC protocols, no *a priori* criteria for acceptability of samples obtained in the field were not developed or followed.

In the lab, samples were sorted and if the number of organisms in each sample was estimated to be greater than 600 individuals, the sample was sub-sampled to achieve a minimum of 300 organisms for identification and enumeration. Organisms were identified to genus or species level. QA/QC procedures and results of QA/QC procedures for lab sorting, sub-sampling, and individual identification were not provided in the 2018 report or in the appendices but were provided in the 2019 report and appendices.

Data analysis in 2018 and 2019 included total abundance per site, total density per site (organisms/m^2), taxonomic richness, Simpson's Diversity Index, and taxon proportion percentage as required by the EMSAMP. However, standard deviation, median, and minimum and maximum values for total density were not calculated, nor were family density, family richness, Simpson's evenness, and a Bray-Curtis index for any site in 2018 and 2019 as was required by the EMSAMP. Abundance, relative abundance, and richness of pollution sensitive Ephemeroptera, Plecoptera, and Trichoptera (EPT taxa) were calculated in both years as was a Hilenshoff Biotic Index. Neither of these indices were required by the EMSAMPs. No statistical comparisons of total invertebrate density, Family richness, Simpson's evenness index, or Bray-Curtis index were analyzed using ANOVAs as required by the EMSAMP. Instead, qualitative comparisons were made between sites sampled in 2018 and 2019. Statistical analyses are planned in 2021 after the completion of the first EEM study year

Data from 2018 and 2019 were compared to previous year's data using total density and Simpson's Diversity Indices as metrics for comparison. No statistical analyses were performed comparing 2018 and 2019 data to pre-construction data and only qualitative trends were identified. As a result, the need for adaptive management actions could not be determined and was not discussed. Although potential effects of elevated arsenic on benthic invertebrate communities was discussed, arsenic concentrations were collected from depositional areas while benthic invertebrates were collected from erosional areas and the discussion does not mention the implications of this difference. There was no discussion of potential effects of environmental variables measured at the time of sampling, or results of fish surveys, or acknowledgment of any outliers or their effects on benthic invertebrate results as was required by the EMSAMP.

3.5.2.3 Summary of Deficiencies and Recommendations

Deficiencies in the 2018 and 2019 annual reports for the benthic invertebrate monitoring program are summarized in Table 38. The identified compliance gaps or deficiencies are being addressed by VGC in the Study Design that Victoria Gold is preparing for submission to Environment and Climate Change Canada for its Environmental Effects Monitoring (EEM) plan under Schedule 5 of the MDMER. However, this EEM plan study design was not included in the scope of this audit and, therefore, the gaps and deficiencies are only based on a comparison of the annual monitoring program reports to the requirements of the EMSAMPs.

Table 38 Benthic Macroinvertebrates Monitoring Program Deficiencies and Recommendations

Compliance Gaps and/or Deficiencies	Recommendation/Corrective Action
Study design – insufficient sites in reference or upstream areas as per EEM guidance	Identify and begin sampling in second reference stream to bring the number of unaffected sites up to 5 as recommended in Environment Canada's EEM guidance; a minimum of three reference sites are recommended in BC's Water and Air Quality Baseline Monitoring Guidance Document
Study design – number of appropriate replicate numbers is unknown	Conduct power analysis on existing data to determine the number of replicate samples required to provide sufficient data to determine statistically significant differences between sites and between years given known variability in benthic communities. Without a power analysis, the default number of replicates per site should be increased to 5.
Field QA/QC procedures – no *a prior* criteria for sample appropriateness as required by EEM	Develop *a priori* criteria and apply to next survey
Lab QA/QC procedures and results – not provided in report or appendices	Provide lab QA/QC procedures and results in appendix
Data analysis - Missing community metrics required in EMSAMP (i.e., family density and richness, Simpson's evenness, and Bray-Curtis)	Include all community indices identified in EMSAMP
Data analysis – missing statistical analyses comparing sites and contemporary data to pre-construction data	Conduct the required ANOVAs and multiple comparison tests as required by EMSAMP (e.g., append appropriate statistical analyses in excel format) and EEM for BACI study design.
Reporting – only qualitative comparisons between sites and years discussed	There is sufficient data from sites and between years to conduct quantitative statistical analysis to determine significant difference between impact and reference sites and trends between years.
Reporting – no discussion of need for adaptive management actions; no statistical analyses performed to inform adaptive management	Discuss adaptive management considering quantitative analysis of site data and trend analysis
Reporting – no indication that results are site averages in the tables	Clearly identify what data in tables represents

Table 38 Benthic Macroinvertebrates Monitoring Program Deficiencies and Recommendations

Compliance Gaps and/or Deficiencies	Recommendation/Corrective Action
Reporting – no reference for Pacific Salmon Federation rating of "good quality" based on EPT taxa in the 2018 annual report	Provide all references in report
Reporting – incorrect identification of "fair" based on HBI to Site W26 in 2018 annual report	Incorporate quality and independent review into reporting structure
Reporting – no analysis or discussion of environmental variables, fish results, or outlier effects on benthic invertebrate results as required by EMSAMP	Discuss all requirements of the EMSAMPs in the annual reports.

3.5.3 Fish and Fish Habitat

3.5.3.1 Documents Reviewed

Documents shown in Table 39 were reviewed for the fish and fish habitat section of the audit.

Table 39 Fish and Fish Habitat Documents Reviewed

Document	Version Reviewed	Sections applicable during construction phase	Sections applicable to mine operations phase
EMSAMP	2018-01	9.0 – Fish and Fish Habitat	N/A
EMSAMP	2019-01	N/A	9.0 – Fish and Fish Habitat
EMSAMP	2020-01	N/A	9.0 – Fish and Fish Habitat
Water Licence QZ14-041 Quartz Mining License QML-0011 2018 Annual Report	N/A	Section 3.5.3 – Fish and Fish Habitat Appendix L Fish and Fish Habitat Monitoring Report	
Water Licence QZ14-041 Quartz Mining License QML-0011 2019 Annual Report	N/A	N/A	Section 3.6.3 – Fish and Fish Habitat Appendix O Fish and Fish Habitat Monitoring Report

3.5.3.2 Fish and Fish Habitat Monitoring Program Design in EMSAMPS

The overall objectives of the Fish and Fish Habitat monitoring program in the 2018, 2019 and 2020 EMSAMPs were to assess the effect of effluent on fish and to document changes to fish habitat downstream of the Project. A fish tissue study was to be undertaken if the concentration of effluent in the exposure area was >1% in the area within 250 m of the final discharge point, as per Environment Canada EEM guidance.

Fish sampling was to occur annually in July or August and was to include sampling locations in Iron Rust Creek (n=1), upstream of the Project, Haggart Creek (n=3), downstream of the project, and Lynx Creek (n=1), a reference site. Sampling was to be conducted with standard collection methods suitable for the habitats present (e.g., electrofishing, baited minnow traps, angling, seining). The following data was to be collected from fish captured at each sample location:

- Abundance (based on catch-per-unit effort)
- Species
- Weight
- Length
- General condition

All data were to be recorded on modified RISC site cards.

Various adaptive management measures would be triggered if direct or indirect mortality of fish or change to fish abundance or community assemblage occur including:

- Fish mortalities
- Chronic toxicity effects to individual fish
- changes to fish abundance or community assemblages
- Acute or chronic toxicity effects are observed while the effluent discharge standards and receiving water quality objectives are consistently met
- Low flows result in decreased habitat availability
- Changes to fish habitat occur as described in hydrology, sediment, and benthic invertebrate sections, including Increased sedimentation

Table 40 summarizes the fish and fish habitat monitoring program compliance with the construction and operations EMSAMPs for the audit.

Table 40 2018 & 2019 Fish and Fish Habitat Monitoring Program Implementation

Stream	Site	Sampling conducted at appropriate time of year? (Yes/No)	Appropriate methods used? (Yes/No)	All required data collected? (Yes/No)	Appropriate data analysis performed? (Yes/No)	Adaptive Management Requirements Met? (Yes/No)	Data meets requirements of future EEM plan? (Yes/No)
Haggart Creek	HC1	No[1]	Yes	No[2]	Yes	No[3]	No[4]
	HC2	No[1]	Yes	No[2]	Yes	No[3]	No[4]
	HC3	No[1]	Yes	No[2]	Yes	No[3]	No[4]
Iron Rust Creek	IR2	No[1]	Yes	No[2]	Yes	No[3]	No[4]
Lynx Creek	L1	No[1]	Yes	No[2]	Yes	No[3]	No[4]

NOTES:

[1] Sampling conducted in September and not in July or August as required by EMSAMP

[2] Condition of fish not recorded

[3] No mention of adaptive management thresholds or triggers in annual reports or appendices

[4] Insufficient fish abundance for non-lethal sampling; no baseline fish tissue concentrations; no data on reproduction, growth, or condition provided; no indicator fish species identified

3.5.3.3 Compliance with the EMSAMP Fish and Fish Habitat Monitoring Program

Fish and fish habitat surveys were conducted in September of 2018 and 2019 instead of July or August as prescribed in the EMSAMP. This delay in sampling likely resulted in results not directly comparable to previous summer surveys due to the onset of winter conditions that may have limited fish efficiency and movement of fish to overwintering areas. Single-pass electrofishing was conducted within open stream sections (i.e., without block nets) and baited minnow traps were set overnight. Both methods are consistent with the EMSAMP.

Results of the fish habitat surveys were presented in site summary sheets (with photos), raw data appendices, tabular summaries, and comparative graphs. Data analyses included characterization of channel, substrate, cover, and habitat conditions at each site, total number of fish captured, by species, at each site and length frequency distributions for fish species with enough individual captures. Condition of individual fish was not recorded. Fish data were compared to previous year's data in text and tables. Only 33 fish were captured in 2018 and only fish 70 fish were captured in 2019 which was below the minimum number of 100 individual fish recommended by EEM technical guidance (Environment Canada 2012). Only 85 fish were captured in 2017 suggesting that the EEM minimum is unlikely to be attained at current effort levels.

There was no mine effluent discharge in 2018, therefore, there was no need for a fish tissue study. Mine effluent was discharged to Haggart Creek on two occasions in 2019: April 20 and April 27–29. Although the 2019 annual report includes a section regarding EEM monitoring requirements under the MDMER (including preparation of a final EEM study design for submission to Environment Canada in April 2020), there was no mention in the fish section of the 2019 annual report or the fish and fish habitat appendix about the need for fish tissue sampling in accordance with the MDMER due to these effluent discharges (i.e., whether the concentration of effluent in the exposure area was >1% in the area within 250 m of the final discharge point).

Neither the 2018 or 2019 annual reports or their appendices indicated whether any of the thresholds for adaptive management were triggered and if any of the prescribed measures were implemented. Neither annual report provided any recommendations for which fish species in any of the affected or unaffected watersheds would be suitable as indicator fish species for EEM.

3.5.3.4 Reporting Adequacy, Compliance and Recommendations

Table 41 summarizes compliance gaps and/or deficiencies for the fish and fish habitat monitoring program and provides recommendations for corrective action. In general, the fish and fish habitat monitoring program in 2018 and 2019 was completed as specified in the EMSAMPs. However, the surveys were conducted in September and not in summer as required by the EMSAMP. As the author's reported, this delay in sampling likely reduced the efficiency of sampling and reduced the numbers of fish captured. Condition of fish was also not recorded in 2018 or 2019 nor were indication of whether adaptive management thresholds were exceeded.

Although not required in the EMSAMPs, future annual reporting should make recommendations for fish tissue and fish community sampling for future EEM programs should mine effluent discharge occur once the mine is in operation. Finally, the identified compliance gaps or deficiencies are being addressed by VGC in the Study Design that Victoria Gold is preparing for submission to Environment and Climate Change Canada for its Environmental Effects Monitoring (EEM) plan under Schedule 5 of the MDMER. However, this EEM plan study design was not included in the scope of this audit and, therefore, the gaps and deficiencies are only based on a comparison of the annual monitoring program reports to the requirements of the EMSAMPs.

Table 41 Fish and Fish Habitat Monitoring Program Deficiencies and Recommendations

Compliance Gaps and/or Deficiencies	Recommendation/Corrective Action
Field methods - Fish and fish habitat surveys conducted in September instead of July or August when fish communities are likely more stable and fish sampling is more efficient	Although not a deficiency of the annual monitoring programs, sampling should be conducted in summer when fish community is most stable and sampling efficiency is highest.
Field methods – fish condition was not documented as required by the EMSAMPs	Conduct external examinations and fill in standardized necropsy form for each fish or sub-sample of fish of each species captured
Field methods – single pass open sites	Although not required by the EMSAMPs and not a deficiency of the annual monitoring programs, multi-pass depletion estimates in closed sites would provide more accurate and repeatable results and be better for long-term monitoring and statistical analyses
Field methods – insufficient numbers of fish captured for EEM program at current effort levels	The EMSAMP references that a minimum of 100 fish is recommended for non-lethal sampling according to EEM technical guidance (Environment Canada 2012). Sampling in summer and using multi-pass electrofishing methods may increase numbers of fish available for capture
Reporting – no mention of need for fish tissue study	Even if no mine effluent discharge occurred, reports should indicate whether a fish tissue study is required or not as part of MDMER monitoring; the EMSAMP indicates that a fish tissue study is required if the concentration of effluent in the exposure area was >1% in the area within 250 m of the final discharge point but the 2019 annual report did not indicate if this criterion was met.
Reporting – no recommendation for indicator fish species for future EEM program	Although not required by the EMSAMPs, the authors should provide a recommendation for a suitable indicator fish species for monitoring potential effects of future mine effluent discharges. Given the fish community present at the site, slimy sculpin would appear to be at least one of the indicator species chosen for future EEM programs
Reporting – no mention of adaptive management trigger or threshold exceedances	Reports should specify whether any of the adaptive management thresholds in the EMSAMPs were exceeded and if any of the adaptive management measures were required and implemented each year

4.0 TERRESTRIAL ENVIRONMENT

This section presents an audit of the terrestrial environment monitoring programs as specified in the applicable EMSAMP documents, compared to the data and information reported in supporting annual and monthly reports. The intent is to determine if ongoing monitoring and data collection meets the commitments outlined in the EMSAMP. This audit is specific to the following areas:

- Vegetation
- Soils
- Wildlife Protection

The scope of this terrestrial environment audit is limited to those monitoring methods as specified in the three versions of the EMSAMPs and in the Wildlife Protection Plan (version 2017-01) effective during the audit period.

4.1 VEGETATION AND SOILS

4.1.1 Documents Reviewed

Documents in Table 42 were reviewed for the vegetation and soils section of the audit:

Table 42 Vegetation, Soils and Reclamation Documents Reviewed

Document	Version Reviewed	Sections applicable during construction phase	Sections applicable to Operations phase
EMSAMP	2018-01	12.0 – Vegetation 13.0 - Soils	N/A
EMSAMP	2019-01	12.0 – Vegetation 13.0 – Soils	N/A
EMSAMP	2020-01	N/A	12.0 – Vegetation 13.0 – Soils
Water Licence QZ14-041 Quartz Mining License QML-0011 2018 Annual Report	N/A	3.8.1 – Vegetation Monitoring Program and Appendix O – Vegetation Monitoring at the Eagle Gold Project 3.8.2 Soils and Appendix P – Soils Monitoring Report	N/A
Water Licence QZ14-041 Quartz Mining License QML-0011 2019 Annual Report	N/A	3.9.1 – Vegetation Monitoring Program and Appendix T – Vegetation Monitoring at the Eagle Gold Project (including soil sampling at D-2B and D-4B. 3.9.3 - Soils	3.9.1 - Vegetation Monitoring Program and Appendix T – Vegetation Monitoring at the Eagle Gold Project (including soil sampling at D-2B and D-4B. 3.9.3 - Soils

4.1.2 Monitoring Program Implementation and Data QA/QC

4.1.2.1 Vegetation Monitoring Program

The objectives of vegetation monitoring program were established prior to the mine construction phase and remain the same for the operations phase. These objectives are:

- To measure plant metal uptake, and
- To identify whether any trends in metal uptake could be attributed to site activities.

Vegetation (foliar) samples are collected annually in the summer (July/August) from four permanent plots at the locations shown in Table 43. Soil monitoring samples are collected in the same plots in conjunction with annual vegetation sampling.

Due to construction in 2019 and evolving operations needs, sites D2B and D4B were re-established at short distances from their original locations, established in 2018.

Table 43 Locations of Vegetation and Soil Monitoring Plots

Plot #	Aspect	Elevation (m)	Site Description
D1	Level	1417	Potato Hills near climate station
D2B	West	834	Upslope of the air quality station and the camp climate station
D3	Southwest	1356	Top of Eagle Pup near the over-the-top road
D4B	Level	757	On the west side of the access road just upstream of the Haggart Creek culverts

Samples are sent for laboratory analysis of 34 total metals concentrations. Total metals concentrations in sample results are compared to toxicity values for cattle (Puls, 1994) as there are no territorial or federal guidelines regarding metals concentrations in vegetation with respect to wildlife consumption (e.g., moose and/or caribou). Results are presented in the annual report and data for metals associated with the gold recovery process (arsenic, cadmium, chromium, mercury and lead) are compared year over year to assess for increases in concentrations over baseline values. Vegetation species composition is also assessed to determine vegetative assembly and local ecosystem changes over the Project phases.

For the purpose of QA/QC of laboratory analytical technique, duplicates of selected vegetation samples and reference standards are completed.

In the event vegetation monitoring indicates that metals concentration in vegetation is significantly increasing, VGC will consider additional dust control contingency measures described by the Dust Control Plan, Air Quality Management Plan, and applicable EMSAMP to limit particulate matter settling on vegetation.

4.1.2.2 Soil Monitoring Program

The objectives of the soils monitoring program were established prior to the mine construction phase and remain the same for the operations phase. These objectives are:

- To measure metal and nutrient levels in soils during operations, and
- To help identify whether any trends in trace metal and nutrient levels in soils could be attributed to site activities.

Soil monitoring is performed in coordination with vegetation monitoring, once annually during the growing season (July /August). Soil samples are collected from the surface soil horizon at depths between 0 and 0.5 m and then sent for laboratory analysis of pH, 36 metals and plant available nutrients. Ten percent of analyzed samples are blind duplicates, as an assurance on analytical quality and consistency.

Soil metals analytical results are compared to Canadian Council of Ministers of the Environment (CCME) soil quality guidelines (2018) and Yukon Contaminated Sites Regulations for agriculture and parklands soils (2002). All results are presented in the annual reports

Due to the need to re-establish vegetation/soil monitoring sites D2 and D4 (now D2B and D4B) in 2019, soil monitoring program results to date are considered representative of baseline soil conditions.

In the event future monitoring data indicates that metals concentration in soil within the mine footprint or at sites established outside the mine footprint are increasing, VGC will engage additional dust control contingency measures to limit particulate matter settling on soils.

Table 44 below provides the audit results of the vegetation and soil monitoring programs.

Table 44 Vegetation and Soils Monitoring Program Implementation

Monitoring Program	EMSAMP Version 2018-01 Compliance	EMSAMP Version 2019-01 Compliance	EMSAMP Version 2020-01 Compliance	Data QA/QC & Reporting
Vegetation	Monitoring program compliant with the EMSAMP for this period	Monitoring program compliant with the EMSAMP for this period	2020 monitoring program schedule outside of audit period	• 2018 annual reporting adequate • 2019 annual reporting adequate • Duplicate samples not collected in 2018 or 2019
Soils	Monitoring program compliant with the EMSAMP for this period	Monitoring program compliant with the EMSAMP for this period	2020 monitoring program schedule outside of audit period	• 2018 annual reporting adequate • 2019 annual reporting adequate • Duplicate samples not collected in 2018 or 2019

4.1.3 Reporting Adequacy, Compliance and Recommendations

The sampling program, data analysis, discussion and regulatory reporting for the vegetation and soils monitoring program was adequate for the audit period and compliant with the versions of the EMSAMP in effect during each sample program. However, Stantec recommends that the adaptive management component of the program rely on a statistical method to determine increases in metals associated with the gold recovery process (arsenic, cadmium, chromium, mercury and lead) in vegetation and soils that are 'significant'. This would facilitate management decision-making on implementing additional dust control contingency measures and would help to determine if the monitoring program is achieving its objectives.

