



2012 Waste Rock, Ore and Quarry Monitoring Report

Prepared for

Hope Bay Mining Ltd.



Prepared by



SRK Consulting (Canada) Inc.
1CH008.057
January 2013

Hope Bay Project

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1 Introduction

Development of the Hope Bay mining project has resulted in the development of quarries, use of quarry rock for construction of roads, pads and other infrastructure, and production of waste rock from the underground mine. Monitoring plans are in place to confirm the potential for acid rock drainage and metal leaching (ARD/ML) from quarry rock and waste rock and to monitor the chemistry of seepage and runoff associated with these materials.

This report presents results from the 2012 quarry and waste rock monitoring programs. The report is organized as follows:

- A summary of the monitoring requirements as presented in the “Doris North Gold Mine Monitoring and Follow-Up Plan” (HBML 2011) is provided in Section 2.
- Results of the geochemical inspections and monitoring of quarry rock solids are summarized in Section 3.
- Results of the geological inspections and monitoring of underground waste rock and ore are summarized in Section 4.
- Results of the seepage surveys around infrastructure areas and downgradient of the waste rock pile are provided in Section 5.
- Detailed technical memorandum on each of these subjects are provided in Appendices A, B and C.

2 Monitoring Requirements

2.1 Quarry Rock

Details on the monitoring program used for quarries and quarry rock along the Doris Windy Road are provided in “*Hope Bay Project Quarry A, B & D Management and Monitoring Plan - Revision 01*” (SRK 2010a). For consistency, those procedures are also used for quarries in the Doris North area. A summary of the requirements is provided as follows (HBML 2011):

- Visual inspections and sampling at the quarry face by site geologist when the quarries are in active use;
- Collection and testing of two samples per year from each active quarry for total sulphur analysis, and, if the sulphur content exceeds 0.1%, the samples would be subjected to full acid base accounting (ABA) tests. A subset of samples will be subjected to shake flask extraction tests. The ABA tests would be done on the whole sample and on the -2mm size fraction to determine whether there is any concentration of sulphides in the fine component of the rock;
- Quarry sumps will be monitored as described under the routine site water quality monitoring program;
- After construction, the mined out quarries, and any roads and other infrastructure components that were constructed using the quarry or waste rock since the previous inspection, will be inspected by a qualified geologist or geochemist to verify that the rock used in construction was suitable for that purpose. During the inspection, samples will be collected for total sulphur analysis. If the sulphur content exceeds 0.1%, the samples will be subjected to full ABA tests. A subset of samples will be subjected to shake flask extraction tests. Where possible, the testing would be done on the whole sample and on the -2mm size fraction to determine whether there is any concentration of sulphides in the fine component of the rock;
- A seep survey will be conducted around all infrastructure components that have been constructed or modified within the previous 3 years, and in the mined out quarries. Field pH, electrical conductivity (EC), Eh, and temperature readings will be collected. A minimum of 10% of the samples will be submitted for laboratory analyses, as detailed in the Quarry A, B and D Management and monitoring Plan (SRK 2010a). The seep survey will include all of the rock drains. Reference stations will also be established to provide basis for comparing this to waters that are not influenced by the development activities; and
- An annual quarry monitoring report, including the results and an interpretation of the geochemical data will be prepared and submitted to the NWB by March 31 of the year following sample collection (i.e. within 6 months of collecting the final quarry samples).

2.2 Underground Waste Rock

Monitoring plans for the waste rock are provided in the “*Doris North Waste Rock and Ore Management Plan*” (SRK 2010b). The program includes inspection and geochemical monitoring of the waste rock solids, routine monitoring of the pollution collection pond, and annual seepage surveys along the downgradient side of the waste rock storage area.

A summary of the requirements is provided as follows:

- Daily visual inspection of the working face and muck pile by a field geologist to confirm rock types, mineralogical characteristics, and to classify the rock as mineralized or non-mineralized;
- Sampling and testing of the underground waste rock, including ABA on a minimum of one sample per 5000 tonnes of rock, with additional analysis of total sulphur and TIC on some rock units (SRK 2010b), and shake flask extraction tests on one sample per 50,000 tonnes of rock;
- Monitoring and recording the volumes of waste rock mined and placed in the mineralized and non-mineralized areas of the waste rock stockpile, and any non-mineralized waste rock that is removed for use in construction (pending approval);
- Regular water quality monitoring will be carried out at a surveillance monitoring station ST-2 located in the pollution control pond;
- Annual inspections by a qualified geochemist of the designated non-mineralized areas of the waste rock pile to confirm that there are no areas with elevated amounts of sulphide mineralization, and inspections of the designated mineralized areas of the pile to look for signs of weathering and oxidation of the sulphides;
- Seep surveys along the down-gradient toe of the waste rock pile and below the pollution control ponds and access road throughout operations and for at least 2 years following mining and backfilling activities. The seep survey will be completed at the same time and will follow the same procedures as used for the seep survey around other infrastructure areas. However, given the increased importance of obtaining samples from this area, all distinct seeps in the immediate vicinity of the waste rock pile (i.e. any seeps spaced more than 50 metres apart) will be tested for a full suite of laboratory parameters;
- Any non-mineralized waste rock in construction will also be inspected and sampled after construction is complete. The inspection and sampling protocols will be the same as those established for the quarry rock. The sampling density would be one sample per 10,000 tonnes of rock; and
- An annual quarry monitoring report, including the results and an interpretation of the geochemical data, will be prepared and submitted to the NWB by March 31 of the year following sample collection (i.e. within 6 months of collecting the final quarry samples).

3 Monitoring of Quarry Rock Geochemistry

3.1 Sampling and Testing Program

Details of the 2012 Quarry Rock Geochemistry Program are presented in Appendix A.

Two samples (split into various size fractions) were collected from Quarry 2, and sixteen rock samples were collected from infrastructure components in the Doris North area, Tail Lake Dam, the airstrip, the upper berm in Doris Camp, and new construction at Roberts Bay.

Samples were submitted to ALS Chemex for total sulphur and total inorganic carbon analysis by Leco. All of the infrastructure samples were submitted to Maxxam Laboratories for full acid base accounting (ABA) analysis, in addition, five of the samples were submitted to Maxxam for shake flask extraction (SFE) tests and elemental analysis by ICP-MS following aqua regia digestion.

3.2 Results

3.2.1 Quarry 2 Monitoring

The majority of the rock from Quarry 2 has been classified as mafic basalt. This material has been thoroughly characterized through previous investigations and monitoring programs and has been classified as not potentially acid generating (non-PAG) due to its consistently low sulphide content and high neutralization potential. The 2012 samples also showed that the basalt had a low sulphide content and was classified as non-PAG. Trace element concentrations were below screening criteria based on ten times the typical crustal abundance for basaltic rocks (Price 1997).

3.2.2 Doris North Area Monitoring

Sixteen quarry rock samples from the Doris North area were submitted for laboratory testing. Results indicate all samples are non-PAG. Elemental analysis results were screened for anomalously high parameters through comparison to ten times average crustal abundances of basaltic rocks (Price 1997), and none of the parameters exceeded these criteria.

Five of the Doris North Area samples were submitted for shake flask extraction analysis. All of the SFE results indicated alkaline pH values (8.2 to 9.4). Sulphate concentrations were low ranging from 3.1 to 14 mg/L indicating little oxidation had occurred in the rocks. Comparison of these results to a screening criteria based on ten times the CCME water quality guidelines for the protection of aquatic life (CCME 2007) indicated no exceedances.

4 Monitoring of Waste Rock Geochemistry

4.1 Sampling and Testing Program

Details of the 2012 Doris North Underground Waste Rock Monitoring Program are presented in Appendix B.

Waste Rock Stockpile

The waste rock stockpile was visually inspected by SRK. The objective of the inspection was to confirm that waste rock was segregated according to the management plan. No samples of rock were collected as this was outside the scope of the inspection.

Ore Stockpile

The ore stockpiles were visually inspected by walking around the periphery of the pad area. In June 2012, samples were collected from a total of 10 sites on the ore stockpile. Samples were collected and visually described by SRK.

All of the samples were shipped to ALS Labs (ALS) in Yellowknife, NWT and Maxxam Analytics in Burnaby, BC for geochemical analysis and the <2 mm sample was retained for contact tests. Three samples were selected for SFE tests at Maxxam.

4.2 Results

The waste rock stockpiled from the Doris North underground mine was inspected with the objective of auditing the operational segregation program. The following was observed:

- Mineralized waste, defined by visual sulphide content, is situated in the southeast quadrant of the pile. Sulphide content in material from other areas of the stockpile was negligible to rare (<0.5%).
- Rock types observed in the stockpile included metavolcanics, diabase and altered / hornfelsed metavolcanics.

Ten samples were obtained from the ore material stockpiled from the Doris North underground mine. The objective of the sampling program was to assess the acid rock drainage and metal leaching potential of the stockpiled material in support of closure planning. The following summarizes the finding of the program:

- The geological composition of the ore was primarily metavolcanics with quartz veining. Visual sulphide content ranged from trace to 3% and mineral habit occurred as granules, small veinlets, disseminations on fracture surfaces and in fine grained clusters.
- Total sulphur levels, which are representative of sulphide content, ranged from 0.2 to 0.8%, with median levels of 0.5%.
- The 25th to 75th percentile levels of TIC and modified Sobek NP were 52 to 132 kg CaCO₃/t. For levels of modified Sobek NP greater than 100 kg CaCO₃/t, levels of TIC were higher

than NP, suggesting the presence of iron carbonates. As a result, Modified NP levels are considered more conservative in the classification of ARD assessment for the ore stockpile samples.

- On the basis of ratios of NP to AP, the majority of the samples were classified as non-PAG, with two samples classified as uncertain.

Shake flask extractions on three samples indicated that the resulting leachate of the samples were alkaline. Elevated levels of soluble ammonia and chloride were attributable to blasting residues and drilling brines, respectively.

5 Seepage Surveys

5.1 Sampling and Testing Program

Details of the 2012 Seep Survey are provided in Appendix C.

The 2012 seep survey was carried out from June 8th to June 21th 2012. Seep survey locations were established by walking the toes of all roadways, building pads and quarry sites. A total of 81 sites, including 3 reference sites, were established and field pH and electrical conductivity readings were taken.

Samples were submitted to ALS-Chemex in Vancouver BC for analysis of nutrients (ammonia, nitrate and chloride), routine parameters (pH, alkalinity and sulphate) and dissolved metals by ICP-MS.

5.2 Results

The results of the seep field measurements are summarized in Table 1. The majority of seepage sites had field pH measurements between 7 and 8.5, and none of the seeps were acidic. The range of pHs were slightly higher than reference point locations. Field conductivity readings varied by location, the highest electrical conductivity (EC) values were in the Waste Rock Influenced areas at the base of the waste rock dump. The lowest EC values were at the reference sites.

Table 1: Mean and Median EC and Field pH of Seepage Sites; Grouped According to Area

Area	Electrical Conductivity		pH	
	Mean	Median	Mean	Median
Waste Rock Influenced Area (n=7)	6136	4152	7.9	8.0
Doris North Areas (n=37)	333	248	8.0	8.0
Doris Windy (n=31)	274	205	8.3	8.2
Reference Points (n=3)	68	62	6.6	6.6

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This is the second year where underground mine rock was present at the site. Seepage in the Mine Area (i.e. below the ore and waste rock piles), had elevated chloride, nitrate, ammonia, cadmium and copper concentrations in comparison to the infrastructure areas. These have been attributed to flushing of drilling brines and blasting residues from the waste rock. The majority of this seepage is now captured by the water management system.

6 Summary and Conclusions

The results of the quarry rock geochemistry investigation indicates that all of the samples collected and submitted for testing are not potentially acid generating. Elemental analyses indicate that concentrations of most parameters are within 10 times the average crustal abundance for basaltic rocks. SFE tests indicate that there is low potential for metal leaching from these materials. These findings are consistent with the results of the 2011 road and quarry monitoring programs and testing completed in support of the permit applications for the Doris Mine Area and for the Doris-Windy Road. The results of the 2012 seepage survey indicated that there were no major issues with respect to ML/ARD in seepage associated with the infrastructure at Hope Bay. Results were comparable to that measured in previous years.

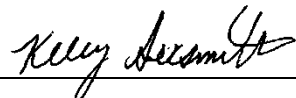
The results from the waste rock stockpile inspection indicate that the waste has been segregated with the mineralized waste situated in the south east corner of the pile, sulphide content in the remainder of the pile was observed to be negligible. Results from the sampling of the ore stockpile indicate that the majority of samples are not potentially acid generating, with two samples classified as uncertain. Elemental analysis indicates some enrichment in gold, silver, sulphur, and arsenic in a portion of the samples.

Shake flask extraction tests on waste rock samples from the underground mine indicated that leachate in contact with these samples had high chloride and ammonia concentrations, and that concentrations of other trace elements were low in comparison to screening criteria. These results were consistent with seepage samples from the Waste Rock Influenced Area. The high chloride and nutrient concentrations have been attributed to flushing of drilling brines and blasting residues from the waste rock. The majority of this seepage is now captured in the water management system.

This report "2012 Waste Rock, Ore and Quarry Monitoring Report" has been prepared by SRK Consulting (Canada) Inc:



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All data used as source material plus the text, tables, figures, and attachments of this document have been reviewed and prepared in accordance with generally accepted professional engineering and environmental practices.

"This report and the opinions and conclusions contained herein ("Report") contains the expression of the professional opinion of SRK Consulting (Canada) Inc. ("SRK") as to the matters set out herein, subject to the terms and conditions of the agreement dated September 30, 2008 (the "Agreement") between Consultant and Hope Bay Mining Ltd. ("Hope Bay Mining"), the methodology, procedures and sampling techniques used, SRK's assumptions, and the circumstances and constraints under which Services under the Agreement were performed by SRK. This Report is written solely for the purpose stated in the Agreement, and for the sole and exclusive benefit of Hope Bay Mining, whose remedies are limited to those set out in the Agreement. This Report is meant to be read as a whole, and sections or parts thereof should thus not be read or relied upon out of context. In addition, this report is based in part on information not within the control of SRK.

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7 References

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Appendices

Appendix A
2012 Quarry Rock Geochemistry

Memo

To:	File	Date:	January 17, 2013
		From:	Ashley Landriault Kelly Sexsmith
		Project #:	1CH008.057
Subject:	2012 Quarry Rock Geochemistry		

1 Introduction

During 2011 and 2012, quarry rock excavated from Quarry 2 and from the new Roberts Bay Tank Farm was used for the construction of various infrastructure associated with development of the Doris Mine. Prior to development, the rock from each of these quarries was characterized geochemically (SRK 2008 and SRK 2010) and classified as not potentially acid generating with low potential for metal leaching. To confirm these results and assess the ARD potential of the fine fraction produced when this material is blasted, further characterization and monitoring was completed during quarrying activities and post-construction. These activities included monitoring within quarries that were active in 2012 (Quarry 2), and monitoring of rock within roads and other infrastructure that was placed since the 2011 inspection. This memo documents the results of the 2012 characterization and monitoring program.

Monitoring requirements for quarries and quarry rock associated with the Doris Mine and Doris-Windy Road are specified in Water Licence 2AM-DOH0713, Water Licence 2BE-HOP1222, and KIA Permits KTP307Q010 and KTP308Q010. These requirements are summarized in the Doris North Gold Project Monitoring and Follow-up Plan for the site (HBML 2011). Details on how the requirements are implemented for quarries and quarry rock associated with the Doris-Windy Road are provided in the Hope Bay Project Quarry A, B & D Management and Monitoring Plan - Revision 01 (SRK 2010b). To ensure consistent procedures are followed in all areas of the site, the monitoring procedures in the Quarry A, B & D Management and Monitoring Plan - Revision 01 are also followed for quarries and quarry rock in the Doris North area.

2 Methods

2.1 Quarry Monitoring, Sampling and Analysis

In 2012, quarrying operations were active in Quarry 2. Freshly exposed rock in active quarry faces was visually inspected and sampled by qualified Newmont geologists. Field notes were taken to document the lithology, sulphide content and veining. Samples were collected from Quarry 2 at two locations. At the first sample site, two bulk samples of various size fractions were collected from the same material. At the second sample site, two samples, one <1cm fraction and one <2mm fraction were collected. These samples were described by Newmont geologists. Samples were obtained from various locations along the dig face.

The routine monitoring samples were sent to ALS Labs (ALS) for sample preparation and total sulphur analysis. Based on the criteria of >0.1 wt. % total sulphur, all of these samples were submitted for analysis of ABA and trace element content. Subsequent analyses were conducted at Maxxam Analytics and included paste pH, total sulphur by Leco, sulphate sulphur by hydrochloric acid leach, Modified Sobek NP (MEND 1991), TIC and elemental analysis by aqua regia digestion with ICP-MS finish. TIC was determined by using a Leco furnace to directly measure CO₂ gas.

evolved from HCl treatment of the sample. A representative split of sample 12Q20004 (-2mm) was taken and relabeled 12Q20005 this portion was used for one shake flask extraction test at Maxxam; using the MEND SFE method, with a 3:1 ratio (solution:solids) and a 24 hour shaking period. SFE leachate was analyzed for pH, EC, SO₄, acidity, alkalinity, Cl, ammonia, TDS, and low level dissolved metals including mercury and selenium. Geochemical analyses were coordinated by SRK.

In June 2012, all Doris North quarries were inspected by SRK for the presence of standing water. Quarry 2 and Quarry D both had standing pools of water. Field measurements were taken at each site, including temperature, pH, electrical conductivity (EC), and oxidation-reduction potential (ORP). Samples were collected by SRK and submitted to ALS-Chemex in Vancouver, BC and analyzed for pH, EC, SO₄, acidity, alkalinity, Cl, F, nitrate, nitrite, phosphorus, ammonia, TDS and low level dissolved metals including mercury and selenium.

All results were reviewed by SRK for quality assurance. Standards were checked and were within tolerance ranges. Ion balances were calculated and were within an acceptable range. All results were deemed acceptable.

2.2 Doris North Area Inspection, Sampling and Analysis

The pads and roads in the Doris North area that were constructed since completion of the 2011 quarry rock geochemistry survey, were visually inspected by SRK in June 2012 by walking the perimeter of the pads. The Doris North monitoring areas consisted of sample collection from Tail Lake Road, Tail Lake Dam, the road from Roberts Bay to Doris Camp and Pad areas in camp. These samples contain material from Quarry 2 and from the 2011 excavation at the new Roberts Bay Tank Farm. Samples were collected from a total of 16 sites (Attachment 1). Fifteen of these sites were pre-determined before going to the field. One site was added in the field (12-QR-13) on the basis of geology.

Samples were collected and visually described by SRK. Field notes were taken to document the lithology, visible sulphide content and veining. At each sample site three fractions were collected, two <1 cm, and one <2 mm. The two <1cm fractions were shipped to the labs, ALS and Maxxam, while the <2 mm fraction was retained at site for contact tests.

While at site, SRK conducted 1:1 (DI water:solids) contact tests using the <2 mm sieved portion of each sample, the pH and EC of these leachates were recorded. The <1 cm fraction of all sixteen samples were shipped to ALS for sample preparation and total sulphur by Leco. Based on the criteria of >0.1 wt. % total sulphur, pulps of all of these samples were submitted for analysis of ABA and trace element content. Subsequent analyses were conducted at Maxxam Analytics and included paste pH, total sulphur by Leco, sulphate sulphur by hydrochloric acid leach, Modified Sobek NP (MEND 1991), TIC and elemental analysis by aqua regia digestion with ICP-MS finish. TIC was determined by using a Leco furnace to directly measure CO₂ gas evolved from HCl treatment of the sample.

Five of the samples were submitted for SFE tests. Selections were based on rinse EC, rinse pH and sample location. SFE tests are performed on the <1cm fraction using the MEND Shakeflask Extraction method (3:1 solid to solution ratio with 24 hours of agitation) (MEND 2009). These tests provide an indication of the relative potential for metal leaching from weathered waste materials. Concentrations in sample leachate are dependent on the solid to water ratio, the amount of time the material has been allowed to weather, the amount of time the water is in contact with the waste material, the grain size distribution of the material, and the presence of secondary minerals that may control or limit concentrations. Therefore, they cannot be directly compared to discharge water quality guidelines but are compared to ten times the guidelines.

One duplicate sample was analyzed; results of the duplicate were well matched to the original sample. ABA data were reviewed to ensure all standards were within tolerance ranges. All data were reviewed for quality assurance by SRK and deemed acceptable.

3 Results

3.1 Quarry Monitoring

3.1.1 Quarry 2 Visual Inspections & Static Test Results

Routine visual inspections by Newmont geologists reported that active faces in Quarry 2 were primarily composed of foliated mafic volcanics with trace sulphides, carbonate alteration and veinlets (Attachment 2). The rock type was green medium grained pillow basalt. Samples were collected from the dig face.

SRK also inspected Quarry 2 during our site visit. Consistent with the Newmont results, the dominant rock type was basalt with trace amounts of pyrite. A small patch (1 x 2 m) of fibrous minerals was observed on the quarry floor.

The samples were analyzed for total sulphur at ALS. Results of the sulphur analyses are provided in Table 1.

Table 1: Total Sulphur Results for Samples of Quarry 2 Material

Sample Location (UTM)	Sample ID	Size Fraction	Rock Type	Total S (wt%)
N7559280, E432390	12Q20001	Bulk sample, various sizes	Basalt	0.17
	12Q20002		Basalt	0.17
N7559249, E432405	12Q20003	<1cm	Basalt	0.15
	12Q20004	<2mm	Basalt	0.18

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As the samples had >0.1% sulphur, samples were submitted for ABA and trace element analysis (Table 2 and Attachment 2). Total sulphur results from ALS were closely correlated with the total sulphur results at Maxxam. Low levels of sulphate were measured, indicating some occurrence of sulphide oxidation in these samples. Sulphide sulphur was used to calculate the acid generation potential of the samples (Table 2).

Levels of NP in the samples ranged from 122 to 188 kg CaCO₃/t, and were slightly higher than TIC levels for all of the samples, suggesting that silicates contributed to the buffering capacity. To be conservative, TIC was used to evaluate the ARD potential of the samples. The samples had levels of TIC ranging from 107 to 180 kg CaCO₃/t (Table 2). All samples were classified as non-PAG with low sulphur content, with TIC/AP and NP/AP ratios well above 3.

The elemental analysis results were compared to ten times the average crustal abundances for basaltic rocks (Price 1997). The majority of the parameters were below these criteria, except Se which was within 10 times the detection limit and therefore within the range of analytical uncertainty, and boron, which was elevated in two samples.

Table 2: Acid Base Accounting Result for Quarry 2 Sample

Sample ID	Paste pH	TIC	Total S	Sulphate Sulphur	AP	NP	NP/AP	TIC/AP
Units	pH Units	kg CaCO ₃ /t	wt%	wt%	kg CaCO ₃ /t	kg CaCO ₃ /t		
12Q20001	8.96	107	0.17	0.04	5.3	122	23	20
12Q20002	8.69	137	0.15	0.09	4.7	149	32	29
12Q20003	8.58	131	0.15	0.09	4.7	143	30	28
12Q20004	8.53	180	0.15	0.01	4.7	188	40	38

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Note: TIC = total inorganic carbon, AP = Acid Potential, NP = Neutralization Potential (modified Sobek method)

3.1.2 Shake Flask Extraction Tests

Sample 12Q20005 was submitted for a SFE test. A summary of the results are presented in Table 3, with complete results presented in Attachment 2. Parameters were compared to ten times CCME water quality guidelines for the protection of aquatic life (CCME 2007) to screen for parameters that were elevated in the test leachate. All parameters were below these screening criteria.

Table 3: Summary of Shake Flask Extraction Results for Quarry 2

Sample ID	Units	12Q20005	Screening Criteria
pH	pH Units	9.42	
EC	uS/cm	199.4	
SO ₄	mg/L	19.6	
Total Alkalinity	mg/L	26	
Total Ammonia	mg N/L	1.32	39*
Al	mg/L	0.349	1
As	mg/L	0.000076	0.05
Cd	mg/L	<0.000005	0.0005**
Cu	mg/L	0.000716	0.02
Fe	mg/L	0.0088	3
Mo	mg/L	0.00175	0.73
Ni	mg/L	0.000218	0.25
Se	mg/L	0.000636	0.01
Ag	mg/L	<0.000005	0.001
U	mg/L	0.0000058	
Zn	mg/L	0.00056	0.3
Hg	mg/L	<0.00005	0.26

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Screening Criteria in the table are ten times the water quality guidelines for these parameters.

*Guideline for ammonia is pH and temperature dependant. Seepage waters had an average temperature of 4°C at time of sampling. This guideline value is approximate.

**Cadmium guideline for a hardness of 25 mg CaCO₃ mg/L.

3.2 Quarry Water Quality Results

Results from the water quality analysis of the standing water collected from Quarry 2 and Quarry D are summarized in Table 4. Complete results are presented in Attachment 3. Although these locations are not considered to be part of the receiving environment, the results were compared to CCME guidelines for the protection of aquatic life to assess whether there would be any potential for impacts if this water was discharged to the environment without dilution. The majority of parameters were below these screening criteria. Exceptions included ammonia and nitrate in Quarry D and nitrate and aluminum in Quarry 2. The nitrate and ammonia levels could be attributed to blasting residues and aluminum may be a result of colloids.

Table 4: Summary of Quarry Water Quality Results, Compared to CCME guidelines

Parameters	Units	12-QUARRY D	12-QUARRY 2	CCME Guidelines
Field Conductivity	(uS/cm)	666	382	
Field pH	s.u.	8.7	10	
Flow	L/s	none	none	
TDS	mg/L	378	202	
Total Alkalinity	mg CaCO ₃ /L	66	72	
Total Ammonia	mg/L as N	15	0.35	3.9*
Cl	mg/L	45	36	128**
Nitrate	mg/L as N	39	4.9	2.9
SO ₄	mg/L	19	22	
Al	mg/L	0.055	0.25	0.1
As	mg/L	0.00038	0.0013	0.005
Cd	mg/L	<0.000010	<0.000010	0.00005***
Cu	mg/L	0.0040	0.0010	0.002 - 0.004
Pb	mg/L	<0.000050	<0.000050	0.001
Ni	mg/L	0.0011	<0.00050	0.025
Zn	mg/L	<0.0010	0.0011	0.03

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Values in **bold** exceed screening criteria

*Guideline for ammonia is pH and temperature dependant. Seepage waters had an average temperature of 4°C at time of sampling. This guideline value is approximate.

**Chloride guideline from the Canadian Water Quality Guideline.

***Cadmium guideline for a hardness of 25 mg CaCO₃ mg/L.

3.3 Doris North Area Monitoring

3.3.1 Visual Observations

Complete visual observations of the road material at the vent raise pad on Tail Lake Road, the spillway to Tail Lake, Frozen Core Plant Pad, the Frozen Core Dam, the Land Farm, the east side of the Airstrip, the Fuel Farm and the Roberts Bay Spur are provided in Attachment 4. The material used for construction of pads and roads was expected to be grey-green metavolcanics with trace sulphides and occasional quartz veins. The majority of the areas met expectations, a small section of the vent raise pad and the Roberts Bay spur had more mafic rock with a slightly larger grain size and an increase in visible sulphides compared to other areas. A salmon pink feldspar mineral was also observed at the Roberts Bay spur and the east side of the airstrip. Samples were collected from these unique areas (12-QR-13 from the Roberts Bay spur, 12-QR-09 from the vent raise pad, 12-QR-07 from the airstrip). The remaining samples collected from the other areas were characterized as grey-green metavolcanics with trace to <1% sulphides, calcite, disseminated throughout or as veinlets, and occasional quartz veins. Complete sample descriptions are presented in Attachment 4.

3.3.2 Contact Test Results

Complete results of the contact tests conducted by SRK while at site, are presented in Attachment 4. The majority of rinse conductivity results ranged from 49 to 427 $\mu\text{S}/\text{cm}$, with one sample registering an EC of 817 $\mu\text{S}/\text{cm}$. The pH values were alkaline and ranged from 8.9 to 9.9. These measurements were taken into consideration when selecting a representative set of sample for SFE tests.

3.3.3 Static Test Results

Total sulphur and complete ABA analyses were conducted for all sixteen samples from the Doris North Area. Sample descriptions are provided in Attachment 4. Summarized ABA results are presented in Table 4, with complete results provided in Attachment 4.

