Minto Mine

Water Licence QZ96-006

Quartz Mining License QML-0001

2013 Annual Report

Prepared by:
Minto Explorations Ltd.
Minto Mine

March 2014

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List of Acronyms

Acronym	Definition
AMMP	Adaptive Monitoring and Management Plan
AP	Acid Potential
BCM	Bank cubic meter
CPUE	Catch per unit effort
dmt	Dry metric tonnes
DPP	Drive point piezometer
DSTSF	Dry stack tailings storage facility
g/t	Gram per tonne
GPS	Global Positioning System
JCS	Juvenile chinook salmon
kVA	Kilo-volt amps
MCDS	Minto Creek Detention Structure
Minto	Minto Explorations Ltd.
Mlb	Million pounds
MVF	Mill Valley Fill
MVFE	Mill valley fill extension
MWD	Main waste dump
NP	Neutralizing potential
NPR	Neutralizing potential ratio
PAG	Potentially acid generating
QA/QC	Quality assurance and quality control
SAT	Waste material destined for subaqueous long term storage
SBR	Sequential batch reactor
SMP	Seepage Monitoring Plan
STP	Sewage treatment plant
SWD	South West Dump
TDS	Total dissolved solids
TSS	Total suspended solids
V	Volt
WGS 84	World Geodetic System 1984
WSP	Water Storage Pond
WUL	Water use licence QZ96-006
YWB	Yukon Water Board
YWCHS	Yukon Workers' Compensation Health and Safety Board

1 Introduction

This annual report has been prepared by Minto Explorations Ltd. (Minto) for the 2013 calendar year, as required by Type A Water Use Licence (WUL) QZ96-006 and Quartz Mining Licence (QML) QML-0001. Specific requirements for the annual report, as outlined in the respective licences, are summarized in Table 1-1.

This report provides a summary of activities at Minto Mine for the reporting year, including production summaries, environmental monitoring studies, physical stability monitoring, progressive reclamation, water management and construction activities.

An aerial photo taken in August 2013, with site infrastructure labeled, is presented in Figure 1-1. For comparison, the preceding year's aerial photo is shown in Figure 1-2.

Table 1-1: 2013 reporting requirements as per WUL and QML

Licence	Section	Clause	Requirement
WUL QZ96-006			
	6		Summary of the review of the *Spill Contingency Plan* include any changes needed.
	8		Summary list of all spills for 2013.
	18	a	Summary of all data generated as a result of the monitoring requirements of the WUL, including analysis and interpretation by a qualified individual of firm and a discussion of any variance from base line conditions, from previous year's data, or from expected performance.
		b	A detailed record of any major maintenance work carried out on any physical works where that maintenance may have a direct or indirect impact on water quality or water quantity, either as a result of the maintenance activity itself or as a result of the changed operation or performance of the physical works following the completion of the maintenance activity.
		c	Updated descriptions and UTM coordinates for the surveillance monitoring sites listed in Appendix 1 of this licence.
		d	details of results, including data collected during freshet for the Yukon River Monitoring Program.
		e	Detailed data on the volume of water used during the year including water withdrawal from each water source, water routed around and through the site as part of the water conveyance system, water diverted around the site, water routed for storage in the pits, water deposited with mine wastes in waste storage facilities, water routed to the Water Storage Pond, water routed to the treatment plant and water discharged to Minto Creek.
		f	Details of results, including data collected, for the Groundwater Monitoring Program.
		g	Details of the review of the AMMP, including the resulting updated AMMP.
		h	Detailed data on tailings deposition in the Main Pit and Area 2 Pit, including volume and tonnage of tailings slurry deposited, cumulative volume of tailings solids stored in the pits, tailings solids surface elevation and pit water elevation.
		i	Details of results, including data collected, for the Seepage Monitoring

Licence	Section	Clause	Requirement
			Program;
		j k l m n o p	Details and findings of the Physical Monitoring Program, including monitoring of the DSTSF. Details of the review of the water balance/water quality model, including the resulting updated water model and results. Results and interpretations of the QA/QC Program. Meteorological data compiled, including evaporation and evapo-transpiration data. Results of the Annual Biological Monitoring Program. Results of the MCDS Seepage Monitoring Program. Any other reports which are required by this licence.
	28		Results and interpretations of the QA/QC Program.
	77		Seepage monitoring results report.
	78		Updated water balance and water quality model as submit the updated model as part of the Annual Report.
		a b c	Updated model input parameters based on the most current climatic, environmental and operational conditions and data. An update of the basic climatic input parameters and the frequency analysis for the regional stations based on current climatic data. Technical information deficiencies that are identified in Water Use Register QZ09-094, exhibit 5.4, Appendix A.
	79		Meteorological data compiled, including evaporation and evapo-transpiration data and snow pack.
	82	e	The Annual Report for each year shall include a list of each of the annual physical inspection recommendations and an explanation of how each recommendation has been addressed.
	85		Results of the MCDS seepage program for the Annual Report.
	86		Annual Biological Monitoring Report.
	89		Results from the full depth dry stack tailings samples.
	93 95	 a b	Review and update the AMMP. Results of the waste rock management verification program. Detailed records on the types and quantity of waste rock placed at each location. Monitoring and verification of the characteristics of the waste rock in accordance with the grades required by Clause 43 of this licence, stored at each location.
	97		Results of the *Groundwater Monitoring Plan*
QML-0001			
	4		As-built drawings of the Mill Valley Fill, stamped by a professional engineer, licensed to practice in the Yukon.
	12	5	Annual Report
QML-0001: Letter from EMR May 24, 2011 detailing Annual Report Requirements			
		a b c	A summary of construction activities associated with the Undertaking; A summary of mining activities; A map showing the status of all structures, works, and installations

Licence	Section	Clause	Requirement
			associated with the Undertaking;
		d	The total amount of ore and waste removed from the underground workings and open pits;
		e	The total amount and the average head grade of ore milled;
		f	The total amount and the average grade of each ore stockpiled;
		g	The remaining reserve life of the mine;
		h	Any temporary closure or permanent closure that has occurred during the year;
		i	The total amount of concentrate produced and removed from the Undertaking;
		j	The total amount of tailings deposited in the tailings facilities;
		k	The total amount of waste rock removed from the mine and its deposit location;
		l	The total amount of waste rock stored in each waste rock storage facility;
		m	As-built drawings of the open pit and underground mines and of all engineered structures, works, and installations constructed or altered at the Undertaking during the year;
		n	Details respecting any action taken as a result of the recommendations made by the engineer in relation to the inspection referred to in 12.1 of QML-0001;
		o	A summary of any updates to estimates of ore reserves and the life of the mine, including reserve category, tonnage and grade;
		p	A summary of any underground stability incidents;
		q	A summary of the programs undertaken for environmental monitoring and surveillance as outlined in the *Environmental Monitoring Plan* and the *Wildlife Protection Plan*, including an analysis of these data and any action taken or adaptive management strategies implemented to monitor or address any changes in environmental performance;
		r	A summary of progressive and ongoing reclamation activities;
		s	A summary of proposed development and production and reclamation activities for the coming year;
		t	A summary of activities related to care and maintenance of the Undertaking, including any temporary closure activities, if applicable;
		u	A summary of spills and accidents that occurred at the Undertaking;
		v	A summary of the level of traffic, access control issues, wildlife incidents and other accidents, and any upgrade or maintenance work planned for the upcoming year.

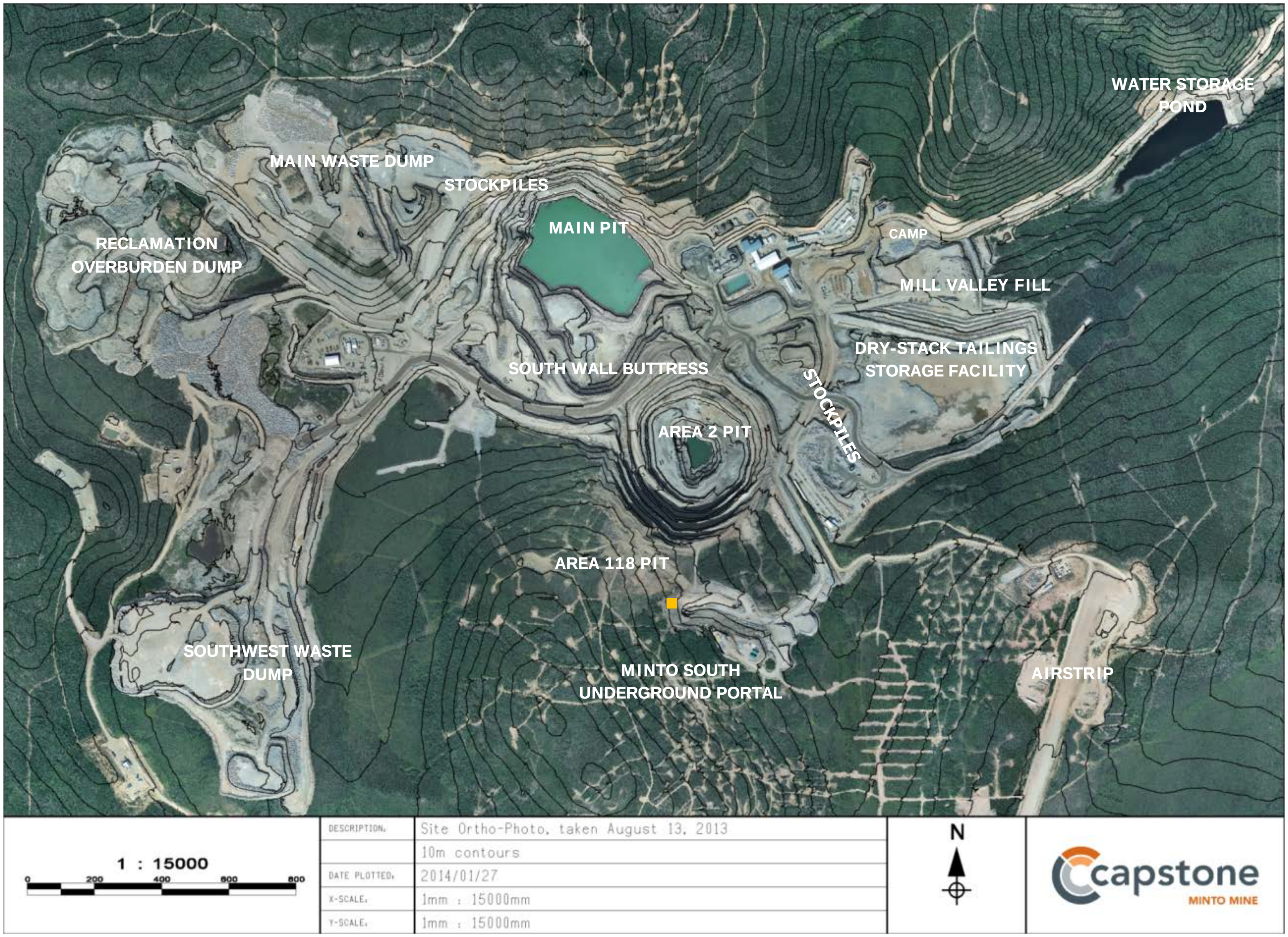


Figure 1-1: Site Layout, August 2013

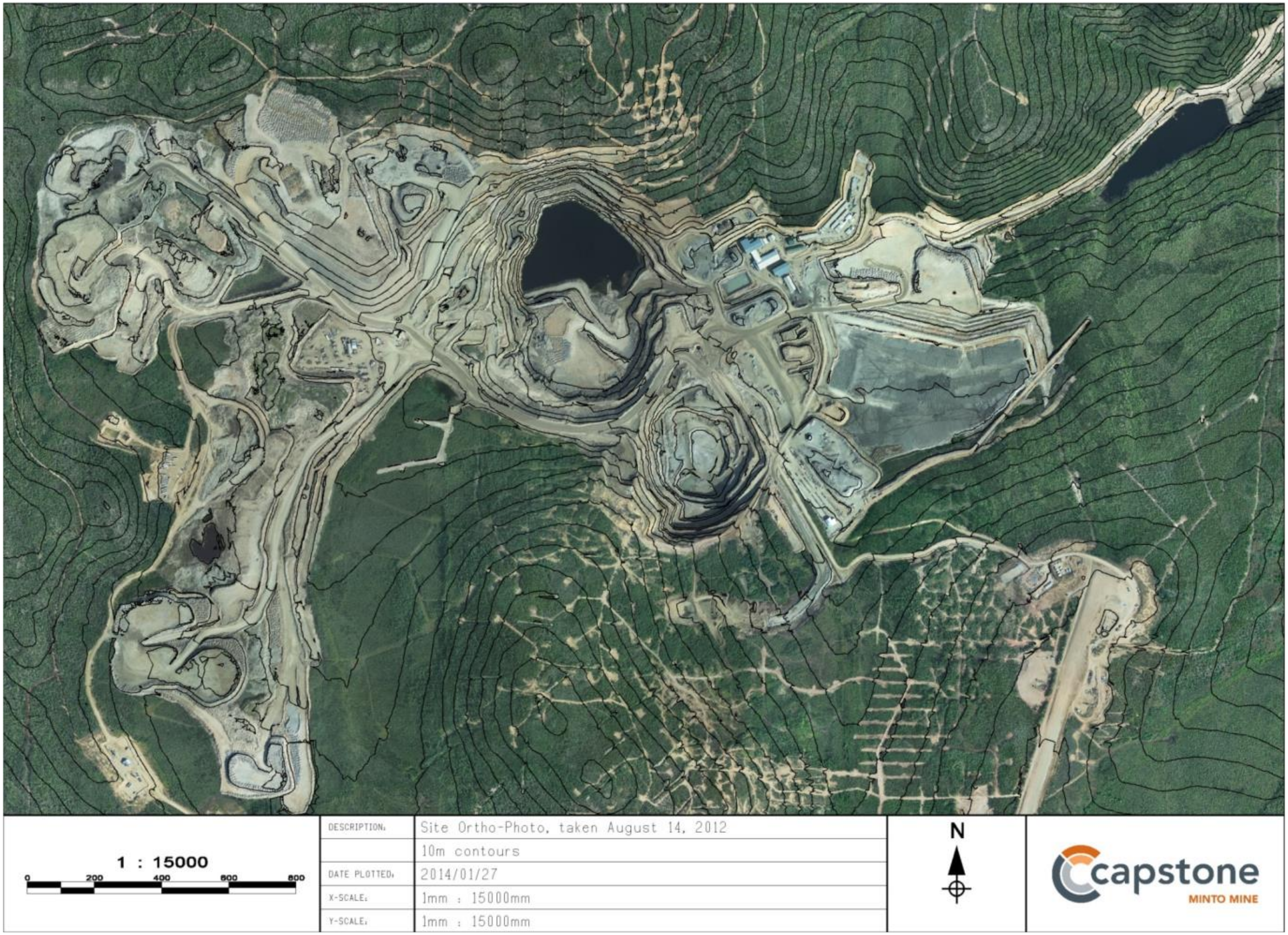


Figure 1-2: Site ortho-photo, August 2012

2 Site Activities

Operation of the Minto Mine continued in 2013, with the production of 37.2 million pounds (Mlb) of copper from the milling of 1.40 Mt of ore. Mining for the year totaled 4.41 M bank cubic meters (BCM).

General site activities included mining of Area 2 and Area 118 open pits, mining of the Minto South underground, milling ore stockpiled from previous mining as well as that mined from Area 2, deposition of tailings into the completed Main Pit as per the Phase IV Tailings Management Plan, hauling of waste to various waste rock dumps as per the *Waste Rock and Overburden Management Plan*, and maintenance and repair work on various structures around the mine site such as access roads.

2.1 Exploration

No exploration drilling took place at Minto in 2013.

2.2 Infrastructure and Construction Projects

A number of construction projects were undertaken in 2013, including expansion of the camp facilities, installation of a new sewage treatment plant, construction of a new warehouse, completion of the Mill Valley Fill Extension and installation of a 4160V power line to the Minto South Underground, detailed below.

2.2.1 Camp Expansion

In order to improve living conditions and to reduce energy consumption, a camp improvement project was initiated in 2013. The construction of a new camp, consisting of 120 sleeping rooms in 89 adapted steel sea containers, began in September, with commissioning scheduled for April 2014. The modules will be insulated to the latest Yukon building code and are designed to be easily and completely removed at the end of mine life.

2.2.2 Sewage Treatment Plant

To service the expanded camp, a new sewage treatment plant (STP) has also been installed (location shown in Figure 2-1 and mechanical room shown in Picture 2-2). The STP uses sequential batch reactor (SBR) technology and is sized for a camp of up to 400 people, providing sufficient redundancy to enable partial maintenance shutdowns and deal with unexpected throughput problems.

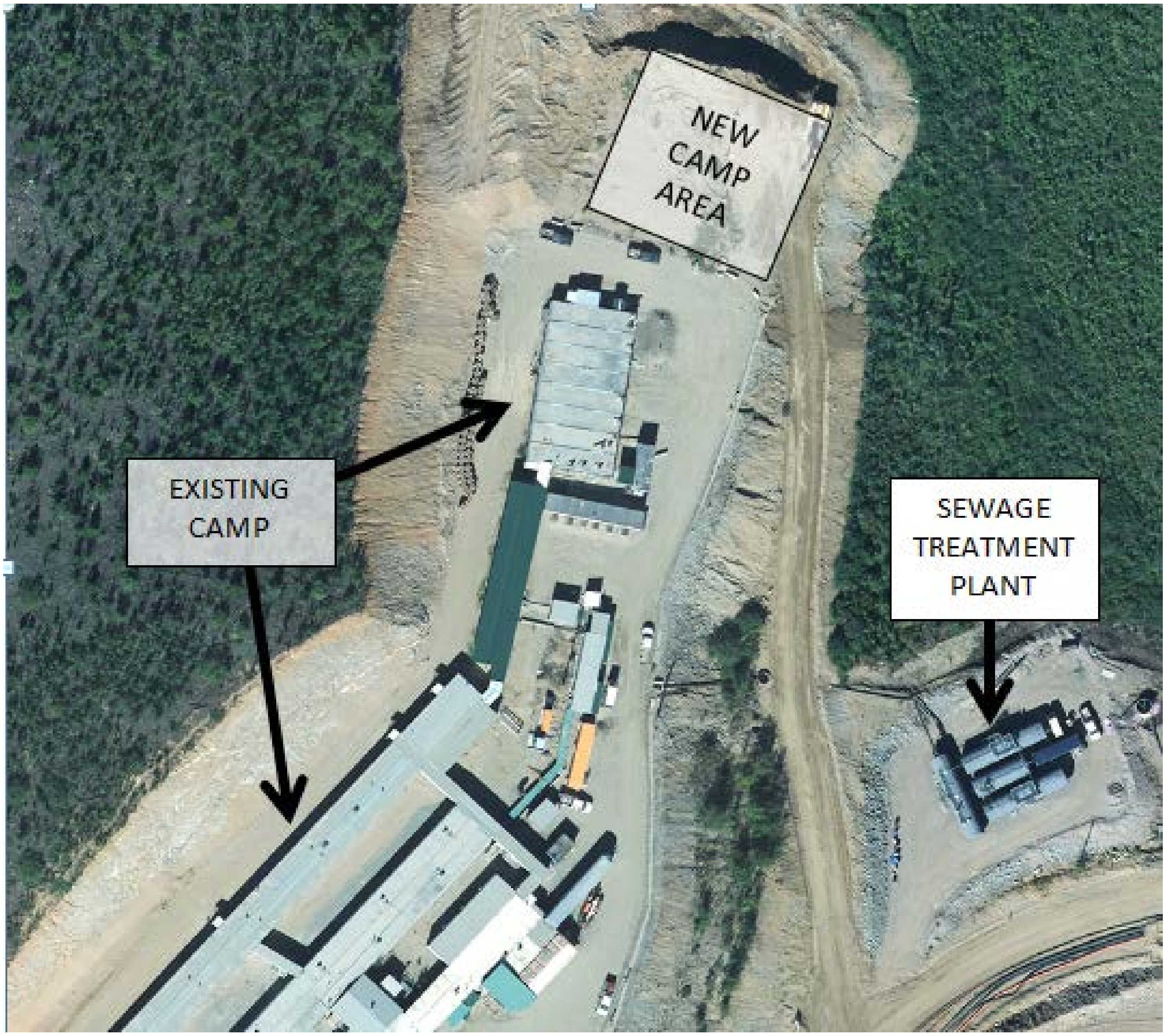


Figure 2-1 Sewage Treatment Plant Location and Camp Excavation

Removal of existing holding tanks, treatment cells and the large septic field serving the eastern portion of the camp occurred in August. During the interim period septic tanks were pumped daily and sewage hauled to the permitted lagoon. In September the new SBR units were inoculated and batching and system start-up took place. In November, commissioning of the plant was completed and all treated effluent discharged via heat traced pipeline to the Main Pit.

Picture 2-1: Minto STP Mechanical Room

2.2.3 Warehouse

In order to provide secure temperature-controlled storage for mechanical parts and consumables, Minto began construction of a warehouse adjacent to the existing tailings building. The warehouse will be an 80’ x 100’ pre-engineered steel-frame building, fully insulated and cladded, supplied by Steel Building Canada.

The building site was engineered by EBA Engineering Consultants, with engineered drawings for the cement foundation and footings provided by Genivar. A grade beam footing was poured by Territorial Concrete in the summer of 2013 and a 3’ high by 4’4” wide anchor footing was established and completed. 30MPa concrete meeting exposure class S-3 was used for the footings.

Building erection was delayed to 2014 due to limited accommodations for crews and scheduling conflicts with the manufacturer’s erection team. Currently, the structure is being erected and completion scheduled in the summer of 2014.

2.2.4 Mill Valley Laydown

The completion of the Mill Valley Fill Extension allowed Minto to move its outdoor laydown of mechanical parts and consumables from its previous location southwest of the Dry Stack Tailings Storage Facility. The new location reduces freight truck exposure to the active mining area while providing 30% more space in a more central location. Figure 2-2 shows the new area created from the Mill Valley Extension to service the needs of the new laydown.

2.2.5 Power Line

In 2013, Minto installed a 4160V power line to the Minto South Underground, providing grid power to both the underground shop and the portal. The circuit was fed from a 200 Amp 4160V feeder from the tailings building. 24 Poles were installed along a 1.3 km line. The capacity at the Underground shop is 300 kVA. The 4160 volt leaves a dead-end pole at a set of 200 Amp cut-out fuses which then feeds a 300 meter length of 4/0 AWG Teck cable which is connected to ESS #1 Substation located inside the Portal. ESS#1 has a capacity of 1500 kVA.

2.3 Mining Activities

2.3.1 Open Pit Mining

Mining in Area 2 and Area 118 pits was ongoing in early 2013. Area 2, Stage 1 mining was completed in April 2013, and Area 2, Stage 2 mining commenced in early 2013, and was completed in January 2014. Wall stability issues had disrupted the mining sequence in late 2012, and were overcome in the 2013 mining program. Implementation of revised blasting standards and real time radar monitoring of the high wall enabled successful mining of Area 2.

A small amount of waste material was mined in Area 118 in January. Total mined waste and ore quantities are summarized in Table 2-1.

Table 2-1: Mined quantities: waste volume and ore volume / tonnes

	Waste / Overburden (BCM)	Ore (BCM)	Ore (t)
Area 2	3,670,519	736,158	2,012,657
Area 118	6,245	8272	22,616
Totals	3,739,288	744,430	2,035,273

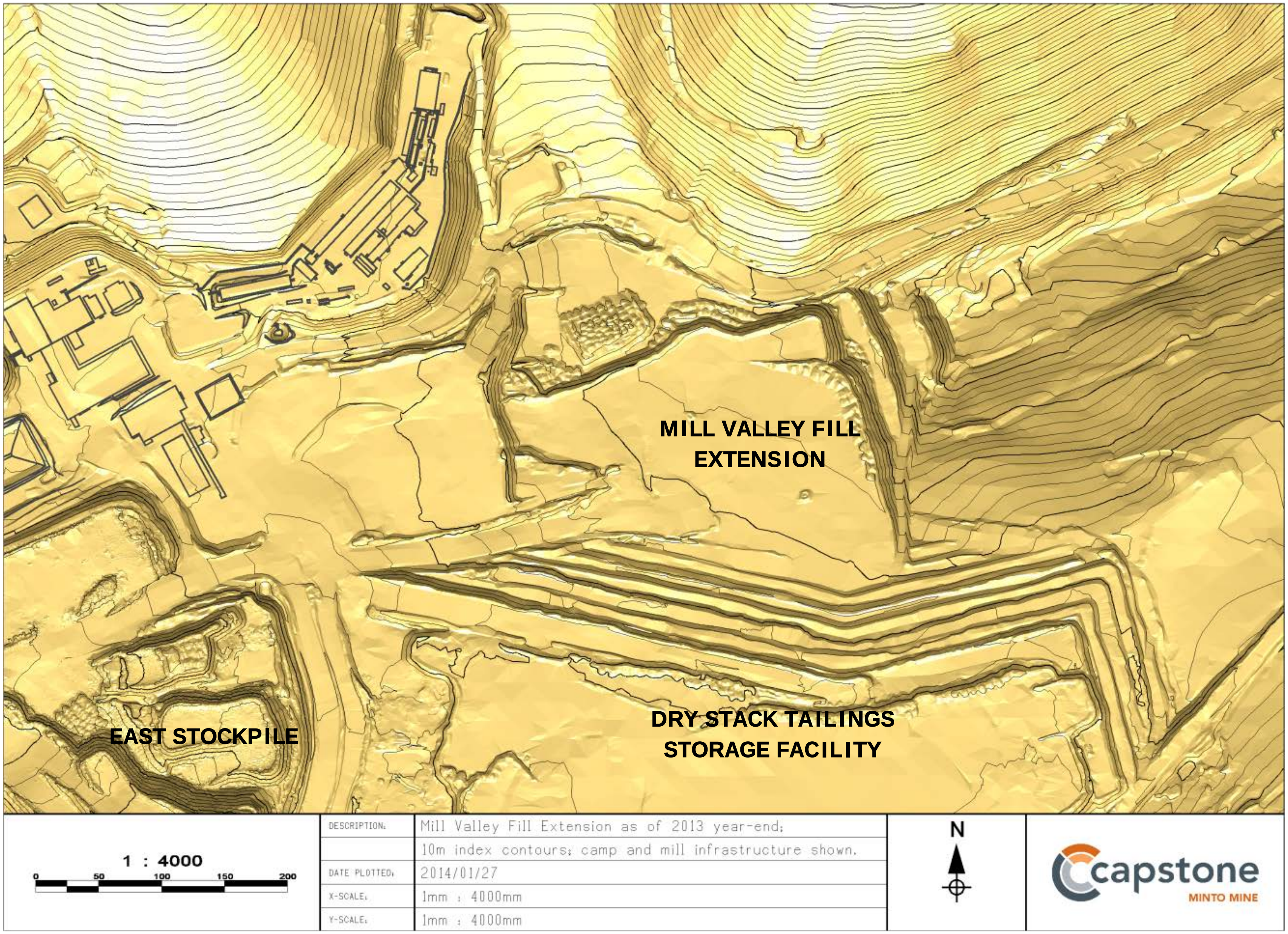


Figure 2-2: Plan view of the Mill Valley Fill Extension as of December 31, 2013

2.3.2 Underground Mining

Underground mine development continued in the Minto South Underground throughout 2013. Ramp development reached the 706 m elevation, from the initial portal elevation of 853m, and total development is shown in Figure 2-3. The main ramp measured 1,100 m long at the end of the 2013. Production mining (i.e., ore extraction) was delayed in 2013 due to lack of a completed secondary egress from the mine. An exploratory ore drift was mined on the 730 m level to confirm the extents of the ore zone and assess its geotechnical characteristics; this resulted in 22,615 tonnes of ore being brought to surface.

To provide both secondary egress and ventilation, a 5x3 m Alimak raise was completed from the 765 m elevation to surface at the 916 m elevation; as of year-end, the raise had broken through, but surface infrastructure and the escape way had not been completed.

2.3.3 Mill Valley Fill Extension

The Mill Valley Fill Extension (MVFE) was designed to reduce ongoing creep movement observed within the DSTSF towards the Minto Creek valley. The MVFE was approximately 97% complete at the beginning of 2013, and construction in 2013 consisted of a small quantity of waste rock being placed to bring the surface up to the design grade. The MVFE was completed in June 2013 and the completed as-built report submitted. The surface MVFE as of year-end is shown in Figure 2-4. The MVFE has substantially reduced the movement rates seen on the DSTSF, as shown in the 2013 monitoring data, summarized in Section 7.1.

2.3.4 Main Pit Buttress Construction

Construction of the Main Pit Buttress to the limits of EBA's 2011 design is essentially complete (Figure 2-5). In addition, a significant quantity of SAT waste has been placed in front of the buttress, where it will be covered by water once the pit is filled to its design elevation as part of Phase V/VI. Should the Phase V/VI approval not be received, the placement of this material will be re-evaluated. The buttress has significantly slowed the South Wall Failure, as shown in the 2013 monitoring data summarized in Section 7.1.

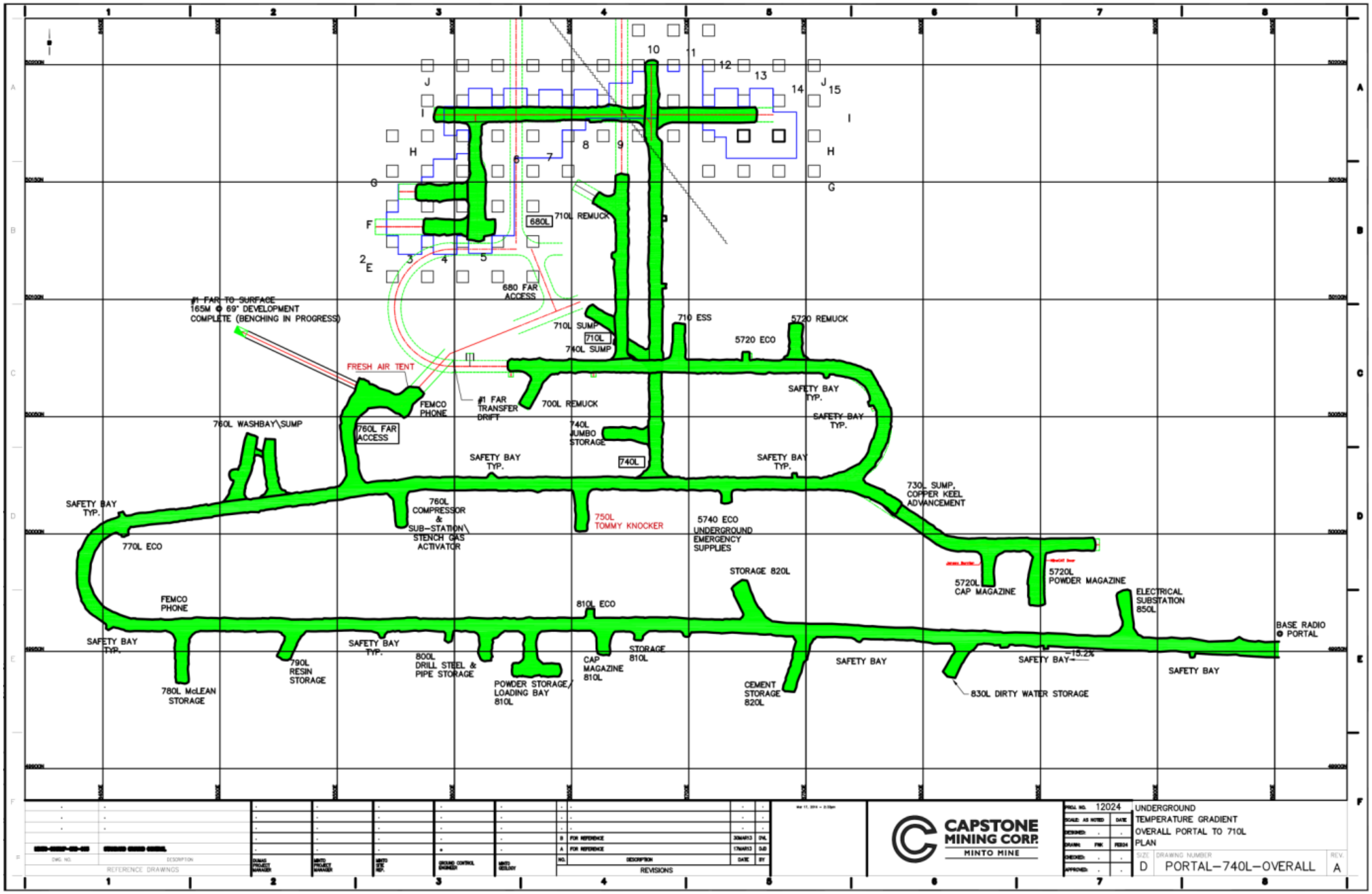


Figure 2-3: As-built drawing of the underground development as of December 31, 2013

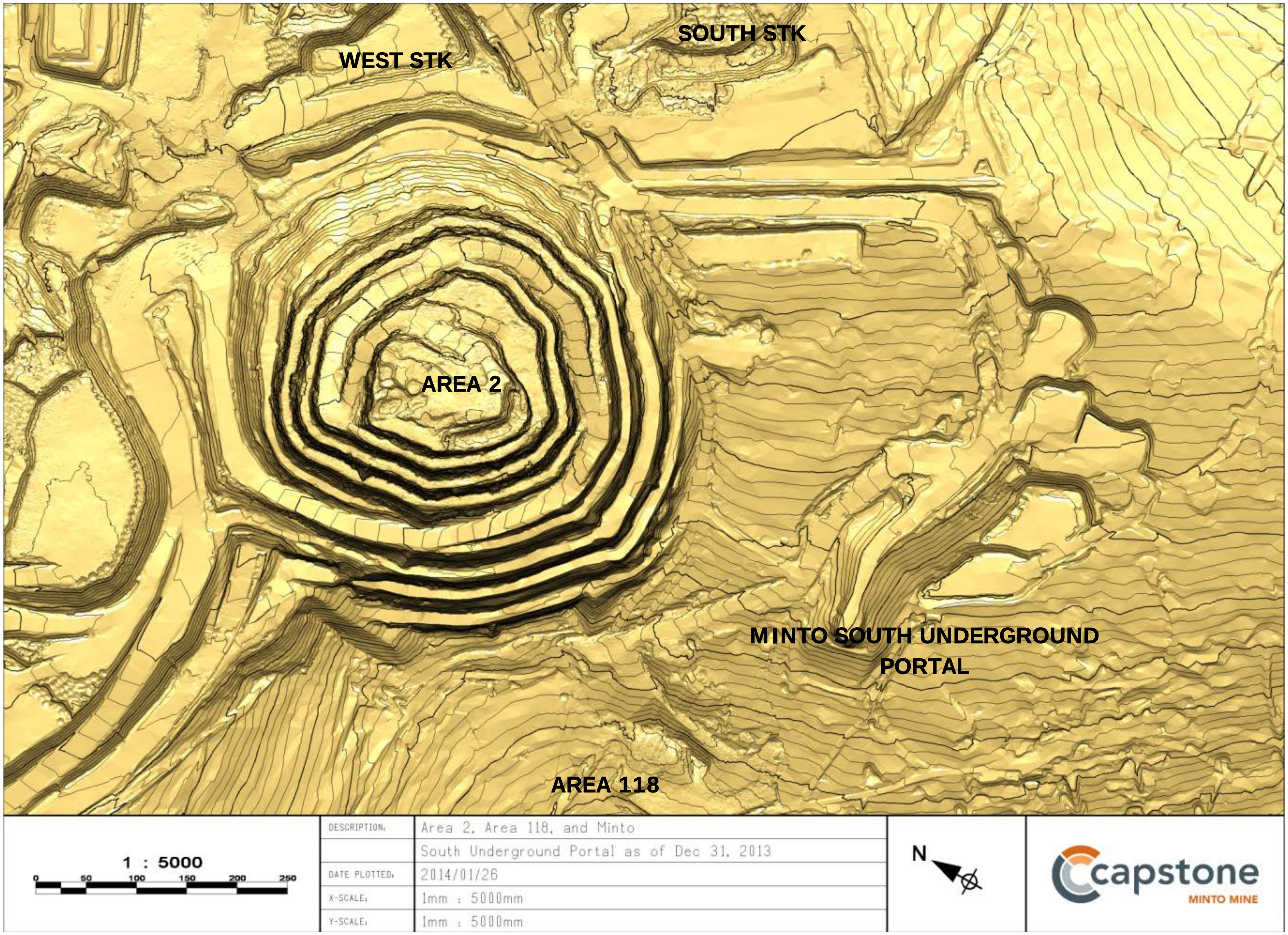


Figure 2-4: Plan view of Area 2, Area 118, and the Minto South Underground as of December 31, 2013 Plan view of the Mill Valley Fill Extension as of December 31, 2013

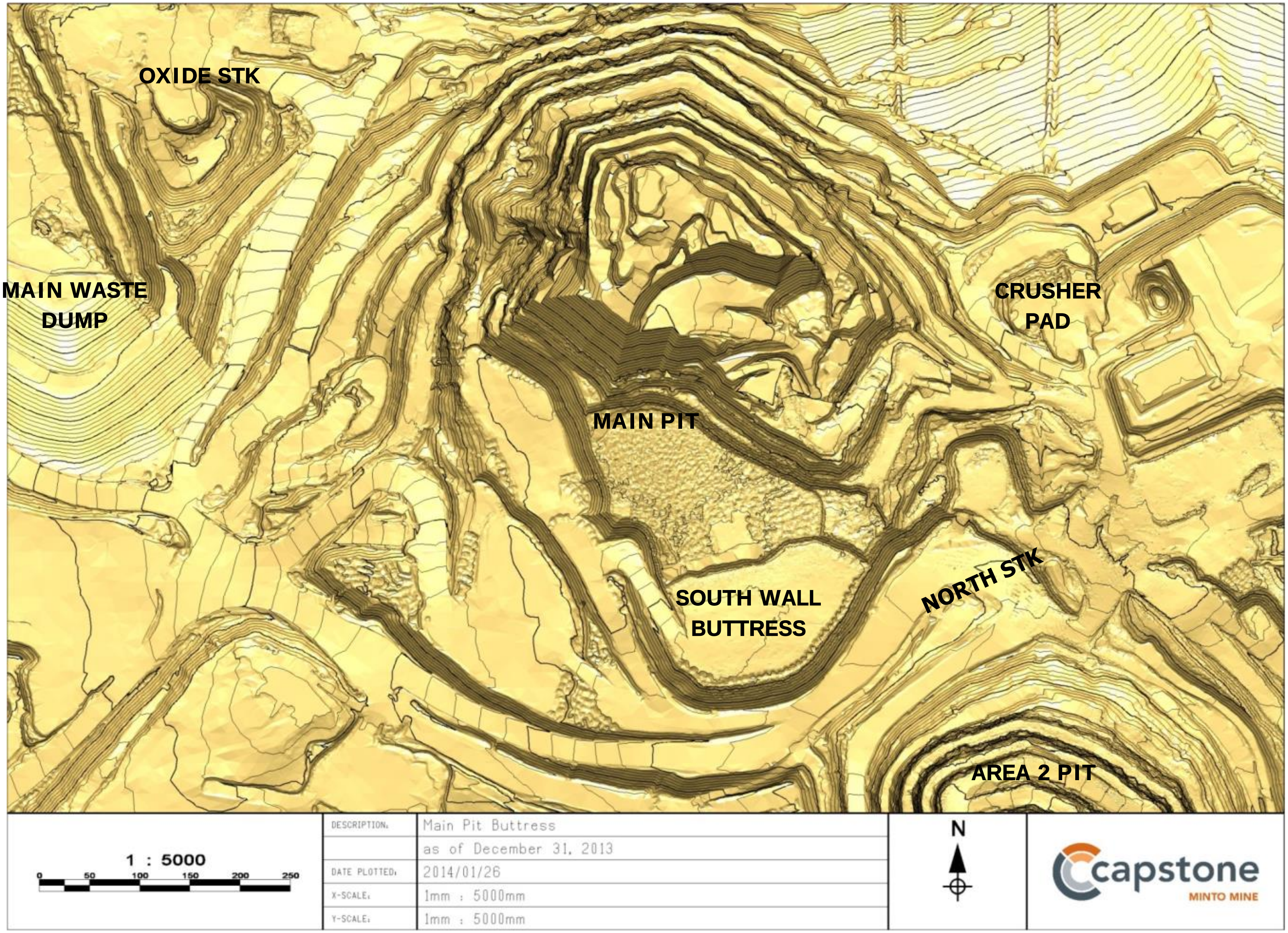


Figure 2-5: Plan view of the Main Pit and South Wall Buttress as of December 31, 2013

2.3.5 Waste Rock Management

Waste rock dump development continued in 2013, as per the *Minto Mine Waste Rock and Overburden Management Plan*, with mid- and high-grade waste types deposited in either the Southwest Dump or in the Main Pit. The Mill Valley Fill Extension was largely complete at the beginning of 2013, which allowed for the placement of low-grade waste in the South Wall Buttress above the final flood elevation of the pit. As the South Wall Buttress neared completion, low-grade waste was deposited at the Southwest Dump, as per the *Waste Rock and Overburden Management Plan*.

Low-grade waste that met construction criteria was also used for several major projects, including a new east-west connector road from Area 2 pit to the west side of the mine, Tailings Diversion Ditch buttressing, and surface grading on the MVFE.

In addition to categorization based on copper grade, Minto continued to use its on-site carbon / sulfur analysis facility to test all blast-hole cuttings for NP/AP ratios. Material with a ratio exceeding 3.0, or with sulfur content exceeding 0.3%, was dispatched to the Main Pit, below the final spill elevation. ABA analysis conducted in 2013 is summarized in Section 6. This material was originally designated potentially acid generating (PAG), but through implementation of the *Waste Rock and Overburden Management* Plan, it was decided that the PAG terminology was not descriptive enough for implementation purposes. As such, Minto adopted a new term for material destined for storage under saturated conditions (SAT).

Additionally, Minto introduced a “construction-specification waste” term to describe low-grade waste that was able to be used as construction material, the requirement for which was an NP/AP ratio < 3 and a sulfur content of < 0.3%. Table 2-2 summarizes the waste materials and ultimate destinations, and the volumes deposited in bank cubic meter (BCM). Current waste rock inventory in the various waste rock and overburden dumps at the Minto Mine site are summarized in Table 2-3.

Table 2-2: Waste destination and volumes

Material Source and Destination	Unreconciled (BCM)*
Overburden to DSTSF starter cover	181,000
Overburden to Reclamation Overburden Dump (ROD)	180,000
Low-grade Waste to SWD (North)	1,014,000
Mid-grade Waste to SWD (South)	678,000
SAT Waste to South Wall Buttress (below final water level)	650,000
Low-grade Waste to Buttress (dumped from 810)	323,000
Mid-grade Waste to South Wall Buttress (below water lvl)	128,000
Low-grade Waste to New East / West Connector road	284,000
Low-grade Waste to ROD for padding roads	126,000
Low-grade Waste to Tailings Diversion Ditch Rehab	116,000
Low-grade Waste to Roadwork	86,000
Low-grade Waste to Crushing	27,000
Low-grade Waste to Mill Valley Fill Extension	24,000

Material Source and Destination	Unreconciled (BCM)*
Low-grade Waste to Propane Pad	24,000
Low-grade Waste to Portal Road / Pads	10,000
Low-grade Waste to Other Projects	71,000
Total	**3,922,000**

*Based on truck count data, not reconciled to survey volumes.

Table 2-3: Waste dump locations and storage volumes

Dump Location	Quantity Stored as of December 31, 2013 (m^3)
Main Pit Buttress	3,840,000
Southwest Dump	11,280,000
Mill Valley Fill Extension	1,430,000
Reclamation Overburden Dump	4,300,000
Main Waste Dump	8,150,000
Total Waste Dumped	**29,000,000**

2.3.6 Tailings Management

Deposition of slurry tailings into the Main pit began on November 1, 2012 and continued uninterrupted throughout 2013; no tailings were deposited on the Dry Stack Tailings Storage Facility. The filter press plant has been deactivated and did not run in 2013. While the filter press plant equipment is still in place, a substantial portion of the building's electrical supply has been re-routed to the Minto South Underground portal.

Deposition in the Main pit was from a single point along the north corner of the pit from a pipe at 784 m elevation, directly into water stored into the pit. Water levels in the pit were maintained above the 765 m elevation, with a year-end water elevation of 781 m. Ice formation around the discharge point was prevented by the discharge temperature of the tailings stream, and the impact into the water. A total of 1,356,000 dry metric tonnes of tailings were discharged to the pit in 2013. Including production from November and December of 2012, the Main pit has received 1,553,000 tonnes of tailings.

As per the terms of the *Tailings Management Plan*, a bathymetric survey of the pit was completed in July 2013, with the goal of mapping the tailings surface. The results of this survey are presented in Figure 2-6 and Figure 2-7. The bathymetric survey did not register certain known rockfill features at the bottom of the pit, indicating that the results may not be reliable for volume calculation purposes. The survey indicates a fill volume of 394,000 m^3 relative to the final configuration of the pit before flooding began. As of the survey date, 911,000 tonnes of tailings had been deposited, suggesting a settled bulk density of 2.31 t/m^3. This corresponds to a dry density of 2.07 t/m^3. These values are unrealistic, indicating that the bathymetric mapping techniques used did not reliably image the true depth of the tailings / water interface.

Figure 2-8 indicates that, directly under the discharge point, the tailings/water interface is as steep as 11°, averaging 9° over the first 75 m. Grading decreases to 5° over the next 80 m, then flattens significantly over the remaining 100 m, with grades between 0.2° and 0.6°. This suggests that the tailings is segregating, with coarse tailings settling near the point of discharge and forming a steeper angle underwater, while fines migrate further from the discharge point and gradually settle. The overall angle is steeper than the 4° used as the basis of the Phase IV tailings management plan and suggests that a greater number of discharge points may be required to maximize the storage volume.

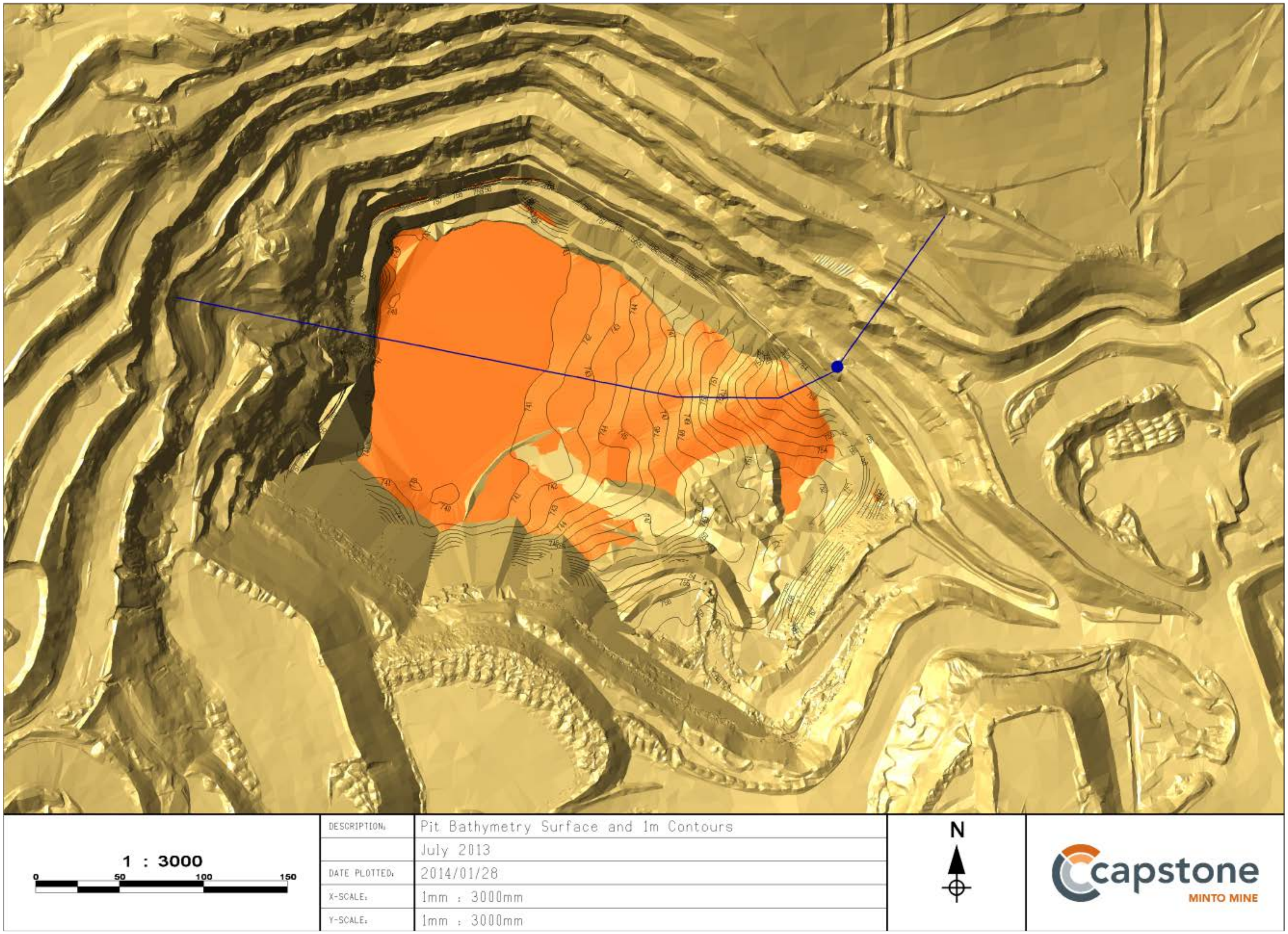
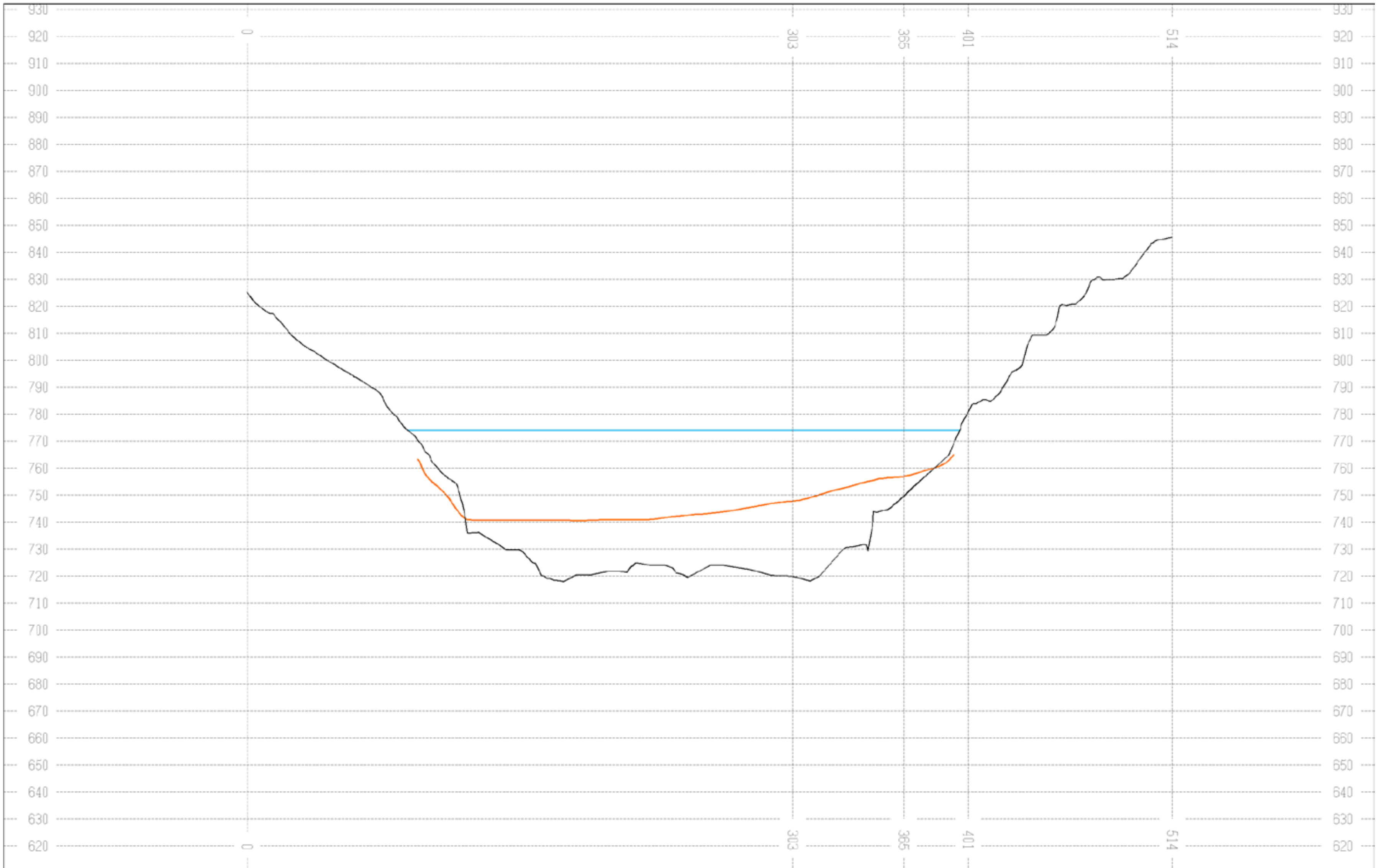


Figure 2-6: Bathymetric survey of the Main pit tailings deposit, showing section line



DESCRIPTION:	Section A-A' through Main Pit tailings deposit
	July 2013
DATE PLOTTED:	2014/01/28
X-SCALE:	1mm : 3000mm
Y-SCALE:	1mm : 2000mm

Figure 2-7: Bathymetric survey of Main pit tailings deposit, section A-A'

2.3.7 Ore Stockpiles

Minto currently maintains six stockpiles, as detailed below:

- North stockpile – setup location for Minto's secondary crushing contractor. Storage location for ore grading more than 2.0% Cu.
- West stockpile – sulfide ore grading 1.0% - 2.0% Cu.
- East stockpile – partially oxidized ore from Area 2 and Stage 5 of the Main pit.
- South stockpile – sulfide ore grading 0.5% - 1.0% Cu.
- Oxide stockpile – partially oxidized ore from the Main pit.
- Blue stockpile – sulfide ore grading 0.5%1.0% Cu.

In addition to the above, which are used for temporary storage of ore, Minto maintains a stockpile of several ore types at the crusher, a live pile of crushed ore, and a portal ore pad for short-term storage of ore trucked out of the Minto South Underground.

In order to provide predictable head grades to the mill and maximize revenue, Minto segregates ore into six categories, as defined below, with the stored quantities summarized in Table 2-4:

- Red: sulfide ore grading >4.0% Cu.
- Yellow: sulfide ore grading 2.0 to 4.0% Cu.
- Green: sulfide ore grading 1.0% to 2.0% Cu.
- Blue: sulfide ore grading 0.50% to 1.0% Cu.
- POX: partially oxidized ore grading >1.0% Cu.
- LGPOX: partially oxidized ore grading 0.50% to 1.0% Cu.

Table 2-4: Stockpile inventory

	December 31, 2012			December 31, 2013		
	Mass (tonnes)	Cu (%)	Ag (g/t)	Mass (tonnes)	Cu (%)	Ag (g/t)
Red	219	5.30	23.32	1,364	3.99	16.36
Yellow	0	0.00	0.00	23,541	2.35	7.03
Green	3,724	1.44	5.06	633,076	1.31	4.41
Blue	334,816	0.76	2.14	591,134	0.66	1.92
POX	234,249	1.29	3.99	188,626	1.34	4.51
LG POX	31,250	0.70	1.00	55,389	0.65	1.11
Portal Ore Pad	0	-	-	4,518	2.16	8.29
Live Pile	12,602	1.12	3.80	24,377	2.25	7.62
Total Ore	**616,860**	**0.97**	**2.84**	**1,522,025**	**1.07**	**3.45**

2.3.8 Operating Results

Ore processing and metal production results for the 2013 calendar year are summarized in Table 2-5.

Table 2-5: 2013 operating results

Metal Production	Quantity
Copper (000s pounds)	37,238
Silver (ounces)	162,300
Gold (ounces)	18,400
Ore Mined	
Tonnes of ore mined	2,013,000
Ore Milled	
Tonnes of ore processed	1,402,000
Copper grade (%)	1.31
Silver grade (g/t)	4.59
Gold grade (g/t)	0.52
Recoveries	
Copper (%)	92.3
Silver (%)	78.5
Gold (%)	78.4
Concentrates Produced	
Copper concentrate (dmt)	46,303
Copper (%)	36.5
Silver (g/t)	109.03
Gold (g/t)	12.33

2.3.9 Concentrate Shipments

Minto produced 50,013 metric tonnes of concentrate at 7.4% moisture content, which corresponds to 46,303 dry metric tonnes. The average concentrate grades were 36.5% Cu, 12.33 g/t Au, and 109.03 g/t Ag. 921 truckloads of concentrate were shipped from Minto in 2013: 389 between January 8 and April 2, and 531 between June 10 and November 10.

2.4 Mine Access Road

2.4.1 Traffic

From January 1 to May 2, access across the Yukon River was over an ice bridge during which time, 1,510 heavy vehicles and 978 light vehicles travelled across the ice bridge. There was no land access to the mine site until June 10, when the summer, tug and barge, operation began. During the barge operating season, 2,599 heavy and 1,593 light vehicles accessed the Minto Mine via the mine access road.

Establishment of the ice bridge was completed at the end of December and opened to traffic in early January 2014.

2.4.2 Access Control Issues

No access control issues were experienced in 2013.

2.5 Accidents and Incidents

2.5.1 Incidents

In 2013 one lost time accident occurred at Minto Mine including Capstone employees and site contractors, 20 Medical Aids and 13 Serious Incidents were reported to the Yukon Workers' Compensation Health and Safety Board (YWCHS).

2.5.2 Wildlife Incidents

There were three incidents involving wildlife in 2013, all of which occurred in the last quarter. In October, a fox was struck and killed by a vehicle leaving the underground portal. In November, a fox was hiding amongst rocks in the Area 2 pit at the time of a blast and died as a result. In December, a fox approached a water truck driver in the Main Pit and bit him on the finger. The animal was seen to be behaving strangely and was shot and killed by Safety Personnel. In all cases, the district Conservation Officer was informed.

2.5.3 Reportable Spills

In 2013, six reportable spills occurred at Minto Mine, summarized in Table 2-6.

Table 2-6: 2013 reportable spills summary

Date	Volume (L)	Substance	Cause
January 11	35	Antifreeze	A hose clamp came off D65 drill, causing the hose to come loose and spill antifreeze to the ground. The leak was not noticed until the drill shut down on overheating.
May 27	1200	Diesel Oil	The PTO on fuel truck was left engaged while driving away from equipment that had been fuelled. When engine revs increased from idle, fuel pump was activated. Pressure blew fueling hose coupling.
June 14	65	Antifreeze	A mechanic was positioning dozer over belly pans after repairs, so they could be re-fitted, when a track caught the edge of one, causing it to flip up and break a hydraulic line.
June 18	350	XD-3 Engine Oil 10W	The back clamp failed on the connecting hose between the circulating pump tube and the hydraulic oil cooler situated behind the radiator. (N.B. W10 engine oil is used in hydraulic circuit on some machines)
July 10	300	Hydraulic oil	A 777 Haul Truck broke frame, causing the hydraulic line to separate and drain hydraulic oil tank.

Date	Volume (L)	Substance	Cause
August 28	200	Waste Oil	The valve on the filler hose extending from the waste oil tank into a drip barrel was left or knocked open, causing the barrel to overflow. The drip barrel is outside of the berm surrounding the tank.

2.5.4 Spill Contingency Plan Review

An update to the *Minto Mine Spill Contingency Plan* is required annually as part of the Annual Report and the *2014 Minto Mine Spill Contingency Plan* is provided in Appendix A.

3 Proposed Mining for 2014

3.1 Proposed Open Pit Mining for 2014

The 2014 mine plan includes completion of the Area 118 pit (predicted mid-August, 2014) and once Phase V/VI licences are acquired, mining will commence in the Minto North pit. The 2014 mining rate will be reduced from 12,100 BCM/d to approximately 5,000 BCM/d, with a concomitant reduction in the mining workforce.

3.2 Proposed Underground Mining for 2014

2014 underground mining will continue in the bottom ore lens of the Area 2 pit, and in early February, will move to the M-zone, a portion of the Phase IV underground reserve. The completion of the Area 2 pit presents an opportunity to mine this ore lens from a portal collared in the highwall, rather than via a long campaign of underground development. While the M-zone is being mined, the Minto South Underground will be placed on care-and-maintenance.

4 Mineral Reserves and Mine Life

Minto Mine's published and estimated mineral reserves are provided in Table 4-1 and Table 4-2, respectively, as of December 31, 2013.

Table 4-1: Mineral Reserves Combined Estimated Mineral Resource for all Minto Mine Deposits as of December 31, 2013

Classification	Tonnes (000's)[1]	Copper (%)	Gold (g/t)	Silver (g/t)	Contained Cu (Mlbs)[1]	Contained Gold (koz)[1]	Contained Silver (koz)[1]
Measured (M)	11,236	1.36	0.55	4.38	334	197	1,583
Indicated (I)	38,023	1.03	0.36	3.70	861	442	4,522
Total (M+I)	49,259	1.10	0.40	3.85	1,195	639	6,105
Inferred	16,211	0.92	0.30	3.17	329	157	1,650

Note 1 - Rounded to nearest thousand; totals may not sum exactly due to rounding.
Note 2 - Excludes material mined but not processed during pre-stripping activities in the Area 2 region of MSD and currently held in stockpile.
Note 3 - Includes any resources remaining in the Minto Main Deposit not considered in the current mine plan.
Note 4 - Metal Price assumptions used to calculate the COG for All Deposits are: Cu=$3.50; Au=$1300; Ag=$16.00 (each in US Funds).

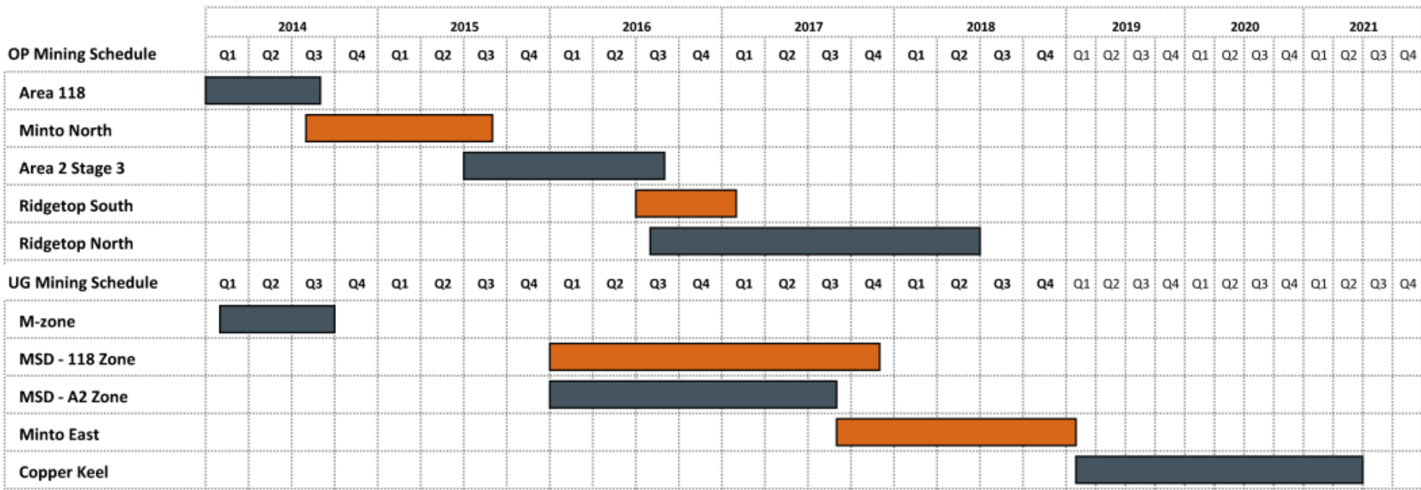
Table 4-2: Minto Estimated Mineral Reserves as of December 31, 2013

	Tonnage (000s)	Cu%	Au (g/t)	Ag (g/t)
Minto North Open Pit				
Proven	1,596	2.26	1.21	8.12
Probable	9	1.68	0.58	6.92
Subtotal Minto North	1,605	2.26	1.21	8.11
MSD - 118 Open Pit				
Proven				
Probable	483	1.28	0.10	1.81
Subtotal 118	483	1.28	0.10	1.81
MSD - Area 2 Open Pit				
Proven	246	1.57	0.62	5.86
Probable	1,314	1.04	0.29	3.51
Subtotal Area 2	1,560	1.13	0.35	3.88
Minto East Underground				
Probable	709	2.28	1.04	6.15
Subtotal Minto East U/G	709	2.28	1.04	6.15
MSD - Area 2 / 118 Underground				
Probable	1,708	1.76	0.74	7.24
Subtotal Area 2/118 U/G	1,708	1.76	0.74	7.24
MSD - Copper Keel Underground				
Proven	106	1.74	0.61	6.3
Probable	1,455	1.81	0.65	6.7
Subtotal Copper Keel	1,561	1.81	0.64	6.67
MSD - Wildfire Underground				
Proven	301	1.80	0.77	6.06
Probable	59	1.59	1.00	7.85
Subtotal Wildfire	360	1.76	0.80	6.35
Stockpiles				
Proven	1,522	1.07	0.41	3.45
Subtotal Stockpiles	1,522	1.07	0.41	3.45
Total Minto Reserves				
Proven	3,771	1.68	0.80	5.87
Probable	5,737	1.63	0.60	5.66
Total	**9,509**	**1.65**	**0.68**	**5.75**

Note 1 - Rounded to nearest thousand; totals may not sum exactly due to rounding.
Note 2 – Includes stockpiled material
Note 3 - Includes any resources remaining in the Minto Main Deposit not considered in the current mine plan.
Note 4 - Metal Price assumptions used to calculate the NSR Cut-off for All Deposits are: Cu=$2.50; Au=$300; Ag=$3.90 (each in US Funds).
Note 5 – Processing Recoveries for All Deposits are: Cu=91%; Au=70%; Ag=78%
Note 6 – Open Pit Mining use a 0.5% copper COG. Underground mining uses a $64.40 NSR COG

The 2013 reserves differ from 2012 as mining of Area 2 is substantially completed. No new ore zones have been added to the reserves. Figure 4-1 shows a Gantt chart of the current life-of-mine plan. The mine plan includes continuous open-pit mining, contingent upon the receipt of the necessary permits and licenses, with a 15 month gap in underground ore production, which will be used to process stockpiles, develop infrastructure, and transition from a contractor to a Minto-operated underground fleet. As noted in Section 3.2, Minto is currently evaluating alternatives, such as bringing forward some underground production.

Figure 4-1: Mining sequence timeline



At the current rate, open-pit reserves are predicted to be exhausted in mid-2018, while underground reserves will last until mid-2021. The production rate from surface mining is not uniform: production from the Ridgetop pits is scheduled at 7,200 BCM/d as compared to 12,000 BCM/d in Minto North and Area 2 Stage 3. Underground production is scheduled at a uniform 1,700 tonnes of ore per day.

5 2013 Environmental Monitoring

Environmental monitoring programs are outlined in the *Environmental Monitoring and Surveillance Program*, and the results for the monitoring conducted in 2013 are provided in this section. These programs include the water quality surveillance program, the Minto Creek hydrology monitoring program, the Yukon River monitoring program, the seepage water quality monitoring program, the MCDS seepage monitoring program, the water discharge monitoring program, the biological monitoring program, the meteorological monitoring program, the QA/QC program, the groundwater monitoring program and the wildlife protection program. Where possible, the 2013 results have been compared to historical results to identify trends and compare 2013 values with previous values.

5.1 Water Quality Surveillance Program

Details of the Water Quality Surveillance Program, including sampling station locations and monitoring frequency, are outlined in the *Minto Mine Environmental Monitoring and Surveillance Plan* and the results are presented below for water quality stations outlined in the WUL. Water quality result statistics including the mean, minimum and maximum water quality concentrations are presented in the summary tables, below. For the purposes of calculating the mean, minimum and maximum concentrations, values less than the detection limit were taken to be half of the detection limit.

The WUL non-freshet water quality standards were compared to the water quality result statistic summaries at stations W2, W3, W12, W15, W16, W16a, and W50.

As water quality stations may be adjusted from year-to-year as a result of environmental changes or modifications to infrastructure, an update to the water quality station locations listed in the WUL is provided in Table 5-1 and Figure 5-1. All surveillance monitoring sites in use in 2013 are confirmed with a Global Positioning System (GPS) unit to determine current UTM coordinates. Coordinates presented in Table 5-1 are associated with the World Geodetic System 1984 (WGS 84) coordinate system.

Table 5-1: Water quality monitoring site descriptions and UTM coordinates (2013)

Site Name	Description	UTM Location (m) Zone 8 (WGS 84)	
		Easting	Northing
W1	Lower reach of Minto Creek.	392445	6948251
W2	Minto Creek, upstream of the Minto Creek/Yukon River confluence where the mine access road crosses Minto Creek.	392584	6948402
W3	Minto Creek, (at the Metal Mining Effluent Regulations compliance point).	387000	6945778
W4	Yukon River, upstream of the confluence with Minto Creek.	394070	6948203
W5	Yukon River, downstream of the confluence with Minto Creek.	392583	6949119
W7	Mouth of the tributary on the south side of Minto Creek, approximately 0.8 km downstream of W50.	387546	6946034
W8	Western collection sump from the DSTSF.	385629	6945076
W8a	Eastern collection sump from DSTSF.	385716	6945012
W10	Headwaters of Minto Creek (southwest fork at headwaters).	383855	6943364
W12 W12a	Main Pit water. W12 and W12a are called W12 internally and represent the same sampling location.	384544	6945137
W13	Mill Water Storage Pond (if not discharging).	385081	6945038
W13a	Discharge from the Mill Water Storage Pond.	385295	6945164
W14	Tailings Thickener Overflow.	385223	6945089
W15	Upper Minto Creek Storm Water Collection Sump, downstream of the overburden dump, and upstream of Main Pit.	384181	6944708
W16	Water Storage Pond.	386402	6945559
W16a	Discharge from the Water Storage Pond.	386679	6945664
W17	Water Storage Pond Dam Seepage.	386679	6945664
W30	Headwaters of Minto Creek (northwest fork).	383693	6945026
W32	At toe of Southwest Dump (southwest fork).	383952	6944564
W33	Above Tailings Diversion Ditches.	385351	6944072
W35a W35b	Storm Water Collection Point - South Diversion Ditch. W35a and W35b are called W35 internally and are the same sampling location.	385223	6944427
W36	Minto Creek Detention Structure.	385892	6945191
W37	100 m downstream of Minto Creek Detention Structure (W36) and upstream of the Water Storage Pond.	385958	6945213
W38	Original Ground near Southwest Dump; approximately 90 m ENE of W15.	384120	6944764
W39	Original Ground near Southwest Dump; approximately 165 m ESE of W15.	384068	6944698
W40	Original Ground near Southwest Dump; approximately 290 m SE of W15.	384008	6944618
W41	Original Ground near Southwest Dump; 130 m NE of W15. This site has been destroyed and is no longer available.	n/a	n/a
W42	Storm Water Collection Sump; north side of mine access road at approximately 0.5 km.	385602	6945241

Site Name	Description	UTM Location (m) Zone 8 (WGS 84)	
		Easting	Northing
W43	Storm Water Collection Sump - north side of mine access road at Water Storage Pond; approximately 1.5 km on access road.	386371	6945614
W44	Area 2 Underground.	384975	6944546
W45	Area 2 Pit.	384912	6944068
W46	Minto Creek downstream of W7 and W6 tributaries.	387873	6946301
W47	Area 118 Pit Water; site not established in 2013.	n/a	n/a
W50	Minto Creek, approximately 50 m downstream of the toe of the Water Storage Pond Dam and downstream of the inflow of the treated water.	386747	6945682
MC1	Minto Creek upstream of Minto Canyon near Km 8 on mine access road.	390967	6947528
WC	Convergence point for W15 and W35 inflows.	384947	6944954
WTP	Treated Water from Water Treatment Plant.	385126	6945154

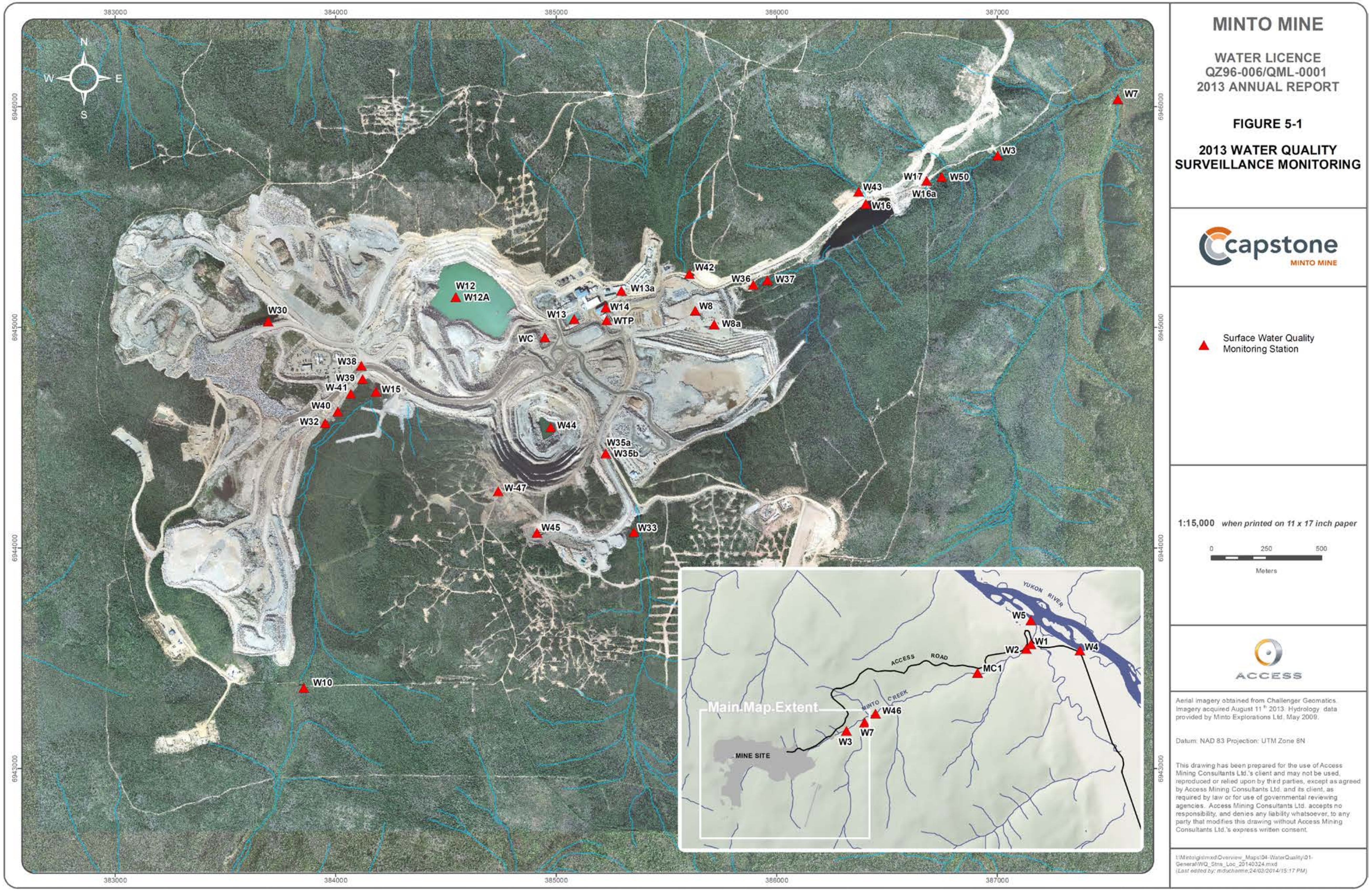


Figure 5-1: 2013 Water Quality Surveillance Monitoring Locations

5.1.1 Monitoring Conformance

2013 conformance with the external and internal water sampling requirements are summarized in Table 5-2. Flow monitoring at water quality surveillance sites is highly variable as a result of site and seasonal conditions and is not presented in Table 5-2, however, full details were provided in the Monthly Reports. Additionally, the specifics of non-conformance in relation to external and internal water sampling requirements are included in the Monthly Reports. Quality assurance and quality control (QA/QC) sampling is not included in sampling events described in Table 5-2, but is provided in Section 5.10.1.

Table 5-2: Water quality sampling monitoring conformance summary (2013)

Site Name	2013 WQ sampling events*	Reason(s) for non-conformance events
W1	N/A	N/A
W2	40	Seasonal conditions (site dry and / or frozen).
W3	57	Sampled as per schedule.
W4	50	Seasonal conditions (site frozen and / or unsafe) and manpower issues.
W5	29	Seasonal conditions (site frozen and / or unsafe) and manpower issues.
W7	9	Seasonal conditions (site dry and / or frozen).
W8	4	Site presented water in October and November 2013; site dry for all remaining months in 2013.
W8a	53	Human error resulted in a minor quantity of internal samples not being collected.
W10	7	Seasonal conditions (site dry and / or frozen).
W12 **W12A**	12	W12 and W12A are internally referred to as W12 and sampled as one site. Human error resulted in one monthly sample being missed.
W13	9	Seasonal conditions (site frozen and / or unsafe).
W13A	0	No water was observed at W13A during 2013.
W14	12	Sampled as per schedule.
W15	33	Seasonal conditions (site dry and / or frozen).
W16	47	Human error.
W16a	8	Sampled as per schedule.
W17	52	Sampled as per schedule.
W30	8	Seasonal conditions (site dry and / or frozen).
W32	4	Seasonal conditions (site dry and / or frozen).
W33	6	Seasonal conditions (site dry and / or frozen).
W35a **W35b**	9	W35a and W35b are internally referred to as W35 and sampled as one site. Seasonal conditions (site dry and / or frozen).
W36	10	Seasonal conditions (site dry and / or frozen).
W37	4	Seasonal conditions (site dry and / or frozen).
W38	3	Site conditions (site dry).
W39	0	Site conditions (site dry).
W40	1	Seasonal conditions (site dry).
W41	0	Site not established due to earthworks in area.
W42	35	Seasonal conditions (site frozen and / or unsafe).
W43	14	Seasonal conditions (site frozen and / or dry and / or unsafe).
W44	47	Site was established in February 2013; sampled as per schedule thereafter.
W45	8	Site conditions (unsafe and / or dry) .
W46	9	Seasonal conditions (site dry and / or frozen).

Site Name	2013 WQ sampling events*	Reason(s) for non-conformance events
W47	0	Area 118 pit undeveloped in 2013; therefore site not established.
W50	14	Site conditions (site dry).
MC-1	35	Seasonal conditions (site dry and / or frozen).
WC	5	Site conditions (site dry).
WTP	5	Site conditions (site dry).

*An external and internal water quality sampling event for the same site is tallied as a singular event.

5.1.2 W2 – Minto Creek at Lower Road Crossing Water Quality

Station W2 2007 to 2013 water quality result statistics are summarized in Table 5-3, and are compared to the WUL non-freshet water quality standard (Clause 73). 40 routine samples were collected from station W2 during the 2013 monitoring period. The W2 station copper, aluminum, cadmium and selenium concentrations, with corresponding non-freshet standards (WUL Clause 73) are displayed in Figure 5-2 and Figure 5-3.

Table 5-3: W2 water quality results summary (2007-2013)

W2	Water Quality Standard (WUL Clause 73)	2007 - 2012 Summary Statistics			2013 Summary Statistics		
Parameters		Mean	Min	Max	Mean	Min	Max
pH	6.0 - 9.0	8.09	7.03	8.46	8.14	7.17	8.37
TSS (mg/L)	-	56.4	0.5	2600.0	94.2	0.5	707.0
Nutrients (mg/L)							
Ammonia Nitrogen	0.35	0.0416	0.0005	**0.8300**	0.0516	0.0180	0.3500
Nitrate Nitrogen	2.9	2.18	0.00	**9.40**	0.31	0.01	1.55
Nitrite Nitrogen	0.06	0.0117	0.0005	**0.3600**	0.0083	0.0025	0.0383
Phosphorus (Total)	0.02	**0.15**	0.01	**1.65**	**0.13**	0.02	**0.75**
Total Metals (mg/L)							
Aluminum	0.62	**1.2932**	0.0050	**30.7000**	**2.1321**	0.0106	**16.2000**
Arsenic	0.005	0.00107	0.00010	**0.01510**	0.00171	0.00047	**0.00736**
Cadmium	0.00004	**0.000063**	0.000005	**0.000940**	0.000038	0.000005	**0.000223**
Chromium	0.002	**0.0028**	0.0002	**0.0582**	**0.0043**	0.0005	**0.0313**
Copper	0.013	0.00783	0.00050	**0.12500**	0.01031	0.00010	**0.03530**
Iron	1.1	**1.5830**	0.0005	**51.5000**	**3.8189**	0.1690	**23.6000**
Lead	0.004	0.00080	0.00005	**0.02900**	0.00095	0.00010	**0.00665**
Molybdenum	0.073	0.0035	0.0002	0.0170	0.0014	0.0005	0.0032
Nickel	0.11	0.0037	0.0005	0.0629	0.0054	0.0011	0.0326
Selenium	0.001	0.00080	0.00005	**0.00440**	0.00021	0.00005	0.00072
Zinc	0.03	0.0092	0.0005	**0.1360**	0.0092	0.0025	**0.0491**

Bold values indicate exceedances of the WUL water quality standards

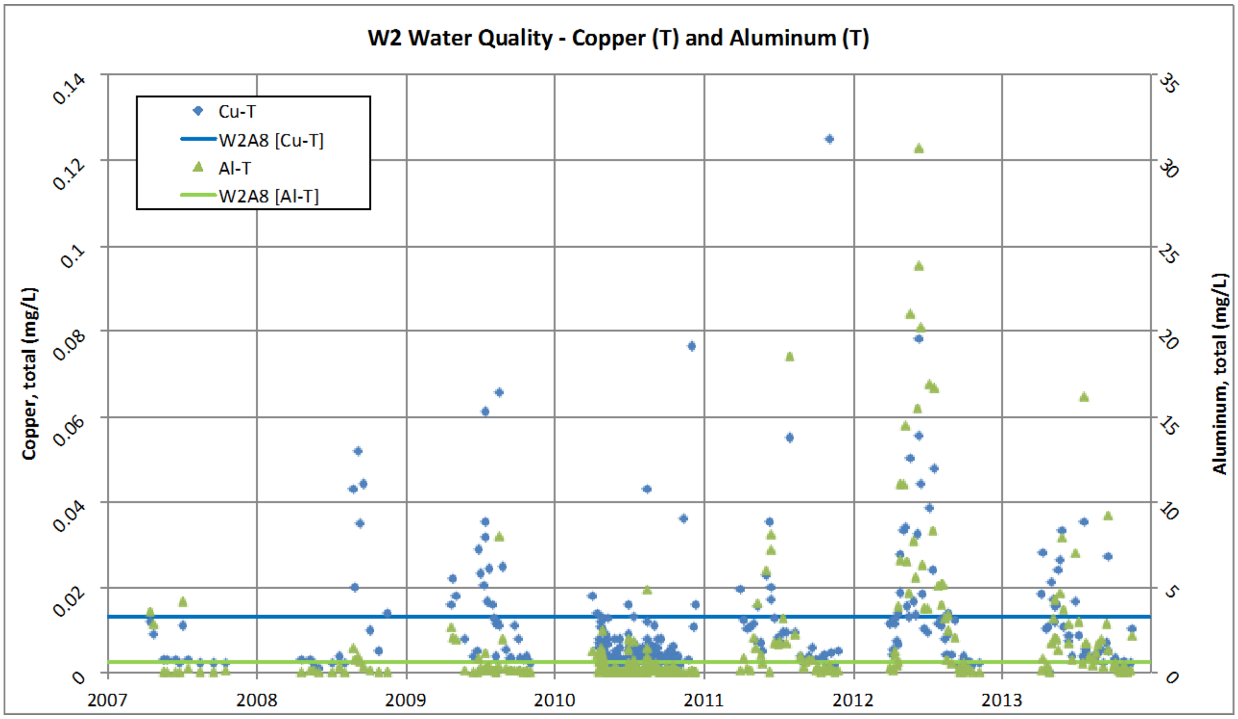


Figure 5-2: W2 copper and aluminum concentrations (2007 - 2013)

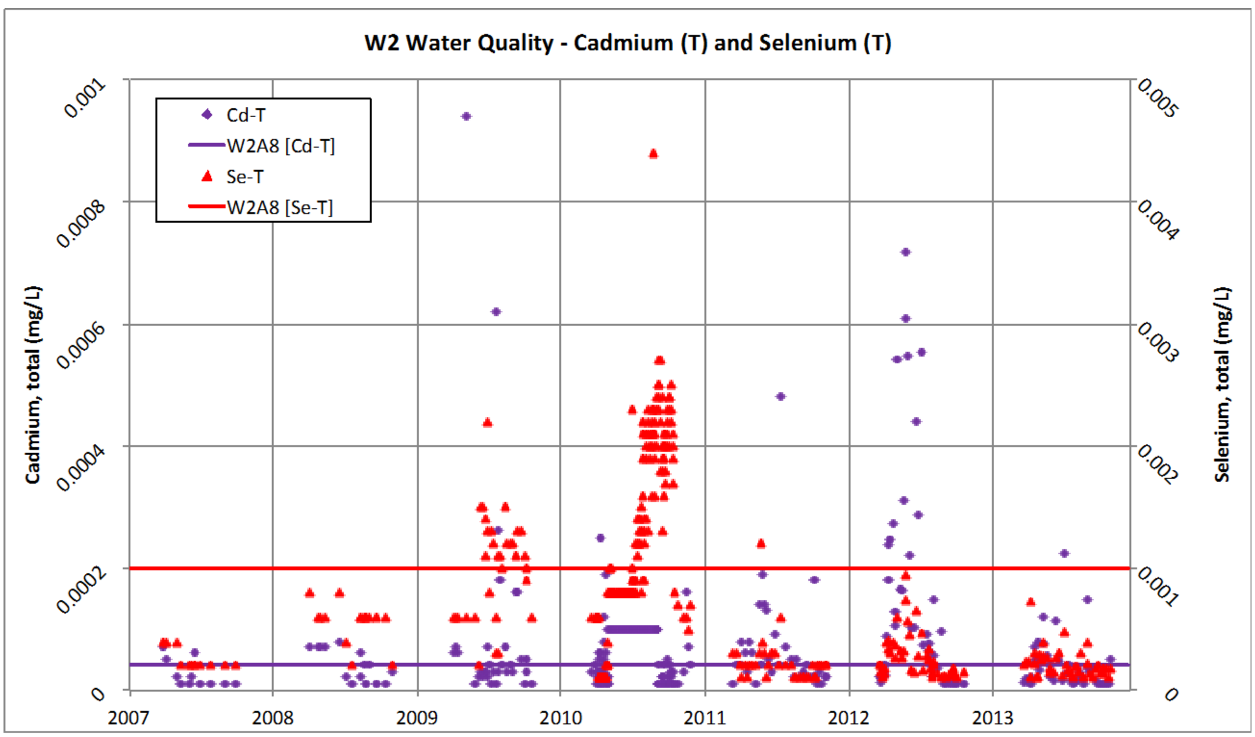


Figure 5-3: W2 cadmium and selenium concentrations (2007 - 2013)

5.1.3 W3 – Minto Creek, at the Federal Metal Mining Effluent Regulations (MMER) Compliance Point

Station W3 2007 to 2013 water quality result statistics are summarized in Table 5-4. 57 routine samples were collected from station W3 during the 2013 monitoring period. The station W3 2007-2013 copper, aluminum, cadmium and selenium concentrations are further displayed in Figure 5-4 and Figure 5-5 (note logarithmic scales).

Table 5-4: W3 water quality results summary (2007 – 2013)

W3	2007 - 2012 Summary Statistics			2013 Summary Statistics		
Parameters	Mean	Min	Max	Mean	Min	Max
pH	8.06	7.40	8.60	8.17	7.65	8.45
TSS (mg/L)	7.6	0.5	985.0	3.9	0.5	42.7
Nutrients (mg/L)						
Ammonia Nitrogen	0.0590	0.0005	0.6200	0.0437	0.0067	0.5400
Nitrate Nitrogen	3.91	0.01	18.70	0.73	0.10	10.80
Nitrite Nitrogen	0.0599	0.0005	4.1300	0.0069	0.0025	0.0487
Total Metals (mg/L)						
Aluminum	0.2399	0.0025	16.6000	0.1652	0.0055	2.2600
Arsenic	0.00042	0.00005	0.00616	0.00032	0.00010	0.00112
Cadmium	0.000772	0.000003	0.372000	0.000008	0.000005	0.000036
Chromium	0.0009	0.0001	0.0247	0.0006	0.0005	0.0026
Copper	0.01067	0.00050	0.25900	0.00908	0.00149	0.08220
Iron	0.2728	0.0005	26.8000	0.2523	0.0148	3.3200
Lead	0.00043	0.00000	0.09350	0.00015	0.00010	0.00087
Molybdenum	0.0062	0.0006	0.1020	0.0046	0.0015	0.0055
Nickel	0.0019	0.0003	0.1390	0.0010	0.0005	0.0032
Selenium	0.00119	0.00010	0.03240	0.00041	0.00015	0.00073
Zinc	0.0067	0.0004	0.1680	0.0031	0.0025	0.0104

Bold values indicate exceedances of the WUL water quality standards

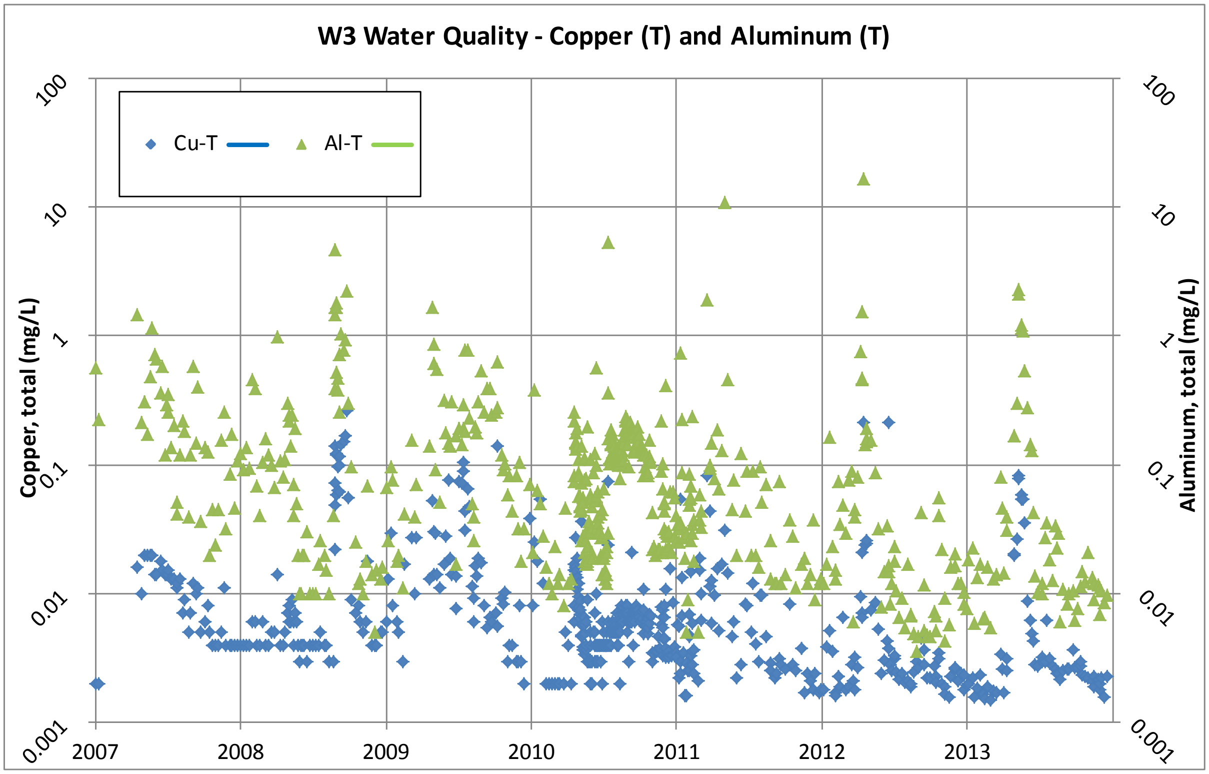


Figure 5-4: W3 copper and aluminum concentrations (2007 – 2013)

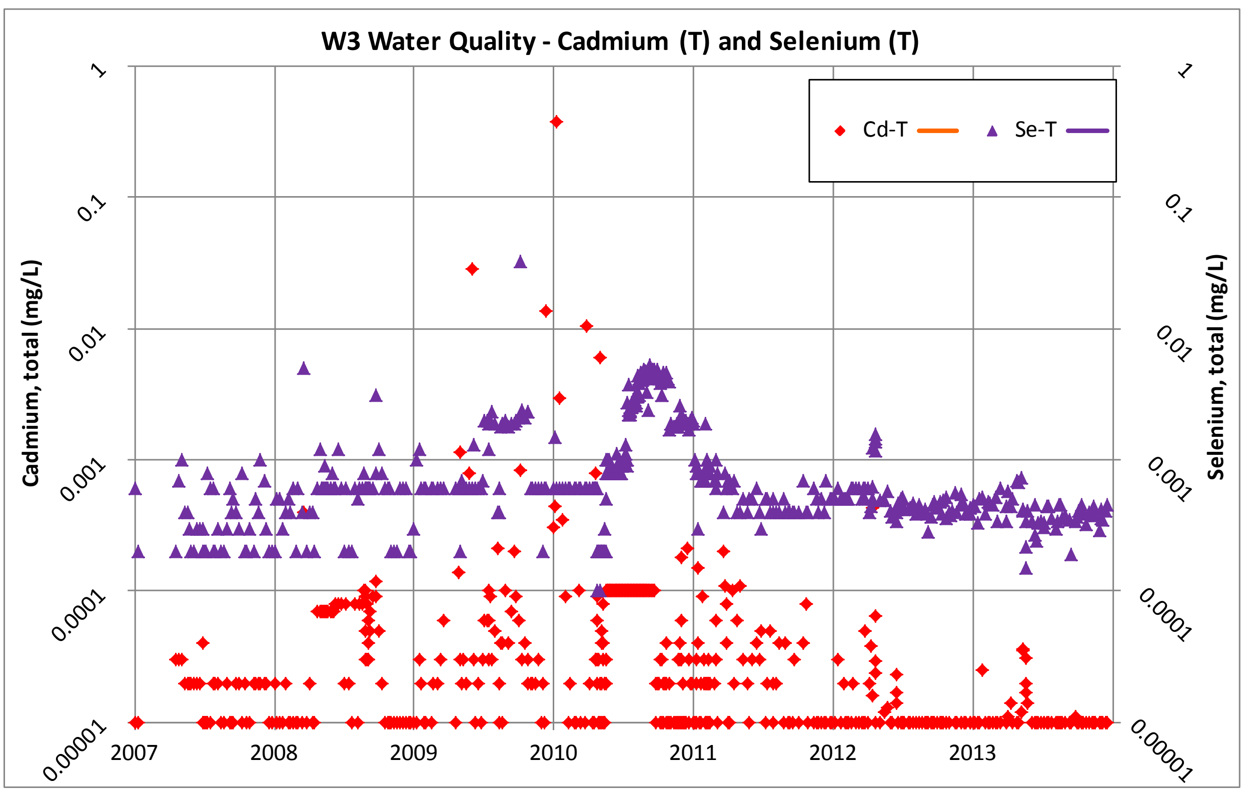


Figure 5-5: W3 cadmium and selenium concentrations (2007 – 2013)

5.1.4 W7 – North Flowing Tributary to Minto Creek

Station W7 2007 to 2013 water quality result statistics are summarized in Table 5-5. Nine routine samples were taken during the 2013 monitoring period.

Table 5-5: W7 water quality results summary (2007 – 2013)

W7	2007 - 2012 Summary Statistics			2013 Summary Statistics		
Parameters	**Mean**	**Min**	**Max**	**Mean**	**Min**	**Max**
pH	7.94	5.74	8.41	8.09	7.58	8.27
TSS (mg/L)	38.1	0.5	400.0	11.2	0.5	55.3
Nutrients (mg/L)						
Ammonia Nitrogen	0.0321	0.0025	0.3400	0.0357	0.0082	0.0660
Nitrate Nitrogen	0.10	0.01	0.32	0.15	0.01	0.26
Nitrite Nitrogen	0.0181	0.0025	0.1400	0.0025	0.0025	0.0025
Total Metals (mg/L)						
Aluminum	0.9205	0.0100	10.3000	0.2596	0.0098	1.3400
Arsenic	0.00083	0.00010	0.00600	0.00062	0.00019	0.00099
Cadmium	0.000050	0.000005	0.000910	0.000008	0.000005	0.000025
Chromium	0.0024	0.0003	0.0250	0.0008	0.0005	0.0027
Copper	0.00555	0.00100	0.02850	0.00230	0.00119	0.00840
Iron	1.5169	0.0430	15.6000	0.7524	0.0288	2.2000
Lead	0.00058	0.00005	0.00520	0.00014	0.00010	0.00046
Molybdenum	0.0011	0.0002	0.0020	0.0013	0.0005	0.0017
Nickel	0.0033	0.0003	0.0300	0.0015	0.0005	0.0029
Selenium	0.00027	0.00005	0.00090	0.00019	0.00011	0.00042
Zinc	0.0091	0.0020	0.1210	0.0028	0.0025	0.0059

5.1.5 W10 – Minto Creek Headwaters (South-West Fork)

Station W10 2007 to 2013 water quality result statistics are summarized in Table 5-6. Seven routine water quality samples were taken during the 2013 monitoring period.

Table 5-6: W10 water quality results summary (2007 – 2013)

W10	2007 - 2012 Summary Statistics			2013 Summary Statistics		
Parameters	Mean	Min	Max	Mean	Min	Max
pH	7.32	8.40	8.40	7.64	6.56	8.14
TSS (mg/L)	8.4	77.0	77.0	6.4	1.0	28.1
Nutrients (mg/L)						
Ammonia Nitrogen	0.0601	0.2700	0.2700	0.1761	0.0120	1.1000
Nitrate Nitrogen	0.03	0.30	0.30	0.04	0.01	0.10
Nitrite Nitrogen	0.0062	0.0250	0.0250	0.0089	0.0025	0.0250
Total Metals (mg/L)						
Aluminum	0.3296	4.5300	4.5300	0.1638	0.0216	0.3340
Arsenic	0.00052	0.00210	0.00210	0.00053	0.00021	0.00111
Cadmium	0.000053	0.000290	0.000290	0.000010	0.000005	0.000031
Chromium	0.0008	0.0030	0.0030	0.0005	0.0005	0.0005
Copper	0.06783	1.02000	1.02000	0.03483	0.00277	0.08330
Iron	1.2138	14.9000	14.9000	2.4616	0.3210	11.5000
Lead	0.00028	0.00440	0.00440	0.00010	0.00010	0.00010
Molybdenum	0.0004	0.0010	0.0010	0.0005	0.0005	0.0005
Nickel	0.0019	0.0170	0.0170	0.0017	0.0005	0.0041
Selenium	0.00025	0.00120	0.00120	0.00011	0.00005	0.00026
Zinc	0.0149	0.0930	0.0930	0.0049	0.0025	0.0159

5.1.6 W12A – Water in the Main Pit

Station W12A (previously station W12) 2007 to 2013 water quality result statistics are summarized in Table 5-7. 12 routine water quality samples were taken in the 2013 monitoring period. The 2007-2013 W12A copper, aluminum, cadmium and selenium concentrations are further displayed in Figures 5-5 and 5-6.

Table 5-7: W12A water quality results summary (2007 – 2013)

W12A	2007 - 2012 Summary Statistics			2013 Summary Statistics		
Parameters	**Mean**	**Min**	**Max**	**Mean**	**Min**	**Max**
pH	8.02	7.27	10.60	8.15	8.00	8.26
TSS (mg/L)	23.9	0.5	251.0	10.0	5.2	20.8
Nutrients (mg/L)						
Ammonia Nitrogen	2.5851	0.0025	24.0000	1.3157	0.3800	4.5000
Nitrate Nitrogen	23.97	0.01	141.00	17.01	10.60	32.20
Nitrite Nitrogen	0.6590	0.0070	8.7800	0.3257	0.0397	0.9410
Total Metals (mg/L)						
Aluminum	1.2014	0.0160	13.8000	0.3138	0.0867	0.5720
Arsenic	0.00144	0.00010	0.01960	0.00069	0.00032	0.00204
Cadmium	0.000198	0.000020	0.001350	0.000025	0.000011	0.000071
Chromium	0.0013	0.0002	0.0076	0.0005	0.0005	0.0005
Copper	0.41671	0.01000	6.21000	0.04584	0.01740	0.11000
Iron	1.9473	0.0240	23.3000	0.4713	0.1590	0.9820
Lead	0.00097	0.00005	0.00560	0.00013	0.00010	0.00029
Molybdenum	0.0245	0.0030	0.0598	0.0439	0.0291	0.0528
Nickel	0.0034	0.0003	0.0510	0.0022	0.0015	0.0035
Selenium	0.00569	0.00090	0.01850	0.00384	0.00064	0.00597
Zinc	0.0164	0.0025	0.1700	0.0027	0.0025	0.0052

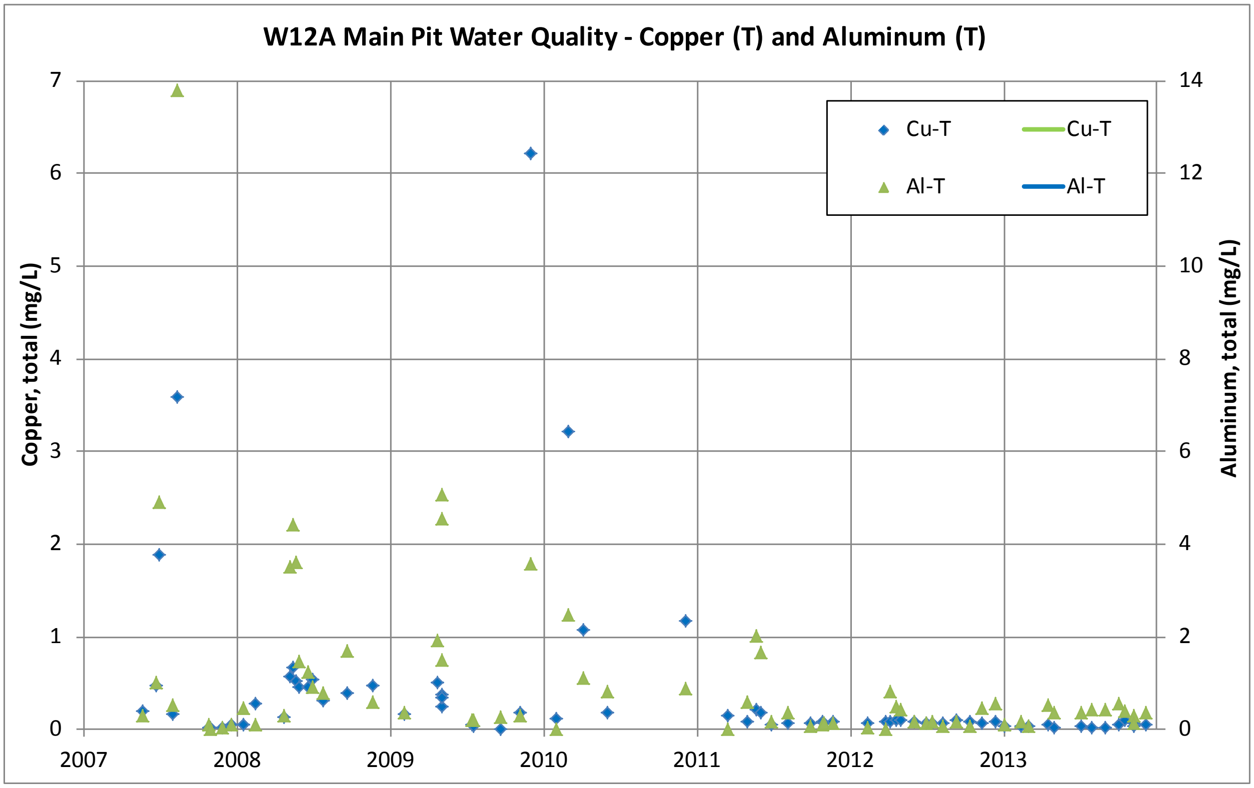


Figure 5-6: W12A copper and aluminum concentrations (2007 – 2013)

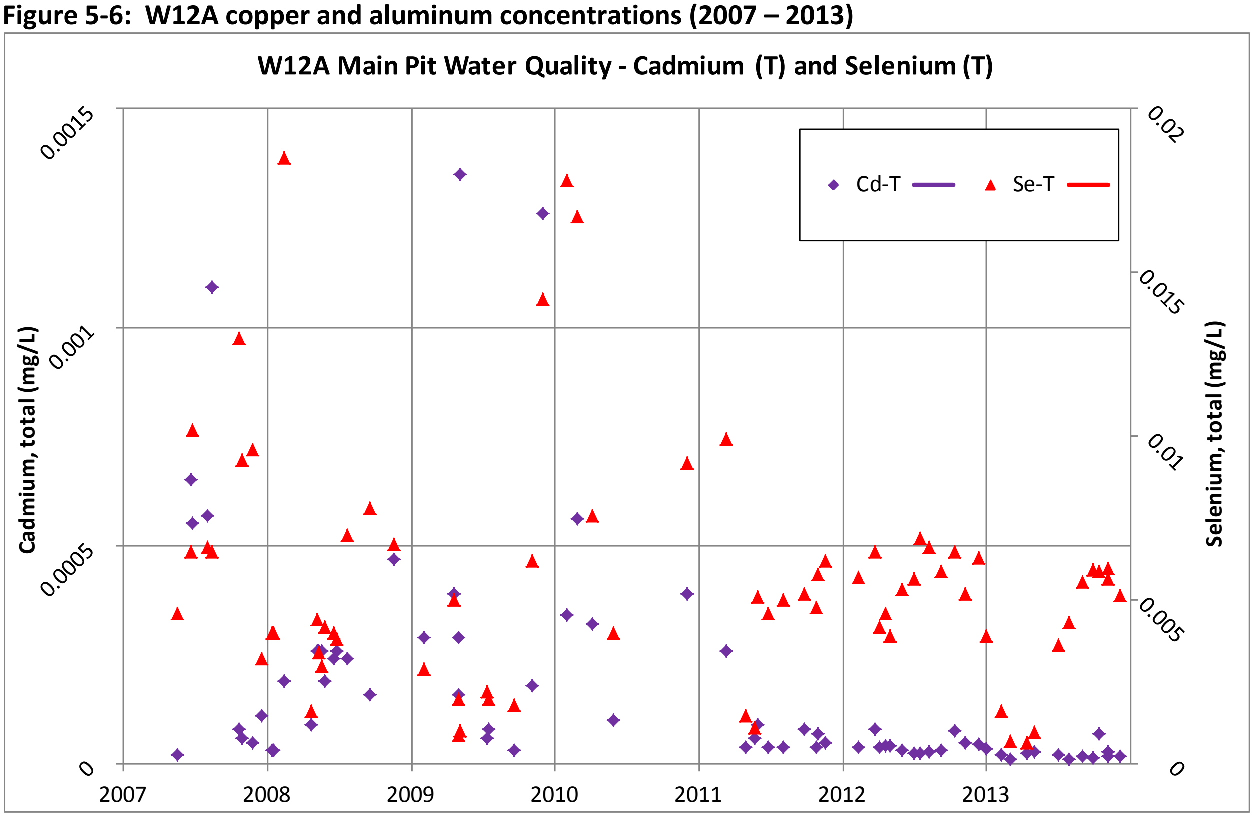


Figure 5-7: W12A cadmium and selenium concentrations (2007 – 2013)

5.1.7 W13 – Mill Water Pond

Station W13 2007 to 2013 water quality result statistics are summarized in Table 5-8. Nine routine water quality samples were taken in 2013.

Table 5-8: W13 water quality results summary (2007 – 2013)

W13	2007 - 2012 Summary Statistics			2013 Summary Statistics		
Parameters	Mean	Min	Max	Mean	Min	Max
pH	7.84	6.97	8.50	8.17	7.97	8.31
TSS (mg/L)	103.9	1.0	5890.0	108.7	9.3	753.0
Nutrients (mg/L)						
Ammonia Nitrogen	2.3092	0.0250	7.8100	0.9000	0.4300	1.6000
Nitrate Nitrogen	26.73	0.01	86.70	15.74	11.60	21.10
Nitrite Nitrogen	1.2852	0.0050	24.0000	0.3406	0.2410	0.4580
Total Metals (mg/L)						
Aluminum	2.9063	0.0050	111.0000	0.9443	0.4170	2.1400
Arsenic	0.00112	0.00010	0.00500	0.00052	0.00037	0.00072
Cadmium	0.000519	0.000035	0.014800	0.000087	0.000014	0.000323
Chromium	0.0019	0.0002	0.0264	0.0007	0.0005	0.0026
Copper	0.30195	0.01500	5.00000	0.41706	0.02180	2.04000
Iron	2.7380	0.0050	94.0000	1.2033	0.2040	5.9300
Lead	0.00113	0.00005	0.02400	0.00061	0.00010	0.00255
Molybdenum	0.0643	0.0027	0.1410	0.0547	0.0413	0.0674
Nickel	0.0035	0.0005	0.0240	0.0017	0.0005	0.0034
Selenium	0.02589	0.00020	0.19200	0.00594	0.00147	0.01090
Zinc	0.0577	0.0025	0.5880	0.0075	0.0025	0.0290

5.1.8 W13A – Discharge from Mill Water Storage Pond

In 2013, Minto Mine made a substantial effort to limit/eliminate the overflow of the Mill Pond. Minto Mine did not record any Mill Pond overflow events in 2013 and therefore, no samples were collected for water quality site W13A. Station W13 2008 to 2011 water quality result statistics are summarized in Table 5-9.

Table 5-9: W13A water quality results summary (2008 – 2011)

W13A	2008 - 2011 Summary Statistics		
Parameters	**Mean**	**Min**	**Max**
pH	7.84	7.47	8.29
TSS (mg/L)	44.4	3.0	240.0
Nutrients (mg/L)			
Ammonia Nitrogen	2.0450	0.0600	7.5000
Nitrate Nitrogen	34.01	0.68	77.00
Nitrite Nitrogen	0.6895	0.0400	1.5100
Total Metals (mg/L)			
Aluminum	1.1182	0.1940	4.1600
Arsenic	0.00086	0.00010	0.00190
Cadmium	0.000133	0.000050	0.000540
Chromium	0.0010	0.0002	0.0030
Copper	0.18974	0.02000	0.89100
Iron	1.3340	0.1740	6.7900
Lead	0.00053	0.00005	0.00220
Molybdenum	0.0691	0.0014	0.1060
Nickel	0.0033	0.0005	0.0350
Selenium	0.01755	0.00030	0.06230
Zinc	0.0273	0.0025	0.2620

5.1.9 W14 – Tailings Thickener Overflow

Station W14 2007 to 2013 water quality result statistics are summarized in Table 5-10. 12 routine water quality samples were taken during the 2013 monitoring period. In the 2012 Annual Report, W14 was presented with results for Total Metals; however sampling for Total Metals is not required as per Appendix 3 of the WUL, therefore, Table 5-10 summarizes the W14 water quality results with Dissolved Metals.

Table 5-10: W14 water quality results summary (2007 – 2013)

W14	2007 - 2012 Summary Statistics			2013 Summary Statistics		
Parameters	Mean	Min	Max	Mean	Min	Max
pH	7.82	7.29	8.27	8.18	7.98	8.38
TDS (mg/L)	786.0	374.0	4680.0	505.7	458.0	572.0
Dissolved Metals (mg/L)						
Aluminum	0.1577	0.0381	1.9100	0.0912	0.0404	0.1680
Arsenic	0.00076	0.00010	0.00520	0.00040	0.00029	0.00047
Cadmium	0.000065	0.000005	0.000300	0.000014	0.000005	0.000032
Chromium	0.0006	0.0002	0.0036	0.0005	0.0005	0.0005
Copper	0.02238	0.00100	0.72300	0.00254	0.00028	0.00963
Iron	0.1475	0.0025	4.8000	0.0085	0.0025	0.0243
Lead	0.00017	0.00005	0.00110	0.00010	0.00010	0.00010
Molybdenum	0.0955	0.0635	0.1660	0.0729	0.0458	0.1380
Nickel	0.0011	0.0003	0.0082	0.0010	0.0005	0.0014
Selenium	0.04623	0.00700	0.22900	0.01006	0.00166	0.02910
Zinc	0.0042	0.0010	0.0280	0.0028	0.0025	0.0059

5.1.10 W15 – Upper Minto Creek Stormwater Collection Point

Station W15 2007 to 2013 water quality result statistics are summarized in Table 5-11. 33 routine water quality samples were taken during the 2013 monitoring period. The 2007-2013 copper, aluminum, cadmium and selenium concentrations are further displayed in Figure 5-8 and Figure 5-9.

Table 5-11: W15 water quality results summary (2010 – 2013)

W15	2007 - 2012 Summary Statistics			2013 Summary Statistics		
Parameters	Mean	Min	Max	Mean	Min	Max
pH	7.81	6.39	8.40	8.10	7.44	8.42
TSS (mg/L)	17.1	0.5	370.0	21.1	1.7	182.0
Nutrients (mg/L)						
Ammonial Nitrogen	0.0915	0.0025	0.7010	0.1278	0.0240	1.2000
Nitrate Nitrogen	7.46	0.01	56.10	12.28	1.01	36.00
Nitrite Nitrogen	0.0954	0.0025	0.4020	0.0481	0.0135	0.2190
Total Metals (mg/L)						
Aluminum	0.4861	0.0060	9.4200	0.9304	0.0161	14.7000
Arsenic	0.00072	0.00020	0.00250	0.00089	0.00027	0.00614
Cadmium	0.000050	0.000005	0.000380	0.000024	0.000005	0.000153
Chromium	0.0009	0.0003	0.0123	0.0014	0.0005	0.0226
Copper	0.04512	0.00200	0.46900	0.05199	0.01200	0.49300
Iron	1.3123	0.1000	10.7000	1.9715	0.2580	24.5000
Lead	0.00032	0.00005	0.00450	0.00042	0.00010	0.00610
Molybdenum	0.0021	0.0002	0.0080	0.0031	0.0010	0.0053
Nickel	0.0019	0.0003	0.0090	0.0020	0.0005	0.0187
Selenium	0.00132	0.00010	0.01130	0.00297	0.00013	0.00731
Zinc	0.0072	0.0020	0.0500	0.0060	0.0025	0.0630

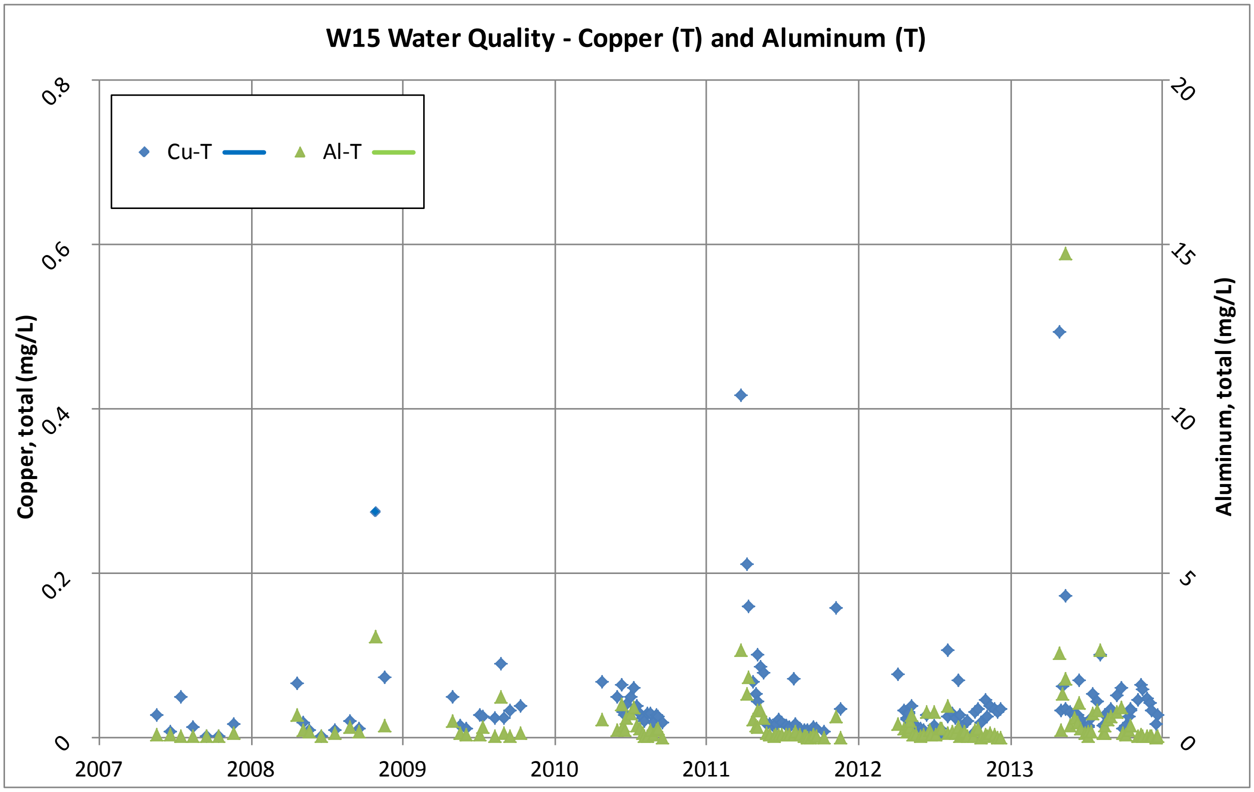


Figure 5-8: W15 copper and aluminum concentrations (2007 – 2013)

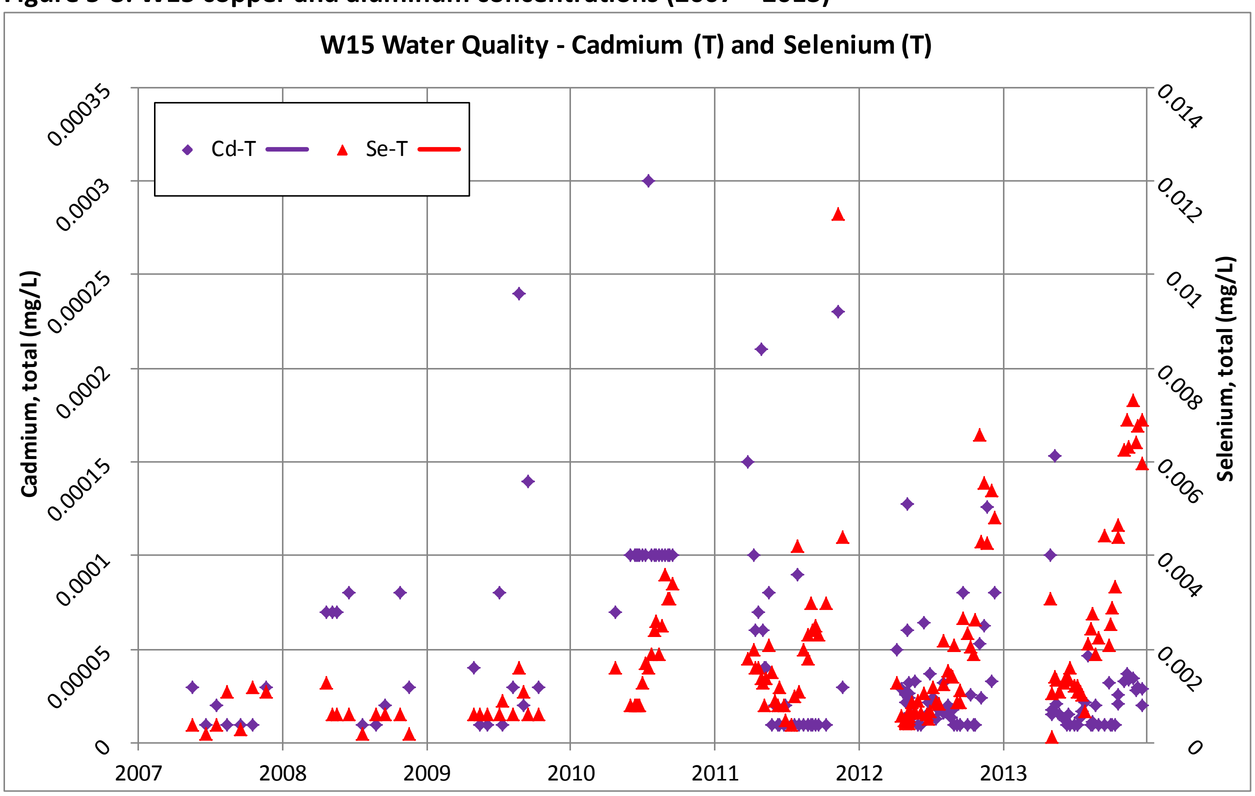


Figure 5-9: W15 cadmium and selenium concentrations (2007 – 2013)

5.1.11 W16 – Water Storage Pond

Station W16 2007 to 2013 water quality result statistics are summarized in Table 5-12 and are compared to the standards outlined in the WUL (Clause 70). 47 routine water quality samples were taken during the 2013 monitoring period. The 2007-2013 copper, aluminum, cadmium and selenium concentrations with non-freshet standards (WUL Clause 70) are further displayed in Figure 5-10 and Figure 5-11. On Figure 5-11, an outlier cadmium concentration (0.0026 mg/L) from the May 5, 2009 sample is not shown.

Table 5-12: W16 water quality results summary (2007 – 2013)

W16	Water Quality Standard (WUL Clause 70)	2007 - 2012 Summary Statistics			2013 Summary Statistics		
Parameters		Mean	Min	Max	Mean	Min	Max
pH	6.5 - 9.0	7.90	6.74	8.76	8.11	7.46	8.44
TSS (mg/L)	15	8.1	0.5	**181.0**	5.8	0.5	**24.0**
Nutrients (mg/L)							
Ammonia Nitrogen	0.89	0.1998	0.0025	**2.0000**	0.0501	0.0110	0.3300
Nitrate Nitrogen	7.65	4.44	0.01	**35.00**	2.08	0.01	5.58
Nitrite Nitrogen	0.15	0.1598	0.0012	**8.6200**	0.0151	0.0025	0.0697
Total Metals (mg/L)							
Aluminum	2.7	0.3522	0.0050	**6.0600**	0.1655	0.0100	1.5400
Arsenic	-	0.00054	0.00010	0.00500	0.00047	0.00028	0.00081
Cadmium	0.00015	0.000051	0.000005	**0.002600**	0.000013	0.000005	0.000049
Chromium	0.008	0.0008	0.0001	0.0066	0.0005	0.0005	0.0013
Copper	0.05	0.04830	0.00300	**0.46800**	0.03261	0.01740	**0.13800**
Iron	3.5	0.6041	0.0220	**8.2000**	0.3304	0.0496	2.7800
Lead	0.02	0.00026	0.00005	0.00250	0.00012	0.00010	0.00081
Molybdenum	0.4	0.0076	0.0005	0.0330	0.0047	0.0011	0.0072
Nickel	0.5	0.0021	0.0003	0.0250	0.0012	0.0005	0.0032
Selenium	0.003	0.00150	0.00010	**0.00670**	0.00067	0.00026	0.00106
Zinc	0.15	0.0097	0.0005	0.1040	0.0035	0.0025	0.0160

Bold values indicate exceedances of the WUL water quality standards

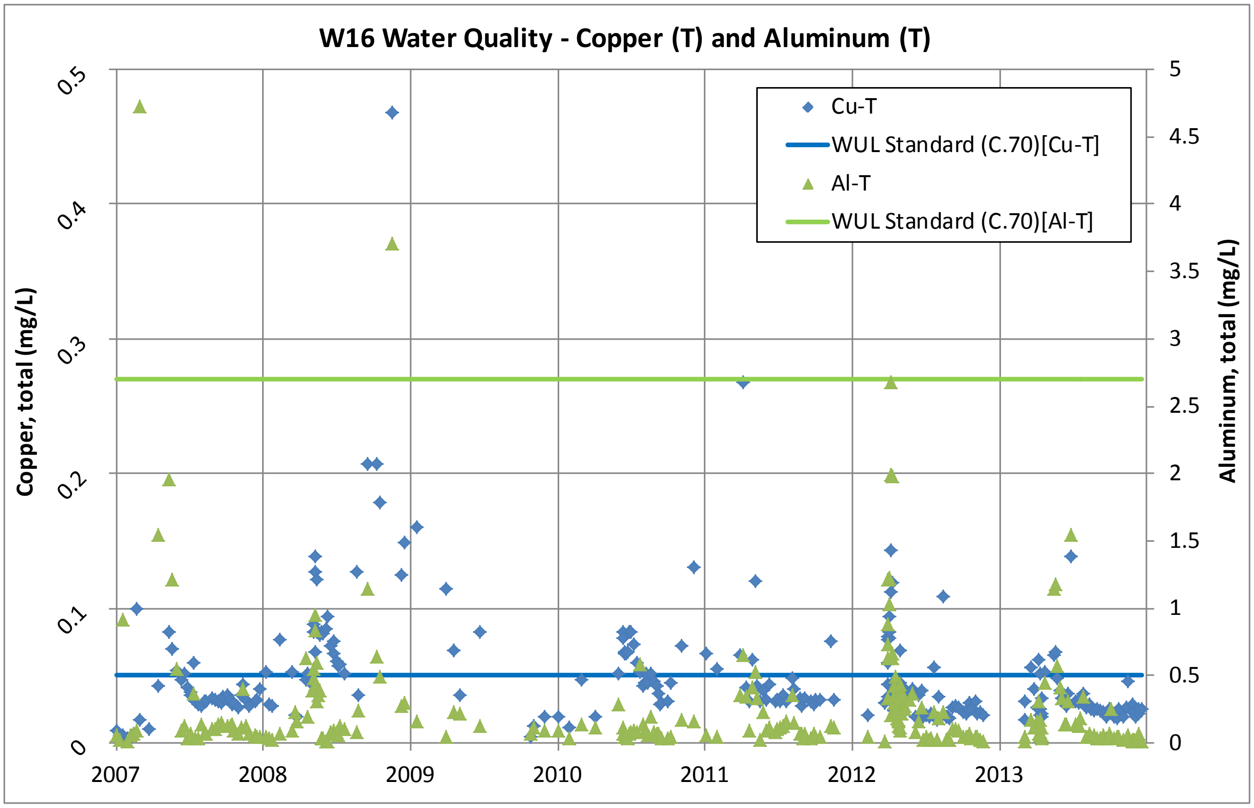


Figure 5-10: W16 copper and aluminum concentrations (2007 – 2013)

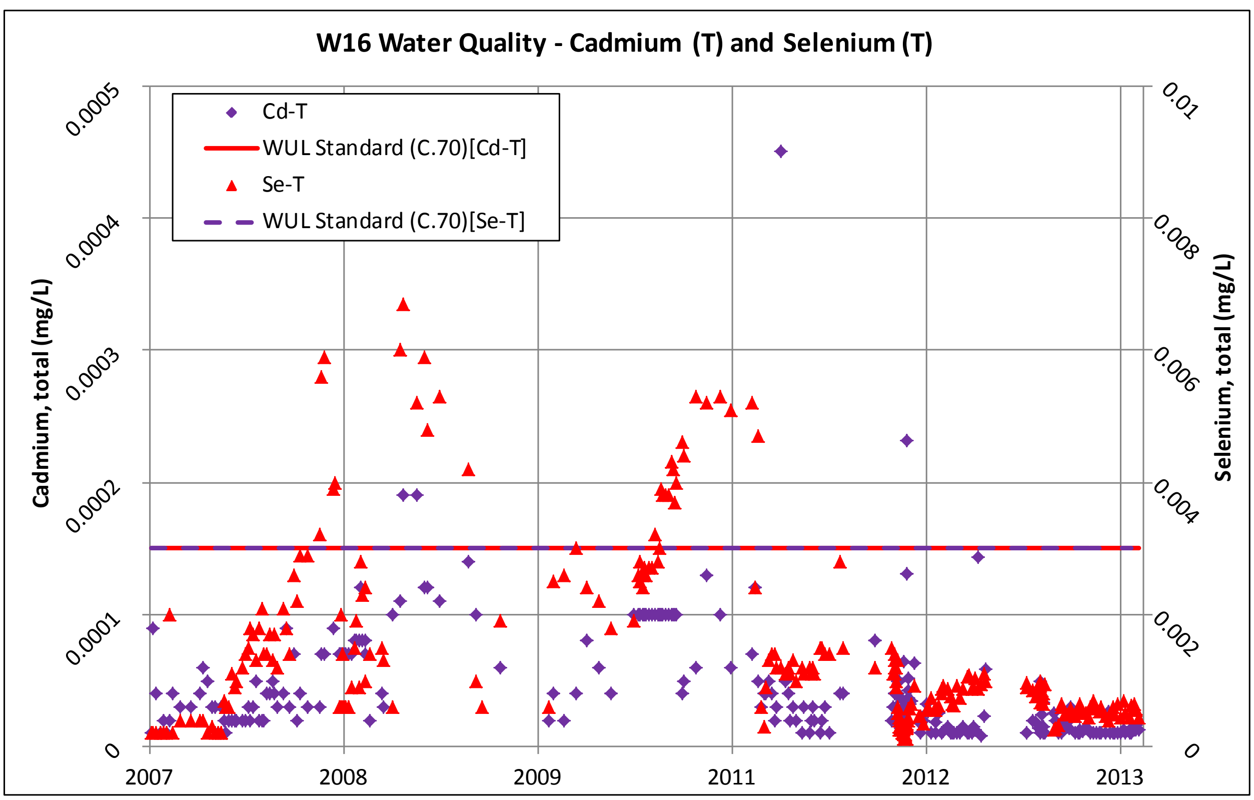


Figure 5-11: W16 cadmium and selenium concentrations (2007 – 2013)

5.1.12 W30 – Headwaters Minto Creek (northwest fork)

Station W30 2009 to 2013 water quality result statistics are summarized in Table 5-13. Eight routine water quality samples were taken during the 2013 monitoring period.

Table 5-13: W30 water quality results summary (2009 – 2013)

W30	2009 - 2012 Summary Statistics			2013 Summary Statistics		
Parameters	Mean	Min	Max	Mean	Min	Max
pH	7.49	6.15	8.23	8.14	7.99	8.32
TSS (mg/L)	25.7	0.5	1110.0	10.2	1.2	34.3
Nutrients (mg/L)						
Ammonia Nitrogen	0.1056	0.0025	0.5600	0.1315	0.0470	0.3100
Nitrate Nitrogen	0.75	0.01	6.58	19.02	2.39	78.60
Nitrite Nitrogen	0.0167	0.0025	0.0999	0.1381	0.0187	0.5790
Total Metals (mg/L)						
Aluminum	2.6862	0.0175	86.0000	0.3416	0.0429	1.1400
Arsenic	0.01854	0.00020	0.60000	0.00069	0.00046	0.00100
Cadmium	0.001258	0.000005	0.040000	0.000030	0.000005	0.000090
Chromium	0.0170	0.0004	0.5000	0.0005	0.0005	0.0005
Copper	0.82160	0.01770	22.70000	0.06035	0.02090	0.17800
Iron	6.9853	0.0797	219.0000	0.5859	0.1300	1.8500
Lead	0.00376	0.00005	0.10000	0.00019	0.00010	0.00057
Molybdenum	0.0170	0.0002	0.5000	0.0060	0.0030	0.0100
Nickel	0.0260	0.0005	1.0000	0.0011	0.0005	0.0023
Selenium	0.01711	0.00030	0.50000	0.00659	0.00223	0.01490
Zinc	0.1478	0.0020	6.0000	0.0034	0.0025	0.0093

5.1.13 W33 – Above Tailings Diversion Ditches

Station W33 2009 to 2013 water quality result statistics are summarized in Table 5-14. Six routine water quality samples were taken during the 2013 monitoring period.

Table 5-14: W33 water quality results summary (2009 – 2013)

W33	2009 - 2012 Summary Statistics			2013 Summary Statistics		
Parameters	Mean	Min	Max	Mean	Min	Max
pH	7.61	6.51	8.25	7.88	7.74	8.05
TSS (mg/L)	11.0	0.5	218.0	6.5	0.5	11.8
Nutrients (mg/L)						
Ammonia Nitrogen	0.0636	0.0025	0.3300	0.0290	0.0160	0.0450
Nitrate Nitrogen	0.03	0.01	0.11	1.35	0.01	4.78
Nitrite Nitrogen	0.0048	0.0025	0.0250	0.0067	0.0025	0.0250
Total Metals (mg/L)						
Aluminum	0.2296	0.0250	3.9400	0.3374	0.0492	1.3200
Arsenic	0.00038	0.00020	0.00253	0.00048	0.00035	0.00083
Cadmium	0.000074	0.000005	0.000950	0.000008	0.000005	0.000021
Chromium	0.0009	0.0005	0.0065	0.0008	0.0005	0.0024
Copper	0.02294	0.00450	0.12500	0.01913	0.01140	0.04100
Iron	0.4312	0.1080	6.5400	0.7208	0.3100	2.1100
Lead	0.00019	0.00010	0.00173	0.00017	0.00010	0.00054
Molybdenum	0.0006	0.0003	0.0016	0.0005	0.0005	0.0005
Nickel	0.0020	0.0005	0.0066	0.0021	0.0017	0.0032
Selenium	0.00025	0.00005	0.00150	0.00015	0.00010	0.00021
Zinc	0.0055	0.0025	0.0200	0.0032	0.0025	0.0067

5.1.14 W35A and W35B– Storm Water Collection Point – South Diversion Ditch

Stations W35A and W35B are sampled from the same location, internally called W35, and the 2013 water quality result statistics are summarized in Table 5-15. Nine routine water quality samples were taken during the 2013 monitoring period.