Table 45 summarizes compliance gaps and/or deficiencies for the soils and vegetation monitoring program and provides recommendations for corrective action.

Table 45 Reclamation, Soils and Vegetation Monitoring Program Compliance and Recommendations

Compliance Gaps and/or Deficiencies	Recommendation/Corrective Action
N/A	Develop statistically-based trigger for determining 'significant' increases in metals (arsenic, cadmium, chromium, mercury and lead) concentrations in vegetation plot samples.
Missing duplicate vegetation sample analysis in 2018 and 2019	Collect duplicate samples, if sufficient vegetation is available

4.2 WILDLIFE PROTECTION

4.2.1 Documents Reviewed

Documents in Table 46 were reviewed for the wildlife protection section of the audit:

Table 46 Wildlife Protection Documents Reviewed

Document	Version Reviewed	Sections Applicable during Construction Phase	Sections Applicable to Operations Phase
Wildlife Protection Plan	2017-01	3.0 – Wildlife Protection Procedures 4.0 - Monitoring	3.0 – Wildlife Protection Procedures 4.0 - Monitoring
Water Licence QZ14-041 Quartz Mining License QML-0011 2018 Annual Report	N/A	3.8.3 - Wildlife	N/A
Water Licence QZ14-041 Quartz Mining License QML-0011 2019 Annual Report	N/A	3.9.4 - Wildlife	N/A

Table 46 Wildlife Protection Documents Reviewed

Document	Version Reviewed	Sections Applicable during Construction Phase	Sections Applicable to Operations Phase
2019 Late Winter Moose Distribution Survey	N/A	All	N/A
2020 Late Winter Moose Distribution Survey	N/A	N/A	All
September 2018 Quartz Mine Licence QML-0011 Quarterly report	N/A	All	N/A
December 2018 Quartz Mine Licence QML-0011 Quarterly report	N/A	All	N/A
March 2019 Quartz Mine Licence QML-0011 Quarterly report	N/A	All	N/A
June 2019 Quartz Mine Licence QML-0011 Quarterly report	N/A	All	N/A
September 2019 Quartz Mine Licence QML-0011 Quarterly report	N/A	N/A	All
December 2019 Quartz Mine Licence QML-0011 Quarterly report	N/A	N/A	All
March 2020 Quartz Mine Licence QML-0011 Quarterly report	N/A	N/A	All
June 2020 Quartz Mine Licence QML-0011 Quarterly report	N/A	N/A	All

4.2.2 Management and Monitoring Program Implementation and Data QA/QC

The Wildlife Protection Plan (the Plan) guides management and monitoring of wildlife during the mine's construction and operations phases. Section 4.0 of the Plan describes four wildlife-related monitoring programs that have been implanted at the Mine:

1. Wildlife Records Program
2. Heap Leach Facility Area and Events Pond Monitoring Program
3. Moose Distribution Surveys
4. Metal Levels in Vegetation Monitoring Program

An audit of the Wildlife Records Program, Heap Leach Facility Area and Events Pond Monitoring Program, and Moose Distribution Surveys are provided in this section. Table 46 lists the documents reviewed. An audit of the Metal Levels in Vegetation Monitoring Program is provided in Section 4.1 (Vegetation, Soils and Reclamation) of this audit.

Wildlife Records Program

The objective of the Wildlife Records Program is to provide data to evaluate changes to wildlife distribution and habitat use as a result of Mine activities during construction and operations. The wildlife records program includes monitoring of wildlife incidents, observations of focal species and species at risk, and monitoring of the implementation of mitigation measures described in Section 3.0 of the Plan. The data collected are also intended to inform adaptive management as required. The Plan requires annual reporting be completed on the findings of the Wildlife Records Program.

The wildlife sections of the 2018 and 2019 Annual Reports were reviewed (Table 46).

Wildlife is addressed in four sections of the 2018 Annual Report. Section 3.8.3 (Wildlife) states that bear aware training was provided to all personnel as part of the site orientation. Section 3.8.3.1 (Pre-Clearing Wildlife Surveys) states that pre-clearing wildlife feature and bird surveys were completed and no notable wildlife features were found. No information is provided on the survey locations or on the number or species of bird nests detected. Section 3.8.3.2 (Wildlife Incidents) summarizes wildlife incidents which occurred in 2018. The report lists three wildlife incidents, one involving an injured red fox and two involving grizzly bears. Finally, Section 3.8.3.3 (Annual Moose Survey) summarizes the annual moose survey.

Wildlife is addressed in four sections of the 2019 Annual Report. Section 3.9.4 (Wildlife) states that wildlife mitigation measures were implemented. Section 3.9.4.1 (Nesting Songbird Surveys) states that pre-clearing nesting bird surveys were completed.. Section 3.9.4.2 (Wildlife Incidents) states that there were several observations of animals near the camp and mine site and that live trapping of nuisance animals was completed three times. There is no information provided on the species trapped or why they were deemed nuisance animals. Finally, Section 3.9.4.3 (Annual Moose Survey) summarizes the annual moose survey.

Quartz Mining License QML-0011 requires that quarterly reporting of wildlife incidents and observation be completed. The September 2018 through June 2020 quarterly reports were reviewed (Table 46). These reports summarized wildlife incidents and observations as required by QML-0011.

Heap Leach Facility Area and Events Pond Monitoring Program

The objective of the Heap Leach Facility Area and Events Pond Monitoring Program is to confirm that wildlife access to process solution is restricted. Section 4.2 of the Plan states that monitoring of the heap leach facility area will be undertaken as part of the Wildlife Records Program and that regular inspections of the events pond will be completed by the Environmental Coordinator. The Plan requires annual reporting be completed on the results of the heap leach facility area monitoring and events pond inspections.

Monitoring and inspection of the heap leach facility area and events pond is only required once process solution is present during operations. These facilities did not become operational until August 2019; therefore, the audit of the Heap Leach Facility Area and Events Pond Monitoring Program is limited to the period from August 2019 to June 30, 2020.

The 2019 Annual Report and QML-0011 quarterly reports do not contain any records from the heap leach facility area during the audit period (Table 47). However, there are wildlife observations from the heap leach facility area recorded as part of the wildlife records program from outside the audit period. The 2019 Annual Report and QML00011 quarterly reports do not contain any information regarding wildlife-related inspections of the events pond during the audit period (Table 47). However, Stantec received verbal confirmation that monitoring of the heap leach facility and events pond is completed routinely. These data are collected on hard copy datasheets before being entered onto internal tracking sheets. Stantec received an internal tracking sheet with records for May 2020 through November 2020. A review of the hand-written records was beyond the scope of this review.

Moose Distribution Surveys

The purpose of the moose distribution surveys is to monitor the distribution and abundance of moose during the late-winter season to inform adaptive management strategies for mitigating mine effects on moose. The Plan commits to annual winter moose distribution surveys during construction and operations. The 2018 moose distribution survey was completed in March 2018, which is outside the period considered by this audit. The 2019 moose distribution survey was completed from March 5 to 7, 2019 and was the second construction phase survey (Table 47). The 2020 moose distribution survey was completed from March 5 to 6, 2020 and was the first operations phase survey (Table 47).

Table 47 Wildlife Protection Monitoring Program Implementation

	Wildlife Records Program		Heap Leach Facility Area and Events Pond Monitoring Program	Moose Distribution Surveys
	Wildlife Incidents	Wildlife Observations		
2018	Completed	Completed	N/A[1]	N/A[2]
2019	Completed	Completed	Completed[3]	Completed
2020	Completed	Completed	Completed[3]	Completed

NOTES:

[1] The heap leach facility area and events pond did not become operational until August 2019. Monitoring of these facilities is only required during operations; therefore, the audit of the Heap Leach Facility Area and Events Pond Monitoring Program is limited to the period from August 2019 to June 30, 2020.

[2] The 2018 moose distribution survey was completed in March 2018, which is outside the period considered by this audit.

[3] Stantec received verbal confirmation that this monitoring was completed

4.2.3 Reporting Adequacy, Compliance and Recommendations

Wildlife Records Program

There were minor discrepancies between the wildlife incidents described in the 2018 Annual Report, the 2018 September Quarterly Report, and the 2018 December Quarterly Report (Table 48). The 2018 Annual Report includes only one wildlife incident during the audit period, the discovery and subsequent euthanasia of an injured red fox on November 20, 2018. However, the 2018 September Quarterly report identifies three additional wildlife incidents: a bird fatality on a site access road, the removal of two squirrel middens, and the relocation of an active bird nest.

Stantec recommends that all wildlife incidents which result in human-wildlife conflict, wildlife fatality or removal, or nest disturbance be documented in a table in the main body of the annual report. Stantec also recommends that where possible the root cause(s) of the incident be determined and included in the annual report, and that this information be used as part of the adaptive management framework as described in the Plan (Table 48).

Stantec also recommends that location names be standardized where possible, and that coordinates be recorded so as to allow more accurate mapping of wildlife observations. This would assist in evaluating changes to wildlife distribution and habitat use as a result of Mine activities (Table 48).

Heap Leach Facility Area and Events Pond Monitoring Program

Stantec received verbal confirmation that routine monitoring of the heap leach facility and events pond is completed. These data are collected on hard copy datasheets before being entered onto internal tracking sheets. Stantec received an internal tracking sheet with records for May 2020 through November 2020. A review of the hand-written records was beyond the scope of this review. Stantec recommends that reporting on the heap leach facility and events pond monitoring be summarized in the annual report (Table 48).

Moose Distribution Surveys

The methods used in the 2019 and 2020 surveys followed those described in the Plan. The 2019 and 2020 surveys and reports are considered reliable, and no compliance gaps or deficiencies were identified. While not a gap, to improve readability Stantec recommends that the summary of incidental observations clearly indicate the current-year's observations before providing a comparison with prior-year surveys.

Table 48 Wildlife Protection Monitoring Program Compliance and Recommendations

Compliance Gaps and/or Deficiencies	Recommendation/Corrective Action
Specific information on wildlife incidents is not provided in the Wildlife Records Program	Provide a summary of all wildlife incidents resulting in human-wildlife conflict, wildlife fatality or removal, or nest disturbance in the annual reports along with a summary of the root cause(s). Any corrective actions should be documented.
There is no formal documentation of the wildlife protection monitoring in the Heap Leach Facility Area and Events Pond Monitoring Program	Include the results of the monitoring program in the annual report or in a separate report.

5.0 GEOTECHNICAL STABILITY OF INFRASTRUCTURE AND FACILITIES

This section presents an audit of the geotechnical and physical stability monitoring procedures of infrastructure and facilities on site as specified in the applicable EMSAMP documents, compared to the data and information reported in supporting annual and monthly reports. The intent is to determine if ongoing monitoring and data collection meets the commitments outlined in the EMSAMP. This audit is specific to the following areas:

- Permafrost foundations
- Open pit
- Material Storage and Stockpiling Areas
- Heap Leach Facility

The scope of this physical stability audit is limited to those monitoring methods as specified in the three EMSAMP documents listed below in Table 49.

This audit does not assess the ongoing geotechnical stability, or infrastructures stabilities outside of the four areas stated above. This audit also excludes review and assessment on the limit equilibrium slope stability and related Factor of Safety (FOS) design criteria, quantifying deformation and/or settlement, comparing reported groundwater tables with established trigger levels in other documentation, open pit wall stability, catch berm adequacy, the surveillance and inspection checklist of the Adsorption Desorption Recovery (ADR) Plant as laid out in EMSAMP 2020-01 Table 18.3-1, and determination if WRSA or stockpile structures were constructed to design specification.

5.1 PERMAFROST MONITORING

5.1.1 Documents Reviewed

The following documents in Table 49 were reviewed as part of the permafrost physical stability section of the audit.

Table 49 Permafrost Monitoring Program Document Review

Document	Version Reviewed	Sections applicable during construction phase	Sections applicable to Operations phase
Quartz Mining License QML-0011	Amendment April 17, 2018 Amendment May 19, 2020	13.0 – Reporting and Inspections	13.0 – Reporting and Inspections
EMSAMP	2018-01	15.0 – Infrastructure and Facilities	N/A
EMSAMP	2019-01	15.0 – Infrastructure and Facilities	15.0 – Infrastructure and Facilities
EMSAMP	2020-01	N/A	15.0 – Infrastructure and Facilities
Water Licence QZ14-041 Quartz Mining License QML-0011 2018 Annual Report	N/A	4.0 - Physical Monitoring	N/A
Water Licence QZ14-041 Quartz Mining License QML-0011 2019 Annual Report	N/A	4.0 - Physical Monitoring	4.0 - Physical Monitoring
Type A Water Use License QZ14-041-1 Monthly Report, Reporting Period: January 2020 to June 2020	N/A	N/A	8.0 - Physical Monitoring

5.1.2 Monitoring Program Implementation and Data QA/QC

This section compares the permafrost monitoring program described in the EMSAMP to the field programs and data collected over the audit period reported in the annual reports.

Permafrost monitoring activities summarized in those documents in 49 The documents were checked for compliance with monitoring frequency and methods described in the EMSAMP documents. Non-compliances, such as missing monitoring results, AMP thresholds, or other deficiencies in carrying out the monitoring programs are identified in Table 50 and discussed in 5.1.3.

Table 50 Permafrost Monitoring Program Implementation

Monitoring Method	EMSAMP – 2018 Monitoring Requirements	Compliance (Yes/No)	EMSAMP – 2019 Monitoring Requirements	Compliance (Yes/No)	EMSAMP – 2020 Monitoring Requirements	Compliance (Yes/No)
Visual Inspection	• Regular Intervals • Freshet, prolonged rainy periods, freeze-up	No[1]	• Regular Intervals • Freshet, prolonged rainy periods, freeze-up	No[1]	• Regular Intervals • Freshet, prolonged rainy periods, freeze-up	No[1]
Subsurface temperature monitoring (thermistor)[2]	• Quarterly	Yes	• Quarterly	Yes	• Quarterly	Yes
Surface water Quality (TSS, Turbidity)	• Freshet, rainy periods, freeze-up	Yes	• Freshet, rainy periods, freeze-up	Yes	• Freshet, rainy periods, freeze-up	Yes
Weather Data Review (precipitation, temperature, freezing/thawing indices)	• Annually	No[3]	• N/A (requirement removed)	N/A[4]	• N/A (requirement removed)	N/A[3]

NOTES:

[1] Execution of visual inspections not documented or discussed in annual or monthly reports.

[2] 13 thermistors are located where visual inspections are required.

[3] Freeze, thaw indices not documented or referenced in 2018 annual report.

[4] Weather data review criteria for removed in EMSAMP 2019-01 and EMSAMP 2020-01.

5.1.3 Reporting Adequacy, Compliance and Recommendations

Table 51 summarizes the compliance gaps and/or deficiencies identified with the permafrost monitoring program.

The notable non-compliance related to permafrost monitoring is the absence of recorded and documented regular visual inspections, specifically during the freshet, rainy periods, and freeze-up. These inspections should be recorded and documented as per the EMSAMP 2020-01 document.

Table 51 Permafrost Monitoring Program Compliance and Recommendations

Compliance Gaps and/or Deficiencies	Recommendation/Corrective Action
Regular visual Inspections not reported.	Include an appendix in Annual and Monthly reporting that summarizes the observations from regular visual inspections to identify and quantify any deformation associated with melting of permafrost, such as but not limited to, cracks, subsidence, sinkholes, and sloughing on existing foundations and slope overlay permafrost. Summarize those visual inspections executed during the freshet, prolonged rainy periods, and rising trend in any thermistors.
Prolonged rainy period not quantified.	Define / quantify duration of a prolonged rainy period based on exceedance of design criteria (duration, precipitation volume).
Freeze/Thaw indices not reported under EMSAMP -2018-01.	Corrective action no longer required because Weather Data Review requirement removed from EMSAMP monitoring program starting June 2019 (EMSAMP 2019-01 and 2020-01).
Thermistor GT18-09 not read in Q3 of 2019	Provide reasoning for missed reading.

5.2 OPEN PIT

5.2.1 Documents Reviewed

The following documents in Table 52 were reviewed as part of the geotechnical stability of the open pit portion of the audit.

Table 52 Open Pit Monitoring Program Document Review

Document	Version Reviewed	Sections applicable during construction phase	Sections applicable to Operations phase
Quartz Mining License QML-0011	Amendment April 17, 2018 Amendment May 19, 2020	13.0 – Reporting and Inspections	13.0 – Reporting and Inspections
EMSAMP	2018-01	16.0 – Open Pit	N/A
EMSAMP	2019-01	16.0 – Open Pit	16.0 – Open Pit
EMSAMP	2020-01	N/A	16.0 – Open Pit
Water Licence QZ14-041 Quartz Mining License QML-0011 2018 Annual Report	2018	3.3 – Groundwater 4.4 – Open Pit	N/A
Water Licence QZ14-041 Quartz Mining License QML-0011 2019 Annual Report	N/A	3.4 – Groundwater 4.1 – Eagle Pit 4.5 – Engineer's Physical Stability Annual Inspection	3.4 – Groundwater 4.1 – Eagle Pit 4.5 – Engineer's Physical Stability Annual Inspection
2019 Physical Stability Inspection	N/A	N/A	6.0 – Open Pit 18.0 - Recommendations
Type A Water Use License QZ14-041-1 Monthly Report, Reporting Period: January 2020 to June 2020	N/A	N/A	4.1 – Groundwater 8.0 – Physical Monitoring Program

5.2.2 Monitoring Program Implementation and Data QA/QC

This section compares the open pit monitoring program described in the EMSAMP to the field programs and data collected over the audit period. The open pit development did not commence prior to 2019, thus the audit is based on one year from the commencement of the operations phase to June 2020.

Open pit monitoring activities summarized in documents shown in Table 52 were checked for compliance with monitoring frequency and methods described in the EMSAMP. Non-compliances, such as missing monitoring results and exceedances of objectives/standards, AMP thresholds, or other deficiencies in carrying out the monitoring programs are identified in Table 53 and discussed in Section 5.2.3.

Table 53 Open Pit Monitoring Program Implementation

Monitoring Method	EMSAMP – 2018 Monitoring Requirements	Compliance (Yes/No)	EMSAMP – 2019 Monitoring Requirements	Compliance (Yes/No)	EMSAMP – 2020 Monitoring Requirements	Compliance (Yes/No)
Visual Inspection	• Daily	N/A[1]	• Daily	No[2]	• Daily	No[2]
Drone Survey	• N/A	N/A[1]	• N/A	N/A[3]	• Regular (bi-weekly)	Yes
Survey Prisms	• Monthly	N/A[1]	• Monthly	N/A[4]	• Monthly	No[4]
Robotic Theodolites	• Hourly (if implemented)	N/A[1]	• Hourly (if implemented)	N/A[5]	• Hourly (if implemented)	N/A[5]
Piezometer	• Monthly • Annual (data summary report)	N/A[1]	• Monthly (Construction) • Quarterly (Operation)	Yes[6]	• Quarterly	No[7]
TDR Cables (not installed)	• No frequency	N/A[1]	• No frequency	N/A[5]	• No frequency	N/A[5]
Slope Inclinometers (not installed)	• No frequency	N/A[1]	• No frequency	N/A[5]	• No frequency	N/A[5]
Extensometers	• No frequency	N/A[1]	• No frequency	No	• No frequency	No
Fixed Slope Radar (not installed)	• No frequency	N/A[1]	• No frequency	N/A[5]	• No frequency	N/A[5]
Mobile Slope Radar (not installed)	• No frequency	N/A[1]	• No frequency	N/A[5]	• No frequency	N/A[5]
Stability Reporting	• Annually, prior to October 1	Yes	• Annually, prior to October 1	Yes	• Annually, prior to October 1	N/A[8]

Table 53 Open Pit Monitoring Program Implementation

Monitoring Method	EMSAMP – 2018 Monitoring Requirements	Compliance (Yes/No)	EMSAMP – 2019 Monitoring Requirements	Compliance (Yes/No)	EMSAMP – 2020 Monitoring Requirements	Compliance (Yes/No)

NOTES:

[1] Open pit not developed in 2018.

[2] Execution of visual inspections not documented or discussed in annual or monthly report

[3] Drone survey criteria not included in EMSAMP 2018-01 and 2019-01.