The total sulphur was analyzed at both labs; results were near parity (Figure 1). Sulphate values ranged from less than detectable to 0.04 wt%, indicating that the sulphur in these samples is predominantly sulphide sulphur (Figure 2). For this reason, total sulphur is used to calculate the acid potential in units of kgCaCO_3/t .

All samples had moderate to high levels of neutralization potential (NP) with values ranging from 51 to 204 kgCaCO_3/t . TIC values ranged from 23 to 241 kgCaCO_3/t (Figure 3), indicating that all of the samples contain substantial amounts of total inorganic carbon. NP slightly exceeded TIC for the majority of the samples, suggesting the contribution of silicates to the buffering capacity during the lab procedure. TIC will be used to represent buffering capacity at site to prevent over estimating levels of neutralization potential.

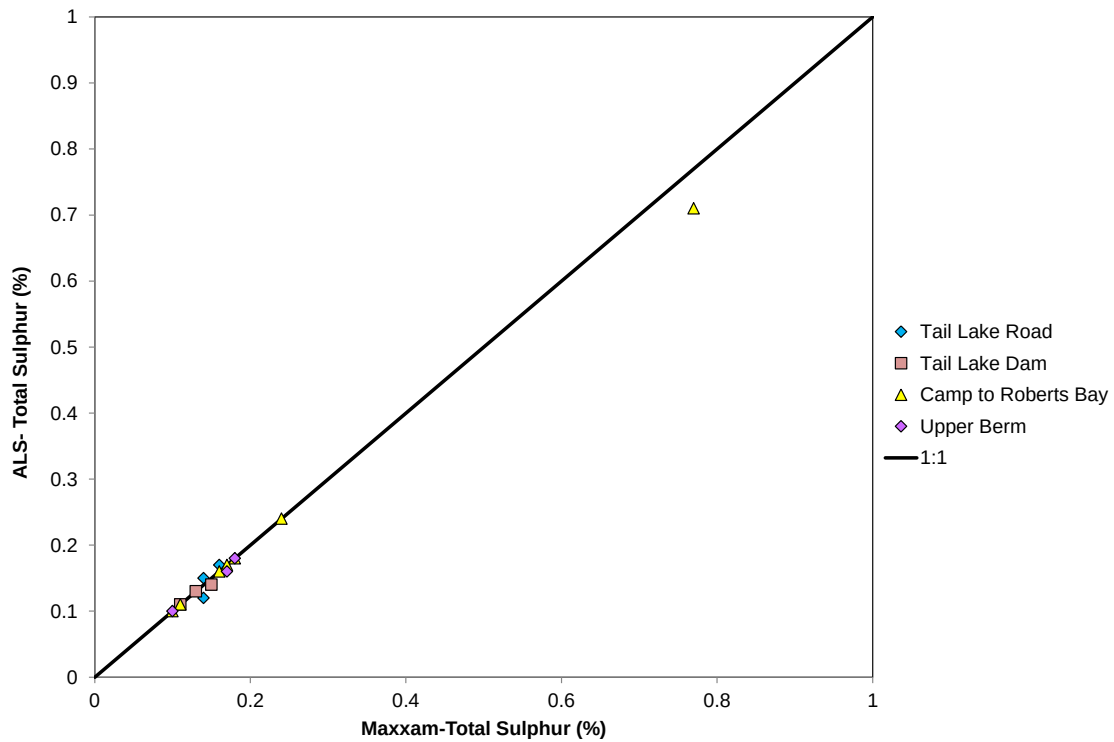
The TIC/AP ratios are significantly greater than 3 (Figure 4, Table 5), indicating that the samples are not potentially acid generating.

Table 5: Summary of Acid Base Accounting Results for 16 Samples from the Doris North Area

Statistic (n-16)	Paste pH	TIC	Total S (Maxxam)	Sulphate	AP	NP	NP/AP	TIC/AP
Units	pH Units	kg CaCO_3/t	wt%	wt%	kg CaCO_3/t	kg CaCO_3/t		
P25	8.7	108	0.13	0.018	3.9	128	30	23
Median	8.7	120	0.16	0.02	4.8	137	35	25
P75	8.8	136	0.17	0.03	5.4	160	40	27
Max	9.0	241	0.77	0.04	24	204	60	41

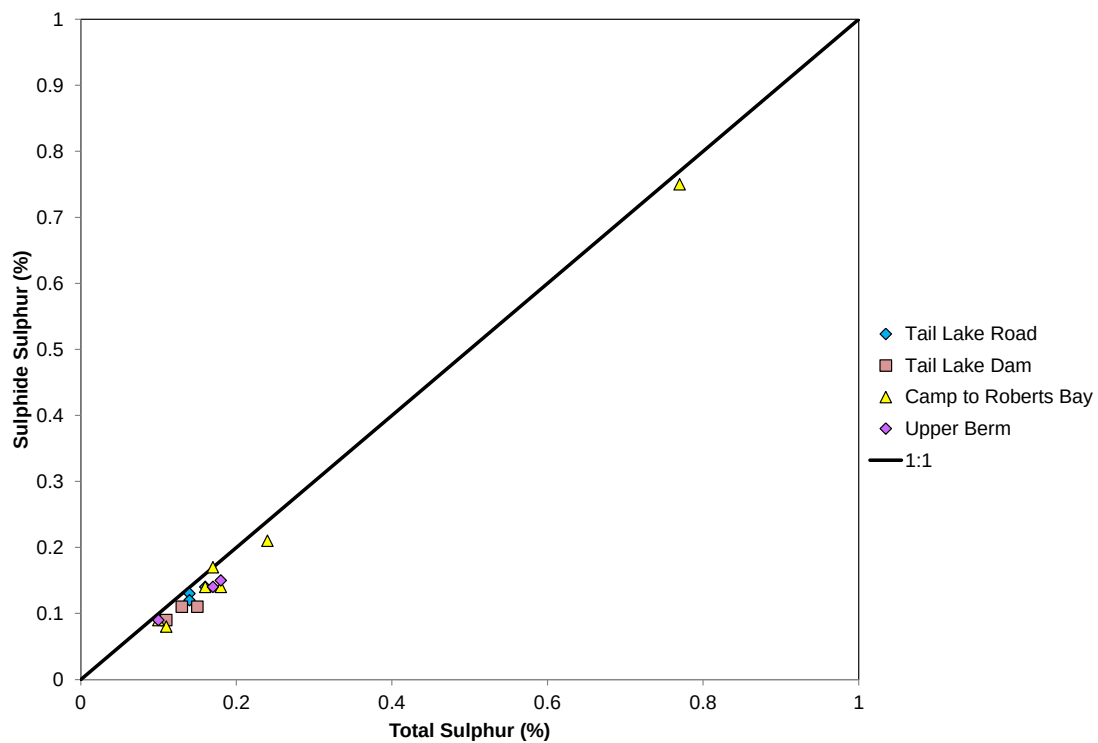
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Notes: 25th Percentile (P25), 75th Percentile (P75), NP = Neutralization Potential



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Figure 1: Total Sulphur ALS compared to Total Sulphur (Maxxam)



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Figure 2: Total Sulphur compared to Sulphide-Sulphur (Maxxam)

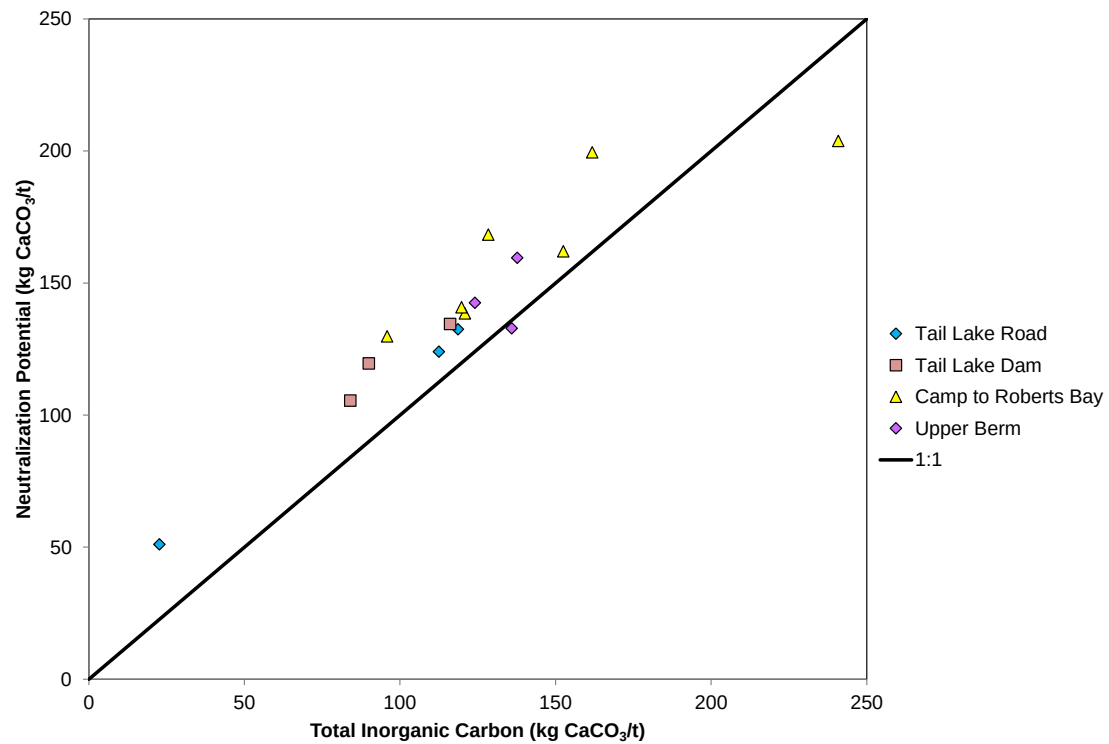


Figure 3: Neutralization Potential versus Total Inorganic Carbon for 2012 Infrastructure Samples

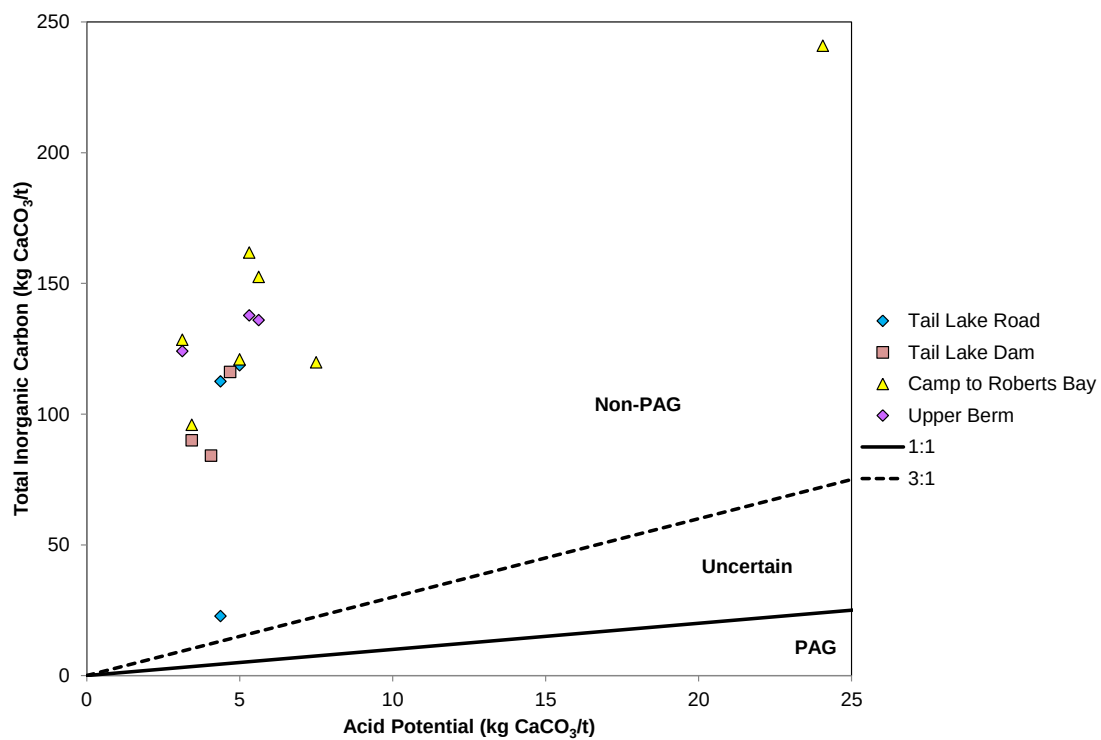


Figure 4: Total Inorganic Carbon versus Acid Potential for 2011 Infrastructure Samples

3.3.4 Elemental Analyses

Results of the elemental analysis of the Doris North area samples are provided in Attachment 4. A summary of these results is provided in Table 6. The data area compared to ten times the average crustal abundance for basaltic rocks (Price 1997) as a means of screening the data for anomalously high values. Most parameters are not elevated compared to these screening criteria. In general, selenium could not be assessed because the detection limits were high in comparison to these screening criteria. The Se levels of the samples were either less than detection or within ten times the detection limit and could not be assessed because of analytical uncertainty.

One sample at Roberts Bay (12-QR-13), that was collected as an additional sample based on geology, exceeded crustal abundance averages for several parameters, including gold, silver, sulphur, selenium, arsenic and bismuth. This sample was collected from a recently constructed and unfinished portion of road. The rock in this area was described as being more mafic than the typical rock used on the roadways, as well as having a coarser grain size and occasional granular crystals of sulphides. Total sulphur for this sample was measured to be 0.77 wt%, TIC was high (240 kgCaCO₃/t), and the sample was classified as non-PAG.

Table 6: Summary of Metals Analyses for 16 Samples from the Doris North Area

Parameter (n=16)	Units	Detection Limit	P25*	Median	P75*	Max	Average Crustal Abundance for Basaltic Rocks
Mo	ppm	0.1	0.20	0.20	0.30	0.60	1.5
Cu	ppm	0.1	115	136	144	215	87
Pb	ppm	0.1	1.8	2.3	3.6	17	6.0
Zn	ppm	1	70	79	86	119	105
Ag	ppm	0.1	<0.1	<0.1	<0.1	2.4	0.11
Ni	ppm	0.1	60	64	88	450	130
Co	ppm	0.1	38	39	41	61	48
Mn	ppm	1	1200	1270	1343	1670	1500
Fe	%	0.01	5.7	6.1	6.5	7.0	8.7
As	ppm	0.5	2.3	3.1	3.5	55	2.0
U	ppm	0.1	<0.1	<0.1	0.10	0.50	1.0
Au	ppb	0.5	4.7	8.9	12	23900	4.0
Th	ppm	0.1	<0.1	0.20	0.30	0.70	4.0
Sr	ppm	1	18	21	25	33	465
Cd	ppm	0.1	<0.1	<0.1	0.20	0.40	0.22
Sb	ppm	0.1	<0.1	<0.1	0.10	0.10	0.2
Bi	ppm	0.1	<0.1	<0.1	<0.1	0.20	0.007
V	ppm	2	122	143	151	177	250
Ca	%	0.01	4.8	5.1	5.5	6.8	7.6
P	%	0.001	0.025	0.027	0.030	0.049	0.11
La	ppm	1	1.0	2.0	2.0	10	15
Cr	ppm	1	150	162	211	687	170
Mg	%	0.01	2.8	3.1	3.4	5.9	4.6
Ba	ppm	1	6.0	7.0	11	91	330
Ti	%	0.001	0.22	0.24	0.28	0.32	1.4
B	ppm	20	<20	<20	<20	42	5
Al	%	0.01	3.1	3.6	3.7	4.1	7.8
Na	%	0.001	0.020	0.028	0.039	0.086	1.8
K	%	0.01	0.02	0.03	0.04	0.09	0.83
W	ppm	0.1	<0.1	<0.1	<0.1	0.10	0.7
Hg	ppm	0.01	<0.01	<0.01	<0.01	<0.01	0.09
Sc	ppm	0.1	8.2	11	12	15	30
Tl	ppm	0.1	<0.1	<0.1	<0.1	<0.1	0.21
S	%	0.05	0.11	0.15	0.16	0.71	0.03
Ga	ppm	1	7.8	8.0	9.0	10	17
Se	ppm	0.5	<0.5	<0.5	0.53	0.70	0.05
Te	ppm	0.2	<0.2	<0.2	<0.2	0.20	D

*25th Percentile (P25), 75th Percentile (P75)

Note: Numbers highlighted in bold exceed 10 times the average crustal abundance for basaltic rocks from Price (1997).

3.3.5 Shake Flask Extraction Tests

SFE tests were completed on 5 of the 16 Doris North area samples. The SFE results are summarized in Table 7, with complete results presented in Attachment 5. All SFE tests had alkaline pH ranging from 8.2 to 9.4. SFE results were compared to ten times the CCME guidelines for the protection of aquatic life (CCME 2007) as screening criteria to evaluate parameters that were elevated in the test leachate. None of the samples exceeded ten times these criteria. Results indicate that the potential for metal leaching from these samples is low.

Table 7: Shake Flask Extraction Test Results for 5 Samples from the Doris North Area

Sample ID	Units	12-QR-06	12-QR-07	12-QR-08	12-QR-09	12-QR-13	Screening Criteria
pH	pH Units	8.2	8.2	9.4	8.9	9.3	
EC	uS/cm	55	77	186	73	87	
SO ₄	mg/L	3.4	3.4	14	3.1	3.7	
Total Alkalinity	mg/L	23	27	33	32	31	
Nitrate-N	mg/L	<0.2	0.7	1.3	0.2	<0.2	29
Cl	mg/L	0.6	2.1	17	1.6	0.7	1280**
Total Ammonia	mg/L	0.18	0.045	0.16	0.32	0.29	39*
Al	mg/L	0.27	0.24	0.30	0.22	0.21	1
As	mg/L	0.00088	0.00082	0.00078	0.0029	0.0016	0.05
Cd	mg/L	<0.000005	<0.000005	<0.000005	<0.000005	<0.000005	0.0005***
Cu	mg/L	0.0010	0.0041	0.00059	0.0023	0.0030	0.02
Fe	mg/L	0.0069	0.019	0.0074	0.209	0.2	3
Mo	mg/L	0.00077	0.00051	0.0014	0.00067	0.00082	0.73
Ni	mg/L	0.000067	0.000093	<0.00002	0.0025	0.0039	0.25
Se	mg/L	0.00051	0.00053	0.0015	0.00058	0.00065	0.01
Ag	mg/L	<0.000005	<0.000005	<0.000005	<0.000005	<0.000005	0.001
U	mg/L	0.000005	0.000013	0.000005	0.000057	0.000012	
Zn	mg/L	0.00012	0.00013	0.00019	0.00094	0.00065	0.3
Hg	mg/L	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	0.26

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Screening Criteria in the table are ten times the water quality guidelines for these parameters.

*Guideline for ammonia is pH and temperature dependant. Seepage waters had an average temperature of 4°C at time of sampling. This guideline value is approximate.

**Chloride guideline from the Canadian Water Quality Guideline.

***Cadmium guideline for a hardness of 25 mg CaCO₃ mg/L.

4 Conclusions

The results of the road and quarry monitoring program indicates that all of the samples collected and submitted for testing are not potentially acid generating. Elemental analyses indicate that concentrations of most parameters are within ten times the average crustal abundance for basaltic rocks. One sample in Roberts Bay has elevated levels of several parameters.

5 Recommendations

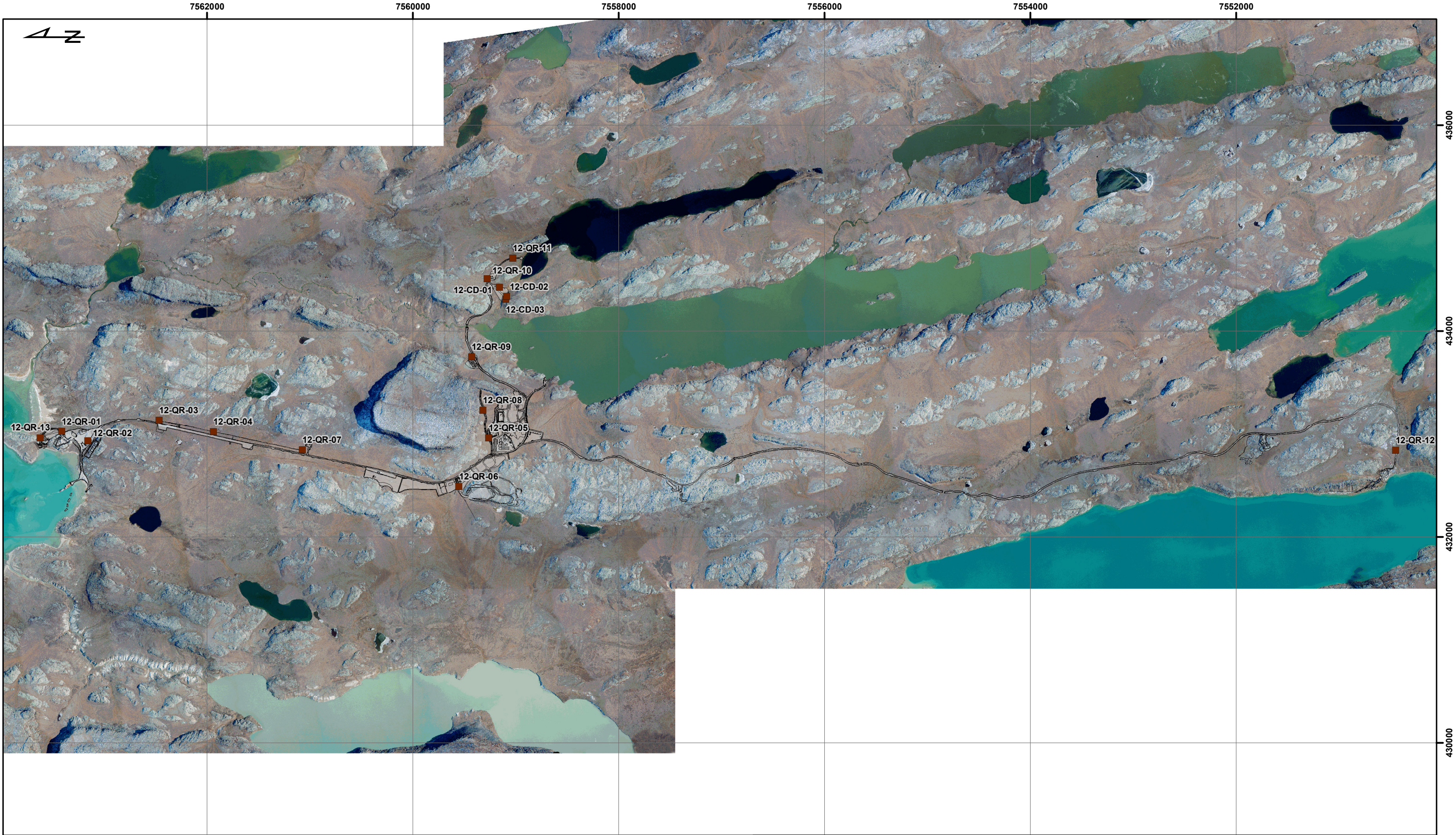
According to licence requirements, road and quarry rock monitoring needs to be completed following construction of any new facilities. No additional construction occurred since June 2012 when our last inspection was completed. Therefore, there is no further solids monitoring requirements anticipated at this time.

6 References

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- Miramar Hope Bay Ltd. 2007. Doris North Gold Mine Project Monitoring and Follow-Up Plan, Nunavut. May 2011.
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- MEND 2009 Prediction Manual for Drainage Chemistry from Sulphidic Geologic Materials. Mine Environment Drainage Program. Report 1.20.1
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- Price, W.A. 1997. DRAFT Guidelines and Recommended Methods for the Prediction of Metal Leaching and Acid Rock Drainage at Minesites in British Columbia. BC Ministry of Employment and Investment, Energy and Minerals Division. 151pp
- SRK Consulting 2008. Hope Bay Project Geochemical Characterization of Quarry Materials for the Doris-Windy All-Weather Road, Nunavut. August 2008.
- SRK Consulting 2010. Geochemical Characterization and Recommendations for Roberts Bay Fuel Tank Farm. Doris North, Hope Bay Project. April 2010
- SRK Consulting 2010b. Hope Bay Project Quarry A, B &D Management and Monitoring Plan, Nunavut. April 2010.
- SRK Consulting 2012. 2011 Waste Rock and Quarry Monitoring Report. 1CH008.023. Prepared for Hope Bay Mining Ltd, March 2012.