Table 5-15: W35 water quality results summary (2013)

W35	2013 Summary Statistics		
Parameters	**Mean**	**Min**	**Max**
pH	7.94	7.39	8.13
TSS (mg/L)	25.8	0.5	222.0
Nutrients (mg/L)			
Ammonia Nitrogen	0.0469	0.0160	0.1300
Nitrate Nitrogen	1.41	0.21	2.64
Nitrite Nitrogen	0.0696	0.0025	0.3350
Total Metals (mg/L)			
Aluminum	1.1490	0.0292	10.3000
Arsenic	0.00061	0.00033	0.00210
Cadmium	0.000020	0.000005	0.000145
Chromium	0.0009	0.0005	0.0047
Copper	0.10765	0.02250	0.70100
Iron	1.9945	0.1450	16.6000
Lead	0.000453	0.0001	0.00363
Molybdenum	0.0016	0.0005	0.0048
Nickel	0.0017	0.0005	0.0037
Selenium	0.00029	0.00011	0.00074
Zinc	0.0081	0.0025	0.0556

5.1.15 W36 – Minto Creek Detention Structure Pond

Station W36 2009 to 2010 and 2012 to 2013 water quality result statistics are summarized in Table 5-16. 10 routine water quality samples were taken during the 2013 monitoring period.

Table 5-16: W36 water quality results summary (2009-2010, 2012-2013)

W36	2009 - 2010, 2012 Summary Statistics			2013 Summary Statistics		
Parameters	Mean	Min	Max	Mean	Min	Max
pH	7.74	6.82	8.29	8.23	8.05	8.41
TSS (mg/L)	51.5	2.7	399.0	14.2	2.0	40.9
Nutrients (mg/L)						
Ammonia Nitrogen	0.0532	0.0056	0.1500	0.0575	0.0250	0.0950
Nitrate Nitrogen	3.46	0.01	7.00	10.16	3.85	17.00
Nitrite Nitrogen	0.0709	0.0300	0.1730	0.1595	0.0245	0.2730
Total Metals (mg/L)						
Aluminum	2.4277	0.0335	21.7000	0.3506	0.0638	1.5700
Arsenic	0.00119	0.00047	0.00300	0.00060	0.00047	0.00076
Cadmium	0.000171	0.000005	0.002120	0.000055	0.000034	0.000067
Chromium	0.0023	0.0005	0.0110	0.0005	0.0005	0.0005
Copper	0.09069	0.03000	0.48000	0.08759	0.05460	0.17500
Iron	2.7557	0.3180	24.4000	0.7244	0.2860	2.1700
Lead	0.00118	0.00010	0.01000	0.00021	0.00010	0.00080
Molybdenum	0.0072	0.0002	0.0140	0.0094	0.0063	0.0167
Nickel	0.0030	0.0010	0.0080	0.0015	0.0012	0.0020
Selenium	0.00068	0.00030	0.00252	0.00513	0.00142	0.00946
Zinc	0.0147	0.0025	0.1000	0.0159	0.0025	0.0626

5.1.16 W42 – Storm Water Collection Sump – North side of Mine Access Road 0.5 km

Station W42 2009 to 2013 water quality result statistics are summarized in Table 5-17. 35 routine water quality samples were taken during the 2013 monitoring period.

Table 5-17: W42 water quality results summary (2009 – 2013)

W42	2009 - 2012 Summary Statistics			2013 Summary Statistics		
Parameters	**Mean**	**Min**	**Max**	**Mean**	**Min**	**Max**
pH	7.93	7.41	8.30	7.99	7.58	8.19
TSS (mg/L)	20.9	0.5	257.0	10.4	0.5	72.0
Nutrients (mg/L)						
Ammonia Nitrogen	0.0411	0.0025	0.2600	0.0419	0.0059	0.2100
Nitrate Nitrogen	0.13	0.01	0.79	0.21	0.02	0.85
Nitrite Nitrogen	0.0085	0.0025	0.0820	0.0154	0.0025	0.0890
Total Metals (mg/L)						
Aluminum	1.0079	0.0102	11.5000	0.5582	0.0351	3.6300
Arsenic	0.00049	0.00011	0.00280	0.00041	0.00015	0.00101
Cadmium	0.000057	0.000005	0.000720	0.000023	0.000005	0.000076
Chromium	0.0010	0.0003	0.0074	0.0008	0.0005	0.0051
Copper	0.07657	0.00790	0.57500	0.04549	0.00658	0.20000
Iron	1.5598	0.0294	16.0000	0.7845	0.0754	4.2200
Lead	0.00044	0.00005	0.00388	0.00022	0.00010	0.00106
Molybdenum	0.0023	0.0005	0.0040	0.0028	0.0005	0.0071
Nickel	0.0017	0.0005	0.0070	0.0012	0.0005	0.0029
Selenium	0.00017	0.00005	0.00150	0.00014	0.00005	0.00066
Zinc	0.0083	0.0025	0.0584	0.0044	0.0025	0.0167

5.1.17 W43 – Storm Water Collection Sump – North side of Mine Access Road at Water Storage Pond

Station W43 2011 to 2013 water quality statistics are summarized in Table 5-18. 14 routine water quality samples were taken during the 2013 monitoring period.

Table 5-18: W43 water quality results summary (2011 – 2013)

W43	2011 - 2012 Summary Statistics			2013 Summary Statistics		
Parameters	Mean	Min	Max	Mean	Min	Max
pH	7.80	7.50	8.17	7.79	7.47	8.04
TSS (mg/L)	301.7	0.5	1790.0	18.8	0.5	126.0
Nutrients (mg/L)						
Ammonia Nitrogen	0.0325	0.0025	0.1100	0.0370	0.0063	0.1900
Nitrate Nitrogen	0.61	0.18	1.26	0.35	0.03	0.61
Nitrite Nitrogen	0.0136	0.0025	0.0750	0.0108	0.0025	0.0377
Total Metals (mg/L)						
Aluminum	12.7640	0.0121	90.8000	1.6258	0.0394	10.1000
Arsenic	0.00215	0.00005	0.01230	0.00044	0.00005	0.00190
Cadmium	0.000223	0.000005	0.001260	0.000030	0.000005	0.000113
Chromium	0.0075	0.0005	0.0460	0.0012	0.0005	0.0062
Copper	0.94030	0.00867	5.95000	0.09709	0.01110	0.72400
Iron	23.6066	0.0190	172.0000	2.3352	0.0602	18.0000
Lead	0.00498	0.0001	0.0303	0.0005429	0.0001	0.00339
Molybdenum	0.0020	0.0005	0.0050	0.0011	0.0005	0.0032
Nickel	0.0060	0.0005	0.0340	0.0012	0.0005	0.0053
Selenium	0.00093	0.00005	0.00500	0.00027	0.00005	0.00059
Zinc	0.1188	0.0025	0.6000	0.0140	0.0025	0.0700

5.1.18 W44 – Area 2 Underground Mine Inflows

Station W44 2013 water quality result statistics are summarized in Table 5-19. 47 routine water quality samples were taken during the 2013 monitoring period.

Table 5-19: W44 water quality results summary (2013)

W44	2013 Summary Statistics		
Parameters	**Mean**	**Min**	**Max**
pH	7.95	7.30	8.28
TSS (mg/L)	884.6	26.5	10500.0
Nutrients (mg/L)			
Ammonia Nitrogen	58.2625	2.3000	230.0000
Nitrate Nitrogen	123.98	0.59	484.00
Nitrite Nitrogen	4.377625	0.776	12.5
Total Metals (mg/L)			
Aluminum	16.2306	0.2590	165.0000
Arsenic	0.00332	0.00060	0.02190
Cadmium	0.000619	0.000005	0.016200
Chromium	0.0071	0.0005	0.0636
Copper	2.81483	0.01880	86.50000
Iron	37.2523	0.6730	486.0000
Lead	0.02192	0.00085	0.21100
Molybdenum	0.0326	0.0084	0.0498
Nickel	0.0097	0.0014	0.0575
Selenium	0.00491	0.00010	0.03550
Zinc	0.2549	0.0092	2.6600

5.1.19 W45 – Area 2 Pit

Station W45 2012 and 2013 water quality result statistics are summarized in Table 5-20. Eight routine water quality samples were taken during the 2013 monitoring period.

Table 5-20: W45 water quality results summary (2012-2013)

W45	2012 Summary Statistics			2013 Summary Statistics		
Parameters	**Mean**	**Min**	**Max**	**Mean**	**Min**	**Max**
pH	8.07	7.94	8.18	8.04	7.94	8.15
TSS (mg/L)	76.2	2.0	291.0	24.4	1.1	76.2
Nutrients (mg/L)						
Ammonia Nitrogen	6.5750	3.7000	9.6000	13.0544	2.4900	37.0000
Nitrate Nitrogen	41.08	26.40	55.90	33.51	7.01	77.20
Nitrite Nitrogen	1.148	0.621	2.27	1.845	0.965	2.53
Total Metals (mg/L)						
Aluminum	0.5270	0.0190	1.8600	0.6998	0.0390	2.2500
Arsenic	0.00174	0.00119	0.00233	0.00164	0.00128	0.00266
Cadmium	0.000014	0.000005	0.000032	0.000211	0.000005	0.000579
Chromium	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
Copper	0.09340	0.04850	0.14500	0.34172	0.02250	1.24000
Iron	0.8020	0.0700	2.6900	1.6443	0.1570	5.7000
Lead	0.00038	0.00010	0.00075	0.00045	0.00010	0.00150
Molybdenum	0.0291	0.0127	0.0437	0.0265	0.0189	0.0403
Nickel	0.0010	0.0005	0.0021	0.0010	0.0005	0.0018
Selenium	0.01066	0.00332	0.02980	0.00359	0.00117	0.00530
Zinc	0.0049	0.0025	0.0120	0.0160	0.0025	0.0425

5.1.20 W46 – Minto Creek, Downstream of W7 and W6

Station W46 2012 and 2013 water quality result statistics are summarized in Table 5-21. Nine routine water quality samples were taken during the 2013 monitoring period.

Table 5-21: W46 water quality results summary (2012-2013)

W46	2012 Summary Statistics			2013 Summary Statistics		
Parameters	Mean	Min	Max	Mean	Min	Max
pH	8.13	7.97	8.29	8.10	7.61	8.33
TSS (mg/L)	32.7	6.9	69.5	22.1	0.5	76.3
Nutrients (mg/L)						
Ammonia Nitrogen	0.0187	0.0099	0.0270	0.0470	0.0180	0.1600
Nitrate Nitrogen	0.18	0.13	0.20	0.19	0.06	0.33
Nitrite Nitrogen	0.0025	0.0025	0.0025	0.0025	0.0025	0.0025
Total Metals (mg/L)						
Aluminum	0.3526	0.0565	0.6180	0.6184	0.0119	2.6200
Arsenic	0.00081	0.00053	0.00110	0.00073	0.00037	0.00129
Cadmium	0.000010	0.000005	0.000013	0.000011	0.000005	0.000040
Chromium	0.0012	0.0005	0.0016	0.0014	0.0005	0.0046
Copper	0.00237	0.00140	0.00354	0.00606	0.00151	0.02010
Iron	1.1903	0.5630	1.6600	1.2070	0.0432	3.7500
Lead	0.00023	0.00010	0.00047	0.00028	0.00010	0.00110
Molybdenum	0.0015	0.0011	0.0018	0.0018	0.0005	0.0023
Nickel	0.0024	0.0020	0.0027	0.0022	0.0005	0.0054
Selenium	0.00018	0.00015	0.00019	0.00022	0.00013	0.00053
Zinc	0.0025	0.0025	0.0025	0.0044	0.0025	0.0109

5.1.21 W47 – Area 118 Pit Water

Area 118 was not developed in 2013 and therefore water quality site W47 was not established.

5.1.22 W50 – Minto Creek, 50m Downstream of the Toe of the Water Storage Pond Dam

Station W50 water quality result statistics for 2008 to 2013 are summarized in Table 5-22, and are compared to the WUL non-freshet water quality standard (Clause 70). 27 routine water quality samples were taken during the 2013 monitoring period. The 2007-2013 copper, aluminum, cadmium and selenium concentrations are shown in Figure 5-12 and Figure 5-13, and are compared to WUL non-freshet water quality standard (Clause 70). An outlier cadmium concentration (0.0185 mg/L value on 2009-05-27) was removed from Figure 5-13 so as to better show typical water quality at station W50.

Table 5-22: W50 water quality results summary (2008 – 2013)

W50	Water Quality Standard (WUL Clause 70)	2008 - 2012 Summary Statistics			2013 Summary Statistics		
Parameters		Mean	Min	Max	Mean	Min	Max
pH	6.5 - 9.0	8.05	6.82	8.40	7.99	7.60	8.29
TSS (mg/L)	15	5.5	0.5	**42.0**	9.7	2.1	**27.8**
Nutrients (mg/L)							
Ammonia Nitrogen	0.89	0.0835	0.0025	**1.0000**	0.0530	0.0230	0.0880
Nitrate Nitrogen	7.65	5.64	0.01	**16.20**	2.59	0.01	**12.20**
Nitrite Nitrogen	0.15	0.0209	0.0025	**0.1580**	0.0261	0.0025	0.0646
Total Metals (mg/L)							
Aluminum	2.7	0.2209	0.0080	2.4000	0.4129	0.0760	1.1500
Arsenic	-	0.00048	0.00020	0.00220	0.00044	0.00027	0.00071
Cadmium	0.00015	**0.000235**	0.000005	**0.018500**	0.000017	0.000005	0.000049
Chromium	0.008	0.0008	0.0002	0.0059	0.0006	0.0005	0.0013
Copper	0.05	0.02363	0.00200	**0.10300**	0.03143	0.01120	**0.05890**
Iron	3.5	0.2889	0.0025	**3.8500**	0.6040	0.1240	1.5100
Lead	0.02	0.00028	0.00005	0.00210	0.00029	0.00010	0.00105
Molybdenum	0.4	0.0083	0.0005	0.0200	0.0040	0.0015	0.0056
Nickel	0.5	0.0019	0.0005	0.0180	0.0014	0.0005	0.0041
Selenium	0.003	0.00148	0.00005	**0.00540**	0.00051	0.00023	0.00076
Zinc	0.15	0.0065	0.0025	0.0330	0.0037	0.0025	0.0082

Bold values indicate exceedances of the non-freshet water quality standard

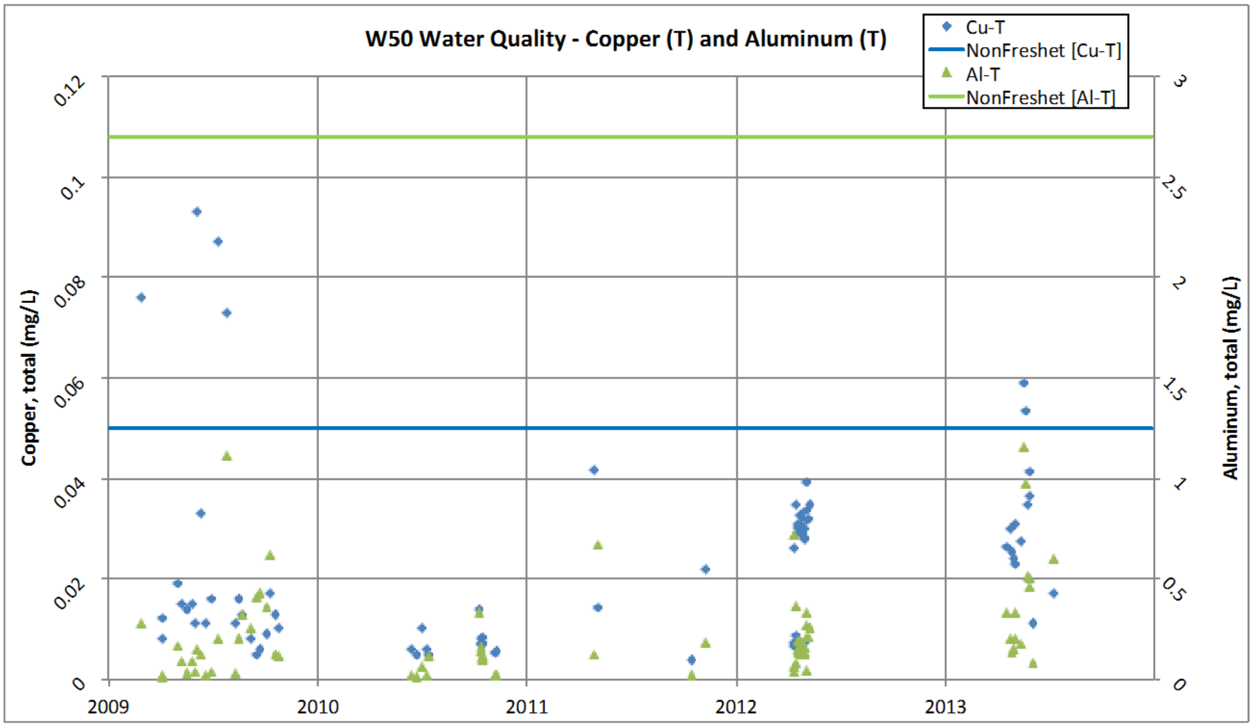


Figure 5-12: W50 copper and aluminum concentrations (2007– 2013)

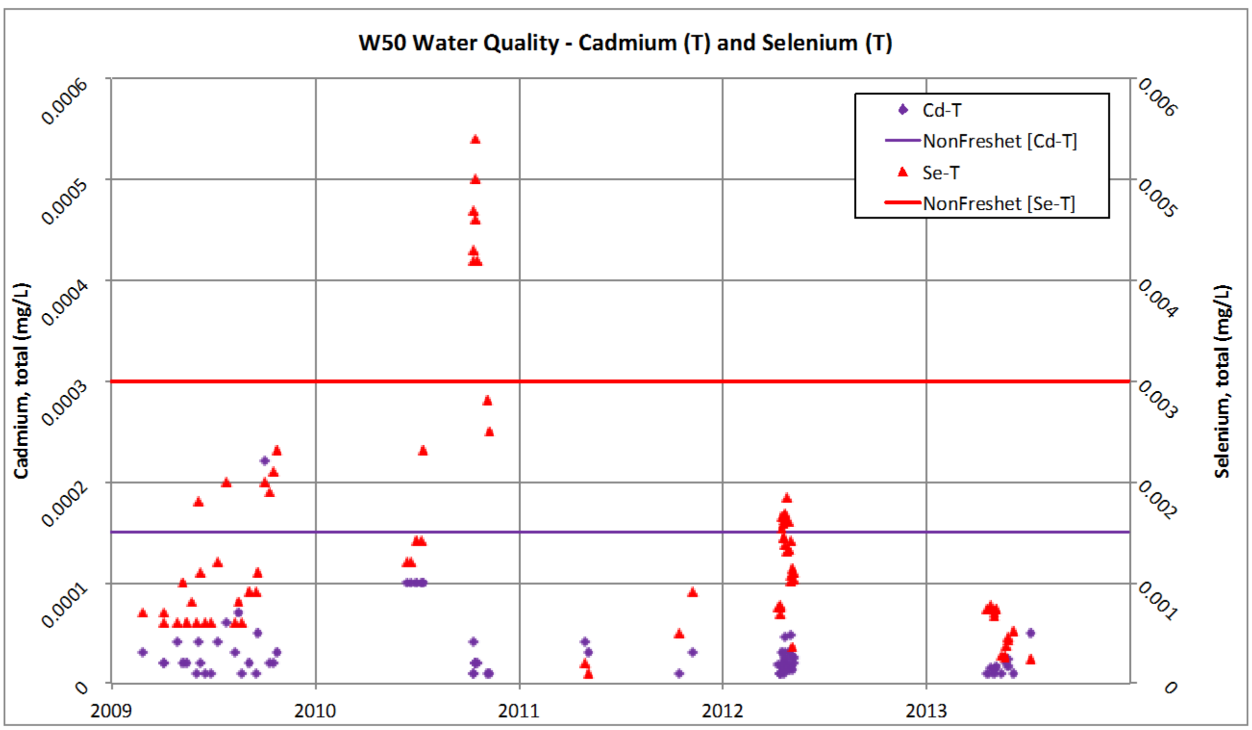


Figure 5-13: W50 cadmium and selenium concentrations (2007 – 2013)

5.1.23 MC-1 – Minto Creek Upstream of Canyon near Km 8 on Mine Access Road

Station MC-1 2009 to 2013 water quality result statistics are summarized in Table 5-23. 35 routine water quality samples were taken during the 2013 monitoring period.

Table 5-23: MC-1 water quality results summary (2009 – 2013)

MC1	2009 - 2012 Summary Statistics			2013 Summary Statistics		
Parameters	Mean	Min	Max	Mean	Min	Max
pH	8.11	7.50	8.40	8.15	7.78	8.34
TSS (mg/L)	58.4	0.5	660.0	95.2	0.5	660.0
Nutrients (mg/L)						
Ammonia Nitrogen	0.0350	0.0025	0.2300	0.0564	0.0150	0.3600
Nitrate Nitrogen	0.68	0.00	7.30	0.23	0.01	1.26
Nitrite Nitrogen	0.0058	0.0005	0.0320	0.0084	0.0025	0.0342
Total Metals (mg/L)						
Aluminum	1.2631	0.0104	14.9000	2.5089	0.0104	14.7000
Arsenic	0.00113	0.00020	0.00730	0.00184	0.00031	0.00794
Cadmium	0.000053	0.000005	0.000450	0.000043	0.000005	0.000209
Chromium	0.0029	0.0005	0.0330	0.0050	0.0005	0.0290
Copper	0.00690	0.00100	0.04170	0.00942	0.00171	0.04880
Iron	2.1664	0.0300	23.9000	4.3175	0.0468	23.2000
Lead	0.00063	0.00010	0.00650	0.00107	0.00010	0.00652
Molybdenum	0.0018	0.0004	0.0090	0.0015	0.0005	0.0035
Nickel	0.0037	0.0005	0.0330	0.0061	0.0005	0.0304
Selenium	0.00040	0.00005	0.00220	0.00024	0.00005	0.00076
Zinc	0.0072	0.0020	0.0560	0.0096	0.0025	0.0538

5.1.24 WC – Convergence Point for W15 and W35 Inflows

Station WC 2011 and 2013 water quality result statistics are summarized in Table 5-24. Five routine water quality samples were taken during the 2013 monitoring period.

Table 5-24: WC water quality results summary (2011 and 2013)

WC	2011 Summary Statistics			2013 Summary Statistics		
Parameters	Mean	Min	Max	Mean	Min	Max
pH	7.91	7.34	8.20	8.00	7.64	8.41
TSS (mg/L)	17.4	1.0	43.0	51.1	18.1	130.0
Nutrients (mg/L)						
Ammonia Nitrogen	0.0744	0.0230	0.1560	0.4220	0.0400	1.0000
Nitrate Nitrogen	3.65	0.11	11.10	5.72	1.39	8.24
Nitrite Nitrogen	0.0643	0.0070	0.2750	0.1683	0.0256	0.5120
Total Metals (mg/L)						
Aluminum	0.6494	0.0670	2.2000	2.5376	0.6280	6.2300
Arsenic	0.00093	0.00040	0.00180	0.00120	0.00062	0.00221
Cadmium	0.000057	0.000005	0.000130	0.000055	0.000018	0.000076
Chromium	0.0019	0.0005	0.0090	0.0021	0.0005	0.0057
Copper	0.11004	0.01610	0.26000	0.20428	0.09610	0.39000
Iron	1.8255	0.2460	10.1000	3.6408	0.8940	9.8200
Lead	0.00069	0.00010	0.00240	0.00098	0.00039	0.00207
Molybdenum	0.0040	0.0005	0.0090	0.0101	0.0041	0.0202
Nickel	0.0071	0.0010	0.0590	0.0018	0.0015	0.0024
Selenium	0.00134	0.00010	0.00530	0.00196	0.00075	0.00307
Zinc	0.0474	0.0025	0.1510	0.0148	0.0055	0.0346

5.2 Minto Creek Hydrology

During the 2013 monitoring period, Minto Mine maintained and collected data from the following four hydrometric stations along Minto Creek:

- W3 (flume downstream of the Water Storage Pond);
- MC-1 (located in Minto Canyon – mid catchment);
- W1 (located approximately 1 km upstream of Yukon River – lower catchment); and
- W7 (tributary on the south side of Minto Creek).

Solinst water level loggers and barometer loggers were used in conjunction with staff gauge readings and manual flow measurements to produce volumetric flow rates. For details on the 2013 results of Minto Creek hydrology see the Minto Creek 2013 Hydrology Update in Appendix B.

5.3 Yukon River Monitoring Program

The Yukon River Monitoring program includes water quality sampling at locations on the Yukon River upstream and downstream of the Minto Creek confluence. Results of the 2013 monitoring are summarized below.

5.3.1 W4 – Yukon River, Upstream of the confluence with Minto Creek

Station W4 2011 to 2013 water quality result statistics are summarized in Table 5-25. 50 routine water quality samples were taken during the 2013 monitoring period.

Table 5-25: W4 water quality results summary (2011 – 2013)

W4	2011- 2012 Summary Statistics			2013 Summary Statistics		
Parameters	**Mean**	**Min**	**Max**	**Mean**	**Min**	**Max**
pH	7.94	7.56	8.10	7.99	7.74	8.17
TSS (mg/L)	45.1	1.2	270.0	13.9	0.5	135.0
Nutrients (mg/L)						
Ammonia Nitrogen	0.0258	0.0025	0.1300	0.0286	0.0025	0.1900
Nitrate Nitrogen	0.06	0.01	0.85	0.08	0.01	0.24
Nitrite Nitrogen	0.0038	0.0025	0.0250	0.0045	0.0025	0.0250
Total Metals (mg/L)						
Aluminum	0.9831	0.0081	7.9500	0.3440	0.0044	3.1400
Arsenic	0.00112	0.00030	0.00671	0.00074	0.00034	0.00308
Cadmium	0.000068	0.000005	0.002040	0.000012	0.000005	0.000071
Chromium	0.0021	0.0005	0.0152	0.0009	0.0005	0.0057
Copper	0.00408	0.00077	0.01730	0.00183	0.00042	0.00879
Iron	1.4135	0.0443	10.4000	0.5053	0.0215	4.4200
Lead	0.00063	0.00010	0.00451	0.00023	0.00010	0.00204
Molybdenum	0.0009	0.0005	0.0019	0.0009	0.0005	0.0015
Nickel	0.0029	0.0005	0.0179	0.0013	0.0005	0.0075
Selenium	0.00015	0.00005	0.00028	0.00015	0.00005	0.00030
Zinc	0.0058	0.0025	0.0319	0.0031	0.0025	0.0150

5.3.2 W5 – Yukon River, Downstream of the Confluence with Minto Creek

Station W5 2011 to 2013 water quality result statistics are summarized in Table 5-26. 29 routine water quality samples were taken during the 2013 monitoring period.

Table 5-26: W5 water quality results summary (2012 – 2013)

W5	2011 - 2012 Summary Statistics			2013 Summary Statistics		
Parameters	Mean	Min	Max	Mean	Min	Max
pH	7.94	7.58	8.10	7.94	7.72	8.07
TSS (mg/L)	56.1	0.5	340.0	37.2	0.5	190.0
Nutrients (mg/L)						
Ammonia Nitrogen	0.0313	0.0025	0.3820	0.0189	0.0066	0.0900
Nitrate Nitrogen	0.06	0.01	0.38	0.05	0.01	0.21
Nitrite Nitrogen	0.0046	0.0025	0.0324	0.0047	0.0025	0.0250
Total Metals (mg/L)						
Aluminum	1.4025	0.0140	11.2000	0.8776	0.0135	5.0800
Arsenic	0.00135	0.00037	0.00690	0.00110	0.00042	0.00344
Cadmium	0.000049	0.000005	0.000290	0.000022	0.000005	0.000111
Chromium	0.0028	0.0005	0.0250	0.0018	0.0005	0.0102
Copper	0.00501	0.00061	0.03310	0.00338	0.00076	0.02020
Iron	2.2226	0.0317	18.2000	1.3058	0.0305	7.6800
Lead	0.00081	0.00010	0.00580	0.00046	0.00010	0.00277
Molybdenum	0.0010	0.0005	0.0020	0.0012	0.0005	0.0016
Nickel	0.0035	0.0005	0.0270	0.0025	0.0005	0.0138
Selenium	0.00016	0.00005	0.00040	0.00017	0.00005	0.00027
Zinc	0.0070	0.0025	0.0510	0.0046	0.0025	0.0216

5.4 Seepage Water Quality Monitoring Program

Minto Mine is required to implement a Seepage Monitoring Plan (SMP) to assess acid rock drainage and metal leaching conditions from several sources including: ore stockpile areas, overburden dumps, waste rock dumps, DSTSF, Mill Valley Fill, the mill area and other seepage locations. The seepage monitoring that was conducted in 2013 was carried out in accordance with *Seepage Monitoring Plan V2012-01*.

The SMP states that seepage surveys will be conducted twice a year, during spring runoff and in early fall, by walking the toe of each waste dump, stockpile or other area of interest. Each seepage monitoring event survey routes are recorded using the tracking function of a GPS. A map showing the 2013 survey routes and monitoring locations can be found in Figure 5-14.

The WUL Water Quality Surveillance Program requires regular monitoring of seepage at a number of permanent seepage water quality stations. These stations include: W8, W8A, W17, W32, W36, W37, W38, W39 and W40. The water quality results for these permanent water quality stations are reported to the Yukon Water Board (YWB) on a monthly basis. Additionally, seepage monitoring stations have been established that are sampled twice annually, and include stations SS1, SS2, SS3, SS4, SS5, SS6, SS7,

SS8, SS10, SS11, SS12, SS13, SS14, SS15, SS16, SS17, SS18, SS22, SS23, and SS24. All lab results for 2013 spring and fall seepage monitoring programs are provided in Appendix C.

Seepage site locations are marked by GPS and data is stored in the Minto Mine Water Quality Database along with results from WUL sampling stations. Minto will continue to monitor these seepage areas and monitor the site workings for seeps on a semi-annual basis.

Observations from the 2013 Seepage Monitoring Program indicate that the majority of the seepage sites identified are seasonally variable with flows observed during spring and early summer months. Analysis of seepage results and water quality analysis assists in improving understanding of water chemistry, load, and water balance issuing from waste dumps, overburden dumps, ore stockpiles, and tailings facilities.

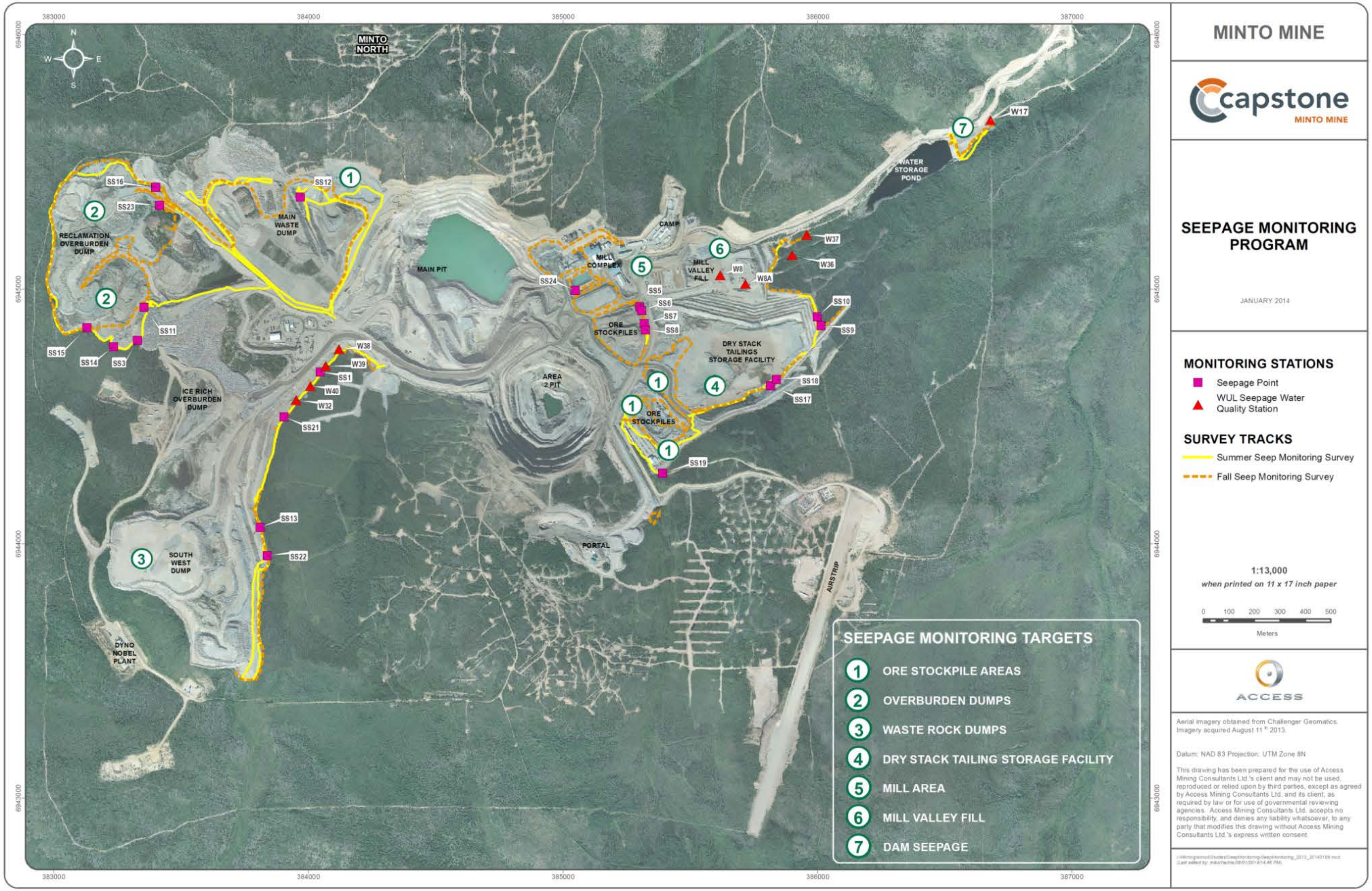


Figure 5-14: 2013 seepage monitoring survey routes and monitoring locations

5.4.1 Mill Valley Fill

The Mill Valley Fill (MVF) was completed in 2012 and vertical culverts were installed at both W8 and W8A to enable water quality monitoring at these locations. Obtaining water samples at W8 has been sporadic since the installation of the vertical culvert; however, in late 2013 field were able to collect enough water required for analysis. Water quality results for W8 and W8A are outlined in

Figure 5-15 through Figure 5-21 and include historic water quality results for dissolved copper, cadmium, iron, selenium and nutrient levels for ammonia, nitrite and nitrate. It is possible that the culvert installation is having some impact on water quality collected at the two sampling locations.

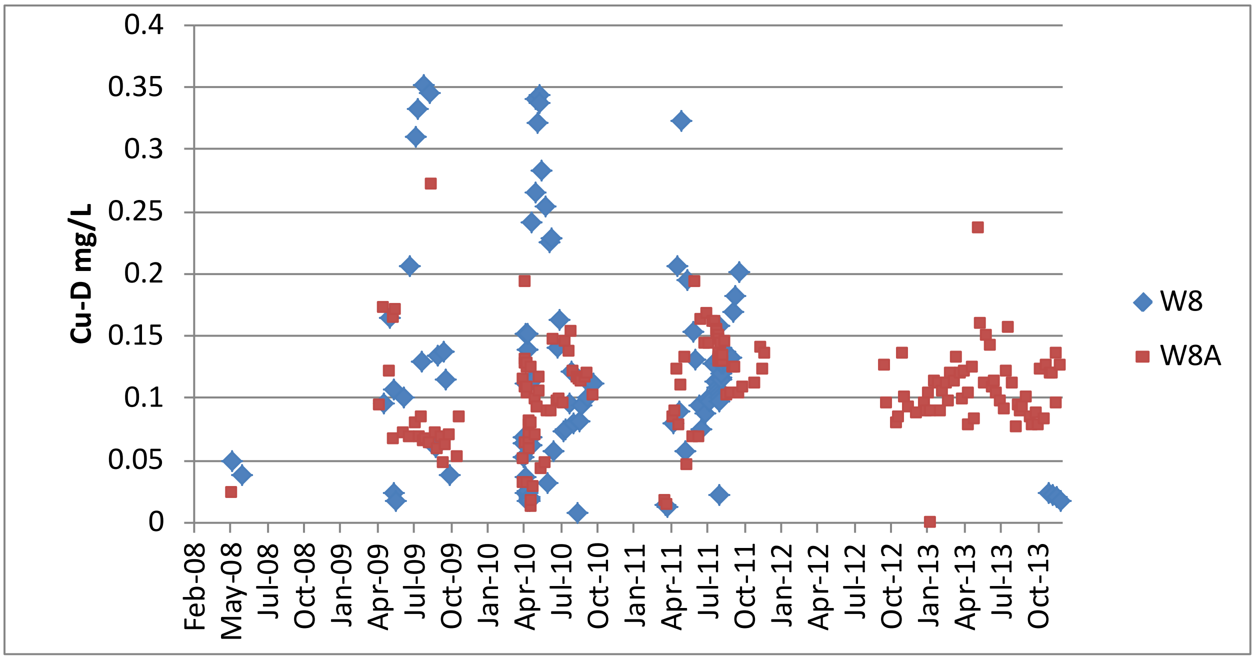


Figure 5-15: Dissolved copper concentrations for W8 and W8A

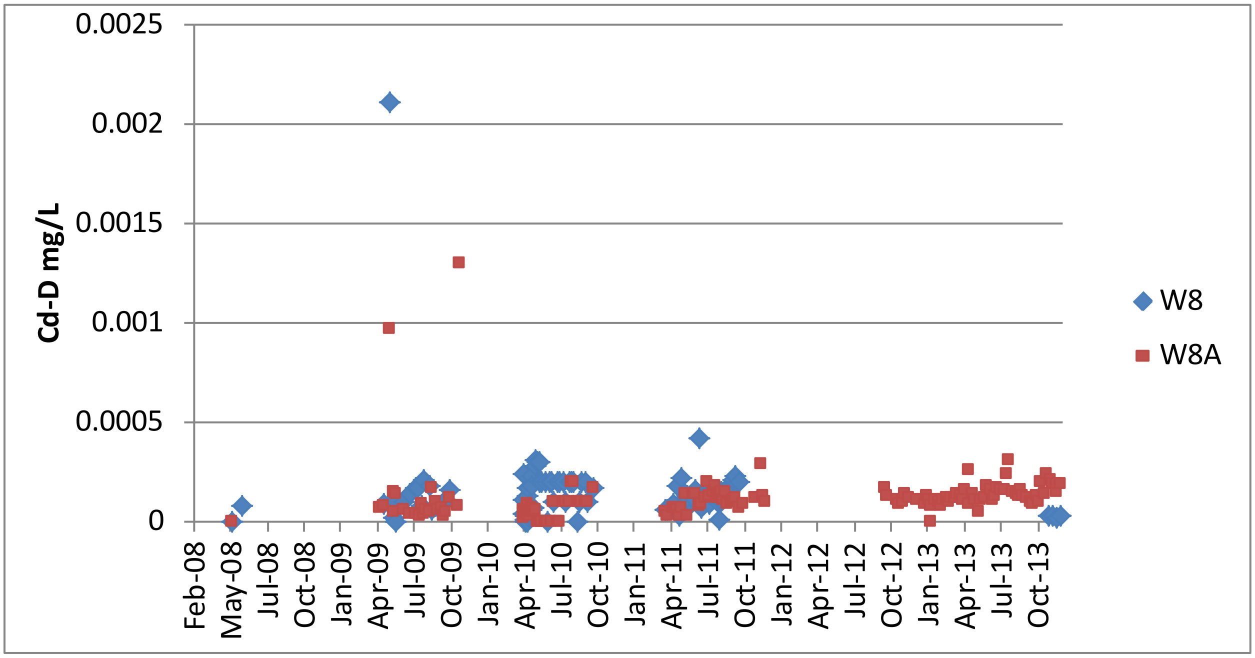


Figure 5-16: Dissolved cadmium concentrations for W8 and W8A

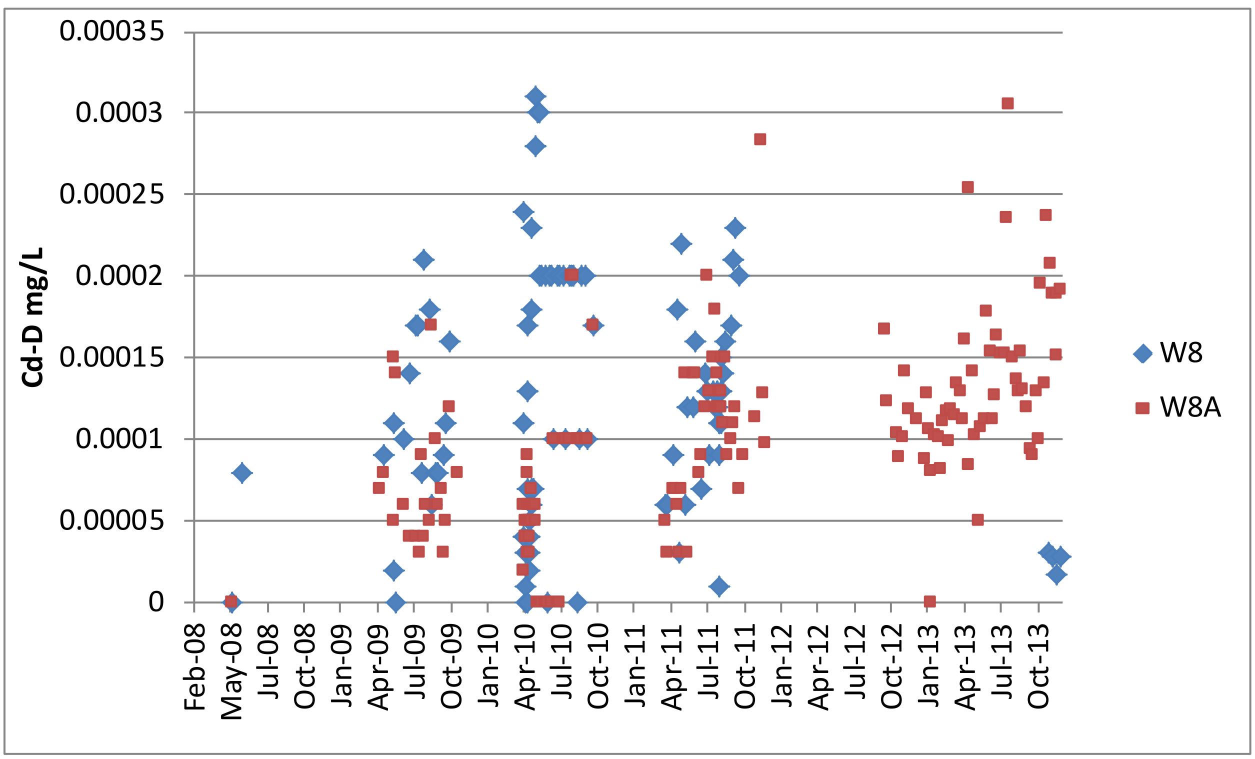


Figure 5-17: Dissolved cadmium concentrations for W8 and W8A, with reduced concentration range

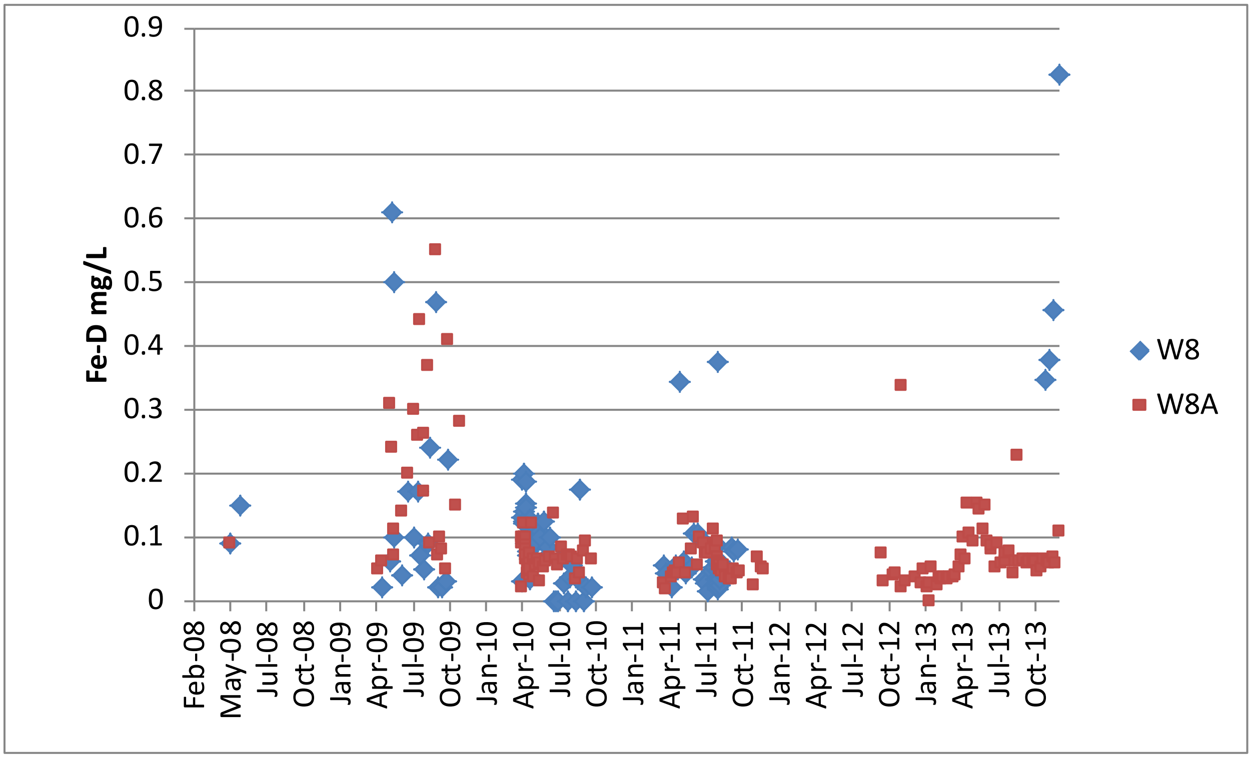


Figure 5-18: Dissolved iron concentrations for W8 and W8A

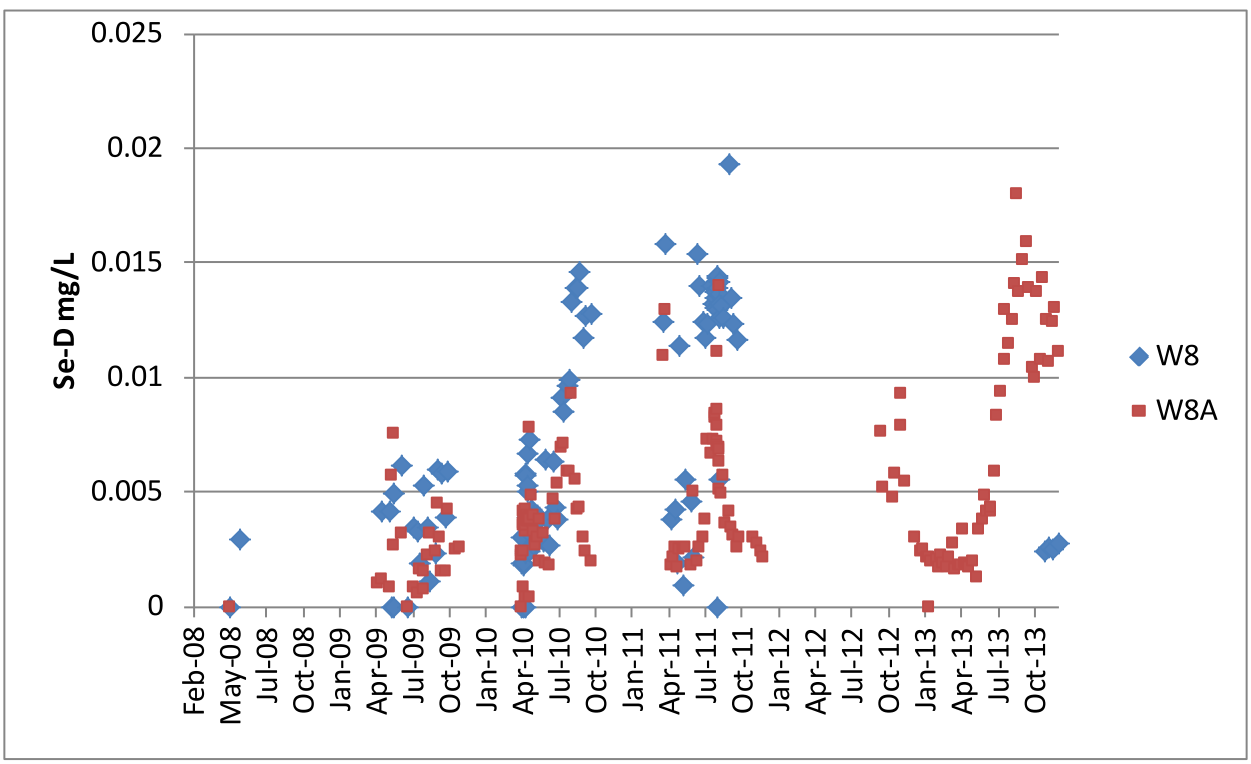


Figure 5-19: Dissolved selenium concentrations for W8 and W8A

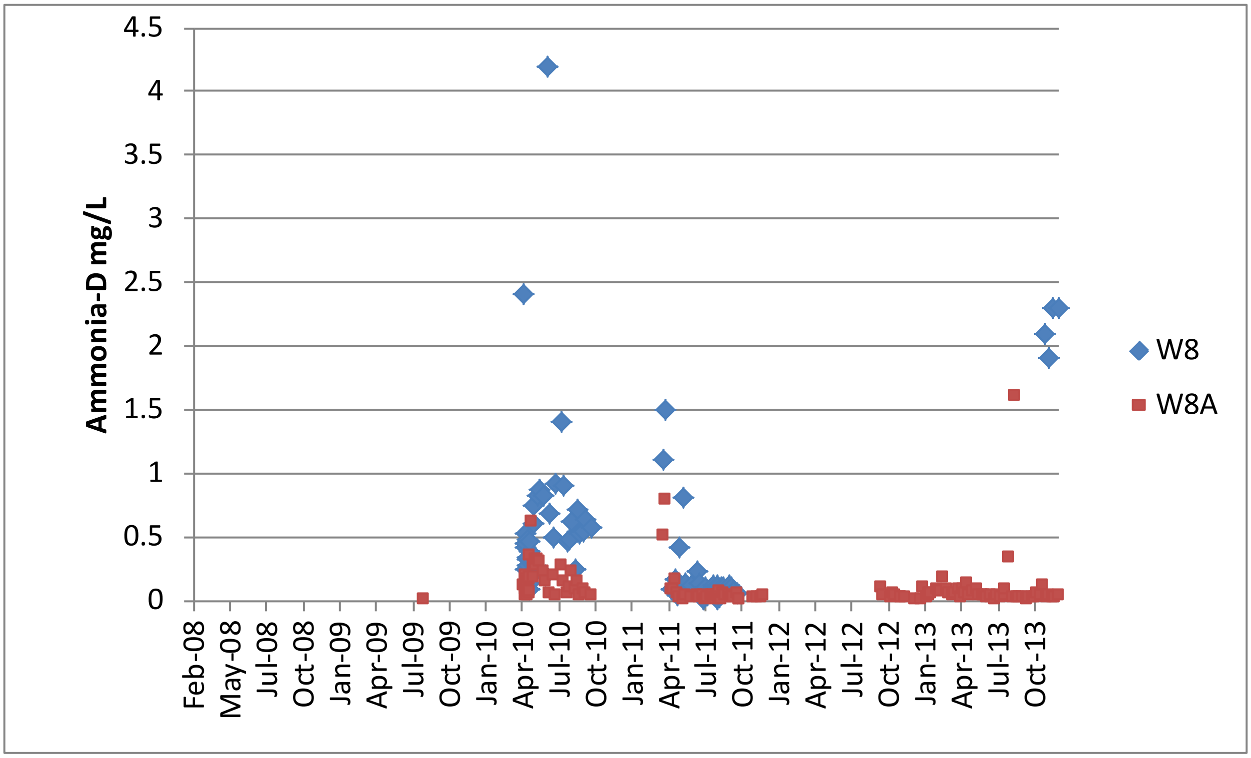


Figure 5-20: Ammonia concentrations for W8 and W8A

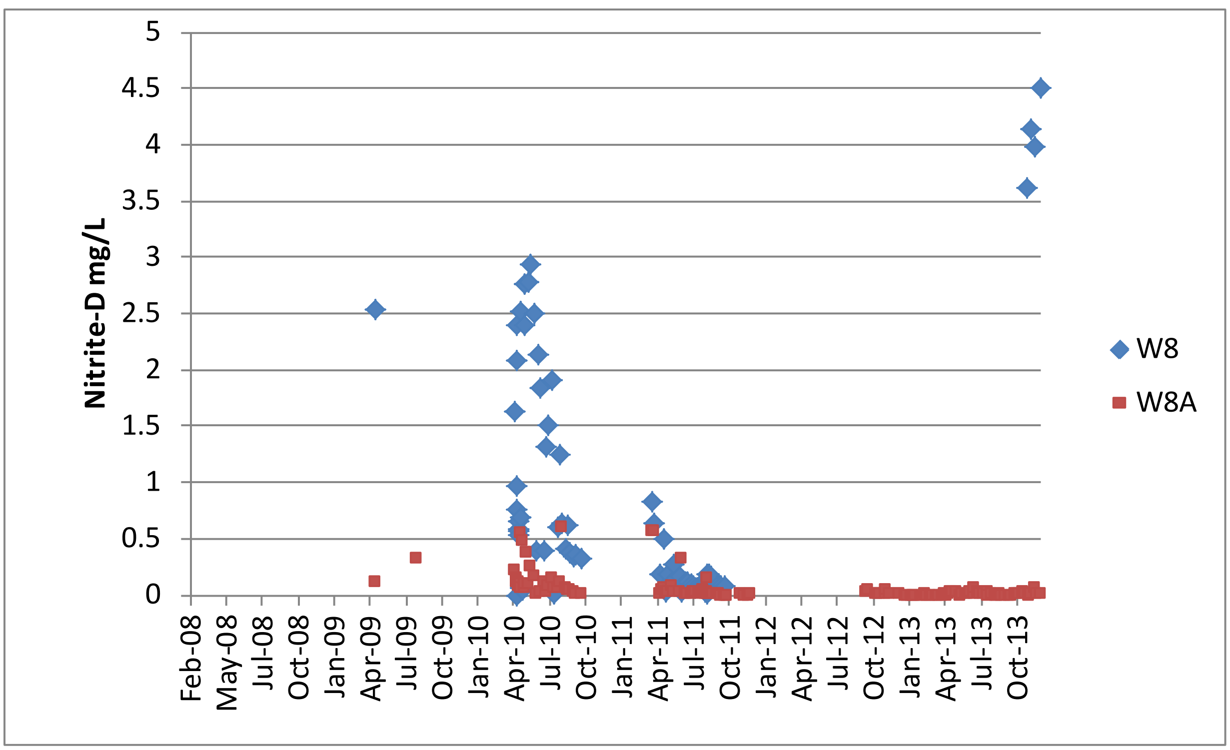


Figure 5-21: Nitrite concentrations for W8, and W8A

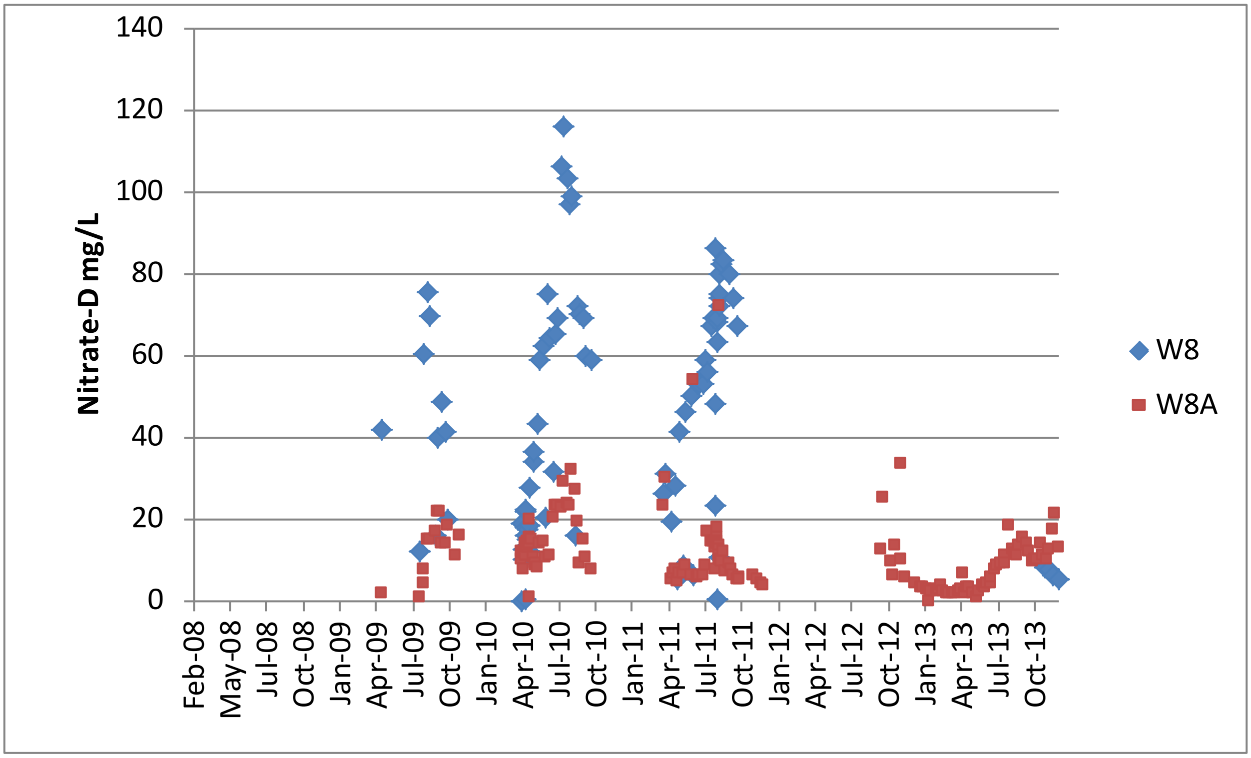


Figure 5-22: Nitrate concentrations for W8, and W8A

5.4.2 South West Dump

Seepage monitoring at the toe of the South West Dump (SWD) includes monthly water quality sampling at stations W32, W38, W39 and W40, as described in Table 5-1. Additionally, seepage is collected at stations SS4, SS13, and SS22, which are monitored during spring and fall. Samples are taken within ±5m of the original GPS point. If there is no seepage within the 5m buffer the site is considered dry during that sampling session. Water quality results for W32, W38, W39, and W40 are outlined in Figure 5-23 through Figure 5-31 and seepage water quality results are summarized in Figure 5-32 through Figure 5-38. The summary figures include historic water quality results for dissolved copper, cadmium, iron, selenium and nutrient levels for ammonia, nitrite and nitrate.

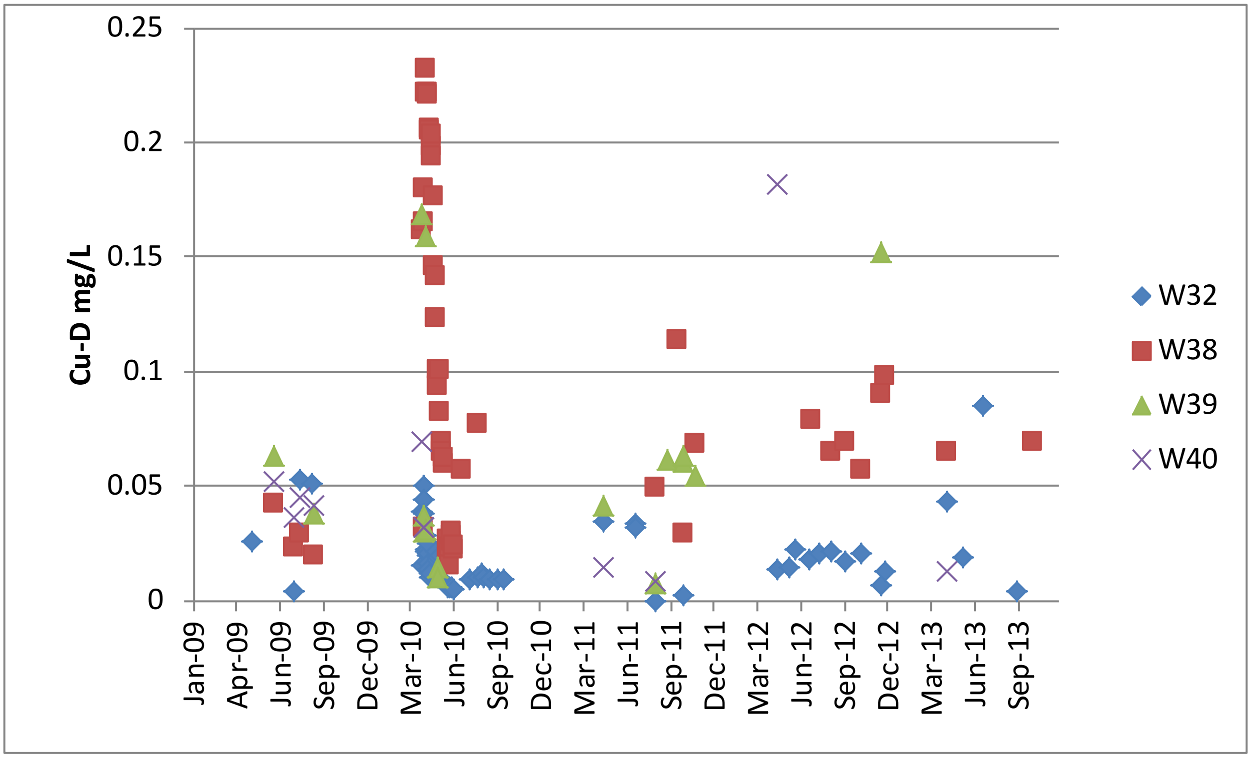


Figure 5-23: Toe of the SWD - Dissolved copper concentrations

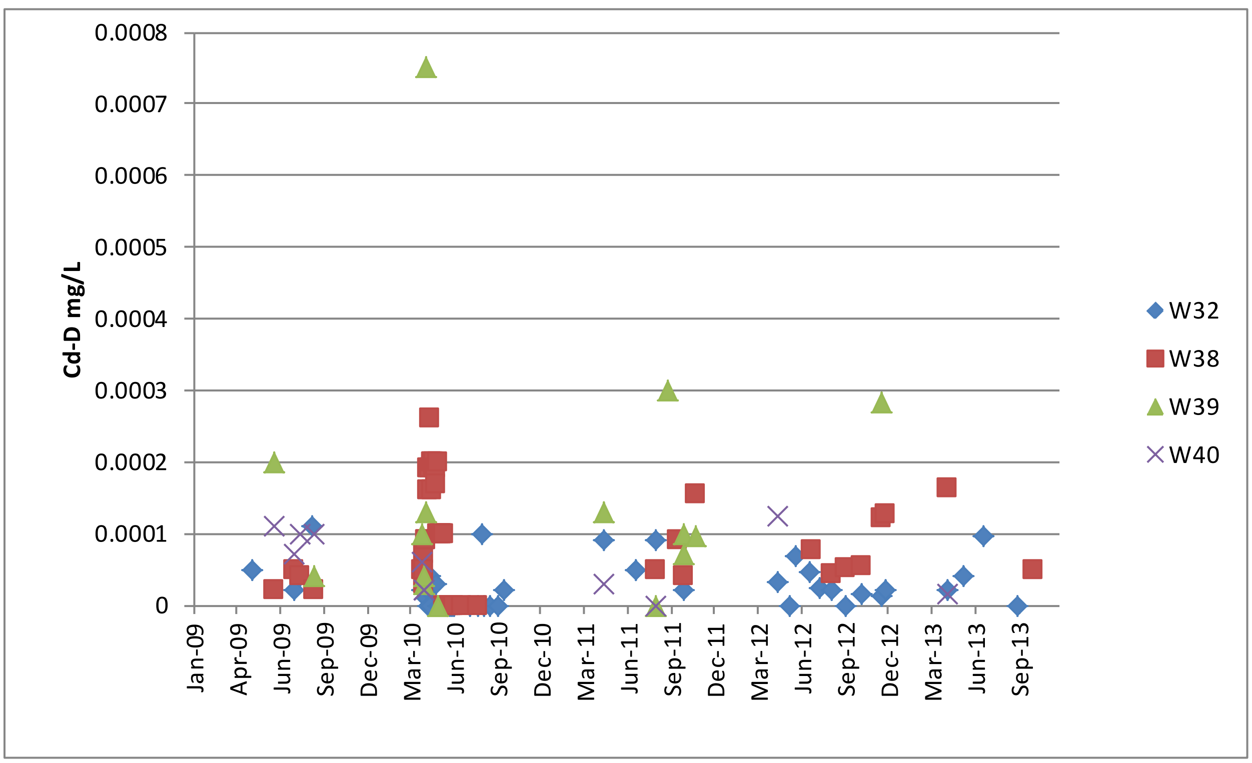


Figure 5-24: Toe of the SWD - Dissolved cadmium concentrations

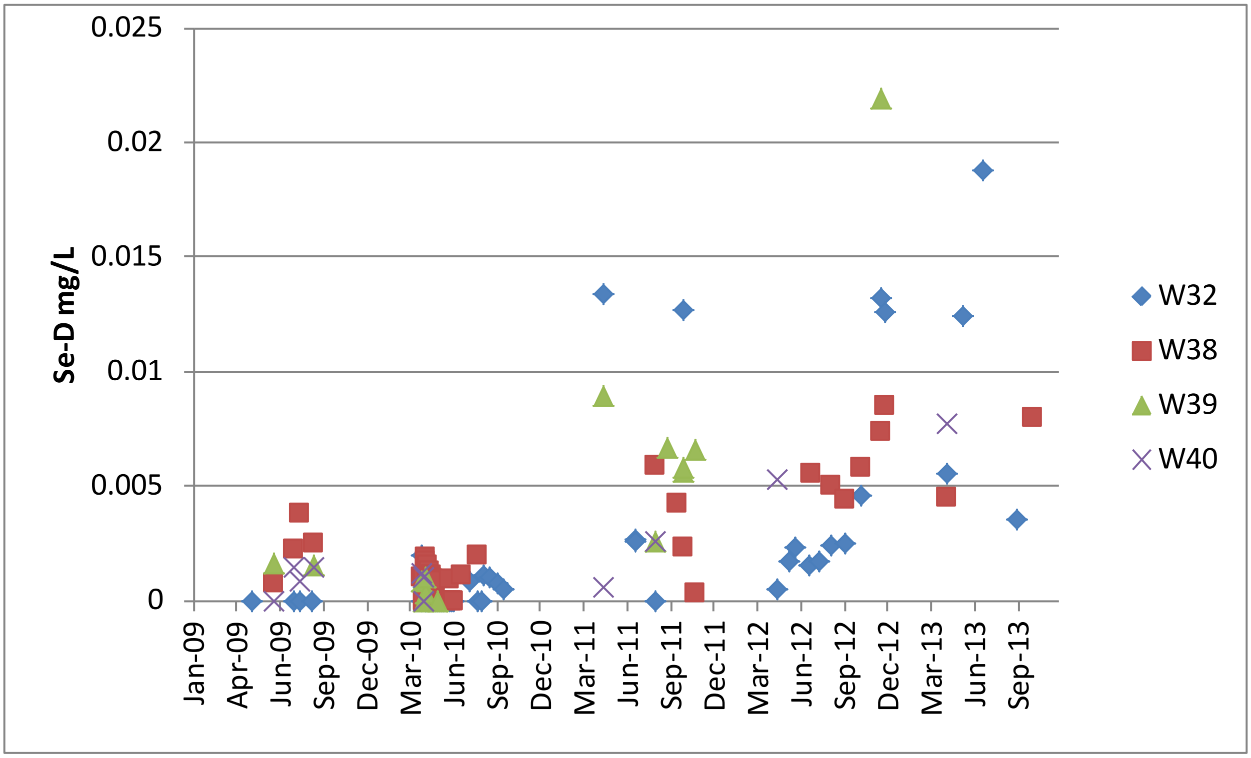


Figure 5-25: Toe of the SWD - Dissolved selenium concentrations

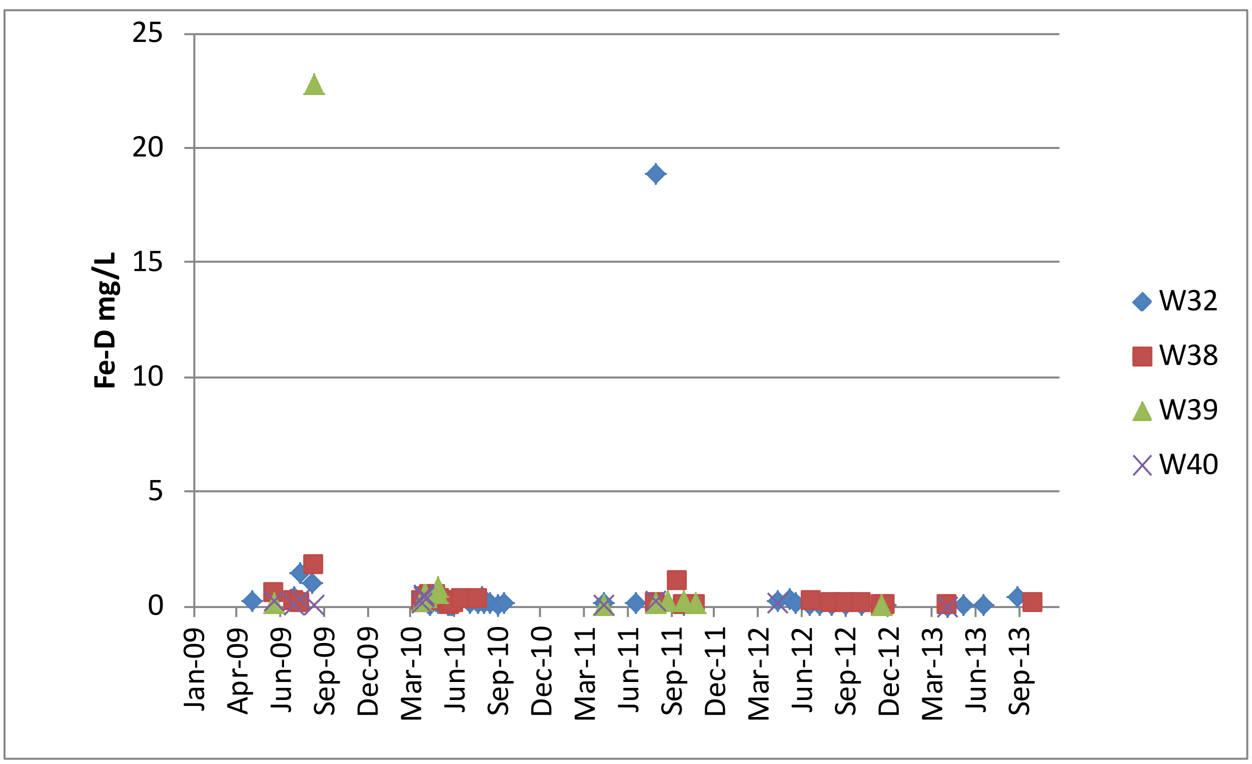


Figure 5-26: Toe of the SWD - Dissolved iron concentrations

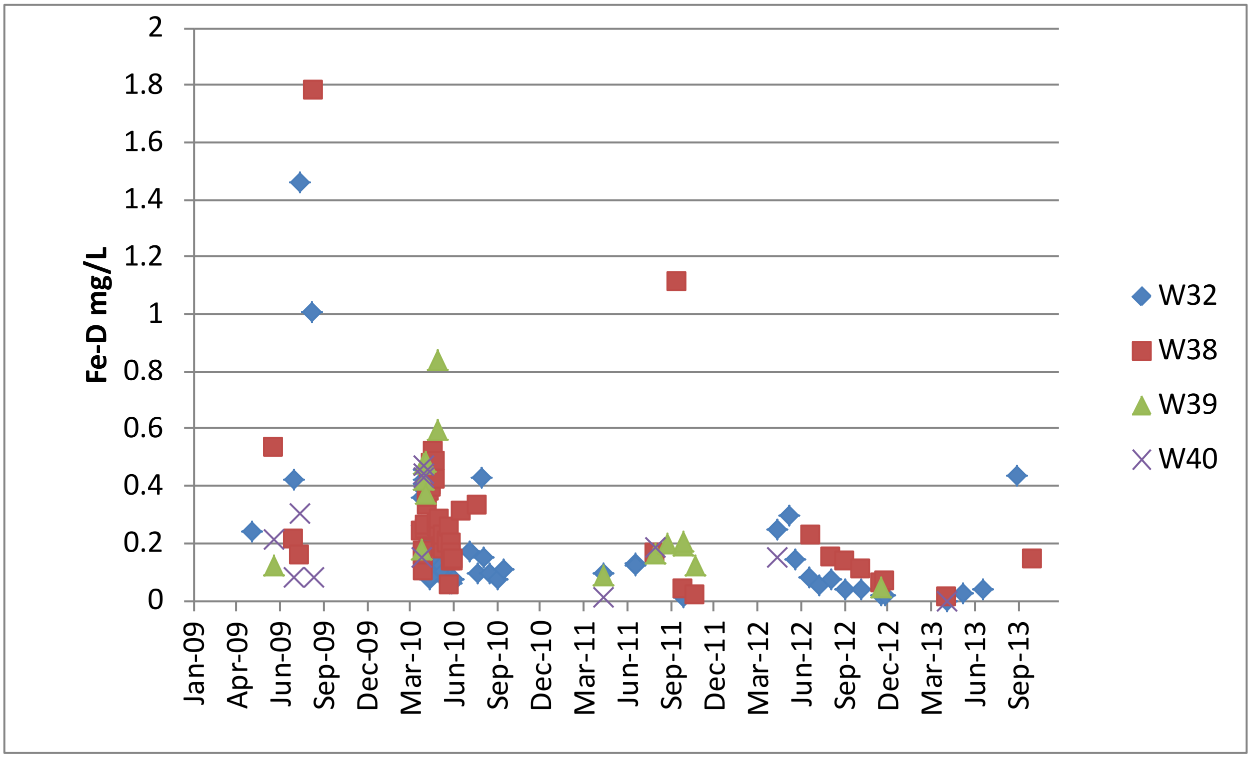


Figure 5-27: Toe of the SWD - Dissolved iron concentrations, with reduced concentration range

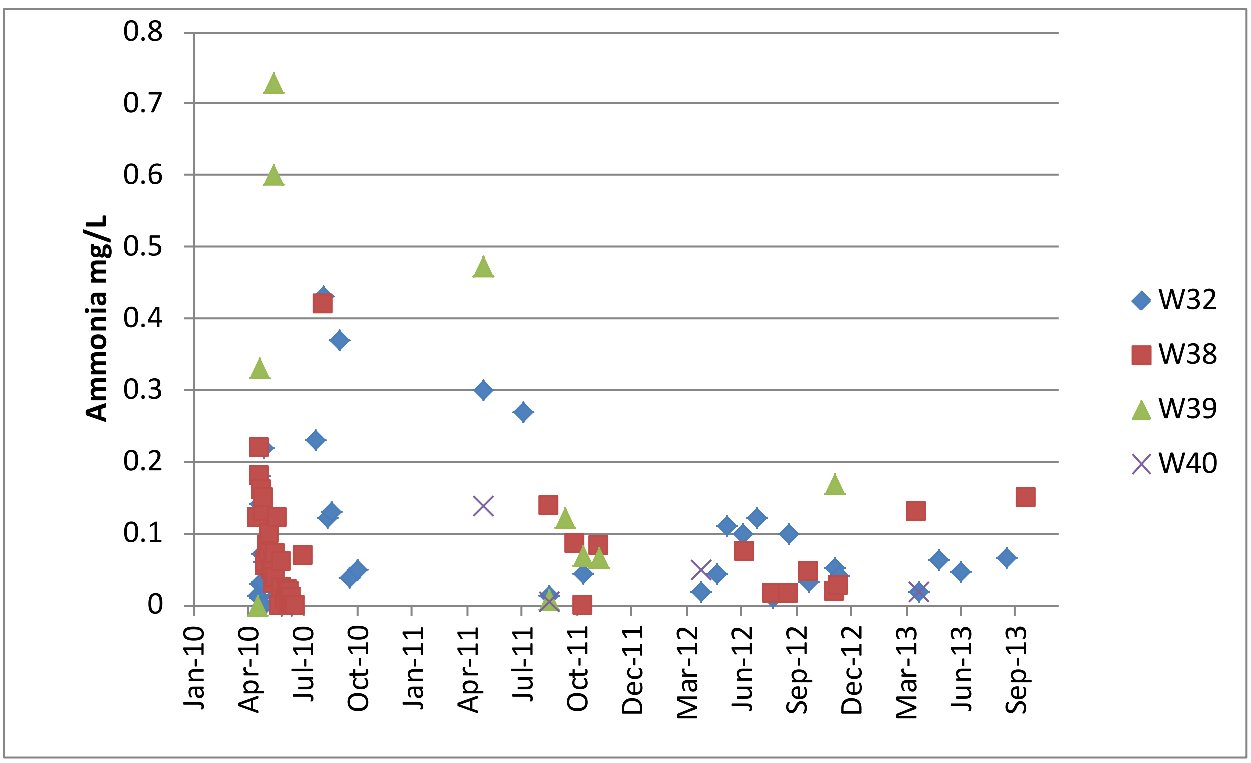


Figure 5-28: Toe of the SWD - Ammonia concentrations

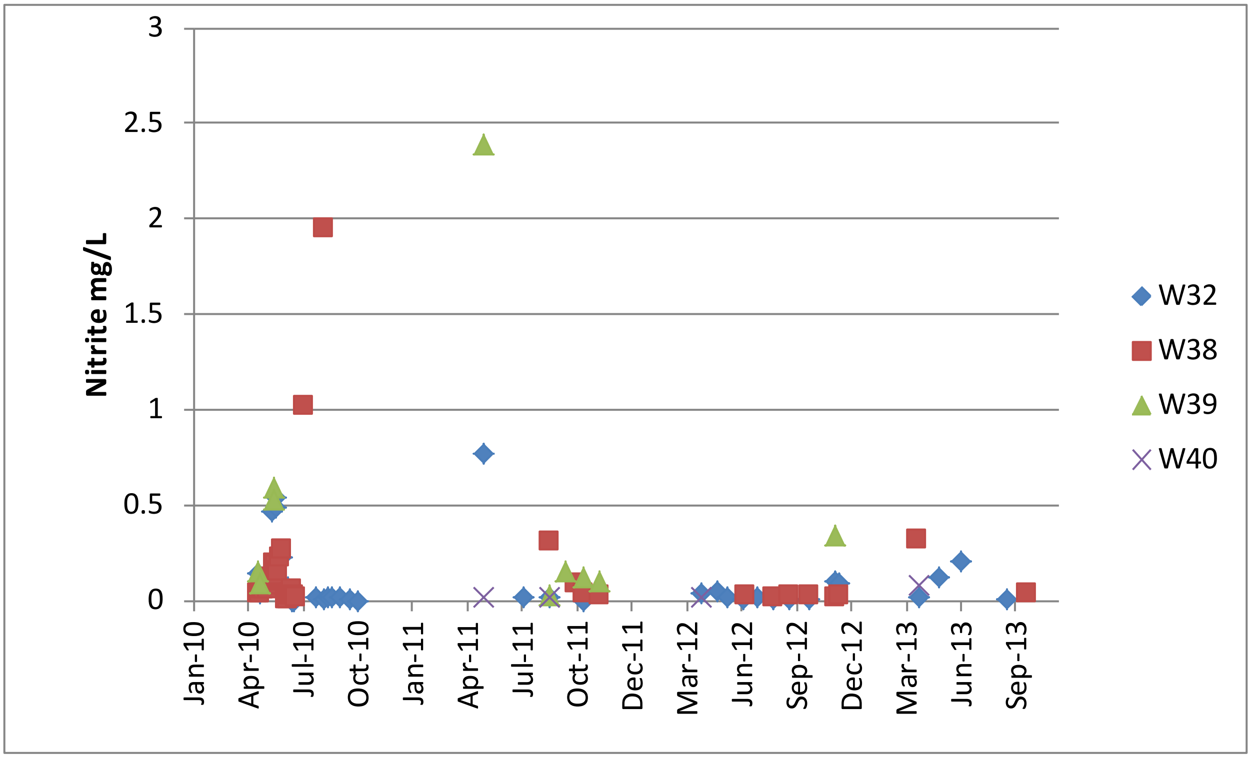


Figure 5-29: Toe of the SWD - Nitrite concentrations

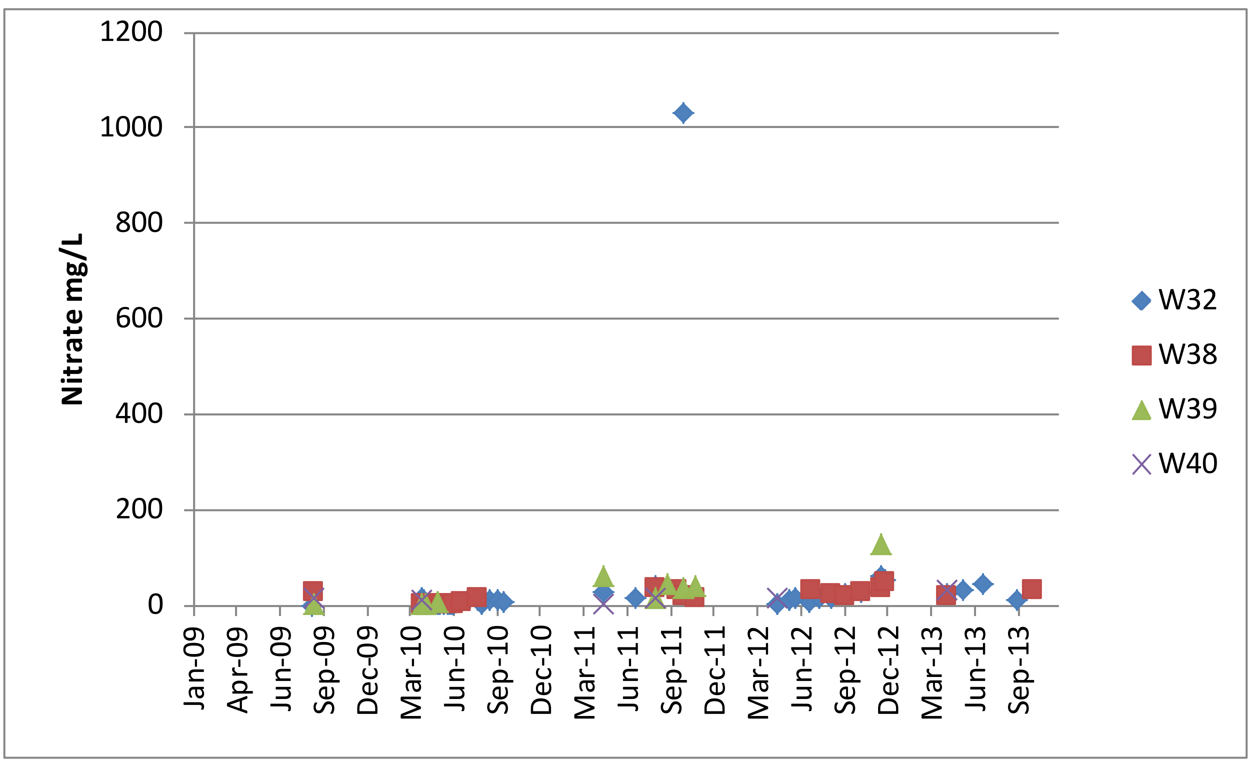


Figure 5-30: Toe of the SWD - Nitrate concentrations

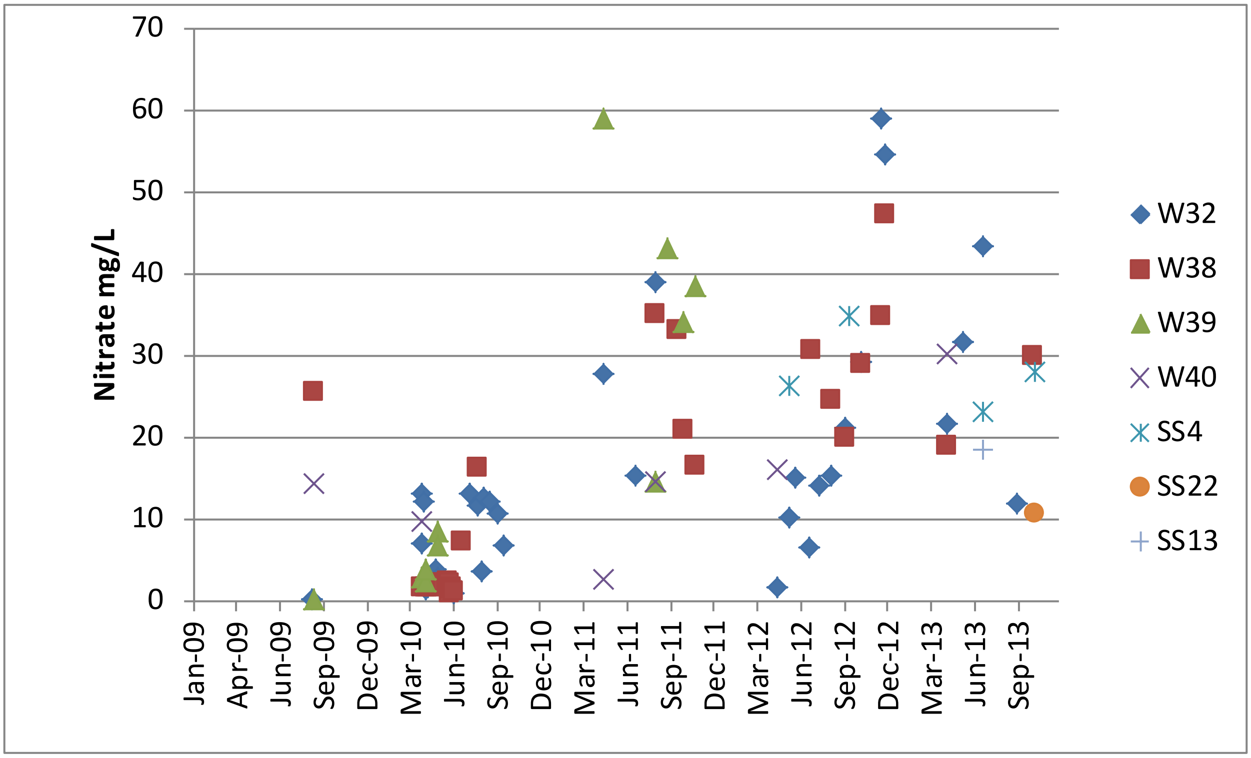


Figure 5-31: Toe of the SWD - Nitrate concentrations, with reduced concentration range

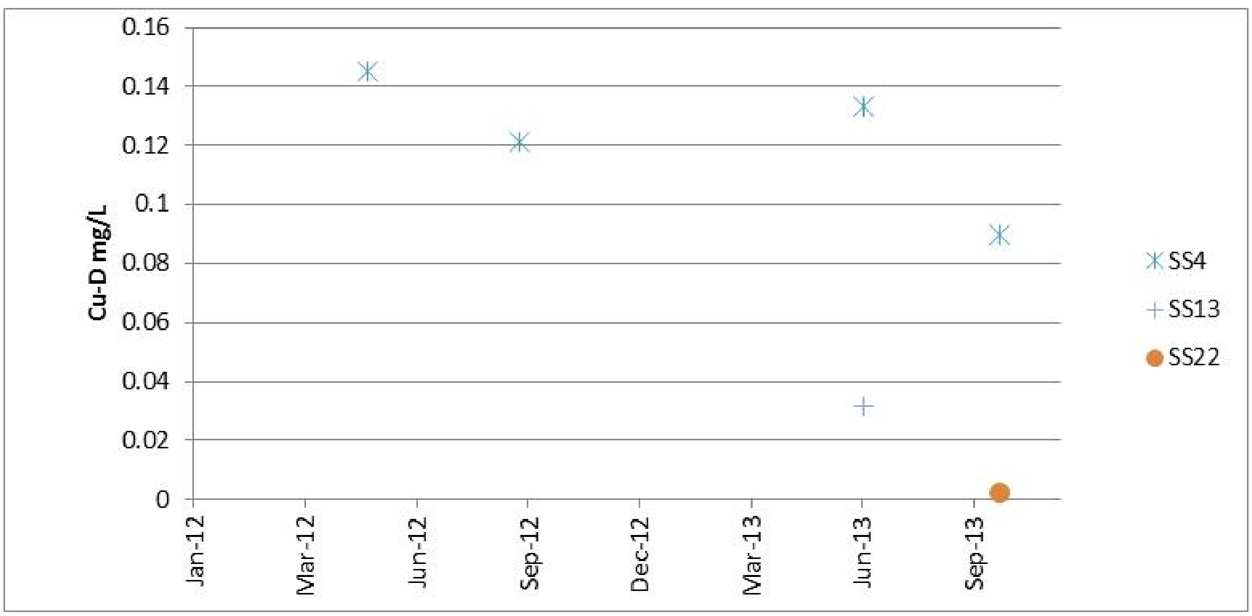


Figure 5-32: Dissolved copper concentrations for SS4, SS13 and SS22

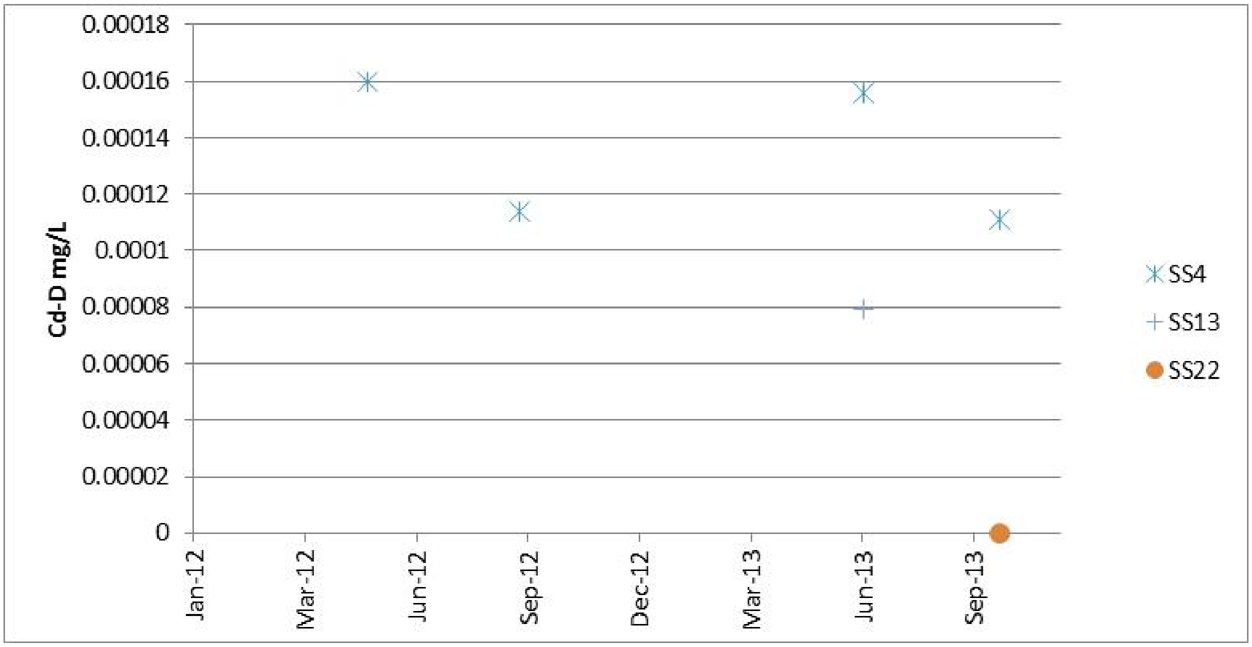


Figure 5-33: Dissolved cadmium concentrations for SS4, SS13 and SS22

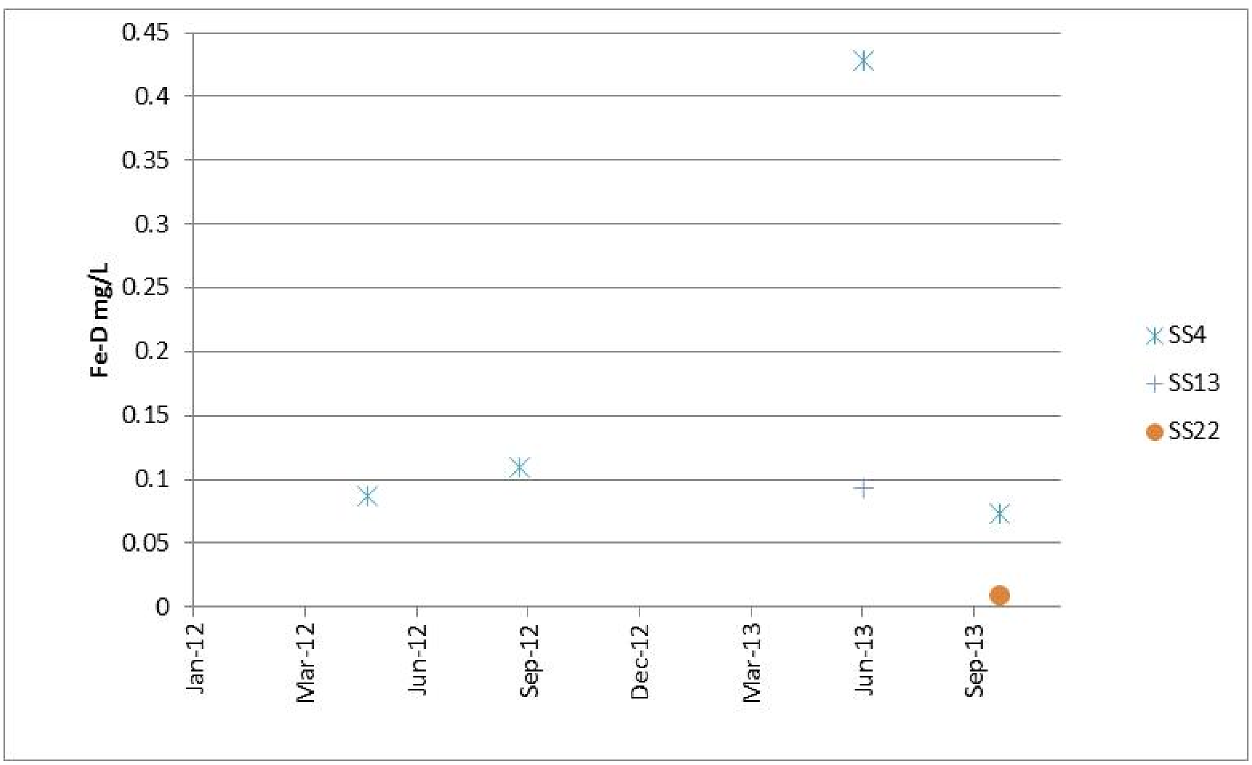


Figure 5-34: Dissolved iron concentrations for SS4, SS13 and SS22

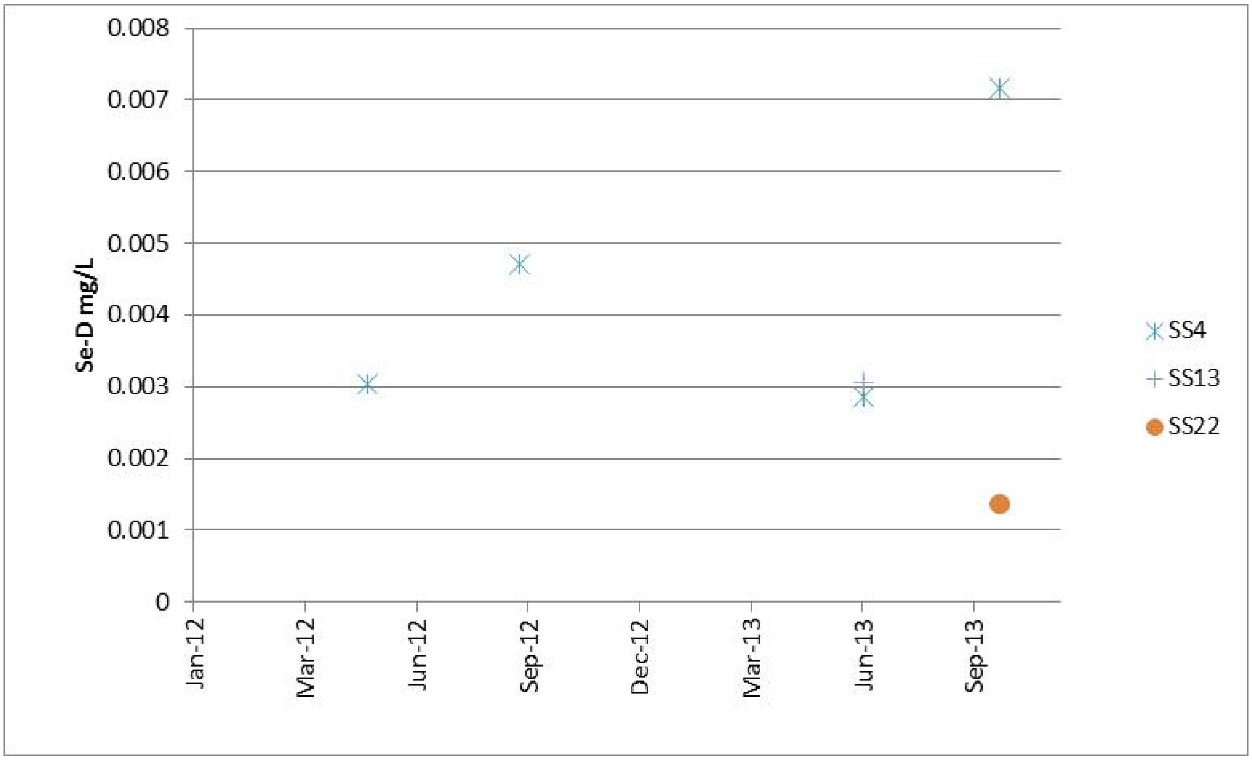


Figure 5-35: Dissolved selenium concentrations for SS4, SS13and SS22

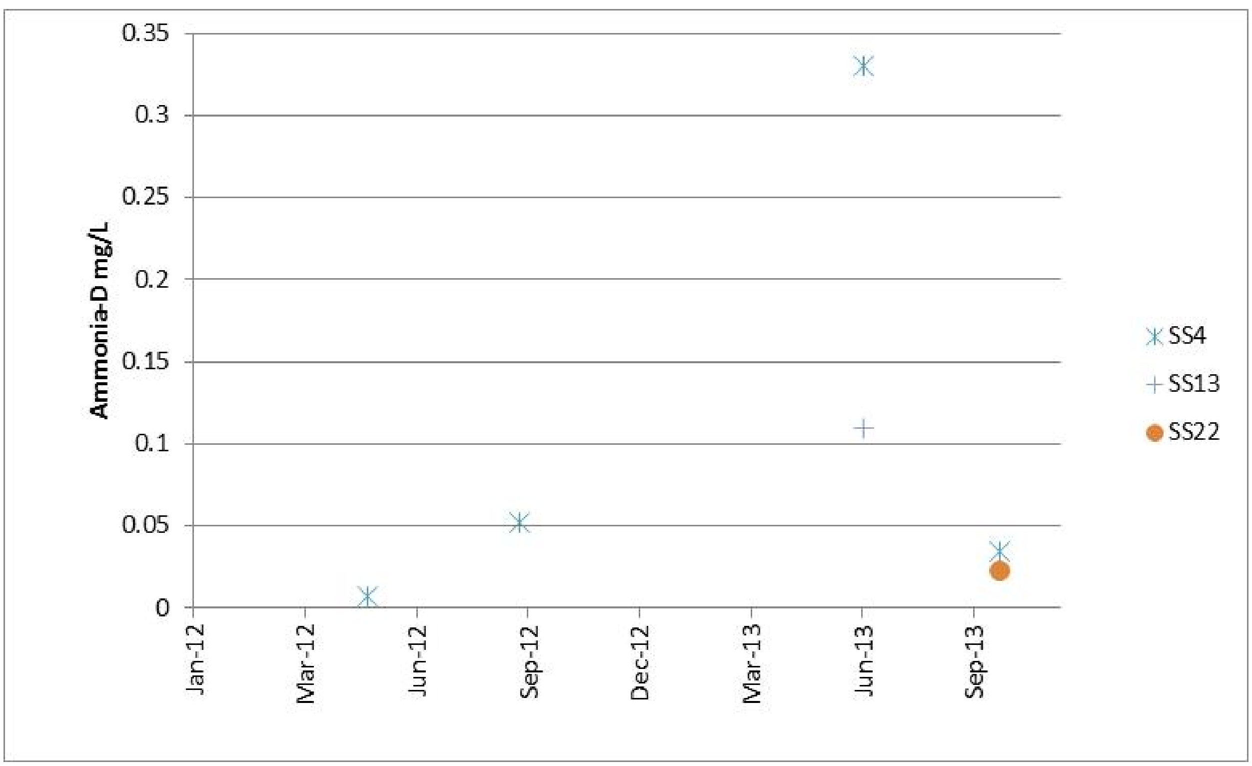


Figure 5-36: Ammonia concentrations for SS4, SS13 and SS22

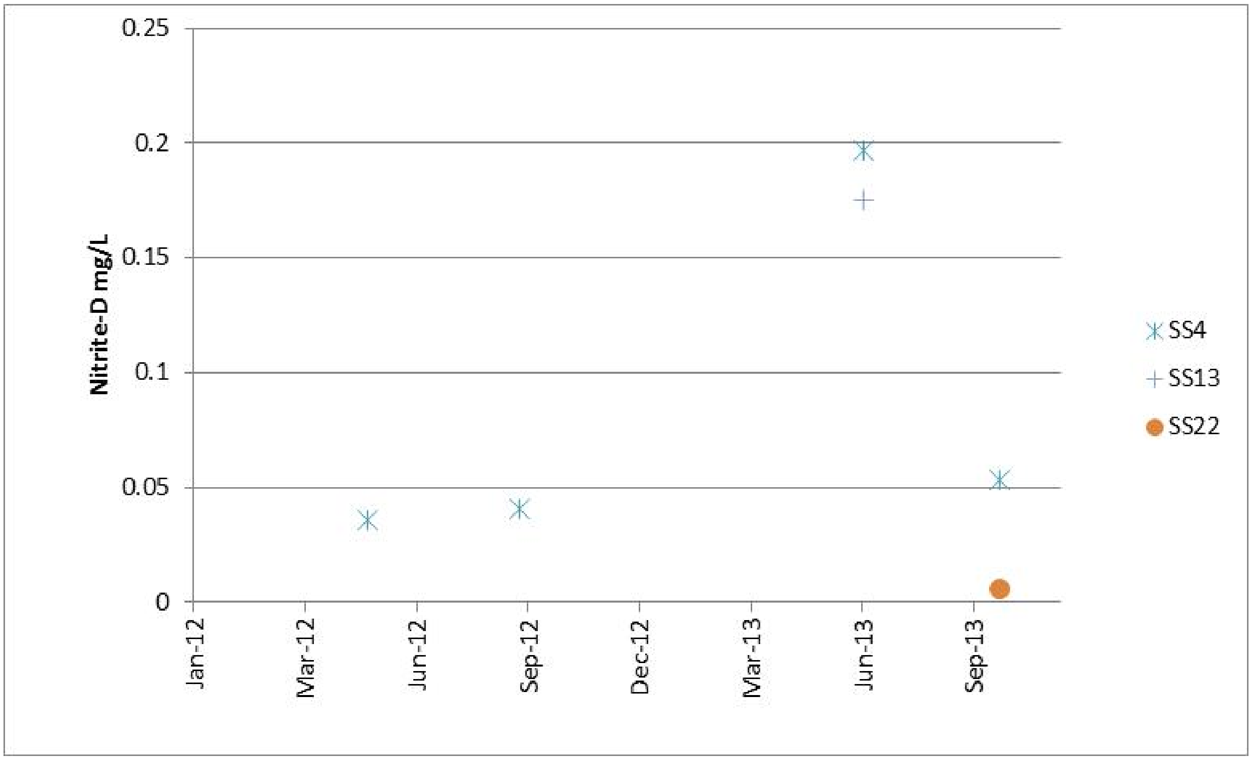


Figure 5-37: Nitrite concentrations for SS4, SS13 and SS22

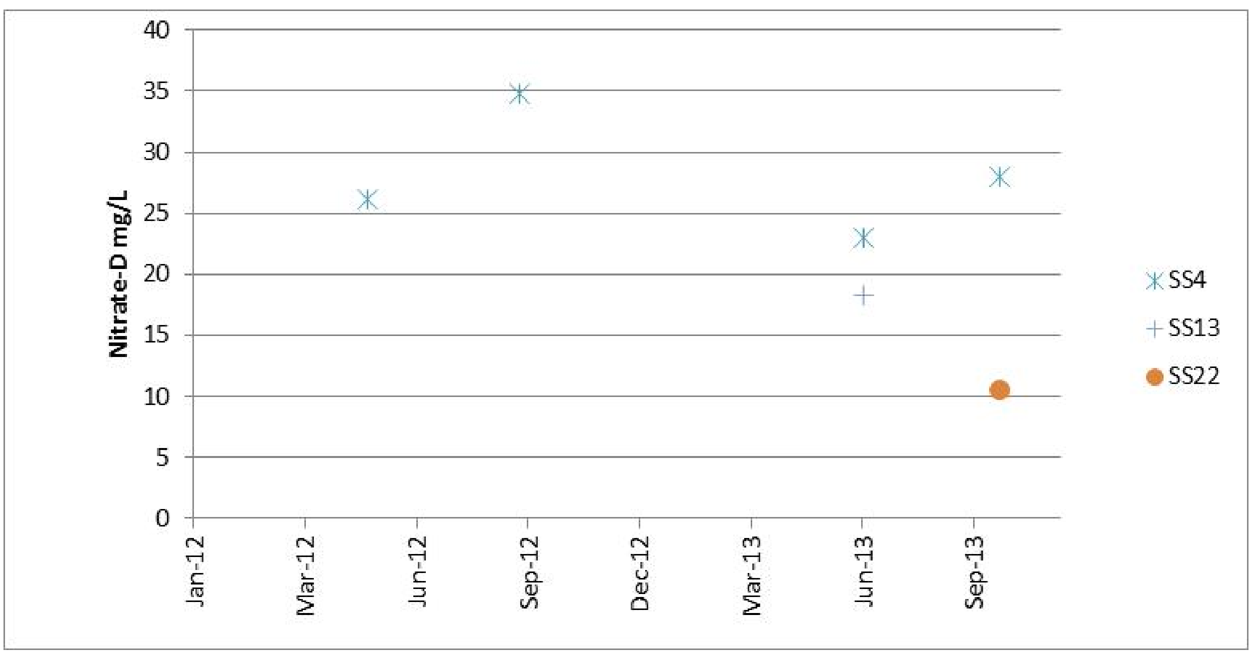


Figure 5-38: Nitrate concentrations for SS4, SS13 and SS22

5.4.3 MCDS and Water Storage Pond

W37 is fed by seepage water from the Minto Creek Detention Structure (W36 Collection Sump), which collects water coming off the Dry Stack Tailing Storage Facility, Mill Valley Fill and overflow water from the mill pond. Water from the MCDS is pumped back to the Main Pit, therefore W37 is often dry during monthly sampling sessions and there may be gaps in data for this sample site. Water quality results for W37 are outlined in Figure 5-39 through Figure 5-45 and include historic water quality results for dissolved copper, cadmium, iron, selenium and nutrient levels for ammonia, nitrite and nitrate.

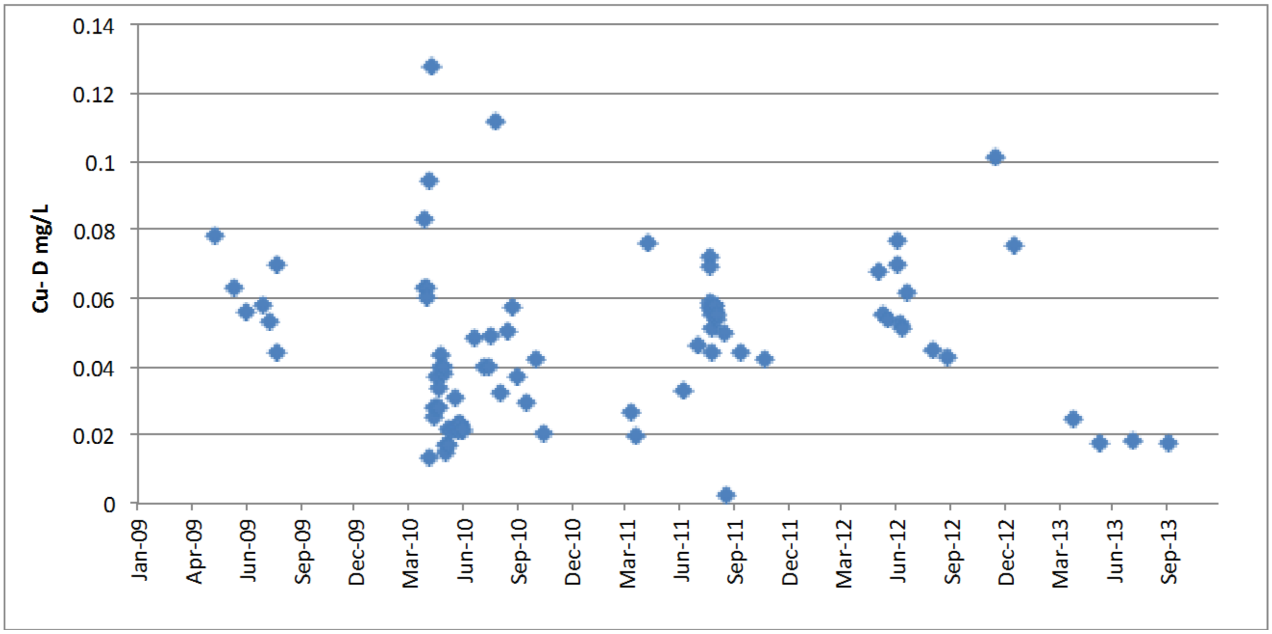


Figure 5-39: Dissolved copper concentrations at W37

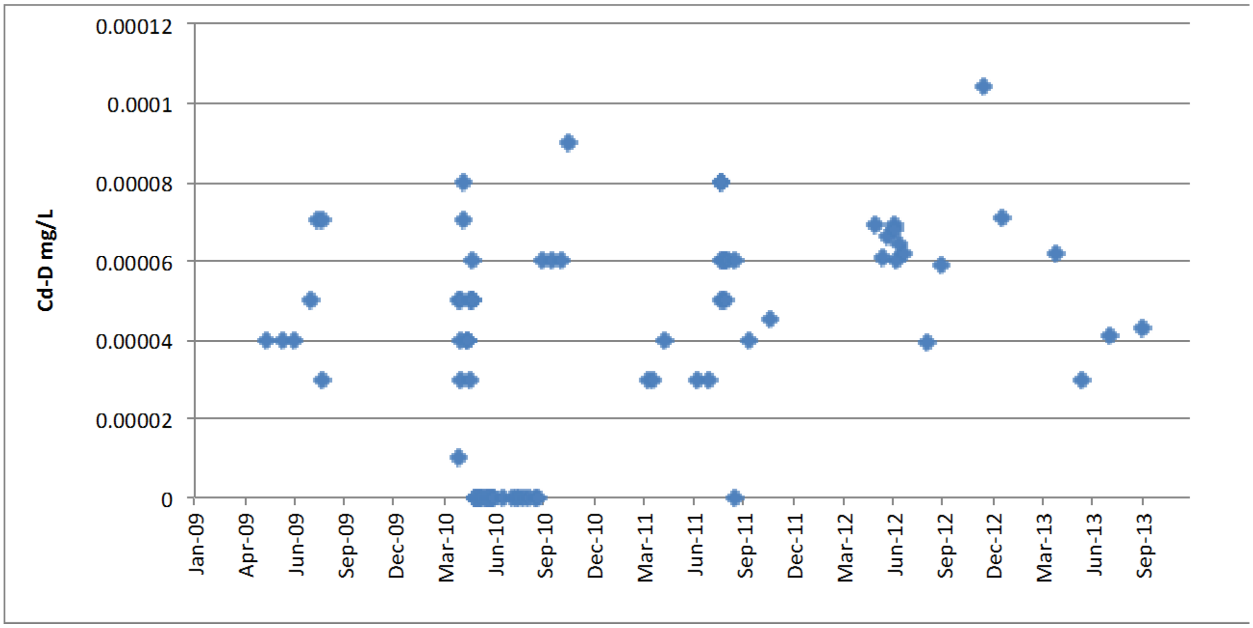


Figure 5-40: Dissolved cadmium concentrations at W37

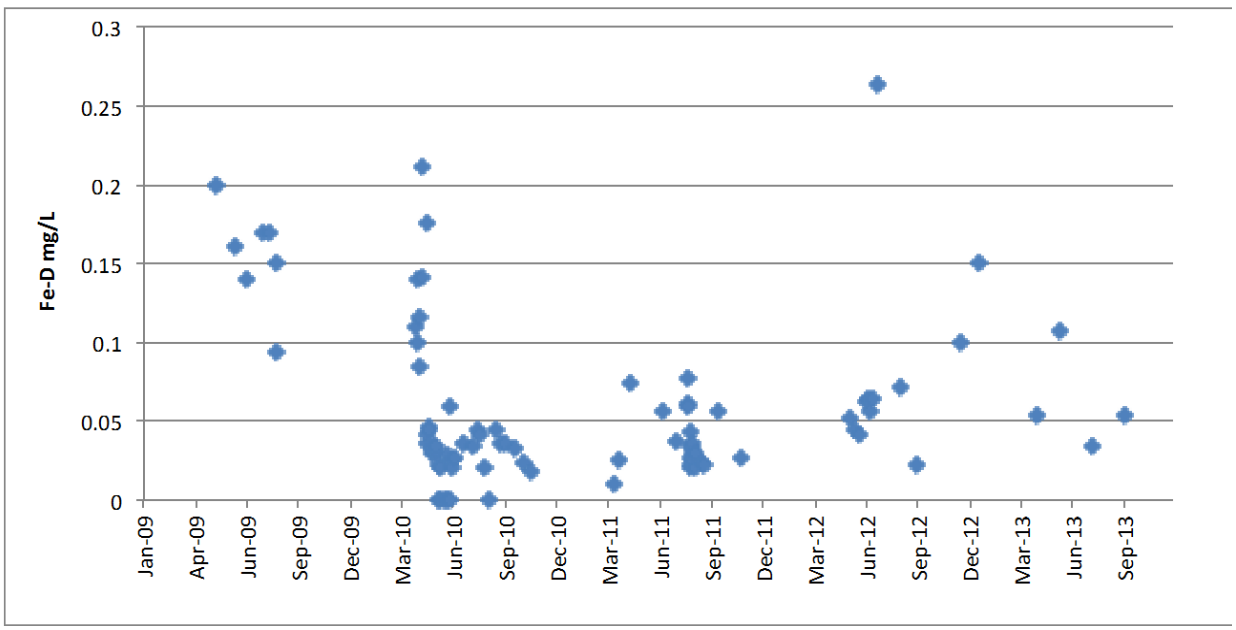


Figure 5-41: Dissolved iron concentrations at W37

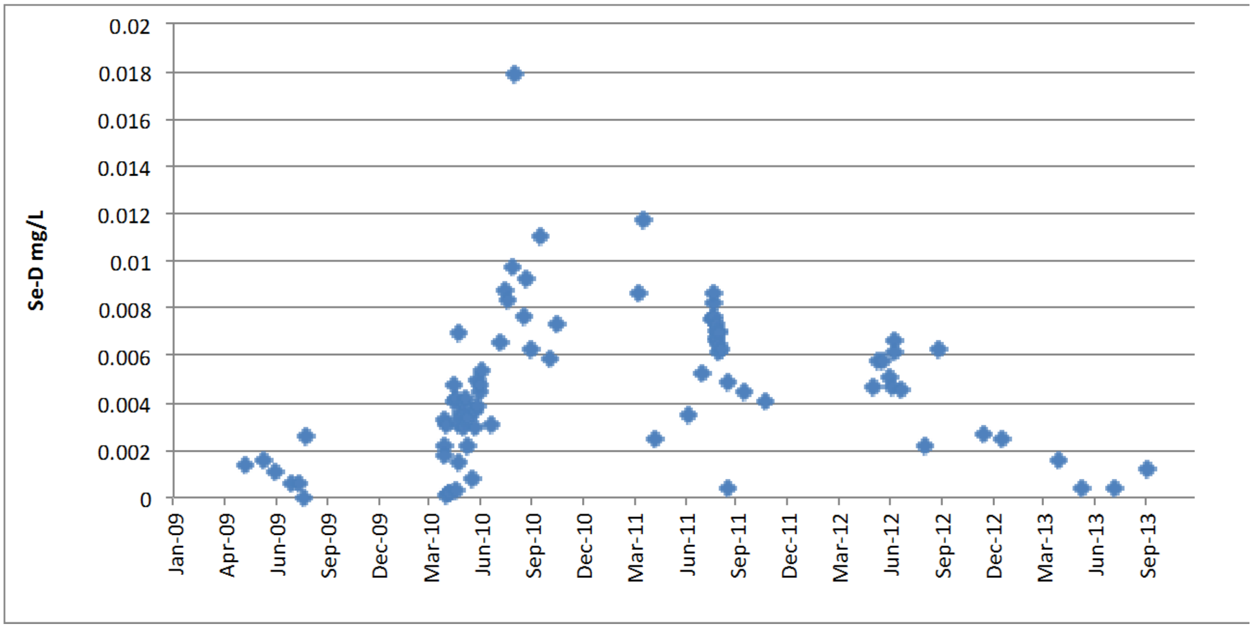


Figure 5-42: Dissolved selenium concentrations at W37

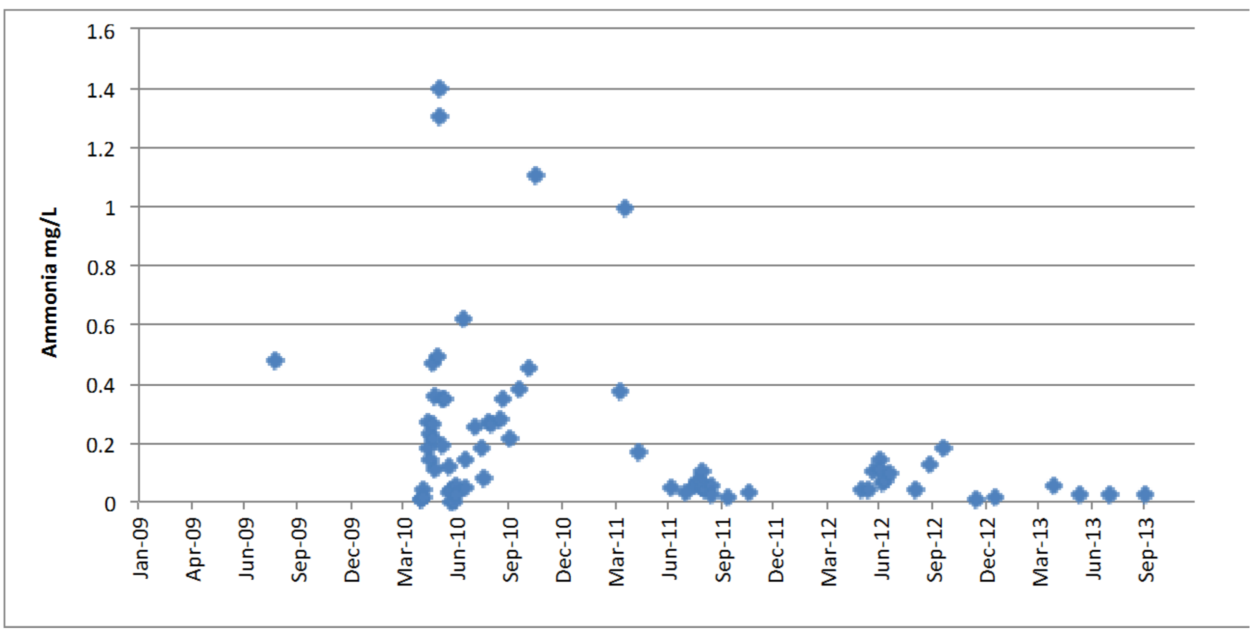


Figure 5-43: Ammonia concentrations at W37

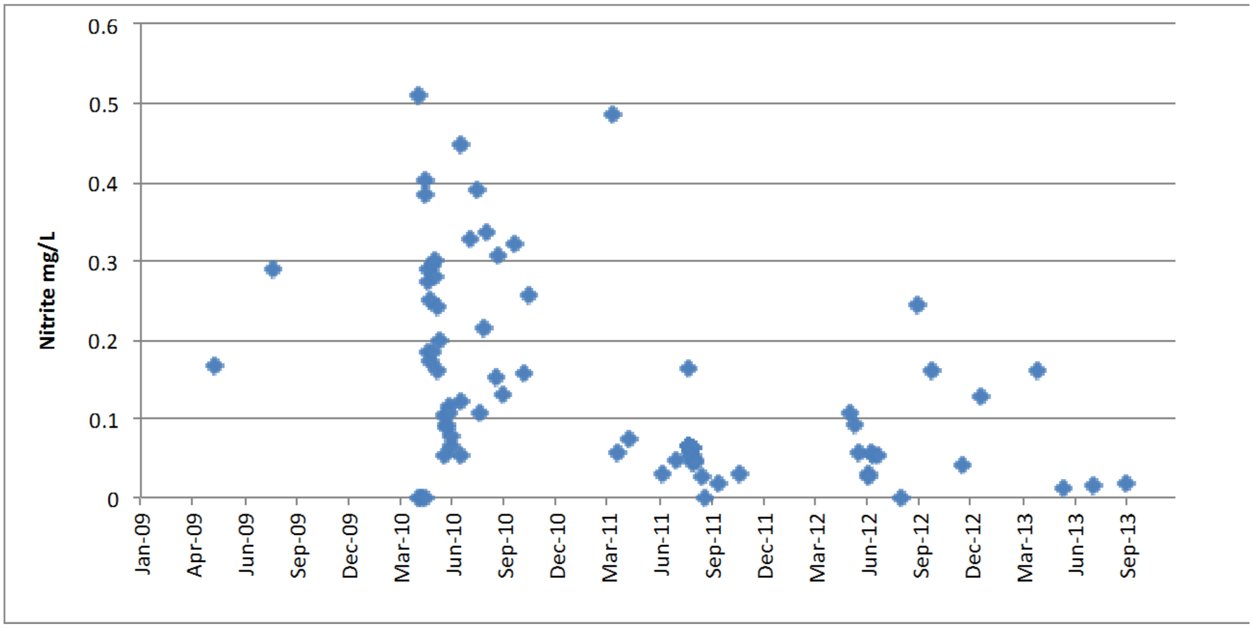


Figure 5-44: Nitrite concentrations at W37

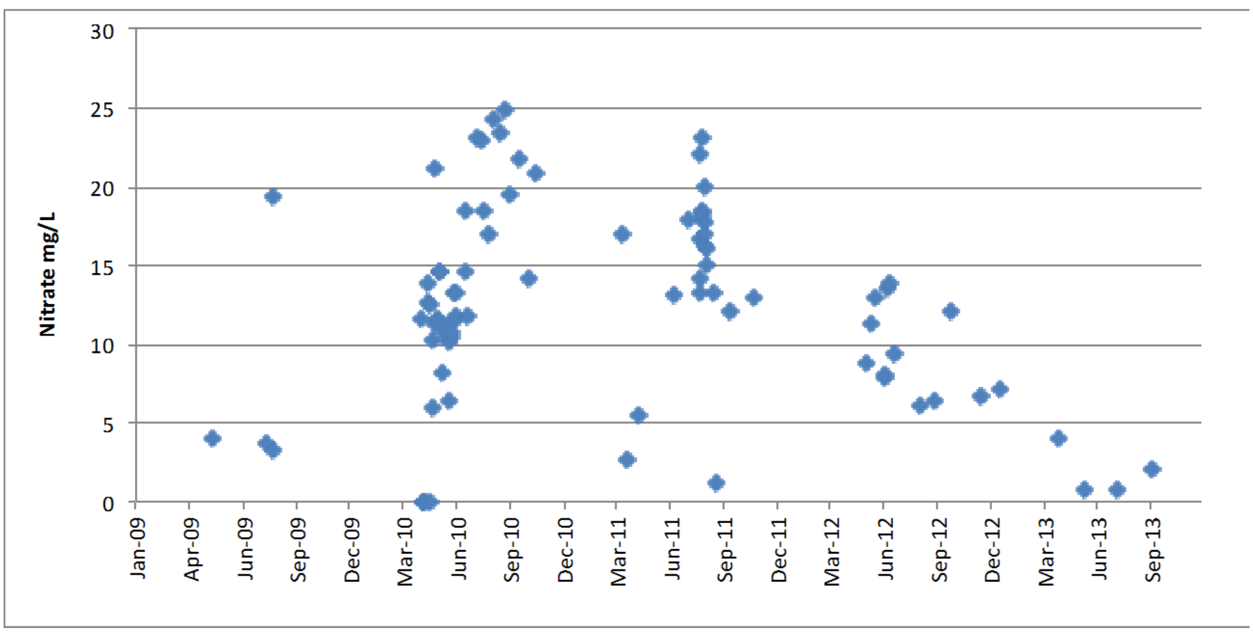


Figure 5-45: Nitrate concentrations at W37

5.4.4 Water Storage Pond Dam

Seepage quality at the Water Storage Pond Dam is represented from water quality at station W17. Water quality at station W17 is relatively consistent due to its being fed by a large stable body of water (Water Storage Pond). All dam seepage is collected in a vertical culvert and pumped back to the WSP via a 4” insulated heat traced pipe. Water quality results for W17 are outlined in Figure 5-46 through Figure

5-52 and include historic water quality results for dissolved copper, cadmium, iron, selenium and nutrient levels for ammonia, nitrite and nitrate.

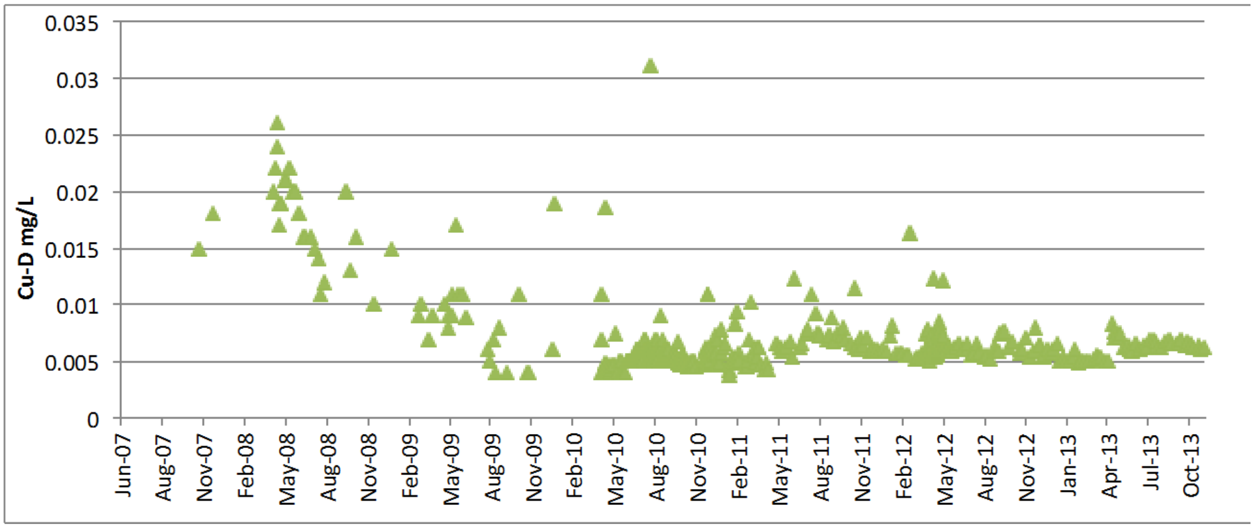
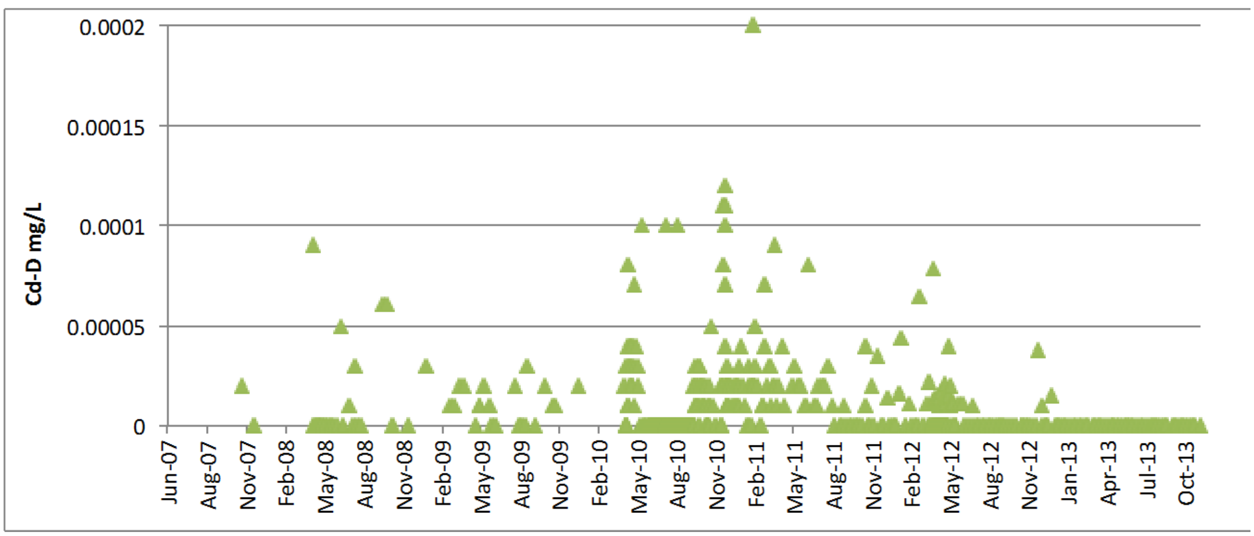
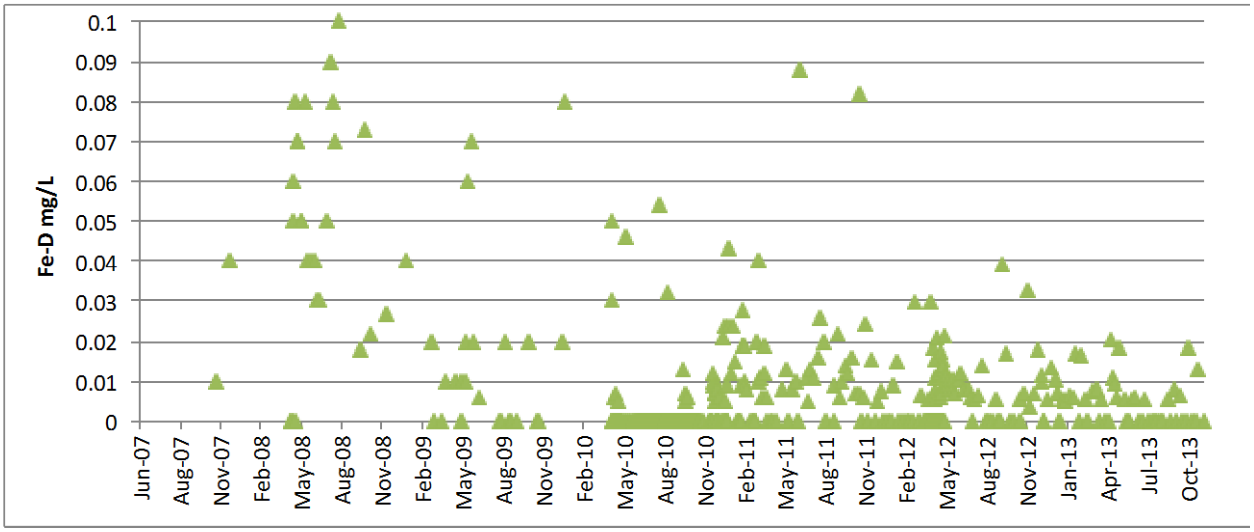


Figure 5-46: Dissolved copper concentrations at W17



Note: Outliers (i.e., concentrations one order of magnitude higher than the majority of samples) from August 24, 2010 (0.0016 mg/L); January 5, 2010 (0.00113 mg/L); May 27, 2009 (0.00208 mg/L); and June 3, 2009 (0.00278 mg/L) have been omitted from the above graph.