[4] Survey prisms scheduled for implementation at open pit.

[5] Monitoring method not implemented / installed at open pit.

[6] The following piezometers listed in EMSAMP2019-01 MW96-17A, MW96-17B 09-BGC-GTH2a, 10-BGC-GTH-05, 10-BGC-GTH-06, 10-BGC-GTH-07, 10-BGC-GTH-08, 10-BGC-GTH-10 are not reported in the 2019 annual report: VGC indicated they were decommissioned in February 2019.

[7] The following piezometer installations listed in EMSAMP2020-01 are not reported in the June 2020 monthly report: BH-BGC11-73a, BH-BGC11-73b, and BH-BGC11-73c. [8] Annual physical stability report deadline given as October 1 2020, beyond the time scope of this audit.

In addition to the EMSAMP monitoring requirements listed above, the Quartz Mining Licence requires VGC to respond to recommendations resulting from the annual stability inspection that are related to the open pit. From the one (1) annual inspection within the audit scope for the open pit, for 2019, Stantec identified three (3) general recommendations relevant to the open pit. These relevant recommendations are listed below, as referenced from the 2019 physical stability inspection (All North, 2019).

1. VGC should assign a qualified, on site, individual to be responsible for monitoring and documentation of any mass earth structures that have significant risks in the case of a failure. The individual should develop a standard operating procedure for the monitoring and risk management of these structures. This individual should be responsible for coordination with a qualified professional to review monitoring data for concerns and trends if they are not qualified themselves.
    a. VGC response: Monitoring of structures is done by the Technical Services department working closely with the EOR for the areas and while following standard operating procedures (ongoing).
2. Any finalized construction of mass earth structures should include a final construction report that includes any operational and maintenance requirements (if any) to ensure stability of the structure.
    a. VGC response: As per both the QML and WL, the EOR will provide a final construction report, which includes requirements for maintenance as needed, once the structures are complete (ongoing).
3. VGC should consider a monitoring program to assist in early warning and detection of any movements in mass earth structures. Such a program might use permanent survey points, slope inclinometers, piezometers, or other tools to measure internal/external movements and pore water pressures. Such a monitoring program should be developed with the assistance of and be implemented with the oversight of a qualified professional.
    a. VGC response: Monitoring programs have been developed, are in use and undergoing further refinement by the technical services department with the oversight of a qualified professional. (Q2 2020).

5.2.3 Reporting Adequacy, Compliance and Recommendations

Table 54 summarizes the compliance gaps and/or deficiencies identified with the open pit monitoring program.

The notable non-compliance related to open monitoring is the absence of reported daily visual inspections. These inspections should be recorded and documented as per the EMSAMP 2020-01 document. There is also a lack of consistency between the number of piezometer instruments listed in the EMSAMP documents (2019-01, 2020-01) and those with reported water tables in the 2019 annual report and June 2020 monthly report. Stantec understands the MW series instruments, MW97-17A and MW96-17B, : 09-BGC-GTH2a, 10-BGC-GTH-05, 10-BGC-GTH-06, 10-BGC-GTH-07, 10-BGC-GTH-08, 10-BGC-GTH-10 were decommissioned in February 2019 and therefore excluded from the 2019 annual report. Stantec also understands the BH-BGC11-73 series instruments (a, b, and c) were decommissioned in early 2020 and therefore excluded from the 2020 monthly report.

VGC plans to implement a system of prisms to detect movements, initially scheduled for implementation in 2020 but delayed due to site access complications. This combined with documented visual inspection, piezometric monitoring, bi-weekly drone survey and annual stability review would provide sufficient general monitoring of the performance of the open pit. There are number of instruments and monitoring listed in EMSAMP that are not yet implemented, such as, robotic theodolite, TDR cables, slope inclinometers, fixed slope radar, and mobile slope radar. These instruments and monitoring can be considered as contingency when movements are observed from the general monitoring. It would be recommended to adjust the EMSAMP to indicate that these are contingent to general monitoring subject to review of the qualified personnel for the open pit stability.

Of the three (3) physical stability recommendations, two (2) are ongoing and Recommendation 3 is addressed by the bi-weekly execution of drone surveys and the planned implementation of monitoring prisms.

Table 54 Open Pit Monitoring Program Compliance and Recommendations

Compliance Gaps and/or Deficiencies	Recommendation/Corrective Action
Daily visual inspections not reported.	Include an appendix in Annual and Monthly reporting that summarizes the observations from these daily visual inspections.
Monthly collection of survey prism data not reported.	Stantec understands there are currently no active prisms installed at the open pit, and VGC is implementing a program scheduled for 2020 to install up to 15 prisms on the 1408, 1375, and 1395 benches. Following prism installation, include in Annual and Monthly reports a list of active survey prisms with coordinates (northing, easting, elevation) and deformation readings.
Piezometers read quarterly instead of monthly in 2018 as required in EMSAMP 2018-01.	Corrective action not required since the piezometer reading frequency is specified as quarterly in subsequent EMSAMP 2019-01, superseding the 2018 requirement and bringing the piezometer reading schedule into compliance.
Scheduled piezometer readings for Q1 2020 not collected due to COVID-19 related staffing issues.	Assess if datalogger installed in Open Pit piezometer BH-BGC11-73a,b,c collected and stored data for Q1 2020. For remaining piezometer(s), collect data as soon as reasonably practical and provide reading summary or reasoning for data gap in Annual reporting.
Piezometer data not collected in Q2 2020.	Assess if datalogger installed in Open Pit piezometer BH-BGC11-73a,b,c collected and stored data for Q2 2020. For remaining piezometer(s), collect data as soon as reasonably practical and provide reading summary or reasoning for data gap in Annual reporting.
Piezometers listed in EMSAMP documentation without reported water tables.	Provide reasoning for piezometers with absence of documented water table readings.
Data for two (2) extensometers installed at open pit not reported.	The EMSAMP documents do not lay out a minimum required monitoring frequency for extensometers installed at the open pit. A qualified personnel should determine a reading frequency for these instruments and should be summarized in the annual reports and compared against established velocity trigger levels.
Multiple instrumentation listed in EMSAMP documentation that is not currently installed on site (robotic theodolites, TDR cables, slope inclinometers, fixed slope radar, mobile slope radar).	Remove from EMSAMP documentation reference to instrumentation not installed (or planned for installation) on Open Pit.
Equipment maintenance logs were not provided to back-up data reported in monthly/annual reports.	Provide equipment maintenance logs as supporting documentation to monthly/annual reports.

5.3 MATERIALS STORAGE AND STOCKPILE MANAGEMENT AREAS

5.3.1 Documents Reviewed

The following documents in Table 55 were reviewed as part of the geotechnical stability of the materials storage and stockpile management areas portion of the audit.

Table 55 Materials Storage and Stockpile Management Areas Monitoring Program Document Review

Document	Version Reviewed	Sections applicable during construction phase	Sections applicable to Operations phase
Quartz Mining License QML-0011	Amendment April 17, 2018 Amendment May 19, 2020	13.0 – Reporting and Inspections	13.0 – Reporting and Inspections
EMSAMP	2018-01	17.0 – Material Storage and Stockpile Management Areas	N/A
EMSAMP	2019-01	17.0 – Material Storage and Stockpile Management Areas	17.0 – Material Storage and Stockpile Management Areas
EMSAMP	2020-01	N/A	17.0 – Material Storage and Stockpile Management Areas
Water Licence QZ14-041 Quartz Mining License QML-0011 2018 Annual Report	N/A	3.3 – Groundwater 4.5 - Material Storage and Stockpile Management Areas	N/A
Water Licence QZ14-041 Quartz Mining License QML-0011 2019 Annual Report	N/A	3.4 - Groundwater 4.4 - Material Storage and Stockpile Management Areas 4.5 – Engineer's Physical Stability Annual Inspection	3.4 - Groundwater 4.4 - Material Storage and Stockpile Management Areas 4.5 – Engineer's Physical Stability Annual Inspection
2018 Physical Stability Inspection	N/A	6.0 – 90 Day Stockpile 10.0 – Stockpile A 11.0 – Stockpile B 12.0 - Recommendations	N/A
2019 Physical Stability Inspection	N/A	4.0 – 90 Day Stockpile 7.0 – Platinum Gulch Dump 17.0 – Un-Named Stockpile Area 18.0 - Recommendations	4.0 – 90 Day Stockpile 7.0 – Platinum Gulch Dump 17.0 – Un-Named Stockpile Area 18.0 - Recommendations
Type A Water Use License QZ14-041-1 Monthly Report, Reporting Period: January 2020 to June 2020	N/A	N/A	4.1 – Groundwater 8.0 – Physical Monitoring Program

5.3.2 Monitoring Program Implementation and Data QA/QC

This section compares the materials storage and stockpile management areas monitoring program described in the EMSAMP to the field programs and data collected over the audit period.

Monitoring activities summarized in documents shown in Table 55 were checked for compliance with monitoring frequency and methods described in the EMSAMP. Non-compliances, such as missing monitoring results and exceedances of objectives/standards, AMP thresholds, or other deficiencies in carrying out the monitoring programs are identified in Table 56 and discussed in section *12.a*.

Table 56 Materials Storage and Stockpile Management Areas Monitoring Program Implementation

Monitoring Method	EMSAMP 2018-01 Monitoring Requirements	Compliance (Yes/No)	EMSAMP 2019-01 Monitoring Requirements	Compliance (Yes/No)	EMSAMP 2020-01 Monitoring Requirements	Compliance (Yes/No)
Visual / Drone inspection	• Daily (WRSA crest) • Weekly (WRSA toe) • Weekly (developing Stockpile) • Monthly (established Stockpile) • Monthly (detailed WRSA)	No[1]	• Daily (WRSA crest) • Weekly (WRSA toe) • Weekly (developing Stockpile) • Monthly (established Stockpile) • Monthly (detailed WRSA)	No[1]	• Daily (WRSA crest) • Weekly (WRSA toe) • Weekly (developing Stockpile) • Monthly (established Stockpile) • Monthly (detailed WRSA)	No[1]
Piezometers	• Quarterly • Annual (data summary Report)	Yes	• Quarterly	Yes	• Quarterly	No[2]
Rock Drain Flow	• Weekly	N/A[3]	• Weekly	N/A[3]	• Weekly	N/A[3]
Survey Prisms	• No frequency	N/A[4]	• No frequency	N/A[4]	• No frequency	N/A[4]
Wireline Extensometers	• No frequency	Yes	• No frequency	Yes	• No frequency	N/A[5]
Inclinometers	• No frequency	N/A[4]	• No frequency	N/A[4]	• No frequency	N/A[4]
Radar / photogrammic surveying	• No frequency	N/A[4]	• No frequency	N/A[4]	• No frequency	N/A[4]
Annual Physical Stability	• Annually, prior to October 1	Yes	• Annually, prior to October 1	Yes	• Annually, prior to October 1	N/A[5]

Table 56 Materials Storage and Stockpile Management Areas Monitoring Program Implementation

Monitoring Method	EMSAMP 2018-01 Monitoring Requirements	Compliance (Yes/No)	EMSAMP 2019-01 Monitoring Requirements	Compliance (Yes/No)	EMSAMP 2020-01 Monitoring Requirements	Compliance (Yes/No)
NOTES: [1] Execution of daily, weekly, monthly visual / drone inspections not documented or discussed in annual or monthly reports. [2] The following piezometer installations listed EMSAMP2020-01 are not listed in the June 2020 monthly report: MW96-15, and MW96-14B Stantec understands these piezometer installations were reported in the monthly report as MW96-15b and MW96-14, respectively. Stantec further understands that MW19-PGW-1b was damaged and could not be sampled for the monthly report. [3] Rock drain under construction as of June 2020 monthly report. [4] Monitoring method not implemented / installed at WRSA or stockpile structures. [5] Annual physical stability report deadline given as October 1 2020, beyond the time scope of this audit. [6] Wireline extensometer reading frequency not listed as monthly, may be provided in 2020 annual report.						

Stantec understands a physical stability inspection for the year ending 2020 was executed over September 23 and 24 of this year,

In addition to the EMSAMP monitoring requirements listed above, the Quartz Mining Licence requires VGC to respond to recommendations resulting from the annual stability inspections that are related to material storage and stockpile. From the two (2) annual inspection completed, by All North in 2018 and 2019, Stantec identified a total of 12 separate recommendations relevant to the material storage and stockpiles, are listed below:

1. 2018 – All stockpiles, material storage areas, and other mass earth structures should all have formal foundation and construction designs completed by a qualified professional.
    a. VGC response: Formal foundation and construction designs are part of EPCM's work for turnover to VGC. All turnover documentation will specifically identify minor modifications from the issued for construction design and the final constructed facility (Jun 2019).
2. 2018 – [related to 90 day stockpile] mitigate risks associated with perched rocks throughout the slope. Boulders should be removed in a controlled manner, or have a machine press (or bury) the boulders into the existing fill so they have a more stable base, and are less likely to become dislodged. Care should be taken during this work to ensure that the critical infrastructure, workers, and equipment are restricted from the fallout path, or other appropriate mitigation measures are pure in place.
    a. VGC response: The 90-day stockpile had only undergone preliminary clearing and earthworks at the time of the annual physical stability assessment. Stability analyses for this facility have been completed (post assessment) and provide recommendations for suitable foundation conditions for the 90-day stockpile to ensure that the required factors of safety are achieved (completed).
3. 2018 - [related to Stockpile B] this stockpile should be graded on top to eliminate or seal tension cracking.
    a. VGC response: Grading has taken place to stabilize the location identified (completed).
4. 2018 – [related to Stockpile B] the extent (volume and location) of ice and other frozen materials in the stockpile should be determined based on site records and information from site staff available. A record of the resulting instability should be noted.
    a. VGC response: Stockpile B will be reviewed post assessment by a Geotechnical Engineer. Any recommendations made (reshaping etc.) will be performed prior to handing over to VGC at completion. A material tracking sheet showing what as hauled to this location has been maintained during construction activities but was inadvertently not made available during the assessment (Jun 2019).
5. 2018 – [related to Stockpile B] have a qualified professional determine if ice and other frozen materials are an acceptable material for construction of a mass earth structure, and if they are, how they should be placed or incorporated in an overall stockpile design to ensure that there are no localized failures as a result.
    a. VGC response: Stockpile B will be reviewed post assessment by a Geotechnical Engineer. Any recommendations that made (reshaping etc.) will be performed prior to handing over to VGC at completion (Jun 2019).

6. 2019 - [related to 90 Day Stockpile] pull back over-steepened walls along the perimeter ditch which are sloughing into the ditch. This ditch may require a liner and/or rock armoring, and final grading to attain physical stability and prevent pooling.
    a. VGC response: Oversteepened slopes were temporary in nature, and have been reduced since observation in Sept 2019. Pad construction will continue after freshet 2020, and so will require ongoing monitoring and maintenance (Q3 2020 / ongoing).
7. 2019 – [related to 90 Day Stockpile] Tie perimeter ditch into the collection sump, directing water away from the road
    a. VGC response: this ditch/sump system will be completed as per engineering specifications and will be tied into the Ditch A pipeline (Q2 2020).
8. 2019 – [related to Un-named Stockpile Area] consider additional ditching and water management in the area to prevent scouring of the road surfaces and erosion around the stockpiles. Ditch water away from the laydown areas to prevent ponding.
    a. VGC response: Continual monitoring of stockpiles underway and will address water management on an as needed basis (on-going).
9. 2018&2019 - VGC should assign a qualified, on site, individual to be responsible for monitoring and documentation of any mass earth structures that have significant risks in the case of a failure. The individual should develop a standard operating procedure for the monitoring and risk management of these structures. This individual should be responsible for coordination with a qualified professional to review monitoring data for concerns and trends, if they are not qualified themselves.
    a. VGC response: Monitoring of structures is done by the Technical Services department working closely with the EOR for the areas and while following standard operating procedures (on-going).
10. 2018&2019 - VGH should continue to assign individuals to document and be responsible for the monitoring and construction review to determine if such structures are constructed in accordance with design. any variations between design documents and final construction should be included in the final record drawings.
    a. VGC response: Monitoring of structures including construction review to meet design specs is done by the Technical Services department working closely with the EOR for the areas. Construction reports and as-built drawings document variations or minor modification from IFC designs (on-going).
11. 2018&2019 - Any finalized construction of mass earth structures should include a final construction report that includes any operational and maintenance requirements (if any) to ensure stability of the structure.
    a. VGC response: VGC response: As per both the QML and WL, the EOR will provide a final construction report, which includes requirements for maintenance as needed, once the structures are complete (ongoing).

12. 2018&2019 - VGH should consider a monitoring program to assist in early warning and detection of any movements in mass earth structures. Such a program might use permanent survey points, slope inclinometers, piezometers, or other tools to measure internal/external movements and pore water pressures. Such a monitoring program should be developed with the assistance of and be implemented with the oversight of a qualified professional.
    a. VGC response: Monitoring programs have been developed, are in use and undergoing further refinement by the technical services department with the oversight of a qualified professional (Q2 2020).

5.3.3 Reporting Adequacy, Compliance and Recommendations

Table 57 summarizes compliance gaps and/or deficiencies identified with the materials storage and stockpile management areas monitoring program.

The notable non-compliance is the absence of documented visual inspections. These inspections should be recorded and documented as required in the EMSAMP 2020-01 document. There is also a lack of consistency between the number of piezometer instruments listed in the EMSAMP document 2020-01 and those with reported water tables in the June 2020 monthly report as listed: MW96-15, MW96-14B, and MW19-PGW-1b. Stantec understands the first two installation, MW96-15 and MW96-14B, were listed as MW96-15B and MW96-14 respectively, in the monthly report. MW19-PGW-1b was reported as damaged and could not be sampled.

The EMSAMP documents require weekly inspections of WRSA rock drain discharge areas. However, Stantec understands that as of June 2020 these structures are still under construction and not yet operational, thus monitoring requirements are not applicable until their completion.

Of the 12 physical stability recommendations, recommendations #1, 4, 5, 7, and 12 are scheduled for completion within the scope of this environmental audit. The remaining recommendations are ongoing, planned for future implementation, or are listed as completed by VGC.

- Recommendation 1 is addressed with the official handover package from construction to operations (Construction release, C1 Certification). Stantec assumes this handover package contains all relevant foundation and construction designs and accepted by a qualified professional.
- Recommendation 4 is not addressed in the available documentation, with no mention of a Stockpile B review.
- Recommendation 5 is not addressed in the available documentation, with no mention of a Stockpile B review.
- Recommendation 7 is scheduled for implementation in March and April 2020. This implementation is not documented in the relevant monthly reports.
- Recommendation 12 is addressed and the 2019 annual report presents readings for two (2) wireline extensometers installed on PG WRSA. Stantec understands an additional two (2) extensometers have been installed on this structure, with data not reported. The WRSA structures are also reported to be monitored bi-weekly with aerial drones.

Table 57 Materials Storage and Stockpile Management Areas Monitoring Program Compliance and Recommendations

Compliance Gaps and/or Deficiencies	Recommendation/Corrective Action
Visual inspections (daily, weekly, monthly) not reported.	Include an appendix in Annual and Monthly reporting that summarizes the observations from these visual inspections.
Not all WRSA and stockpile piezometers as listed in EMSAMP 2020-01 have water levels reported in June 2020 monthly report.	Confirm list of active piezometers installed in WRSA and stockpiles, include data in monthly and annual reports. Provide reasoning behind non-documented groundwater tables.
Multiple instrumentation listed in EMSAMP documentation that is not currently installed on site (Survey Prisms, Inclinometers, Radar / photogrammic surveying).	Remove from EMSAMP documentation reference to instrumentation not installed (or planned for installation) on WRSA and stockpile structures.
Existing monitoring methods (wireline extensometer) implemented on site do not state a monitoring frequency.	VGC should consider discrete reading frequencies for wireline extensometers, specify in EMSAMP documentation.
Follow up and close out of physical stability recommendation 4 and 5 not documented in annual or monthly reports.	Provide documentation detailing the follow up and response actions for addressing recommendations.

5.4 HEAP LEACH FACILITY

5.4.1 Documents Reviewed

The following documents in Table 58 were reviewed as part of the physical stability of the Heap Leach Facility portion of the audit.