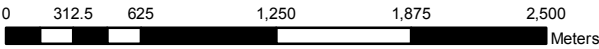
Attachment 1: Sample Locations

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Legend

■ 2012 Sample points



Job No: 1CH008.057
Filename: 1CH008.057_hb_quarry_rock_geochem_2012



2012 Quarry Rock Geochemistry

Hope Bay Gold Project		
Date: November 2012	Approved: -	Figure:

Attachment 2: Newmont Inspection Logs and Test Results



Maxxam Analytics 4606 Canada Way, Burnaby, BC Canada V5G 1K5 Tel: 604 734 7276 Fax: 604 731 2386 www.maxxam.ca

Client: Newmont USA Limited

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Table 4: MEND SFE Test Results for project NMS Hopebay Doris Rock Quarry

Sample ID	Maxxam Sample No	Sample Weight	Volume Used	pH	EC	SO4	Acidity to pH4.5	Acidity to pH8.3	Total Alkalinity	Bicarbonate	Carbonate	Hydroxide
Units		g	mL	pH Units	uS/cm	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
12Q20005	DP2042	250	750	9.42	199.4	19.6	<0.5	<0.5	26	31	<0.5	<0.5
QAQC												
Duplicates												
12Q20005	DP2042 Dup						<0.5	<0.5				
Blanks												
Method Blank												
Method Blank							<0.5	<0.5				
Method Blank				5.94					<0.5	<0.5	<0.5	<0.5
Method Blank												
Method Blank		0	750									
Method Blank					1.3							
Method Blank												
Method Blank												
Method Blank												
Method Blank						<0.5						
Reference Material												
Ammonia-Van (5933686)												
True Values Ammonia-Van												
Percent Difference (5933686)												
Reference Material												
Acidity 8.3 W-Van (5935131)								101.4				
True Values Acidity 8.3 W-Van								100				
Percent Difference (5935131)								1.40				
Reference Material												
Alkalinity W Soln' B (5936275)									46.65			
True Values Alkalinity W Soln' B									47.6			
Percent Difference (5936275)									-2.0			
Reference Material												
Chloride W Kone-Van (5937162)												
True Values Chloride W Kone-Van												
Percent Difference (5937162)												
Reference Material												
CRC ICPMS H2O 10 ppb (5938007)												
True Values CRC ICPMS H2O 10 ppb												
Percent Difference (5938007)												
Reference Material												
TDS 100 -Van (5942040)												
True Values TDS 100 -Van												
Percent Difference (5942040)												
Reference Material												
Sulphate W Kone- Van (5944484)						19.32						
True Values Sulphate W Kone- Van						20						
Percent Difference (5944484)						-3.4						
Detection Limits				N/A	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Maxxam SOP #						BBY6SOP-	BBY6SOP-000	BBY6SOP-0003	BBY6SOP-00026, BBY03	BBY6SOP-000	BBY6SOP-000	BBY6SOP-000

References:
Hardness = (Calcium*2.497) + (Magnesium*4.118)

Anions = DissSO4*2/96+TotAlk*60/100*2/60+Cl*1/35.5+F*1/19
Cations = DissAl*3/27+DissCa*2/40.08+DissCu*2/63.5+DissFe*2/55.8+DissMg*2/24.3+DissMn*2/54.9+DissK*1/39.1+DissNa*1/23+DissZn*2/65.4
Ion Balance Ratio = (Anions-Cations)/(Anions+Cations)*100

Sample ID	Dissolved Chloride	Total Ammonia	Total Dissolved Solids	Hardness CaCO3	Dissolved Aluminum (Al)	Dissolved Antimony (Sb)	Dissolved Arsenic (As)	Dissolved Barium (Ba)	Dissolved Beryllium (Be)	Dissolved Bismuth (Bi)	Dissolved Boron (B)	Dissolved Cesium (Cs)	Dissolved Cadmium (Cd)	Dissolved Calcium (Ca)	Dissolved Chromium (Cr)	Dissolved Cobalt (Co)	Dissolved Copper (Cu)
Units	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
12Q20005	17.6	1.32	100	27.0	0.349	0.000122	0.000076	0.00255	0.000012	<0.0000050	0.197	0.000096	<0.0000050	7.32	<0.00010	0.000651	0.000716
QAQC																	
Duplicates																	
12Q20005		1.33	100		0.349	0.000133	0.000085	0.00256	<0.000010	<0.0000050	0.204	0.000072	<0.0000050	7.59	<0.00010	0.000672	0.000752
Blanks																	
Method Blank		<0.005															
Method Blank																	
Method Blank																	
Method Blank	<0.5																
Method Blank																	
Method Blank																	
Method Blank					0.00021	<0.000020	<0.000020	<0.000020	<0.000010	<0.0000050	<0.050	<0.000050	<0.0000050	<0.050	<0.00010	<0.0000050	<0.000050
Method Blank			<10														
Method Blank																	
Reference Material																	
Ammonia-Van (5933686)		0.098															
True Values Ammonia-Van		0.1															
Percent Difference (5933686)		-2															
Reference Material																	
Acidity 8.3 W-Van (5935131)																	
True Values Acidity 8.3 W-Van																	
Percent Difference (5935131)																	
Reference Material																	
Alkalinity W Soln' B (5936275)																	
True Values Alkalinity W Soln' B																	
Percent Difference (5936275)																	
Reference Material																	
Chloride W Kone-Van (5937162)	20.2																
True Values Chloride W Kone-Van	20																
Percent Difference (5937162)	1.0																
Reference Material																	
CRC ICPMS H2O 10 ppb (5938007)					99.3	0.98	9.76	10.5	9.03	0.99		1	9.37		9.15	9.26	9.27
True Values CRC ICPMS H2O 10 ppb					100	1	10	10	10	1		1	10		10	10	10
Percent Difference (5938007)					-0.7	-2	-2.4	5	-9.7	-1		0	-6.3		-8.5	-7.4	-7.3
Reference Material																	
TDS 100 -Van (5942040)			90														
True Values TDS 100 -Van			100														
Percent Difference (5942040)			-10														
Reference Material																	
Sulphate W Kone- Van (5944484)																	
True Values Sulphate W Kone- Van																	
Percent Difference (5944484)																	
Detection Limits	0.5	0.005	10	0.50	0.00020	0.000020	0.000020	0.000020	0.000010	0.0000050	0.050	0.000050	0.0000050	0.050	0.00010	0.0000050	0.000050
Maxxam SOP #	BBY6SOP-00	BBY6SOP-00	BBY6SOP-00	Calculation	BBY7SOP-00	BBY7SOP-00	BBY7SOP-00	BBY7SOP-00	BBY7SOP-00	BBY7SOP-00	BBY7SOP-00	BBY7SOP-00	BBY7SOP-0000	BBY7SOP-0000	BBY7SOP-0000	BBY7SOP-0000	BBY7SOP-00

Sample ID	Dissolved Lanthanum (La)	Dissolved Iron (Fe)	Dissolved Lead (Pb)	Dissolved Lithium (Li)	Dissolved Magnesium (Mg)	Dissolved Manganese (Mn)	Dissolved Phosphorus (P)	Dissolved Molybdenum (Mo)	Dissolved Nickel (Ni)	Dissolved Potassium (K)	Dissolved Rubidium (Rb)	Dissolved Selenium (Se)	Dissolved Silicon (Si)	Dissolved Silver (Ag)	Dissolved Sodium (Na)	Dissolved Strontium (Sr)	Dissolved Sulphur (S)	Dissolved Tellurium (Te)
Units	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
12Q20005	<0.000050	0.0088	0.000228	0.00068	2.12	0.00131	0.0108	0.00175	0.000218	1.66	0.00182	0.000636	0.96	<0.0000050	23.9	0.0160	<10	<0.000020
QAQC																		
Duplicates																		
12Q20005	<0.000050	0.0094	0.000224	0.00069	2.09	0.00121	0.0100	0.00170	0.000226	1.63	0.00174	0.000619	1.00	<0.0000050	23.4	0.0158	<10	<0.000020
Blanks																		
Method Blank																		
Method Blank																		
Method Blank																		
Method Blank																		
Method Blank																		
Method Blank																		
Method Blank	<0.000050	<0.0010	<0.0000050	<0.00050	<0.050	<0.000050	<0.0020	<0.000050	<0.000020	<0.050	<0.000050	<0.000040	<0.10	<0.0000050	<0.050	<0.000050	<10	<0.000020
Method Blank																		
Method Blank																		
Reference Material																		
Ammonia-Van (5933686)																		
True Values Ammonia-Van																		
Percent Difference (5933686)																		
Reference Material																		
Acidity 8.3 W-Van (5935131)																		
True Values Acidity 8.3 W-Van																		
Percent Difference (5935131)																		
Reference Material																		
Alkalinity W Soln' B (5936275)																		
True Values Alkalinity W Soln' B																		
Percent Difference (5936275)																		
Reference Material																		
Chloride W Kone-Van (5937162)																		
True Values Chloride W Kone-Van																		
Percent Difference (5937162)																		
Reference Material																		
CRC ICPMS H2O 10 ppb (5938007)	1.02	108	9.82	9.49		9.78		0.98	9.28			10.4		0.95		9.88		1.11
True Values CRC ICPMS H2O 10 ppb	1	100	10	10		10		1	10			10		1		10		1
Percent Difference (5938007)	2	8	-1.8	-5.1		-2.2		-2	-7.2			4		-5		-1.2		11
Reference Material																		
TDS 100 -Van (5942040)																		
True Values TDS 100 -Van																		
Percent Difference (5942040)																		
Reference Material																		
Sulphate W Kone- Van (5944484)																		
True Values Sulphate W Kone- Van																		
Percent Difference (5944484)																		
Detection Limits	0.000050	0.0010	0.0000050	0.00050	0.050	0.000050	0.0020	0.000050	0.000020	0.050	0.000050	0.000040	0.10	0.0000050	0.050	0.000050	10	0.000020
Maxxam SOP #	BBY7SOP-00	BBY7SOP-00	BBY7SOP-00	BBY7SOP-00	BBY7SOP-00	BBY7SOP-00	BBY7SOP-00	BBY7SOP-00	BBY7SOP-00	BBY7SOP-00	BBY7SOP-00	BBY7SOP-00	BBY7SOP-00	BBY7SOP-00	BBY7SOP-00	BBY7SOP-0	BBY7SOP-0	BBY7SOP-00

Attachment 3: Quarry Water Quality Results

Station	WP	Easting	Northing	Date	Time	Sampled	Description	Temperature	Field Conductivity	Field pH	ORP	Flow	Date Sampled	Time Sampled	ALS Sample ID	Matrix
Units								°C	SpCond (uS/cm)		mV	L/s				
12-QUARRY D	113	432942	7551700	17-Jun-12	11:15	yes	quarry D west side of DW road, ~7.1km marker. Large pool, snow melt from furhter west, slightly turbid, some TSS, no apparent flow.	11.12	666	8.7	116	none	17-JUN-12	11:45	L1164182-9	Water
12-QUARRY 2	122	432447	7559240	17-Jun-12		yes	back wall of quarry, near crush piles, sampled, murky water, suspeded sed, coating on rocks in bottom, base is crush. Ponded	15.7	382	10.47	7.9	none	17-JUN-12	16:00	L1164182-13	Water

Station	Conductivity	Hardness	pH	Total Suspended Solids	Total Dissolved Solids	Acidity	Total Alkalinity	Ammonia, Total	Bromide (Br)	Chloride (Cl)	Fluoride (F)	Nitrate	Nitrite	Phosphorus (P)-Total	Sulfate (SO4)
Units	uS/cm	mg CaCO ₃ /L	pH	mg/L	mg/L	mg CaCO ₃ /L	mg CaCO ₃ /L	mg/L as N	mg/L	mg/L	mg/L	mg/L as N	mg/L	mg/L	mg/L
12-QUARRY D	622	75.4	7.94	#N/A	378	5	66.4	14.7	0.159	45.3	0.052	39.3	0.156	0.0083	19.1
12-QUARRY 2	346	9.91	9.86	#N/A	202	<1.0	71.8	0.349	0.171	35.6	0.184	4.88	0.091	0.0084	22.3

Station	Aluminum (Al)-Dissolved	Antimony (Sb)-Dissolved	Arsenic (As)-Dissolved	Barium (Ba)-Dissolved	Beryllium (Be)-Dissolved	Bismuth (Bi)-Dissolved	Boron (B)-Dissolved	Cadmium (Cd)-Dissolved	Calcium (Ca)-Dissolved	Chromium (Cr)-Dissolved	Cobalt (Co)-Dissolved	Copper (Cu)-Dissolved	Iron (Fe)-Dissolved	Lead (Pb)-Dissolved	Lithium (Li)-Dissolved	Magnesium (Mg)-Dissolved
Units	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
12-QUARRY D	0.0549	0.00018	0.00038	0.00601	<0.00010	<0.00050	0.198	<0.000010	19.7	0.00012	0.00172	0.00395	<0.010	<0.000050	0.00078	6.36
12-QUARRY 2	0.245	0.00028	0.0013	0.00451	<0.00010	<0.00050	0.085	<0.000010	3.08	0.00991	<0.00010	0.00104	0.026	<0.000050	<0.00050	0.54

Station	Manganese (Mn)-Dissolved	Mercury (Hg)-Dissolved	Molybdenum (Mo)-Dissolved	Nickel (Ni)-Dissolved	Potassium (K)-Dissolved	Selenium (Se)-Dissolved	Silicon (Si)-Dissolved	Silver (Ag)-Dissolved	Sodium (Na)-Dissolved	Strontium (Sr)-Dissolved	Thallium (Tl)-Dissolved	Tin (Sn)-Dissolved	Titanium (Ti)-Dissolved	Uranium (U)-Dissolved	Vanadium (V)-Dissolved	Zinc (Zn)-Dissolved
Units	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
12-QUARRY D	0.0218	<0.000010	0.00107	0.00108	5.69	0.00023	0.792	<0.000010	62.5	0.0424	0.000028	<0.00010	<0.010	0.000064	<0.0010	<0.0010
12-QUARRY 2	0.000504	<0.000010	0.00297	<0.00050	15.4	0.00092	5.47	<0.000010	53.2	0.0729	<0.000010	<0.00010	<0.010	0.000026	0.0143	0.0011

Attachment 4: SRK Field Observations and Lab Test Results

Sample ID	Stn ID	WP	Easting	Northing	Location	Description of sample point	Date	Time	Sampler	Percent distribution			
Units										>1cm	<1cm	2mm-1cm	<2mm
12-QR-09A	12-QR-09	63	433750	7559429	TLR	east side of vent raise pad, facing Doris creek (river?)	15-Jun-12	9:00	AML	70	30	80	20
12-QR-11A	12-QR-11	55	434707	7559028	TLR	south side of spillway road to Tail Lake, N side of power plant, almost where road joins pad	13-Jun-12	18:00	AML	90	10	85	15
12-QR-10A	12-QR-10	64	434511	7559276	TLR		15-Jun-12	10:30	AML	50	50	90	10
12-CD-03A	12-CD-03	47	434313	7559096	TLD	north west side of dam, far end near the cooling towers	13-Jun-12	12:00	AML	85	15	90	10
12-CD-02A	12-CD-02	46	434339	7559086	TLD	SE side of dam, at end (furthest from road)	13-Jun-12	11:30	AML	80	20	90	10
12-CD-01A	12-CD-01	45	434423	7559158	TLD	SE side of dam at beginning of dam near road	13-Jun-12	11:00	AML	60	40	90	10
12-QR-13A	12-QR-13	39	432964	7563620	C to RB	north side of road that curves around to rob bay, blocked road, 3/4 of the way along the road.	11-Jun-12	11:30	AML	50	50	80	20
12-QR-01A	12-QR-01	40	433025	7563412	C to RB	south east side of road (that is blocked off) that curves around to Rob Bay. Beginning of road, lower berm of fuel farm pad, east of tanks, midway along length of berm south side of road to quarry 2, north extent of pad with landfarm on it, berm between road and pad	11-Jun-12	11:30	AML	80	20	95	5
12-QR-02A	12-QR-02	38	432933	7563158	C to RB		11-Jun-12	10:30	AML	80	20	90	10
12-QR-06A	12-QR-06	36	432488	7559551	C to RB		11-Jun-12	9:30	AML	70	30	80	20
12-QR-07A	12-QR-07	44	432845	7561073	C to RB	south end of airstrip on east side	11-Jun-12	15:35	AML	70	30	80	20
12-QR-03A	12-QR-03	#N/A	433131	7562466	C to RB	sample site at north end of airstrip on east side of strip	11-Jun-12	14:30	AML	60	40	90	10
12-QR-04A	12-QR-04	43	433023	7561937	C to RB	midway down airstrip on east side, ~4ft from edge of pond	11-Jun-12	15:10	AML	50	50	80	20
12-QR-08A	12-QR-08	140	433230	7559318	CP	upper diversion berm	18-Jun-12	13:30	AML	60	40	90	10
12-QR-05A	12-QR-05	141	432962	7559263	CP	upper diversion berm	18-Jun-12	14:00	AML	80	20	60	40
12-QR-12A 12-QR-13A DUP	12-QR-12	142	432841	7550450	CP	end of DW road, close to Windy Camp	18-Jun-12	14:30	AML	80	20	50	50
Detection Limits													
Maxxam SOP #													
Average Crustal Abundances Basalt (ppm) Avg CA (units matched) Avg CA*10													

Sample ID	Description of rock samples	Visible sulphides	Colour of fines	Rinse pH of <1cm fraction	Rinse Sp_Cond	pH of DI water	EC of DI water
Units					(uS/cm)		
12-QR-09A	grey green metavolcanics, slightly more mafic in comparison to surrounding material, some carbonate on fracture surfaces, some visible iron carbonates.	trace-0.2%, disseminated, fine grained, occasional bleb.	dark grey, greenish tint	9.56	119.4	5.53	6.6
12-QR-11A	consistent grey green metavocanic rocks, occasional quartz carbonate fracture infill/on faces, visible iron carbonates	none	grey green	9.1	85.1	5.53	6.6
12-QR-10A	green grey metavolcanics, dusty/finer grained rock mixed in, some is wet from snow melt, grey green metavolcanics, visible iron carbonates, qtz/carb fracture infill, no quartz chunks.	trace	green grey	9.22	113.9	5.53	6.6
12-CD-03A	grey green metavolcanics, very fine grained trace sulphides, disseminated. , vis. Iron carbonate,carb/qtz fracture infill/fracture surfaces.	none	light grey	8.86	341	5.53	6.6
12-CD-02A	grey green metavolcanics, very trace disseminated fine grained sulphides, visible iron carbonate weathering, no quartz chunks	trace	light grey	9.24	472	5.53	6.6
12-CD-01A	took additional sample to proposed points due to darker, coarse grained mafic metavolcanics, occasional granular sulphides that are associated with quartz and quartz carbonate veins, visible iron carbonates, some grains of sulphide are oxidized some are fresh	trace	light grey	9.12	187	5.53	6.6
12-QR-13A	mafic metavolcaic, fine grainde w/ evidence of iron carbonates, some carbonate on fracture surfaces, not much quartz, fine grained disseminated sulphides that are occasionally oxidized, usually fresh.	trace-0.5%	dark grey, greenish tint	9.82	169.8	5.53	6.6
12-QR-01A	mafic metavolcanics, trace vis sulphides, disseminated, fine grained, very occasional qtz veins in some chunks, visible iron carbonate weathering	trace	grey brownish reddish	9.45	49.4	5.53	6.6
12-QR-02A	crushed mafic metavocanics, greeny grey color, fine grained disseminated sulphides on occasional faces, trace. Some carbonate on fracture surfaces	trace	green grey, small amt brown (reddy brown)	9.46	66.3	5.53	6.6
12-QR-06A	grey green metavolcanics, visible iron carbonates, qtz carbonate fracture infill and on fracture surfaces, not much (trace) quartz chunks, trace sulphides fine grained disseminated, presence of salmon colored feldspar	trace	green grey	9.21	93.8	5.53	6.6
12-QR-07A	green grey mafic metavolcanic, hand specimens with fine grained sulphides, disseminated or associated with quartz carb frac infill	trace	grey green, tint of brown	9.19	132.6	5.53	6.6
12-QR-03A	consistent light grey green mafic metavolcanics, fine grained trace sulphides on fracture surfaces, qtz carb on fracture surfaces, occasional qtz chunk, visible iron carbonates	trace	dark grey, greenish tint	9.43	76.6	5.53	6.6
12-QR-04A	grey green metavolcanics, trace sulphides, disseminated fine grained, carbonates on fracture surfaces.	trace	grey with tint of green	9.32	95.8	5.53	6.6
12-QR-08A	grey green metavolcanics, coarse grained, sulphides visible as fine grained and disemm. Visible iron carbonates, carbonate on fracture surfaces, occasional quartz vein.	trace	light grey	9.9	817	5.53	6.6
12-QR-05A	grey green metavolcanics, slightly less mafic than usual samples, very dusty. Photo 818. Trace sulphides, carbonates on fracture surfaces, visible iron carbonates in surrounding area.	trace	grey/green, slight brown tint	9.52	327	5.53	6.6
12-QR-12A		trace	light grey	9.45	351	5.53	6.6
12-QR-13A DUP							
Detection Limits							
Maxxam SOP #							
Average Crustal Abundances							
Basalt (ppm)							
Avg CA (units matched)							
Avg CA*10							

Sample ID	Total S (ALS)	AP (ALS)	Paste pH	CO2	CaCO3 Equiv.	Total S	HCl Extractable Sulphur	Sulphide Sulphur (by diff.)	Acid Generation Potential	Mod. ABA Neutralization Potential	NP/AP	Fizz Rating	Net Neutralization Potential	Neutralization Potential Ratio
Units	wt%	kg CaCO3/t	pH Units	wt%	kg CaCO3/t	wt%	wt%	wt%	kg CaCO3/t	kg CaCO3/t		N/A	kg CaCO3/t	N/A
12-QR-09A	0.12	3.8	9.02	1	22.7	0.14	0.01	0.13	4.1	51	12	SLIGHT	46.9	12.6
12-QR-11A	0.15	4.7	8.72	4.95	112.5	0.14	0.02	0.12	3.8	124	33	STRONG	120.3	33.1
12-QR-10A	0.17	5.3	8.59	5.22	118.6	0.16	0.02	0.14	4.4	132.5	30	STRONG	128.1	30.3
12-CD-03A	0.11	3.4	8.84	3.96	90	0.11	0.02	0.09	2.8	119.5	43	STRONG	116.7	42.5
12-CD-02A	0.14	4.4	8.86	5.11	116.1	0.15	0.04	0.11	3.4	134.5	40	STRONG	131.1	39.1
12-CD-01A	0.13	4.1	8.92	3.7	84.1	0.13	0.02	0.11	3.4	105.5	31	STRONG	102.1	30.7
12-QR-13A	0.71	22.2	8.02	10.6	240	0.77	0.02	0.75	23.4	203.8	8.7	STRONG	180.4	8.7
12-QR-01A	0.18	5.6	8.65	6.71	152.5	0.18	0.04	0.14	4.4	162	37	STRONG	157.6	37
12-QR-02A	0.11	3.4	8.7	4.22	95.9	0.11	0.03	0.08	2.5	129.8	52	MODERATE	127.3	51.9
12-QR-06A	0.17	5.3	8.73	7.12	161.8	0.17	<0.01	0.17	5.3	199.5	38	STRONG	194.2	37.6
12-QR-07A	0.16	5.0	8.68	5.32	120.9	0.16	0.02	0.14	4.4	138.5	31	STRONG	134.1	31.6
12-QR-03A	0.24	7.5	8.73	5.27	119.8	0.24	0.03	0.21	6.6	140.8	21	STRONG	134.2	21.5
12-QR-04A	0.1	3.1	8.79	5.65	128.4	0.1	0.01	0.09	2.8	168.3	60	STRONG	165.5	59.9
12-QR-08A	0.18	5.6	8.76	5.98	135.9	0.18	0.03	0.15	4.7	132.8	28	STRONG	128.1	28.3
12-QR-05A	0.16	5.0	8.81	6.06	137.7	0.17	0.03	0.14	4.4	159.5	36	STRONG	155.1	36.4
12-QR-12A	0.1	3.1	8.83	5.46	124.1	0.1	0.01	0.09	2.8	142.5	51	STRONG	139.7	50.7
12-QR-13A DUP			8.04	10.8	245	0.73	0.01	0.72	22.5	201.3	8.9	STRONG	178.8	8.9
Detection Limits			N/A	0.02	0.5	0.02	0.01	0.01	0.6	0.1		N/A	0.1	N/A
Maxxam SOP #			7160	LECO	Calculation	LECO	BBY0SOP-00010	Calculation	Calculation	BBY0SOP-00020	Calculation	BBY0SOP-00	Calculation	Calculation
Average Crustal Abundances														
Basalt (ppm)														
Avg CA (units matched)														
Avg CA*10														

Sample ID	Mo	Cu	Pb	Zn	Ag	Ni	Co	Mn	Fe	As	U	Au	Th	Sr	Cd	Sb	Bi	V	Ca	P	La
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	%	ppm	ppm	ppb	ppm	ppm	ppm	ppm	ppm	ppm	%	%	ppm
12-QR-09A	0.1	90.1	1	58	<0.1	450	61	770	6.1	3.2	0.1	4.6	0.7	15	<0.1	<0.1	<0.1	72	1.52	0.049	10
12-QR-11A	0.3	144	1.7	73	<0.1	64.9	38.2	1200	5.3	2.3	<0.1	13.5	0.3	27	0.1	<0.1	<0.1	123	5.18	0.027	2
12-QR-10A	0.2	133	2.2	79	<0.1	64.2	38.9	1250	5.87	3.4	<0.1	7.6	0.2	24	0.1	<0.1	<0.1	144	4.88	0.03	2
12-CD-03A	0.3	126	1.1	70	<0.1	87.5	37.9	1130	5.4	2.2	<0.1	88.3	0.3	24	0.2	<0.1	<0.1	124	4.35	0.03	2
12-CD-02A	0.2	135	1.5	78	<0.1	57.3	37.4	1260	5.81	3.6	0.1	7.1	0.1	18	0.1	<0.1	<0.1	159	4.87	0.026	1
12-CD-01A	0.3	114	1.9	69	<0.1	101	37.9	1050	5.16	4.1	<0.1	10.2	0.5	29	<0.1	<0.1	<0.1	119	3.79	0.035	4
12-QR-13A	0.6	99.9	3.9	119	2.4	50.2	37.2	1670	6.73	55.4	<0.1	23900	0.2	33	0.4	<0.1	0.2	34	5.13	0.036	2
12-QR-01A	0.3	164	6.6	99	<0.1	57.2	40.6	1350	6.57	1.8	0.1	10.3	<0.1	17	0.2	<0.1	<0.1	141	6.41	0.022	1
12-QR-02A	0.2	115	1.8	68	<0.1	70.9	38.7	1290	6.14	3.4	0.2	11.4	0.2	20	<0.1	<0.1	<0.1	149	4.46	0.028	2
12-QR-06A	0.2	144	6.2	100	<0.1	62.2	40.3	1470	6.4	2.7	<0.1	2.2	0.1	26	0.3	<0.1	<0.1	159	6.82	0.026	2
12-QR-07A	0.2	150	16.9	106	<0.1	60.4	38.9	1280	6.51	1.3	<0.1	2.9	0.4	21	0.3	<0.1	<0.1	149	5.05	0.027	3
12-QR-03A	0.1	215	3.5	82	<0.1	54.6	42.4	1200	6.36	3.1	0.4	4.1	<0.1	17	0.1	<0.1	<0.1	140	5.15	0.024	1
12-QR-04A	0.2	145	2.4	70	<0.1	88.4	42.8	1340	6.61	17.3	<0.1	18.8	0.1	23	<0.1	<0.1	<0.1	149	5.5	0.023	2
12-QR-08A	0.3	136	2.5	82	<0.1	62.5	38.3	1340	6.11	3.1	<0.1	11.4	0.2	19	0.1	<0.1	<0.1	158	5.49	0.025	1
12-QR-05A	0.2	138	2.1	79	<0.1	64.5	40.8	1480	6.96	1.7	0.5	6.8	<0.1	20	0.1	<0.1	<0.1	177	5.69	0.026	1
12-QR-12A	<0.1	92.4	3	75	<0.1	247	52	1200	5.37	2.9	<0.1	4.7	<0.1	16	0.1	<0.1	<0.1	108	5.01	0.018	1
12-QR-13A DUP	0.4	102	4	118	3.3	48.9	36.1	1670	6.63	54.4	<0.1	33100	0.2	32	0.4	<0.1	0.2	33	5.16	0.036	2
Detection Limits	0.1	0.1	0.1	1	0.1	0.1	0.1	1	0.01	0.5	0.1	0.5	0.1	1	0.1	0.1	0.1	2	0.01	0.001	1
Maxxam SOP #	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX
Average Crustal Abundances Basalt (ppm)	1.5	87	6	105	0.11	130	48	1500	86500	2	1	0.004	4	465	0.22	0.2	0.007	250	76000	1100	15
Avg CA (units matched)	1.5	87	6	105	0.11	130	48	1500	8.65	2	1	4	4	465	0.22	0.2	0.007	250	7.6	0.11	15
Avg CA*10	15	870	60	1050	1.1	1300	480	15000	86.5	20	10	40	40	4650	2.2	2	0.07	2500	76	1.1	150

Sample ID	Cr	Mg	Ba	Ti	B	Al	Na	K	W	Hg	Sc	Tl	S	Ga	Se	Te
Units	ppm	%	ppm	%	ppm	%	%	%	ppm	ppm	ppm	ppm	%	ppm	ppm	ppm
12-QR-09A	687	5.86	13	0.097	<20	3.72	0.023	0.01	<0.1	<0.01	3.6	<0.1	0.11	8	<0.5	<0.2
12-QR-11A	148	2.33	6	0.324	42	3.03	0.042	0.02	<0.1	<0.01	7.7	<0.1	0.15	6	0.7	<0.2
12-QR-10A	151	2.6	9	0.239	<20	3.11	0.02	0.02	0.1	<0.01	10	<0.1	0.15	8	<0.5	<0.2
12-CD-03A	193	2.66	7	0.281	<20	3.08	0.041	0.03	<0.1	<0.01	7.4	<0.1	0.1	7	0.6	<0.2
12-CD-02A	164	2.84	10	0.293	<20	3.28	0.041	0.02	<0.1	<0.01	10.7	<0.1	0.13	8	<0.5	<0.2
12-CD-01A	215	2.78	10	0.23	<20	2.96	0.035	0.03	<0.1	<0.01	8.3	<0.1	0.12	7	<0.5	<0.2
12-QR-13A	19	1.91	12	0.002	<20	1.35	0.086	0.09	<0.1	<0.01	10.8	<0.1	0.71	4	0.7	0.2
12-QR-01A	83	3.41	2	0.24	<20	3.86	0.015	0.03	<0.1	<0.01	10.5	<0.1	0.18	8	0.5	<0.2
12-QR-02A	209	3.56	6	0.228	<20	3.63	0.021	0.04	<0.1	<0.01	12.8	<0.1	0.1	9	<0.5	<0.2
12-QR-06A	155	2.99	5	0.273	<20	3.61	0.017	0.03	<0.1	<0.01	12.6	<0.1	0.17	8	<0.5	<0.2
12-QR-07A	150	3.39	6	0.247	<20	3.68	0.034	0.04	<0.1	<0.01	11.7	<0.1	0.15	9	<0.5	<0.2
12-QR-03A	80	3.34	3	0.241	<20	3.5	0.021	0.04	<0.1	<0.01	9.8	<0.1	0.23	9	<0.5	<0.2
12-QR-04A	271	4.12	6	0.13	<20	4.08	0.015	0.06	<0.1	<0.01	15.2	<0.1	0.1	10	<0.5	<0.2
12-QR-08A	159	2.92	18	0.291	<20	3.34	0.038	0.02	<0.1	<0.01	11	<0.1	0.16	8	<0.5	<0.2
12-QR-05A	168	3.14	91	0.304	<20	3.68	0.032	0.03	<0.1	<0.01	12.5	<0.1	0.16	9	0.6	<0.2
12-QR-12A	594	4.04	7	0.212	35	3.82	0.019	0.02	<0.1	<0.01	6.7	<0.1	0.1	8	<0.5	<0.2
12-QR-13A DUP	18	1.91	11	0.002	<20	1.34	0.087	0.09	<0.1	<0.01	10.6	<0.1	0.72	4	0.8	0.2
Detection Limits	1	0.01	1	0.001	20	0.01	0.001	0.01	0.1	0.01	0.1	0.1	0.05	1	0.5	0.2
Maxxam SOP #	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX
Average Crustal Abundances Basalt (ppm)	170	46000	330	13800	5	78000	18000	8300	0.7	0.09	30	0.21	300	17	0.05	D
Avg CA (units matched)	170	4.6	330	1.38	5	7.8	1.8	0.83	0.7	0.09	30	0.21	0.03	17	0.05	D
Avg CA*10	1700	46	3300	13.8	50	78	18	8.3	7	0.9	300	2.1	0.3	170	0.5	D

Attachment 5: Shake Flask Extraction Test Results

Table 1: MEND SFE Test Results for project HOPEBAY 2012 SOLID ANALYSES

Sample ID	Maxxam Sample No	Sample Weight	Volume Used	pH	EC	SO4	Acidity to pH4.5	Acidity to pH8.3	Total Alkalinity	Bicarbonate	Carbonate
Units		g	mL	pH Units	uS/cm	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
12-QR-06B	EX2587	250	750	8.21	55.3	3.4	<0.5	<0.5	23	28	<0.5
12-QR-07B	EX2588	250	750	8.18	76.6	3.4	<0.5	<0.5	27	32	<0.5
12-QR-08B	EX2589	250	750	9.4	186.1	13.5	<0.5	<0.5	33	40	<0.5
12-QR-09B	EX2590	250	750	8.85	72.5	3.1	<0.5	<0.5	32	39	<0.5
12-QR-13B	EX2591	250	750	9.27	87.2	3.7	<0.5	<0.5	31	38	<0.5
QAQC											
Duplicates											
12-QR-06B	EX2587 Dup										
12-QR-13B	EX2591 Dup										
Blanks											
Method Blank		0	750	6.73	1.6	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Reference Material											
TDS 100 -Van (6340181)											
True Values TDS 100 -Van											
Percent Difference (6340181)											
Reference Material											
Ammonia-Van (6340798)											
True Values Ammonia-Van											
Percent Difference (6340798)											
Reference Material											
CRC ICPMS H2O 10 ppb (6341720)											
True Values CRC ICPMS H2O 10 ppb											
Percent Difference (6341720)											
Reference Material											
Acidity 8.3 W-Van (6344106)								103			
True Values Acidity 8.3 W-Van								100			
Percent Difference (6344106)								3			
Reference Material											
Chloride W Kone-Van (6345668)											
True Values Chloride W Kone-Van											
Percent Difference (6345668)											
Reference Material											
Sulphate W Kone- Van (6345670)						18.4					
True Values Sulphate W Kone- Van						20					
Percent Difference (6345670)						-8					
Reference Material											
Alkalinity W Soln' B (6346541)									43.32		
True Values Alkalinity W Soln' B									47.6		
Percent Difference (6346541)									-9		
Detection Limits				N/A	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Maxxam SOP #						BBY6SOP	BBY6SOP-000	BBY6SOP-0003	BBY6SOP-00026, BBY	BBY6SOP-00026,	BBY6SOP-00026

Notes:
RDL raised due to sample matrix interference.