Figure 5-47: Dissolved cadmium concentrations at W17



Note: An outlier (i.e., concentrations one order of magnitude higher than the majority of samples) from April 26, 2010 (0.358 mg/L) has been omitted from the above graph.

Figure 5-48: Dissolved iron concentrations at W17

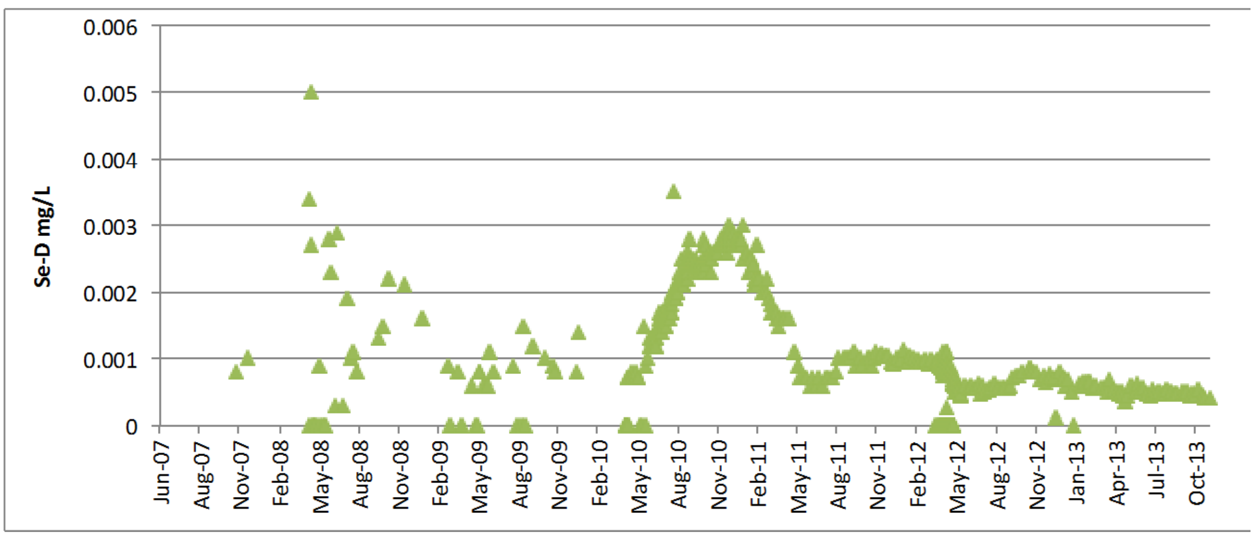
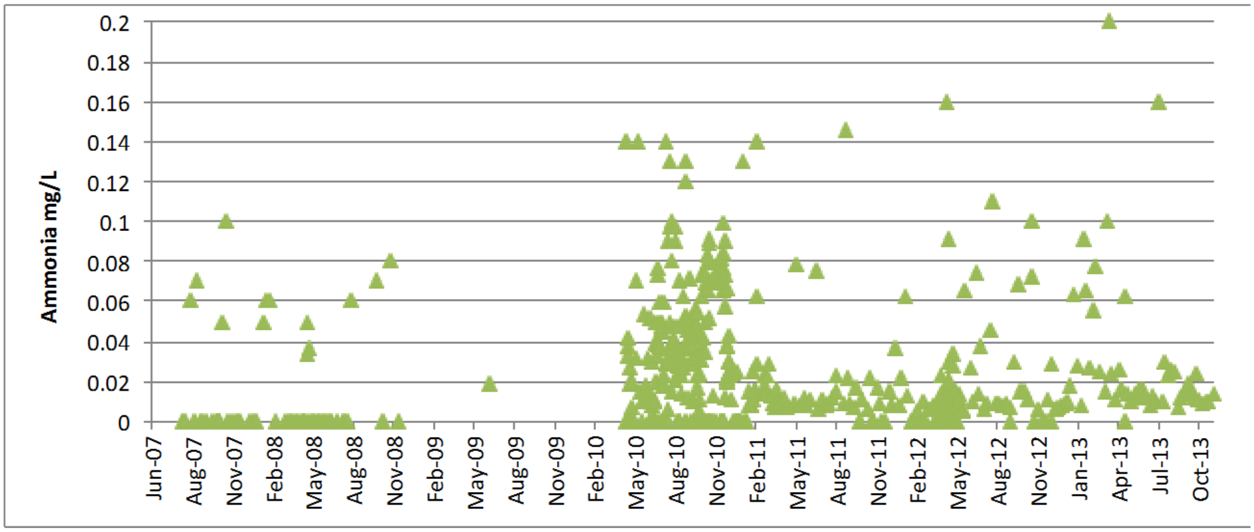
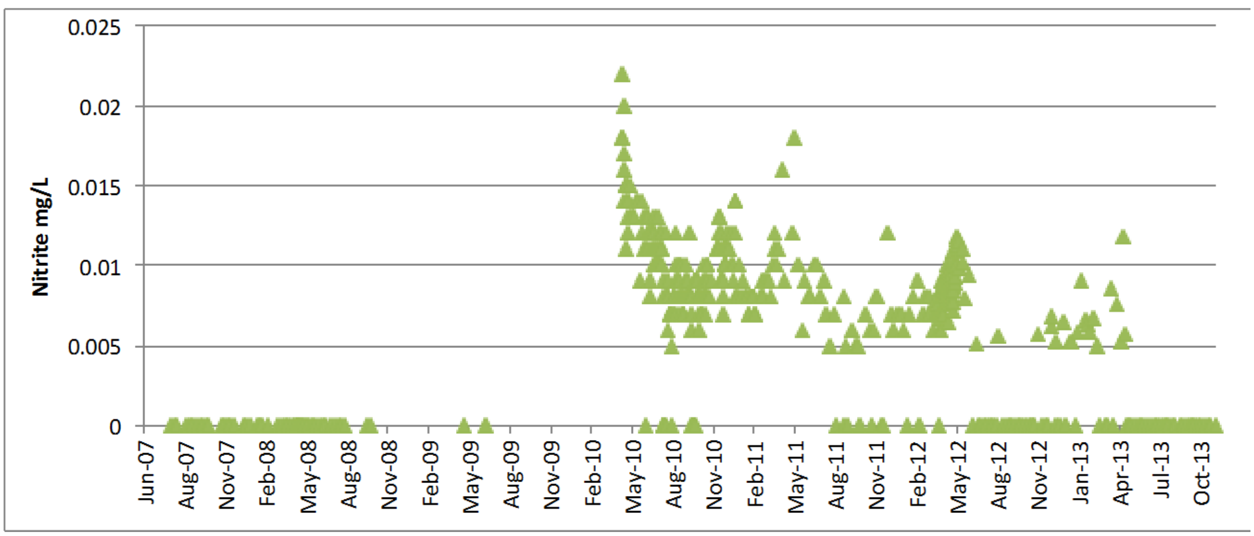


Figure 5-49: Dissolved selenium concentrations at W17



Note: Outliers (i.e., concentrations one order of magnitude higher than the majority of samples) from February 26, 2011 (0.85 mg/L) and April 28, 2010 (0.8 mg/L) have been omitted from the above graph.

Figure 5-50: Ammonia concentrations at W17



Note: An outlier (i.e., concentrations one order of magnitude higher than the majority of samples) from October 20, 2007 (7.84 mg/L) has been omitted from the above graph.

Figure 5-51: Nitrite concentrations at W17

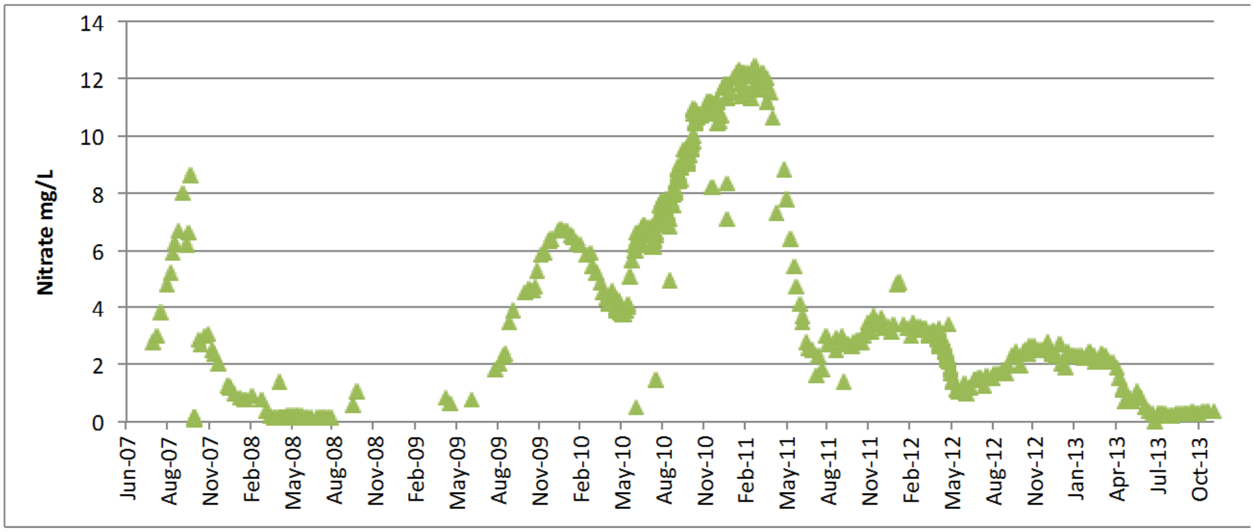


Figure 5-52: Nitrate concentrations at W17

5.4.5 Dry Stack Tailings Storage Facility

Water flows out along the tailings diversion ditch road and travels along the toe of the south side of the DSTF. Samples were taken as close to the source and to previous seepage survey locations as possible, within ±10m of the original GPS location. Seepage water quality monitoring sites SS10, SS17 and SS18 are taken from the tailings diversion ditch and the South side of the dry stack tailings facility, and are monitored during spring and fall. Water quality results for SS10, SS17 and SS18 are outlined in Figure 5-53 through Figure 5-59 and include historic water quality results for dissolved copper, cadmium, iron, selenium and nutrient levels for ammonia, nitrite and nitrate.

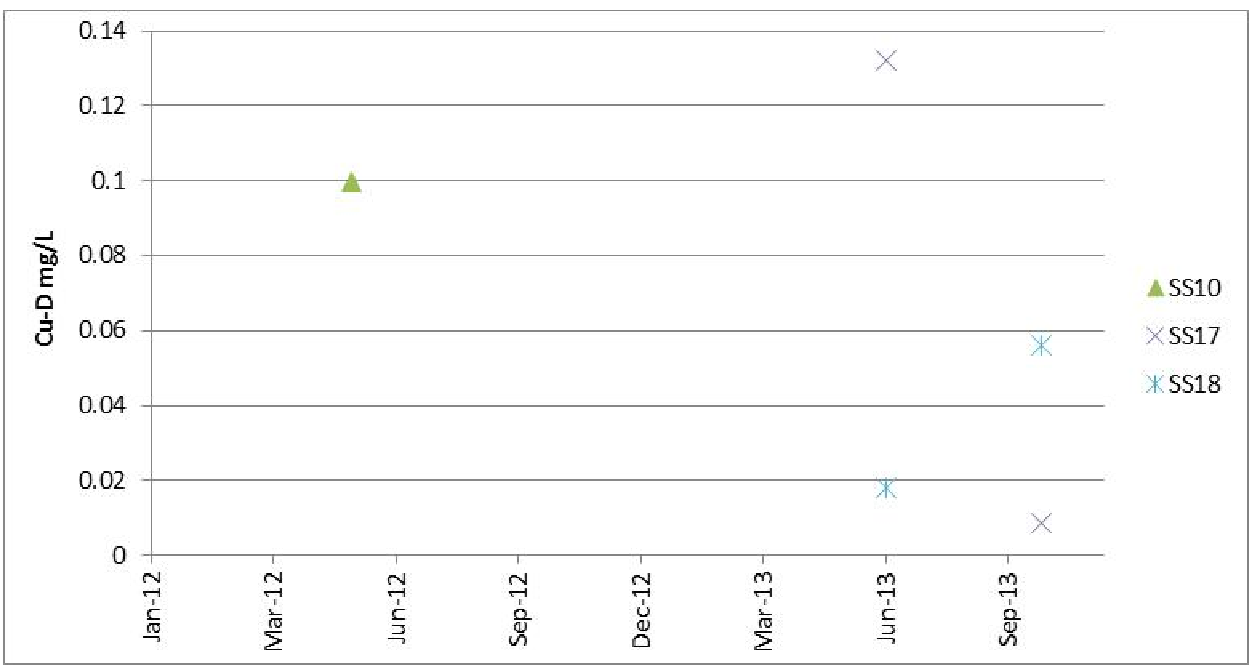


Figure 5-53: Dissolved copper concentrations around the Dry Stack Tailings Facility

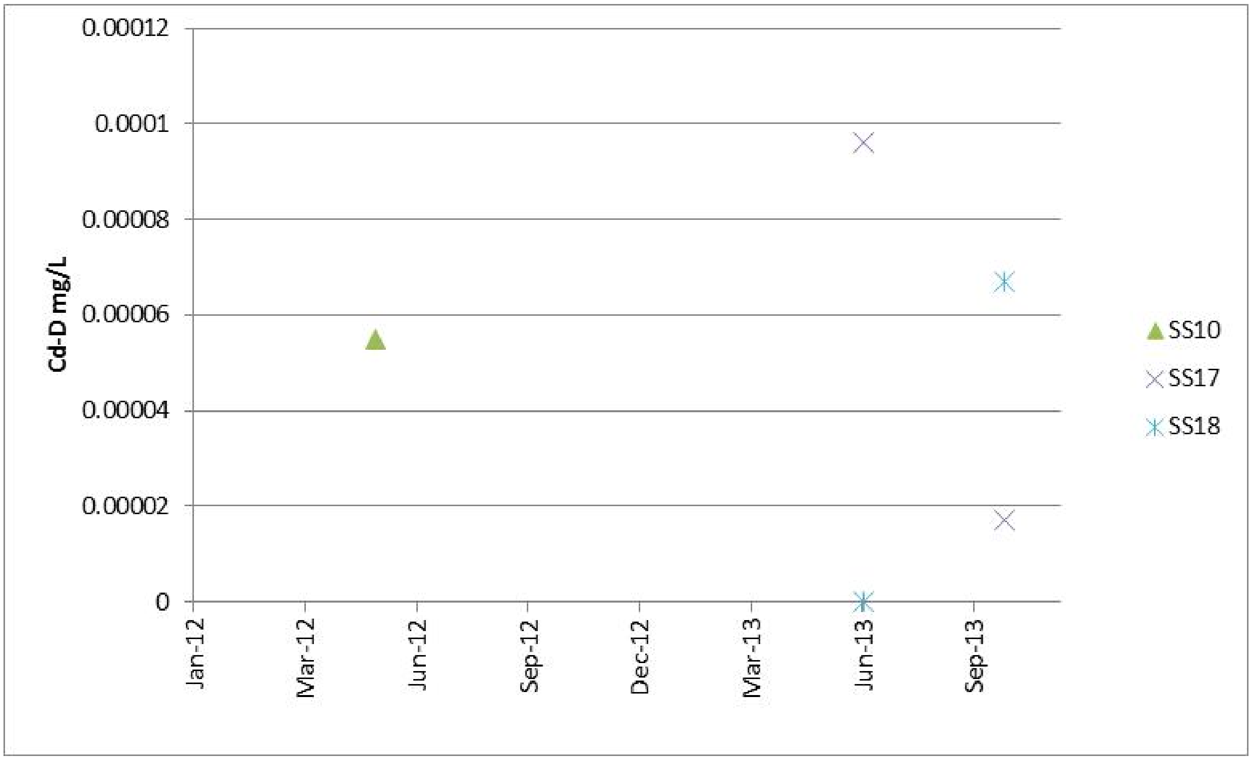


Figure 5-54: Dissolved cadmium concentrations around the Dry Stack Tailings Facility

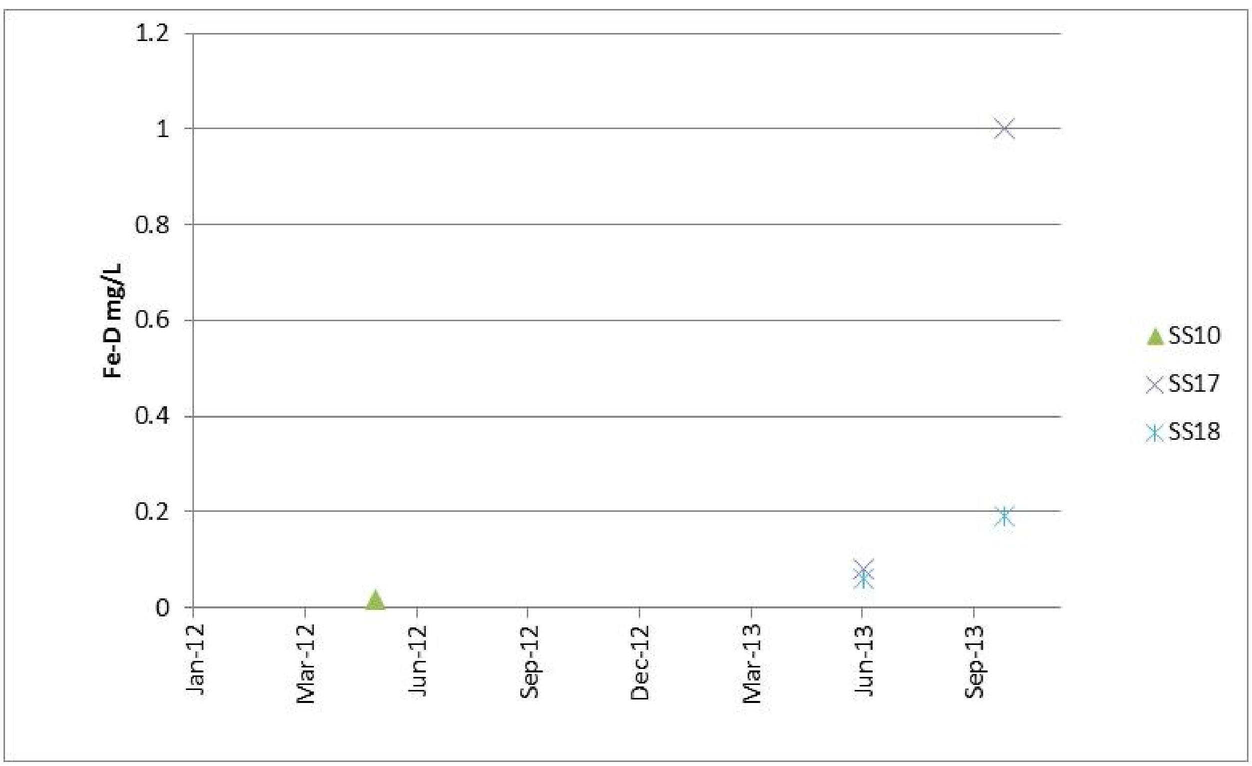


Figure 5-55: Dissolved iron concentrations around the Dry Stack Tailings Facility

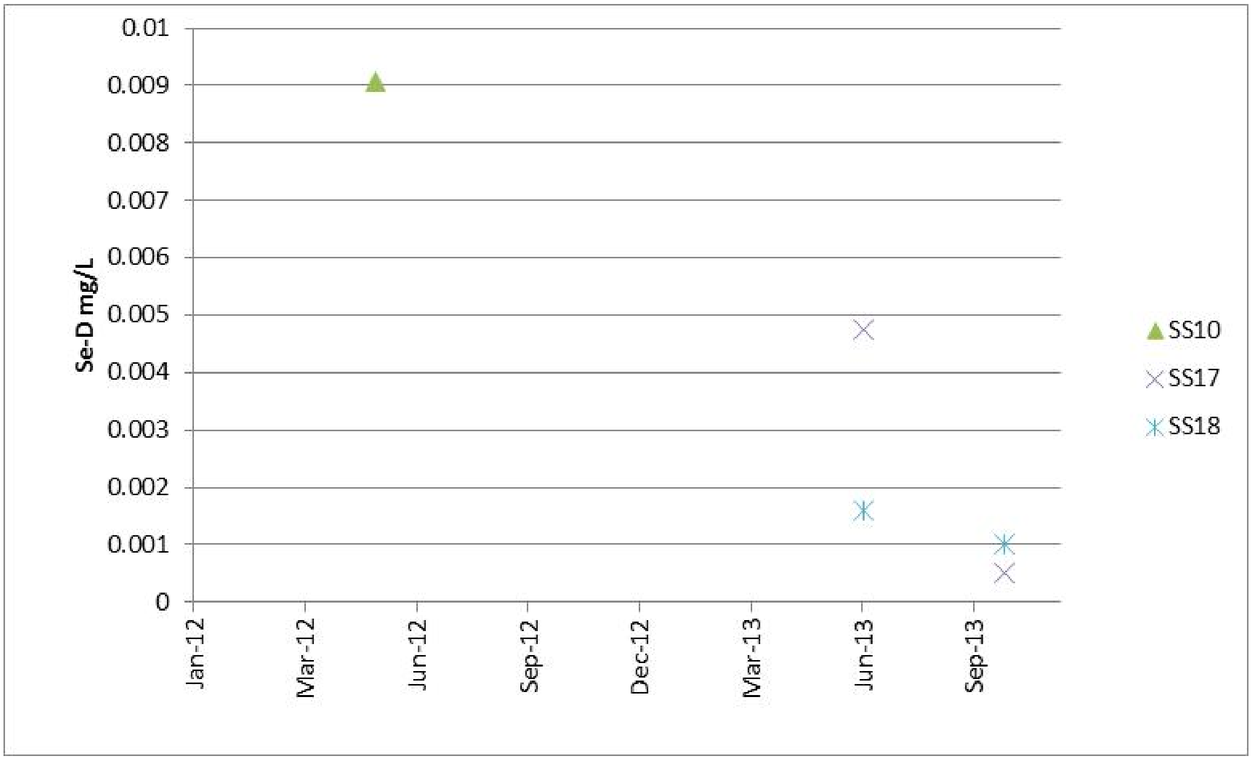


Figure 5-56: Dissolved selenium concentrations around the Dry Stack Tailings Facility

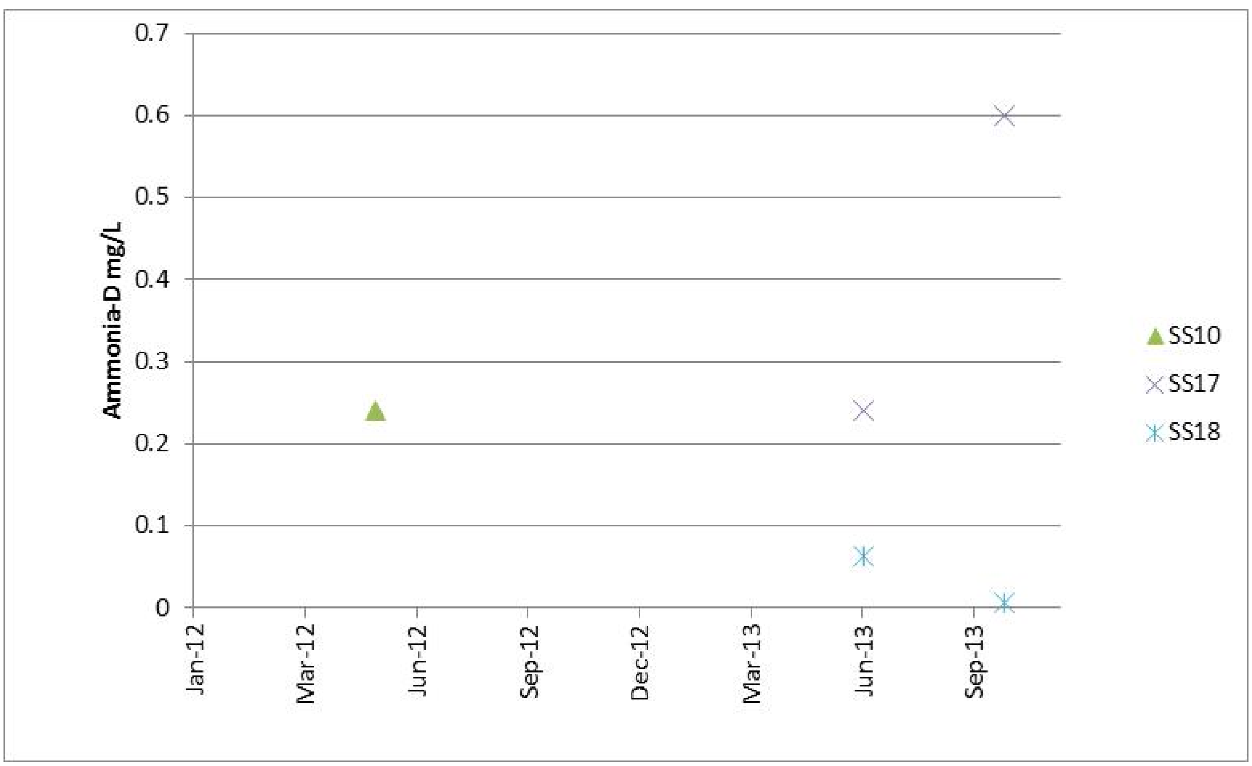


Figure 5-57: Ammonia concentrations around the Dry Stack Tailings Facility

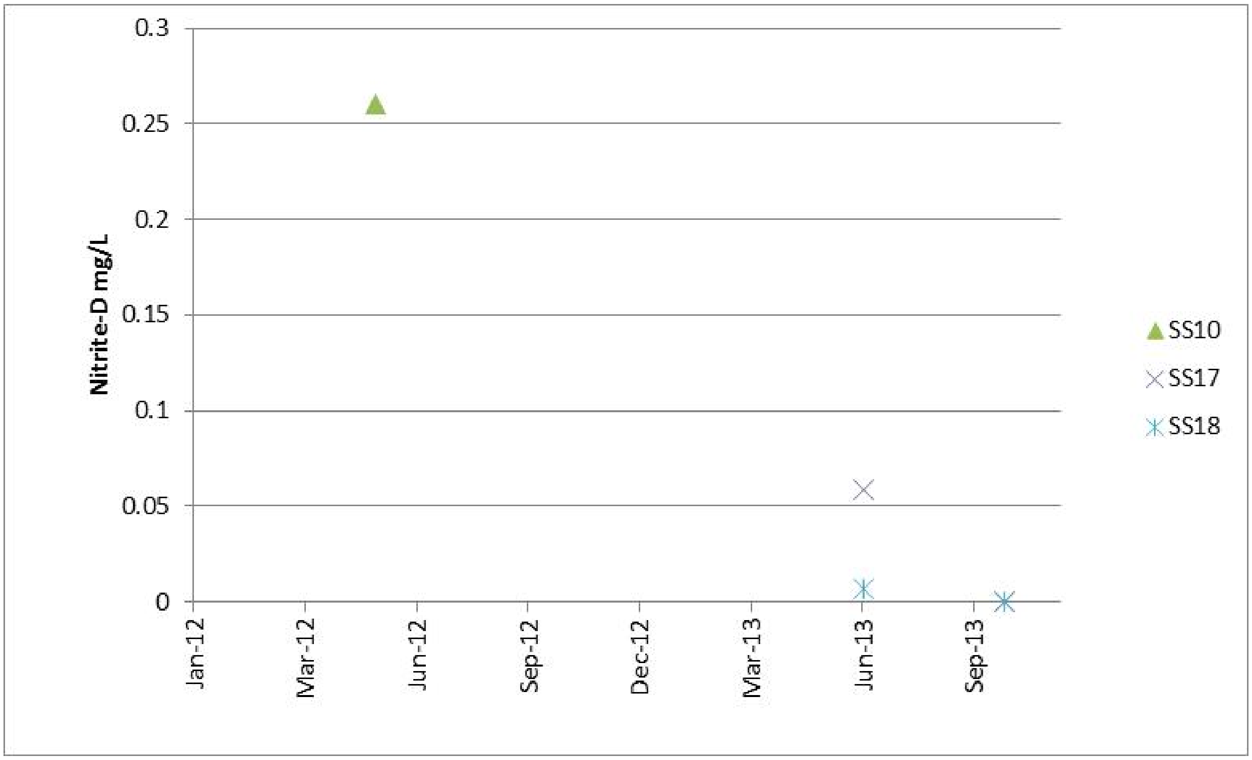


Figure 5-58: Nitrite concentrations around the Dry Stack Tailings Facility

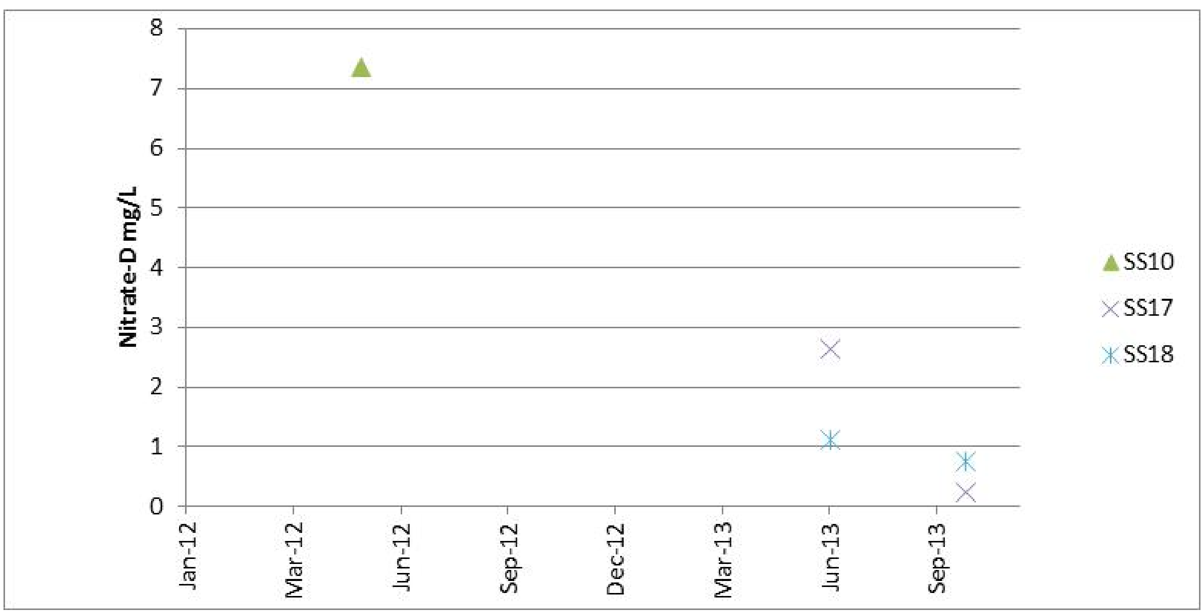


Figure 5-59: Nitrate concentrations around the Dry Stack Tailings Facility

5.4.6 South East side of the Yellow Ore Stockpile

Surface seepage runs along the toe of the yellow ore stockpile and into the ditch parallel to the heavy vehicle road. All seeps in this area drain into the ore stockpile sump and are pumped to the Main pit. Seepage water quality monitoring stations SS5, SS6, SS7, SS8 and SS24 capture seepage from the stockpile, and are monitored during spring and fall. Water quality results are outlined in Figure 5-60 through Figure 5-66 and include historic water quality results for dissolved copper, cadmium, iron, selenium and nutrient levels for ammonia, nitrite and nitrate.

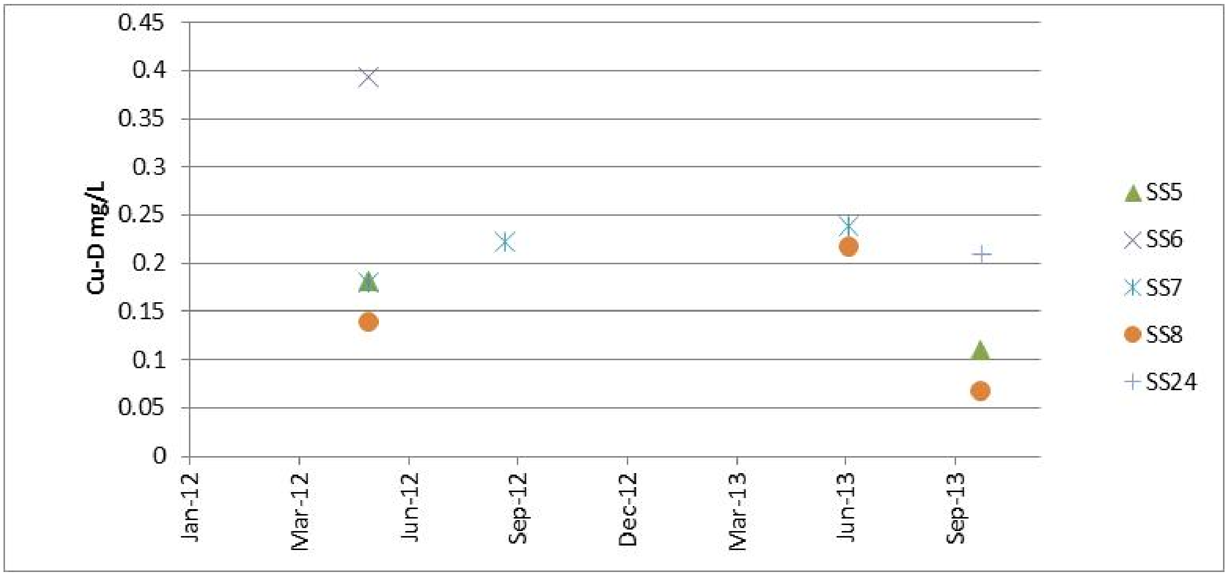


Figure 5-60: Dissolved copper concentrations for seepage at the toe of the yellow stockpile

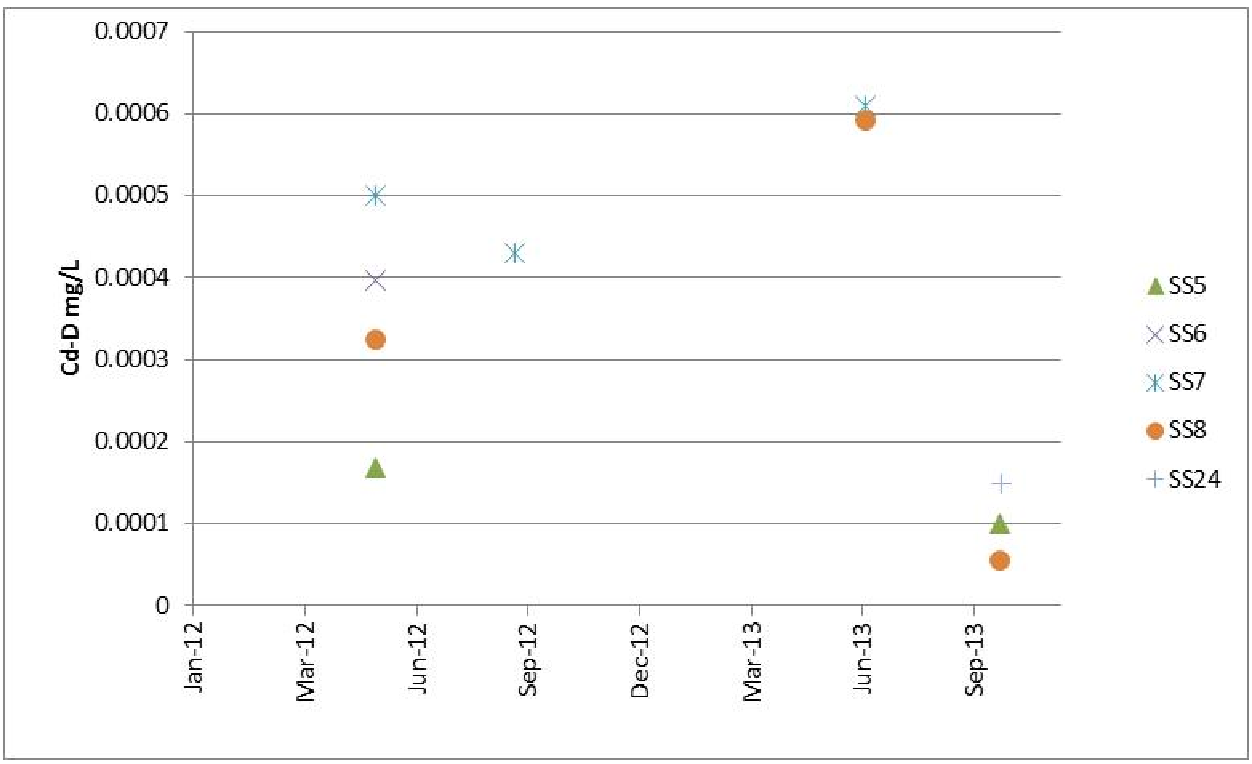


Figure 5-61: Dissolved cadmium concentrations for seepage at the toe of the yellow stockpile

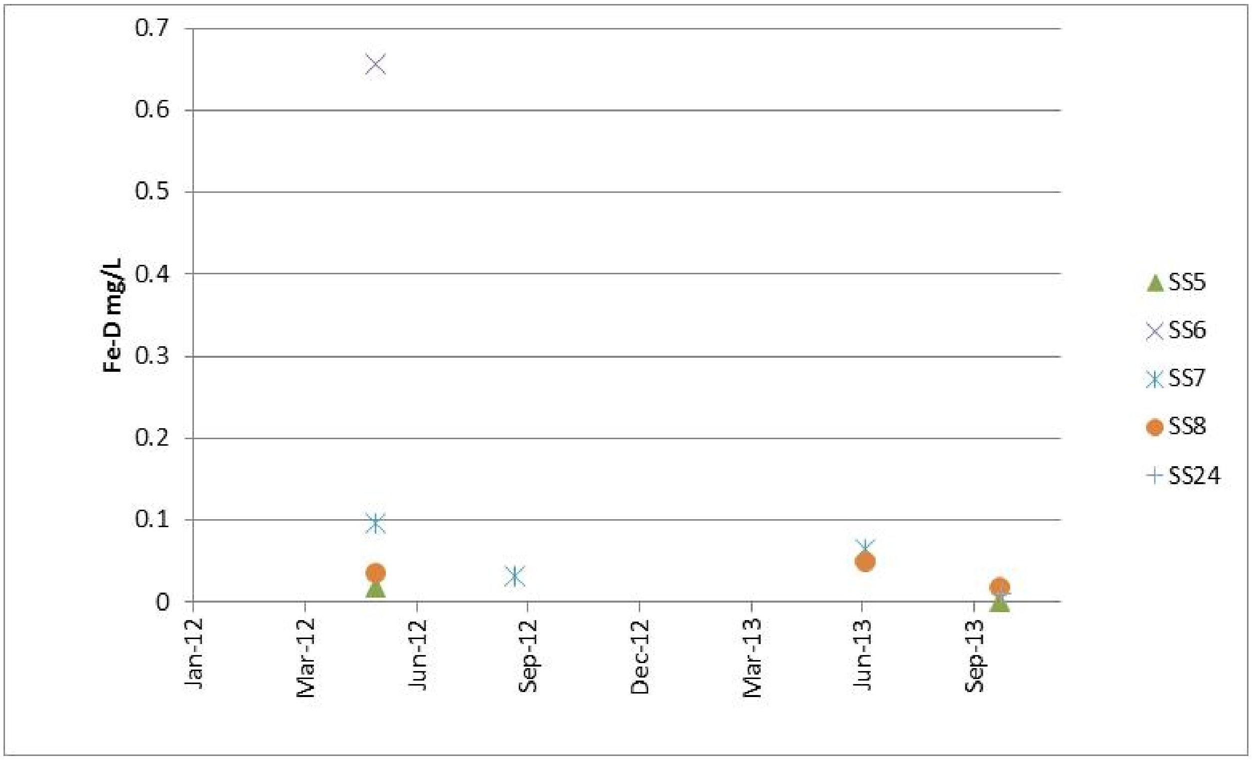


Figure 5-62: Dissolved iron concentrations for seepage at the toe of the yellow stockpile

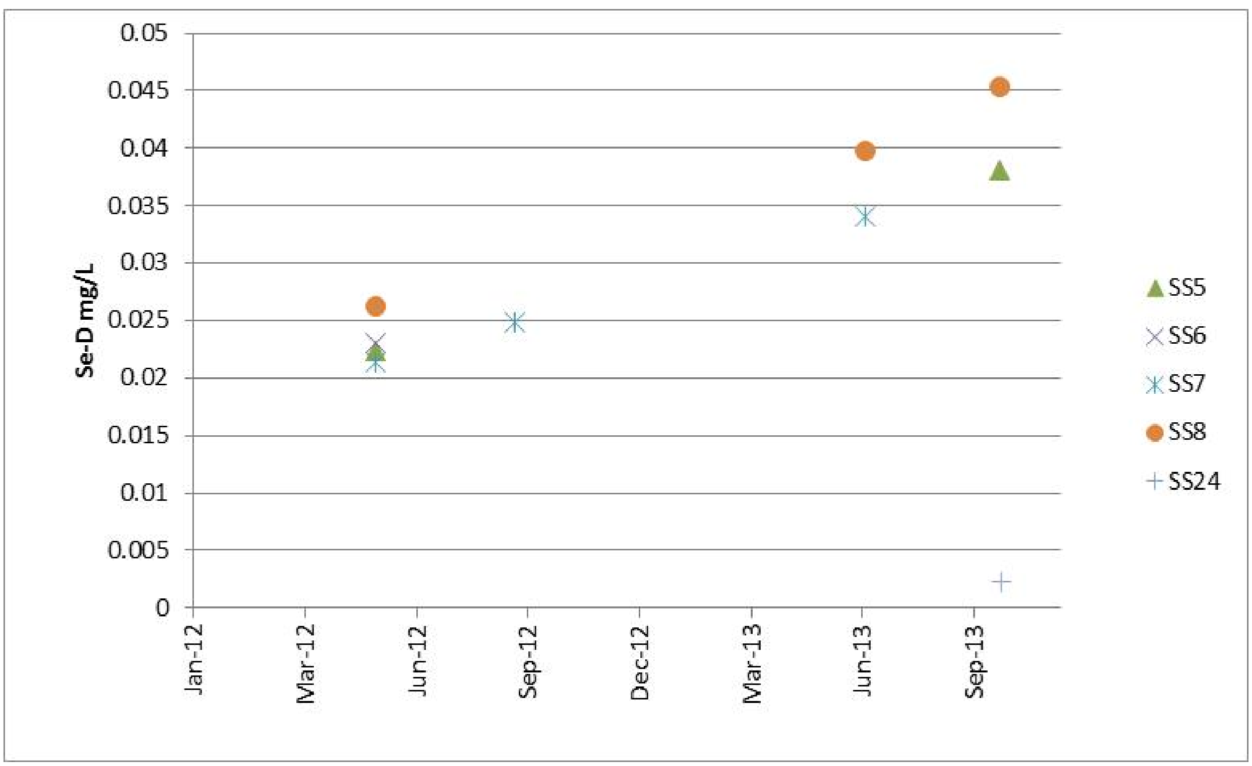


Figure 5-63: Dissolved selenium concentrations for seepage at the toe of the yellow stockpile

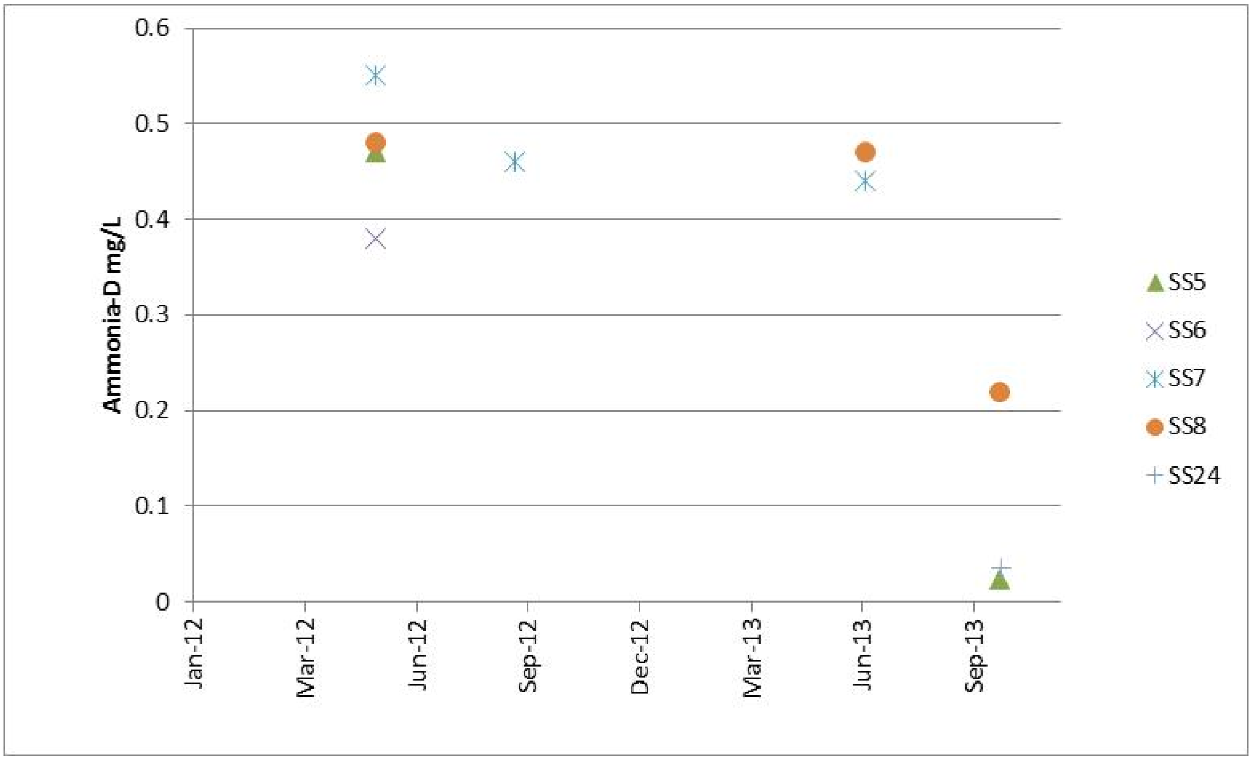


Figure 5-64: Ammonia concentrations for seepage at the toe of the yellow stockpile

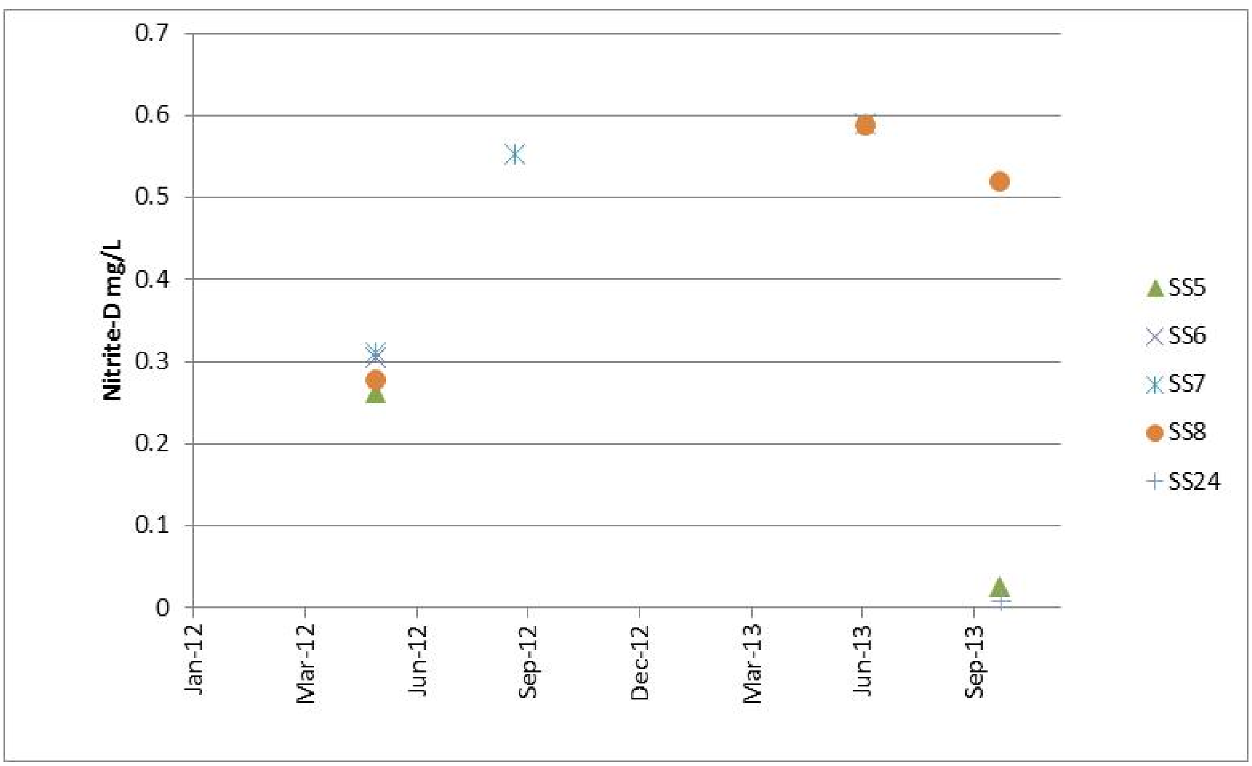


Figure 5-65: Nitrite concentrations for seepage at the toe of the yellow stockpile

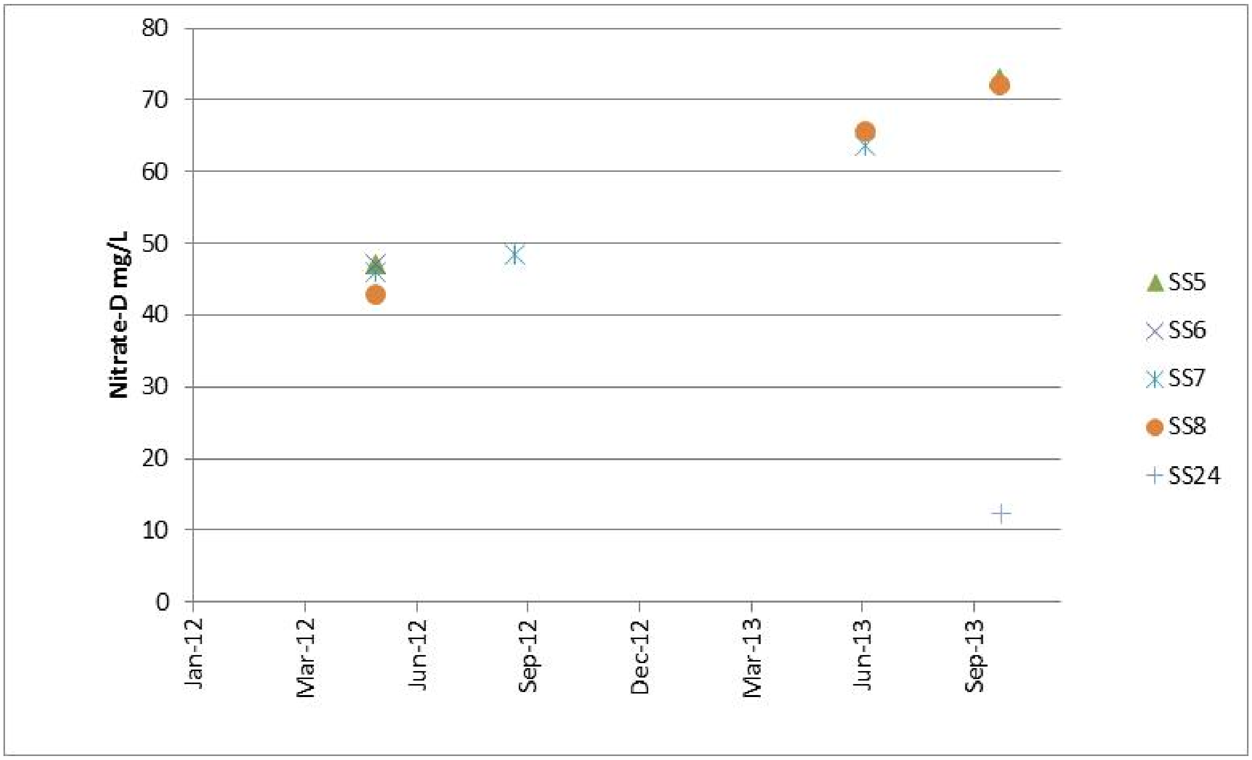


Figure 5-66: Nitrate concentrations for seepage at the toe of the yellow stockpile

5.4.7 Reclamation Overburden Dump

The majority of sample locations at the reclamation overburden dump (ROD) are seepage from original ground which runs along the toe of the overburden dumps at various locations. Seepage water quality monitoring stations SS1, SS3, SS11, SS14 and SS15 capture seepage from the ROD, and are monitored during spring and fall. Water quality results are outlined in Figure 5-67 through Figure 5-73 and include historic water quality results for dissolved copper, cadmium, iron, selenium and nutrient levels for ammonia, nitrite and nitrate.

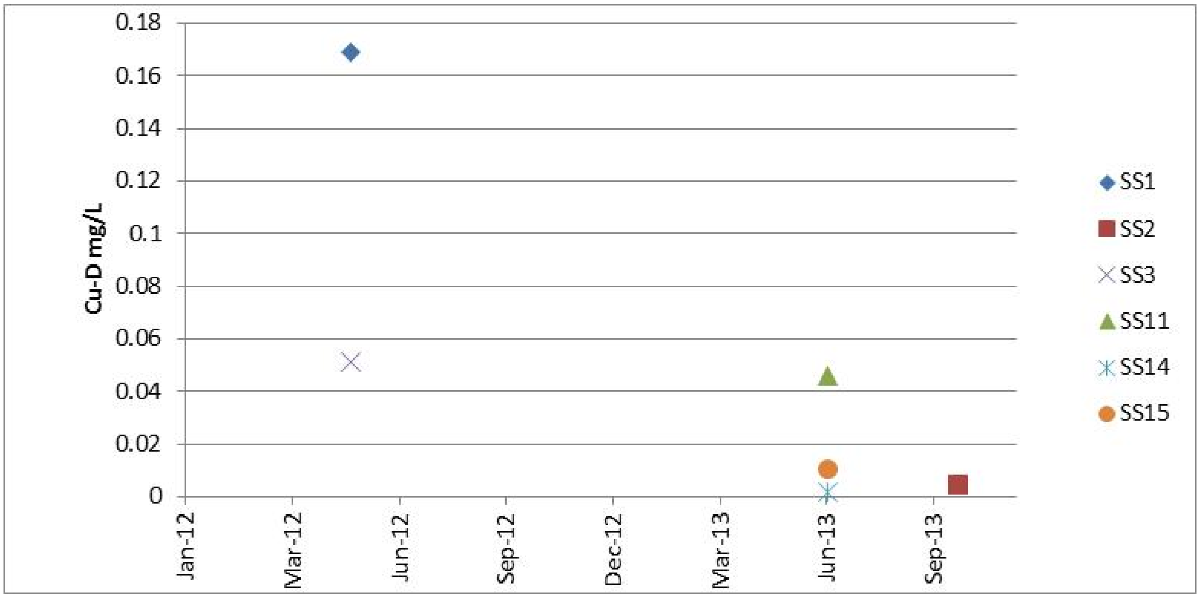


Figure 5-67: Dissolved copper concentrations at the ROD

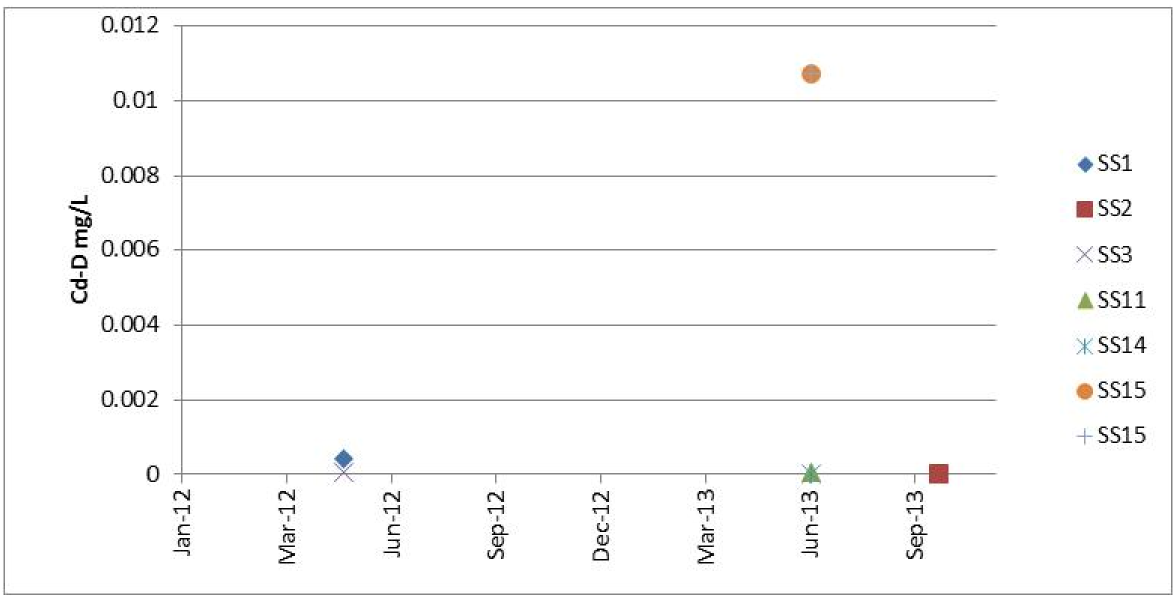


Figure 5-68: Dissolved cadmium concentrations at ROD

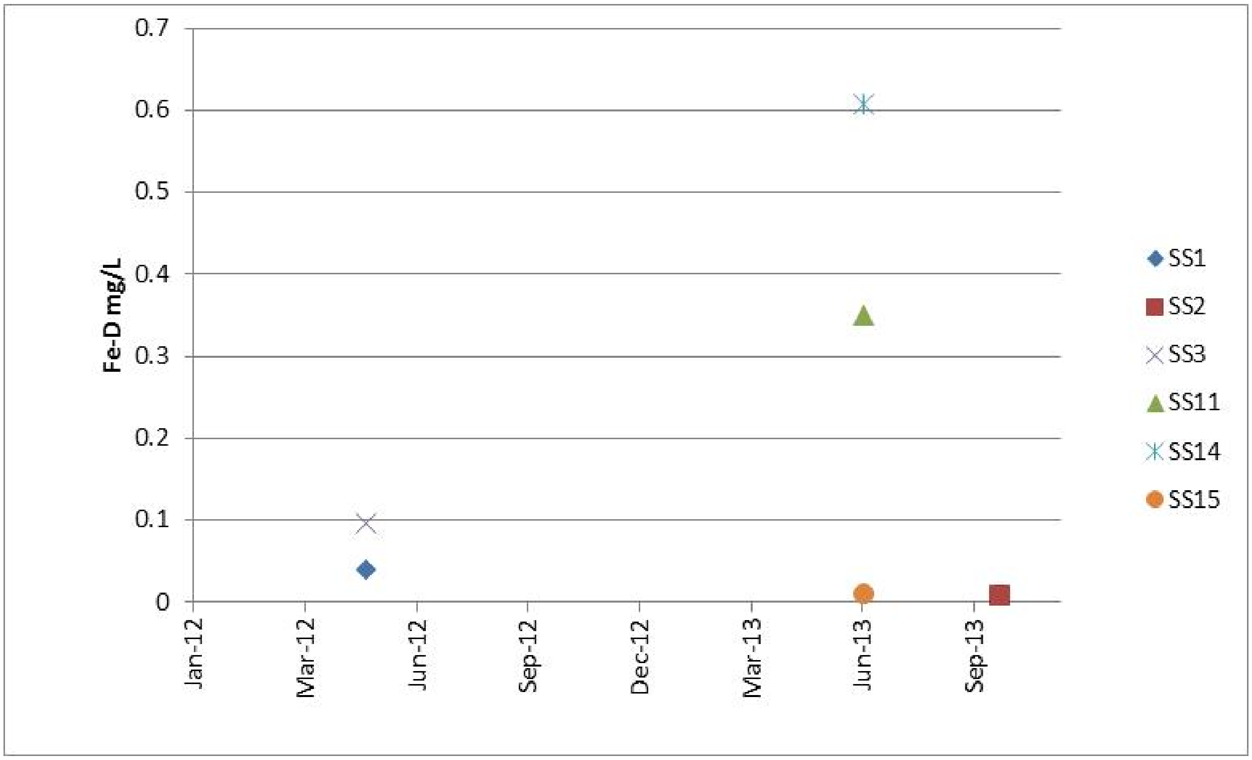


Figure 5-69: Dissolved iron concentrations at ROD

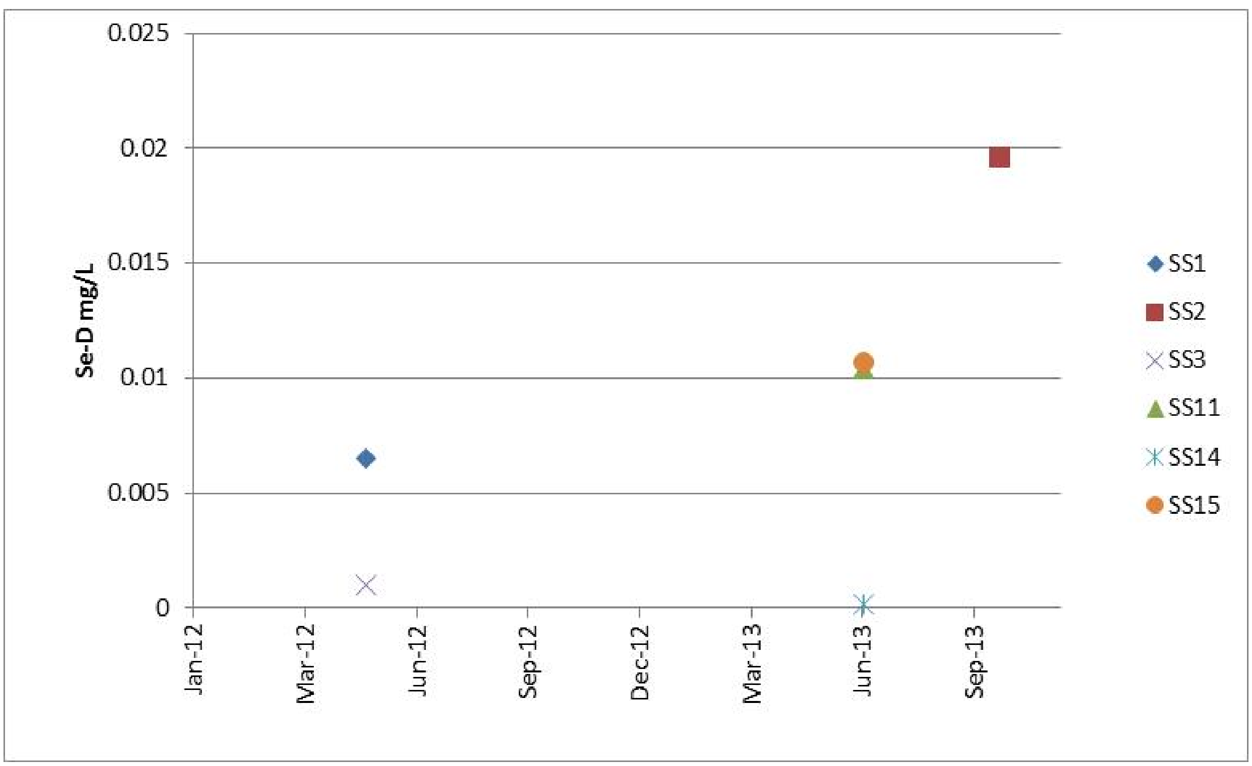


Figure 5-70: Dissolved selenium concentrations at ROD

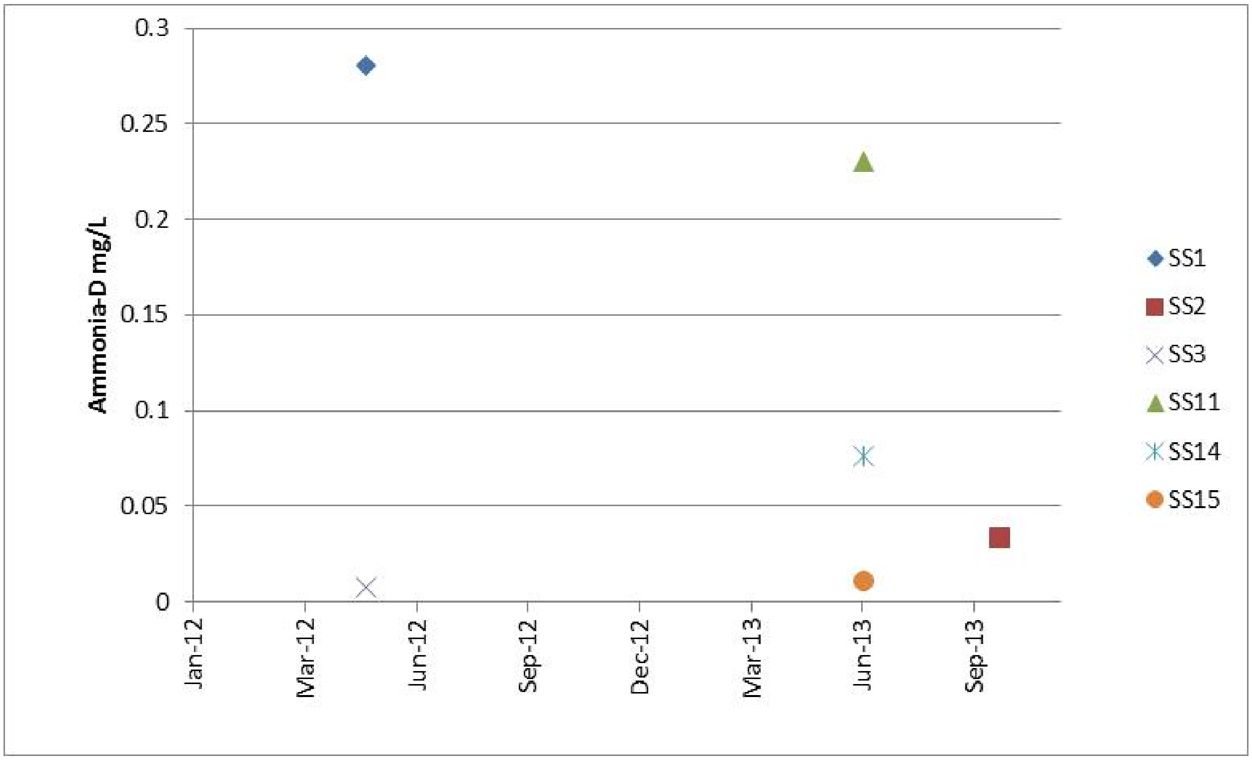


Figure 5-71: Ammonia concentrations at ROD

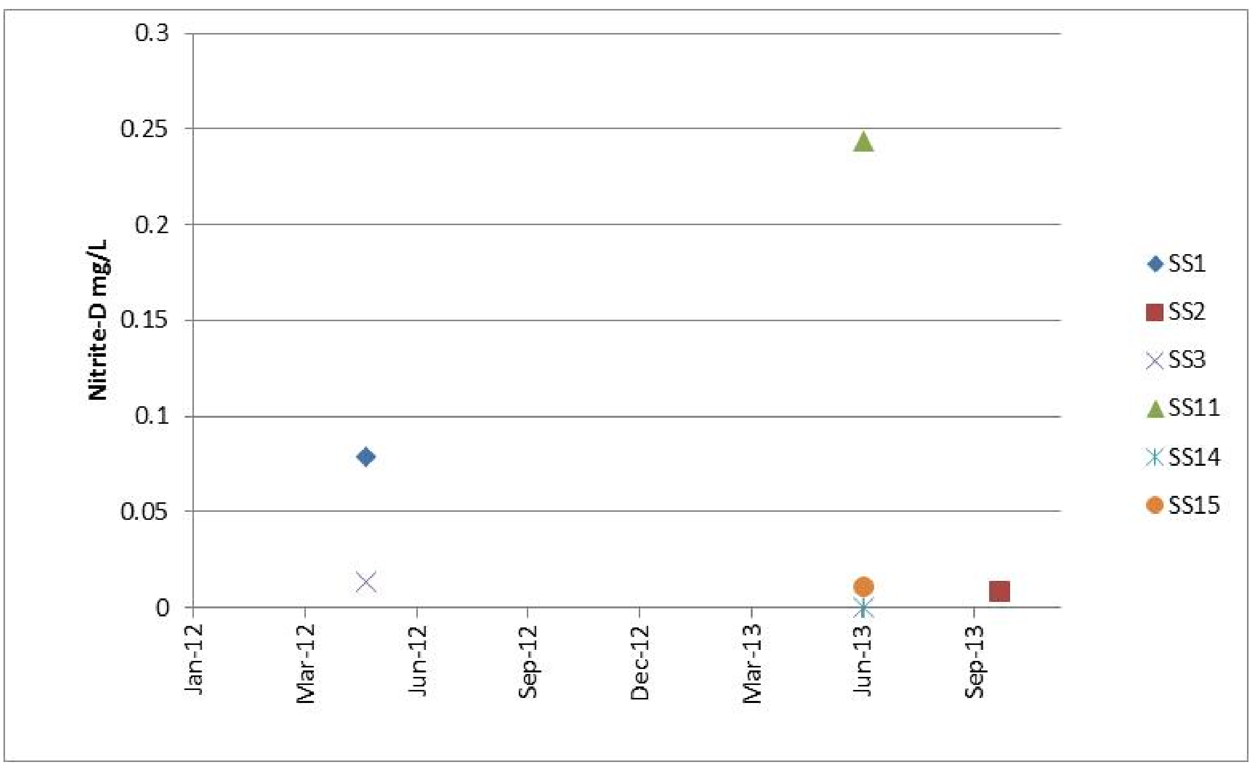


Figure 5-72: Nitrite concentrations at ROD

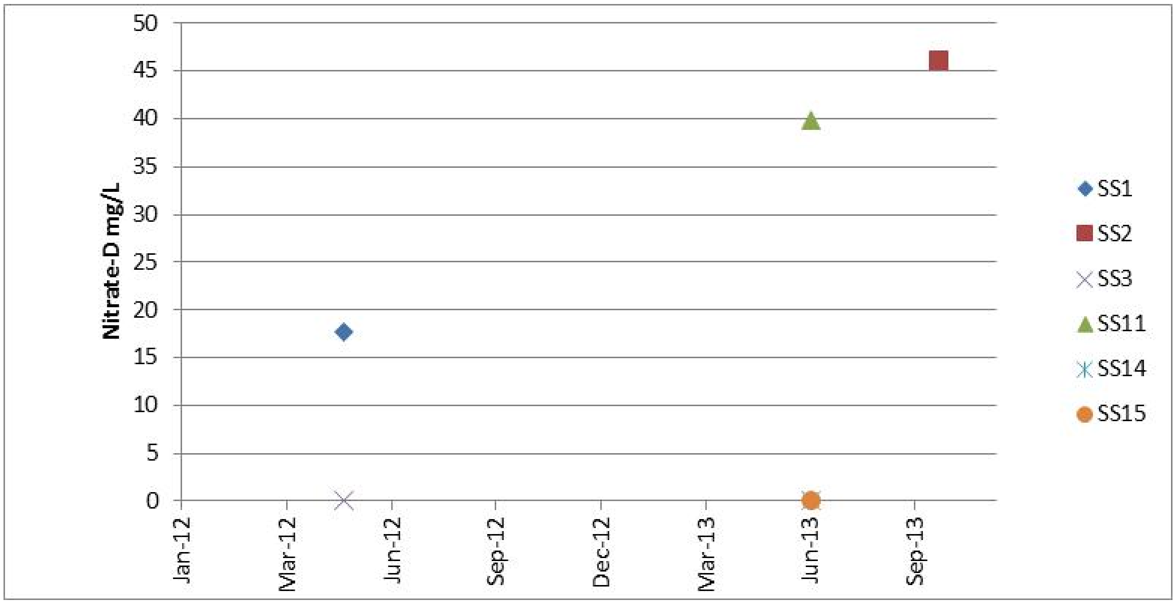


Figure 5-73: Nitrate concentrations at ROD

5.4.8 Main Waste Dump

Seepage found around the main waste dump daylights from original ground and runs over onto the Main Waste Dump. Seepage from the main waste dump is captured at water quality monitoring stations SS12, SS16 and SS23 and water quality results are summarized in Figure 5-74 through Figure 5-80 and include historic water quality results for dissolved copper, cadmium, iron, selenium and nutrient levels for ammonia, nitrite and nitrate.

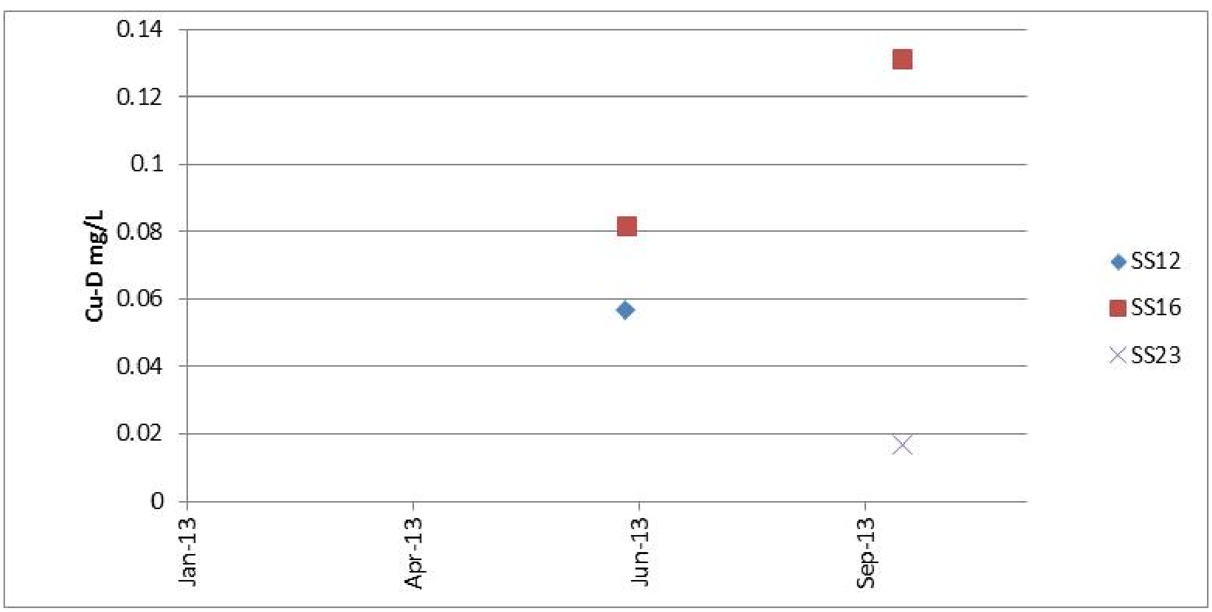


Figure 5-74: Dissolved copper concentrations at SS12, SS16, SS23

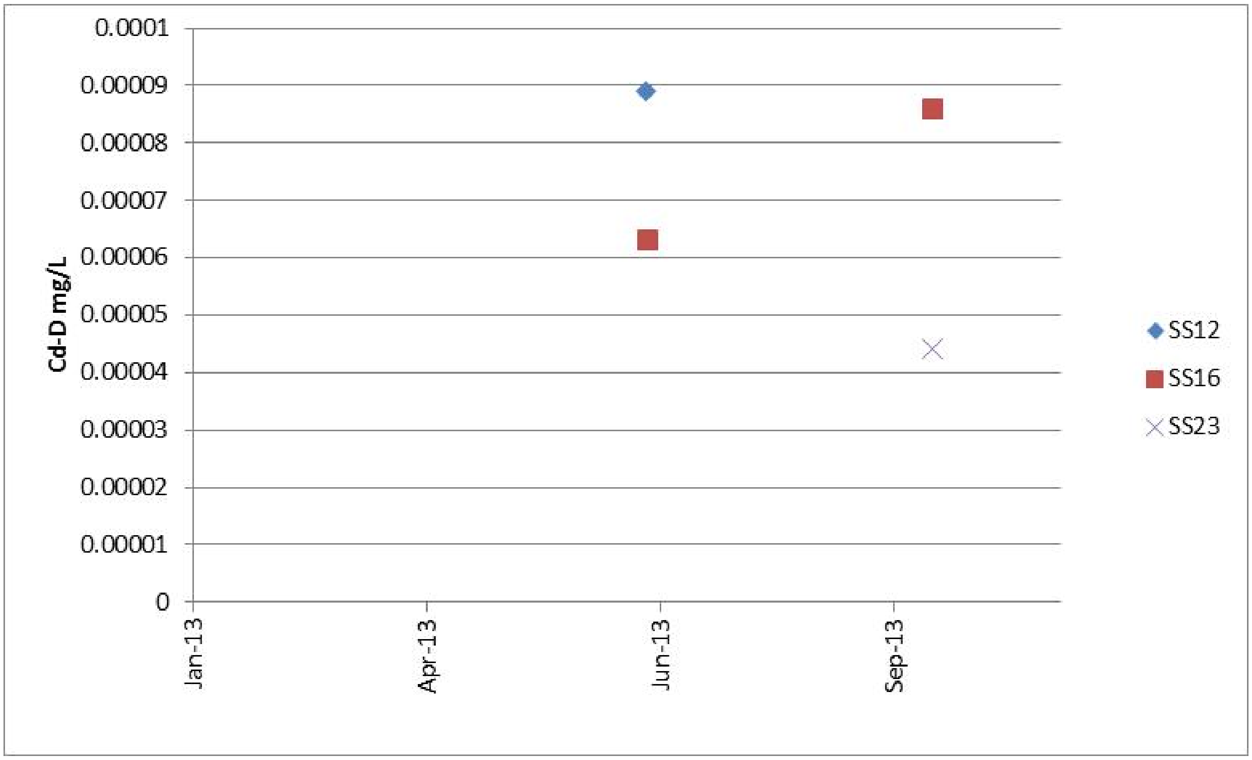


Figure 5-75: Dissolved cadmium concentrations at SS12, SS16, SS23

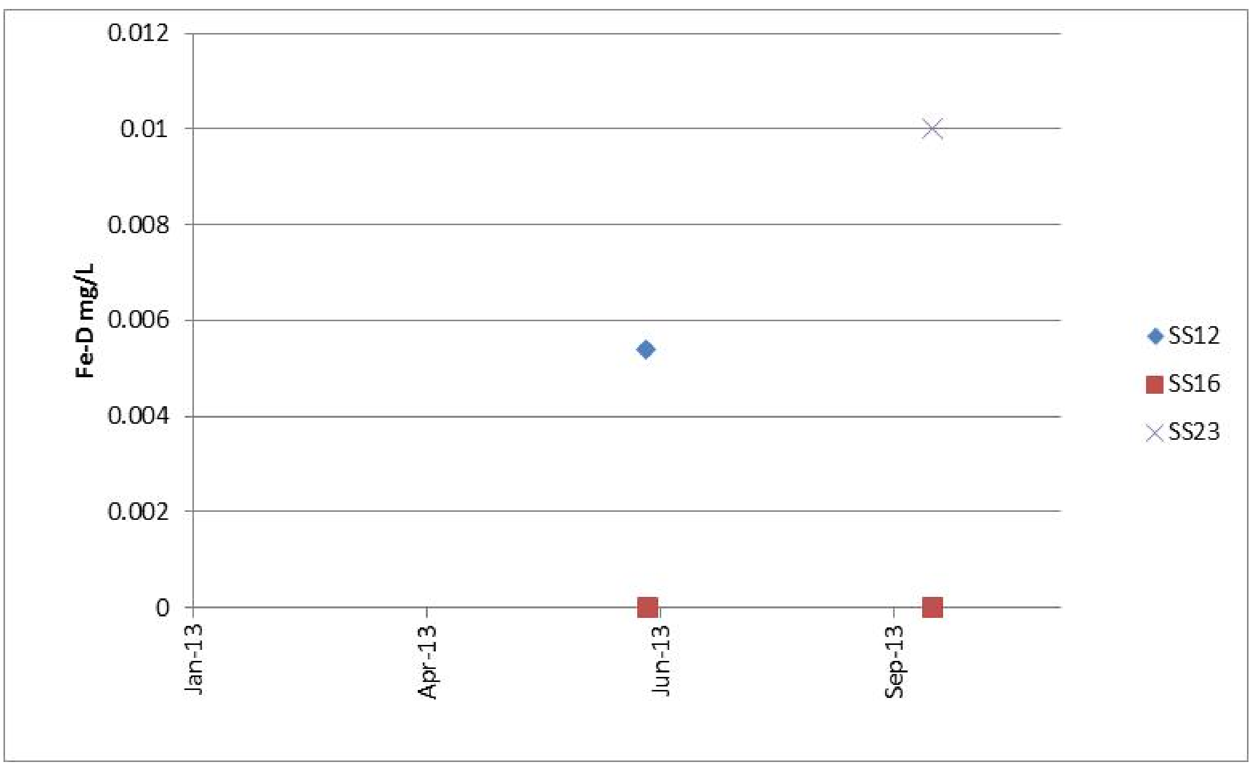


Figure 5-76: Dissolved iron concentrations at SS12, SS16, SS23

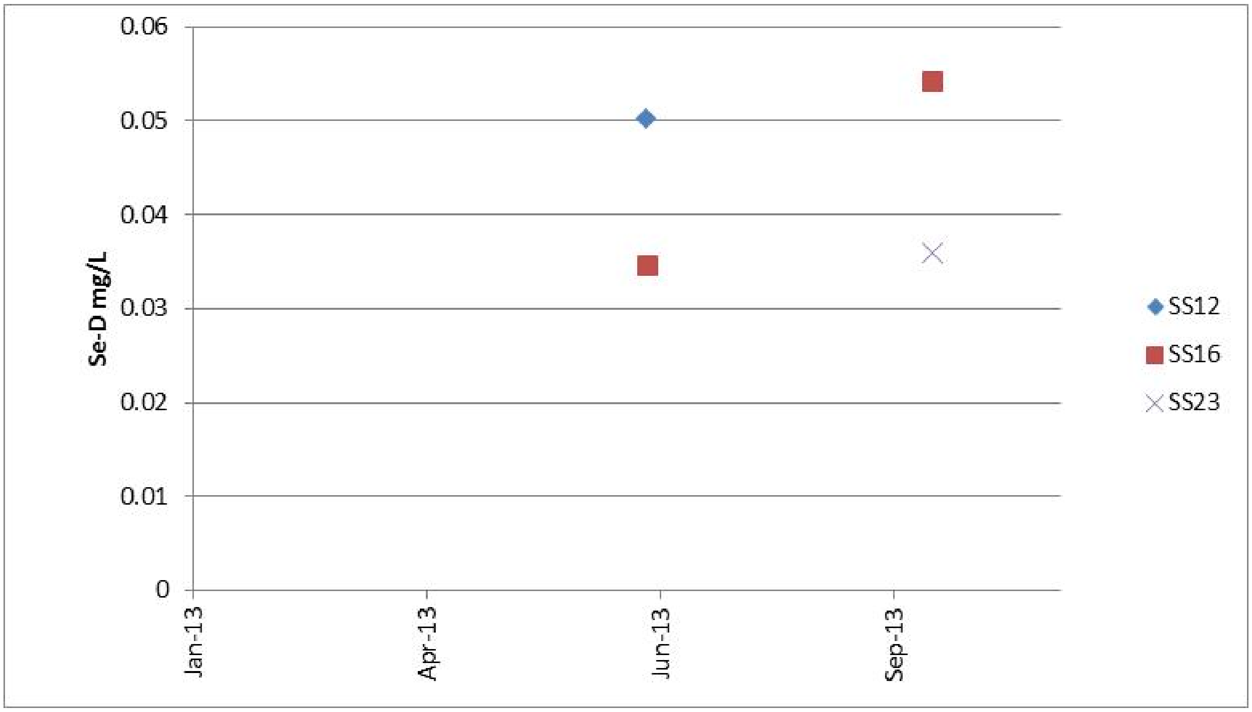


Figure 5-77: Dissolved selenium concentrations at SS12, SS16, SS23

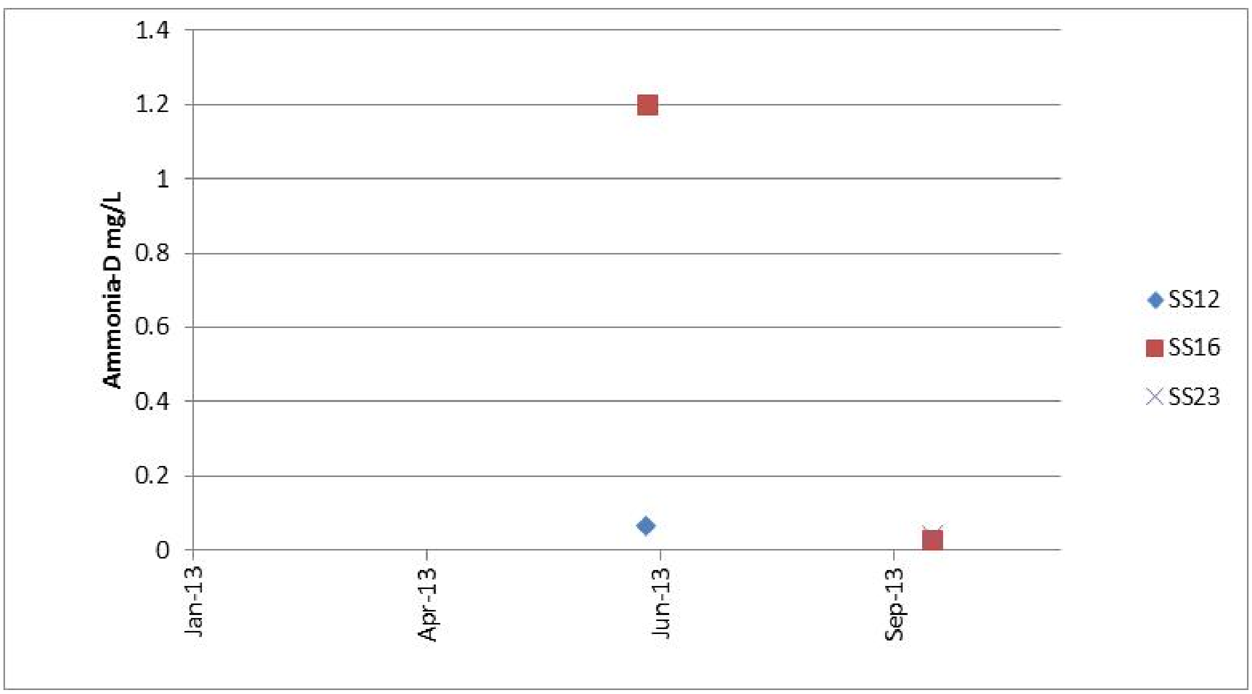


Figure 5-78: Ammonia concentrations at SS12, SS16, SS23

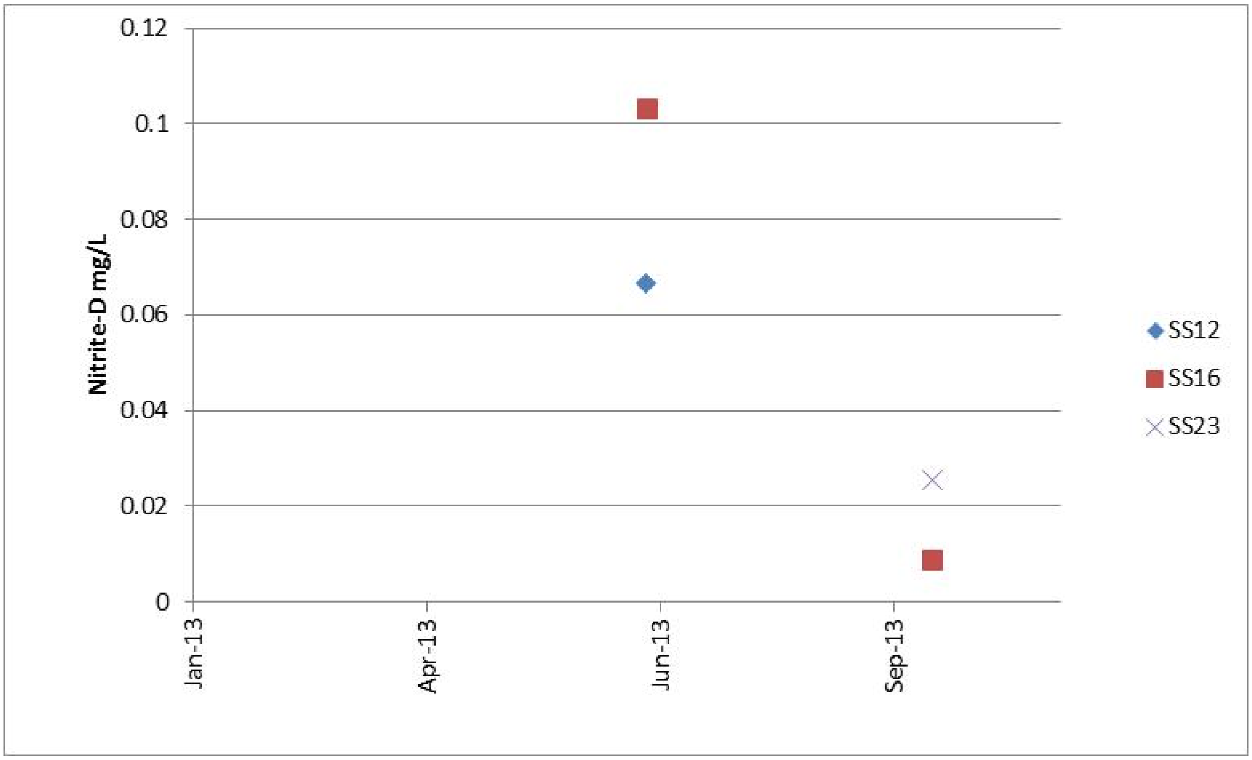


Figure 5-79: Nitrite concentrations at SS12, SS16, SS23

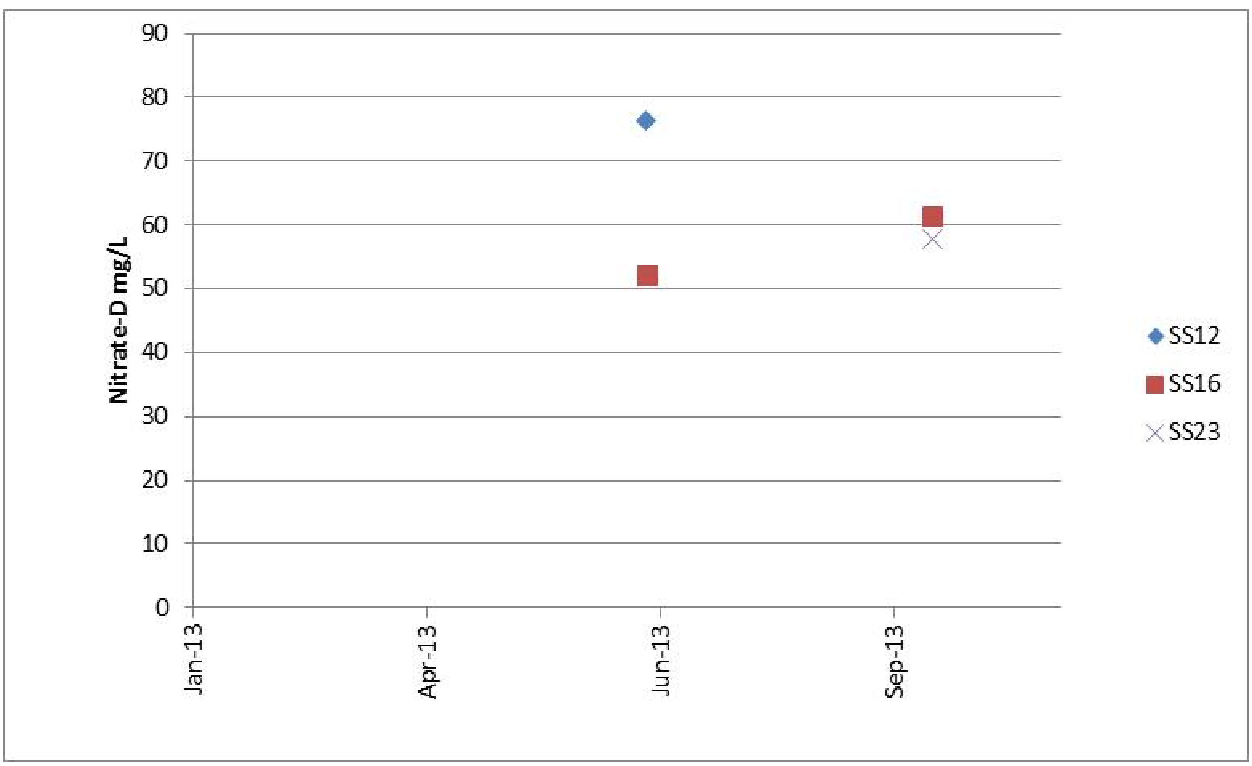


Figure 5-80: Nitrate concentrations at SS12, SS16, SS23

5.5 MCDS Seepage Monitoring Program

As required by Clause 84 and 85 of the WUL, Minto Mine is required to submit and implement a MCDS Seepage Monitoring Program and report the results of the program in the Annual Report. The MCDS Seepage Monitoring Program was submitted to the Yukon Water Board on January 15, 2013 and includes regular physical monitoring, MCDS Pond water level recording, installation of ground temperature cables and assessment of foundation thawing, contaminant monitoring and transport assessment, and the establishment of appropriate triggers and adaptive responses.

5.5.1 Physical Monitoring

Semi-annual geotechnical inspections were completed on May 27 and September 12, 2013 by Peter Mikes, P.Eng, of SRK. The inspections documented the physical condition of the site based on visual observations and provided geotechnical assessment, noting potential signs of physical instability such as erosion, differential settlement, sloughing or bulging of material, seepage, and permafrost degradation.

Monthly inspections were performed by Minto Mine Environmental Monitors and any questionable findings were reported to the Mine Technical department for further inspection.

There were no problematic findings at the MCDS from monthly and semi-annual inspections in 2013. Recommendations from SRK consisted of continued semi-annual monitoring to inspect for signs of instability or seepage on the downstream site of the MCDS.

5.5.2 Equipment and Instrumentation

During the majority of 2013, flow rates were calculated from a totalizer located at the MCDS. Towards the end of 2013 a continuous flow meter was installed and set up on the HMI system that is now monitored remotely through the mill control room.

In response to the problems with the dewatering program in 2012 (conveyance system freezing), changes were made to the system in 2013. Upgrades consisted of: the addition of a vertical culvert, tying the power supply into the main power grid, heat tracing the pipeline, and addition of a recirculating line to keep the culvert ice free. As of December 31, 2013 the new system was fully functional and water is being pumped back to the mill and main pit. Ground temperature cables were not installed at the MCDS in 2013.

5.5.3 Water Quality Monitoring

Groundwater quality monitoring at the MCDS consists of drive point piezometer (DPP) monitoring at DPP MW12-DP4, groundwater wells MW12-06, MW12-06 and MW12-06 and surface water quality monitoring site at W37. A second DPP (MW13-DP5) was scheduled to be installed in the spring of 2013, however, due to frozen ground installation was postponed until October and no sample was collected in 2013. As W37 is downstream of the MCDS (W36) it is often dry due to water being pumped back to the Main Pit from W36. Therefore station W37 was only sampled four times in 2013. Water quality monitoring laboratory results are summarized in Table 5-27 and laboratory results are provided in Appendix D.

Table 5-27: MCDS Groundwater and Surface Water Quality Sampling Results

Station Name	Sample Date	Parameters (mg/L)						
		Cadmium (D)	Copper (D)	Iron (D)	Selenium (D)	Ammonia	Nitrite	Nitrate
MW12-DP4	7/27/2013	0.000046	0.0044	0.0229	0.00097	0.038	0.0093	1.12
MW12-DP4	10/9/2013	-	-	-	-	0.043	0.0744	3.78
MW12-06-02	8/18/2013	<0.000010	0.0007	0.954	0.00028	0.048	0.787	0.25
MW12-06-02	10/11/2013	0.000018	0.00042	1.67	0.00018	0.052	0.302	0.052
MW12-06-04	8/18/2013	<0.000010	<0.00020	0.67	0.00014	0.021	0.463	0.128
MW12-06-04	10/11/2013	0.000039	0.0007	0.759	0.00012	0.018	0.173	0.03
MW12-06-04	10/11/2013	<0.000010	0.00038	0.713	<0.00010	0.019	0.167	0.022
MW12-06-06	8/18/2013	0.000011	0.00036	0.009	0.00022	0.011	0.0953	0.952
MW12-06-06	10/11/2013	<0.000010	0.00047	0.0197	0.00018	0.018	0.0896	0.871
W37	4/6/2013	0.000062	0.0245	0.0535	0.00155	0.051	0.162	4.03
W37	5/20/2013	0.00003	0.0178	0.107	0.0004	0.027	0.0123	0.683
W37	7/13/2013	0.000041	0.0183	0.0348	0.00039	0.025	0.0133	0.662
W37	9/9/2013	0.000043	0.0174	0.0537	0.00114	0.024	0.0168	2.07

5.6 Water Discharge

Minto Mine discharged approximately 385,000m^3 of water to Minto Creek during the freshet period. Water quality was monitored at the end of the pipe, and is labelled station W16A. Station W16A 2012 and 2013 water quality results statistics are summarized in Table 5-28, and are compared to WUL water quality standards (Clause 70). Eight water quality samples were taken from station W16A during the 2013 monitoring period. The station W16A copper, aluminum, cadmium and selenium concentrations, with corresponding non-freshet standards (WUL Clause 70) are displayed in Figure 5-81 and Figure 5-82. The maximum results indicated in bold were associated with a high TSS sampling event in May 2013, during a period of intermittent discharge.

Table 5-28: W16A water quality results summary (2012 -2013)

W16A	Water Quality Standard (WUL Clause 70)	2012 Summary Statistics			2013 Summary Statistics		
Parameters		Mean	Min	Max	Mean	Min	Max
pH	6.5 - 9.0	8.05	6.86	8.32	7.89	7.57	8.26
TSS (mg/L)	15	4.2	1.5	7.5	14.7	1.5	**55.1**
Nutrients (mg/L)							
Ammonia Nitrogen	0.89	0.0372	0.0169	0.2600	0.0536	0.0210	0.0970
Nitrate Nitrogen	7.65	4.62	3.12	5.20	1.80	0.79	3.09
Nitrite Nitrogen	0.15	0.0091	0.0070	0.0121	0.0237	0.0025	0.0519
Total Metals (mg/L)							
Aluminum	2.7	0.2121	0.1060	1.0200	1.0729	0.0733	**3.0700**
Arsenic	-	0.00040	0.00025	0.00058	0.00065	0.00027	0.00140
Cadmium	0.00015	0.000024	0.000005	0.000101	0.000021	0.000005	0.000046
Chromium	0.008	0.0005	0.0003	0.0005	0.0014	0.0005	0.0034
Copper	0.05	0.03465	0.02690	**0.07070**	**0.05663**	0.02190	**0.10500**
Iron	3.5	0.3136	0.1590	1.2200	1.5522	0.1400	**4.4500**
Lead	0.02	0.00037	0.00010	0.00251	0.00106	0.00010	0.00470
Molybdenum	0.4	0.0055	0.0040	0.0063	0.0029	0.0012	0.0045
Nickel	0.5	0.0012	0.0005	0.0025	0.0023	0.0005	0.0058
Selenium	0.003	0.00158	0.00105	0.00190	0.00049	0.00017	0.00089
Zinc	0.15	0.0035	0.0025	0.0120	0.0094	0.0025	0.0306

Bold values indicate exceedances of the WUL water quality standards

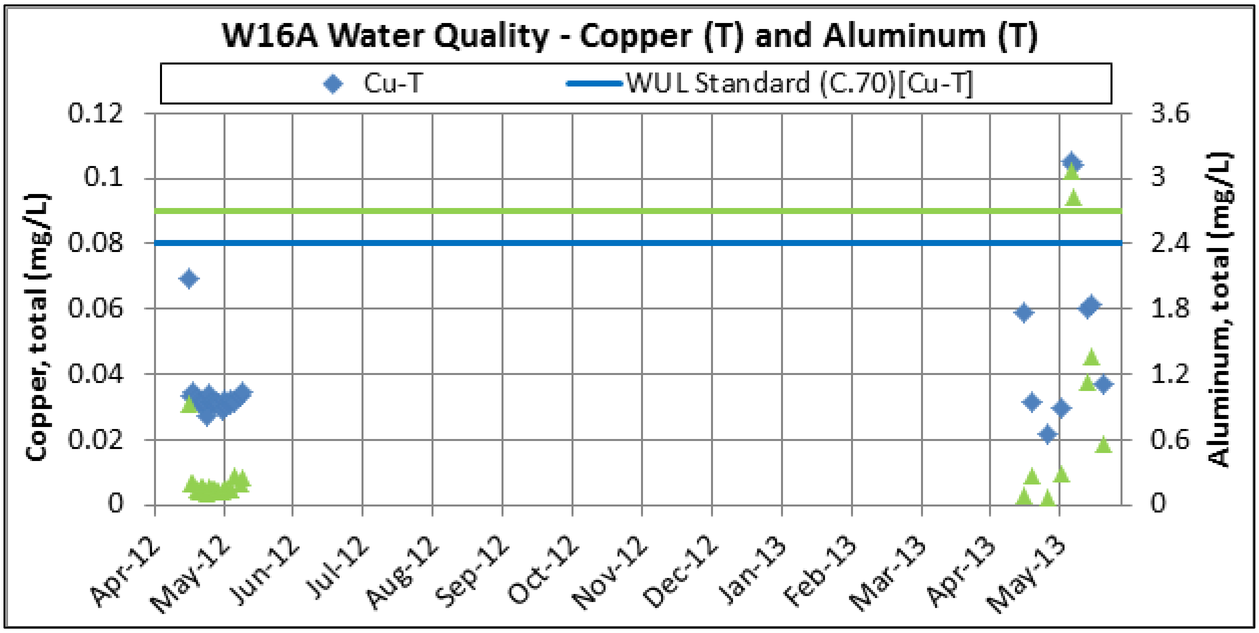


Figure 5-81: W16A copper and aluminum concentrations (2012 – 2013)

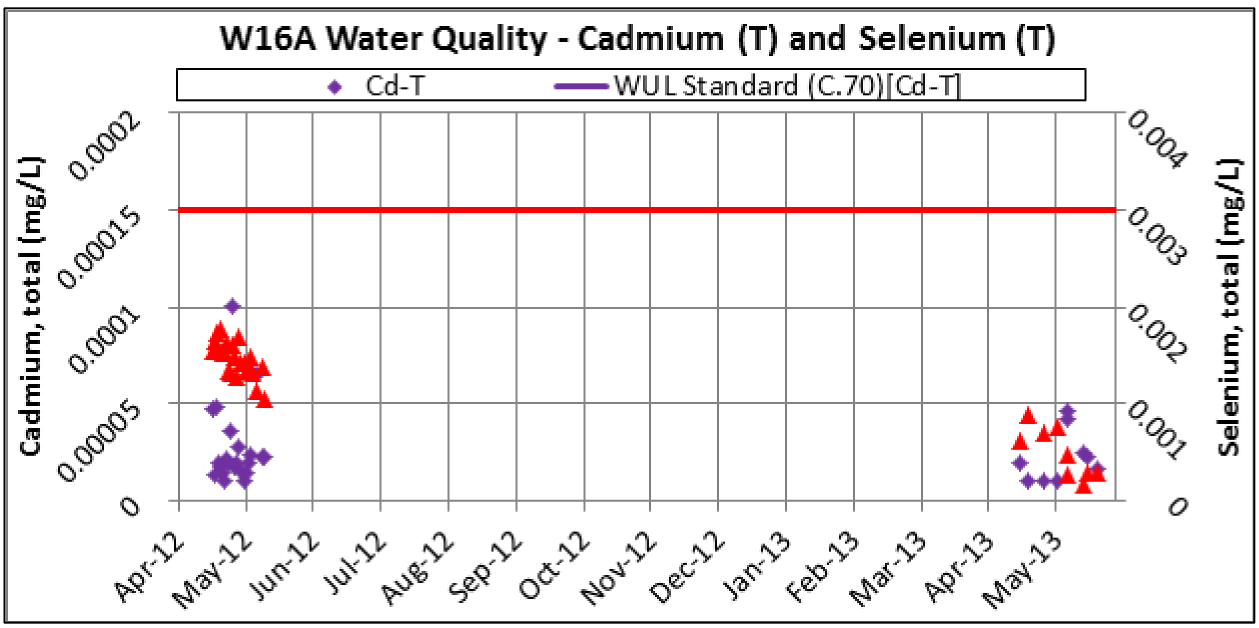


Figure 5-82: W16A cadmium and selenium concentrations (2012 – 2013)

5.7 Biological Monitoring Program

The Annual Biological Monitoring Program includes monitoring of sediment, periphyton, benthic invertebrates, fish and fish habitat. Details of the program are found in the *Environmental Monitoring and Surveillance Plan*. The following sections summarize the 2013 monitoring program results and the detailed sediment, periphyton and benthic invertebrate monitoring program results and 2013 fisheries monitoring program results are provided in Appendix E and Appendix F, respectively.

5.7.1 Sediment Monitoring Program

The objectives of the sediment monitoring program are to characterize particle size and total organic carbon content of sediments collected from the lower Minto Creek receiving environment and reference area (lower Wolverine Creek). Further, the program is to characterize and evaluate concentrations of metals, metalloids and nutrients in the receiving environment (upper and lower Minto Creek) and reference area (upper McGinty Creek and lower Wolverine Creek) sediments.

Results from the 2013 monitoring program are summarized in Table 5-29 and historic copper concentrations are presented in Figure 5-83. 2013 samples were largely composed of fine particles in the silt and sand size categories. Mean total organic carbon (TOC) content from lower Minto Creek and lower Wolverine Creek were comparable (i.e., mean values were 0.13 and 0.15 mg/kg, respectively), whereas as sediment collected from upper Minto Creek had slightly lower TOC (mean value 0.1 mg/kg) than upper McGinty Creek (0.13 mg/kg).

Mean arsenic concentrations exceeded the Interim Sediment Quality Guidelines for the protection of aquatic life (ISQG) at all four sampling sites. Mean copper concentrations in upper and lower Minto Creek and mean chromium concentrations in Lower Wolverine Creek exceeded the ISQG values. Mean copper concentration decreased with distance downstream from a mean concentration of 84.1 mg/kg in upper Minto Creek to 41.6 mg/kg in lower Minto Creek (only slightly greater than the ISQG; Figure 5-83). Due to the predominantly erosional habitat in upper Minto Creek, there are relatively few areas where sediment is deposited and this only in small quantities that likely wash away each year during freshet. Therefore, elevated sediment copper in fine sediment in the upper reaches of Minto Creek may be of limited importance in terms of exposure and potential toxicity to biota. In lower Minto Creek, fine sediment deposits are more common and therefore more relevant to aquatic life. Overall, concentrations of metals in Minto Creek sediments were lower than reference and/or sediment quality guidelines with the sole exception of copper.

Table 5-29: Sediment chemistry data collected at exposure and reference areas (2013)

	Analytes	Units	CSQG [a]		Upper McGinty Creek		Lower Wolverine Creek		Upper Minto Creek		Lower Minto Creek	
			ISQG	PEL	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation
Particle size, TKN, carbon analytes and pH	Loss on Ignition	%			17.4	4.0	12.8	4.7	9.6	2.9	14.4	6.9
	pH (1:2 soil:water)	pH units			6.98	0.19	7.00	0.11	7.76	0.16	7.89	0.06
	% Gravel (>2mm)	%			< 0.1	0.0	< 0.1	0.0	**0.9**	1.8	< 0.1	0.0
	% Sand (2.0mm - 0.063mm)	%			8.1	2.6	33.7	10.8	36.0	12.5	5.9	5.9
	% Silt (0.063mm - 4um)	%			82.8	2.9	59.6	10.3	53.3	14.1	82.9	4.3
	% Clay (<4um)	%			9.1	1.1	6.7	1.0	9.9	1.1	11.3	2.0
	Total Kjeldahl Nitrogen	%			0.464	0.082	0.332	0.112	0.271	0.069	0.385	0.181
	CaCO3 Equivalent	%			1.06	0.21	1.06	0.44	0.87	0.10	1.30	0.20
	Inorganic Carbon	%			0.13	0.02	0.13	0.05	0.10	0.01	0.15	0.02
	Inorganic Carbon (as CaCO3 Equivalent)	%			1.05	0.21	1.05	0.43	0.87	0.10	1.30	0.20
	Total Carbon by Combustion	%			9.32	2.11	6.32	2.25	4.94	1.50	7.44	3.69
	Total Organic Carbon	%			9.21	2.06	6.26	2.30	4.91	1.51	7.27	3.72
Total Metals	Aluminum (Al)	mg/kg			14,600	1,196	12,400	738	12,240	1,240	14,100	1,089
	Antimony (Sb)	mg/kg			0.52	0.04	0.43	0.07	0.49	0.07	0.66	0.09
	Arsenic (As)	mg/kg	5.9	17	7.47	1.29	6.25	0.82	6.01	0.75	8.12	0.92
	Barium (Ba)	mg/kg			304	32	193	36	200	37	314	45
	Beryllium (Be)	mg/kg			0.45	0.05	0.72	0.11	0.44	0.06	0.58	0.08
	Bismuth (Bi)	mg/kg			< 0.2	0.0	< 0.2	0.0	< 0.2	0.0	< 0.2	0.0
	Cadmium (Cd)	mg/kg	0.6	3.5	0.205	0.035	0.199	0.066	0.180	0.027	0.276	0.081
	Calcium (Ca)	mg/kg			10,504	1,705	9,090	1,802	8,768	1,131	15,740	2,141
	Chromium (Cr)	mg/kg	37.3	90	29.4	2.4	39.1	3.2	29.1	2.9	32.9	2.5
	Cobalt (Co)	mg/kg			11.7	1.3	12.9	0.8	10.1	0.8	11.6	0.9
	Copper (Cu)	mg/kg	35.7	197	28.8	3.6	25.0	5.3	**84.1**	19.6	41.6	5.9
	Iron (Fe)	mg/kg			25,980	2,720	25,520	1,064	22,840	1,552	26,100	1,997
	Lead (Pb)	mg/kg	35	91.3	5.67	0.47	5.79	0.46	5.84	0.49	6.62	0.49
	Lithium (Li)	mg/kg			8.62	0.62	9.10	0.42	8.36	1.00	10.90	0.63
	Magnesium (Mg)	mg/kg			5,086	385	8,798	288	6,968	679	7,598	457
	Manganese (Mn)	mg/kg			1,086	291	510	116	641	130	832	225
	Mercury (Hg)	mg/kg	0.17	0.49	0.069	0.018	0.042	0.012	0.029	0.007	0.072	0.019
	Molybdenum (Mo)	mg/kg			0.68	0.21	0.57	0.04	1.04	0.22	0.70	0.15
	Nickel (Ni)	mg/kg			21.0	1.8	35.5	2.4	29.3	3.6	30.9	2.8
	Phosphorus (P)	mg/kg			908	108	1,012	53	871	76	865	48
	Potassium (K)	mg/kg			782	92	822	38	1,246	167	1,012	111
	Selenium (Se)	mg/kg			0.56	0.13	0.36	0.12	0.38	0.06	0.54	0.13
	Silver (Ag)	mg/kg			0.11	0.01	0.11	0.02	< 0.10	0.00	0.13	0.01
	Sodium (Na)	mg/kg			230	27	344	18	332	24	250	30
	Strontium (Sr)	mg/kg			86	16	89	15	95	15	133	24
	Thallium (Tl)	mg/kg			0.082	0.014	0.067	0.012	0.090	0.013	0.092	0.008
	Tin (Sn)	mg/kg			< 2.0	0.0	< 2.0	0.0	< 2.0	0.0	< 2.0	0.0
	Titanium (Ti)	mg/kg			757	81	741	25	696	51	595	96
	Uranium (U)	mg/kg			1.53	0.27	2.35	0.80	0.98	0.24	1.35	0.25
	Vanadium (V)	mg/kg			55.0	5.2	63.3	3.5	51.3	4.2	55.7	4.5
	Zinc (Zn)	mg/kg	123	315	52.4	4.0	56.5	2.5	57.4	4.2	62.1	3.7

[a] Canadian Sediment Quality Guidelines - ISQG = interim sediment quality guideline; PEL = probable effect level (CCME 1999).

Indicates sediment concentration exceeding CSQG ISQG.

Indicates sediment concentration exceeding CSQG PEL.

bold Indicates sediment concentration exceeding the higher reference mean by more than 2 times

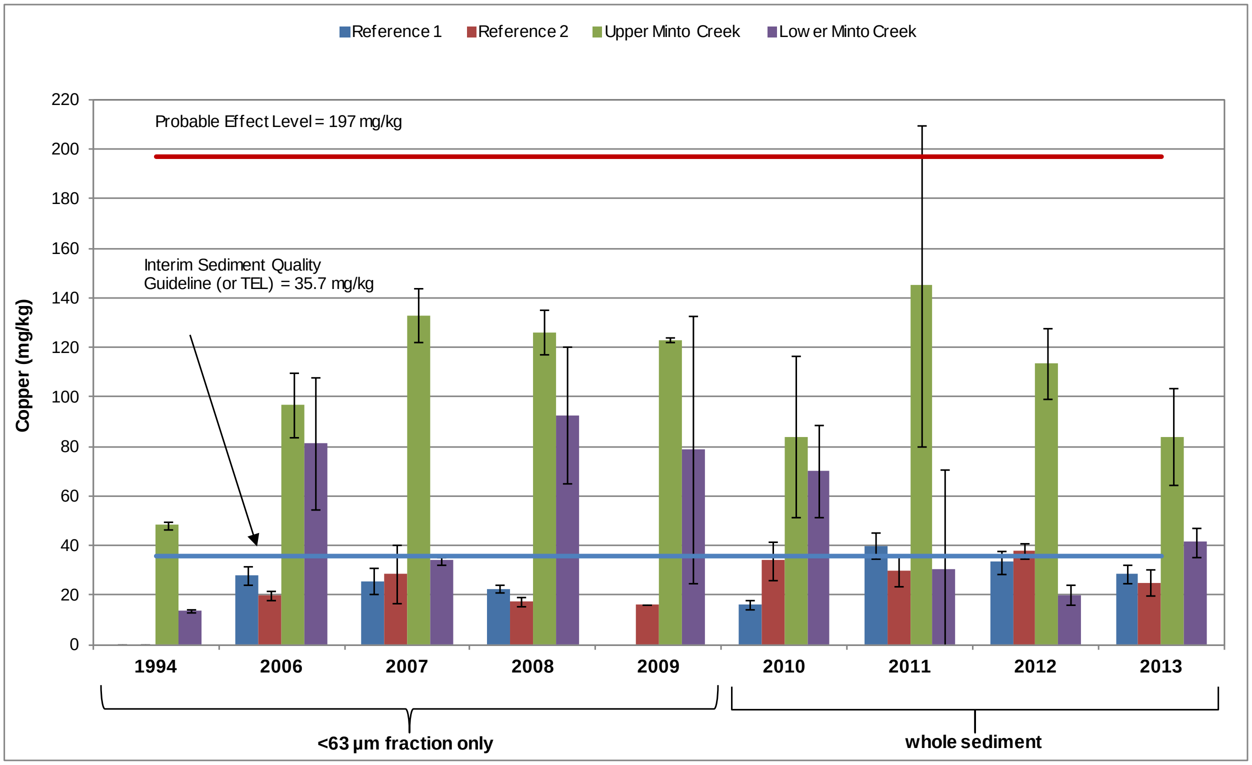


Figure 5-83: Mean copper concentrations in sediment collected in Minto Creek and reference locations, 1994-2013 (mean ± standard deviation)

5.7.2 Periphyton and Chlorophyll a Monitoring

The productivity of lower Minto Creek and lower Wolverine Creek was assessed through measurements of chlorophyll *a* in periphyton (used as a surrogate for the productivity of photosynthetic organisms) and collection of periphyton for community assessment. The 2013 results are presented in Figure 5-84 and Figure 5-85 for chlorophyll *a* and periphyton community, respectively. Chlorophyll *a* concentrations, evaluated on a surface area basis (i.e., mg chlorophyll *a* / m^2) were not significantly different in lower Minto Creek than lower Wolverine Creek (Figure 5-84). Any differences observed were likely due to light penetration to the substrate rather than the influence of water quality, and concentrations were consistent with low to moderate productivity.

The periphyton community of lower Minto Creek was evaluated and compared to lower Wolverine Creek for any potential mine-related effects. Some differences in periphyton communities were observed between Minto Creek and Wolverine Creek (Figure 5-85), likely due to differences in light penetration. Bacillariophycae (diatoms) were the dominant taxa at lower Minto Creek making up 75% of the community, whereas at lower Wolverine Creek, Cyanophyta (blue-green algae) were the dominant taxa making up 68% of the community (Figure 5-85). Temporal variability in community composition has been high in both exposure and reference areas (Figure 5-85). For example, at lower Minto Creek, Bacillariophycae were dominant in 1994, Cyanophyta in 2011, Rhodophyta and Cyanophyta in 2012 and Bacillariophycae in 2013. This lack of consistency was also observed at lower Wolverine Creek, with Cyanophyta dominant in 2011 and 2013 and Bacillariophycae in 2012 (Figure 5-85).

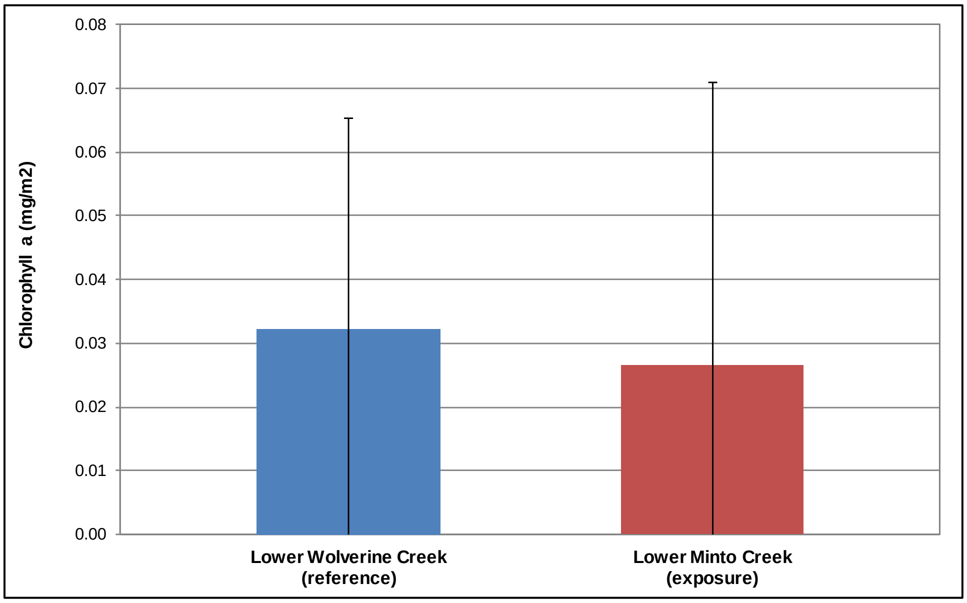


Figure 5-84: Mean chlorophyll a on cobble substrate in lower Wolverine Creek and lower Minto Creek from 2013 sample (mean ± standard deviation)

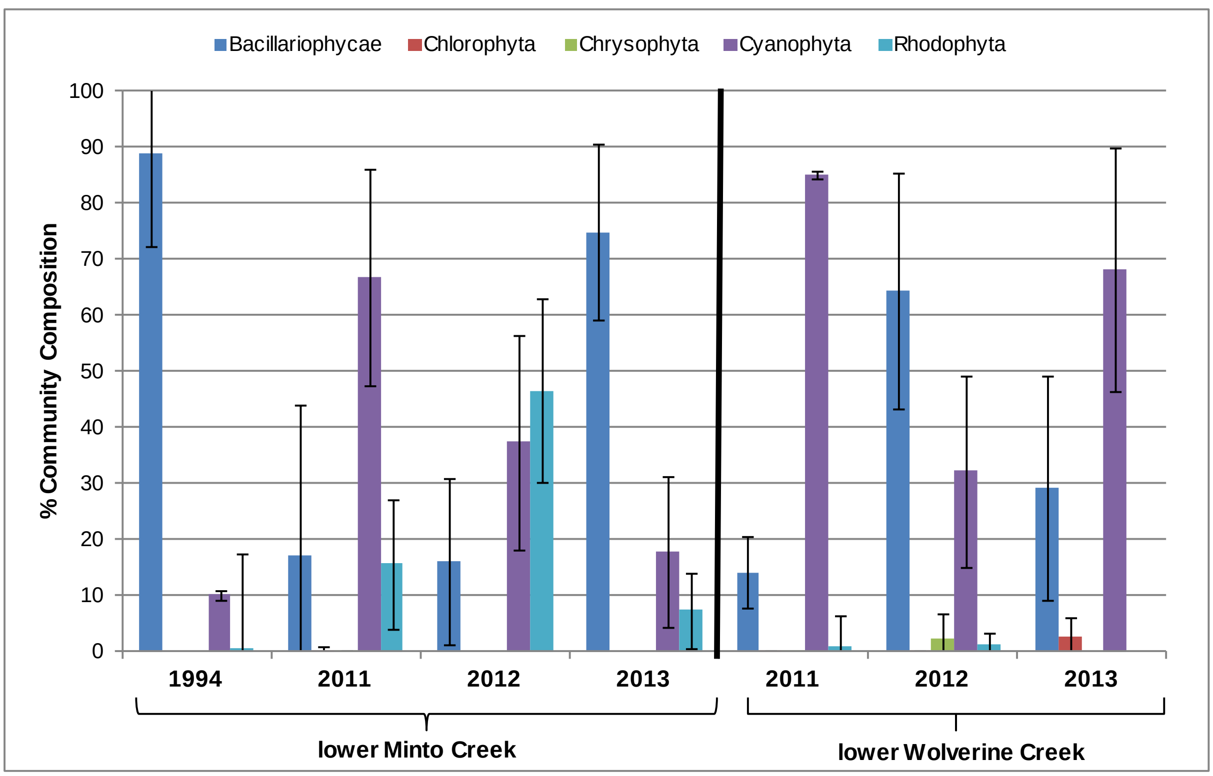


Figure 5-85: Periphyton community composition in lower Minto Creek and lower Wolverine Creek (mean ± standard deviation) (1994 – 2013)

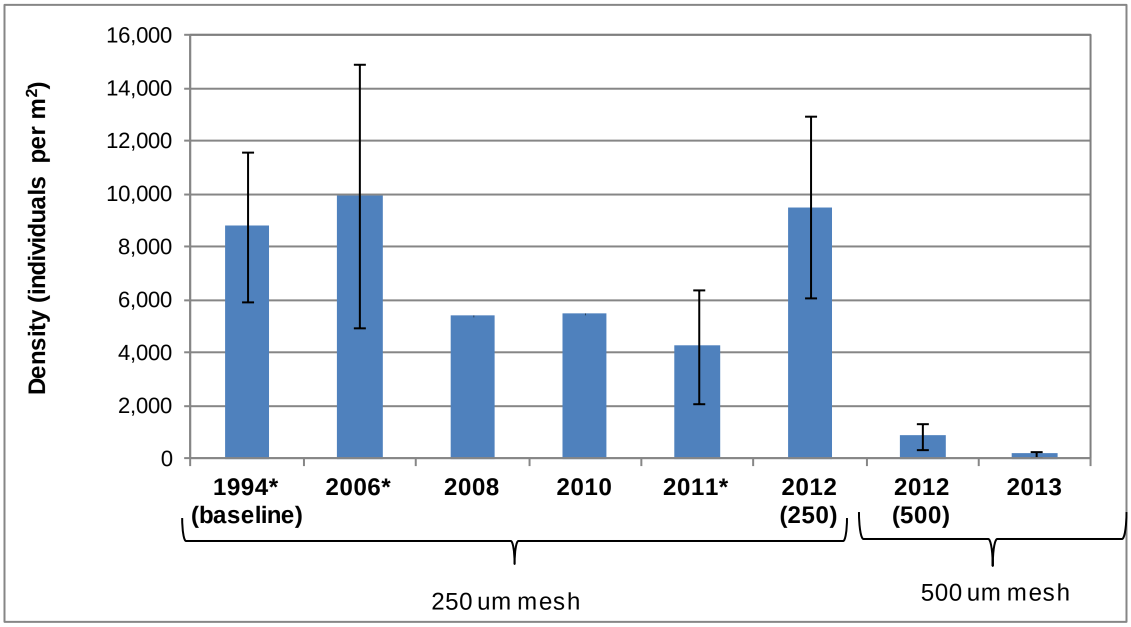
5.7.3 Benthic Invertebrate Monitoring

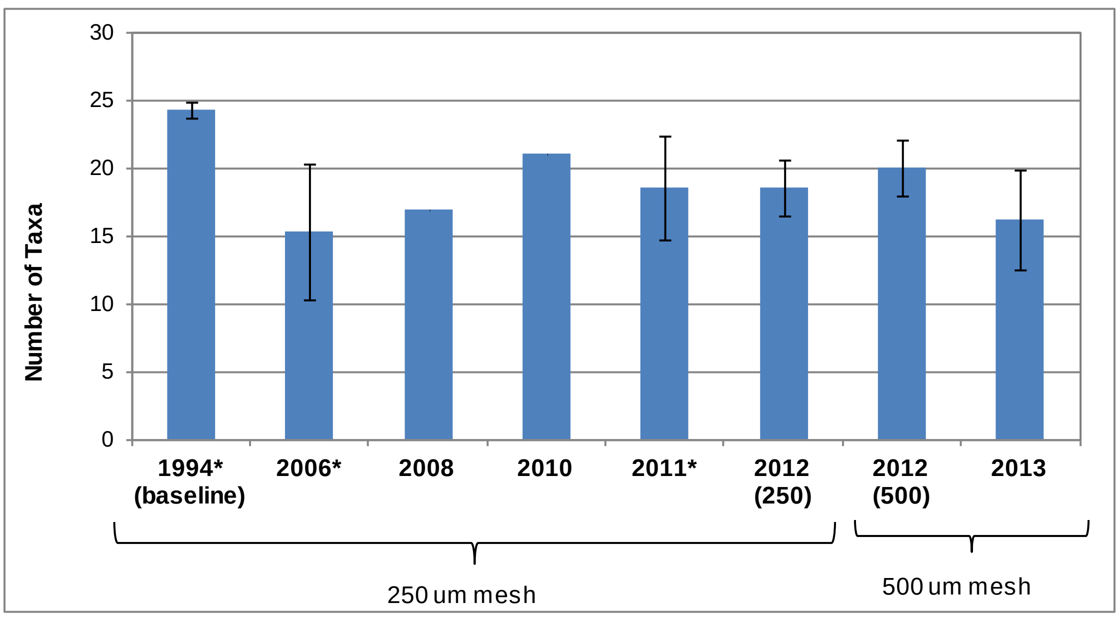
The benthic invertebrate community of erosional areas in lower Minto Creek were evaluated and compared to erosional areas of lower Wolverine Creek for any potential mine-related effects. The 2013 results are presented in Table 5-30 and are compared to historic values in Figure 5-86. Control-impact comparison of benthic invertebrate data indicates that the benthic invertebrate community of lower Minto Creek had lower density relative to lower Wolverine Creek (Table 5-30). In addition, lower Minto Creek had higher Simpson's Diversity, greater Bray-Curtis dissimilarity, higher percent EPT (mayflies, stoneflies and caddisflies), lower percent Chironomidae (non-biting midges), lower percent Oligochaetae (worms) and higher percent Nemata (roundworms) (Table 5-30). The higher percent EPT and lower percent Chironomids at lower Minto Creek is relevant as EPT taxa are considered to be sensitive to pollution whereas Chironomids are generally considered to be tolerant to pollution. This pattern suggests limited influence of the mine on the benthic invertebrate community.

Comparisons of benthic invertebrate community metrics in 2013 to those documented in previous years indicated substantial temporal variability (as also observed with periphyton communities) at both the receiving environment and reference areas, possibly due to inter-annual variability in environmental conditions (e.g., flow, ice scour) and/or differences in collection methods/replication between studies (Figure 5-86). Benthic invertebrate density in 2013 was lower than in 2012 (the only year to which it can be compared due to a mesh size change), but it showed the same trend, lower density at lower Minto Creek compared to lower Wolverine Creek. Conversely, some differences in the exposure, reference comparisons were observed between 2013 and 2012. Specifically, taxon richness did not differ in 2013 but was significantly greater in lower Minto Creek than in lower Wolverine Creek in 2012 (Figure 5-86). Similarly, Simpson's Evenness was higher at lower Minto Creek in 2013 but did not differ from lower Wolverine Creek in 2012. This suggests that natural temporal variability may be greater than any variability caused by mine activity.

Table 5-30: Benthic invertebrate community metrics and statistical comparisons (2013)

Metric	Lower Wolverine Creek				Lower Minto Creek				Statistical Contrasts		
	Mean	Standard Deviation	Min	Max	Mean	Standard Deviation	Min	Max	Significant Difference between areas (p-value)		Magnitude of Difference (SDs)
Density (organisms/m^2)	460	138	288	608	182	123	44	352	Yes	0.010	2
Number of Taxa	15.2	2.3	12	18	16.2	3.6	12	20	No	0.616	-
Simpson's Diversity	0.36	0.11	0.21	0.51	0.77	0.05	0.71	0.81	Yes	0.001	3.6
Simpson's Evenness	0.12	0.03	0.07	0.15	0.31	0.08	0.19	0.41	Yes	0.000	5.7
Bray-Curtis Distance	0.17	0.05	0.11	0.24	0.81	0.06	0.78	0.91	Yes	0.000	13.3
EPT (%) (mayflies, stoneflies and caddisflies)	3.9	1.5	2.4	5.6	22.2	6.5	15.3	31.8	Yes	0.000	11.9
Chironomidae (%) (non-biting midges)	77.7	9.6	63.9	89	53.8	8.1	41.5	62.8	Yes	0.003	2.5
Oligochaetae (%) (worms)	15.6	10.4	1.3	29.4	4.4	3.4	1.5	9.1	Yes	0.051	1.1
Nemata (%) (roundworms)	0.2	0.2	0	0.3	11.2	12	0.8	25.6	Yes	0.074	64.6





*indicates a year where no discharge occurred

Figure 5-86: Benthic invertebrate community density and taxon richness at lower Minto Creek and Minto Creek (mean ± standard deviation) (1994 – 2013)

5.7.4 Fisheries Monitoring Program

Fisheries monitoring in 2013 consisted of a fish and fish habitat assessment program in lower Minto Creek, the full study and results of which are provided in Appendix F. 2013 monitoring included baited gee-type minnow traps at previously identified sampling sites May to October, and electrofishing on the lower reach of Minto Creek in May and June and on Big Creek in June. All fish captured were identified, enumerated and measured (length), weighed, inspected for abnormalities and released at the vicinity of their trapping location. Additional data collected during sampling events included water temperature, flow, staff gauge reading, conductivity, pH, dissolved oxygen and oxidation-reduction potential (ORP).

In Minto Creek, only five fish were caught in period May to July monitoring period (three slimy sculpin, one arctic grayling and one burbot). In the August to October monitoring period, a total of 121 juvenile chinook salmon (JCS) and six slimy sculpin were caught in minnow traps. This represents a higher catch per unit effort (CPUE) than in the previous two years. Following a forest fire in 2010, more sediment had been entering the system, and turbidity had possibly been further increased by a small landslide observed in an upstream tributary in May 2012. In 2013, TSS values recorded at W2 were similar to those recorded in 2011, and a decreasing trend in turbidity was observed throughout the 2013 season. This may have created more favourable conditions for JCS during the latter part of the season. Previous studies have indicated that fish tend not to enter the system until after June, as temperature differences between Minto Creek and the Yukon River diminish.

Big Creek was also sampled monthly from June to October 2013. A total of 48 fish were captured, including 19 juvenile chinook salmon. As with Minto Creek, all JCS were caught in the latter part of the season, with CPUE for JCS being slightly lower than in Minto Creek. A natural fish barrier (composed of large organic debris) that impedes passage of fish upstream was identified during a 2010 assessment. This barrier, located approximately 1.2 km upstream from the Yukon River, was still in place during the 2013 study and continues to impede fish passage (i.e. traps set upstream of the barrier did not result in the capture of any fish). No fish were observed to use the mouth of Minto Creek or the Yukon River immediately in the vicinity of the mouth for spawning as determined through an aerial reconnaissance survey conducted over the Minto Creek/Yukon River confluence and downstream to McGinty Creek and the Ingersol Islands on August 28th.

5.8 Wildlife Protection Program

The work done in 2012 to reinforce wildlife protection continued in 2013. By means of toolbox talks, posters and seasonally timed safety news flashes, frequent reminders were communicated to staff and contractors to keep all food and food-contaminated waste in the appropriate receptacles. Outside waste bins, the burn pit and landfill were regularly inspected for animal attractants. The entrance to the landfill was closed off and access was diverted through the gated Waste Management Area, to ensure material destined for the landfill could be inspected before dumping.