Table 58 Heap Leach Facility Monitoring Program Document Review

Document	Version Reviewed	Sections applicable during construction phase	Sections applicable to Operations phase
Quartz Mining License QML-0011	Amendment April 17, 2018 Amendment May 19, 2020	13.0 – Reporting and Inspections	13.0 – Reporting and Inspections
EMSAMP	2018-01	18.0 – Heap Leach and Process Facilities	N/A
EMSAMP	2019-01	18.0 – Heap Leach and Process Facilities	18.0 – Heap Leach and Process Facilities
EMSAMP	2020-01	N/A	18.0 – Heap Leach and Process Facilities
Water Licence QZ14-041 Quartz Mining License QML-0011 2018 Annual Report	N/A	3.3 – Groundwater 4.7 - Heap Leach and Process Facilities	N/A

Table 58 Heap Leach Facility Monitoring Program Document Review

Document	Version Reviewed	Sections applicable during construction phase	Sections applicable to Operations phase
Water Licence QZ14-041 Quartz Mining License QML-0011 2019 Annual Report	N/A	3.4 – Groundwater 4.3 - Heap Leach and Process Facilities 4.5 – Engineer's Physical Stability Annual Inspection	3.4 – Groundwater 4.3 - Heap Leach and Process Facilities 4.5 – Engineer's Physical Stability Annual Inspection
2018 Physical Stability Inspection	N/A	8.0 – Heap Leach Facility 12.0 - Recommendations	N/A
2019 Physical Stability Inspection	N/A	5.0 – Heap Leach Facility 18.0 - Recommendations	5.0 – Heap Leach Facility 18.0 - Recommendations
Type A Water Use License QZ14-041-1 Monthly Report, Reporting Period: January 2020 to June 2020	N/A	N/A	2.3.3 – In-Heap Pond 4.1 – Groundwater Monitoring

5.4.2 Monitoring Program Implementation and Data QA/QC

This section compares the Heap Leach Facility monitoring program described in the EMSAMP to the field programs and data collected and provided for the purpose of the audit over the audit period.

Heap Leach Facility monitoring activities summarized in documents shown in Table 58 were checked for compliance with monitoring frequency and methods described in the EMSAMP. The details for the non-compliance, such as missing monitoring results and exceedances of objectives/standards, AMP thresholds, or other deficiencies in carrying out the monitoring programs are identified in Table 59 and discussed in Section 5.4.3.

Table 59 Heap Leach Facility Monitoring Program Implementation

Monitoring Method	EMSAMP 2018-01 Monitoring Requirements	Compliance (Yes/No)	EMSAMP 2019-01 Monitoring Requirements	Compliance (Yes/No)	EMSAMP 2020-01 Monitoring Requirements	Compliance (Yes/No)
Routine (visual) Inspection	• Weekly • Daily (General Visual)	No[1]	• Weekly • Daily (General Visual)	No[1]	• Weekly (Embankment)	No[1]
Piezometer	• Quarterly • Weekly (Embankment, In Heap) • Annual (data summary Report)	Yes	• Quarterly • Weekly (Embankment, In Heap) • Annual (data summary Report)	No[2]	• Continuous (Embankment, In Heap) • Daily (Heap leap pad during freshet)	No[3]
Inclinometer	• Monthly	N/A[4]	• Monthly	No[4]	• Monthly	No[4]
Fluid Levels (Events Pond)	• N/A	N/A[5]	• N/A	N/A[5]	• Daily	Yes
HLF and Dam Inspection	• Annually	Yes	• Annually	Yes	• Annually	N/A[6]
Physical Stability Inspection	• Annually, prior to October 1	Yes	• Annually, prior to October 1	Yes	• Annually, prior to October 1	N/A[6]

Table 59 Heap Leach Facility Monitoring Program Implementation

Monitoring Method	EMSAMP 2018-01 Monitoring Requirements	Compliance (Yes/No)	EMSAMP 2019-01 Monitoring Requirements	Compliance (Yes/No)	EMSAMP 2020-01 Monitoring Requirements	Compliance (Yes/No)
DSR	• Every 5 years	N/A[7]	• Every 5 years	N/A[7]	• Every 5 years	N/A[7]
Surveillance and Inspection of Adsorption, Desorption, and Recovery (ADR) Plant	• Regularly	N/A[8]	• Regularly	N/A[8]	• Regularly	N/A[8]

NOTES:

[1] Execution of daily, weekly, visual inspections not documented or discussed in annual or monthly reports.

[2] The following piezometers listed in EMSAMP 2019-01 are not reported in the 2019 annual report: MW10-AG6, BG-BGC11-26, MW19-HLF2a, MW19-HLF2b.

[3] The following piezometer listed in EMSAMP 2020-01 are not reported in the June 2020 monthly report: MWXX-AGR6, MW10-AG3A, MWXX-HLF2a, MWXX-HLF2b, MWXX-HLF3a, MWXX-HLF3b, MWXX-HL4a, MWXX-HLF4b. Stantec assumes the “XX” series instruments were not installed prior to June 30, 2020.

[4] Inclinometer data not reported in 2019 annual report, Q1/Q2 monthly reports.

[5] Monitoring requirement not laid out in relevant EMSAMP document.

[6] Annual physical stability, HLF and Dam Inspection for 2020 can be carried out in remainder of 2020 calendar year, outside scope of this audit.

[7] Dam Safety Review (DSR) not required during time scope of audit.

[8] ADR Plant surveillance and inspection checklist laid out in EMSAMP documents outside scope of this physical stability section of the environmental audit. Stantec assumes this is documented by VGC supervisor and operator and records filed on site.

Stantec understands a physical stability inspection for the year ending 2020 was executed over September 23 and 24 of this year.

In addition to the EMSAMP monitoring requirements listed above, the Quartz Mining Licence requires VGC to respond to recommendations resulting from the annual stability inspection that are related to the Heap Leach Facility. From the two (2) annual inspection completed, by All North in 2018 and 2019, Stantec identified a total of 12 separate recommendations relevant to the ADR and heap leach facility, are listed below:

1. 2018 – [related to ADR] reduce the outside slope of material in the stockpile above the ADR Access Road. The stockpile West Northwest of the ADR Building is composed of a mix of several materials with unknown compaction and possibly over steepened outside slopes. It is recommended that the stockpile be shaped within geotechnical design specifications, or that the location of the pile is adjusted so that there is a bench between the crest of the adjacent slope, and the toe of the stockpile. If the stockpile is to remain long term, the structure should have a design completed by a qualified professional.
    a. VGC response: The over-steepening of the crest area was addressed when an access road adjacent to the area was developed. Slopes above ADR access road will be addressed as part of the final area handover. Post completion a Geotechnical Engineer will conduct a further review of the installation and provide recommendations for additional mitigations as necessary (Jun 2019).
2. 2018 - [related to ADR] at the time of inspection, there appeared to be over-steepened temporary cut slopes created adjacent to short term haul roads used for construction access in the area. Cut back slopes adjacent to haul roads that do not meet geotechnical specifications for the site, or have recommendations in place for temporary slopes during construction.
    a. VGC response: The area adjacent to the ADR pad continues to be used for construction purposes. The interior area has been utilized as a storage area for unsuitable materials backhauled from local cut areas which has been used as backfill to mitigate this concern (completed).
3. 2019 - [related to ADR] review engineering requirements for the North Toe Ditch to confirm ditch size, and need for rock armoring. Toe ditch is currently tied into the roadside ditch, which should also be reviewed for engineering requirements. Recommend reviewing hydraulic design of both ditches to determine what is necessary.
    a. VGC response: Review of design to be done and if necessary ditch system will be modified (Q2 2020).
4. 2019 – [related to HLF] continue to monitor the cut slopes around the perimeter of the HLF for erosion. Maintain the upper bench and remove sloughing material as required.
    a. VGC response: This area will be monitored and repaired with the Phase 1B Expansion (Q2/Q3 2020).

5. 2019 – [related to HLF] install further ditching at the top of the temporary upper overburden stockpile area to control water flow and address scouring issue on the access road.
    a. VGC response: This area will be regraded and grubbed as part of the Phase 1 B Expansion (Q2/Q3 2020).
6. 2019 – [related to HLF] consider re-shaping the temporary upper overburden stockpile to reduce risk of material sloughing down towards the access road.
    a. VGC response: This area will be monitored and repaired with the Phase 1B Expansion (Q2/Q3 2020).
7. 2019 – [related to HLF] review requirements of Phase 1 Interception ditch outfall. Currently the ditch terminates at the top of an un-vegetated slope, and would be more stable with an armored exfiltration outfall/sediment sump.
    a. VGC response: Most of this area will be grubbed and regraded in preparation for the Phase 1 B Expansion. The outfall for the interceptor ditch will be constructed in Q2/Q3 (Q2/Q3 2020).
8. 2019 – [related to HLF] monitor road settlement around 0+650 of the interceptor ditch alignment. Currently this section requires some additional fill to facilitate truck traffic. Additional settlement could impact the functionality of the interception ditch. Additional settlement or failure is unlikely to impact other infrastructure, due to adequate setback from the toe of the slope.
    a. VGC response: Most of this area will be grubbed and regraded in preparation for the Phase 1 B Expansion. The outfall for the interceptor ditch will be constructed in Q2/Q3 (Q2/Q3 2020).
9. 2018&2019 - VGC should assign a qualified, on site, individual to be responsible for monitoring and documentation of any mass earth structures that have significant risks in the case of a failure. The individual should develop a standard operating procedure for the monitoring and risk management of these structures. This individual should be responsible for coordination with a qualified professional to review monitoring data for concerns and trends, if they are not qualified themselves.
    a. VGC response: VGC response: Monitoring of structures is done by the Technical Services department working closely with the EOR for the areas and while following standard operating procedures (on-going).
10. 2018&2019 - VGC should continue to assign individuals to document and be responsible for the monitoring and construction review to determine if such structures are constructed in accordance with design. any variations between design documents and final construction should be included in the final record drawings.
    a. VGC response: Monitoring of structures including construction review to meet design specs is done by the Technical Services department working closely with the EOR for the areas. Construction reports and as-built drawings document variations or minor modification from IFC designs (on-going).

11. 2018&2019 - Any finalized construction of mass earth structures should include a final construction report that includes any operational and maintenance requirements (if any) to ensure stability of the structure.
    a. VGC response: As per both the QML and WUL, the EOR will provide a final construction report, which includes requirements for maintenance as needed, once the structures are complete (ongoing).
12. 2018&2019 - VGC should consider a monitoring program to assist in early warning and detection of any movements in mass earth structures. Such a program might use permanent survey points, slope inclinometers, piezometers, or other tools to measure internal/external movements and pore water pressures. Such a monitoring program should be developed with the assistance of and be implemented with the oversight of a qualified professional.
    a. VGC response: Monitoring programs have been developed, are in use and undergoing further refinement by the technical services department with the oversight of a qualified professional (Q2 2020).

5.4.3 Reporting Adequacy, Compliance and Recommendations

Table 60 summarizes the compliance gaps and/or deficiencies identified with the Heap Leach Facility monitoring program.

The notable non-compliance is the absence of documented routine (visual) inspections. These inspections should be recorded and documented as per the EMSAMP 2020-01 document. There is also a lack of consistency between the piezometer instruments listed in the EMSAMP documents (2019-01, 2020-01) and those with reported water tables in the 2019 annual report and June 2020 monthly report. The piezometers listed in EMSAMP 2019-01 without reported water levels in the 2019 annual report are: MW10-AG6, BG-BGC11-26, MW19-HLF2a, MW19-HLF2b. MW10-AG3a is listed in EMSAMP 2020-01 and is not documented in the June 2020 monthly report. Stantec is assuming the following piezometers listed in EMSAMP 2020-01 were not installed prior to June 30, 2020: MWXX-HLF2a, MWXX-AGR6 MWXX-HLF2b, MWXX-HLF3a, MWXX-HLF3b, MWXX-HL4a, MWXX-HLF4b.

Of the 12 physical stability recommendations, recommendation #1, 3, and 12 are scheduled for completion within the scope of this environmental audit. The remaining recommendations are listed as ongoing, scheduled for future implementation, or listed as complete by VGC.

- Recommendation 1 is addressed with the official handover package from construction to operations (Construction release, C1 Certification). Stantec assumes this handover package contains all relevant foundation and construction designs and accepted by a qualified professional.
- Recommendation 3 is not addressed in the 2020 monthly reports, and review of the North Toe Ditch has not been documented in the available reports.
- Recommendation 12 is addressed with the installation of piezometers P1, P2, and P3 through the HLF embankment, in addition to an inclinometer casing for monitoring deformation. Available documentation does not present inclinometer casing readings.

Table 60 Heap Leach Facility Monitoring Program Compliance and Recommendations

Compliance Gaps and/or Deficiencies	Recommendation/Corrective Action
Routine (visual) inspections (daily, weekly) not reported.	Include an appendix in Annual and Monthly reporting that summarizes the observations from these visual inspections.
Embankment Piezometers P1, P2, P3 appear to be collecting data continuously but data not reported monthly.	Provide continuous data plots of embankment piezometers P1, P2, P3 in monthly reports. Include these instruments in next EMSAMP revision.
Partial reporting of piezometer readings as listed in EMSAMP 2019-01 in 2019 annual report.	Confirm HLF piezometers as listed in EMSAMP 2019-01 are reporting groundwater readings, include in monthly and annual reporting. Provide reasoning for missing groundwater level readings.
Partial reporting of piezometer readings as listed in EMSAMP 2020-01 in June 2020 monthly report.	Confirm HLF piezometers as listed in EMSAMP 2020-01 are reporting groundwater readings, include in monthly and annual reporting. Provide reasoning for missing groundwater level readings.
Existing monitoring methods (slope inclinometer casing) implemented on site do not state a monitoring frequency.	VGC to consider discrete reading frequencies for slope inclinometer casing, specify in EMSAMP documentation.
Follow up and close out of physical stability recommendation 3 not documented in annual or monthly reports.	Provide documentation detailing the follow up and response actions for addressing recommendation.

6.0 SOLID WASTE AND HAZARDOUS MATERIALS MANAGEMENT

6.1 DOCUMENTS REVIEWED

Documents in Table 61 were reviewed for the solid waste and hazardous materials management section of the audit. As this aspect of site environmental management is carried out in the field and documented by hand written reports required at various frequencies (daily, weekly, monthly, quarterly), Stantec modified the audit approach to review representative inspection logs and reports (Table 62). This review was supported by an interview with the site Environmental Superintendent regarding oversight of this program (personal communication, B. Bowden, September 23, 2020). Table 63 was prepared in consultation with VGCs site services department.

Table 61 Solid Waste and Hazardous Materials Management Document Reviewed

Document	Version Reviewed	Sections applicable during construction phase	Sections applicable to Operations phase
Solid Waste and Hazardous Materials Management Plan	2017-02	All sections	All sections

Version 2017-01 of the Solid Waste and Hazardous Materials Management Plan was approved on March 17, 2017. Version 2017-02, approved in July 2017, incorporated revisions made to update the site layout, and to support applications for permits under the *Environment Act* (i.e. Waste Management Permit, Air Emissions Permit, Burning Permit, Permit/certificate for Transport of Dangerous Goods and Land Treatment Facility Permit). Version 2017-02 was the approved plan effective during the audit period.

6.2 PLAN IMPLEMENTATION

Implementation of the Solid Waste and Hazardous Materials Management Plan (during construction and operations) was and is carried out through scheduled inspections and related documentation of inspections. Field inspections are carried out, according to the frequencies specified in the Solid Waste and Hazardous Materials Management Plan by VGC Environmental Technicians, and reports are reviewed by site VGC Environmental Coordinators for items that require corrective action by operations staff or senior management. Corrective actions are tracked in a dedicated log and updated upon completion.

Stantec reviewed inspections records shown in Table 62.

Table 62 Solid Waste and Hazardous Materials Management Inspections Records Reviewed

Waste Category	Frequency	Record	Record Date/Period
Hazardous Waste	As Required	Completed hazardous waste manifest	July 13, 2020
Wet/Dry Waste	As Required	Incinerator Operations Log	July 26–Sept 1, 2020
Wet/Dry Waste	Weekly	Incinerator Maintenance Log	May–June 2019
Hazardous Waste	Daily	Hazardous Substance Inspection Checklist (Fuel Stations/Propane Tanks	Week of July 21, 2020
Solid Waste/Fuel	Weekly	Environmental QA/QC Inspection (includes inspection of site waste management, fuel management and spill kits)	Week of July 10 and 27, 2020
Brush	As Required	Control Burn Log	January–August 2020

Table 63 below provides the audit results of the solid and hazardous waste management program.

Table 63 Solid Waste and Hazardous Materials Management Program Implementation

Solid Waste and Hazardous Materials Storage Areas	Inspections[a]		Record Keeping[b]	
	Frequency	Compliance (Yes/No)	Frequency	Compliance (Yes/No)
Waste Storage Areas	Daily	Yes	n/a	Yes
Landfill Area	Weekly	Yes	As Required	Yes
Incinerator	Monthly or As Required	Yes	As Required Per Use	Yes
Incinerator Stack Tests	n/a	n/a	Quarterly or to supplier recommended frequency	n/a[d]o
Waste Oil Burner	Monthly or As Required	Yes	Monthly or Each Inspection	Yes
Land Treatment Facility	Quarterly or As Required	Yes	Quarterly or Each Inspection	Yes
Used Tire Storage Area (Truck Shop)	Quarterly or As Required	Yes	Quarterly or As Required	Yes
Haz.Mat. & Special Waste Storage Areas	Weekly or As Required	Yes	Monthly or As Required	Yes
Open Burning Area	n/a	Yes	As Required Per Use	Yes
Spills and Leaks	n/a	Yes	See audit section 4.0	Yes

NOTES:

[a] Inspection requirements are as set out in the plan and permits

[b] Record keeping requirements are as set out in the plan and permits

[c] As required when wastes are disposed of and when cells are activated or closed

[d] As per the incinerator supplier recommended frequency, the incinerator did not require at stack test during the audit period.

6.3 REPORTING ADEQUACY, COMPLIANCE AND RECOMMENDATIONS

Based on the organization and inspection details in the various logs and inspection reports kept by VGC, Stantec confirms that implementation of the solid waste and hazardous materials management program was carried out adequately during the audit period.

Regular inspections are conducted by a Yukon Government (YG) Inspector and include inspection of solid waste and hazardous waste management areas. There were no corrective actions related to solid and hazardous waste management required by the YG Inspector during the audit period.

Table 64 Solid and Hazardous Waste Management Plan Compliance and Recommendations

Compliance Gaps and/or Deficiencies	Recommendation/Corrective Action
None	

7.0 SPILL RESPONSE

7.1 DOCUMENTS REVIEWED

Documents in Table 65 were reviewed for the spill response section of the audit. Spill response training, procedures and reporting measures were audited against the 2017-02 version of the Spill Response Plan as it was the approved version for the audit period.

Table 65 Spill Response Plan Documents Reviewed

Document	Version Reviewed	Sections applicable during construction phase	Sections applicable to Operations phase
Spill Response Plan	2017-02	All sections	N/A
Water Licence QZ14-041 Quartz Mining License QML-0011 2018 Annual Report	N/A	3.10 - Spills and Accidents and Appendix U – Spill Response Forms	N/A
Water Licence QZ14-041 Quartz Mining License QML-0011 2019 Annual Report	N/A	3.12 - Spills and Accidents and Appendix X – Spill Response Forms	NA
Type A Water Use License QZ14-041-1 Monthly Report, Reporting Period: January 2020 to June 2020	N/A	N/A	All sections

Table 66 below provides the audit results of the spill response program.