References:
Hardness = (Calcium*2.497) + (Magnesium*4.118)

Sample ID	Hydroxide	Dissolved Chloride	Nitrate-N	Nitrite-N	Total Ammonia	Total Dissolved Solids	Hardness CaCO3	Dissolved Aluminum (Al)	Dissolved Antimony (Sb)	Dissolved Arsenic (As)	Dissolved Barium (Ba)	Dissolved Beryllium (Be)	Dissolved Bismuth (Bi)
Units	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
12-QR-06B	<0.5	0.6	<0.2	<0.05	0.18	34	17.9	0.269	0.000144	0.000882	0.000471	<0.000010	<0.0000050
12-QR-07B	<0.5	2.1	0.7	<0.05	0.045	40	19	0.235	0.00008	0.000819	0.000479	<0.000010	<0.0000050
12-QR-08B	<0.5	17.4	1.3	<0.05	0.158	88	9.01	0.304	0.000093	0.000777	0.00503	<0.000010	<0.0000050
12-QR-09B	<0.5	1.6	0.2	<0.05	0.317	50	10.3	0.221	0.000233	0.00289	0.00555	<0.000010	<0.0000050
12-QR-13B	<0.5	0.7	<0.2	<0.05	0.291	52	10.5	0.213	0.000083	0.00157	0.00676	<0.000010	<0.0000050
QAQC													
Duplicates													
12-QR-06B								0.266	0.00015	0.000792	0.000453	<0.000010	<0.0000050
12-QR-13B						44							
Blanks													
Method Blank	<0.5	<0.5	<0.2	<0.05	<0.005	<10	<0.50	<0.00020	<0.000020	<0.000020	<0.000020	<0.000010	<0.0000050
Reference Material													
TDS 100 -Van (6340181)						110							
True Values TDS 100 -Van						100							
Percent Difference (6340181)						10							
Reference Material													
Ammonia-Van (6340798)					0.1								
True Values Ammonia-Van					0.1								
Percent Difference (6340798)					0								
Reference Material													
CRC ICPMS H2O 10 ppb (6341720)								106	1.03	10	9.99	9.77	0.95
True Values CRC ICPMS H2O 10 ppb								100	1	10	10	10	1
Percent Difference (6341720)								6	3	0	-0.1	-2.3	-5
Reference Material													
Acidity 8.3 W-Van (6344106)													
True Values Acidity 8.3 W-Van													
Percent Difference (6344106)													
Reference Material													
Chloride W Kone-Van (6345668)		20											
True Values Chloride W Kone-Van		20											
Percent Difference (6345668)		0											
Reference Material													
Sulphate W Kone- Van (6345670)													
True Values Sulphate W Kone- Van													
Percent Difference (6345670)													
Reference Material													
Alkalinity W Soln' B (6346541)				0.101									
True Values Alkalinity W Soln' B				0.1									
Percent Difference (6346541)				1									
Detection Limits	0.5	0.5	0.02	0.005	0.005	10	0.5	0.0002	0.00002	0.00002	0.00002	0.00001	0.000005
Maxxam SOP #	BBY6SOP-0004	BBY6SOP-0004	BBY6SOP-0004	BBY6SOP-0004	BBY6SOP-00004	BBY6SOP-00033	Calculation	BBY7SOP-0004	BBY7SOP-0004	BBY7SOP-0004	BBY7SOP-0004	BBY7SOP-0004	BBY7SOP-0004

Notes:
RDL raised due to sample matrix interference.

References:
Hardness = (Calcium*2.497) + (Magnesium*4.118)

Sample ID	Dissolved Boron (B)	Dissolved Cesium (Cs)	Dissolved Cadmium (Cd)	Dissolved Calcium (Ca)	Dissolved Chromium (Cr)	Dissolved Cobalt (Co)	Dissolved Copper (Cu)	Dissolved Lanthanum (La)	Dissolved Iron (Fe)	Dissolved Lead (Pb)	Dissolved Lithium (Li)	Dissolved Magnesium (Mg)	Dissolved Manganese (Mn)
Units	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
12-QR-06B	<0.050	<0.000050	<0.0000050	6.1	0.00012	0.000033	0.000963	<0.000050	0.0069	0.000013	0.00074	0.644	0.000486
12-QR-07B	<0.050	<0.000050	<0.0000050	6	<0.00010	0.000035	0.0041	<0.000050	0.0188	0.00003	0.0007	0.978	0.000954
12-QR-08B	0.102	<0.000050	<0.0000050	3.17	0.0001	0.000105	0.000593	<0.000050	0.0074	0.00001	<0.00050	0.265	0.00029
12-QR-09B	0.056	<0.000050	<0.0000050	2.89	0.00355	0.000266	0.0023	0.000117	0.209	0.00223	0.00052	0.757	0.00493
12-QR-13B	<0.050	<0.000050	<0.0000050	2.91	0.00571	0.000333	0.00301	0.000158	0.2	0.000194	<0.00050	0.785	0.00465
QAQC													
Duplicates													
12-QR-06B	<0.050	<0.000050	<0.0000050	6.09	0.0001	0.000035	0.000952	<0.000050	0.0061	0.00001	0.0007	0.66	0.000492
12-QR-13B													
Blanks													
Method Blank	<0.050	<0.000050	<0.0000050	<0.050	<0.00010	<0.0000050	<0.000050	<0.000050	<0.0010	<0.0000050	<0.00050	<0.050	<0.000050
Reference Material													
TDS 100 -Van (6340181)													
True Values TDS 100 -Van													
Percent Difference (6340181)													
Reference Material													
Ammonia-Van (6340798)													
True Values Ammonia-Van													
Percent Difference (6340798)													
Reference Material													
CRC ICPMS H2O 10 ppb (6341720)		1.03	9.96		10.3	10.4	10.3	1	109	10.2	10		10.3
True Values CRC ICPMS H2O 10 ppb		1	10		10	10	10	1	100	10	10		10
Percent Difference (6341720)		3	-0.4		3	4	3	0	9	2	0		3
Reference Material													
Acidity 8.3 W-Van (6344106)													
True Values Acidity 8.3 W-Van													
Percent Difference (6344106)													
Reference Material													
Chloride W Kone-Van (6345668)													
True Values Chloride W Kone-Van													
Percent Difference (6345668)													
Reference Material													
Sulphate W Kone- Van (6345670)													
True Values Sulphate W Kone- Van													
Percent Difference (6345670)													
Reference Material													
Alkalinity W Soln' B (6346541)													
True Values Alkalinity W Soln' B													
Percent Difference (6346541)													
Detection Limits	0.05	0.00005	0.000005	0.05	0.0001	0.000005	0.00005	0.00005	0.001	0.000005	0.0005	0.05	0.00005
Maxxam SOP #	BBY7SOP-000	BBY7SOP-000	BBY7SOP-000	BBY7SOP-000	BBY7SOP-000	BBY7SOP-000	BBY7SOP-000	BBY7SOP-00002	BBY7SOP-000	BBY7SOP-000	BBY7SOP-000	BBY7SOP-0000	BBY7SOP-00002

Notes:
RDL raised due to sample matrix interference.

References:
Hardness = (Calcium*2.497) + (Magnesium*4.118)

Sample ID	Dissolved Phosphorus (P)	Dissolved Molybdenum (Mo)	Dissolved Nickel (Ni)	Dissolved Potassium (K)	Dissolved Rubidium (Rb)	Dissolved Selenium (Se)	Dissolved Silicon (Si)	Dissolved Silver (Ag)	Dissolved Sodium (Na)	Dissolved Strontium (Sr)	Dissolved Sulphur (S)	Dissolved Tellurium (Te)
Units	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
12-QR-06B	0.0032	0.000768	0.000067	0.767	0.000714	0.000505	0.56	<0.0000050	2.35	0.0076	<10	<0.000020
12-QR-07B	0.0065	0.000513	0.000093	1.15	0.000564	0.000533	0.73	<0.0000050	6.39	0.00851	<10	<0.000020
12-QR-08B	0.0071	0.00137	<0.000020	1.58	0.00122	0.00149	0.74	<0.0000050	29.4	0.00789	<10	<0.000020
12-QR-09B	0.0375	0.000671	0.00253	1.02	0.000941	0.000584	1.11	<0.0000050	10	0.00686	<10	<0.000020
12-QR-13B	0.0464	0.000818	0.00394	0.724	0.000716	0.000648	0.89	<0.0000050	8.91	0.00613	<10	<0.000020
QAQC												
Duplicates												
12-QR-06B	0.0049	0.000797	0.00003	0.8	0.000785	0.000546	0.56	<0.0000050	2.38	0.00751	<10	<0.000020
12-QR-13B												
Blanks												
Method Blank	<0.0020	<0.000050	<0.000020	<0.050	<0.000050	<0.000040	<0.10	<0.0000050	<0.050	<0.000050	<10	<0.000020
Reference Material												
TDS 100 -Van (6340181)												
True Values TDS 100 -Van												
Percent Difference (6340181)												
Reference Material												
Ammonia-Van (6340798)												
True Values Ammonia-Van												
Percent Difference (6340798)												
Reference Material												
CRC ICPMS H2O 10 ppb (6341720)		0.98	10.4			11.2		1.04		10.1		0.89
True Values CRC ICPMS H2O 10 ppb		1	10			10		1		10		1
Percent Difference (6341720)		-2	4			12		4		1		-11
Reference Material												
Acidity 8.3 W-Van (6344106)												
True Values Acidity 8.3 W-Van												
Percent Difference (6344106)												
Reference Material												
Chloride W Kone-Van (6345668)												
True Values Chloride W Kone-Van												
Percent Difference (6345668)												
Reference Material												
Sulphate W Kone- Van (6345670)												
True Values Sulphate W Kone- Van												
Percent Difference (6345670)												
Reference Material												
Alkalinity W Soln' B (6346541)												
True Values Alkalinity W Soln' B												
Percent Difference (6346541)												
Detection Limits	0.002	0.00005	0.00002	0.05	0.00005	0.00004	0.1	0.000005	0.05	0.00005	10	0.00002
Maxxam SOP #	BBY7SOP-00002	BBY7SOP-00002	BBY7SOP-000	BBY7SOP-00002	BBY7SOP-000	BBY7SOP-000	BBY7SOP-000	BBY7SOP-000	BBY7SOP-000	BBY7SOP-000	BBY7SOP-000	BBY7SOP-000

Notes:
RDL raised due to sample matrix interference.

References:
Hardness = (Calcium*2.497) + (Magnesium*4.118)

Sample ID	Dissolved Thallium (Tl)	Dissolved Thorium (Th)	Dissolved Tin (Sn)	Dissolved Titanium (Ti)	Dissolved Tungsten (W)	Dissolved Uranium (U)	Dissolved Vanadium (V)	Dissolved Zinc (Zn)	Dissolved Zirconium (Zr)	Dissolved Mercury (Hg)	Anion Sum	Cation Sum	Balance %
Units	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	N/A	N/A	N/A
12-QR-06B	0.000005	<0.0000050	<0.00020	<0.00050	0.000032	0.000005	0.00251	0.00012	<0.00010	<0.000050	0.544	0.509	3.3
12-QR-07B	0.000002	<0.0000050	<0.00020	0.00056	0.000034	0.000013	0.00287	0.00013	<0.00010	<0.000050	0.662	0.714	-3.8
12-QR-08B	0.000003	<0.0000050	<0.00020	<0.00050	0.000028	0.000005	0.00788	0.00019	<0.00010	<0.000050	1.44	1.53	-3.3
12-QR-09B	0.000003	<0.0000050	<0.00020	0.00176	0.000016	0.000057	0.0141	0.00094	<0.00010	<0.000050	0.756	0.7	3.8
12-QR-13B	0.000002	<0.0000050	0.00025	0.00107	0.000013	0.000012	0.0153	0.00065	<0.00010	<0.000050	0.714	0.647	4.9
QAQC													
Duplicates													
12-QR-06B	0.000006	<0.0000050	<0.00020	<0.00050	0.000035	0.000005	0.00259	<0.00010	<0.00010	<0.000050			
12-QR-13B													
Blanks													
Method Blank	<0.0000020	<0.0000050	<0.00020	<0.00050	<0.000010	<0.0000020	<0.00020	<0.00010	<0.00010	<0.000050			
Reference Material													
TDS 100 -Van (6340181)													
True Values TDS 100 -Van													
Percent Difference (6340181)													
Reference Material													
Ammonia-Van (6340798)													
True Values Ammonia-Van													
Percent Difference (6340798)													
Reference Material													
CRC ICPMS H2O 10 ppb (6341720)	1.02		1.06	9.67		9.92	10.1	11.6		0.96			
True Values CRC ICPMS H2O 10 ppb	1		1	10		10	10	10		1			
Percent Difference (6341720)	2		6	-3.3		-0.8	1	16		-4			
Reference Material													
Acidity 8.3 W-Van (6344106)													
True Values Acidity 8.3 W-Van													
Percent Difference (6344106)													
Reference Material													
Chloride W Kone-Van (6345668)													
True Values Chloride W Kone-Van													
Percent Difference (6345668)													
Reference Material													
Sulphate W Kone- Van (6345670)													
True Values Sulphate W Kone- Van													
Percent Difference (6345670)													
Reference Material													
Alkalinity W Soln' B (6346541)													
True Values Alkalinity W Soln' B													
Percent Difference (6346541)													
Detection Limits	0.000002	0.000005	0.0002	0.0005	0.00001	0.000002	0.0002	0.0001	0.0001	0.00005			
Maxxam SOP #	BBY7SOP-000	BBY7SOP-000	BBY7SOP-000	BBY7SOP-000	BBY7SOP-000	BBY7SOP-000	BBY7SOP-000	BBY7SOP-000	BBY7SOP-00002	BBY7SOP-00002	Calculation	Calculation	Calculation

Notes:
RDL raised due to sample matrix interference.

References:
Hardness = (Calcium*2.497) + (Magnesium*4.118)

Appendix B
2012 Doris North Underground Waste Rock Monitoring
Program

Memo

To:	File	Date:	January 17, 2013
		From:	Ashley Landriault Lisa Barazzuol
		Project #:	1CH008.057
Subject:	2012 Doris North Underground Waste Rock Monitoring Program		

1 Introduction

Hope Bay Mining Ltd. (HBML) operated the Doris North underground mine, located at the Hope Bay Project, from 2010 to 2011. As of January 2012, the operation was placed under care and maintenance. During operations, waste rock was geochemically monitored and segregated in the waste rock storage area according to management plans described in the *Hope Bay Project Doris North Waste Rock and Ore Management Plan* (SRK 2010). The results of the waste rock monitoring program are documented in *2011 Waste Rock and Quarry Monitoring Report* (SRK 2012).

Ore was stockpiled in a separate area but was not part of the operational geochemical monitoring program of underground materials as it was anticipated that these materials would report to the mill. This material is now expected to remain stockpiled and will now need to be addressed in closure planning. Therefore, in June 2012, samples of stockpiled ore were obtained for the purpose of geochemical characterization. Also in June 2012, the waste rock stockpile was visually inspected to audit the segregation program.

This memorandum documents the inspection of the waste rock stockpile area, and describes the geochemical characterization program of the ore. For the latter, the data are interpreted to assess the acid rock drainage and/or metal leaching potential of the ore samples and recommendations are suggested. Seepage from the waste rock stockpile is addressed in SRK (2012).

2 Methods

2.1 Waste Rock Stockpile

The waste rock stockpile was visually inspected by SRK. The inspection included the base of the stockpile, the ramp and also the pad on the top, which was accessed via the ramp. The objective of the inspection was to confirm that waste rock was segregated according to the management plan. Specifically, material from blast rounds containing sulphides (determined visually during operations) was placed in the quadrant of the stockpile designated for mineralized waste and other material was in the area designated for waste (all other material). No samples of rock were collected as this was outside the scope of the inspection.

2.2 Ore Stockpile

The ore stockpiles were visually inspected by walking around the periphery of the pad area. In June 2012, samples were collected from a total of 10 sites on the ore stockpile. Sample points were selected with the intent of gaining a spatially representative sample set, as well as a varied range of visible quartz content. Samples were collected and visually described by SRK. Field notes were taken to document the lithology, visible quartz content, visible sulphide content and quartz veining. At each site, the sample was sieved and <1 cm, and <2 mm size fractions collected as separate samples. Splits of the <1 cm sample were shipped to ALS Labs (ALS) in Yellowknife, NWT and Maxxam Analytics in Burnaby, BC for geochemical analysis and the <2 mm sample was retained for contact test.

Contact tests on the <2 mm fraction were conducted by SRK using a 1 to 1 ratio of deionized water to solids. The pH and electrical conductivity (EC) of the leachates were recorded using hand held meters. The <1 cm fraction of all ten samples were shipped to ALS for sample preparation and total sulphur by Leco. Based on the criteria of >0.1 wt. % total sulphur, pulps of all of these samples were submitted for analysis of ABA and trace element content. Subsequent analyses were conducted at Maxxam and included paste pH, total sulphur by Leco, sulphate sulphur by hydrochloric acid leach, Modified Sobek neutralization potential (NP) (MEND 1991), total inorganic carbon (TIC) and elemental analysis by aqua regia digestion with ICP-MS finish. TIC was determined by using a Leco furnace to directly measure CO₂ gas evolved from HCl treatment of the sample.

Three samples were selected for shake flask extraction (SFE) tests to assess the soluble trace element content of the material. Selections were based on selecting samples with a range of EC values, as determined from the contact tests. SFE tests were performed on the as received <1 cm fraction using a 3:1 solid to solution ratio with 24 hours of agitation (MEND 2009). The objective of the test is to provide an indication of the relative potential for metal leaching from weathered waste materials. However, the actual concentrations in sample leachate will depend on the solid to water ratio, the amount of time the material has been allowed to weather, the amount of time the water is in contact with the waste material, the grain size distribution of the material, and the presence of secondary minerals that may control or limit concentrations. Therefore, the results cannot be directly compared to discharge water quality guidelines.

3 Results and Discussion

3.1 Waste Rock Stockpile

The base of the stockpile was primarily composed of coarse grain green-black to grey-black metavolcanics. Other geological features observed along the base include the following:

- In the southeast quadrant, a high density of quartz veining associated with defined crystals of pyrite or <1% very fine grained, disseminated pyrite were observed. There were no visible sulphides observed at the base of the stockpile in the other areas.
- In the northwest quadrant, rare quartz veining was observed, but the veining was not in association with sulphide minerals.
- In the southwest quadrant, a discrete area containing very fine grained black-green basalt was observed. This is likely the basalt found along the contact with the diabase intrusion that has been altered (or hornfelsed) as a result of heat from the intrusion.

The rock on the access ramp, and also the pad on the top in the northwest quadrant is described as a mixture of very fine grained green-black basalt with no visible sulphides; black coarse-grained diabase containing <0.5% fine grained and disseminated pyrite and intermixed with quartz vein rock fragments; and fine grained altered / hornfelsed basalt with no visible sulphides. The top of the stockpile in the northeast quadrant contained primarily green-black fine grained metavolcanics without visible sulphides. In addition, coarser-grained metavolcanic containing <0.5% very fine grained disseminated pyrite were observed. The pad area on top of the waste rock stockpile did not extend to the southwest or southeast areas of the stockpile.

Three flowing seeps were observed flowing from the southern side of the waste rock stockpile. These seeps were sampled with results and observations documented in SRK (2012).

3.2 Ore Stockpile

3.2.1 Visual Inspections

Complete visual inspections of each sample site are presented in Attachment 1. In summary, ore stockpile material was described as grey-green metavolcanics with moderate to high (15% to 75%) amounts of quartz, trace to 3% sulphides which occurred as granules, small veinlets, disseminations on fracture surfaces and in fine grained clusters. Material varied in crush size from fines to boulders.

3.2.2 Static Test Results

All samples were analyzed for total sulphur, ABA and elemental analysis because total sulphur content was greater than 0.1%. Table 1 summarizes these results with complete results presented in Attachment 1.

Total sulphur as measured at ALS and Maxxam, were at near parity, though results from Maxxam were slightly higher (Figure 1). The relative percent difference (RPD) between the two data sets ranged between 0% and 12%, where RPD is defined as

$$RPD = \frac{x_1 - x_2}{x_1 + x_2} * 100$$

Sulphur values ranged between 0.2% and 0.78%. Sulphate levels were less than detection (<0.01%) or slightly above (0.02%). The low sulphate values indicate that the sulphur in these samples is predominantly sulphide sulphur. Accordingly, acid potential (AP) is calculated from the total sulphur results.

The buffering capacities of the samples were high, with levels of TIC and NP at near parity for values of NP less than 100 kg CaCO₃/t (Figure 2). Above this level, TIC levels slightly exceeded NP. This suggests the presence of iron carbonate minerals for levels of NP greater than 100 kg CaCO₃/t, which have less buffering capacity than calcium- and magnesium- carbonate minerals. Accordingly, NP will be used to evaluate the potential of these samples to become acid generating.

The following criteria are used to classify the samples:

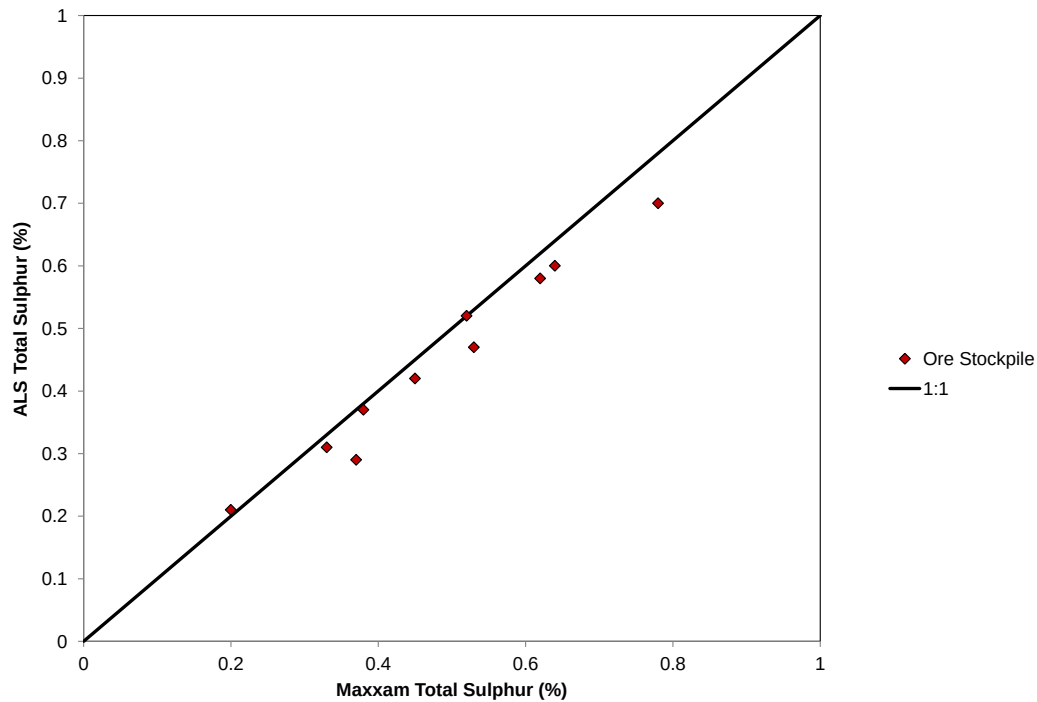
- Potentially acid generating (PAG) samples are those having a NP/AP of less than 1;
- Samples classified as uncertain have a NP/AP ratio less than 3 but greater than 1; and
- Samples that are non-potentially acid generating (Non-PAG) have a NP/AP ratio of greater than 3.

The NP/AP ratios of the samples indicate that most samples were classified as non-PAG, with two of the ten samples classified as uncertain (Figure 3).