Environmental staff underwent further training in non-lethal hazing and undertook early morning and late evening patrols of key areas during the summer, to minimize the risk of bear-human encounters near the periphery of the active mine area. A greater effort was made in encouraging employees to report and record all wildlife sightings, with reporting forms posted at high-traffic locations. These forms were changed frequently and recorded on a spreadsheet, and at the end of the year prizes were awarded for wildlife reporting. As a result of awareness-raising work, continued emphasis on waste management, and ramped-up reporting effort, bear-related concerns were well controlled. Human/Red Fox interactions did increase in the active mining and camp areas, and this was the focus of awareness-raising effort in the latter part of the year.

5.9 Meteorological Monitoring Program

Minto Mine has two meteorological stations located approximately 70 m northeast of the north end of the airstrip. Both stations are located in an area that allows ample meteorological exposure from all directions. Trees are clear for a radius of 30 m from both meteorology stations and beyond that radius is a sparse growth of 2 m tall conifers.

The first meteorology station (Met Station 1) was installed September 18, 2005 and records data on a HOBO datalogger. Met Station 1 consists of a 3 m tripod with instrumentation to measure air temperature, relative humidity, barometric pressure, incident solar radiation and rainfall (wet precipitation). Data is averaged over the one-hour archiving period and then is saved to the datalogger.

The second meteorology station (Met Station 2) was installed October 15, 2010 and runs on a Campbell Scientific CR1000 datalogger. Met Station 2 consists of a 10 m tower with instrumentation to measure air temperature (Figure 5-87), incident solar radiation (Figure 5-88), precipitation – rain and snowfall (Figure 5-89), barometric pressure (Figure 5-90), evapotranspiration (Figure 5-91), relative humidity (Figure 5-92), and wind speed, direction and events (Figure 5-93 and Figure 5-94). Data is averaged over the one-hour archiving period and then saved to the datalogger.

During the 2013 reporting period, Met station 1 recorded no system interruptions. Met Station 2, however, did have a problem of ice build-up on the anemometer in January and February and as a result wind speed and direction data were not logged between January 14th and February 9th. Met Station 2's other functions were not interrupted.

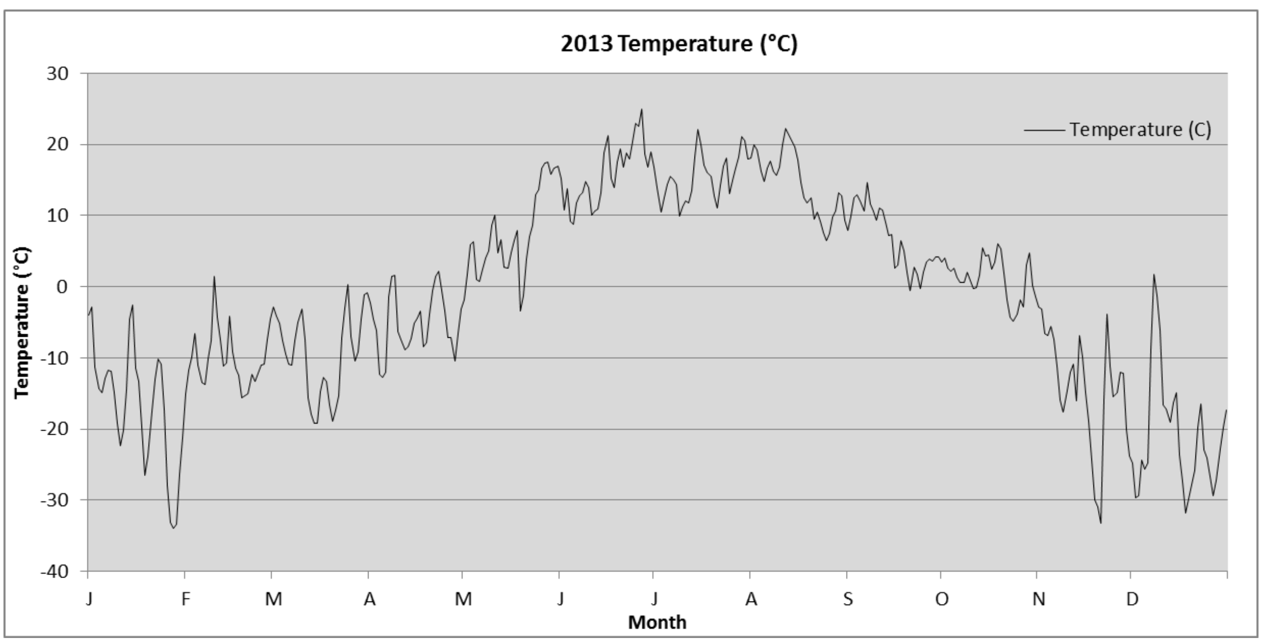


Figure 5-87: 2013 Temperature

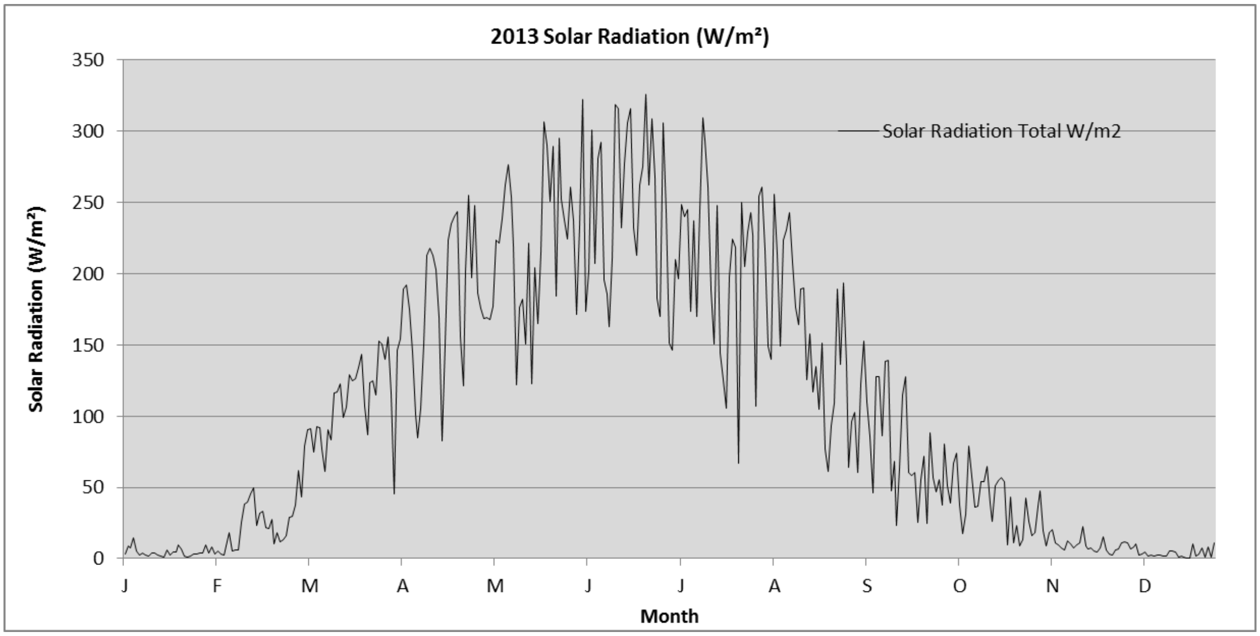


Figure 5-88: 2013 Solar Radiation

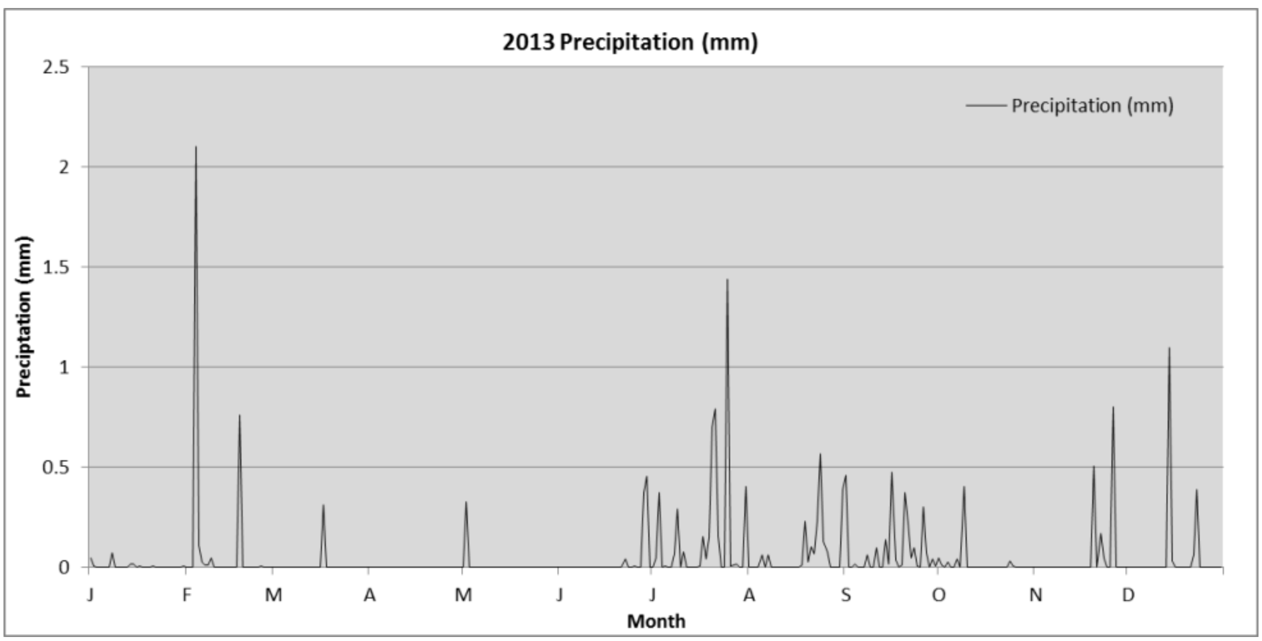


Figure 5-89: 2013 Precipitation

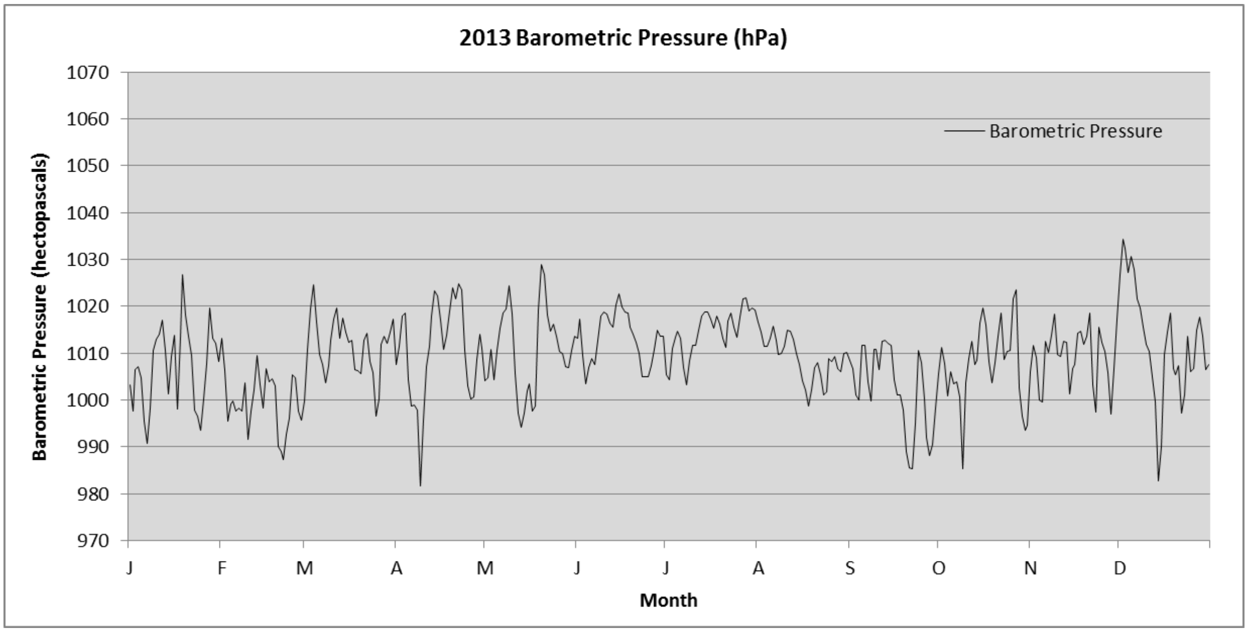


Figure 5-90: 2013 Barometric Pressure

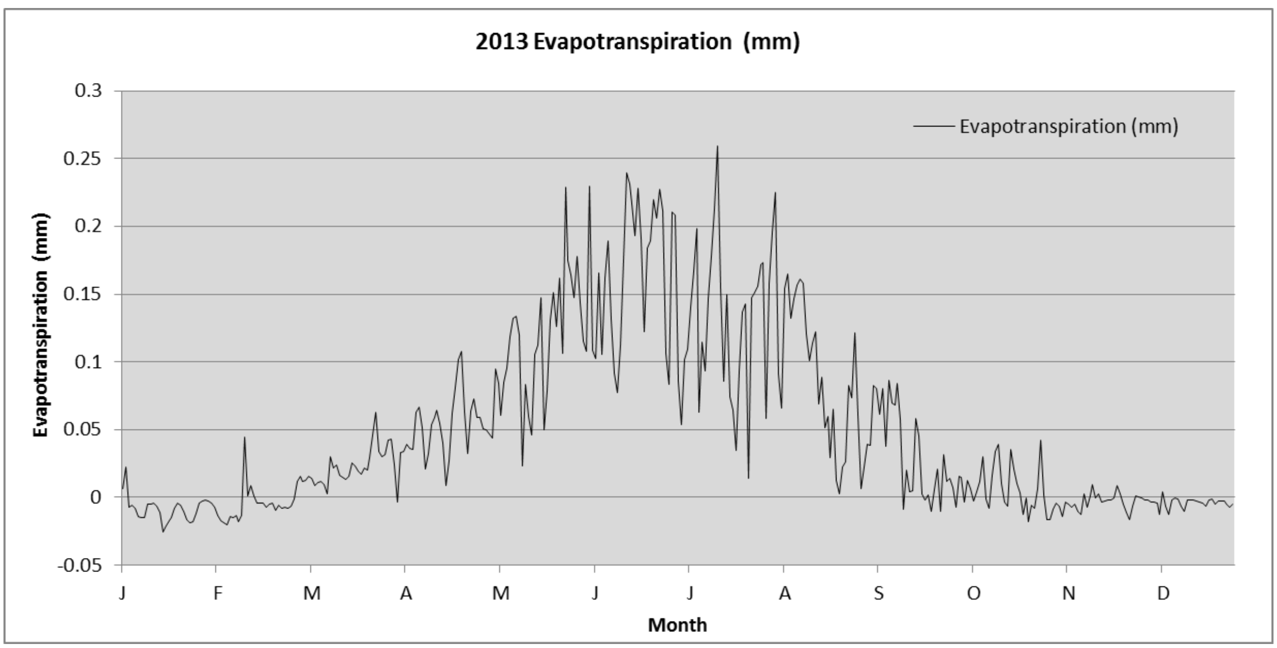


Figure 5-91: 2013 Evapotranspiration

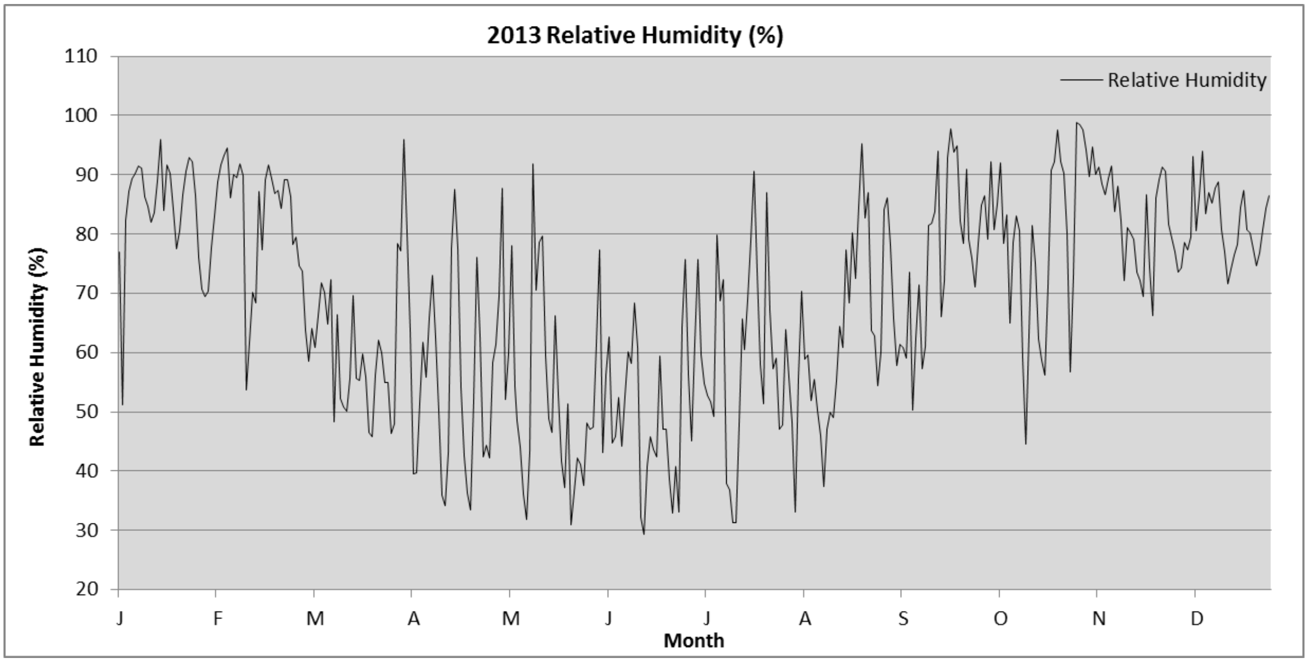


Figure 5-92: 2013 Relative Humidity

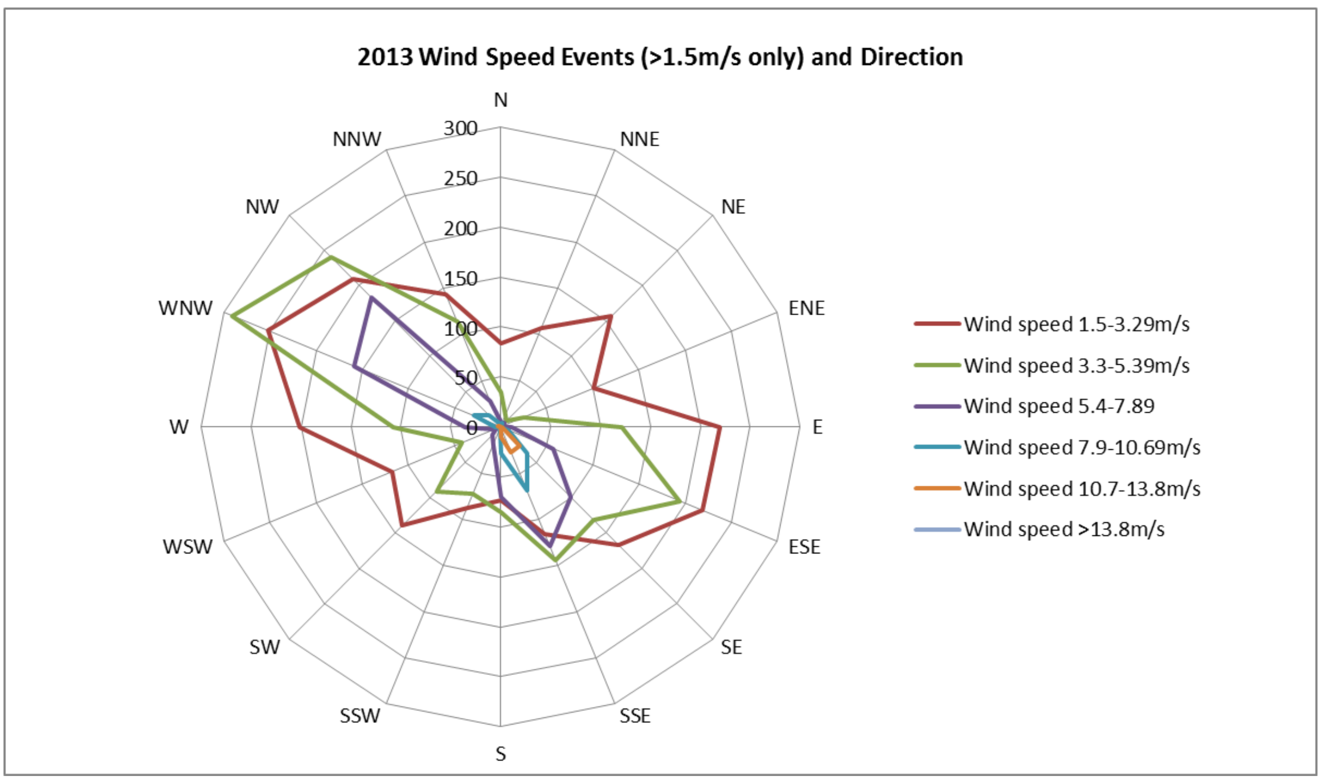


Figure 5-93: 2013 Wind Speed Events

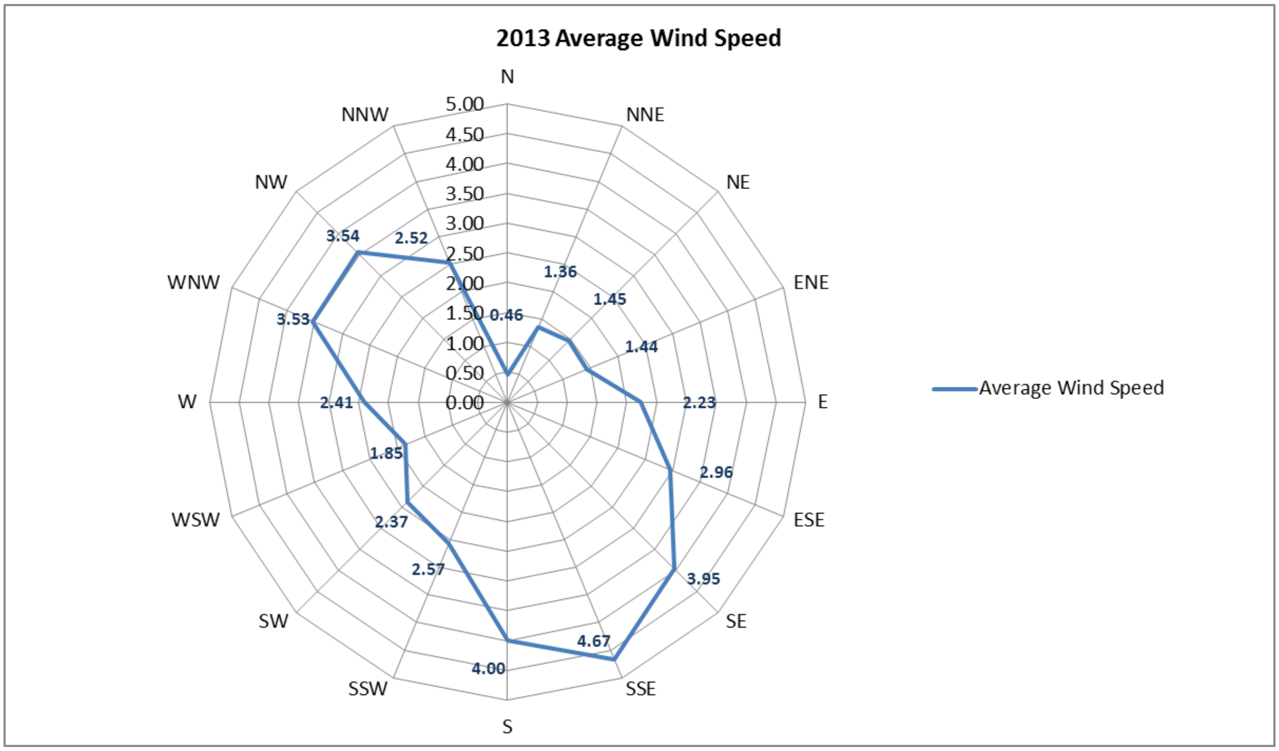


Figure 5-94: 2013 Average Wind Speed

5.10 Quality Assurance and Quality Control Program

As required by Clause 18(l) of the WUL, Minto Mine is required to submit the results and interpretations of the Quality Assurance and Quality Control Program (QA/QC Program). The QA/QC program is directed through the *Minto Mine Quality Assurance and Quality Control Plan*. Implementation of the Minto Mine QA/QC Program occurred in November 2012.

The primary objective of the QA/QC Program is to ensure that data collected, analyzed and evaluated through the environmental monitoring programs at the Minto Mine are representative of the environmental conditions present at the time of sampling. The *Minto Mine Quality Assurance and Quality Control Plan* has been developed using recognized QA/QC protocols. Specific procedures for data collection at the Minto Mine are detailed in Standard Operating Procedures (SOPs) included as Appendices to the *Minto Mine Quality Assurance and Quality Control Plan*. SOPs are internal documents to the Minto Mine that may be modified or improved as required.

The main components of the QA/QC Program presented in the following sections include QA/QC results and interpretations with regards to water quality monitoring, external and on-site laboratory reporting, and environmental programs monitoring.

5.10.1 **Water Quality QA/QC**

Procedures for water quality monitoring at the Minto Mine are detailed in the *Minto Mine Surface Water Quality Monitoring Standard Operating Procedures*. The 2013 improvements to the *Surface Water Quality Monitoring Standard Operating Procedures* included revisions to the sample labelling procedure, Chain of Command inspections and Water Quality Field Form.

In 2013, approximately 639 routine water quality samples were collected during the water quality monitoring program. Quality control samples represented 10.4% of the total number of samples collected in 2013, and included 36 field duplicates, 15 field blanks, and 10 trip blanks. The *Minto Mine Surface Water Quality Monitoring Standard Operating Procedures* describes a 1:10 routine sampling to quality control sampling ratio and this ratio was achieved in 2013.

5.10.2 **External Laboratory QA/QC**

The 2013 external laboratory water quality analysis were performed by Maxxam Environmental in Burnaby, BC. As described in the *Minto Mine Quality Assurance and Quality Control Plan*, all results provided by the external laboratory were accompanied by a Quality Assurance Report. If procedural deviations or exceedances in standard holding time occurred the details of such nonconformities were included in each report. Additionally, each report contained QC batch numbers enhancing sample result traceability.

As reported in the February 2013 Monthly Report submitted to the Water Board, the external laboratory utilized by Minto Mine discovered organic carbon contamination on a shipment of Dissolved Organic Carbon filters in March 2013. The same model of filters were supplied to and utilized by the Minto Mine for February 2013 and it was unknown whether contamination was present on the filters. Minto Mine disposed of the potentially contaminated filters and the external laboratory provided Minto Mine with a new batch of filters.

5.10.3 **On-site Laboratory QA/QC**

Procedures for analyzing water samples at the on-site laboratory are detailed in a variety of SOPs such as, but not limited to the *Lab QA/QC Guidelines SOP*; *Preparation of Dissolved and Total Metals SOP (Cu, Al, Cd) SOP; Preparation of Dissolved and Total Selenium SOP*; and *Total Dissolved Solids SOP*. There were no updates made to the on-site laboratory SOPs in 2013. All on-site laboratory equipment was calibrated according to manufacturer's specifications in 2013.

2013 on-site laboratory analysis of water quality samples occurred at W3, W8, W8A, W16, W16a and W50 as per the WUL Appendix 3 monitoring requirements (as environmental conditions allowed). Additionally, the on-site laboratory analyzed water from sites W2, MC-1, W15, W17, W35 and WTP during spring freshet in order to inform day-to-day discharge-related decisions.

The 2013 QC procedures performed by the on-site laboratory included spiked blanks and calibration checks. In the event that two or more QC failures occurred, the 2013 QC procedures involved re-analyzing the entire batch of samples. In 2013, the on-site laboratory reported that Selenium spiked blanks and calibration tests could not be performed when limited quantities of Selenium were present in the sample water. This was a function of the laboratory equipment (Vapour Gas Generator) used for performing the tests inability to execute a spiked blank or calibration with limited quantities of Selenium.

On-site and external laboratory water quality results for water quality sites W3, W8, W8A, W16, and W16a are presented in each Monthly Report submitted to the Water Board. In 2013 it was noted that discrepancies in results from the external and on-site laboratories occurred and were likely as a result of different methods and/or equipment utilized in analyzing water samples, different processing times between sampling and processing the samples, and the associated use of non-preserved versus preserved samples.

5.10.4 Environmental Monitoring QA/QC

5.10.5 Hydrology QA/QC

Procedures for hydrology monitoring at the Minto Mine are detailed in the *Minto Mine Surface Water Hydrology Standard Operating Procedures*. Improvements to the *Minto Mine Surface Water Hydrology Standard Operating Procedures* in 2013 included the addition of duplicate flow measurements at a ratio of 1:10 routine flow monitoring measurements. This procedure was initiated late in the 2013 field season.

5.10.6 Meteorology QA/QC

Procedures for meteorology monitoring at the Minto Mine are detailed in the *Meteorology Station Download Procedures*. Data downloads are performed twice per month and data is reviewed after the download to ensure that the meteorological stations are recording all necessary parameters.

5.10.7 Hydrogeology QA/QC

Schedules and general procedures for hydrogeology monitoring at the Minto Mine are detailed in the *Minto Mine Groundwater Monitoring Plan Version 2013-01*. In 2013, 40 groundwater samples were taken at the Minto Mine. QC samples represented 27.5% of the total number of samples collected in 2013, and included 9 field duplicates and 2 field blanks.

The *Minto Mine Groundwater Monitoring Plan Version 2013-01* recommends field duplicate sampling be conducted at a frequency of one field duplicate sample per ten groundwater monitoring samples; a higher rate of field duplicate sampling was achieved in 2013. Additionally the *Minto Mine Groundwater Monitoring Plan Version 2013-01* states that “one field blank sample will be collected during each Spring/Fall groundwater monitoring event”. The 2013 spring groundwater sampling event did not obtain a field blank sample and effort will be made to ensure that field staff collect the appropriate quality control samples as detailed in the *Minto Mine Groundwater Monitoring Plan Version 2013-01*.

The two field blanks detailed were collected during the 2013 fall groundwater sampling event.

Collection rates for trip blanks are not detailed in the *Minto Mine Groundwater Monitoring Plan Version 2013-01* and in 2013 there were no trip blanks collected in conjunction with the hydrogeology monitoring.

5.11 Groundwater Monitoring Program

Groundwater monitoring program details are provided in the *Minto Mine Environmental Monitoring and Surveillance Plan*. The primary monitoring objective of the groundwater monitoring program is to identify potential impacts on groundwater from the Minto Mine components including, but not limited to the DSTSF, Mill area, Main Pit, Area 2 Pit, waste rock dumps, and the Water Storage Pond. Additionally, groundwater monitoring of hydrogeological conditions in areas of proposed future mine components including the Minto North Pit, Ridgetop North Pit and Ridgetop South Pit is also conducted.

The Groundwater Monitoring Program is comprised of operational and baseline monitoring. Water quality samples for the program are collected according to standard procedures such as those summarized in the ASTM (2007) *Standard Guide for Sampling Ground-Water Monitoring Wells*. The main components of the groundwater monitoring program include groundwater quality, vibrating wire piezometers, and ground temperature cable monitoring.

5.11.1 Groundwater Wells

The *Minto Mine Environmental Monitoring and Surveillance Plan* details the groundwater wells at the Minto Mine, including operative and inoperative wells. Figure 5-95 shows a location map of the operative wells. In 2013, 16 groundwater wells at the Minto Mine were operative. MW13-DP5 was the singular well installation for 2013.

In 2013, adjustments were made to the numbering convention of the zones in groundwater wells MW12-05-01 and MW12-06-02. During the 2012 field installation of the groundwater wells, the zones were numbered according to the sampling series and not the zone location. The numbering convention of the zones has now been adjusted to represent the zone location in the groundwater wells.

Table 5-31 lists the operational status and location of the groundwater wells at the Minto Mine for 2013. Complete results for the 2013 Groundwater Monitoring Program groundwater wells are presented in Appendix D.

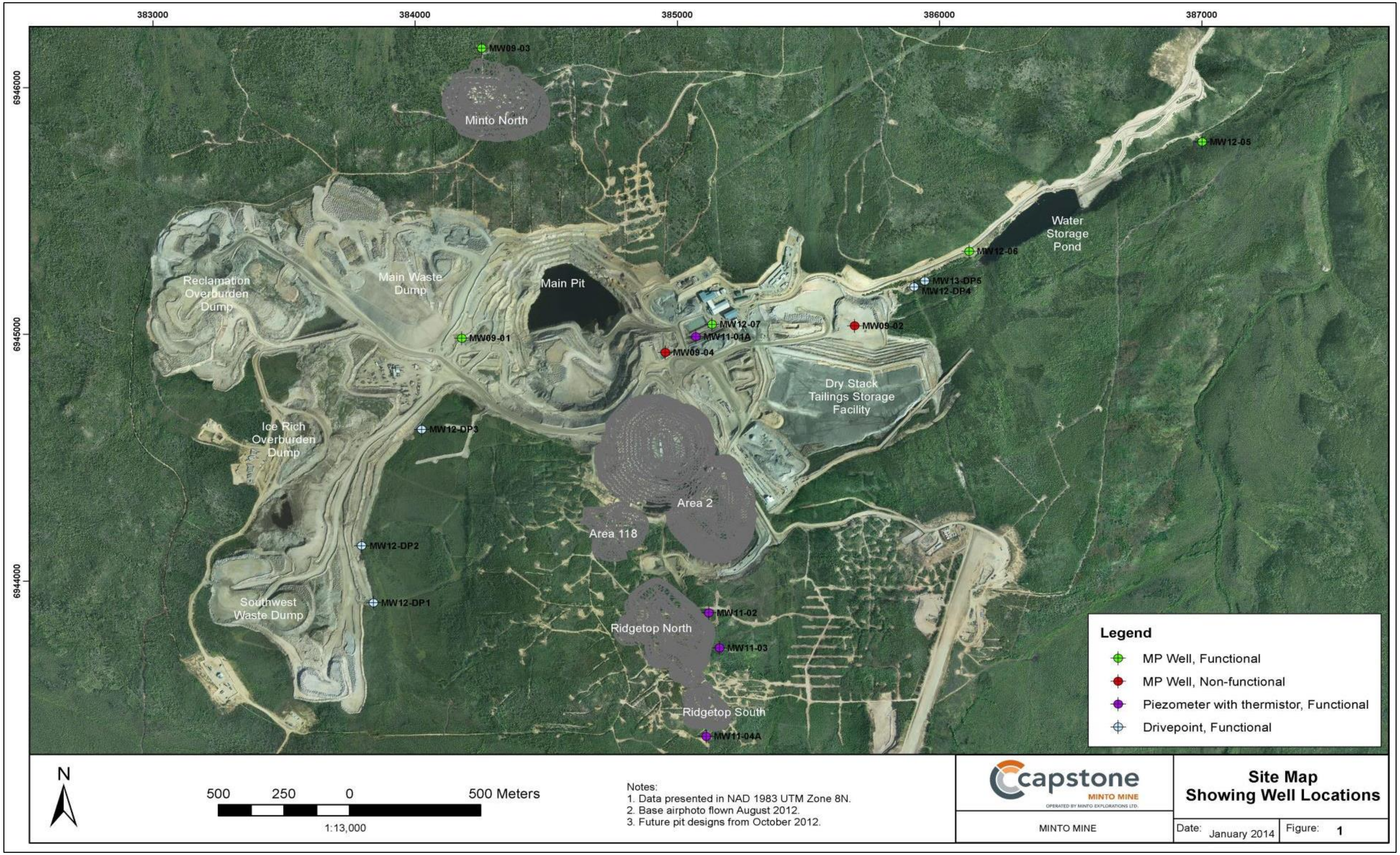


Figure 5-95: 2013 Minto Mine Groundwater Well Locations

Table 5-31: Minto Mine groundwater wells operational status summary (2013)

Groundwater Well Name	Location	Status
08SWC270	Southwest Waste Dump area	*Destroyed*
08SWC271	Southwest Waste Dump area	*Destroyed*
08SWC272	Southwest Waste Dump area	*Destroyed (Buried by waste rock)*
08SWC273	Southwest Waste Dump area	*Destroyed*
08SWC274	Southwest Waste Dump area	*Destroyed*
08SWC275	Southwest Waste Dump area	*Destroyed*
08SWC277	Southwest Waste Dump area	*Destroyed*
08SWC278	Southwest Waste Dump area	*Destroyed*
08SWC280	Southwest Waste Dump area	*Destroyed (Buried by waste rock)*
MW09-01	Main Waste Dump area	Operational
MW09-02	DSTSF Area	*Destroyed*
MW09-03	Minto North Pit area	Operational
MW09-04	Main Pit area	*Destroyed*
MW11-01A	Downgradient of Main Pit	Operational (sometimes frozen)
MW11-02	NE of Ridgetop North Pit	Operational (sometimes frozen)
MW11-03	SE of Ridgetop North Pit	Operational (sometimes frozen)
MW11-04A	S of Ridgetop South Pit	Operational
MW12-05	Downgradient of WSP	Operational
MW12-06	Downgradient of MVF/DSTSF	Operational
MW12-07	Downgradient of Main Pit	Operational
MW12-DP1	West of Southwest Waste Dump	Operational
MW12-DP2	West of Southwest Waste Dump	Operational
MW12-DP3	West of Southwest Waste Dump	Operational
MW12-DP4	Downgradient of MVF/DSTSF	Operational
MW13-DP5	Downgradient of MVF/DSTSF	Operational
P93-E	Main Pit area	*Destroyed during mining*
P94-20	Main Water Dam area	*Destroyed*
Unnamed auxiliary well near mill	Mill area	Operational
Unnamed camp water well	Camp area	Operational

5.11.1.1 ***MW09-01***

Groundwater well MW09-01 water quality results are summarized in Table 5-32 for samples taken in 2013. MW09-01 was monitored in 2012, however all zones were dry. A pressure profile was completed in March 2013; however, water could not be extracted from the well. Zone 3 (MW09-01-03) was the singular zone to produce a water quality sample in the fall of 2013.

Table 5-32: MW09-01-03 water quality results summary table (2013)

MW09-01-03	2013 Results
Parameters	2013-Oct-14
pH	7.69
TDS (mg/L)	3220
Sulfate-dissolved (mg/L)	*
Nutrients (mg/L)	
Ammonia Nitrogen	31
Nitrate Nitrogen	124
Nitrite Nitrogen	4.99
Dissolved Metals (mg/L)	
Calcium	436
Cadmium	0.000163
Copper	0.0056
Iron	0.0246
Selenium	0.0146

*Not available

5.11.1.2 *MW09-03*

Groundwater well MW09-03 water quality results are summarized in Table 5-33 through Table 5-35 for samples taken in 2012 - 2013. MW09-03 produced results from all sampling zones (01, 02 and 03) during the 2013 monitoring period.

Table 5-33: MW09-03-01 water quality results summary table (2012 - 2013)

MW09-03-01	2012 Results		2013 Results		
Parameters	2012-May-10	2012-Nov-17	2013-Mar-12	2013-Aug-18	2013-Oct-12
pH	7.99	*	8.23	8.18	8.03
TDS (mg/L)	162	160	188	184	196
Sulfate-dissolved (mg/L)	21.4	22.2	24.4	21.9	22.1
Nutrients (mg/L)					
Ammonia Nitrogen	0.073	0.12	0.065	0.053	0.05
Nitrate Nitrogen	0.109	0.069	0.052	0.669	<0.020
Nitrite Nitrogen	0.182	0.118	0.161	1.63	0.174
Dissolved Metals (mg/L)					
Calcium	42	46.9	38.8	40.6	44.2
Cadmium	0.000085	0.000683	0.000028	0.000022	0.000018
Copper	0.00281	0.00182	0.00031	0.00075	0.00028
Iron	<0.0050	0.0116	<0.0050	0.0065	<0.0050
Selenium	<0.00010	0.000052	<0.00010	<0.00010	<0.00010

*Not available

Table 5-34: MW09-03-02 water quality results summary table (2012 - 2013)

MW09-03-02	2012 Results		2013 Results		
Parameters	2012-May-10	2012-Nov-17	2013-Mar-12	2013-Aug-18	2013-Oct-12
pH	7.59	*	8.03	8.08	7.92
TDS (mg/L)	716	648	670	622	598
Sulfate-dissolved (mg/L)	<0.50	<0.50	0.53	9.2	0.98
Nutrients (mg/L)					
Ammonia Nitrogen	0.23	0.23	0.33	0.24	0.21
Nitrate Nitrogen	0.1	0.035	0.021	<0.020	<0.020
Nitrite Nitrogen	0.171	0.0924	0.0915	0.0888	0.0805
Dissolved Metals (mg/L)					
Calcium	154	161	158	149	166
Cadmium	0.000028	<0.000025	0.000011	0.000026	<0.000010
Copper	0.00107	0.00073	<0.00020	0.00066	0.00119
Iron	19.2	19.4	14.7	19.3	23.8
Selenium	0.0002	<0.00020	0.00017	0.00011	<0.00010

*Not available

Table 5-35: MW09-03-03 water quality results summary table (2012 - 2013)

MW09-03-03	2012 Results		2013 Results		
Parameters	2012-May-10	2012-Nov-17	2013-Mar-12	2013-Aug-18	2013-Oct-14
pH	7.92	*	7.91	7.99	7.99
TDS (mg/L)	106	114	130	104	128
Sulfate-dissolved (mg/L)	11.2	9.79	12.8	9.4	11.2
Nutrients (mg/L)					
Ammonia Nitrogen	<0.0050	0.0054	0.025	0.013	0.063
Nitrate Nitrogen	0.302	0.248	0.366	0.426	0.412
Nitrite Nitrogen	0.0145	0.0058	0.01	0.0239	<0.0050
Dissolved Metals (mg/L)					
Calcium	28.1	31.9	28.1	30.3	28.7
Cadmium	0.000069	0.000023	0.000015	0.00001	0.0001
Copper	0.0032	0.00174	0.00139	0.00222	0.00217
Iron	0.0164	0.0113	0.0195	0.157	0.0068
Selenium	0.00031	0.000414	0.00036	0.00029	0.0003

*Not available

5.11.1.3 *MW11-01A*

MW11-01A was frozen throughout 2013, therefore water quality results are not available for the 2013 monitoring period.

5.11.1.4 *MW11-02*

MW11-02 was frozen throughout 2013, therefore water quality results are not available for the 2013 monitoring period.

5.11.1.5 *MW11-03*

MW11-03 was frozen throughout 2013, therefore water quality results are not available for the 2013 monitoring period.

5.11.1.6 *MW11-04A*

Groundwater well MW11-04A water quality results are summarized in Table 5-36 for samples taken in 2012 - 2013. MW11-04A was sampled twice in 2013.

Table 5-36: MW11-04A water quality results summary table (2012 – 2013)

MW11-04A	2012 Results	2013 Results	
Parameters	2012-May-18	2013-Jul-02	2013-Oct-15
pH	11.5	11.7	11.3
TDS (mg/L)	*	396	200
Sulfate-dissolved (mg/L)	<5.0	3.47	3.72
Nutrients (mg/L)			
Ammonia Nitrogen	1.5	0.18	0.081
Nitrate Nitrogen	1.6	1.15	1.16
Nitrite Nitrogen	0.0234	0.0098	0.0116
Dissolved Metals (mg/L)			
Calcium	86	170	86.5
Cadmium	0.000015	<0.000010	<0.000010
Copper	0.0932	0.0406	0.0345
Iron	0.0161	0.0107	0.0057
Selenium	0.00334	0.00175	0.00201

*Not available

5.11.1.7 *MW12-DP1*

Drivepoint well MW12-DP1 produced a limited quantity of water in October 2013. Complete water quality analysis for the parameters outlined in the *Minto Mine Environmental Monitoring and Surveillance Plan* could not be accomplished in 2013.

5.11.1.8 *MW12-DP2*

Drivepoint well MW11-03 was dry and / or frozen throughout 2013, therefore water quality results are not available for the 2013 monitoring period.

5.11.1.9 *MW12-DP3*

Drivepoint well MW12-DP2 produced a limited quantity of water in October 2013. Complete water quality analysis for the parameters outlined in the *Minto Mine Environmental Monitoring and Surveillance Plan* could not be accomplished in 2013.

5.11.1.10 *MW12-DP4*

Drivepoint well MW12-DP4 water quality results are summarized in Table 5-37 for samples taken in 2013. MW12-DP3 was sampled twice in 2013.

Table 5-37: MW12-DP4 water quality results summary table (2013)

MW12-DP4	2013 Results	
Parameters	2013-Jul-27	2013-Oct-09
pH	7.93	8.07
TDS (mg/L)	612	506
Sulfate-dissolved (mg/L)	96.2	89.3
Nutrients (mg/L)		
Ammonia Nitrogen	0.038	0.043
Nitrate Nitrogen	1.12	3.78
Nitrite Nitrogen	0.0093	0.0744
Dissolved Metals (mg/L)		
Calcium	104	*
Cadmium	0.000046	*
Copper	0.0044	*
Iron	0.0229	*
Selenium	0.00097	*

*Not available

5.11.1.11 *MW12-05*

Groundwater well MW12-05 water quality results are summarized in Table 5-38 through Table 5-41 for samples taken in 2012 - 2013. MW12-05 produced results from all sampling zones (01, 03, 05 and 07) during the 2013 monitoring period.

Table 5-38: MW12-05-01 water quality results summary table (2012 - 2013)

MW12-05-01	2012 Results	2013 Results	
Parameters	2012-Nov-11	2013-Aug-21	2013-Oct-10
pH	*	8.31	8.23
TDS (mg/L)	706	912	1030
Sulfate-dissolved (mg/L)	350	483	532
Nutrients (mg/L)			
Ammonia Nitrogen	<0.0050	0.078	0.37
Nitrate Nitrogen	0.368	0.021	<0.020
Nitrite Nitrogen	0.0517	0.0581	0.195
Dissolved Metals (mg/L)			
Calcium	117	160	168
Cadmium	0.00014	0.000012	<0.000010
Copper	0.00737	<0.00020	<0.00020
Iron	0.0085	0.0323	0.0218
Selenium	0.00047	0.00033	0.0009

*Not available

Table 5-39: MW12-05-03 water quality results summary table (2012 - 2013)

MW12-05-03	2012 Results	2013 Results	
Parameters	2012-Nov-12	2013-Aug-21	2013-Oct-10
pH	*	8.16	8.1
TDS (mg/L)	880	1240	1330
Sulfate-dissolved (mg/L)	456	633	686
Nutrients (mg/L)			
Ammonia Nitrogen	0.019	0.051	0.066
Nitrate Nitrogen	0.03	0.035	<0.020
Nitrite Nitrogen	0.109	0.0252	0.0565
Dissolved Metals (mg/L)			
Calcium	120	188	189
Cadmium	0.000214	<0.000010	<0.000010
Copper	0.0022	<0.00020	0.00023
Iron	0.0981	1.82	1.9
Selenium	0.000364	<0.00010	<0.00010

*Not available

Table 5-40: MW12-05-05 water quality results summary table (2012 - 2013)

MW12-05-05	2012 Results	2013 Results	
Parameters	2012-Nov-12	2013-Aug-21	2013-Oct-10
pH	*	8.21	8.26
TDS (mg/L)	288	276	292
Sulfate-dissolved (mg/L)	46.3	40.7	42.5
Nutrients (mg/L)			
Ammonia Nitrogen	0.016	0.013	0.014
Nitrate Nitrogen	0.817	0.614	0.467
Nitrite Nitrogen	0.195	0.122	0.16
Dissolved Metals (mg/L)			
Calcium	47.2	46.4	43.9
Cadmium	0.000016	0.00001	<0.000010
Copper	0.00154	0.0014	0.00119
Iron	0.0152	0.0284	0.044
Selenium	0.000164	0.00012	0.00017

*Not available

Table 5-41 MW12-05-07 water quality results summary table (2012 - 2013)

MW12-05-07	2012 Results	2013 Results	
Parameters	2012-Nov-12	2013-Aug-21	2013-Oct-10
pH	*	8.4	8.23
TDS (mg/L)	260	298	306
Sulfate-dissolved (mg/L)	40.6	11.5	18.5
Nutrients (mg/L)			
Ammonia Nitrogen	0.21	0.1	0.068
Nitrate Nitrogen	<0.020	<0.020	<0.020
Nitrite Nitrogen	0.0298	0.0427	<0.0050
Dissolved Metals (mg/L)			
Calcium	49.4	51.9	49
Cadmium	<0.0000050	<0.000010	<0.000010
Copper	0.000477	0.00065	0.0002
Iron	0.867	0.928	0.387
Selenium	0.000108	0.00014	0.0003

*Not available

5.11.1.12 *MW12-06*

Groundwater well MW12-06 water quality results are summarized in Table 5-42 through Table 5-44 for samples taken in 2012 - 2013. MW12-06 produced results from all sampling zones (02, 04 and 06) during the 2013 monitoring period.

Table 5-42: MW12-06-02 water quality results summary table (2012 – 2013)

MW12-06-02	2012 Results	2013 Results	
Parameters	2012-Nov-16	2013-Aug-18	2013-Oct-11
pH	*	8.2	8.16
TDS (mg/L)	636	646	686
Sulfate-dissolved (mg/L)	208	206	227
Nutrients (mg/L)			
Ammonia Nitrogen	0.0074	0.048	0.052
Nitrate Nitrogen	0.081	0.25	0.052
Nitrite Nitrogen	0.263	0.787	0.302
Dissolved Metals (mg/L)			
Calcium	113	132	137
Cadmium	0.000047	<0.000010	0.000018
Copper	0.00115	0.0007	0.00042
Iron	0.726	0.954	1.67
Selenium	0.000238	0.00028	0.00018

*Not available

Table 5-43: MW12-06-04 water quality results summary table (2012 – 2013)

MW12-06-04	2012 Results	2013 Results	
Parameters	2012-Nov-16	2013-Aug-18	2013-Oct-11
pH	*	8.21	8.12
TDS (mg/L)	618	602	620
Sulfate-dissolved (mg/L)	178	163	161
Nutrients (mg/L)			
Ammonia Nitrogen	0.0059	0.021	0.019
Nitrate Nitrogen	0.08	0.128	0.022
Nitrite Nitrogen	0.229	0.463	0.167
Dissolved Metals (mg/L)			
Calcium	97.2	103	104
Cadmium	0.000012	<0.000010	<0.000010
Copper	0.000106	<0.00020	0.00038
Iron	0.717	0.67	0.713
Selenium	0.000083	0.00014	<0.00010

*Not available

Table 5-44: MW12-06-06 water quality results summary table (2012 – 2013)

MW12-06-06	2012 Results	2013 Results	
Parameters	2012-Nov-16	2013-Aug-18	2013-Oct-11
pH	*	8.26	8.25
TDS (mg/L)	538	510	528
Sulfate-dissolved (mg/L)	171	154	158
Nutrients (mg/L)			
Ammonia Nitrogen	0.085	0.011	0.018
Nitrate Nitrogen	0.45	0.952	0.871
Nitrite Nitrogen	0.0651	0.0953	0.0896
Dissolved Metals (mg/L)			
Calcium	81.2	79.2	82.7
Cadmium	0.000012	0.000011	<0.000010
Copper	0.000261	0.00036	0.00047
Iron	0.0833	0.009	0.0197
Selenium	0.000511	0.00022	0.00018

*Not available

5.11.1.13 *MW12-07*

Groundwater well MW12-07 water quality results are summarized in Table 5-45 and Table 5-46 for samples taken in 2012 - 2013. MW12-07 produced results from all sampling zones (01 and 02) during the 2013 monitoring period.

Table 5-45: MW12-07-01 water quality results summary table (2012 – 2013)

MW12-07-01	2012 Results	2013 Results		
Parameters	2012-Nov-03	2013-Aug-06	2013-Aug-20	2013-Oct-15
pH	*	8.28	8.33	8.12
TDS (mg/L)	870	900	902	868
Sulfate-dissolved (mg/L)	193	198	213	256
Nutrients (mg/L)				
Ammonia Nitrogen	<0.0050	0.025	0.027	0.07
Nitrate Nitrogen	53.2	45.3	40.6	23.8
Nitrite Nitrogen	0.0731	3.05	1.83	2.46
Dissolved Metals (mg/L)				
Calcium	177	184	186	176
Cadmium	0.000224	0.000309	0.000081	0.000033
Copper	0.077	0.0265	0.0288	0.0107
Iron	0.23	0.226	0.222	0.233
Selenium	0.0337	0.0274	0.0248	0.0134

*Not available

Table 5-46: MW12-07-02 water quality results summary table (2012 – 2013)

MW12-07-02	2012 Results	2013 Results	
Parameters	2012-Nov-03	2013-Aug-20	2013-Oct-15
pH	*	7.99	8.06
TDS (mg/L)	782	1100	1020
Sulfate-dissolved (mg/L)	283	631	633
Nutrients (mg/L)			
Ammonia Nitrogen	<0.0050	0.087	0.27
Nitrate Nitrogen	21.3	0.158	0.271
Nitrite Nitrogen	0.148	0.287	0.652
Dissolved Metals (mg/L)			
Calcium	140	187	187
Cadmium	0.000269	<0.000010	<0.000010
Copper	0.0217	0.00039	<0.00020
Iron	0.0069	1.3	0.151
Selenium	0.0148	0.00019	0.00041

*Not available

5.11.1.14 *MW13-DP5*

Drivepoint well MW13-DP5 was installed in 2013. Once installed, MW13-DP5 was found to be dry and / or frozen; therefore water quality results are not available for the 2013 monitoring period.

5.11.2 Vibrating Wire Piezometers

There are currently 18 operating vibrating wire piezometers installed on site. An additional three (DSP-1, DSP-2 and DSP-3) were destroyed in 2011/2012 and one (DSP-4) is no longer operational. There were no changes to the operational status of any piezometers in 2013. Table 5-47 contains a summary of the current status of piezometers on site. Summaries of data collected from each piezometer are provided below.

Table 5-47: Vibrating Wire Piezometer Summary

Vibrating Wire Piezometer	Location	Operational Status
DSP-1	DSTSF	Destroyed (2011)
DSP-2	DSTSF	Destroyed (2011)
DSP-3	DSTSF	Destroyed (2012)
DSP-4	DSTSF	Inoperative
DSP-5	DSTSF	Operational
DSP-6	DSTSF	Operational
SDP-2	Southwest Dump	Operational
SDP-3	Southwest Dump	Operational
SDP-4	Southwest Dump	Operational
WDP-2	Water Retention Dam	Operational
WDP-3A	Water Retention Dam	Operational
WDP-3	Water Retention Dam	Operational
WDP-4	Water Retention Dam	Operational
WDP-5	Water Retention Dam	Operational
WDP-6	Water Retention Dam	Operational
WDP-7	Water Retention Dam	Operational
WDP-8	Water Retention Dam	Operational
WDP-9	Water Retention Dam	Operational
WDP-10	Water Retention Dam	Operational
WDP-11	Water Retention Dam	Operational
WDP-12	Water Retention Dam	Operational
WDP-13	Water Retention Dam	Operational

5.11.2.1 *DSTSF Piezometers*

Water elevations collected from DSTSF vibrating wire piezometers are presented in Figure 5-96. Sensor DSP-6A is above the water table and hasn't been included. Data are collected monthly. Due to manpower issues, no data were collected from August to October, 2013.

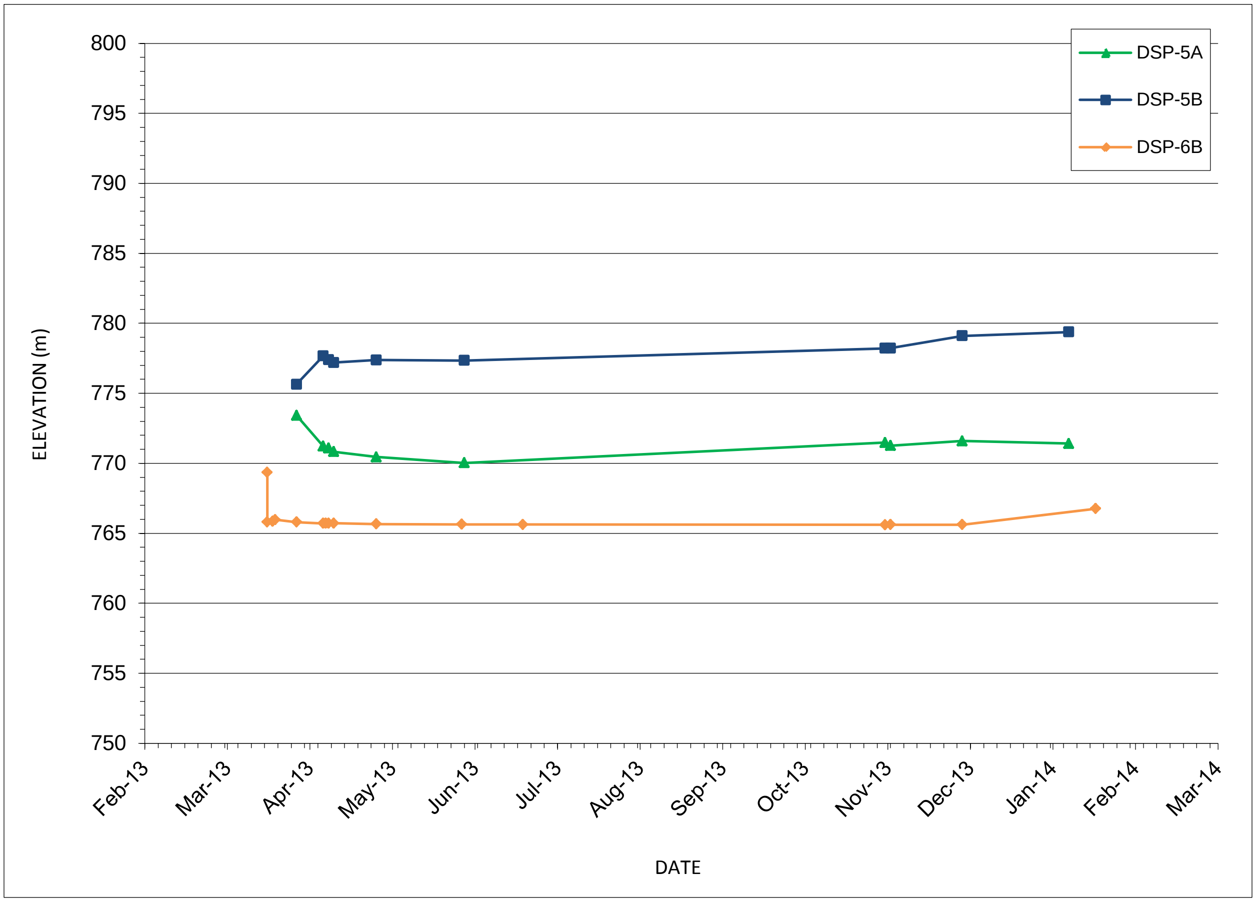


Figure 5-96: Dry Stack Tailings Storage Facility Groundwater Elevations

5.11.2.2 *Southwest Dump Piezometers*

Water elevations collected from Southwest Dump vibrating wire piezometers are presented in Figure 5-97. Sensors SDP-3A and SDP-3B are above the water table and haven't been included. Data are collected monthly. Due to manpower issues, no data were collected in January, March, April, August, September and October.

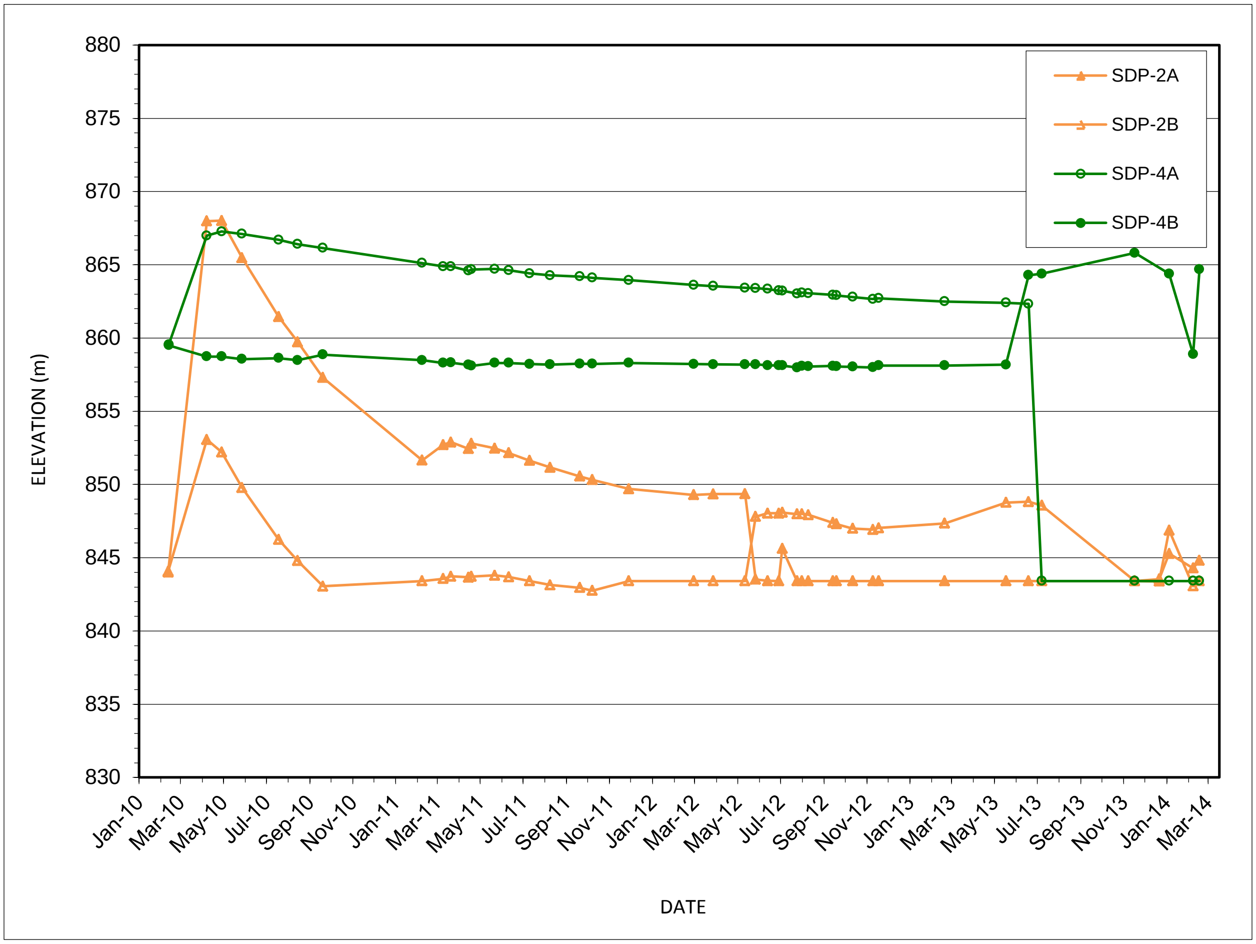


Figure 5-97: Southwest Dump Groundwater Elevations

5.11.2.3 *Water Retention Dam Piezometers*

Water elevations collected from Water Retention Dam vibrating wire piezometers are presented in Figure 5-98. Data are collected monthly. Due to manpower issues, no data were collected in January, March, April, August, September and October.

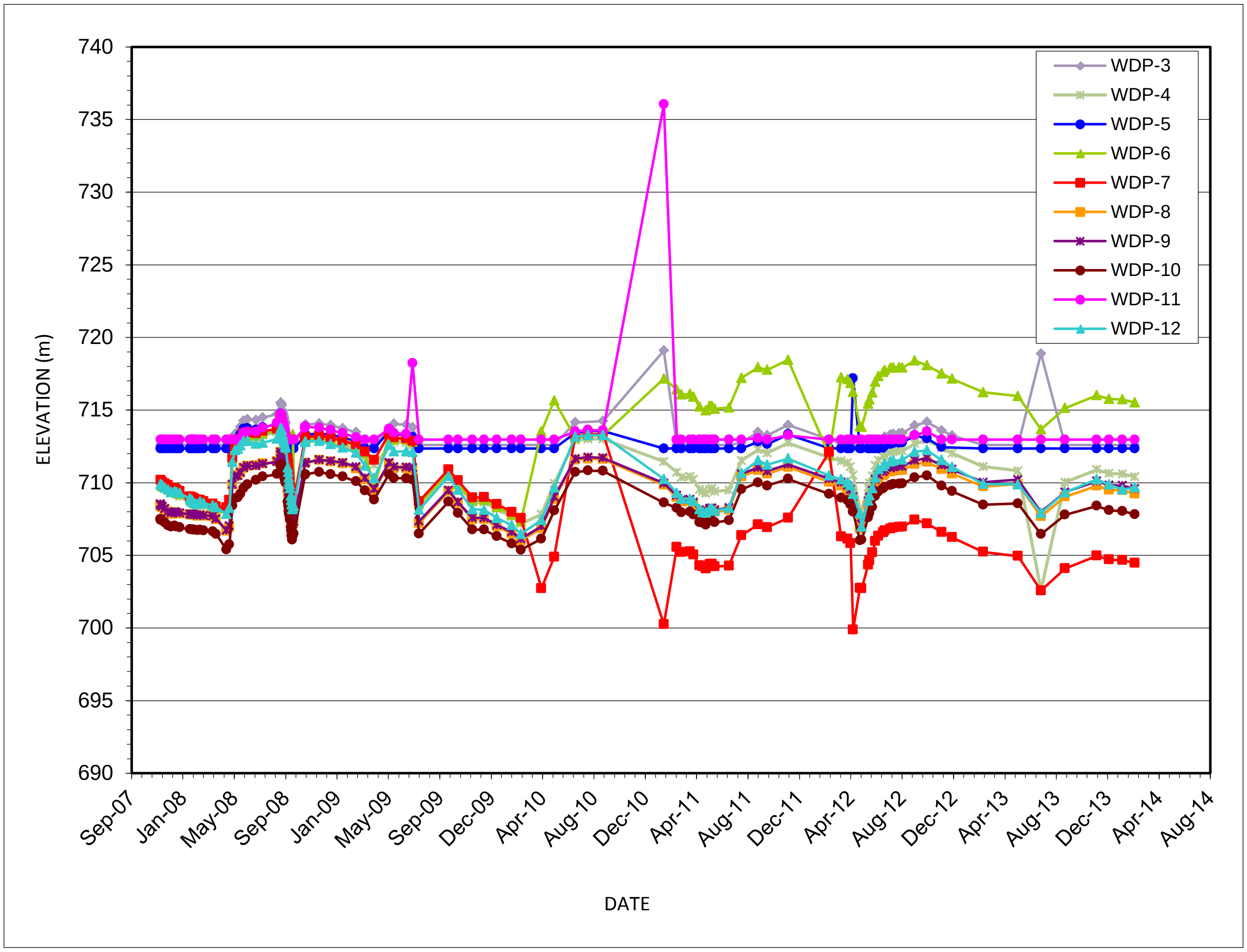


Figure 5-98: Water Retention Dam Groundwater Elevations

5.11.3 Ground Temperature Cables

There are currently 24 operating thermistors installed on site, listed in Table 1-1. There were no changes to the operational status of any of the existing thermistors in 2013. Six new thermistors, DST-10, DST-11, DST-12, DST-13, DST-14 and DST-15 were installed in April, 2013. Summaries of data collected from each thermistor are contained in the following sections.

Table 5-48: Thermistor Summary

Thermistor	Location	Operational Status
A2T-1	DSTSF	Operational
DST-1	DSTSF	Destroyed (2011)
DST-2	DSTSF	Destroyed (2011)
DST-3	DSTSF	Destroyed (2012)
DST-4	DSTSF	Inoperative (2012)
DST-5	DSTSF	Destroyed (2011)
DST-6	DSTSF	Destroyed (2011)
DST-7	DSTSF	Destroyed (2010)

Thermistor	Location	Operational Status
DST-8	DSTSF	Destroyed (2011)
DST-9	DSTSF	Destroyed (2011)
DST-10	DSTSF	Operational
DST-11	DSTSF	Operational
DST-12	DSTSF	Inoperative (2012)
DST-13	DSTSF	Operational
DST-14	DSTSF	Operational
DST-15	DSTSF	Operational
MWPT1	Mill Water Pond	Operational
MWPT2	Mill Water Pond	Operational
MW11-01A	Mill Water Pond	Operational
MW11-02	Ridgetop North	Operational
MW11-03	Ridgetop North	Operational
MW11-04A	Ridgetop South	Destoyed
WDT - 1	Water Storage Pond	Operational
WDT - 2	Water Storage Pond	Operational
WDT - 3	Water Storage Pond	Operational
WDT - 4	Water Storage Pond	Operational
WDT - 5	Water Storage Pond	Operational
WDT - 6	Water Storage Pond	Operational
WDT - 7	Water Storage Pond	Operational
WDT - 8	Water Storage Pond	Operational
SDT-1	Southwest Dump	Operational
SDT-2	Southwest Dump	Operational
SDT-3	Southwest Dump	Operational
SDT-4	Southwest Dump	Operational
08SWC271	Southwest Dump	Destroyed (2010)
08SWC274	Southwest Dump	Destroyed (2011)
08SWC275	Southwest Dump	Destroyed (2008)
08SWC277	Southwest Dump	Destroyed (2008)
08SWC278	Southwest Dump	Destroyed (2008)
08SWC280	Southwest Dump	Destroyed (2008)

5.11.3.1 *DSTSF Thermistors*

Data collected from DSTSF thermistors are presented in Figure 5-99 through Figure 5-104. Data are collected monthly (only quarterly data are shown in the figures for clarity). Due to manpower issues, no data were collected for DST-10 and DST-14 in September; no data were collected for DST-11 in October; no data were collected for DST-13 in May, June, July and August; and, no data were collected for DST-15 in May, June, July, October and November.

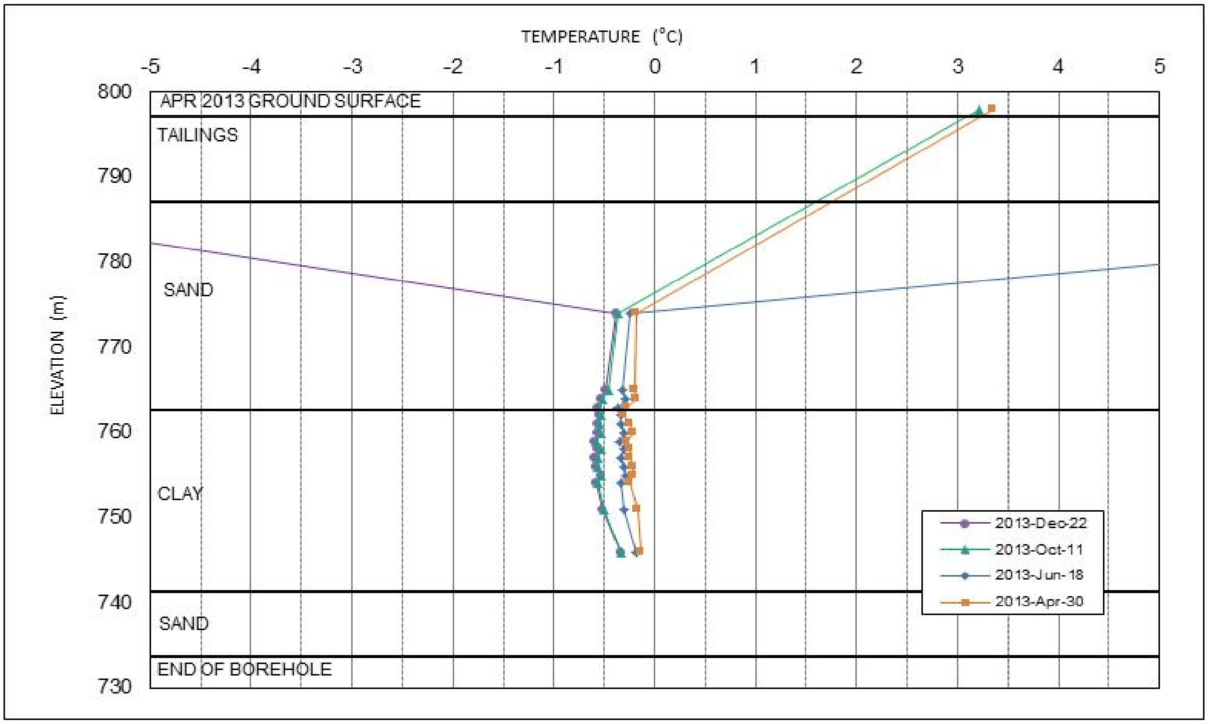


Figure 5-99: Thermistor DST-10

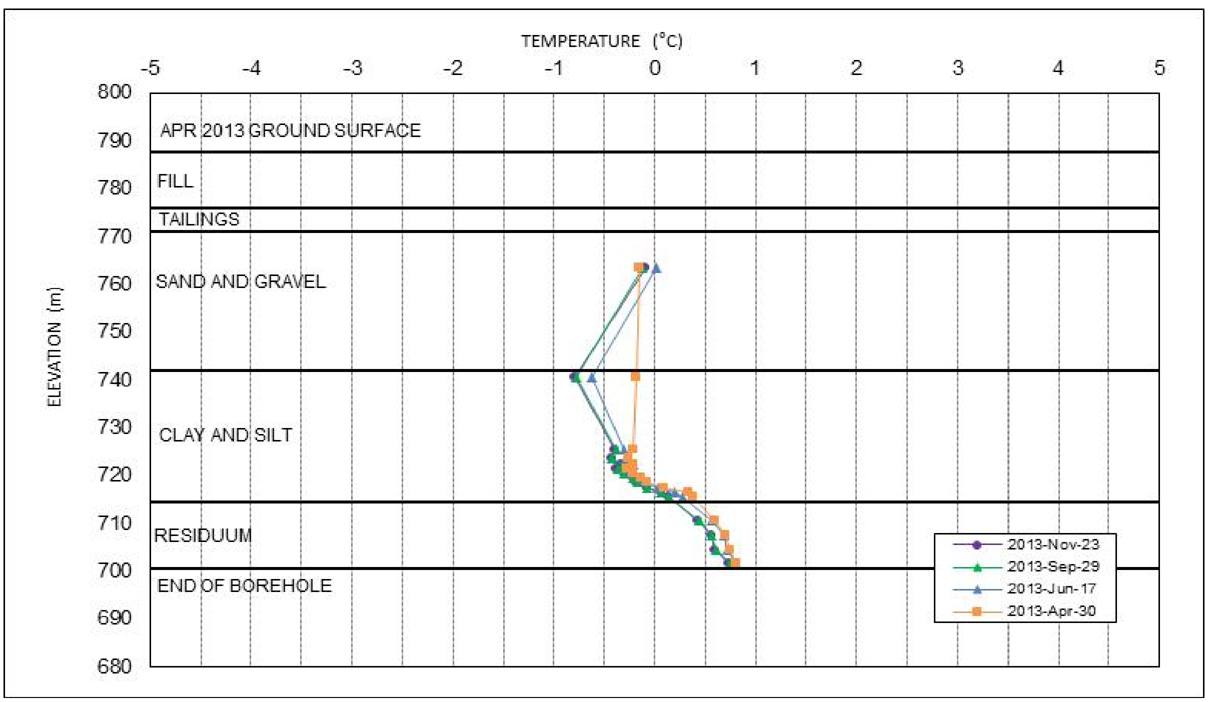


Figure 5-100: Thermistor DST-11

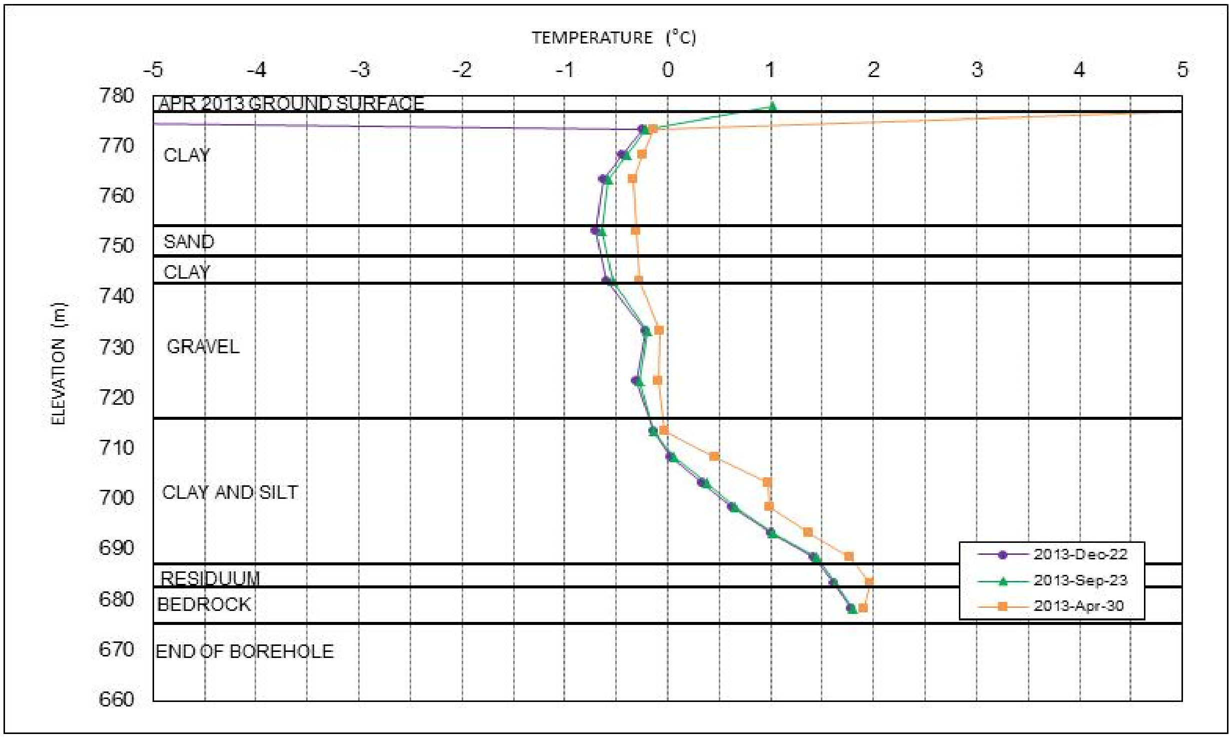


Figure 5-101: Thermistor DST-13

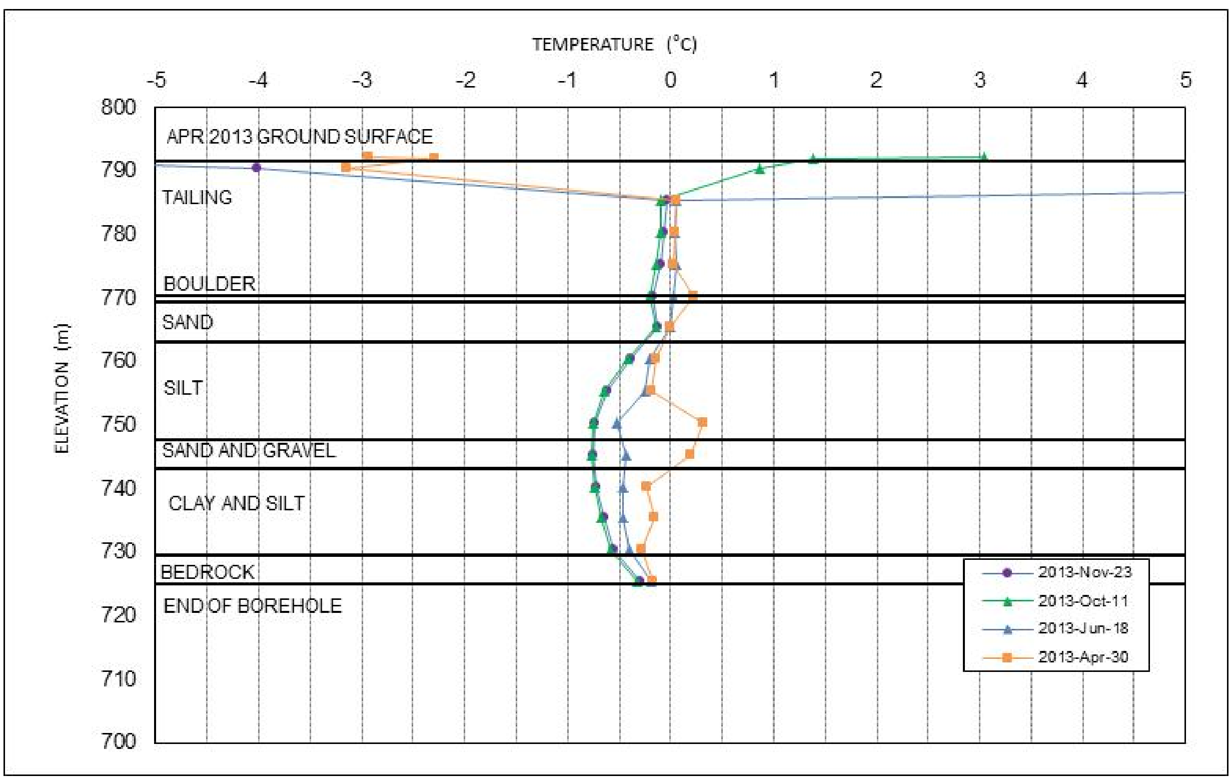


Figure 5-102: Thermistor DST-14

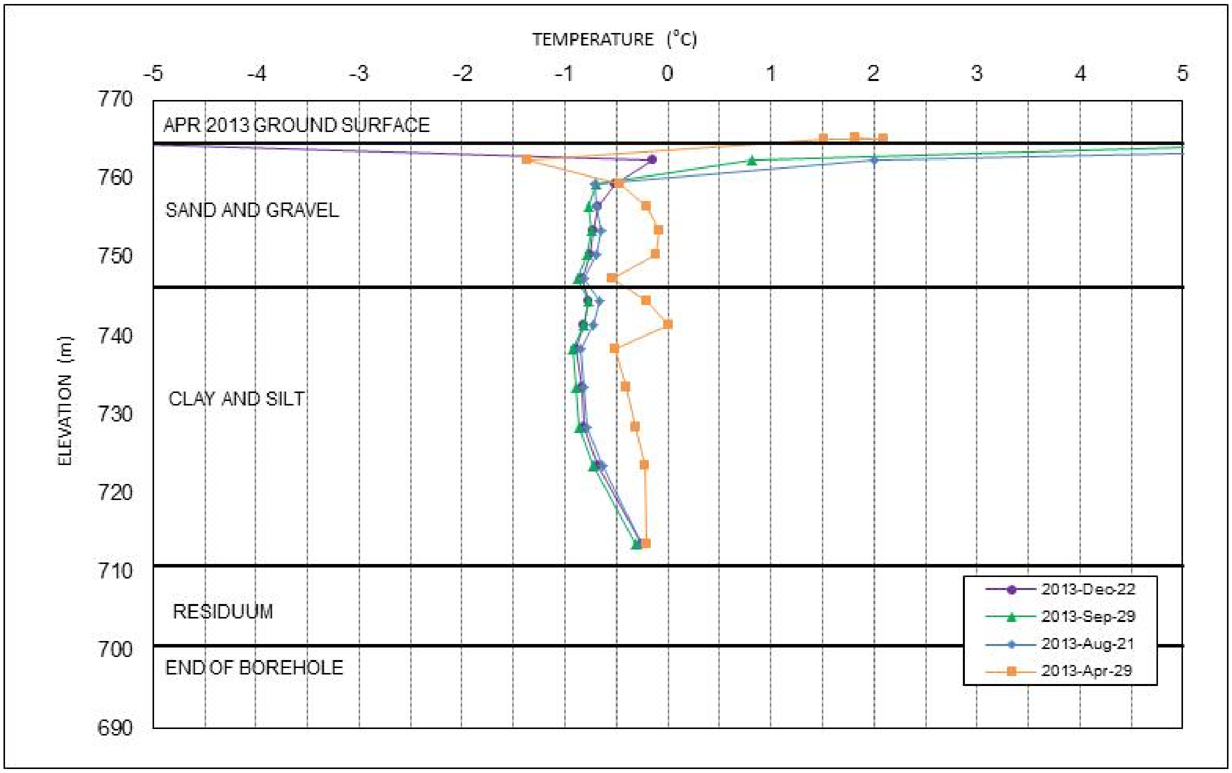


Figure 5-103: Thermistor DST-15

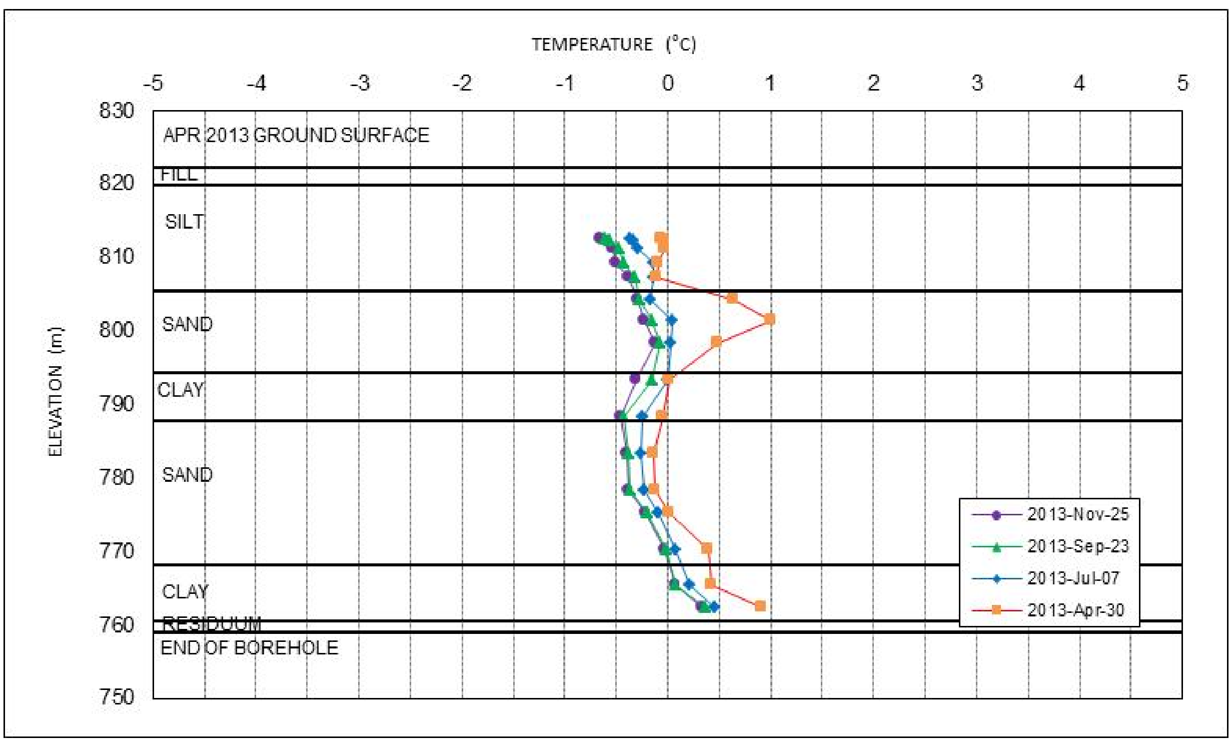


Figure 5-104: Thermistor AT2-1

5.11.3.2 *Mill Water Pond Thermistors*

Only one reading in November was taken for each of the Mill Water Pond thermistors in 2013. Regular, quarterly readings have now resumed.

5.11.3.3 *Ridgetop Thermistors*

Data was not collected from the Ridgetop thermistors in 2013. Monitoring will resume in the 2014 season.

5.11.3.4 *Water Retention Dam Thermistors*

Data collected from water retention dam thermistors are presented in Figure 5-105 through Figure 5-112. Data are collected monthly (only quarterly data are shown in the figures for clarity). Due to manpower issues, no data were collected in January, February and June to September.

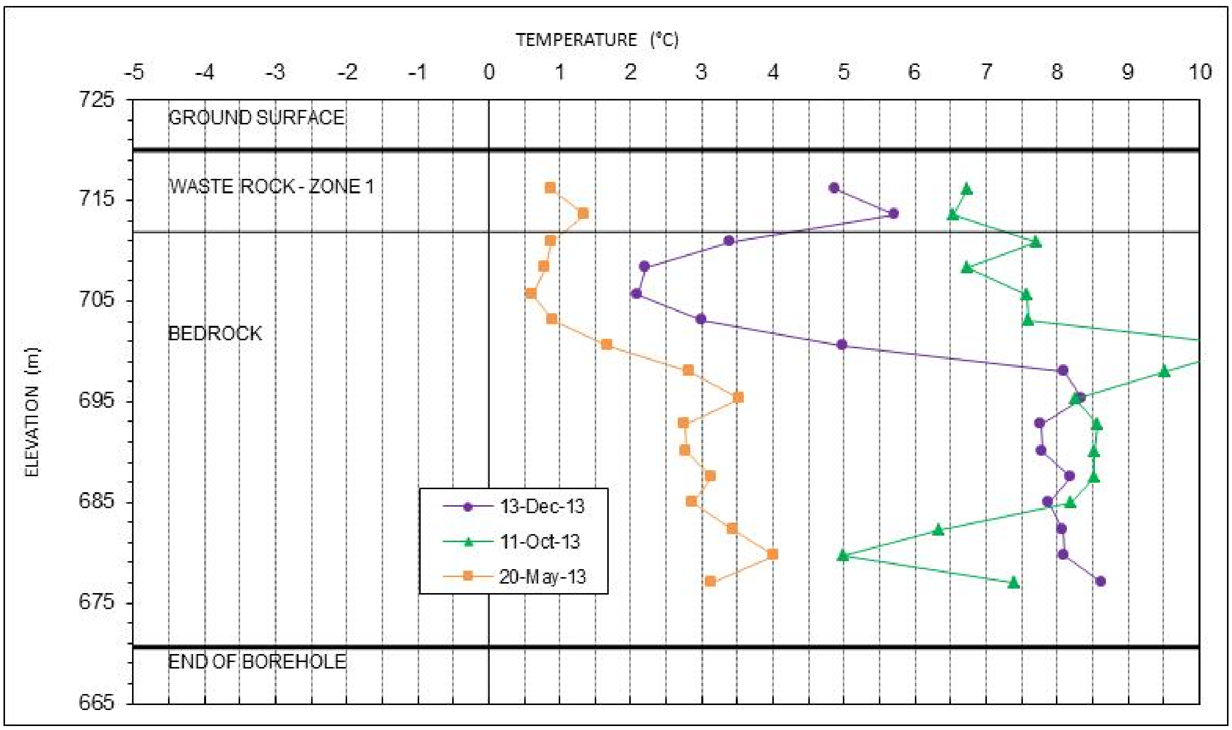


Figure 5-105: Thermistor WDT-1

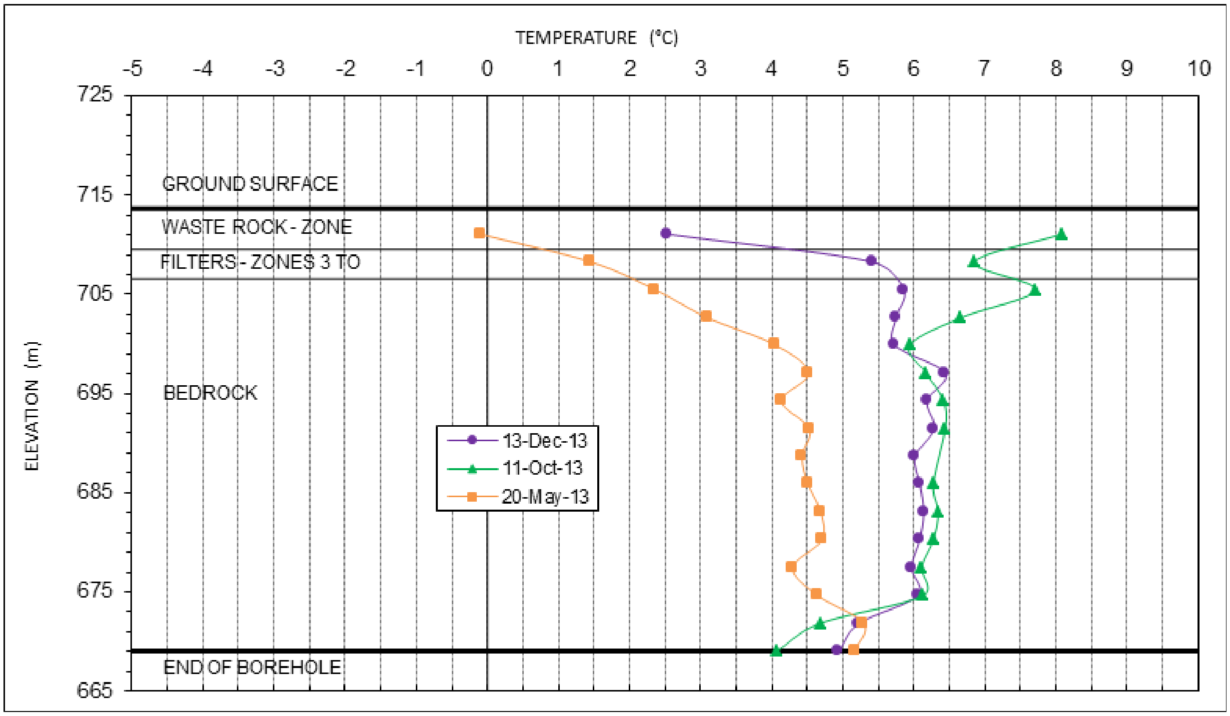


Figure 5-106: Thermistor WDT-2

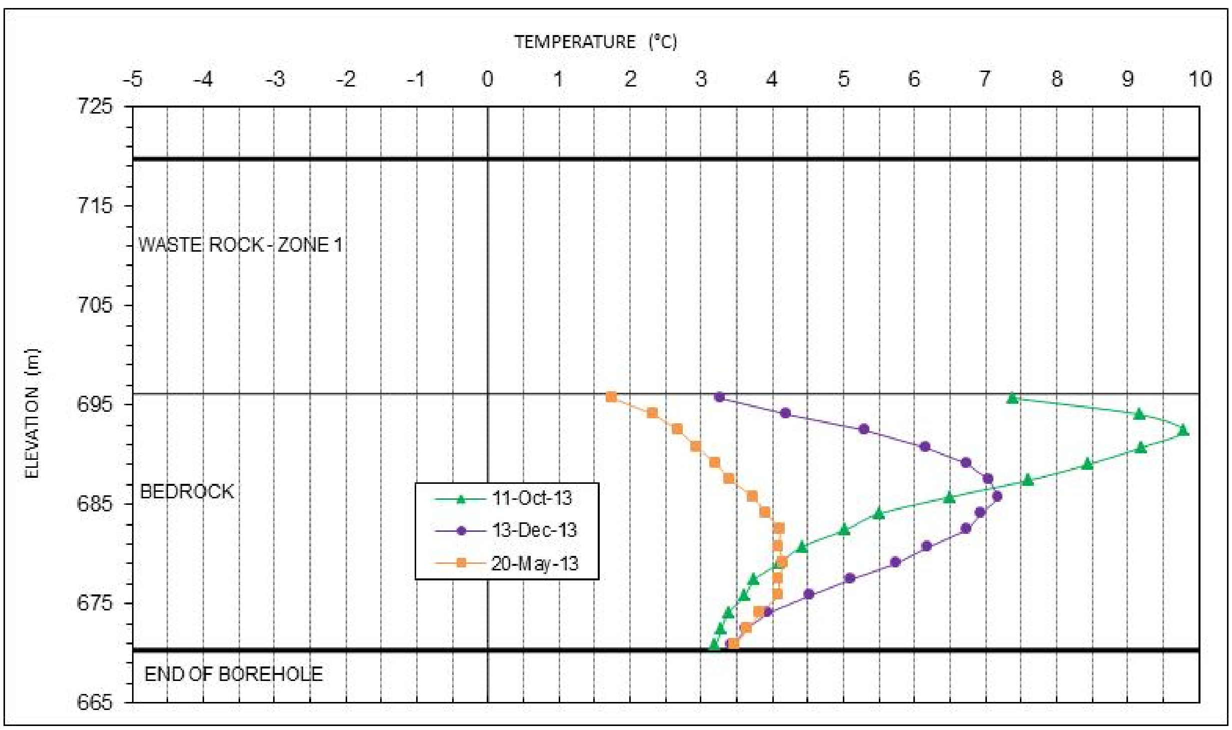


Figure 5-107: Thermistor WDT-3

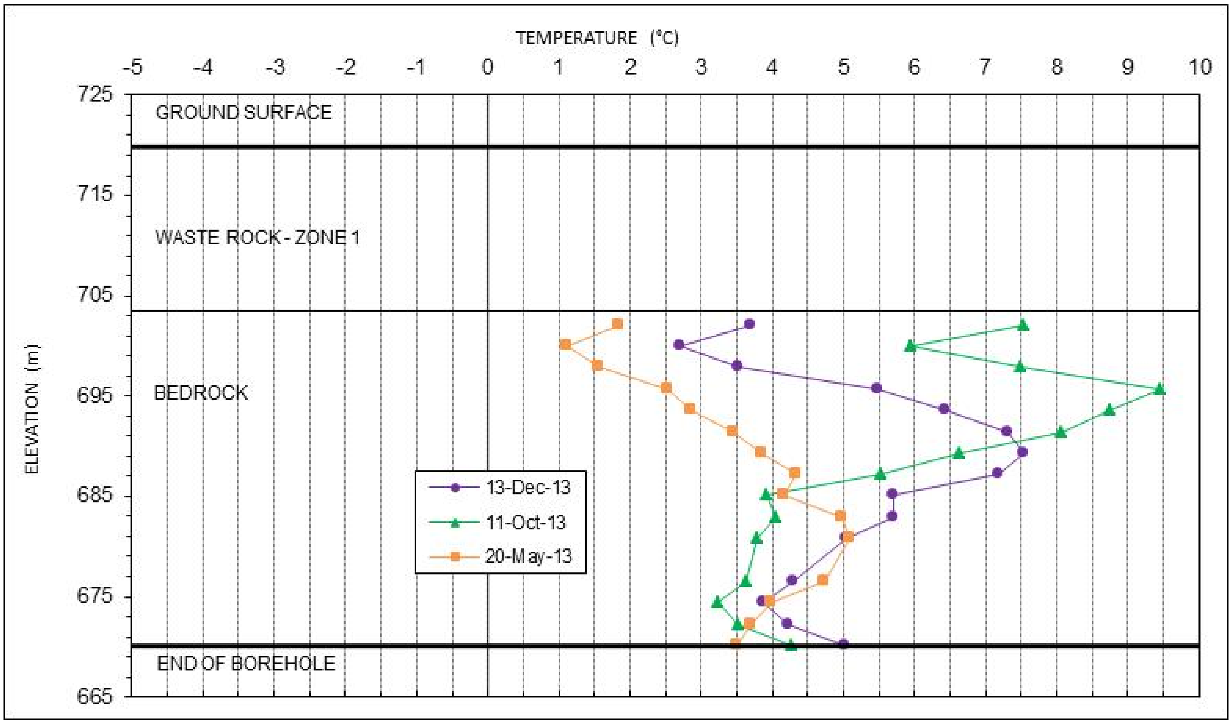


Figure 5-108: Thermistor WDT-4

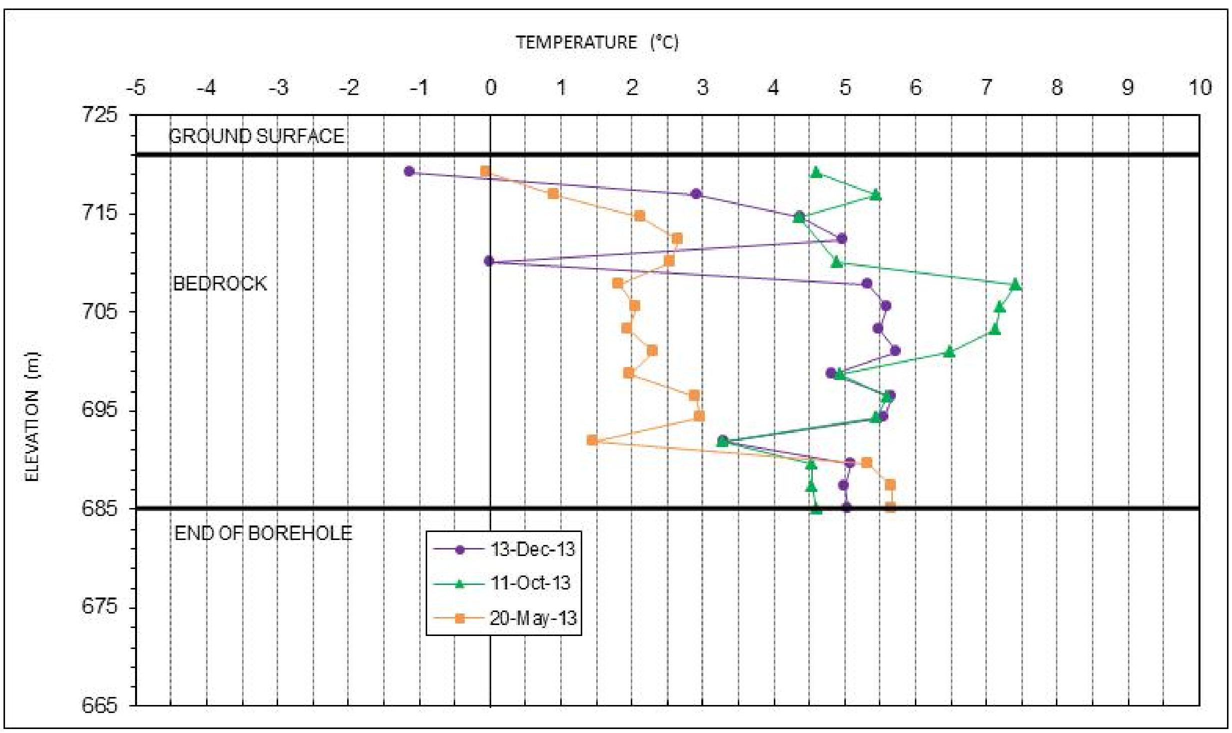


Figure 5-109: Thermistor WDT-5

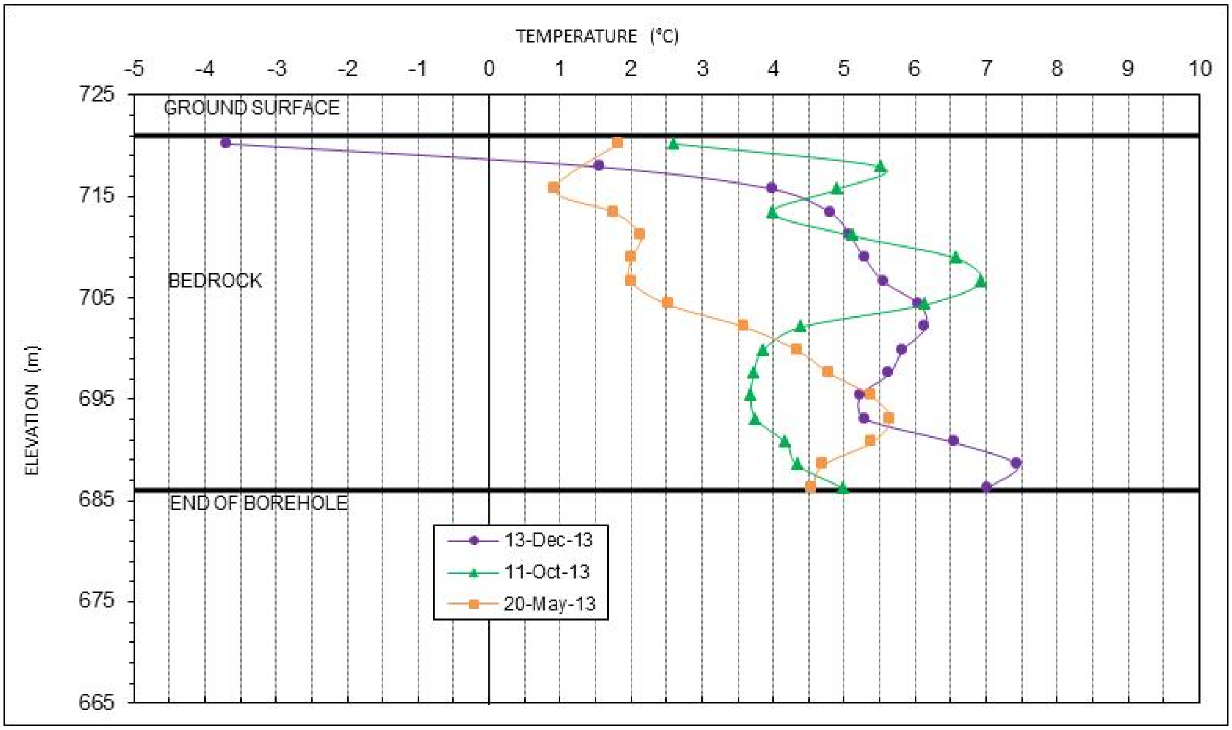


Figure 5-110: Thermistor WDT-6

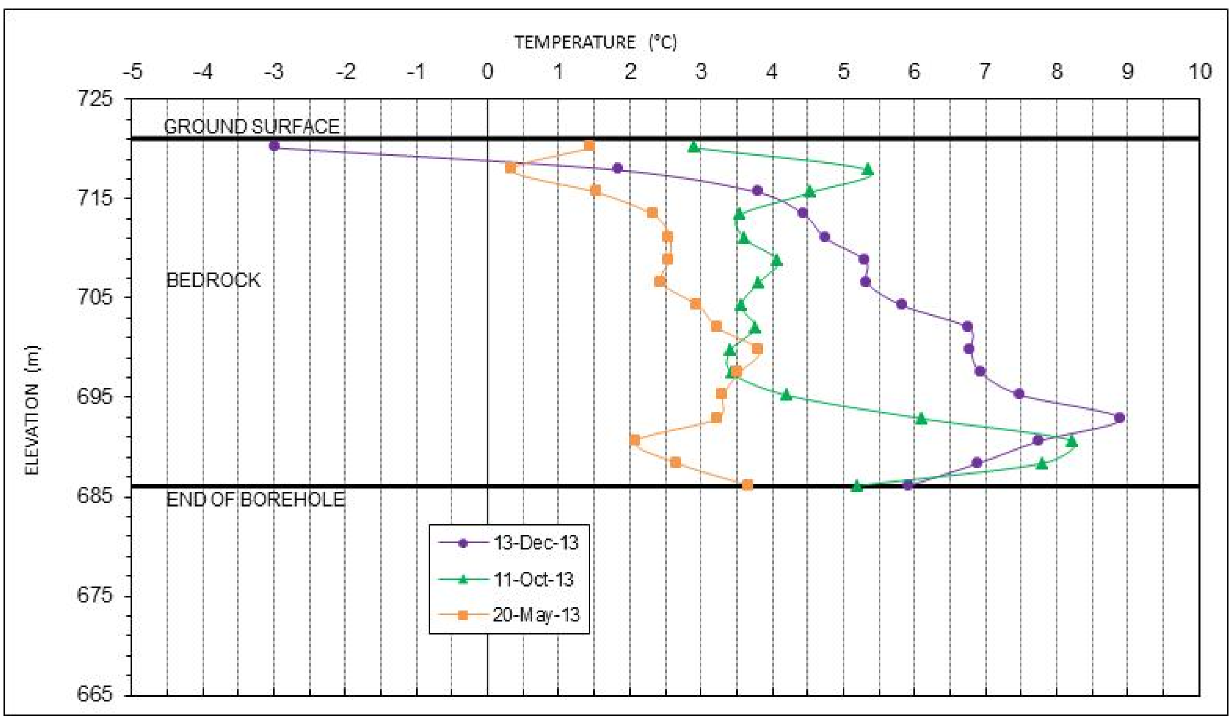


Figure 5-111: Thermistor WDT-7

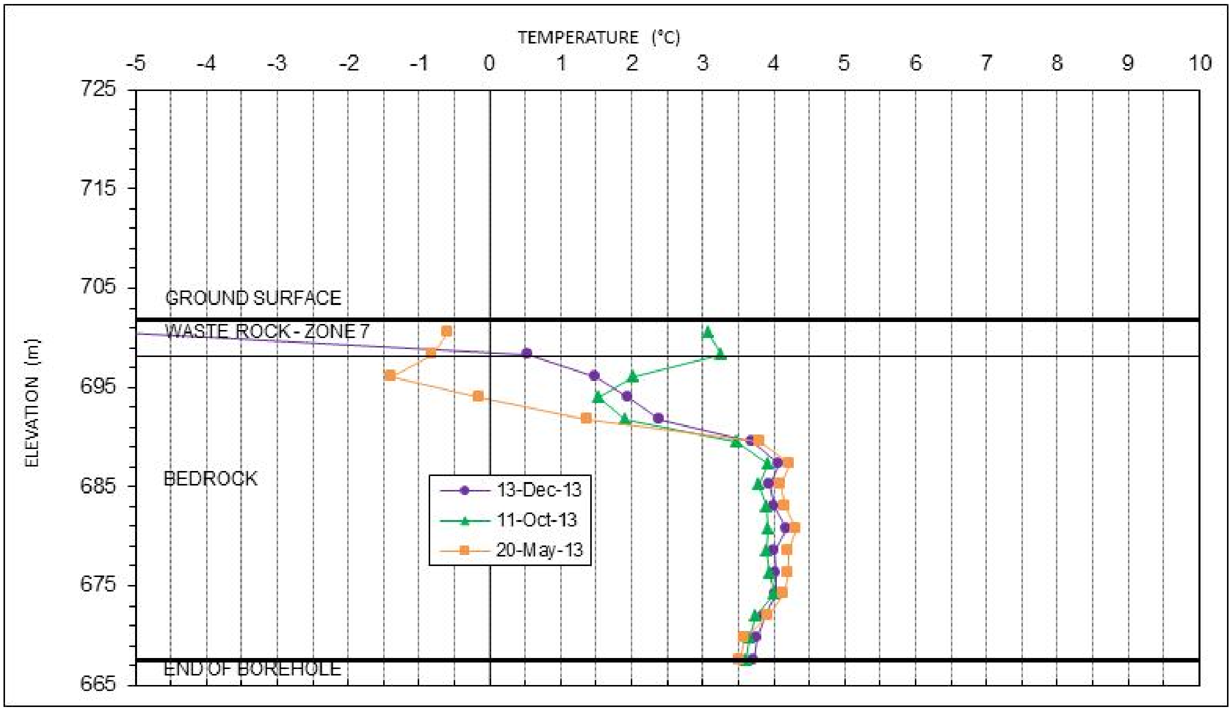


Figure 5-112: Thermistor WDT-8

5.11.3.5 *Southwest Dump Thermistors*

Data collected from southwest dump thermistors are presented in Figure 5-113 through Figure 5-116. Data are collected monthly (only quarterly data are shown in the figures for clarity). Due to manpower issues, no data were collected in January to May, and August.

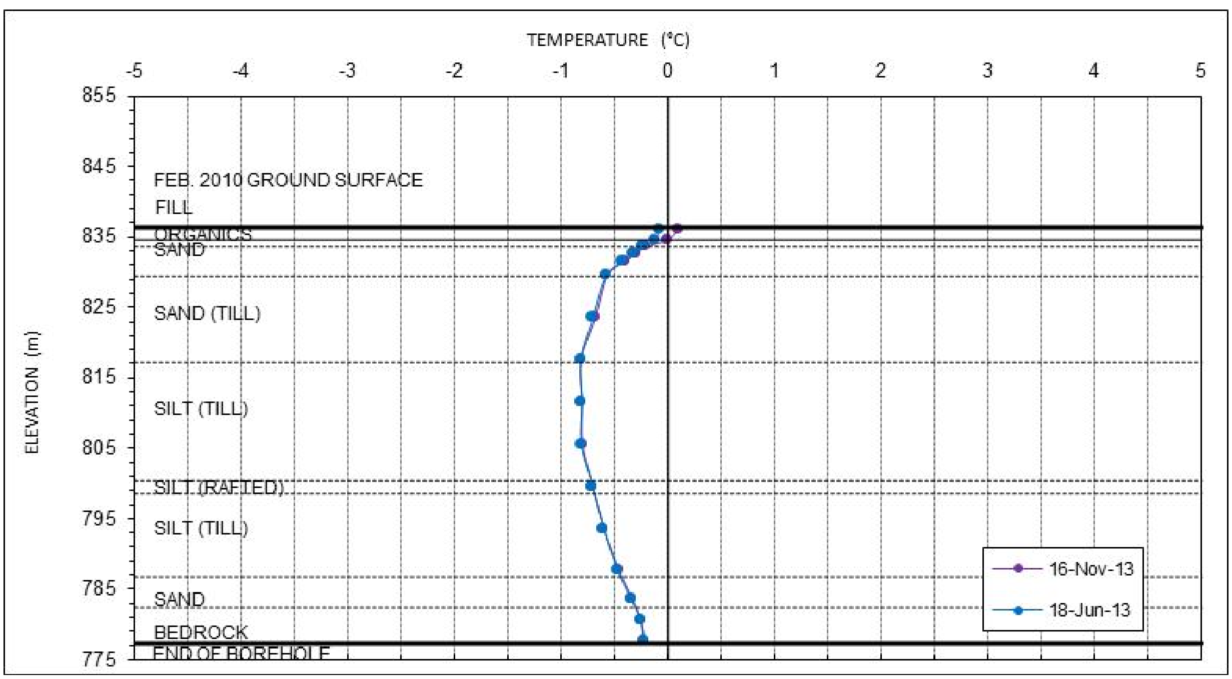


Figure 5-113: Thermistor SDT-1

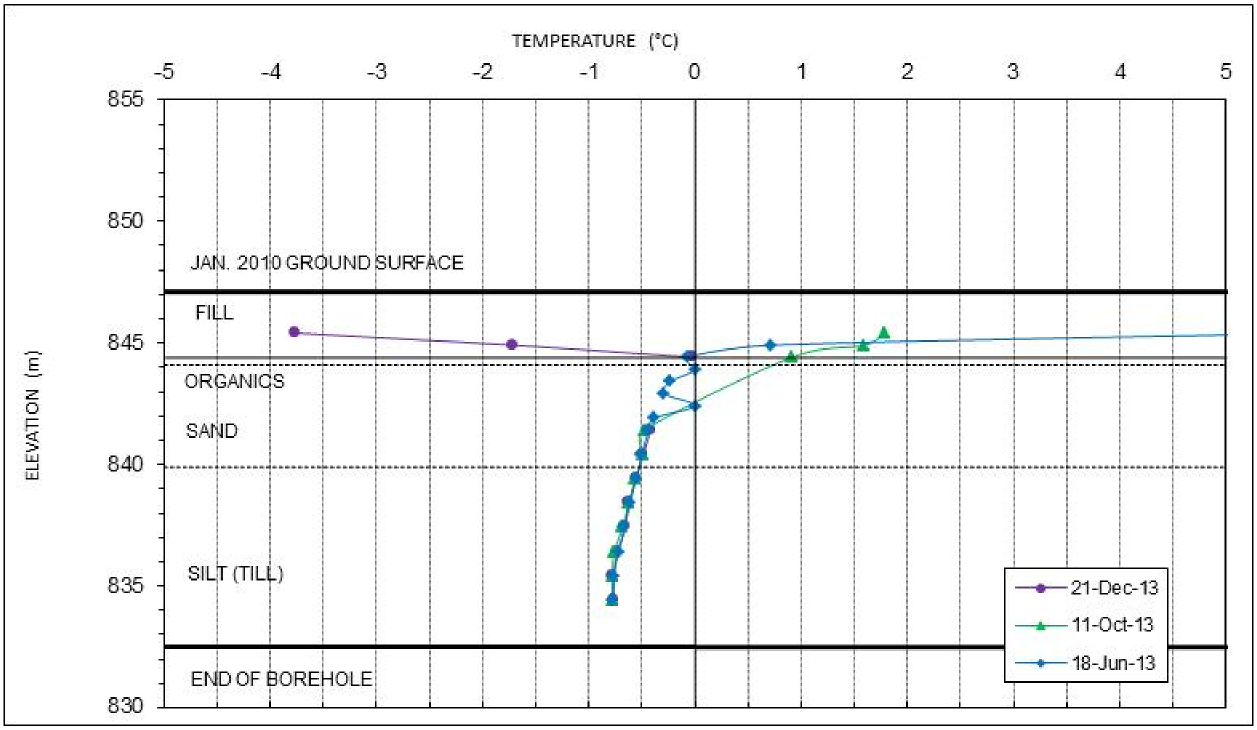


Figure 5-114: Thermistor SDT-2

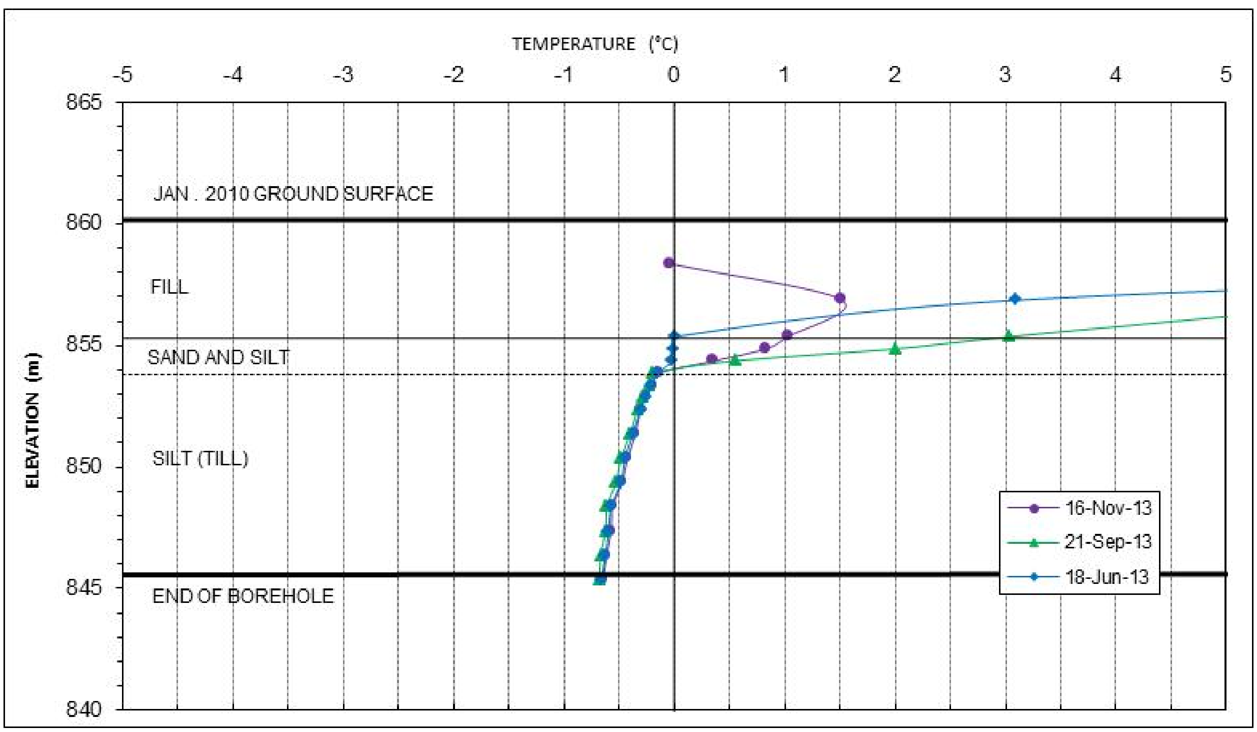


Figure 5-115: Thermistor SDT-3

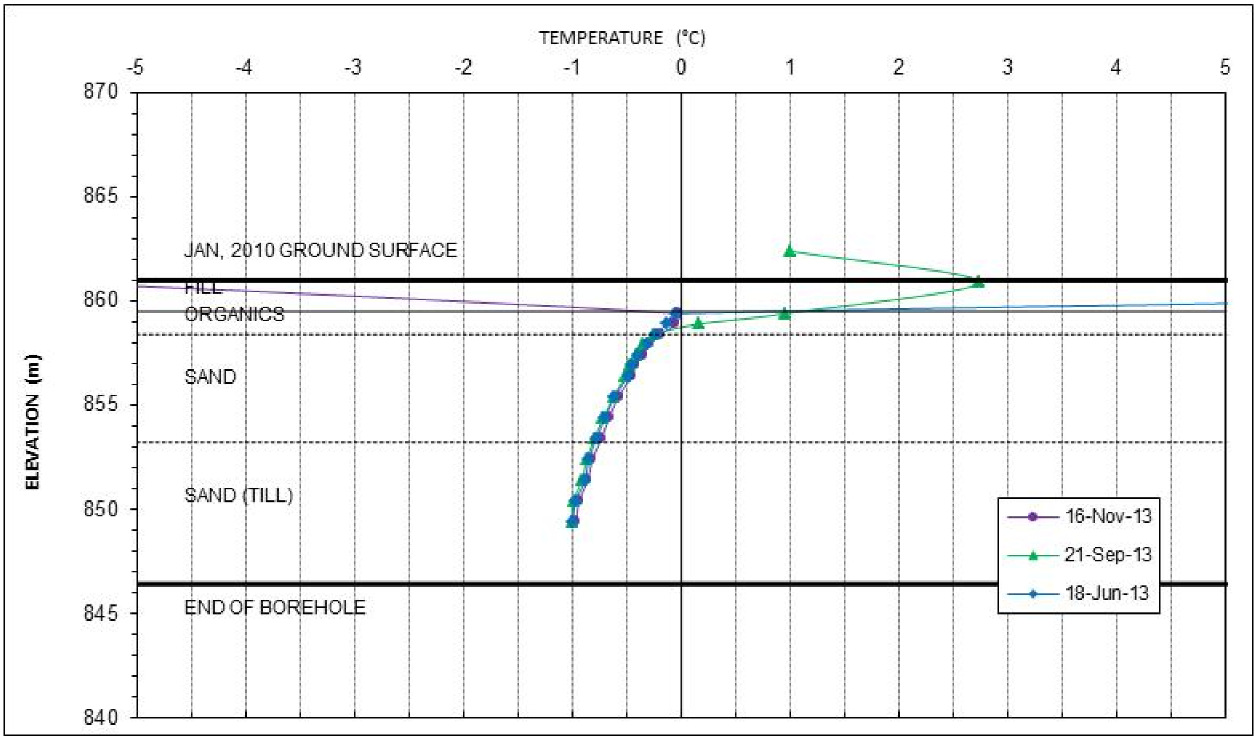


Figure 5-116: Thermistor SDT-4

6 Acid-Base Accounting Program

Appendix 6 of the WUL requires submission of the results of the Acid-Base Accounting program (ABA program) that was conducted during the reporting year. The ABA program determines the NPR (defined as Neutralizing Potential divided by Acid Potential [NP/AP]) for overburden and waste rock to confirm that the NPR is greater than 3. An NPR value of 3 or greater is generally considered to indicate non-acid generating material. A separate, parallel program was initiated to determine the NPR of the tailings solids.

The following is a summary of results from the ABA program for the monitoring period January to December 2013 (results pending from October 29, 2013 to end of year). The second 2013 semi-annual report is provided in Appendix G.

A total of 717 samples were collected from the Area 2 Pit and Area 118 Underground working and sent to the accredited laboratory (SGS CEMI Ltd.) during the 2013 monitoring period. Of the 717 samples, 591 results were received with the remaining 126 samples pending results. The samples were analyzed according to the BC Research Standard Method as required by the WUL. The mean NPR results for the duration of the monitoring period for waste rock samples was 5.8.

59 samples during the 2013 monitoring period were below the NPR threshold of 3. Paste pH values were all above the required threshold of 5 with a mean value of 8.71. The mean sulphide sulphur content for waste rock samples during the 2013 monitoring period was 0.22%. In 2013, 45 samples were

above the sulphide sulphur content for construction grade waste (waste grading Cu <0.1%, NPR>3, SS<0.3%).

Tailings samples analyzed in this period had a mean NPR of 20.7. All tailings samples were within the required limits (NPR >4). All 9 samples (3 pending results) of tailings were also compliant in Paste pH and sulphide sulphur content.

In 2013, Minto Mine will continue with the waste rock dispatching system implemented in 2012 which accounts for the increase in waste rock volumes not meeting the NPR threshold of 3. To aid in the dispatching of waste rock an Eltra carbon-sulphur induction furnace (Eltra) was purchased and setup by Minto Mine. The results received from the Eltra allowed for waste rock to be categorized by sulphur percentage as well as a calculated NPR, then allowing for waste to be dispatched to appropriate waste storage facilities.

7 Physical Monitoring Program

Minto's physical monitoring program consists of a combination of instrumentation and regular inspections. Annual inspections by a qualified engineer are carried out in accordance with Clause 21.1 of the QML, described in Section 7.2. As specified in the WUL, the following regular visual inspections are also required:

- Waste rock and overburden dumps – daily
- Diversion ditch – daily
- Water retention dam – weekly
- Mill water pond - weekly

Deformation monitoring instrumentation includes survey hubs and borehole inclinometers, described in Section 7.1. A layout of physical monitoring instrumentation is provided inFigure 7-1.

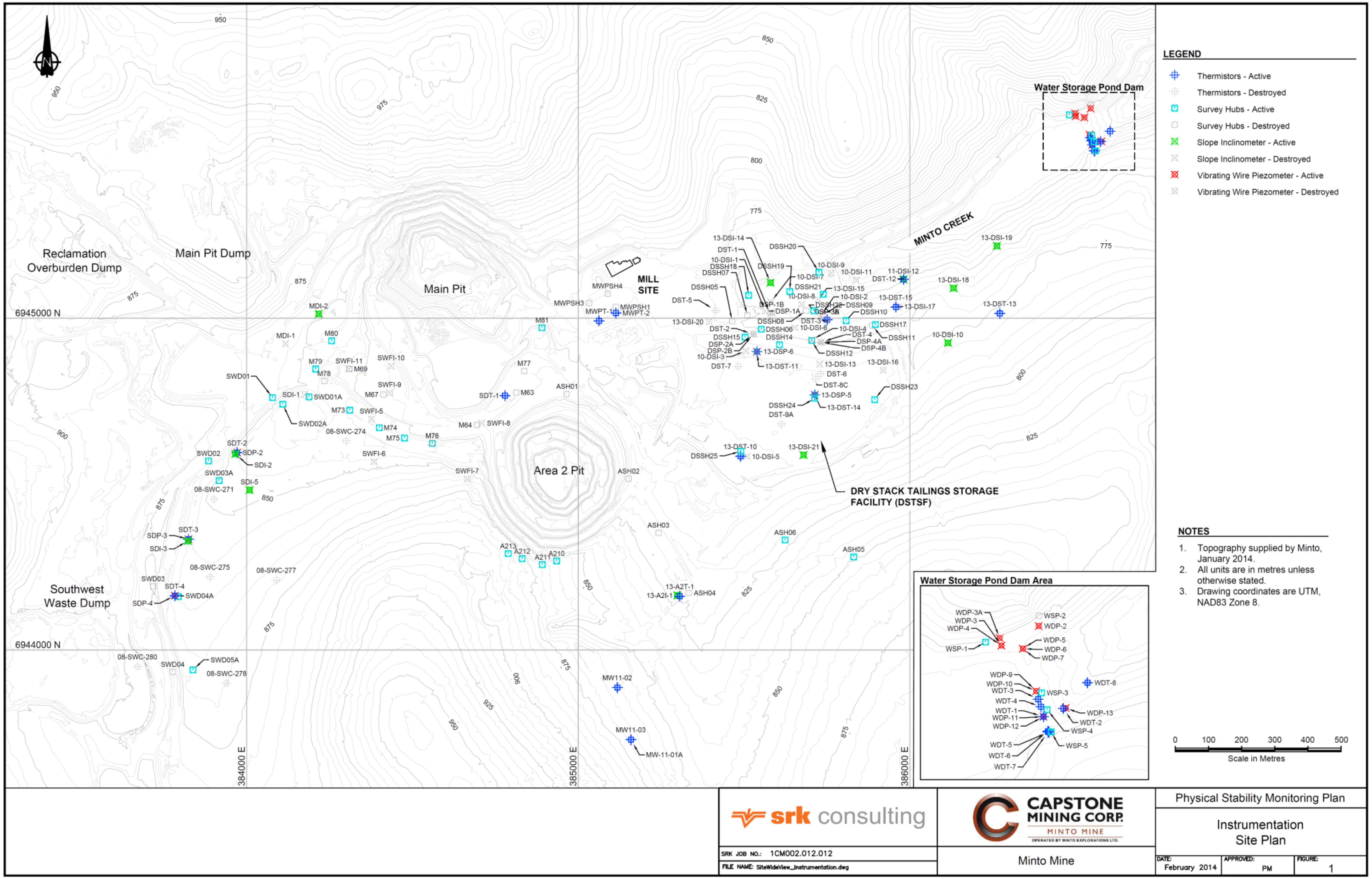


Figure 7-1: Minto Mine Physical Instrumentation Layout

7.1 Physical Deformation Monitoring Instrumentation

Physical deformation monitoring consists of survey hubs at the Main Pit, DSTSF, Southwest Dump, Water retention dam, and of inclinometers at the DSTF and Main Pit. The monitoring results are summarized below.

7.1.1 Survey Hubs

7.1.1.1 *Main Pit/South Wall Buttress Survey Hubs*

There are currently 9 operating survey hubs on the Main Pit south wall buttress. Four hubs, MM02, M63, M77, M78, were destroyed in 2013. Data collected are presented in Figure 7-2. Data were collected weekly from January to June and October to December. No data were collected from July to September due to manpower issues.

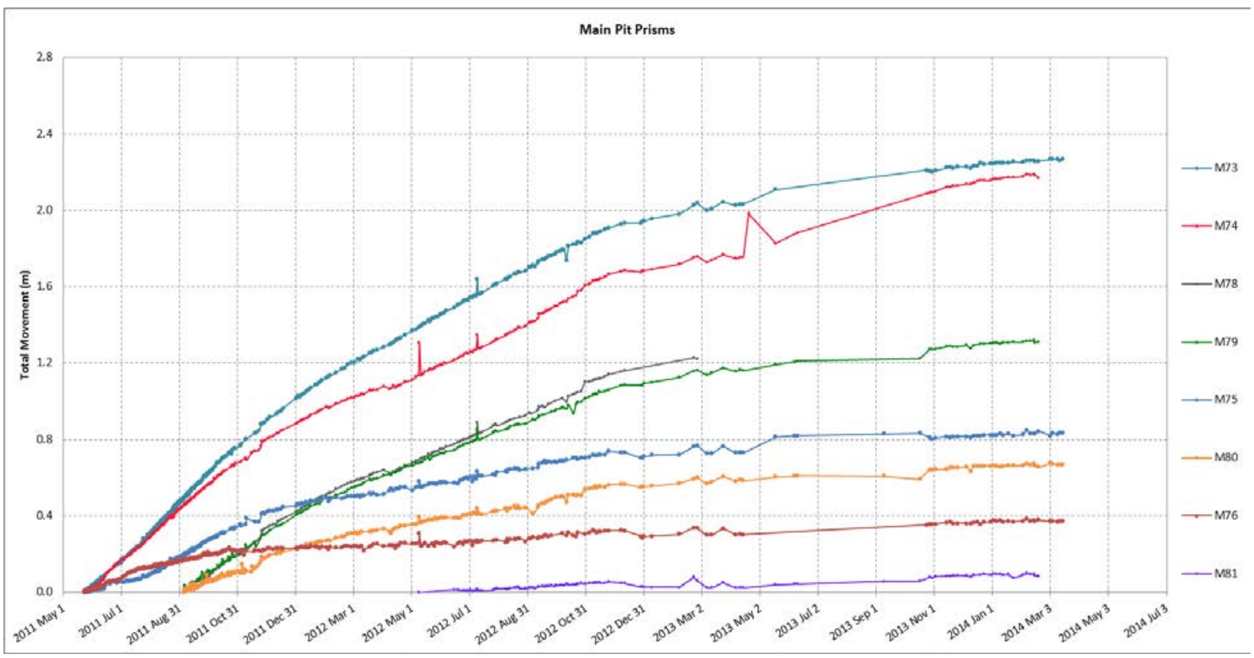


Figure 7-2: Main Pit/South Wall Buttress Survey Hub Results (2011 – 2013)

7.1.1.2 *DSTSF Survey Hubs*

There are currently 6 operating survey hubs on the DSTSF. DSSH11 was destroyed in March, 2013. Data collected are presented in Figure 7-3. Data are collected monthly.