7.2 SPILL RESPONSE PLAN IMPLEMENTATION

Table 66 Spill Response Plan Implementation

Year	No. of Reportable Spills	Response Procedures Implemented	Reporting	Training and Prevention
2018	• 9 Septic • 3 Coolant	• Spill response procedures implemented as per the Spill Response Plan • Construction of Land Treatment Facility planned for 2019	• Spills reported to Yukon Spill Report Line	• Spill response training was a component of site orientation for all staff • Spill prevention was carried out through routine vehicle and equipment maintenance and pre-operation inspections
2019	• 1 Diesel • 4 Coolant • 1 Waste Oil • 3 Hydraulic Oil	• Spill response procedures implemented as per the Spill Response Plan • Land Treatment Facility (LTF) constructed in summer of 2019 • Excavated contaminated materials were transferred to the LTF	• Spills reported to Yukon Spill Report Line • Spills reports sent to the Yukon Water Board and the Dept. of Energy, Mines and Resources	• Spill response training was a component of site orientation for all staff • Spill prevention was carried out through routine vehicle and equipment maintenance and pre-operation inspections
2020	• 1 Diesel • 5 Coolant • 3 Hydraulic Oil	• Spill response procedures implemented as per the Spill Response Plan • Excavated contaminated materials were transferred to the LTF	• Spills reported to Yukon Spill Report Line • Spills reports sent to the Yukon Water Board and the Dept. of Energy, Mines and Resources	• Spill response training was a component of site orientation for all staff • Spill prevention was carried out through routine vehicle and equipment maintenance and pre-operation inspections

7.3 REPORTING ADEQUACY, COMPLIANCE AND RECOMMENDATIONS

Spill training and prevention, response and reporting was carried out according to the Spill Response Plan effective during the audit period (version 2017-02). All reportable spills were reported to the Yukon Spill Line, the Department of Energy, Mines and Resources and the Yukon Water Board within the required timeframe. VGC has notified FNNND Lands and Resources Manager of reportable spills (by email) since November 2019 (personal communication, L.Rear, September 29, 2020). An FNNND site Environmental Monitor also assists with liaising with FNNND regarding spills by providing spill status updates and carrying out inspections.

All reportable spills, with the exception of the spill (control pond discharge to ground) described in Section 3.2.3 (Table 19) are considered closed by the YG Inspector (i.e. remediation is complete). VGC has completed corrective actions regarding the first spill and expects that the incident will be closed by the YG Inspector within 2020. VGC conducted excavation and sampling operations from February to April to remediate the diesel spill. Final soil samples taken from the excavation floor and walls show that soil quality meets the Yukon Contaminated Sites Regulation standards for commercial and industrial soils. A 0final report describing the incident, remediation operations and soil sampling results was submitted to the Yukon Government on May 28, 2020.

VGC provided adequate responses to spills and is compliant with reporting requirements and personnel training specified in the Spill Response Plan.

Note that:

- VGC maintains records of preventative maintenance and all work orders in a dedicated database named PRONTO Xi. This software is used for tracking assets, work orders, and procurement,
- Light Vehicles are inspected prior to use.
- Both reportable and non-reportable spills, are tracked in a log specifying key information such as date, spill type, quantity, location, cause, mitigations employed and clean-up status.

Table 67 Spill Response Program Compliance and Recommendations

Compliance Gaps and/or Deficiencies	Recommendation/Corrective Action
None	None

8.0 SUMMARY AND RECOMMENDATIONS

Stantec has conducted this audit and prepared this report with the objective of assessing whether VGC's environmental management plans and regulatory controls set out in the Quartz Mining Licence (QML)-0011 are implemented in and about the mine, and that the environmental management systems and controls are functioning as intended.

Stantec has audited VGCs implementation of environmental and physical stability monitoring programs against versions of the EMSAMP, Water Management Plan and Wildlife Protection Plan in effect during the mine construction (July 1, 2018–March 16, 2019) and operations phases (March 17, 2019–June 2020) for compliance with these plans and with regulatory standards and thresholds set out in these plans.

Overall the implementation of VGC's environmental management system has been adequate and has demonstrated continual improvement throughout the audit period. Reports and data reviewed do not indicate there is any immediate concerns for water quality and quantity, aquatic habitat, air quality, soils, vegetation, wildlife and wildlife habitat, stability of physical structures and waste management.

Gaps, deficiencies and recommendations for corrective actions and improvements discussed above are shown in Table 68 for all disciplines. Stantec noted that there were some common themes with regard to deficiencies across several monitoring programs:

- Reporting monitoring activities and results without sufficient supporting data and information (e.g., validated datasets, statistical analyses, results compared against relevant standards or guidelines)
- Inconsistent implementation and/or documentation of QA/QC monitoring programs,
- Equipment malfunction resulting in gaps in datasets (i.e. climate, hydrology),
- Missing rationale in reports for gaps in implementation of the monitoring schedule,
- For monitoring programs with threshold standards or objectives, statistical analyses were not performed to determine statistically significant changes occurred to the receiving environment (i.e., air quality, hydrology, surface water quality, groundwater, soils, vegetation)
- Lack of adaptive management responses or rationale for not implementing adaptive management measures.

With respect to the last two deficiencies, the EMSAMP lacks quantitative adaptive management thresholds for certain monitored parameters/functional areas that would provide clear triggers for implementation of management actions. Stantec recommends that VGC work towards setting up statistically based sampling plans to help inform development of some adaptive management trigger thresholds into the next version of the EMSAMP.

Table 68 Recommendations for Improvements and Corrective Actions

Discipline	Compliance Gaps and/or Deficiencies	Recommendation/Corrective Action
Atmospheric Environment		
Climate	Incomplete climate data recorded between 2018–2020 during the construction phase and portions of the operations phase of mining	• Keep spare climate station sensors on-site for rapid deployment should sensors/equipment begin to fail or data gaps are noted. • Append annual QP climate stations' calibration report/records to annual report.
Air Quality	Inconsistency in data reporting	Submit validated datasets with all annual and quarterly reports, and compare monitoring results to AQC
Water Resources		
Surface Water Hydrology	EMSAMPs reference RISC (2009) as the document which was used to develop hydrology data collection. This document is out of date; Version 2.0 of that document was published in 2018.	The EMSAMP surface water hydrology program should be updated to reflect Version 2 of the hydrometric standards (RISC 2018).
	Insufficient documentation of revised sampling approaches for various stations based on data collection challenges or change in phase (e.g., monitoring frequency, monitoring type).	Explicitly document and provide rationale for changes to station monitoring approach or regime where applicable, and indicate plans for revising applicable EMSAMP sections.
	Prior to the 2020 monthly reports, there was insufficient documentation of periods where "discharging" or "dewatering" was occurring; this informs the requirement for monitoring at several stations.	Based on review of monthly reports from 2020, it appears that VGC has improved this. The 2020 annual report, and future monthly and annual reports, should continue to document periods of discharging or dewatering at applicable locations throughout site to inform the need for monitoring at applicable sites.
	For automated stations, winter and freshet time periods were not clearly delineated as to allow for demonstration of compliance as outlined in the EMSAMPs.	Recommend one of <u>two</u> changes: 1. Document dates of freshet start and logger deployment each year in the monthly and annual reports to delineate winter, freshet, and open water periods (each of which have different monitoring requirements), <u>or</u> 2. Update the EMSAMP requirements for the freshet period to better acknowledge i) the subjectivity of determining freshet period and/or ii) the difficulty of obtaining flow measurements during freshet flows.
	Prior to the 2020 Monthly Reports, not all of the monitoring stations outlined in the EMSAMPs are discussed/addressed in the annual reports.	Discuss/address all monitoring stations listed in the applicable EMSAMP, noting the status (e.g., active, not active) of each. Include data for all active monitoring stations (automated, manual) in reporting.
	Quarterly manual monitoring stations are not completed at consistent times of the year.	Clarify "quarterly monitoring" schedule, with backup sampling protocols if conditions are unsafe.
	The EMSAMPs list general tasks to be completed at each field visit (Section 2.3.1). Completion of these tasks was discussed in general in annual reports but documentation was not provided per requirements of RISC (2018).	Provide summary information regarding the completion of the tasks associated with each field visit in the annual reports, and/or indicate (in reporting) that these data have been documented internally and are available upon request.
	Logger malfunctions resulted in the loss of partial or full open water season datasets at several stations.	As outlined in the general tasks in the EMSAMPs (Section 2.3.1), download logger data either at every monitoring visit, or at an appropriate regular frequency, to minimize data loss and rectify issues.
	Sites experienced flows which were too high to safely obtain a flow measurement. The flows experienced in June are part of the seasonal range in flows and should be captured as part of the rating curve development or verification.	If possible, considering a reasonable level of effort and resources, safe flow measurement methods and procedures should be developed and implemented to capture high flows which are essential to development of reliable rating curves. If no method is safe considering reasonable levels of effort and resources, it should be stated in the reporting as such (e.g., as was completed in 2020 Monthly Reports) with a rationale, and the rating curves identified as valid below an identified threshold.
	QA/QC related to field and analytical tasks (e.g., benchmark surveys, station condition, field processes, photos, equipment calibration) were not documented.	Recommend that QA/QC processes in accordance with Section 2.3.1 in EMSAMP2018-01, EC 2001, RISC 2018 are documented and provided in reporting.
	Flow records are in partial compliance due to lack of winter and freshet measurements and/or logger malfunctions.	Implement monitoring program as outlined in applicable EMSAMP , or provide rationale for implementation not being possible in reporting and amend EMSAMP.
	For automated stations, it is not clear what the manual monitoring frequency is during the freshet in EMSAMP2020-01.	Clarify this in future EMSAMPs/reporting.
	It is not clear in the EMSAMPs if the adaptive management performance thresholds are applicable to manual monitoring stations.	Clarify this in future EMSAMPs/reporting.

Table 68 Recommendations for Improvements and Corrective Actions

Discipline	Compliance Gaps and/or Deficiencies	Recommendation/Corrective Action
Surface Water Hydrology (cont'd)	Average monthly flows were used instead of median monthly flows (as specified in Table 2.4-1 in EMSAMP2019-01 and EMSAMP2020-01) in evaluation of performance thresholds.	Use median monthly flows in evaluation of performance thresholds as outlined in EMSAMP.
	The method of evaluation of performance thresholds for adaptive management was not completed in accordance with quantitative procedure outlined in EMSAMPs.	Apply the quantitative evaluation protocol outlined in the EMSAMPs for performance thresholds for adaptive management at relevant monitoring locations.
	The evaluation of performance thresholds for adaptive management was not completed for all automated stations listed in the EMSAMPs.	Perform evaluation of performance thresholds for adaptive management for all relevant automated stations as outlined in the EMSAMP.
	Adaptive management responses were not clearly performed following exceedance of performance thresholds.	Implement and document the adaptive management responses if performance thresholds exceeded at relevant monitoring locations as outlined in EMSAMPs.
	Full documentation of completion timelines and dates for key water management infrastructure not documented.	Include specific completion dates in annual reporting for all key water management components.
Surface Water Quality	2018 Annual Report – Rationale for missing sample events	Include a footnote for each table describing missing data rationale (e.g., frozen water)
	2018 Annual Report – QA/QC results not described	Include text in the report body describing the results of the QA/QC program (e.g., number of QA/QC samples, summary of results, DQOs, and corrective actions for failed DQOs). Also include these data in the database (Appendix D) or tabulated form.
	2019 Annual Report – Water Quality Results	Include a tabulated form of all water quality data including QA/QC samples
	2019 Annual Report – QA/QC results not completely described	Include results of duplicate sample results as well as total amount of QA/QC samples collected and summarize data in a tabulated form.
	2019 Annual Report – Quality of plots	Improve quality of plots so axes can be read (Appendix F)
	2019 Annual Report – Statistical and trend analysis	For WQO exceedances, the EMSAMP commits VGC to compare values to baseline to determine if any significant changes have occurred to the receiving environment water quality, complete a trend analysis, and include methods and results in the report. We recommend an adjustment to this commitment with the goal of an achievable exercise for this project (e.g., monitor over x number of sampling events to determine if it is a real change in water quality)
	2019 Annual Report – Cyanide species	Include cyanate and thiocyanate in the analytical suite for compliance with EMSAMP 2019-01
	2019 Annual Report – AMT Responses	The EMSAMPs requests VGC to describe in detail the response for any AMT exceedances. As per the Water Management Plan, sampling frequency will increase accordingly (next higher order) to better characterize trends.
	2020 Monthly Reports – QA/QC	Report on QA/QC samples collected monthly and include results in the report body including laboratory QA/QC results. Frequency of QA/QC samples are to meet >10% ratio of QA/QC samples to total water quality samples. *(Stantec understands that currently, Field blanks are being collected and are documented in the 2020 monthly report water quality appendices.)*
	2020 Monthly Reports – AMT Responses	For WQO and AMT exceedances, the EMSAMP commits VGC to compare values to baseline to determine if any significant changes have occurred to the receiving environment water quality, complete a trend analysis and include methods and results in the report. We recommend an adjustment to this commitment with the goal of an achievable exercise for this project (e.g., monitor over x number of sampling events to determine if it is a real change in water quality). We also recommend to include a detailed AMT response. As per the Water Management Plan, sampling frequency should increase accordingly (next higher order) to better characterize trends.

Table 68 Recommendations for Improvements and Corrective Actions

Discipline	Compliance Gaps and/or Deficiencies	Recommendation/Corrective Action
Groundwater Quantity and Quality	Groundwater quantity and quality monitoring from some wells was performed less frequently than the schedule prescribed in the relevant EMSAMPs.	• A number of factors, including those beyond the control of VGC may result in a scheduled monitoring not being performed (e.g. weather, equipment malfunction, unsafe condition, construction, pandemic). The monthly and annual reporting needs to provide the rationale for missed monitoring in tabular format and if any corrective action will be taken. • The annual and monthly reporting should include the installation and decommission date, and operational status of monitoring wells. • A maintenance log should be maintained for any maintenance or repairs made to logs and reported in the annual report.
	EMSAMP (2020-01, S. 4.5) states that groundwater levels will be compared to predicted (modeled) effects due to the loss of recharge in the HLF and WRSA. However, trends were not quantitatively compared with predicted (modelled) effect in the 2019 Annual Report or 2020 Monthly Reports. It is unclear if trends are consistent with the predicted thresholds or if the model requires calibration based on field observation.	• Compare measured groundwater levels to predicated effects in assessment. • Calibrate modeled adaptive management thresholds for groundwater quantity based on field observation.
	EMSAMP (2020-01, S. 4.4) states that groundwater hydrographs will be compared with existing baseline data to assess potential change associated with the Project. The 2019 Annual Report in S. 3.4.3.1 presents a qualitative discussion of the observed changes in groundwater quantity associated with the construction and operation of mine. This discussion is not presented in the context of modelled effect or groundwater quantity indicators.	Present further assessment of the change in groundwater quantity associated with the Project. The assessment would be strengthened if a list of groundwater quantity indicators and associated triggers were developed and utilized in the operation stage.
	EMSAMP (2020-01, S. 5.2) presents groundwater quality parameters to be analyzed in the monitoring program. Review of groundwater quality records in the 2019 Annual Report suggests some samples were not analyzed for the full suite of parameters.	• Review water licence conditions and lab records to confirm if required parameters were analyzed. • Include all analyzed parameters and lab reports in annual reporting.
	• EMSAMP (2020-01, S. 5.3.2 and 5.3.3) describes the field QA/QC program for groundwater quality monitoring, which includes collection and analysis of trip blanks, field blanks and duplicates. • The 2019 Annual Report does not present information on the implementation of the QA/QC program. Appendix K of the 2019 Annual Report (Groundwater Quality Data) does not contain records of the QA/QC samples.	Present information on the implementation of the field QA/QC program and the results of the QA/QC program in the annual reports.
	EMSAMP (2020-01, S. 5.3.3) states that plots of concentrations of regulated constituents and key indicator parameters versus time will also show applicable standards and baseline concentration. Plots in the 2019 Annual Report do not contain the applicable standards and baseline concentration.	Present applicable standards and baseline concentration in the groundwater water sample constituent concentration plots for the annual report.
	EMSAMP (2020-01, S. 5.4.1) describes that trends in groundwater quality will be examined to potentially inform management actions. The existing analysis of the water quality trend in the 2019 Annual Report contains discussion of the trend but in some cases does not provide rationale for the observed trends.	• Present groundwater quality trend analysis in monthly and annual reporting to confirm that trends are being monitored appropriately. • Present groundwater quality trend assessment in the context of baseline water quality and predicted effects of the Project. • Provide greater logical link between discussion of observed groundwater quality trend and proposed adaptive management actions (e.g., no action).

Table 68 Recommendations for Improvements and Corrective Actions

Discipline	Compliance Gaps and/or Deficiencies	Recommendation/Corrective Action
Geochemistry	2018 Annual Report – QA/QC samples	Collect duplicate samples of construction monitoring samples and include discussion of results including relative percent differences in report body and append dataset.
	2018 Annual Report – Report NPR values	Report NPR values in addition to NP:AP for better interpretation of results. This was corrected in the 2019 Annual Report.
	2018 and 2019 Annual Report – Sample type description	Include details on the material sample collected (i.e., surficial, or bedrock) and why these samples were collected (i.e., 1 per 100,000 m^3 material moved or distinct geological unit).
	2018 Annual Report – Appended analytical data	Include all analytical data in appendices. Missing: acid base accounting, rinse pH, and electrical conductivity.
	2019 Annual Report – Appended analytical data	Include field barrel analytical data in appendices.
	2019 Annual Report – QA/QC samples	Collect duplicate samples of construction and operational monitoring samples, include discussion of result (including relative percent differences) in report body, and append dataset.
	2019 Annual Report – Details of blast rounds	Include details of blast rounds so compliance with EMSAMP can be evaluated. Include geological logs of blast holes.
	2019 Annual Report – Monthly seep sample survey	Include details of monthly seep sample survey in report.
	2019 Annual Report – Shake flask extraction size fraction	Check with off-site laboratory (ALS) if shake flask extraction is conducted on <2 mm and <1cm size fraction.
	2020 Monthly Reports – QA/QC samples	Collect duplicate samples of construction monitoring samples and include discussion in report body and append dataset. For operational samples, include relative percent differences and discuss results in the report body. Consider re-naming duplicate samples to not include parent sample name. Explicitly describe which samples are duplicates of respective parent sample.
Aquatic Environment		
Stream Sediment	Field methods – use of stainless-steel trowel to collect samples	Samples collected for analysis of metal concentrations should be collected with plastic utensils to avoid potential contamination
	Field methods – out of date field method guidelines	Methods should be consistent with updated BC Field Sampling Manual from 2020 and with BC's "Water and Air Baseline Monitoring Guidance Document for Mine Proponents and Operators" (BC MoE 2016)
	Field methods – site documentation	Water depth, sediment texture and color, and presence of debris, biofilms, odours, or sheens should be described at each site. Sites should be photographed showing upstream, downstream, obliques, banks, riparian vegetation, and substrates
	Lab methods – screening equipment	Laboratories should be required to screen sediment samples for particle size distribution and <63 µm fraction using non-metallic screens to avoid potential contamination
	Reporting – units	Clearly document that guidelines and concentrations are reported as dry or wet weight
	Reporting - guidelines	Sediment quality guideline for selenium is only an "alert" concentration and not a working sediment quality guideline
	Reporting - guidelines	Clearly indicate whether guidelines for specific parameters are from CCME and/or BC WQG
	Reporting – detection limits	Reports should identify results that are below detection limits (e.g., boron and silver)
	QA/QC – field methods	Clearly document the field QA/QC procedures followed
	QA/QC – field duplicates	Every third or fifth sample should be "field split" to assess sampler and laboratory QA/QC as per BC MoE 2016
	QA/QC – laboratory detection limits	Reports should describe instances where laboratory detection limits are not ≤ $1/5^{th}$ of the respective sediment quality guideline or ≤ $1/5^{th}$ of the lowest background concentration
	Reporting – lack of statistical analyses	Reports should include statistical comparison of data to pre-construction baseline data as required by EMSAMP
	Reporting – lack of discussion of need for adaptive management due to PEL exceedances for arsenic	Conduct statistical analyses comparing contemporary and pre-construction data to identify any significant differences and conduct arsenic speciation analyses on future stream sediment samples