Table 1: Summary of Acid Base Accounting Results for Ore Stockpile Samples

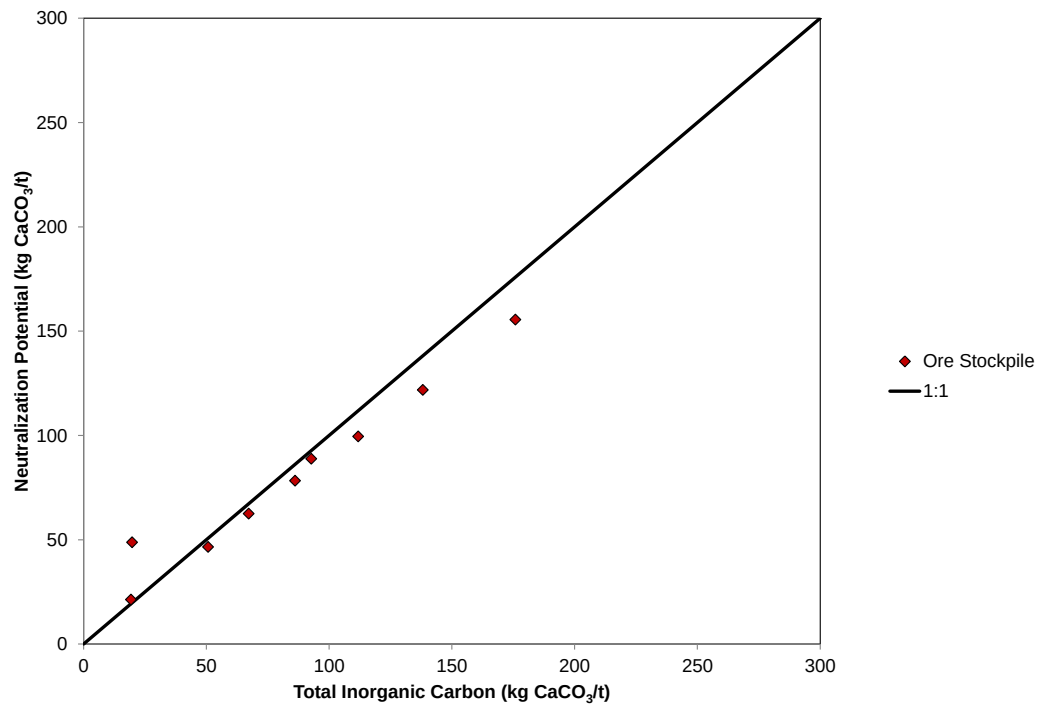
Statistic (n=10)	Paste pH	TIC	Total S (ALS)	Total S (Maxxam)	SO ₄	Sulphide Sulphur	AP	NP	NP/AP
Units	s.u.	kg CaCO ₃ /t	wt%	wt%	wt%	wt%	kg CaCO ₃ /t	kg CaCO ₃ /t	
P25	7.7	55	0.33	0.37	0.01	0.36	11	52	4.6
Median	7.7	89	0.45	0.49	0.01	0.47	15	84	5.7
P75	8.1	132	0.57	0.60	0.01	0.60	19	116	6.3
Max	9.1	311	0.70	0.78	0.02	0.77	24	251	10.4

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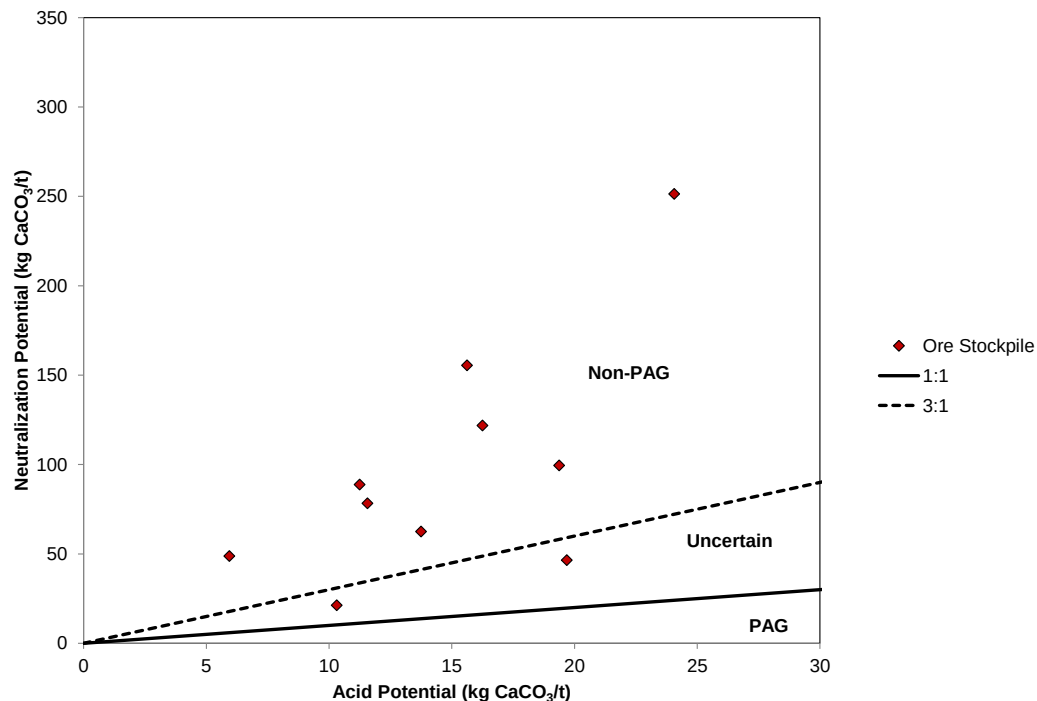
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Figure 1: Total Sulphur comparison of Maxxam and ALS Data



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Figure 2: Comparison of Total Inorganic Carbon and Modified Neutralization Potential



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Figure 3: Neutralization Potential vs Acid potential

3.2.3 Elemental Analysis

Results of the elemental analysis of the ore stockpile samples are provided in Attachment 1. A summary of these results is provided in Table 2. The data area compared to ten times the average crustal abundance for basaltic rocks (Price 1997) as a means of screening the data for anomalously high values. Gold and sulphur were elevated in nine of the ten samples compared to these screening criteria, silver was elevated in seven and arsenic was elevated in four. In general, selenium and bismuth could not be assessed because levels were either less than detection or within ten times the detection limit, the latter which indicates analytical uncertainty. The data suggest that for all other parameters, there was no appreciable enrichment in trace element content.

Table 2: Summary of Metals Analyses for 10 Ore Stockpile Samples

Parameter (n=10)	Units	DL	P25	Median	P75	Max	Average Crustal Abundance for Basaltic Rocks
Mo	ppm	0.1	0.33	0.4	0.5	0.7	1.5
Cu	ppm	0.1	42	58	87	185	87
Pb	ppm	0.1	3.3	3.9	5.4	8.2	6
Zn	ppm	1	36	65	99	472	105
Ag	ppm	0.1	0.93	2.0	5.5	9.6	0.11
Ni	ppm	0.1	18	27	36	566	130
Co	ppm	0.1	15	18	30	75	48
Mn	ppm	1	658	761	952	1680	1500
Fe	%	0.01	3.3	3.4	5.6	6.8	8.7
As	ppm	0.5	14	19	34	55	2
U	ppm	0.1	<0.1	<0.1	<0.1	0.1	1
Au	ppb	0.5	6788	17850	64875	100000	4
Th	ppm	0.1	<0.1	0.1	0.175	0.7	4
Sr	ppm	1	11	17	23	57	465
Cd	ppm	0.1	0.1	0.2	0.28	1.7	0.22
Sb	ppm	0.1	<0.1	<0.1	<0.1	<0.1	0.2
Bi	ppm	0.1	<0.1	0.1	0.1	0.3	0.007
V	ppm	2	13.5	25	46	75	250
Ca	%	0.01	1.5	2.4	3.1	6.3	7.6
P	%	0.001	0.01	0.02	0.03	0.05	0.11
La	ppm	1	1	1	2	11	15
Cr	ppm	1	14	17	21	841	170
Mg	%	0.01	0.75	0.78	1.5	6.7	4.6
Ba	ppm	1	8.5	11	13	16	330
Ti	%	0.0010	0.0013	0.0020	0.0028	0.079	1.38
B	ppm	20	<20	<20	<20	<20	5
Al	%	0.01	0.71	0.76	1.3	4.0	7.8
Na	%	0.001	0.056	0.078	0.099	0.133	1.8
K	%	0.01	0.05	0.065	0.08	0.11	0.83
W	ppm	0.1	<0.1	<0.1	0.1	0.6	0.7
Hg	ppm	0.01	<0.01	0.01	0.01	0.01	0.09
Sc	ppm	0.1	4.2	5.2	7.4	12.3	30
Tl	ppm	0.1	0.1	0.1	0.1	0.1	0.21
S	%	0.05	0.33	0.46	0.57	0.67	0.03
Ga	ppm	1	2	2.5	4	8	17
Se	ppm	0.5	0.5	0.5	0.6	0.7	0.05
Te	ppm	0.2	0.20	0.20	0.28	0.4	D

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3.2.4 Shake Flask Extraction Tests

SFE tests were completed on 3 of the 10 ore stockpile samples. The SFE results are summarized in Table 3, with complete results presented in Attachment 2. All SFE tests had neutral pH between 7.7 and 7.8. Electrical conductivity was elevated for two of the three samples. Elevated levels of ammonia and chloride have been attributed to flushing of drilling brines and blasting residues from the waste rock. SFE metals results were compared to ten times CCME guidelines to screen for elevated parameters. None of the metals exceeded these screening criteria.

Table 3: Shake Flask Extraction Test Results for 3 Samples from the Ore Stockpile

Parameters		12-ORE-03	12-ORE-08	12-ORE-09	Screening Criteria
pH	s.u.	7.7	7.7	7.8	
EC	µS/cm	956	5220	110	
SO ₄	mg/L	5.7	13	8.8	
Total Alkalinity	mg/L	11	14	16	
Cl	mg/L	157	992	9.4	1280**
Nitrate-N	mg/L	8.7	58	0.8	29
Total Ammonia	mg/L	3.6	34	0.43	39*
Al	mg/L	0.012	0.024	0.11	1
As	mg/L	0.00092	0.0012	0.016	0.05
Cd	mg/L	0.000051	0.00093	<0.000005	0.0005***
Cu	mg/L	0.0011	0.0024	0.00027	0.02
Fe	mg/L	0.009	0.0055	0.0047	3
Mo	mg/L	0.0015	0.00074	0.00088	0.73
Ni	mg/L	0.0014	0.00671	0.00012	0.2
Se	mg/L	0.00032	0.00045	0.00087	0.01
Ag	mg/L	<0.000005	0.000059	<0.000005	0.001
U	mg/L	0.00002	0.00006	0.000006	
Zn	mg/L	0.0018	0.10	0.00029	0.3
Hg	mg/L	<0.00005	<0.00025	<0.00005	0.00026

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Screening criteria is based on ten times CCME Guidelines.

*Guideline for ammonia is pH and temperature dependant. Seepage waters had an average temperature of 4°C at time of sampling. This guideline value is approximate.

**Chloride guideline from the Canadian Water Quality Guideline.

***Cadmium guideline for a hardness of 25 mg CaCO₃ mg/L.

4 Conclusions

The waste rock stockpiled from the Doris North underground mine was inspected with the objective of auditing the operational segregation program. The following was observed:

- Mineralized waste, defined by visual sulphide content, is situated in the southeast quadrant of the pile. Sulphide content in material from other areas of the stockpile was negligible to rare (<0.5%).
- Rock types observed in the stockpile included metavolcanics, diabase and altered / hornfelsed metavolcanics.

Ten samples were obtained from the ore material stockpiled from the Doris North underground mine. The objective of the sampling program was to assess the acid rock drainage and metal leaching potential of the stockpiled material in support of closure planning. The following summarizes the finding of the program:

- The geological composition of the ore was primarily metavolcanics with quartz veining. Visual sulphide content ranged from trace to 3% and mineral habit occurred as granules, small veinlets, and disseminations on fracture surfaces and in fine grained clusters.
- Total sulphur levels, which are representative of sulphide content, ranged from 0.2 to 0.8%, with median levels of 0.5%.
- The 25th to 75th percentile levels of TIC and modified Sobek NP were 52 to 132 kg CaCO₃/t. For levels of modified Sobek NP greater than 100 kg CaCO₃/t, levels of TIC were higher than NP, suggesting the presence of iron carbonates. As a result, Modified NP levels are considered more conservative in the classification of ARD assessment for the ore stockpile samples.
- On the basis of ratios of NP to AP, the majority of the samples were classified as non-PAG, with two samples classified as uncertain.
- Shake flask extractions on three samples indicated that the resulting leachate of the samples were alkaline. Elevated levels of soluble ammonia and chloride were attributable to blasting residues and drilling brines, respectively.

5 References

CCME, 1999, updated 2007. Canadian Environmental Quality Guidelines. Canadian Council of Ministers of Environment.

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Attachment 1: SRK Field Observations and Lab Test Results

SRK Field Observations and Lab Test Results										Percent distribution				Description of rock samples
Maxxam Sample No	Sample ID	WP	Easting	Northing	Source quarry	Description of sample point	Date	Time	Sampler	>1cm	<1cm	2mm-1cm	<2mm	
	Units									(%)	(%)	(%)	(%)	
EM1063	12-ORE-01A	#N/A	433296	7559142	Ore stockpile	south side of road entrance to top of ore stockpile, north east corner area of overall pile.	41069	6:15:00 PM	AML	65	35	85	15	grey green metavolcanics, not much quartz in comparison to rest of ore stockpile, small pieces of qtz ~5% of area sampled, trace visible sulphides
EM1077	12-ORE-02A	131	433296	7559131	Ore stockpile	SE side of pile	41078	8:45:00 AM	AML	60	40	80	20	grey green metavolcanics w/ moderate amount of quarts (~15%) in area sampled, trace-0.3% sulphides, disseminated fine grained or in blebs, usually associated w/ quartz, some just on fracture surfaces (with no qtz association)
EM1078	12-ORE-09A	138	433271	7559150	Ore stockpile	furthest NW corner of pile, slightly separate from rest of pile	41078	11:30:00 AM	AML	60	40	50	50	pale beige/buff color, ~75% qtz, sulphides in crystals/blebs, ~1-3%, some with oxidation rims.
EM1079	12-ORE-04A	133	433285	7559106	Ore stockpile	south side of pile	41078	9:45:00 AM	AML	30	70	65	35	fine grained, looks like sand in some areas, ~50% qtz, visible sulphides, blebs, veinlets, fine grained disseminated, crystals. Oxidized and unox.
EM1081	12-ORE-06A	135	433274	7559119	Ore stockpile	south west/west side	41078	10:20:00 AM	AML	40	60	70	30	combination qtz and mafic volcanics, sulphides in various forms (blebs, veinlets, cubic crystals) ~0.5-1%, qtz ~30%
EM1086	12-ORE-08A	137	433272	7559136	Ore stockpile	NW corner of pile	41078	11:00:00 AM	AML	50	50	50	50	combination mafic and quartz, ~30-40% quartz, sulphides in veinlets/frac surfaces, some crystals.
EM1087	12-ORE-10A	139	433284	7559128	Ore stockpile	North/NW side	41078	11:40:00 AM	AML	60	40	70	30	mix of mafic volcanics and quartz, qtz ~20-25%, sulphides are fine grained clumps, disseminated on fracture surfaces, ~1% sulph.
EM1088	12-ORE-07A	136	433272	7559128	Ore stockpile	west side of pile	41078	10:45:00 AM	AML	60	40	80	20	mix of grain sizes, some sand/fines, some >1cm but less than 2cm. Some large hand sized chunks. Qtz mixed with mafic volcanics, fine grained sulphides in veinlets and disseminated on fracture surfaces. Oxidized piece of metal under rocks, tried not to sample it
EM1089	12-ORE-03A	132	433296	7559118	Ore stockpile	SE corner of pile	41078	9:30:00 AM	AML	40	60	60	40	higher qtz content, much more pale in color, ~75% quartz, some oxidized surfaces, orange/yellow coating (Photo 784), visible sulphide in hand specimen, disseminated fine grained, blebs, crystals (cubes) and veinlets, some oxidized some fresh, 0.5-2%. Dusty, fine grained rock.
EM1090	12-ORE-05A	134	433275	7559112	Ore stockpile	south west corner of pile	41078	10:00:00 AM	AML	60	40	75	25	darker (more mafic) patch, qtz ~3%, sulphides are fine grained dissemin or veinlets, and on fracture surfaces. ~0.1-0.5%
Detection Limits														
Maxxam SOP #														

		Rinse of <1mm fraction																
Visible sulphides	Colour of fines	pH	Sp_ Cond	Total S (ALS)	AP (ALS)	Paste pH	CO2	CaCO3 Equiv.	Total S	RPD S(ALS) vs S (Maxxam)	HCl Extractable Sulphur	Sulphide Sulphur (by diff.)	Acid Generation Potential	Mod. ABA Neutralization Potential	NP/AP	Fizz Rating	Net Neutralization Potential	Neutralization Potential Ratio
(%)			Units	(%)		pH Units	wt%	kg CaCO3/t	wt%		wt%	wt%	kg CaCO3/t	kg CaCO3/t		N/A	kg CaCO3/t	N/A
trace	grey	7.73	7340	0.21	6.6	8.6	0.87	19.8	0.2	-2%	0.01	0.19	5.9	48.8	8.2	SLIGHT	42.9	8.2
tr-0.3%	grey	7.75	5990	0.52	16.3	7.74	7.74	175.9	0.52	0%	0.02	0.5	15.6	155.5	10.0	MODERATE	139.9	9.9
1-3	light grey	9.12	10820	0.58	18.1	9.07	4.92	111.8	0.62	3%	<0.01	0.62	19.4	99.5	5.1	MODERATE	80.1	5.1
N/A	light grey	7.53	10380	0.6	18.8	7.7	2.23	50.7	0.64	3%	0.01	0.63	19.7	46.5	2.4	SLIGHT	26.8	2.4
0.5-1	light grey	7.69	9910	0.42	13.1	7.58	2.96	67.3	0.45	3%	0.01	0.44	13.8	62.5	4.5	SLIGHT	48.8	4.5
N/A	light grey	7.56	out of range	0.37	11.6	7.68	3.79	86.1	0.38	1%	0.01	0.37	11.6	78.3	6.8	MODERATE	66.7	6.8
1	grey	7.58	out of range	0.47	14.7	7.69	6.08	138.2	0.53	6%	0.01	0.52	16.3	121.8	7.5	MODERATE	105.6	7.5
1	light grey	7.48	15760	0.29	9.1	7.5	4.08	92.7	0.37	12%	0.01	0.36	11.3	88.8	7.9	MODERATE	77.6	7.9
0.5-2%	light grey	8.03	2380	0.31	9.7	8.22	0.85	19.3	0.33	3%	<0.01	0.33	10.3	21.3	2.1	SLIGHT	11	2.1
0.1-0.5	very dark grey	7.53	out of range	0.7	21.9	7.72	13.7	311.4	0.78	5%	0.01	0.77	24.1	251.3	10.4	STRONG	227.2	10.4
			DL			N/A	0.02	0.5	0.02		0.01	0.02	0.6	0.1		N/A	0.1	N/A
						7160	LECO	Calculation	LECO		BBY0SOP-00010	Calculation	Calculation	BBY0SOP-00020	Calculation	BBY0SOP-00030	Calculation	Calculation

Mo	Cu	Pb	Zn	Ag	Ni	Co	Mn	Fe	As	U	Au	Th	Sr	Cd	Sb	Bi	V	Ca	P	La	Cr	Mg	Ba	Ti	B	Al	Na	K	W	Hg	Sc	Tl	S	Ga	Se	Te	
ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	%	ppm	ppm	ppb	ppm	ppm	ppm	ppm	ppm	ppm	%	%	ppm	ppm	%	ppm	%	ppm	%	%	%	%	ppm	ppm	ppm	ppm	%	ppm	ppm	ppm
0.1	125	2	63	<0.1	566	74.9	767	6.57	4	0.1	19.1	0.7	8	<0.1	<0.1	0.3	75	1.13	0.051	11	841	6.69	16	0.079	<20	4.04	0.024	<0.01	<0.1	<0.01	3.7	0.10	0.17	8	0.5	<0.2	
0.5	93.2	5.8	149	3.3	33.8	33.3	1330	5.99	36.3	<0.1	34500	0.2	28	0.3	<0.1	<0.1	58	4.25	0.039	2	16	1.65	13	0.003	<20	1.75	0.1	0.09	<0.1	<0.01	11.7	0.10	0.52	6	0.6	0.4	
0.3	35.7	4.3	21	1.9	36.6	20.1	869	3.31	39	<0.1	16600	<0.1	12	<0.1	<0.1	<0.1	10	2.55	0.007	1	17	0.75	8	<0.001	<20	0.3	0.055	0.05	<0.1	<0.01	4.2	0.10	0.59	1	0.5	0.4	
0.7	42.6	3.2	27	0.4	13.2	12.7	636	3.32	13.5	<0.1	4350	<0.1	10	<0.1	<0.1	<0.1	11	1.38	0.021	1	16	0.63	10	<0.001	<20	0.71	0.06	0.06	<0.1	<0.01	4.2	0.10	0.63	2	0.5	<0.2	
0.4	61.6	7.9	65	2	21.5	14.7	645	3.2	17.3	<0.1	19100	<0.1	16	0.2	<0.1	<0.1	28	2.03	0.014	1	20	0.77	10	0.002	<20	0.81	0.076	0.07	<0.1	<0.01	5.3	0.10	0.44	3	0.7	<0.2	
0.4	54.3	3.5	82	6.2	27.5	15.5	697	3.27	19.8	<0.1	75000	<0.1	18	0.2	<0.1	<0.1	22	2.22	0.012	1	21	0.79	12	0.003	<20	0.71	0.099	0.08	<0.1	<0.01	5.1	0.10	0.37	2	0.5	<0.2	
0.3	67.7	4.2	104	1.6	26.3	21.3	980	4.37	25.2	<0.1	14100	0.1	24	0.3	<0.1	<0.1	36	3.26	0.026	2	13	1.1	12	0.002	<20	1.13	0.099	0.08	<0.1	<0.01	7.9	0.10	0.47	4	0.6	<0.2	
0.5	41.3	3.5	64	9.6	16.8	15.2	755	3.46	15.1	<0.1	>100000	0.1	20	0.2	<0.1	<0.1	21	2.58	0.021	1	13	0.76	7	0.002	<20	0.71	0.079	0.05	<0.1	0.01	5.9	0.10	0.31	2	0.7	<0.2	
0.4	23.3	3.2	23	8.6	9	7.3	304	2.09	10.1	<0.1	88900	<0.1	6	<0.1	<0.1	<0.1	8	0.64	0.005	1	13	0.24	6	<0.001	<20	0.26	0.028	0.03	0.6	0.01	1.7	0.10	0.32	1	0.5	<0.2	
0.5	185	8.2	472	0.7	72	40.4	1680	6.76	54.7	<0.1	831	0.3	57	1.7	<0.1	0.2	49	6.3	0.034	2	29	2.08	15	0.002	<20	1.4	0.133	0.11	<0.1	<0.01	12.3	0.10	0.67	4	0.5	0.3	
0.1	0.1	0.1	1	0.1	0.1	0.1	1	0.01	0.5	0.1	0.5	0.1	1	0.1	0.1	0.1	2	0.01	0.001	1	1	0.01	1	0.001	20	0.01	0.001	0.01	0.1	0.01	0.1	0.1	0.05	1	0.5	0.2	
1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	

Attachment 2: Shake Flask Extraction Test Results

Table 1: MEND SFE Test Results for project HOPEBAY 2012 SOLID ANALYSES

Sample ID	Maxxam Sample No	Sample Weight	Volume Used	pH	EC	SO4	Acidity to pH4.5	Acidity to pH8.3	Total Alkalinity	Bicarbonate	Carbonate	Hydroxide	Dissolved Chloride	Nitrate-N
Units		g	mL	pH Units	uS/cm	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
12-ORE-03B	EX2592	250	750	7.65	956	5.7	<0.5	2	11	14	<0.5	<0.5	157	8.7
12-ORE-08B	EX2593	250	750	7.68	5220	13.4	<0.5	12.3	14	18	<0.5	<0.5	992	58
12-ORE-09B	EX2594	250	750	7.84	110.1	8.8	<0.5	<0.5	16	19	<0.5	<0.5	9.4	0.8
12-ORE-09B DUP	EX2595	250	750	7.83	117	8.8	<0.5	<0.5	17	20	<0.5	<0.5	9.3	0.8
QAQC Blanks														
Method Blank		0	750	6.73	1.6	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.2
Reference Material														
TDS 100 -Van (6340181)														
True Values TDS 100 -Van														
Percent Difference (6340181)														
Reference Material														
Ammonia-Van (6340798)														
True Values Ammonia-Van														
Percent Difference (6340798)														
Reference Material														
CRC ICPMS H2O 10 ppb (6341720)														
True Values CRC ICPMS H2O 10 ppb														
Percent Difference (6341720)														
Reference Material														
Acidity 8.3 W-Van (6344106)								103						
True Values Acidity 8.3 W-Van								100						
Percent Difference (6344106)								3						
Reference Material														
Chloride W Kone-Van (6345668)													20	
True Values Chloride W Kone-Van													20	
Percent Difference (6345668)													0	
Reference Material														
Sulphate W Kone- Van (6345670)						18.4								
True Values Sulphate W Kone- Van						20								
Percent Difference (6345670)						-8								
Reference Material														
Alkalinity W Soln' B (6346541)									43.32					
True Values Alkalinity W Soln' B									47.6					
Percent Difference (6346541)									-9					
Detection Limits				N/A	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.02
Maxxam SOP #						BBY6SOP-	BBY6SOP-000	BBY6SOP-0003	BBY6SOP-00026, BBY0	BBY6SOP-000	BBY6SOP-000	BBY6SOP-000	BBY6SOP-000	BBY6SOP-000

Notes:
RDL raised due to sample matrix interference.

References:
Hardness = (Calcium*2.497) + (Magnesium*4.118)

Sample ID	Dissolved Lanthanum (La)	Dissolved Iron (Fe)	Dissolved Lead (Pb)	Dissolved Lithium (Li)	Dissolved Magnesium (Mg)	Dissolved Manganese (Mn)	Dissolved Phosphorus (P)	Dissolved Molybdenum (Mo)	Dissolved Nickel (Ni)	Dissolved Potassium (K)	Dissolved Rubidium (Rb)	Dissolved Selenium (Se)	Dissolved Silicon (Si)	Dissolved Silver (Ag)	Dissolved Sodium (Na)	Dissolved Strontium (Sr)	Dissolved Sulphur (S)	Dissolved Tellurium (Te)
Units	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
12-ORE-03B	<0.000050	0.009	0.000026	0.0148	4.42	0.118	0.0166	0.00153	0.00135	3.64	0.00625	0.000316	0.46	<0.0000050	18.1	0.261	<10	<0.000020
12-ORE-08B	<0.00025	0.0055	0.000125	0.0379	14.4	0.305	<0.010	0.00074	0.00671	15.2	0.0249	0.00045	<0.50	0.000059	72	1.09	<50	<0.00010
12-ORE-09B	<0.000050	0.0047	0.000023	0.001	1.95	0.00763	0.0103	0.000884	0.000122	1.16	0.00156	0.000871	0.39	<0.0000050	3.99	0.0137	<10	<0.000020
12-ORE-09B DUP	<0.000050	0.0054	0.000016	0.00093	2.03	0.0056	0.008	0.00085	0.000167	1.19	0.00168	0.000755	0.4	<0.0000050	3.91	0.0114	<10	<0.000020
QAQC																		
Blanks																		
Method Blank	<0.000050	<0.0010	<0.0000050	<0.00050	<0.050	<0.000050	<0.0020	<0.000050	<0.000020	<0.050	<0.000050	<0.000040	<0.10	<0.0000050	<0.050	<0.000050	<10	<0.000020
Reference Material																		
TDS 100 -Van (6340181)																		
True Values TDS 100 -Van																		
Percent Difference (6340181)																		
Reference Material																		
Ammonia-Van (6340798)																		
True Values Ammonia-Van																		
Percent Difference (6340798)																		
Reference Material																		
CRC ICPMS H2O 10 ppb (6341720)	1	109	10.2	10		10.3		0.98	10.4			11.2		1.04		10.1		0.89
True Values CRC ICPMS H2O 10 ppb	1	100	10	10		10		1	10			10		1		10		1
Percent Difference (6341720)	0	9	2	0		3		-2	4			12		4		1		-11
Reference Material																		
Acidity 8.3 W-Van (6344106)																		
True Values Acidity 8.3 W-Van																		
Percent Difference (6344106)																		
Reference Material																		
Chloride W Kone-Van (6345668)																		
True Values Chloride W Kone-Van																		
Percent Difference (6345668)																		
Reference Material																		
Sulphate W Kone- Van (6345670)																		
True Values Sulphate W Kone- Van																		
Percent Difference (6345670)																		
Reference Material																		
Alkalinity W Soln' B (6346541)																		
True Values Alkalinity W Soln' B																		
Percent Difference (6346541)																		
Detection Limits	0.00005	0.001	0.000005	0.0005	0.05	0.00005	0.002	0.00005	0.00002	0.05	0.00005	0.00004	0.1	0.000005	0.05	0.00005	10	0.00002
Maxxam SOP #	BBY7SOP-000	BBY7SOP-00	BBY7SOP-00	BBY7SOP-00	BBY7SOP-000	BBY7SOP-0000	BBY7SOP-0000	BBY7SOP-00002	BBY7SOP-00	BBY7SOP-000	BBY7SOP-00	BBY7SOP-00	BBY7SOP-00	BBY7SOP-00	BBY7SOP-00	BBY7SOP-00	BBY7SOP-00	BBY7SOP-00

Notes:
RDL raised due to sample matrix interference.

