**Faro Mine Complex, September 2016**

**Groundwater Sampling**

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# Introduction

Hemmera Envirochem Inc. (Hemmera) and Ecological Logistics & Research Ltd. (ELR) were retained by the Government of Yukon (GY), Assessment and Abandoned Mines (AAM) to conduct a groundwater sampling program at the Faro Mine Complex (FMC). The program consists of two sampling events: June and September, 2016. This report summarizes the activities completed and analytical results from the September 2016 sampling event.

This Work was performed in accordance with contract C00033457 between Hemmera and the Government of Yukon (“Client”), dated May 13, 2016 (“Contract”). This Report has been prepared by Hemmera/ELR, based on fieldwork conducted by Hemmera/ELR, for sole benefit and use by the Government of Yukon. In performing this work, Hemmera has relied in good faith on information provided by others, and has assumed that the information provided by those individuals is both complete and accurate. This work was performed to current industry standard practice for similar environmental work, within the relevant jurisdiction and same locale. The findings presented herein should be considered within the context of the scope of work and project terms of reference; further, the findings are time sensitive and are considered valid only at the time the Report was produced. The conclusions and recommendations contained in this Report are based upon the applicable guidelines, regulations, and legislation existing at the time the Report was produced; any changes in the regulatory regime may alter the conclusions and/or recommendations.

## Site Location

The FMC is located approximately thirteen (13) kilometres (km) northeast of the Town of Faro, Yukon (20 km by road). The FMC consists of two distinct areas, the Faro Mine Area and the Vangorda/Grum Area (**Figure 1-1**), which are connected by a fourteen (14) km roadway (the Haul Road; **Figure 1-1**). Groundwater sampling stations exist throughout the FMC and surrounding area, a series of which were sampled during the September 2016 program. Specific sampling locations and general sample site distribution are described in **Sections 1.2** and **1.3**.

## Scope of Work

The scope of work (SOW) included the coordination and execution of the September 2016 groundwater sampling program and the preparation of this summary report. This report provides a summary of the sampling program activities, methodologies (including any deviations from standard methodologies), field *in-situ* and laboratory analytical results, concentrations of contaminants exceeding applicable guidelines, and recommendations relating to sample procedures and monitoring well conditions. This report does not provide an interpretation of the analytical results or provide recommendations relating to program design. The groundwater sampling event at the FMC was conducted over a six (6) day period between September 20 and September 25, 2016. 103 groundwater wells were specified by AAM for the event (**Table 1-1**), 50 of which were not included in the June 2016 sampling event (Hemmera, 2016). Sampling was conducted by a team of four (4) field staff from Hemmera/ELR.

Figure 1-1 Site Location – Faro Mine Complex

At each well (sampling station) the groundwater level and depth to bottom of the well were measured, the well was purged appropriately, and field parameters were measured (pH, water temperature, conductivity, specific conductivity, oxidation-reduction potential, and dissolved oxygen). Groundwater samples were collected following field measurements and purging, and were analysed for general groundwater quality chemistry (dissolved metals, major anions/cations, and physical parameters). A detailed description of the sampling methodology is provided in **Section 2**.

## Sample Sites

September 2016 groundwater sampling was conducted at 103 wells across seven (7) different areas of the FMC (**Table 1-1**; **Figures 1-1** to **1-4**). 102 of the 103 wells identified for the event were successfully located. One (1) well (sampling station S3) was not located during the spring or fall 2016 events and is presumed to have been destroyed. The majority of the sample sites included in the program were located in the Faro Mine Area (92 wells), with the remaining wells located in the Vangorda/Grum Area (11 wells). A large portion of the wells sampled in the Faro Mine Area were located in the S-Wells Area (27 wells; **Figure 1-3**), with additional wells in the surrounding areas. Wells in the Vangorda/Grum Area were primarily located in the vicinity of the Grum Sulphide Cell (**Figure 1-4**). **Table 1-1** summarizes sample sites included in the sampling program, while **Figures 1-2** through **1-4** show locations and general distribution of the sites. Photographs of each sample site are included as **Appendix A**.

Table 1-1 Summary of Groundwater Sample Sites Identified for September 2016 Program

| Area | Well Name | UTM (Zone 8N) | Well Status | Sample Collected | QA/QC Sample Collected |
| --- | --- | --- | --- | --- | --- |
| Easting | Northing |
| Cross Valley Dam (CVD) Area | P01-02A | 579962 | 6914224 | Damaged1 | **✓** | - |
| P01-02B | 579962 | 6914224 | Damaged1 | **✓** | - |
| P01-11 | 580092 | 6914486 | Good | **✓** | - |
| P03-09-02 | 579948 | 6914410 | Good | **✓** | - |
| P03-09-04 | 579948 | 6914410 | Good | **✓** | - |
| P03-09-6 | 579948 | 6914411 | Good | **✓** | - |
| P03-09-08 | 579948 | 6914410 | Good | **✓** | - |
| P03-09-9 | 579948 | 6914411 | Good | **✓** | - |
| P05-01-01 | 580061 | 6914510 | Good | **✓** | - |
| P05-01-02 | 580056 | 6914505 | Good | **✓** | - |
| P05-01-03 | 580056 | 6914505 | Good | **✓** | - |
| P05-01-04 | 580056 | 6914505 | Good | **✓** | - |
| P05-01-05 | 580056 | 6914505 | Good | **✓** | - |
| P05-02 | 580036 | 6914439 | Good | **✓** | DUP-6 |
| P05-03 | 579982 | 6914346 | Good | **✓** | FB-4 |
| Down Gradient of CVD Area | CH14-107-MW006A | 579346 | 6915090 | Good | **✓** | - |
| CH14-107-MW006B | 579348 | 6915088 | Good | **✓** | - |
| P01-01A | 579701 | 6914854 | Good | **✓** | DUP-5 |
| P01-01B | 579701 | 6914854 | Good | **✓** | - |
| X16A | 579446 | 6914842 | Good | **✓** | - |
| X16B | 579446 | 6914842 | Good | **✓** | - |
| X17A | 579756 | 6914648 | Good | **✓** | - |
| X17B | 579756 | 6914648 | Good | **✓** | - |
| X18A | 579986 | 6914713 | Good | **✓** | - |
| X18B | 579986 | 6914713 | Good | **✓** | - |
| Emergency Tailings Area (ETA) | P09-ETA-2 | 582700 | 6913812 | Good | **✓** | - |
| P96-8A | 583220 | 6914072 | Good | **✓** | - |
| P96-8B | 583220 | 6914072 | Good | **✓** | - |
| SRK04-3A | 582870 | 6913995 | Good | **✓** | - |
| SRK05-ETA-BR1 | 582863 | 6914019 | Good | **✓** | - |
| SRK05-ETA-BR2 | 582879 | 6913997 | Good | **✓** | - |
| Intermediate Dam | P01-03 | 580516 | 6914255 | Good | **✓** | DUP-3 |
| P01-04A | 580372 | 6914074 | Good | **✓** | - |
| P01-04B | 580372 | 6914074 | Frozen |  | - |
| X24-96D | 580544 | 6914298 | Good | **✓** | FB-2 |
| X25-96A | 580544 | 6914298 | Good | **✓** | - |
| X25-96B | 580407 | 6914119 | Good | **✓** | - |
| Northeast Waste Rock Dumps | BH14A | 585584 | 6914005 | Good | **✓** | DUP-11 |
| BH14B | 585584 | 6914005 | Good | **✓** | - |
| CH15-107-MW029 | 585765 | 6914129 | Good | **✓** | FB-5 |
| CH15-107-MW030 | 585832 | 6914180 | Good | **✓** | - |
| CH15-107-MW032 | 585763 | 6914249 | Slow Recharge2 | **✓** | - |
| CH15-107-MW033 | 585764 | 6914248 | Good | **✓** | - |
| CH15-107-MW034 | 585752 | 6914496 | Good | **✓** | DUP-9 |
| Second Impoundment | P03-04-02 | 581968 | 6913367 | Good | **✓** | - |
| P03-04-04 | 581968 | 6913367 | Good | **✓** | - |
| P03-04-06 | 581968 | 6913367 | Good | **✓** | - |
| P03-05-02 | 582488 | 6913115 | Good | **✓** | - |
| P03-05-04 | 582605 | 6912934 | Good | **✓** | - |
| P03-05-05 | 582488 | 6913115 | Good | **✓** | - |
| P03-06-1 | 582452 | 6913496 | Slow Recharge2 | **✓** | - |
| P03-06-2 | 582452 | 6913496 | Good | **✓** | - |
| P03-06-03 | 582454 | 6913490 | Good | **✓** | - |
| P03-06-04 | 582454 | 6913490 | Good | **✓** | - |
| P03-06-05 | 582454 | 6913490 | Good | **✓** | - |
| S-Wells Area | CH14-107-MW007A | 584491 | 6913091 | Good | **✓** | - |
| CH14-107-MW007B | 584489 | 6913092 | Good | **✓** | DUP-1 |
| CH14-107-MW009 | 584499 | 6913099 | Good | **✓** | - |
| CH14-107-MW010 | 584497 | 6913098 | Good | **✓** | - |
| CH15-107-MW019 | 584288 | 6912966 | Good | **✓** | - |
| CH15-107-MW022 | 584288 | 6913049 | Good | **✓** | - |
| CH15-107-MW023 | 584119 | 6912962 | Good | **✓** | - |
| CH15-107-MW025 | 584136 | 6912881 | Direct Sample3 | **✓** | - |
| P09-SIS1 | 584478 | 6913128 | Good | **✓** | - |
| P09-SIS2 | 584487 | 6913125 | Good | **✓** | - |
| P09-SIS3 | 584493 | 6913117 | Good | **✓** | - |
| P09-SIS4 | 584512 | 6913107 | Good | **✓** | - |
| P09-SIS6 | 584519 | 6913109 | Good | **✓** | - |
| P96-7 | 584127 | 6913287 | Good | **✓** | - |
| S1A | 584433 | 6913114 | Good | **✓** | - |
| S1B | 584433 | 6913114 | Slow Recharge2 | **✓** | - |
| S2A | 584471 | 6913123 | Good | **✓** | - |
| S2B | 584471 | 6913123 | Slow Recharge2 | **✓** | - |
| S3 | 584481 | 6913091 | Destroyed4 |  | - |
| SRK05-SP-4A | 584506 | 6913110 | Good | **✓** | - |
| SRK05-SP-4B | 584506 | 6913110 | Good | **✓** | - |
| SRK05-SP-5 | 584467 | 6913133 | Good | **✓** | - |
| SRK08-SBR2 | 584484 | 6913123 | Good | **✓** | DUP-2, FB-1 |
| SRK08-SBR3 | 584394 | 6913146 | Good | **✓** | - |
| SRK08-SBR4 | 584447 | 6913140 | Good | **✓** | - |
| SRK08-SP-7A | 584437 | 6913095 | Good | **✓** | - |
| SRK08-SP-7B | 584437 | 6913095 | Good | **✓** | - |
| Vangorda Grum Area | P09-GS1A | 592494 | 6904832 | Good | **✓** | - |
| P09-GS1B | 592485 | 6904833 | Good | **✓** | - |
| P09-LCD1 | 593358 | 6903316 | Good | **✓** | DUP-7 |
| Vangorda Grum Area | P09-LCD4 | 593330 | 6903278 | Slow Recharge2 | **✓** | - |
| P09-LCD6 | 593313 | 6903251 | Good | **✓** | - |
| P2001-02A | 593132 | 6902866 | Slow Recharge2 | **✓** | - |
| P2001-02B | 593132 | 6902866 | Slow Recharge2 | **✓** | - |
| P96-9A | 592648 | 6903345 | Good | **✓** | - |
| SRK05-07 | 592375 | 6903189 | Good | **✓** | - |
| SRK05-08 | 592582 | 6903238 | Good | **✓** | - |
| SRK05-9 | 592949 | 6903158 | Good | **✓** | - |
| V34 | 593428 | 6902476 | Good | **✓** | - |
| V35 | 593175 | 6902554 | Good | **✓** | - |
| V36 | 593133 | 6902916 | Good | **✓** | DUP-4, FB-3 |
| V37 | 593309 | 6903079 | Slow Recharge2 | **✓** | - |
| Zone 2 Pit Outwash Area | BH10A | 585122 | 6913711 | Good | **✓** | DUP-8 |
| BH10B | 585122 | 6913711 | Good | **✓** | - |
| BH8 | 585144 | 6913777 | Slow Recharge2 | **✓** | - |
| CH14-107-MW001 | 585079 | 6913406 | Good | **✓** | - |
| CH14-107-MW002 | 585078 | 6913511 | Good | **✓** | DUP-10 |
| P05-04 | 585115 | 6913650 | Good | **✓** | - |