Table 68 Recommendations for Improvements and Corrective Actions

Discipline	Compliance Gaps and/or Deficiencies	Recommendation/Corrective Action
Benthic Macroinvertebrates	Study design – insufficient sites in reference or upstream areas as per EEM guidance	Identify and begin sampling in second reference stream to bring the number of unaffected sites up to 5 as recommended in Environment Canada's EEM guidance; a minimum of three reference sites are recommended in BC's Water and Air Quality Baseline Monitoring Guidance Document. (*Stantec understands that VGC is currently preparing an Environmental Effects Monitoring plan for submission to Environment and Climate Change Canada in 2021 that will address this recommendation.)*
	Study design – number of appropriate replicate numbers is unknown	Conduct power analysis on existing data to determine the number of replicate samples required to provide sufficient data to determine statistically significant differences between sites and between years given known variability in benthic communities. Without a power analysis, the default number of replicates per site should be increased to 5. (*Stantec understands that VGC is currently preparing an Environmental Effects Monitoring plan for submission to Environment and Climate Change Canada in 2021 that will address this recommendation.)*
	Field QA/QC procedures – not *a prior* criteria for sample appropriateness as required by EEM	Develop *a priori* criteria and apply to next survey (*Stantec understands that VGC is currently preparing an Environmental Effects Monitoring plan for submission to Environment and Climate Change Canada in 2021 that will address this recommendation.)*
	Lab QA/QC procedures and results – not provided in report or appendices	Provide lab QA/QC procedures and results in appendix
	Data analysis - Missing community metrics required in EMSAMP (i.e., family density and richness, Simpson's evenness, and Bray-Curtis)	Include all community indices identified in EMSAMP
	Data analysis – missing statistical analyses comparing sites and contemporary data to pre-construction data	Conduct the required ANOVAs and multiple comparison tests as required by EMSAMP (e.g., append appropriate statistical analyses in excel format) and EEM for BACI study design. (*Stantec understands that VGC is currently preparing an Environmental Effects Monitoring plan for submission to Environment and Climate Change Canada in 2021 that will address this recommendation.)*
	Reporting – only qualitative comparisons between sites and years discussed	There is sufficient data from sites and between years to conduct quantitative statistical analysis to determine significant difference between impact and reference sites and trends between years.
	Reporting – no discussion of need for adaptive management actions; no statistical analyses performed to inform adaptive management	Discuss adaptive management considering quantitative analysis of site data and trend analysis
	Reporting – no indication that results are site averages in the tables	Clearly identify what data in tables represents
	Reporting – no reference for Pacific Salmon Federation rating of "good quality" based on EPT taxa in the 2018 annual report	Provide all references in report
	Reporting – incorrect identification of "fair" based on HBI to Site W26 in 2018 annual report	Incorporate quality and independent review into reporting structure
	Reporting – no analysis or discussion of environmental variables, fish results, or outlier effects on benthic invertebrate results as required by EMSAMP	Discuss all requirements of the EMSAMPs in the annual reports.
Fish and Fish Habitat	Field methods - Fish and fish habitat surveys conducted in September instead of July or August when fish communities are likely more stable and fish sampling is more efficient	Although not a deficiency of the annual monitoring programs, sampling should be conducted in summer when fish community is most stable and sampling efficiency is highest.
	Field methods – fish condition was not documented as required by the EMSAMPs	Conduct external examinations and fill in standardized necropsy form for each fish or sub-sample of fish of each species captured
	Field methods – single pass open sites	Although not required by the EMSAMPs and not a deficiency of the annual monitoring programs, multi-pass depletion estimates in closed sites would provide more accurate and repeatable results and be better for long-term monitoring and statistical analyses
	Field methods – insufficient numbers of fish captured for EEM program at current effort levels	The EMSAMP references that a minimum of 100 fish is recommended for non-lethal sampling according to EEM technical guidance (Environment Canada 2012). Sampling in summer and using multi-pass electrofishing methods may increase numbers of fish available for capture

Table 68 Recommendations for Improvements and Corrective Actions

Discipline	Compliance Gaps and/or Deficiencies	Recommendation/Corrective Action
Fish and Fish Habitat (cont'd)	Reporting – no mention of need for fish tissue study	Even if no mine effluent discharge occurred, reports should indicate whether a fish tissue study is required or not as part of MDMER monitoring; the EMSAMP indicates that a fish tissue study is required if the concentration of effluent in the exposure area was >1% in the area within 250 m of the final discharge point but the 2019 annual report did not indicate if this criterion was met. (*Stantec understands that VGC is currently preparing an Environmental Effects Monitoring plan for submission to Environment and Climate Change Canada in 2021 that will address this recommendation.)*
	Reporting – no recommendation for indicator fish species for future EEM program	Although not required by the EMSAMPs, the authors should provide a recommendation for a suitable indicator fish species for monitoring potential effects of future mine effluent discharges. Given the fish community present at the site, slimy sculpin would appear to be at least one of the indicator species chosen for future EEM programs. (*Stantec understands that VGC is currently preparing an Environmental Effects Monitoring plan for submission to Environment and Climate Change Canada in 2021 that will address this recommendation.)*
	Reporting – no mention of adaptive management trigger or threshold exceedances	Reports should specify whether any of the adaptive management thresholds in the EMSAMPs were exceeded and if any of the adaptive management measures were required and implemented each year
Terrestrial Environment		
Vegetation and Soils	N/A	Develop statistically-based trigger for determining 'significant' increases in metals (arsenic, cadmium, chromium, mercury and lead) concentrations in vegetation plot samples.
	Missing duplicate vegetation sample analysis in 2018 and 2019	Collect duplicate samples if sufficient vegetation is available
Wildlife Protection	Specific information on wildlife incidents is not provided in the Wildlife Records Program	Provide a summary of all wildlife incidents resulting in human-wildlife conflict, wildlife fatality or removal, or nest disturbance in the annual reports along with a summary of the root cause(s). Any corrective actions should be documented.
	There is no formal documentation of the wildlife protection monitoring in the Heap Leach Facility Area and Events Pond Monitoring Program	Include the results of the monitoring program in the annual report or in a separate report.
Geotechnical Stability of Infrastructure and Facilities		
Permafrost	Regular visual Inspections not reported.	Include an appendix in Annual and Monthly reporting that summarizes the observations from regular visual inspections to identify and quantify any deformation associated with melting of permafrost, such as but not limited to, cracks, subsidence, sinkholes, and sloughing on existing foundations and slope overlay permafrost. Summarize those visual inspections executed during the freshet, prolonged rainy periods, and rising trend in any thermistors.
	Prolonged rainy period not quantified.	Define / quantify duration of a prolonged rainy period based on exceedance of design criteria (duration, precipitation volume).
	Freeze/Thaw indices not reported under EMSAMP -2018-01.	Corrective action no longer required because Weather Data Review requirement removed from EMSAMP monitoring program starting June 2019 (EMSAMP 2019-01 and 2020-01).
	Thermistor GT18-09 not read in Q3 of 2019	Provide reasoning for missed reading.
Open Pit	Daily visual inspections not reported.	Include an appendix in Annual and Monthly reporting that summarizes the observations from these daily visual inspections.
	Monthly collection of survey prism data not reported.	Stantec understands there are currently no active prisms installed at the open pit, and VGC is implementing a program scheduled for 2020 to install up to 15 prisms on the1408, 1375, and 1395 benches. Following prism installation, include in Annual and Monthly reports a list of active survey prisms with coordinates (northing, easting, elevation) and deformation readings.
	Piezometers read quarterly instead of monthly in 2018 as required in EMSAMP 2018-01.	Corrective action not required since the piezometer reading frequency is specified as quarterly in subsequent EMSAMP 2019-01, superseding the 2018 requirement and bringing the piezometer reading schedule into compliance.
	Scheduled piezometer readings for Q1 2020 not collected due to COVID-19 related staffing issues.	Assess if datalogger installed in Open Pit piezometer BH-BGC11-73a,b,c collected and stored data for Q1 2020. For remaining piezometer(s), collect data as soon as reasonably practical and provide reading summary or reasoning for data gap in Annual reporting.

Table 68 Recommendations for Improvements and Corrective Actions

Discipline	Compliance Gaps and/or Deficiencies	Recommendation/Corrective Action
Open Pit (cont'd)	Piezometer data not collected in Q2 2020.	Assess if datalogger installed in Open Pit piezometer BH-BGC11-73a,b,c collected and stored data for Q2 2020. For remaining piezometer(s), collect data as soon as reasonably practical and provide reading summary or reasoning for data gap in Annual reporting.
	Piezometers listed in EMSAMP documentation without reported water tables.	Provide reasoning for piezometers with absence of documented water table readings.
	Data for two (2) extensometers installed at open pit not reported.	The EMSAMP documents do not lay out a minimum required monitoring frequency for extensometers installed at the open pit. A qualified personnel should determine a reading frequency for these instruments and should be summarized in the annual reports and compared against established velocity trigger levels.
	Multiple instrumentation listed in EMSAMP documentation that is not currently installed on site (robotic theodolites, TDR cables, slope inclinometers, fixed slope radar, mobile slope radar).	Remove from EMSAMP documentation reference to instrumentation not installed (or planned for installation) on Open Pit.
	Equipment maintenance logs were not provided to back-up data reported in monthly/annual reports.	Provide equipment maintenance logs as supporting documentation to monthly/annual reports.
Materials Storage and Stockpile Management	Visual inspections (daily, weekly, monthly) not reported.	Include an appendix in Annual and Monthly reporting that summarizes the observations from these visual inspections.
	Not all WRSA and stockpile piezometers as listed in EMSAMP 2020-01 have water levels reported in June 2020 monthly report.	Confirm list of active piezometers installed in WRSA and stockpiles, include data in monthly and annual reports. Provide reasoning behind non-documented groundwater tables.
	Multiple instrumentation listed in EMSAMP documentation that is not currently installed on site (Survey Prisms, Inclinometers, Radar / photogrammic surveying).	Remove from EMSAMP documentation reference to instrumentation not installed (or planned for installation) on WRSA and stockpile structures.
	Existing monitoring methods (wireline extensometer) implemented on site do not state a monitoring frequency.	VGC should consider discrete reading frequencies for wireline extensometers, specify in EMSAMP documentation.
	Follow up and close out of physical stability recommendation 4 and 5 not documented in annual or monthly reports.	Provide documentation detailing the follow up and response actions for addressing recommendations.
Heap Leach Facility	Routine (visual) inspections (daily, weekly) not reported.	Include an appendix in Annual and Monthly reporting that summarizes the observations from these visual inspections.
	Embankment Piezometers P1, P2, P3 appear to be collecting data continuously but data not reported monthly.	Provide continuous data plots of embankment piezometers P1, P2, P3 in monthly reports. Include these instruments in next EMSAMP revision.
	Partial reporting of piezometer readings as listed in EMSAMP 2019-01 in 2019 annual report.	Confirm HLF piezometers as listed in EMSAMP 2019-01 are reporting groundwater readings, include in monthly and annual reporting. Provide reasoning for missing groundwater level readings.
	Partial reporting of piezometer readings as listed in EMSAMP 2020-01 in June 2020 monthly report.	Confirm HLF piezometers as listed in EMSAMP 2020-01 are reporting groundwater readings, include in monthly and annual reporting. Provide reasoning for missing groundwater level readings.
	Existing monitoring methods (slope inclinometer casing) implemented on site do not state a monitoring frequency.	VGC to consider discrete reading frequencies for slope inclinometer casing, specify in EMSAMP documentation.
	Follow up and close out of physical stability recommendation 3 not documented in annual or monthly reports.	Provide documentation detailing the follow up and response actions for addressing recommendation.
Solid Waste and Hazardous Materials Management	No recommendation	
Spill Response	No recommendation	

9.0 CLOSURE AND LIMITATIONS

The audit was executed by the Stantec Consulting Limited by qualified professionals in their identified area of competency shown in Table 69.

Table 69 List of Auditors and their Credentials for the Eagle Gold Mine 2020 Environmental Audit Report

Auditors & Reviewers	Credentials	Discipline
Christiane Buie	M.A., Dipl.Tech., EPt	Auditor: Air quality, Climate, Spill response, Solid Waste and Hazardous Materials Management
Jeff Muirhead	M.A.Sc., P.Eng. (Yukon), CISEC	Auditor: Hydrology and Water Management
Xéna McArthur	B.Sc., P.Geo (BC)	Auditor: Surface Water Quality and Geochemistry
Ryan Shao	MSc., P.Geo (BC)	Auditor: Hydrogeology
Brad Horne	M Sc., R.P. Bio. (BC)	Auditor: Aquatic Resources
Andrew Burgin	P.Eng. (BC)	Auditor: Geotechnical Engineering
Christina Ball	B.Sc., R.P.Bio (BC)	Auditor: Wildlife Protection
Ali Naghibi	Ph.D., P.Eng. (BC)	Hydrology Quality Reviewer
Brenda Bailey	Ph.D, P.Geo. (BC)	Surface Water Quality and Geochemistry Quality Reviewer
Alvin Tong	P.Eng. (BC)	Geotechnical Engineering Quality Reviewer
Colleen Bryden	M.Sc., R.P.Bio.(BC)	Wildlife Quality Reviewer
Dan Jarratt	Ph.D, P.Eng. (BC)	Meteorological and Atmospheric Quality Reviewer
Sandra Nelson	M.Sc., R.P. Bio. (BC)	Aquatic Resources Quality Reviewer
Natalie Tashe	M.Sc., P.Ag.,(BC) MCPM	Independent Reviewer

Stantec's Quality and Independent Reviewers have employed Stantec's strict Quality Assurance (QA) and Quality Control (QC) program throughout the audit execution process. The QA/QC program is designed to reduce the potential for errors while providing a systematic review of all facets of the audit. Our Quality and Independent Reviewers have provided critical quality review to verify that key issues were addressed, and that VGC's and Stantec's internal quality control standards were met.

This document entitled Eagle Gold Mine 2020 Environmental Audit Report was prepared by Stantec Consulting Ltd. ("Stantec") for the account of Victoria Gold Corp. (the "Client"). The material in it reflects Stantec's professional judgment in light of the scope, schedule and other limitations stated in the document and in the contract between Stantec and the Client. The audit objective is to report on the findings of the documents reviewed with respect to protection of the receiving environment.

Closure and LImitations
November 30, 2020

The audit recommendations in the document are based on conditions and information existing at the time the document was published and do not take into account any subsequent changes that may happened at the mine. The audit is a desktop assessment and does not include site verification. In preparing the document, Stantec did not verify information supplied to it by others. Any use which a third party makes of this document is the responsibility of such third party. Such third party agrees that Stantec shall not be responsible for costs or damages of any kind, if any, suffered by it or any other third party as a result of decisions made or actions taken based on this document.

10.0 REFERENCES

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Table 1: Third Party Audit Findings and Victoria Gold Response

Discipline	Compliance Gaps and/or Deficiencies	Recommendation/Corrective Action	VGC Response
		ATMOSPHERIC ENVIRONMENT	
Climate	Incomplete climate data recorded between 2018–2020 during the construction phase and portions of the operations phase of mining	• Keep spare climate station sensors on-site for rapid deployment should sensors/equipment begin to fail or data gaps are noted. • Append annual QP climate stations' calibration report/records to annual report.	VGC has received the recommended equipment maintenance and part replacement summary from the supplier of the two site climate stations. Based on the summary, a critical parts procurement and maintenance program will be instituted by the VGC Environmental Department that is further informed by their site experience with the equipment. Relevant calibration and maintenance logs for climate stations will be provided in future annual report.
Air Quality	Inconsistency in data reporting	Submit validated datasets with all annual and quarterly reports, and compare monitoring results to AQC	The scope of the audit did not initially include review of the quarterly reports required under the Air Emissions Permit issued for the Eagle Gold Mine. The quarterly reports prepared up to the effective date of the audit were subsequently provided to the auditor and, as noted in Table 6 of audit, were found to be adequate. VGC will continue to prepare and submit air quality information as required by Air Emissions Permit #60-060. Inconsistency in data reporting identified in the audit were based on annual reports prepared by VGC prior to the receipt of Permit #60-060. Future annual reporting under the QML with respect to air quality will be informed by the detailed quarterly reports which VGC believes will address the findings of the audit.
		WATER RESOURCES	
Surface Water Hydrology	EMSAMPs reference RISC (2009) as the document which was used to develop hydrology data collection. This document is out of date; Version 2.0 of that document was published in 2018.	The EMSAMP surface water hydrology program should be updated to reflect Version 2 of the hydrometric standards (RISC 2018).	In the event that an update to the EMSAMP is warranted in the future, the most current RISC standards will be referenced as recommended.
	Insufficient documentation of revised sampling approaches for various stations based on data collection challenges or change in phase (e.g., monitoring frequency, monitoring type).	Explicitly document and provide rationale for changes to station monitoring approach or regime where applicable, and indicate plans for revising applicable EMSAMP sections.	As noted in Tables 10 to 12 in the audit, VGC's compliance with the frequency and reporting of field programs improved over time and, based on EMSAMP v2020-01, were found to be compliant. VGC has reviewed summary information relating to QA/QC and site task programs contained within monthly reporting for the Wolverine Mine (as these reports are completed by a third-party consultant on behalf of Yukon Government) and will work towards emulating this information in future reporting as necessary. In the event that an update to the EMSAMP is warranted in the future, changes to station monitoring approach or regime will be updated as necessary
	Prior to the 2020 monthly reports, there was insufficient documentation of periods where "discharging" or "dewatering" was occurring; this informs the requirement for monitoring at several stations.	Based on review of monthly reports from 2020, it appears that VGC has improved this. The 2020 annual report, and future monthly and annual reports, should continue to document periods of discharging or dewatering at applicable locations throughout site to inform the need for monitoring at applicable sites.	As noted by the auditor, the deficiency in monthly reporting prior to 2020 has been corrected. Ongoing annual and monthly reports will continue to document periods of discharge as recommended.
	For automated stations, winter and freshet time periods were not clearly delineated as to allow for demonstration of compliance as outlined in the EMSAMPs.	Recommend one of <u>two</u> changes: 1) Document dates of freshet start and logger deployment each year in the monthly and annual reports to delineate winter, freshet, and open water periods (each of which have different monitoring requirements), <u>or</u>	Data logger deployment and winterization are performed when the task is deemed safe for access and when monitoring will have minimal impact from ice conditions. VGC will clearly report the date of the deployment of hydrology loggers in future monthly and annual reports.