References:
Hardness = (Calcium*2.497) + (Magnesium*4.118)

Sample ID	Dissolved Thallium (Tl)	Dissolved Thorium (Th)	Dissolved Tin (Sn)	Dissolved Titanium (Ti)	Dissolved Tungsten (W)	Dissolved Uranium (U)	Dissolved Vanadium (V)	Dissolved Zinc (Zn)	Dissolved Zirconium (Zr)	Dissolved Mercury (Hg)	Anion Sum	Cation Sum	Balance %
Units	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	N/A	N/A	N/A
12-ORE-03B	0.000046	<0.0000050	<0.00020	<0.00050	0.0018	0.00002	<0.00020	0.00176	<0.00010	<0.000050	4.76	6.2	-13.2
12-ORE-08B	0.000292	<0.000025	<0.0010	<0.0025	0.000372	0.00006	<0.0010	0.101	<0.00050	<0.00025	28.5	26.1	4.4
12-ORE-09B	0.000004	<0.0000050	<0.00020	<0.00050	0.000142	0.000006	0.00034	0.00029	<0.00010	<0.000050	0.762	0.807	-2.9
12-ORE-09B DUP	0.000004	<0.0000050	<0.00020	<0.00050	0.000103	0.000005	0.00031	0.00075	<0.00010	<0.000050	0.778	0.834	-3.5
QAQC Blanks													
Method Blank	<0.0000020	<0.0000050	<0.00020	<0.00050	<0.000010	<0.0000020	<0.00020	<0.00010	<0.00010	<0.000050			
Reference Material													
TDS 100 -Van (6340181) True Values TDS 100 -Van Percent Difference (6340181)													
Reference Material													
Ammonia-Van (6340798) True Values Ammonia-Van Percent Difference (6340798)													
Reference Material													
CRC ICPMS H2O 10 ppb (6341720) True Values CRC ICPMS H2O 10 ppb Percent Difference (6341720)	1.02 1 2		1.06 1 6	9.67 10 -3.3		9.92 10 -0.8	10.1 10 1	11.6 10 16		0.96 1 -4			
Reference Material													
Acidity 8.3 W-Van (6344106) True Values Acidity 8.3 W-Van Percent Difference (6344106)													
Reference Material													
Chloride W Kone-Van (6345668) True Values Chloride W Kone-Van Percent Difference (6345668)													
Reference Material													
Sulphate W Kone- Van (6345670) True Values Sulphate W Kone- Van Percent Difference (6345670)													
Reference Material													
Alkalinity W Soln' B (6346541) True Values Alkalinity W Soln' B Percent Difference (6346541)													
Detection Limits	0.000002	0.000005	0.0002	0.0005	0.00001	0.000002	0.0002	0.0001	0.0001	0.00005			
Maxxam SOP #	BBY7SOP-00	BBY7SOP-00	BBY7SOP-00	BBY7SOP-00	BBY7SOP-00	BBY7SOP-00	BBY7SOP-00	BBY7SOP-00	BBY7SOP-0000	BBY7SOP-000	Calculation	Calculation	Calculation

Notes:
RDL raised due to sample matrix interference.

References:
Hardness = (Calcium*2.497) + (Magnesium*4.118)

Appendix C
2012 Hope Bay Seepage Monitoring Program

Memo

To:	File	Date:	January 17, 2013
		From:	Ashley Landriault
		Project #:	1CH008.057
Subject:	2012 Hope Bay Seepage Monitoring Program		

1 Introduction

As part of the verification, monitoring and quarry management plans for the Hope Bay Project, Hope Bay Mining Ltd. (HBML) is required to monitor seep surveys around the Doris North roads, airstrip, camp area and quarries. SRK was asked to complete the seepage surveys and annual reports from 2009-2012. Results of the most recent seep survey are reported in the *2011 Waste Rock and Quarry Monitoring Report* (SRK 2012).

This memo presents results of the 2012 freshet seep survey. The seepage program was completed in accordance with conditions outlined in Part D "Conditions applying to Construction" Item 21 of Water License 2AM-DOH0713 (Nunavut Water Board 2007) and the *Quarry A, B & D Management and Monitoring Plan, Revision 01* (SRK 2010).

2 Methods

2.1 Seep Survey and Sample Collection

The seep survey was carried out between June 8th and June 21st, 2012. Seep survey locations were established by walking the toes of all roadways, building pads and quarry sites along the Doris North and Doris-Windy roads (Attachment 1, Figures 1 to 9). The samples used as reference points (not subject to mine influences) were collected from the same points as the 2011 Seep Survey (in the vicinity of the Doris-Windy Road, Attachment 1, Figures 6 to 9).

Field measurements were taken at all locations where water was observed flowing into and out of construction rock material including true seeps where precipitation runoff and snowmelt came into contact with rock along the roadways, building pads and quarry sites. Electrical conductivity (EC), pH, temperature, oxidation reduction potential (ORP) and flow rates were measured at each of these locations at the time of monitoring. Due to unseasonably dry conditions, some measurements were taken from small ponded pools of water to attempt to collect enough sample points to satisfy license requirements.

A total of 81 sites were established. A minimum of 10% of the total sample set including any sites with elevated EC were submitted for laboratory analysis. Seventeen samples were sent to an external laboratory for analysis. Three duplicates and two field blanks were collected and submitted for laboratory analysis to provide quality control.

2.2 Laboratory Analysis

Samples were collected by SRK and submitted to ALS-Chemex in Vancouver, BC and analyzed for pH, EC, SO₄, acidity, alkalinity, Cl, F, nitrate, nitrite, phosphorus, ammonia, TDS and low level dissolved metals including mercury and selenium.

3 Results and Discussion

3.1 Field Observations

A complete set of field observations and measurements is provided in Attachment 2. Due to an uncharacteristically dry spring, and an early warming, many previously established seeps were not flowing.

3.2 Field Measurements

Table 1 outlines the mean and median statistics of conductivity measures and pH levels at each of the areas sampled. The pH levels measured across all established sites ranged from 6.9 to 9.4 (not including Reference Points). One ponded seep on the Doris-Windy road had a pH of 10; this measurement was recorded one evening of sampling, the next day the site was revisited to double check the value and the pH was re-measured at 7.8. The conductivity of seeps varied by area:

- The samples from the area influenced by the waste rock pile had a median field conductivity of 4152 $\mu\text{S}/\text{cm}$.
- The conductivity measurements in the Doris North area had a median of 248 $\mu\text{S}/\text{cm}$. One high conductivity sample (12-RB-31 with a value of 2420 $\mu\text{S}/\text{cm}$) was observed in the Roberts Bay area, this sample was collected from a flowing seep on a newly constructed (unfinished) portion of the road.
- Doris Windy Road samples had a median conductivity of 205 $\mu\text{S}/\text{cm}$.

The reference points that were measured as representative of conditions outside the influence of mining operations, had the lowest conductivity values with a median of 62 $\mu\text{S}/\text{cm}$.

Table 1: Mean and Median EC and Field pH of Seepage Sites; Grouped According to Area

Location	Conductivity		pH	
	Mean	Median	Mean	Median
Statistic				
Waste Rock Influenced Area (n=7)	6136	4152	7.9	8.0
Doris North Area (n=37)	333	248	8.0	8.0
Doris Windy Road (n=31)	274	205	8.3	8.2
Reference Points (n=3)	68	62	6.6	6.6

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3.3 Laboratory Data

A summary of water quality analyses is presented in Table 2. Complete results are presented in Attachment 2. All parameters were compared to the Canadian Council of Ministers of the Environment (CCME) water quality guidelines for the protection of aquatic life to screen for elevated parameters.

3.3.1 Waste Rock Influenced Area

Five samples from the Waste Rock Influenced Area were submitted for laboratory analysis (Table 2). Laboratory pH levels of these samples ranged from 6.7 to 8.6. Ammonia, chloride, nitrate, cadmium and copper in four of the five samples were elevated in comparison to CCME guidelines.

3.3.2 Doris North Areas

Eight samples from the Doris North Areas (Roberts Bay, Tail Lake Road, road north of camp) were submitted for laboratory analysis (Table 2). The pH values of the samples were neutral to alkaline (between 7.6 and 9.4). One sample had slightly elevated levels of copper when compared to CCME guidelines. Sample 12-RB-31 (sample with high conductivity in the Roberts Bay area) had elevated nitrate, chloride and cadmium compared to the CCME guidelines. This sample was collected from snow melt seeping off of a partially constructed portion of road. Further investigation into the rock type used in this particular segment of road is presented in the 2012 Quarry Rock Geochemistry memo of this report.

3.3.3 Doris-Windy Road

Four samples from the Doris-Windy Road were submitted for laboratory analysis (Table 2). One sample had elevated chloride in comparison to CCME guidelines.

3.3.4 Reference Point Samples

All three Reference Point Samples were submitted for laboratory analysis.

The pH of these samples was lower than other samples at site, ranging from 6.6 to 6.7. Dissolved metal concentrations are generally similar or slightly lower than those measured at other seepage locations. These results are consistent with the 2011 reference point samples, taken from the same locations.

Table 2: Summary of Water Quality Results

Group	Sample ID	Field pH	Lab pH	Flow	Alkalinity, Total	SO ₄	Ammonia	Nitrate	Chloride	Al	As	Cd	Cu	Pb	Ni	Zn
	Units	s.u.	s.u.	L/s	mg CaCO ₃ /L	mg/L	mg N/L	mg N/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
	CCME guideline	6.5-9	6.5 - 9				3.9*	2.9	128**	0.1	0.005	0.00005***	0.002 - 0.004	0.001	0.025	0.03
WR Influenced Area	12-DC-05	8.6	8.1	0.125	117	21	0.15	1.9	59	0.0061	0.00027	0.00001	0.0023	0.00005	0.0006	0.0012
	12-DC-07	8.0	7.4	0.093	102	101	11	44	807	0.017	0.0011	0.000065	0.01	0.0001	0.0043	0.0020
	12-WR-SEEP-01	7.6	7.6	0.075	75	59	68	134	2280	0.0074	0.0013	0.00029	0.0065	0.00025	0.0036	0.0050
	12-WR-SEEP-02	6.7	7.7	<5	80	76	67	137	2550	0.0078	0.0013	0.00032	0.0059	0.00025	0.0038	0.0050
	12-WR-SEEP-03	8.0	7.7	<5	84	75	62	136	2530	0.0083	0.0013	0.00034	0.0063	0.00025	0.0045	0.0050
Doris North Area	12-DC-03	8.4	8.2	high, diverging flow	101	18	0.36	1.7	52	0.0082	0.00042	0.00001	0.0040	0.00005	0.00068	0.0010
	12-DC-18	7.9	8.2	0.075	106	16	0.05	1.0	25	0.0071	0.00065	0.00001	0.0063	0.00005	0.0008	0.0010
	12-DC-19	8.4	8.2	0.2	25	2.9	0.13	0.509	6.2	0.028	0.00023	0.00001	0.0021	0.00005	0.0005	0.0010
	12-DC-73	7.9	8.3	not measurable	106	20	0.03	2.3	61	0.0073	0.00023	0.00001	0.0034	0.00005	0.00065	0.0010
	12-TLR-10	8.2	8.1	not measurable	36	4.0	0.07	0.0342	20	0.029	0.00013	0.00001	0.010	0.00005	0.0012	0.0030
	12-TLR-14	7.6	8.0	none/trace	148	9.0	0.72	0.729	30	0.038	0.00041	0.00001	0.0038	0.000056	0.0015	0.0029
	12-RB-31	8.6	8.1	not measurable	80	90	0.96	3.3	545	0.028	0.00081	0.00002	0.0033	0.0001	0.001	0.0020
	12-RB-34	9.4	8.2	0.125	69	9.4	0.02	0.0866	32	0.013	0.00016	0.00001	0.0038	0.00005	0.0005	0.0010
Doris-Windy Road	12-DW-42	8.8	8.1	1	42	1.6	0.01	0.0078	4.33	0.005	0.00015	0.00001	0.0018	0.00005	0.0005	0.0010
	12-DW-56	7.8	7.9	not measurable	25	1.1	0.06	0.0608	5.8	0.019	0.00022	0.00001	0.0016	0.00005	0.0012	0.0014
	12-DW-61	8.6	7.2	not measurable	61	6.9	0.14	1.3	244	0.0073	0.00024	0.000011	0.0018	0.00005	0.0020	0.0017
	12-DW-65	7.7	8.0	3	38	2.3	0.34	1.1	50	0.03	0.00025	0.00001	0.0018	0.000051	0.0022	0.0015
Reference Points	12-REF 01	6.7	6.9	2	21	0.5	0.01	0.005	5.1	0.046	0.0002	0.00001	0.0012	0.00005	0.0023	0.0050
	12-REF 02	6.6	7.4	0.25	20	0.77	0.01	0.005	5.5	0.012	0.0001	0.00001	0.0010	0.00005	0.00061	0.0044
	12-REF 03	6.57	7.91	not measurable	22	2.5	0.01	0.005	8.3	0.024	0.0001	0.00001	0.0013	0.00005	0.00092	0.0030

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Values in **bold** indicates value exceeds respective water quality guideline.

*Guideline for ammonia is pH and temperature dependant. Seepage waters had an average temperature of 4°C at time of sampling. This guideline value is approximate.

**Chloride guideline from the Canadian Water Quality Guideline.

***Cadmium guideline for a hardness of 25 mg CaCO₃ mq/L.

3.4 Quality Assurance and Quality Control

Two duplicates and two field blanks were collected to ensure quality control. Duplicate results were well within the accepted range for all parameters. Analysis of the field blanks indicated that most parameters were below detection limits.

Ion balances for 2012 indicate that the samples had cation-anion ratios that were within normal ranges

Measured values for total dissolved solids (TDS) demonstrate a strong positive correlation with values for conductivity for all of the points.

3.5 Comparison to Previous Seep Surveys

3.5.1 Doris North (Excluding Waste Rock Influenced Area)

Historical summary statistics of EC and pH for all sites except the Mine Area are provided in Table 3. The electrical conductivity of seepage waters across the site was slightly higher in 2012 in comparison to 2011 measurements, but was still below the mean and median measurements from 2009 and 2010. Dusty conditions were observed during the 2012 survey and the site was uncharacteristically dry during the two weeks SRK was at site. Dust at site during the survey could have resulted in higher EC values. Additionally, the lack of flow at many of the seeps may have been a contributing factor.

Table 3: Historical Summary Statistics of EC and pH of Areas Excluding Mine Area

Statistic	Conductivity μS/cm				pH			
Year	2009	2010	2011	2012	2009	2010	2011	2012
p25	195	162	107	179	7.5	7.3	7.6	7.6
Mean	374	336	274	330	7.6	7.4	7.7	8.0
Median	269	197	190	248	7.8	7.5	7.8	7.9
p95	896	671	554	575	8.3	8.1	8.2	8.9

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Very few of the 2012 seepage sites were in the exact same locations as the 2011 seepage sites. In the 2011 seepage survey, one site (TLR-5) at the base of the frozen core dam was sampled and found to be elevated in sulphate, chloride, ammonia, nitrate and copper in comparison to CCME guidelines. These elevated values were attributed to the fact that the water sample was not a true seep; it was a ponded pool at the base of the dam. In the 2012 survey, this site was revisited (12-TLR-14), the seep was flowing slowly, a sample was collected and all parameters were below CCME guidelines.

3.5.2 Waste Rock Influenced Area

Comparisons between 2011 and 2012 of the waste rock influenced seepage are presented in Tables 4 and 5.

A comparison between 2011 and 2012 seeps collected at the toe of the waste rock dump is presented in Table 4. Parameters that have increased in concentration include: conductivity, ammonia, chloride, nitrate and sulphate. Changes in detection limits have allowed for more precise measurements of several metals. The increased concentrations of these parameters could be partly attributed to the drier than normal conditions observed during the seep survey. Seepage from the waste rock dump is directed to the pollution control pond, therefore parameters are not compared directly to the CCME guidelines.

Seeps that were measured in the camp area that report directly to the tundra have decreased in EC and maintained neutral to slightly alkaline pH. One sample from the 2012 survey (12-DC-05) was sampled very close to a historical sample (DC02) from the 2011. A comparison of these samples revealed a decrease in ammonia, chloride, nitrate and copper from the previous year (Table 5). All

parameters are within guidelines outlined by the CCME for the protection of aquatic life (CCME 2007). For full results refer to Attachment 2.

Table 4: Comparison of Summary Statistics of the WR Influenced Area 2011 vs 2012

Parameter	Units	2011			2012		
		DC09	DC08	DC07	WR-SEEP-01	WR-SEEP-02	WR-SEEP-03
SpCond	uS/cm	5776	4410	3888	10,405	14,600	12,227
pH		7.4	7.5	7.5	7.6	6.7	8.0
Flow	L/s	0.5	0.5	5-10	0.075	<5	<5
Alkalinity	mg CaCO ₃ /L	50	70	69	75	80	84
Ammonia	mg/L N	35	27	24	68	67	62
Chloride	mg/L	1660	1220	1090	2280	2550	2530
Nitrate	mg/L N	63	50	44	134	137	136
Sulfate	mg/L	28	39	36	59	76	75
Al	mg/L	<0.03	<0.03	<0.015	0.0074	0.0078	0.0083
As	mg/L	<0.004	<0.002	<0.003	0.0013	0.0013	0.0013
Cd	mg/L	0.00018	<0.00017	<0.000085	0.00029	0.00032	0.00034
Ca	mg/L	738	508	453	830	859	857
Cu	mg/L	0.0097	0.014	0.015	0.0065	0.0059	0.0063
Fe	mg/L	0.064	<0.03	<0.03	0.046	0.036	0.038
Mg	mg/L	34	36	34	67	80	79
Mn	mg/L	0.72	0.25	0.23	0.46	0.79	0.82
Mo	mg/L	0.0017	0.0021	0.0017	0.0029	0.0037	0.0037
Ni	mg/L	0.0067	<0.005	0.0031	0.0036	0.0038	0.0045
Se	mg/L	<0.01	<0.01	<0.01	0.0012	0.0014	0.0014
U	mg/L	0.00057	0.00052	0.00047	0.0013	0.0012	0.0012

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Table 5: Comparison of 11-DC02 and 12-DC-05

Station ID	Units	11-DC02	12-DC-05	CCME
Field pH	s.u.	7.59	8.62	6.5-9
Alkalinity Total	mg CaCO ₃ /L	127	117	
Ammonia	mg N/L	1.36	0.15	3.9
Cl	mg/L	98	59	128
Nitrate	mg N/L	2.8	1.9	2.9
SO ₄	mg/L	19	20	
Cd	mg/L	<0.00001	<0.00001	0.00005*
Cu	mg/L	0.0032	0.0022	0.002-0.004
Pb	mg/L	<0.00005	<0.00005	0.001
Ni	mg/L	0.0007	0.0006	0.025
Zn	mg/L	<0.003	0.0012	0.03

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*Cadmium guideline for a hardness of 25 mg CaCO₃ mg/L

4 Conclusions and Recommendations

The results of the 2012 sampling program indicate that there were no major issues with respect to ML/ARD in seepage associated with the infrastructure at Hope Bay. Results were comparable to that measured in previous years. Seepage from areas impacted by waste rock had elevated levels of ammonia, chloride, nitrate, cadmium and copper concentrations in comparison to seeps from the infrastructure areas. These have been attributed to flushing of drilling brines and blasting residues from the waste rock. The majority of this seepage is now captured in the water management system implemented by HBML. Continued management of seepage from the waste rock pile is recommended.

The water licence specifies that seep surveys need to be completed for a period of 3 years following construction. Although this is the third year that comprehensive surveys have been completed, additional construction has occurred and further surveys should be continued in the areas that have had new construction following the 2010 survey. In particular, seeps in the vicinity of the Mine Area, the pollution control pond and the waste rock pile should continue to be monitored.

5 References

CCME, 1999, updated 2007. Canadian Environmental Quality Guidelines. Canadian Council of Ministers of Environment.

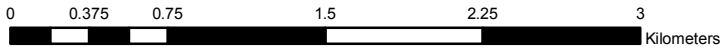
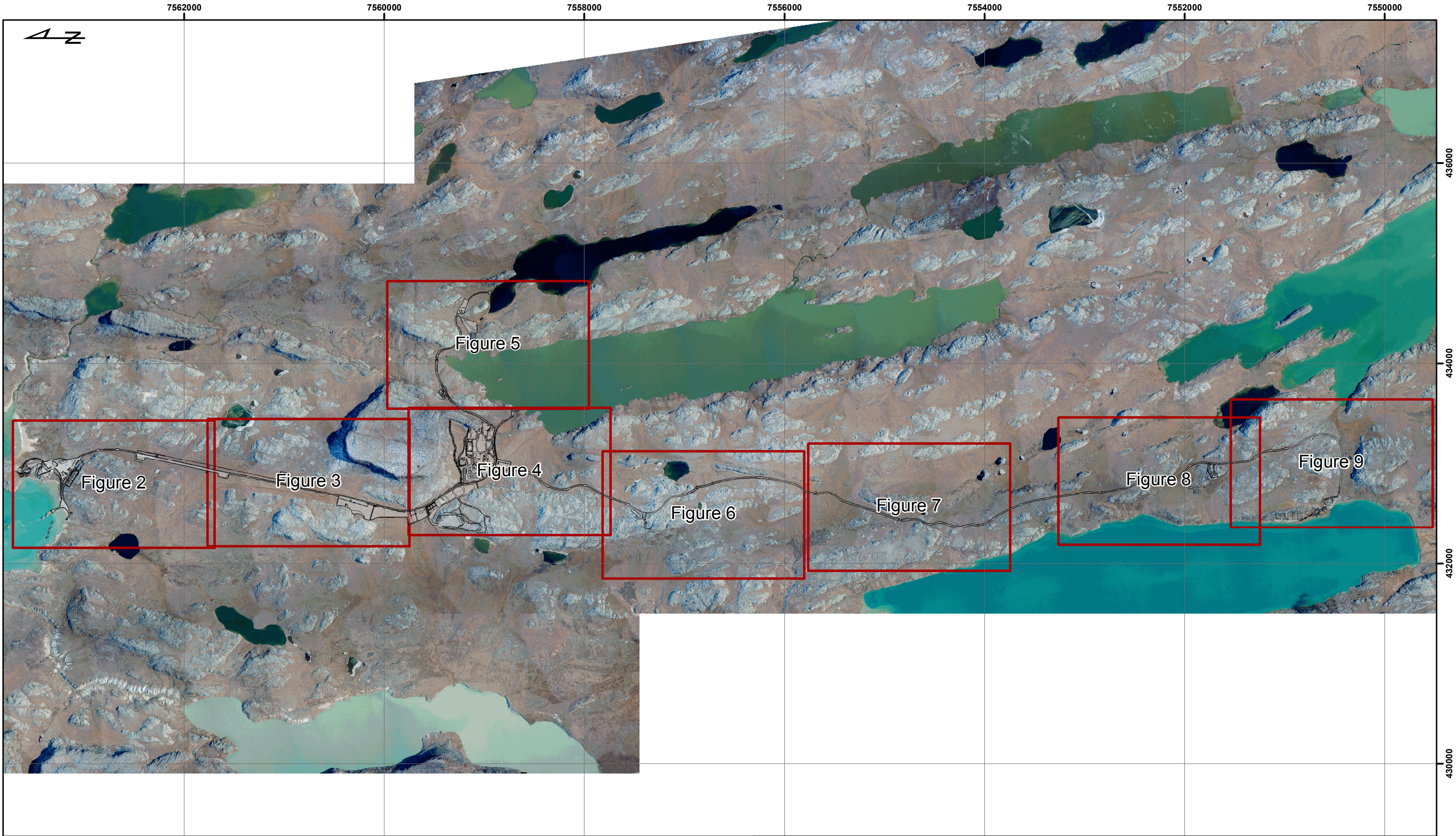
Nunavut Water Board, 2007. Licence No: 2AM-DOH0713. September 19, 2007.

SRK Consulting, 2010. Quarry A, B & D Management and Monitoring Plan. Report 1CH008.038.002 prepared by SRK Consulting (Canada) Ltd. for Hope Bay Mining Ltd. October 2010.