**Notes:**

1 Although groundwater well P01-02B was found damaged in the field, this did not prevent sampling of the well.

2 Sample sites are flagged as “slow recharge” when sample collection requires purging the well dry and returning to collect a sample following an extended period of recharge (typically 24 hours).

3 Sample was collected directly without purging due to slow recharge rate.

4 Groundwater well S3 was not located in the field and is presumed to have been destroyed.

Figure 1-2 Groundwater Sampling Locations – Faro Mine Area

Figure 1-3 Groundwater Sampling Locations – S-Wells Area

Figure 1-4 Groundwater Sampling Locations – Vangorda/Grum Mine Area

# Methodology

## Protocols

Groundwater purging and sampling conducted by Hemmera/ELR was in accordance with Yukon Environment’s *Protocol for the Contaminated Sites Regulation #7 – Groundwater Monitoring Well Installation, Sampling and Decommissioning* (Yukon Environment, March 2011). Methods used were also consistent with the ASTM *D4448-01 Standard Guide for Sampling Groundwater Monitoring Wells* (ASTM, 2013), the *D6452-99 Guide for Purging Methods for Wells used for Groundwater Quality Investigations* (ASTM, 2012) and in accordance with *Standard Methods for the Examination of Water and Wastewater* (Riceet al.,2012*)*.

## Well Measurements and Purging

Upon arriving at each location, the well structure and casing were inspected for damage, closure, and general conditions. Several measurements were recorded from each well, including depth to water (DTW; m), depth to bottom (DTB; m), well diameter (cm), and well stick-up height (m).

DTB and DTW were measured using either a Solinst - Model 102 Water Level Meter (for 2.54 cm diameter wells) or a Heron Water Tape (for wells with diameter greater than 2.54 cm). DTB and DTW were measured from (in order of preference): 1) a black mark drawn on the top of the well; 2) the bottom of the most significant notch found on the top of the PVC if a mark was not present; or 3) a line was drawn on the highest point of the well and measurement taken from that line if no distinguishable point of measure was present. Based on information reviewed by Hemmera/ELR, it is unknown where the point of measurement was for previous sampling programs. Stick-up height was measured from the lowest point on the bottom of the well casing to the highest point (or distinguishing mark) on the well. Water level meters were decontaminated between each sample site using a combination of Alconox low-foaming phosphate-free detergent solution and de-ionized water.

Following the initial checks and measurements described above, groundwater wells were purged and sampled using one (1) of three (3) techniques: 1) Hydrolift electric inertial pump using dedicated high density polyethelene (HDPE) Waterra tubing and footvalve, 2) Manual purging using dedicated HDPE Waterra tubing and footvalve, or 3) GeoPump peristaltic pump using dedicated HDPE and silicone tubing. The purging technique chosen for each well was that which would produce the most representative groundwater sample.

Groundwater wells were determined to be sufficiently purged when either three (3) successive field parameter measurements were recorded to be within an allowable tolerance level (as summarized in **Table 2-1**), when a volume of groundwater equivalent to three (3) standing well volumes of groundwater had been purged, or, in the case of wells with extremely poor recharge (i.e., wells that require over 24 hours to recharge), the well has been purged dry and allowed to fully recharge to its initial DTW. Groundwater turbidity measured in Nephelometric Turbidity Units (NTU) or Attenuation Units (AU) was also measured prior to sampling and was used as an indication of sample quality. Where possible samples were not collected until turbidity was less than 50 NTU.

Purge volume measurements were collected using a graduated container and stop watch. All well measurements, purging details, and additional field notes were recorded on field forms.

Table 2-1 Groundwater Sampling – Field Parameter Purging Criteria

|  |  |
| --- | --- |
| Field Parameter | Allowable Variance Across 3 Consecutive Readings |
| Temperature (°C) | ±3% |
| pH (pH Units) | ±0.1 |
| Conductivity (µS/cm) | ±3% |

## Field Parameters

Hemmera/ELR measured general field parameters using a YSI Professional Plus multi-parameter meters and Lamotte 2020we turbidity meters. Where possible, field parameters were collected using a flow through cell in order to minimize field parameter variability. Field parameters recorded at each sample site included: groundwater temperature (oC), conductivity (μs/cm), specific conductivity (μs/cm), pH (pH Units), oxidation-reduction potential (ORP; mV), dissolved oxygen (mg/l and percent saturation), and turbidity (NTU or AU).

During purging, field parameters were monitored at 3-5 minute intervals, or at volume related intervals (e.g., every 500 mL) in the case of wells with slow recharge. In-situ measurements for reporting purposes were recorded at the conclusion of purging.

## Groundwater Quality Sample Collection

Groundwater quality samples were collected and preserved in accordance with laboratory directions, and using techniques consistent with *Standard Methods for the Examination of Water and Wastewater* (Rice et al., 2012). ALS Global was the analytical subcontractor chosen for this project, and an example summary of the sample set collected at each sample location, including parameters analysed and preservation techniques, is provided in **Table 2-2**.

Table 2-2 Groundwater Sampling – Preservation and Intended Analysis

|  |  |  |  |
| --- | --- | --- | --- |
| Bottle Type | Parameters Analyzed | Sample Treatment | Preservation Added |
| 120 mL (Plastic) | Dissolved Metals (excluding mercury) | Field Filtered and Preserved | HNO3 |
| 1 L (Plastic) | Acidity, alkalinity, chloride, conductivity, pH, hardness, sulfate, total suspended solids (TSS) | - | None |

## Data Analysis

Groundwater analytical results were compared to the Canadian Council of Ministers of the Environment (CCME) Water Quality Guidelines for the Protection of Freshwater Aquatic Life (FAL; CCME, 2016).

## Quality Assurance and Quality Control (QA/QC)

### Field QA/QC

Several controls were used by Hemmera/ELR staff while in the field to help ensure that sample integrity was maintained and that data was recorded completely and accurately. All equipment used during the sampling process was dedicated to individual wells, including HDPE tubing and Waterra footvalves, laboratory provided pre-cleaned sample bottles, disposable filters, and disposable syringes. Field staff wore dedicated disposable nitrile gloves for all measurements, purging, and sampling. Water level meters were cleaned between wells using Alconox low-foaming phosphate-free detergent and de-ionized water, and field instruments (YSI field meters and turbidity meters) were checked and/or calibrated before each site visit to ensure the parameters recorded were as accurate as possible.

Project-specific field data sheets were created for the sampling event to help ensure that all required measurements were taken, and that information was recorded correctly. Field data sheets have been included as **Appendix B** of this report.

### Laboratory and Sampling QA/QC

Laboratory and sampling QA/QC measures taken as part of the September 2016 sampling program include the collection of duplicates and field blanks, and the inclusion of a travel blank, as outlined in the SOW and as per standard industry practice. Eleven (11) duplicate samples were collected in relation to 101 regular samples. Additionally, five (5) field blanks were collected, and one (1) travel blank accompanied the analytical supplies and samples during shipping to and from the laboratory.

The variation between sample and duplicate pair results was calculated as relative percent difference (RPD). RPD provides a measure of the relative difference between two values in comparison to their mean value, and is calculated as the difference between a sample and its field duplicate over the average of two (2) values. RPD values greater than 20% indicates a greater variance than would normally be anticipated and may be due to a number of factors (e.g., short term change in parameter concentration, sediment in the sample, sampling or instrument error, large relative % difference but very low actual difference in concentration, such as 0.0001 vs 0.0002 mg/L). RPD was calculated according to the following formula:

$$\%RPD=\left(\frac{χ\_{1}-χ\_{2}}{\left(\frac{χ\_{1}+χ\_{2}}{2}\right)}\right) x 100$$

Where *X1* is the sample result and *X2* is the corresponding duplicate result. RPD is not considered valid and is therefore not calculated if either the sample or the field duplicate concentration is less than five times the detection limit.

The analytical results for field and travel blanks were reviewed to determine whether any of the parameters tested were detected (i.e., result exceeded the reported detection limit). In such cases, the parameter or element in question and its concentration were reviewed to determine potential sources of contamination or error.

# Results

Summary tables of the laboratory analytical results are presented in **Table 3-1** of this report, including comparison of results to CCME FAL guidelines. A summary of the QA/QC sampling results is also attached, including analytical data for duplicates, field blanks, and travel blanks (**Table 3-2**). Laboratory analytical reports are provided as **Appendix C**.