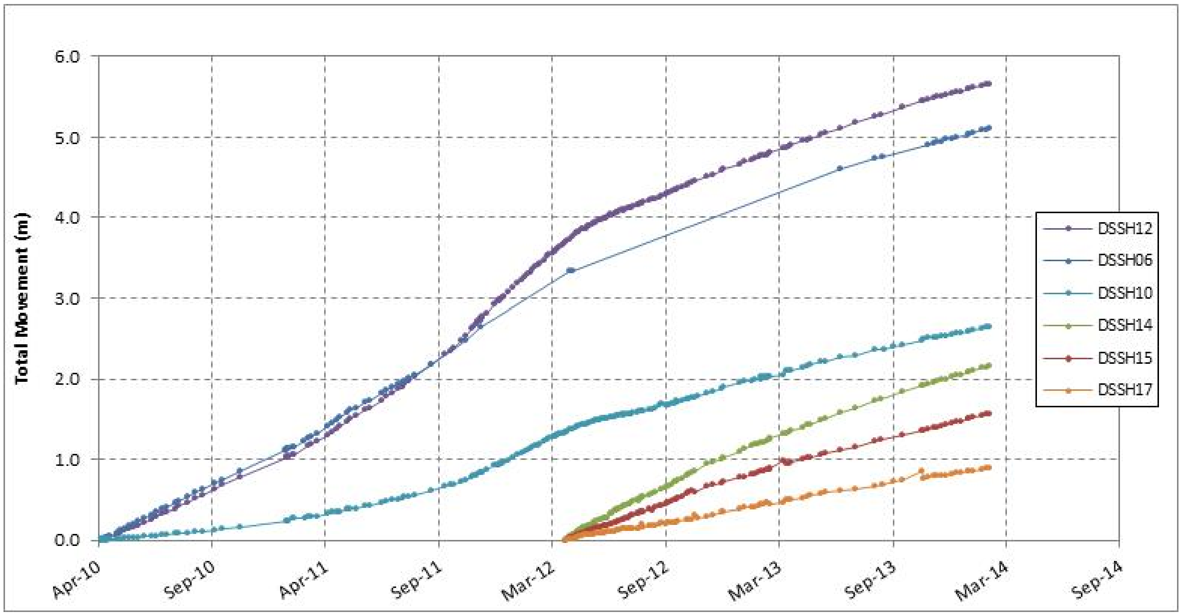


Figure 7-3: DSTSF Survey Hub Results (2010 – 2013)

7.1.1.3 *Southwest Dump Survey Hubs*

There are currently 7 operating survey hubs on the southwest dump. Data collected are presented in Figure 7-4. Data are collected monthly. No data were collected in January and March due to manpower issues.

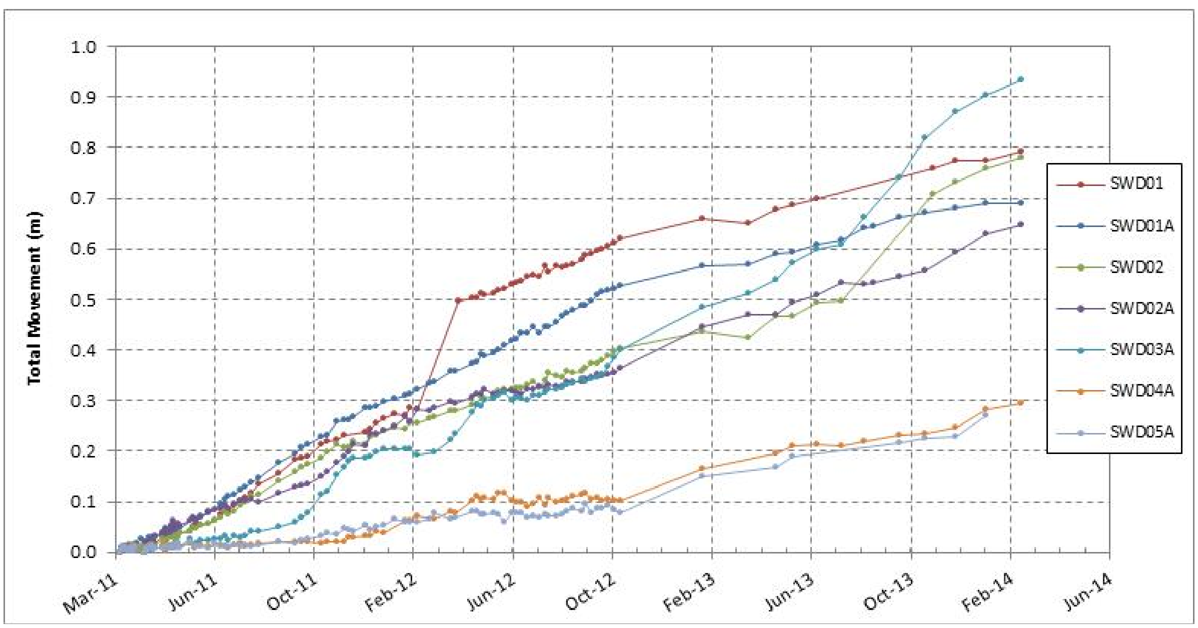


Figure 7-4: Southwest Dump Survey Hub Results (2011 - 2013)

7.1.1.4 *Water Retention Dam Survey Hubs*

There are currently 4 operating survey hubs on the water retention dam. Data collected are presented in Figure 7-5. Data are collected monthly. No data were collected from January to April, August and September due to manpower issues.

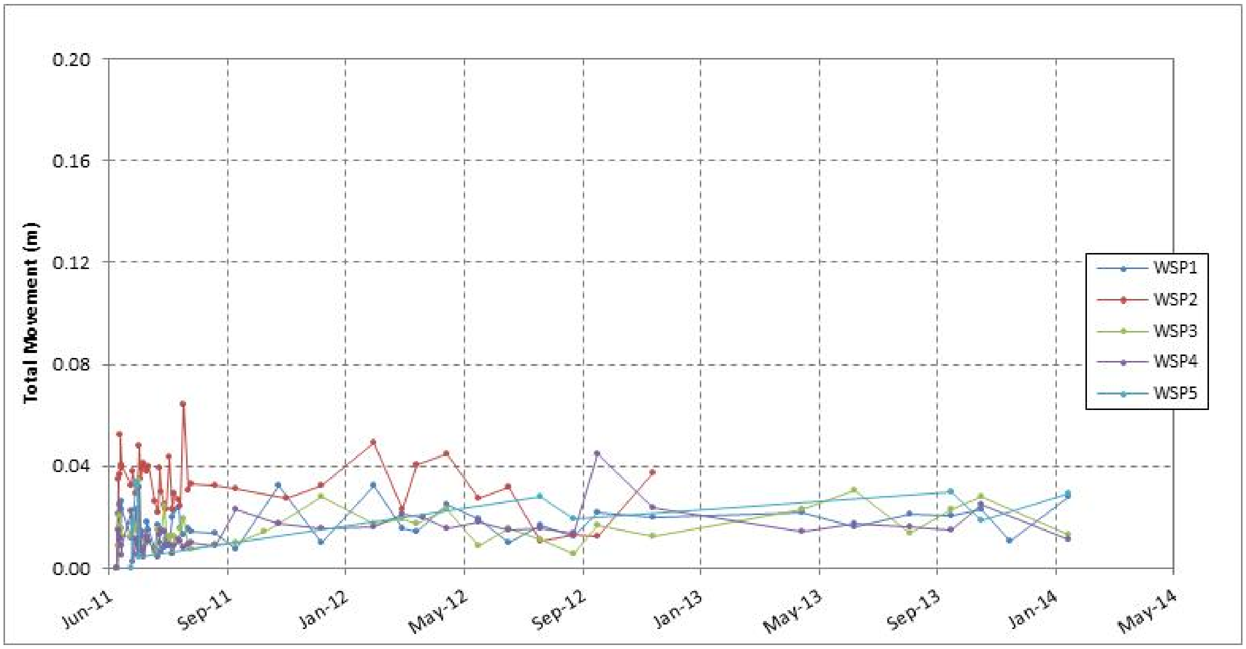


Figure 7-5: Water Retention Dam Survey Hub Results (2011 – 2013)

7.1.2 Inclinometers

7.1.2.1 *DSTSF Inclinometers*

There are currently 4 operating inclinometers in the DSTSF area. Eight new inclinometers were installed in April, 2013. Five inclinometers, DSI-16, DSI-17, DSI-18, DSI-19 and DSI-20 are now deformed beyond the tolerance of the probe and can no longer be monitored. DSI-12, DSI-13 and DSI-15 are damaged and cannot be monitored. Data collected for the most recent survey in 2013 are presented in Figure 7-6 through Figure 7-14. DSI-10, DSI-14 and DSI-21 are monitored bi-weekly. A2I-1 is monitored quarterly. Only one reading for DSI-10 was taken due to access issues to the location.

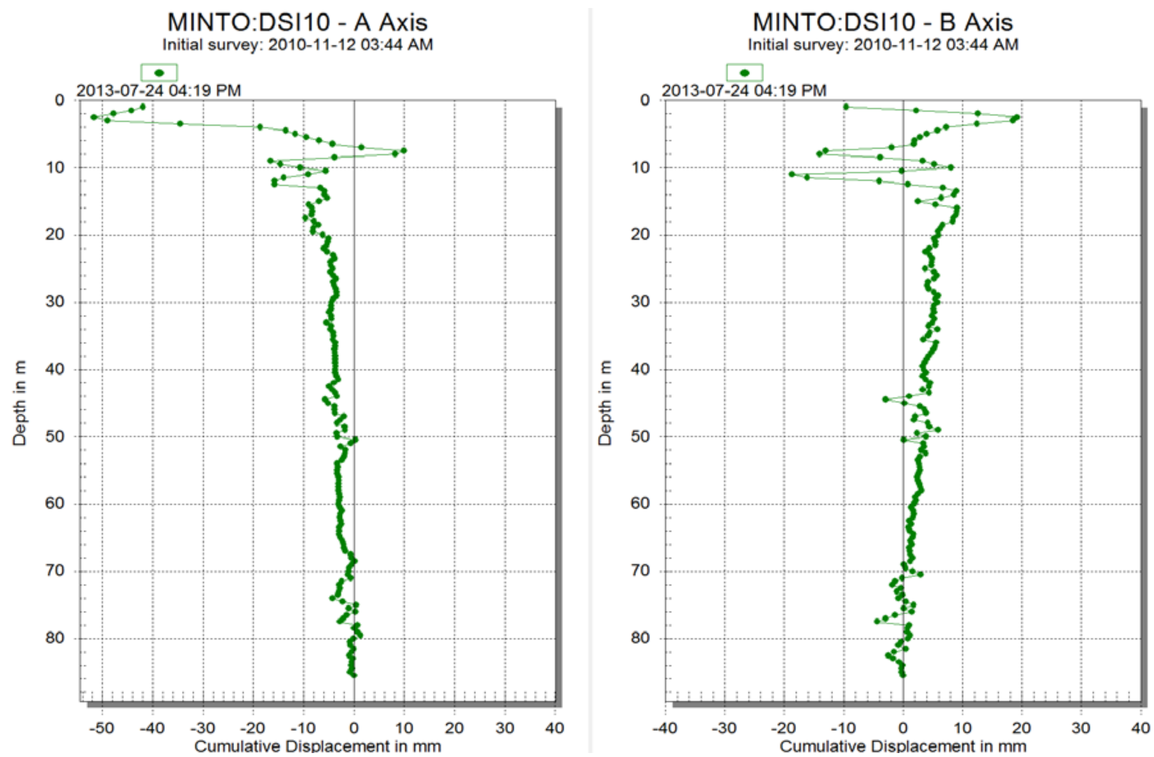


Figure 7-6: DSTSF Inclinometer DSI-10

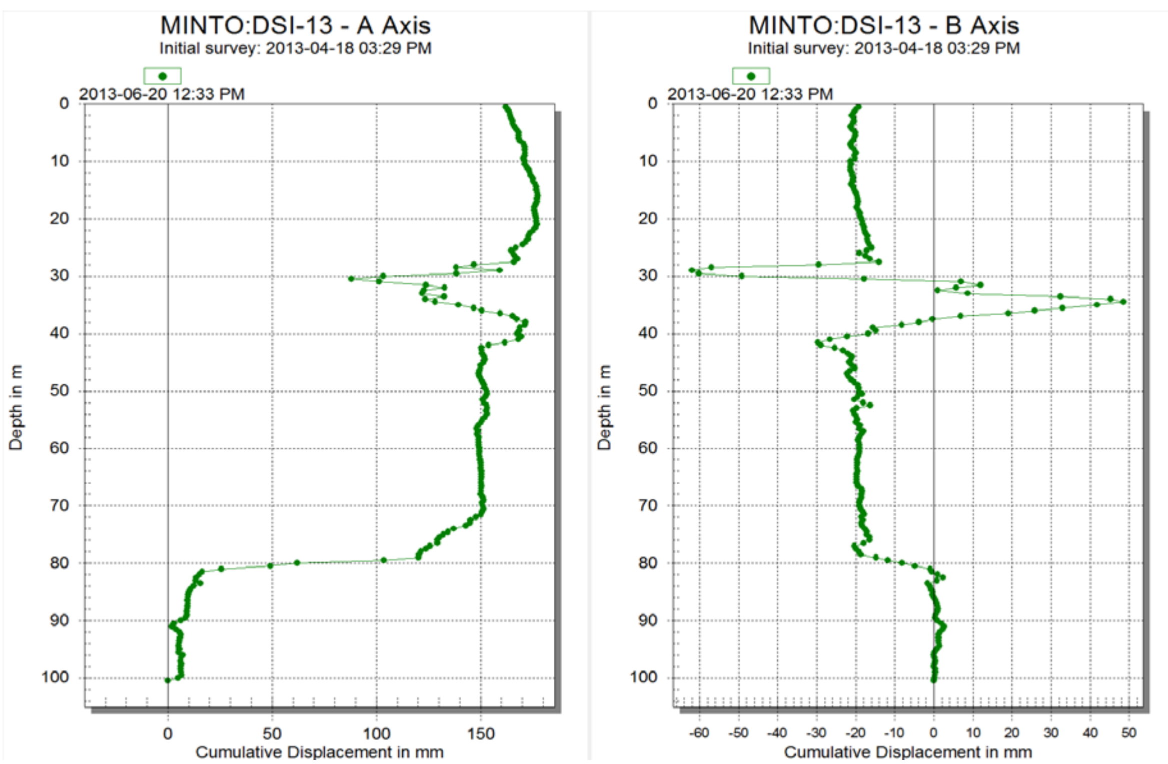


Figure 7-7: DSTSF Inclinometer DSI-13

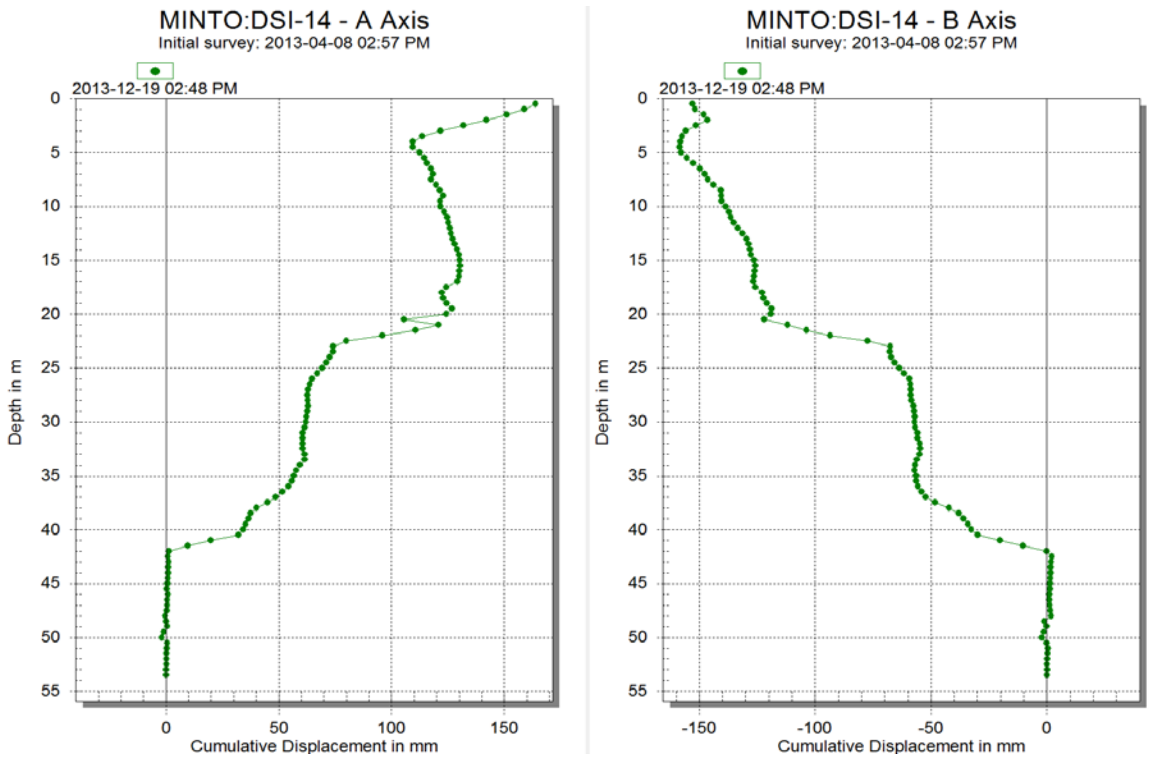


Figure 7-8: DSTSF Inclinometer DSI-14

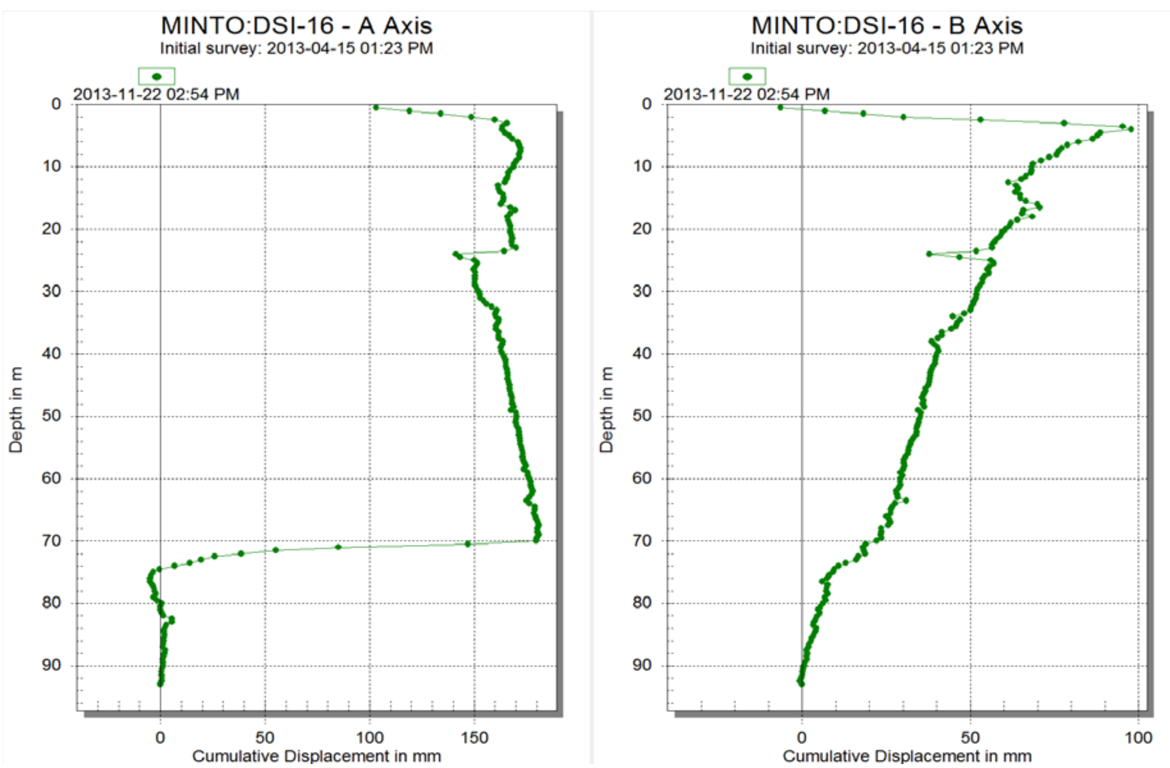


Figure 7-9: DSTSF Inclinometer DSI-16

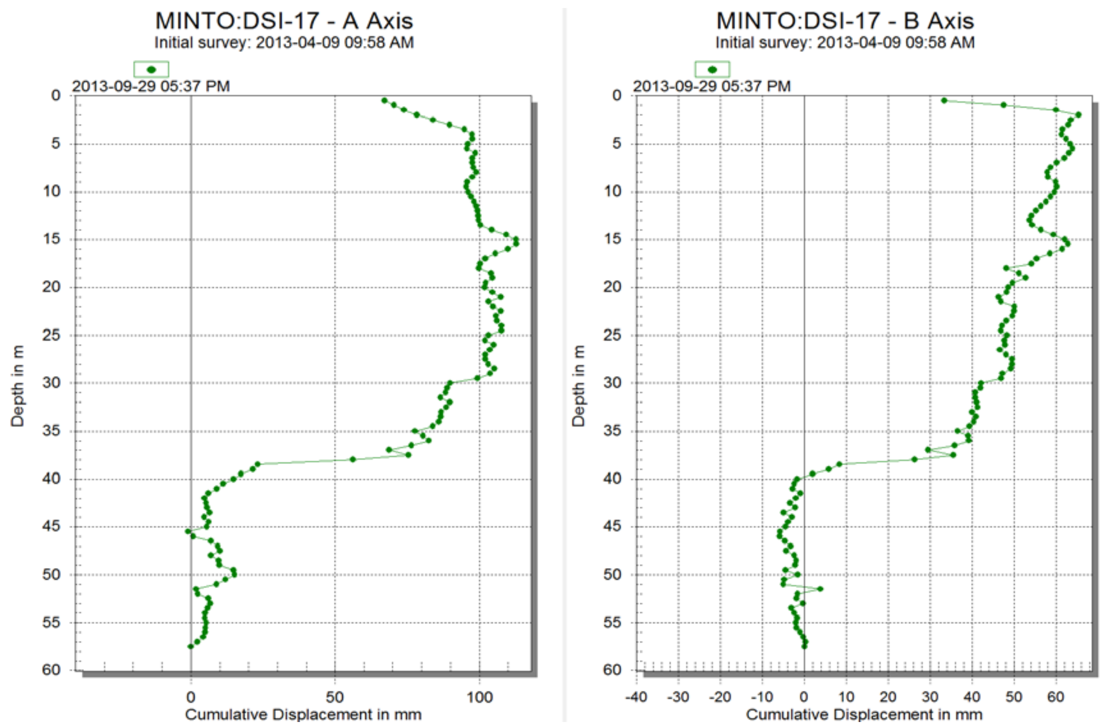


Figure 7-10: DSTSF Inclinometer DSI-17

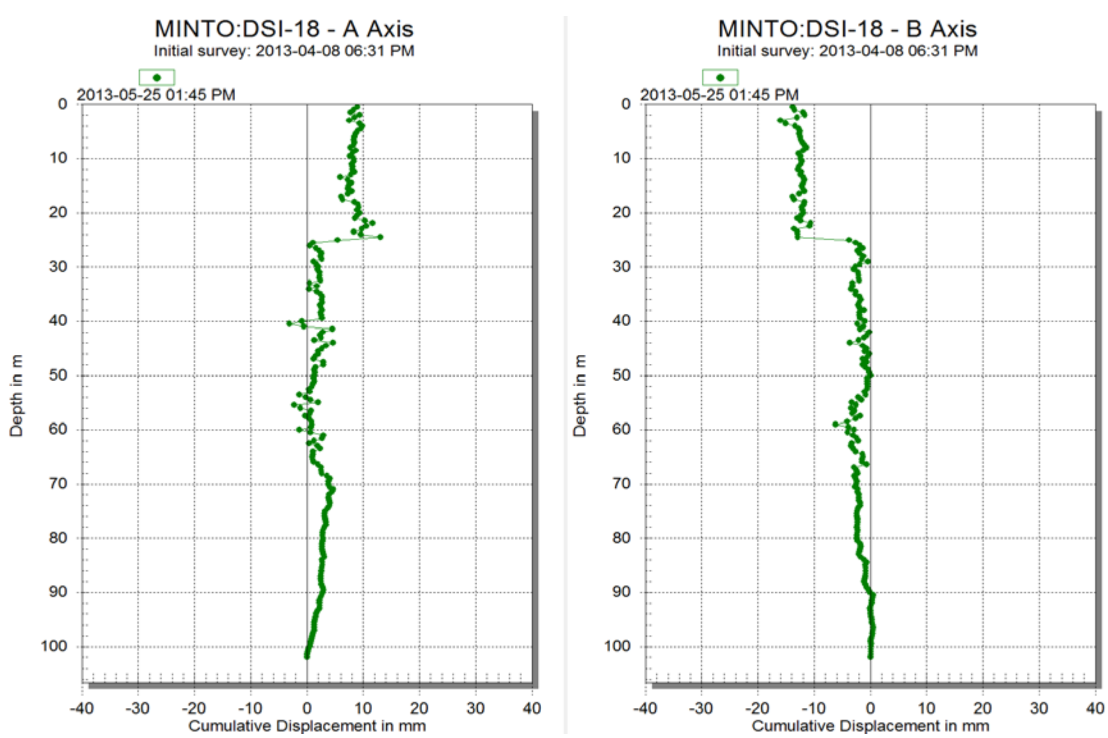


Figure 7-11: DSTSF Inclinometer DSI-18

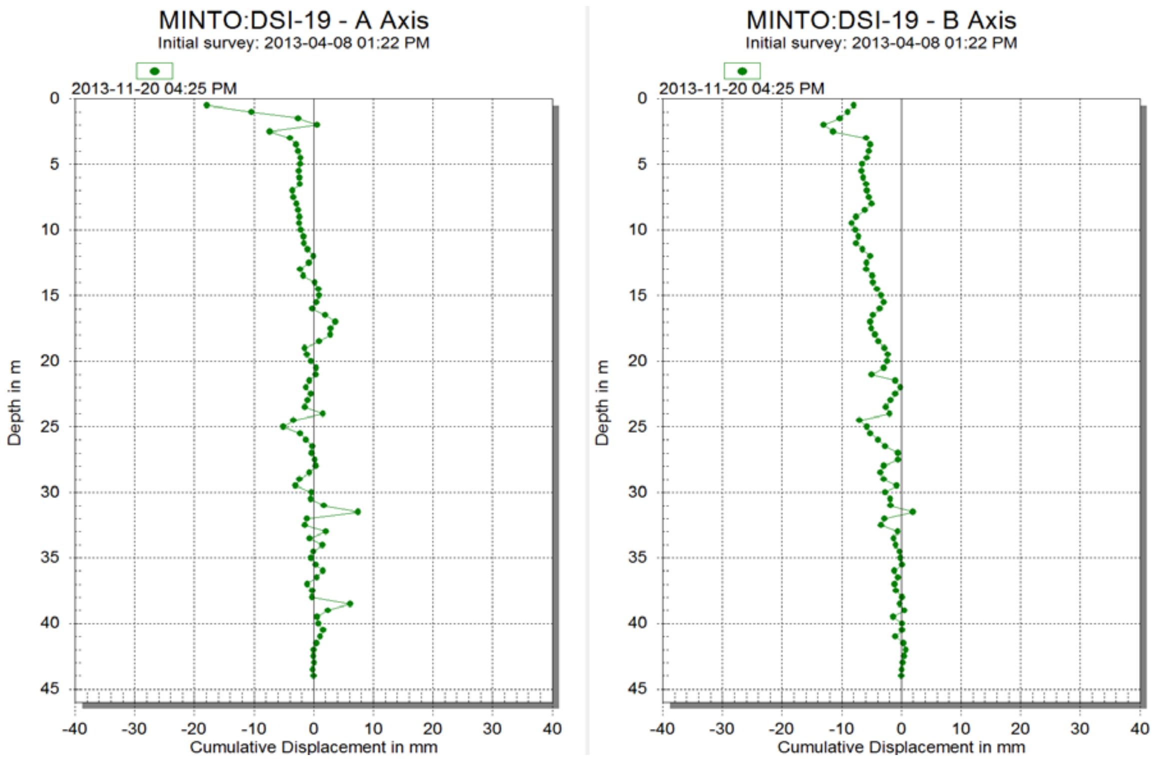


Figure 7-12: DSTSF Inclinometer DSI-19

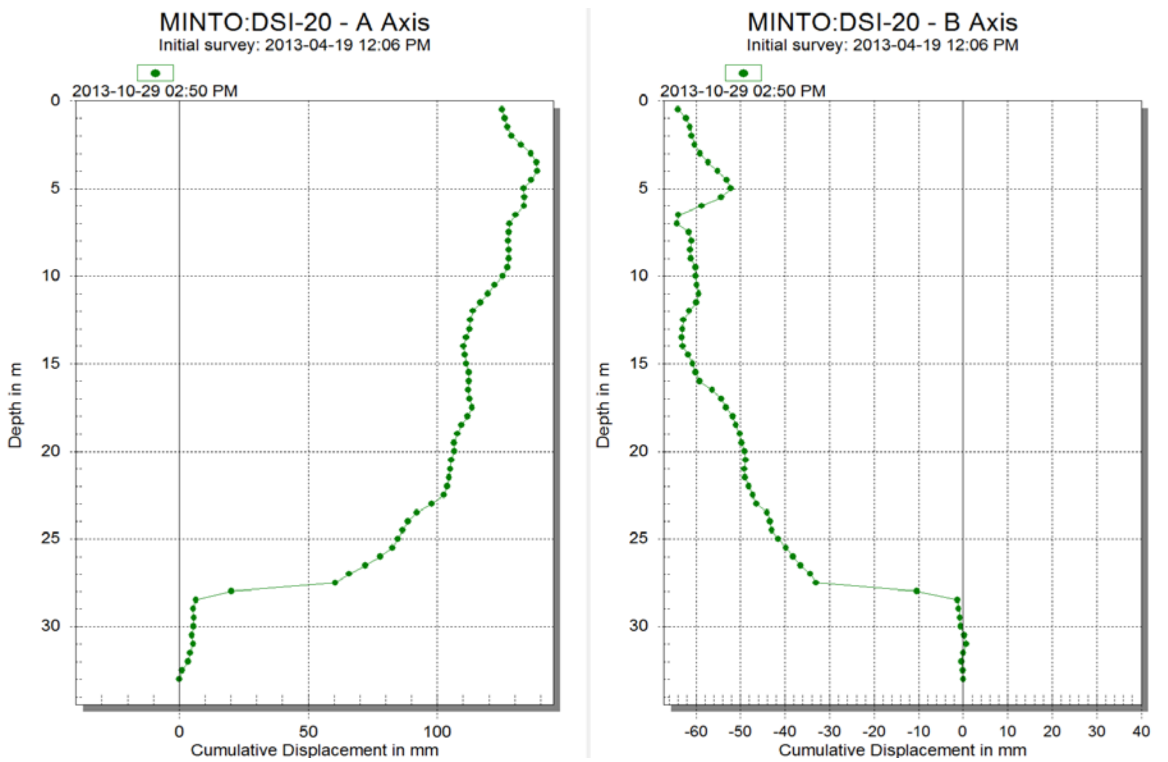


Figure 7-13: DSTSF Inclinometer DSI-20

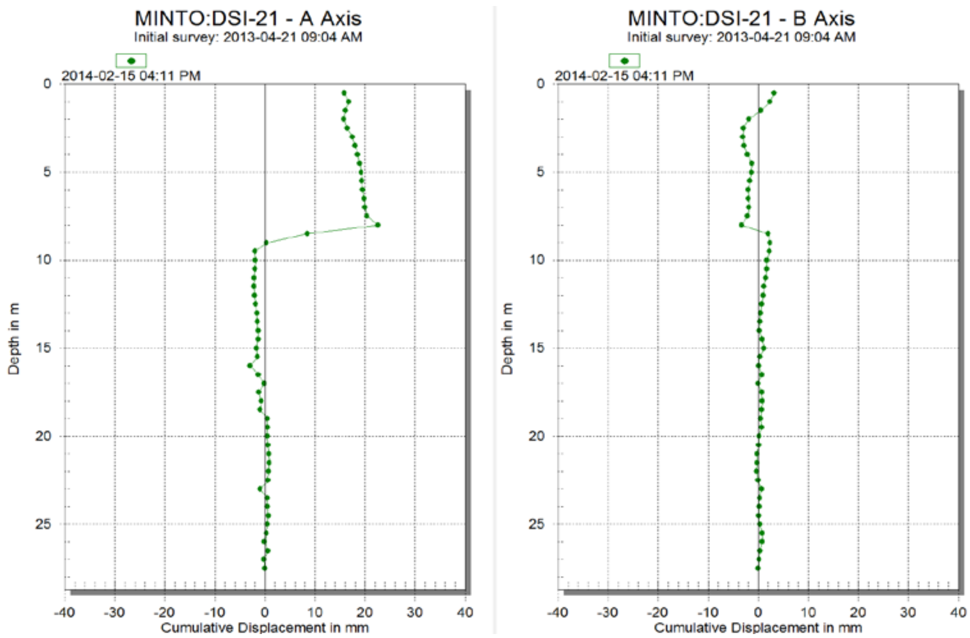


Figure 7-14: DSTSF Inclinometer DSI-21

7.1.2.2 *Main Pit Inclinometers*

There is currently one operating inclinometer in the Main Pit west/south wall area. Readings re-commenced in October, 2013 after not having been read since November, 2012. Data is now collected monthly. Data collected for the most recent survey is presented in Figure 7-15.

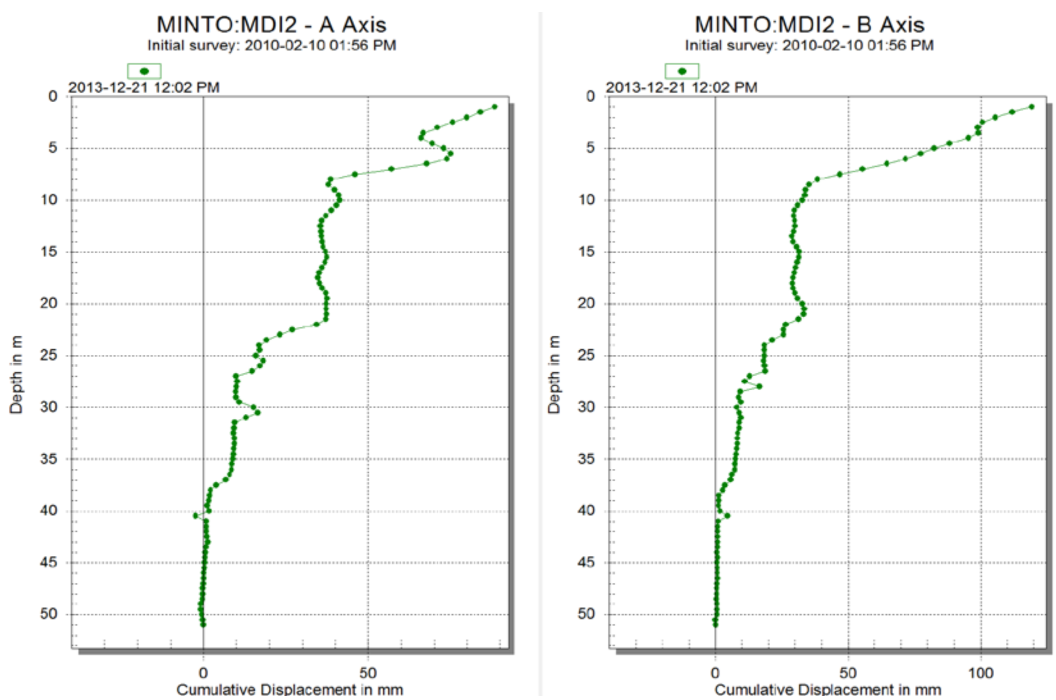


Figure 7-15: Main Pit Inclinometer IDI-2

7.2 Engineer's Annual Physical Inspection Reports

As required by the WUL and QML, Minto Mine has had the following structures inspected by a qualified engineer licenced to practice in the Yukon:

- Big Creek Bridge
- Mill and Camp
- DSTSF
- Fuel Containment Facility
- Ice Rick Overburden Dump
- Main Waste Dump
- Mill Water Pond
- Ore Stockpiles
- Reclamation Overburden Dump
- South Diversion Ditch
- Southwest Dump
- Water Storage Pond Dam

The annual inspection reports are intended to consider works undertaken throughout the reporting period and provide recommendations for the following year. Inspections in 2013 were completed in May and September by a Professional Engineer licenced to practice in the Yukon, Peter Mikes of SRK Consulting's Vancouver office. Table 7-1 summarizes the engineer's recommendations from the most recent visit in September and planned actions for rectifying deficiencies noted in the recommendations.

Table 7-1: Annual Physical Inspection Report Summary

Area	Recommendation	Action
General	At facilities where monitoring guidance is in place, insufficient data collection has generally taken place in past year. In view of this situation, a site-wide geotechnical monitoring plan should be created that details: • Inspection and instrumentation monitoring frequencies, • Roles and responsibilities of personnel assigned to monitor the facility and ensure safe operations and conditions, • Surveillance procedures and requirements, • Inspection and Instrumentation criteria (triggers) that require action, • Operation/emergency procedures in case the instrumentation triggers are reached.	A geotechnical engineer and a monitoring technician were hired in September, 2013 and are now responsible for data collection. Compliance with the required monitoring frequencies is now achieved. A Physical Stability Monitoring Plan is currently being developed and will be completed in Q2, 2014.
	Record barometric pressures when collecting vibrating wire piezometers readings to allow for accurate calculation of pore pressures.	Barometric pressures are recorded by Minto's weather monitoring station and used in piezometer calculations.
Dry Stack Tailings Storage Facility & Mill Valley Fill Extension	Regrade the DSTSF overburden surface to promote runoff once the final cover design has been determined and cover the remaining areas of exposed tailings on the south edge of the facility.	DSTSF cover design has not been completed. Plans for removal or burial of temporary diversion ditch are not complete; south end of the facility has not been covered.
	The area of settlement on the Mill Valley Fill Extension should be regraded and filled in.	Completed.
Main Waste Dump	As part of regular site inspections, continue to monitor the slough location and the area where tension cracks were noted in the 2011 and 2012 inspections. Check for signs of additional movement or instabilities.	The slough location will be inspected when accessible and visible in the spring and summer.
Southwest Waste Dump	Complete reading of the survey hub and slope inclinometers on at least a monthly and bimonthly basis, respectively, and continue monitoring ground movement rates. Notify SRK of any other observations or increases in movement that indicate a significant change in dump performance or dump stability.	Minto has implemented a compliance tracking system. The recommended reading intervals for the southwest dump are being adhered to.
	One large ponded area of water was noted. Before placing the next lift, regrade this area to promote runoff.	Not completed. No further dumping in this area.
	Continue to monitor erosion at the culvert outlet located near the W-15 Detention Structure and maintain a photographic record to inspect for changes in condition.	Planned for spring, summer 2014.
	Continue to monitor sediment accumulation in the culvert at the inlet and outlet. Maintain a photographic record to inspect for changes in condition.	Planned for spring, summer 2014.
Reclamation Overburden Dump	Install a rip-rap channel down the slope to minimize slope erosion. Regrade areas near the exiting erosion channels to direct runoff to the rip-rap channel.	Not completed. Will monitor conditions in spring, summer 2014.
	Monitor the ponded water to ensure that the 40 m offset from the dump toe is maintained as stipulated in the design report (EBA 2008a).	Will be monitored during spring, summer 2014.
	Survey dump toe annually to confirm that it is within the permitted boundary.	Annual flyover survey shows that dump is within permitted boundary.
Mill and Camp Site	Regrade the area above the erosion channels on the camp pad to promote runoff away from these areas.	Complete in 2013
	In addition to the surface regrading, fill the channel by the carpenter's shop with rip-rap or a half culvert to provide a path for the water to drain. In place of the surface grading, consider constructing a small ditch near the slope crest to direct runoff to the	Not completed

Area	Recommendation	Action
	drop channel or half culvert.	
Mill Water Pond	Re-establish survey hubs and collect monthly data until results are consistent. Reduce monitoring frequency to biannual thereafter.	Not completed.
	Resume ground temperature cable readings with a minimum quarterly monitoring frequency.	Quarterly readings resumed in November, 2013. MW-11-01A is now read weekly for Main Pit Dam design.
	Patch tears in the liner system the next time that a liner crew is on site. Fill the voids under the tears before patching.	Not completed.
	Continue to monitor the condition of the liner under the by-pass pipe supports.	Will be inspected when exposed after thaw in spring, 2014.
	Clean out sediments accumulated in the surface runoff ponds and culverts.	Inspected and cleaned as required.
South Diversion Ditch	Remove ditch obstructions such as road fill, vegetation, GCL to increase the flow capacity.	Planned for spring, 2014.
	Cover the exposed liner as per the channel design.	Will be inspected when exposed after thaw in spring, 2014.
	Complete an as-built survey of the pipe intake structure and overflow spillway and confirm that the spillway is constructed to design.	Planned for spring, 2014.
	Remove the three large boulders at the overflow spillway and replace with traffic pylons.	Legal requirement for berm and safety of truck operations requires physical barrier. Boulders can be quickly removed if necessary.
Minto Creek Detention Structure	Continue annual monitoring for further signs of instability or seepage on the downstream slope of the MCDS.	The MCDS will be inspected again in spring 2014.
Water Retention Dam	Continue regular monitoring of the dam, noting specifically the clarity of the seepage and flow exiting the stilling basin and the seepage rate through the weir.	Seepage rate is monitored bi-monthly.
	The discharge point of the water (from the pit, water treatment plant, etc.) influences the seepage pump data at W-3 in the seepage pump house. Options to obtain accurate seepage measurements should be explored such as moving the discharge point a further downstream of the pump house. The issue should be resolved prior to 2014 spring melt.	Pipe was extended in summer, 2013. Performance will be monitored in spring, 2014.
	Review and update the Operation, Maintenance, and Surveillance Manual for the dam.	Planned for summer, 2014.
Big Creek Bridge	Continue regular annual monitoring of sediment accumulation in the culverts. If sediments continue to accumulate, clean them out.	Planned for spring, summer 2014.
South Wall Buttress	Continue regular monitoring of the surface cracking at the west end of the buttress maintaining a photographic record to inspect for changes in condition. Following completion of the buttress, additional survey hubs should be installed along the crest to monitor movement.	The area of cracking is now covered; however regular inspections are carried out. Inclinometer MDI-2 also monitors the west end of the pit/buttress and is read monthly. Additional survey hubs will be installed when dumping is complete.

8 Reclamation

Reclamation at Minto Mine progressed throughout the monitoring period. The current Decommissioning and Reclamation Plan (approved in September, 2011) has guided the reclamation efforts on-site to date. The primary focus for progressive reclamation in 2013 included:

- 17km Borrow reclamation.
- Temporary cover of the Dry Stack Tailings Storage Facility (DSTSF).
- Re-vegetation of deactivated areas.

8.1 KM 17 Borrow Reclamation

The land adjacent to Minto's access road at km 17 was used as a gravel borrow in previous years. The area was re-contoured, seeded with fall rye and lightly fertilized in early July 2013. At the time of seeding there was already visible colonization on the edges of the area and the surrounding vegetation will provide an ample seed bank for natural regeneration. The addition of fall rye was a short term solution to minimize any potential dust and the application of fertilizer should encourage the establishment of natural seedlings, blown-in as seed from the surrounding area.

Although the area is made of well drained, gravel rich soils, willow bunches were added to the low lying center of the disturbed area. The center of this reclamation plot was visibility wetter and appears to have some water retention capabilities. The area is suitable for willows to establish and will promote the natural colonization process. Picture 8-1 below was taken before seeding was started. Natural regeneration was observed after contouring was completed. The area will be monitored in future years; however, no further reclamation is planned or expected in the area.

Picture 8-1: 17KM Borrow after contouring and prior to seeding

8.2 Dry Stack Tailings Storage Facility Cover

The DSTSF was deactivated on November 1, 2012 and as outlined in condition 37 of the WUL "*Within 12 months of the cessation of tailing placement, all exposed tailings surfaces at the DSTSF must be covered with either trial, temporary, or permanent covers to limit fugitive dust, erosion, and infiltration of precipitation, snow melt or run-on water into the tailings".* Therefore, in early 2013 Minto began construction of an initial overburden cover of the DSTSF. Currently 92% of the DSTSF area has been covered (Picture 8-2). The 8% that was not covered was due to unsafe access and will be revaluated in 2014. Once a final cover design has been determined consideration will be given to the final closure cover of the DSTSF.

Picture 8-2: DSTSF cover as of June 17th 2013

8.3 Re-vegetation of Deactivated Areas

The slope above the portal entrance was seeded in the fall of 2012 and the flanks of the portal entrance were seeded in 2013 (Picture 8-3). Seeding of this area was done as a mitigation measure to reduce slope erosion. Success of the 2013 fall seeding will be assesed in 2014, at which time it will be determined if further action is required to mitigate erosion in this area.

Picture 8-3: Side of the portal entrance

The final reclamation project that took place in 2013 was the decommissioning and reclamation of a landfill that was closed, covered, and contoured in 2012. In the summer of 2013, once the area was cleared, the remaining material was seeded and fertilized by SFN summer students.

8.4 2013 Reclamation Research

Reclamation research in 2013 focused on the carryover of research from previous years. Large scale reclamation research included vegetation surveys on the MWD, cover design study, and passive water treatment research. In addition to the large scale reclamation research, other research focused on small scale pilot projects and inclusion of SFN summer students in the research process. The full list of research subjects includes:

- Main waste dump vegetation survey
- Cover Design
- Passive Water Treatment
- Willow bunch erosion control
- Pilot project using peat bags

8.4.1 Main Waste Dump Vegetation Survey

The Main waste dump (MWD) was seeded with a dry land seed mix during the summer of 2012. Seeding of the upper MWD was completed in late June and the lower slope was completed in mid-August, 2012. Since completion of this large scale re-vegetation project, two vegetation surveys have been completed. In the fall of 2012 only a percent cover survey was completed, as new growth was difficult to identify. In the fall of 2013 grass morphology was at maturity (florets and seed present) during the survey on the upper slope and it was possible to accurately classify the various grass species. Seeding that took place later in the summer (August of 2012) did not have vigorous growth, therefore, the vegetation survey on the lower portion of the MWD consisted of only a percent cover analysis.

As seen in Picture 8-4, the lower east side of the MWD (LES 4-A and LES 4-B) had sufficient growth to conduct a vegetation survey, only general observations were documented. This was due to the plot area being heavily seeded and fertilized and results are not representative of what is realistic of long term vegetation. Likewise, the amount of seed and fertilizer used in this small area is not practical for any large scale reclamation application.

Picture 8-4: Main waste dump vegetation survey area

A 50 x 50 cm quadrant was used for the vegetation survey. Ten sample quadrants were taken along a diagonal transect line, which crossed each plot area from an upper corner to a lower corner. The lower slopes (lower bench) are only sparsely covered and grasses were generally small and without florets or seed making them difficult to distinguish. Therefore it was determined that a percent cover would be sufficient on the lower portion of the MWD for the 2013 survey.

Figure 8-1 illustrates the MWD plot area layout and Table 8-1 summarizes the application rates. Overburden on the upper slope was taken from pre-stripping Area 2 pit. The lower slopes were taken from four donor sites, which are most representative of soils found on site. These soils have been stockpiled in the reclamation overburden dump and ice rich overburden dump and will be used in future reclamation projects. Soil characterization for each soil type was completed in 2012.

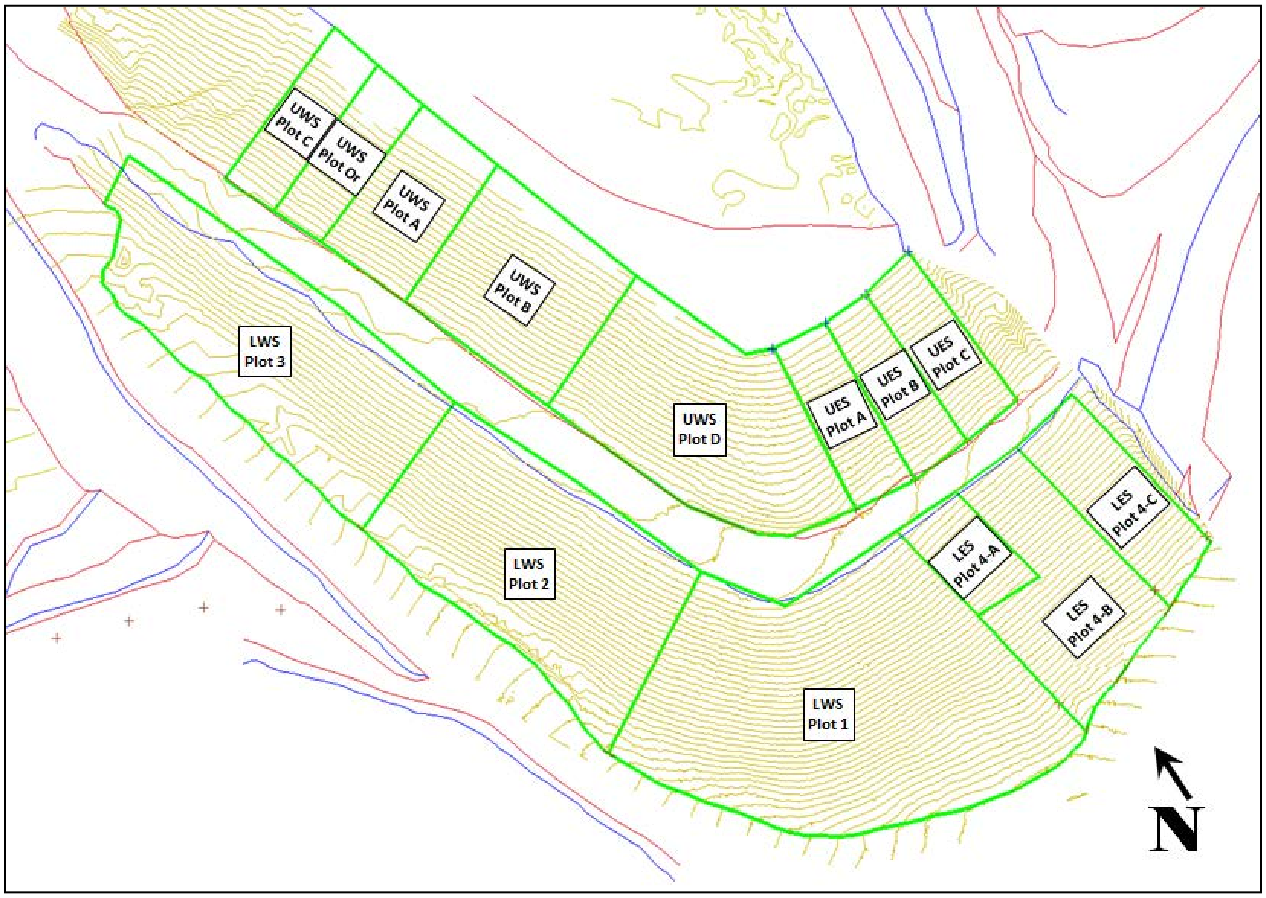


Figure 8-1: MWD Plot Location

Seed mix consists of: Violet Wheatgrass (Elymus alaskanus ssp.), Sheep fescue (Festuca filiformis), Tufted hairgrass (Deschampsia cespitosa ssp.), Fowl Bluegrass (Poa palustris), Rocky mountain fescue (Festuca saxamontana), and Glaucous bluegrass (Poa glauca ssp.). Table 8-2 highlights the 3 most prevalent species in each plot area. Root and shoot lengths were taken from grasses close to, but outside of the quadrant area in order to preserve the plots for surveys in future years.

The Upper West Slope Plot C (UWS C) was the control area for the upper bench (no seed, no fertilizer), and there was very little natural regrowth present. The Upper West Slope – Organics (UWS OR), had average seeding rates (34kg/ha) and lower fertilizer rates (4.1kg/ha), when compared to other plot areas on the Upper slope of the MWD. Organics were mixed into the soil medium at the time of spreading. Results from the survey showed, the only plot areas that outperformed UWS OR was UES A and UES B. These plot areas received a seed rate of 340kg/ha and roughly 40kg/ha of fertilizer, 10 times the amount used on UWS OR. A vegetation survey was omitted from UES B due to an inadvertent rich seed and fertilizer application that is beyond the scope of reasonable practices for a full scale reclamation project.

Table 8-1: MWD Plot Amendments

LOCATION			Area	Area	Seeding Rate	Seed Applied	Fertilizer Rate	Fertilizer Applied	Organic Material Applied	Date Seeded
			(m^2)	(ha)	(kg/ha)	(kg)	(kg/ha)	(kg)	(m^2)	
Plot Name	Upper West Slope (UWS)	UWS Plot C	1200	0.12	-	-	-	-	-	-
		UWS Plot Or	1200	0.12	34	4.1	-	-	-	3-Jul-12
		UWS Plot A	2037	0.20	34	6.8	-	-	-	2-Jul-12
		UWS Plot B	3516	0.35	340	119	-	-	-	28-Jul-12
		UWS Plot D	5256	0.53	34	17.9	-	-	-	30-Jun-12 and 24-Aug-12
	Upper East Slope (UES)	UES Plot A	1260	0.13	340	44.2	1250	162.5	-	22-Jul-12
		UES Plot B	1140	0.11	340	37.4	-	-	-	23-Jul-12
		UES Plot C	1620	0.16	-	-	-	-	-	-
	Lower West Slope (LWS)	LWS Plot 3-C	6219	0.62	-	-	-	-	-	-
		LWS Plot 3-B	3470	0.35	34	11.8	-	-	-	22-Aug-12
		LWS Plot 3-A	910	0.09	34	3.1	125	11.4	-	22-Aug-12
		LWS Plot 2-C	1030	0.10	-	-	-	-	-	-
		LWS Plot 2-B	4540	0.45	37.3	12.9	-	-	-	23-Aug-12
		LWS Plot 2-A	1330	0.13	37.3	3.4	125	16.6	-	23-Aug-12
		LWS Plot 1-C	1200	0.12	-	-	-	-	-	-
		LWS Plot 1-B	6600	0.66	34	22.4	-	-	-	24-Aug-12
		LWS Plot 1-A	2500	0.25	34	8.5	125	31.25	-	23-Aug-12
	Lower East Slope (LES)	LES Plot 4-A	948	0.09	340	30.6	1250	22.5	-	26-Jun-12
		LES Plot 4-B	1069	0.11	340	37.4	-	-	-	27-Jun-12
		LES Plot 4-C	1953	0.20	-	-	-	-	-	-
		Total Area of Seeded Plots =	48998	4.89	**Total Seed Used =**	359.5	**Total Fertilizer Used =**	244.25		

UES-C and UWS-C are controls plots on the upper slope and LWS 1-C, LWS 2-C, LWS 3-C, LES 4-C were controls on the lower slopes. None of these plot areas received any seed or fertilizer. The plot areas listed above typically had moderate to heavy erosion. LWS 1 (LWS 1-C, LWS 1-B, LWS 1-A), showed most widespread erosion on the MWD. The lower slope was seeded in August 2012 and seed has not yet effectively established. Also, the late summer seeding could have negatively impacted the survival rate of the seed. Minto will continue to monitor and document erosional characteristics in this area.

Rocky mountain fescue was overall the most successful species from the dry land seed mix. It is doing well on drier gravel rich sites where light erosion (sheet wash) had removed some fines. It was also very typical to find it in low lying micro-topography made by the tracks of the bulldozer. Although the Rocky mountain fescue is not as tall as other grass species it covers a lot of ground by growing in thick bunches. The Rocky mountain fescue on the MWD had slightly longer root length averages and slightly shorter shoot length when compared to the second most dominant species (Tuffed hairgrass).

Table 8-2: Grass Information Broken Down By Plot Area

Plot Name	Percent Cover	Dominant Species			Average Root Length (cm)			Average Shoot Length (cm)		
		1	2	3	1	2	3	1	2	3
Upper West Slope Plot C	>0.5	Poa palustris	Festuca saximontana	*	16.5	14.5	N/A	27.7	5.2	*
Upper West Slope Plot OR	28	Festuca saximontana	Deschampsia cespitosa ssp.	Festuca filiformis	14.8	15	12.7	28.8	19.2	11
Upper West Slope Plot A	21.25	Festuca saximontana	Deschampsia cespitosa ssp.	Festuca filiformis	18.6	18.8	13.7	22.8	39.8	11.7
Upper West Slope Plot B	26.5	Festuca saximontana	festuca filiformis	Deschampsia cespitosa ssp.	18.3	15.7	*	31	45	*
Upper West Slope Plot D	26.9	Festuca saximontana	Deschampsia cespitosa ssp.	Festuca filiformis	21.7	21.7	18	18.7	41.7	8.7
Upper East Slope Plot A	N/A	*	*	*	*	*	*	*	*	*
Upper East Slope Plot B	53	Festuca saximontana	Deschampsia cespitosa ssp.	Poa palustris	16.1	12.5		31.7	33.5	
Upper East Slope Plot C	>0.5	Festuca saximontana	*	*	14.3	*	*	31.5	*	*

8.4.2 Cover Design

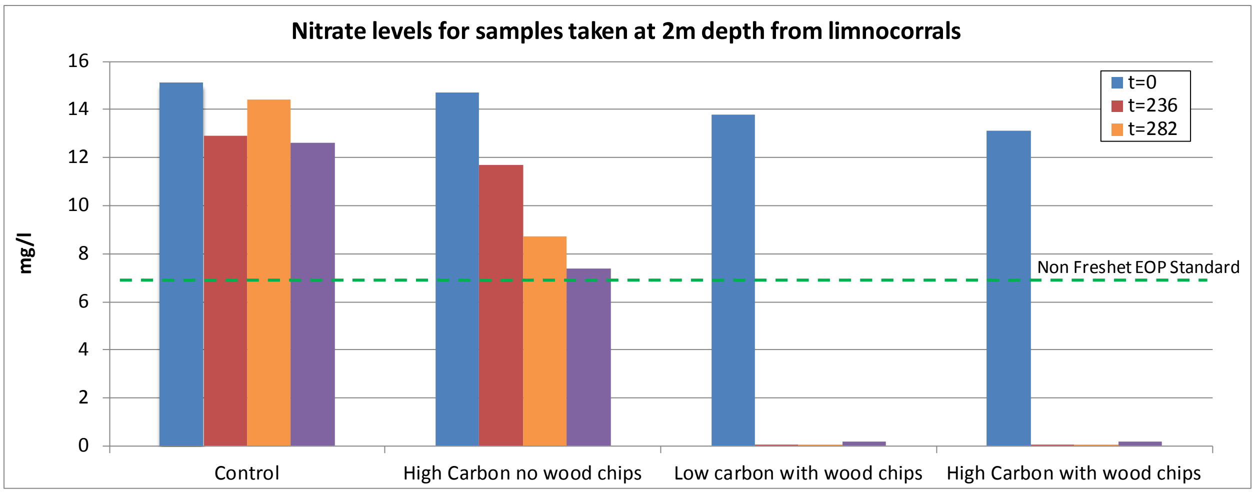
In 2013, Minto Mine continued to retain the services of SRK for the development of closure covers. Using the data from the soil characteristics study completed in 2012 SRK produced a scoping level assessment with recommendations for the conceptual type of covers that should be built at Minto Mine. The cover assessment provided Minto Mine with appropriate cover design concepts that will be considered for final design. The recommendation for final cover took into account climatic conditions and locally available materials. It was determined through the assessment that water covers and/or infiltration reducing covers will have the greatest success at Minto Mine. In contrast, it was determined that store and release and thermal covers are not likely to be successful. It was also noted that given the characteristics of the soil at Minto Mine, a low or very low infiltration barrier cover would not be well suited. The expected performance given the local climatic condition and soil characteristics is overall infiltration between 10% and 20% of mean annual precipitation with periodic higher breakthrough events.

8.4.3 Passive Water Treatment

Four test limno-corrals were deployed in the mined out Main Pit of Minto Mine on October 9th 2012 to evaluate the viability of full-scale passive in- pit treatment using the addition of a carbon source and growing medium to facilitate biological reduction of metals through nutrient attenuation, metals assimilation and precipitation. This pilot –scale study is to be continued until October 2014. Water samples were collected and analyzed for biological plate counts and water quality. The limno-corrals are cylindrical water filled columns, 3 meters in diameter and 10 meters deep, all corals including the control were filled with sediment from a natural wetland to introduce microbial activity and 1m^3 of wood chips to encourage surface attachment of biological activity.

The test cases that were subsequently developed included a Main Pit background control, inoculum only control group and three carbon groups as follows: (a) Main Pit background control (b) control: only inoculum, (c) low carbon with surface area: 40mg/L molasses and alcohol, and wood chips (d) high carbon: 120mg/L molasses and alcohol (e) high carbon with surface area: 120mg/L molasses and alcohol, and wood chips.

Analysis of the results indicate that the bacteria inoculum did establish reducing conditions and concomitant reduction in metal concentrations. The high carbon level promoted the reduction of nitrates and sulfates (later in the experimental period), but was less conclusive as to its effect on nitrites, copper, selenium and ammonia (Figure 8-2). The wood chips may have contributed to the effectiveness of nitrate and sulfate reduction but cannot be confirmed due to the intrusion of pit water that occurred into the control corral and the high carbon corral. The combination of a carbon source and wood chips was most effective but there was no significant differences observed between the 40mg/L application and the 120mg/L application.



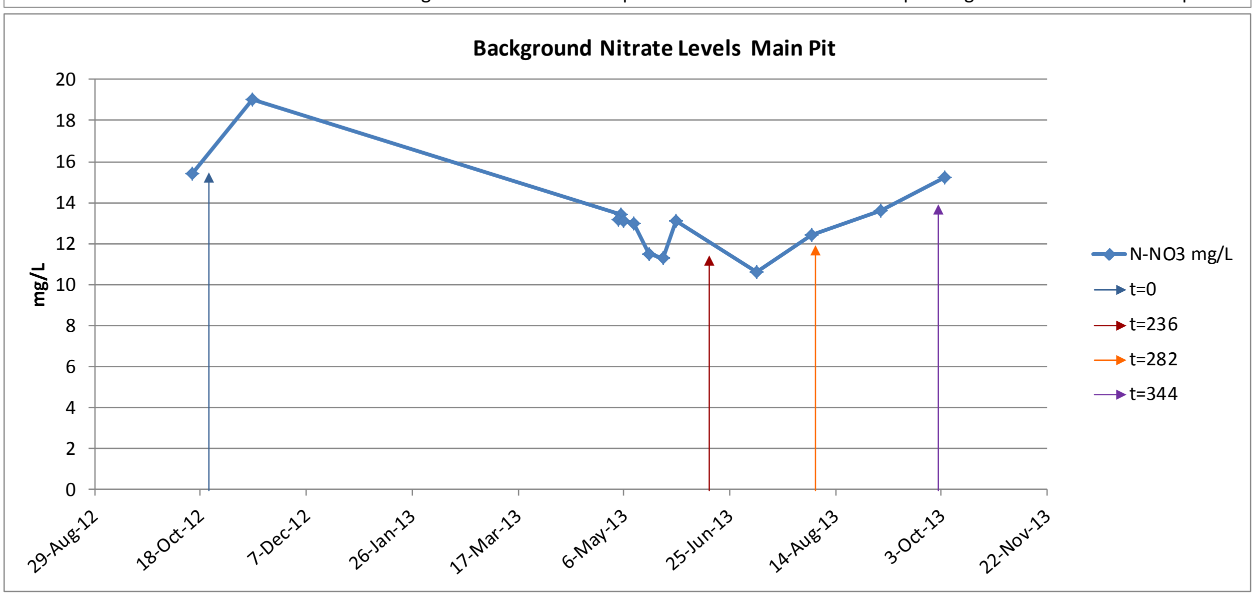
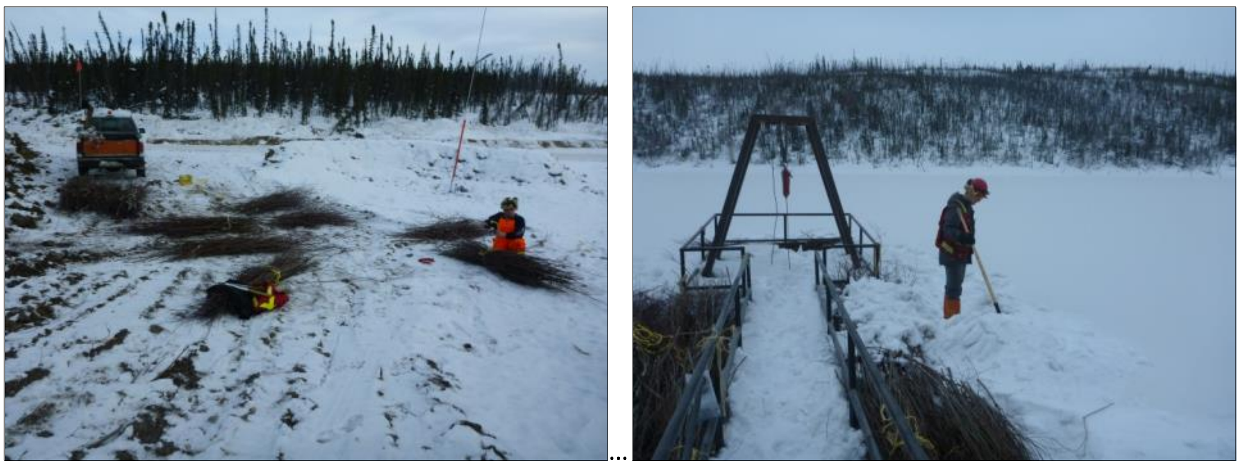


Figure 8-2: Nitrate levels for samples taken at 2m depth from limno-corrals and Main Pit Control

8.4.4 Willow Bunches

Preliminary willow bunching (harvesting) took place in the spring of 2013. The intent of this project was to evaluate the effectiveness of using locally sourced vegetation for site reclamation. Minto hopes to gain a better understanding of the effectiveness of using willows in various soil types and conditions on site. The information gathered from this trial will assist in future full scale reclamation project planning. To achieve a variety of site conditions, three locations were chosen to be planted during the 2013 field season; mid-bench of the MWD, around the sump at Km 0.5 (W42 WUL sampling site), and reclaimed land at Km 17. Willows were harvested in March 2013 and temporarily stored in the water storage pond until the receiving sites were sufficiently thawed and dry enough to work on. Bunches consisted of full length cutting with an approximate length of 3m, once tied bunches were 20-30cm in diameter.



Picture 8-5: Willow harvest in 2013 and harvest storage under the snow on the WSP

Picture 8-6: Willows at the WSP prior to planting

Picture 8-7: Planting willow on the MWD and the trench filled in after a rain storm

The lower half of the MWD has had extensive erosion since overburden was placed in 2011-2012. In an effort to reduce water flowing off the mid bench and eventually channel down the face of the lower slope, a trench was constructed along the toe of the upper bench (Picture 8-7). Willow bunches were laid out perpendicular to the slope, along the trench and then soil was loosely backfilled with hand tools.

W42 sump was chosen for accessibility and because it drains into the water storage pond. Due to the desire to keep all water reporting to the WSP clean, efforts should be made to ensure impacts to W42 water quality are minimized. A swath of willows around the backside of the sump was stacked, trying to slow the flow of water reporting to this area, in turn reducing suspended solids entering the water. This site is south facing, has sandy soil and does experience periods of drought throughout the summer growing season. It is considered one of the more challenging sites to re-vegetation and regrowth will be monitored closely in 2014.

8.4.5 Pilot project at Km 0.5

At Km 0.5 is a barren slope that has been slow to naturally regenerate. A pilot project was created to address issues such as; dry, south facing sandy soil, poor access for heavy equipment, nutrient poor soil and minimal microsites for plant establishment. A work plan was created to address the above issues and to include SFN summer students. The concept behind this project was to create micro sites on a barren slope and add nutrients (peat) to the system to encourage the natural seed banks to colonize the area. Likewise the short term goal of the project is to address erosion issues by breaking up the natural flow of water by establishing micro-sites (burlap sacks filled with peat) in the flow channels.

Due to the steep angle and poor access it was not feasible to get heavy equipment onto the slope to place topsoil and contour the area. Therefore, burlap sacks were filled with a peat/topsoil mixture and carried into place. Soil for this project was sourced from pre-stripping of Area 2 pit. One cup of fall rye was added to each bag to ensure seed was present, and to help stabilize the sacks to the slope. By allowing the seed to mature and establish roots into the slope the sacks should be stable enough to resist movement during spring melt in 2014.

As the area is sandy and south facing the top layer of soil dries out very quickly, making it difficult for vegetation to establish. The bags of peat are expected to retain enough water and add sufficient nutrients to the system and allow seeds to germinate and colonize the around the microsites.

Picture 8-8: Burlap bags filled with Fall Rye and locally sources peat

9 Water Management and Water Balance

The water balance for the Minto Mine forms the basis of the water management strategy. Conveyance structures divert and release clean surface water and direct impacted water to the Main Pit and eventually treatment.

The Minto Mine generally has a positive water balance, meaning that the site-wide annual runoff is greater than the volume of water required to operate the mine. Therefore, it is necessary to release water to Minto Creek. In the event surface runoff does not meet the discharge limits stipulated in the WUL, Minto Mine has the ability to treat and release water using a combination of active treatment, conveyance and water storage features. The following sections will summarize water treatment, conveyance and storage during the year from each water source.

9.1 Water treatment

Surface runoff that did not meet the WUL discharge standards was directed to the Main Pit through the W15 Pipeline, W35 (South Diversion Ditch), or via the W36 (MCDS) pump back.

Minto has the option of treating for:

- Total suspended solids (TSS) only: clarification;
- TSS, copper and cadmium: clarification and chemical precipitation; or
- All water quality parameters present in the Main Pit: clarification and reverse osmosis (RO).

Water treatment by-products including TSS sludge and RO reject is pumped back the Main Pit.

9.1.1 Operations Overview

The water treatment system operated for 38 days, and treated 87,305 m^3 of water during the 2013 season. Operations were suspended on May 31 once the Water Storage Pond reached a conservative capacity to allow for storage of water from the collection ditches during the remainder of the season. Reverse Osmosis removal efficiency decreased through the operating season as membrane performance was compromised by silt and sand breakthrough from the membrane filtration process. Table 9-1 and Table 9-2, summarize the 2013 water treatment operations statistics, reagent consumption and contaminant removal efficiency.

Table 9-1: 2013 WTP Operating Statistics

WTP Statistics 2013	
Plant Feed (m3)	145072.9
RO Treated (m3)	116049.4
Discharged to WSP (m3)	87305.4
Runtime (hr)	759.25
Recovery (%)	68.13
Yardney psi	39.5
Reagent Consumption	
Polyclear 2528 (floc) bags	6
Flowrate floc (avg ml/min)	1.2
Aluminex5 (totes)	22
Flowrate ALX (avg ml/min)	151
TMT liters	1410
Flowrate TMT (avg ml/min)	45
Actisand (microsand) kg	179
Sodium Bicarbonate bags	119
Antiscalant liters	1269
1 micron filters each	816

Table 9-2: 2013 WTP Constituent Removal Summary

Parameter	Units	Average WTP Feed	Average WTP Product
pH-L	pH units	8.16	7.81
Ammonia	mg/L	0.625	0.140
N-NO2	mg/L	0.1872	0.0571
N-NO3	mg/L	12.533	3.421
TSS	mg/L	27.0	4.8
Al-T	mg/L	0.749	0.104
Cd-T	mg/L	0.00003	0.00001
Cr-T	mg/L	0.001	0.001
Cu-T	mg/L	0.0488	0.0085

Parameter	Units	Average WTP Feed	Average WTP Product
Fe-T	mg/L	0.712	0.116
Pb-T	mg/L	0.0002	0.0002
Mo-T	mg/L	0.033	0.007
Ni-T	mg/L	0.003	0.001
Se-T	mg/L	0.0012	0.0004
Zn-T	mg/L	0.005	0.005

9.2 Water Storage and Conveyance Network

There were no major changes to the management of water storage conveyance structures in the 2013 The strategy for managing the mine water inventory was unchanged in 2013, and the water conveyance network is illustrated in Figure 9-1. Discharge-compliant (clean) runoff was collected and diverted to the Water Storage Pond (WSP), and subsequently discharged to Minto Creek. Runoff from developed mine areas (mine water) was collected and stored in the Main Pit and was used for ore processing, deposition of tailings and feed water for the Water Treatment Plant.

9.3 Water Storage Volumes Movement and Tracking

The main water balance components are summarized in Table 9-3, and include the volumes of water stored at the Minto Mine, and the volume discharge to Minto Creek in 2013. Table 9-4 provides a summary of water volumes moved by conveyance structure but is not reconciled against the water balance.

Table 9-3: 2013 Minto Mine Water Balance Summary

Storage Location	Units	Volume
Pit Volume Increase 2013 (765.1 m to 780.8 m Level)	m^3	1,600,000
Tailings to Main Pit, total	BCM	530,000
SAT, deposited sub-aqueously in Main Pit	BCM	0
Main Pit Water Volume Increase 2013	m^3	1,080,000
WSP Net Water Volume Increase 2013	m^3	-80,000
Water stored in DSTSF tailings	m^3	0
Water Discharged to Minto Creek in 2013	m^3	385,000
Estimated groundwater inflow to Area 2 Pit	m^3	130,000
Total Surface Runoff Above WSP in 2013	**m^3**	**1,250,000**

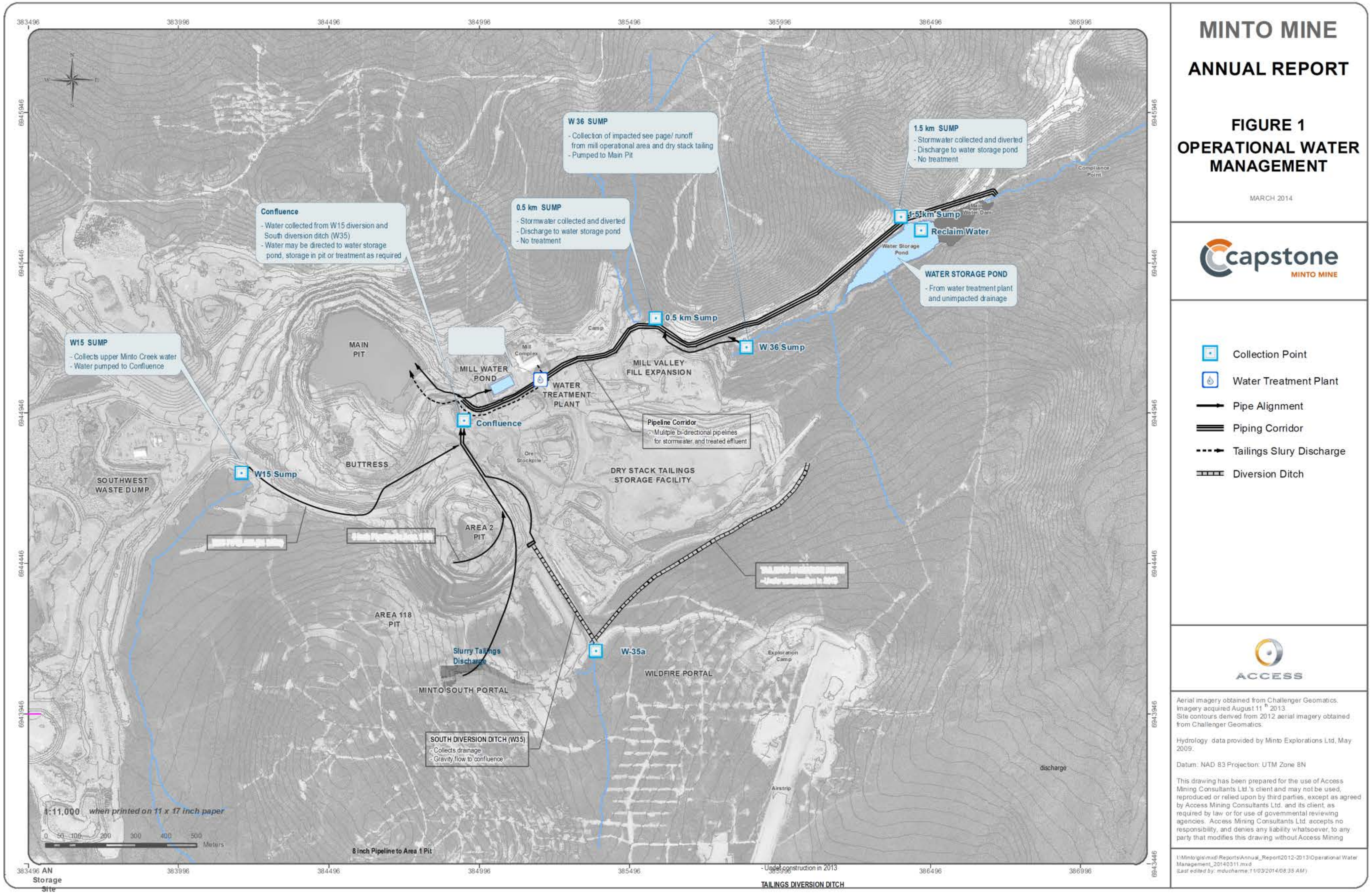


Figure 9-1: Minto Mine 2013 water conveyance network

Table 9-4: Volume of water moved by conveyance structure in 2013

Station	m^3 moved to WSP	m^3 moved to Main Pit	total m^3
W35	91507	137261	228768
W15	96705	145058	241763
W45	0	131000	131000
W44	0	109200	109200
WSP reclaim	0	78944	78944
W37	0	157843	157843
Total	**188212**	**759306**	**947518**

- *approximately 102 000m3 reports directly to the Main Pit and is not captured by flow monitoring devices above*

** *approximately 187 800m3 reports directly to the WSP and is not captured by flow monitoring devices above*

9.3.1 Water Conveyance Tracking

Diversion of W35A water (South Diversion Ditch): Water was diverted from the southwest catchment (collected at station W35A) to the Water Storage Pond. This catchment measures approximately 200 ha and thus represents about 20% of the total catchment for the Minto Mine. Historically, the water at W35A has been of a similar quality to undisturbed surface runoff measured at catchments outside of the Minto Mine. Therefore, the diverted water is unlikely to compromise the water quality in the Water Storage Pond. On-going water quality monitoring will ensure that water in the Water Storage Pond remains in compliance with discharge standards in effect. An estimated total of 228,000 m^3 was moved through this structure in 2013 (Table 9-4).

Diversion of W15 water: Water collected at W15 collects surface runoff from undisturbed areas and from waste rock. The total catchment measures between 250 and 300 ha and thus represents between 25% and 30% of the total catchment for the Minto Mine. The water quality parameter concentrations have historically been elevated compared to undisturbed catchments but have in many instances been below discharge standards for the majority of parameters. On-going water quality monitoring will ensure that water diverted from W15 and water in the Water Storage Pond remains in compliance with discharge standards in effect. A total of 242,000 $m^3$was moved through this structure in 2012 (Table 9-4).

Pump Back of W36 water (Minto Creek Detention Structure): Water collected downstream of the mill area, ore stockpiles and DSTSF is pumped back to the Main Pit for treatment. The water quality parameter concentrations have historically been elevated compared to other sites on the property. This structure is essential to maintain water quality in the Water Storage Pond and is a key component of the water conveyance network. On-going water quality monitoring ensures that trends in quality and quantity are tracked. A total of 158,000 $m^3$was pumped back to the Main Pit from the MCDS in 2013 (Table 9-4).

9.3.2 Water Storage Tracking

Main Pit: The Main Pit was used as a reservoir to support water use for the Mill process and in addition was used to collect impacted runoff and supply feed water to the water treatment plant. Water quality dictates that all water reporting to this location must undergo treatment prior to discharge. A total of 759,000 m^3 of water was conveyed to the Main Pit in 2013 (Table 9-4).

Water Storage Pond: The Water Storage Pond worked effectively as a storage location for un-impacted water and maintaining water quality below discharge criteria. A total of 188,000m^3 of water was conveyed to the WSP in 2013 (Table 9-4).

9.3.3 Water Balance and Water Quality Predictions Modeling

In partial fulfillment of the Water Balance and Water Quality Model as required under Clause 78 of the WUL), Minto Mine retained SRK Consulting to complete a 2013 site water balance and water quality prediction update, provided in Appendix H.

9.3.4 Water Conveyance Construction

The Tailings Diversion Ditch construction began in the late summer/early fall of 2013. The original alignment remained in place, as work began in the fall, as surface flows had subsided. Therefore, construction of the Tailings Diversion Ditch did not affect the manner in which water was conveyed during the reporting year. The tailings diversion ditch embankment fill, for the segment C lined ditch section (Picture 9-1), identified in the *EBA design drawings: Figures 6 and 7 Dry Stack Surface Water Diversion System*, was constructed, as well as much of the proposed buttress identified for a typical section for segment A. A roughly graded ditch was cut into existing ground along Segments A and B (Picture 9-2) with no rip rap liner being placed as work was stopped due to frozen conditions which were impacting the quality of the remaining work (primarily in terms of ability to cut smooth ditch grades and side walls in frozen earth).

Additional water conveyance structure modifications included the winterization of the Minto Creek Detention Structure pump back system and minor modifications to pipelines for access points to assist in early season de-icing and steaming.

Picture 9-1: A view looking west of the segment C lined ditch embankment fill

Picture 9-2: A view looking east of the segment A and B ditch and buttress

10 Closure

We trust this document fulfills the annual reporting requirements of Minto Mine's WUL and QML.

Appendix A

Minto Mine Spill Contingency Plan

Minto Mine

2014 Spill Contingency Plan

Prepared by:

Minto Explorations Ltd.

Minto Mine

March 2014

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1 Introduction

Minto Mine (administered by Minto Explorations Ltd. (Minto)) is a high-grade copper and gold mine that is located 240 km north of Whitehorse, Yukon. Operations are ongoing at this time and began in October 2007. The mineral deposits mined at the site were identified during exploration programs occurring in the area in the 1970's; exploration activities occurred sporadically since that time until construction of the mine and related facilities began in earnest in 2006.

This Spill Contingency Plan (SCP) is an update to the previous SCP, submitted in March 2011 and approved in October 2011. The content of this SCP is derived from the *Plan Requirement Guidance for Quartz Mining Projects* (Yukon Government, 2013). The SCP has been updated annually and submitted as part of Minto's Water Use Licence and Quartz Mining Licence annual reports.

The purpose of the SCP is to establish guidelines for staff, contractors and suppliers working at the site with a formal framework of actions to be taken when responding to spills during mine operation. The SCP includes practices and planning of future efforts to further reduce the potential for environmental contamination and other spill-related impacts. The SCP describes the fuels, chemicals and other materials used at the Minto Mine, reporting thresholds for those materials, a spill action plan for responding to unintentional spills of those materials, reporting sequences and forms, training requirements, spill prevention activities and routine monitoring and maintenance.

1.1 Project Description

Minto Explorations Ltd. (Minto), a wholly owned subsidiary of Capstone Mining Corporation (Capstone), owns and operates the Minto Project located 240 km (150 miles) northwest of Whitehorse, Yukon. The Minto Mine is a high-grade copper and gold mine with ongoing operations since October 2007. The Project area encompasses the Minto Creek Valley which collects and drains in to the Yukon River (Figure 1-1). The Minto Mine is currently in Phase IV of operations, with an application for expansion to Phase V/VI submitted to YESAB for review and environmental assessment. An overview of major infrastructure at the Minto Mine and expansion in Phase V/VI is shown on Figure 1-2.

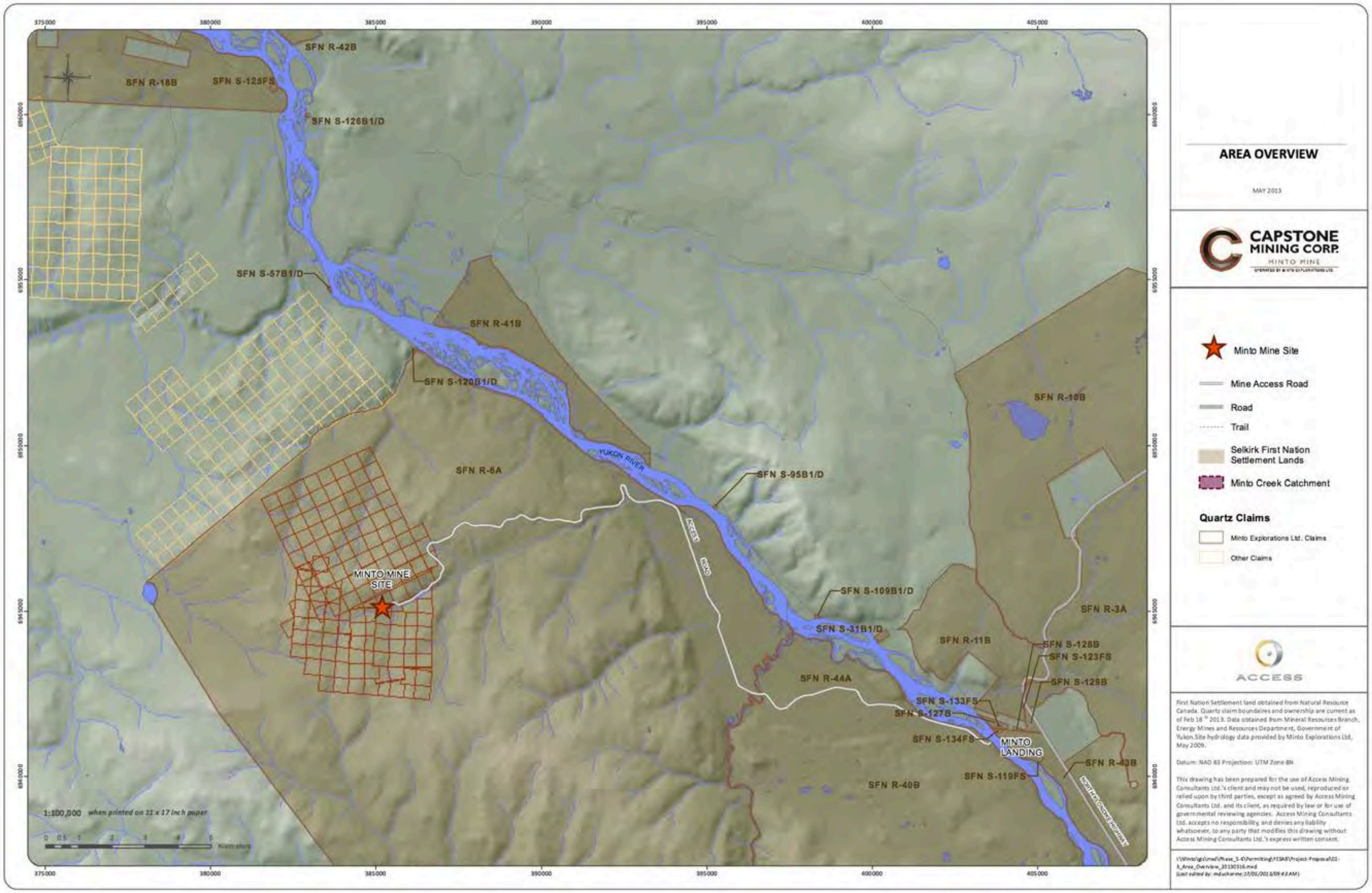

Figure 1-1: Minto Mine Area Overview

Figure 1-2: Minto Mine Area Overview – Existing and Phase V/VI Proposed Infrastructure

2 Definitions

The following definitions apply to the components of the Spill Contingency Plan outlined herein.

Dangerous Good - A product, substance or organism included by its nature or by the regulations in any of the classes listed in the schedule to the act (*Transportation of Dangerous Goods Act)*.

Deposit out of the normal course of events - A deposit that can reasonably be expected to occur at the mine and that can reasonably be expected to result in damage or danger to fish habitat or fish or the use by man of fish, and the identification of the damage or danger (*Metal Mining Effluent Regulations, Part 3, SOR/2002-222)*.

Discoverer - The person that discovers an incident that could possibly result in a spill or has resulted in a spill.

Spill - A release of a substance in to the natural environment that is abnormal in quantity or quality in light of all circumstances of the release; or is in excess of an amount specified in the regulations (*Yukon Environment Act, Part 11*):

> **Emergency Spill -** A release of a hazardous product where there is potential for that product to enter a waterway or cause significant danger to life, health or environment.
>
> **Non-Emergency Spill -** All spills that do not meet criteria of an *emergency spill* or a spill of any diesel product, blasting agent, oil, lubricant or coolant that the responsible party is competent to manage safely and efficiently in terms of assessment, prevention, containment and clean-up.

Substance - A hazardous substance, pesticide, contaminant or special waste often referred to as a "**deleterious substance".**

3 Purpose and Scope

Minto Mine will ensure that all requirements related to Spill Response and reporting within these regulated documents are implemented throughout the property for the life of mine. These statutory and regulatory responsibilities may change over time and will therefore result in the updating of this Plan.

This Spill Contingency Plan (SCP) is prepared in accordance with Minto Mine's Type "A" Water Use License QZ96-006 (WUL), which states that:

> *"The Licensee shall apply the relevant procedures in the Spill Contingency Plan. The Licensee shall review the spill contingency plan annually and shall provide a summary of that review, including any revisions to the plan, as a component of the annual report."*

As well as *Part 3 – Deposits Out of the Normal Course of Events*, Section 30 of the Metal Mining Effluent Regulations (MMER), which indicates that:

> *"The owner or operator of a mine shall prepare an emergency response that describes the measures to be taken in respect of a deleterious substance within the meaning of subsection 34(1) of the Act to prevent any deposit out of the normal course of events of such a substance or to mitigate the effects of such a deposit."*

And under *Part 7 – Emergency Response Assistance Plans and Security Plans of* the Transportation of Dangerous Goods Act:

> *"No person shall import, offer for transport, handle or transport dangerous goods in a quantity or concentration that is specified by regulation — or that is within a range of quantities or concentrations that is specified by regulation — unless the person has an emergency response assistance plan that is approved under this section."*

And finally to satisfy the requirements of the Quartz Mining License QML-0001 Schedule B, that requires "*a plan that describes the measures designed to minimize the potential impact to the environment following a fuel or chemical spill."*

The SCP will apply to Minto Mine and the main access route for one year, whereby the owner or operator shall update and test the SCP to ensure it continues to meet the requirements of both the WUL and subsection 30(2) of the MMER.

3.1 Purpose

The purpose of the SCP is to outline a general set of procedures to be followed to assess, prevent, contain and clean-up (APCC) a spill at the Minto Mine. For procedures to be effective, Minto Mine must ensure that employees and contractors, through experience and training, possess the skills necessary to safely APCC a spill or potential spill. These procedures are necessary to ensure continuity and develop the foundation for a robust and effective Spill Contingency Plan. The SCP is also designed to establish clear reporting and clean up procedures as they apply to emergency and non-emergency spills and incidents.

This document also addresses opportunities to improve spill preparedness, response, and mitigation for Deposits Out of the Normal Course of Events (DONCE) that have the potential to impact the Yukon River and its tributaries within the project site.

All Minto Mine employees and contract staff must be familiar with the general spill reporting procedures outlined in this document and will be introduced to them as part of their site orientation.

3.2 Scope

The objectives of the SCP are to:

- identify potentially hazardous materials located on site;

- identify spill prevention measures;
- establish a high order of preparedness in the event that a spill occurs;
- ensure an orderly and timely decision-making, response and reporting process; and
- describe current and planned protective measures for all areas of the Mine Site

The *Minto Mine Emergency Response Plan* (Minto, 2014) contains other information that relates to Emergency spill procedures. The Emergency Response Team (ERT) and members of the Environmental Department have been training on responding to Hazmat Spills. It is beyond the scope of this document to define the specific Spill Response Procedures and decision loops involved in an ERT response. Any details pertaining to a response from ERT to APCC at a spill incident is the responsibility of the Site Safety Department. General procedures for spill response procedures to emergency spills will be detailed herein.

3.2.1 Hardcopy Locations

Copies of the SCP are kept on-site at all times in the following locations: Mill Control Room; Site Safety Office; Environmental Office; General Manager's Office; Site Services Office; and on the Copper Queen Tug. Contact information is provided in Table 4-2.

4 Communication and Spill Reporting

Any spill that occurs at the Minto Mine site must be reported through the internal reporting chain of command and follow the procedures for assessment, prevention, containment and clean-up and reporting. Should a spill exceed the thresholds set by the Yukon Government (Table 4-1) then it must be reported to external authorities.

A spill in excess of the thresholds outlined in Table 4-1 or any spill that is abnormal in quality or quantity is considered a "reportable spill" under the *Yukon Spill Regulations* (O.I.C. 1996/193), pursuant to the Environment Act.

Table 4-1: Reportable Spill Thresholds

Product	TDG[1.] Code	Threshold Quantity
Explosives	1	Any amount
Flammable gases	2.1	> 100 liters
Non-flammable gases	2.2	> 100 liters
Non-poisonous gases	2.2	> 100 liters
Corrosive gases	2.4	Any amount
Non-corrosive gases	2.2	> 100 liters
Flammable liquids	3	> 200 liters
Flammable solids	4	> 25 kg
Spontaneously combustibles	4	> 25 kg
Dangerous when wet	4	> 25 kg
Oxidizers	5.1	> 50 kg or 50 liters
Organic peroxides	5.2	> 1 kg or 1 liter
Poisonous substances	6.1	> 5 kg or 5 liters
Corrosive materials	8	> 5 kg or 5 liters
Miscellaneous Dangerous Goods	9.1	> 50 kg
Special wastes	9.3	> 5 kg or 5 liters

1. TDG = Transportation of Dangerous Good Regulations (Government of Canada, 1985)

4.1 Internal Reporting (All Spills)

All spills (whether reportable externally or not) must be reported by the discoverer to their immediate supervisor and then to either Site Safety or the Environmental Department by radio or telephone following assessment of the scene. The Environmental Department will issue an Environmental Incident Notification (EIN) to notify the site and its directors including senior management. This typically occurs concurrently with spill response (prevention, containment and clean-up) activities.

Following the spill response, responsible department heads will be required to document the spill on an Environmental Incident Report (EIR), available through the Environmental Department, and provided in Appendix A. The report requires inclusion of photos, a description of clean-up activities, subsequent actions, and identifies root cause and any required corrective actions.

4.2 External Reporting (Reportable Spills Only)

Under federal and territorial regulations, the environmental lead will call the 24-hour Yukon Spill Report line should a spill of a reportable quantity occur (Table 4-1). Although several government agencies at the federal, territorial and municipal levels may ultimately be informed, only the Yukon 24-Hour Emergency Spill Response Number is required for reporting purposes. The Environmental Lead will ensure that the appropriate information is collected before reporting to the Spill Report line. Any spill of an amount greater than those listed in Table 4-1 or a spill of any amount that enters the Yukon River or a tributary of the river is a "reportable spill".

The following information should be provided to the 24-Hour Spill Report line:

- Name
- Phone number
- Product spilled
- Quantity spilled
- Quality of product (thin, viscous etc.)
- Location of spill
- Distance to water
- Distance to drinking water wells
- What happened
- Responsible party
- Actions to contain the spill
- Obtain the Environment Yukon Spill Reporting Number and first/last name of the person whom the report has been made to (in the event of a reporting discrepancy it's always good to know this information).

Minto will also contact: the Selkirk First Nation Lands Director; Energy Mines and Resources Client Services and Inspections; and Environment Canada via email or phone after discovery of a reportable spill. A detailed written report will be submitted to the regulatory authorities within 10 days after the event. The contact information for the various Minto Mine employees, emergency response and external reporting personnel is provided in Table 4-2.

Table 4-2: Contact Information for Minto Mine Personnel and External Agencies

Resource	Email	Contact Number
Minto Mine Internal Communications Contact Info		
Health and Safety Department	safety@mintomine.com	604 759-0860 ext. 4644
Environmental Department	minto_environment@mintomine.com	604 759-0860 ext. 4659
Ron Light, General Manager	ronl@mintomine.com	604 759-0860 ext. 4639
Jennie Gjertsen, Environmental Manager	jennieg@mintomine.com	604 759-0860 ext. 4634
Emergency Phone Contacts		
Yukon 24- Hour Spill Line		867 667-7244
CANUTEC-Dangerous Goods Help		0-613-996-6666

Resource	Email	Contact Number
(Transport Canada)		
Fire Department – Pelly (Emergency)		867 537-3000
Police – Pelly		867 537-5555
Hospital – Whitehorse		867 667-8700
Fire Department – Whitehorse		867 668-8699 or 867 668-2462
Police – Whitehorse		867 667-5555
YG Department of Environment, Water Resources Branch		867 667-3227
YG Environmental Protection Branch		867 667-3436
Selkirk First Nations, William Sydney, Lands Director		867 537-3331
YG EMR, Client Services and Inspections		867 667-3199
External Reporting and Contacts for Submission of Spill Reports		
YG EMR, Steve Colp, Natural Resources Officer - Mining	Steve.Colp@gov.yk.ca	867 456-3839
YG EMR, Sevn Bohnet, Senior Natural Resources Officer - Mining	Sevn.Bohnet@gov.yk.ca	867 456-3884
Selkirk First Nation, William Sydney, SFN Lands Director	sydneyw@selkirkfn.com	867 537-3331 ext. 257
YG Environmental Health Services, Craig Vanlankveld, Environmental Health Officer	craig.vanlankveld@gov.yk.ca	867 667-8316
Environment Canada, Travis Teele, Enforcement Officer	Travis.Teel@ec.gc.ca	867-393-6705

5 Spill Action Plan

Implementation of the spill action plan requires knowledge of spill response supplies and locations, spill response procedures (Sections 5.1 and 5.2) and clean-up protocols (Section 5.3). In addition to the internal and external reporting requirements spills must further be defined as “emergency” or “non-emergency" incidents as the action plans and reporting requirements will differ according to the type of spill.

5.1 Spill Response Procedures: Non-Emergency

The majority of spills that are likely to occur on the Minto Mine Site will include a simple stepwise process initiated by the discoverer. If the safety at the scene is in doubt then it is imperative that the Site Safety department is notified immediately. A "non-emergency" spill is defined as a spill of any product that the discoverer, or other personnel within close proximity, of the incident can competently, safely, and efficiently manage in terms of assessment, prevention, containment and clean-up. This typically includes fuels, blasting agents, oils, lubricants or coolants and many of the reagents involved in mill operations. Once the scene is assessed for safety by the discoverer or supervisor and deemed non-emergency, they should prevent, contain and clean-up (PCC) and contact the environmental team as soon as practical. If assistance is required to deal with the incident, the environmental team is to be notified by radio/telephone immediately.

Major contractors have personnel trained to NFPA 472 Awareness level and are able to respond to non-emergency spills. A complete inventory of Dangerous Goods stored and used at the Minto Mine, including; details on material handling and clean-up, reporting thresholds, special precautions, PPE requirements, and disposal methods is provided for reference during spill response activities (Appendix B).

5.2 Spill Response Procedures: Emergency

An "emergency spill" is a release of a hazardous product where there is potential for that product to enter a waterway or cause significant danger to life, health or environment. When a spill is discovered the first step is to assess the scene for safety and **if safe to do so** immediately control and contain the spill, by any means necessary, if the discoverer or other personnel within close proximity of the incident, do not have the required training, resources or equipment to deal with the incident then the individual must report a "Code 1" callout. This protocol will initiate response of the Safety Department, Environmental Lead and the Emergency Response Team. The Emergency Spill Response Command Structure and General Spill Procedure are detailed in Figure 5-1 and Figure 5-2, respectively. If the scene is safe and the discoverer and the immediate supervisor have the means necessary to control, contain and recover the spill then they should proceed as such.

Once called via a "Code 1" the Safety Coordinator/Medic will respond to the scene and conduct an initial assessment and assume command of the scene. If the Safety Coordinator/Medic is required to treat patients, command is transferred to the Health and Safety Superintendent/Officer or Emergency Response Team Captain. Unified Command Structure will be initiated once the General Manager, Area Manager, or Environmental Lead is on scene. The Unified Command Structure is a cooperative effort command between the General Manager, Health and Safety Superintendent/Officer, Area Manager of involved Department and the Environmental Lead. Transfer of command includes a detailed verbal report of the incident and activities conducted and underway.

A "Code 1" Protocol initiated by an emergency spill will trigger the Specific Spill Response Procedure based on the product type, quantity and environmental and safety conditions.

Initial spill response will be conducted in accordance to *Transport Canada's 2012 Emergency Response Guidebook* (Transport Canada, 2012). This Guidebook will assist Incident Command with information to identify the material, use the guide to reference potential hazards, public safety and emergency response information. The *Table of Initial Isolation and Protective Action Distances* will be used to dictate isolation and protection for large and small spills. However, this is not a comprehensive spill mitigation and response document and will only assist responders in making initial decisions upon arriving at the scene of a dangerous goods incident. It should not be considered as a substitute for emergency response training, knowledge or sound judgment. The *Emergency Response Guidebook* does not address all possible circumstances that may be associated with a dangerous goods incident. The ERT (Appendix C) has additional specific procedures for responding to the most commonly transported and hazardous materials including Nitric Acid, Gasoline, Diesel, Ammonium Nitrate, Sodium Sulfide and Propane.

In addition to on-site response, Minto Mine, through its carriers of dangerous goods, has contracts in place with spill responders. These are full service response agencies that have commitments to mobilize fully trained emergency response teams and equipment 24 hours a day 7 days a week.

5.2.1 CANUTEC Transport Canada

In the event that a spill requires additional technical resources Minto Mine is registered with CANUTEC, a division of Transport Canada, for 24 hour Spill Response support and information to deal with emergency situations. If a spill occurs beyond the boundaries of the Minto property, the owner of the transportation firm and the owner or consignor of the dangerous goods will communicate with the regulators, however for incidents that occur on the Minto property, the Environmental Department will ensure reporting to regulators is performed appropriately.

5.2.2 Surrounding and Downstream Communities

Notification of downstream water users of a spill, if required, is the responsibility of the Yukon Government, Environmental Protection Branch. Minto Mine will also notify the authorities including police and fire departments and the Selkirk First Nation community of Pelly Crossing.

5.2.3 Public Relations

The General Manager is the designated spokesman for Minto Mine. The General Manager may delegate his responsibility for public relations if required to do so by the scale of the incident.

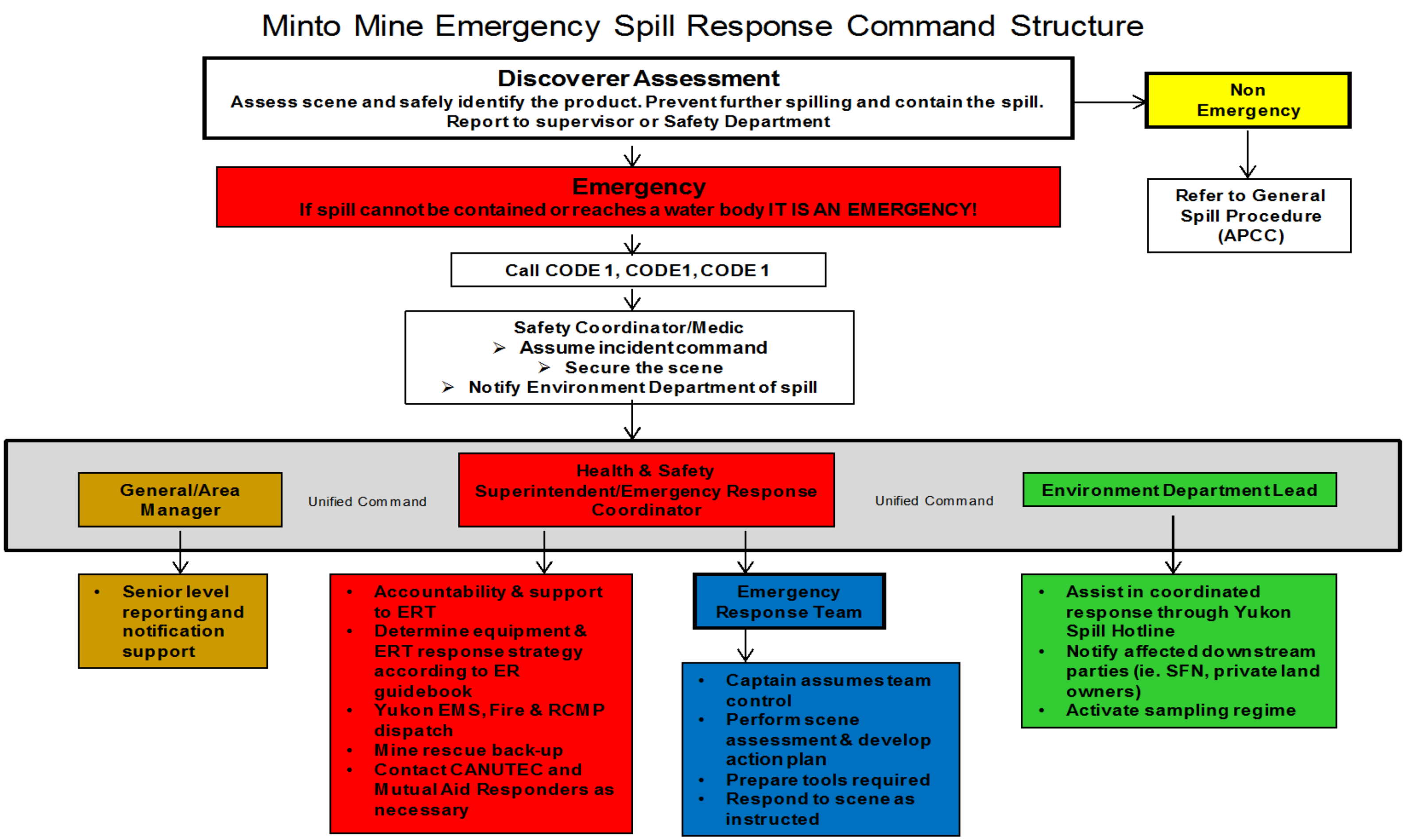

Figure 5-1: Minto Mine Emergency Spill Response Command Structure

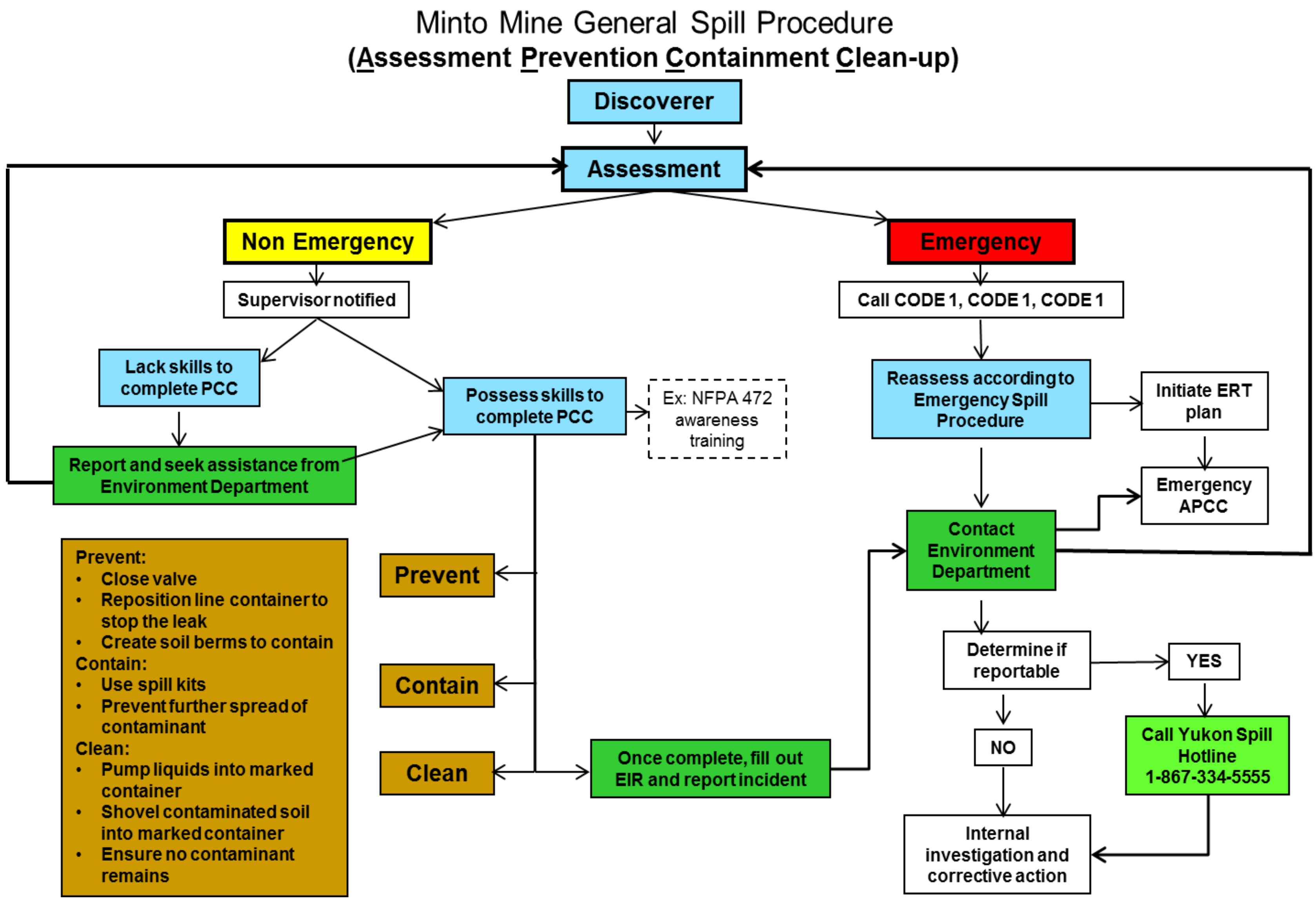

Figure 5-2: Minto Mine General Spill Procedure

5.3 Disposal and clean-up

Disposal and treatment methods of contaminated material are outlined below, and are further detailed in the *Minto Mine Spill Response Procedure: Non-emergency spills on soil* and the *Minto Mine Land Treatment Facility Standard Operating Procedure* documents which are both updated frequently by the Environmental Department. The Minto Mine Site has a Land Treatment Facility to accept incoming contaminated material from hydrocarbon and petroleum hydrocarbon spills. Depending on the state and substrate of the surface material, the clean-up and disposal location will differ. Brief practical descriptions of the clean-up procedures are summarized in Table 5-1.

Table 5-1: Disposal and Movement of Contaminated Material from Spill Sites

WASTE TYPE	DESCRIPTION	MOVEMENT OF MATERIAL FROM SPILLS
Oil or Glycol Contaminated Soil	Soil, Organics, and granular material (avoid coarse rock) contaminated as a result of a hydrocarbon or glycol spill	Contaminated soil will be transferred to the Land Treatment Facility. Contaminated soil will first be placed in a holding cell and labelled to be later categorized and farmed. Contact Environment dept. before dropping off material in the Land Treatment Facility. Small spills will be stored in a composite pile in the staging area. Larger spills will be stored separately in staging while waiting for lab results.
Oil or Glycol Contaminated Rock	Blasted rock and coarse material and/or bedrock, contaminated as result of a hydrocarbon spill or glycol spill	If blasted rock contains ore and has been cleared by Mill operations ore will be processed through the mill. Non-ore containing rock will be placed in the main pit and in-situ bioremediation will be applied to the pile.
Oil or Glycol Contaminated Snow/ Ice/Water	Snow, Ice, and/or Water that has been contaminated as a result of a hydrocarbon spill or glycol spill	Contaminated snow/water will be transferred to the Main Pit or shipped off site at the discretion of the Environmental Lead

**** Any amount of material that has more them 30000 ppm oil or glycol is considered special waste and must be disposed of off-site to a Special Waste Facility**

6 Spill Response Supplies

Spill kits (yellow and blue drums) are located throughout the Minto Mine Property at locations indicated in Figure 6-2. Additionally, there are blue barrels located at the km 12 gravel pit, Minto Creek and at the east and west terminals of Minto Landing. The contents of the yellow and blue barrels are summarized in Table 6-1. Spill kits are also supplied for each heavy and light truck at the Minto Mine. Contractor supervisor trucks have spill kits permanently affixed to the truck body. All contract trucking agencies coming to the mine are required to carry spill kits within or affixed to the truck.

Table 6-1: Spill Kit Contents

Spill Kit Item	Yellow Barrel	Blue Barrel	Yellow Truck Bag
Tyvek splash suits	2	2	
Chemical master gloves	2	2	1
Garbage bags with ties	10	5	3
Oil only booms (5” x 10’)	4	2	1
Oil only mats (16” x 20”)	100	100	
Universal sorbent mat	20	20	10
Sorbent socks	20	20	
Sorbent pads (pillows)	10	10	
Absorb-all pellet bags	2	2	
Tarp	2	1	
Duct tape	1	1	
Utility knife	1	1	
Field notebook and pencil	1	1	
Rake	1		
Pick axe	1		
Aluminum scoop shovels	2	2	
Instruction binder	1	1	1

Heavy machinery at the mine site is available for use in spill response and clean up, as required under contract. Additionally, Minto Mine has a 1991 Chevrolet Top Kick Fire truck with a 3200 L/min pump with 3800 liter supply tank and 3000L drop tank. This truck can support all spill response activities with SCBA, Class A and B foam capabilities, decontamination needs, as well as fire suppression/protection tools and equipment common to a truck of this nature. All ERT members are competent with the operation of this fire truck and related equipment in accordance with NFPA standards.

In 2013, Minto Mine, on advice from Emergency Response Action Plan (ERAP) providers, procured a 20’ Hazmat trailer and a helicopter-portable In-Viro-Drum vacuum unit (Figure 6-1) capable of being transported to locations not reachable with a vacuum truck. It has a liquid cooled three cylinder Kubota diesel engine and 250 CFM non-sparking blower, which makes it safe to vacuum flammable liquids and solids from water or dry land. It comes with a Double Port Vac Drum that allows for transfer of product from the drum to one of our 9500 Liter bladders, while the drum continues to be filled. This system allows for quick, efficient and effective clean-up of hazardous products from hard to reach locations.

Figure 6-1: In-Viro Drum and vacuum unit and 24’ Packman vessel for spill response operations

Further training and skill development will take place in Spill Response Evolutions to be staged in 2014.

Minto Mine also recently acquired a 24’ Packman man boat, which is described, further in the “Barge Emergency Contingency Plan” (Appendix D).

Spill contingency equipment and earth moving equipment located at Minto Mine are listed in Table 6-2. All contractor equipment is available for use in spills and clean-up operations.

Table 6-2: Spill contingency equipment located at Minto Mine

Quantity of Units	Equipment		Quantity of Units	Equipment
1	416 Backhoe		1	Assorted Wooden Plugs
1	3800 Liter Vacuum Truck		4	773DTruck
Various	Dozers, Excavator, Loaders		9	777 Truck
1	In-Viro Drum Portable Vacuum unit		1	Hazmat trailer 20’
2	9500 Liter bladders		1	Top Kick fire truck
1	24’ Packman Response Vessel		500’	Sorbent Boom (various sizes)
2	10000 Liter Fuel Trucks		1	Storage Sea Can at Landing
1	Roll Over Kit		3	Trash pumps
1	Pipe Plug kit			

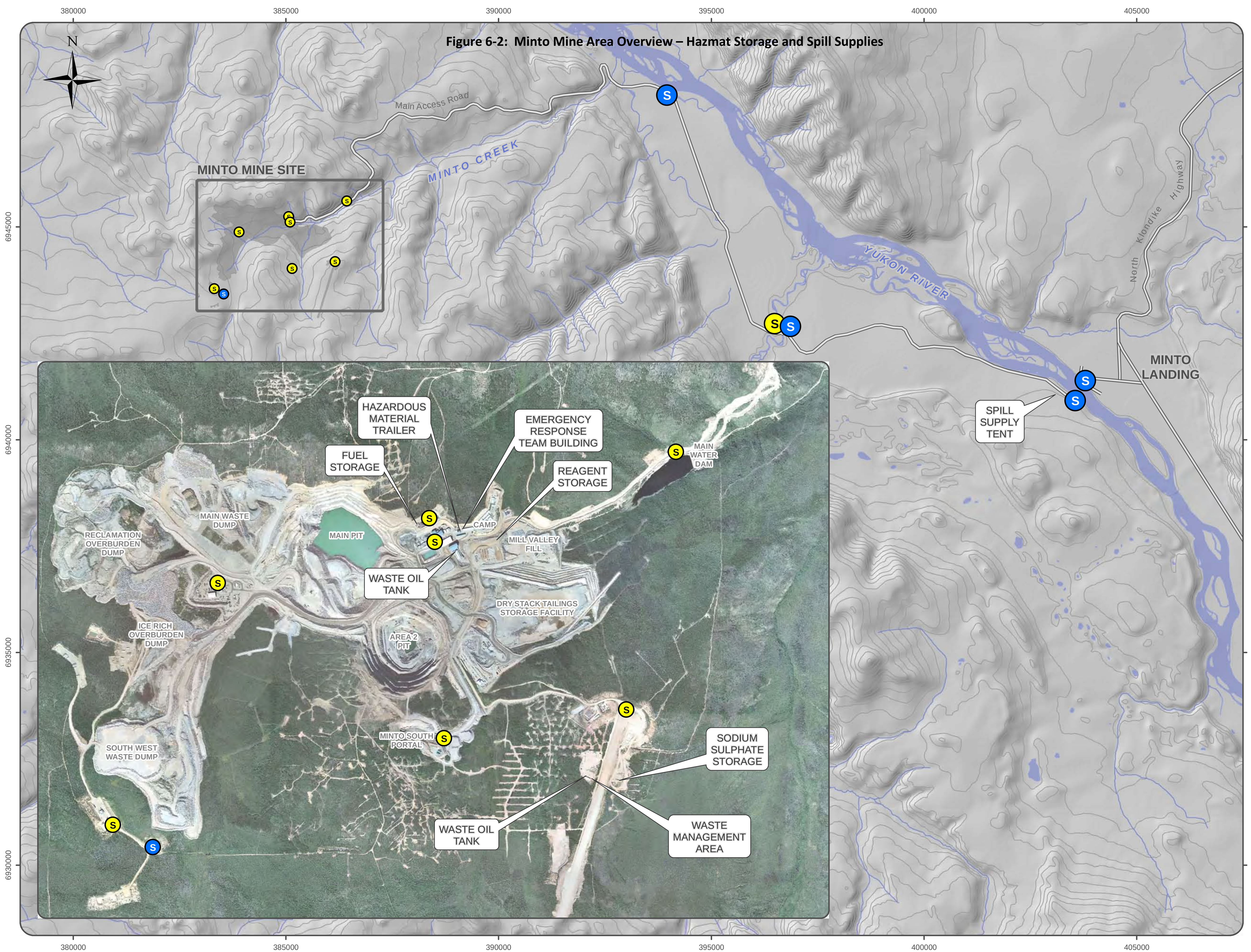

Figure 6-2: Minto Mine Area Overview – Hazmat Storage and Spill Supplies

MINTO MINE

capstone
MINTO MINE

MINTO AREA SPILL KIT LOCATIONS

JANUARY 2014

- Yellow Spill Kit Locations
- Blue Spill Kit Locations
- Roads
- Watercourse
- Waterbodies
- Contours

1:85,000

when printed on 11 by 17 inch paper

0 500 1,000 2,000 3,000 4,000

Meters

ACCESS

Aerial imagery obtained from Challenger Geomatics. Imagery acquired August 11 th 2013.
Site contours derived from 2012 aerial imagery obtained from Challenger Geomatics.

Hydrology data provided by Minto Explorations Ltd, May 2009.

Datum: NAD 83 Projection: UTM Zone 8N

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(Last edited by: jpan;1/22/2014/09:26 AM)

7 Spill Prevention and Response Training

Education and training are critical to the success of any site-wide initiative, and the most important tool to ensuring the success of the SCP. Minto has a comprehensive training program in place that ensures all workers and supervisors are aware of their responsibilities and the practices that personnel and contractors must adhere to. Records are kept of the names of all employees or contractors that receive training, tracked though the Simply Safety software program. Annual re-training is scheduled for all Minto and major contractor employees.

7.1 Existing Spill Prevention and Response Training

In 2012, Hazmat and Transportation of Dangerous Goods training was carried out to the National Fire Protection Association (NFPA) 472 Awareness Level for all departments and major contractors. Employees are trained to understand the potentially hazardous situations that spills can create with respect to the health and safety of workers and the environment. They are trained to understand responsibilities as employees to Assess, Prevent, Contain, and Cleanup as well as to report any spills. The SCP is made available to all employees and employees will be advised of revisions or changes to the SCP.

7.1.1 Orientation

Employees and visitors are required to sign off on the environmental policy as part of the employee, contractor and visitor orientations that include a summary of the response required when a spill has occurred. The orientation has a strong focus on ensure proper reporting of spills, so that the appropriate response and clean up can occur.

7.1.2 "Big 6" Training

As part of the orientation, all Minto employees receive further training that is a computer based PowerPoint presentation, followed by a written test. Prior to 2013, the "Big 5" package was focused on some of the most common safety training required for site, which included WHMIS (Workplace Hazardous Material Information System), fall protection, confined spaces, lock out and hot work training. In early 2013, a sixth component to the program was added that is specifically focussed on Environmental Awareness training. One module is dedicated to Spill Response and covers reporting and basic steps for APCC.

7.1.3 Site-wide Contractor and Group Training

Prior to the addition of the Environmental Awareness training to the "Big 6" program, training was often given to larger audiences of workers, contractors and special groups. As contractors on site are not required to take "Big 6" training, it is important to ensure that groups and contractors that handle hazardous materials or could potentially cause a spill receive additional training in spill prevention, response and waste materials handling. These training sessions are put on by the Environmental Department, and efforts are made to tailor the training to the attending group (i.e. underground miners, surface contractors, site services, etc).

7.1.4 Training for Fuel Handling Employees

Currently there are Safe Work Practices (SWP) designed for bulk fuelling at the fuel farm and for fueling of equipment in the field. These SWPs include descriptions of the stepwise procedure for safely performing the task and also includes steps to take for emergency shut-off. Both the procedure and the equipment are audited during workplace inspections and Planned Job Observations by immediate supervisors and the Environmental department.

7.1.5 ERT Training

An Emergency Response Team (ERT) has been established to, among other duties, respond to emergency spills. The Emergency Response Team will receive training to the NFPA 472 Operations Level Responder and be required to thoroughly understand this document in order to immediately respond to spills or incidents of a specific nature. This training is required as a foundation to develop site specific contingency planning for response tactics in areas specific to the Minto Mine associated activities that present a risk to the Yukon River and its tributaries.

7.2 Planned Spill Prevention and Response Training

Training planned to be added to the current training regime is summarized in sub-sections below.

7.2.1 Targeted practical training

Smaller groups will be identified and targeted for specialised spill prevention training that is more job-specific. These will include, but not be limited to; maintenance personnel (mechanics), waste and water truck operators, fuelling personnel, and warehouse workers. Training in smaller groups will focus on spill prevention techniques.

7.2.2 Emergency Spill Response drills

Table top and/or field drills will help to prepare the ERT and other mine staff to respond to a major spill safely by identifying any deficiencies in the equipment or processes in place. There is a planned Hazmat ERT drill in 2014.

7.2.3 KPIs and Scheduled Re-Training

Individuals who receive training are tracked, and training numbers can be used as a key performance indicator (KPI) with annual targets. In addition, re-training frequencies can be set and measured against key performance indicators.

8 Routine Maintenance and Monitoring

The Fuel Farm is inspected twice monthly for any leakages and, through the Human Machine Interface (HMI) readout, regular inventory is tracked daily to identify any incidental losses. An overfill protection system is installed on the two main diesel tanks using a visual indicator and a relay to the control room that will alarm on the HMI to alert maintenance personnel. The area also receives inspections by a qualified engineer and recommendations are recorded and deficiencies corrected as per the *CCME Environmental Code of Practice for Aboveground and Underground Storage Tank Systems Containing Petroleum and Allied Petroleum Products* (Canadian Council of Ministers of the Environment, 2003).

The tug and barge receive frequent inventory inspections for spill equipment and have had major overhauls in the last few years to ensure that the operation is continually improving. Maintenance activities are also carried out regularly and systems are inspected as per Transport Canada Regulations. The daily start-up procedure includes checking for leaks and ensuring all systems are performing to specifications. Annual maintenance activities have included the following: prop repairs, controls work, system checks and repairs. Substantive refits have included: cylinder heads, exhaust manifold seals, motor mounts, transmission mounts and water pumps replaced. A new transmission, propulsion seals and propellers have been installed and aligned. Other improvements have included welding reinforcements on the bow of the barge for landings, electrical upgrades, and the installation of an anchor with hawser.

The open pit mining equipment is outfitted with Wiggins Fast Fuel Systems on newer contractor open equipment that is a fail-safe system for overflow protection. All fuel trucks receive a daily walk-around inspection to ensure emergency shutoffs and hatches and tank valves are operating properly and are free of leaks. These are recorded daily.

The Waste Management Area (WMA) is restricted to access between 1-3 pm daily by an attendant familiar with the protocols for waste segregation, incineration, special waste handling and landfilling. The attendant will inspect all loads that come into the WMA to ensure that waste has been properly sorted before any material is off loaded. The Environmental Department is directly responsible for the administration, compliance and procedures associated with the management of waste. They are also responsible for providing support and manpower to prepare shipments for backhauling and to ensure the WMA is maintained in accordance with the Waste Management Permit (# 81-005). The Environmental Monitors are responsible for conducting weekly inspections to ensure that the WMA is in compliance.

9 References

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Transport Canada. (2012). 2012 Emergency Response Guidebook. *A Guidebook for First Responders During the Initial Phase of a Dangerous Goods/Hazardous Materials Transportation INcident*.

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Appendix A: Spill Report and Environmental Incident Report Forms

Spill Report Form

Spill Name:			

General Report Information: **(To be completed by the supervisor of responsible department or company)**

EIR #:		Location of Incident:	
Date of Incident:		Time of Incident:	
Contaminant Type:		Volume of Spill (L):	
Equipment (Type):		Equipment (#):	
Company or Department:		Supervisor	
Hours since last PM:		Proximity to nearest waterbody:	
Previous indication of leak (i.e. Prior Drip) (Yes/No):		Estimated cost of spill:	

Failure of Mechanism: **(Check one box below)**

Blown Hose		Failed Hose Connection		Human Error	
Unforseen		Blown or Leaking Seal		Unknown	
Other					

Brief Description of Cause: **(conditions at time of spill, what was happening at the time, specific direct cause of spill, etc.)**

Clean Up Actions Undertaken:

Land Treatment Facility Information: **(To be filled out by Environment Department)**

Material Moved to LTF (Yes/No):		Material Sampled (Yes/No):		Quantity (m^3):	
Notes:					

Corrective Actions: **(Must fill out for all reportable and preventable spills)**

Action Item #	Responsible Department	Corrective Action	Due Date

Reporting Sequence:			
First Observer:			
	Name	Company	Date/Time
Reported To:			
	Name	Company	Date/Time
Reported To Environmental:			
	Name	Company	Date/Time
Reported To General Manager:			
	Name	Company	Date/Time

Regulatory Tracking: **(To be completed by Environment Department)**					
24 Hour Spill Hotline (867) 667-7244:					
Reported By:		Reported To:		Date/Time:	
Selkirk First Nation Lands Director (867)-537-3331					
Reported By:		Reported To:		Date/Time:	
EMR - Client services and Inspections (867) 456-3882: (or site inspectors)					
Reported By:		Reported To:		Date/Time:	
Environment Canada in the event of a discharge to a waterway (867)-667-3400					
Reported By:		Reported To:		Date/Time:	
Detailed written report and MSDS to YWB, EMR, EC and SFN (Required within 10 days of spill):					
Submitted By:		Date of Submission:			

Photos:	

Appendix B: Reporting Threshold, Special Precautions, PPE Requirements, and Cleanup and Disposal Methods

Common Name (Synonyms)	Chemical Name	Manufacture / Supplier	Phase	TDG Class	WHMIS Class	NFPA Rating	Reporting Threshold	Use	Special Precautions	PPE Required	Special Cleanup and Disposal Info
Acetone	2-Propanone	Anachemia	Liquid	3	B-2, D-2B	1, 3, 0	200 L	Solvent	Extremely Flammable	Goggles, gloves. SCBA if in confined space	Eliminate all sources of ignition. Ventilate area if required. Use absorbent. In case of fire, use dry chemical, CO2, Alcohol-resistant foam. Do not allow into waterway or drains. Contain spread of spill and soak up with absorb all, absorbant pads. Clear up using non-sparking tools. Place liquid and absorbents into tighly sealed container, label clearly and dispose of as hazardous waste offsite.
Acetylene	C_2H_2	AIRGAS INC	Pressurized gas dissolved	2.1	A, B-1, F	1, 4, 3	any if container larger than 100 L	Welding/cutting gas	Extremely flammable, pressurized gas dissolved in an extremely flammable liquid (Acetone)	Goggles, gloves. Respirator or SCBA if in confined space	Eliminate all sources of ignition, if possible without risk, shut off bottles. If bottle is ruptured after the gas has been expelled, the bottle will release the Acetone. At that point treat as an Acetone spill.
AERO 6493 Promoter	Alkyl hydroxamate	Cytec Canada	Liquid above 15C	9		2, 1, 2		Metal flotation in mill			Soak up with absorbent (do NOT use sawdust. Use PLASTIC tools). In case of fire, use dry chemical, CO2, Alcohol-resistant Foam or water spray. Place recovered spilt liquid in labelled drums for disposal as Special waste. Incinerate used absorbent pads.
AERO MX-5149	Modified Thionocarbamate 15-40%Xanthate esther 40-70%	Cytec Canada	Liquid	3				Metal flotation in mill	Flammable		
Aerodri 100 Dewatering Agent		Cytec Canada	Liquid	3	B-2, D-2A	2, 3, 0	200 L		Avoid contact with strong oxidizers or acids.	Safety Glasses, Gloves	Eliminate all sources of ignition. Ventilate area if required. Use absorbent. In case of fire, use dry chemical, CO2, Alcohol-resistant Foam or water spray. Incinerate waste. Soak up with absorbent materials and dispose of offsite in clearly labeled containers
Alconox		Anachemia	solid	not regulated	D-2B	1, 0, 0	50 kg			Safety Glasses, Gloves	Clean up uncontaminated material for reuse. Incinerate waste.
ALIQUAT 336	Methytrioctyl-ammonium Chloride	Sigma-Aldrich Canada	Liquid	6	D-2B	2, 1, 1	5 kg		Toxic if swallowed. Very corrosive. Will burn skin and eyes. Avoid contact with strong oxidizers. Hygroscopic: avoid contact with moist air.	Safety Glasses, Gloves	Eliminate all sources of ignition. Ventilate area if required. Use absorbent. In case of fire, use dry chemical, CO2, Alcohol-resistant Foam or water spray. Incinerate waste.
AlphaSolve II	>50% Sodium Hydroxide <50% Silicate	Alpha Resources	Solid						Avoid contact with strong oxidizers.	Safety Glasses, Impervious Gloves.	Highly caustic. Will produce heat and steam on contact with water. May boil and spatter. May generate hydrogen gas on contact with metals. Sweep or vaccum and, if not re-useable, send offsite as hazardous waste, in tightly closed, well labeled containers.
Aluminex 5	Aluminum Chloride Hydroxide Sulphate 15%	NALCO	Liquid					Coagulant		Safety Glasses, Gloves	Soak up with absorbent materials. These can be incinerated. Any remaining spilt liquid should be stored in closed container, labelled and disposed of off-site as Special Waste.
Aluminum Standard - AA		Anachemia	Liquid	8	E	4, 0, 0	5 L		Dilute Nitric Acid <5%	Safety Glasses, Gloves	Neutralize with soda ash or lime. Contain spill, **do not** allow un-neutralized acid to enter water systems. Neutralized spill can be pumped to the pit or tailings system.
AM28 Flotation Reagent	Mixture of Potassium Hydroxide Alkyl hydroxamate	Australian Metallurgical Services	Liquid	not regulated	D-2B	1, 0, 0				Safety Glasses, Gloves	Soak up with absorbent (do NOT use sawdust. Use PLASTIC tools). In case of fire, use dry chemical, CO2, Alcohol-resistant Foam or water spray. Place recovered spilt liquid in labelled drums for disposal as Special waste. Incinerate used absorbent pads.
Amco Clear Turbidity Standard		GFS Chemicals	Liquid	not regulated	not regulated					Safety Glasses, Gloves	Contain spill. Incinerate waste or place in landfill
Ammonia, Refrigerant	Ammonia, Anhydrous	GT&S, INC	Liquefied Gas	2.3, 8	does not appear classified??	3, 0, 0	any amount		Liquefied gas, will produce extreme cold when released. Death has occurred at 5000ppm exposure for 5 minutes. Evacuate release area upwind and avoid low areas.	Goggles, gloves. SCBA.	Toxic gas and will react with a large number of substances, many in a violent manner, Gas will dissipate quickly in air. Small spills can be dissolved in water at ratio of 1:10 Not very flamable. Do not attempt to neutralise.
Ammonium Nitrate prill	Ammonium Nitrate										

Common Name (Synonyms)	Chemical Name	Manufacture / Supplier	Phase	TDG Class	WHMIS Class	NFPA Rating	Reporting Threshold	Use	Special Precautions	PPE Required	Special Cleanup and Disposal Info
Ammonium Nitrate Emulsion	Ammonium Nitrate Emulsion										
Arsenic Standard - AA		Anachemia	Liquid	8	D-2A, E	4, 0, 0	5 L		Dilute Nitric Acid <5%	Safety Glasses, Gloves	Neutralize with soda ash or lime. Contain spill, **do not** allow un-neutralized acid to enter water systems. Neutralized spill can be pumped to the pit or tailings system.
Ascorbic Acid	L-Ascorbic Acid (Vitamin C)	Anachemia	solid	not regulated	not regulated	1, 1, 1			also known as Vitamin C	Safety Glasses, Gloves	Contain spill. Incinerate waste or place in landfill
Brake & Parts Kleen	CO_2 aerosol of Heptane and Isopropyl alcohol	Kleen-Flo Tumbler Industries	aerosol	Consumer Commodity	A, B5, D2-B	1, 3, 0			Highly flammable	Safety Glasses, Gloves	Eliminate all sources of ignition. Ventilate area if required. Use absorbent. In case of fire, use dry chemical, CO2, Alcohol-resistant Foam or water spray. Incinerate waste.
Buffer Solution pH 10		Anachemia	Liquid	not regulated	D-2A	1, 0, 0			Dilute Sodium Hydroxide	Safety Glasses, Gloves	Contain spill. Absorb with sand, vermiculite or sorbal. Incinerate waste.
Buffer Solution pH 4		Anachemia	Liquid	not regulated	not regulated	1, 0, 0				Safety Glasses, Gloves	Contain spill. Absorb with sand, vermiculite or sorbal. Incinerate waste.
Buffer Solution pH 7		Anachemia	Liquid	not regulated	not regulated	1, 0, 0				Safety Glasses, Gloves	Contain spill. Absorb with sand, vermiculite or sorbal. Incinerate waste.
Cadmium Standard - AA		Anachemia	Liquid	8	D-2A, E	4, 0, 0	5 L		Dilute Nitric Acid <5%	Safety Glasses, Gloves	Eliminate all sources of ignition. Ventilate area if required. Use absorbent. In case of fire, use flooding quantities of water. Contributes to combustion of other materials. Neutralize with soda ash or lime. Contain spill, keep from entering ground water. Neutralized spill can be pumped to the pit or tailings system.
Calcium Chloride		J.T. Baker	solid	not regulated		1, 0, 2, 3			Road Salt, will corrode metals	Safety Glasses, Gloves	Sweep up spilled material and it my be deposed of in dilute form to the pit or tailings system. In case of fire use appropriate measures for surrounding fire.
Carbon Dioxide in Argon		Mittler Supply Inc.	Pressurized gas	2.2	A, D-2B	1, 0, 0	any if container larger then 100 L		Non-Flammable but will replace the O_2 in confined space	Goggles, gloves. SCBA if in confined space	close valve if possible without risk, or allow the vent. In case of fire use any media suitable for surrounding fire. Use water spray to cool fire exposed containers.
Caustic Soda (solid)	Sodium Hydroxide	Fisher Scientific	solid	8	E	3, 0, 1	5 kg		very corrosive solid	Safety Glasses, Gloves	Sweep up spilled material for reuse. In case of fire use appropriate measures for the surrounding fire. Minimise direct water spray on material. This material melts and 318°C and when molten reacts violently with water. Neutralize the residue with a dilute solution of acetic acid. Neutralized solution can be disposed of in the pit or tailings system.
Caustic Soda (solution)		DOW	Liquid	8	E	3, 0, 1	5 L		very corrosive liquid	Safety Glasses, Gloves	Contain spill and pump to plastic barrel for re-use. In case of fire use appropriate measures for the surrounding fire. Neutralize the residue with a dilute solution of acetic acid. Neutralized solution can be disposed of in the pit or tailings system.
Caustic Potash	Potassium Hydroxide	Brenntag Canada	Solid		D-1B, E						
Chevron 2-Cycle Oil		Chevron Lubricants Canada	Liquid	not regulated	B-3	1, 2, 0			flammable oil for 2-storke fuel	Safety Glasses, Gloves	contain spill and use absorbent and incinerate waste
Chevron ATF+3 Automatic Transmission Fluid		Chevron Lubricants Canada	Liquid	not regulated	not regulated	1, 1, 0				Safety Glasses, Gloves	contain spill. Small amounts can use absorbent and incinerate waste. Larger material pumped into plastic drums and used in a waste oil heating system.
Chevron Automatic Transmission Fluid MD-3		Chevron Lubricants Canada	Liquid	not regulated	not regulated	1, 1, 0				Safety Glasses, Gloves	contain spill. Small amounts can use absorbent and incinerate waste. Larger material pumped into plastic drums and used in a waste oil heating system.
Chevron Clarity Synthetic Machine Oil		Chevron Lubricants Canada	Liquid	not regulated	not regulated	1, 1, 0				Safety Glasses, Gloves	contain spill. Small amounts can use absorbent and incinerate waste. Larger material pumped into plastic drums and used in a waste oil heating system.
Chevron Compressor Oil 260		Chevron Lubricants Canada	Liquid	not regulated	not regulated	1, 1, 0				Safety Glasses, Gloves	contain spill. Small amounts can use absorbent and incinerate waste. Larger material pumped into plastic drums and used in a waste oil heating system.
Chevron Coupling Grease	Grease	Chevron Lubricants Canada	Semi-Solid	not regulated	not regulated	1, 1, 0				Safety Glasses, Gloves	contain spill. Small amounts can use absorbent and incinerate waste. Larger absorbent material in plastic drums and shipped off site for disposal.