SRK Consulting 2012. 2011 Waste Rock and Quarry Monitoring Report. 1CH008.023. Prepared for Hope Bay Mining Ltd, March 2012

Attachment 1: Seep Survey Locations

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Job No: 1CH008.###
Filename: 1CH008.057_hb_seepage_maps_keymap_2012



2012 Quarry Rock Seepage Monitoring

Hope Bay Gold Project

Seepage Survey Locations
Key Map

Date: November 2012	Approved: -	Figure: 1
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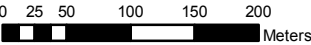
2012 Seepage

- Sampled
- Not Sampled

Previous Surveys

- △ 2011 Seepage
- 2010 Seepage

	Number of Samples		
	pH 6.0 to 7	pH 7 to 8	>pH 8
EC ≤ 500µS/cm	4	33	30
500µS/cm < EC < 2000µS/cm	0	2	8
EC > 2000µS/cm	1	1	3



Job No: 1CH008.057
Filename: 1CH008.057_hb_seepage_maps_2012



2012 Quarry Rock Seepage Monitoring

Hope Bay Gold Project

Seep Survey Locations
North

Date: November 2012	Approved: -	Figure: 2
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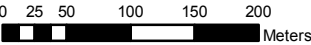
2012 Seepage

- Sampled
- Not Sampled

Previous Surveys

- △ 2011 Seepage
- 2010 Seepage

	Number of Samples		
	pH 6.0 to 7	pH 7 to 8	>pH 8
EC≤ 500µS/cm	4	33	30
500µS/cm<EC< 2000µS/cm	0	2	8
EC> 2000µS/cm	1	1	3



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Filename: 1CH008.057_hb_seepage_maps_2012



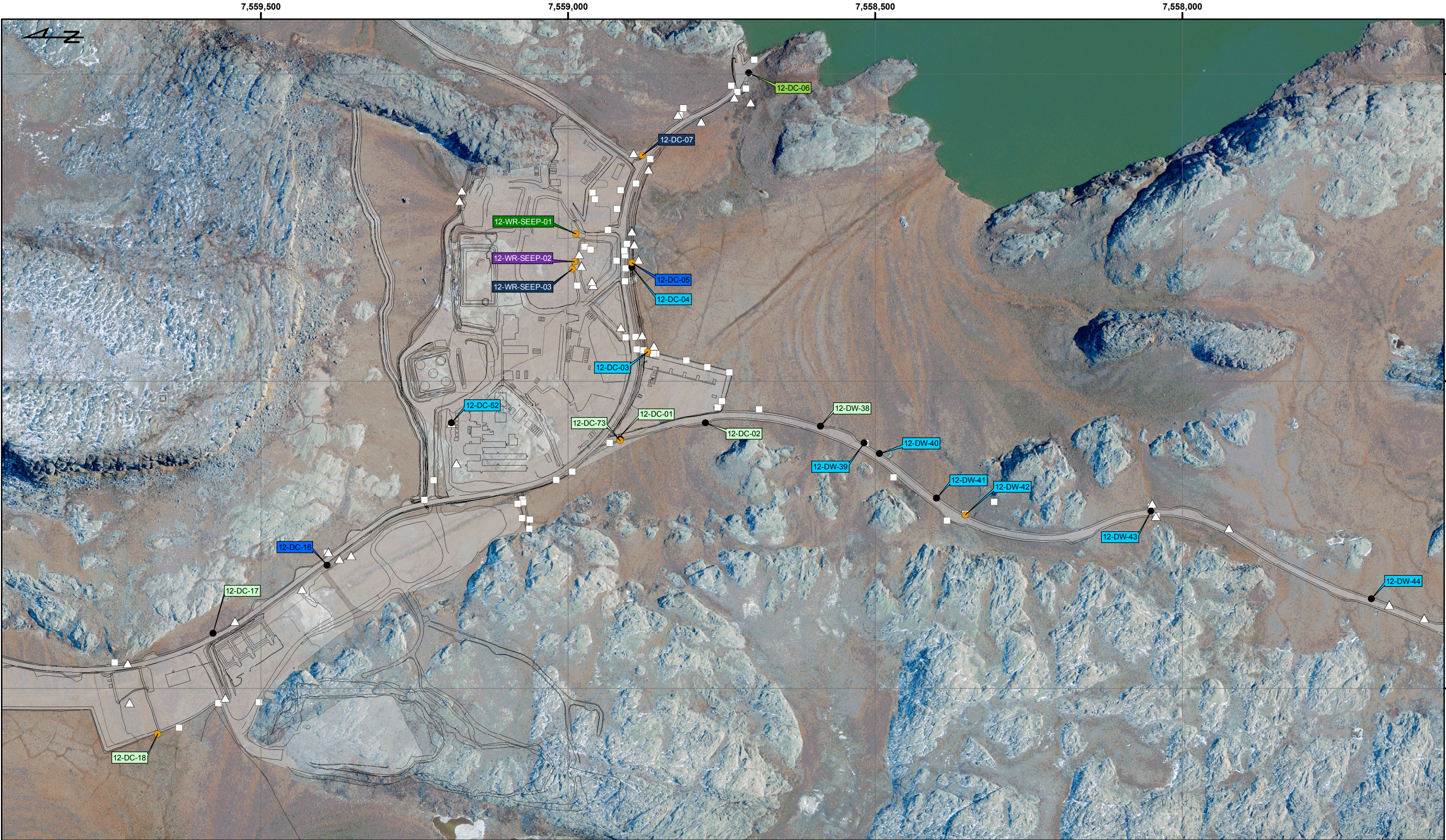
2012 Quarry Rock Seepage Monitoring

Hope Bay Gold Project

**Seep Survey Locations
Central**

Date: November 2012	Approved: -	Figure: 3
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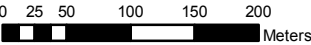
2012 Seepage

- Sampled
- Not Sampled

Previous Surveys

- △ 2011 Seepage
- 2010 Seepage

	Number of Samples		
	pH 6.0 to 7	pH 7 to 8	>pH 8
EC ≤ 500µS/cm	4	33	30
500µS/cm < EC < 2000µS/cm	0	2	8
EC > 2000µS/cm	1	1	3



Job No: 1CH008.057
Filename: 1CH008.057_hb_seepage_maps_2012



2012 Quarry Rock Seepage Monitoring

Hope Bay Gold Project

**Seep Survey Locations
Mine Area**

Date: November 2012	Approved: -	Figure: 4
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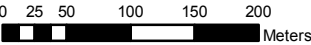
2012 Seepage

- Sampled
- Not Sampled

Previous Surveys

- △ 2011 Seepage
- 2010 Seepage

	Number of Samples		
	pH 6.0 to 7	pH 7 to 8	>pH 8
EC≤ 500µS/cm	4	33	30
500µS/cm<EC< 2000µS/cm	0	2	8
EC> 2000µS/cm	1	1	3



Job No: 1CH008.057
Filename: 1CH008.057_hb_seepage_maps_2012



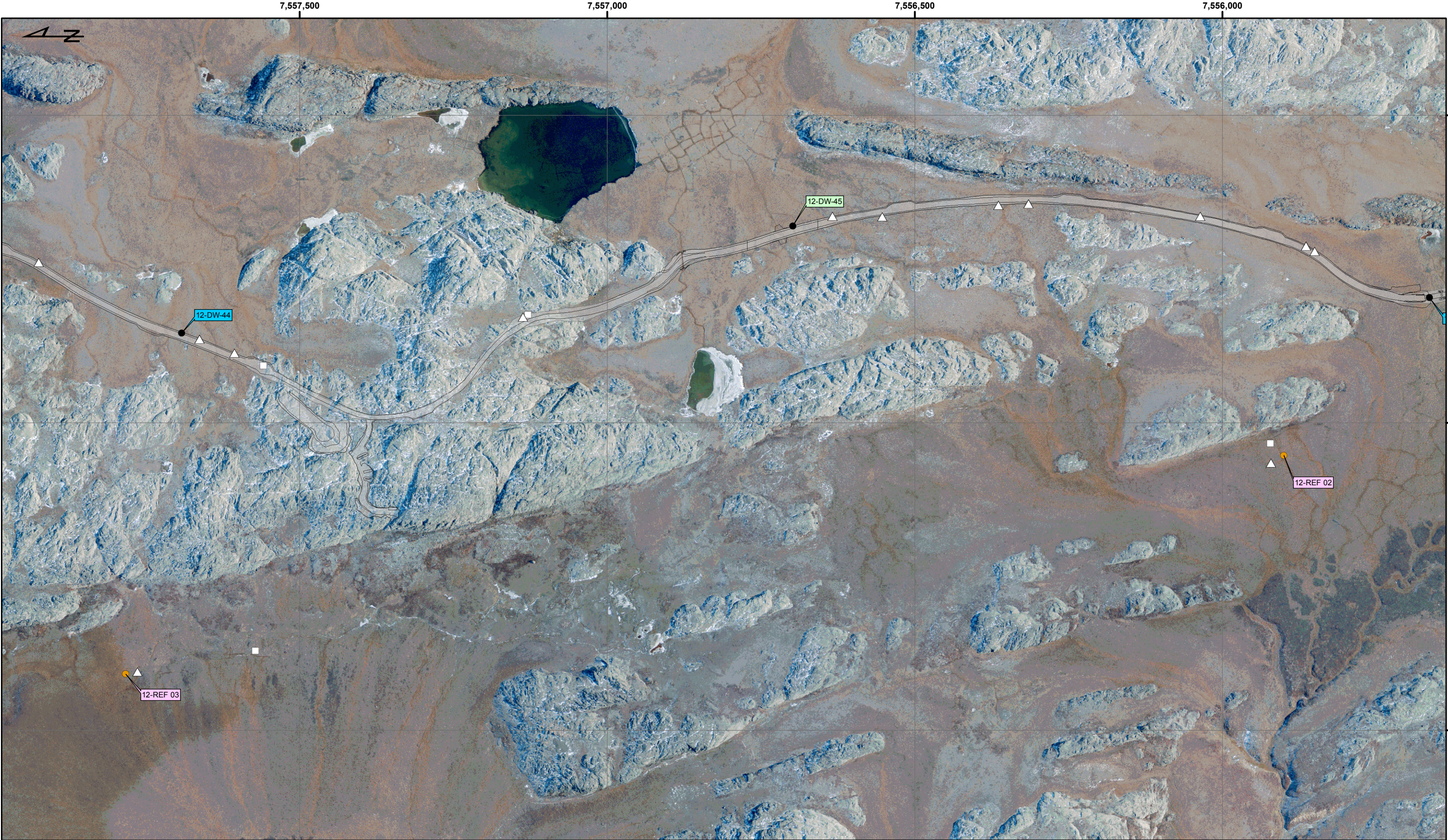
2012 Quarry Rock Seepage Monitoring

Hope Bay Gold Project

**Seep Survey Locations
Tail Lake Road**

Date: November 2012	Approved: -	Figure: 5
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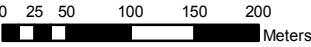
2012 Seepage

- Sampled
- Not Sampled

Previous Surveys

- △ 2011 Seepage
- 2010 Seepage

	Number of Samples		
	pH 6.0 to 7	pH 7 to 8	>pH 8
EC ≤ 500µS/cm	4	33	30
500µS/cm < EC < 2000µS/cm	0	2	8
EC > 2000µS/cm	1	1	3



Job No: 1CH008.057
Filename: 1CH008.057_hb_seepage_maps_2012



2012 Quarry Rock Seepage Monitoring

Hope Bay Gold Project

Seep Survey Locations
Doris Windy Road

Date: November 2012	Approved: -	Figure: 6
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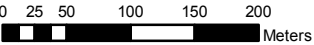
2012 Seepage

- Sampled
- Not Sampled

Previous Surveys

- △ 2011 Seepage
- 2010 Seepage

	Number of Samples		
	pH 6.0 to 7	pH 7 to 8	>pH 8
EC ≤ 500µS/cm	4	33	30
500µS/cm < EC < 2000µS/cm	0	2	8
EC > 2000µS/cm	1	1	3



Job No: 1CH008.057
Filename: 1CH008.057_hb_seepage_maps_2012



2012 Quarry Rock Seepage Monitoring

Hope Bay Gold Project

**Seep Survey Locations
Doris Windy Road**

Date: November 2012	Approved: -	Figure: 7
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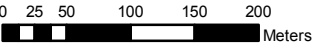
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- 2012 Seepage**

 - Sampled
 - Not Sampled
- Previous Surveys**

 - △ 2011 Seepage
 - 2010 Seepage

	Number of Samples		
	pH 6.0 to 7	pH 7 to 8	>pH 8
EC ≤ 500µS/cm	4	33	30
500µS/cm < EC < 2000µS/cm	0	2	8
EC > 2000µS/cm	1	1	3



Job No: 1CH008.057
Filename: 1CH008.057_hb_seepage_maps_2012



2012 Quarry Rock Seepage Monitoring

Hope Bay Gold Project			
Seep Survey Locations Doris Windy Road			
Date: November 2012	Approved: -	Figure:	8

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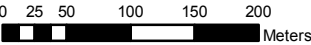
2012 Seepage

- Sampled
- Not Sampled

Previous Surveys

- △ 2011 Seepage
- 2010 Seepage

	Number of Samples		
	pH 6.0 to 7	pH 7 to 8	>pH 8
EC ≤ 500µS/cm	4	33	30
500µS/cm < EC < 2000µS/cm	0	2	8
EC > 2000µS/cm	1	1	3



Job No: 1CH008.057
Filename: 1CH008.057_hb_seepage_maps_2012



2012 Quarry Rock Seepage Monitoring

Hope Bay Gold Project

**Seep Survey Locations
Doris Windy Road**

Date: November 2012	Approved: -	Figure: 9
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Attachment 2: Field Data and Observations

Station	WP	Easting	Northing	Date	Time	Sampled (y/n)	Description	Temperature 'C	Field Conductivity
Units									SpCond (uS/cm)
12-DC-01	22	432906	7558915	10-Jun-12	9:00	n	ponded beside road, upstream of heli pad	3.7	11.7
12-DC-02	23	432932	7558776	10-Jun-12	9:50	n	small ponded puddle, no flow visible on west side of road at helipad, where beginning of DW road. Stagnant, greenish tinted, small bush growing in water.	2.3	345.9
12-DC-03	24	433048	7558870	10-Jun-12	10:15	y	NON CONTACT WATER east corner of helipad, below where helipad and doris camp road merge, high flow from under pad, coming from DC-01, clear water, dusty coating on snow nearby and water surface (from heil/road), mafic metavolcanic rocks, on flow path of non contact water from the upper diversion berm.	1.4	402
12-DC-04	25	433186	7558896	10-Jun-12	10:50	n	across road from PCP, saw flow under rocks here on June 9, now no flow. May be from flow parallel to road from DC-03, slight hydrocarbon sheen nearby, merging w flow from DC-03, (Newmont sample point ST10-L)	3.7	486.6
12-DC-05	26	433193	7558896	10-Jun-12	11:03	y	10m from DC-04, flow from under road below from PCP, down road from DC-04 and DC-03, small seep w/ 2 exits points from under road, measured one of the seeps	5.1	522.5
12-DC-06	27	433502	7558706	10-Jun-12	11:55	n	stagnant water on rocks on N side of raod to Doris Lake, murky greenish water, puddle. Looking for field measurements in area, not much to choose from, walked N side of road to Doris Lake (from Sump 1 to Doris Lake), no water, dry or muddy.	5	561.7
12-DC-07	28	433368	7558879	10-Jun-12	12:00	y	seep under culvert pipes at jxn of TLR and Doris camp road, clear water, sediment coating on rocks in bottom, could be water from WR pile bypassing PCP, duplicate taken	2.6	4152
12-WR-SEEP-01		433240	7558787	10-Jun-12		y	SE quadrant of dump - ramp at front of dump. Water flows below surface along boundary of WR pad and into NE corner of PCP by liner.Mafic metavolcanics; mineralized waste to east and not ass'd with seep. Seep flowing over ice and below waste rock. Field measurements in cup. Water heated up before measurement noted. Flow estd by comparison to DC-05. Flow dammed with nitrile glove and sampled w syringe	<5.5	10,405
12-WR-SEEP-02		433195	7558989	10-Jun-12		y	Seep flowing from toe of dump, west of SEEP-01. Flow path approx 5 m to north end of PCP. Mafic metavolcanics. Diffusive flow, approx 30 cm in width.Field measurements in cup. Flow dammed with nitrile glove and sampled w. syringe from water flowing on pad directly at toe.	5.1	14,600
12-WR-SEEP-03		433183	7558993	10-Jun-12		y	Seep flowing from toe of dump west of SEEP-02. Flow path approx 5 m to north end of PCP. Mafic metavolcanics. Sampled with syringe from pad directly at toe. Diffusive flow approx. 2 m across. Field measurements in cup.	6.9	12,227
12-TLR-09	48	433657	7559347	13-Jun-12	14:20	n	stagnant pool/puddle between 2 large rocks, some overburder on each side, rocks: grey mafic metavolcanic, water clear, some sedimnet and floating debris	8.5	185.1
12-TLR-10	49	433681	7559360	13-Jun-12	14:40	y	water flowing from across road, just past crest of 1st hill of TLR, 300ft from new air vent pad construction, uphill of doris lake creek, clear water, running across green grey metavolcanic rocks which are consistent with road construction rocks. True seep	1.7	154.7
12-TLR-11	50	433905	7559467	13-Jun-12	15:40	n	could be a seep, or lateral flow along side of road just under rocks, has rock and water interaction, water clear, rock consistent with green/grey metavolcanics, multiple exits onto tundra, measured main one, some floating grass, some light brown sediment in bottom	3.2	194.1
12-TLR-12	51	434151	7559355	13-Jun-12	15:55	n	ponded, no flow. Rock bottom pool w/ brown sediment coating on bottom, beside TLR, south side of road, across from outcrop. On east side of the creek of Doris lake	1.6	247
12-TLR-13	52	434402	7559215	13-Jun-12	16:10	n	ponded, no flow. Appears as though it used to be flowing, north end of dam, west side, at base where rock meets tundra, clear/yellowish water, sediment layer on bottom, some grass in it	3.2	139.3
12-TLR-14	53	434290	7559143	13-Jun-12	16:30	y	11-TLR5!!!can see evidence of former seep. Currently stagnant or minimal, non-visible flow. Existing path runs in direction toward creek of doris lake/doris lake. Found 2011 tag. Hydrocarbon sheen on surface. Brown coating of sediment on bottom, could be lateral flow along base of dam, see photo 546, hard to tell as flow is nonexistent now.	1.7	409
12-TLR-15	54	434507	7559204	13-Jun-12	18:10	n	stagnant pool of snow melt, behind shed at frozen core plant pad, consistent rock type grey green metavolcanics, mixed with top crush from road presumably from snow clearing	3.5	437
12-DC-16	66	432701	7559392	15-Jun-12	13:45	n	ponded w/ rick interaction. West side of road, north of camp. No flow. Former seep, evidence of several former seeps along this area of the road	3.4	545
12-DC-17	67	432590	7559578	15-Jun-12	13:55	n	ponded, no flow. Rock bottom pool, could be water from the tundra or snow melt, directly across from landfarm. Road rock is green grey metavolcanic	4.9	471
12-DC-18	68	432426	7559668	15-Jun-12	14:20	y	seep flowing from under reagent pad, 4 exits into one puddled area/ponded area. Measured one exit point, rocks are green grey metavolcanic, some top crush from road, some larger material, water is clear and cold. West side of reagent pad	0.8	347
12-DC-19	69	432440	7560132	15-Jun-12	14:45	y	seep flowing under rocks on west side of pad, could be from along outcrop, BUT definitely pad and water interaction, clear water, (see sketch on pg 51 of field book)	0.2	74.2
12-DC-20	70	432606	7560479	15-Jun-12	15:30	n	flow from under pad, very small trickle over ice under rocks, rocks are grey green metavol, trace fine grained sulphides, vest side of main road, along north edge of pad, at the furthest north extent of the pad, water is clear	1.1	577

Station	WP	Easting	Northing	Date	Time	Sampled (y/n)	Description	Temperature °C	Field Conductivity
Units									SpCond (uS/cm)
12-DC-21	71	432709	7560626	15-Jun-12	15:55	n	small trickle from under road (road to airport), west side of road, water coming from east side, rock is dusty, green grey metavol, spills onto small rock strewn area on tundra, it is possible there was previously multiple exits, not sure now as flow is so small, some lateral flow from south is joining puddle/ponded, measured as near to source as possible.	2.9	361
12-DC-22	72	432716	7560676	15-Jun-12	16:30	n	flow appears to be travelling diagonally under road from ~100-150ft south on east side of road (seems like only source around), small trickle, measured between rocks, water clear, midway between reagent pad and airstrip, on west side of road, continues to flow laterally along road	3.6	407
12-DC-23	73	432728	7560651	15-Jun-12	16:30	n	very dusty in the whole area, source of DC-22 (seems so), murky water, slow flow if any, more like slowly leaking under road, coming from east (tundra), east side of road to the north, midway between reagent pad and airstrip.	3.5	248
12-DC-24	74	432742	7560791	15-Jun-12	16:50	n	merging w/ lateral flow from tundra, source on east side a bit south from point of exit. Definite under road flow, clear water, dusty on top. Some organic matter debris, pond/pool that the seep flows into is muddy and has a tundra bottom.	4.6	275
12-DC-25	75	432759	7560808	15-Jun-12	17:15	n	flow from downstream of DC-24 turns under road, emerges on east side of road in 2 small trickle seeps, clear water, road top crush on sides, pool has grass/sed/organic matter in it, definite flow, estimate 50mL/2seconds-100mL/2 seconds, flow is too diffuse to measure	4.7	185.4
12-DC-26	76	432781	7560907	15-Jun-12	17:45	n	seems to be from under road, could be lateral flow or mixing w/lateral, east side of road between reagent pad and airstrip, clear water, small v.minimal flow, trickle. Field measurement from hole in rocks.	4.1	220
12-DC-27	77	432779	7560948	15-Jun-12	18:00	n	from under road, source on east side, point is on west side, small flow/trickle again. Combining w/ lateral flow coming from south along road, clear water, dusty.	5.1	292
12-DC-28	78	432814	7561063	15-Jun-12	18:30	n	trickle, point taken on east side of road, just past turn off to explosives facility, very shallow, right before new part of airstrip, flow appears to be from west side of road, very dusty.	3.6	238
12-RB-29	79	432515	7563160	6/16/2012	8:15	n	small seep coming down hill headed into rob bay, at north side of road that is at west extent of rob bay. Clear water, some algae on bottom, rock is green grey metavolcanics w/ trace disseminated fine grained sulphides, evidence of prev. seeps down beach from the uphill, most are dry now, some still damp. Flow is too diffuse to measure, but similar to DC-30	4.9	188.9
12-RB-30	80	432519	7563163	6/16/2012	8:30	n	just east of RB29, seep from uphill pouring through road onto beach, very small trickle, sandy bottom (from beach), rocks are green grey metavol, evidence of previous flow path, suggests this was a larger seep	4.5	182.1
12-RB-31	82	433055	7563454	6/16/2012	9:15	y	small trickle seep out onto tundra, point located on east side of curved road (unfinished road) to rob bay at east side of bay. Some sed in water, clear water can hear under road running across snow onto tundra. Appears to be snow melting on top of crush/upper pad, leaking through and down.	0.4	2420
12-RB-32	83	433059	7563511	6/16/2012	9:45	n	slightly north east around road from RB31, tiny trickle, clear water, vis sulphides on rocks, fine grained, blebs or disseminated. Have rock sample near to this one.	0.9	589
12-RB-33	84	433008	7563602	6/16/2012	9:55	n	further around curve, east side of rob bay, clear trickle out from under road, source: melting snow on top of road, snow melting uphill along side of road. Grey green metavol rocks, spilling onto tundra from ~3 exits all very small flows. mixing with organic matter, quite a lot of floating dirt, leafy, organic matter. combo from across road and lateral from uphill.	0.7	424
12-RB-34	85	433060	7563079	6/16/2012	10:20	y	dusty area, entrance to Rob bay work area, east side of road, seeps running under road from west side, snow melt over there could be source, multiple exits, sampled this one as has least tundra interference. Water clear, some organic matter, some sediment	1.7	271
12-RB-35	86	433092	7563022	6/16/2012	10:55	n	just south of 12-RB-34, east side of the road into Rob bay, DUSTY, small seep at start of area where water first crosses road, clear water, some suspended solids, rocks are g/g metavol. Walk out of Rob bay to south, lateral flow along west side, originates from snow melt on outcrop, runs across tundra, along road and under, comes out around where RB 34-35 are located.	2.1	284
12-RB-36	87	433031	7562237	6/16/2012		n	very close to 11-DC-, west side, 1/4 way along strip heading south, in line w/ little lake, found small seep from under road, could be lateral flow moving under rocks but definitely rock/water interaction. Brown sed in bottom, tundra mixing w/ water, dirty, some OM, seeds. Clear water, not turbid. Dusty area, flowing slowly from under road rocks.	0.2	331
12-RB-37	88	432995	7561805	6/16/2012		n	rock pool, flow in from tundra, muddy/sed on rocks on bottom, brown tint water, transparent, halfway along airstrip east side, rock interaction	8.3	213

Station	WP	Easting	Northing	Date	Time	Sampled (y/n)	Description	Temperature °C	Field Conductivity
Units									SpCond (uS/cm)
12-DW-38	89	432927	7558589	6/16/2012	15:00	n	seep from SW side, spilling onto tundra on east side (point), some tundra mixing, grass in pool, definite flow, source uphill to the SW (snow)rocks are g/g metavol, sediment on rocks in bottom, dusty	2.9	215
12-DW-39	90	432899	7558518	6/16/2012	15:10	n	point is on east side, south of DW-38, same source, snow melt on west side (south up the hill), good rock interaction, several exits w/in 3-4m along road, clear water, sediment on bottom, minor turbidity	0.7	101.6
12-DW-40	91	432882	7558493	6/16/2012	15:20	n	snow source uphill to the SW, moderate sized seep, exit is ~1ft wide, clear water, spills into ponded area w/ grass, some turbidity	1.1	59
12-DW-41	92	432810	7558400	6/16/2012		n	moderate sized seep, 1-1.5ft wide exit, fast flow, clear water, minimal turbidity, rocks are g/gmetavol, source is snow up road to SW, point is on east side of road (uphill of Doris lake) several seeps like this one along area ~3 total.	3.7	81.3
12-DW-42	93	432783	7558353	6/16/2012		n	3 exit points (this is one of the mentioned ones in above cell), ~1.5ft wide exit, fast flow, clear, clean, not turbid.	5.7	100.3
12-DW-43	94	432789	7558051	6/16/2012		n	on top of first hill headed south out of camp. Small slow flowing seep, headed east downhill toward doris lake, source is across road (on west side) snow melt off outcrop, tundra mixing, bottom of pool is grass, field measurement was taken between 2 rocks.	7.2	99.5
12-DW-44	95	432646	7557692	6/16/2012		n	east side of road, ~1.3 km from camp headed south, slow flow seep, clear seep running onto tundra, source=snow melt/pond on west side further south up the road, sampled in rock bottom area, has sediment on bottom coating rocks.	7.7	207
12-DW-45	96	432820	7556698	6/16/2012	17:00	n	very slow moving seep, possibly lateral flow, point is on east side of road ~100ft south of dry rock dam. Water is grass bottom, brown tint, some sediment, dusty	1.15	120.8
12-DW-46	97	432703	7555663	6/16/2012	17:20	n	under bridge, snow melt from east side, small ponded puddle in rocks, rock bottom, some sediment coating, dusty, No flow. Murky puddle, not clear	2.9	209
12-DW-47	98	432628	7555438	6/16/2012	17:30	n	ponded, no flow. Previous seep, west side of road, rocky bottom in contact w/ road, sediment dust settled on rocks, dusty, yellow brown tint, clear water, source is snow melt on east side to the north	6.1	115
12-DW-48	99	432550	7555198	6/16/2012	17:50	n	small seep, flow into a little pond/lake, OM bottom, overburden piled on toe of road, field measurement between rocks, some OM debris, algae/moss on bottom, 3 small trickles exiting on west side of road, clear water.	2.1	52.2
12-DW-49	100	432472	7554968	6/16/2012	18:00	n	lots of mucked up overburden, seep flowing from under road, poont on west side of road, source is snow melt from east side, clear water, lots OM.	0.3	58.9
12-DW-50	101	432412	7554587	6/16/2012	18:45	n	small trickle on east side, just past outcrop (on both sides) source is snow melt from other side of road, base of pool is OM/tundra, some algae growth on bottom, definite flow. High pH so went to the other side to check pH of source.	7.2	152.2
12-DW-51	102	432402	7554596	6/16/2012	18:45	n	snow melt off outcrop, south and uphill of quarry B on same side of road.km ~4.3 on doris windy road.	1.03	121.9
12-DC-52	104	432932	7559190	6/16/2012	20:00	n	12-DC-52=11-DC-16, wet/damp rock wall, evidence of prev. flow/trickle, no flow now, also no water at base. Some water further east (15ft), puddle, no flow, puddle very dirty, dusty on top, stagnant, took field measurement.	13.1	456
12-DW-50A		432412	7554587	6/17/2012	8:00	n	high pH, was suspicious, came back early morning June 17, 8am, remeasured. Hypothesis: much colder morning, w/ less melt coming down than yesterday evening after a full day of melt. Change in values could be due to change in volume and temperature. Ponded, not flowing anymore.	5.5	225
12-DW-51A		432402	7554596	6/17/2012	8:00	n		5.2	205
12-DW-52	105	432406	7554524	6/17/2012	8:20	n	ponded, no flow, in contact w/ rocks, murky, brown tint w/ suspended solids, east side of road, south of Quarry B, source is snow melt on west side. Rocks are g/g metavol.	6.5	202
12-DW-53	106	432417	755414	6/17/2012	8:45	n	ponded, no flow, evidence of prev. flow, point is on east side of DW road, souce is snow melt on out crop on west side, grassy bottom w/ tundra in contact w/ rocks of roadside, some sediment settled on bottom, water is clear.	2	119.4
12-DW-54	107	432396	7554060	6/17/2012	9:00	n	ponded, no flow, very stagnant, scum of dust on top, murky with suspended solids, in contact with road wall, point on east side, souce could have been previous lateral flow or snow melt on the other side.. No snow now.	7.8	279
12-DW-55	108	432698	7553044	6/17/2012	9:30	n	ponded, no flow, stagnant, sediment on bottom, seep that had existed fed several tundra pools. West side of DW road, near 6km mark, potential source is snow melt on east side.	0.9	56.5
12-DW-56	109	432798	7552177	6/17/2012	10:00	y	small pool few by slow moving seep, very slow flow into rock pool, water is clear. West side of DW road, source is a snow drift melting on the east side of the road	0.6	74.3
12-DW-58	110	432803	7552158	6/17/2012	10:30	n	slow moving seep, slightly south of DC-56, flows into rock pool, very slow, rock is g/g metavol, water is clear, some floating debris, dusty area.	1.2	217
12-DW-59	111	433006	7551895	6/17/2012	11:10	n	ponded, no flow, stagnant puddle, dusty area, on rocks, prev seep from snow melt on other side, east side of DW road, south of overburden pad, murky brown tint.	11.1	219
12-DW-60	114	433177	7550930	6/17/2012		n	tiny puddle between 2 rocks, ~0.5-1ft across. Ponded, no flow, east side of road, prev. seep can see where path may have been, some minimal snow on west side, small bush in middle of puddle, clear water, dusty area, some floating debris/OM	4.8	507
12-DW-61	115	433232	7550807	6/17/2012	12:00	y	sand bottom stream, lateral flow from tundra uphill, hooks briefly under the road rock at a pull out, could be joined by water on other side coming through, very hard to tell. Clear water fast flow, can see that flow was once larger, carved trench in tundra down hill to south, on west side of road, dusty area, rocks are coated in dust/dry mud	1.4	970
12-DW-62	116	433288	7550692	6/17/2012		n	small ponded area, ver muddy/silty, former flow, seems to be same stream as DW-61 crossing road (eastside), murky, TSS, sediment, silty DUSTY	2	964