## Groundwater Sampling Summary

Groundwater sampling was completed between September 20 and September 25, 2016. Weather conditions varied throughout the sampling program, with ambient air temperature ranging from -4°C to 13°C. Weather conditions were predominantly overcast, with occasional sunny periods and light wind. One hundred and two (102) of the one hundred and three (103) groundwater wells specified for the September 2016 sampling event were located and assessed by Hemmera/ELR. As noted in **Section 1.2**, one (1) well (sampling station S3) could not be located in the field. Groundwater samples were successfully collected from one hundred and one (101) of the one hundred and two (102) wells located, as outlined in **Table 1-1**. The one (1) well that could not be sampled (P01-04B) was found frozen during the time of sampling. A summary of groundwater wells sampled during the September 2016 sampling event, including field parameters and well measurements, is provided in **Table 3-3**. All samples were received by the laboratory within the required holding times and temperature limits.

A summary of the sampling results in the context of CCME-FAL guideline exceedances is provided in the following sections, organized by area.

Table 3-3 Groundwater Field Parameters and Well Measurements Recorded During the September 2016 Sampling Program

| **Area** | **Well Name** | **Sample Date** | **Well Status** | **Stick up Height (m)** | **Depth To Water (m)** | **Depth To Bottom (m)** | **Standing Water volume (L)** | **Volume Purged (L)** | **Purge Start time** | **Purge End Time** | **Elapsed Purge Time** | **Purge Rate (l/min)** | **Criteria 1****(3WV / PS / DS / PDR)** | **Draw Down (m)** | **pH (pH Units)** | **Temperature (°C)** | **Conductivity (µs/cm)** | **Specific Conductivity (µs/cm)** | **Oxidation Reduction Potential (mV)** | **Dissolved Oxygen (mg/L)** | **Field Turbidity (NTU)** | **Method Used** | **Well diameter (cm)** |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Cross Valley Dam (CVD) Area | P01-02A | 23/09/2016 | Good | 0.361 | 1.988 | 14.22 | 24.5 | 2.5 | 14:23 | 14:36 | 0:13 | 0.19 | PS | 0.024 | 7.56 | 4.3 | 457.7 | 758 | -66.7 | 0.0 | 0.21 | Peri. Pump | 5.08 |
| P01-02B | 23/09/2016 | Good | 1.583 | 04 | 29.982 | 56.8 | 4 | 14:00 | 14:16 | 0:16 | 0.25 | PS | 0 | 7.63 | 4.1 | 341.2 | 567 | -90.2 | 0.01 | 4.69 | Peri. Pump | 5.08 |
| P01-11 | 23/09/2016 | Good | 1.295 | 1.259 | 11.034 | 22 | 20 | 9:55 | 10:08 | 0:13 | 0.15 | PS | 0 | 6.44 | 4.4 | 2378 | 3919 | -35.5 | 0.03 | 27.2 | Peri. Pump | 5.08 |
| P03-09-02 | 23/09/2016 | Good | 0.46 | 2.8 | 32.94 | 7.5 | 6.5 | 16:17 | 16:40 | 0:23 | 0.28 | PS | NR\* | 6.87 | 4.2 | 1172 | 1944 | -33.6 | 0.08 | 1.85 | Peri. Pump | 1.58 |
| P03-09-04 | 23/09/2016 | Good | 0.58 | 3.154 | 24.436 | 5.3 | 10.5 | 16:48 | 17:09 | 0:21 | 0.50 | PS | NR\* | 6.71 | 4.1 | 1319 | 2195 | 0.7 | 0.0 | 1.26 | Peri. Pump | 1.58 |
| P03-09-6 | 23/09/2016 | Good | 0.63 | 3.228 | 19.572 | 4 | 2 | 17:24 | 17:30 | 0:06 | 0.33 | PS | NR\* | 6.75 | 4.2 | 1310 | 2173 | 6.2 | 0.04 | 3.08 | Peri. Pump | 1.58 |
| P03-09-08 | 23/09/2016 | Good | 0.65 | 3.611 | 10.266 | 1.66 | 2.5 | 17:37 | 17:44 | 0:07 | 0.36 | PS | NR\* | 6.69 | 4.1 | 1395 | 2323 | 15.7 | 0.03 | 8.69 | Peri. Pump | 1.58 |
| P03-09-9 | 23/09/2016 | Good | 3.942 | 3.942 | 8.392 | 2.23 | 2 | 17:49 | 17:57 | 0:08 | 0.25 | PS | NR\* | 6.69 | 4.2 | 1390 | 2308 | 22.6 | 0.0 | 17.4 | Peri. Pump | 1.58 |
| P05-01-01 | 23/09/2016 | Good | 0.455 | 1.312 | 26.243 | 6.23 | 6 | 11:38 | 12:05 | 0:27 | 0.22 | PS | NR\* | 6.31 | 5.4 | 2216 | 3540 | 1.9 | 0.02 | 3.62 | Peri. Pump | 1.58 |
| P05-01-02 | 23/09/2016 | Good | 0.48 | 1.529 | 20.768 | 4.8 | 1.5 | 11:28 | 11:40 | 0:12 | 0.13 | PS | NR\* | 6.28 | 5.6 | 2300 | 3658 | 2.5 | 0.78 | 1.79 | Peri. Pump | 1.58 |
| P05-01-03 | 23/09/2016 | Good | 0.519 | 1.566 | 17.803 | 4.1 | 3 | 11:17 | 11:29 | 0:12 | 0.25 | PS | NR\* | 6.29 | 5.2 | 2375 | 3815 | -4.7 | 0.1 | 3.59 | Peri. Pump | 1.58 |
| P05-01-04 | 23/09/2016 | Good | 0.532 | 1.805 | 12.309 | 2.63 | 2 | 10:53 | 11:16 | 0:23 | 0.09 | PS | NR\* | 6.33 | 5.3 | 2301 | 3685 | -17.3 | 0.64 | 6.87 | Peri. Pump | 1.58 |
| P05-01-05 | 23/09/2016 | Good | 0.552 | 1.982 | 6.553 | 1.14 | 2.5 | 10:53 | 11:05 | 0:12 | 0.21 | PS | NR\* | 6.42 | 5.9 | 2228 | 3504 | -21.8 | 0.01 | 2.4 | Peri. Pump | 1.58 |
| P05-02 | 23/09/2016 | Good | 1.89 | 2.745 | 5.922 | 6.354 | 3 | 12:47 | 13:06 | 0:19 | 0.16 | PS | 0.012 | 6.3 | 5.8 | 2205 | 3487 | 5.8 | 0.68 | 3.42 | Peri. Pump | 5.08 |
| P05-03 | 23/09/2016 | Good | 0.812 | 4.469 | 8.01 | 7.1 | 3.5 | 12:41 | 13:06 | 0:25 | 0.14 | PS | 0.021 | 6.82 | 4.8 | 1272 | 2073 | -34.6 | 0.08 | 1.49 | Peri. Pump | 5.08 |
| Down Gradient of CVD Area | CH14-107-MW006A | 22/09/2016 | Good | 0.000 | 1.682 | 2.582 | 7.29 | 6 | 17:05 | 17:43 | 0:38 | 0.16 | PS | 0.038 | 7.22 | 4.9 | 376.6 | 611 | 14.7 | 4.09 | 16 | Peri. Pump | 10.16 |
| CH14-107-MW006B | 22/09/2016 | Good | 0.000 | 2.607 | 5.795 | 24.90 | 2.5 | 17:55 | 18:07 | 0:12 | 0.21 | PS | 0 | 7.39 | 3.5 | 391.9 | 666 | 21.7 | 7.59 | 2.14 | Peri. Pump | 10.16 |
| P01-01A | 22/09/2016 | Good | 0.61 | 3.543 | 20.377 | 33.8 | 50 | 15:30 | 15:46 | 0:16 | 3.13 | PS | 0.09 | 6.88 | 2.1 | 1292 | 2293 | 31.1 | 2.19 | 0.15 | Hydrolift | 5.08 |
| P01-01B | 22/09/2016 | Good | 0.57 | 3.704 | 35.544 | 63.7 | 105 | 16:00 | 16:29 | 0:29 | 3.62 | PS | 0 | 7.22 | 2.3 | 908 | 1602 | -9.8 | 1.77 | 0.08 | Hydrolift | 5.08 |
| X16A | 22/09/2016 | Good | 0.842 | 3.65 | 5.41 | 3.52 | 4 | 11:48 | 12:08 | 0:20 | 0.20 | PS | 0 | 7.55 | 6.5 | 239.8 | 370.7 | -37.9 | 2.44 | 0.42 | Peri. Pump | 3.81 |
| X16B | 22/09/2016 | Good | 1.03 | 3.751 | 29.05 | 50.6 | 30 | 12:13 | 12:27 | 0:14 | 2.14 | PS | 0 | 7.78 | 3.5 | 243.8 | 414 | -39.5 | 4.67 | 96.4 | Manual | 7.62 |
| X17A | 23/09/2016 | Good | 0.84 | 2.261 | 6.085 | 4.2 | 3.75 | 15:02 | 15:23 | 0:21 | 0.18 | PS | 0.008 | 7.34 | 3.2 | 315.4 | 541 | 3.5 | 0.19 | 0.83 | Peri. Pump | 3.81 |
| X17B | 23/09/2016 | Good | 0.38 | 1.829 | 22.1 | 92.4 | 26 | 15:28 | 15:38 | 0:10 | 2.60 | PS | NR\* | 6.84 | 2.8 | 1060 | 1842 | -32 | 2.15 | 483 | Manual | 7.62 |
| X18A | 22/09/2016 | Good | 0.622 | 4.282 | 12.349 | 16.1 | 6.5 | 13:18 | 14:01 | 0:43 | 0.15 | PS | 0.647 | 6.91 | 3.4 | 1068 | 1817 | -19.9 | 0.0 | 1.13 | Peri. Pump | 5.08 |
| X18B | 22/09/2016 | Good | 0.632 | 4.012 | 10.736 | 12.4 | 6.5 | 14:11 | 14:49 | 0:38 | 0.17 | PS | 0 | 6.85 | 3.5 | 1003 | 1705 | -0.1 | 0.0 | 0.04 | Peri. Pump | 5.08 |
| Emergency Tailings Area (ETA) | P09-ETA-2 | 23/09/2016 | Good | 0.74 | 10.38 | 16.17 | 11.6 | 40 | 17:41 | 17:53 | 0:12 | 3.33 | 3WV | NR\* | 6.33 | 5.7 | 4026 | 6371 | -35.3 | 2.89 | 2.2 | Hydrolift | 5.08 |
| P96-8A | 23/09/2016 | Good | 0.71 | 2.625 | 4.895 | 4.5 | 4.4 | 16:19 | 16:40 | 0:21 | 0.21 | PS | 0 | 3.76 | 9.2 | 5549 | 7939 | 305.2 | 0.45 | 0.32 | Peri. Pump | 5.08 |