Common Name (Synonyms)	Chemical Name	Manufacture / Supplier	Phase	TDG Class	WHMIS Class	NFPA Rating	Reporting Threshold	Use	Special Precautions	PPE Required	Special Cleanup and Disposal Info
Chevron Delo 300 Motor Oil		Chevron Lubricants Canada	Liquid	not regulated	not regulated	1, 1, 0				Safety Glasses, Gloves	contain spill. Small amounts can use absorbent and incinerate waste. Larger material pumped into plastic drums and used in a waste oil heating system.
Chevron Delo Grease EP	Grease	Chevron Lubricants Canada	Semi-Solid	not regulated	not regulated	1, 1, 0				Safety Glasses, Gloves	contain spill. Small amounts can use absorbent and incinerate waste. Larger absorbent material in plastic drums and shipped off site for disposal.
Chevron Diesel Engine Oil Delo 6170 CFO		Chevron Lubricants Canada	Liquid	not regulated	not regulated	1, 1, 0				Safety Glasses, Gloves	contain spill. Small amounts can use absorbent and incinerate waste. Larger material pumped into plastic drums and used in a waste oil heating system.
Chevron Drive Train Fluid HD		Chevron Lubricants Canada	Liquid	not regulated	not regulated	1, 1, 0				Safety Glasses, Gloves	contain spill. Small amounts can use absorbent and incinerate waste. Larger material pumped into plastic drums and used in a waste oil heating system.
Chevron ECO Hydraulic Oil AW		Chevron Lubricants Canada	Liquid	not regulated	not regulated	0, 1, 0				Safety Glasses, Gloves	contain spill. Small amounts can use absorbent and incinerate waste. Larger material pumped into plastic drums and used in a waste oil heating system.
Chevron Gas Engine Oil 930 and 940		Chevron Lubricants Canada	Liquid	not regulated	not regulated	0, 1, 0				Safety Glasses, Gloves	contain spill. Small amounts can use absorbent and incinerate waste. Larger material pumped into plastic drums and used in a waste oil heating system.
Chevron Mid-grade unleaded gasoline		Chevron Products	Liquid	3	B-2, D-2A, D-2B	2, 3, 0	200 L		Extremely Flammable, Vapours are harmful and they may be explosive. Non-sparking tools required. Vapours will collect in low areas and travel along the ground to an ignition source.	Goggles, gloves. Respirator or SCBA if in confined space	Eliminate all sources of ignition. Ventilate area if required. Dike the spill and pump to containers for recycling. Use absorbent. In case of fire, use dry chemical, CO2, Alcohol-resistant Foam or water spray. Allow waste absorbent to evaporate and then Incinerate waste.
Chevron NWS Manual Transmission Fluid 6044GR		Chevron Lubricants Canada	Liquid	not regulated	not regulated	1, 1, 0				Safety Glasses, Gloves	contain spill. Small amounts can use absorbent and incinerate waste. Larger material pumped into plastic drums and used in a waste oil heating system.
Chevron RPM Universal Gear Lubricant		Chevron Lubricants Canada	Liquid	not regulated	not regulated	1, 1, 0				Safety Glasses, Gloves	contain spill. Small amounts can use absorbent and incinerate waste. Larger material pumped into plastic drums and used in a waste oil heating system.
Chevron Supreme Antifreeze/Coolant	Ethylene Glycol	Chevron Lubricants Canada	Liquid	not regulated under 5000 lb.	D-2A	1, 1, 0			may be fatal by ingestion	Safety Glasses, Gloves	contain spill. Can be pumped, filtered and reused. Small amounts can use absorbent and incinerate waste. Larger absorbent material in plastic drums and shipped off site for disposal.
Chevron Ulti-Plex® Grease EP		Chevron Lubricants Canada	Semi-Solid	not regulated	not regulated	1, 1, 0				Safety Glasses, Gloves	contain spill. Small amounts can use absorbent and incinerate waste. Larger absorbent material in plastic drums and shipped off site for disposal.
Chloramine T	Chloramine-T trihydrate	Fisher	solid	8	D-2A, E	3, 1, 1			Container may explode under fire conditions. Will release toxic fumes with fire or when mixed with strong oxidizers or acids	Goggles, gloves. SCBA if in confined space	Eliminate all sources of ignition. Ventilate area if required. In case of fire. Material by itself is non-flammable, may decompose violently >100°C, use dry chemical, CO_2 foam or water spray. DISPOSAL mix with flammable solvent and incinerate.
Chromium Standard - AA		Anachemia	Liquid	8	D-2A, E	3, 0, 0	5 L		Dilute Nitric Acid <5%	Safety Glasses, Gloves	Neutralize with soda ash or lime. Contain spill, **do not** allow un-neutralized acid to enter water systems. Neutralized spill can be pumped to the pit or tailings system.
Citric Acid	Citric Acid, Monohydrate	Anachemia	solid	not regulated	E	2, 1, 0			Will cause severe eye damage. Avoid oxidizers, acids, bases and bleach.	Safety Glasses, Gloves	Eliminate all sources of ignition. Ventilate area if required. In case of fire, use flooding quantities of water. Will decompose at high temperatures and emit acrid smoke and fumes.
Copper Standard - AA		Anachemia	Liquid	8	E	4, 0, 0	5 L		Dilute Nitric Acid <5%	Safety Glasses, Gloves	Neutralize with soda ash or lime. Contain spill, **do not** allow un-neutralized acid to enter water systems. Neutralized spill can be pumped to the pit or tailings system.
Crystal 78	Sodium Silicate	Quadra Chemicals	Liquid	not regulated	D-2B				Caustic solution. Avoid mixing with strong acids. Contact with metals such as aluminum, tin, lead and zinc generates hydrogen gas.	Goggles, gloves. Respirator	solution can be pumped into plastic drum and possibly recycled in mill circuit, or shipped off site. In case of fire use appropriate measures for surrounding fire.
Cyquest DP-6	Sodium polyacrylate in water	Cytec Canada	Liquid	not regulated				Mill reagent	Slippery	Goggles, Impervious gloves	Soak up with absorbent materials. These can be incinerated. Any remaining spilt liquid should be stored in closed container, labelled and disposed of off-site as Special Waste.

Common Name (Synonyms)	Chemical Name	Manufacture / Supplier	Phase	TDG Class	WHMIS Class	NFPA Rating	Reporting Threshold	Use	Special Precautions	PPE Required	Special Cleanup and Disposal Info
Delo Diesel Fuel System Cleaner		Chevron Lubricants Canada	Liquid	3	B-3, D-2A, D-2B		200 L			Safety Glasses, Gloves	Eliminate all sources of ignition. Ventilate area if required. Use absorbent. In case of fire, use dry chemical, CO2, Alcohol-resistant Foam or water spray. Incinerate waste.
Diesel Fuel No. 2		Chevron Products Company	Liquid	3	B-3, D-2A, D-2B	0, 2, 0	200 L			Safety Glasses, Gloves	contain spill. Small amounts can use absorbent and incinerate waste. Larger material pumped into plastic drums and used in a waste oil heating system.
DIISOBUTYL KETONE	2,6-Dimethyl-4-heptanone	J.T. Baker	Liquid	3	B-2, D-2A	2, 2, 0	200 L		Avoid contact with strong oxidizers or acids.	Safety Glasses, Gloves	Eliminate all sources of ignition. Ventilate area if required. Use absorbent. In case of fire, use dry chemical, CO2, Alcohol-resistant Foam or water spray. Incinerate waste.
Drierite, indicating		Anachemia	solid	not regulated	D-2A	1, 0, 1				Safety Glasses, Gloves	Eliminate all sources of ignition. In case of fire use measures dictated by surrounding fire. Will decompose at 1450°C liberating Cl_2 and SO_2. This product can be dried and reused, recycled.
FLEET CHARGE 50/50 Antifreeze	Ethylene Glycol	OLD WORLD INDUSTRIES	Liquid	not regulated under 5000 lb.	D-2A	1, 1, 0			may be fatal by ingestion	Safety Glasses, Gloves	contain spill. Can be pumped, filtered and reused. Small amounts can use absorbent and incinerate waste. Larger absorbent material in plastic drums and shipped off site for disposal.
Fleet Charge PG Antifreeze/Coolant	Propylene Glycol	OLD WORLD INDUSTRIES	Liquid	not regulated	not regulated	0, 1, 0				Safety Glasses, Gloves	contain spill. Can be pumped, filtered and reused. Small amounts can use absorbent and incinerate waste. Larger absorbent material in plastic drums and shipped off site for disposal.
Flomin C 3505 Collector	Potassium amyl xanthate (PAX)	Flomin Inc.	solid	4	not regulated	2, 2, 1	25 kg		Product is spontaneously combustible. Avoid contact with heat, moist air, and water.	Safety Glasses, Gloves	Sweep up spilled material and place in closed container for reuse. Solutions of product my be deposed of on the pit or tailings system. In case of fire use appropriate measures for surrounding fire.
Flomin F 500 Frother	4-METHYL-2-PENTANOL (Methyl isobutyl carbinol - MIBC)	Flomin Inc.	Liquid	3	B-2, D-2B	2, 2, 0	200 L		Acids, acid chlorides, alkalis, oxidizing agents. Will attack some forms of plastics, rubber and coatings	Goggles, gloves. Respirator or SCBA if in confined space	Eliminate all sources of ignition. Ventilate area if required. Use absorbent. In case of fire, use dry chemical, CO2, Alcohol-resistant Foam or water spray. Incinerate waste.
Floran Catalyst	Proprietary Inorganic Peroxide Blend	Floran Technologies	Liquid	5	C, D-2B	2, 0, 1, OX	50 L		Non-Flammable but will aid combustion of other materials	Safety Glasses, Gloves	Eliminate all sources of ignition. Ventilate area if required. Use absorbent. In case of fire, use flooding quantities of water. Contributes to combustion of other materials. Contain spill, keep from entering ground water. Absorbed pill can be disposed in the pit or tailings system.
Frost Killer (Tannergas)	Methyl alcohol	TANNER SYSTEMS, INC.	Liquid	3, 6.1	B-2, D-1B, D-2A,D-2B	1, 3, 0	200 L		Extremely Flammable, Vapours are harmful and solution is poisonous	Goggles, gloves. Respirator or SCBA if in confined space	Eliminate all sources of ignition. Ventilate area if required. Use absorbent. In case of fire, use dry chemical, CO2, Alcohol-resistant Foam or water spray. Incinerate waste.
FUEL INJECTOR CLEANER		Radiator Specialty Co	Liquid	3	B-3, D-2A, D-2B		200 L			Safety Glasses, Gloves	Eliminate all sources of ignition. Ventilate area if required. Use absorbent. In case of fire, use dry chemical, CO2, Alcohol-resistant Foam or water spray. Incinerate waste.
Gasoline, Unleaded		Petro-Canada	Liquid	3	B-2, D-2A, D-2B	2, 3, 0	200 L		Extremely Flammable, Vapours are harmful and they may be explosive. Non-sparking tools required. Vapours will collect in low areas and travel along the ground to an ignition source.	Goggles, gloves. Respirator or SCBA if in confined space	Eliminate all sources of ignition. Ventilate area if required. Dike the spill and pump to containers for recycling. Use absorbent. In case of fire, use dry chemical, CO2, Alcohol-resistant Foam or water spray. Allow waste absorbent to evaporate and then Incinerate waste.
Havoline DEX-COOL Extended Life 50/50 Anti-Freeze/Coolant	Ethylene Glycol	Chevron Lubricants Canada	Liquid	not regulated	D-1b, D-2A	2, 0, 0			may be fatal by ingestion	Safety Glasses, Gloves	contain spill. Can be pumped, filtered and reused. Small amounts can use absorbent and incinerate waste. Larger absorbent material in plastic drums and shipped off site for disposal.
HAVOLINE DEX-COOL extended life anti-freeze/coolant-B	Ethylene Glycol	Chevron Lubricants Canada	Liquid	not regulated	D-1b, D-2A	2, 1, 0			may be fatal by ingestion	Safety Glasses, Gloves	contain spill. Can be pumped, filtered and reused. Small amounts can use absorbent and incinerate waste. Larger absorbent material in plastic drums and shipped off site for disposal.
Havoline Power Steering Fluid		Chevron Products	Liquid	not regulated	not regulated	0, 1, 0				Safety Glasses, Gloves	contain spill. Small amounts can use absorbent and incinerate waste. Larger material pumped into plastic drums and used in a waste oil heating system.
Hot 4-in-1 Heating Oil Treatment	Proprietary Blend	FPPF Chemical Company, Inc.	Liquid	3	B-3, D-1A, D-2A, D-2B	3, 2, 0	200 L		Fuel Additive, fumes will collect in low area's.	Safety Glasses, Gloves	Eliminate all sources of ignition. Ventilate area if required. Use absorbent. In case of fire, use dry chemical, CO2, Alcohol-resistant Foam or water spray. Incinerate waste.
Hydrated Lime	$Ca(OH)_2$	Chemical Lime Company of Canada Inc.	Solid		D-2A, E				Will cause severe caustic burns. Avoid strong acids, and aluminum	Safety Glasses, Gloves	sweep up uncontaminated material for reuse. Neutralize with dilute acid and may be disposed of in pit or tailings system.

Common Name (Synonyms)	Chemical Name	Manufacture / Supplier	Phase	TDG Class	WHMIS Class	NFPA Rating	Reporting Threshold	Use	Special Precautions	PPE Required	Special Cleanup and Disposal Info
Hydraulic Oil SAE 10W		EXXON MOBIL	Liquid	not regulated	not regulated	0, 1, 0				Safety Glasses, Gloves	Eliminate all sources of ignition. Ventilate area if required. Use absorbent. In case of fire, use dry chemical, CO2, Alcohol-resistant Foam or water spray. Incinerate waste.
Hydrochloric Acid		Anachemia	Liquid	8	D-1A, E	3, 0, 1	5 L		Concentrated acid, Extremely corrosive. Ventilate or stay upwind	Goggles, gloves. Respirator or SCBA if in confined space	Neutralize with soda ash or lime. Contain spill, **do not** allow un-neutralized acid to enter water systems. Neutralized spill can be pumped to the pit or tailings system.
Hydrofluoric acid, 47 - 51%		Fisher	Liquid	8, 6.1	D-1A, D-2A, E	4, 0, 1	5 L		**Extremely corrosive and Toxic acid. Causes very severe acid burns with symptoms being delayed. Skin contact of <10% can be fatal from cardio-pulmonary problems. IMMEDIATE medical attention is required for all exposures.**	**Goggles, gloves. Respirator or SCBA if in confined space (Actually SCBA should be used anywhere unless spill is in a fumehood)**	Neutralize with soda ash. Contain spill, **do not** allow un-neutralized acid to enter water systems. Neutralized spill can be pumped to a plastic barrel and then disposed of in the pit or tailings system.
IPAC 6832		Quadra Chemicals	Liquid	not regulated	not regulated				water soluble	Safety Glasses, Gloves	No special clean up procedures,
Iron Standard - AA		Anachemia	Liquid	8	E	1, 0, 0	5 L		Dilute Nitric Acid <5%	Safety Glasses, Gloves	Neutralize with soda ash or lime. Contain spill, **do not** allow un-neutralized acid to enter water systems. Neutralized spill can be pumped to the pit or tailings system.
Javex Liquid Bleach		Colgate Palmolive	Liquid								
KOPR-KOTE	Graphite, Cu & MoS_2 mixture	Jet-Lube of Canada	paste	not regulated	not regulated					Safety Glasses, Gloves	Wipe up spill with rages and incinerate waste.
Lead Standard - AA		Anachemia	Liquid	8	D-2A, E	4, 0, 0	5 L		Dilute Nitric Acid <5%	Safety Glasses, Gloves	Neutralize with soda ash or lime. Contain spill, **do not** allow un-neutralized acid to enter water systems. Neutralized spill can be pumped to the pit or tailings system.
Lime		Chemical Lime Company of Canada Inc.	powder	not regulated	E	3, 0, 1			Will cause severe caustic burns. Avoid strong acids, and aluminum	Safety Glasses, Gloves	sweep up uncontaminated material for reuse. Neutralize with dilute acid and may be disposed of in pit or tailings system.
Liquid Nitrogen	Nitrogen	Praxair Canada Inc.	Liquefied Gas	2.2 Non-flammable gas	A	3, 0, 2	any if container larger then 100 L		Use air supplied respirator when working in confined space, Loose-fitting cryogenic gloves, Metatarsal shoes for cylinder handling. Protective clothing where needed. Cuff less trousers should be worn outside of shoes	Extremely cold liquefied gas, Will cause severe frost bite Use SCBA when working in confined space,	Evacuate all personnel from danger area. Allow spilled liquid to evaporate. Use self-contained breathing apparatus where needed. Shut off flow if you can do so without risk. Ventilate area or move cylinder to a well-ventilated area. Test for sufficient oxygen, especially in confined spaces, before allowing re-entry
LIQUID WRENCH SUPER LUBRICANT (AEROSOL)	Proprietary Blend	Radiator Specialty Co	aerosol	2.1	A, B5, D-1A, D2-B		any if container larger then 100 L		containers may rupture if exposed to high temperatures.	Safety Glasses, Gloves	Allow container to completely discharge while eliminating ignitions sources. Wipe up spill with rages and incinerate waste.
Loctite Belt Dressing	Proprietary Blend t	Henkel Canada, Inc.	aerosol	2.2	A, D-2A, D-2B		any if container larger then 100 L		containers may rupture if exposed to high temperatures.	Safety Glasses, Gloves	Allow container to completely discharge Wipe up spill with rags and incinerate waste.
LPS 2 Spray Lubricant	Proprietary Blend	LPS Laboratories	aerosol	2.2	A, D-2A, D-2B		any if container larger then 100 L		containers may rupture if exposed to high temperatures.	Safety Glasses, Gloves	Allow container to completely discharge Wipe up spill with rages and incinerate waste.
Magnesium Nitrate Matrix Modifier		Spex CertiPrep	Liquid	8	D-2A, E	3, 0, 0	5 L		Dilute Nitric Acid <5%	Safety Glasses, Gloves	Neutralize with soda ash or lime. Contain spill, **do not** allow un-neutralized acid to enter water systems. Neutralized spill can be pumped to the pit or tailings system.
MAXGOLD™ 900 Promoter	Proprietary Blend	Cytec Canada	Liquid	3	B-3, D-2A	3, 2, 0	200 L		slightly yellow liquid that has a slight sulphur smell. In confined space use respirator with organic vapour cartridges	Goggles, gloves. Respirator or SCBA if in confined space	eliminate ignition sources, use absorbent on small spills, for large spill pump to plastic drum for shipment off site. In case of fire use dry chemical extinguisher, CO_2 or foam. Water likely not effective.
MERCSORB Mercury Amalgamation Powder		NPS Corporation	solid	4		0, 1, 1	25 kg		Dry zinc dust will not ignite spontaneously, but once ignited, it may burn readily in air	Safety Glasses, Gloves	Sweep up spilled material and place in closed container for reuse. In case of fire use appropriate measures for surrounding fire.

Common Name (Synonyms)	Chemical Name	Manufacture / Supplier	Phase	TDG Class	WHMIS Class	NFPA Rating	Reporting Threshold	Use	Special Precautions	PPE Required	Special Cleanup and Disposal Info
Mercury Indicator Powder	Proprietary Blend	NPS Corporation	solid	not regulated		2, 1, 0			Odorless, yellowish-tan to gray powder. Dust may form a flammable or explosive mixture in air. When heated to decomposition, toxic fumes of sulfur oxides are produced	Safety Glasses, Gloves	Sweep up spilled material and place in closed container for reuse. In case of fire use appropriate measures for surrounding fire. This product in itself is considered to be non-hazardous.
Mercury Standard - AA		Anachemia	Liquid	8	D-2A, E	3, 0, 0	5 L		Dilute Nitric Acid <5%	Safety Glasses, Gloves	Neutralize with soda ash or lime. Contain spill, **do not** allow un-neutralized acid to enter water systems. Neutralized spill can be pumped to the pit or tailings system.
Mercury Vapor Suppressor	Proprietary Blend	NPS Corporation	solid	not regulated		2, 1, 0			Odorless, black, irregular, dry granular solid. Wet activated carbon removes oxygen from the air causing a severe hazard to workers in confined space.	Safety Glasses, Gloves	Sweep up spilled material and place in closed container for reuse. Contaminated waste can be incinerated. In case of fire use appropriate measures for surrounding fire. This product in itself is considered to be non-hazardous.
Methanol		Anachemia	Liquid	3, 6.1	B-2, D-1B, D-2A,D-2B	1, 3, 0	200 L		Extremely Flammable, Vapours are harmful and solution is poisonous	Goggles, gloves. Respirator or SCBA if in confined space	Eliminate all sources of ignition. Ventilate area if required. Use absorbent. In case of fire, use dry chemical, CO2, Alcohol-resistant Foam or water spray. Incinerate waste.
MIBK	4-Methyl-2-pentanone	Fisher Scientific	Liquid	3	B-2	2, 3, 0	200 L		clear liquid that has a slightly sweet smell. In confined space use respirator with organic vapour cartridges	Safety Glasses, Gloves	Clear liquid that is immiscible with water. Use absorbent for small spills and incinerate waste. Large spills, eliminate ignitions sources and pump to plastic drum for shipment off site.
Molybdenum Standard - AA		Anachemia	Liquid	not regulated	not regulated	0, 0, 0				Safety Glasses, Gloves	Contain spill. Incinerate waste or place in landfill
Mucasol universal detergent		Sigma-Aldrich Canada	Liquid	not regulated	D-2B	2, 0, 0				Safety Glasses, Gloves	
Nickel Standard - AA		Anachemia	Liquid	8	D-2A, E	1, 0, 0	5 L		Dilute Nitric Acid <5%	Safety Glasses, Gloves	Neutralize with soda ash or lime. Contain spill, **do not** allow un-neutralized acid to enter water systems. Neutralized spill can be pumped to the pit or tailings system.
Nitric Acid		Anachemia	Liquid	8	C, D-1A, E	4, 0, 0, OX	5 L		Concentrated acid, Extremely corrosive. Ventilate or stay upwind. **Strong Oxidizer**	Goggles, gloves. Respirator or SCBA if in confined space	Neutralize with soda ash or lime. Contain spill, **do not** allow un-neutralized acid to enter water systems. Neutralized spill can be pumped to the pit or tailings system.
Nitric Acid 40%		Quadra Chemicals	Liquid	8	C, D-1A, E	4, 0, 0, OX	5 L		Concentrated acid, Extremely corrosive. Ventilate or stay upwind. **Strong Oxidizer**	Goggles, gloves. Respirator or SCBA if in confined space	Neutralize with soda ash or lime. Contain spill, **do not** allow un-neutralized acid to enter water systems. Neutralized spill can be pumped to the pit or tailings system.
Oxygen		BOC Canada Limited (Linde)	Pressurized gas	2.2	A, C	0, 3, 0, OX	any if container larger then 100 L		Strong Oxidizer will Contribute to combustion of other materials.	Safety Glasses, Gloves	close valve if possible without risk, or allow the vent. In case of fire use any media suitable for surrounding fire. Use water spray to cool fire exposed containers.
Oxygen Refrigerant		Air Liquide Canada	Liquefied Gas	2.2	A, C	0, 3, 0, OX	any if container larger then 100 L		Strong Oxidizer will Contribute to combustion of other materials. Liquefied gas, will produce extreme cold when released.	Safety Glasses, Gloves	close valve if possible without risk, or allow the vent. In case of fire use any media suitable for surrounding fire. Use water spray to cool fire exposed containers.
Palladium Nitrate Matrix Modifier		Spex CertiPrep	Liquid	8	D-2A, E	3, 0, 0	5 L		Dilute Nitric Acid <5%	Safety Glasses, Gloves	Neutralize with soda ash or lime. Contain spill, **do not** allow un-neutralized acid to enter water systems. Neutralized spill can be pumped to the pit or tailings system.
Phosphoric acid		Sigma-Aldrich Canada	Liquid	8	D-1A, D-2B, E		5 L		Concentrated acid, Extremely corrosive. Ventilate or stay upwind.	Goggles, gloves. Respirator	Neutralize with soda ash or lime. Contain spill, **do not** allow un-neutralized acid to enter water systems. Neutralized spill can be pumped to the pit or tailings system.
Polyclear 2528	Polyclear Floc	QUADRA CHEMICALS	solid	not regulated	not regulated				concentrated solution is extremely slippery, use caution	Safety Glasses, Gloves	Sweep up spilled material and it my be deposed of in dilute form to the pit or tailings system. In case of fire use appropriate measures for surrounding fire.
Potassium hydroxide	KOH	Science lab	Solid	8	D-1B	3, 0, 1	5 kg		very corrosive solid	Safety Glasses, Gloves	Use appropriate tools to put the spilled solid in a convenient waste disposal container. If necessary: Neutralize the residue with a dilute solution of acetic acid.
Potassium Iodide		Anachemia	solid	not regulated	D-2A	1, 1, 1			light and water exposure will cause breakdown	Safety Glasses, Gloves	Eliminate all sources of ignition. In case of fire use measures dictated by surrounding fire. Will decompose at high temperatures and emit toxic I_2 fumes. Use appropriate SCBA.
Potassium permanganate		CAIROX	Solid	5.1	C, E	1, 0, 0, OX	50 kg		corrosive solid. Oxidizing solid	Safety Glasses, Gloves	Sweep up solid spill for possible reuse. If necessary reduce material in aqueous solution with sodium thiosulfate (hypo), In case of fire use flooding quantities of water, material will contribute to combustion.
Propane		Superior Propane	Liquefied Gas	2.1	A, B-1		any if container larger then 100 L		Extremely flammable. Liquefied gas, will produce extreme cold when released.	Goggles, gloves. SCBA if in confined space	close valve if possible without risk, or allow the vent. In case of fire use any media suitable for surrounding fire. Use water spray to cool fire exposed containers.
Selenium Standard - AA		Anachemia	Liquid	8	E	1, 0, 0	5 L		Dilute Nitric Acid <5%	Safety Glasses, Gloves	Neutralize with soda ash or lime. Contain spill, **do not** allow un-neutralized acid to enter water systems. Neutralized spill can be pumped to the pit or tailings system.

Common Name (Synonyms)	Chemical Name	Manufacture / Supplier	Phase	TDG Class	WHMIS Class	NFPA Rating	Reporting Threshold	Use	Special Precautions	PPE Required	Special Cleanup and Disposal Info
Sodium Borohydride		Anachemia	solid	4.3	B-6, B-4, D-1B, E	3, 1, 2	25 kg		Flammable solid. Reacts violently with water and acids to produce flammable H_2 gas. Strong reducing agent.	Safety Glasses, Gloves	Eliminate ignition sources, sweep up dry material. In case of fire use only dry chemical extinguisher, DO NOT USE WATER OR CO_2
Sodium Hydroxide Solutions (various strengths)	NaOH (The Anachemia MSDS is current, treat all solutions in the same manner regardless of strength.)	Various Suppliers	Liquid	8	E	3, 0, 1	5 L		Caustic solution. Avoid mixing with strong acids. Contact with metals such as aluminum, tin, lead and zinc generates hydrogen gas.	Safety Glasses, Gloves	Neutralize the residue with a dilute solution of acetic acid. Neutralized solution can be disposed of in the pit or tailings system.
Sodium Nitrite		Anachemia	solid	5.1, 6.1	C, D-1B, D-2A	3, 0, 2, OX	50 kg		**Strong Oxidizer** will Contribute to combustion of other materials.	Safety Glasses, Gloves	Eliminate all sources of ignition. In case of fire, use flooding quantities of water. Will decompose at high temperatures and emit acrid smoke. Strong oxidizer, may form compound that are sensitive to shock, friction. Sweep up solid spill for disposal. Dispose of contaminated solution in the pit or tailings system.
sodium sulphide Flakes	Sodium sulphide Hydrated	Quadra Chemicals	solid	8	D-1B, E		5 kg		caustic, very corrosive solid	Goggles, gloves. And a respirator, avoid creating dust and avoid any acids. Contact with acids liberate toxic H_2S	Sweep up spilled material an place in plastic sealed container for shipment off site.
TMT 15%		Quadra Chemicals	Liquid	not regulated	D-2B				water soluble	Safety Glasses, Gloves	No special clean up procedures,
Urea		Anachemia	solid	not regulated	not regulated	1, 0, 0			Avoid contact with strong oxidizers. In fire conditions it can produce oxides of nitrogen. Also ammonia, and HCN	Safety Glasses, Gloves	Sweep up spilled material and it my be deposed of in dilute form to the pit or tailings system. In case of fire use appropriate measures for surrounding fire.
VARSOL 3139 SOLVENT	Petroleum Hydrocarbons	Imperial Oil Chemicals	Liquid	3	B-3, D-2B	1, 2, 0	200 L		Flammable solvent	Safety Glasses, Gloves	Clean up uncontaminated material for reuse. Incinerate waste.
VoltEsso 35		Imperial Oil Chemicals	Liquid	not regulated	not regulated	1, 1, 0			electrical insulating oil	Safety Glasses, Gloves	Clean up uncontaminated material for reuse. Incinerate waste.
Zinc Standard - AA		Anachemia	Liquid	8	E	1, 0, 0	5 L		Dilute Nitric Acid <5%	Safety Glasses, Gloves	Neutralize with soda ash or lime. Contain spill, **do not** allow un-neutralized acid to enter water systems. Neutralized spill can be pumped to the pit or tailings system.

Appendix C: ERT Response to HazMat Spills

ERT Response to Hazmat Spill

Spill Contact: Yukon Territory Spill Line 1-867-667-7244

Canutec: 1-613-996-6666 Cell: *666

1. **Site Management and control**

   Initial responders will :

   - Approach the scene from uphill and upwind.
   - Establish command uphill and upwind of spill at an appropriate distance.
   - Establish 2 isolation perimeters: one that separates the hot zone from the warm zone and another that separates the warm zone from the cold zone. Emergency Response Guide or Canutec shall be referenced for perimeter size.
   - Evacuate affected area or 'protect in place', as req'd. Emergency Response Guide or Canutec shall be referenced for evacuation zone.
   - Identify contaminated persons and ensure they remain isolated until they can be decontaminated.
   - Establish a staging area.
   - Designate an information officer.
   - Possible unification of command.

2. **Identification of the problem**

   I/C will identify the:

   - Spilled product, as per witness testimony, placards, labels, bill of lading, type of container, etc. If product cannot be identified from command position, then a recon team will be tasked with identification.
   - Size of container.
   - Size and nature of release.
   - Conditions and # of victims at accident site.
   - Topography of area, and exposures threatened.

3. **Hazard & Risk Evaluation**

   A risk evaluation will be conducted, taking into consideration:

   - Product hazards
   - Access & Egress

- Size of Spill
- Condition of container
- Proximity of exposures
- Personnel available to perform operations, and their level of training/experience
- Information from MSDS, ERG, Canutec, etc., minimum 3 sources

4. Personal Protective Equipment

PPE will be selected for Ops, RIT, and Decon teams, considering:

- Flammability/explosiveness of product
- Toxicity of product
- Route of entry of product
- Permeation rate of PPE
- Breakthrough time of PPE
- Availability of PPE
- Visibility and workability while wearing PPE

5. Information management and resource coordination

The information officer will begin to gather information about the product once it has been identified. The information officer can use the MSDS, ERG, Canutec, or many other resources to gather information, such as:

- Properties of the product
- Hazards of the product
- Expected travel of product released
- Populations/ environment in jeopardy
- PPE req'd by responders
- Decontamination requirements

Command will prioritize the information and ensure that the correct people receive the correct information.

6. Implementing Response Objectives

Command will develop an overall strategy, which may be offensive (entry of hot zone to gain quick control), defensive (contain from the cold zone to prevent spread), or passive (isolate only, and wait for incident to run its course), considering:

- Life safety
- Incident stabilization
- Environmental protection
- Property salvage

Command will delegate tactics to operations teams, such as:

- Reconnaissance for unknown product
- Evacuation for toxic gas leak, fire, or explosive hazard
- Fire control for flammable gas, flammable liquid, or oxidizer
- Search and rescue
- Leak control
- Neutralization of corrosives
- Deployment of boom, drain covers, etc.
- Building of dams, dykes, etc.

To follow: specific tactic options will be discussed in more detail, pertaining to hazardous materials that are commonly found in large quantities at the Minto Mine.

Entry teams will enter with a clear objective, but must assess for the next team's objective. For example, the 1st entry team may be tasked with rescuing the driver of a fuel truck that rolled down a bank and is spilling fuel. Although their objective is to rescue, while they are on scene they should observe where the leak is, consider what could be used to stop it, where the fuel is going, and what is needed to contain it. They should bring a camera, so that pictures can be brought back to command. This will give command crucial information and better prepare the next team for their task.

7. Decontamination

Considerations for decontamination should begin at the outset of the incident. A decontamination construct will exist in the warm zone prior to any team entering the hot zone. It will typically consist of a large berm fashioned out of a large chemical resistant tarp, wrapped over a charged 2 ½" hose-line. There will be a charged 1 ½" hose-line nearby for emergency decontamination. Within the berm, there will be a series of smaller berms, in which, personnel will stand while being decontaminated. Personnel conducting the decontamination will be wearing the appropriate PPE (typically 1 class below ops) and will use detergent and water to gently scrub and rinse ops personnel and rescuees as they exit the hot zone. Tools and anything else exiting the hot zone will be decontaminated as well.

Once decontamination is complete, all product collected by the berms, will be handled as per the MSDS.

8. Termination

Once emergency operations are complete, the scene will be handed over to clean-up & recovery operations. Command will ensure that the hand-off includes all pertinent information about the spilled product:

- Properties
- Hazards
- Location
- Safe-handling
- Exposure signs and symptoms
- Req'd PPE
- Disposal procedures

Command will conduct an on-site debrief. As well, a more formal debrief will be conducted, with all parties involved, at a later time. The incident will be documented, including exposure records for all personnel that entered the warm and/or hot zones.

Nitric Acid 40%

Note: when it comes to corrosives such as Nitric Acid, the solution to pollution is NOT dilution. For a spill of 1 45 gal drum, it would take over 450,000 gal of pure water to make the solution habitable for fish. It would take over 45,000,000 gal of pure water to neutralize it.

Site management and control

- Set up perimeter with at least 50m radius.
- Command, staging, & decon shall be positioned uphill.
- Unify command with Safety Superintendent, Mine Manager, Environmental Dept., product Carrier (if spill occurs during delivery to mine).

Identification

- UN# 2031
- Liquid state
- Colourless to yellow
- Transported in 45 gallon drums
- # of 45 gal drums possibly damaged will help estimate size of spill.
- What is downhill from spill? Could acid reach a stream?

Hazard & risk evaluation

- Strong acid, very corrosive.
- Severely hazardous to eyes and skin
- Ingestion could cause death
- Inhalation hazard, although low vapour pressure 1.3kPa (wants to be a liquid).
- Could be devastating to stream life.
- Strong oxidizer, could have explosive reaction with organic or combustible materials

PPE

- If there is a fire situation, PPE will consist of full turn-out gear and SCBA.
  Otherwise
- Know and heed permeability rate and breakthrough times of all PPE.
- Acid resistant, class B suit with hood.
- Full-face respirator with appropriate chemical cartridges.
- Chemical resistant gloves & boots
- Chemical resistant tape used to seal between boots/suit, gloves/suit, and mask/hood.

Information management and resource coordination

- See MSDS for product information.
- Know the product's route of travel.
- Was anyone exposed?
- Will non-human life be exposed?
- Standard decon set-up will be constructed.
- Have tools cribbed for entry teams.
- Ensure there is enough PPE at the site to complete the task.
- Ensure there is enough neutralizing agent at the site to complete the task. ***See below for chart***
- Ensure there is drinking water for responders.
- Have hazmat trailer, ambulance & fire truck in staging area, as req'd
- Have Site Services staged for digging, damming, product extraction, as req'd.

Implementing Response Objectives

- Rescue injured/exposed personnel.
- Prevent from entering streams
- Prevent from contacting combustibles and organics.
- If possible, stop the leak.
- If possible, contain by covering drains/culverts, damming, diverting to a berm, etc.
- Use over-pack to contain leaking drums that still contain product.
- Neutralize spilled product with weak caustic – primary neutralizing agent is Ansul Spill X-A, alternatively hydrated lime or baking soda (if available). Be cautious of chemical reaction.
- Use Litmus paper to test for pH when neutralizing with lime or baking soda.
- Site Services Vac-truck is an option for cleaning up product before or after neutralized, as necessary.

Decontamination

Standard decon set-up will be utilized in warm zone:

- Large berm fashioned out of large chemical resistant tarp, wrapped over charged 2 ½" hose-line, 2 small berms, will be in series, within the large berm.
- Decon personnel shall don class C suits without need for respiratory or splash protection, other than safety glasses.
- Ensure all personnel that entered hot zone are properly decontaminated.
- Ensure that all tools that entered the hot zone are properly decontaminated.

Termination

- Once operation complete, vac-truck can be utilized to clean up solution contained with the decon berms.
- Safe and proper disposal of all spent PPE.

- Transition of command.
- Debrief

Quick Access Chart for Estimating Amount of Caustic Req'd to Neutralize 40% Nitric Acid

For **Spill X-A**, use 1:1 ratio by volume, or 10lbs Spill X-A per 1 gal Nitric Acid.

Amount of Nitric Acid Spilled (in Gal.)	Amount of Baking Soda Req'd (in Lbs.)
1	5.6
2	11
5	28
10	56
20	110
45	252
90	504
135	756
180	1,008

Amount of Nitric Acid Spilled (in Gal.)	Amount of Lime Req'd (in Lbs.)
1	2.4
2	4.8
5	12
10	24
20	48
45	108
90	216
135	324
180	432

Charts derived from formulas below

Specific Gravity Nitric Acid: 1.2455

Concentration: 40%

1 gal HNO_3 x 1.24 x 8.34 lbs/gal x 0.40 = 4.14 lbs HNO_3

$HNO_3 + NaHCO_3 \rightarrow NaNO_3 + H_2O + CO_2$ Therefore 1 mol Nitric Acid per 1 mol Sodium Bicarb (Baking Soda)

$2HNO_3 + Ca(OH)_2 \rightarrow Ca(NO_3)_2 + 2H_2O$ Therefore 2 mol Nitric Acid per 1 mol Calcium Hydroxide (Lime)

HNO_3 = 63 amu

$NaHCO_3$ = 85 amu

$Ca(NO_3)_2$ = 74 amu

(4.14 lbs HNO_3/63 amu-HNO_3) x 85 amu-$NaHCO_3$ = 5.6 lbs $NaHCO_3$

Therefore 1 gallon of Nitric Acid req's 5.6 lbs of baking soda

(4.14 lbs HNO_3/2(63) amu-HNO_3) x 74 amu-$Ca(OH)_2$ = 2.4lbs $Ca(NO_3)_2$

Neutralization Formulas and Quick Access Charts **Formulas**

The key to effective and efficient neutralization, is knowing how to use the following formulas.

1. The first formula indicates how much acid is spilled in weight.

Step #1- Determine the quantity of acid spilled, usually in gallons.
Step #2- Determine the specific gravity of the acid usually provided in MSDS.
Step #3- Determine the concentration of the acid spilled usually in %.
Step #4- The weight of water is 8.34 pounds per gallon.

After the above figures are known plug them into the following formula.

Quantity of spill X specific gravity X weight of water X concentration = weight of the spill

Example
One gallon of sulfuric X 1.84 X 8.34 X 98% = 15.04 pounds of sulfuric

2. The second formula will determine the quantity of the neutralizer needed. The type of neutralizer needs to be selected based on costs and availability. Plug numbers into the following formula.
3.

Weight of the acid spilled X number in the chart for the selected neutralizer.

Example

15.04 pounds of sulfuric X 1.06 for Soda Ash = 15.94 pounds of Soda Ash

Determination through Chemistry

To calculate the amount of neutralization agent needed the balanced chemical reaction must be written and the equivalent weights of acid and base determined.

Example: 1,000 gallons of 38% hydrochloric acid will be neutralized with lime.

Step #1 – Write the complete balanced neutralization reaction:
$2HCl + CaO \rightarrow CaCl_2 + H_2O$
This equation shows that 2 moles of HCl are required in the reaction with one mole of calcium oxide (lime).

Step #2 – Calculate the molecular weight of each compound:
HCl – H = 1, Cl = 35.5, Total = 36.5 amu
CaO – Ca = 40, O = 16, Total = 56

Step #3 – Calculate the weight of the HCl spill:
1,000 gallons X 1.20 X 8.34 X 0.38 = 3,803.04 pounds of HCl
Step #4 – Calculate the amount of neutralizer needed:
From Step #1 it was found that 2 moles of HCl are needed to react with 1 mole of CaO. From Step #2 it was found that 1 mole of HCl weighs 36.5 amu's so 2 moles weigh 73.0 amu's. The formula is**;** **weight of acid/formula weight of acid X formula weight of base = pounds of the neutralizer needed.**
3,803.04/73 X 56 = 2,917.4 pounds of lime

Finer Points
The final amount is an approximation and in actual practice more neutralizing agent should be obtained. The neutralization process needs to be checked at several spots to assure pH levels are acceptable and uniform.

Neutralization Precautions
Remember, the neutralization process is exothermic and it may involve splashing of product. Safety is paramount and proper protective equipment is very important. Also, the neutralizer is hazardous in its own right and needs to be handled with care. Consider expense and availability in selecting neutralizer. Other weak bases that may be used and their molecular weights are; sodium bicarbonate ($NaHCO_3$)- 85, and magnesium hydroxide ($Mg(OH)_2$)-58.

Neutralization Chart Information
Acids

Hydrochloric Acid, HCl, MW = 36.5, density/specific gravity is 1.19, weight of a gallon is 3.77 pounds at 38% concentration. Synonyms are chlorohydric acid and muriatic acid.

Nitric Acid, HNO_3, MW = 63, density/specific gravity is 1.41, weight of a gallon is 8.23 pounds at 70% concentration. Synonyms are Aqua Fortis and Azotic Acid. (Aqua Regia is a mixture of nitric and hydrochloric acids).

Phosphoric Acid, H_3PO_4, MW = 98, density/specific gravity is 1.69, weight of a gallon is 11.98 pounds at 85% concentration. Synonyms are orthophosphoric acid.

Sulfuric Acid, H_2SO_4, MW = 98, density/specific gravity is 1.84, weight of a gallon is 15.04 pounds at 98% concentration. Synonyms are Oil of vitriol and "oleum" is fuming sulfuric acid.

Bases

Ammonium hydroxide, NH_4OH, MW = 35, clear solution, synonyms are ammonia solution and aqua ammonia. Strong ammonia odor evolves from liquid. High vapor pressure.
Calcium carbonate, $CaCO_3$, MW = 100, white powder, synonyms are crushed limestone and dolomite. Low heat of reaction that gives off carbon dioxide gas.
Calcium hydroxide, $Ca(OH)_2$, MW = 74, white powder, synonyms are slaked lime, hydrated lime, and calcium hydrate.
Calcium oxide, CaO, MW = 56, white powder, synonyms are quicklime, lime, and unslaked lime. Most economical, lowest cost, neutralizer. **Best choice!** Maximum pH is 12.45 at 25C.
Magnesium carbonate, $MgCO_3$, MW = 84, synonyms are magnesia alba and carbonate magnesium.
Magnesium hydroxide, $Mg(OH)_2$, MW = 58, white powder, synonyms are milk of magnesia and magnesia hydrate. Good neutralization agent. Maximum pH is 10.6 at 25C.
Potassium hydroxide, KOH, MW = 56, white flakes, synonyms are caustic potash. High heat of reaction with toxic fumes. Maximum pH is 14 at 25C.
Sodium bicarbonate, $NaHCO_3$, MW = 85, white powder, synonyms are baking soda and sodium acid carbonate. Low heat of reaction with carbon dioxide gas evolution.
Sodium Carbonate, Na_2CO_3, MW = 106, white powder, synonyms are soda ash. **Second most economical neutralization agent next to lime.** Maximum pH is approximately 11 at 25C.
Sodium hydroxide, NaOH, MW = 40, white powder, synonyms are caustic soda, soda lye, caustic, and lye. High heat of reaction with toxic fumes. Maximum pH is 14 at 25C.

Quick Access Charts

Sulfuric Acid neutralization using Baking Soda (Sodium Bicarbonate)

Amount of Sulfuric Acid spilled	Amount of Baking Soda needed in pounds
1 gallon	25.6
2 gallons	51.2
3 gallons	76.8
4 gallons	102.4
5 gallons	128.0
10 gallons	256.0
50 gallons	1280.0
55 gallons	1408.0
100 gallons	2560.0

Hydrochloric Acid neutralization using Baking Soda

Amount of Hydrochloric Acid spilled	Amount of Baking Soda needed in pounds
1 gallon	5.5
2 gallons	11.0
3 gallons	16.5
4 gallons	22.0
5 gallons	27.5
10 gallons	55.0

50 gallons	275.0
55 gallons	302.5
100 gallons	550.0

Nitric Acid neutralization using Baking Soda

Amount of Nitric Acid spilled	Amount of Baking Soda needed in pounds
1 gallon	7.4
2 gallons	14.8
3 gallons	22.2
4 gallons	29.6
5 gallons	37.0
10 gallons	74.0
50 gallons	370.0
55 gallons	407.0
100 gallons	740.0

Sodium Sulfide

Site management and control

- Set up perimeter with at least 50m radius if water introduced, or 25m if solid.
- Command, staging, & decon shall be position upwind and uphill.
- Unify command with Safety Superintendent, Mine Manager, Environmental Dept., product carrier (if spill occurs during delivery to mine).

Identification

- UN# 1849
- Solid state
- Yellow
- Smell sulfurous or like rotten eggs with introduction of moisture.
- Transported in 1000 Kg 'Super-Sacks'.
- # of super-sacks possibly damaged, will help estimate size of spill.
- Is water being introduced to the spill? If so, what is downhill form the spill? Could run-off reach a stream?
- Are corrosives being introduced to spill? If so, what is downwind?

Hazard & risk evaluation

- Strong caustic.

- Severely corrosive to digestive tract, respiratory system, eyes, and skin.
- Dust is powerful systemic poison. Inhalation could cause headache, dizziness, unconsciousness, pulmonary edema, asphyxiation, death.
- Contact with acid releases toxic and flammable Hydrogen Sulfide.
- Routes of entry include absorption, inhalation, and ingestion.
- Keep spilled product dry
- If water introduced, avoid run-off, contact with soil, waterways.

PPE

- If there is a fire situation, PPE will consist of full turn-out gear and SCBA.
  Otherwise
- Know and heed permeability rate and breakthrough times of all PPE.
- SCBA if significant H2S release, otherwise, full-face respirator & OV cartridges with pre-filter.
- Corrosive resistant, class B suit with hood.
- Chemical resistant gloves & boots
- Chemical resistant tape used to seal between boots/suit, gloves/suit, and mask/suit.

Information management and resource coordination

- See MSDS for product information.
- Was anyone exposed?
- Will non-human life be exposed?
- Standard decon set-up will be constructed.
- Have tools cribbed for entry team.
- Ensure there is enough PPE at the site to complete the task.
- Ensure there is drinking water for responders.
- Have hazmat trailer, ambulance & fire truck in staging area, as req'd
- Have Site Services staged for digging, damming, product extraction, as req'd.

Implementing Response Objectives

- Rescue injured/exposed personnel.
- Keep product dry.
- Monitor atmosphere for H2S and SO2.
- If water introduced, contain run-off by covering drains/culverts, damming, diverting to a berm, etc. Solution collected can be mixed with oxidizing agent, such as hydrogen peroxide or sodium hypochlorite to prevent evolution of H2S.
- If product has entered a stream, consider using over-flow dams to contain product, for extraction.
- Vacuum or sweep up dry product
- Disposal as per Environmental Dept. recommendations

Decontamination

Standard decon set-up will be utilized in warm zone:

- Large berm fashioned out of large chemical resistant tarp, wrapped over charged 2 ½” hose-line, 2 small berms, will be in series, within the large berm.
- Decon personnel shall don class C suits without need for respiratory or splash protection, other than safety glasses.
- Ensure all personnel that entered hot zone are properly decontaminated.
- Ensure that all tools that entered the hot zone are properly decontaminated.

Termination

- Once operation complete, solution in decon berms to be disposed of, as per Environmental recommendations.
- Safe and proper disposal of all spent PPE.
- Transition of command.
- Debrief

LPG (Propane)

Note: Minto gas detectors are calibrated to methane, and must be corrected to propane prior to use, during propane leak mitigation.

Site management and control

- Set up initial perimeter of at least 100m. For large tank where there is fire, set up perimeter of at least 1600m.
- Command, staging, & decon shall be positioned uphill and upwind.
- Eliminate sources of ignition.
- Unify command with Safety Superintendent, Mine Manager, Environmental Dept., product carrier (if spill occurs during delivery to mine).

Identification

- UN# 1075
- Colourless liquid and vapour while stored under pressure.
- Colourless and odourless gas in natural state at any concentration.
- Commercial propane has an odorant added which is commonly ethyl.
- Transported by tanker truck.
- Stored in 12,000L tank at ramp to camp and twin 18,000L tanks at Km 0 of the access road.

- What is downhill from spill?
- Is there threat to life?
- Is there threat to a stream?

Hazard & risk evaluation

- Extremely flammable gas.
- Vapour could be ignited by any source of ignition.
- Vapour is heavier than air and may travel considerable distance to an ignition source, and flash back.
- Stored under pressure, as a liquid.
- Product extraction methods could create static if not bonded/grounded, and serve as an ignition source.
- Massive explosion hazard where flame impingement on tank.

PPE

- Full turn-out gear with SCBA.

` **Information management and resource coordination**

- See MSDS for product information.
- Consider contacting Canutec.
- Know the product's route of travel.
- Ensure tools are cribbed for entry teams.
-
- Have fire truck at scene and ambulance in staging area, as req'd

Implementing Response Objectives Leak in an enclosed space

- Evacuate structure.
- Close supply valve remotely if possible.
- Eliminate any source of ignition.
- Use positive pressure to ventilate space, ensure that it is exhausting to safe location.

If no remote isolation valve:

- Entry team (2 ERT members) & RIT team (2 ERT members) will don full turn-out gear & SCBA.
- Any electronic equipment being carried, such as radio or gas detector, must be intrinsically safe.
- Entry team will enter with charged 1 ½" hose-line and gas detector equipped with LEL sensor, while RIT stages in the cold zone .

- Once entry team is at ‘reach of stream’ distance from the leak, the nozzleman (Entry member 1) will set-up, with nozzle fixed on Entry member 2. Entry member 2 will continue toward valve, with gas detector.

  If LEL sensor rises above 20%, entry team will retreat until ventilation can be made adequate.

- Once Entry member 2 reaches the valve, he will close the valve, then back away until he reaches entry member 1.
- Entry team will exit the structure, until it has been adequately ventilated.
- Once adequately ventilated, ERT members, wearing appropriate PPE, will sweep the structure with gas detector(s), to ensure there are no pockets of gas, before deeming the structure ‘safe to enter’.

LPG line on fire, with no impingement

Note: a propane leak that is burning is safer than one that is not burning, as long as there is no impingement on a tank or structure. Therefore, in this scenario, gas will be allowed to burn until the valve can be shut off.

- Evacuate immediate area.
- If possible, close isolation valve from remote location.

  If no remote isolation valve:

- Eliminate any further source of ignition.
- 2 or more ERT members in full turn-out gear & SCBA will be on 1 ½” hose-line.
- Nozzle will be turned to full fog, which will create a water-curtain between the fire and the fire fighters.
- The fire team will approach the isolation valve, keeping the water-curtain between themselves and the fire at all times, being careful not to put the fire out with the stream
- When the valve is reached by the team, the 2nd member on the line will let go of the hose and approach the valve, while the nozzleman maintains the water-curtain between the fire and the valve/fire team.
- The 2nd member will close the valve then back away from the fire until he regains his position on the hose.
- The team will maintain the water-curtain while they back away from the damaged gas-line.
- Once the team is at a safe distance, a 45 degree pattern can be fixed on the broken gas-line to cool it, and disperse any residual gases.

LPG leak, not enclosed, not on fire

Note: LPG has a very high vapour pressure (1013 kPa) so it wants to be a gas, a high vapour density (1.52) so it's heavier than air, and a low flash point (-103.4 C). This combination means that it can form an explosive gas cloud that will stay close to the ground, may linger in incident area, or migrate downwind and/or downhill, possibly settling in low lying areas.

- Evacuate immediate area as well as areas downwind/downhill as per ERG recommendations.
- If possible, close isolation valve from remote location.
- From 'reach of stream', set up ground monitor and fix a 45 degree fog pattern on area of concern. This will push gas cloud away from area and disperse it. Be sure to push it to a safe location.

If no remote isolation valve:

- Entry team (2 ERT members) & RIT team (2 ERT members) will don full turn-out gear & SCBA.
- Any electronic equipment being carried, such as radio or gas detector, must be intrinsically safe.
- Entry team will enter with charged 1 ½" hose-line and gas detector equipped with LEL sensor, while RIT stages in the cold zone.
- While ground monitor continues to 'make it rain' in the hot zone, nozzleman (entry member 1) will fix nozzle on entry member 2, as entry member 2 approaches the isolation valve, with gas detector.

If LEL sensor rises above 20%, entry team will retreat until water stream can be made more effective

- Once Entry member 2 reaches the valve, he will close the valve, then back away until he reaches entry member 1.
- Entry team will retreat to the cold zone until gases are adequately dispersed
- Once the gas is adequately dispersed, ERT members, wearing appropriate PPE, will sweep the area with gas detector(s), including low-lying areas where gas may have migrated to, before deeming the area 'safe to enter'.

Fire where there is flame impingement on LPG tank

- Evacuate all non-ERT members for at least 1,800 m where there is flame impingement on either the 12,000 L tank or the tandem 18,000 L tanks.
- Command will know and understand the signs of imminent BLEVE.
- If Command witnesses signs of imminent BLEVE from an upright tank, there shall be no attempt made to cool tanks, rather, all focus shall be on a rapid evacuation of all personnel, at least 1,800m.
- If tank has been knocked over, there may be little or no warning signs of BLEVE, therefore no attempt shall be made to cool, rather, all focus shall be on a rapid evacuation of all personnel, at least 1,800m.
- If a BLEVE is not imminent, an attempt will be made to connect a ground monitor to the stand-pipe at the Tailings bldg.
- A narrow fog stream will be fixed on the tank at the area of flame impingement.
- The monitor will be left unmanned and the remaining ERT will evacuate at least 1,800m.

Where a tanker truck carrying propane has over-turned on the access road, causing damage to the tank trailer and subsequent rapid release of propane, the strategy for the hazmat portion of the incident response, will be passive and conducted from an upwind/uphill location, at a safe distance, as per the ERG. Transfer of residual product for the scenario, will be conducted by outside resource.

Decontamination

- 1 ½" charged hose-line, as emergency decon

Termination

- Debrief

BW GasAlert Micro 5 is intrinsically safe, as per: *http://directories.csa-international.org/xml_transform.asp?xml=certxml%5C080259_0_000-4828-82.xml&xsl=xsl/certrec.xsl*

- GasAlert Micro 5 Portable Gas Detector, Model M5-xwt1t2-r-p-d-a-b-cc & M5PID-xwt1t2-r-p-d-a-b-cc; utilizing electrochemical, catalytic bead and photo-ionization sensors; Intrinsically Safe when powered by one of the following AA Size Batteries /

Battery Pack
- Duracell MN1500; T-Code T4; Ambient -20 to +40°C; T-Code 139.8°C (T3C); Ambient -20 to +50°C
- Energizer E91; T-Code 153°C(T3C); Ambient -20 to +40°C; T-Code 163°C (T3B); Ambient -20 to +50°C
- NiMH Rechargeable Battery Pack "M5-BAT01"; T-code T4; Ambient -20 to +50°C
- Lithium Polymer Rechargeable Battery pack “M5-BAT07B”; T-Code T4; Ambient -20 to +50°C

Diesel, Kerosene, CFE 150

Note: LEL sensor will not detect presence of long-chain hydrocarbon vapour. Photo-ionization detector (PID) should be used, if available.

Site management and control

- Set up perimeter with at least 50m radius.
- Command, staging, & decon shall be positioned uphill and upwind.
- Eliminate sources of ignition.
- Unify command with Safety Superintendent, Mine Manager, Environmental Dept, Dyno Nobel (if spilled product is CFE 150), product carrier (if spill occurs during delivery to mine).

Identification

- UN# 1202.
- Liquid state.
- Colour varies.
- Petroleum odour.
- Transported by B-train, tidy-tanks.
- Stored in tanks at fuel farm.
- What is downhill from spill??
- Is there threat to life?
- Is there threat to a stream?

Hazard & risk evaluation

- Combustible liquid.
- Vapour could be ignited by any source of ignition.
- Extraction methods could create static if not bonded/grounded, and serve as an ignition source.
- Ambient temperature relevant.

- Irritant to eyes and skin
- Ingestion and inhalation hazard
- Toxic to aquatic life.

PPE

- If there is a fire situation, PPE will consist of full turn-out gear with SCBA.
  Otherwise
- For offensive strategies, such as rescue or plugging, full turn-out gear with SCBA
- For defensive strategies, such as diverting, damming, booming, diking, class B suit.
- Respirator with OV cartridges.
- Oil resistant gloves & boots

Information management and resource coordination

- See MSDS for product information.
- Know the product's route of travel.
- Standard decon set-up will be constructed.
- Ensure tools are cribbed for entry teams.
- Ensure there is enough PPE at the site to complete the task.
- Ensure there is drinking water for responders.
- Have hazmat trailer, ambulance & fire truck in staging area, as req'd.
- Have Site Services staged for digging, damming, product extraction, as req'd.

Implementing Response Objectives

- Rescue injured personnel.
- Consider using fog stream to protect rescuers.
- Fire-fighting: Use dry chemical, CO2, Class B foam, or water with fog pattern.
- If using fog, considering increased run-off hazard
- Prevent from entering streams.
- If possible, stop the leak: close valves, use plugs, plug n' dyke, gaskets, straps, jacks, cribbing, etc.
- Containment berm at source, 'Surrey Condom'.
- If possible, contain by covering drains/culverts, diking, diverting to a berm, absorbing, etc.
- If product has entered a stream, use booms, hydrocarbon-only absorbent socks and pads, under-flow dams, diversion-booms, skimmers to contain and extract, as per instructions found later in this document.
- If transfer of product req'd, ensure entire system is bonded/grounded.
- Use non-sparking tools, such as pneumatics.
- Site Services Vac-truck is an option for cleaning up product.

Decontamination

Standard decon set-up will be utilized in warm zone:

- Large berm fashioned out of large chemical resistant tarp, wrapped over charged 2 ½” hose-line, 2 small berms, will be in series, within the large berm.
- Decon personnel shall don class C suits without need for respiratory or splash protection, other than safety glasses.
- Ensure all personnel that entered hot zone are properly decontaminated.
- Ensure that all tools that entered the hot zone are properly decontaminated.

Termination

- Once operation complete, vac-truck can be utilized to clean up solution contained with the decon berms.
- Safe and proper disposal of all spent PPE.
- Transition of command.
- Debrief

Gasoline

Note: Minto gas detectors are calibrated to methane and must be corrected to gasoline, or alternatively pentane, prior to use during gasoline spill mitigation

Site management and control

- Set up perimeter. Consider radius up to 800m depending on amount of product and level of explosion hazard.
- Command, staging, & decon shall be positioned uphill and upwind.
- Eliminate sources of ignition.
- Unify command with Safety Superintendent, Mine Manager, Environmental Dept., product carrier (if spill occurs during delivery to mine).

Identification

- UN# 1203.
- Liquid state.
- Colourless to slightly yellow.
- Recognizable odour.

- Transported by B-train, tidy-tanks.
- Stored in tank at fuel farm.
- What is downhill from spill??
- Is there threat to life?
- Is there threat to a stream?

Hazard & risk evaluation

- Flammable liquid. Extremely flammable in presence of ignition source, at nearly any temperature.
- Vapour could be ignited by any source of ignition.
- Vapour is heavier than air and may travel considerable distance to an ignition source, and flash back.
- Product extraction methods could create static if not bonded/grounded, and serve as an ignition source.
- Explosion hazard where flame impingement on tank.
- Irritant to eyes.
- Ingestion and inhalation hazard
- Toxic to aquatic life.

PPE

- If there is a fire situation, PPE will consist of full turn-out gear with SCBA.
  Otherwise
- For offensive strategies, such as rescue or plugging, full turn-out gear with SCBA
- For defensive strategies, such as diverting, damming, booming, diking, fire resistant class B suit.
- Respirator with OV cartridges, only if LEL's are being monitored, otherwise, do not dampen sense of smell. Rather, move upwind of product vapour.

Information management and resource coordination

- See MSDS for product information.
- Know the product's route of travel.
- Standard decon set-up will be constructed.
- Ensure tools are cribbed for entry teams.
- Ensure there is enough PPE at the site to complete the task.
- Ensure there is drinking water for responders.
- Have hazmat trailer, ambulance & fire truck in staging area, as req'd
- Have Site Services staged for digging, damming, product extraction, as req'd.

Implementing Response Objectives

- Offensive tactics for rescue of injured personnel only.
- Consider blanketing affected area with class B foam, prior to rescuers entering hot zone.

- Use fog stream to suppress vapours and protect rescuers.
- Rescuers will carry intrinsically-safe radios and gas-detector.
- Prevent from entering streams
- If possible, stop the leak.
- If possible, contain by covering drains/culverts, diking, diverting to a berm, absorbing, etc.
- If product can or has has entered a stream, use booms, hydrocarbon-only absorbent socks and pads, under-flow dams, diversion-booms, as per instructions found later in this document.
- Safe handling and disposal of all waste product.

Decontamination

Standard decon set-up will be utilized in warm zone:

- Large berm fashioned out of large chemical resistant tarp, wrapped over charged 2 ½" hose-line, 2 small berms, will be in series, within the large berm.
- Decon personnel shall don class C suits without need for respiratory or splash protection, other than safety glasses.
- Ensure all personnel that entered hot zone are properly decontaminated.
- Ensure that all tools that entered the hot zone are properly decontaminated.

Termination

- Once operation complete, safe disposal of decon berm contents
- Safe and proper disposal of all spent PPE
- Hand-over command of operation to Environmental Dept.
- Debrief

Ammonium Nitrate

Site management and control

- Set up perimeter with at least 25m radius.
- Command, staging, & decon shall be positioned upwind.

- Eliminate sources of ignition.
- Unify command with Safety Superintendent, Mine Manager, Environmental Dept, Dyno Nobel, product carrier (if spill occurs during delivery to mine).

Identification

- UN# 1942.
- Solid state. Prills or granules.
- White.
- Odorless.
- Is there threat to a stream?

Hazard & risk evaluation

- Oxidizer .
- Exposure to high heat may evolve toxic, flammable gases.
- Explosive when confined and exposed to high heat.
- Ingestion and inhalation hazard.
- Toxic to aquatic life.

PPE

- If there is a fire situation, PPE will consist of full turn-out gear with SCBA.
  Otherwise
- Class C suit with long sleeves.
- Dust mask.
- Oil resistant gloves & boots

Information management and resource coordination

- See MSDS for product information.
- Work closely with Dyno.
- Standard decon set-up will be constructed.
- Have tools cribbed for entry teams.
- Ensure there is enough PPE at the site to complete the task.
- Ensure there is drinking water for responders.
- Have hazmat trailer, ambulance & fire truck in staging area, as req'd
- Have Site Services staged for digging, damming, product extraction, as req'd.

Implementing Response Objectives

- Rescue injured personnel.
- Fire-fighting: If flame impingement on tank, use unmanned ground monitor to supply flooding quantities of water via straight-stream, to cool tank. Then, evacuate area 800m in all directions. If signs of imminent explosion are present prior to setting up ground monitor, do not attempt to set it up, just evacuate for 800m in all directions.
- Prevent from entering streams.
- Once in stream, may be unrecoverable. Underflow dams should be constructed, and surface can be skimmed.
- If possible, stop anymore product from being spilled.
- Follow Dyno's recommendations for recovery and clean-up of product.

Decontamination

Standard decon set-up will be utilized in warm zone:

- Large berm fashioned out of large chemical resistant tarp, wrapped over charged 2 ½" hose-line, 2 small berms, will be in series, within the large berm.
- Decon personnel shall don class C suits without need for respiratory or splash protection, other than safety glasses.
- Ensure all personnel that entered hot zone are properly decontaminated.
- Ensure that all tools that entered the hot zone are properly decontaminated.

Termination

- Once operation complete, vac-truck can be utilized to clean up solution contained with the decon berms.
- Safe and proper disposal of all spent PPE.
- Transition of command.
- Debrief.

Emulsion

Site management and control

- Consider initial perimeter of 800m.

- Command, staging, & decon shall be positioned upwind.
- Eliminate sources of ignition.
- Unify command with Safety Superintendent, Mine Manager, Environmental Dept, Dyno Nobel, product carrier (if spill occurs during delivery to mine).

Identification

- UN# 0332.
- Viscous liquid.
- Pink, opaque.
- Slight fuel oil odour.
- Shipped in bulk by tanker truck.

Hazard & risk evaluation

- Emulsion explosives.
- Stable under normal conditions.
- May explode under fire conditions.
- Eye & skin irritant.
- Slight ingestion & inhalation hazard.
- Avoid contact with corrosives.
- Is there threat to a stream?

PPE

- Class C suit with long sleeves.
- Standard PPE

Information management and resource coordination

- See MSDS for product information.
- Work closely with Dyno.
- Standard decon set-up will be constructed.
- Have tools cribbed for entry teams.
- Ensure there is enough PPE at the site to complete the task.
- Ensure there is drinking water for responders.
- Have hazmat trailer, ambulance & fire truck in staging area, as req'd
- Have Site Services staged for digging, damming, product extraction, as req'd.

Implementing Response Objectives

- Rescue injured personnel.
- Fire-fighting: If fire reaches cargo, DO NOT ATTEMPT TO FIGHT FIRE. Cargo may explode. Evacuate in all directions for 1600m.
- Prevent from entering streams.
- If possible, stop anymore product from being spilled.
- Follow Dyno's recommendations for recovery and clean-up of product.

Decontamination

Standard decon set-up will be utilized in warm zone:

- Large berm fashioned out of large chemical resistant tarp, wrapped over charged 2 ½" hose-line, 2 small berms, will be in series, within the large berm.
- Decon personnel shall don class C suits without need for respiratory or splash protection, other than safety glasses.
- Ensure all personnel that entered hot zone are properly decontaminated.
- Ensure that all tools that entered the hot zone are properly decontaminated.

Termination

- Once operation complete, clean out berms under direction of Dyno.
- Safe and proper disposal of all spent PPE.
- Transition of command.
- Debrief.

Appendix D: Tug and Barge Emergency Contingency Plan

MINTO MINE

Tug and Barge Emergency Contingency Plan

VERSION 2013-01

Prepared by:
Capstone Mining Corporation
Minto Mine
January 15, 2013

1.0 Introduction

Minto Mine (Minto) a subsidiary of Capstone Mining Corporation is pleased to submit the following contingency plan (plan) as per requirements of the access and land use permit “Minto Landing Ice Bridge and Marshalling Area and West Side Barge Landing and Marshalling Area” (the permit). It is Minto’s intention that this plan will fulfill the requirement as stated in Schedule 2, Section 9.0 Contingency Plan of the permit. It is not Minto’s objective for this plan to mitigate all possible accidents or malfunction in regards to the in stream operation of the Copper Queen tug and barge.

The SCP as prepared is adaptive and will be amended as is practicable. This plan is intended to deliver the best possible means of mitigating an accident or malfunction of the loading/unloading or in-stream operation of the tug and barge with the resources available at Minto. Preventing such an occurrence requires a combination of: procedural and engineering controls, based on an awareness of at risk conditions. These documents exist in the form of the Spill Contingency Plan, Emergency Response Plan, any procedures or plans on the tug or barge from Site Services. This document serves as a contingency plan in the event that an accident or malfunction occurs when loading, unloading, and in-stream operations of the Copper Queen tug and barge (CQTB).

2.0 General Procedures

Any Response to an Emergency condition will be based on a priority sequence of Life, Environment and Property. Therefore every event will be regarded with these priorities in mind. Initial on scene assessment of the accident or malfunction will be called out on channel one as a “Code 1”. The Emergency Response Team will be dispatched, communication established and the barge operator and deckhand will respond to control the scene.

Deckhands will mitigate all emergencies on the barge to the best of their ability given the resources available. General procedure in the event of an emergency would have the barge move to the west landing if possible or practical unless otherwise communicated to the barge captain. To mitigate an emergency in offloading or loading vehicles onto the barge the deckhand will utilize the anchor points on both landings. Slack will be left in the rope to ensure the barge captain is able to maneuver when docked at the landing. Tying off to the anchor points will mitigate complete catastrophe if the barge loses power during loading and offloading and will be discussed further under the specific procedures section of this plan.

Minto is currently in discussion with JDS about a mutual aid agreement. It is Minto's intention to have the agreement in place before the 2013 barge operating season. The mutual aid agreement will be for assistance on the east side landing (equipment, manpower etc.) as well as in-stream support. To mitigate the risk of losing control of the barge downstream Minto will be installing an anchor on the barge. In the event of an emergency the deckhand would be able to deploy the anchor allowing the barge a safety contingency if control was lost.

3.0 Specific Procedures

Below is a list of the current on site procedures for dealing with various emergencies in regards to the CQTB at Minto Mine.

1. Emergency Response to Sinking
2. Emergency Response to Loss of Power or Control
3. Emergency Response to Fire Onboard
4. Emergency Response to Man Overboard
5. Emergency Response to Freight or Vehicle Overboard
6. Emergency Response to Medical Emergency on Board of the Barge
7. Emergency Response to Spill Response

3.1 Emergency Response to Sinking of CQTB

1. Activation of Emergency Protocol onboard CQTB calling code 1 to initiate ERT response.
2. Captain and deckhand will deploy Canadian Coast Guard approved life rafts.
3. As per Emergency Response Plan, Incident command (IC) will communicate with Deckhand by radio to determine any further details of events, number of injured or trapped people, risks to property and environment.

4. IC will respond to scene in one emergency vehicle ahead of remaining ERT. IC will upon arrival to scene provide initial scene assessment and gather any additional information available. Minimum ERT response will include full ERT member compliment, Environmental Lead, Hazardous materials response trailer, fire truck, ambulance and all associated equipment. ERT operations to be under the control of the ERT Captain. Additional response needs based on initial assessment and evaluation by IC will be communicated to the Emergency Communications Center (ECC) as per Emergency Response Plan.
5. Incident Accountability will be established and adhered to throughout the operation.
6. IC will determine the need for rescue of people downstream. Option to deploy rescue ropes via launcher considered for KM 12.
7. Alternate access to river to be determined by nature of incident, KM 20 provides a second potential access. All other access would require trail cutting which is possible but would take more time.
8. IC, ERT Captain, and Environmental Lead (Unified Incident Command Support) will assess ongoing situation and need for additional or fewer resources.
9. Alternate man boat (see Appendix A for details on man boat) will be deployed from landing as needed to support rescue and/or to gain more information regarding location of sunken vessel and determine possible plan for retrieval/securing. Man boat operator will work under the direction of IC.
10. If available and a benefit, Minto would exercise the use of the mutual aid agreement with JDS.
11. Once rescued, all patients will be treated as per OFA3/EMR protocols transported as per Yukon EMS dispatch confirmation aligned with Minto Emergency Response Plan.

3.2 Emergency Response to Loss of Power or Control of CQTB

The tug operates on two engines so total loss of power is not likely; however, is still possible and below is the emergency procedure that would be activated in the event that total loss or control of the CQTB was to occur.

12. Activation of Emergency Protocol onboard CQTB calling code 1 to initiate ERT response. Captain will also communicate freight details and passenger numbers on board.
13. Passengers and crew will follow instructions from Captain and remaining on board if deemed safe. The Captain and deckhand will follow MED protocol in decision making in regards to passenger safety.
14. Captain and deckhand will deploy Canadian Coast Guard approved life rafts if deemed unsafe to stay on board by Captain.
15. IC will respond to scene or as close to it, in one emergency vehicle ahead of remaining ERT. IC will upon arrival to scene provide initial scene assessment and gather any additional information available. Minimum ERT response will include full ERT member compliment, Environmental Lead, Hazardous materials response trailer, fire truck, ambulance and all associated equipment. ERT operations to be under the control of the ERT Captain. Additional response needs and downstream communication and reporting requirements based on initial assessment and evaluation by IC will be communicated to the Emergency Communications Center (ECC) as per Emergency Response Plan.
16. Incident Accountability will be established and adhered to throughout the operation.
17. Captain will navigate to the best of his ability to the safest downstream location possible. Under the direction of the Captain the deckhand may deploy the anchor to assist in stopping the barge and tug.
18. Captain will communicate to IC location and details of condition of vessel and people and assist in determining plans for action.
19. Once vessel is secured to shore or where landed in river, Man boat will be deployed to assist with additional securing and remove non-essential people to location where they can be transferred back to site or alternate safe location.
20. If available and a benefit, Minto would exercise the use of the mutual aid agreement with JDS.
21. Plan for retrieval will be based appropriate to the conditions and location of vessel. Plan to be developed cooperatively through Barge Captain, Minto ECC and Mutual Aid resources.

Equipment and additional resources will be sourced through ECC as per Minto Emergency Response Plan.

3.3 Emergency Response to Fire on the CQTB

22. Activation of Emergency Protocol onboard CQTB calling code 1 to initiate ERT response.
23. If safe to do so, deckhand will attempt to supress fire using equipment on board following Marine Emergency Duty (MED) protocol.
24. Captain and deckhand will deploy Canadian Coast Guard approved life rafts if vessel in immediate danger. If possible and practical the Captain will position barge so that wind is blowing port to star board, to keep smoke/flames away from life raft.
25. If able to do so Barge will cross to West Bank of crossing and continue to use barge supplied fire suppression equipment. All passengers will disembark under direction of deckhand.
26. IC will respond to scene in one emergency vehicle ahead of remaining ERT. IC will upon arrival to scene provide initial scene assessment and gather any additional information available. Minimum ERT response will include full ERT member compliment, Environmental Lead, Hazardous materials response trailer, fire truck, ambulance and all associated equipment. ERT operations to be under the control of the ERT Captain. Additional response needs based on initial assessment and evaluation by IC will be communicated to the Emergency Communications Center (ECC) as per Emergency Response Plan.
27. Incident Accountability will be established and adhered to throughout the operation.
28. Once IC on scene and vessel safely secured, fire suppression will be conducted under the direction of the IC following NFPA 1081 standards. Industrial Fire Brigade.
29. Consideration of environmental sensitivity need to be considered by IC in cooperation with the Environmental Lead (unified incident command support).
30. Defensive spill containment methods to be utilized to control run off and releases from firefighting operations. This may include tactics such as extinguishing agent selection, damming and berming on barge, boom placement around vessel, removal of burning equipment once fire controlled, etc.

3.4 Emergency Response to Man Overboard

31. Activation of Emergency Protocol onboard CQTB calling code 1 to initiate ERT response.
32. Captain and deckhand will throw out provided Canadian Coast Guard approved life-rings to all personnel overboard. The response from the barge crew will conducted as per their MED training.
33. If able to successfully rescue person overboard, deckhand will treat person based on marine first aid protocols awaiting response by ERT and site Medic.
34. If unable to successfully achieve rescue, vessel will continue to West landing and man boat deployed for downstream rescue. Communication to IC on Radio Channel 1 must be available at all times. Man boat operation will be conducted under the direction of IC once in place.
35. Captain will communicate to IC of possible downstream rescue requirement.
36. IC will instruct ERT to stage at KM 12 with option to deploy rescue ropes via launcher considered for KM 12.
37. Incident Accountability will be established and adhered to throughout the operation.
38. IC to stage ambulance for patient pick up.
39. IC will communicate the need for mutual aid to ECC who will follow the Minto ERP by contacting local agencies for assistance on East side of river.
40. Once rescued, all patients will be treated as per OFA3/EMR protocols transported as per Yukon EMS dispatch confirmation aligned with Minto Emergency Response Plan.

3.5 Emergency Response to Freight or Vehicle Overboard of the CQTB

41. Activation of Emergency Protocol onboard CQTB calling code 1 to initiate ERT response. Captain will also communicate freight details and passenger numbers on board.
42. Passengers and crew will follow instructions from Captain (Captain will respond as per MED training) remaining on board if deemed safe.
43. Captain and deckhand will deploy Canadian Coast Guard approved life rafts if deemed unsafe to stay on board by Captain. If at landing passengers will be offloaded to safe location on shore.

44. IC will respond to scene or as close to it, in one emergency vehicle ahead of remaining ERT. IC will upon arrival to scene provide initial scene assessment and gather any additional information available. Minimum ERT response will include full ERT member compliment, Environmental Lead, Hazardous materials response trailer, fire truck, ambulance and all associated equipment. ERT operations to be under the control of the ERT Captain. Additional response needs and downstream communication and reporting requirements based on initial assessment and evaluation by IC will be communicated to the Emergency Communications Center (ECC) as per Emergency Response Plan.
45. Incident Accountability will be established and adhered to throughout the operation.
46. Captain will navigate to the best of his ability to the landing, preferably west landing.
47. Once vessel is secured to shore, man boat will be deployed by deckhand or ERT members to assist with additional securing of vessel and freight, and deployment of containment booms located at landing and on vessel. Man boat operation under the direction of IC once in place.
48. Plan for retrieval of freight will be determined appropriate to the condition and location of freight. Plan developed cooperatively through Barge Captain, Minto ECC and Mutual Aid resources.
49. Equipment and additional resources will be sourced through ECC as per Minto Emergency Response Plan including manpower, expertise, heavy equipment, etc.
50. Special considerations for support in the event of incident occurring on East side of river to include Yukon Emergency Measures Organization, local first responders and alternate equipment operations contractor.

3.6 Emergency Response to Medical Emergency on board CQTB

51. Activation of Emergency Protocol onboard CQTB calling code 1 to initiate ERT response.
52. For serious injury as defined in the ERP, Yukon EMS will be notified immediately.
53. Deckhand will treat patient per Marine Emergency First Aid protocols.
54. Captain will navigate barge to west bank of Yukon River and all vehicles will offload on west bank, giving clear passage for Ambulance.

55. ERT response will include medic, ambulance, fire truck and compliment of team members to assist with patient transfer and packaging.
56. Incident Accountability will be established and adhered to throughout the operation.
57. Yukon EMS dispatch will be updated of situation once history and assessment confirmed.
58. Upon arrival, Minto Medic will take control of scene and advise ERT Captain of resources needed on scene.
59. Upon history and assessment, patient will be treated, packaged and transferred as per OFA3/ERM protocols transported as per Yukon EMS dispatch confirmation aligned with Minto Emergency Response Plan.

3.7 Emergency Response to a Spill

60. Activation of Emergency Protocol onboard CQTB calling code 1 to initiate ERT response.
61. Deckhand will attempt to contain spill using on board spill kit, to prevent spill into Yukon River.
62. IC will respond to scene in one emergency vehicle ahead of remaining ERT. IC will upon arrival to scene provide initial scene assessment and gather any additional information available. Minimum ERT response will include full ERT member compliment, Environmental Lead, Hazardous materials response trailer, fire truck, ambulance and all associated equipment. ERT operations to be under the control of the ERT Captain. Additional response needs, downstream communication, communication with CANUTEC and reporting requirements based on initial assessment and evaluation by IC will be communicated to the ECC as per Emergency Response Plan and Spill Contingency Plan.
63. Incident Accountability will be established and adhered to throughout the operation.
64. If practical the barge captain will navigate the barge to west landing.
65. All passengers will disembark vessel.
66. All vehicles and machinery that is not in the spill zone will disembark.
67. Deckhand and ERT members under the direction of IC will use the man boat to deploy containment booms around the barge.

68. IC with advice from the Environment Lead will develop and implement the SCP for stopping the spill if possible.
69. If the spill cannot be stopped a plan to mitigate the quantity of contaminant spilt to environment will be developed and implemented.
70. If safe and practical to do so Environment Lead will deploy environment staff to sample downstream of spill to measure contamination concentration.
71. IC with advice from the Environment Lead will oversee cleanup of the spill.
72. Special considerations for support in the event of incident occurring on East side of river to access the barge with ERT by man boat.

4.0 Minto Mine Training

The barge crew were trained and certified in Marine Emergency Duties (MED) A1 and A2 in 2012. The MED course meets the standards of training, certification and watchkeeping and is run by Transport Canada. The A1 MED course covers basic safety with a focus on hazards and emergencies awareness, firefighting, emergency response, lifesaving appliances and abandonment, survival and rescue. The A2 MED course covers small passenger-carrying vessel safety with the same focus as A1 with the addition of maintenance and inspection of emergency equipment and passenger control. As well the barge crew is trained in Marine First Aid.

The ERT team and environment staff has been trained in NFPA 472 Hazardous Materials Response Certification, awareness and operations for responders. In 2014 Minto is planning to host a table top and field exercise in regards to Yukon River response. The table top and field exercise will be held in conjunction with ERT, barge crew, environment department, management, and consultants.

Appendix B

Minto Creek 2013 Hydrology Update

3 Calcite Business Centre, 151 Industrial Road
Whitehorse, Yukon Y1A 2V3
Phone (867) 668-6463 Fax (867) 633-4882
www.accessconsulting.ca

Memorandum

To: Minto Explorations Ltd.

From: Anthony Bier, Access Consulting Group (ACG)

CC: Scott Keesey

Date: March 13, 2014

Re: Minto Creek 2013 Hydrology Update

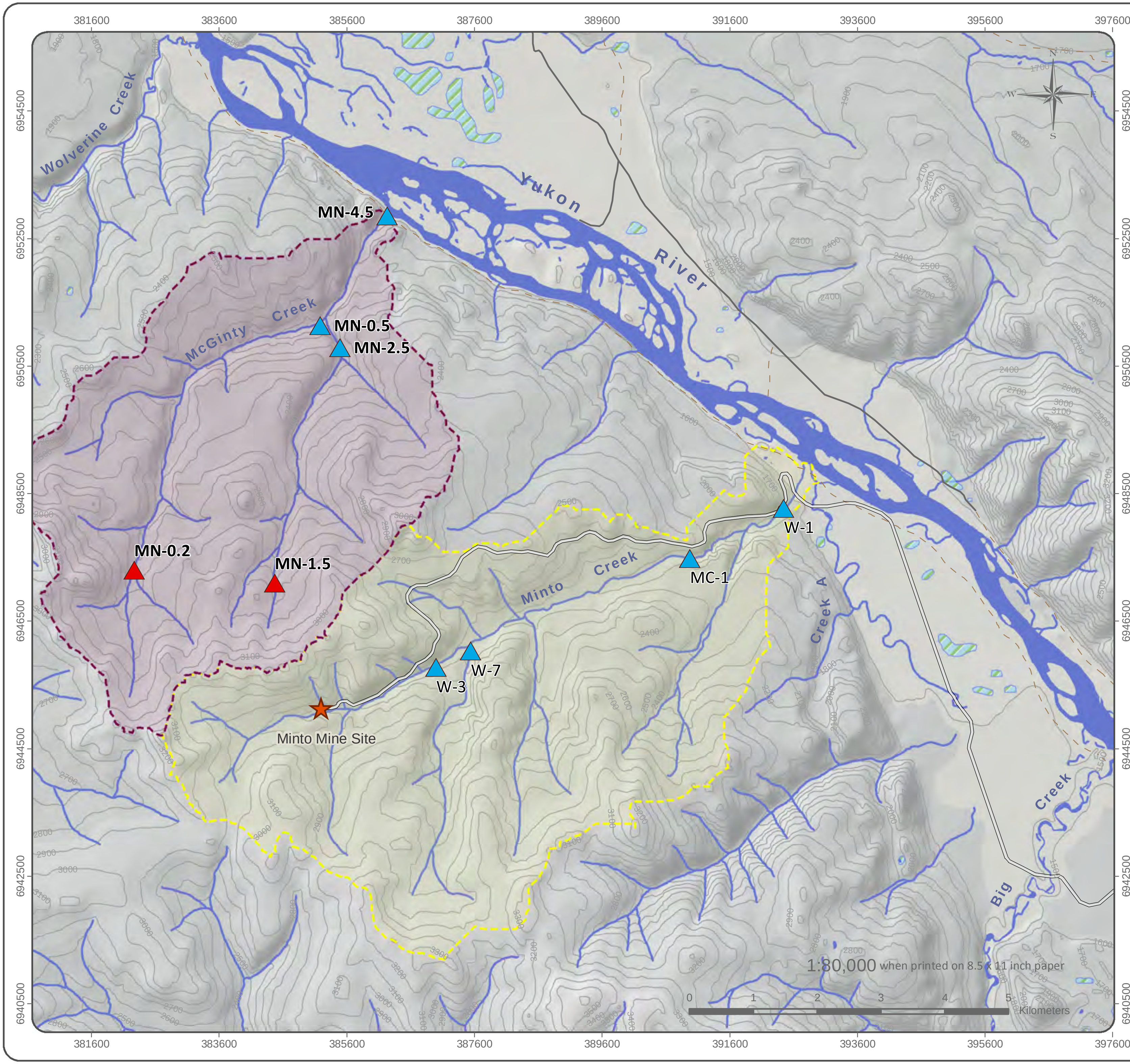
1 INTRODUCTION

The Minto Mine Environment Department (Minto) maintains a network of hydrometric stations as part of its regular monitoring of surface water hydrological conditions in Minto and McGinty Creeks. Minto Mine personnel conduct regular discharge measurements at these stations and deploy Solinst Level Loggers and Barometric Loggers in order to capture continuous stage records to enable the development of discharge records. Access Consulting Group (ACG) has been retained to process these data into discharge records for the 2013 season. This memorandum presents the methods, observations and results of this program and data processing. Recommendations for further improvement of the hydrological data collection program have been provided under separate cover.

2 METHODS

Hydrometric data are collected throughout the open water season by Minto and 2013 data were provided to ACG in early 2014. These data are in the format of discharge measurements manually entered into spreadsheets and some field notes. Photos are also taken of the staff gauge at each visit. These data are checked for entry and calculation errors and suspicious measurements are confirmed with Minto. They are then entered into a master spreadsheet and .CSV files are created which include data, time, staff gauge height and discharge measured. These rating measurements are then imported into Aquarius time series software and a rating curve is built. Suspicious measurements are confirmed against photos and if they differ greatly from the stage discharge relationship. This can be due to the effects of ice or other changing control conditions, and if so they are ignored for rating curve development but included in the hydrographs. Rating curves may undergo a shift at certain times of the year but with appropriate observations, these shifts can be accounted for. Rating curve shifts are used at some Minto sites where appropriate.

Barometrically compensated Solinst water level data were imported into Aquatic Informatics (Aquarius) time series software from .CSV files which are exported from Solinst software following compensation. Aquarius allows for adjustment of the Solinst record to match the staff gauge observations, for development of rating curves with the field data, and for automatic processing of a continuous discharge record. This preserves the raw data in an easy to reference format and changes can be made to the data at any time which then cascade through the various time series. Stage time series are adjusted for drift, offset and erroneous data it deleted. The rating curve is automatically applied to the continuous stage record for a specified time period to create the continuous discharge time series.



MINTO MINE

SURFACE WATER HYDROLOGY

FIGURE 1 MINTO AND MCGINTY CREEK HYDROMETRIC MONITORING NETWORK

- Water Quality Station with Discharge Measurements
- Hydrometric Station
- Minto Access Road
- Limited-use road
- Trail
- Contours (ft)
- Watercourse
- Minto Creek Catchment
- McGinty Creek Catchment
- Waterbody
- Wetland

NAD 83 UTM Zone 8N

capstone MINTO MINE
OPERATED BY MINTO EXPLORATIONS LTD.

ACCESS

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(*Last edited by: jpan;3/3/2014/09:10 AM*)

3 MINTO CREEK

The hydrological monitoring program includes four hydrometric stations on Minto Creek, three of which were established prior to 2013 and a new location (W-7) established in midsummer 2013. The W-7 station was established on a southern tributary which joins the main creek just below W-3. The three existing monitoring stations are all below the main mine site and include W-3 (the regulated flume at the dam), MC-1 (a station mid-catchment in low angle terrain) and W-1 (lower Minto Creek above the road crossing and approximately 1 km upstream of the confluence with the Yukon River) (Figure 1). Hydrographs for 2013 and mean monthly flows are presented below in separate sections for each station. The annual hydrographs are included in Appendix A and discrete measurements and observations carried out by the Minto Environmental Team in 2013 are presented in Appendix B.

3.1 STATION W-3 - FLUME BELOW WATER STORAGE POND DAM

Water level is continuously monitored in the flume at the toe of the Minto mine dam via a Solinst Level Logger in combination with a barometric logger. Frequent observations by Minto staff allow for correction of the level logger to the actual height of water in the flume and confirmation of the manufacturer specified stage discharge relationship. This provides a record which a high degree of accuracy. Figure 2 (Appendix A) shows the hydrograph for the 2013 season and Table 1 summarizes the continuous data as mean monthly flows. Note that from the 21st of May to June 1st the average discharge was 0.111 m^3/s, but this was not included in the table as the sample size of observations is much smaller than other represented months.

Table 1 – Mean monthly discharge (m^3/s), Minto Creek at W-3

	Month					
Year	May	Jun	Jul	Aug	Sep	Oct
2011	-	0.005	0.005	0.006	0.005	
2012	0.02	0.003	0.004	0.004	0.004	
2013	-	<0.001	<0.001	0.002	0.003	0.003

Note: Grey numbers indicate estimate due to incomplete data.

3.2 STATION MC-1 - MINTO CREEK MID-CATCHMENT

Hydrometric station MC-1 is located between the flume at W-3 and, just upstream of the canyon on lower Minto Creek. This site is characterized by shallower channel angles and slower moving water above the control of the canyon. Figure 3 (Appendix A) shows the discharge time series for the 2013 open water season and Table 2 summarizes these data as mean monthly flows.

Table 2 – Mean monthly discharge (m^3/s), Minto Creek at MC-1

	Month				
Year	**May**	**Jun**	**Jul**	**Aug**	**Sep**
2012	0.153	0.059	0.048	0.038	0.096
2013	0.287	0.074	0.085	0.042	0.081

Note: Grey numbers indicate estimate due to incomplete data.

3.3 STATION W-1 – LOWER MINTO CREEK ABOVE ROAD CROSSING

The 2013 continuous discharge record for Minto Creek at W-1 extends from early May through early October. Appendix B shows the calculated discharge time series. The time series for discharge was cut off in early October due to daily ice formation causing large fluctuations in stage and unreliable discharge calculations (Figure 4, Appendix A). The Levelogger appears to have been out of water for a portion of July, a period for which the record was patched with data from MC-1. The high frequency of discrete observations made this possible. Mean monthly flows have been tabulated (Table 3). It is important to note that May is calculated from incomplete data, however there is more than 75% data coverage.

Table 3 – Mean Monthly Discharge (m^3/s), Minto Creek at W-1

	Month				
Year	**May**	**Jun**	**Jul**	**Aug**	**Sep**
2012	0.174	0.071	0.048	0.048	0.082
2013	0.485	0.064	0.066	0.044	0.085

Note: Grey numbers indicate estimate due to incomplete data.

3.4 STATION W-7 - TRIBUTARY OF MINTO CREEK

A staff gauge was established on a tributary of Minto Creek in the summer of 2013. This site is located on the most upstream of the southern tributaries meeting the main channel of Minto Creek below W-3 (Figure 1). W-7 has been a regularly monitored surface water quality station for a number of years, but the hydrometric station and instrumentation was only recently installed in 2013. The first staff gauge observation occurred on August 11th and there were two rating measurements, one in August and one in September. The level record extends from August to late October (at which time it became ice affected). The level is corrected to the two measurements which occurred concurrently, however no discharge is computed given how close the stage of two rating measurements are. Generally, three reasonably well spaced measurements are required for a rating curve. It is expected that a robust set of rating measurements will be provided in 2014, and it is recommended that at least one high-stage observation is collected to enable this processing. Figure 5 (Appendix A) shows the stage hydrograph for 2013 while Table 4 presents the discrete measurements gathered to date (also included in Appendix B).

Table 4 – Discrete measurements at Minto Creek W-7 in 2013

Date	Time	Stage (m)	Discharge (m^3/s)
13/07/2013	14:25	-	0.01308
17/08/2013	15:57	0.110	-
24/08/2013	14:45	0.145	0.03061
06/09/2013	15:21	0.134	0.01906
21/10/2013	6:10	0.185	0.00581

4 McGinty Creek

McGinty creek is divided into two main sub-catchments which each have two monitoring stations, one just above the confluence and one near the headwaters. MN-4.5 is located on the main stem below the confluence of the tributaries near the mouth at the Yukon River (Figure 1).

4.1 Station MN-4.5 - McGinty Creek near the Mouth

Datalogger data from 2013 extends from mid-June to early October when ice formation begins (Figure 6, Appendix A). Table 5 summarizes the monthly mean values from the continuous record. Snow and ice persisted later in the spring of 2013 than previous years, delaying the start of the reliable continuous discharge record until later in the season.

Table 5 – Mean monthly discharge (m^3/s), McGinty Creek at MN-4.5

		Month				
Year	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**
2011	-	0.482	0.096	0.13	0.138	0.068
2012	0.224	0.245	0.189	0.082	0.052	0.173
2013	-	-	0.054	0.103	0.093	0.116

Note: Grey numbers indicate estimate due to incomplete data.

4.2 Station MN-2.5 - East Branch of McGinty Creek

A Solinst Levelogger was deployed at MN-2.5 from mid-June to mid-September in 2013 and a Barologger at this site is also used for compensation at MN-0.5 due to the small difference in elevation. Figure 7 (Appendix A) shows the 2013 stage hydrograph at MN-2.5. Spot measurements are included in Appendix A. The measurement on July 15th of only 9.1 L/s which corresponds to a stage height of 0.432m is not consistent with the other observed relationships. The following month on August 8th a measurement of 19.4 L/s was taken (more than double the discharge) at a lower stage height of 0.422m. The Levelogger record as a whole could be adjusted based on the observations except that on July 15th, however, the photograph taken on this visit shows that it is not an observational error. It is therefore possible that the control on this section is changing. As a result of this there are only three measurements with which to build a rating curve and they do not confidently relate to the stage record in July. These three measurements are also at very similar stages so a continuous record could not be produced.

ACG recommends that the measurement reach for this station be assessed for what might be causing this and if necessary, that the control be modified or the station be relocated if control improvements are not possible.

4.3 STATION MN-0.5 - WEST BRANCH OF MCGINTY CREEK

Stage at MN-0.5 is provisional. The rating curve is developed from four rating measurements, two occurring in 2012 and 2013 each. Photographic documentation shows heavy ice at the hydrometric station as late as mid-June. A stage observation of 0.400m on June 17th is indicative that this ice is damming the section. As such, continuous discharge cannot be calculated prior to June 20th when the level record suddenly drops, presumably due to an ice dam failure (Figure 8, Appendix A). Additionally it appears that the control changed again in late July, a period after which the water level is typically below the 0 mark on the staff gauge. ACG recommends re-evaluation of this site for suitability and possibly the installation of a small weir or other control feature such as a staked log to ensure a more stable measurement reach. The average discharge for the last 10 days of June is 0.040 m^3/s and for the period of record in July it is 0.037 m^3/s. Field observations from 2013 are included in Appendix B.

4.4 STATION MN-0.2 AND MN-1.5 MCGINTY CREEK HEADWATERS

These sites generally exhibit very low flows; observations for 2013 are included in Appendix A. MN-0.2 is near the headwaters of the west sub-catchment of McGinty Creek and has an average measured flow in the open water season of 2.5 L/s. MN-1.5 is near the headwaters of the eastern sub-catchment of McGinty creek and has an average measured flow during the open water season of 4.6 L/s.

5 CLOSURE

ACG trusts that this review of the 2013 hydrometric data collected at Minto meets the needs of Minto Explorations Ltd. ACG is able to provide continuous data in CSV format on any time step which Minto or their consultants may require. This is a quick and easy request for ACG to execute at any time. Lastly, ACG thanks Minto for the opportunity to continue to support your hydrometric monitoring program.

Anthony Bier, M.Sc
Hydrologist

APPENDIX A

HYDROGRAPHS 2013

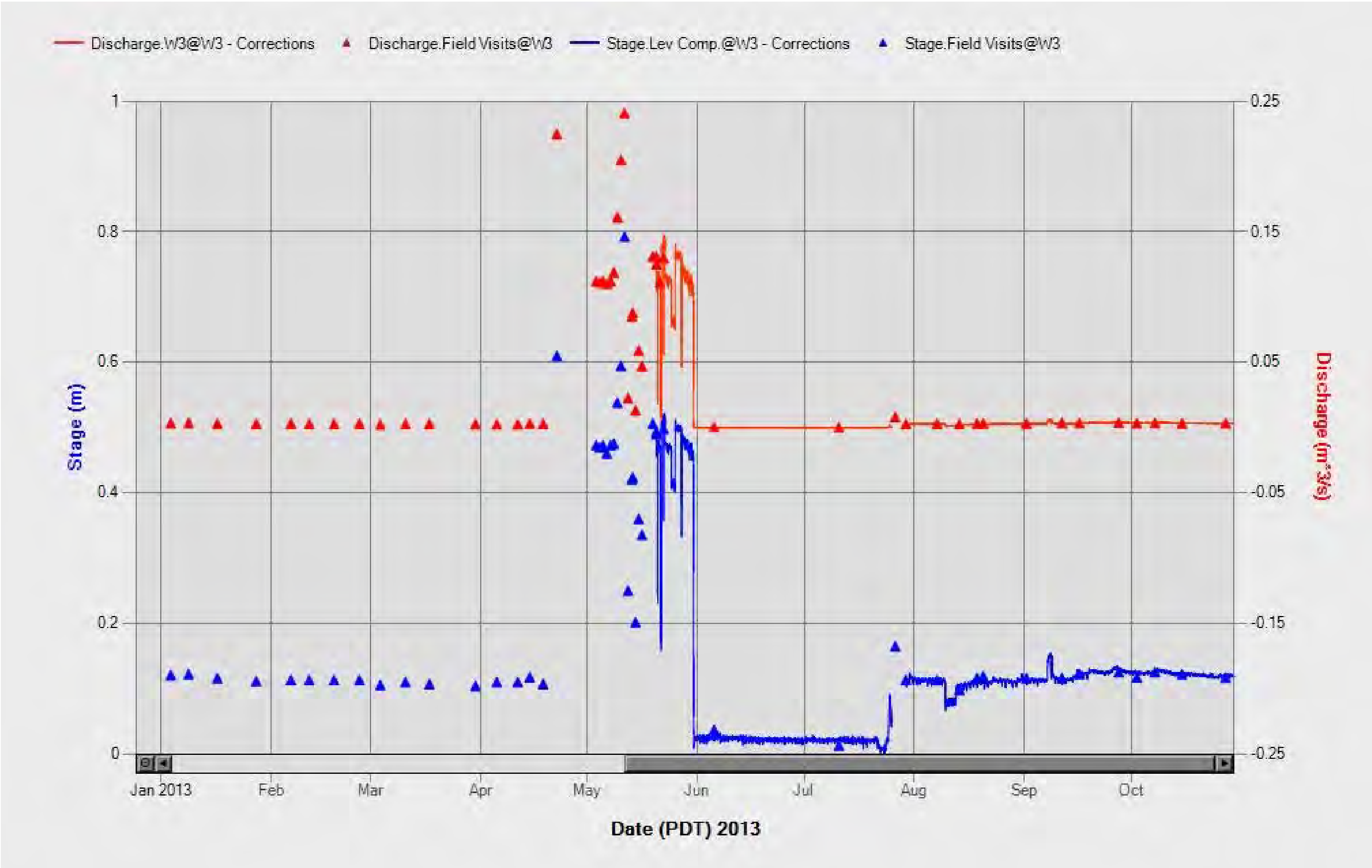

Figure 2 - Flume at W-3 2013 open water season hydrograph

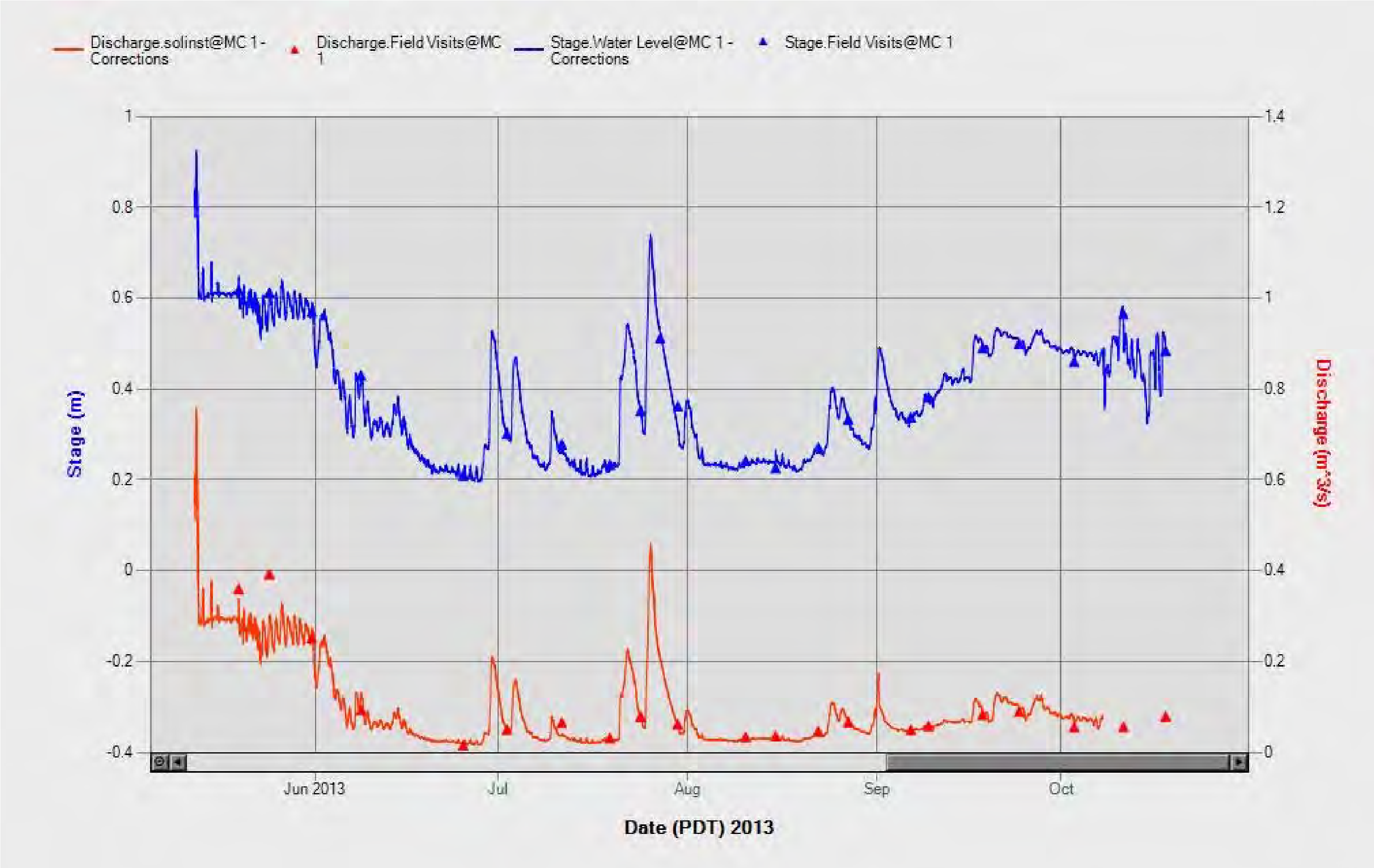

Figure 3 - Minto Creek at MC-1 2013 open water season hydrograph

Figure 4 – Minto Creek at W-1 2013 open water season hydrograph

Figure 5 - Minto Creek at W-7 2013 open water season hydrograph

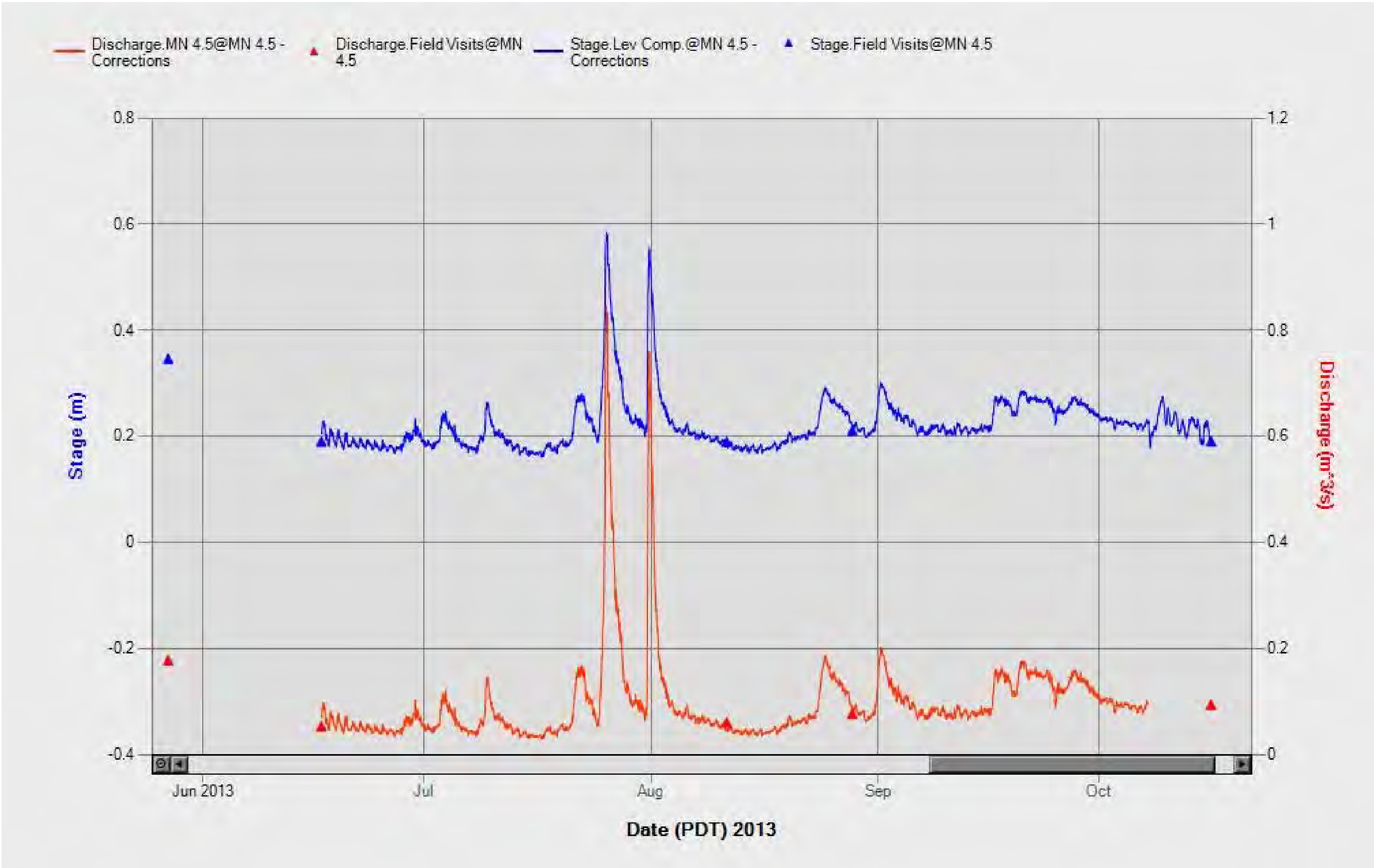

Figure 6 – McGinty Creek at MN-4.5 2013 open water season hydrograph

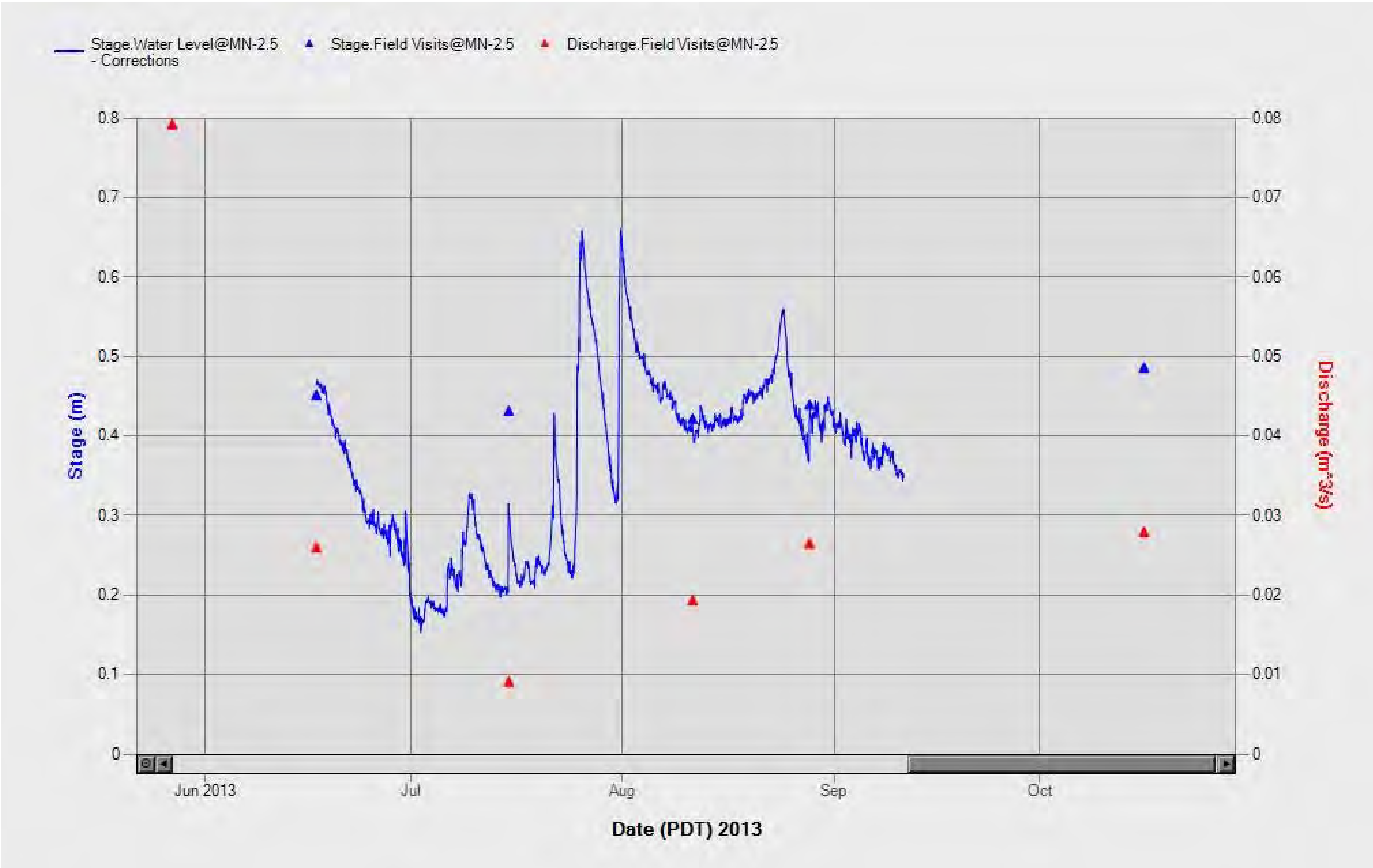

Figure 7 – McGinty Creek at MN-2.5 2013 open water season hydrograph

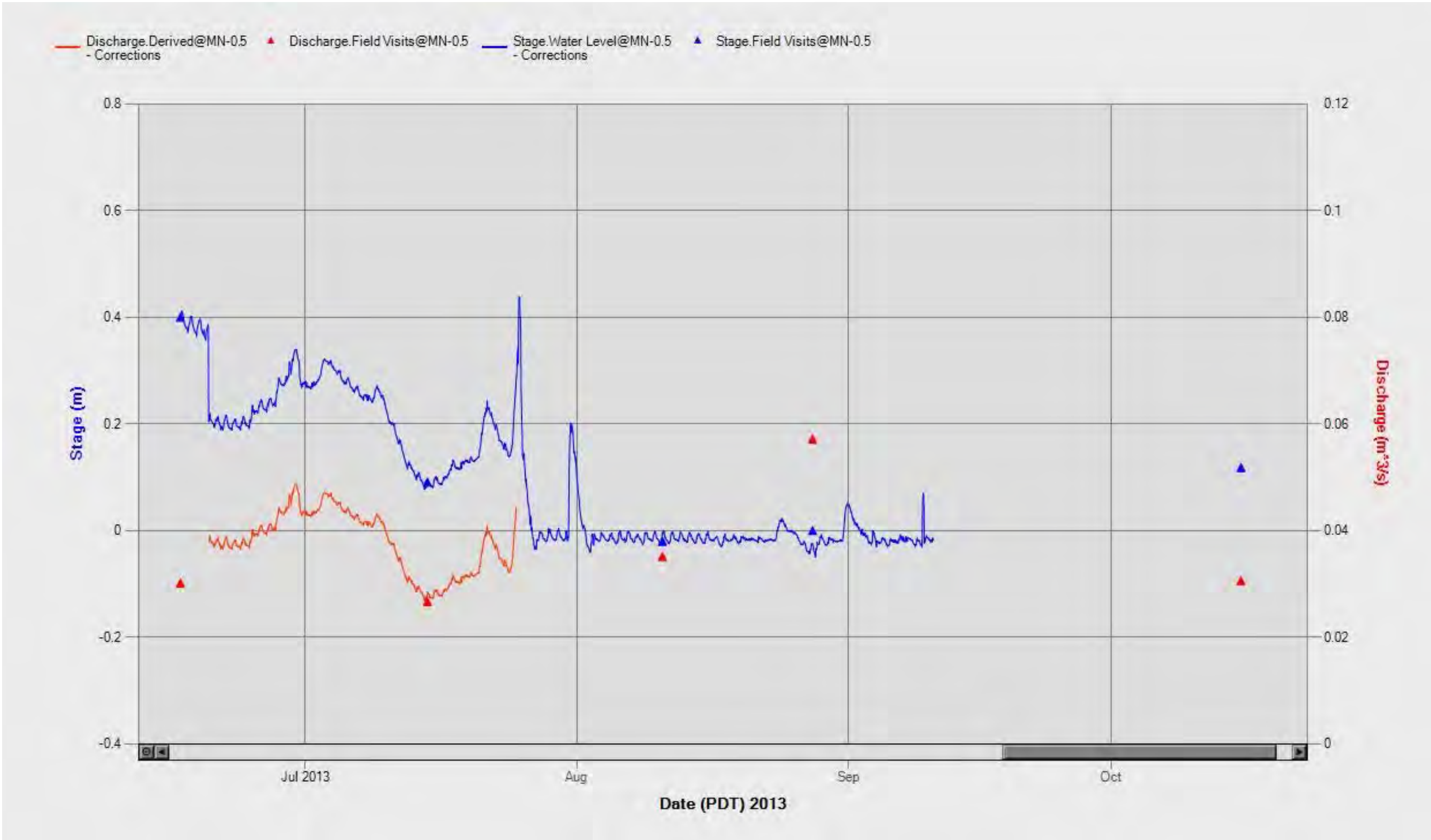

Figure 8 – McGinty Creek at MN-0.5 2013 open water season hydrograph

APPENDIX B

DISCRETE DISCHARGE MEASUREMENTS 2013

W-1			
Date	Time	Stage (m)	Discharge (m^3/s)
07/05/2013	12:00	0.695	
19/05/2013	13:47	0.483	0.37199
24/05/2013	14:05	0.493	0.40634
31/05/2013	14:20	0.398	0.29032
08/06/2013	14:54	0.214	0.08889
20/06/2013	9:18	0.125	0.03395
25/06/2013	9:47	0.120	0.0257
02/07/2013	10:28	0.165	0.05041
11/07/2013	11:40	0.155	0.04275
18/07/2013	10:20	0.135	0.02981
23/07/2013	10:02	0.245	0.12248
27/07/2013	16:34	0.285	
30/07/2013	11:22	0.176	0.04717
12/08/2013	14:39	0.242	0.0332
15/08/2013	14:35	0.140	0.02719
22/08/2013	10:52	0.154	0.04251
27/08/2013	10:00	0.179	0.06978
03/09/2013	15:24	0.195	0.07639
09/09/2013	12:20	0.172	0.06908
18/09/2013	9:46	0.250	0.10001
24/09/2013	9:29	0.278	0.09947
03/10/2013	9:52	0.238	0.07513
11/10/2013	10:55	0.318	0.04082
18/10/2013	9:06	0.198	0.06056
22/10/2013	9:07	0.257	0.01454
31/10/2013	13:17	0.279	0.04956

MC-1			
Date	Time	Stage (m)	Discharge (m^3/s)
07/05/2013	8:12	1.085	
19/05/2013	16:30	0.618	0.26571
24/05/2013	17:12	0.612	0.39255
31/05/2013	16:14	0.570	0.252183
08/06/2013	16:36	0.430	0.093895
25/06/2013	11:28	0.210	0.015449
02/07/2013	13:44	0.301	0.05039
11/07/2013	14:14	0.278	0.06578
19/07/2013	10:52	0.234	0.03166

W-3			
Date	Time	Stage (m)	Discharge (m^3/s)
04/01/2013	15:43	0.120	0.0032
09/01/2013	16:00	0.122	0.0035
17/01/2013	17:30	0.116	0.003
28/01/2013	17:00	0.111	0.0028
07/02/2013	11:00	0.113	0.0029
12/02/2013	14:35	0.113	0.0029
19/02/2013	14:30	0.113	0.0029
26/02/2013	17:15	0.113	0.0029
04/03/2013	15:00	0.105	0.0022
11/03/2013	17:40	0.110	0.0029
18/03/2013	11:00	0.107	0.0028
31/03/2013	10:00	0.104	0.0026
06/04/2013	9:10	0.110	0.0025
12/04/2013	7:30	0.110	0.0025
15/04/2013	17:15	0.117	0.003
19/04/2013	10:40	0.107	0.00275
23/04/2013	8:05	0.610	0.225
04/05/2013	9:35	0.472	0.112
05/05/2013	9:50	0.469	0.111
06/05/2013	7:30	0.472	0.112
07/05/2013	9:40	0.460	0.11
08/05/2013	12:00	0.472	0.112
09/05/2013	8:45	0.475	0.119
10/05/2013	8:45	0.538	0.161
11/05/2013	9:00	0.594	0.205
12/05/2013	9:15	0.792	0.241
13/05/2013	8:40	0.250	0.0225
14/05/2013	10:50	0.421	0.085
14/05/2013	16:40	0.424	0.088
15/05/2013	11:10	0.201	0.013
16/05/2013	9:00	0.360	0.059
17/05/2013	7:25	0.335	0.047
20/05/2013	7:45	0.506	0.131
21/05/2013	7:20	0.494	0.131
21/05/2013	8:40	0.490	0.125
22/05/2013	8:30	0.466	0.111
23/05/2013	8:50	0.498	0.13
06/06/2013	15:50	0.037	0.0003

24/07/2013	11:36	0.352	0.078671
27/07/2013	16:50	0.512	
30/07/2013	13:49	0.362	0.06161
10/08/2013	16:07	0.242	0.34218
15/08/2013	13:52	0.226	0.03651
22/08/2013	13:24	0.272	0.04658
27/08/2013	11:21	0.333	0.06684
06/09/2013	16:54	0.338	0.049512
09/09/2013	14:37	0.382	0.058033
18/09/2013	11:25	0.490	0.08263
24/09/2013	11:07	0.500	0.089499
03/10/2013	11:10	0.460	0.055778
11/10/2013	12:15	0.565	0.05678
18/10/2013	10:41	0.484	0.07889

W-7			
Date	Time	Stage (m)	Discharge (m^3/s)
13/07/2013	14:25		0.01308
24/08/2013	14:45	0.145	0.03061
06/09/2013	15:21	0.134	0.01906
21/10/2013	6:10	0.185	0.00581

MN-4.5			
Date	Time	Stage (m)	Discharge (m^3/s)
06/08/2012	15:13	0.194	0.043049
07/09/2012	13:17	0.216	0.056445
01/10/2012	12:08	0.235	0.056126
27/05/2013	13:42	0.346	0.177811
17/06/2013	10:30	0.190	0.053101
11/08/2013	15:52	0.190	0.060571
28/08/2013	18:07	0.211	0.07662
16/10/2013	15:50	0.191	0.09372

MN-0.5			
Date	Time	Stage (m)	Discharge (m^3/s)
06/08/2012	14:12		0.30857

11/07/2013	17:10	0.012	0.00007
27/07/2013	14:30	0.165	0.008
30/07/2013	14:30	0.113	0.0028
08/08/2013	8:50	0.113	0.0028
14/08/2013	16:10	0.098	0.00275
19/08/2013	14:50	0.116	0.003
21/08/2013	8:40	0.119	0.003
02/09/2013	12:55	0.116	0.003
12/09/2013	12:15	0.116	0.0035
17/09/2013	11:00	0.122	0.0035
28/09/2013	11:50	0.125	0.0039
03/10/2013	15:00	0.117	0.0032
08/10/2013	17:15	0.125	0.0035
16/10/2013	8:30	0.122	0.0031
28/10/2013	14:40	0.116	0.0032
05/11/2013	8:00	0.128	0.0042
14/11/2013	10:30	0.128	0.0041
18/11/2013	8:12	0.165	0.008
30/11/2013	17:50	0.177	0.009
05/12/2013	16:45	0.107	0.003
09/12/2013	15:00	0.107	0.003
16/12/2013	17:00	0.107	0.003
23/12/2013	12:00	0.128	0.004

MN-2.5			
Date	Time	Stage (m)	Discharge (m^3/s)
06/08/2012	12:42		0.017845
07/09/2012	12:19	0.335	0.027087
07/10/2012	13:15	0.486	0.023991
27/05/2013	12:40		0.079237
17/06/2013	13:55	0.452	0.026005
15/07/2013	16:52	0.432	0.009139
11/08/2013	14:38	0.422	0.019387
28/08/2013	17:17	0.440	0.026536
16/10/2013	15:02	0.487	0.02793

07/09/2012	14:32	0.199	0.03704
01/10/2012	10:31	0.212	0.04101
27/05/2013	11:40		0.136907
17/06/2013	12:05	0.400	0.030156
15/07/2013	16:52	0.091	0.026693
11/08/2013	13:05	-0.020	0.035168
28/08/2013	16:20	0.000	0.057184
16/10/2013	14:20	0.118	0.030599

MN-0.2			
Date	Time	Stage (m)	Discharge (m^3/s)
06/08/2012	10:08		0.000315
08/09/2012	10:27		0.000844
01/10/2012	14:13		0.000068
27/05/2012	10:32		0.016958
18/06/2013	16:47		0.000782
15/07/2013	12:42		0.00157
11/09/2013	11:52		0.000802
28/08/2013	15:35		0.00091
16/10/2013	13:25		0.000304

MN-1.5			
Date	Time	Stage (m)	Discharge (m^3/s)
06/08/2012	10:44		0.00276
08/09/2012	9:25		0.003443
01/10/2012	14:52		0.00547
27/05/2013	14:55		0.01137
17/06/2013	15:26		0.002519
28/08/2013	14:41		0.00357
11/09/2013	10:07		0.00463
16/10/2013	13:02		0.00303

Appendix C

Seepage Monitoring Program Lab Results

Maxxam

Success Through Science®

Your P.O. #: 204251
Your Project #: MINTO.ENV. MONITORING
Your C.O.C. #: EBB77031, EBB770313

Attention: MINTO DISTRIBUTION LIST
MINTO EXPLORATIONS LTD.
Yukon/Whitehorse
2 - 25 Pilgrim Way
Whitehorse, YT
CANADA Y1A 6E6

Report Date: 2013/07/08

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B354015
Received: 2013/06/27, 09:10

Sample Matrix: Water
Samples Received: 9

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Analytical Method
Alkalinity - Water	9	2013/06/29	2013/06/30	BBY6SOP-00026	SM2320B
Chloride by Automated Colourimetry	9	N/A	2013/06/28	BBY6SOP-00011	SM-4500-Cl-
Conductance - water	9	N/A	2013/06/30	BBY6SOP-00026	SM-2510B
Fluoride	9	N/A	2013/07/02	BBY6SOP-00012	SM - 4500 F C
Hardness (calculated as CaCO3)	9	N/A	2013/07/08	BBY7SOP-00002	EPA 6020A
Mercury (Dissolved) by CVAF	9	N/A	2013/07/05	BBY7SOP-00015	EPA 245.7
Na, K, Ca, Mg, S by CRC ICPMS (diss.)	9	N/A	2013/07/08	BBY7SOP-00002	EPA 6020A
Elements by CRC ICPMS (dissolved)	9	N/A	2013/07/05	BBY7SOP-00002	EPA 6020A
Ammonia-N (Preserved)	9	N/A	2013/06/28	BBY6SOP-00009	SM-4500NH3G
Nitrate + Nitrite (N)	3	N/A	2013/06/28	BBY6SOP-00010	SM 4500NO3-I
Nitrate + Nitrite (N)	6	N/A	2013/06/29	BBY6SOP-00010	SM 4500NO3-I
Nitrite (N) by CFA	7	N/A	2013/06/28	BBY6SOP-00010	EPA 353.2
Nitrite (N) by CFA	2	N/A	2013/06/29	BBY6SOP-00010	EPA 353.2
Nitrogen - Nitrate (as N)	3	N/A	2013/07/02	BBY6SOP-00010	SM 4500NO3-I
Nitrogen - Nitrate (as N)	6	N/A	2013/07/04	BBY6SOP-00010	SM 4500NO3-I
Filter and HNO3 Preserve for Metals	9	N/A	2013/06/27	BBY6WI-00001	EPA 200.2
pH Water	9	N/A	2013/06/30	BBY6SOP-00026	SM-4500H+B
Sulphate by Automated Colourimetry	8	N/A	2013/06/28	BBY6SOP-00017	SM4500-SO42- E
Sulphate by Automated Colourimetry	1	N/A	2013/07/02	BBY6SOP-00017	SM4500-SO42- E
Total Dissolved Solids (Filt. Residue)	9	2013/06/28	2013/06/29	BBY6SOP-00033	SM 2540C
Total Suspended Solids-Low Level	9	2013/06/29	2013/07/02	BBY6SOP-00034	SM-2540 D

* Results relate only to the items tested.

Encryption Key

Please direct all questions regarding this Certificate of Analysis to your Project Manager.

Arshdeep Khalsa, Burnaby Project Manager
Email: AKhalsa@maxxam.ca
Phone# (604) 638-5019

==
Maxxam has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per section 5.10.2 of ISO/IEC 17025:2005(E), signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

Total cover pages: 1

Maxxam Job #: B354015
Report Date: 2013/07/08

MINTO EXPLORATIONS LTD.
Client Project #: MINTO.ENV. MONITORING

Your P.O. #: 204251

RESULTS OF CHEMICAL ANALYSES OF WATER

Maxxam ID		GT5892		GT5893		GT5894		
Sampling Date		2013/06/24 09:36		2013/06/24 00:00		2013/06/24 00:00		
	UNITS	**SS4**	**RDL**	**SS11**	**RDL**	**SS12**	**RDL**	**QC Batch**
ANIONS								
Nitrite (N)	mg/L	0.197(1)	0.0050	0.244(1)	0.0050	0.0668(1)	0.0050	6945990
Calculated Parameters								
Filter and HNO3 Preservation	N/A	FIELD	N/A	FIELD	N/A	FIELD	N/A	ONSITE
Nitrate (N)	mg/L	23.0	0.40	39.9	1.0	76.3	2.0	6937464
Misc. Inorganics								
Fluoride (F)	mg/L	0.170	0.010	0.250	0.010	0.600	0.010	6946656
Alkalinity (Total as CaCO3)	mg/L	420	0.50	217	0.50	109	0.50	6944431
Alkalinity (PP as CaCO3)	mg/L	<0.50	0.50	<0.50	0.50	<0.50	0.50	6944431
Bicarbonate (HCO3)	mg/L	512	0.50	265	0.50	133	0.50	6944431
Carbonate (CO3)	mg/L	<0.50	0.50	<0.50	0.50	<0.50	0.50	6944431
Hydroxide (OH)	mg/L	<0.50	0.50	<0.50	0.50	<0.50	0.50	6944431
Anions								
Dissolved Sulphate (SO4)	mg/L	56.1	0.50	105	0.50	180	0.50	6943938
Dissolved Chloride (Cl)	mg/L	6.2	0.50	3.0	0.50	1.7	0.50	6943901
Nutrients								
Ammonia (N)	mg/L	0.33	0.0050	0.23	0.0050	0.066	0.0050	6941772
Nitrate plus Nitrite (N)	mg/L	23.2(1)	0.40	40.1(1)	1.0	76.4(1)	2.0	6944721
Physical Properties								
Conductivity	uS/cm	990	1.0	903	1.0	1100	1.0	6944436
pH	pH Units	8.12		8.24		8.06		6944434
Physical Properties								
Total Suspended Solids	mg/L	6.7	1.0	3.2	1.0	64.5	1.0	6944105
Total Dissolved Solids	mg/L	848	10	718	10	820	10	6941744

N/A = Not Applicable
RDL = Reportable Detection Limit
(1) - Sample analysed past recommended hold time.