Station	WP	Easting	Northing	Date	Time	Sampled (y/n)	Description	Temperature °C	Field Conductivity
Units									SpCond (uS/cm)
12-DW-63	117	433300	7550627	6/17/2012	13:15	n	fast flowing seep, multiple exits running down hill to lake, east side of road, stream on west side is the source, dusty area, rocks are g/gmetavol, trace disemm sulph (new part of road) grass bottom.	6.3	416
12-DW-64	118	433299	7550605	6/17/2012	13:20	n	ponded pool, clear water, sediment layer coating bottom, dusty area, rocks are g/g metavol, in contact with water. Lateral flow from tundra at south end, stream from tundra goes under road, doesn't come out. Comes out ~700ft from entrance on same side of road. FLOWS UNDER MIDDLE OF ROAD?! Photo 750	1.8	683
12-DW-63A	119	433182	7550438	6/17/2012	13:30	n	small seep coming from other side of road, point is on south side of DW road, clear water, dusty area,	1.6	442
12-DW-64A	120	433004	7550420	6/17/2012		n	ponded, against road rocks, evidence of iron carb weathering, sediment coating on bottom, base is combo of rock and grass, south side of road across from coreland, dusty.	11.9	943
12-DW-65	121	432703	7550454	6/17/2012	14:10	n	large seep appears from under road, no water on opposite side of road. Seems to be lateral flow from further east that has emerged. Flow goes down under middle of the road? Photo 752-755 clear fast moving water, headed onto tundra and into windy lake, estimated flow, can't measure as the bottle is too small.	8.2	268
12-TLR-66	123	433736	7559456	6/17/2012		n	seep from under pad @ vent raise on TLR road. Some suspended solids, slightly murky, sediment/silty bottom, north side of road, east side of vent raise pad, draining down hill to doris creek.	1.9	154.1
12-TLR-67	124	433738	7559453	6/17/2012	4:30	n	just south of TLR 66 (~5-10ft) seep from under vent raise pad, north side of TLR east of vent, very silty, high TSS, murky, draingn down tundra to doris creek.	1.1	157.4
12-TLR-68	125	433741	7559450	6/17/2012		n	just south of TLR 66 and 67, same seep type, high TSS, silty, dusty, drains into pool on tundra and downhill	0.5	178.4
12-TLR-69	126	433663	7559351	6/17/2012		n	south side of TLR road, just west of vent raise (on opp side) there were seeps here before, but not as many, came back to get more measurements, clear fast flowing water, going downhill toward doris lake, coming from under road, source appears to be snow melting on outcrop across road and up the hill.	0.7	132.8
12-TLR-70	127	433674	7559356	6/17/2012		n	just east of TLR 69, slower flow, slity pool, headed same direction towards lake, murky water	3.9	160.9
12-TLR-71	128	433679	7559358	6/17/2012	17:00	n	clear flowing seep from snow melt on opp side TLR road, point is on south side TLR road, flowing to doris lake/creek, some OM floating debris, sediment coating on rocks in bottom.	4	145.7
12-TLR-72	129	433698	7559369	6/17/2012		n	south side of TLR, across from vent raise area, small seep, murky water, silty bottom, draining down to doris lake, forgot to take photo, very similar to TLR71	4.8	141
12-DC-73	130	432903	7558915	6/17/2012	17:45	y	sample of non contact water upstream of helipad, upstream sample to compared to downstream of helipad. Yellow brown tint, very dusty, clear water, dust/sediment settled in bottom, combo grass and top crush (from road) in base of pool. Water coming from north west up road (diverted water from berm, water management team)	9.3	462
12-REF 01	143	433480	7550097	6/19/2012	9:00	y	clear flowing stream, grass bottom, south of DW road, east of windy lake, up hill from road, flowing S to N, ligh brown tint	3.6	62.4
12-REF 02	144	432447	7555900	6/19/2012	9:30	y	small stream, slow flow ~500ml/sec, west of road, slightly uphill, some floating OM grass, seeds, mosquitoes, clear water, brown yellow tint.	2.7	61.7
12-REF 03	145	432091	7557783	6/19/2012	9:45	y	very very slow flow/stagnant, could have been faster earlier (maybe a week ago) clear water, grass bottom, mosquito larvae in it, some OM debris.	4.4	78.7

Station	Field pH	ORP (mV)	Flow	ALS File No.	Date Received	Date	Date Sampled	Time Sampled	ALS Sample ID	Matrix	Conductivity	Hardness (as CaCO3)	Lab pH	Total Suspended Solids	Total Dissolved Solids	Acidity (as CaCO3)
Units			L/s								uS/cm	mg/L	pH	mg/L	mg/L	mg/L
12-DC-01	7.87	-274.4	none	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
12-DC-02	7.38	-120.9	none	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
12-DC-03	8.38	116.4	high, diverging flow, non contact water	L1160441	11-Jun-12 15:52	9-Jul-12	10-Jun-12	10:15	L1160430-12	Water	394	120	8.18	<3	230	1.6
12-DC-04	8.57	-159.4	none	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
12-DC-05	8.62	-187.3	250ml/2sec	L1160443	11-Jun-12 15:54	11-Jul-12	10-Jun-12	11:03	L1160430-14	Water	448	132	8.1	-	244	2.4
12-DC-06	7.41	-27	none	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
12-DC-07	8.04	-22.6	185mL/2sec	L1160435	11-Jun-12 15:46	3-Jul-12	10-Jun-12	14:00	L1160430-6	Water	3050	963	7.43	-	2630	12.4
12-WR-SEEP-01	7.59	7.5		L1160430	11-Jun-12 15:41	28-Jun-12	10-Jun-12	15:15	L1160430-1	Water	7720	2350	7.61	-	7060	22.1
12-WR-SEEP-02	6.73	<5		L1160431	11-Jun-12 15:42	29-Jun-12	10-Jun-12	16:10	L1160430-2	Water	8480	2470	7.66	-	5500	22.2
12-WR-SEEP-03	8.03	<5		L1160433	11-Jun-12 15:44	1-Jul-12	10-Jun-12	16:35	L1160430-4	Water	8460	2470	7.67	-	7110	21.5
12-TLR-09	7.99	245	none	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
12-TLR-10	8.22	179	not measurable	L1163287	15-Jun-12 15:18	29-Jun-12	13-Jun-12	15:00	L1163287-6	Water	144	43.7	8.09	#N/A	94	2.8
12-TLR-11	7.77	211	100mL/sec	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
12-TLR-12	8.04	191	none	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
12-TLR-13	7.3	219	none	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
12-TLR-14	7.6	105	none/trace	L1163287	15-Jun-12 15:18	29-Jun-12	13-Jun-12	16:30	L1163287-7	Water	371	137	7.99	#N/A	230	3.7
12-TLR-15	6.98	70	none	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
12-DC-16	8.42	345	none	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
12-DC-17	7.5	317	none	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
12-DC-18	7.9	245	150ml/2sec from each seep exit (4)	L1164182	19-Jun-12 09:50	28-Jun-12	15-Jun-12	14:00	L1164182-5	Water	307	118	8.15	#N/A	186	2.2
12-DC-19	8.4	286	400mL/2 seconds	L1164182	19-Jun-12 09:50	28-Jun-12	15-Jun-12	14:45	L1164182-1	Water	79.1	24.3	8.17	#N/A	42	1.9
12-DC-20	8.25	322	not measurable	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A

Station	Field pH	ORP (mV)	Flow	ALS File No.	Date Received	Date	Date Sampled	Time Sampled	ALS Sample ID	Matrix	Conductivity	Hardness (as CaCO3)	Lab pH	Total Suspended Solids	Total Dissolved Solids	Acidity (as CaCO3)
Units			L/s								uS/cm	mg/L	pH	mg/L	mg/L	mg/L
12-DC-21	7.43	307	not measurable	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
12-DC-22	7.4	219	not measurable	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
12-DC-23	7.57	209	not measurable	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
12-DC-24	7.61	165	not measurable	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
12-DC-25	7.53	170	estimated	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
12-DC-26	7.71	115	not measurable	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
12-DC-27	7.63	159	not measurable	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
12-DC-28	7.47	142	not measurable	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
12-RB-29	7.83	193	not measurable	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
12-RB-30	7.9	194	50mL/2sec	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
12-RB-31	8.58	163	not measurable	L1164182	19-Jun-12 09:50	28-Jun-12	16-Jun-12	16:00	L1164182-4	Water	2000	243	8.13	#N/A	1130	2.8
12-RB-32	8.88	180	not measurable	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
12-RB-33	9.02	171	not measurable	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
12-RB-34	9.39	174	250mL/2seconds	L1164182	19-Jun-12 09:50	28-Jun-12	16-Jun-12	10:20	L1164182-2	Water	245	70.3	8.19	#N/A	128	1.8
12-RB-35	8.86	177	not measurable	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
12-RB-36	8.64	181	not measurable	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
12-RB-37	8.5	163	not measurable	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A

Station	Field pH	ORP (mV)	Flow	ALS File No.	Date Received	Date	Date Sampled	Time Sampled	ALS Sample ID	Matrix	Conductivity	Hardness (as CaCO3)	Lab pH	Total Suspended Solids	Total Dissolved Solids	Acidity (as CaCO3)
Units			L/s								uS/cm	mg/L	pH	mg/L	mg/L	mg/L
12-DW-38	7.9	156	500mL/2sec	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
12-DW-39	8.2	151	500mL/2sec	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
12-DW-40	8.13	119	300mL/2sec	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
12-DW-41	8.69	140	600ml/2sec	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
12-DW-42	8.84	145	1L/sec	L1164182	19-Jun-12 09:50	28-Jun-12	16-Jun-12	15:40	L1164182-7	Water	95	41.4	8.12	#N/A	60	2.4
12-DW-43	8.15	129	not measurable	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
12-DW-44	8.28	132	not measurable	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
12-DW-45	7.79	104	not measurable	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
12-DW-46	9.16	128	None	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
12-DW-47	9.42	112	None	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
12-DW-48	7.68	126	50ml/2sec	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
12-DW-49	9.36	140	not measurable	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
12-DW-50	10.12	147	not measurable	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
12-DW-51	9.22	139	not measurable	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
12-DC-52	8.5	152	None	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
12-DW-50A	7.78	365	not measurable	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
12-DW-51A	7.62	398	not measurable	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
12-DW-52	7.93	381	None	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
12-DW-53	7.99	346	None	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
12-DW-54	8.4	321	None	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
12-DW-55	7.84	264	None	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
12-DW-56	7.77	274	not measurable	L1164182	19-Jun-12 09:50	28-Jun-12	17-Jun-12	10:00	L1164182-10	Water	70	24.6	7.93	#N/A	46	3.5
12-DW-58	8.07	218	not measurable	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
12-DW-59	7.93	231	None	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
12-DW-60	8.23	192	None	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
12-DW-61	8.59	174	not measurable	L1164182	19-Jun-12 09:50	28-Jun-12	17-Jun-12	12:00	L1164182-8	Water	911	347	7.24	#N/A	922	2.1
12-DW-62	8.18	216	None	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A

Station	Field pH	ORP (mV)	Flow	ALS File No.	Date Received	Date	Date Sampled	Time Sampled	ALS Sample ID	Matrix	Conductivity	Hardness (as CaCO3)	Lab pH	Total Suspended Solids	Total Dissolved Solids	Acidity (as CaCO3)
Units			L/s								uS/cm	mg/L	pH	mg/L	mg/L	mg/L
12-DW-63	8.43	201	1L/sec	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
12-DW-64	8.78	207	None	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
12-DW-63A	7.33	201	not measurable	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
12-DW-64A	7.58	201	None	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
12-DW-65	7.69	132	~3L/sec	L1164182	19-Jun-12 09:50	28-Jun-12	17-Jun-12	14:10	L1164182-6	Water	254	91.9	7.99	#N/A	219	3.4
12-TLR-66	8.23	148	125mL/sec	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
12-TLR-67	8.52	147	125mL/sec	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
12-TLR-68	8.61	133	125mL/sec	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
12-TLR-69	7.91	159	~1L/sec	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
12-TLR-70	8	140	250mL/sec	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
12-TLR-71	7.95	135	not measurable	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
12-TLR-72	8.04	143	100ml/2sec	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
12-DC-73	7.94	155	not measurable	L1164182	19-Jun-12 09:50	28-Jun-12	17-Jun-12	17:30	L1164182-14	Water	450	135	8.27	#N/A	264	<1
12-REF 01	6.74	198	2L/sec	L1165998	21-Jun-12 13:00	6-Jul-12	19-Jun-12	09:00	L1165998-1	Water	57.9	22.6	6.93	#N/A	55	4.2
12-REF 02	6.59	166	500ml/2sec	L1165998	21-Jun-12 13:00	6-Jul-12	19-Jun-12	09:30	L1165998-2	Water	57.3	21.3	7.35	#N/A	40	5.7
12-REF 03	6.57	171	Not measurable	L1165998	21-Jun-12 13:00	6-Jul-12	19-Jun-12	09:45	L1165998-3	Water	74.8	23.4	7.91	#N/A	52	4.4

Station	Alkalinity, Total	Ammonia	Br	Cl	F	Nitrate (as N)	Nitrite (as N)	P Total	SO ₄	Al	Sb	As	Ba	Be	Bi	B	Cd	Ca
Units	mg CaCO ₃ /L	mg/L as N	mg/L	mg/L	mg/L	mg/L as N	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
12-DC-01	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
12-DC-02	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
12-DC-03	101	0.363	0.158	51.7	0.051	1.67	0.0095	0.0115	17.8	0.0082	0.00011	0.00042	0.00661	<0.0001	<0.0005	0.044	<0.00001	35.3
12-DC-04	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
12-DC-05	117	0.146	0.196	59	0.052	1.91	0.0125	0.0091	20.9	0.0061	<0.0001	0.00027	0.0082	<0.0001	<0.0005	0.052	<0.00001	38.9
12-DC-06	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
12-DC-07	102	11.4	1.2	807	<0.4	44.4	0.327	0.0127	101	0.017	0.00032	0.00112	0.0721	0.0002	<0.001	0.332	0.000065	312
12-WR-SEEP-01	74.8	68.4	3.1	2280	<1	134	0.688	0.0133	59	0.0074	<0.0005	0.00132	0.141	<0.0005	<0.0025	0.252	0.000287	830
12-WR-SEEP-02	80	66.7	3.5	2550	<1	137	0.685	0.0119	76	0.0078	<0.0005	0.00126	0.148	<0.0005	<0.0025	0.286	0.000324	859
12-WR-SEEP-03	83.5	61.5	3.6	2530	<1	136	0.744	0.0169	75	0.0083	<0.0005	0.00133	0.148	<0.0005	<0.0025	0.301	0.000338	857
12-TLR-09	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
12-TLR-10	36.3	0.068	#N/A	20.2	0.023	0.0342	0.0014	0.0144	3.98	0.029	<0.0001	0.00013	0.0068	<0.0001	<0.0005	0.017	<0.00001	12
12-TLR-11	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
12-TLR-12	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
12-TLR-13	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
12-TLR-14	148	0.716	#N/A	30.1	0.095	0.729	0.0209	0.0348	9.01	0.0377	<0.0001	0.00041	0.00611	<0.0001	<0.0005	0.03	<0.00001	38.4
12-TLR-15	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
12-DC-16	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
12-DC-17	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
12-DC-18	106	0.0475	0.063	25.2	0.035	1.02	0.0037	0.0143	16	0.0071	<0.0001	0.00065	0.00429	<0.0001	<0.0005	0.026	<0.00001	37.4
12-DC-19	24.8	0.125	<0.05	6.19	<0.02	0.509	0.0074	0.0076	2.94	0.028	<0.0001	0.00023	0.00211	<0.0001	<0.0005	<0.01	<0.00001	7.33
12-DC-20	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A

Station	Alkalinity, Total	Ammonia	Br	Cl	F	Nitrate (as N)	Nitrite (as N)	P Total	SO ₄	Al	Sb	As	Ba	Be	Bi	B	Cd	Ca
Units	mg CaCO ₃ /L	mg/L as N	mg/L	mg/L	mg/L	mg/L as N	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
12-DC-21	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
12-DC-22	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
12-DC-23	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
12-DC-24	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
12-DC-25	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
12-DC-26	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
12-DC-27	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
12-DC-28	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
12-RB-29	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
12-RB-30	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
12-RB-31	80.1	0.96	1.9	545	<0.4	3.28	0.051	0.0215	90	0.0282	<0.0002	0.00081	0.00831	0.0002	<0.001	0.146	<0.00002	42
12-RB-32	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
12-RB-33	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
12-RB-34	68.9	0.0166	0.072	31.7	0.027	0.0866	0.0021	0.0093	9.39	0.0131	<0.0001	0.00016	0.00236	<0.0001	<0.0005	0.014	<0.00001	18.6
12-RB-35	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
12-RB-36	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
12-RB-37	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A

Station	Alkalinity, Total	Ammonia	Br	Cl	F	Nitrate (as N)	Nitrite (as N)	P Total	SO ₄	Al	Sb	As	Ba	Be	Bi	B	Cd	Ca
Units	mg CaCO ₃ /L	mg/L as N	mg/L	mg/L	mg/L	mg/L as N	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
12-DW-38	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
12-DW-39	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
12-DW-40	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
12-DW-41	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
12-DW-42	41.5	0.0107	<0.05	4.33	<0.02	0.0078	<0.001	0.0055	1.59	0.005	<0.0001	0.00015	0.00188	<0.0001	<0.0005	0.015	<0.00001	14.2
12-DW-43	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
12-DW-44	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
12-DW-45	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
12-DW-46	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
12-DW-47	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
12-DW-48	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
12-DW-49	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
12-DW-50	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
12-DW-51	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
12-DC-52	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
12-DW-50A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
12-DW-51A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
12-DW-52	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
12-DW-53	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
12-DW-54	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
12-DW-55	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
12-DW-56	24.9	0.0589	<0.05	5.75	<0.02	0.0608	0.0025	0.0376	1.1	0.0191	<0.0001	0.00022	0.00176	<0.0001	<0.0005	0.014	<0.00001	6.74
12-DW-58	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
12-DW-59	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
12-DW-60	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
12-DW-61	61.3	0.135	<0.5	244	<0.2	1.27	0.014	0.0336	6.9	0.0073	<0.0001	0.00024	0.0324	<0.0001	<0.0005	0.014	0.000011	110
12-DW-62	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A

Station	Alkalinity, Total	Ammonia	Br	Cl	F	Nitrate (as N)	Nitrite (as N)	P Total	SO ₄	Al	Sb	As	Ba	Be	Bi	B	Cd	Ca
Units	mg CaCO ₃ /L	mg/L as N	mg/L	mg/L	mg/L	mg/L as N	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
12-DW-63	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
12-DW-64	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
12-DW-63A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
12-DW-64A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
12-DW-65	37.5	0.337	0.081	50.4	0.05	1.05	0.0096	0.0081	2.29	0.03	<0.0001	0.00025	0.0123	<0.0001	<0.0005	0.015	<0.00001	29.2
12-TLR-66	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
12-TLR-67	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
12-TLR-68	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
12-TLR-69	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
12-TLR-70	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
12-TLR-71	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
12-TLR-72	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
12-DC-73	106	0.0331	0.177	61.3	0.057	2.31	0.0158	0.007	19.5	0.0073	<0.0001	0.00023	0.00811	<0.0001	<0.0005	0.044	<0.00001	41.2
12-REF 01	20.8	0.0063	#N/A	5.08	0.056	<0.005	<0.001	#N/A	<0.5	0.0457	<0.0001	0.0002	0.00275	<0.0001	<0.0005	<0.01	<0.00001	4.84
12-REF 02	19.9	<0.005	#N/A	5.49	0.025	<0.005	<0.001	#N/A	0.77	0.0122	<0.0001	<0.0001	0.00245	<0.0001	<0.0005	<0.01	<0.00001	5.28
12-REF 03	21.8	0.0068	#N/A	8.31	0.025	<0.005	<0.001	#N/A	2.52	0.024	<0.0001	<0.0001	0.00312	<0.0001	<0.0005	<0.01	<0.00001	5.28

Station	Cr	Co	Cu	Fe	Pb	Li	Mg	Mn	Hg	Mo	Ni	K	Se	Si	Ag	Na	Sr	Tl	Sn	Ti	U	V	Zn
Units	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
12-DC-01	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
12-DC-02	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
12-DC-03	0.0001	0.00018	0.00398	0.023	<0.00005	0.00171	7.61	0.02	<0.00001	0.00072	0.00068	2.64	0.00018	1.37	<0.00001	31.3	0.0884	<0.00001	<0.0001	<0.01	0.000242	<0.001	<0.001
12-DC-04	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
12-DC-05	<0.0001	0.00013	0.00226	0.026	<0.00005	0.002	8.54	0.00603	<0.00001	0.000891	0.0006	3.01	0.00016	1.16	<0.00001	37.6	0.0977	<0.00001	<0.0001	<0.01	0.000183	<0.001	0.0012
12-DC-06	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
12-DC-07	<0.0002	0.00198	0.01	0.026	<0.0001	0.0128	44.9	0.0513	<0.00001	0.00447	0.0043	16.3	0.00219	2.21	<0.00002	202	0.931	0.000062	<0.0002	<0.02	0.00144	<0.002	<0.002
12-WR-SEEP-01	<0.0005	0.00308	0.0065	0.046	<0.00025	0.0625	67.1	0.46	<0.00001	0.00292	0.0036	39.1	0.00117	1.76	<0.00005	494	2.67	0.000092	<0.0005	<0.05	0.00134	<0.005	<0.005
12-WR-SEEP-02	<0.0005	0.00382	0.0059	0.036	<0.00025	0.0862	79.5	0.79	<0.00001	0.00373	0.0038	44.4	0.00137	1.94	<0.00005	608	2.98	0.000095	<0.0005	<0.05	0.00123	<0.005	<0.005
12-WR-SEEP-03	<0.0005	0.00387	0.0063	0.038	<0.00025	0.0896	79.3	0.821	<0.00001	0.00367	0.0045	43.9	0.00144	1.95	<0.00005	610	2.97	0.000103	<0.0005	<0.05	0.00123	<0.005	<0.005
12-TLR-09	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
12-TLR-10	0.00021	0.00015	0.0101	0.052	<0.00005	0.00071	3.31	0.0547	<0.00001	0.000112	0.00122	1.08	<0.0001	1.83	<0.00001	10.8	0.033	<0.00001	<0.0001	<0.01	0.000016	<0.001	0.003
12-TLR-11	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
12-TLR-12	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
12-TLR-13	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
12-TLR-14	0.00024	0.00054	0.00375	0.416	0.000056	0.00288	9.93	0.144	<0.00001	0.000656	0.00148	3.75	0.00011	2.68	<0.00001	26.8	0.0656	<0.00001	<0.0001	<0.01	0.000347	<0.001	0.0029
12-TLR-15	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
12-DC-16	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
12-DC-17	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
12-DC-18	0.00022	<0.0001	0.00632	0.022	<0.00005	0.00104	6.05	0.0181	<0.00001	0.000529	0.0008	1.59	0.00026	1.65	<0.00001	18.6	0.0417	<0.00001	<0.0001	<0.01	0.000144	<0.001	<0.001
12-DC-19	<0.0001	<0.0001	0.00213	0.011	<0.00005	<0.0005	1.46	0.0104	<0.00001	0.000113	<0.0005	0.4	<0.0001	0.251	<0.00001	5.19	0.00802	<0.00001	<0.0001	<0.01	0.000022	<0.001	<0.001
12-DC-20	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A

Station	Cr	Co	Cu	Fe	Pb	Li	Mg	Mn	Hg	Mo	Ni	K	Se	Si	Ag	Na	Sr	Tl	Sn	Ti	U	V	Zn
Units	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
12-DC-21	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
12-DC-22	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
12-DC-23	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
12-DC-24	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
12-DC-25	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
12-DC-26	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
12-DC-27	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
12-DC-28	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
12-RB-29	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
12-RB-30	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
12-RB-31	<0.0002	<0.0002	0.00334	<0.01	<0.0001	0.0042	33.6	0.0206	<0.00001	0.00228	<0.001	10.6	0.00035	0.669	0.00002	274	0.181	<0.00002	<0.0002	<0.02	0.00182	<0.002	<0.002
12-RB-32	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
12-RB-33	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
12-RB-34	<0.0001	<0.0001	0.00376	<0.01	<0.00005	0.00109	5.77	0.00377	<0.00001	0.000221	<0.0005	1.06	<0.0001	1.16	<0.00001	21.3	0.025	<0.00001	<0.0001	<0.01	0.000046	<0.001	<0.001
12-RB-35	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
12-RB-36	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
12-RB-37	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A

Station	Cr	Co	Cu	Fe	Pb	Li	Mg	Mn	Hg	Mo	Ni	K	Se	Si	Ag	Na	Sr	Tl	Sn	Ti	U	V	Zn
Units	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
12-DW-38	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
12-DW-39	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
12-DW-40	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
12-DW-41	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
12-DW-42	<0.0001	<0.0001	0.00179	<0.01	<0.00005	<0.0005	1.45	0.00176	<0.00001	0.000083	<0.0005	0.34	<0.0001	0.906	<0.00001	3.29	0.0226	<0.00001	<0.0001	<0.01	<0.00001	<0.001	<0.001
12-DW-43	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
12-DW-44	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
12-DW-45	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
12-DW-46	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
12-DW-47	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
12-DW-48	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
12-DW-49	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
12-DW-50	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
12-DW-51	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
12-DC-52	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
12-DW-50A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
12-DW-51A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
12-DW-52	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
12-DW-53	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
12-DW-54	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
12-DW-55	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
12-DW-56	0.00015	0.00021	0.00159	0.026	<0.00005	<0.0005	1.88	0.0556	<0.00001	0.00014	0.00119	0.68	<0.0001	0.629	<0.00001	4.08	0.00894	<0.00001	<0.0001	<0.01	0.000022	<0.001	0.0014
12-DW-58	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
12-DW-59	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
12-DW-60	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
12-DW-61	0.00023	0.0002	0.00184	0.013	<0.00005	0.0118	17.8	0.023	<0.00001	0.000182	0.00198	3.68	<0.0001	2.23	<0.00001	25	0.387	<0.00001	<0.0001	<0.01	0.000044	<0.001	0.0017
12-DW-62	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A

Station	Cr	Co	Cu	Fe	Pb	Li	Mg	Mn	Hg	Mo	Ni	K	Se	Si	Ag	Na	Sr	Tl	Sn	Ti	U	V	Zn
Units	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
12-DW-63	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
12-DW-64	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
12-DW-63A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
12-DW-64A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
12-DW-65	0.00028	0.00026	0.00176	0.097	0.000051	0.00361	4.62	0.0508	<0.00001	0.00037	0.00215	1.31	<0.0001	0.912	<0.00001	11.6	0.0754	<0.00001	<0.0001	<0.01	0.000039	<0.001	0.0015
12-TLR-66	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
12-TLR-67	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
12-TLR-68	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
12-TLR-69	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
12-TLR-70	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
12-TLR-71	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
12-TLR-72	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
12-DC-73	0.0001	0.00014	0.00338	0.018	<0.00005	0.00202	7.81	0.00439	<0.00001	0.000716	0.00065	2.53	0.00011	1.02	<0.00001	35.2	0.115	<0.00001	<0.0001	<0.01	0.000215	<0.001	<0.001
12-REF 01	0.00053	<0.0001	0.00115	0.156	<0.00005	0.00272	2.55	0.00134	<0.00001	0.000181	0.00227	0.591	<0.0001	0.99	<0.00001	3.61	0.0131	<0.00001	<0.0001	<0.01	0.000017	<0.001	0.005
12-REF 02	0.0002	<0.0001	0.00102	0.037	<0.00005	0.00111	1.96	0.000996	<0.00001	<0.00005	0.00061	0.358	<0.0001	0.923	<0.00001	3.37	0.0129	<0.00001	<0.0001	<0.01	<0.00001	<0.001	0.0044
12-REF 03	0.00017	<0.0001	0.00127	0.027	<0.00005	0.00076	2.49	0.00142	<0.00001	<0.00005	0.00092	0.483	<0.0001	1.06	<0.00001	5.75	0.0143	<0.00001	<0.0001	<0.01	<0.00001	<0.001	0.003