| P96-8B | 23/09/2016 | Good | 0.61 | 2.537 | 9.41 | 13.7 | 4.55 | 16:49 | 17:09 | 0:20 | 0.23 | PS | 0 | 5.12 | 8 | 5951 | 8808 | 148.3 | 0.9 | 0.11 | Peri. Pump | 5.08 |
| SRK04-3A | 23/09/2016 | Good | 0.625 | 6.02 | 12.41 | 12.8 | 2.85 | 8:05 | 8:27 | 0:22 | 0.13 | PS | 0.005 | 5.68 | 6.4 | 5275 | 8192 | 9.1 | 1.02 | 7.21 | Peri. Pump | 5.08 |
| SRK05-ETA-BR1 | 23/09/2016 | Good | 0.701 | 6.859 | 13.283 | 3.2 | 1.5 | 8:18 | 8:35 | 0:17 | 0.09 | PS | 0 | 5.3 | 5.5 | 5392 | 8583 | 100.8 | 0.08 | 18 | Peri. Pump | 2.54 |
| SRK05-ETA-BR2 | 23/09/2016 | Good | 0.398 | 4.829 | 19.372 | 7.3 | 2 | 8:56 | 9:15 | 0:19 | 0.11 | PS | 0.404 | 6.88 | 5 | 1659 | 2684 | -72.5 | 0.0 | 9.6 | Peri. Pump | 2.54 |
| Intermediate Dam | P01-03 | 22/09/2016 | Good | 0.45 | 3.134 | 9.583 | 12.89 | 2 | 9:19 | 9:36 | 0:17 | 0.12 | PS | 1.22 | 6.13 | 4.8 | 2647 | 4313 | -27 | 0.05 | 13.6 | Peri. Pump | 5.08 |
| P01-04A | 22/09/2016 | Good | 0.255 | 1.419 | 53.65 | 52.2 | 40 | 10:45 | 11:03 | 0:18 | 2.22 | PS | 0.1 | 6.71 | 3.6 | 715 | 1210 | -19.7 | 2.06 | 1.37 | Hydrolift | 5.08 |
| P01-04B | 22/09/2016 | Frozen | - | 1.400 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 5.08 |
| X24-96D | 22/09/2016 | Good | 0.799 | 3.735 | 28.472 | 49.5 | 4 | 8:28 | 9:04 | 0:36 | 0.11 | PS | 1.142 | 6.08 | 4.7 | 2566 | 4198 | -19.4 | 0.05 | 11.23 | Peri. Pump | 5.08 |
| X25-96A | 22/09/2016 | Good | 0.485 | 3.339 | 9.505 | 12.3 | 2 | 9:56 | 10:08 | 0:12 | 0.17 | PS | 0 | 6.82 | 4 | 1166 | 1949 | -60.4 | 0.02 | 0 | Peri. Pump | 5.08 |
| X25-96B | 22/09/2016 | Good | 0.429 | 3.202 | 19.75 | 33.1 | 2 | 10:20 | 10:31 | 0:11 | 0.18 | PS | 0 | 7.42 | 4.1 | 1178 | 1960 | -100.8 | 0.01 | 0.35 | Peri. Pump | 5.08 |
| Northeast Waste Rock Dumps | BH14A | 24/09/2016 | Good | 0.050 | 3.495 | 6.452 | 5.91 | 2 | 18:26 | 18:51 | 0:25 | 0.08 | PS | 0.112 | 6.53 | 5.1 | 2674 | 4312 | 56 | 0.29 | 5.75 | Peri. Pump | 5.08 |
| BH14B | 24/09/2016 | Good | 0.644 | 4.1 | 10.005 | 11.80 | 2.6 | 18:24 | 18:55 | 0:31 | 0.08 | PS | 0.6 | 6.74 | 4.7 | 2252 | 3684 | 219.1 | 1.78 | 10.47 | Peri. Pump | 5.08 |
| CH15-107-MW029 | 24/09/2016 | Good | 0.91 | 1.883 | 3.671 | 14.4 | 4 | 16:29 | 16:51 | 0:22 | 0.18 | PS | 0 | 6.96 | 3.2 | 1297 | 2225 | 216.6 | 7.32 | 1.71 | Peri. Pump | 10.16 |
| CH15-107-MW030 | 24/09/2016 | Good | 0.9 | 4.263 | 5.14 | 8 | 1.9 | 13:35 | 13:52 | 0:17 | 0.11 | PS | 0.01 | 6.95 | 5.1 | 1173 | 1890 | 178.2 | 7.39 | 13.3 | Peri. Pump | 10.16 |
| Northeast Waste Rock Dumps | CH15-107-MW032 2 | 25/09/2016 | Slow recharge | 1.03 | 2.331 | 9.152 | 54 | 49 | 19:00 | 19:17 | 0:17 | 3.18 | PDR | 6.069 | 7.55 | 3.6 | 1507 | 2545 | 192.9 | 2.12 | 19.6 | Peri. Pump | 10.16 |
| CH15-107-MW033 | 24/09/2016 | Good | 1.1 | 2.542 | 3.96 | 11.3 | 4.4 | 15:20 | 15:36 | 0:16 | 0.28 | PS | 0 | 7.02 | 4.2 | 952 | 1580 | 197.3 | 6.87 | 1.14 | Peri. Pump | 10.16 |
| CH15-107-MW034 | 24/09/2016 | Good | 1.1 | 3.78 | 6.125 | 18.8 | 2.55 | 14:35 | 14:51 | 0:16 | 0.16 | PS | 0.04 | 6.81 | 4.3 | 579 | 959 | 187 | 6.14 | 10.01 | Peri. Pump | 10.16 |
| Second Impoundment | P03-04-02 | 24/09/2016 | Good | 0.595 | 11.988 | 48.68 | 4.7 | 1.5 | 8:32 | 8:46 | 0:14 | 0.11 | PS | NR\* | 6.34 | 3.1 | 1296 | 2230 | 181.3 | 2.21 | 29.7 | Micro Wat. | 1.58 |
| P03-04-04 | 24/09/2016 | Good | 0.625 | 12.319 | 36.28 | 3 | 7 | 9:14 | 9:47 | 0:33 | 0.21 | PS | NR\* | 7.12 | 4.2 | 966 | 1601 | -56.3 | 3.23 | 714 | Micro Wat. | 1.58 |
| P03-04-06 | 21/09/2016 | Good | 0.675 | 12.26 | 18.48 | 0.8 | 2.4 | 15:07 | 15:12 | 0:05 | 0.16 | 3WV | NR\* | 6.3 | 5.4 | 3112 | 4968 | -55.7 | 1.33 | 11.21 | Micro Wat. | 1.58 |
| P03-05-02 | 21/09/2016 | Good | 0.785 | 8.374 | 37.777 | 7.351 | 1.5 | 15:05 | 15:53 | 0:48 | 0.03 | PS | NR\* | 5.73 | 12.2 | 1720 | 2274 | 25.4 | 0.48 | 1.67 | Peri. Pump | 1.58 |
| P03-05-4 | 21/09/2016 | Good | 0.821 | 8.563 | 24.523 | 4.056 | 1.2 | 16:27 | 17:10 | 0:43 | 0.03 | PS | NR\* | 5.83 | 11.5 | 1586 | 2139 | 27.7 | 0.33 | 0.38 | Peri. Pump | 1.58 |
| P03-05-05 | 24/09/2016 | Good | 0.84 | 8.622 | 22.611 | 3.497 | 3.5 | 10:36 | 10:52 | 0:16 | 0.22 | PS | NR\* | 6.13 | 5.1 | 4812 | 7768 | -34.8 | 2.29 | 1910 AU3 | Micro Wat. | 1.58 |
| P03-06-1 2 | 24/09/2016 | Slow recharge | 0.8 | 16.12 | 26.56 | 1.3 | 1.8 | 17:31 | 17:39 | 0:08 | 0.16 | PDR | NR\* | 3.97 | 6.5 | 2217 | 3416 | 285.5 | 4.66 | 11 | Micro Wat. | 1.58 |
| P03-06-2 | 21/09/2016 | Good | 0.775 | 10.725 | 23.64 | 1.6 | 4.8 | 17:01 | 17:12 | 0:11 | 0.44 | 3WV | NR\* | 4.63 | 4.8 | 3436 | 5599 | 179.1 | 1.16 | 2055 AU3 | Micro Wat. | 1.58 |
| P03-06-03 | 24/09/2016 | Good | 0.83 | 5.314 | 20.87 | 1.97 | 5 | 12:32 | 12:56 | 0:24 | 0.21 | PS | NR\* | 5.67 | 5.4 | 3459 | 5530 | 21.5 | 1.61 | 24.4 | Micro Wat. | 1.58 |
| P03-06-04 | 24/09/2016 | Good | 0.88 | 12.04 | 17.56 | 0.7 | 2.5 | 13:07 | 13:19 | 0:12 | 0.21 | 3WV | NR\* | 6.36 | 4.9 | 2063 | 3346 | -51 | 1.55 | 29.7 | Micro Wat. | 1.58 |
| P03-06-05 | 24/09/2016 | Good | 0.91 | 9.73 | 15.14 | 0.7 | 3.5 | 11:23 | 11:43 | 0:20 | 0.18 | 3WV | NR\* | 6.39 | 5.3 | 2960 | 4742 | -68.5 | 1.93 | 1866 AU3 | Micro Wat. | 1.58 |
| S-Wells Area | CH14-107-MW007A | 20/09/2016 | Good | 0.880 | 3.774 | 5.753 | 4.00 | 2.95 | 11:53 | 12:26 | 0:33 | 0.09 | PS | 0.226 | 5.95 | 6.3 | 2960 | 4600 | 75.6 | 2.85 | 7.21 | Peri. Pump | 5.08 |
| CH14-107-MW007B | 20/09/2016 | Good | 0.76 | 4.177 | 9.723 | 45 | 5.7 | 12:43 | 13:09 | 0:26 | 1.73 | PS | 0 | 5.97 | 5 | 992 | 1603 | 45.6 | 3.14 | 1.37 | Peri. Pump | 10.16 |
| CH14-107-MW009 | 20/09/2016 | Good | 0.95 | 4.413 | 12.065 | 61.9 | 4.45 | 10:22 | 10:54 | 0:32 | 1.93 | PS | 0 | 5.95 | 4.2 | 765 | 1270 | 41.8 | 3.92 | 0.85 | Peri. Pump | 10.16 |
| CH14-107-MW010 | 20/09/2016 | Good | 1.015 | 2.795 | 32.65 | 241.8 | 119 | 11:02 | 11:47 | 0:45 | 2.64 | PS | 0 | 5.9 | 2.8 | 471 | 817 | 89 | 5.3 | 3.05 | Hydrolift | 10.16 |
| CH15-107-MW019 | 21/09/2016 | Good | 1.18 | 2.54 | 21.58 | 38.1 | 3.9 | 11:32 | 11:48 | 0:16 | 0.24 | PS | 0 | 6.01 | 3 | 2078 | 3587 | 45.9 | 1.63 | 14.8 | Peri. Pump | 5.08 |
| CH15-107-MW022 | 21/09/2016 | Good | 1.1 | 1.866 | 21.47 | 39.2 | 6.7 | 10:35 | 11:06 | 0:31 | 0.22 | PS | 0.329 | 6.34 | 3 | 837 | 1445 | 33.9 | 0.72 | 10.99 | Peri. Pump | 5.08 |
| CH15-107-MW023 | 21/09/2016 | Good | 0.92 | 15.736 | 28.52 | 25.6 | 77 | 12:56 | 13:27 | 0:31 | 2.48 | 3WV | 0 | 6.54 | 1.7 | 511 | 919 | 36.3 | 1.16 | 54 | Manual | 5.08 |
| CH15-107-MW025 | 21/09/2016 | Good | 0.88 | 14.785 | 18.951 | 2.088 | 0.75 | 12:32 | 12:52 | 0:20 | 0.04 | DS | 1.23 | 7.12 | 3.6 | 1760 | 2976 | 80.5 | 16.7 | 26.4 | Bailer | 2.54 |
| P09-SIS1 | 20/09/2016 | Good | 0.979 | 4.613 | 6.631 | 4 | 3.5 | 17:06 | 17:41 | 0:35 | 0.10 | PS | 0.705 | 6.33 | 6.8 | 4786 | 7333 | 26.7 | 0.21 | 8.33 | Peri. Pump | 5.08 |