Success Through Science®

Maxxam Job #: B354015
Report Date: 2013/07/08

MINTO EXPLORATIONS LTD.
Client Project #: MINTO.ENV. MONITORING

Your P.O. #: 204251

RESULTS OF CHEMICAL ANALYSES OF WATER

Maxxam ID		GT5895			GT5896		GT5897		
Sampling Date		2013/06/24 00:00			2013/06/24 00:00		2013/06/24 00:00		
	UNITS	**SS13**	**RDL**	**QC Batch**	**SS14**	**QC Batch**	**SS15**	**RDL**	**QC Batch**
ANIONS									
Nitrite (N)	mg/L	0.175(1)	0.0050	6945990	<0.0050(1)	6944722	0.0258(1)	0.0050	6945990
Calculated Parameters									
Filter and HNO3 Preservation	N/A	FIELD	N/A	ONSITE	FIELD	ONSITE	FIELD	N/A	ONSITE
Nitrate (N)	mg/L	18.3	0.20	6937464	<0.020	6937464	0.690	0.020	6937464
Misc. Inorganics									
Fluoride (F)	mg/L	0.320	0.010	6946656	0.120	6946656	0.120	0.010	6946656
Alkalinity (Total as CaCO3)	mg/L	212	0.50	6944431	166	6944431	213	0.50	6944431
Alkalinity (PP as CaCO3)	mg/L	<0.50	0.50	6944431	<0.50	6944431	<0.50	0.50	6944431
Bicarbonate (HCO3)	mg/L	259	0.50	6944431	202	6944431	260	0.50	6944431
Carbonate (CO3)	mg/L	<0.50	0.50	6944431	<0.50	6944431	<0.50	0.50	6944431
Hydroxide (OH)	mg/L	<0.50	0.50	6944431	<0.50	6944431	<0.50	0.50	6944431
Anions									
Dissolved Sulphate (SO4)	mg/L	47.8	0.50	6943938	50.4	6949096	58.8	0.50	6943938
Dissolved Chloride (Cl)	mg/L	2.6	0.50	6943901	1.5	6943901	1.2	0.50	6943901
Nutrients									
Ammonia (N)	mg/L	0.11	0.0050	6941772	0.076	6941772	0.16	0.0050	6941772
Nitrate plus Nitrite (N)	mg/L	18.5(1)	0.20	6945980	<0.020(1)	6944721	0.715(1)	0.020	6945980
Physical Properties									
Conductivity	uS/cm	626	1.0	6944436	413	6944436	508	1.0	6944436
pH	pH Units	8.25		6944434	8.18	6944434	8.23		6944434
Physical Properties									
Total Suspended Solids	mg/L	5.5	1.0	6944105	4.2	6944105	64.0	1.0	6944105
Total Dissolved Solids	mg/L	454	10	6941744	292	6941744	348	10	6941744

N/A = Not Applicable
RDL = Reportable Detection Limit
(1) - Sample analysed past recommended hold time.

RESULTS OF CHEMICAL ANALYSES OF WATER

Maxxam ID		GT5898			GT5899			GT5900		
Sampling Date		2013/06/24 00:00			2013/06/24 00:00			2013/06/24 00:00		
	UNITS	**SS16**	**RDL**	**QC Batch**	**SS17**	**RDL**	**QC Batch**	**SS18**	**RDL**	**QC Batch**
ANIONS										
Nitrite (N)	mg/L	0.103(1)	0.0050	6945990	0.0589(2)	0.0050	6944722	0.0071(1)	0.0050	6945990
Calculated Parameters										
Filter and HNO3 Preservation	N/A	FIELD	N/A	ONSITE	FIELD	N/A	ONSITE	FIELD	N/A	ONSITE
Nitrate (N)	mg/L	52.1	0.80	6937464	2.63	0.040	6937464	1.11	0.020	6937464
Misc. Inorganics										
Fluoride (F)	mg/L	<0.010	0.010	6946656	0.300	0.010	6946656	0.360	0.010	6946656
Alkalinity (Total as CaCO3)	mg/L	173	0.50	6944431	394	0.50	6944431	415	0.50	6944431
Alkalinity (PP as CaCO3)	mg/L	<0.50	0.50	6944431	12.7	0.50	6944431	15.3	0.50	6944431
Bicarbonate (HCO3)	mg/L	211	0.50	6944431	450	0.50	6944431	469	0.50	6944431
Carbonate (CO3)	mg/L	<0.50	0.50	6944431	15.3	0.50	6944431	18.4	0.50	6944431
Hydroxide (OH)	mg/L	<0.50	0.50	6944431	<0.50	0.50	6944431	<0.50	0.50	6944431
Anions										
Dissolved Sulphate (SO4)	mg/L	311	5.0	6943938	122	0.50	6943938	84.8	0.50	6943938
Dissolved Chloride (Cl)	mg/L	3.3	0.50	6943901	1.8	0.50	6943901	2.0	0.50	6943901
Nutrients										
Ammonia (N)	mg/L	1.2	0.0050	6941772	0.24	0.0050	6941772	0.063	0.0050	6941772
Nitrate plus Nitrite (N)	mg/L	52.2(1)	0.80	6944721	2.69(1)	0.040	6944721	1.11(1)	0.020	6945980
Physical Properties										
Conductivity	uS/cm	1260	1.0	6944436	879	1.0	6944436	848	1.0	6944436
pH	pH Units	8.16		6944434	8.52		6944434	8.55		6944434
Physical Properties										
Total Suspended Solids	mg/L	32.1	1.0	6944105	45.0	1.0	6944105	<1.0	1.0	6944105
Total Dissolved Solids	mg/L	962	10	6941744	660	10	6941744	534	10	6941744

N/A = Not Applicable
RDL = Reportable Detection Limit
(1) - Sample analysed past recommended hold time.
(2) - Sample analyzed past recommended hold time.

CCME DISSOLVED METALS IN WATER (WATER)

Maxxam ID		GT5892	GT5893	GT5894	GT5895		GT5896		
Sampling Date		2013/06/24 09:36	2013/06/24 00:00	2013/06/24 00:00	2013/06/24 00:00		2013/06/24 00:00		
	UNITS	**SS4**	**SS11**	**SS12**	**SS13**	**QC Batch**	**SS14**	**RDL**	**QC Batch**
Misc. Inorganics									
Dissolved Hardness (CaCO3)	mg/L	527	362	485	306	6940598	205	0.50	6940598
Elements									
Dissolved Mercury (Hg)	ug/L	<0.010	<0.010	<0.010	<0.010	6956380	<0.010	0.010	6956380
Dissolved Metals by ICPMS									
Dissolved Aluminum (Al)	ug/L	69.6	12.7	3.1	93.2	6951232	13.3	3.0	6951235
Dissolved Antimony (Sb)	ug/L	<0.50	<0.50	<0.50	<0.50	6951232	<0.50	0.50	6951235
Dissolved Arsenic (As)	ug/L	0.61	0.80	0.58	0.62	6951232	0.66	0.10	6951235
Dissolved Barium (Ba)	ug/L	118	181	65.8	89.5	6951232	366	1.0	6951235
Dissolved Beryllium (Be)	ug/L	<0.10	<0.10	<0.10	<0.10	6951232	<0.10	0.10	6951235
Dissolved Bismuth (Bi)	ug/L	<1.0	<1.0	<1.0	<1.0	6951232	<1.0	1.0	6951235
Dissolved Boron (B)	ug/L	<50	<50	57	<50	6951232	<50	50	6951235
Dissolved Cadmium (Cd)	ug/L	0.156	0.047	0.089	0.079	6951232	<0.010	0.010	6951235
Dissolved Chromium (Cr)	ug/L	<1.0	<1.0	<1.0	<1.0	6951232	<1.0	1.0	6951235
Dissolved Cobalt (Co)	ug/L	1.10	1.97	<0.50	<0.50	6951232	1.53	0.50	6951235
Dissolved Copper (Cu)	ug/L	133	45.9	56.9	31.8	6951232	1.71	0.20	6951235
Dissolved Iron (Fe)	ug/L	428	350	5.4	93.5	6951232	607	5.0	6951235
Dissolved Lead (Pb)	ug/L	0.21	<0.20	<0.20	<0.20	6951232	<0.20	0.20	6951235
Dissolved Lithium (Li)	ug/L	<5.0	<5.0	<5.0	<5.0	6951232	<5.0	5.0	6951235
Dissolved Manganese (Mn)	ug/L	2190	742	65.0	392	6951232	978	1.0	6951235
Dissolved Molybdenum (Mo)	ug/L	3.8	11.5	7.6	7.1	6951232	<1.0	1.0	6951235
Dissolved Nickel (Ni)	ug/L	<1.0	1.4	<1.0	<1.0	6951232	<1.0	1.0	6951235
Dissolved Phosphorus (P)	ug/L	101	20	<10	288	6951232	32	10	6951235
Dissolved Selenium (Se)	ug/L	2.87	10.4	50.3	3.06	6951232	0.14	0.10	6951235
Dissolved Silicon (Si)	ug/L	8780	4670	4120	6790	6951232	4730	100	6951235
Dissolved Silver (Ag)	ug/L	<0.020	<0.020	<0.020	<0.020	6951232	<0.020	0.020	6951235
Dissolved Strontium (Sr)	ug/L	918	829	4110	431	6951232	267	1.0	6951235
Dissolved Thallium (Tl)	ug/L	<0.050	<0.050	<0.050	<0.050	6951232	<0.050	0.050	6951235
Dissolved Tin (Sn)	ug/L	<5.0	<5.0	<5.0	<5.0	6951232	<5.0	5.0	6951235
Dissolved Titanium (Ti)	ug/L	<5.0	<5.0	<5.0	<5.0	6951232	<5.0	5.0	6951235
Dissolved Uranium (U)	ug/L	6.39	4.84	4.69	2.05	6951232	0.17	0.10	6951235
Dissolved Vanadium (V)	ug/L	<5.0	<5.0	<5.0	<5.0	6951232	<5.0	5.0	6951235
Dissolved Zinc (Zn)	ug/L	8.8	<5.0	<5.0	12.7	6951232	<5.0	5.0	6951235
Dissolved Zirconium (Zr)	ug/L	<0.50	<0.50	<0.50	<0.50	6951232	<0.50	0.50	6951235
Dissolved Calcium (Ca)	mg/L	153	99.0	152	98.1	6938014	60.3	0.050	6938014

RDL = Reportable Detection Limit

CCME DISSOLVED METALS IN WATER (WATER)

Maxxam ID		GT5892	GT5893	GT5894	GT5895		GT5896		
Sampling Date		2013/06/24 09:36	2013/06/24 00:00	2013/06/24 00:00	2013/06/24 00:00		2013/06/24 00:00		
	UNITS	**SS4**	**SS11**	**SS12**	**SS13**	**QC Batch**	**SS14**	**RDL**	**QC Batch**
Dissolved Magnesium (Mg)	mg/L	35.4	27.9	25.7	14.9	6938014	13.3	0.050	6938014
Dissolved Potassium (K)	mg/L	5.73	4.79	2.51	6.46	6938014	3.14	0.050	6938014
Dissolved Sodium (Na)	mg/L	16.7	16.6	21.4	10.3	6938014	5.45	0.050	6938014
Dissolved Sulphur (S)	mg/L	20.5	33.7	61.5	24.1	6938014	18.6	3.0	6938014

RDL = Reportable Detection Limit

Maxxam Job #: B354015
Report Date: 2013/07/08

MINTO EXPLORATIONS LTD.
Client Project #: MINTO.ENV. MONITORING

Your P.O. #: 204251

CCME DISSOLVED METALS IN WATER (WATER)

Maxxam ID		GT5897		GT5898		GT5899		GT5900		
Sampling Date		2013/06/24 00:00		2013/06/24 00:00		2013/06/24 00:00		2013/06/24 00:00		
	UNITS	**SS15**	**QC Batch**	**SS16**	**QC Batch**	**SS17**	**QC Batch**	**SS18**	**RDL**	**QC Batch**
Misc. Inorganics										
Dissolved Hardness (CaCO3)	mg/L	260	6940598	579	6940598	412	6940598	402	0.50	6940598
Elements										
Dissolved Mercury (Hg)	ug/L	<0.010	6956380	<0.010	6956380	<0.010	6956711	<0.010	0.010	6956711
Dissolved Metals by ICPMS										
Dissolved Aluminum (Al)	ug/L	8.5	6951232	3.1	6951235	30.9	6951235	27.6	3.0	6951232
Dissolved Antimony (Sb)	ug/L	<0.50	6951232	<0.50	6951235	<0.50	6951235	<0.50	0.50	6951232
Dissolved Arsenic (As)	ug/L	0.38	6951232	0.52	6951235	1.11	6951235	0.86	0.10	6951232
Dissolved Barium (Ba)	ug/L	440	6951232	37.8	6951235	86.3	6951235	88.0	1.0	6951232
Dissolved Beryllium (Be)	ug/L	<0.10	6951232	<0.10	6951235	<0.10	6951235	<0.10	0.10	6951232
Dissolved Bismuth (Bi)	ug/L	<1.0	6951232	<1.0	6951235	<1.0	6951235	<1.0	1.0	6951232
Dissolved Boron (B)	ug/L	<50	6951232	72	6951235	<50	6951235	<50	50	6951232
Dissolved Cadmium (Cd)	ug/L	0.033	6951232	0.063	6951235	0.096	6951235	<0.010	0.010	6951232
Dissolved Chromium (Cr)	ug/L	<1.0	6951232	<1.0	6951235	<1.0	6951235	<1.0	1.0	6951232
Dissolved Cobalt (Co)	ug/L	1.00	6951232	<0.50	6951235	<0.50	6951235	<0.50	0.50	6951232
Dissolved Copper (Cu)	ug/L	10.7	6951232	81.5	6951235	132	6951235	18.1	0.20	6951232
Dissolved Iron (Fe)	ug/L	195	6951232	<5.0	6951235	80.6	6951235	62.6	5.0	6951232
Dissolved Lead (Pb)	ug/L	<0.20	6951232	<0.20	6951235	<0.20	6951235	<0.20	0.20	6951232
Dissolved Lithium (Li)	ug/L	<5.0	6951232	7.2	6951235	9.0	6951235	11.9	5.0	6951232
Dissolved Manganese (Mn)	ug/L	871	6951232	184	6951235	432	6951235	3.1	1.0	6951232
Dissolved Molybdenum (Mo)	ug/L	2.2	6951232	30.5	6951235	2.8	6951235	1.9	1.0	6951232
Dissolved Nickel (Ni)	ug/L	<1.0	6951232	<1.0	6951235	1.1	6951235	<1.0	1.0	6951232
Dissolved Phosphorus (P)	ug/L	<10	6951232	<10	6951235	57	6951235	39	10	6951232
Dissolved Selenium (Se)	ug/L	0.53	6951232	34.5	6951235	4.76	6951235	1.59	0.10	6951232
Dissolved Silicon (Si)	ug/L	5070	6951232	4090	6951235	7660	6951235	7450	100	6951232
Dissolved Silver (Ag)	ug/L	<0.020	6951232	<0.020	6951235	<0.020	6951235	<0.020	0.020	6951232
Dissolved Strontium (Sr)	ug/L	271	6951232	3700	6951235	1670	6951235	1330	1.0	6951232
Dissolved Thallium (Tl)	ug/L	<0.050	6951232	<0.050	6951235	<0.050	6951235	<0.050	0.050	6951232
Dissolved Tin (Sn)	ug/L	<5.0	6951232	<5.0	6951235	<5.0	6951235	<5.0	5.0	6951232
Dissolved Titanium (Ti)	ug/L	<5.0	6951232	<5.0	6951235	<5.0	6951235	<5.0	5.0	6951232
Dissolved Uranium (U)	ug/L	0.78	6951232	8.11	6951235	2.96	6951235	3.62	0.10	6951232
Dissolved Vanadium (V)	ug/L	<5.0	6951232	<5.0	6951235	<5.0	6951235	<5.0	5.0	6951232
Dissolved Zinc (Zn)	ug/L	<5.0	6951232	<5.0	6951235	<5.0	6951235	<5.0	5.0	6951232
Dissolved Zirconium (Zr)	ug/L	<0.50	6951232	<0.50	6951235	<0.50	6951235	<0.50	0.50	6951232
Dissolved Calcium (Ca)	mg/L	78.8	6938014	130	6938014	68.0	6938014	62.5	0.050	6938014

RDL = Reportable Detection Limit

CCME DISSOLVED METALS IN WATER (WATER)

Maxxam ID		GT5897		GT5898		GT5899		GT5900		
Sampling Date		2013/06/24 00:00		2013/06/24 00:00		2013/06/24 00:00		2013/06/24 00:00		
	UNITS	**SS15**	**QC Batch**	**SS16**	**QC Batch**	**SS17**	**QC Batch**	**SS18**	**RDL**	**QC Batch**
Dissolved Magnesium (Mg)	mg/L	15.3	6938014	61.6	6938014	58.8	6938014	59.7	0.050	6938014
Dissolved Potassium (K)	mg/L	2.75	6938014	7.51	6938014	4.15	6938014	3.54	0.050	6938014
Dissolved Sodium (Na)	mg/L	5.63	6938014	33.9	6938014	36.3	6938014	34.6	0.050	6938014
Dissolved Sulphur (S)	mg/L	20.5	6938014	124	6938014	42.5	6938014	28.4	3.0	6938014

RDL = Reportable Detection Limit

General Comments

Sample GT5892-01: The BC-MOE and APHA Standard Method require pH to be analysed within 15 minutes of sampling and therefore field analysis is required for compliance. All Laboratory pH analyses in this report are reported past the BC-MOE/APHA Standard Method holding time.

Sample GT5893-01: The BC-MOE and APHA Standard Method require pH to be analysed within 15 minutes of sampling and therefore field analysis is required for compliance. All Laboratory pH analyses in this report are reported past the BC-MOE/APHA Standard Method holding time.

Sample GT5894-01: The BC-MOE and APHA Standard Method require pH to be analysed within 15 minutes of sampling and therefore field analysis is required for compliance. All Laboratory pH analyses in this report are reported past the BC-MOE/APHA Standard Method holding time.

Sample GT5895-01: The BC-MOE and APHA Standard Method require pH to be analysed within 15 minutes of sampling and therefore field analysis is required for compliance. All Laboratory pH analyses in this report are reported past the BC-MOE/APHA Standard Method holding time.

Sample GT5896-01: The BC-MOE and APHA Standard Method require pH to be analysed within 15 minutes of sampling and therefore field analysis is required for compliance. All Laboratory pH analyses in this report are reported past the BC-MOE/APHA Standard Method holding time.

Sample GT5897-01: The BC-MOE and APHA Standard Method require pH to be analysed within 15 minutes of sampling and therefore field analysis is required for compliance. All Laboratory pH analyses in this report are reported past the BC-MOE/APHA Standard Method holding time.

Sample GT5898-01: The BC-MOE and APHA Standard Method require pH to be analysed within 15 minutes of sampling and therefore field analysis is required for compliance. All Laboratory pH analyses in this report are reported past the BC-MOE/APHA Standard Method holding time.

Sample GT5899-01: The BC-MOE and APHA Standard Method require pH to be analysed within 15 minutes of sampling and therefore field analysis is required for compliance. All Laboratory pH analyses in this report are reported past the BC-MOE/APHA Standard Method holding time.

Sample GT5900-01: The BC-MOE and APHA Standard Method require pH to be analysed within 15 minutes of sampling and therefore field analysis is required for compliance. All Laboratory pH analyses in this report are reported past the BC-MOE/APHA Standard Method holding time.

QUALITY ASSURANCE REPORT

			Matrix Spike		Spiked Blank		Method Blank		RPD	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits
6941744	Total Dissolved Solids	2013/06/29	NC	80 - 120	108	80 - 120	<10	mg/L	3.4	20
6941772	Ammonia (N)	2013/06/28	96	80 - 120	101	80 - 120	<0.0050	mg/L	NC	20
6943901	Dissolved Chloride (Cl)	2013/06/28	98	80 - 120	98	80 - 120	<0.50	mg/L	3.3	20
6943938	Dissolved Sulphate (SO4)	2013/06/28	NC	80 - 120	94	80 - 120	<0.50	mg/L	0.7	20
6944105	Total Suspended Solids	2013/07/02			102	80 - 120	<1.0	mg/L		
6944431	Alkalinity (Total as CaCO3)	2013/06/29	NC	80 - 120	101	80 - 120	<0.50	mg/L	0.06	20
6944431	Alkalinity (PP as CaCO3)	2013/06/29					<0.50	mg/L	NC	20
6944431	Bicarbonate (HCO3)	2013/06/29					<0.50	mg/L	0.08	20
6944431	Carbonate (CO3)	2013/06/29					<0.50	mg/L	NC	20
6944431	Hydroxide (OH)	2013/06/29					<0.50	mg/L	NC	20
6944436	Conductivity	2013/06/30			100	80 - 120	<1.0	uS/cm	0.4	20
6944721	Nitrate plus Nitrite (N)	2013/06/29	107	80 - 120	106	80 - 120	<0.020	mg/L	0.6	25
6944722	Nitrite (N)	2013/06/29	91	80 - 120	98	80 - 120	<0.0050	mg/L	0	20
6945980	Nitrate plus Nitrite (N)	2013/06/28	98	80 - 120	103	80 - 120	<0.020	mg/L	NC	25
6945990	Nitrite (N)	2013/06/28	91	80 - 120	97	80 - 120	<0.0050	mg/L	NC	20
6946656	Fluoride (F)	2013/07/02	NC	80 - 120	96	80 - 120	<0.010	mg/L	NC	20
6949096	Dissolved Sulphate (SO4)	2013/07/02	NC	80 - 120	92	80 - 120	<0.50	mg/L	1.2	20
6951232	Dissolved Aluminum (Al)	2013/07/05	108	80 - 120	102	80 - 120	<3.0	ug/L		
6951232	Dissolved Antimony (Sb)	2013/07/05	101	80 - 120	99	80 - 120	<0.50	ug/L	NC	20
6951232	Dissolved Arsenic (As)	2013/07/05	104	80 - 120	99	80 - 120	<0.10	ug/L	NC	20
6951232	Dissolved Barium (Ba)	2013/07/05	NC	80 - 120	98	80 - 120	<1.0	ug/L	0.04	20
6951232	Dissolved Beryllium (Be)	2013/07/05	103	80 - 120	98	80 - 120	<0.10	ug/L	NC	20
6951232	Dissolved Bismuth (Bi)	2013/07/05	97	80 - 120	103	80 - 120	<1.0	ug/L	NC	20
6951232	Dissolved Cadmium (Cd)	2013/07/05	102	80 - 120	99	80 - 120	<0.010	ug/L	0.7	20
6951232	Dissolved Chromium (Cr)	2013/07/05	102	80 - 120	102	80 - 120	<1.0	ug/L	NC	20
6951232	Dissolved Cobalt (Co)	2013/07/05	100	80 - 120	100	80 - 120	<0.50	ug/L	NC	20
6951232	Dissolved Copper (Cu)	2013/07/05	97	80 - 120	99	80 - 120	<0.20	ug/L	NC	20
6951232	Dissolved Iron (Fe)	2013/07/05	103	80 - 120	107	80 - 120	<5.0	ug/L	NC	20
6951232	Dissolved Lead (Pb)	2013/07/05	97	80 - 120	101	80 - 120	<0.20	ug/L		
6951232	Dissolved Lithium (Li)	2013/07/05	100	80 - 120	99	80 - 120	<5.0	ug/L	NC	20
6951232	Dissolved Manganese (Mn)	2013/07/05	98	80 - 120	99	80 - 120	<1.0	ug/L	NC	20
6951232	Dissolved Molybdenum (Mo)	2013/07/05	NC	80 - 120	95	80 - 120	<1.0	ug/L	NC	20
6951232	Dissolved Nickel (Ni)	2013/07/05	99	80 - 120	100	80 - 120	<1.0	ug/L	NC	20
6951232	Dissolved Selenium (Se)	2013/07/05	111	80 - 120	104	80 - 120	<0.10	ug/L		
6951232	Dissolved Silver (Ag)	2013/07/05	101	80 - 120	95	80 - 120	<0.020	ug/L	NC	20
6951232	Dissolved Strontium (Sr)	2013/07/05	NC	80 - 120	94	80 - 120	<1.0	ug/L	1.8	20
6951232	Dissolved Thallium (Tl)	2013/07/05	96	80 - 120	102	80 - 120	<0.050	ug/L	NC	20
6951232	Dissolved Tin (Sn)	2013/07/05	98	80 - 120	98	80 - 120	<5.0	ug/L	NC	20
6951232	Dissolved Titanium (Ti)	2013/07/05	116	80 - 120	103	80 - 120	<5.0	ug/L	NC	20

Maxxam

Success Through Science®

Maxxam Job #: B354015
Report Date: 2013/07/08

MINTO EXPLORATIONS LTD.
Client Project #: MINTO.ENV. MONITORING

Your P.O. #: 204251

QUALITY ASSURANCE REPORT

			Matrix Spike		Spiked Blank		Method Blank		RPD	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits
6951232	Dissolved Uranium (U)	2013/07/05	97	80 - 120	97	80 - 120	<0.10	ug/L	3.7	20
6951232	Dissolved Vanadium (V)	2013/07/05	98	80 - 120	96	80 - 120	<5.0	ug/L	NC	20
6951232	Dissolved Zinc (Zn)	2013/07/05	NC	80 - 120	99	80 - 120	<5.0	ug/L	NC	20
6951232	Dissolved Boron (B)	2013/07/05					<50	ug/L	NC	20
6951232	Dissolved Phosphorus (P)	2013/07/05					<10	ug/L		
6951232	Dissolved Silicon (Si)	2013/07/05					<100	ug/L	1.2	20
6951232	Dissolved Zirconium (Zr)	2013/07/05					<0.50	ug/L	NC	20
6951235	Dissolved Aluminum (Al)	2013/07/05	108	80 - 120	105	80 - 120	<3.0	ug/L	NC	20
6951235	Dissolved Antimony (Sb)	2013/07/05	102	80 - 120	96	80 - 120	<0.50	ug/L	NC	20
6951235	Dissolved Arsenic (As)	2013/07/05	109	80 - 120	97	80 - 120	<0.10	ug/L	7.1	20
6951235	Dissolved Barium (Ba)	2013/07/05	NC	80 - 120	100	80 - 120	<1.0	ug/L	0.3	20
6951235	Dissolved Beryllium (Be)	2013/07/05	104	80 - 120	100	80 - 120	<0.10	ug/L	NC	20
6951235	Dissolved Bismuth (Bi)	2013/07/05	99	80 - 120	100	80 - 120	<1.0	ug/L	NC	20
6951235	Dissolved Cadmium (Cd)	2013/07/05	104	80 - 120	100	80 - 120	<0.010	ug/L	NC	20
6951235	Dissolved Chromium (Cr)	2013/07/05	96	80 - 120	98	80 - 120	<1.0	ug/L	NC	20
6951235	Dissolved Cobalt (Co)	2013/07/05	96	80 - 120	99	80 - 120	<0.50	ug/L	NC	20
6951235	Dissolved Copper (Cu)	2013/07/05	94	80 - 120	96	80 - 120	<0.20	ug/L	3.2	20
6951235	Dissolved Iron (Fe)	2013/07/05	NC	80 - 120	105	80 - 120	<5.0	ug/L	0.4	20
6951235	Dissolved Lead (Pb)	2013/07/05	99	80 - 120	102	80 - 120	<0.20	ug/L	NC	20
6951235	Dissolved Lithium (Li)	2013/07/05	107	80 - 120	102	80 - 120	<5.0	ug/L	NC	20
6951235	Dissolved Manganese (Mn)	2013/07/05	NC	80 - 120	101	80 - 120	<1.0	ug/L	3.3	20
6951235	Dissolved Molybdenum (Mo)	2013/07/05	NC	80 - 120	102	80 - 120	<1.0	ug/L	NC	20
6951235	Dissolved Nickel (Ni)	2013/07/05	94	80 - 120	97	80 - 120	<1.0	ug/L	NC	20
6951235	Dissolved Selenium (Se)	2013/07/05	110	80 - 120	105	80 - 120	<0.10	ug/L	NC	20
6951235	Dissolved Silver (Ag)	2013/07/05	97	80 - 120	93	80 - 120	<0.020	ug/L	NC	20
6951235	Dissolved Strontium (Sr)	2013/07/05	NC	80 - 120	101	80 - 120	<1.0	ug/L	4.4	20
6951235	Dissolved Thallium (Tl)	2013/07/05	97	80 - 120	102	80 - 120	<0.050	ug/L	NC	20
6951235	Dissolved Tin (Sn)	2013/07/05	100	80 - 120	97	80 - 120	<5.0	ug/L	NC	20
6951235	Dissolved Titanium (Ti)	2013/07/05	94	80 - 120	94	80 - 120	<5.0	ug/L	NC	20
6951235	Dissolved Uranium (U)	2013/07/05	102	80 - 120	99	80 - 120	<0.10	ug/L	NC	20
6951235	Dissolved Vanadium (V)	2013/07/05	100	80 - 120	99	80 - 120	<5.0	ug/L	NC	20
6951235	Dissolved Zinc (Zn)	2013/07/05	115	80 - 120	100	80 - 120	<5.0	ug/L	NC	20
6951235	Dissolved Boron (B)	2013/07/05					<50	ug/L	NC	20
6951235	Dissolved Phosphorus (P)	2013/07/05					<10	ug/L	NC	20
6951235	Dissolved Silicon (Si)	2013/07/05					<100	ug/L	1.4	20
6951235	Dissolved Zirconium (Zr)	2013/07/05					<0.50	ug/L	NC	20

QUALITY ASSURANCE REPORT

			Matrix Spike		Spiked Blank		Method Blank		RPD	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits
6956380	Dissolved Mercury (Hg)	2013/07/05	97	80 - 120	90	80 - 120	<0.010	ug/L	NC	20
6956711	Dissolved Mercury (Hg)	2013/07/05	101	80 - 120	98	80 - 120	<0.010	ug/L	NC	20

N/A = Not Applicable
RPD = Relative Percent Difference
Duplicate: Paired analysis of a separate portion of the same sample. Used to evaluate the variance in the measurement.
Matrix Spike: A sample to which a known amount of the analyte of interest has been added. Used to evaluate sample matrix interference.
Spiked Blank: A blank matrix sample to which a known amount of the analyte, usually from a second source, has been added. Used to evaluate method accuracy.
Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.
NC (Matrix Spike): The recovery in the matrix spike was not calculated. The relative difference between the concentration in the parent sample and the spiked amount was not sufficiently significant to permit a reliable recovery calculation.
NC (RPD): The RPD was not calculated. The level of analyte detected in the parent sample and its duplicate was not sufficiently significant to permit a reliable calculation.

Maxxam

Burnaby: 4606 Canada Way, Burnaby, BC V5G 1K5 Ph: (604) 734-7276 Fax (604) 731-2386, Toll Free: (800) 665-8566

CHAIN OF CUSTODY RECORD

Maxxam Job #: B354015

Click here to get the COC number

COC #: EB770313

Page: 1 of 1

Invoice To: Require Report? Yes ☑ No ☐

Company Name:	Minto Explorations Ltd
Contact Name:	Elvina Wong
Address:	Suite 900 - 999 West Hastings St
	Vancouver, B.C. PC: V6C 2W2
Phone / Fax#:	Ph: 604-684-8894 Fax: 604-688-2120
E-mail	

Report To:

Company Name:	Minto Explorations Ltd
Contact Name:	Minto Environment
Address:	Suite 900-999 West Hastings St
	Vancouver, B.C. PC: V6C 2W2
Phone / Fax#:	Ph: 604-684-8894 Fax: 604-688-2120
E-mail	minto_environment@mintomine.com

PO #:	204251
Quotation #:	
Project # :	
Proj. Name:	Minto Env. Monitoring
Location:	Yukon
Sampled by:	

REGULATORY REQUIREMENTS:

- ☐ CSR
- ☑ CCME
- ☐ BC Water Quality
- ☐ Other
- ☐ DRINKING WATER

SERVICE REQUESTED:

- ◉ Regular Turn Around Time (TAT) (5 days for most tests)
- **RUSH** (Please contact the lab)
  - ○ 1 Day ○ 2 Day ○ 3 Day
- Date Required:

SPECIAL INSTRUCTIONS:

Return Cooler ☐ **Ship Sample Bottles (please specify)** ☐

ANALYSIS REQUESTED

Field Filtered? Y ☑ N ☐ — Dissolved Metals (DM); Field Acidified? Y ☑ N ☐ — Dissolved Metals (DM); Field Acidified? Y ☑ N ☐ — Total Metals; ☑ Nitrate ☐ Nitrite ☑ Ammonia ☑; ☑ Total Suspended Solids (TSS) ☑ TDS ☑; ☑ pH ☑ Conductivity ☑ Alkalinity ☑; ☑ Chloride ☑ Fluoride ☑ Sulphate ☑

#	Sample Identification	Lab Identification (Lab Use Only)	Sample Type	Date/Time(24hr) Sampled	Dissolved Metals (DM) – Field Filtered?	Dissolved Metals (DM) – Field Acidified?	Total Metals – Field Acidified?	Nitrate / Nitrite / Ammonia	Total Suspended Solids (TSS) / TDS	pH / Conductivity / Alkalinity	Chloride / Fluoride / Sulphate	Phosphate	DOC (Diss'd Organic Carbon)	TOC (Total Organic Carbon)	Ra 226	Number of Containers
1	SS4 GT5892		Water	6/24/13 9:36	X	X		X	X	X	X					4
2	SS11 GT5893			6/24/13 0:00	X	X		X	X	X	X					4
3	SS12 GT5894			6/24/13 0:00	X	X		X	X	X	X					4
4	SS13 GT5895			6/24/13 9:50	X	X		X	X	X	X					4
5	SS14 GT5896			6/24/13 0:00	X	X		X	X	X	X					4
6	SS15 GT5897			6/24/13 0:00	X	X		X	X	X	X					4
7	SS16 GT5898			6/24/13 0:00	X	X		X	X	X	X					4
8	SS17 GT5899			6/24/13 0:00	X	X		X	X	X	X					4
9	SS18 GT5900			6/24/13 0:00	X	X		X	X	X	X					4
10																
11																
12																

B354015

*Relinquished By: (Print name and sign)	Date (yy/mm/dd):	Time (24hr):	Received by : (Print name and sign)	Date (yy/mm/dd):	Time (24 hr):	Time Sensitive	Temperature on Receipt (°C) (Laboratory Use Only)	Custody Seal	Yes	No
Phil Emerson			Wilson Tsai	13/06/27	09:00	☑	A) 4 B) 3 C) 4	Present?		N/A
							Just sampled & rec'd on ice: ☐	Intact?		

*IT IS THE RESPONSIBILITY OF THE RELINQUISHER TO ENSURE THE ACCURACY OF THE CHAIN OF CUSTODY RECORDS. AN INCOMPLETE CHAIN OF CUSTODY MAY RESULT IN ANALYTICAL TAT DELAYS.

Maxxam

Success Through Science®

Your P.O. #: 204251
Your Project #: MINTO ENV. MONITORING
Site Location: YUKON
Your C.O.C. #: EB869713

Attention: MINTO DISTRIBUTION LIST
MINTO EXPLORATIONS LTD.
Yukon/Whitehorse
2 - 25 Pilgrim Way
Whitehorse, YT
CANADA Y1A 6E6

Report Date: 2013/10/25

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B396894
Received: 2013/10/21, 09:20

Sample Matrix: Water
Samples Received: 2

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Analytical Method
Alkalinity - Water	2	2013/10/22	2013/10/23	BBY6SOP-00026	SM2320B
Chloride by Automated Colourimetry	2	N/A	2013/10/22	BBY6SOP-00011	SM-4500-Cl-
Conductance - water	2	N/A	2013/10/23	BBY6SOP-00026	SM-2510B
Fluoride	2	N/A	2013/10/23	BBY6SOP-00012	SM - 4500 F C
Hardness (calculated as CaCO3)	2	N/A	2013/10/25	BBY7SOP-00002	EPA 6020A
Mercury (Dissolved) by CVAF	2	N/A	2013/10/25	BBY7SOP-00015	EPA 245.7
Na, K, Ca, Mg, S by CRC ICPMS (diss.)	2	N/A	2013/10/25	BBY7SOP-00002	EPA 6020A
Elements by CRC ICPMS (dissolved)	2	N/A	2013/10/25	BBY7SOP-00002	EPA 6020A
Ammonia-N (Preserved)	2	N/A	2013/10/22	BBY6SOP-00009	SM-4500NH3G
Nitrate + Nitrite (N)	2	N/A	2013/10/22	BBY6SOP-00010	SM 4500NO3-I
Nitrite (N) by CFA	2	N/A	2013/10/22	BBY6SOP-00010	EPA 353.2
Nitrogen - Nitrate (as N)	2	N/A	2013/10/23	BBY6SOP-00010	SM 4500NO3-I
Filter and HNO3 Preserve for Metals	2	N/A	2013/10/21	BBY6WI-00001	EPA 200.2
pH Water	2	N/A	2013/10/23	BBY6SOP-00026	SM-4500H+B
Sulphate by Automated Colourimetry	1	N/A	2013/10/22	BBY6SOP-00017	SM4500-SO42- E
Sulphate by Automated Colourimetry	1	N/A	2013/10/23	BBY6SOP-00017	SM4500-SO42- E
Total Dissolved Solids (Filt. Residue)	2	2013/10/22	2013/10/23	BBY6SOP-00033	SM 2540C
Total Suspended Solids-Low Level	2	2013/10/22	2013/10/23	BBY6SOP-00034	SM-2540 D

* Results relate only to the items tested.

Encryption Key

Please direct all questions regarding this Certificate of Analysis to your Project Manager.

Ken Pomeroy, Project Manager
Email: KPomeroy@maxxam.ca
Phone# (604) 638-5020

==
This report has been generated and distributed using a secure automated process.
Maxxam has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per section 5.10.2 of ISO/IEC 17025:2005(E), signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

Total cover pages: 1

Maxxam Job #: B396894
Report Date: 2013/10/25

MINTO EXPLORATIONS LTD.
Client Project #: MINTO ENV. MONITORING
Site Location: YUKON
Your P.O. #: 204251

RESULTS OF CHEMICAL ANALYSES OF WATER

Maxxam ID		HW4794			HW4795		
Sampling Date		2013/10/16 14:00			2013/10/16 14:30		
	UNITS	**SS17**	**RDL**	**QC Batch**	**SS18**	**RDL**	**QC Batch**
ANIONS							
Nitrite (N)	mg/L	<0.050(1)	0.050	7242483	<0.0050(2)	0.0050	7242483
Calculated Parameters							
Filter and HNO3 Preservation	N/A	FIELD	N/A	ONSITE	FIELD	N/A	ONSITE
Nitrate (N)	mg/L	0.24	0.20	7239545	0.741	0.020	7239545
Misc. Inorganics							
Fluoride (F)	mg/L	0.320	0.010	7243947	0.320	0.010	7243947
Alkalinity (Total as CaCO3)	mg/L	388	0.50	7242954	422	0.50	7242954
Alkalinity (PP as CaCO3)	mg/L	<0.50	0.50	7242954	3.46	0.50	7242954
Bicarbonate (HCO3)	mg/L	473	0.50	7242954	507	0.50	7242954
Carbonate (CO3)	mg/L	<0.50	0.50	7242954	4.15	0.50	7242954
Hydroxide (OH)	mg/L	<0.50	0.50	7242954	<0.50	0.50	7242954
Anions							
Dissolved Sulphate (SO4)	mg/L	75.0	0.50	7242897	94.7	0.50	7244533
Dissolved Chloride (Cl)	mg/L	2.1	0.50	7242866	1.8	0.50	7242866
Nutrients							
Ammonia (N)	mg/L	0.60	0.0050	7243000	0.0069	0.0050	7243000
Nitrate plus Nitrite (N)	mg/L	0.24(1)	0.20	7242433	0.741(2)	0.020	7242433
Physical Properties							
Conductivity	uS/cm	795	1.0	7242972	865	1.0	7242972
pH	pH Units	8.11		7242971	8.32		7242971
Physical Properties							
Total Suspended Solids	mg/L	77.3	1.0	7241606	77.2	1.0	7241606
Total Dissolved Solids	mg/L	524	10	7241686	532	10	7241686

N/A = Not Applicable
RDL = Reportable Detection Limit
(1) - RDL raised due to sample matrix interference.
(2) - Sample arrived to laboratory past recommended hold time.

Maxxam Job #: B396894
Report Date: 2013/10/25

MINTO EXPLORATIONS LTD.
Client Project #: MINTO ENV. MONITORING
Site Location: YUKON
Your P.O. #: 204251

CCME DISSOLVED METALS IN WATER (WATER)

Maxxam ID		HW4794	HW4795		
Sampling Date		2013/10/16 14:00	2013/10/16 14:30		
	UNITS	**SS17**	**SS18**	**RDL**	**QC Batch**
Misc. Inorganics					
Dissolved Hardness (CaCO3)	mg/L	368	425	0.50	7238581
Elements					
Dissolved Mercury (Hg)	ug/L	<0.010	<0.010	0.010	7246639

RDL = Reportable Detection Limit

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Success Through Science®

Maxxam Job #: B396894
Report Date: 2013/10/25

MINTO EXPLORATIONS LTD.
Client Project #: MINTO ENV. MONITORING
Site Location: YUKON
Your P.O. #: 204251

CCME DISSOLVED METALS IN WATER (WATER)

Maxxam ID		HW4794	HW4795		
Sampling Date		2013/10/16 14:00	2013/10/16 14:30		
	UNITS	**SS17**	**SS18**	**RDL**	**QC Batch**
Dissolved Metals by ICPMS					
Dissolved Aluminum (Al)	ug/L	19.4	71.6	3.0	7246883
Dissolved Antimony (Sb)	ug/L	<0.50	<0.50	0.50	7246883
Dissolved Arsenic (As)	ug/L	0.79	0.19	0.10	7246883
Dissolved Barium (Ba)	ug/L	141	55.4	1.0	7246883
Dissolved Beryllium (Be)	ug/L	<0.10	<0.10	0.10	7246883
Dissolved Bismuth (Bi)	ug/L	<1.0	<1.0	1.0	7246883
Dissolved Boron (B)	ug/L	<50	<50	50	7246883
Dissolved Cadmium (Cd)	ug/L	0.017	0.067	0.010	7246883
Dissolved Chromium (Cr)	ug/L	<1.0	<1.0	1.0	7246883
Dissolved Cobalt (Co)	ug/L	1.26	<0.50	0.50	7246883
Dissolved Copper (Cu)	ug/L	8.76	55.9	0.20	7246883
Dissolved Iron (Fe)	ug/L	1000	192	5.0	7246883
Dissolved Lead (Pb)	ug/L	<0.20	<0.20	0.20	7246883
Dissolved Lithium (Li)	ug/L	8.7	12.9	5.0	7246883
Dissolved Manganese (Mn)	ug/L	692	17.3	1.0	7246883
Dissolved Molybdenum (Mo)	ug/L	2.2	1.2	1.0	7246883
Dissolved Nickel (Ni)	ug/L	1.3	<1.0	1.0	7246883
Dissolved Phosphorus (P)	ug/L	231	114	10	7246883
Dissolved Selenium (Se)	ug/L	0.50	1.02	0.10	7246883
Dissolved Silicon (Si)	ug/L	7640	7340	100	7246883
Dissolved Silver (Ag)	ug/L	<0.020	<0.020	0.020	7246883
Dissolved Strontium (Sr)	ug/L	956	1200	1.0	7246883
Dissolved Thallium (Tl)	ug/L	<0.050	<0.050	0.050	7246883
Dissolved Tin (Sn)	ug/L	<5.0	<5.0	5.0	7246883
Dissolved Titanium (Ti)	ug/L	<5.0	<5.0	5.0	7246883
Dissolved Uranium (U)	ug/L	1.43	3.63	0.10	7246883
Dissolved Vanadium (V)	ug/L	<5.0	<5.0	5.0	7246883
Dissolved Zinc (Zn)	ug/L	<5.0	12.5	5.0	7246883
Dissolved Zirconium (Zr)	ug/L	<0.50	<0.50	0.50	7246883
Dissolved Calcium (Ca)	mg/L	61.8	59.2	0.050	7238582
Dissolved Magnesium (Mg)	mg/L	51.9	67.2	0.050	7238582
Dissolved Potassium (K)	mg/L	4.47	3.38	0.050	7238582
Dissolved Sodium (Na)	mg/L	32.8	34.4	0.050	7238582
Dissolved Sulphur (S)	mg/L	27.3	37.4	3.0	7238582

RDL = Reportable Detection Limit

General Comments

Samples received at laboratory past the recommended hold time for NO2/NO3 analysis.
(jm3)

Sample HW4794-01: The BC-MOE and APHA Standard Method require pH to be analysed within 15 minutes of sampling and therefore field analysis is required for compliance. All Laboratory pH analyses in this report are reported past the BC-MOE/APHA Standard Method holding time.

Sample HW4795-01: The BC-MOE and APHA Standard Method require pH to be analysed within 15 minutes of sampling and therefore field analysis is required for compliance. All Laboratory pH analyses in this report are reported past the BC-MOE/APHA Standard Method holding time.

Maxxam

Success Through Science®

Maxxam Job #: B396894
Report Date: 2013/10/25

MINTO EXPLORATIONS LTD.
Client Project #: MINTO ENV. MONITORING
Site Location: YUKON
Your P.O. #: 204251

QUALITY ASSURANCE REPORT

			Matrix Spike		Spiked Blank		Method Blank		RPD	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits
7241606	Total Suspended Solids	2013/10/23			90	80 - 120	<1.0	mg/L		
7241686	Total Dissolved Solids	2013/10/23	NC	80 - 120	106	80 - 120	<10	mg/L	3.1	20
7242433	Nitrate plus Nitrite (N)	2013/10/22	101	80 - 120	104	80 - 120	<0.020	mg/L	0.4	25
7242483	Nitrite (N)	2013/10/22	NC	80 - 120	98	80 - 120	<0.0050	mg/L	NC	20
7242866	Dissolved Chloride (Cl)	2013/10/22	96	80 - 120	98	80 - 120	0.55, RDL=0.50	mg/L	NC	20
7242897	Dissolved Sulphate (SO4)	2013/10/22	NC	80 - 120	103	80 - 120	0.73, RDL=0.50	mg/L	2.7	20
7242954	Alkalinity (Total as CaCO3)	2013/10/23	NC	80 - 120	101	80 - 120	<0.50	mg/L	1.9	20
7242954	Alkalinity (PP as CaCO3)	2013/10/23					<0.50	mg/L	NC	20
7242954	Bicarbonate (HCO3)	2013/10/23					<0.50	mg/L	1.9	20
7242954	Carbonate (CO3)	2013/10/23					<0.50	mg/L	NC	20
7242954	Hydroxide (OH)	2013/10/23					<0.50	mg/L	NC	20
7242972	Conductivity	2013/10/23			100	80 - 120	1.3, RDL=1.0	uS/cm	1.9	20
7243000	Ammonia (N)	2013/10/22	94	80 - 120	96	80 - 120	<0.0050	mg/L	0.5	20
7243947	Fluoride (F)	2013/10/23	NC	80 - 120	98	80 - 120	<0.010	mg/L	3.9	20
7244533	Dissolved Sulphate (SO4)	2013/10/23	NC	80 - 120	98	80 - 120	0.87, RDL=0.50	mg/L	7.8	20
7246639	Dissolved Mercury (Hg)	2013/10/25	82	80 - 120	104	80 - 120	<0.010	ug/L	NC	20
7246883	Dissolved Aluminum (Al)	2013/10/25	108	80 - 120	104	80 - 120	<3.0	ug/L	NC	20
7246883	Dissolved Antimony (Sb)	2013/10/25	107	80 - 120	100	80 - 120	<0.50	ug/L	NC	20
7246883	Dissolved Arsenic (As)	2013/10/25	105	80 - 120	103	80 - 120	<0.10	ug/L	NC	20
7246883	Dissolved Barium (Ba)	2013/10/25	NC	80 - 120	101	80 - 120	<1.0	ug/L	2.2	20
7246883	Dissolved Beryllium (Be)	2013/10/25	104	80 - 120	95	80 - 120	<0.10	ug/L	NC	20
7246883	Dissolved Bismuth (Bi)	2013/10/25	100	80 - 120	99	80 - 120	<1.0	ug/L	NC	20
7246883	Dissolved Cadmium (Cd)	2013/10/25	102	80 - 120	100	80 - 120	<0.010	ug/L	NC	20
7246883	Dissolved Chromium (Cr)	2013/10/25	99	80 - 120	100	80 - 120	<1.0	ug/L	NC	20
7246883	Dissolved Cobalt (Co)	2013/10/25	98	80 - 120	100	80 - 120	<0.50	ug/L	NC	20
7246883	Dissolved Copper (Cu)	2013/10/25	94	80 - 120	98	80 - 120	<0.20	ug/L	NC	20
7246883	Dissolved Iron (Fe)	2013/10/25	104	80 - 120	109	80 - 120	<5.0	ug/L	NC	20
7246883	Dissolved Lead (Pb)	2013/10/25	97	80 - 120	97	80 - 120	<0.20	ug/L	NC	20
7246883	Dissolved Lithium (Li)	2013/10/25	105	80 - 120	94	80 - 120	<5.0	ug/L	NC	20
7246883	Dissolved Manganese (Mn)	2013/10/25	100	80 - 120	100	80 - 120	<1.0	ug/L	NC	20
7246883	Dissolved Molybdenum (Mo)	2013/10/25	101	80 - 120	101	80 - 120	<1.0	ug/L	NC	20
7246883	Dissolved Nickel (Ni)	2013/10/25	100	80 - 120	101	80 - 120	<1.0	ug/L	NC	20
7246883	Dissolved Selenium (Se)	2013/10/25	105	80 - 120	101	80 - 120	<0.10	ug/L	NC	20
7246883	Dissolved Silver (Ag)	2013/10/25	104	80 - 120	97	80 - 120	<0.020	ug/L	NC	20
7246883	Dissolved Strontium (Sr)	2013/10/25	NC	80 - 120	101	80 - 120	<1.0	ug/L	0.8	20
7246883	Dissolved Thallium (Tl)	2013/10/25	91	80 - 120	100	80 - 120	<0.050	ug/L	NC	20
7246883	Dissolved Tin (Sn)	2013/10/25	102	80 - 120	100	80 - 120	<5.0	ug/L	NC	20
7246883	Dissolved Titanium (Ti)	2013/10/25	98	80 - 120	105	80 - 120	<5.0	ug/L	NC	20
7246883	Dissolved Uranium (U)	2013/10/25	98	80 - 120	96	80 - 120	<0.10	ug/L	NC	20

Maxxam

Maxxam Job #: B396894
Report Date: 2013/10/25

MINTO EXPLORATIONS LTD.
Client Project #: MINTO ENV. MONITORING
Site Location: YUKON
Your P.O. #: 204251

QUALITY ASSURANCE REPORT

			Matrix Spike		Spiked Blank		Method Blank		RPD	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits
7246883	Dissolved Vanadium (V)	2013/10/25	102	80 - 120	98	80 - 120	<5.0	ug/L	NC	20
7246883	Dissolved Zinc (Zn)	2013/10/25	101	80 - 120	99	80 - 120	<5.0	ug/L	NC	20
7246883	Dissolved Boron (B)	2013/10/25					<50	ug/L	NC	20
7246883	Dissolved Phosphorus (P)	2013/10/25					<10	ug/L		
7246883	Dissolved Silicon (Si)	2013/10/25					<100	ug/L	1.9	20
7246883	Dissolved Zirconium (Zr)	2013/10/25					<0.50	ug/L	NC	20

N/A = Not Applicable
RDL = Reportable Detection Limit
RPD = Relative Percent Difference
Duplicate: Paired analysis of a separate portion of the same sample. Used to evaluate the variance in the measurement.
Matrix Spike: A sample to which a known amount of the analyte of interest has been added. Used to evaluate sample matrix interference.
Spiked Blank: A blank matrix sample to which a known amount of the analyte, usually from a second source, has been added. Used to evaluate method accuracy.
Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.
NC (Matrix Spike): The recovery in the matrix spike was not calculated. The relative difference between the concentration in the parent sample and the spiked amount was not sufficiently significant to permit a reliable recovery calculation.
NC (RPD): The RPD was not calculated. The level of analyte detected in the parent sample and its duplicate was not sufficiently significant to permit a reliable calculation.

Validation Signature Page

Maxxam Job #: B396894

The analytical data and all QC contained in this report were reviewed and validated by the following individual(s).

Andy Lu, Data Validation Coordinator

==

Maxxam has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per section 5.10.2 of ISO/IEC 17025:2005(E), signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

Maxxam

Burnaby: 4606 Canada Way, Burnaby, BC V5G 1K5 Ph: (604) 734-7276 Fax: (604) 731-2386, Toll Free: (800) 665-8566

CHAIN OF CUSTODY RECORD

Click here to get the COC number

Maxxam Job #: B396894 **COC #:** EB869713 Page: 1 of 1

Invoice To: Require Report? Yes ☑ No ☐		**Report To:**	
Company Name:	Minto Explorations Ltd	Company Name:	Minto Explorations Ltd
Contact Name:	Elvina Wong	Contact Name:	Minto Environment
Address:	Suite 900 - 999 West Hastings St	Address:	Suite 900-999 West Hastings St
	Vancouver, B.C. PC: V6C 2W2		Vancouver, B.C. PC: V6C 2W2
Phone / Fax#:	Ph: 604-684-8894 Fax: 604-688-2120	Phone / Fax#:	Ph: 604-684-8894 Fax: 604-688-2120
E-mail		E-mail	minto_environment@mintomine.com

PO #:	204251
Quotation #:	
Project # :	
Proj. Name:	Minto Env. Monitoring
Location:	Yukon
Sampled by:	Phil Emerson

REGULATORY REQUIREMENTS:

- ☐ CSR
- ☑ CCME
- ☐ BC Water Quality
- ☐ Other
- ☐ DRINKING WATER

SERVICE REQUESTED:

- ◉ Regular Turn Around Time (TAT) (5 days for most tests)
- **RUSH** (Please contact the lab) ◯ 1 Day ◯ 2 Day ◯ 3 Day
- Date Required:

SPECIAL INSTRUCTIONS:

Return Cooler ☐ **Ship Sample Bottles (please specify)** ☐

ANALYSIS REQUESTED

	Sample Identification	Lab Identification (Lab Use Only)	Sample Type	Date/Time(24hr) Sampled	Dissolved Metals (DM) Field Filtered? Y N	Field Acidified? Y ☑ N	Total Metals Field Acidified? Y ☑ N	☑ Nitrate ☑ Nitrite ☑ Ammonia	☑ Total Suspended Solids (TSS) ☑ TDS	☑ pH ☑ Conductivity ☑ Alkalinity	☑ Chloride ☑ Fluoride ☑ Sulphate	Phosphate	DOC (Diss'd Organic Carbon)	TOC (Total Organic Carbon)	Ra 226	Number of Containers
1	SS17	AW4794	Water	10/16/13 14:00	X	X		X	X	X	X					4
2	SS18	AW4795	Water	10/16/13 14:30	X	X		X	X	X	X					4
3																
4																
5																
6																
7																
8																
9																
10																
11																
12																

B396894

Print name and sign

*Relinquished By:	Date (yy/mm/dd):	Time (24hr):	Received by	Date (yy/mm/dd)	Time (24 hr)	Time Sensitive
Chris Harry	17-Oct-13	8:10	[illegible signature]	2013/10/21	09:20	☑

Laboratory Use Only: Temperature on Receipt (C) A) 1 B) 1 C) 1; Custody Seal Present? Yes ☐ No ☑; Intact? Yes ☐ No ☐ N/A

*IT IS THE RESPONSIBILITY OF THE RELINQUISHER TO ENSURE THE ACCURACY OF THE CHAIN OF CUSTODY RECORDS. AN INCOMPLETE CHAIN OF CUSTODY MAY RESULT IN ANALYTICAL TAT DELAYS.

Maxxam

Success Through Science®

Your P.O. #: 204251
Your Project #: MINTO ENV. MONITORING
Site Location: YUKON
Your C.O.C. #: EB866213

Attention: MINTO DISTRIBUTION LIST
MINTO EXPLORATIONS LTD.
Yukon/Whitehorse
2 - 25 Pilgrim Way
Whitehorse, YT
CANADA Y1A 6E6

Report Date: 2013/10/22

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B395345
Received: 2013/10/16, 14:00

Sample Matrix: Water
Samples Received: 1

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Analytical Method
Alkalinity - Water	1	2013/10/17	2013/10/17	BBY6SOP-00026	SM2320B
Chloride by Automated Colourimetry	1	N/A	2013/10/17	BBY6SOP-00011	SM-4500-Cl-
Conductance - water	1	N/A	2013/10/17	BBY6SOP-00026	SM-2510B
Fluoride	1	N/A	2013/10/22	BBY6SOP-00012	SM - 4500 F C
Hardness (calculated as CaCO3)	1	N/A	2013/10/21	BBY7SOP-00002	EPA 6020A
Mercury (Dissolved) by CVAF	1	N/A	2013/10/20	BBY7SOP-00015	EPA 245.7
Na, K, Ca, Mg, S by CRC ICPMS (diss.)	1	N/A	2013/10/21	BBY7SOP-00002	EPA 6020A
Elements by CRC ICPMS (dissolved)	1	N/A	2013/10/18	BBY7SOP-00002	EPA 6020A
Ammonia-N (Preserved)	1	N/A	2013/10/17	BBY6SOP-00009	SM-4500NH3G
Nitrate + Nitrite (N)	1	N/A	2013/10/17	BBY6SOP-00010	SM 4500NO3-I
Nitrite (N) by CFA	1	N/A	2013/10/17	BBY6SOP-00010	EPA 353.2
Nitrogen - Nitrate (as N)	1	N/A	2013/10/18	BBY6SOP-00010	SM 4500NO3-I
Filter and HNO3 Preserve for Metals	1	N/A	2013/10/16	BBY6WI-00001	EPA 200.2
pH Water	1	N/A	2013/10/17	BBY6SOP-00026	SM-4500H+B
Sulphate by Automated Colourimetry	1	N/A	2013/10/17	BBY6SOP-00017	SM4500-SO42- E
Total Dissolved Solids (Filt. Residue)	1	2013/10/17	2013/10/18	BBY6SOP-00033	SM 2540C
Total Suspended Solids-Low Level	1	2013/10/17	2013/10/18	BBY6SOP-00034	SM-2540 D

* Results relate only to the items tested.

Encryption Key

Please direct all questions regarding this Certificate of Analysis to your Project Manager.

Ken Pomeroy, Project Manager
Email: KPomeroy@maxxam.ca
Phone# (604) 638-5020

==
This report has been generated and distributed using a secure automated process.
Maxxam has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per section 5.10.2 of ISO/IEC 17025:2005(E), signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

Total cover pages: 1

Maxxam Job #: B395345
Report Date: 2013/10/22

MINTO EXPLORATIONS LTD.
Client Project #: MINTO ENV. MONITORING
Site Location: YUKON
Your P.O. #: 204251
Sampler Initials: PE

RESULTS OF CHEMICAL ANALYSES OF WATER

Maxxam ID		HV3937		
Sampling Date		2013/10/14 17:00		
	UNITS	**SS15**	**RDL**	**QC Batch**
ANIONS				
Nitrite (N)	mg/L	0.0050	0.0050	7235442
Calculated Parameters				
Filter and HNO3 Preservation	N/A	FIELD	N/A	ONSITE
Nitrate (N)	mg/L	1.24	0.020	7229544
Misc. Inorganics				
Fluoride (F)	mg/L	0.140	0.010	7242263
Alkalinity (Total as CaCO3)	mg/L	239	0.50	7233914
Alkalinity (PP as CaCO3)	mg/L	<0.50	0.50	7233914
Bicarbonate (HCO3)	mg/L	292	0.50	7233914
Carbonate (CO3)	mg/L	<0.50	0.50	7233914
Hydroxide (OH)	mg/L	<0.50	0.50	7233914
Anions				
Dissolved Sulphate (SO4)	mg/L	50.3	0.50	7234526
Dissolved Chloride (Cl)	mg/L	1.4	0.50	7234512
Nutrients				
Ammonia (N)	mg/L	0.026	0.0050	7234456
Nitrate plus Nitrite (N)	mg/L	1.24	0.020	7235431
Physical Properties				
Conductivity	uS/cm	539	1.0	7233959
pH	pH Units	7.78		7233958
Physical Properties				
Total Suspended Solids	mg/L	6.1	1.0	7232641
Total Dissolved Solids	mg/L	342	10	7232846

N/A = Not Applicable
RDL = Reportable Detection Limit

Maxxam Job #: B395345
Report Date: 2013/10/22

MINTO EXPLORATIONS LTD.
Client Project #: MINTO ENV. MONITORING
Site Location: YUKON
Your P.O. #: 204251
Sampler Initials: PE

CCME DISSOLVED METALS IN WATER (WATER)

Maxxam ID		HV3937		
Sampling Date		2013/10/14 17:00		
	UNITS	**SS15**	**RDL**	**QC Batch**
Misc. Inorganics				
Dissolved Hardness (CaCO3)	mg/L	284	0.50	7232043
Elements				
Dissolved Mercury (Hg)	ug/L	<0.010	0.010	7237933

RDL = Reportable Detection Limit

Maxxam Job #: B395345
Report Date: 2013/10/22

MINTO EXPLORATIONS LTD.
Client Project #: MINTO ENV. MONITORING
Site Location: YUKON
Your P.O. #: 204251
Sampler Initials: PE

CCME DISSOLVED METALS IN WATER (WATER)

Maxxam ID		HV3937		
Sampling Date		2013/10/14 17:00		
	UNITS	**SS15**	**RDL**	**QC Batch**
Dissolved Metals by ICPMS				
Dissolved Aluminum (Al)	ug/L	6.7	3.0	7234465
Dissolved Antimony (Sb)	ug/L	<0.50	0.50	7234465
Dissolved Arsenic (As)	ug/L	0.28	0.10	7234465
Dissolved Barium (Ba)	ug/L	387	1.0	7234465
Dissolved Beryllium (Be)	ug/L	<0.10	0.10	7234465
Dissolved Bismuth (Bi)	ug/L	<1.0	1.0	7234465
Dissolved Boron (B)	ug/L	<50	50	7234465
Dissolved Cadmium (Cd)	ug/L	6.13	0.010	7234465
Dissolved Chromium (Cr)	ug/L	<1.0	1.0	7234465
Dissolved Cobalt (Co)	ug/L	<0.50	0.50	7234465
Dissolved Copper (Cu)	ug/L	18.4	0.20	7234465
Dissolved Iron (Fe)	ug/L	256	5.0	7234465
Dissolved Lead (Pb)	ug/L	<0.20	0.20	7234465
Dissolved Lithium (Li)	ug/L	<5.0	5.0	7234465
Dissolved Manganese (Mn)	ug/L	391	1.0	7234465
Dissolved Molybdenum (Mo)	ug/L	2.2	1.0	7234465
Dissolved Nickel (Ni)	ug/L	1.6	1.0	7234465
Dissolved Phosphorus (P)	ug/L	<10	10	7234465
Dissolved Selenium (Se)	ug/L	0.67	0.10	7234465
Dissolved Silicon (Si)	ug/L	5120	100	7234465
Dissolved Silver (Ag)	ug/L	<0.020	0.020	7234465
Dissolved Strontium (Sr)	ug/L	316	1.0	7234465
Dissolved Thallium (Tl)	ug/L	<0.050	0.050	7234465
Dissolved Tin (Sn)	ug/L	<5.0	5.0	7234465
Dissolved Titanium (Ti)	ug/L	<5.0	5.0	7234465
Dissolved Uranium (U)	ug/L	0.79	0.10	7234465
Dissolved Vanadium (V)	ug/L	<5.0	5.0	7234465
Dissolved Zinc (Zn)	ug/L	<5.0	5.0	7234465
Dissolved Zirconium (Zr)	ug/L	<0.50	0.50	7234465
Dissolved Calcium (Ca)	mg/L	86.3	0.050	7229542
Dissolved Magnesium (Mg)	mg/L	16.7	0.050	7229542
Dissolved Potassium (K)	mg/L	3.05	0.050	7229542
Dissolved Sodium (Na)	mg/L	7.09	0.050	7229542
Dissolved Sulphur (S)	mg/L	17.6	3.0	7229542

RDL = Reportable Detection Limit

General Comments

Sample HV3937-01: The BC-MOE and APHA Standard Method require pH to be analysed within 15 minutes of sampling and therefore field analysis is required for compliance. All Laboratory pH analyses in this report are reported past the BC-MOE/APHA Standard Method holding time.

Maxxam Job #: B395345
Report Date: 2013/10/22

MINTO EXPLORATIONS LTD.
Client Project #: MINTO ENV. MONITORING
Site Location: YUKON
Your P.O. #: 204251
Sampler Initials: PE

QUALITY ASSURANCE REPORT

			Matrix Spike		Spiked Blank		Method Blank		RPD	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits
7232641	Total Suspended Solids	2013/10/18			97	80 - 120	<1.0	mg/L		
7232846	Total Dissolved Solids	2013/10/18	NC	80 - 120	98	80 - 120	<10	mg/L	NC	20
7233914	Alkalinity (Total as CaCO3)	2013/10/18	NC	80 - 120	97	80 - 120	<0.50	mg/L	0.6	20
7233914	Alkalinity (PP as CaCO3)	2013/10/18					<0.50	mg/L	NC	20
7233914	Bicarbonate (HCO3)	2013/10/18					<0.50	mg/L	0.6	20
7233914	Carbonate (CO3)	2013/10/18					<0.50	mg/L	NC	20
7233914	Hydroxide (OH)	2013/10/18					<0.50	mg/L	NC	20
7233959	Conductivity	2013/10/17			99	80 - 120	1.1, RDL=1.0	uS/cm	0.2	20
7234456	Ammonia (N)	2013/10/17	100	80 - 120	100	80 - 120	<0.0050	mg/L	NC	20
7234465	Dissolved Aluminum (Al)	2013/10/18	106	80 - 120	108	80 - 120	<3.0	ug/L	NC	20
7234465	Dissolved Antimony (Sb)	2013/10/18	108	80 - 120	106	80 - 120	<0.50	ug/L	NC	20
7234465	Dissolved Arsenic (As)	2013/10/18	104	80 - 120	98	80 - 120	<0.10	ug/L	NC	20
7234465	Dissolved Barium (Ba)	2013/10/18	NC	80 - 120	100	80 - 120	<1.0	ug/L	0.5	20
7234465	Dissolved Beryllium (Be)	2013/10/18	104	80 - 120	99	80 - 120	<0.10	ug/L	NC	20
7234465	Dissolved Bismuth (Bi)	2013/10/18	79 (1)	80 - 120	96	80 - 120	<1.0	ug/L	NC	20
7234465	Dissolved Cadmium (Cd)	2013/10/18	103	80 - 120	101	80 - 120	<0.010	ug/L	NC	20
7234465	Dissolved Chromium (Cr)	2013/10/18	100	80 - 120	101	80 - 120	<1.0	ug/L	NC	20
7234465	Dissolved Cobalt (Co)	2013/10/18	98	80 - 120	99	80 - 120	<0.50	ug/L	NC	20
7234465	Dissolved Copper (Cu)	2013/10/18	101	80 - 120	101	80 - 120	<0.20	ug/L	NC	20
7234465	Dissolved Iron (Fe)	2013/10/18	108	80 - 120	112	80 - 120	<5.0	ug/L	NC	20
7234465	Dissolved Lead (Pb)	2013/10/18	96	80 - 120	95	80 - 120	<0.20	ug/L	NC	20
7234465	Dissolved Lithium (Li)	2013/10/18	102	80 - 120	99	80 - 120	<5.0	ug/L	NC	20
7234465	Dissolved Manganese (Mn)	2013/10/18	NC	80 - 120	103	80 - 120	<1.0	ug/L	3.0	20
7234465	Dissolved Molybdenum (Mo)	2013/10/18	NC	80 - 120	96	80 - 120	<1.0	ug/L	NC	20
7234465	Dissolved Nickel (Ni)	2013/10/18	97	80 - 120	102	80 - 120	<1.0	ug/L	NC	20
7234465	Dissolved Selenium (Se)	2013/10/18	111	80 - 120	108	80 - 120	<0.10	ug/L	NC	20
7234465	Dissolved Silver (Ag)	2013/10/18	96	80 - 120	92	80 - 120	<0.020	ug/L	NC	20
7234465	Dissolved Strontium (Sr)	2013/10/18	NC	80 - 120	98	80 - 120	<1.0	ug/L	0.05	20
7234465	Dissolved Thallium (Tl)	2013/10/18	100	80 - 120	103	80 - 120	<0.050	ug/L	NC	20
7234465	Dissolved Tin (Sn)	2013/10/18	85	80 - 120	96	80 - 120	<5.0	ug/L	NC	20
7234465	Dissolved Titanium (Ti)	2013/10/18	102	80 - 120	101	80 - 120	<5.0	ug/L	NC	20
7234465	Dissolved Uranium (U)	2013/10/18	98	80 - 120	95	80 - 120	<0.10	ug/L	0.1	20
7234465	Dissolved Vanadium (V)	2013/10/18	104	80 - 120	100	80 - 120	<5.0	ug/L	NC	20
7234465	Dissolved Zinc (Zn)	2013/10/18	106	80 - 120	105	80 - 120	<5.0	ug/L	NC	20
7234465	Dissolved Boron (B)	2013/10/18					<50	ug/L	NC	20
7234465	Dissolved Phosphorus (P)	2013/10/18					<10	ug/L		
7234465	Dissolved Silicon (Si)	2013/10/18					<100	ug/L	1.4	20
7234465	Dissolved Zirconium (Zr)	2013/10/18					<0.50	ug/L	NC	20
7234512	Dissolved Chloride (Cl)	2013/10/17	NC	80 - 120	99	80 - 120	<0.50	mg/L	2.5	20

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Maxxam Job #: B395345
Report Date: 2013/10/22

MINTO EXPLORATIONS LTD.
Client Project #: MINTO ENV. MONITORING
Site Location: YUKON
Your P.O. #: 204251
Sampler Initials: PE

QUALITY ASSURANCE REPORT

			Matrix Spike		Spiked Blank		Method Blank		RPD	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits
7234526	Dissolved Sulphate (SO4)	2013/10/17	NC	80 - 120	97	80 - 120	0.99, RDL=0.50	mg/L	NC	20
7235431	Nitrate plus Nitrite (N)	2013/10/17	93	80 - 120	103	80 - 120	<0.020	mg/L	0.4	25
7235442	Nitrite (N)	2013/10/17	99	80 - 120	98	80 - 120	<0.0050	mg/L	NC	20
7237933	Dissolved Mercury (Hg)	2013/10/20	118	80 - 120	107	80 - 120	<0.010	ug/L	NC	20
7242263	Fluoride (F)	2013/10/22	102	80 - 120	100	80 - 120	<0.010	mg/L		

N/A = Not Applicable
RDL = Reportable Detection Limit
RPD = Relative Percent Difference
Duplicate: Paired analysis of a separate portion of the same sample. Used to evaluate the variance in the measurement.
Matrix Spike: A sample to which a known amount of the analyte of interest has been added. Used to evaluate sample matrix interference.
Spiked Blank: A blank matrix sample to which a known amount of the analyte, usually from a second source, has been added. Used to evaluate method accuracy.
Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.
NC (Matrix Spike): The recovery in the matrix spike was not calculated. The relative difference between the concentration in the parent sample and the spiked amount was not sufficiently significant to permit a reliable recovery calculation.
NC (RPD): The RPD was not calculated. The level of analyte detected in the parent sample and its duplicate was not sufficiently significant to permit a reliable calculation.
(1) - Recovery or RPD for this parameter is outside control limits. The overall quality control for this analysis meets acceptability criteria.

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Validation Signature Page

Maxxam Job #: B395345

The analytical data and all QC contained in this report were reviewed and validated by the following individual(s).

Rob Reinert, Data Validation Coordinator

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Maxxam

Burnaby: 4606 Canada Way, Burnaby, BC V5G 1K5 Ph: (604) 734-7276 Fax: (604) 731-2386, Toll Free: (800) 665-8566

CHAIN OF CUSTODY RECORD

Click here to get the COC number

Maxxam Job #: B395345 **COC #:** EB866213 Page: 1 of 1

Invoice To: Require Report? Yes ☑ No ☐

Company Name:	Minto Explorations Ltd
Contact Name:	Elvina Wong
Address:	Suite 900 - 999 West Hastings St
	Vancouver, B.C. PC: V6C 2W2
Phone / Fax#:	Ph: 604-684-8894 Fax: 604-688-2120
E-mail	

Report To:

Company Name:	Minto Explorations Ltd
Contact Name:	Minto Environment
Address:	Suite 900-999 West Hastings St
	Vancouver, B.C. PC: V6C 2W2
Phone / Fax#:	Ph: 604-684-8894 Fax: 604-688-2120
E-mail	minto_environment@mintomine.com

PO #:	204251
Quotation #:	
Project # :	
Proj. Name:	Minto Env. Monitoring
Location:	Yukon
Sampled by:	Phil Emerson

REGULATORY REQUIREMENTS:

- ☐ CSR
- ☑ CCME
- ☐ BC Water Quality
- ☐ Other
- ☐ DRINKING WATER

SERVICE REQUESTED:

- ◉ Regular Turn Around Time (TAT) (5 days for most tests)
- **RUSH** (Please contact the lab) ○ 1 Day ○ 2 Day ○ 3 Day
- Date Required:

SPECIAL INSTRUCTIONS:

Return Cooler ☐ **Ship Sample Bottles (please specify)** ☐

ANALYSIS REQUESTED

Field Filtered? Y ☑ N ☐ — Field Acidified? Y ☑ N ☐ — Field Acidified? Y ☑ N ☐

	Sample Identification	Lab Use Only: Lab Identification	Sample Type	Date/Time(24hr) Sampled	Dissolved Metals (DM)	Field Acidified?	Total Metals	Nitrate ☑ Nitrite ☑ Ammonia ☑	Total Suspended Solids (TSS) ☑ TDS ☑	pH ☑ Conductivity ☑ Alkalinity ☑	Chloride ☑ Fluoride ☑ Sulphate ☑	Phosphate	DOC (Diss'd Organic Carbon)	TOC (Total Organic Carbon)	Ra 226	Number of Containers
1	SS15	AV3437	Seepage	10/14/13 17:00	X	X		X	X	X	X					4
2																
3																
4																
5																
6																
7																
8																
9																
10																
11																
12																

B395345

Print name and sign

*Relinquished By:	Date (yy/mm/dd):	Time (24hr):	Received by	Date (yy/mm/dd)	Time 24hr	Time Sensitive	Temperature on Receipt (°C)	Custody Seal	Yes	No
Chris Harry	15-Oct-13	7:35	Pacheco ROCHELLE PACHECO	2013/10/16	14:00	☑	3 / 1 / 3	Present		
							Just sampled / Iced on ice ☐	Intact		

*IT IS THE RESPONSIBILITY OF THE RELINQUISHER TO ENSURE THE ACCURACY OF THE CHAIN OF CUSTODY RECORDS. AN INCOMPLETE CHAIN OF CUSTODY MAY RESULT IN ANALYTICAL TAT DELAYS.

CS: N/A

Maxxam

Success Through Science®

Your P.O. #: 204251
Your Project #: MINTO ENV. MONITORING
Site Location: YUKON
Your C.O.C. #: EB865713

Attention: MINTO DISTRIBUTION LIST
MINTO EXPLORATIONS LTD.
Yukon/Whitehorse
2 - 25 Pilgrim Way
Whitehorse, YT
CANADA Y1A 6E6

Report Date: 2013/10/21

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B394653
Received: 2013/10/15, 09:10

Sample Matrix: Water
Samples Received: 10

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Analytical Method
Alkalinity - Water	10	2013/10/16	2013/10/16	BBY6SOP-00026	SM2320B
Chloride by Automated Colourimetry	10	N/A	2013/10/16	BBY6SOP-00011	SM-4500-Cl-
Conductance - water	10	N/A	2013/10/16	BBY6SOP-00026	SM-2510B
Fluoride	10	N/A	2013/10/21	BBY6SOP-00012	SM - 4500 F C
Hardness (calculated as CaCO3)	10	N/A	2013/10/18	BBY7SOP-00002	EPA 6020A
Mercury (Dissolved) by CVAF	10	N/A	2013/10/20	BBY7SOP-00015	EPA 245.7
Na, K, Ca, Mg, S by CRC ICPMS (diss.)	10	N/A	2013/10/18	BBY7SOP-00002	EPA 6020A
Elements by CRC ICPMS (dissolved)	10	N/A	2013/10/18	BBY7SOP-00002	EPA 6020A
Ammonia-N (Preserved)	10	N/A	2013/10/16	BBY6SOP-00009	SM-4500NH3G
Nitrate + Nitrite (N)	10	N/A	2013/10/16	BBY6SOP-00010	SM 4500NO3-I
Nitrite (N) by CFA	10	N/A	2013/10/16	BBY6SOP-00010	EPA 353.2
Nitrogen - Nitrate (as N)	10	N/A	2013/10/17	BBY6SOP-00010	SM 4500NO3-I
Filter and HNO3 Preserve for Metals	10	N/A	2013/10/15	BBY6WI-00001	EPA 200.2
pH Water	10	N/A	2013/10/16	BBY6SOP-00026	SM-4500H+B
Sulphate by Automated Colourimetry	7	N/A	2013/10/16	BBY6SOP-00017	SM4500-SO42- E
Sulphate by Automated Colourimetry	3	N/A	2013/10/17	BBY6SOP-00017	SM4500-SO42- E
Total Dissolved Solids (Filt. Residue)	10	2013/10/16	2013/10/17	BBY6SOP-00033	SM 2540C
Total Suspended Solids-Low Level	10	2013/10/16	2013/10/17	BBY6SOP-00034	SM-2540 D

* Results relate only to the items tested.

Encryption Key

Please direct all questions regarding this Certificate of Analysis to your Project Manager.

Ken Pomeroy, Project Manager
Email: KPomeroy@maxxam.ca
Phone# (604) 638-5020

==
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Maxxam has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per section 5.10.2 of ISO/IEC 17025:2005(E), signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

Total cover pages: 1

Maxxam Job #: B394653
Report Date: 2013/10/21

MINTO EXPLORATIONS LTD.
Client Project #: MINTO ENV. MONITORING
Site Location: YUKON
Your P.O. #: 204251
Sampler Initials: PE

RESULTS OF CHEMICAL ANALYSES OF WATER

Maxxam ID		HV0024			HV0025		HV0026		HV0027			HV0028		
Sampling Date		2013/10/12 12:00			2013/10/12 12:30		2013/10/12 13:00		2013/10/12 13:30			2013/10/12 14:30		
	UNITS	**SS2**	**RDL**	**QC Batch**	**SS21**	**RDL**	**SS4**	**RDL**	**SS13**	**RDL**	**QC Batch**	**SS22**	**RDL**	**QC Batch**
ANIONS														
Nitrite (N)	mg/L	0.0090 (1)	0.0050	7232079	0.0104 (1)	0.0050	0.0534 (1)	0.0050	0.0109 (1)	0.0050	7232079	0.0059 (1)	0.0050	7232079
Calculated Parameters														
Filter and HNO3 Preservation	N/A	FIELD	N/A	ONSITE	FIELD	N/A	FIELD	N/A	FIELD	N/A	ONSITE	FIELD	N/A	ONSITE
Nitrate (N)	mg/L	46.1	2.0	7227064	23.5	0.40	28.0	1.0	1.65	0.020	7227064	10.6	0.20	7227064
Misc. Inorganics														
Fluoride (F)	mg/L	0.460	0.010	7239926	0.290	0.010	0.180	0.010	0.290	0.010	7239926	0.140	0.010	7239926
Alkalinity (Total as CaCO3)	mg/L	308	0.50	7230217	441	0.50	407	0.50	245	0.50	7230217	263	0.50	7230217
Alkalinity (PP as CaCO3)	mg/L	<0.50	0.50	7230217	<0.50	0.50	<0.50	0.50	<0.50	0.50	7230217	<0.50	0.50	7230217
Bicarbonate (HCO3)	mg/L	376	0.50	7230217	538	0.50	497	0.50	299	0.50	7230217	321	0.50	7230217
Carbonate (CO3)	mg/L	<0.50	0.50	7230217	<0.50	0.50	<0.50	0.50	<0.50	0.50	7230217	<0.50	0.50	7230217
Hydroxide (OH)	mg/L	<0.50	0.50	7230217	<0.50	0.50	<0.50	0.50	<0.50	0.50	7230217	<0.50	0.50	7230217
Anions														
Dissolved Sulphate (SO4)	mg/L	343	5.0	7232016	92.4	0.50	106	0.50	58.2	0.50	7234526	36.2	0.50	7232016
Dissolved Chloride (Cl)	mg/L	5.8	0.50	7231993	5.4	0.50	5.3	0.50	2.3	0.50	7231993	2.4	0.50	7231993
Nutrients														
Ammonia (N)	mg/L	0.034	0.0050	7231997	0.029	0.0050	0.034	0.0050	0.056	0.0050	7231997	0.023	0.0050	7231997
Nitrate plus Nitrite (N)	mg/L	46.1 (1)	2.0	7232075	23.5 (1)	0.40	28.1 (1)	1.0	1.67 (1)	0.020	7232075	10.6 (1)	0.20	7232075
Physical Properties														
Conductivity	uS/cm	1450	1.0	7230273	1100	1.0	1110	1.0	569	1.0	7230273	636	1.0	7230273
pH	pH Units	8.16		7230270	8.20		8.22		8.11		7230270	8.17		7230270
Physical Properties														
Total Suspended Solids	mg/L	13.1	1.0	7229448	3.4	1.0	2.7	1.0	58.8	1.0	7229448	13.9	1.0	7229448
Total Dissolved Solids	mg/L	1070	10	7229690	742	10	752	10	412	10	7229690	402	10	7229690

N/A = Not Applicable
RDL = Reportable Detection Limit
(1) - Sample analysed past hold time: sample was received on the hold time expiry date which did not allow sufficient time for preparation and analysis.

Maxxam Job #: B394653
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Sampler Initials: PE

RESULTS OF CHEMICAL ANALYSES OF WATER

Maxxam ID		HV0029	HV0030		HV0031		HV0032		HV0033		
Sampling Date		2013/10/12 15:00	2013/10/12 15:30		2013/10/12 16:30		2013/10/12 17:00		2013/10/13 14:30		
	UNITS	**SS16**	**SS23**	**RDL**	**SS8**	**RDL**	**SS5**	**RDL**	**SS24**	**RDL**	**QC Batch**
ANIONS											
Nitrite (N)	mg/L	0.0088(1)	0.0254(1)	0.0050	0.519(1)	0.010	0.0266(1)	0.0050	0.0082	0.0050	7232079
Calculated Parameters											
Filter and HNO3 Preservation	N/A	FIELD	FIELD	N/A	FIELD	N/A	FIELD	N/A	FIELD	N/A	ONSITE
Nitrate (N)	mg/L	61.3	57.8	2.0	72.1	2.0	73.0	2.0	12.3	0.20	7227064
Misc. Inorganics											
Fluoride (F)	mg/L	0.470	0.210	0.010	0.300	0.010	0.280	0.010	0.190	0.010	7239926
Alkalinity (Total as CaCO3)	mg/L	201	230	0.50	316	0.50	282	0.50	417	0.50	7230217
Alkalinity (PP as CaCO3)	mg/L	<0.50	<0.50	0.50	<0.50	0.50	<0.50	0.50	<0.50	0.50	7230217
Bicarbonate (HCO3)	mg/L	246	281	0.50	386	0.50	345	0.50	508	0.50	7230217
Carbonate (CO3)	mg/L	<0.50	<0.50	0.50	<0.50	0.50	<0.50	0.50	<0.50	0.50	7230217
Hydroxide (OH)	mg/L	<0.50	<0.50	0.50	<0.50	0.50	<0.50	0.50	<0.50	0.50	7230217
Anions											
Dissolved Sulphate (SO4)	mg/L	528	453	5.0	269	5.0	259	5.0	247	5.0	7232016
Dissolved Chloride (Cl)	mg/L	4.9	5.2	0.50	11	0.50	11	0.50	5.8	0.50	7231993
Nutrients											
Ammonia (N)	mg/L	0.027	0.040	0.0050	0.22	0.0050	0.024	0.0050	0.036	0.0050	7231997
Nitrate plus Nitrite (N)	mg/L	61.3(1)	57.8(1)	2.0	72.6(1)	2.0	73.1(1)	2.0	12.4	0.20	7232075
Physical Properties											
Conductivity	uS/cm	1730	1620	1.0	1620	1.0	1510	1.0	1180	1.0	7230273
pH	pH Units	8.16	7.99		8.05		7.93		8.10		7230270
Physical Properties											
Total Suspended Solids	mg/L	6.8	16.2	1.0	31.4	1.0	10.5	1.0	48.3	1.0	7229448
Total Dissolved Solids	mg/L	1380	1260	10	1240	10	1160	10	840	10	7229690

N/A = Not Applicable
RDL = Reportable Detection Limit
(1) - Sample analysed past hold time: sample was received on the hold time expiry date which did not allow sufficient time for preparation and analysis.

Maxxam Job #: B394653
Report Date: 2013/10/21

MINTO EXPLORATIONS LTD.
Client Project #: MINTO ENV. MONITORING
Site Location: YUKON
Your P.O. #: 204251
Sampler Initials: PE

CCME DISSOLVED METALS IN WATER (WATER)

Maxxam ID		HV0024	HV0025	HV0026	HV0027		
Sampling Date		2013/10/12 12:00	2013/10/12 12:30	2013/10/12 13:00	2013/10/12 13:30		
	UNITS	**SS2**	**SS21**	**SS4**	**SS13**	**RDL**	**QC Batch**
Misc. Inorganics							
Dissolved Hardness (CaCO3)	mg/L	665	582	577	290	0.50	7227062
Elements							
Dissolved Mercury (Hg)	ug/L	<0.010	<0.010	<0.010	<0.010	0.010	7237933
Dissolved Metals by ICPMS							
Dissolved Aluminum (Al)	ug/L	3.6	7.4	7.2	22.1	3.0	7232759
Dissolved Antimony (Sb)	ug/L	<0.50	<0.50	<0.50	<0.50	0.50	7232759
Dissolved Arsenic (As)	ug/L	0.45	0.45	0.36	0.99	0.10	7232759
Dissolved Barium (Ba)	ug/L	104	129	114	97.7	1.0	7232759
Dissolved Beryllium (Be)	ug/L	<0.10	<0.10	<0.10	<0.10	0.10	7232759
Dissolved Bismuth (Bi)	ug/L	<1.0	<1.0	<1.0	<1.0	1.0	7232759
Dissolved Boron (B)	ug/L	59	<50	<50	<50	50	7232759
Dissolved Cadmium (Cd)	ug/L	0.019	0.035	0.111	0.016	0.010	7232759
Dissolved Chromium (Cr)	ug/L	<1.0	<1.0	<1.0	<1.0	1.0	7232759
Dissolved Cobalt (Co)	ug/L	<0.50	<0.50	<0.50	<0.50	0.50	7232759
Dissolved Copper (Cu)	ug/L	4.88	95.3	89.7	22.0	0.20	7232759
Dissolved Iron (Fe)	ug/L	8.7	22.6	72.7	54.6	5.0	7232759
Dissolved Lead (Pb)	ug/L	<0.20	<0.20	<0.20	<0.20	0.20	7232759
Dissolved Lithium (Li)	ug/L	5.5	<5.0	<5.0	<5.0	5.0	7232759
Dissolved Manganese (Mn)	ug/L	19.3	783	736	23.6	1.0	7232759
Dissolved Molybdenum (Mo)	ug/L	7.4	6.0	3.8	3.4	1.0	7232759
Dissolved Nickel (Ni)	ug/L	<1.0	1.0	<1.0	<1.0	1.0	7232759
Dissolved Phosphorus (P)	ug/L	16	26	30	53	10	7232759
Dissolved Selenium (Se)	ug/L	19.6	7.56	7.17	0.72	0.10	7232759
Dissolved Silicon (Si)	ug/L	5230	9730	9170	10500	100	7232759
Dissolved Silver (Ag)	ug/L	<0.020	<0.020	<0.020	<0.020	0.020	7232759
Dissolved Strontium (Sr)	ug/L	4610	2010	1090	458	1.0	7232759
Dissolved Thallium (Tl)	ug/L	<0.050	<0.050	<0.050	<0.050	0.050	7232759
Dissolved Tin (Sn)	ug/L	<5.0	<5.0	<5.0	<5.0	5.0	7232759
Dissolved Titanium (Ti)	ug/L	<5.0	<5.0	<5.0	<5.0	5.0	7232759
Dissolved Uranium (U)	ug/L	4.09	4.21	6.60	1.50	0.10	7232759
Dissolved Vanadium (V)	ug/L	<5.0	<5.0	<5.0	<5.0	5.0	7232759
Dissolved Zinc (Zn)	ug/L	<5.0	<5.0	<5.0	<5.0	5.0	7232759
Dissolved Zirconium (Zr)	ug/L	<0.50	<0.50	<0.50	<0.50	0.50	7232759
Dissolved Calcium (Ca)	mg/L	177	163	172	88.4	0.050	7227063

RDL = Reportable Detection Limit

Maxxam Job #: B394653
Report Date: 2013/10/21

MINTO EXPLORATIONS LTD.
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Site Location: YUKON
Your P.O. #: 204251
Sampler Initials: PE

CCME DISSOLVED METALS IN WATER (WATER)

Maxxam ID		HV0024	HV0025	HV0026	HV0027		
Sampling Date		2013/10/12 12:00	2013/10/12 12:30	2013/10/12 13:00	2013/10/12 13:30		
	UNITS	**SS2**	**SS21**	**SS4**	**SS13**	**RDL**	**QC Batch**
Dissolved Magnesium (Mg)	mg/L	54.2	42.8	35.9	16.8	0.050	7227063
Dissolved Potassium (K)	mg/L	6.84	6.26	5.85	5.44	0.050	7227063
Dissolved Sodium (Na)	mg/L	49.1	17.4	16.3	9.09	0.050	7227063
Dissolved Sulphur (S)	mg/L	125	33.5	34.8	19.4	3.0	7227063

RDL = Reportable Detection Limit

Maxxam Job #: B394653
Report Date: 2013/10/21

MINTO EXPLORATIONS LTD.
Client Project #: MINTO ENV. MONITORING
Site Location: YUKON
Your P.O. #: 204251
Sampler Initials: PE

CCME DISSOLVED METALS IN WATER (WATER)

Maxxam ID		HV0028	HV0029	HV0030	HV0031	HV0032	HV0033		
Sampling Date		2013/10/12 14:30	2013/10/12 15:00	2013/10/12 15:30	2013/10/12 16:30	2013/10/12 17:00	2013/10/13 14:30		
	UNITS	**SS22**	**SS16**	**SS23**	**SS8**	**SS5**	**SS24**	**RDL**	**QC Batch**
Misc. Inorganics									
Dissolved Hardness (CaCO3)	mg/L	308	818	812	803	745	632	0.50	7227062
Elements									
Dissolved Mercury (Hg)	ug/L	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	0.010	7237933
Dissolved Metals by ICPMS									
Dissolved Aluminum (Al)	ug/L	4.8	<3.0	8.0	9.0	<3.0	<3.0	3.0	7232759
Dissolved Antimony (Sb)	ug/L	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	0.50	7232759
Dissolved Arsenic (As)	ug/L	0.45	0.69	0.42	0.38	0.36	0.37	0.10	7232759
Dissolved Barium (Ba)	ug/L	161	45.4	118	57.2	68.7	196	1.0	7232759
Dissolved Beryllium (Be)	ug/L	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.10	7232759
Dissolved Bismuth (Bi)	ug/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	1.0	7232759
Dissolved Boron (B)	ug/L	<50	70	<50	59	51	<50	50	7232759
Dissolved Cadmium (Cd)	ug/L	<0.010	0.086	0.044	0.056	0.100	0.148	0.010	7232759
Dissolved Chromium (Cr)	ug/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	1.0	7232759
Dissolved Cobalt (Co)	ug/L	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	0.50	7232759
Dissolved Copper (Cu)	ug/L	2.23	131	17.0	67.9	110	210	0.20	7232759
Dissolved Iron (Fe)	ug/L	9.4	<5.0	10.0	18.8	<5.0	10.3	5.0	7232759
Dissolved Lead (Pb)	ug/L	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	0.20	7232759
Dissolved Lithium (Li)	ug/L	<5.0	7.9	<5.0	6.3	5.8	5.1	5.0	7232759
Dissolved Manganese (Mn)	ug/L	4.0	73.3	6.4	304	125	8.6	1.0	7232759
Dissolved Molybdenum (Mo)	ug/L	<1.0	24.6	1.8	6.8	6.4	3.1	1.0	7232759
Dissolved Nickel (Ni)	ug/L	<1.0	1.0	<1.0	<1.0	<1.0	<1.0	1.0	7232759
Dissolved Phosphorus (P)	ug/L	29	<10	53	11	<10	13	10	7232759
Dissolved Selenium (Se)	ug/L	1.36	54.2	35.9	45.4	38.1	2.20	0.10	7232759
Dissolved Silicon (Si)	ug/L	5960	4760	6810	7380	7210	8060	100	7232759
Dissolved Silver (Ag)	ug/L	<0.020	<0.020	<0.020	0.043	0.028	0.024	0.020	7232759
Dissolved Strontium (Sr)	ug/L	630	3220	2100	3620	3340	1010	1.0	7232759
Dissolved Thallium (Tl)	ug/L	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	0.050	7232759
Dissolved Tin (Sn)	ug/L	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	5.0	7232759
Dissolved Titanium (Ti)	ug/L	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	5.0	7232759
Dissolved Uranium (U)	ug/L	0.53	13.3	2.45	7.08	9.65	7.72	0.10	7232759
Dissolved Vanadium (V)	ug/L	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	5.0	7232759
Dissolved Zinc (Zn)	ug/L	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	5.0	7232759
Dissolved Zirconium (Zr)	ug/L	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	0.50	7232759
Dissolved Calcium (Ca)	mg/L	86.0	198	226	233	217	189	0.050	7227063

RDL = Reportable Detection Limit

Maxxam Job #: B394653
Report Date: 2013/10/21

MINTO EXPLORATIONS LTD.
Client Project #: MINTO ENV. MONITORING
Site Location: YUKON
Your P.O. #: 204251
Sampler Initials: PE

CCME DISSOLVED METALS IN WATER (WATER)

Maxxam ID		HV0028	HV0029	HV0030	HV0031	HV0032	HV0033		
Sampling Date		2013/10/12 14:30	2013/10/12 15:00	2013/10/12 15:30	2013/10/12 16:30	2013/10/12 17:00	2013/10/13 14:30		
	UNITS	**SS22**	**SS16**	**SS23**	**SS8**	**SS5**	**SS24**	**RDL**	**QC Batch**
Dissolved Magnesium (Mg)	mg/L	22.7	78.6	60.1	53.8	49.4	39.2	0.050	7227063
Dissolved Potassium (K)	mg/L	3.04	9.53	7.10	6.29	6.11	4.58	0.050	7227063
Dissolved Sodium (Na)	mg/L	9.76	55.2	39.4	37.0	32.0	21.6	0.050	7227063
Dissolved Sulphur (S)	mg/L	12.6	186	163	96.4	89.9	77.0	3.0	7227063

RDL = Reportable Detection Limit

General Comments

Sample HV0024-01: The BC-MOE and APHA Standard Method require pH to be analysed within 15 minutes of sampling and therefore field analysis is required for compliance. All Laboratory pH analyses in this report are reported past the BC-MOE/APHA Standard Method holding time.

Sample HV0025-01: The BC-MOE and APHA Standard Method require pH to be analysed within 15 minutes of sampling and therefore field analysis is required for compliance. All Laboratory pH analyses in this report are reported past the BC-MOE/APHA Standard Method holding time.

Sample HV0026-01: The BC-MOE and APHA Standard Method require pH to be analysed within 15 minutes of sampling and therefore field analysis is required for compliance. All Laboratory pH analyses in this report are reported past the BC-MOE/APHA Standard Method holding time.

Sample HV0027-01: The BC-MOE and APHA Standard Method require pH to be analysed within 15 minutes of sampling and therefore field analysis is required for compliance. All Laboratory pH analyses in this report are reported past the BC-MOE/APHA Standard Method holding time.

Sample HV0028-01: The BC-MOE and APHA Standard Method require pH to be analysed within 15 minutes of sampling and therefore field analysis is required for compliance. All Laboratory pH analyses in this report are reported past the BC-MOE/APHA Standard Method holding time.

Sample HV0029-01: The BC-MOE and APHA Standard Method require pH to be analysed within 15 minutes of sampling and therefore field analysis is required for compliance. All Laboratory pH analyses in this report are reported past the BC-MOE/APHA Standard Method holding time.

Sample HV0030-01: The BC-MOE and APHA Standard Method require pH to be analysed within 15 minutes of sampling and therefore field analysis is required for compliance. All Laboratory pH analyses in this report are reported past the BC-MOE/APHA Standard Method holding time.

Sample HV0031-01: The BC-MOE and APHA Standard Method require pH to be analysed within 15 minutes of sampling and therefore field analysis is required for compliance. All Laboratory pH analyses in this report are reported past the BC-MOE/APHA Standard Method holding time.

Sample HV0032-01: The BC-MOE and APHA Standard Method require pH to be analysed within 15 minutes of sampling and therefore field analysis is required for compliance. All Laboratory pH analyses in this report are reported past the BC-MOE/APHA Standard Method holding time.

Sample HV0033-01: The BC-MOE and APHA Standard Method require pH to be analysed within 15 minutes of sampling and therefore field analysis is required for compliance. All Laboratory pH analyses in this report are reported past the BC-MOE/APHA Standard Method holding time.

QUALITY ASSURANCE REPORT

			Matrix Spike		Spiked Blank		Method Blank		RPD	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits
7229448	Total Suspended Solids	2013/10/17			95	80 - 120	<1.0	mg/L		
7229690	Total Dissolved Solids	2013/10/17	NC	80 - 120	92	80 - 120	<10	mg/L	2.1	20
7230217	Alkalinity (Total as CaCO3)	2013/10/16	NC	80 - 120	93	80 - 120	<0.50	mg/L	1.4	20
7230217	Alkalinity (PP as CaCO3)	2013/10/16					<0.50	mg/L	NC	20
7230217	Bicarbonate (HCO3)	2013/10/16					<0.50	mg/L	1.4	20
7230217	Carbonate (CO3)	2013/10/16					<0.50	mg/L	NC	20
7230217	Hydroxide (OH)	2013/10/16					<0.50	mg/L	NC	20
7230273	Conductivity	2013/10/16			98	80 - 120	1.2, RDL=1.0	uS/cm	0.8	20
7231993	Dissolved Chloride (Cl)	2013/10/16	109	80 - 120			<0.50	mg/L	NC	20
7231997	Ammonia (N)	2013/10/16	110	80 - 120	98	80 - 120	<0.0050	mg/L	NC	20
7232016	Dissolved Sulphate (SO4)	2013/10/16	NC	80 - 120	102	80 - 120	0.84, RDL=0.50	mg/L	0.1	20
7232075	Nitrate plus Nitrite (N)	2013/10/16	102	80 - 120	106	80 - 120	<0.020	mg/L	8.2	25
7232079	Nitrite (N)	2013/10/16	101	80 - 120	102	80 - 120	<0.0050	mg/L	NC	20
7232759	Dissolved Aluminum (Al)	2013/10/18	107	80 - 120	108	80 - 120	<3.0	ug/L	NC	20
7232759	Dissolved Antimony (Sb)	2013/10/18	107	80 - 120	102	80 - 120	<0.50	ug/L	NC	20
7232759	Dissolved Arsenic (As)	2013/10/18	110	80 - 120	103	80 - 120	<0.10	ug/L	NC	20
7232759	Dissolved Barium (Ba)	2013/10/18	103	80 - 120	102	80 - 120	<1.0	ug/L	NC	20
7232759	Dissolved Beryllium (Be)	2013/10/18	103	80 - 120	99	80 - 120	<0.10	ug/L	NC	20
7232759	Dissolved Bismuth (Bi)	2013/10/18	104	80 - 120	100	80 - 120	<1.0	ug/L	NC	20
7232759	Dissolved Cadmium (Cd)	2013/10/18	111	80 - 120	105	80 - 120	<0.010	ug/L	NC	20
7232759	Dissolved Chromium (Cr)	2013/10/18	106	80 - 120	98	80 - 120	<1.0	ug/L	NC	20
7232759	Dissolved Cobalt (Co)	2013/10/18	105	80 - 120	100	80 - 120	<0.50	ug/L	NC	20
7232759	Dissolved Copper (Cu)	2013/10/18	107	80 - 120	99	80 - 120	<0.20	ug/L	NC	20
7232759	Dissolved Iron (Fe)	2013/10/18	109	80 - 120	101	80 - 120	<5.0	ug/L	NC	20
7232759	Dissolved Lead (Pb)	2013/10/18	101	80 - 120	98	80 - 120	<0.20	ug/L	NC	20
7232759	Dissolved Lithium (Li)	2013/10/18	98	80 - 120	98	80 - 120	<5.0	ug/L	NC	20
7232759	Dissolved Manganese (Mn)	2013/10/18	105	80 - 120	102	80 - 120	<1.0	ug/L	NC	20
7232759	Dissolved Molybdenum (Mo)	2013/10/18	101	80 - 120	107	80 - 120	<1.0	ug/L	NC	20
7232759	Dissolved Nickel (Ni)	2013/10/18	107	80 - 120	101	80 - 120	<1.0	ug/L	NC	20
7232759	Dissolved Selenium (Se)	2013/10/18	113	80 - 120	106	80 - 120	<0.10	ug/L	NC	20
7232759	Dissolved Silver (Ag)	2013/10/18	110	80 - 120	104	80 - 120	<0.020	ug/L	NC	20
7232759	Dissolved Strontium (Sr)	2013/10/18	107	80 - 120	103	80 - 120	<1.0	ug/L	NC	20
7232759	Dissolved Thallium (Tl)	2013/10/18	101	80 - 120	102	80 - 120	<0.050	ug/L	NC	20
7232759	Dissolved Tin (Sn)	2013/10/18	103	80 - 120	100	80 - 120	<5.0	ug/L	NC	20
7232759	Dissolved Titanium (Ti)	2013/10/18	103	80 - 120	104	80 - 120	<5.0	ug/L	NC	20
7232759	Dissolved Uranium (U)	2013/10/18	102	80 - 120	99	80 - 120	<0.10	ug/L	NC	20
7232759	Dissolved Vanadium (V)	2013/10/18	102	80 - 120	99	80 - 120	<5.0	ug/L	NC	20
7232759	Dissolved Zinc (Zn)	2013/10/18	120	80 - 120	104	80 - 120	<5.0	ug/L	NC	20
7232759	Dissolved Boron (B)	2013/10/18					<50	ug/L	NC	20

Success Through Science®

Maxxam Job #: B394653
Report Date: 2013/10/21

MINTO EXPLORATIONS LTD.
Client Project #: MINTO ENV. MONITORING
Site Location: YUKON
Your P.O. #: 204251
Sampler Initials: PE

QUALITY ASSURANCE REPORT

			Matrix Spike		Spiked Blank		Method Blank		RPD	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits
7232759	Dissolved Phosphorus (P)	2013/10/18					<10	ug/L		
7232759	Dissolved Silicon (Si)	2013/10/18					<100	ug/L	NC	20
7232759	Dissolved Zirconium (Zr)	2013/10/18					<0.50	ug/L	NC	20
7234526	Dissolved Sulphate (SO4)	2013/10/17	NC	80 - 120	97	80 - 120	0.99, RDL=0.50	mg/L	NC	20
7237933	Dissolved Mercury (Hg)	2013/10/20	118	80 - 120	107	80 - 120	<0.010	ug/L	NC	20
7239926	Fluoride (F)	2013/10/21	98	80 - 120	98	80 - 120	<0.010	mg/L	0	20

N/A = Not Applicable
RDL = Reportable Detection Limit
RPD = Relative Percent Difference
Duplicate: Paired analysis of a separate portion of the same sample. Used to evaluate the variance in the measurement.
Matrix Spike: A sample to which a known amount of the analyte of interest has been added. Used to evaluate sample matrix interference.
Spiked Blank: A blank matrix sample to which a known amount of the analyte, usually from a second source, has been added. Used to evaluate method accuracy.
Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.
NC (Matrix Spike): The recovery in the matrix spike was not calculated. The relative difference between the concentration in the parent sample and the spiked amount was not sufficiently significant to permit a reliable recovery calculation.
NC (RPD): The RPD was not calculated. The level of analyte detected in the parent sample and its duplicate was not sufficiently significant to permit a reliable calculation.

Validation Signature Page

Maxxam Job #: B394653

The analytical data and all QC contained in this report were reviewed and validated by the following individual(s).

Andy Lu, Data Validation Coordinator

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Maxxam has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per section 5.10.2 of ISO/IEC 17025:2005(E), signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

Maxxam

Burnaby: 4606 Canada Way, Burnaby, BC V5G 1K5 Ph: (604) 734-7276 Fax: (604) 731-2386, Toll Free: (800) 665-8566

CHAIN OF CUSTODY RECORD

Click here to get the COC number

Maxxam Job #: B394653 **COC #:** EB865713 Page: 1 of 1

Invoice To: Require Report? Yes ☑ No ☐

	Invoice To		Report To
Company Name:	Minto Explorations Ltd	Company Name:	Minto Explorations Ltd
Contact Name:	Elvina Wong	Contact Name:	Minto Environment
Address:	Suite 900 - 999 West Hastings St	Address:	Suite 900-999 West Hastings St
	Vancouver, B.C. PC: V6C 2W2		Vancouver, B.C. PC: V6C 2W2
Phone / Fax#:	Ph: 604-684-8894 Fax: 604-688-2120	Phone / Fax#:	Ph: 604-684-8894 Fax: 604-688-2120
E-mail		E-mail	minto_environment@mintomine.com

PO #:	204251
Quotation #:	
Project # :	
Proj. Name:	Minto Env. Monitoring
Location:	Yukon
Sampled by:	Phil Emerson

REGULATORY REQUIREMENTS:

- ☐ CSR
- ☑ CCME
- ☐ BC Water Quality
- ☐ Other
- ☐ DRINKING WATER

SERVICE REQUESTED:

- ◉ Regular Turn Around Time (TAT) (5 days for most tests)
- **RUSH** (Please contact the lab) ○ 1 Day ○ 2 Day ○ 3 Day
- Date Required:

SPECIAL INSTRUCTIONS:

Return Cooler ☐ **Ship Sample Bottles (please specify)** ☐

ANALYSIS REQUESTED

	Sample Identification	Lab Identification (Lab Use Only)	Sample Type	Date/Time(24hr) Sampled	Dissolved Metals (DM) (Field Filtered? Y☑ N☐)	Total Metals (Field Acidified? Y☑ N☐)	Field Acidified? Y☑ N☐	Nitrate ☑ Nitrite ☑ Ammonia ☑	Total Suspended Solids (TSS) ☑ TDS ☑	pH ☑ Conductivity ☑ Alkalinity ☑	Chloride ☑ Fluoride ☑ Sulphate ☑	Phosphate	DOC (Diss'd Organic Carbon)	TOC (Total Organic Carbon)	Ra 226	Number of Containers
1	SS2 HV0024		Water	10/12/13 12:00	X	X		X	X	X	X					4
2	SS21 HV0025			10/12/13 12:30	X	X		X	X	X	X					4
3	SS4 HV0026			10/12/13 13:00	X	X		X	X	X	X					4
4	SS13 HV0027			10/12/13 13:30	X	X		X	X	X	X					4
5	SS22 HV0028			10/12/13 14:30	X	X		X	X	X	X					4
6	SS16 HV0029			10/12/13 15:00	X	X		X	X	X	X					4
7	SS23 HV0030			10/12/13 15:30	X	X		X	X	X	X					4
8	SS8 HV0031			10/12/13 16:30	X	X		X	X	X	X					4
9	SS5 HV0032			10/12/13 17:00	X	X		X	X	X	X					4
10	SS24 HV0033			10/13/13 14:30	X	X		X	X	X	X					4
11																
12																

B394653

Print name and sign

*Relinquished By:	Date (yy/mm/dd):	Time (24hr):	Received by	Date (yy/mm/dd)	Time (24 hr)	Time Sensitive	Temperature on Receipt °C	Custody Seal	Yes	No
Phil Emerson	14-Oct-13	7:00	Delbert Pascual	2013/10/15	09:10	☑	A) B) C)	Present? N/A		
							Just sampled & iced on ice: ☐	Intact? N/A		

*IT IS THE RESPONSIBILITY OF THE RELINQUISHER TO ENSURE THE ACCURACY OF THE CHAIN OF CUSTODY RECORDS. AN INCOMPLETE CHAIN OF CUSTODY MAY RESULT IN ANALYTICAL TAT DELAYS.

Maxxam

Success Through Science®

Your P.O. #: 204251
Your Project #: MINTO ENV.MONITORING
Site Location: YUKON
Your C.O.C. #: EB771313

Attention: MINTO DISTRIBUTION LIST
MINTO EXPLORATIONS LTD.
Yukon/Whitehorse
2 - 25 Pilgrim Way
Whitehorse, YT
CANADA Y1A 6E6

Report Date: 2013/07/08

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B354470
Received: 2013/06/28, 09:20

Sample Matrix: Water
Samples Received: 3

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Analytical Method
Alkalinity - Water	3	2013/06/29	2013/06/30	BBY6SOP-00026	SM2320B
Chloride by Automated Colourimetry	3	N/A	2013/07/02	BBY6SOP-00011	SM-4500-Cl-
Conductance - water	3	N/A	2013/06/30	BBY6SOP-00026	SM-2510B
Fluoride	3	N/A	2013/07/03	BBY6SOP-00012	SM - 4500 F C
Hardness (calculated as CaCO3)	3	N/A	2013/07/06	BBY7SOP-00002	EPA 6020A
Mercury (Dissolved) by CVAF	3	N/A	2013/07/05	BBY7SOP-00015	EPA 245.7
Na, K, Ca, Mg, S by CRC ICPMS (diss.)	3	N/A	2013/07/06	BBY7SOP-00002	EPA 6020A
Elements by CRC ICPMS (dissolved)	3	N/A	2013/07/05	BBY7SOP-00002	EPA 6020A
Ammonia-N (Preserved)	3	N/A	2013/07/02	BBY6SOP-00009	SM-4500NH3G
Nitrate + Nitrite (N)	3	N/A	2013/06/29	BBY6SOP-00010	SM 4500NO3-I
Nitrite (N) by CFA	3	N/A	2013/06/29	BBY6SOP-00010	EPA 353.2
Nitrogen - Nitrate (as N)	3	N/A	2013/07/04	BBY6SOP-00010	SM 4500NO3-I
Filter and HNO3 Preserve for Metals	3	N/A	2013/06/28	BBY6WI-00001	EPA 200.2
pH Water	3	N/A	2013/06/30	BBY6SOP-00026	SM-4500H+B
Sulphate by Automated Colourimetry	3	N/A	2013/07/02	BBY6SOP-00017	SM4500-SO42- E
Total Dissolved Solids (Filt. Residue)	3	2013/07/03	2013/07/04	BBY6SOP-00033	SM 2540C
Total Suspended Solids-Low Level	3	2013/07/03	2013/07/04	BBY6SOP-00034	SM-2540 D

* Results relate only to the items tested.

Encryption Key

Please direct all questions regarding this Certificate of Analysis to your Project Manager.

Arshdeep Khalsa, Burnaby Project Manager
Email: AKhalsa@maxxam.ca
Phone# (604) 638-5019

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Maxxam has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per section 5.10.2 of ISO/IEC 17025:2005(E), signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

Total cover pages: 1

Maxxam Job #: B354470
Report Date: 2013/07/08

MINTO EXPLORATIONS LTD.
Client Project #: MINTO ENV.MONITORING
Site Location: YUKON
Your P.O. #: 204251

RESULTS OF CHEMICAL ANALYSES OF WATER

Maxxam ID		GT8170		GT8171		GT8172		
Sampling Date		2013/06/26 11:05		2013/06/26 11:15		2013/06/26 13:55		
	UNITS	**LDP**	**RDL**	**SS7**	**RDL**	**SS8**	**RDL**	**QC Batch**
ANIONS								
Nitrite (N)	mg/L	0.0059	0.0050	0.590	0.010	0.588	0.010	6944722
Calculated Parameters								
Filter and HNO3 Preservation	N/A	FIELD	N/A	FIELD	N/A	FIELD	N/A	ONSITE
Nitrate (N)	mg/L	0.750	0.020	63.6	1.0	65.7	2.0	6941115
Misc. Inorganics								
Fluoride (F)	mg/L	0.390	0.010	0.430	0.010	0.420	0.010	6951453
Alkalinity (Total as CaCO3)	mg/L	160	0.50	408	0.50	396	0.50	6944431
Alkalinity (PP as CaCO3)	mg/L	<0.50	0.50	<0.50	0.50	<0.50	0.50	6944431
Bicarbonate (HCO3)	mg/L	195	0.50	498	0.50	483	0.50	6944431
Carbonate (CO3)	mg/L	<0.50	0.50	<0.50	0.50	<0.50	0.50	6944431
Hydroxide (OH)	mg/L	<0.50	0.50	<0.50	0.50	<0.50	0.50	6944431
Anions								
Dissolved Sulphate (SO4)	mg/L	31.5	0.50	183	0.50	185	0.50	6948853
Dissolved Chloride (Cl)	mg/L	6.1	0.50	5.2	0.50	5.1	0.50	6948824
Nutrients								
Ammonia (N)	mg/L	0.032	0.0050	0.44	0.0050	0.47	0.0050	6948080
Nitrate plus Nitrite (N)	mg/L	0.756	0.020	64.2	1.0	66.3	2.0	6944721
Physical Properties								
Conductivity	uS/cm	385	1.0	1480	1.0	1470	1.0	6944436
pH	pH Units	8.23		8.13		8.09		6944434
Physical Properties								
Total Suspended Solids	mg/L	<1.0	1.0	29.9	1.0	<1.0	1.0	6948840
Total Dissolved Solids	mg/L	220	10	1090	10	1180	10	6951231

N/A = Not Applicable
RDL = Reportable Detection Limit

Maxxam Job #: B354470
Report Date: 2013/07/08

MINTO EXPLORATIONS LTD.
Client Project #: MINTO ENV.MONITORING
Site Location: YUKON
Your P.O. #: 204251

CCME DISSOLVED METALS IN WATER (WATER)

Maxxam ID		GT8170	GT8171	GT8172		
Sampling Date		2013/06/26 11:05	2013/06/26 11:15	2013/06/26 13:55		
	UNITS	**LDP**	**SS7**	**SS8**	**RDL**	**QC Batch**
Misc. Inorganics						
Dissolved Hardness (CaCO3)	mg/L	169	754	801	0.50	6941241
Elements						
Dissolved Mercury (Hg)	ug/L	<0.010	<0.010	<0.010	0.010	6956711

RDL = Reportable Detection Limit

CCME DISSOLVED METALS IN WATER (WATER)

Maxxam ID		GT8170	GT8171	GT8172		
Sampling Date		2013/06/26 11:05	2013/06/26 11:15	2013/06/26 13:55		
	UNITS	**LDP**	**SS7**	**SS8**	**RDL**	**QC Batch**
Dissolved Metals by ICPMS						
Dissolved Aluminum (Al)	ug/L	5.1	17.7	11.2	3.0	6951634
Dissolved Antimony (Sb)	ug/L	<0.50	<0.50	<0.50	0.50	6951634
Dissolved Arsenic (As)	ug/L	0.37	0.52	0.44	0.10	6951634
Dissolved Barium (Ba)	ug/L	59.6	126	122	1.0	6951634
Dissolved Beryllium (Be)	ug/L	<0.10	<0.10	<0.10	0.10	6951634
Dissolved Bismuth (Bi)	ug/L	<1.0	<1.0	<1.0	1.0	6951634
Dissolved Boron (B)	ug/L	<50	63	61	50	6951634
Dissolved Cadmium (Cd)	ug/L	<0.010	0.610	0.591	0.010	6951634
Dissolved Chromium (Cr)	ug/L	<1.0	<1.0	<1.0	1.0	6951634
Dissolved Cobalt (Co)	ug/L	<0.50	<0.50	<0.50	0.50	6951634
Dissolved Copper (Cu)	ug/L	6.53	238	218	0.20	6951634
Dissolved Iron (Fe)	ug/L	10.8	65.9	50.1	5.0	6951634
Dissolved Lead (Pb)	ug/L	<0.20	<0.20	<0.20	0.20	6951634
Dissolved Lithium (Li)	ug/L	<5.0	<5.0	<5.0	5.0	6951634
Dissolved Manganese (Mn)	ug/L	146	891	872	1.0	6951634
Dissolved Molybdenum (Mo)	ug/L	7.1	15.2	15.3	1.0	6951634
Dissolved Nickel (Ni)	ug/L	<1.0	<1.0	<1.0	1.0	6951634
Dissolved Phosphorus (P)	ug/L	<10	16	14	10	6951634
Dissolved Selenium (Se)	ug/L	0.51	34.1	39.8	0.10	6951634
Dissolved Silicon (Si)	ug/L	4420	7430	8270	100	6951634
Dissolved Silver (Ag)	ug/L	<0.020	0.082	0.071	0.020	6951634
Dissolved Strontium (Sr)	ug/L	504	4600	4480	1.0	6951634
Dissolved Thallium (Tl)	ug/L	<0.050	<0.050	<0.050	0.050	6951634
Dissolved Tin (Sn)	ug/L	<5.0	<5.0	<5.0	5.0	6951634
Dissolved Titanium (Ti)	ug/L	<5.0	<5.0	<5.0	5.0	6951634
Dissolved Uranium (U)	ug/L	1.62	6.25	6.08	0.10	6951634
Dissolved Vanadium (V)	ug/L	<5.0	<5.0	<5.0	5.0	6951634
Dissolved Zinc (Zn)	ug/L	<5.0	6.2	6.0	5.0	6951634
Dissolved Zirconium (Zr)	ug/L	<0.50	<0.50	<0.50	0.50	6951634
Dissolved Calcium (Ca)	mg/L	45.5	210	233	0.050	6941242
Dissolved Magnesium (Mg)	mg/L	13.6	55.8	52.9	0.050	6941242
Dissolved Potassium (K)	mg/L	3.06	6.91	6.89	0.050	6941242
Dissolved Sodium (Na)	mg/L	12.5	26.0	24.8	0.050	6941242
Dissolved Sulphur (S)	mg/L	10.6	62.8	63.9	3.0	6941242

RDL = Reportable Detection Limit

General Comments

Sample GT8170-01: The BC-MOE and APHA Standard Method require pH to be analysed within 15 minutes of sampling and therefore field analysis is required for compliance. All Laboratory pH analyses in this report are reported past the BC-MOE/APHA Standard Method holding time.

Sample GT8171-01: The BC-MOE and APHA Standard Method require pH to be analysed within 15 minutes of sampling and therefore field analysis is required for compliance. All Laboratory pH analyses in this report are reported past the BC-MOE/APHA Standard Method holding time.

Sample GT8172-01: The BC-MOE and APHA Standard Method require pH to be analysed within 15 minutes of sampling and therefore field analysis is required for compliance. All Laboratory pH analyses in this report are reported past the BC-MOE/APHA Standard Method holding time.

Maxxam Job #: B354470
Report Date: 2013/07/08

MINTO EXPLORATIONS LTD.
Client Project #: MINTO ENV.MONITORING
Site Location: YUKON
Your P.O. #: 204251

QUALITY ASSURANCE REPORT

			Matrix Spike		Spiked Blank		Method Blank		RPD	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits
6944431	Alkalinity (Total as CaCO3)	2013/06/30	NC	80 - 120	101	80 - 120	<0.50	mg/L	0.5	20
6944431	Alkalinity (PP as CaCO3)	2013/06/30					<0.50	mg/L	NC	20
6944431	Bicarbonate (HCO3)	2013/06/30					<0.50	mg/L	0.5	20
6944431	Carbonate (CO3)	2013/06/30					<0.50	mg/L	NC	20
6944431	Hydroxide (OH)	2013/06/30					<0.50	mg/L	NC	20
6944436	Conductivity	2013/06/30			100	80 - 120	<1.0	uS/cm	0.2	20
6944721	Nitrate plus Nitrite (N)	2013/06/29	107	80 - 120	106	80 - 120	<0.020	mg/L	0.6	25
6944722	Nitrite (N)	2013/06/29	91	80 - 120	98	80 - 120	<0.0050	mg/L	0	20
6948080	Ammonia (N)	2013/07/02	108	80 - 120	100	80 - 120	<0.0050	mg/L	2.3	20
6948824	Dissolved Chloride (Cl)	2013/07/02	101	80 - 120	100	80 - 120	<0.50	mg/L	0.4	20
6948840	Total Suspended Solids	2013/07/04			95	80 - 120	<1.0	mg/L		
6948853	Dissolved Sulphate (SO4)	2013/07/02	NC	80 - 120	94	80 - 120	<0.50	mg/L	0.3	20
6951231	Total Dissolved Solids	2013/07/04	NC	80 - 120	96	80 - 120	<10	mg/L	2.4	20
6951453	Fluoride (F)	2013/07/03	90	80 - 120	98	80 - 120	<0.010	mg/L	2.6	20
6951634	Dissolved Aluminum (Al)	2013/07/05	105	80 - 120	101	80 - 120	<3.0	ug/L		
6951634	Dissolved Antimony (Sb)	2013/07/05	108	80 - 120	102	80 - 120	<0.50	ug/L		
6951634	Dissolved Arsenic (As)	2013/07/05	108	80 - 120	102	80 - 120	<0.10	ug/L		
6951634	Dissolved Barium (Ba)	2013/07/05	105	80 - 120	102	80 - 120	<1.0	ug/L		
6951634	Dissolved Beryllium (Be)	2013/07/05	103	80 - 120	95	80 - 120	<0.10	ug/L		
6951634	Dissolved Bismuth (Bi)	2013/07/05	105	80 - 120	103	80 - 120	<1.0	ug/L		
6951634	Dissolved Cadmium (Cd)	2013/07/05	106	80 - 120	102	80 - 120	<0.010	ug/L		
6951634	Dissolved Chromium (Cr)	2013/07/05	108	80 - 120	107	80 - 120	<1.0	ug/L		
6951634	Dissolved Cobalt (Co)	2013/07/05	106	80 - 120	104	80 - 120	<0.50	ug/L		
6951634	Dissolved Copper (Cu)	2013/07/05	110	80 - 120	107	80 - 120	<0.20	ug/L		
6951634	Dissolved Iron (Fe)	2013/07/05	114	80 - 120	110	80 - 120	<5.0	ug/L		
6951634	Dissolved Lead (Pb)	2013/07/05	98	80 - 120	95	80 - 120	<0.20	ug/L		
6951634	Dissolved Lithium (Li)	2013/07/05	103	80 - 120	99	80 - 120	<5.0	ug/L		
6951634	Dissolved Manganese (Mn)	2013/07/05	107	80 - 120	104	80 - 120	<1.0	ug/L		
6951634	Dissolved Molybdenum (Mo)	2013/07/05	106	80 - 120	105	80 - 120	<1.0	ug/L		
6951634	Dissolved Nickel (Ni)	2013/07/05	108	80 - 120	105	80 - 120	<1.0	ug/L		
6951634	Dissolved Selenium (Se)	2013/07/05	117	80 - 120	107	80 - 120	<0.10	ug/L		
6951634	Dissolved Silver (Ag)	2013/07/05	100	80 - 120	99	80 - 120	<0.020	ug/L		
6951634	Dissolved Strontium (Sr)	2013/07/05	101	80 - 120	99	80 - 120	<1.0	ug/L		
6951634	Dissolved Thallium (Tl)	2013/07/05	91	80 - 120	105	80 - 120	<0.050	ug/L		
6951634	Dissolved Tin (Sn)	2013/07/05	105	80 - 120	100	80 - 120	<5.0	ug/L		
6951634	Dissolved Titanium (Ti)	2013/07/05	114	80 - 120	112	80 - 120	<5.0	ug/L		
6951634	Dissolved Uranium (U)	2013/07/05	98	80 - 120	95	80 - 120	<0.10	ug/L		
6951634	Dissolved Vanadium (V)	2013/07/05	109	80 - 120	105	80 - 120	<5.0	ug/L		
6951634	Dissolved Zinc (Zn)	2013/07/05	125(1)	80 - 120	113	80 - 120	<5.0	ug/L		

Maxxam Job #: B354470
Report Date: 2013/07/08

MINTO EXPLORATIONS LTD.
Client Project #: MINTO ENV.MONITORING
Site Location: YUKON
Your P.O. #: 204251

QUALITY ASSURANCE REPORT

			Matrix Spike		Spiked Blank		Method Blank		RPD	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits
6951634	Dissolved Boron (B)	2013/07/05					<50	ug/L		
6951634	Dissolved Phosphorus (P)	2013/07/05					<10	ug/L		
6951634	Dissolved Silicon (Si)	2013/07/05					<100	ug/L		
6951634	Dissolved Zirconium (Zr)	2013/07/05					<0.50	ug/L		
6956711	Dissolved Mercury (Hg)	2013/07/05	101	80 - 120	98	80 - 120	<0.010	ug/L	NC	20

N/A = Not Applicable
RPD = Relative Percent Difference
Duplicate: Paired analysis of a separate portion of the same sample. Used to evaluate the variance in the measurement.
Matrix Spike: A sample to which a known amount of the analyte of interest has been added. Used to evaluate sample matrix interference.
Spiked Blank: A blank matrix sample to which a known amount of the analyte, usually from a second source, has been added. Used to evaluate method accuracy.
Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.
NC (Matrix Spike): The recovery in the matrix spike was not calculated. The relative difference between the concentration in the parent sample and the spiked amount was not sufficiently significant to permit a reliable recovery calculation.
NC (RPD): The RPD was not calculated. The level of analyte detected in the parent sample and its duplicate was not sufficiently significant to permit a reliable calculation.
(1) - Recovery or RPD for this parameter is outside control limits. The overall quality control for this analysis meets acceptability criteria.

Maxxam

Burnaby: 4606 Canada Way, Burnaby, BC V5G 1K5 Ph: (604) 734-7276 Fax: (604) 731-2386, Toll Free: (800) 665-8566

CHAIN OF CUSTODY RECORD

Maxxam Job #: B354470 COC #: EB771313 (Click here to get the COC number) Page: 1 of 1

Invoice To: Require Report? Yes ☑ No ☐

Invoice To		Report To			
Company Name:	Minto Explorations Ltd	Company Name:	Minto Explorations Ltd	PO #:	204251
Contact Name:	Elvina Wong	Contact Name:	Minto Environment	Quotation #:	
Address:	Suite 900 - 999 West Hastings St	Address:	Suite 900-999 West Hastings St	Project # :	
	Vancouver, B.C. PC: V6C 2W2		Vancouver, B.C. PC: V6C 2W2	Proj. Name:	Minto Env. Monitoring
Phone / Fax#:	Ph: 604-684-8894 Fax: 604-688-2120	Phone / Fax#:	Ph: 604-684-8894 Fax: 604-688-2120	Location:	Yukon
E-mail		E-mail	minto_environment@mintomine.com	Sampled by:	PE/Students

REGULATORY REQUIREMENTS:

- ☐ CSR
- ☑ CCME
- ☐ BC Water Quality
- ☐ Other
- ☐ DRINKING WATER

SERVICE REQUESTED:

- ◉ Regular Turn Around Time (TAT) (5 days for most tests)
- **RUSH** (Please contact the lab) ○ 1 Day ○ 2 Day ○ 3 Day
- Date Required:

SPECIAL INSTRUCTIONS:

Return Cooler ☐ **Ship Sample Bottles (please specify)** ☐

ANALYSIS REQUESTED

#	Sample Identification	Lab Identification (Lab Use Only)	Sample Type	Date/Time(24hr) Sampled	Dissolved Metals (DM) (Field Filtered? Y ☑)	Field Acidified? Y ☑	Total Metals (Field Acidified? Y ☑)	Nitrate ☑ Nitrite ☑ Ammonia ☑	Total Suspended Solids (TSS) ☑ TDS ☑	pH ☑ Conductivity ☑ Alkalinity ☑	Chloride ☑ Fluoride ☑ Sulphate ☑	Phosphate	DOC (Diss'd Organic Carbon)	TOC (Total Organic Carbon)	Ra 226	Number of Containers
1	LDP	GT8170	Water	6/26/13 11:05	X	X		X	X	X	X					4
2	SS7	GT8171	Water	6/26/13 11:15	X	X		X	X	X	X					4
3	SS8	GT8172	Water	6/26/13 13:55	X	X		X	X	X	X					4
4																
5																
6																
7																
8																
9																
10																
11																
12																

B354470

*Relinquished By: (Print name and sign)	Date (yy/mm/dd):	Time (24hr):	Received by: (Print name and sign)	Date (yy/mm/dd)	Time (24 hr)	Time Sensitive	Temperature on Receipt (°C)	Custody Seal	Yes	No
Phil Emerson	27-Jun-13	7:30	Yolanda YOLANDA	2013/06/28	09:20	☑	A) 1 B) 3 C) 4	Present?	☐	☑
							Just sampled & rec'd on ice ☐	Intact? NA	☐	☐

*IT IS THE RESPONSIBILITY OF THE RELINQUISHER TO ENSURE THE ACCURACY OF THE CHAIN OF CUSTODY RECORDS. AN INCOMPLETE CHAIN OF CUSTODY MAY RESULT IN ANALYTICAL TAT DELAYS.

BBY FCD-00077R2_C

Appendix D

Groundwater Quality Monitoring Laboratory Results

Maxxam

Success Through Science®

Your P.O. #: 113796
Your Project #: MINTO ENV. MONITORING
Site Location: YUKON
Your C.O.C. #: EB687913

Attention: MINTO DISTRIBUTION LIST
MINTO EXPLORATIONS LTD.
Yukon/Whitehorse
2 - 25 Pilgrim Way
Whitehorse, YT
CANADA Y1A 6E6

Report Date: 2013/03/22

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B320260
Received: 2013/03/14, 10:20

Sample Matrix: Water
Samples Received: 4

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Analytical Method
Alkalinity - Water	4	2013/03/15	2013/03/15	BBY6SOP-00026	SM2320B
Chloride by Automated Colourimetry	4	N/A	2013/03/15	BBY6SOP-00011	SM-4500-Cl-
Conductance - water	4	N/A	2013/03/15	BBY6SOP-00026	SM-2510B
Fluoride	4	N/A	2013/03/15	BBY6SOP-00038	SM - 4500 F C
Hardness Total (calculated as CaCO3)	4	N/A	2013/03/20	BBY WI-00033	Calculated Parameter
Hardness (calculated as CaCO3)	4	N/A	2013/03/20	BBY WI-00033	Calculated Parameter
Mercury (Dissolved) by CVAF	4	N/A	2013/03/18	BBY7SOP-00015	EPA 245.7
Mercury (Total) by CVAF	4	2013/03/18	2013/03/18	BBY7SOP-00015	EPA 245.7
Na, K, Ca, Mg, S by CRC ICPMS (diss.)	4	N/A	2013/03/20	BBY7SOP-00002	EPA 6020A
Elements by CRC ICPMS (dissolved)	4	N/A	2013/03/19	BBY7SOP-00002	EPA 6020A
Na, K, Ca, Mg, S by CRC ICPMS (total)	4	2013/03/14	2013/03/20	BBY7SOP-00002	EPA 6020A
Elements by CRC ICPMS (total)	4	2013/03/19	2013/03/20	BBY7SOP-00002	EPA 6020A
Ammonia-N (Preserved)	4	N/A	2013/03/15	BBY6SOP-00009	SM-4500NH3G
Nitrate + Nitrite (N)	4	N/A	2013/03/15	BBY6SOP-00010	USEPA 353.2
Nitrite (N) by CFA	4	N/A	2013/03/15	BBY6SOP-00010	EPA 353.2
Nitrogen - Nitrate (as N)	4	N/A	2013/03/16	BBY6SOP-00010	Based on EPA 353.2
Filter and HNO3 Preserve for Metals	4	N/A	2013/03/14	BBY6WI-00001	EPA 200.2
pH Water	4	N/A	2013/03/15	BBY6SOP-00026	SM-4500H+B
Sulphate by Automated Colourimetry	2	N/A	2013/03/15	BBY6SOP-00017	SM4500-SO42- E
Sulphate by Automated Colourimetry	2	N/A	2013/03/16	BBY6SOP-00017	SM4500-SO42- E
Total Dissolved Solids (Filt. Residue)	4	2013/03/19	2013/03/19	BBY6SOP-00033	SM 2540C
Total Suspended Solids-Low Level	4	2013/03/18	2013/03/18	BBY6SOP-00034	SM-2540 D

* Results relate only to the items tested.