Discipline	Compliance Gaps and/or Deficiencies	Recommendation/Corrective Action	VGC Response
		2) Update the EMSAMP requirements for the freshet period to better acknowledge i) the subjectivity of determining freshet period and/or ii) the difficulty of obtaining flow measurements during freshet flows.	Winter and freshet time periods are subjective definitions which has been generally acknowledged by the regulatory bodies involved with the Project to date thus, VGC does not believe an update to the EMSAMP is warranted.
	Prior to the 2020 Monthly Reports, not all of the monitoring stations outlined in the EMSAMPs are discussed/addressed in the annual reports.	Discuss/address all monitoring stations listed in the applicable EMSAMP, noting the status (e.g., active, not active) of each. Include data for all active monitoring stations (automated, manual) in reporting.	As noted by the auditor, the deficiency in monthly reporting prior to 2020 has been corrected. The status of each monitoring station will continue to be provided in monthly reporting and will be provided in annual reports.
	Quarterly manual monitoring stations are not completed at consistent times of the year.	Clarify “quarterly monitoring” schedule, with backup sampling protocols if conditions are unsafe.	Quarterly flow measurement will comply with EMSAMP and Water Use Licence (WUL) timing requirements as safe sampling conditions allow. Should quarterly measurement not occur during the licenced time period, the backup protocol is to sample during the next safest condition.
	The EMSAMPs list general tasks to be completed at each field visit (Section 2.3.1). Completion of these tasks was discussed in general in annual reports but documentation was not provided per requirements of RISC (2018).	Provide summary information regarding the completion of the tasks associated with each field visit in the annual reports, and/or indicate (in reporting) that these data have been documented internally and are available upon request.	Confirmation that tasks associated with each field visit will be provided in future annual reports and that documentation is available upon request. For clarity, documentation is prepared as required by RISC (2018); however, the data was not provided in VGC reporting but has been and will continue to be checked to ensure compliance with the requirements of RISC (2018).
	Logger malfunctions resulted in the loss of partial or full open water season datasets at several stations.	As outlined in the general tasks in the EMSAMPs (Section 2.3.1), download logger data either at every monitoring visit, or at an appropriate regular frequency, to minimize data loss and rectify issues.	Logger data will be downloaded at regular intervals to minimize potential for data loss. VGC plans to install direct read cables in 2021 to allow for more efficient and accurate data transfer and in field determination of the adequacy of data collection.
	Sites experienced flows which were too high to safely obtain a flow measurement. The flows experienced in June are part of the seasonal range in flows and should be captured as part of the rating curve development or verification.	If possible, considering a reasonable level of effort and resources, safe flow measurement methods and procedures should be developed and implemented to capture high flows which are essential to development of reliable rating curves. If no method is safe considering reasonable levels of effort and resources, it should be stated in the reporting as such (e.g., as was completed in 2020 Monthly Reports) with a rationale, and the rating curves identified as valid below an identified threshold.	While VGC endeavors to retrieve all data samples staff safety is the first consideration. Where a flow measurement is omitted due to unsafe conditions this will continue to be stated in reporting.
	QA/QC related to field and analytical tasks (e.g., benchmark surveys, station condition, field processes, photos, equipment calibration) were not documented.	Recommend that QA/QC processes in accordance with Section 2.3.1 in EMSAMP2018-01, EC 2001, RISC 2018 are documented and provided in reporting.	The review of this information was not within the scope of the audit, nevertheless, summary information and confirmation that data related to field and analytical tasks have been documented internally. Confirmation that QA/QC related to field and analytical tasks will be provided in annual reports. Documentation is available upon request.
	Flow records are in partial compliance due to lack of winter and freshet measurements and/or logger malfunctions.	Implement monitoring program as outlined in applicable EMSAMP, or provide rationale for implementation not being possible in reporting and amend EMSAMP.	VGC endeavors to complete flow measurements as outlined in the EMSAMP; however, winter hydrological monitoring at certain stations is not always possible due to ice and frozen conditions on creeks and streams. Where a flow measurement is omitted due to winter access conditions or safety concerns, this will continue to be stated in reporting.
	For automated stations, it is not clear what the manual monitoring frequency is during the freshet in EMSAMP2020-01.	Clarify this in future EMSAMPs/reporting.	The frequency for manual measurements listed in EMSMAP 2020-01 is taken verbatim from the WUL. VGC undertakes monthly manual flow measurements when the automated stations are not installed and again when the station is installed.
	It is not clear in the EMSAMPs if the adaptive management performance thresholds are applicable to manual monitoring stations.	Clarify this in future EMSAMPs/reporting.	In general, AMT’s do not apply to those considered only manual monitoring stations. As the execution of the program is VGC’s responsibility, our Environmental Department understands that the thresholds are intended to apply year-round to W4 and W99 (for additional comparison to W29 baseline and W99 established dataset), which are continuous gaged stations during

Discipline	Compliance Gaps and/or Deficiencies	Recommendation/Corrective Action	VGC Response
			ice-free season and manually monitored otherwise. No additional clarification to the EMSAMP is required.
	Average monthly flows were used instead of median monthly flows (as specified in Table 2.4-1 in EMSAMP2019-01 and EMSAMP2020-01) in evaluation of performance thresholds.	Use median monthly flows in evaluation of performance thresholds as outlined in EMSAMP.	Median monthly flows will be used when comparing hydrology performance thresholds as outlined in the EMSAMP (this is available in 2020 August and September monthly reports).
	The method of evaluation of performance thresholds for adaptive management was not completed in accordance with quantitative procedure outlined in EMSAMPs.	Apply the quantitative evaluation protocol outlined in the EMSAMPs for performance thresholds for adaptive management at relevant monitoring locations.	Quantitative evaluations when adaptive management triggers have been reached were initiated subsequent to the effective date of the audit. This information is available for review by interested parties in the August and September monthly reports. Additionally, VGC has recently purchased a more robust software package to support our adaptive management evaluations.
	The evaluation of performance thresholds for adaptive management was not completed for all automated stations listed in the EMSAMPs.	Perform evaluation of performance thresholds for adaptive management for all relevant automated stations as outlined in the EMSAMP.	Quantitative evaluations when adaptive management triggers have been reached were initiated subsequent to the effective date of the audit. This information is available for review by interested parties in the August and September monthly reports. Additionally, VGC has recently purchased a more robust software package to support our adaptive management evaluations.
	Adaptive management responses were not clearly performed following exceedance of performance thresholds.	Implement and document the adaptive management responses if performance thresholds exceeded at relevant monitoring locations as outlined in EMSAMPs.	Adaptive management responses will be implemented as necessary and documented if performance thresholds are exceeded at relevant monitoring locations as outlined in the EMSAMP. This evaluation first considers whether the exceedances are attributable to Project influence (i.e., very high or low flows attributed to seasonally wet or dry periods).
	Full documentation of completion timelines and dates for key water management infrastructure not documented.	Include specific completion dates in annual reporting for all key water management components.	All key water management component completion dates will be documented in annual reporting. Completion timelines and dates were provided to the relevant regulatory agencies in as built reports submitted 60 days after infrastructure completion; however, review of this documentation was not within the scope of the audit.
Surface Water Quality	2018 Annual Report – Rationale for missing sample events	Include a footnote for each table describing missing data rationale (e.g., frozen water)	The observation provided by the auditor was not found again in response to their review of the 2019 annual report thus VGC considers this deficiency to have been resolved. VGC will continue to provide a rationale for missing sampling events, where applicable, in future annual reporting.
	2018 Annual Report – QA/QC results not described	Include text in the report body describing the results of the QA/QC program (e.g., number of QA/QC samples, summary of results, DQOs, and corrective actions for failed DQOs). Also include these data in the database (Appendix D) or tabulated form.	QA/QC program results including duplicates and total amount of QA/QC sampling will be included in future annual reports.
	2019 Annual Report – Water Quality Results	Include a tabulated form of all water quality data including QA/QC samples	Water quality data and QA/QC program results are provided in monthly water use licence reports. VGC does not consider the duplication of this information in annual reporting necessary.
	2019 Annual Report – QA/QC results not completely described	Include results of duplicate sample results as well as total amount of QA/QC samples collected and summarize data in a tabulated form.	QA/QC program results including duplicates and total amount of QA/QC sampling will be included in future annual reports.
	2019 Annual Report – Quality of plots	Improve quality of plots so axes can be read (Appendix F)	Diagrams in annual reporting will be reviewed for legibility.
	2019 Annual Report – Statistical and trend analysis	For WQO exceedances, the EMSAMP commits VGC to compare values to baseline to determine if any significant changes have occurred to the receiving environment water quality, complete a trend analysis, and include methods and results in the report. We recommend an adjustment to this commitment with the goal of an achievable exercise for this project (e.g.,	Quantitative evaluations when water quality objective adaptive management triggers have been reached were initiated subsequent to the effective date of the audit. This information is available for review by interested parties in the August and September monthly reports. Additionally, VGC has recently purchased a more robust software package to support our adaptive

Discipline	Compliance Gaps and/or Deficiencies	Recommendation/Corrective Action	VGC Response
		monitor over x number of sampling events to determine if it is a real change in water quality)	management evaluations. We will consider the recommendation to revise the way in which the data is analyzed.
	2019 Annual Report – Cyanide species	Include cyanate and thiocyanate in the analytical suite for compliance with EMSAMP 2019-01	ESAMP 2019-01 is no longer the active version of the Plan. Audit review of compliance with EMSAMP 2020-01 (which mimics WUL requirements) indicates that this matter has been resolved.
	2019 Annual Report – AMT Responses	The EMSAMPs requests VGC to describe in detail the AMT response for any AMT exceedances. As per the Water Management Plan, sampling frequency will increase accordingly (next higher order) to better characterize trends.	Section 3.2.5 of the audit references adaptive management reporting with respect to a discharge event in April 2019. A full, detailed report for this discharge including sampling approach and frequency was provided as an appendix to the 2019 annual report. The full review of this appendix was not within the scope of the audit and VGC believes sufficiently detailed information was provided and that the adaptive management approach was sufficient.
	2020 Monthly Reports – QA/QC	Report on QA/QC samples collected monthly and include results in the report body including laboratory QA/QC results. Frequency of QA/QC samples are to meet >10% ratio of QA/QC samples to total water quality samples. *(Stantec understands that currently, Field blanks are being collected and are documented in the 2020 monthly report water quality appendices.)*	QA/QC water quality samples are collected currently at a rate of >10% ratio to total water quality samples. VGC has reviewed summary information relating to QA/QC and site task programs contained within monthly reporting for the Wolverine Mine as a recent Yukon example (as these reports are completed by a third-party consultant on behalf of Yukon Government). Based on this review we will use this as a good example as one to follow in future reporting as necessary.
	2020 Monthly Reports – AMT Responses	For WQO and AMT exceedances, the EMSAMP commits VGC to compare values to baseline to determine if any significant changes have occurred to the receiving environment water quality, complete a trend analysis and include methods and results in the report. We recommend an adjustment to this commitment with the goal of an achievable exercise for this project (e.g., monitor over x number of sampling events to determine if it is a real change in water quality). We also recommend to include a detailed AMT response. As per the Water Management Plan, sampling frequency should increase accordingly (next higher order) to better characterize trends.	Quantitative evaluations when water quality objective adaptive management triggers have been reached were initiated subsequent to the effective date of the audit. This information is available for review by interested parties in the August and September monthly reports. For future reporting, we will consider the recommendation to revise the way in which the data is analyzed. Additionally, VGC has recently purchased a more robust software package to support our adaptive management evaluations.
Groundwater Quantity and Quality	Groundwater quantity and quality monitoring from some wells was performed less frequently than the schedule prescribed in the relevant EMSAMPs.	• A number of factors, including those beyond the control of VGC may result in a scheduled monitoring not being performed (e.g. weather, equipment malfunction, unsafe condition, construction, pandemic). The monthly and annual reporting needs to provide the rationale for missed monitoring in tabular format and if any corrective action will be taken. • The annual and monthly reporting should include the installation and decommission date, and operational status of monitoring wells. • A maintenance log should be maintained for any maintenance or repairs made to logs and reported in the annual report.	The rationale for missed monitoring events will be expanded upon in relevant monthly reports and in the annual report. VGC can include well installation, decommissioning and operational status in future annual reports. Maintenance records are currently maintained for groundwater wells and will be referenced in future annual reports as necessary.
	EMSAMP (2020-01, S. 4.5) states that groundwater levels will be compared to predicted (modeled) effects due to the loss of recharge in the HLF and WRSA. However, trends were not quantitatively compared with predicted (modelled) effect in the 2019 Annual Report or 2020 Monthly Reports. It is unclear if trends are consistent with the predicted thresholds or if the model requires calibration based on field observation.	• Compare measured groundwater levels to predicated effects in assessment. • Calibrate modeled adaptive management thresholds for groundwater quantity based on field observation.	VGC intends to complete quantitative comparison between observed and modeled groundwater levels in future annual reports. Given the level of effort to undertake such comparisons, and that the groundwater level data is collected quarterly, meaningful comparisons cannot really be made until full hydrologic cycle has occurred, thus quarterly comparisons are not believed to be necessary.
	EMSAMP (2020-01, S. 4.4) states that groundwater hydrographs will be compared with existing baseline data to assess potential change associated	Present further assessment of the change in groundwater quantity associated with the Project. The assessment would be strengthened if a list	VGC intends to complete quantitative comparison between observed and modeled groundwater levels in future annual reports.

Discipline	Compliance Gaps and/or Deficiencies	Recommendation/Corrective Action	VGC Response
	with the Project. The 2019 Annual Report in S. 3.4.3.1 presents a qualitative discussion of the observed changes in groundwater quantity associated with the construction and operation of mine. This discussion is not presented in the context of modelled effect or groundwater quantity indicators.	of groundwater quantity indicators and associated triggers were developed and utilized in the operation stage.	VGC acknowledges that adaptive management thresholds still need further development and will endeavor to complete this work for use in 2021.
	EMSAMP (2020-01, S. 5.2) presents groundwater quality parameters to be analyzed in the monitoring program. Review of groundwater quality records in the 2019 Annual Report suggests some samples were not analyzed for the full suite of parameters.	• Review water licence conditions and lab records to confirm if required parameters were analyzed. • Include all analyzed parameters and lab reports in annual reporting.	At the time of the preparation of this response, VGC had not clarified with the auditor which parameter(s) had been omitted in the suite of parameters analyzed at reported on for 2019. VGC will ensure that all future groundwater quality samples are analyzed for the parameters required by the WUL conditions and the EMSAMP and that laboratory data is reported in future annual reports.
	• EMSAMP (2020-01, S. 5.3.2 and 5.3.3) describes the field QA/QC program for groundwater quality monitoring, which includes collection and analysis of trip blanks, field blanks and duplicates. • The 2019 Annual Report does not present information on the implementation of the QA/QC program. Appendix K of the 2019 Annual Report (Groundwater Quality Data) does not contain records of the QA/QC samples.	Present information on the implementation of the field QA/QC program and the results of the QA/QC program in the annual reports.	Groundwater quality QA/QC data results will be included in annual reporting.
	EMSAMP (2020-01, S. 5.3.3) states that plots of concentrations of regulated constituents and key indicator parameters versus time will also show applicable standards and baseline concentration. Plots in the 2019 Annual Report do not contain the applicable standards and baseline concentration.	Present applicable standards and baseline concentration in the groundwater water sample constituent concentration plots for the annual report.	Applicable standards and baseline concentrations will be included in the groundwater constituent concentration plots in future annual reports.
	EMSAMP (2020-01, S. 5.4.1) describes that trends in groundwater quality will be examined to potentially inform management actions. The existing analysis of the water quality trend in the 2019 Annual Report contains discussion of the trend but in some cases does not provide rationale for the observed trends.	• Present groundwater quality trend analysis in monthly and annual reporting to confirm that trends are being monitored appropriately. • Present groundwater quality trend assessment in the context of baseline water quality and predicted effects of the Project. • Provide greater logical link between discussion of observed groundwater quality trend and proposed adaptive management actions (e.g. no action).	VGC intends to complete quantitative comparison between observed and baseline groundwater quality trends in future annual reports. VGC acknowledges that adaptive management thresholds still need further development and will endeavor to complete this work for use in 2021.
Geochemistry	2018 Annual Report – QA/QC samples	Collect duplicate samples of construction monitoring samples and include discussion of results including relative percent differences in report body and append dataset.	Total QA/QC samples endeavor to be equal or greater to 10%, relative to project samples. Certain programs may have more or less than this general overall target. QA/QC duplicate samples for construction material geochemical analysis will be conducted and reported in the annual report.
	2018 Annual Report – Report NPR values	Report NPR values in addition to NP:AP for better interpretation of results. This was corrected in the 2019 Annual Report.	No further action necessary.
	2018 and 2019 Annual Report – Sample type description	Include details on the material sample collected (i.e., surficial, or bedrock) and why these samples were collected (i.e., 1 per 100,000m^3 material moved or distinct geological unit).	Material sample information will be included in future annual reports.
	2018 Annual Report – Appended analytical data	Include all analytical data in appendices. Missing: acid base accounting, rinse pH, and electrical conductivity.	Analytical data, including ABA, rinse pH and EC, are currently provided in monthly reporting. This data is also provided to a third-party consultant responsible for the development and assessment of source term chemistry for the site water quality model. Submission of this information is thus considered by VGC to be sufficient.
	2019 Annual Report – Appended analytical data	Include field barrel analytical data in appendices.	Analytical data, including the field barrel data, are currently provided in monthly reporting. This data is also provided to a third-party consultant responsible for the development and assessment of source term chemistry

Discipline	Compliance Gaps and/or Deficiencies	Recommendation/Corrective Action	VGC Response
			for the site water quality model. Submission of this information is thus considered by VGC to be sufficient.
	2019 Annual Report – QA/QC samples	Collect duplicate samples of construction and operational monitoring samples, include discussion of result (including relative percent differences) in report body, and append dataset.	Total QA/QC samples endeavor to be equal or greater to 10%, relative to project samples. Certain programs may have more or less than this general overall target. QA/QC duplicate samples for construction material geochemical analysis will be conducted and reported in the annual report.
	2019 Annual Report – Details of blast rounds	Include details of blast rounds so compliance with EMSAMP can be evaluated. Include geological logs of blast holes.	Geological logging of blast hole composites will be undertaken, and provided in annual reports, as considered in the EMSAMP. This will not be completed for each blast hole, but on a representative basis
	2019 Annual Report – Monthly seep sample survey	Include details of monthly seep sample survey in report.	Monthly surveys of the WRSAs are undertaken during normal stacking operations for the facilities and as a component of the physical stability inspection program. To date, there has been no report of the development of seeps which is to be expected given the configuration of the active dump (the Platinum Gulch WRSA) being only in the upland section of the drainage where groundwater levels are not near surface.
	2019 Annual Report – Shake flask extraction size fraction	Check with off-site laboratory (ALS) if shake flask extraction is conducted on <2mm and <1cm size fraction.	Analytical methods will be confirmed with external laboratory to confirm that the methods are as proposed in the EMSAMP.
	2020 Monthly Reports – QA/QC samples	Collect duplicate samples of construction monitoring samples and include discussion in report body and append dataset. For operational samples, include relative percent differences and discuss results in the report body. Consider re-naming duplicate samples to not include parent sample name. Explicitly describe which samples are duplicates of respective parent sample.	Total QA/QC samples endeavor to be equal or greater to 10%, relative to project samples. Certain programs may have more or less than this general overall target. RPDs and QA/QC results will be discussed in future annual reporting. The naming convention that VGC has adopted for QA/QC samples has met our needs and will continue.
AQUATIC ENVIRONMENT			
Stream Sediment	Field methods – use of stainless-steel trowel to collect samples	Samples collected for analysis of metal concentrations should be collected with plastic utensils to avoid potential contamination	To date, the execution of the stream sediment field program has been undertaken by an independent qualified third party. VGC will discuss the methods proposed in the EMSMAP and actually used for the field programs to ensure that an appropriate utensil is used. In the event that an update to the EMSAMP is warranted in the future, the sampling method will be updated as necessary.
	Field methods – out of date field method guidelines	Methods should be consistent with updated BC Field Sampling Manual from 2020 and with BC's "Water and Air Baseline Monitoring Guidance Document for Mine Proponents and Operators" (BC MoE 2016)	To date, the execution of the stream sediment field program has been undertaken by an independent qualified third party. VGC will discuss the methods proposed in the EMSMAP and actually used for the field programs to ensure that appropriate methods are used. In the event that an update to the EMSAMP is warranted in the future, the sampling methods will be updated as necessary.
	Field methods – site documentation	Water depth, sediment texture and color, and presence of debris, biofilms, odours, or sheens should be described at each site. Sites should be photographed showing upstream, downstream, obliques, banks, riparian vegetation, and substrates	
	Lab methods – screening equipment	Laboratories should be required to screen sediment samples for particle size distribution and <63 µm fraction using non-metallic screens to avoid potential contamination	The lab certificates for stream sediment samples acknowledge that the correct screen size has been utilized but does not state the material that the screen is made from. VGC will raise this matter with the third party engaged to complete the stream sediment monitoring to ensure that industry standard practices are followed.
	Reporting – units	Clearly document that guidelines and concentrations are reported as dry or wet weight	Future reporting will document whether the guidelines and concentrations reported are dry or wet weight.