| P09-SIS2 | 20/09/2016 | Good | 1.13 | 3.943 | 6.335 | 4.78 | 2 | 15:39 | 15:55 | 0:16 | 0.13 | PS | 0.037 | 5.55 | 7.3 | 6806 | 10277 | 83.8 | 0.12 | 11.67 | Peri. Pump | 5.08 |
| P09-SIS3 | 20/09/2016 | Good | 1.11 | 3.989 | 4.589 | 1 | 2 | 14:49 | 15:11 | 0:22 | 0.05 | PS | 0.023 | 5.68 | 7.2 | 7377 | 11172 | 57.7 | 0.01 | 2.23 | Peri. Pump | 5.08 |
| P09-SIS4 | 20/09/2016 | Good | 0.954 | 4.047 | 4.46 | 0.826 | 4.5 | 11:45 | 12:51 | 1:06 | 0.07 | 3WV | 0.263 | 6.31 | 7.1 | 5740 | 8729 | 22.9 | 0.42 | 2.85 | Peri. Pump | 5.08 |
| P09-SIS6 | 20/09/2016 | Good | 1.281 | 3.793 | 6.305 | 5.024 | 3 | 10:37 | 11:14 | 0:37 | 0.08 | PS | 1.136 | 6.83 | 6 | 3826 | 6007 | -70 | 0.13 | 27.1 | Peri. Pump | 5.08 |
| P96-7 | 21/09/2016 | Good | 0.791 | 4.33 | 9.894 | 11.128 | 3 | 10:59 | 11:23 | 0:24 | 0.13 | PS | 0.131 | 7.21 | 2.8 | 1735 | 3016 | 44.7 | 10.58 | 0.96 | Peri. Pump | 5.08 |
| S1A | 20/09/2016 | Good | 1.32 | 4.729 | 13.1 | 16.7 | 3.55 | 15:35 | 15:57 | 0:22 | 0.16 | PS | 0 | 5.84 | 4 | 1181 | 1971 | 111.1 | 3.84 | 0.55 | Peri. Pump | 5.08 |
| S1B 2 | 21/09/2016 | Slow recharge | 1.175 | 4.521 | 5.168 | 1.3 | 1.3 | 15:16 | 15:29 | 0:13 | 0.10 | PDR | 5.168 | 6.66 | 2.6 | 482.2 | 843 | 130.9 | 2.74 | 23.5 | Peri. Pump | 5.08 |
| S2A | 21/09/2016 | Good | 0.35 | 4.355 | 11.82 | 14.9 | 3.7 | 8:37 | 9:04 | 0:27 | 0.14 | PS | 0 | 6 | 2.7 | 1072 | 1867 | 43.1 | 1.49 | 129 | Peri. Pump | 5.08 |
| S2B 2 | 21/09/2016 | Slow recharge | 0.54 | 4.448 | 7.074 | 5.3 | 10.85 | 16:17 | 17:44 | 1:27 | 0.12 | PDR | 7.074 | 5.8 | 3.3 | 6020 | 10267 | 51.1 | 0.34 | 6.54 | Peri. Pump | 5.08 |
| SRK05-SP-4A | 20/09/2016 | Good | 0.659 | 4.699 | 22.565 | 35.7 | 2.5 | 14:03 | 14:28 | 0:25 | 0.10 | PS | 0.231 | 5.91 | 5.1 | 842 | 1358 | 40.6 | 0.09 | 0.63 | Peri. Pump | 5.08 |
| SRK05-SP-4B | 20/09/2016 | Good | 0.794 | 3.969 | 4.773 | 1.5 | 2.5 | 13:16 | 13:47 | 0:31 | 0.08 | PS | 0.262 | 5.85 | 7.6 | 6397 | 9574 | 33.8 | 0.3 | 9.47 | Peri. Pump | 5.08 |
| SRK05-SP-5 | 21/09/2016 | Good | 0.981 | 6.869 | 14.685 | 15.6 | 3 | 8:32 | 9:02 | 0:30 | 0.10 | PS | 0 | 5.73 | 2.8 | 6024 | 10447 | 82.1 | 0.09 | 2.81 | Peri. Pump | 5.08 |
| SRK08-SBR2 | 20/09/2016 | Good | 0.84 | 6.749 | 19.102 | 24.7 | 2 | 16:14 | 16:33 | 0:19 | 0.11 | PS | 0.14 | 5.89 | 5.8 | 1508 | 2380 | 86 | 0.98 | 27.7 | Peri. Pump | 5.08 |
| SRK08-SBR3 | 21/09/2016 | Good | 0.985 | 11.615 | 13.245 | 3.26 | 25 | 10:10 | 10:22 | 0:12 | 2.08 | 3WV | 0.005 | 6.76 | 1.4 | 2097 | 3824 | 51.5 | 2.83 | 25.3 | Manual | 5.08 |
| SRK08-SBR4 | 21/09/2016 | Good | 0.7 | 7.315 | 21.383 | 28.1 | 2.5 | 9:18 | 9:53 | 0:35 | 0.07 | PS | 0 | 5.84 | 3.1 | 5163 | 8881 | 93.6 | 0.19 | 1.15 | Peri. Pump | 5.08 |
| SRK08-SP-7A | 20/09/2016 | Good | 1.2 | 2.713 | 17.73 | 30 | 80 | 14:21 | 14:51 | 0:30 | 2.67 | 3WV | 0 | 6.13 | 2.5 | 890 | 1559 | 67 | 1.53 | 59.4 | Manual | 5.08 |
| SRK08-SP-7B | 20/09/2016 | Good | 1.11 | 2.795 | 8.78 | 12 | 4 | 13:52 | 14:17 | 0:25 | 0.16 | PS | 0.017 | 6.44 | 4.5 | 116.2 | 191.2 | 47.9 | 0.37 | 6.47 | Peri. Pump | 5.08 |
| Vangorda/Grum Area | P09-GS1A | 24/09/2016 | Good | 1.29 | 2.875 | 7.38 | 9 | 4.5 | 11:57 | 12:13 | 0:16 | 0.28 | PS | 0 | 6.93 | 9 | 780 | 1124 | 11.8 | 0.18 | 1.86 | Peri. Pump | 5.08 |
| P09-GS1B | 24/09/2016 | Good | 0.96 | 2.559 | 29.645 | 54 | 1.9 | 12:20 | 12:37 | 0:17 | 0.11 | PS | 0.575 | 6.83 | 7.6 | 1014 | 1518 | -47.9 | 0.42 | 8.55 | Peri. Pump | 5.08 |
| P09-LCD1 | 24/09/2016 | Good | 0.92 | 3.783 | 7.346 | 7.1 | 7.05 | 8:34 | 8:55 | 0:21 | 0.34 | PS | 0.07 | 7.13 | 3.3 | 684 | 1170 | -113.6 | 0.31 | 0.57 | Peri. Pump | 5.08 |
| P09-LCD4 2 | 25/09/2016 | Slow recharge | 0.96 | 2.363 | 12.4 | 20.1 | 20 | 9:09 | 10:15 | 1:06 | 0.30 | PDR | 20 | 7.44 | 3.8 | 465.9 | 783.8 | 48.2 | 0.36 | 10.03 | Peri. Pump | 5.08 |
| P09-LCD6 | 24/09/2016 | Good | 0.77 | 5.914 | 7.91 | 4 | 5.4 | 9:53 | 10:15 | 0:22 | 0.25 | PS | 0.036 | 7.23 | 3.5 | 653 | 1107 | -112 | 0.5 | 8.9 | Peri. Pump | 5.08 |
| P2001-02A 2 | 24/09/2016 | Slow recharge | 0.605 | 4.386 | 6.366 | 4 | 4 | 10:56 | 11:32 | 0:36 | 0.11 | PDR | 4.386 | 6.72 | 5.8 | 2490 | 3932 | 67.2 | 0.9 | 27.7 | Peri. Pump | 5.08 |
| P2001-02B 2 | 24/09/2016 | Slow recharge | 0.37 | 4.16 | 27.565 | 46.8 | 59 | 11:10 | 11:53 | 0:43 | 1.37 | PDR | 0.176 | 6.84 | 4.9 | 2331 | 3783 | 96.2 | 4.35 | 17 | Manual | 5.08 |
| P96-9A | 22/09/2016 | Good | 1.01 | 5.941 | 9.419 | 7 | 1.7 | 16:06 | 16:24 | 0:18 | 0.09 | PS | 0.035 | 6.61 | 7.2 | 2130 | 3231 | 179.3 | 1.23 | 2.8 | Peri. Pump | 5.08 |
| SRK05-07 | 22/09/2016 | Good | 0.67 | 5.765 | 6.43 | 1.3 | 3 | 14:25 | 14:47 | 0:22 | 0.14 | PS | 0.085 | 6.91 | 5.1 | 2146 | 3465 | 140.7 | 3.28 | 8.16 | Peri. Pump | 5.08 |
| SRK05-08 | 22/09/2016 | Good | 0.76 | 5.94 | 8.478 | 5.1 | 1.7 | 15:10 | 15:32 | 0:22 | 0.08 | PS | 0.15 | 6.83 | 5.9 | 1816 | 2857 | 171 | 4.71 | 1.03 | Peri. Pump | 5.08 |
| SRK05-9 | 22/09/2016 | Good | 0.52 | 3.016 | 3.896 | 1 | 3 | 17:00 | 17:22 | 0:22 | 0.05 | 3WV | 0.028 | 7.34 | 4.6 | 780 | 1279 | 174.4 | 5.52 | 0.57 | Peri. Pump | 3.81 |
| V34 | 22/09/2016 | Good | 0.52 | 5.725 | 12.036 | 12.6 | 2.55 | 8:25 | 8:53 | 0:28 | 0.09 | PS | 0.502 | 6.8 | 4.3 | 1353 | 2236 | -37.4 | 1.34 | 1.54 | Peri. Pump | 5.08 |
| V35 | 22/09/2016 | Good | 0.48 | 6.626 | 16.003 | 18.8 | 2 | 9:36 | 10:06 | 0:30 | 0.07 | PS | 0.554 | 6.96 | 4.2 | 1556 | 2581 | 147.1 | 1.72 | 22 | Peri. Pump | 5.08 |
| V36 | 22/09/2016 | Good | 0.5 | 8.847 | 11.24 | 4.8 | 15 | 12:50 | 13:02 | 0:12 | 1.25 | 3WV | NR | 6.91 | 4 | 1896 | 3168 | 31.2 | 2.43 | 5.44 | Manual | 5.08 |
| V37 2 | 24/09/2016 | Slow recharge | 0.485 | 8.553 | 14.41 | 11.7 | 12 | 13:54 | 13:59 | 0:05 | 2.40 | PDR | 14.4 | 7.48 | 3.6 | 671 | 1133 | 96.7 | 4.15 | 23.4 | Manual | 5.08 |
| Zone 2 Pit Outwash Area | BH10A | 24/09/2016 | Good | 1.704 | 6.186 | 6.969 | 1.60 | 2 | 14:37 | 14:50 | 0:13 | 0.15 | PS | 0 | 6.39 | 3.5 | 193.3 | 327.7 | 18.1 | 0.91 | 7.08 | Peri. Pump | 5.08 |
| BH10B | 24/09/2016 | Good | 0.899 | 5.356 | 9.228 | 7.70 | 1.5 | 14:59 | 15:12 | 0:13 | 0.09 | PS | 0 | 6.73 | 3.2 | 234.3 | 402 | 36 | 2.09 | 14.9 | Peri. Pump | 5.08 |
| BH8 2 | 25/09/2016 | Slow recharge | 0.811 | 15.658 | 20.795 | 10.30 | 10 | 17:37 | 17:50 | 0:13 | 0.77 | PDR | 10 | 3.59 | 4.2 | 2360 | 3913 | 199.2 | 4.77 | 49.4 | Manual | 5.08 |
| CH14-107-MW001 | 24/09/2016 | Good | 0.845 | 2.729 | 13.689 | 88.70 | 2 | 16:29 | 16:44 | 0:15 | 0.13 | PS | 0 | 5.34 | 4.1 | 601 | 1007 | 115.5 | 0.12 | 21.4 | Peri. Pump | 10.16 |
| CH14-107-MW002 | 24/09/2016 | Good | 0.989 | 2.162 | 11.555 | 76.00 | 1.5 | 15:57 | 16:08 | 0:11 | 0.14 | PS | 0 | 5.54 | 3.9 | 376.8 | 630.3 | 102.1 | 2.59 | 2.6 | Peri. Pump | 10.16 |
| P05-04 | 24/09/2016 | Good | 0.679 | 3.111 | 7.107 | 7.9 | 1.5 | 15:25 | 15:40 | 0:15 | 0.10 | PS | 0.002 | 6.08 | 3.5 | 263.5 | 448.1 | 59.1 | 0.05 | 0.52 | Peri. Pump | 5.08 |

**Notes:**

NR = Not recorded in the field due to equipment errors, NR\* = Not recorded due to limiting diameter of well casing, or risk of equipment damage

‘-‘ = Not Applicable.

1 3WV = Three Well Volumes, PS=Parameters Stable, DS=Direct Sampled, PDR=Purge Dry & Return

2 Groundwater well had a slow recharge rate, and was therefore purged dry and sampled the following day.

3 AU= Attenuation Units. This alternate unit of measure is reported by the turbidity meter in cases of turbidity >500. They are comparable to NTU, but are measured using transmitted rather than scattered light.

4 Well P01-02B was showing artesian characteristics in that water was flowing from the casing. Accordingly, depth to groundwater was recorded as being zero.

## Analytical Results

Analytical results, including a brief summary of CCME FAL guideline exceedances and factors which may have influenced data precision, are provided below. In some instances the reportable detection limits (RDL) exceeded applicable CCME FAL standards (values shaded in light grey in **Table 3-1**). This occurs when samples with high levels of some elements or compounds require dilution in order for the lab to properly analyse the sample. Accordingly, the laboratory detection limit must then be increased. For the purpose of this report, results that are reported below the RDL, but also have an adjusted RDL that is higher than the applicable guideline, have not been reported as CCME FAL exceedances.

### Cross Valley Dam

Groundwater wells located in the Cross Valley Dam (CVD) area were sampled on September 23, 2016. Samples were obtained from all fifteen (15) of the wells within this area identified for the sampling event. Groundwater well P01-02B was found to be partially obstructed by an unidentified object during the June 2016 sampling event (Hemmera, 2016). This blockage was investigated during the September 2016 sampling event using a down-well camera. The only obstruction visible during this investigation was a breakage in the well casing located near ground level. This well was also exhibiting artesian qualities, and accordingly the depth to water was recorded as being zero. Groundwater was observed flowing up from of the well casing and leaking from the breakage found at ground level. This damage did not prevent sampling of the well but may have reduced the quality of other samples collected at this location (namely well P01-02A that is adjacent). In addition to the damage identified at groundwater well P01-02B, site P01-02A was also observed to have a breakage in the well casing just above ground level. Damage to both these wells is likely the result of a truck or heavy object leaning or pushing against the well stick-up.

Concentrations of dissolved aluminum, arsenic, cadmium, iron, lead, and zinc in groundwater exceeded the CCME FAL guidelines in one (1) or more samples collected in the CVD area. Field dissolved oxygen concentrations were below the CCME FAL minimum guideline concentration for all measurements collected in this area. Field and/or laboratory groundwater pH was below the CCME FAL guideline range in seven (7) of the fifteen (15) wells. Observed specific guideline exceedences are provided in **Table 3-4**, as well as noted in **Table 3-1**. Groundwater turbidity of all CVD samples was less than 50 NTU.

Table 3-4 CCME FAL Exceedences for Wells in Cross Valley Dam Area During September 2016

| **Station** | **CCME FAL Exceedences in September 2016** |
| --- | --- |
| P01-02A | Field Dissolved Oxygen (DO) |
| P01-02B | DO, dissolved Iron (Fe-D) |
| P01-11 | Field pH (pH-F), DO, dissolved Arsenic (As-D), Fe-D |
| P03-09-02 | DO, Fe-D |
| P03-09-04 | DO, dissolved Cadmium (Cd-D) |
| P03-09-6 | DO, Cd-D |
| P03-09-08 | DO, Cd-D |
| P03-09-9 | DO, Cd-D |
| P05-01-01 | pH-F, DO, dissolved Aluminum (Al-D), Fe-D, dissolved Lead (Pb-D) |
| P05-01-02 | pH-F, DO, Fe-D |
| P05-01-03 | Lab pH (pH-L), pH-F, DO, Fe-D |
| P05-01-04 | pH-L, pH-F, DO, Fe-D |
| P05-01-05 | pH-F, DO, Al-D, As-D, Cd-D, Fe-D, Pb-D |
| P05-02 | pH-F, DO, Al-D, Fe-D, dissolved Zinc (Zn-D) |
| P05-03 | DO, Cd-D, Fe-D |

### Down Gradient of Cross Valley Dam

Groundwater wells located down gradient of the CVD area were sampled between September 22 and September 23, 2016. Samples were obtained from all ten (10) wells within this area identified for the sampling event.

Concentrations of dissolved arsenic, cadmium, iron, and selenium in groundwater exceeded the CCME FAL guidelines in one (1) or more samples collected down gradient of the CVD area. Field dissolved oxygen concentrations were below the CCME FAL minimum guideline concentration for all measurements collected in this area. Observed specific guideline exceendences are provided in **Table 3-5** as noted in **Table 3-1**. Groundwater was extremely turbid at site X16B (96.4 NTU) and site X17B (483 NTU) during the time of sampling. Groundwater turbidity of all other collected samples down gradient of the CVD area was less than 50 NTU.

Table 3-5 CCME FAL Exceedences for Wells Down Gradient of the Cross Valley Dam During September 2016

|  |  |
| --- | --- |
| **Station** | **CCME FAL Exceedences in September 2016** |
| CH14107MW006A | DO, dissolved Selenium (Se-D) |
| CH14107MW006B | DO, Se-D |
| P01-01A | DO, Cd-D |
| P01-01B | DO, Fe-D |
| X16A | DO, Se-D |
| X16B | DO, Se-D |
| X17A | DO |
| X17B | DO, Fe-D |
| X18A | DO, As-D, Fe-D |
| X18B | DO |

### Emergency Tailings Area

Groundwater wells located in the Emergency Tailings Area (ETA) were sampled between September 22 and September 23, 2016. Samples were obtained from all six (6) wells in this area identified for the sampling event.

Concentrations of dissolved aluminum, arsenic, cadmium, copper, iron, lead, nickel, thallium, uranium, and zinc in groundwater exceeded the CCME FAL guidelines in one (1) or more samples collected in the ETA. Field dissolved oxygen concentrations were below the CCME FAL minimum guideline concentration for all measurements collected in this area. Field and/or laboratory groundwater pH was below the CCME FAL guideline range in five (5) of the six (6) wells. Observed specific guideline exceedences are provided in **Table 3-6** as noted in **Table 3-1**. Groundwater turbidity in all samples within this area was less than 50 NTU.