Discipline	Compliance Gaps and/or Deficiencies	Recommendation/Corrective Action	VGC Response
	Reporting - guidelines	Sediment quality guideline for selenium is only an “alert” concentration and not a working sediment quality guideline	Noted.
	Reporting - guidelines	Clearly indicate whether guidelines for specific parameters are from CCME and/or BC WQG	Future reporting will clearly indicate specific guideline sources.
	Reporting – detection limits	Reports should identify results that are below detection limits (e.g., boron and silver)	Future reporting will identify whether results are below detection limits.
	QA/QC – field methods	Clearly document the field QA/QC procedures followed	QA/QC field procedures will be included in final reports as appropriate or indicate that this information can be provided upon request.
	QA/QC – field duplicates	Every third or fifth sample should be “field split” to assess sampler and laboratory QA/QC as per BC MoE 2016	To date, the execution of the stream sediment field program has been undertaken by an independent qualified third party. VGC will discuss the QA/QC proposed in the EMSMAP and actually used for the field programs to ensure that appropriate QA/QC approach is used.
	QA/QC – laboratory detection limits	Reports should describe instances where laboratory detection limits are not ≤ 1/5th of the respective sediment quality guideline or ≤ 1/5th of the lowest background concentration	
	Reporting – lack of statistical analyses	Reports should include statistical comparison of data to pre-construction baseline data as required by EMSAMP	VGC will evaluate how best to conduct statistical comparisons with pre-construction baseline data as a component of future stream sediment sampling programs.
	Reporting – lack of discussion of need for adaptive management due to PEL exceedances for arsenic	Conduct statistical analyses comparing contemporary and pre-construction data to identify any significant differences and conduct arsenic speciation analyses on future stream sediment samples	
Benthic Macroinvertebrates	Study design – insufficient sites in reference or upstream areas as per EEM guidance	Identify and begin sampling in second reference stream to bring the number of unaffected sites up to 5 as recommended in Environment Canada’s EEM guidance; a minimum of three reference sites are recommended in BC’s Water and Air Quality Baseline Monitoring Guidance Document. (*Stantec understands that VGC is currently preparing an Environmental Effects Monitoring plan for submission to Environment and Climate Change Canada in 2021 that will address this recommendation.)*	VGC became subject to ECCC’s EEM Sampling program requirements in April 2019 (with the first site discharge) requiring an EEM Study to be submitted in April 2020, with study implementation planned for 2021. VGC is currently finalizing an EEM Study Design in compliance with ECCC’s technical guidance that will address this recommendation.
	Study design – number of appropriate replicate numbers is unknown	Conduct power analysis on existing data to determine the number of replicate samples required to provide sufficient data to determine statistically significant differences between sites and between years given known variability in benthic communities. Without a power analysis, the default number of replicates per site should be increased to 5. (*Stantec understands that VGC is currently preparing an Environmental Effects Monitoring plan for submission to Environment and Climate Change Canada in 2021 that will address this recommendation.)*	
	Field QA/QC procedures – no *a prior* criteria for sample appropriateness as required by EEM	Develop *a priori* criteria and apply to next survey (*Stantec understands that VGC is currently preparing an Environmental Effects Monitoring plan for submission to Environment and Climate Change Canada in 2021 that will address this recommendation.)*	
	Lab QA/QC procedures and results – not provided in report or appendices	Provide lab QA/QC procedures and results in appendix	A summary of lab QA/QC procedures will be provided in future annual reports and results will be provided upon request.
	Data analysis - Missing community metrics required in EMSAMP (i.e., family density and richness, Simpson’s evenness, and Bray-Curtis)	Include all community indices identified in EMSAMP	Appropriate community metrics will be provided based on the results obtained from EEM studies.

Discipline	Compliance Gaps and/or Deficiencies	Recommendation/Corrective Action	VGC Response
	Data analysis – missing statistical analyses comparing sites and contemporary data to pre-construction data	Conduct the required ANOVAs and multiple comparison tests as required by EMSAMP (e.g., append appropriate statistical analyses in excel format) and EEM for BACI study design. (*Stantec understands that VGC is currently preparing an Environmental Effects Monitoring plan for submission to Environment and Climate Change Canada in 2021 that will address this recommendation.)*	VGC is currently finalizing an EEM Study Design in compliance with ECCC's technical guidance that will address this recommendation.
	Reporting – only qualitative comparisons between sites and years discussed	There is sufficient data from sites and between years to conduct quantitative statistical analysis to determine significant difference between impact and reference sites and trends between years.	As stated in the EMSMAP, the current aquatic environment monitoring program is considered interim until the finalization of the EEM study design. As stated in section 3.5.2.2, statistical analyses are planned in 2021 after the completion of the first EEM study year.
	Reporting – no discussion of need for adaptive management actions; no statistical analyses performed to inform adaptive management	Discuss adaptive management considering quantitative analysis of site data and trend analysis	VGC will work with third party consultants engaged to prepare reports on our behalf to ensure that statistical analyses are performed as necessary to inform adaptive management.
	Reporting – no indication that results are site averages in the tables	Clearly identify what data in tables represents	VGC will work with third party consultants engaged to prepare reports on our behalf to ensure that tables in final reporting clearly indicate the type of data presented.
	Reporting – no reference for Pacific Salmon Federation rating of "good quality" based on EPT taxa in the 2018 annual report	Provide all references in report	VGC will discuss this matter with the author of the report and follow up with the auditor as necessary. The referenced section appears to list the Pacific Stream Keepers Federation document with "DFO" listed as the source and the refence being "Stream Keepers Module 4 Stream Invertebrate Survey. Stewardship Series. British Columbia." thus the concern is unclear at this time.
	Reporting – incorrect identification of "fair" based on HBI to Site W26 in 2018 annual report	Incorporate quality and independent review into reporting structure	Quality reviews of final reports are included through consultant and VGC report production. If future audits identify additional review issues, VGC will consider engaging alternate consultant support to ensure reports are sufficiently prepared.
	Reporting – no analysis or discussion of environmental variables, fish results, or outlier effects on benthic invertebrate results as required by EMSAMP	Discuss all requirements of the EMSAMPs in the annual reports.	Benthic invertebrate study results will be incorporated into the fish studies as supporting information (as an indication of overall health of system from keystone species condition).
Fish and Fish Habitat	Field methods - Fish and fish habitat surveys conducted in September instead of July or August when fish communities are likely more stable and fish sampling is more efficient	Although not a deficiency of the annual monitoring programs, sampling should be conducted in summer when fish community is most stable and sampling efficiency is highest.	VGC environmental staff have conducted fish studies in collaboration with Aquatic Biologists familiar with the regional area and fish community habits and will continue to rely on their expertise, and that of our own field staff, with respect to the most appropriate time of year to conduct sampling.
	Field methods – fish condition was not documented as required by the EMSAMPs	Conduct external examinations and fill in standardized necropsy form for each fish or sub-sample of fish of each species captured	VGC is currently finalizing an EEM Study Design to be in compliance with ECCC's technical guidance which currently includes an assessment of the external condition of each fish with standard necropsy observations.
	Field methods – single pass open sites	Although not required by the EMSAMPs and not a deficiency of the annual monitoring programs, multi-pass depletion estimates in closed sites would provide more accurate and repeatable results and be better for long-term monitoring and statistical analyses	VGC has historically conducted Catch Per Unit Effort (CPUE) sampling procedures, due to the low population numbers typical of the local stream systems. VGC is currently finalizing an EEM Study Design in compliance with ECCC's technical guidance that will address this recommendation.
	Field methods – insufficient numbers of fish captured for EEM program at current effort levels	Although not specified in the EMSAMPs, a minimum of 100 fish is required for non-lethal sampling according to EEM technical guidance. Sampling in summer and using multi-pass electrofishing methods may increase numbers of fish available for capture	CPUE can be used to justify lower catch. Streams in the project area have low density of fish and with high effort required

Discipline	Compliance Gaps and/or Deficiencies	Recommendation/Corrective Action	VGC Response
	Reporting – no mention of need for fish tissue study	Even if no mine effluent discharge occurred, reports should indicate whether a fish tissue study is required or not as part of MDMER monitoring; the EMSAMP indicates that a fish tissue study is required if the concentration of effluent in the exposure area was >1% in the area within 250 m of the final discharge point but the 2019 annual report did not indicate if this criterion was met. (*Stantec understands that VGC is currently preparing an Environmental Effects Monitoring plan for submission to Environment and Climate Change Canada in 2021 that will address this recommendation.)*	Data obtained to date indicate that mercury and selenium concentrations were below the EEM triggers for conducting applicable fish tissue surveys as defined in the MDMER. Therefore, VGC is not required to conduct either a fish tissue mercury or selenium survey.
	Reporting – no recommendation for indicator fish species for future EEM program	Although not required by the EMSAMPs, the authors should provide a recommendation for a suitable indicator fish species for monitoring potential effects of future mine effluent discharges. Given the fish community present at the site, slimy sculpin would appear to be at least one of the indicator species chosen for future EEM programs. (*Stantec understands that VGC is currently preparing an Environmental Effects Monitoring plan for submission to Environment and Climate Change Canada in 2021 that will address this recommendation.)*	VGC became subject to ECCC's EEM Sampling program requirements in April 2019 (with the first site discharge) requiring an EEM Study to be submitted in April 2020, with study implementation planned for 2021. VGC is currently finalizing an EEM Study Design in compliance with ECCC's technical guidance that will address this recommendation.
	Reporting – no mention of adaptive management trigger or threshold exceedances	Reports should specify whether any of the adaptive management thresholds in the EMSAMPs were exceeded and if any of the adaptive management measures were required and implemented each year	VGC is currently finalizing an EEM Study Design in compliance with ECCC's technical guidance that will address this recommendation. Any quantitative analysis conducted will inform on adaptive management strategies and be reported in annual reporting.
TERRESTRIAL ENVIRONMENT			
Vegetation and Soils	N/A	Develop statistically-based trigger for determining 'significant' increases in metals (arsenic, cadmium, chromium, mercury and lead) concentrations in vegetation plot samples.	VGC will work the third-party contractor engaged for sampling and reporting on the vegetation monitoring program and will develop statistically based triggers for determining significance that can be used in future reports.
	Missing duplicate vegetation sample analysis in 2018 and 2019	Collect duplicate samples if sufficient vegetation is available	QA/QC duplicate samples are collected if sufficient vegetation is available.
Wildlife Protection	Specific information on wildlife incidents is not provided in the Wildlife Records Program	Provide a summary of all wildlife incidents resulting in human-wildlife conflict, wildlife fatality or removal, or nest disturbance in the annual reports along with a summary of the root cause(s). Any corrective actions should be documented.	A summary and resulting corrective actions of all wildlife incidents resulting in human-wildlife conflict, wildlife fatality or removal, or nest disturbance will be included in the annual reports. This data and information are also currently provided in quarterly wildlife reports provided to EMR.
	There is no formal documentation of the wildlife protection monitoring in the Heap Leach Facility Area and Events Pond Monitoring Program	Include the results of the monitoring program in the annual report or in a separate report.	To date, there has only been one wildlife related incident related to the HLF and Events Pond. The findings from this incident have been provided to the appropriate Conservation Officer and in the pertinent quarterly wildlife report provided to EMR. Summaries of the wildlife monitoring program will continue to be provided to EMR by way of quarterly wildlife reports and in future annual reporting.
GEOTECHNICAL STABILITY OF INFRASTRUCTURE AND FACILITIES			
Permafrost	Regular visual Inspections not reported.	Include an appendix in Annual and Monthly reporting that summarizes the observations from regular visual inspections to identify and quantify any deformation associated with melting of permafrost, such as but not limited to, cracks, subsidence, sinkholes, and sloughing on existing foundations and slope overlay permafrost. Summarize those visual inspections executed during the freshet, prolonged rainy periods, and rising trend in any thermistors.	Infrastructure monitoring including permafrost will continue to be summarized in annual reporting. Geotechnical stability of major infrastructure is also considered in the annual independent physical stability inspection conducted to fulfill conditions in the Quartz Mine Licence. Areas of specific concern identified by the independent third party (note - no significant concerns have been raised to date) will be specific focus areas for VGC operational staff.

Discipline	Compliance Gaps and/or Deficiencies	Recommendation/Corrective Action	VGC Response
	Prolonged rainy period not quantified.	Define / quantify duration of a prolonged rainy period based on exceedance of design criteria (duration, precipitation volume).	The design basis for various infrastructure adjacent to permafrost includes concepts for short term rain events (i.e., 100 yr 24-hr) and long term (monthly) conditions as evaluated using water balance models that consider upset conditions (including sustained rainy periods). These considerations are already reflected in the design and capacity for each structure. For natural terrain, such as permafrost, a subjective analysis focusing on actual observed effects of rainy periods on the terrain is better suited to evaluate terrain stability. Thus, this recommendation is not considered necessary.
	Freeze/Thaw indices not reported under EMSAMP -2018-01.	Corrective action no longer required because Weather Data Review requirement removed from EMSAMP monitoring program starting June 2019 (EMSAMP 2019-01 and 2020-01).	Noted.
	Thermistor GT18-09 not read in Q3 of 2019	Provide reasoning for missed reading.	While VGC endeavors to fulfill all EMSAMP listed sampling, occasionally samples are missed based on adverse weather conditions or department resource constraints. Future annual reports will include reasoning for missed readings.
Open Pit	Daily visual inspections not reported.	Include an appendix in Annual and Monthly reporting that summarizes the observations from these daily visual inspections.	Infrastructure monitoring including the open pit is conducted regularly and will continue to be summarized in annual reporting.
	Monthly collection of survey prism data not reported.	Stantec understands there are currently no active prisms installed at the open pit, and VGC is implementing a program scheduled for 2020 to install up to 15 prisms on the1408, 1375, and 1395 benches. Following prism installation, include in Annual and Monthly reports a list of active survey prisms with coordinates (northing, easting, elevation) and deformation readings.	VGC has scheduled installation of survey prism within the pit benches over the winter of 2020/2021. Resulting data will be included in future annual reporting.
	Piezometers read quarterly instead of monthly in 2018 as required in EMSAMP 2018-01.	Corrective action not required since the piezometer reading frequency is specified as quarterly in subsequent EMSAMP 2019-01, superseding the 2018 requirement and bringing the piezometer reading schedule into compliance.	Noted.
	Scheduled piezometer readings for Q1 2020 not collected due to COVID-19 related staffing issues.	Assess if datalogger installed in Open Pit piezometer BH-BGC11-73a,b,c collected and stored data for Q1 2020. For remaining piezometer(s), collect data as soon as reasonably practical and provide reading summary or reasoning for data gap in Annual reporting.	Data collection and rationale for missed samples will be included in future annual reporting.
	Piezometer data not collected in Q2 2020.	Assess if datalogger installed in Open Pit piezometer BH-BGC11-73a,b,c collected and stored data for Q2 2020. For remaining piezometer(s), collect data as soon as reasonably practical and provide reading summary or reasoning for data gap in Annual reporting.	Data collection and rationale for missed samples will be included in future annual reporting. Note that BH-BGC11-73a,b,c was decommissioned in early 2020 during open pit advancement, therefore there was no data to collect.
	Piezometers listed in EMSAMP documentation without reported water tables.	Provide reasoning for piezometers with absence of documented water table readings.	All data collection and rationale for missed samples will be included in annual reporting.
	Data for two (2) extensometers installed at open pit not reported.	The EMSAMP documents do not lay out a minimum required monitoring frequency for extensometers installed at the open pit. A qualified personnel should determine a reading frequency for these instruments and should be summarized in the annual reports and compared against established velocity trigger levels.	The implementation of monitoring strategies and instrumentation is ongoing and future annual reports will provide relevant information as it becomes available. The discussion provided in the EMSAMP was intended to provide context for overall environmental monitoring on the site only. Observation of pit wall stability is undertaken by qualified personnel on the mine site on a regular and frequent basis.
	Multiple instrumentation listed in EMSAMP documentation that is not currently installed on site (robotic theodolites, TDR cables, slope inclinometers, fixed slope radar, mobile slope radar).	Remove from EMSAMP documentation reference to instrumentation not installed (or planned for installation) on Open Pit.	Instrumentation proposed for the observation of facilities was intended to be understood to develop over time. The implementation of monitoring strategies and instrumentation is ongoing and future annual reports will

Discipline	Compliance Gaps and/or Deficiencies	Recommendation/Corrective Action	VGC Response
			provide relevant information as it becomes available. The discussion provided in the EMSAMP was intended to provide context for overall environmental monitoring on the site only.
	Equipment maintenance logs were not provided to back-up data reported in monthly/annual reports.	Provide equipment maintenance logs as supporting documentation to monthly/annual reports.	A summary of relevant equipment maintenance logs will be included in future annual reports and will be made available upon request.
Materials Storage and Stockpile Management	Visual inspections (daily, weekly, monthly) not reported.	Include an appendix in Annual and Monthly reporting that summarizes the observations from these visual inspections.	Future annual reports will include a summary of material storage and stockpile monitoring undertaken the previous year. Additionally, the annual independent third-party inspection, provided to EMR, includes observation of material storage and stockpile areas.
	Not all WRSA and stockpile piezometers as listed in EMSAMP 2020-01 have water levels reported in June 2020 monthly report.	Confirm list of active piezometers installed in WRSA and stockpiles, include data in monthly and annual reports. Provide reasoning behind non-documented groundwater tables.	Available data from relevant monitoring instrumentation is provided in monthly and annual reports. Additional installations proposed for the operations period of the mine have been impacted by COVID-19 travel restrictions. The planned installations will take place when travel and site restrictions allow.
	Multiple instrumentation listed in EMSAMP documentation that is not currently installed on site (Survey Prisms, Inclinometers, Radar / photogrammic surveying).	Remove from EMSAMP documentation reference to instrumentation not installed (or planned for installation) on WRSA and stockpile structures.	Instrumentation proposed for the observation of facilities was intended to be understood to develop over time. The implementation of monitoring strategies and instrumentation is ongoing and future annual reports will provide this information as it becomes available
	Existing monitoring methods (wireline extensometer) implemented on site do not state a monitoring frequency.	VGC should consider discrete reading frequencies for wireline extensometers, specify in EMSAMP documentation.	Monitoring of material storage and stockpiles provided in the EMSAMP is to provide overall context for site inspections and management. Details regarding frequencies for monitoring these facilities are considered in plan outside of the scope of the audit and standard operating procedures followed at the project site. Inclusion of this level of detail in the EMSAMP is not considered appropriate as it is not an environmental monitoring function.
	Follow up and close out of physical stability recommendation 4 and 5 not documented in annual or monthly reports.	Provide documentation detailing the follow up and response actions for addressing recommendations.	The physical stability inspection is conducted on an annual basis and the selected firm utilizes previous reports to describe activities undertaken by VGC to address previously identified issues and whether a concern remains. Any facility that requires major construction or maintenance to address performance issues will have follow up documentation included in the annual report as required by the QML and WUL.
Heap Leach Facility	Routine (visual) inspections (daily, weekly) not reported.	Include an appendix in Annual and Monthly reporting that summarizes the observations from these visual inspections.	Visual inspections for the HLF are part of routine operations. This information is provided to the EOR for the facility which is then used for their third-party reporting and as design input for subsequent phases of the HLF. VGC considers this approach more appropriate than providing raw inspection data as a component of EMSAMP reporting.
	Embankment Piezometers P1, P2, P3 appear to be collecting data continuously but data not reported monthly.	Provide continuous data plots of embankment piezometers P1, P2, P3 in monthly reports. Include these instruments in next EMSAMP revision.	Piezometers installed in the HLF are recording data continuously and this information will be provided in future annual reports
	Partial reporting of piezometer readings as listed in EMSAMP 2019-01 in 2019 annual report.	Confirm HLF piezometers as listed in EMSAMP 2019-01 are reporting groundwater readings, include in monthly and annual reporting. Provide reasoning for missing groundwater level readings.	Piezometers installed in the HLF are recording data continuously and this information will be provided in future annual reports
	Partial reporting of piezometer readings as listed in EMSAMP 2020-01 in June 2020 monthly report.	Confirm HLF piezometers as listed in EMSAMP 2020-01 are reporting groundwater readings, include in monthly and annual reporting. Provide reasoning for missing groundwater level readings.	Piezometers installed in the HLF are recording data continuously and this information will be provided in future annual reports.
	Existing monitoring methods (slope inclinometer casing) implemented on site do not state a monitoring frequency.	VGC to consider discrete reading frequencies for slope inclinometer casing, specify in EMSAMP documentation.	Monitoring frequencies are evaluated on a case by case basis depending on overall assessment of the facility and daily observations made by the general foreman. Discrete (or absolute) reading frequencies are not recommended.

Discipline	Compliance Gaps and/or Deficiencies	Recommendation/Corrective Action	VGC Response
	Follow up and close out of physical stability recommendation 3 not documented in annual or monthly reports.	Provide documentation detailing the follow up and response actions for addressing recommendation.	The physical stability inspection is conducted on an annual basis and the selected firm utilizes previous reports to describe activities undertaken by VGC to address previously identified issues and whether a concern remains. Any facility that requires major construction or maintenance to address performance issues will have follow up documentation included in the annual report as required by the QML and WUL.
OTHER PLANS			
Solid Waste and Hazardous Materials Management	No recommendation		
Spill Response	No recommendation		