Table 3-6 CCME FAL Exceedences for Eells in the Emergency Tailings Area During September 2016

|  |  |
| --- | --- |
| **Station** | **CCME FAL Exceedences in September 2016** |
| P09-ETA-2 | pH-L, pH-F, DO, Al-D, As-D, Fe-D, dissolved Nickel (Ni-D), Zn-D |
| P96-8A | pH-L, pH-F, DO, AL-D, Cd-D, dissolved Copper (Cu-D), Fe-D, Pb-D, Ni-D, dissolved Thallium (Tl-D), dissolved Uranium (U-D), Zn-D |
| P96-8B | pH-L, pH-F, DO, Al-D, Cd-D, Fe-D, Pb-D, Ni-D, Tl-D, Zn-D |
| SRK04-3A | pH-L, pH-F, DO, Al-D, As-D, Cd-D, Fe-D, Pb-D, Ni-D, Zn-D |
| SRK05-ETA-BR1 | pH-L, pH-F, DO, Al-D, As-D, Cd-D, Fe-D, Pb-D, Ni-D, Zn-D |
| SRK05-ETA-BR2 | DO, Fe-D, Zn-D |

### Intermediate Dam

Groundwater wells located within the intermediate dam area were sampled on September 22, 2016. Samples were collected from five (5) of the six (6) wells within this area identified for the sampling event. Groundwater well P01-04B was found frozen during the time of sampling.

Concentrations of dissolved cadmium, iron, nickel, silver, and zinc in groundwater exceeded the CCME FAL guidelines in one (1) or more samples collected within the intermediate dam area. Field and/or laboratory groundwater pH in the intermediate dam area was outside the CCME FAL guideline range in two (2) of the six (6) samples. Dissolved oxygen concentrations were below the CCME FAL minimum guideline concentration for all measurements collected in this area. Observed specific guideline exceedences are provided in **Table 3-7** as noted in **Table 3-1**.

Table 3-7 CCME FAL Exceedences for Wells in the Intermediate Dam Area During September 2016

|  |  |
| --- | --- |
| **Station** | **CCME FAL Exceedences in September 2016** |
| P01-03 | pH-L, pH-F, DO, Cd-D, Fe-D, Ni-D, Zn-D |
| P01-04A | DO, Fe-D, dissolved Silver (Ag-D) |
| X24-96D | pH-L, pH-F, DO, Cd-D, Fe-D, Ni-D, Zn-D |
| X25-96A | DO, Fe-D |
| X25-96B | DO, Fe-D |

Groundwater turbidity in all samples within this area was less than 50 NTU.

### Northeast Waste Rock Dump

Groundwater wells located within the northeast waste rock dump area were sampled between September 24 and September 25, 2016. Samples were collected from all seven (7) wells within this area identified for the sampling event.

Concentrations of dissolved cadmium, lead, nickel, selenium, uranium, and zinc in groundwater exceeded the CCME FAL guidelines in one (1) or more samples collected within the northeast waste rock dump area. Field dissolved oxygen concentrations were less than the CCME FAL guideline level for all measurements collected in this area. Observed specific guideline exceedences are provided in **Table 3-8** as noted in **Table 3-1**. Groundwater turbidity in all samples within this area was less than 50 NTU.

Table 3-8 CCME FAL Exceedences for Wells in the Northeast Waste Rock Dump Area During September 2016

|  |  |
| --- | --- |
| **Station** | **CCME FAL Exceedences in September 2016** |
| BH14A | DO, Cd-D, Ni-D, U-D, Zn-D |
| BH14B | DO, Pb-D, U-D, Zn-D |
| CH15107MW029 | DO, Cd-D, Se-D, Zn-D |
| CH15107MW030 | DO, Se-D, Zn-D |
| CH15107MW032 | DO, U-D |
| CH15107MW033 | DO, Cd-D, Se-D, Zn-D |
| CH15107MW034 | DO, Se-D |

### Second Impoundment

Groundwater wells located within the second impoundment area were sampled between September 21 and September 24, 2016. Samples were collected from all eleven (11) wells within this area identified for the sampling event.

Concentrations of dissolved aluminum, arsenic, cadmium, copper, iron, lead, nickel, uranium, and zinc in groundwater exceeded the CCME FAL guidelines in one (1) or more samples collected within the second impoundment area. Field dissolved oxygen concentrations were less than the CCME FAL guideline level for all measurements collected in this area. Field and/or laboratory groundwater pH was below the CCME FAL guideline range in ten (10) of the eleven (11) wells sampled. Observed specific guideline exceedences are provided in **Table 3-9** as noted in **Table 3-1**. Groundwater was extremely turbid at site P03-04-04 (714 NTU), P03-05-05 (1910 AU), P03-06-2 (2055 AU), and P03-06-05 (1866 AU) during the time of sampling. Groundwater turbidity of all other collected samples second impoundment area was less than 50 NTU.

Table 3-9 CCME FAL Exceedences for Wells in the Second Impoundment Area During September 2016

|  |  |
| --- | --- |
| **Station** | **CCME FAL Exceedences in September 2016** |
| P03-04-02 | pH-F, DO, Fe-D, Zn-D |
| P03-04-04 | DO, As-D, Fe-D |
| P03-04-06 | pH-L, pH-F, DO, As-D, Fe-D, Zn-D |
| P03-05-02 | pH-L, pH-F, DO, Al-D, As-D, Cd-D, Fe-D, Ni-D, Zn-D |
| P03-05-4 | pH-L, pH-F, DO, Al-D, Cd-D, Fe-D, Ni-D, Zn-D |
| P03-05-05 | pH-L, pH-F, DO, Al-D, As-D, Cd-D, Fe-D, Ni-D, Zn-D |
| P03-06-1 | pH-L, pH-F, DO, Al-D, Cd-D, Cu-D, Fe-D, Pb-D, Ni-D, Zn-D |
| P03-06-2 | pH-L, pH-F, DO, Al-D, Cd-D, Cu-D, Fe-D, Pb-D, Ni-D, Zn-D |
| P03-06-03 | pH-L, pH-F, DO, Al-D, Cd-D, Fe-D, Ni-D, Zn-D |
| P03-06-04 | pH-L, pH-F, DO, Al-D, Cd-D, Fe-D, U-D, Zn-D |
| P03-06-05 | pH-L, pH-F, DO, Al-D, Cd-D, Fe-D, Ni-D, Zn-D |

### S-Wells Area

Groundwater wells located in the S-Wells area were sampled between September 20 and September 21, 2016. Samples were collected from twenty-six (26) of the twenty-seven (27) wells in this area identified for the sampling event. Groundwater well S3 was not located in the field and is presumed to have been destroyed, potentially by road maintenance or general construction activities in the area.

Concentrations of dissolved aluminum, arsenic, cadmium, copper, iron, nickel, selenium, uranium, and zinc in groundwater exceeded the CCME FAL guidelines in one (1) or more samples collected from the S-Wells area. Field and/or laboratory groundwater pH in the S-Wells area was below the CCME FAL guideline range in twenty (20) of the twenty-six (26) samples collected. Field dissolved oxygen concentrations were below the CCME FAL minimum guideline concentration for twenty-four (24) of twenty-six (26) samples collected in this area. Observed specific guideline exceedences are provided in **Table** **3-10** as noted in **Table 3-1**. Groundwater was found to be turbid at sites CH15107MW023 (54 NTU), S2A (129 NTU), and SRK08-SP-7A (59.4 NTU) during the time of sampling. Groundwater turbidity of all other collected samples in the S-Wells area was less than 50 NTU.

Table 3-10 CCME FAL Exceedences for Wells in the S-Wells Area during September 2016

| **Station** | **CCME FAL Exceedences in September 2016** |
| --- | --- |
| CH14107MW007A | pH-L, pH-F, DO, Al-D, As-D, Cd-D, Fe-D, Ni-D, Zn-D |
| CH14107MW007B | pH-F, DO, Al-D, As-D, Fe-D, Zn-D |
| CH14107MW009 | pH-L, pH-F, DO, Al-D, Fe-D, Zn-D |
| CH14107MW010 | pH-L, pH-F, DO, Al-D, As-D, Fe-D, Zn-D |
| CH15107MW019 | pH-F, DO, Al-D, As-D, Fe-D, Zn-D |
| CH15107MW022 | pH-F, DO, Fe-D, Zn-D |
| CH15107MW023 | DO, As-D, Fe-D, Zn-D |
| CH15107MW025 | Fe-D, U-D, Zn-D |
| P09-SIS1 | pH-F, DO, Al-D, Cd-D, Cu-D, Fe-D, Ni-D, Zn-D |
| P09-SIS2 | pH-L, pH-F, DO, Al-D, Cd-D, Fe-D, Ni-D, Zn-D |
| P09-SIS3 | pH-F, DO, Al-D, Cd-D, Cu-D, Ni-D, Zn-D |
| P09-SIS4  | pH-F, DO, Cd-D, Cu-D, Ni-D, U-D, Zn-D |
| P09-SIS6 | DO, Cd-D, Fe-D, Zn-D |
| P96-7 | U-D |
| S1A | pH-F, DO, Al-D, Cd-D, Fe-D, Zn-D |
| S1B | DO |
| S2A | pH-L, pH-F, DO, Al-D, Cd-D, Fe-D, Zn-D |
| S2B | pH-L, pH-F, DO, Cd-D, Fe-D, Ni-D, Zn-D |
| SRK05-SP-4A | pH-L, pH-F, DO, Al-D, Cd-D, Fe-D, Zn-D |
| SRK05-SP-4B | pH-F, DO, Al-D, Cd-D, Fe-D, Ni-D, Zn-D |
| SRK05-SP-5 | pH-L, DO, Al-D, Cd-D, Fe-D, Ni-D, Zn-D |
| SRK08-SBR2 | pH-F, DO, Al-D, Cd-D, Cu-D, Fe-D, Ni-D, Zn-D |
| SRK08-SBR3 | DO, Se-D, U-D, Zn-D |
| SRK08-SBR4 | pH-F, DO, Al-D, Cd-D, Cu-D, Fe-D, Ni-D, Zn-D |
| SRK08-SP-7A | pH-F, DO, As-D, Fe-D, Zn-D |
| SRK08-SP-7B | pH-F, DO, Al-D, Fe-D, Zn-D |

### Vangorda/Grum Area

Groundwater wells located in the Vangorda/Grum area were sampled between September 22 and September 25, 2016. Samples were collected from all fifteen (15) wells in this area identified for the sampling event.

Concentrations of dissolved arsenic, cadmium, copper, iron, lead, selenium, thallium, uranium, and zinc in groundwater exceeded the CCME FAL guidelines in one (1) or more samples collected from the Vangorda/Grum area. Field dissolved oxygen concentrations were below the CCME FAL minimum guideline concentration for all measurements collected in this area. Observed specific guideline exceedences are provided in **Table 3-11** as noted in **Table 3-1**. Groundwater turbidity in all samples within this area was less than 50 NTU.

Table 3-11 CCME FAL Exceedences for Wells in the Vangorda/Grum Area During September 2016

| **Station** | **CCME FAL Exceedences in September 2016** |
| --- | --- |
| P09-GS1A: | DO, As-D, Cd-D, Fe-D, Pb-D, Tl-D, Zn-D |
| P09-GS1B: | DO, As-D, Fe-D, Zn-D |
| P09-LCD1: | DO, As-D, Fe-D, Pb-D |
| P09-LCD4: | DO, Cu-D |
| P09-LCD6: | DO, As-D, Fe-D, Pb-D |
| P2001-02A: | DO, Fe-D, U-D |
| P2001-02B: | DO, Fe-D, U-D |
| P96-9A: | DO, Cd-D, U-D, Zn-D |
| SRK05-07: | DO, U-D |
| SRK05-08: | DO, U-D |
| SRK05-9: | DO, Zn-D |
| V34: | DO, Fe-D, U-D |
| V35: | DO, Se-D, U-D |
| V36: | DO, Fe-D, U-D, Zn-D |
| V37: | DO |

### Zone 2 Pit Outwash

Groundwater wells located in the Zone 2 Pit outwash area were sampled between September 24 and September 25, 2016. Samples were collected from all six (6) wells in this area identified for the sampling event.

Concentrations of dissolved aluminum, arsenic, cadmium, copper, iron, lead, nickel, thallium, uranium, and zinc in groundwater exceeded the CCME FAL guidelines in one (1) or more samples collected from the Zone 2 Pit outwash area. Field and/or laboratory groundwater pH in the Zone 2 Pit outwash area was below the CCME FAL guideline range in five (5) of the six (6) samples collected. Field dissolved oxygen concentrations were below the CCME FAL minimum guideline concentration for all measurements collected in this area. Observed specific guideline exceedences are provided in **Table 3-12** as noted in **Table 3-1**. Groundwater turbidity in all samples within this area was less than 50 NTU.

Table 3-12 CCME FAL Exceedences for Wells in the Zone 2 Pit Outwash Area During September 2016

|  |  |
| --- | --- |
| **Station** | **CCME FAL Exceedences in September 2016** |
| BH10A: | pH-F, DO, Cd-D, Zn-D |
| BH10B: | DO, Cd-D, Zn-D |
| BH8: | pH-L, pH-F, DO, Al-D, As-D, Cd-D, Cu-D, Fe-D, Pb-D, Ni-D, Tl-D, U-D, Zn-D |
| CH14107MW001: | pH-L, pH-F, DO, Al-D, Fe-D, Zn-D |
| CH14107MW002: | pH-L, pH-F, DO, Al-D, Cd-D, Fe-D, Zn-D |
| P05-04: | pH-F, DO, Al-D, Cd-D, Zn-D |

## Quality Assurance and Quality Control Results

Eleven (11) duplicate groundwater samples were collected during the September 2016 sampling event. One (1) travel blank was provided by the laboratory and accompanied the samples throughout the program. Five (5) field blanks were prepared during the sampling program between September 20 and September 24, 2016. The detailed results of the QA/QC sampling program are provided in **Table 3-2**, including RPD values for all duplicate and sample pairs collected.

### Field and Travel Blanks

All field blank and travel blank analytical results were reported less than the Reportable Detection Limit (RDL) with exception of acidity as CaCO2, which was detected in four (4) field blanks, as well as the laboratory supplied travel blank. In all cases acidity was measured only slightly above the RDL (<1.0 mg/L), with results ranging between 1.0 mg/L and 1.6 mg/L (**Table 3-2**). The program analytical supplier (ALS Global) has indicated that this occurs periodically through the absorption of carbon dioxide into deionized water, and that it should not be considered as a form of contamination at the field or laboratory level.

All other travel blank and field blank analytical results were reported as less than the RDL.

### Field Duplicates

#### DUP1 / CH14-107-MW007B

The RPD values for all corresponding pairs of results between DUP1 and CH14-107-MW007B were within the 20% QA/QC threshold, indicating that sampling variation was within acceptable limits (**Table 3-2**).

#### DUP2 / SRK08-SBR2

The RPD value for acidity (58.76%) between DUP2 and SRK08-SBR2 was outside the acceptable range of variability (<20%). Field notes and measurements do not identify any potential source of contamination or suggest variability in groundwater quality during the purging process (**Table 3-3**). All other analytical results for this duplicate pair were within the 20% RPD threshold limit (**Table 3-2**).

#### DUP3 / P01-03

The RPD value for TSS (41.36%) between DUP3 and P01-03 was outside the acceptable range of variability (<20%). Field notes and measurements do not identify any potential source of contamination or suggest variability in groundwater quality during the purging process (**Table 3-3**). All other analytical results for this duplicate pair were within the 20% RPD threshold limit (**Table 3-2**).

#### DUP4 / V36

The RPD values for all corresponding pairs of results between DUP4 and V36 were within the 20% QA/QC threshold, indicating that sampling variation was within acceptable limits (**Table 3-2**).

#### DUP5 / P01-01A

The RPD values for all corresponding pairs of results between DUP5 and P01-01A were within the 20% QA/QC threshold, indicating that sampling variation was within acceptable limits (**Table 3-2**).

#### DUP6 / P05-02

The RPD value for TSS (40.00%) between DUP6 and P05-02 was outside the acceptable range of variability (<20%). Field notes and measurements do not identify any potential source of contamination or suggest variability in groundwater quality during the purging process (**Table 3-3**). All other analytical results for this duplicate pair were within the 20% RPD threshold limit (**Table 3-2**).

#### DUP7 / P09-LCD1

The RPD value for acidity (68.38%) between DUP7 and P09-LCD1 was outside the acceptable range of variability (<20%). Field notes and measurements do not identify any potential source of contamination or suggest variability in groundwater quality during the purging process (**Table 3-3**). All other analytical results for this duplicate pair were within the 20% RPD threshold limit (**Table 3-2**).

#### DUP8 / BH10A

The RPD value for acidity (57.03%) between DUP8 and BH10A was outside the acceptable range of variability (<20%). Field notes and measurements do not identify any potential source of contamination or suggest variability in groundwater quality during the purging process (**Table 3-3**). All other analytical results for this duplicate pair were within the 20% RPD threshold limit (**Table 3-2**).

#### DUP9 / CH15-107-MW034

The RPD value for acidity (45.26%) between DUP9 and CH15-107-MW034 was outside the acceptable range of variability (<20%). Field notes and measurements do not identify any potential source of contamination or suggest variability in groundwater quality during the purging process (**Table 3-3**). All other analytical results for this duplicate pair were within the 20% RPD threshold limit (**Table 3-2**).

#### DUP10 / CH14-107-MW002

The RPD value for acidity (33.30%) between DUP10 and CH14-107-MW002 was outside the acceptable range of variability (<20%). Field notes and measurements do not identify any potential source of contamination or suggest variability in groundwater quality during the purging process (**Table 3-3**). All other analytical results for this duplicate pair were within the 20% RPD threshold limit (**Table 3-2**).

#### DUP11 / BH14A

The RPD value for dissolved lead (115.71%) between DUP11 and BH14A was outside the acceptable range of variability (<20%). Field notes and measurements do not identify any potential source of contamination or suggest variability in groundwater quality during the purging process (**Table 3-3**). All other analytical results for this duplicate pair were within the 20% RPD threshold limit (**Table 3-2**).

### Quality Assurance and Quality Control Summary

Results for the QA/QC analytical program did not show evidence of sample contamination, and show only minor variability during the field collection and laboratory analytical processes. Overall, amongst the five (5) field blanks, analytical results show no detections related to contamination. Results from the one (1) travel blank that accompanied the samples throughout the program also show no detections related to contamination. This suggests that no contamination occurred during field collection or sample transportation.

Duplicate and duplicate pair analytical results demonstrated several isolated cases of variability in acidity and total suspended solids (TSS), as well as a single duplicate pair showing significant variability in dissolved lead concentrations. Overall, amongst eleven (11) duplicate sample pairs, cases of RPD exceedances occurred in five (5) for acidity, two (2) for TSS, and one (1) for dissolved lead. The isolated and large variance in the dissolved lead result at BH14A cannot be readily explained, and analytical data have been confirmed, however this was the only observed occurrence of unacceptable variance.

Analytical and spatial data (well locations) were reviewed for 2015 and 2016 June and September sampling programs to determine whether any spatial and/or temporal trends in the elevated RPD values could be observed for acidity and TSS.

#### Spatial trends

The elevated RPD values observed for samples analyzed for acidity appear in a few different areas at the mine site, with nearly all of them being disturbed areas (previously mined and/or having mine infrastructure). Sample variation is considered to be the likely cause of the high RPD values when comparing acidity values in the samples and duplicate samples. The acidity parameter is analyzed from the general parameter bottle set which is unfiltered and not preserved. Sampling methods using unfiltered methods can introduce sediment into the sample, if the sediment is acid-generating the inclusion of the solid phase can bias the result.

The majority of samples where elevated RPD values were observed for TSS were also located in disturbed area (previously mined and/or having mine infrastructure). These activities can change soil makeup, creating areas with larger voids in the soil columns where samples are collected, compared with areas of undisturbed soil. This could lead to variability in TSS values.

#### Temporal Trends

Occurrences of elevated RPD values for samples analyzed for acidity and TSS were observed to be consistent among the sampling events reviewed, although the frequency of TSS RPD exceedences was lower. There were no temporal trends identified.

Overall, the variances are not assumed to constitute systematic differences amongst various parameters.

# Recommendations

Hemmera/ELR prepared the following recommendations based on the observations and results of the September 2016 groundwater sampling program.

1. Wells that produce consistently turbid groundwater could be re-developed in an attempt to collect more representative samples.

Groundwater was found to be extremely turbid at sites X16B (96.4 NTU), X17B (483 NTU), P03-04-04 (714 NTU), P03-05-05 (1910 AU), P03-06-2 (2055 AU), P03-06-05 (1866 AU), S2A (129 NTU) and SRK08-SP-7A (59.4 NTU) during the time of sampling. Although re-development may improve sample quality at each of these locations, groundwater wells located at certain depths in the second impoundment area may always remain turbid due to the presence of tailings material.

1. Attempts could be made to repair groundwater wells P01-02A and P01-02B, however both can currently be sampled properly. For both wells a repair would include exposing the PVC, removing the well casing below the damaged area, adding a new coupler, and replacing the existing stick-up. Due to the elevated water level in P01-02B, this may prove challenging depending on the actual static water level or artesian head found at this location.

# Closure

We have appreciated the opportunity of working with you on this project and trust that this report is satisfactory to your requirements. Please feel free to contact the undersigned regarding any questions or further information that you may require.

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TABLES

Appendix A

Site Photos

Appendix B

Field Forms

Appendix C

Laboratory Analytical Reports

Appendix D

Response to Comments Received on Draft Report