Encryption Key

Please direct all questions regarding this Certificate of Analysis to your Project Manager.

Ashley Nivison, Burnaby Senior Project Manager
Email: ANivison@maxxam.ca
Phone# (604) 639-2616 Ext:230

==
Maxxam has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per section 5.10.2 of ISO/IEC 17025:2005(E), signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

Total cover pages: 1

Maxxam Job #: B320260
Report Date: 2013/03/22

MINTO EXPLORATIONS LTD.
Client Project #: MINTO ENV. MONITORING
Site Location: YUKON
Your P.O. #: 113796
Sampler Initials: CH

RESULTS OF CHEMICAL ANALYSES OF WATER

Maxxam ID		FW4882		FW4883		FW4884		FW4885		
Sampling Date		2013/03/12		2013/03/12		2013/03/12		2013/03/12		
	UNITS	**MW09-03-01**	**QC Batch**	**MW09-03-02**	**QC Batch**	**MW09-03-03**	**QC Batch**	**DUP**	**RDL**	**QC Batch**
ANIONS										
Nitrite (N)	mg/L	0.161	6656112	0.0915	6656112	0.0100	6656112	0.160	0.0050	6656112
Calculated Parameters										
Filter and HNO3 Preservation	N/A	FIELD	ONSITE	FIELD	ONSITE	FIELD	ONSITE	FIELD	N/A	ONSITE
Nitrate (N)	mg/L	0.052	6648376	0.021	6648376	0.366	6648376	0.037	0.020	6648376
Misc. Inorganics										
Fluoride (F)	mg/L	0.850	6656104	0.780	6656104	0.370	6656104	0.840	0.010	6656104
Alkalinity (Total as CaCO3)	mg/L	133	6655891	524	6655891	82.2	6655891	132	0.50	6655891
Alkalinity (PP as CaCO3)	mg/L	<0.50	6655891	<0.50	6655891	<0.50	6655891	<0.50	0.50	6655891
Bicarbonate (HCO3)	mg/L	163	6655891	639	6655891	100	6655891	161	0.50	6655891
Carbonate (CO3)	mg/L	<0.50	6655891	<0.50	6655891	<0.50	6655891	<0.50	0.50	6655891
Hydroxide (OH)	mg/L	<0.50	6655891	<0.50	6655891	<0.50	6655891	<0.50	0.50	6655891
Anions										
Dissolved Sulphate (SO4)	mg/L	24.4	6656242	0.53	6658360	12.8	6656242	23.5	0.50	6658360
Dissolved Chloride (Cl)	mg/L	1.0	6656241	5.1	6656241	1.1	6656241	0.89	0.50	6656241
Nutrients										
Ammonia (N)	mg/L	0.065	6653826	0.33	6653826	0.025	6653826	0.051	0.0050	6653826
Nitrate plus Nitrite (N)	mg/L	0.213	6656109	0.112	6656109	0.376	6656109	0.197	0.020	6656109
Physical Properties										
Conductivity	uS/cm	304	6655890	991	6655890	189	6655890	301	1.0	6655890
pH	pH Units	8.23	6655881	8.03	6655881	7.91	6655881	8.14		6655881
Physical Properties										
Total Suspended Solids	mg/L	2.8	6656658	54.2	6656658	<1.0	6656658	3.0	1.0	6656658
Total Dissolved Solids	mg/L	188	6663469	670	6663469	130	6663469	182	10	6663469

N/A = Not Applicable
RDL = Reportable Detection Limit

Maxxam Job #: B320260
Report Date: 2013/03/22

MINTO EXPLORATIONS LTD.
Client Project #: MINTO ENV. MONITORING
Site Location: YUKON
Your P.O. #: 113796
Sampler Initials: CH

CCME DISSOLVED METALS IN WATER (WATER)

Maxxam ID		FW4882	FW4883	FW4884	FW4885		
Sampling Date		2013/03/12	2013/03/12	2013/03/12	2013/03/12		
	UNITS	**MW09-03-01**	**MW09-03-02**	**MW09-03-03**	**DUP**	**RDL**	**QC Batch**
Misc. Inorganics							
Dissolved Hardness (CaCO3)	mg/L	137	503	85.8	139	0.50	6648373
Elements							
Dissolved Mercury (Hg)	ug/L	<0.010	<0.010	<0.010	<0.010	0.010	6659074

RDL = Reportable Detection Limit

Maxxam Job #: B320260
Report Date: 2013/03/22

MINTO EXPLORATIONS LTD.
Client Project #: MINTO ENV. MONITORING
Site Location: YUKON
Your P.O. #: 113796
Sampler Initials: CH

CCME DISSOLVED METALS IN WATER (WATER)

Maxxam ID		FW4882	FW4883	FW4884	FW4885		
Sampling Date		2013/03/12	2013/03/12	2013/03/12	2013/03/12		
	UNITS	**MW09-03-01**	**MW09-03-02**	**MW09-03-03**	**DUP**	**RDL**	**QC Batch**
Dissolved Metals by ICPMS							
Dissolved Aluminum (Al)	ug/L	3.2	3.8	<3.0	3.1	3.0	6665641
Dissolved Antimony (Sb)	ug/L	<0.50	<0.50	<0.50	<0.50	0.50	6665641
Dissolved Arsenic (As)	ug/L	<0.10	0.38	<0.10	<0.10	0.10	6665641
Dissolved Barium (Ba)	ug/L	44.9	631	57.3	45.3	1.0	6665641
Dissolved Beryllium (Be)	ug/L	<0.10	<0.10	<0.10	<0.10	0.10	6665641
Dissolved Bismuth (Bi)	ug/L	<1.0	<1.0	<1.0	<1.0	1.0	6665641
Dissolved Boron (B)	ug/L	104	409	<50	105	50	6665641
Dissolved Cadmium (Cd)	ug/L	0.028	0.011	0.015	0.015	0.010	6665641
Dissolved Chromium (Cr)	ug/L	<1.0	<1.0	<1.0	<1.0	1.0	6665641
Dissolved Cobalt (Co)	ug/L	<0.50	1.05	<0.50	<0.50	0.50	6665641
Dissolved Copper (Cu)	ug/L	0.31	<0.20	1.39	0.31	0.20	6665641
Dissolved Iron (Fe)	ug/L	<5.0	14700	19.5	<5.0	5.0	6665641
Dissolved Lead (Pb)	ug/L	<0.20	<0.20	<0.20	<0.20	0.20	6665641
Dissolved Lithium (Li)	ug/L	<5.0	<5.0	<5.0	<5.0	5.0	6665641
Dissolved Manganese (Mn)	ug/L	73.2	20400	57.3(1)	73.1	1.0	6665641
Dissolved Molybdenum (Mo)	ug/L	4.5	17.6	12.8	4.5	1.0	6665641
Dissolved Nickel (Ni)	ug/L	1.3	<1.0	<1.0	1.3	1.0	6665641
Dissolved Phosphorus (P)	ug/L	<10	<10	<10	<10	10	6665641
Dissolved Selenium (Se)	ug/L	<0.10	0.17	0.36	<0.10	0.10	6665641
Dissolved Silicon (Si)	ug/L	4330	10200	4270	4490	100	6665641
Dissolved Silver (Ag)	ug/L	<0.020	<0.020	<0.020	<0.020	0.020	6665641
Dissolved Strontium (Sr)	ug/L	738	1610	174	737	1.0	6665641
Dissolved Thallium (Tl)	ug/L	<0.050	<0.050	<0.050	<0.050	0.050	6665641
Dissolved Tin (Sn)	ug/L	<5.0	<5.0	<5.0	<5.0	5.0	6665641
Dissolved Titanium (Ti)	ug/L	<5.0	<5.0	<5.0	<5.0	5.0	6665641
Dissolved Uranium (U)	ug/L	1.50	0.22	1.08	1.49	0.10	6665641
Dissolved Vanadium (V)	ug/L	<5.0	<5.0	<5.0	<5.0	5.0	6665641
Dissolved Zinc (Zn)	ug/L	<5.0	<5.0	<5.0	<5.0	5.0	6665641
Dissolved Zirconium (Zr)	ug/L	<0.50	<0.50	<0.50	<0.50	0.50	6665641
Dissolved Calcium (Ca)	mg/L	38.8	158	28.1	39.4	0.050	6648374
Dissolved Magnesium (Mg)	mg/L	9.69	26.3	3.79	9.87	0.050	6648374
Dissolved Potassium (K)	mg/L	2.69	4.25	1.89	2.62	0.050	6648374
Dissolved Sodium (Na)	mg/L	5.26	17.2	3.32	5.32	0.050	6648374
Dissolved Sulphur (S)	mg/L	7.9	<3.0	5.0	8.2	3.0	6648374

RDL = Reportable Detection Limit
(1) - Dissolved greater than total. Reanalysis yields similar results.

Success Through Science®

MINTO EXPLORATIONS LTD.
Client Project #: MINTO ENV. MONITORING
Site Location: YUKON
Your P.O. #: 113796
Sampler Initials: CH

Maxxam Job #: B320260
Report Date: 2013/03/22

CCME TOTAL METALS IN WATER (WATER)

Maxxam ID		FW4882	FW4883	FW4884	FW4885		
Sampling Date		2013/03/12	2013/03/12	2013/03/12	2013/03/12		
	UNITS	**MW09-03-01**	**MW09-03-02**	**MW09-03-03**	**DUP**	**RDL**	**QC Batch**
Calculated Parameters							
Total Hardness (CaCO3)	mg/L	141	505	88.8	141	0.50	6648372
Elements							
Total Mercury (Hg)	ug/L	<0.010	<0.010	<0.010	<0.010	0.010	6638404

RDL = Reportable Detection Limit

Maxxam Job #: B320260
Report Date: 2013/03/22

MINTO EXPLORATIONS LTD.
Client Project #: MINTO ENV. MONITORING
Site Location: YUKON
Your P.O. #: 113796
Sampler Initials: CH

CCME TOTAL METALS IN WATER (WATER)

Maxxam ID		FW4882	FW4883	FW4884	FW4885		
Sampling Date		2013/03/12	2013/03/12	2013/03/12	2013/03/12		
	UNITS	**MW09-03-01**	**MW09-03-02**	**MW09-03-03**	**DUP**	**RDL**	**QC Batch**
Total Metals by ICPMS							
Total Aluminum (Al)	ug/L	38.2	32.8	6.8	41.5	3.0	6662907
Total Antimony (Sb)	ug/L	1.17	0.51	<0.50	<0.50	0.50	6662907
Total Arsenic (As)	ug/L	<0.10	0.87	<0.10	<0.10	0.10	6662907
Total Barium (Ba)	ug/L	46.6	755	57.3	46.8	1.0	6662907
Total Beryllium (Be)	ug/L	<0.10	<0.10	<0.10	<0.10	0.10	6662907
Total Bismuth (Bi)	ug/L	<1.0	<1.0	<1.0	<1.0	1.0	6662907
Total Boron (B)	ug/L	157	374	<50	123	50	6662907
Total Cadmium (Cd)	ug/L	0.169	0.019	0.035	0.024	0.010	6662907
Total Chromium (Cr)	ug/L	1.1	<1.0	<1.0	<1.0	1.0	6662907
Total Cobalt (Co)	ug/L	<0.50	1.09	<0.50	<0.50	0.50	6662907
Total Copper (Cu)	ug/L	2.73	5.88	1.91	0.58	0.20	6662907
Total Iron (Fe)	ug/L	90.2	23000	39.9	95.1	5.0	6662907
Total Lead (Pb)	ug/L	0.32	<0.20	<0.20	<0.20	0.20	6662907
Total Lithium (Li)	ug/L	<5.0	<5.0	<5.0	<5.0	5.0	6662907
Total Manganese (Mn)	ug/L	88.3	20500	27.0	80.7	1.0	6662907
Total Molybdenum (Mo)	ug/L	5.4	18.0	12.6	4.5	1.0	6662907
Total Nickel (Ni)	ug/L	4.1	<1.0	<1.0	1.6	1.0	6662907
Total Phosphorus (P)	ug/L	<10	<10	<10	<10	10	6662907
Total Selenium (Se)	ug/L	<0.10	0.17	0.44	<0.10	0.10	6662907
Total Silicon (Si)	ug/L	4820	10800	4460	4770	100	6662907
Total Silver (Ag)	ug/L	<0.020	0.107	<0.020	<0.020	0.020	6662907
Total Strontium (Sr)	ug/L	726	1650	173	739	1.0	6662907
Total Thallium (Tl)	ug/L	<0.050	<0.050	<0.050	<0.050	0.050	6662907
Total Tin (Sn)	ug/L	<5.0	<5.0	<5.0	<5.0	5.0	6662907
Total Titanium (Ti)	ug/L	<5.0	<5.0	<5.0	<5.0	5.0	6662907
Total Uranium (U)	ug/L	1.45	0.25	1.06	1.45	0.10	6662907
Total Vanadium (V)	ug/L	<5.0	<5.0	<5.0	<5.0	5.0	6662907
Total Zinc (Zn)	ug/L	10.9	9.2	<5.0	8.3	5.0	6662907
Total Zirconium (Zr)	ug/L	<0.50	<0.50	<0.50	<0.50	0.50	6662907
Total Calcium (Ca)	mg/L	40.4	160	29.4	40.4	0.050	6649012
Total Magnesium (Mg)	mg/L	9.61	25.9	3.76	9.63	0.050	6649012
Total Potassium (K)	mg/L	2.66	4.16	1.90	2.60	0.050	6649012
Total Sodium (Na)	mg/L	5.47	16.5	3.21	5.22	0.050	6649012
Total Sulphur (S)	mg/L	7.8	<3.0	4.2	7.9	3.0	6649012

RDL = Reportable Detection Limit

General Comments

Sample FW4882-01: The BC-MOE and APHA Standard Method require pH to be analysed within 15 minutes of sampling and therefore field analysis is required for compliance. All Laboratory pH analyses in this report are reported past the BC-MOE/APHA Standard Method holding time.

Sample FW4883-01: The BC-MOE and APHA Standard Method require pH to be analysed within 15 minutes of sampling and therefore field analysis is required for compliance. All Laboratory pH analyses in this report are reported past the BC-MOE/APHA Standard Method holding time.

Sample FW4884-01: The BC-MOE and APHA Standard Method require pH to be analysed within 15 minutes of sampling and therefore field analysis is required for compliance. All Laboratory pH analyses in this report are reported past the BC-MOE/APHA Standard Method holding time.

Sample FW4885-01: The BC-MOE and APHA Standard Method require pH to be analysed within 15 minutes of sampling and therefore field analysis is required for compliance. All Laboratory pH analyses in this report are reported past the BC-MOE/APHA Standard Method holding time.

Success Through Science®

Maxxam Job #: B320260
Report Date: 2013/03/22

MINTO EXPLORATIONS LTD.
Client Project #: MINTO ENV. MONITORING
Site Location: YUKON
Your P.O. #: 113796
Sampler Initials: CH

QUALITY ASSURANCE REPORT

			Matrix Spike		Spiked Blank		Method Blank		RPD	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits
6638404	Total Mercury (Hg)	2013/03/18	88	80 - 120	82	80 - 120	<0.010	ug/L	NC	20
6653826	Ammonia (N)	2013/03/15	98	80 - 120	104	80 - 120	<0.0050	mg/L	0.05	20
6655890	Conductivity	2013/03/15			99	80 - 120	<1.0	uS/cm	0	20
6655891	Alkalinity (Total as CaCO3)	2013/03/15	NC	80 - 120	95	80 - 120	<0.50	mg/L	0.5	20
6655891	Alkalinity (PP as CaCO3)	2013/03/15					<0.50	mg/L	NC	20
6655891	Bicarbonate (HCO3)	2013/03/15					<0.50	mg/L	0.5	20
6655891	Carbonate (CO3)	2013/03/15					<0.50	mg/L	NC	20
6655891	Hydroxide (OH)	2013/03/15					<0.50	mg/L	NC	20
6656104	Fluoride (F)	2013/03/15	NC	80 - 120	100	80 - 120	<0.010	mg/L	2.7	20
6656109	Nitrate plus Nitrite (N)	2013/03/15	110	80 - 120	105	80 - 120	<0.020	mg/L	0.2	25
6656112	Nitrite (N)	2013/03/15	109	80 - 120	94	80 - 120	<0.0050	mg/L	0.7	20
6656241	Dissolved Chloride (Cl)	2013/03/15	106	80 - 120	102	80 - 120	0.54, RDL=0.50	mg/L	NC	20
6656242	Dissolved Sulphate (SO4)	2013/03/15	NC	80 - 120	103	80 - 120	<0.50	mg/L	NC	20
6656658	Total Suspended Solids	2013/03/18			100	80 - 120	<1.0	mg/L		
6658360	Dissolved Sulphate (SO4)	2013/03/16	97	80 - 120	100	80 - 120	<0.50	mg/L	NC	20
6659074	Dissolved Mercury (Hg)	2013/03/18	81	80 - 120	93	80 - 120	<0.010	ug/L	NC	20
6662907	Total Aluminum (Al)	2013/03/20	99	80 - 120	103	80 - 120	<3.0	ug/L	0.4	20
6662907	Total Antimony (Sb)	2013/03/20	104	80 - 120	107	80 - 120	<0.50	ug/L	NC	20
6662907	Total Arsenic (As)	2013/03/20	103	80 - 120	102	80 - 120	<0.10	ug/L	1.2	20
6662907	Total Barium (Ba)	2013/03/20	98	80 - 120	99	80 - 120	<1.0	ug/L	NC	20
6662907	Total Beryllium (Be)	2013/03/20	99	80 - 120	96	80 - 120	<0.10	ug/L	NC	20
6662907	Total Bismuth (Bi)	2013/03/20	96	80 - 120	97	80 - 120	<1.0	ug/L	NC	20
6662907	Total Cadmium (Cd)	2013/03/20	103	80 - 120	101	80 - 120	<0.010	ug/L	NC	20
6662907	Total Chromium (Cr)	2013/03/20	97	80 - 120	100	80 - 120	<1.0	ug/L	NC	20
6662907	Total Cobalt (Co)	2013/03/20	97	80 - 120	99	80 - 120	<0.50	ug/L	NC	20
6662907	Total Copper (Cu)	2013/03/20	98	80 - 120	101	80 - 120	<0.20	ug/L	0.2	20
6662907	Total Iron (Fe)	2013/03/20	95	80 - 120	105	80 - 120	<5.0	ug/L	0.7	20
6662907	Total Lead (Pb)	2013/03/20	97	80 - 120	101	80 - 120	<0.20	ug/L	NC	20
6662907	Total Lithium (Li)	2013/03/20	103	80 - 120	106	80 - 120	<5.0	ug/L	NC	20
6662907	Total Manganese (Mn)	2013/03/20	94	80 - 120	100	80 - 120	<1.0	ug/L	NC	20
6662907	Total Molybdenum (Mo)	2013/03/20	100	80 - 120	93	80 - 120	<1.0	ug/L	NC	20
6662907	Total Nickel (Ni)	2013/03/20	97	80 - 120	102	80 - 120	<1.0	ug/L	NC	20
6662907	Total Selenium (Se)	2013/03/20	108	80 - 120	104	80 - 120	<0.10	ug/L	NC	20
6662907	Total Silver (Ag)	2013/03/20	95	80 - 120	94	80 - 120	<0.020	ug/L	NC	20
6662907	Total Strontium (Sr)	2013/03/20	NC	80 - 120	98	80 - 120	<1.0	ug/L	0.5	20
6662907	Total Thallium (Tl)	2013/03/20	94	80 - 120	102	80 - 120	<0.050	ug/L	NC	20
6662907	Total Tin (Sn)	2013/03/20	100	80 - 120	101	80 - 120	<5.0	ug/L	NC	20
6662907	Total Titanium (Ti)	2013/03/20	99	80 - 120	103	80 - 120	<5.0	ug/L	NC	20
6662907	Total Uranium (U)	2013/03/20	96	80 - 120	98	80 - 120	<0.10	ug/L	NC	20

Maxxam Job #: B320260
Report Date: 2013/03/22

MINTO EXPLORATIONS LTD.
Client Project #: MINTO ENV. MONITORING
Site Location: YUKON
Your P.O. #: 113796
Sampler Initials: CH

QUALITY ASSURANCE REPORT

			Matrix Spike		Spiked Blank		Method Blank		RPD	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits
6662907	Total Vanadium (V)	2013/03/20	99	80 - 120	98	80 - 120	<5.0	ug/L	NC	20
6662907	Total Zinc (Zn)	2013/03/20	NC	80 - 120	107	80 - 120	<5.0	ug/L	NC	20
6662907	Total Boron (B)	2013/03/20					<50	ug/L	NC	20
6662907	Total Phosphorus (P)	2013/03/20					<10	ug/L		
6662907	Total Silicon (Si)	2013/03/20					<100	ug/L	0.5	20
6662907	Total Zirconium (Zr)	2013/03/20					<0.50	ug/L	NC	20
6663469	Total Dissolved Solids	2013/03/19			102	80 - 120	<10	mg/L	NC	20
6665641	Dissolved Aluminum (Al)	2013/03/19	108	80 - 120	104	80 - 120	<3.0	ug/L	NC	20
6665641	Dissolved Antimony (Sb)	2013/03/19	110	80 - 120	102	80 - 120	<0.50	ug/L	NC	20
6665641	Dissolved Arsenic (As)	2013/03/19	112	80 - 120	99	80 - 120	<0.10	ug/L	NC	20
6665641	Dissolved Barium (Ba)	2013/03/19	NC	80 - 120	102	80 - 120	<1.0	ug/L	0.9	20
6665641	Dissolved Beryllium (Be)	2013/03/19	105	80 - 120	97	80 - 120	<0.10	ug/L	NC	20
6665641	Dissolved Bismuth (Bi)	2013/03/19	100	80 - 120	96	80 - 120	<1.0	ug/L	NC	20
6665641	Dissolved Cadmium (Cd)	2013/03/19	109	80 - 120	103	80 - 120	<0.010	ug/L	NC	20
6665641	Dissolved Chromium (Cr)	2013/03/19	107	80 - 120	99	80 - 120	<1.0	ug/L	NC	20
6665641	Dissolved Cobalt (Co)	2013/03/19	104	80 - 120	100	80 - 120	<0.50	ug/L	NC	20
6665641	Dissolved Copper (Cu)	2013/03/19	103	80 - 120	99	80 - 120	<0.20	ug/L	NC	20
6665641	Dissolved Iron (Fe)	2013/03/19	109	80 - 120	106	80 - 120	<5.0	ug/L	NC	20
6665641	Dissolved Lead (Pb)	2013/03/19	102	80 - 120	97	80 - 120	<0.20	ug/L	NC	20
6665641	Dissolved Lithium (Li)	2013/03/19	107	80 - 120	101	80 - 120	<5.0	ug/L	NC	20
6665641	Dissolved Manganese (Mn)	2013/03/19	NC	80 - 120	99	80 - 120	<1.0	ug/L	1.2	20
6665641	Dissolved Molybdenum (Mo)	2013/03/19	NC	80 - 120	100	80 - 120	<1.0	ug/L	NC	20
6665641	Dissolved Nickel (Ni)	2013/03/19	101	80 - 120	101	80 - 120	<1.0	ug/L	NC	20
6665641	Dissolved Selenium (Se)	2013/03/19	112	80 - 120	107	80 - 120	<0.10	ug/L	NC	20
6665641	Dissolved Silver (Ag)	2013/03/19	106	80 - 120	99	80 - 120	<0.020	ug/L	NC	20
6665641	Dissolved Strontium (Sr)	2013/03/19	NC	80 - 120	100	80 - 120	<1.0	ug/L	0.7	20
6665641	Dissolved Thallium (Tl)	2013/03/19	102	80 - 120	101	80 - 120	<0.050	ug/L	NC	20
6665641	Dissolved Tin (Sn)	2013/03/19	108	80 - 120	102	80 - 120	<5.0	ug/L	NC	20
6665641	Dissolved Titanium (Ti)	2013/03/19	117	80 - 120	98	80 - 120	<5.0	ug/L	NC	20
6665641	Dissolved Uranium (U)	2013/03/19	106	80 - 120	99	80 - 120	<0.10	ug/L	2.0	20
6665641	Dissolved Vanadium (V)	2013/03/19	107	80 - 120	97	80 - 120	<5.0	ug/L	NC	20
6665641	Dissolved Zinc (Zn)	2013/03/19	112	80 - 120	102	80 - 120	<5.0	ug/L	NC	20
6665641	Dissolved Boron (B)	2013/03/19					<50	ug/L	NC	20
6665641	Dissolved Phosphorus (P)	2013/03/19					<10	ug/L	NC	20

Maxxam Job #: B320260
Report Date: 2013/03/22

MINTO EXPLORATIONS LTD.
Client Project #: MINTO ENV. MONITORING
Site Location: YUKON
Your P.O. #: 113796
Sampler Initials: CH

QUALITY ASSURANCE REPORT

			Matrix Spike		Spiked Blank		Method Blank		RPD	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits
6665641	Dissolved Silicon (Si)	2013/03/19					<100	ug/L	8.5	20
6665641	Dissolved Zirconium (Zr)	2013/03/19					<0.50	ug/L	NC	20

N/A = Not Applicable
RDL = Reportable Detection Limit
RPD = Relative Percent Difference
Duplicate: Paired analysis of a separate portion of the same sample. Used to evaluate the variance in the measurement.
Matrix Spike: A sample to which a known amount of the analyte of interest has been added. Used to evaluate sample matrix interference.
Spiked Blank: A blank matrix sample to which a known amount of the analyte, usually from a second source, has been added. Used to evaluate method accuracy.
Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.
NC (Matrix Spike): The recovery in the matrix spike was not calculated. The relative difference between the concentration in the parent sample and the spiked amount was not sufficiently significant to permit a reliable recovery calculation.
NC (RPD): The RPD was not calculated. The level of analyte detected in the parent sample and its duplicate was not sufficiently significant to permit a reliable calculation.

Maxxam

Burnaby: 4606 Canada Way, Burnaby, BC V5G 1K5 Ph: (604) 734-7276 Fax: (604) 731-2386, Toll Free: (800) 665-8566

CHAIN OF CUSTODY RECORD

Click here to get the COC number

Maxxam Job #: B320260 **COC #:** EB687913 Page: 1 of 1

Invoice To: Require Report? Yes ☑ No ☐

Invoice To	
Company Name:	Minto Explorations Ltd
Contact Name:	Elvina Wong
Address:	Suite 900 - 999 West Hastings St
	Vancouver, B.C. PC: V6C 2W2
Phone / Fax#:	Ph: 604-684-8894 Fax: 604-688-2120
E-mail	

Report To:

Report To	
Company Name:	Minto Explorations Ltd
Contact Name:	Minto Environment
Address:	Suite 900-999 West Hastings St
	Vancouver, B.C. PC: V6C 2W2
Phone / Fax#:	Ph: 604-684-8894 Fax: 604-688-2120
E-mail	minto_environment@mintomine.com

PO #:	113796
Quotation #:	
Project # :	
Proj. Name:	Minto Env. Monitoring
Location:	Yukon
Sampled by:	Chris Harry

REGULATORY REQUIREMENTS:

- ☐ CSR
- ☑ CCME
- ☑ BC Water Quality
- ☐ Other
- ☐ DRINKING WATER

SERVICE REQUESTED:

- ◉ Regular Turn Around Time (TAT) (5 days for most tests)
- **RUSH** (Please contact the lab) ○ 1 Day ○ 2 Day ○ 3 Day
- Date Required:

SPECIAL INSTRUCTIONS:

Return Cooler ☑ **Ship Sample Bottles (please specify)** ☐

ANALYSIS REQUESTED

Field Filtered? Y ☑ N ☐ — Field Acidified? Y ☑ N ☐ — Field Acidified? Y ☑ N ☐

#	Sample Identification	Lab Identification (Lab Use Only)	Sample Type	Date/Time(24hr) Sampled	Dissolved Metals (DM)	Total Metals	☑ Nitrate ☑ Nitrite ☑ Ammonia	☑ Total Suspended Solids (TSS) ☑ TDS	☑ pH ☑ Conductivity ☑ Alkalinity	☑ Chloride ☑ Fluoride ☑ Sulphate	DOC (Diss'd Organic Carbon)	TOC (Total Organic Carbon)	Phosphate	Ra 226	cyanide	Number of Containers
1	MW09-03-01	EW4882	Ground W	3/12/13 0:00	x	x	x	x	x	x						4
2	MW09-03-02	EW4883	Ground W	3/12/13 0:00	x	x	x	x	x	x						4
3	MW09-03-03	EW4884	Ground W	3/12/13 0:00	x	x	x	x	x	x						4
4	DUP	EW4885	Ground W	3/12/13 0:00	x	x	x	x	x	x						4
5																
6																
7																
8																
9																
10																
11																
12																

B320260

Print name and sign

*Relinquished By:	Date (yy/mm/dd):	Time (24hr):	Received by:	Date (yy/mm/dd):	Time (24hr):
Chris Harry	13-Mar-13	8:00	[illegible]	2013/03/14	10:20

Laboratory Use Only

Time Sensitive	Temperature on Receipt (°C)	Custody Seal	Yes	No
☑	A) B) C)	Present?	☐	☑
	Just sampled & rec'd on ice: ☐	Intact?	☐	N/A

*IT IS THE RESPONSIBILITY OF THE RELINQUISHER TO ENSURE THE ACCURACY OF THE CHAIN OF CUSTODY RECORDS. AN INCOMPLETE CHAIN OF CUSTODY MAY RESULT IN ANALYTICAL TAT DELAYS.

Maxxam

Success Through Science®

Your P.O. #: 204253
Your Project #: MINTO ENV. MONITORING
Site Location: YUKON
Your C.O.C. #: EB775313

Attention: MINTO DISTRIBUTION LIST
MINTO EXPLORATIONS LTD.
Yukon/Whitehorse
2 - 25 Pilgrim Way
Whitehorse, YT
CANADA Y1A 6E6

Report Date: 2013/07/15

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B356131
Received: 2013/07/04, 13:15

Sample Matrix: Water
Samples Received: 1

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Analytical Method
Alkalinity - Water	1	2013/07/05	2013/07/06	BBY6SOP-00026	SM2320B
Chloride by Automated Colourimetry	1	N/A	2013/07/05	BBY6SOP-00011	SM-4500-Cl-
Conductance - water	1	N/A	2013/07/06	BBY6SOP-00026	SM-2510B
Fluoride	1	N/A	2013/07/05	BBY6SOP-00012	SM - 4500 F C
Hardness (calculated as CaCO3)	1	N/A	2013/07/12	BBY7SOP-00002	EPA 6020A
Mercury (Dissolved) by CVAF	1	N/A	2013/07/09	BBY7SOP-00015	EPA 245.7
Na, K, Ca, Mg, S by CRC ICPMS (diss.)	1	N/A	2013/07/12	BBY7SOP-00002	EPA 6020A
Elements by CRC ICPMS (dissolved)	1	N/A	2013/07/12	BBY7SOP-00002	EPA 6020A
Ammonia-N (Preserved)	1	N/A	2013/07/09	BBY6SOP-00009	SM-4500NH3G
Nitrate + Nitrite (N)	1	N/A	2013/07/05	BBY6SOP-00010	SM 4500NO3-I
Nitrite (N) by CFA	1	N/A	2013/07/05	BBY6SOP-00010	EPA 353.2
Nitrogen - Nitrate (as N)	1	N/A	2013/07/06	BBY6SOP-00010	SM 4500NO3-I
Filter and HNO3 Preserve for Metals	1	N/A	2013/07/04	BBY6WI-00001	EPA 200.2
pH Water	1	N/A	2013/07/06	BBY6SOP-00026	SM-4500H+B
Sulphate by Automated Colourimetry	1	N/A	2013/07/15	BBY6SOP-00017	SM4500-SO42- E
Total Dissolved Solids (Filt. Residue)	1	2013/07/05	2013/07/06	BBY6SOP-00033	SM 2540C
Total Suspended Solids-Low Level	1	2013/07/05	2013/07/06	BBY6SOP-00034	SM-2540 D

* Results relate only to the items tested.

Encryption Key

Please direct all questions regarding this Certificate of Analysis to your Project Manager.

Arshdeep Khalsa, Burnaby Project Manager
Email: AKhalsa@maxxam.ca
Phone# (604) 638-5019

==
Maxxam has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per section 5.10.2 of ISO/IEC 17025:2005(E), signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

Total cover pages: 1

Maxxam Job #: B356131
Report Date: 2013/07/15

MINTO EXPLORATIONS LTD.
Client Project #: MINTO ENV. MONITORING
Site Location: YUKON
Your P.O. #: 204253
Sampler Initials: PE

RESULTS OF CHEMICAL ANALYSES OF WATER

Maxxam ID		GU9819		
Sampling Date		2013/07/02 10:15		
	UNITS	**MW11-04A**	**RDL**	**QC Batch**
ANIONS				
Nitrite (N)	mg/L	0.0098	0.0050	6959266
Calculated Parameters				
Filter and HNO3 Preservation	N/A	FIELD	N/A	ONSITE
Nitrate (N)	mg/L	1.15	0.020	6952784
Misc. Inorganics				
Fluoride (F)	mg/L	0.087	0.010	6957616
Alkalinity (Total as CaCO3)	mg/L	239	0.50	6956740
Alkalinity (PP as CaCO3)	mg/L	222	0.50	6956740
Bicarbonate (HCO3)	mg/L	<0.50	0.50	6956740
Carbonate (CO3)	mg/L	21.1	0.50	6956740
Hydroxide (OH)	mg/L	69.4	0.50	6956740
Anions				
Dissolved Sulphate (SO4)	mg/L	3.47	0.50	6984211
Dissolved Chloride (Cl)	mg/L	1.1	0.50	6958826
Nutrients				
Ammonia (N)	mg/L	0.18	0.0050	6965701
Nitrate plus Nitrite (N)	mg/L	1.16	0.020	6959259
Physical Properties				
Conductivity	uS/cm	873	1.0	6956739
pH	pH Units	11.7		6956715
Physical Properties				
Total Suspended Solids	mg/L	34.8	1.0	6956242
Total Dissolved Solids	mg/L	396	10	6957187

N/A = Not Applicable
RDL = Reportable Detection Limit

Maxxam Job #: B356131
Report Date: 2013/07/15

MINTO EXPLORATIONS LTD.
Client Project #: MINTO ENV. MONITORING
Site Location: YUKON
Your P.O. #: 204253
Sampler Initials: PE

CCME DISSOLVED METALS IN WATER (WATER)

Maxxam ID		GU9819		
Sampling Date		2013/07/02 10:15		
	UNITS	**MW11-04A**	**RDL**	**QC Batch**
Misc. Inorganics				
Dissolved Hardness (CaCO3)	mg/L	425	0.50	6955461
Elements				
Dissolved Mercury (Hg)	ug/L	<0.010	0.010	6966617

RDL = Reportable Detection Limit

Maxxam

Success Through Science®

Maxxam Job #: B356131
Report Date: 2013/07/15

MINTO EXPLORATIONS LTD.
Client Project #: MINTO ENV. MONITORING
Site Location: YUKON
Your P.O. #: 204253
Sampler Initials: PE

CCME DISSOLVED METALS IN WATER (WATER)

Maxxam ID		GU9819		
Sampling Date		2013/07/02 10:15		
	UNITS	**MW11-04A**	**RDL**	**QC Batch**
Dissolved Metals by ICPMS				
Dissolved Aluminum (Al)	ug/L	671	3.0	6963491
Dissolved Antimony (Sb)	ug/L	<0.50	0.50	6963491
Dissolved Arsenic (As)	ug/L	0.61	0.10	6963491
Dissolved Barium (Ba)	ug/L	656	1.0	6963491
Dissolved Beryllium (Be)	ug/L	<0.10	0.10	6963491
Dissolved Bismuth (Bi)	ug/L	<1.0	1.0	6963491
Dissolved Boron (B)	ug/L	<50	50	6963491
Dissolved Cadmium (Cd)	ug/L	<0.010	0.010	6963491
Dissolved Chromium (Cr)	ug/L	3.4	1.0	6963491
Dissolved Cobalt (Co)	ug/L	<0.50	0.50	6963491
Dissolved Copper (Cu)	ug/L	40.6	0.20	6963491
Dissolved Iron (Fe)	ug/L	10.7	5.0	6963491
Dissolved Lead (Pb)	ug/L	<0.20	0.20	6963491
Dissolved Lithium (Li)	ug/L	30.9	5.0	6963491
Dissolved Manganese (Mn)	ug/L	<1.0	1.0	6963491
Dissolved Molybdenum (Mo)	ug/L	2.2	1.0	6963491
Dissolved Nickel (Ni)	ug/L	<1.0	1.0	6963491
Dissolved Phosphorus (P)	ug/L	<10	10	6963491
Dissolved Selenium (Se)	ug/L	1.75	0.10	6963491
Dissolved Silicon (Si)	ug/L	3380	100	6963491
Dissolved Silver (Ag)	ug/L	<0.020	0.020	6963491
Dissolved Strontium (Sr)	ug/L	1190	1.0	6963491
Dissolved Thallium (Tl)	ug/L	<0.050	0.050	6963491
Dissolved Tin (Sn)	ug/L	<5.0	5.0	6963491
Dissolved Titanium (Ti)	ug/L	<5.0	5.0	6963491
Dissolved Uranium (U)	ug/L	<0.10	0.10	6963491
Dissolved Vanadium (V)	ug/L	<5.0	5.0	6963491
Dissolved Zinc (Zn)	ug/L	<5.0	5.0	6963491
Dissolved Zirconium (Zr)	ug/L	<0.50	0.50	6963491
Dissolved Calcium (Ca)	mg/L	170	0.050	6953404
Dissolved Magnesium (Mg)	mg/L	<0.050	0.050	6953404
Dissolved Potassium (K)	mg/L	5.89	0.050	6953404
Dissolved Sodium (Na)	mg/L	4.91	0.050	6953404
Dissolved Sulphur (S)	mg/L	3.6	3.0	6953404

RDL = Reportable Detection Limit

General Comments

Sample GU9819-01: The BC-MOE and APHA Standard Method require pH to be analysed within 15 minutes of sampling and therefore field analysis is required for compliance. All Laboratory pH analyses in this report are reported past the BC-MOE/APHA Standard Method holding time.

Maxxam Job #: B356131
Report Date: 2013/07/15

MINTO EXPLORATIONS LTD.
Client Project #: MINTO ENV. MONITORING
Site Location: YUKON
Your P.O. #: 204253
Sampler Initials: PE

QUALITY ASSURANCE REPORT

			Matrix Spike		Spiked Blank		Method Blank		RPD	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits
6956242	Total Suspended Solids	2013/07/06			100	80 - 120	<1.0	mg/L		
6956739	Conductivity	2013/07/06			98	80 - 120	1.0, RDL=1.0	uS/cm	0.2	20
6956740	Alkalinity (Total as CaCO3)	2013/07/06	NC	80 - 120	99	80 - 120	<0.50	mg/L	1.4	20
6956740	Alkalinity (PP as CaCO3)	2013/07/06					<0.50	mg/L		
6956740	Bicarbonate (HCO3)	2013/07/06					<0.50	mg/L		
6956740	Carbonate (CO3)	2013/07/06					<0.50	mg/L		
6956740	Hydroxide (OH)	2013/07/06					<0.50	mg/L		
6957187	Total Dissolved Solids	2013/07/06	NC	80 - 120	100	80 - 120	<10	mg/L	NC	20
6957616	Fluoride (F)	2013/07/05	88	80 - 120	96	80 - 120	<0.010	mg/L	NC	20
6958826	Dissolved Chloride (Cl)	2013/07/05	90	80 - 120	100	80 - 120	<0.50	mg/L	0.6	20
6959259	Nitrate plus Nitrite (N)	2013/07/05	NC	80 - 120	101	80 - 120	<0.020	mg/L	NC	25
6959266	Nitrite (N)	2013/07/05	103	80 - 120	95	80 - 120	<0.0050	mg/L	NC	20
6963491	Dissolved Aluminum (Al)	2013/07/12	102	80 - 120	109	80 - 120	<3.0	ug/L	NC	20
6963491	Dissolved Antimony (Sb)	2013/07/12	103	80 - 120	103	80 - 120	<0.50	ug/L	NC	20
6963491	Dissolved Arsenic (As)	2013/07/12	NC	80 - 120	101	80 - 120	<0.10	ug/L	0.2	20
6963491	Dissolved Barium (Ba)	2013/07/12	NC	80 - 120	103	80 - 120	<1.0	ug/L	0.3	20
6963491	Dissolved Beryllium (Be)	2013/07/12	98	80 - 120	103	80 - 120	<0.10	ug/L	NC	20
6963491	Dissolved Bismuth (Bi)	2013/07/12	95	80 - 120	106	80 - 120	<1.0	ug/L	NC	20
6963491	Dissolved Cadmium (Cd)	2013/07/12	96	80 - 120	103	80 - 120	<0.010	ug/L	NC	20
6963491	Dissolved Chromium (Cr)	2013/07/12	96	80 - 120	102	80 - 120	<1.0	ug/L	NC	20
6963491	Dissolved Cobalt (Co)	2013/07/12	94	80 - 120	102	80 - 120	<0.50	ug/L	NC	20
6963491	Dissolved Copper (Cu)	2013/07/12	88	80 - 120	101	80 - 120	<0.20	ug/L	NC	20
6963491	Dissolved Iron (Fe)	2013/07/12	NC	80 - 120	114	80 - 120	<5.0	ug/L	6.5	20
6963491	Dissolved Lead (Pb)	2013/07/12	95	80 - 120	103	80 - 120	<0.20	ug/L	NC	20
6963491	Dissolved Lithium (Li)	2013/07/12	NC	80 - 120	99	80 - 120	<5.0	ug/L	0.8	20
6963491	Dissolved Manganese (Mn)	2013/07/12	NC	80 - 120	104	80 - 120	<1.0	ug/L	2.0	20
6963491	Dissolved Molybdenum (Mo)	2013/07/12	NC	80 - 120	96	80 - 120	<1.0	ug/L	0.7	20
6963491	Dissolved Nickel (Ni)	2013/07/12	91	80 - 120	103	80 - 120	<1.0	ug/L	NC	20
6963491	Dissolved Selenium (Se)	2013/07/12	107	80 - 120	110	80 - 120	<0.10	ug/L	NC	20
6963491	Dissolved Silver (Ag)	2013/07/12	95	80 - 120	100	80 - 120	<0.020	ug/L	NC	20
6963491	Dissolved Strontium (Sr)	2013/07/12	NC	80 - 120	100	80 - 120	<1.0	ug/L	1.8	20
6963491	Dissolved Thallium (Tl)	2013/07/12	101	80 - 120	103	80 - 120	<0.050	ug/L	NC	20
6963491	Dissolved Tin (Sn)	2013/07/12	100	80 - 120	102	80 - 120	<5.0	ug/L	NC	20
6963491	Dissolved Titanium (Ti)	2013/07/12	105	80 - 120	103	80 - 120	<5.0	ug/L	NC	20
6963491	Dissolved Uranium (U)	2013/07/12	100	80 - 120	100	80 - 120	<0.10	ug/L	NC	20
6963491	Dissolved Vanadium (V)	2013/07/12	101	80 - 120	104	80 - 120	<5.0	ug/L	NC	20
6963491	Dissolved Zinc (Zn)	2013/07/12	91	80 - 120	105	80 - 120	<5.0	ug/L	NC	20
6963491	Dissolved Boron (B)	2013/07/12					<50	ug/L	NC	20
6963491	Dissolved Phosphorus (P)	2013/07/12					<10	ug/L		

QUALITY ASSURANCE REPORT

			Matrix Spike		Spiked Blank		Method Blank		RPD	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits
6963491	Dissolved Silicon (Si)	2013/07/12					<100	ug/L	6.5	20
6963491	Dissolved Zirconium (Zr)	2013/07/12					<0.50	ug/L	NC	20
6965701	Ammonia (N)	2013/07/09	93	80 - 120	98	80 - 120	<0.0050	mg/L	5.4	20
6966617	Dissolved Mercury (Hg)	2013/07/09	91	80 - 120	84	80 - 120	<0.010	ug/L	NC	20
6984211	Dissolved Sulphate (SO4)	2013/07/15			100	80 - 120	0.53, RDL=0.50	mg/L		

N/A = Not Applicable
RDL = Reportable Detection Limit
RPD = Relative Percent Difference
Duplicate: Paired analysis of a separate portion of the same sample. Used to evaluate the variance in the measurement.
Matrix Spike: A sample to which a known amount of the analyte of interest has been added. Used to evaluate sample matrix interference.
Spiked Blank: A blank matrix sample to which a known amount of the analyte, usually from a second source, has been added. Used to evaluate method accuracy.
Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.
NC (Matrix Spike): The recovery in the matrix spike was not calculated. The relative difference between the concentration in the parent sample and the spiked amount was not sufficiently significant to permit a reliable recovery calculation.
NC (RPD): The RPD was not calculated. The level of analyte detected in the parent sample and its duplicate was not sufficiently significant to permit a reliable calculation.

Maxxam

Burnaby: 4606 Canada Way, Burnaby, BC V5G 1K5 Ph: (604) 734-7276 Fax: (604) 731-2386, Toll Free: (800) 665-8566

CHAIN OF CUSTODY RECORD

B356131

Maxxam Job #:

Click here to get the COC number

COC #: EB775313

Page: 1 of 1

Invoice To: Require Report? Yes ☑ No ☐

Company Name:	Minto Explorations Ltd
Contact Name:	Elvina Wong
Address:	Suite 900 - 999 West Hastings St
	Vancouver, B.C. PC: V6C 2W2
Phone / Fax#:	Ph: 604-684-8894 Fax: 604-688-2120
E-mail	

Report To:

Company Name:	Minto Explorations Ltd
Contact Name:	Minto Environment
Address:	Suite 900-999 West Hastings St
	Vancouver, B.C. PC: V6C 2W2
Phone / Fax#:	Ph: 604-684-8894 Fax: 604-688-2120
E-mail	minto_environment@mintomine.com

PO #:	204253
Quotation #:	
Project # :	
Proj. Name:	Minto Env. Monitoring
Location:	Yukon
Sampled by:	Phil Emerson

REGULATORY REQUIREMENTS:

- ☐ CSR
- ☑ CCME
- ☐ BC Water Quality
- ☐ Other
- ☐ DRINKING WATER

SERVICE REQUESTED:

- ◉ Regular Turn Around Time (TAT) (5 days for most tests)
- **RUSH** (Please contact the lab)
- ○ 1 Day ○ 2 Day ○ 3 Day
- Date Required:

SPECIAL INSTRUCTIONS:

Return Cooler ☐ **Ship Sample Bottles (please specify)** ☐

ANALYSIS REQUESTED

Field Filtered? ☑ Y ☐ N; Field Acidified? ☑ Y ☐ N; Field Acidified? ☑ Y ☐ N

	Sample Identification	Lab Identification (Lab Use Only)	Sample Type	Date/Time(24hr) Sampled	Dissolved Metals (DM)		Total Metals	☑ Nitrate ☑ Nitrite ☑ Ammonia	☑ Total Suspended Solids (TSS) ☑ TDS	☑ pH ☑ Conductivity ☑ Alkalinity	☑ Chloride ☑ Fluoride ☑ Sulphate	Phosphate	DOC (Diss'd Organic Carbon)	TOC (Total Organic Carbon)	Ra 226	Number of Containers
1	MW11-04A 609819		Water	7/2/13 10:15	X	X		X	X	X	X					4
2																
3																
4																
5																
6																
7																
8																
9																
10																
11																
12																

B356131

Print name and sign

*Relinquished By:	Date (yy/mm/dd):	Time (24hr):	Received by	Date (yy/mm/dd)	Time (24 hr)	Time Sensitive
Phil Emerson	3-Jul-13	8:00	HELEN ZHEN	2013/07/04	13:15	☑

Laboratory Use Only

Temperature on Receipt (°C)			Custody Seal	Yes	No
A) 5	B) 3	C) 5	Present?	☐	☐ N/A
Just sampled & rec'd on ice: ☐			Intact?	☐	☐

*IT IS THE RESPONSIBILITY OF THE RELINQUISHER TO ENSURE THE ACCURACY OF THE CHAIN OF CUSTODY RECORDS. AN INCOMPLETE CHAIN OF CUSTODY MAY RESULT IN ANALYTICAL TAT DELAYS.

4, 3, 5

Maxxam

Success Through Science®

Your P.O. #: 204253
Your Project #: MINTO ENV. MONITORING
Site Location: YUKON
Your C.O.C. #: EB802013

Attention: MINTO DISTRIBUTION LIST
MINTO EXPLORATIONS LTD.
Yukon/Whitehorse
2 - 25 Pilgrim Way
Whitehorse, YT
CANADA Y1A 6E6

Report Date: 2013/08/02

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B365412
Received: 2013/07/30, 09:15

Sample Matrix: Water
Samples Received: 1

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Analytical Method
Alkalinity - Water	1	2013/07/30	2013/07/31	BBY6SOP-00026	SM2320B
Chloride by Automated Colourimetry	1	N/A	2013/07/30	BBY6SOP-00011	SM-4500-Cl-
Conductance - water	1	N/A	2013/07/31	BBY6SOP-00026	SM-2510B
Fluoride	1	N/A	2013/07/31	BBY6SOP-00012	SM - 4500 F C
Hardness (calculated as CaCO3)	1	N/A	2013/08/02	BBY7SOP-00002	EPA 6020A
Mercury (Dissolved) by CVAF	1	N/A	2013/08/01	BBY7SOP-00015	EPA 245.7
Na, K, Ca, Mg, S by CRC ICPMS (diss.)	1	N/A	2013/08/02	BBY7SOP-00002	EPA 6020A
Elements by CRC ICPMS (dissolved)	1	N/A	2013/08/01	BBY7SOP-00002	EPA 6020A
Ammonia-N (Preserved)	1	N/A	2013/07/30	BBY6SOP-00009	SM-4500NH3G
Nitrate + Nitrite (N)	1	N/A	2013/07/30	BBY6SOP-00010	SM 4500NO3-I
Nitrite (N) by CFA	1	N/A	2013/07/30	BBY6SOP-00010	EPA 353.2
Nitrogen - Nitrate (as N)	1	N/A	2013/07/31	BBY6SOP-00010	SM 4500NO3-I
Filter and HNO3 Preserve for Metals	1	N/A	2013/07/30	BBY6WI-00001	EPA 200.2
pH Water	1	N/A	2013/07/31	BBY6SOP-00026	SM-4500H+B
Sulphate by Automated Colourimetry	1	N/A	2013/07/30	BBY6SOP-00017	SM4500-SO42- E
Total Dissolved Solids (Filt. Residue)	1	2013/07/31	2013/08/01	BBY6SOP-00033	SM 2540C
Total Suspended Solids-Low Level	1	2013/07/31	2013/08/01	BBY6SOP-00034	SM-2540 D

* Results relate only to the items tested.

Encryption Key

Please direct all questions regarding this Certificate of Analysis to your Project Manager.

Ken Pomeroy, Project Manager
Email: KPomeroy@maxxam.ca
Phone# (604) 638-5020

==
Maxxam has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per section 5.10.2 of ISO/IEC 17025:2005(E), signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

Total cover pages: 1

Maxxam Job #: B365412
Report Date: 2013/08/02

MINTO EXPLORATIONS LTD.
Client Project #: MINTO ENV. MONITORING
Site Location: YUKON
Your P.O. #: 204253
Sampler Initials: PE

RESULTS OF CHEMICAL ANALYSES OF WATER

Maxxam ID		HA9838		
Sampling Date		2013/07/27 15:00		
	UNITS	**MW 12-DP4**	**RDL**	**QC Batch**
ANIONS				
Nitrite (N)	mg/L	0.0093	0.0050	7035063
Calculated Parameters				
Filter and HNO3 Preservation	N/A	FIELD	N/A	ONSITE
Nitrate (N)	mg/L	1.12	0.020	7033095
Misc. Inorganics				
Fluoride (F)	mg/L	0.310	0.010	7039065
Alkalinity (Total as CaCO3)	mg/L	343	0.50	7035315
Alkalinity (PP as CaCO3)	mg/L	<0.50	0.50	7035315
Bicarbonate (HCO3)	mg/L	419	0.50	7035315
Carbonate (CO3)	mg/L	<0.50	0.50	7035315
Hydroxide (OH)	mg/L	<0.50	0.50	7035315
Anions				
Dissolved Sulphate (SO4)	mg/L	96.2	0.50	7034997
Dissolved Chloride (Cl)	mg/L	21	0.50	7034975
Nutrients				
Ammonia (N)	mg/L	0.038	0.0050	7033424
Nitrate plus Nitrite (N)	mg/L	1.13	0.020	7035025
Physical Properties				
Conductivity	uS/cm	838	1.0	7035320
pH	pH Units	7.93		7035319
Physical Properties				
Total Suspended Solids	mg/L	157	1.0	7035765
Total Dissolved Solids	mg/L	612	10	7036132

N/A = Not Applicable
RDL = Reportable Detection Limit

Maxxam Job #: B365412
Report Date: 2013/08/02

MINTO EXPLORATIONS LTD.
Client Project #: MINTO ENV. MONITORING
Site Location: YUKON
Your P.O. #: 204253
Sampler Initials: PE

CCME DISSOLVED METALS IN WATER (WATER)

Maxxam ID		HA9838		
Sampling Date		2013/07/27 15:00		
	UNITS	**MW 12-DP4**	**RDL**	**QC Batch**
Misc. Inorganics				
Dissolved Hardness (CaCO3)	mg/L	409	0.50	7033092
Elements				
Dissolved Mercury (Hg)	ug/L	<0.010	0.010	7040245

RDL = Reportable Detection Limit

Maxxam Job #: B365412
Report Date: 2013/08/02

MINTO EXPLORATIONS LTD.
Client Project #: MINTO ENV. MONITORING
Site Location: YUKON
Your P.O. #: 204253
Sampler Initials: PE

CCME DISSOLVED METALS IN WATER (WATER)

Maxxam ID		HA9838		
Sampling Date		2013/07/27 15:00		
	UNITS	**MW 12-DP4**	**RDL**	**QC Batch**
Dissolved Metals by ICPMS				
Dissolved Aluminum (Al)	ug/L	9.0	3.0	7042131
Dissolved Antimony (Sb)	ug/L	<0.50	0.50	7042131
Dissolved Arsenic (As)	ug/L	0.31	0.10	7042131
Dissolved Barium (Ba)	ug/L	220	1.0	7042131
Dissolved Beryllium (Be)	ug/L	<0.10	0.10	7042131
Dissolved Bismuth (Bi)	ug/L	<1.0	1.0	7042131
Dissolved Boron (B)	ug/L	<50	50	7042131
Dissolved Cadmium (Cd)	ug/L	0.046	0.010	7042131
Dissolved Chromium (Cr)	ug/L	<1.0	1.0	7042131
Dissolved Cobalt (Co)	ug/L	0.57	0.50	7042131
Dissolved Copper (Cu)	ug/L	4.40	0.20	7042131
Dissolved Iron (Fe)	ug/L	22.9	5.0	7042131
Dissolved Lead (Pb)	ug/L	<0.20	0.20	7042131
Dissolved Lithium (Li)	ug/L	<5.0	5.0	7042131
Dissolved Manganese (Mn)	ug/L	1100	1.0	7042131
Dissolved Molybdenum (Mo)	ug/L	9.1	1.0	7042131
Dissolved Nickel (Ni)	ug/L	2.3	1.0	7042131
Dissolved Phosphorus (P)	ug/L	14	10	7042131
Dissolved Selenium (Se)	ug/L	0.97	0.10	7042131
Dissolved Silicon (Si)	ug/L	6150	100	7042131
Dissolved Silver (Ag)	ug/L	<0.020	0.020	7042131
Dissolved Strontium (Sr)	ug/L	949	1.0	7042131
Dissolved Thallium (Tl)	ug/L	<0.050	0.050	7042131
Dissolved Tin (Sn)	ug/L	<5.0	5.0	7042131
Dissolved Titanium (Ti)	ug/L	<5.0	5.0	7042131
Dissolved Uranium (U)	ug/L	5.52	0.10	7042131
Dissolved Vanadium (V)	ug/L	<5.0	5.0	7042131
Dissolved Zinc (Zn)	ug/L	<5.0	5.0	7042131
Dissolved Zirconium (Zr)	ug/L	<0.50	0.50	7042131
Dissolved Calcium (Ca)	mg/L	104	0.050	7033094
Dissolved Magnesium (Mg)	mg/L	36.0	0.050	7033094
Dissolved Potassium (K)	mg/L	4.90	0.050	7033094
Dissolved Sodium (Na)	mg/L	25.9	0.050	7033094
Dissolved Sulphur (S)	mg/L	33.1	3.0	7033094

RDL = Reportable Detection Limit

General Comments

Sample HA9838-01: The BC-MOE and APHA Standard Method require pH to be analysed within 15 minutes of sampling and therefore field analysis is required for compliance. All Laboratory pH analyses in this report are reported past the BC-MOE/APHA Standard Method holding time.

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Success Through Science®

Maxxam Job #: B365412
Report Date: 2013/08/02

MINTO EXPLORATIONS LTD.
Client Project #: MINTO ENV. MONITORING
Site Location: YUKON
Your P.O. #: 204253
Sampler Initials: PE

QUALITY ASSURANCE REPORT

			Matrix Spike		Spiked Blank		Method Blank		RPD	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits
7033424	Ammonia (N)	2013/07/30	101	80 - 120	100	80 - 120	<0.0050	mg/L	1.4	20
7034975	Dissolved Chloride (Cl)	2013/07/30	99	80 - 120	103	80 - 120	<0.50	mg/L	2.4	20
7034997	Dissolved Sulphate (SO4)	2013/07/30	NC	80 - 120	100	80 - 120	0.76, RDL=0.50	mg/L	4.5	20
7035025	Nitrate plus Nitrite (N)	2013/07/30	NC	80 - 120	102	80 - 120	<0.020	mg/L	NC	25
7035063	Nitrite (N)	2013/07/30	101	80 - 120	101	80 - 120	<0.0050	mg/L	NC	20
7035315	Alkalinity (Total as CaCO3)	2013/07/30	95	80 - 120	96	80 - 120	<0.50	mg/L	0.4	20
7035315	Alkalinity (PP as CaCO3)	2013/07/30					<0.50	mg/L	5.1	20
7035315	Bicarbonate (HCO3)	2013/07/30					<0.50	mg/L	0.9	20
7035315	Carbonate (CO3)	2013/07/30					<0.50	mg/L	5.1	20
7035315	Hydroxide (OH)	2013/07/30					<0.50	mg/L	NC	20
7035320	Conductivity	2013/07/30			98	80 - 120	<1.0	uS/cm	0.3	20
7035765	Total Suspended Solids	2013/08/01			100	80 - 120	<1.0	mg/L		
7036132	Total Dissolved Solids	2013/08/01	NC	80 - 120	92	80 - 120	<10	mg/L	4.0	20
7039065	Fluoride (F)	2013/07/31	95	80 - 120	100	80 - 120	<0.010	mg/L	NC	20
7040245	Dissolved Mercury (Hg)	2013/08/01	83	80 - 120	87	80 - 120	<0.010	ug/L	NC	20
7042131	Dissolved Aluminum (Al)	2013/08/01	102	80 - 120	103	80 - 120	<3.0	ug/L	NC	20
7042131	Dissolved Antimony (Sb)	2013/08/01	NC	80 - 120	101	80 - 120	<0.50	ug/L	0.3	20
7042131	Dissolved Arsenic (As)	2013/08/01	107	80 - 120	101	80 - 120	<0.10	ug/L	2.1	20
7042131	Dissolved Barium (Ba)	2013/08/01	NC	80 - 120	103	80 - 120	<1.0	ug/L	1.3	20
7042131	Dissolved Beryllium (Be)	2013/08/01	98	80 - 120	97	80 - 120	<0.10	ug/L	NC	20
7042131	Dissolved Bismuth (Bi)	2013/08/01	98	80 - 120	105	80 - 120	<1.0	ug/L	NC	20
7042131	Dissolved Cadmium (Cd)	2013/08/01	97	80 - 120	101	80 - 120	<0.010	ug/L	NC	20
7042131	Dissolved Chromium (Cr)	2013/08/01	93	80 - 120	96	80 - 120	<1.0	ug/L	NC	20
7042131	Dissolved Cobalt (Co)	2013/08/01	90	80 - 120	96	80 - 120	<0.50	ug/L	NC	20
7042131	Dissolved Copper (Cu)	2013/08/01	NC	80 - 120	94	80 - 120	<0.20	ug/L	2.2	20
7042131	Dissolved Iron (Fe)	2013/08/01	102	80 - 120	110	80 - 120	<5.0	ug/L	NC	20
7042131	Dissolved Lead (Pb)	2013/08/01	100	80 - 120	104	80 - 120	<0.20	ug/L	NC	20
7042131	Dissolved Lithium (Li)	2013/08/01	NC	80 - 120	99	80 - 120	<5.0	ug/L	4.0	20
7042131	Dissolved Manganese (Mn)	2013/08/01	NC	80 - 120	99	80 - 120	<1.0	ug/L	0.8	20
7042131	Dissolved Molybdenum (Mo)	2013/08/01	NC	80 - 120	100	80 - 120	<1.0	ug/L	0.1	20
7042131	Dissolved Nickel (Ni)	2013/08/01	89	80 - 120	93	80 - 120	<1.0	ug/L	NC	20
7042131	Dissolved Selenium (Se)	2013/08/01	104	80 - 120	103	80 - 120	<0.10	ug/L	2.7	20
7042131	Dissolved Silver (Ag)	2013/08/01	98	80 - 120	94	80 - 120	<0.020	ug/L	NC	20
7042131	Dissolved Strontium (Sr)	2013/08/01	NC	80 - 120	101	80 - 120	<1.0	ug/L	0.6	20
7042131	Dissolved Thallium (Tl)	2013/08/01	105	80 - 120	106	80 - 120	<0.050	ug/L	NC	20
7042131	Dissolved Tin (Sn)	2013/08/01	100	80 - 120	100	80 - 120	<5.0	ug/L	NC	20
7042131	Dissolved Titanium (Ti)	2013/08/01	106	80 - 120	103	80 - 120	<5.0	ug/L	NC	20
7042131	Dissolved Uranium (U)	2013/08/01	103	80 - 120	102	80 - 120	<0.10	ug/L	2.6	20
7042131	Dissolved Vanadium (V)	2013/08/01	98	80 - 120	96	80 - 120	<5.0	ug/L	NC	20

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Success Through Science®

Maxxam Job #: B365412
Report Date: 2013/08/02

MINTO EXPLORATIONS LTD.
Client Project #: MINTO ENV. MONITORING
Site Location: YUKON
Your P.O. #: 204253
Sampler Initials: PE

QUALITY ASSURANCE REPORT

			Matrix Spike		Spiked Blank		Method Blank		RPD	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits
7042131	Dissolved Zinc (Zn)	2013/08/01	93	80 - 120	103	80 - 120	<5.0	ug/L	NC	20
7042131	Dissolved Boron (B)	2013/08/01					<50	ug/L	NC	20
7042131	Dissolved Phosphorus (P)	2013/08/01					<10	ug/L	NC	20
7042131	Dissolved Silicon (Si)	2013/08/01					<100	ug/L	0.9	20
7042131	Dissolved Zirconium (Zr)	2013/08/01					<0.50	ug/L	NC	20

N/A = Not Applicable
RDL = Reportable Detection Limit
RPD = Relative Percent Difference
Duplicate: Paired analysis of a separate portion of the same sample. Used to evaluate the variance in the measurement.
Matrix Spike: A sample to which a known amount of the analyte of interest has been added. Used to evaluate sample matrix interference.
Spiked Blank: A blank matrix sample to which a known amount of the analyte, usually from a second source, has been added. Used to evaluate method accuracy.
Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.
NC (Matrix Spike): The recovery in the matrix spike was not calculated. The relative difference between the concentration in the parent sample and the spiked amount was not sufficiently significant to permit a reliable recovery calculation.
NC (RPD): The RPD was not calculated. The level of analyte detected in the parent sample and its duplicate was not sufficiently significant to permit a reliable calculation.

Burnaby: 4606 Canada Way, Burnaby, BC V5G 1K5 Ph: (604) 734-7276 Fax: (604) 731-2386, Toll Free: (800) 665-8566

CHAIN OF CUSTODY RECORD

Maxxam Job #: B365412 | COC #: EB802013 | Page: 1 of 1

Click here to get the COC number

Invoice To: Require Report? Yes ☑ No ☐

Company Name:	Minto Explorations Ltd
Contact Name:	Elvina Wong
Address:	Suite 900 - 999 West Hastings St, Vancouver, B.C. PC: V6C 2W2
Phone / Fax#:	Ph: 604-684-8894 Fax: 604-688-2120
E-mail	

Report To:

Company Name:	Minto Explorations Ltd
Contact Name:	Minto Environment
Address:	Suite 900-999 West Hastings St, Vancouver, B.C. PC: V6C 2W2
Phone / Fax#:	Ph: 604-684-8894 Fax: 604-688-2120
E-mail	minto_environment@mintomine.com

PO #:	204253
Quotation #:	
Project # :	
Proj. Name:	Minto Env. Monitoring
Location:	Yukon
Sampled by:	Phil Emerson/Chris Harry

REGULATORY REQUIREMENTS:

- ☐ CSR
- ☑ CCME
- ☐ BC Water Quality
- ☐ Other
- ☐ DRINKING WATER

SERVICE REQUESTED:

- ◉ Regular Turn Around Time (TAT) (5 days for most tests)
- **RUSH** (Please contact the lab) ○ 1 Day ○ 2 Day ○ 3 Day
- Date Required:

SPECIAL INSTRUCTIONS:

Return Cooler ☐ **Ship Sample Bottles (please specify)** ☐

ANALYSIS REQUESTED

Field Filtered? ☑ Y ☐ N; Field Acidified? ☑ Y ☐ N; Field Acidified? ☑ Y ☐ N; ☑ Nitrate ☑ Nitrite ☑ Ammonia; ☑ Total Suspended Solids (TSS) ☑ TDS; ☑ pH ☑ Conductivity ☑ Alkalinity; ☑ Chloride ☑ Fluoride ☑ Sulphate

	Sample Identification	Lab Identification (Lab Use Only)	Sample Type	Date/Time(24hr) Sampled	Dissolved Metals (DM)	Field Acidified?	Total Metals	Nitrate / Nitrite / Ammonia	Total Suspended Solids (TSS) / TDS	pH / Conductivity / Alkalinity	Chloride / Fluoride / Sulphate	Phosphate	DOC (Diss'd Organic Carbon)	TOC (Total Organic Carbon)	Ra 226	Number of Containers
1	MW12-DP4	HA9838	Ground W	7/27/13 15:00	X	X		X	X	X	X					4
2																
3																
4																
5																
6																
7																
8																
9																
10																
11																
12																

B365412

*Relinquished By: (Print name and sign)	Date (yy/mm/dd):	Time (24hr):	Received by: (Print name and sign)	Date (yy/mm/dd):	Time (24 hr):	Time Sensitive	Temperature on Receipt (°C)	Custody Seal	Yes	No
Chris Harry	29-Jul-13	7:15	[signature]	2013/07/30	09:15	☑	A) B) 2 C) 1	Present?	☐	☑
							Just sampled & rec'd on ice: ☐	Intact?	☐	☐ NA

Laboratory Use Only

*IT IS THE RESPONSIBILITY OF THE RELINQUISHER TO ENSURE THE ACCURACY OF THE CHAIN OF CUSTODY RECORDS. AN INCOMPLETE CHAIN OF CUSTODY MAY RESULT IN ANALYTICAL TAT DELAYS.

Maxxam

Success Through Science®

Your P.O. #: 204253
Your Project #: MINTO ENV. MONITORING
Site Location: YUKON
Your C.O.C. #: EB808513

Attention: MINTO DISTRIBUTION LIST
MINTO EXPLORATIONS LTD.
Yukon/Whitehorse
2 - 25 Pilgrim Way
Whitehorse, YT
CANADA Y1A 6E6

Report Date: 2013/08/12

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B368800
Received: 2013/08/08, 09:15

Sample Matrix: Water
Samples Received: 1

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Analytical Method
Alkalinity - Water	1	2013/08/08	2013/08/09	BBY6SOP-00026	SM2320B
Chloride by Automated Colourimetry	1	N/A	2013/08/09	BBY6SOP-00011	SM-4500-Cl-
Conductance - water	1	N/A	2013/08/09	BBY6SOP-00026	SM-2510B
Fluoride	1	N/A	2013/08/08	BBY6SOP-00012	SM - 4500 F C
Hardness (calculated as CaCO3)	1	N/A	2013/08/10	BBY7SOP-00002	EPA 6020A
Mercury (Dissolved) by CVAF	1	N/A	2013/08/09	BBY7SOP-00015	EPA 245.7
Na, K, Ca, Mg, S by CRC ICPMS (diss.)	1	N/A	2013/08/10	BBY7SOP-00002	EPA 6020A
Elements by CRC ICPMS (dissolved)	1	N/A	2013/08/09	BBY7SOP-00002	EPA 6020A
Ammonia-N (Preserved)	1	N/A	2013/08/08	BBY6SOP-00009	SM-4500NH3G
Nitrate + Nitrite (N)	1	N/A	2013/08/08	BBY6SOP-00010	SM 4500NO3-I
Nitrite (N) by CFA	1	N/A	2013/08/08	BBY6SOP-00010	EPA 353.2
Nitrogen - Nitrate (as N)	1	N/A	2013/08/08	BBY6SOP-00010	SM 4500NO3-I
Filter and HNO3 Preserve for Metals	1	N/A	2013/08/08	BBY6WI-00001	EPA 200.2
pH Water	1	N/A	2013/08/09	BBY6SOP-00026	SM-4500H+B
Sulphate by Automated Colourimetry	1	N/A	2013/08/08	BBY6SOP-00017	SM4500-SO42- E
Total Dissolved Solids (Filt. Residue)	1	2013/08/09	2013/08/10	BBY6SOP-00033	SM 2540C
Total Suspended Solids-Low Level	1	2013/08/09	2013/08/10	BBY6SOP-00034	SM-2540 D

* Results relate only to the items tested.

Encryption Key

Please direct all questions regarding this Certificate of Analysis to your Project Manager.

Ken Pomeroy, Project Manager
Email: KPomeroy@maxxam.ca
Phone# (604) 638-5020

==

Maxxam has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per section 5.10.2 of ISO/IEC 17025:2005(E), signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

Total cover pages: 1

Maxxam Job #: B368800
Report Date: 2013/08/12

MINTO EXPLORATIONS LTD.
Client Project #: MINTO ENV. MONITORING
Site Location: YUKON
Your P.O. #: 204253
Sampler Initials: CH

RESULTS OF CHEMICAL ANALYSES OF WATER

Maxxam ID		HD0873		
Sampling Date		2013/08/06 16:25		
	UNITS	**MW 12-07-01**	**RDL**	**QC Batch**
ANIONS				
Nitrite (N)	mg/L	3.05	0.050	7061352
Calculated Parameters				
Filter and HNO3 Preservation	N/A	FIELD	N/A	ONSITE
Nitrate (N)	mg/L	45.3	1.0	7058216
Misc. Inorganics				
Fluoride (F)	mg/L	0.650	0.010	7059537
Alkalinity (Total as CaCO3)	mg/L	311	0.50	7059906
Alkalinity (PP as CaCO3)	mg/L	<0.50	0.50	7059906
Bicarbonate (HCO3)	mg/L	380	0.50	7059906
Carbonate (CO3)	mg/L	<0.50	0.50	7059906
Hydroxide (OH)	mg/L	<0.50	0.50	7059906
Anions				
Dissolved Sulphate (SO4)	mg/L	198	0.50	7061653
Dissolved Chloride (Cl)	mg/L	4.4	0.50	7065892
Nutrients				
Ammonia (N)	mg/L	0.025	0.0050	7060092
Nitrate plus Nitrite (N)	mg/L	48.3	1.0	7061305
Physical Properties				
Conductivity	uS/cm	1230	1.0	7059918
pH	pH Units	8.28		7059921
Physical Properties				
Total Suspended Solids	mg/L	2.7	1.0	7062675
Total Dissolved Solids	mg/L	900	10	7063485

N/A = Not Applicable
RDL = Reportable Detection Limit

CCME DISSOLVED METALS IN WATER (WATER)

Maxxam ID		HD0873		
Sampling Date		2013/08/06 16:25		
	UNITS	**MW 12-07-01**	**RDL**	**QC Batch**
Misc. Inorganics				
Dissolved Hardness (CaCO3)	mg/L	557	0.50	7058078
Elements				
Dissolved Mercury (Hg)	ug/L	<0.010	0.010	7062465

RDL = Reportable Detection Limit

Maxxam Job #: B368800
Report Date: 2013/08/12

MINTO EXPLORATIONS LTD.
Client Project #: MINTO ENV. MONITORING
Site Location: YUKON
Your P.O. #: 204253
Sampler Initials: CH

CCME DISSOLVED METALS IN WATER (WATER)

Maxxam ID		HD0873		
Sampling Date		2013/08/06 16:25		
	UNITS	**MW 12-07-01**	**RDL**	**QC Batch**
Dissolved Metals by ICPMS				
Dissolved Aluminum (Al)	ug/L	8.5	3.0	7061759
Dissolved Antimony (Sb)	ug/L	0.73	0.50	7061759
Dissolved Arsenic (As)	ug/L	1.05	0.10	7061759
Dissolved Barium (Ba)	ug/L	82.7	1.0	7061759
Dissolved Beryllium (Be)	ug/L	<0.10	0.10	7061759
Dissolved Bismuth (Bi)	ug/L	<1.0	1.0	7061759
Dissolved Boron (B)	ug/L	321	50	7061759
Dissolved Cadmium (Cd)	ug/L	0.309	0.010	7061759
Dissolved Chromium (Cr)	ug/L	<1.0	1.0	7061759
Dissolved Cobalt (Co)	ug/L	<0.50	0.50	7061759
Dissolved Copper (Cu)	ug/L	26.5	0.20	7061759
Dissolved Iron (Fe)	ug/L	226	5.0	7061759
Dissolved Lead (Pb)	ug/L	0.62	0.20	7061759
Dissolved Lithium (Li)	ug/L	11.7	5.0	7061759
Dissolved Manganese (Mn)	ug/L	194	1.0	7061759
Dissolved Molybdenum (Mo)	ug/L	21.5	1.0	7061759
Dissolved Nickel (Ni)	ug/L	3.3	1.0	7061759
Dissolved Phosphorus (P)	ug/L	10	10	7061759
Dissolved Selenium (Se)	ug/L	27.4	0.10	7061759
Dissolved Silicon (Si)	ug/L	5740	100	7061759
Dissolved Silver (Ag)	ug/L	0.037	0.020	7061759
Dissolved Strontium (Sr)	ug/L	7720	1.0	7061759
Dissolved Thallium (Tl)	ug/L	<0.050	0.050	7061759
Dissolved Tin (Sn)	ug/L	<5.0	5.0	7061759
Dissolved Titanium (Ti)	ug/L	<5.0	5.0	7061759
Dissolved Uranium (U)	ug/L	6.32	0.10	7061759
Dissolved Vanadium (V)	ug/L	<5.0	5.0	7061759
Dissolved Zinc (Zn)	ug/L	51.0	5.0	7061759
Dissolved Zirconium (Zr)	ug/L	<0.50	0.50	7061759
Dissolved Calcium (Ca)	mg/L	184	0.050	7058079
Dissolved Magnesium (Mg)	mg/L	23.6	0.050	7058079
Dissolved Potassium (K)	mg/L	4.57	0.050	7058079
Dissolved Sodium (Na)	mg/L	40.0	0.050	7058079
Dissolved Sulphur (S)	mg/L	69.5	3.0	7058079

RDL = Reportable Detection Limit

MINTO EXPLORATIONS LTD.
Maxxam Job #: B368800
Report Date: 2013/08/12

Client Project #: MINTO ENV. MONITORING
Site Location: YUKON
Your P.O. #: 204253
Sampler Initials: CH

General Comments

Sample HD0873-01: The BC-MOE and APHA Standard Method require pH to be analysed within 15 minutes of sampling and therefore field analysis is required for compliance. All Laboratory pH analyses in this report are reported past the BC-MOE/APHA Standard Method holding time.

Success Through Science®

Maxxam Job #: B368800
Report Date: 2013/08/12

MINTO EXPLORATIONS LTD.
Client Project #: MINTO ENV. MONITORING
Site Location: YUKON
Your P.O. #: 204253
Sampler Initials: CH

QUALITY ASSURANCE REPORT

			Matrix Spike		Spiked Blank		Method Blank		RPD	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits
7059537	Fluoride (F)	2013/08/08	102	80 - 120	100	80 - 120	<0.010	mg/L	0	20
7059906	Alkalinity (Total as CaCO3)	2013/08/08	NC	80 - 120	100	80 - 120	<0.50	mg/L	1.0	20
7059906	Alkalinity (PP as CaCO3)	2013/08/08					<0.50	mg/L	NC	20
7059906	Bicarbonate (HCO3)	2013/08/08					<0.50	mg/L	1.0	20
7059906	Carbonate (CO3)	2013/08/08					<0.50	mg/L	NC	20
7059906	Hydroxide (OH)	2013/08/08					<0.50	mg/L	NC	20
7059918	Conductivity	2013/08/09			98	80 - 120	<1.0	uS/cm	0.07	20
7060092	Ammonia (N)	2013/08/08	NC	80 - 120	98	80 - 120	<0.0050	mg/L	2.2	20
7061305	Nitrate plus Nitrite (N)	2013/08/08	NC	80 - 120	100	80 - 120	<0.020	mg/L	0.2	25
7061352	Nitrite (N)	2013/08/08	104	80 - 120	97	80 - 120	<0.0050	mg/L	0.6	20
7061653	Dissolved Sulphate (SO4)	2013/08/08	95	80 - 120	92	80 - 120	0.61, RDL=0.50	mg/L	NC	20
7061759	Dissolved Aluminum (Al)	2013/08/09	102	80 - 120	103	80 - 120	<3.0	ug/L		
7061759	Dissolved Antimony (Sb)	2013/08/09	92	80 - 120	95	80 - 120	<0.50	ug/L		
7061759	Dissolved Arsenic (As)	2013/08/09	98	80 - 120	100	80 - 120	<0.10	ug/L		
7061759	Dissolved Barium (Ba)	2013/08/09	NC	80 - 120	98	80 - 120	<1.0	ug/L		
7061759	Dissolved Beryllium (Be)	2013/08/09	93	80 - 120	93	80 - 120	<0.10	ug/L		
7061759	Dissolved Bismuth (Bi)	2013/08/09	101	80 - 120	89	80 - 120	<1.0	ug/L		
7061759	Dissolved Cadmium (Cd)	2013/08/09	94	80 - 120	95	80 - 120	<0.010	ug/L		
7061759	Dissolved Chromium (Cr)	2013/08/09	102	80 - 120	98	80 - 120	<1.0	ug/L		
7061759	Dissolved Cobalt (Co)	2013/08/09	99	80 - 120	98	80 - 120	<0.50	ug/L		
7061759	Dissolved Copper (Cu)	2013/08/09	98	80 - 120	94	80 - 120	<0.20	ug/L		
7061759	Dissolved Iron (Fe)	2013/08/09	98	80 - 120	97	80 - 120	<5.0	ug/L		
7061759	Dissolved Lead (Pb)	2013/08/09	94	80 - 120	98	80 - 120	<0.20	ug/L		
7061759	Dissolved Lithium (Li)	2013/08/09	106	80 - 120	101	80 - 120	<5.0	ug/L		
7061759	Dissolved Manganese (Mn)	2013/08/09	102	80 - 120	100	80 - 120	<1.0	ug/L		
7061759	Dissolved Molybdenum (Mo)	2013/08/09	NC	80 - 120	86	80 - 120	<1.0	ug/L		
7061759	Dissolved Nickel (Ni)	2013/08/09	101	80 - 120	98	80 - 120	<1.0	ug/L		
7061759	Dissolved Selenium (Se)	2013/08/09	108	80 - 120	102	80 - 120	<0.10	ug/L		
7061759	Dissolved Silver (Ag)	2013/08/09	93	80 - 120	76 (1, 2)	80 - 120	<0.020	ug/L		
7061759	Dissolved Strontium (Sr)	2013/08/09	NC	80 - 120	96	80 - 120	<1.0	ug/L		
7061759	Dissolved Thallium (Tl)	2013/08/09	94	80 - 120	93	80 - 120	<0.050	ug/L		
7061759	Dissolved Tin (Sn)	2013/08/09	94	80 - 120	97	80 - 120	<5.0	ug/L		
7061759	Dissolved Titanium (Ti)	2013/08/09	104	80 - 120	95	80 - 120	<5.0	ug/L		
7061759	Dissolved Uranium (U)	2013/08/09	99	80 - 120	98	80 - 120	<0.10	ug/L		
7061759	Dissolved Vanadium (V)	2013/08/09	100	80 - 120	95	80 - 120	<5.0	ug/L		
7061759	Dissolved Zinc (Zn)	2013/08/09	103	80 - 120	96	80 - 120	<5.0	ug/L		
7061759	Dissolved Boron (B)	2013/08/09					<50	ug/L		
7061759	Dissolved Phosphorus (P)	2013/08/09					<10	ug/L		
7061759	Dissolved Silicon (Si)	2013/08/09					<100	ug/L		

Maxxam Job #: B368800
Report Date: 2013/08/12

MINTO EXPLORATIONS LTD.
Client Project #: MINTO ENV. MONITORING
Site Location: YUKON
Your P.O. #: 204253
Sampler Initials: CH

QUALITY ASSURANCE REPORT

			Matrix Spike		Spiked Blank		Method Blank		RPD	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits
7061759	Dissolved Zirconium (Zr)	2013/08/09					<0.50	ug/L		
7062465	Dissolved Mercury (Hg)	2013/08/09	98	80 - 120	101	80 - 120	<0.010	ug/L	NC	20
7062675	Total Suspended Solids	2013/08/10			97	80 - 120	<1.0	mg/L		
7063485	Total Dissolved Solids	2013/08/10	NC	80 - 120	90	80 - 120	<10	mg/L	3.4	20
7065892	Dissolved Chloride (Cl)	2013/08/09	NC	80 - 120	101	80 - 120	<0.50	mg/L	0.3	20

N/A = Not Applicable
RDL = Reportable Detection Limit
RPD = Relative Percent Difference
Duplicate: Paired analysis of a separate portion of the same sample. Used to evaluate the variance in the measurement.
Matrix Spike: A sample to which a known amount of the analyte of interest has been added. Used to evaluate sample matrix interference.
Spiked Blank: A blank matrix sample to which a known amount of the analyte, usually from a second source, has been added. Used to evaluate method accuracy.
Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.
NC (Matrix Spike): The recovery in the matrix spike was not calculated. The relative difference between the concentration in the parent sample and the spiked amount was not sufficiently significant to permit a reliable recovery calculation.
NC (RPD): The RPD was not calculated. The level of analyte detected in the parent sample and its duplicate was not sufficiently significant to permit a reliable calculation.
(1) - Recovery or RPD for this parameter is outside control limits. The overall quality control for this analysis meets acceptability criteria.
(2) - Blank Spike outside acceptance criteria (10% of analytes failure allowed).

Maxxam

Burnaby: 4606 Canada Way, Burnaby, BC V5G 1K5 Ph: (604) 734-7276 Fax: (604) 731-2386, Toll Free: (800) 665-8566

CHAIN OF CUSTODY RECORD

Click here to get the COC number

Maxxam Job #: B368800 **COC #:** EB808513 Page: 1 of 1

Invoice To: Require Report? Yes ☑ No ☐

Invoice To		Report To	
Company Name:	Minto Explorations Ltd	Company Name:	Minto Explorations Ltd
Contact Name:	Elvina Wong	Contact Name:	Minto Environment
Address:	Suite 900 - 999 West Hastings St	Address:	Suite 900-999 West Hastings St
	Vancouver, B.C. PC: V6C 2W2		Vancouver, B.C. PC: V6C 2W2
Phone / Fax#:	Ph: 604-684-8894 Fax: 604-688-2120	Phone / Fax#:	Ph: 604-684-8894 Fax: 604-688-2120
E-mail		E-mail	minto_environment@mintomine.com

PO #:	204253
Quotation #:	
Project # :	
Proj. Name:	Minto Env. Monitoring
Location:	Yukon
Sampled by:	C Harry and J Dobson

REGULATORY REQUIREMENTS:

- ☐ CSR
- ☑ CCME
- ☐ BC Water Quality
- ☐ Other
- ☐ DRINKING WATER

SERVICE REQUESTED:

- ◉ Regular Turn Around Time (TAT) (5 days for most tests)
- **RUSH** (Please contact the lab) ○ 1 Day ○ 2 Day ○ 3 Day
- Date Required:

SPECIAL INSTRUCTIONS:

Return Cooler ☐ **Ship Sample Bottles (please specify)** ☐

ANALYSIS REQUESTED

Lab Use Only

	Sample Identification	Lab Identification	Sample Type	Date/Time(24hr) Sampled	Dissolved Metals (DM) — Field Filtered? ☑Y ☐N	Field Acidified? ☑Y ☐N	Total Metals — Field Acidified? ☑Y ☐N	☑ Nitrate ☑ Nitrite ☑ Ammonia	☑ Total Suspended Solids (TSS) ☑ TDS	☑ pH ☑ Conductivity ☑ Alkalinity	☑ Chloride ☑ Fluoride ☑ Sulphate	Phosphate	DOC (Diss'd Organic Carbon)	TOC (Total Organic Carbon)	Ra 226	Number of Containers
1	MW12-07-01	HD0873	Water	13-08-06 16:25	X	X		X	X	X	X					4
2																
3																
4																
5																
6																
7																
8																
9																
10																
11																
12																

B368800

Print name and sign — Print name and sign — Laboratory Use Only

*Relinquished By:	Date (yy/mm/dd):	Time (24hr):	Received by :	Date (yy/mm/dd):	Time (24 hr):	Time Sensitive	Temperature on Receipt (°C)	Custody Seal	Yes	No
J Dobson	13-08-07	10:00	[signature]	2013/08/08	09:15	☑	A) 6 B) 6 C) 7	Present?	☐	☑
							Just sampled & rec'd on ice: ☐	Intact?	☐	☐ N/A

*IT IS THE RESPONSIBILITY OF THE RELINQUISHER TO ENSURE THE ACCURACY OF THE CHAIN OF CUSTODY RECORDS. AN INCOMPLETE CHAIN OF CUSTODY MAY RESULT IN ANALYTICAL TAT DELAYS.

Maxxam

Success Through Science®

Your P.O. #: 204253
Your Project #: MINTO ENV. MONITORING
Site Location: YUKON
Your C.O.C. #: EB817413

Attention: MINTO DISTRIBUTION LIST
MINTO EXPLORATIONS LTD.
Yukon/Whitehorse
2 - 25 Pilgrim Way
Whitehorse, YT
CANADA Y1A 6E6

Report Date: 2013/08/26

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B373293
Received: 2013/08/20, 09:20

Sample Matrix: Water
Samples Received: 8

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Analytical Method
Alkalinity - Water	6	2013/08/21	2013/08/21	BBY6SOP-00026	SM2320B
Alkalinity - Water	2	2013/08/21	2013/08/22	BBY6SOP-00026	SM2320B
Chloride by Automated Colourimetry	8	N/A	2013/08/21	BBY6SOP-00011	SM-4500-Cl-
Conductance - water	6	N/A	2013/08/21	BBY6SOP-00026	SM-2510B
Conductance - water	2	N/A	2013/08/22	BBY6SOP-00026	SM-2510B
Fluoride	8	N/A	2013/08/21	BBY6SOP-00012	SM - 4500 F C
Hardness (calculated as CaCO3)	1	N/A	2013/08/23	BBY7SOP-00002	EPA 6020A
Hardness (calculated as CaCO3)	4	N/A	2013/08/25	BBY7SOP-00002	EPA 6020A
Hardness (calculated as CaCO3)	3	N/A	2013/08/26	BBY7SOP-00002	EPA 6020A
Mercury (Dissolved) by CVAF	8	N/A	2013/08/26	BBY7SOP-00015	EPA 245.7
Na, K, Ca, Mg, S by CRC ICPMS (diss.)	1	N/A	2013/08/23	BBY7SOP-00002	EPA 6020A
Na, K, Ca, Mg, S by CRC ICPMS (diss.)	4	N/A	2013/08/25	BBY7SOP-00002	EPA 6020A
Na, K, Ca, Mg, S by CRC ICPMS (diss.)	3	N/A	2013/08/26	BBY7SOP-00002	EPA 6020A
Elements by CRC ICPMS (dissolved)	8	N/A	2013/08/23	BBY7SOP-00002	EPA 6020A
Ammonia-N (Preserved)	7	N/A	2013/08/21	BBY6SOP-00009	SM-4500NH3G
Ammonia-N (Preserved)	1	N/A	2013/08/23	BBY6SOP-00009	SM-4500NH3G
Nitrate + Nitrite (N)	8	N/A	2013/08/21	BBY6SOP-00010	SM 4500NO3-I
Nitrite (N) by CFA	8	N/A	2013/08/21	BBY6SOP-00010	EPA 353.2
Nitrogen - Nitrate (as N)	8	N/A	2013/08/22	BBY6SOP-00010	SM 4500NO3-I
Filter and HNO3 Preserve for Metals	8	N/A	2013/08/20	BBY6WI-00001	EPA 200.2
pH Water	6	N/A	2013/08/21	BBY6SOP-00026	SM-4500H+B
pH Water	2	N/A	2013/08/22	BBY6SOP-00026	SM-4500H+B
Sulphate by Automated Colourimetry	6	N/A	2013/08/21	BBY6SOP-00017	SM4500-SO42- E
Sulphate by Automated Colourimetry	2	N/A	2013/08/22	BBY6SOP-00017	SM4500-SO42- E
Total Dissolved Solids (Filt. Residue)	8	2013/08/21	2013/08/22	BBY6SOP-00033	SM 2540C
Total Suspended Solids	8	N/A	2013/08/22	BBY6SOP-00034	SM - 2540 D

* Results relate only to the items tested.

Maxxam Job #: B373293
Report Date: 2013/08/26

MINTO EXPLORATIONS LTD.
Client Project #: MINTO ENV. MONITORING
Site Location: YUKON
Your P.O. #: 204253
Sampler Initials: PE

Encryption Key

Please direct all questions regarding this Certificate of Analysis to your Project Manager.

Ken Pomeroy, Project Manager
Email: KPomeroy@maxxam.ca
Phone# (604) 638-5020

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Maxxam has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per section 5.10.2 of ISO/IEC 17025:2005(E), signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

Total cover pages: 2

Maxxam Job #: B373293
Report Date: 2013/08/26

MINTO EXPLORATIONS LTD.
Client Project #: MINTO ENV. MONITORING
Site Location: YUKON
Your P.O. #: 204253
Sampler Initials: PE

RESULTS OF CHEMICAL ANALYSES OF WATER

Maxxam ID		HG2623			HG2624			HG2625			HG2626		
Sampling Date		2013/08/18 09:00			2013/08/18 10:30			2013/08/18 12:00			2013/08/18 00:00		
	UNITS	**MW09-03-01**	**RDL**	**QC Batch**	**MW09-03-02**	**RDL**	**QC Batch**	**MW09-03-03**	**RDL**	**QC Batch**	**DUP**	**RDL**	**QC Batch**
ANIONS													
Nitrite (N)	mg/L	1.63	0.025	7100847	0.0888	0.0050	7100847	0.0239	0.0050	7100847	0.0867	0.0050	7100847
Calculated Parameters													
Filter and HNO3 Preservation	N/A	FIELD	N/A	ONSITE	FIELD	N/A	ONSITE	FIELD	N/A	ONSITE	FIELD	N/A	ONSITE
Nitrate (N)	mg/L	0.669	0.040	7094886	<0.020	0.020	7094886	0.426	0.020	7094886	<0.020	0.020	7094886
Misc. Inorganics													
Fluoride (F)	mg/L	0.870	0.010	7101485	0.770	0.010	7101485	0.490	0.010	7101485	0.740	0.010	7101485
Alkalinity (Total as CaCO3)	mg/L	141	0.50	7099238	535	0.50	7099238	80.9	0.50	7099238	534	0.50	7099238
Alkalinity (PP as CaCO3)	mg/L	<0.50	0.50	7099238	<0.50	0.50	7099238	<0.50	0.50	7099238	<0.50	0.50	7099238
Bicarbonate (HCO3)	mg/L	172	0.50	7099238	653	0.50	7099238	98.6	0.50	7099238	651	0.50	7099238
Carbonate (CO3)	mg/L	<0.50	0.50	7099238	<0.50	0.50	7099238	<0.50	0.50	7099238	<0.50	0.50	7099238
Hydroxide (OH)	mg/L	<0.50	0.50	7099238	<0.50	0.50	7099238	<0.50	0.50	7099238	<0.50	0.50	7099238
Anions													
Dissolved Sulphate (SO4)	mg/L	21.9	0.50	7102179	9.2(1)	5.0	7108894	9.40	0.50	7102179	5.0(1)	5.0	7108894
Dissolved Chloride (Cl)	mg/L	0.55	0.50	7102174	4.5	0.50	7102174	0.59	0.50	7102174	4.4	0.50	7102174
Nutrients													
Ammonia (N)	mg/L	0.053	0.0050	7099301	0.24	0.0050	7099301	0.013	0.0050	7099301	0.25	0.0050	7099301
Nitrate plus Nitrite (N)	mg/L	2.30	0.040	7100706	0.099	0.020	7100706	0.449	0.020	7100706	0.090	0.020	7100706
Physical Properties													
Conductivity	uS/cm	324	1.0	7099270	965	1.0	7099270	181	1.0	7099270	965	1.0	7099270
pH	pH Units	8.18		7099268	8.08		7099268	7.99		7099268	8.13		7099268
Physical Properties													
Total Suspended Solids	mg/L	<4.0	4.0	7098834	53.0	4.0	7098834	<4.0	4.0	7098834	53.0	4.0	7098834
Total Dissolved Solids	mg/L	184	10	7099224	622	10	7099224	104	10	7099224	626	10	7099224

N/A = Not Applicable
RDL = Reportable Detection Limit
(1) - RDL raised due to sample matrix interference.

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Maxxam Job #: B373293
Report Date: 2013/08/26

MINTO EXPLORATIONS LTD.
Client Project #: MINTO ENV. MONITORING
Site Location: YUKON
Your P.O. #: 204253
Sampler Initials: PE

RESULTS OF CHEMICAL ANALYSES OF WATER

Maxxam ID		HG2627		HG2628	HG2629		HG2630		
Sampling Date		2013/08/18 14:00		2013/08/18 15:30	2013/08/18 16:30		2013/08/18 00:00		
	UNITS	**MW12-06-01**	**RDL**	**MW12-06-02**	**MW12-06-03**	**QC Batch**	**F-BL**	**RDL**	**QC Batch**
ANIONS									
Nitrite (N)	mg/L	0.787	0.010	0.463	0.0953	7100847	<0.0050	0.0050	7100847
Calculated Parameters									
Filter and HNO3 Preservation	N/A	FIELD	N/A	FIELD	FIELD	ONSITE	FIELD	N/A	ONSITE
Nitrate (N)	mg/L	0.250	0.020	0.128	0.952	7094886	<0.020	0.020	7094886
Misc. Inorganics									
Fluoride (F)	mg/L	1.60	0.010	1.30	0.670	7101485	<0.010	0.010	7101485
Alkalinity (Total as CaCO3)	mg/L	346	0.50	403	315	7099238	0.89	0.50	7099238
Alkalinity (PP as CaCO3)	mg/L	<0.50	0.50	<0.50	<0.50	7099238	<0.50	0.50	7099238
Bicarbonate (HCO3)	mg/L	422	0.50	491	384	7099238	1.09	0.50	7099238
Carbonate (CO3)	mg/L	<0.50	0.50	<0.50	<0.50	7099238	<0.50	0.50	7099238
Hydroxide (OH)	mg/L	<0.50	0.50	<0.50	<0.50	7099238	<0.50	0.50	7099238
Anions									
Dissolved Sulphate (SO4)	mg/L	206	5.0	163	154	7102179	0.57	0.50	7102179
Dissolved Chloride (Cl)	mg/L	2.1	0.50	1.2	3.0	7102174	<0.50	0.50	7102174
Nutrients									
Ammonia (N)	mg/L	0.048	0.0050	0.021	0.011	7099301	0.024	0.0050	7108781
Nitrate plus Nitrite (N)	mg/L	1.04	0.020	0.591	1.05	7100706	<0.020	0.020	7100706
Physical Properties									
Conductivity	uS/cm	979	1.0	962	821	7099270	1.9	1.0	7099270
pH	pH Units	8.20		8.21	8.26	7099268	6.35		7099268
Physical Properties									
Total Suspended Solids	mg/L	80.5	4.0	4.5	<4.0	7098834	<4.0	4.0	7098834
Total Dissolved Solids	mg/L	646	10	602	510	7099224	<10	10	7099224

N/A = Not Applicable
RDL = Reportable Detection Limit

Maxxam Job #: B373293
Report Date: 2013/08/26

MINTO EXPLORATIONS LTD.
Client Project #: MINTO ENV. MONITORING
Site Location: YUKON
Your P.O. #: 204253
Sampler Initials: PE

CCME DISSOLVED METALS IN WATER (WATER)

Maxxam ID		HG2623	HG2624		
Sampling Date		2013/08/18 09:00	2013/08/18 10:30		
	UNITS	**MW09-03-01**	**MW09-03-02**	**RDL**	**QC Batch**
Misc. Inorganics					
Dissolved Hardness (CaCO3)	mg/L	141	475	0.50	7094775
Elements					
Dissolved Mercury (Hg)	ug/L	<0.010	<0.010	0.010	7115658

RDL = Reportable Detection Limit

Maxxam Job #: B373293
Report Date: 2013/08/26

MINTO EXPLORATIONS LTD.
Client Project #: MINTO ENV. MONITORING
Site Location: YUKON
Your P.O. #: 204253
Sampler Initials: PE

CCME DISSOLVED METALS IN WATER (WATER)

Maxxam ID		HG2623	HG2624		
Sampling Date		2013/08/18 09:00	2013/08/18 10:30		
	UNITS	**MW09-03-01**	**MW09-03-02**	**RDL**	**QC Batch**
Dissolved Metals by ICPMS					
Dissolved Aluminum (Al)	ug/L	8.6	7.0	3.0	7103988
Dissolved Antimony (Sb)	ug/L	0.52	<0.50	0.50	7103988
Dissolved Arsenic (As)	ug/L	<0.10	0.69	0.10	7103988
Dissolved Barium (Ba)	ug/L	44.0	753	1.0	7103988
Dissolved Beryllium (Be)	ug/L	<0.10	<0.10	0.10	7103988
Dissolved Bismuth (Bi)	ug/L	<1.0	<1.0	1.0	7103988
Dissolved Boron (B)	ug/L	1580	350	50	7103988
Dissolved Cadmium (Cd)	ug/L	0.022	0.026	0.010	7103988
Dissolved Chromium (Cr)	ug/L	<1.0	<1.0	1.0	7103988
Dissolved Cobalt (Co)	ug/L	<0.50	1.60	0.50	7103988
Dissolved Copper (Cu)	ug/L	0.75	0.66	0.20	7103988
Dissolved Iron (Fe)	ug/L	6.5	19300	5.0	7103988
Dissolved Lead (Pb)	ug/L	<0.20	<0.20	0.20	7103988
Dissolved Lithium (Li)	ug/L	<5.0	<5.0	5.0	7103988
Dissolved Manganese (Mn)	ug/L	68.7	20700	1.0	7103988
Dissolved Molybdenum (Mo)	ug/L	8.7	18.2	1.0	7103988
Dissolved Nickel (Ni)	ug/L	1.7	<1.0	1.0	7103988
Dissolved Phosphorus (P)	ug/L	<10	<10	10	7103988
Dissolved Selenium (Se)	ug/L	<0.10	0.11	0.10	7103988
Dissolved Silicon (Si)	ug/L	4870	9480	100	7103988
Dissolved Silver (Ag)	ug/L	<0.020	0.030	0.020	7103988
Dissolved Strontium (Sr)	ug/L	701	1570	1.0	7103988
Dissolved Thallium (Tl)	ug/L	<0.050	<0.050	0.050	7103988
Dissolved Tin (Sn)	ug/L	<5.0	<5.0	5.0	7103988
Dissolved Titanium (Ti)	ug/L	<5.0	<5.0	5.0	7103988
Dissolved Uranium (U)	ug/L	1.41	0.25	0.10	7103988
Dissolved Vanadium (V)	ug/L	<5.0	<5.0	5.0	7103988
Dissolved Zinc (Zn)	ug/L	5.9	<5.0	5.0	7103988
Dissolved Zirconium (Zr)	ug/L	<0.50	<0.50	0.50	7103988
Dissolved Calcium (Ca)	mg/L	40.6	149	0.050	7095248
Dissolved Magnesium (Mg)	mg/L	9.77	24.9	0.050	7095248
Dissolved Potassium (K)	mg/L	2.72	3.93	0.050	7095248
Dissolved Sodium (Na)	mg/L	13.2	15.7	0.050	7095248
Dissolved Sulphur (S)	mg/L	7.0	<3.0	3.0	7095248

RDL = Reportable Detection Limit

Maxxam Job #: B373293
Report Date: 2013/08/26

MINTO EXPLORATIONS LTD.
Client Project #: MINTO ENV. MONITORING
Site Location: YUKON
Your P.O. #: 204253
Sampler Initials: PE

CCME DISSOLVED METALS IN WATER (WATER)

Maxxam ID		HG2625		HG2626	HG2627	HG2628	HG2629		
Sampling Date		2013/08/18 12:00		2013/08/18 00:00	2013/08/18 14:00	2013/08/18 15:30	2013/08/18 16:30		
	UNITS	**MW09-03-03**	**QC Batch**	**DUP**	**MW12-06-01**	**MW12-06-02**	**MW12-06-03**	**RDL**	**QC Batch**
Misc. Inorganics									
Dissolved Hardness (CaCO3)	mg/L	91.5	7094775	512	445	488	393	0.50	7094775
Elements									
Dissolved Mercury (Hg)	ug/L	<0.010	7114992	<0.010	<0.010	<0.010	<0.010	0.010	7114992

RDL = Reportable Detection Limit

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Maxxam Job #: B373293
Report Date: 2013/08/26

MINTO EXPLORATIONS LTD.
Client Project #: MINTO ENV. MONITORING
Site Location: YUKON
Your P.O. #: 204253
Sampler Initials: PE

CCME DISSOLVED METALS IN WATER (WATER)

Maxxam ID		HG2625		HG2626	HG2627	HG2628	HG2629		
Sampling Date		2013/08/18 12:00		2013/08/18 00:00	2013/08/18 14:00	2013/08/18 15:30	2013/08/18 16:30		
	UNITS	**MW09-03-03**	**QC Batch**	**DUP**	**MW12-06-01**	**MW12-06-02**	**MW12-06-03**	**RDL**	**QC Batch**
Dissolved Metals by ICPMS									
Dissolved Aluminum (Al)	ug/L	4.7	7103988	6.2	4.5	5.1	3.8	3.0	7103967
Dissolved Antimony (Sb)	ug/L	<0.50	7103988	<0.50	<0.50	<0.50	<0.50	0.50	7103967
Dissolved Arsenic (As)	ug/L	<0.10	7103988	0.67	6.64	2.31	0.13	0.10	7103967
Dissolved Barium (Ba)	ug/L	38.8	7103988	709	29.2	20.7	14.4	1.0	7103967
Dissolved Beryllium (Be)	ug/L	<0.10	7103988	<0.10	<0.10	<0.10	<0.10	0.10	7103967
Dissolved Bismuth (Bi)	ug/L	<1.0	7103988	<1.0	<1.0	<1.0	<1.0	1.0	7103967
Dissolved Boron (B)	ug/L	<50	7103988	373	742	372	88	50	7103967
Dissolved Cadmium (Cd)	ug/L	0.010	7103988	0.030	<0.010	<0.010	0.011	0.010	7103967
Dissolved Chromium (Cr)	ug/L	<1.0	7103988	<1.0	<1.0	<1.0	<1.0	1.0	7103967
Dissolved Cobalt (Co)	ug/L	<0.50	7103988	1.48	<0.50	<0.50	<0.50	0.50	7103967
Dissolved Copper (Cu)	ug/L	2.22	7103988	1.21	0.70	<0.20	0.36	0.20	7103967
Dissolved Iron (Fe)	ug/L	157	7103988	20700	954	670	9.0	5.0	7103967
Dissolved Lead (Pb)	ug/L	<0.20	7103988	<0.20	<0.20	<0.20	<0.20	0.20	7103967
Dissolved Lithium (Li)	ug/L	<5.0	7103988	<5.0	10.6	6.6	<5.0	5.0	7103967
Dissolved Manganese (Mn)	ug/L	277	7103988	20300	44.1	53.6	55.1	1.0	7103967
Dissolved Molybdenum (Mo)	ug/L	4.9	7103988	17.9	6.9	8.9	5.8	1.0	7103967
Dissolved Nickel (Ni)	ug/L	<1.0	7103988	<1.0	<1.0	<1.0	<1.0	1.0	7103967
Dissolved Phosphorus (P)	ug/L	<10	7103988	<10	<10	12	<10	10	7103967
Dissolved Selenium (Se)	ug/L	0.29	7103988	0.12	0.28	0.14	0.22	0.10	7103967
Dissolved Silicon (Si)	ug/L	4710	7103988	11300	11800	9110	7400	100	7103967
Dissolved Silver (Ag)	ug/L	<0.020	7103988	0.023	<0.020	<0.020	<0.020	0.020	7103967
Dissolved Strontium (Sr)	ug/L	177	7103988	1590	11500	2950	1610	1.0	7103967
Dissolved Thallium (Tl)	ug/L	<0.050	7103988	<0.050	<0.050	<0.050	<0.050	0.050	7103967
Dissolved Tin (Sn)	ug/L	<5.0	7103988	<5.0	<5.0	<5.0	<5.0	5.0	7103967
Dissolved Titanium (Ti)	ug/L	<5.0	7103988	<5.0	<5.0	<5.0	<5.0	5.0	7103967
Dissolved Uranium (U)	ug/L	0.90	7103988	0.26	1.74	6.23	3.77	0.10	7103967
Dissolved Vanadium (V)	ug/L	<5.0	7103988	<5.0	<5.0	<5.0	<5.0	5.0	7103967
Dissolved Zinc (Zn)	ug/L	<5.0	7103988	10.2	<5.0	<5.0	<5.0	5.0	7103967
Dissolved Zirconium (Zr)	ug/L	<0.50	7103988	<0.50	<0.50	<0.50	<0.50	0.50	7103967
Dissolved Calcium (Ca)	mg/L	30.3	7095248	163	132	103	79.2	0.050	7095248
Dissolved Magnesium (Mg)	mg/L	3.83	7095248	25.3	28.1	56.1	47.4	0.050	7095248
Dissolved Potassium (K)	mg/L	1.79	7095248	4.00	3.57	3.62	3.24	0.050	7095248
Dissolved Sodium (Na)	mg/L	3.50	7095248	15.7	50.7	36.9	29.1	0.050	7095248
Dissolved Sulphur (S)	mg/L	3.4	7095248	<3.0	71.7	56.8	51.1	3.0	7095248

RDL = Reportable Detection Limit

Maxxam Job #: B373293
Report Date: 2013/08/26

MINTO EXPLORATIONS LTD.
Client Project #: MINTO ENV. MONITORING
Site Location: YUKON
Your P.O. #: 204253
Sampler Initials: PE

CCME DISSOLVED METALS IN WATER (WATER)

Maxxam ID		HG2630		
Sampling Date		2013/08/18 00:00		
	UNITS	**F-BL**	**RDL**	**QC Batch**
Misc. Inorganics				
Dissolved Hardness (CaCO3)	mg/L	<0.50	0.50	7094775
Elements				
Dissolved Mercury (Hg)	ug/L	<0.010	0.010	7114992

RDL = Reportable Detection Limit

Maxxam Job #: B373293
Report Date: 2013/08/26

MINTO EXPLORATIONS LTD.
Client Project #: MINTO ENV. MONITORING
Site Location: YUKON
Your P.O. #: 204253
Sampler Initials: PE

CCME DISSOLVED METALS IN WATER (WATER)

Maxxam ID		HG2630		
Sampling Date		2013/08/18 00:00		
	UNITS	**F-BL**	**RDL**	**QC Batch**
Dissolved Metals by ICPMS				
Dissolved Aluminum (Al)	ug/L	<3.0	3.0	7103967
Dissolved Antimony (Sb)	ug/L	<0.50	0.50	7103967
Dissolved Arsenic (As)	ug/L	<0.10	0.10	7103967
Dissolved Barium (Ba)	ug/L	<1.0	1.0	7103967
Dissolved Beryllium (Be)	ug/L	<0.10	0.10	7103967
Dissolved Bismuth (Bi)	ug/L	<1.0	1.0	7103967
Dissolved Boron (B)	ug/L	<50	50	7103967
Dissolved Cadmium (Cd)	ug/L	<0.010	0.010	7103967
Dissolved Chromium (Cr)	ug/L	<1.0	1.0	7103967
Dissolved Cobalt (Co)	ug/L	<0.50	0.50	7103967
Dissolved Copper (Cu)	ug/L	1.53	0.20	7103967
Dissolved Iron (Fe)	ug/L	<5.0	5.0	7103967
Dissolved Lead (Pb)	ug/L	<0.20	0.20	7103967
Dissolved Lithium (Li)	ug/L	<5.0	5.0	7103967
Dissolved Manganese (Mn)	ug/L	<1.0	1.0	7103967
Dissolved Molybdenum (Mo)	ug/L	<1.0	1.0	7103967
Dissolved Nickel (Ni)	ug/L	<1.0	1.0	7103967
Dissolved Phosphorus (P)	ug/L	<10	10	7103967
Dissolved Selenium (Se)	ug/L	<0.10	0.10	7103967
Dissolved Silicon (Si)	ug/L	<100	100	7103967
Dissolved Silver (Ag)	ug/L	<0.020	0.020	7103967
Dissolved Strontium (Sr)	ug/L	<1.0	1.0	7103967
Dissolved Thallium (Tl)	ug/L	<0.050	0.050	7103967
Dissolved Tin (Sn)	ug/L	<5.0	5.0	7103967
Dissolved Titanium (Ti)	ug/L	<5.0	5.0	7103967
Dissolved Uranium (U)	ug/L	<0.10	0.10	7103967
Dissolved Vanadium (V)	ug/L	<5.0	5.0	7103967
Dissolved Zinc (Zn)	ug/L	<5.0	5.0	7103967
Dissolved Zirconium (Zr)	ug/L	<0.50	0.50	7103967
Dissolved Calcium (Ca)	mg/L	<0.050	0.050	7095248
Dissolved Magnesium (Mg)	mg/L	<0.050	0.050	7095248
Dissolved Potassium (K)	mg/L	<0.050	0.050	7095248
Dissolved Sodium (Na)	mg/L	<0.050	0.050	7095248
Dissolved Sulphur (S)	mg/L	<3.0	3.0	7095248

RDL = Reportable Detection Limit

General Comments

Sample HG2623-01: The BC-MOE and APHA Standard Method require pH to be analysed within 15 minutes of sampling and therefore field analysis is required for compliance. All Laboratory pH analyses in this report are reported past the BC-MOE/APHA Standard Method holding time.

Sample HG2624-01: The BC-MOE and APHA Standard Method require pH to be analysed within 15 minutes of sampling and therefore field analysis is required for compliance. All Laboratory pH analyses in this report are reported past the BC-MOE/APHA Standard Method holding time.

Sample HG2625-01: The BC-MOE and APHA Standard Method require pH to be analysed within 15 minutes of sampling and therefore field analysis is required for compliance. All Laboratory pH analyses in this report are reported past the BC-MOE/APHA Standard Method holding time.

Sample HG2626-01: The BC-MOE and APHA Standard Method require pH to be analysed within 15 minutes of sampling and therefore field analysis is required for compliance. All Laboratory pH analyses in this report are reported past the BC-MOE/APHA Standard Method holding time.

Sample HG2627-01: The BC-MOE and APHA Standard Method require pH to be analysed within 15 minutes of sampling and therefore field analysis is required for compliance. All Laboratory pH analyses in this report are reported past the BC-MOE/APHA Standard Method holding time.

Sample HG2628-01: The BC-MOE and APHA Standard Method require pH to be analysed within 15 minutes of sampling and therefore field analysis is required for compliance. All Laboratory pH analyses in this report are reported past the BC-MOE/APHA Standard Method holding time.

Sample HG2629-01: The BC-MOE and APHA Standard Method require pH to be analysed within 15 minutes of sampling and therefore field analysis is required for compliance. All Laboratory pH analyses in this report are reported past the BC-MOE/APHA Standard Method holding time.

Sample HG2630-01: The BC-MOE and APHA Standard Method require pH to be analysed within 15 minutes of sampling and therefore field analysis is required for compliance. All Laboratory pH analyses in this report are reported past the BC-MOE/APHA Standard Method holding time.

Maxxam

Success Through Science®

Maxxam Job #: B373293
Report Date: 2013/08/26

MINTO EXPLORATIONS LTD.
Client Project #: MINTO ENV. MONITORING
Site Location: YUKON
Your P.O. #: 204253
Sampler Initials: PE

QUALITY ASSURANCE REPORT

			Matrix Spike		Spiked Blank		Method Blank		RPD	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits
7098834	Total Suspended Solids	2013/08/22	104	80 - 120	99	80 - 120	<4.0	mg/L	NC	20
7099224	Total Dissolved Solids	2013/08/22	NC	80 - 120	98	80 - 120	<10	mg/L	NC	20
7099238	Alkalinity (Total as CaCO3)	2013/08/21	NC	80 - 120	101	80 - 120	<0.50	mg/L	2.5	20
7099238	Alkalinity (PP as CaCO3)	2013/08/21					<0.50	mg/L	NC	20
7099238	Bicarbonate (HCO3)	2013/08/21					<0.50	mg/L	2.5	20
7099238	Carbonate (CO3)	2013/08/21					<0.50	mg/L	NC	20
7099238	Hydroxide (OH)	2013/08/21					<0.50	mg/L	NC	20
7099270	Conductivity	2013/08/21			98	80 - 120	<1.0	uS/cm	0.4	20
7099301	Ammonia (N)	2013/08/21	104	80 - 120	100	80 - 120	<0.0050	mg/L	NC	20
7100706	Nitrate plus Nitrite (N)	2013/08/21	104	80 - 120	103	80 - 120	<0.020	mg/L	NC	25
7100847	Nitrite (N)	2013/08/21	100	80 - 120	99	80 - 120	<0.0050	mg/L	NC	20
7101485	Fluoride (F)	2013/08/21	103	80 - 120	98	80 - 120	<0.010	mg/L	3.4	20
7102174	Dissolved Chloride (Cl)	2013/08/21	102	80 - 120	99	80 - 120	0.53, RDL=0.50	mg/L	1.9	20
7102179	Dissolved Sulphate (SO4)	2013/08/21	94	80 - 120	94	80 - 120	<0.50	mg/L	0.4	20
7103967	Dissolved Aluminum (Al)	2013/08/23	111	80 - 120	109	80 - 120	<3.0	ug/L	NC	20
7103967	Dissolved Antimony (Sb)	2013/08/23	102	80 - 120	101	80 - 120	<0.50	ug/L	NC	20
7103967	Dissolved Arsenic (As)	2013/08/23	104	80 - 120	99	80 - 120	<0.10	ug/L	NC	20
7103967	Dissolved Barium (Ba)	2013/08/23	103	80 - 120	98	80 - 120	<1.0	ug/L	NC	20
7103967	Dissolved Beryllium (Be)	2013/08/23	103	80 - 120	97	80 - 120	<0.10	ug/L	NC	20
7103967	Dissolved Bismuth (Bi)	2013/08/23	98	80 - 120	93	80 - 120	<1.0	ug/L	NC	20
7103967	Dissolved Cadmium (Cd)	2013/08/23	105	80 - 120	101	80 - 120	<0.010	ug/L	NC	20
7103967	Dissolved Chromium (Cr)	2013/08/23	104	80 - 120	101	80 - 120	<1.0	ug/L	NC	20
7103967	Dissolved Cobalt (Co)	2013/08/23	100	80 - 120	100	80 - 120	<0.50	ug/L	NC	20
7103967	Dissolved Copper (Cu)	2013/08/23	102	80 - 120	99	80 - 120	<0.20	ug/L	1.8	20
7103967	Dissolved Iron (Fe)	2013/08/23	106	80 - 120	108	80 - 120	<5.0	ug/L	NC	20
7103967	Dissolved Lead (Pb)	2013/08/23	98	80 - 120	96	80 - 120	<0.20	ug/L	NC	20
7103967	Dissolved Lithium (Li)	2013/08/23	95	80 - 120	96	80 - 120	<5.0	ug/L	NC	20
7103967	Dissolved Manganese (Mn)	2013/08/23	101	80 - 120	103	80 - 120	<1.0	ug/L	NC	20
7103967	Dissolved Molybdenum (Mo)	2013/08/23	103	80 - 120	96	80 - 120	<1.0	ug/L	NC	20
7103967	Dissolved Nickel (Ni)	2013/08/23	104	80 - 120	103	80 - 120	<1.0	ug/L	NC	20
7103967	Dissolved Selenium (Se)	2013/08/23	108	80 - 120	104	80 - 120	<0.10	ug/L	NC	20
7103967	Dissolved Silver (Ag)	2013/08/23	102	80 - 120	99	80 - 120	<0.020	ug/L	NC	20
7103967	Dissolved Strontium (Sr)	2013/08/23	102	80 - 120	99	80 - 120	<1.0	ug/L	NC	20
7103967	Dissolved Thallium (Tl)	2013/08/23	102	80 - 120	100	80 - 120	<0.050	ug/L	NC	20
7103967	Dissolved Tin (Sn)	2013/08/23	100	80 - 120	101	80 - 120	<5.0	ug/L	NC	20
7103967	Dissolved Titanium (Ti)	2013/08/23	102	80 - 120	97	80 - 120	<5.0	ug/L	NC	20
7103967	Dissolved Uranium (U)	2013/08/23	99	80 - 120	97	80 - 120	<0.10	ug/L	NC	20
7103967	Dissolved Vanadium (V)	2013/08/23	103	80 - 120	100	80 - 120	<5.0	ug/L	NC	20
7103967	Dissolved Zinc (Zn)	2013/08/23	110	80 - 120	103	80 - 120	<5.0	ug/L	NC	20

Maxxam Job #: B373293
Report Date: 2013/08/26

MINTO EXPLORATIONS LTD.
Client Project #: MINTO ENV. MONITORING
Site Location: YUKON
Your P.O. #: 204253
Sampler Initials: PE

QUALITY ASSURANCE REPORT

			Matrix Spike		Spiked Blank		Method Blank		RPD	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits
7103967	Dissolved Boron (B)	2013/08/23					<50	ug/L	NC	20
7103967	Dissolved Phosphorus (P)	2013/08/23					<10	ug/L	NC	20
7103967	Dissolved Silicon (Si)	2013/08/23					<100	ug/L	NC	20
7103967	Dissolved Zirconium (Zr)	2013/08/23					<0.50	ug/L	NC	20
7103988	Dissolved Aluminum (Al)	2013/08/23	NC	80 - 120	103	80 - 120	<3.0	ug/L	0.5	20
7103988	Dissolved Antimony (Sb)	2013/08/23	104	80 - 120	98	80 - 120	<0.50	ug/L	NC	20
7103988	Dissolved Arsenic (As)	2013/08/23	105	80 - 120	96	80 - 120	<0.10	ug/L	NC	20
7103988	Dissolved Barium (Ba)	2013/08/23	NC	80 - 120	100	80 - 120	<1.0	ug/L	1.6	20
7103988	Dissolved Beryllium (Be)	2013/08/23	102	80 - 120	96	80 - 120	<0.10	ug/L		
7103988	Dissolved Bismuth (Bi)	2013/08/23	101	80 - 120	83	80 - 120	<1.0	ug/L		
7103988	Dissolved Cadmium (Cd)	2013/08/23	104	80 - 120	101	80 - 120	<0.010	ug/L	NC	20
7103988	Dissolved Chromium (Cr)	2013/08/23	104	80 - 120	99	80 - 120	<1.0	ug/L	NC	20
7103988	Dissolved Cobalt (Co)	2013/08/23	102	80 - 120	96	80 - 120	<0.50	ug/L	NC	20
7103988	Dissolved Copper (Cu)	2013/08/23	105	80 - 120	98	80 - 120	<0.20	ug/L	7.5	20
7103988	Dissolved Iron (Fe)	2013/08/23	105	80 - 120	111	80 - 120	<5.0	ug/L	9.9	20
7103988	Dissolved Lead (Pb)	2013/08/23	99	80 - 120	96	80 - 120	<0.20	ug/L	NC	20
7103988	Dissolved Lithium (Li)	2013/08/23	107	80 - 120	100	80 - 120	<5.0	ug/L		
7103988	Dissolved Manganese (Mn)	2013/08/23	104	80 - 120	95	80 - 120	<1.0	ug/L	NC	20
7103988	Dissolved Molybdenum (Mo)	2013/08/23	NC	80 - 120	90	80 - 120	<1.0	ug/L	NC	20
7103988	Dissolved Nickel (Ni)	2013/08/23	104	80 - 120	99	80 - 120	<1.0	ug/L	NC	20
7103988	Dissolved Selenium (Se)	2013/08/23	112	80 - 120	105	80 - 120	<0.10	ug/L	NC	20
7103988	Dissolved Silver (Ag)	2013/08/23	107	80 - 120	87	80 - 120	<0.020	ug/L	NC	20
7103988	Dissolved Strontium (Sr)	2013/08/23	NC	80 - 120	98	80 - 120	<1.0	ug/L		
7103988	Dissolved Thallium (Tl)	2013/08/23	103	80 - 120	103	80 - 120	<0.050	ug/L		
7103988	Dissolved Tin (Sn)	2013/08/23	104	80 - 120	95	80 - 120	<5.0	ug/L		
7103988	Dissolved Titanium (Ti)	2013/08/23	107	80 - 120	94	80 - 120	<5.0	ug/L		
7103988	Dissolved Uranium (U)	2013/08/23	100	80 - 120	97	80 - 120	<0.10	ug/L		
7103988	Dissolved Vanadium (V)	2013/08/23	105	80 - 120	96	80 - 120	<5.0	ug/L	NC	20
7103988	Dissolved Zinc (Zn)	2013/08/23	108	80 - 120	100	80 - 120	<5.0	ug/L	NC	20
7103988	Dissolved Boron (B)	2013/08/23					<50	ug/L	NC	20
7103988	Dissolved Phosphorus (P)	2013/08/23					<10	ug/L		
7103988	Dissolved Silicon (Si)	2013/08/23					<100	ug/L		
7103988	Dissolved Zirconium (Zr)	2013/08/23					<0.50	ug/L		
7108781	Ammonia (N)	2013/08/23	NC	80 - 120	102	80 - 120	<0.0050	mg/L	1.0	20
7108894	Dissolved Sulphate (SO4)	2013/08/22	NC	80 - 120	100	80 - 120	<0.50	mg/L	NC	20

Maxxam Job #: B373293
Report Date: 2013/08/26

MINTO EXPLORATIONS LTD.
Client Project #: MINTO ENV. MONITORING
Site Location: YUKON
Your P.O. #: 204253
Sampler Initials: PE

QUALITY ASSURANCE REPORT

			Matrix Spike		Spiked Blank		Method Blank		RPD	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits
7114992	Dissolved Mercury (Hg)	2013/08/26	104	80 - 120	109	80 - 120	<0.010	ug/L	NC	20
7115658	Dissolved Mercury (Hg)	2013/08/26	101	80 - 120	97	80 - 120	<0.010	ug/L	NC	20

N/A = Not Applicable
RDL = Reportable Detection Limit
RPD = Relative Percent Difference
Duplicate: Paired analysis of a separate portion of the same sample. Used to evaluate the variance in the measurement.
Matrix Spike: A sample to which a known amount of the analyte of interest has been added. Used to evaluate sample matrix interference.
Spiked Blank: A blank matrix sample to which a known amount of the analyte, usually from a second source, has been added. Used to evaluate method accuracy.
Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.
NC (Matrix Spike): The recovery in the matrix spike was not calculated. The relative difference between the concentration in the parent sample and the spiked amount was not sufficiently significant to permit a reliable recovery calculation.
NC (RPD): The RPD was not calculated. The level of analyte detected in the parent sample and its duplicate was not sufficiently significant to permit a reliable calculation.

Maxxam

Burnaby: 4606 Canada Way, Burnaby, BC V5G 1K5 Ph: (604) 734-7276 Fax: (604) 731-2386, Toll Free: (800) 665-8566

CHAIN OF CUSTODY RECORD

Click here to get the COC number

Maxxam Job #: B373293 COC #: EB817413 Page: 1 of 1

Invoice To: Require Report? Yes ☑ No ☐

	Invoice To		Report To
Company Name:	Minto Explorations Ltd	Company Name:	Minto Explorations Ltd
Contact Name:	Elvina Wong	Contact Name:	Minto Environment
Address:	Suite 900 - 999 West Hastings St	Address:	Suite 900-999 West Hastings St
	Vancouver, B.C. PC: V6C 2W2		Vancouver, B.C. PC: V6C 2W2
Phone / Fax#:	Ph: 604-684-8894 Fax: 604-688-2120	Phone / Fax#:	Ph: 604-684-8894 Fax: 604-688-2120
E-mail		E-mail	minto_environment@mintomine.com

PO #:	204253
Quotation #:	
Project #:	
Proj. Name:	Minto Env. Monitoring
Location:	Yukon
Sampled by:	Phil Emerson / Chris Harry

REGULATORY REQUIREMENTS:

- ☐ CSR
- ☑ CCME
- ☐ BC Water Quality
- ☐ Other ________
- ☐ DRINKING WATER

SERVICE REQUESTED:

- ◉ Regular Turn Around Time (TAT) (5 days for most tests)
- **RUSH** (Please contact the lab) ○ 1 Day ○ 2 Day ○ 3 Day
- Date Required:

SPECIAL INSTRUCTIONS:

Return Cooler ☐ **Ship Sample Bottles (please specify)** ☐

ANALYSIS REQUESTED

Field Filtered? Y ☑ N ☐; Field Acidified? Y ☑ N ☐; Field Acidified? Y ☑ N ☐

#	Sample Identification	Lab Identification (Lab Use Only)	Sample Type	Date/Time(24hr) Sampled	Dissolved Metals (DM) (Field Filtered?)	Dissolved Metals (DM) (Field Acidified?)	Total Metals (Field Acidified?)	☑ Nitrate ☑ Nitrite ☑ Ammonia	☑ Total Suspended Solids (TSS) ☑ TDS	☑ pH ☑ Conductivity ☑ Alkalinity	☑ Chloride ☑ Fluoride ☑ Sulphate	Phosphate	DOC (Diss'd Organic Carbon)	TOC (Total Organic Carbon)	Ra 226	Number of Containers
1	MW09-03-01	HG2623	Ground W	8/18/13 9:00	X	X		X	X	X	X					3
2	MW09-03-02	HG2624	Ground W	8/18/13 10:30	X	X		X	X	X	X					3
3	MW09-03-03	HG2625	Ground W	8/18/13 12:00	X	X		X	X	X	X					3
4	DUP	HG2626	Ground W	8/18/13 0:00	X	X		X	X	X	X					3
5	MW12-06-01	HG2627	Ground W	8/18/13 14:00	X	X		X	X	X	X					3
6	MW12-06-02	HG2628	Ground W	8/18/13 15:30	X	X		X	X	X	X					3
7	MW12-06-03	HG2629	Ground W	8/18/13 16:30	X	X		X	X	X	X					3
8	F-BL	HG2630	Water	8/18/13 0:00	X	X		X	X	X	X					3
9																
10																
11																
12																

B373293

*Relinquished By: (Print name and sign)	Date (yy/mm/dd):	Time (24hr):	Received by (Print name and sign)	Date (yy/mm/dd)	Time (24 hr)	Time Sensitive
Chris Harry	19-Aug-13		Heleza Hilin Zhen	2013/08/20	09:20	☑

Laboratory Use Only: Temperature on Receipt (°C): A) 2 B) 4 C) 5; Just sampled & recd on ice ☐; Custody Seal: Present? Yes ☐ No ☐; Intact? Yes ☐ No ☐ NA

*IT IS THE RESPONSIBILITY OF THE RELINQUISHER TO ENSURE THE ACCURACY OF THE CHAIN OF CUSTODY RECORDS. AN INCOMPLETE CHAIN OF CUSTODY MAY RESULT IN ANALYTICAL TAT DELAYS.

BBY FCD-00077R2_C

Maxxam

Success Through Science®

Your P.O. #: 204253
Your Project #: MINTO ENV.MONITORING
Site Location: YUKON
Your C.O.C. #: EB821113

Attention: MINTO DISTRIBUTION LIST
MINTO EXPLORATIONS LTD.
Yukon/Whitehorse
2 - 25 Pilgrim Way
Whitehorse, YT
CANADA Y1A 6E6

Report Date: 2013/08/28

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B374541
Received: 2013/08/22, 09:20

Sample Matrix: Water
Samples Received: 4

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Analytical Method
Alkalinity - Water	4	2013/08/22	2013/08/23	BBY6SOP-00026	SM2320B
Chloride by Automated Colourimetry	4	N/A	2013/08/23	BBY6SOP-00011	SM-4500-Cl-
Conductance - water	4	N/A	2013/08/23	BBY6SOP-00026	SM-2510B
Fluoride	4	N/A	2013/08/23	BBY6SOP-00012	SM - 4500 F C
Hardness (calculated as CaCO3)	4	N/A	2013/08/25	BBY7SOP-00002	EPA 6020A
Mercury (Dissolved) by CVAF	4	N/A	2013/08/28	BBY7SOP-00015	EPA 245.7
Na, K, Ca, Mg, S by CRC ICPMS (diss.)	4	N/A	2013/08/25	BBY7SOP-00002	EPA 6020A
Elements by CRC ICPMS (dissolved)	4	N/A	2013/08/23	BBY7SOP-00002	EPA 6020A
Ammonia-N (Preserved)	4	N/A	2013/08/26	BBY6SOP-00009	SM-4500NH3G
Nitrate + Nitrite (N)	4	N/A	2013/08/23	BBY6SOP-00010	SM 4500NO3-I
Nitrite (N) by CFA	4	N/A	2013/08/23	BBY6SOP-00010	EPA 353.2
Nitrogen - Nitrate (as N)	4	N/A	2013/08/24	BBY6SOP-00010	SM 4500NO3-I
Filter and HNO3 Preserve for Metals	4	N/A	2013/08/22	BBY6WI-00001	EPA 200.2
pH Water	4	N/A	2013/08/23	BBY6SOP-00026	SM-4500H+B
Sulphate by Automated Colourimetry	4	N/A	2013/08/23	BBY6SOP-00017	SM4500-SO42- E
Total Dissolved Solids (Filt. Residue)	4	2013/08/24	2013/08/27	BBY6SOP-00033	SM 2540C
Total Suspended Solids-Low Level	4	2013/08/24	2013/08/26	BBY6SOP-00034	SM-2540 D

* Results relate only to the items tested.

Encryption Key

Please direct all questions regarding this Certificate of Analysis to your Project Manager.

Ken Pomeroy, Project Manager
Email: KPomeroy@maxxam.ca
Phone# (604) 638-5020

==
Maxxam has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per section 5.10.2 of ISO/IEC 17025:2005(E), signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

Total cover pages: 1

Maxxam Job #: B374541
Report Date: 2013/08/28

MINTO EXPLORATIONS LTD.
Client Project #: MINTO ENV.MONITORING
Site Location: YUKON
Your P.O. #: 204253

RESULTS OF CHEMICAL ANALYSES OF WATER

Maxxam ID		HH0126		HH0127		HH0128		HH0129		
Sampling Date		2013/08/20 14:00		2013/08/20 15:00		2013/08/20 16:45		2013/08/20 00:00		
	UNITS	**MW-12-07-01**	**RDL**	**MW-12-07-02**	**RDL**	**MW-12-07-03**	**RDL**	**DUP**	**RDL**	**QC Batch**
ANIONS										
Nitrite (N)	mg/L	1.83	0.025	0.287	0.0050	0.420	0.0050	0.477	0.0050	7112433
Calculated Parameters										
Filter and HNO3 Preservation	N/A	FIELD	N/A	FIELD	N/A	FIELD	N/A	FIELD	N/A	ONSITE
Nitrate (N)	mg/L	40.6	1.0	0.158	0.020	0.159	0.020	0.201	0.020	7102811
Misc. Inorganics										
Fluoride (F)	mg/L	0.660	0.010	1.30	0.010	0.350	0.010	1.30	0.010	7109547
Alkalinity (Total as CaCO3)	mg/L	315	0.50	126	0.50	281	0.50	128	0.50	7107317
Alkalinity (PP as CaCO3)	mg/L	3.10	0.50	<0.50	0.50	3.55	0.50	<0.50	0.50	7107317
Bicarbonate (HCO3)	mg/L	377	0.50	154	0.50	334	0.50	156	0.50	7107317
Carbonate (CO3)	mg/L	3.72	0.50	<0.50	0.50	4.26	0.50	<0.50	0.50	7107317
Hydroxide (OH)	mg/L	<0.50	0.50	<0.50	0.50	<0.50	0.50	<0.50	0.50	7107317
Anions										
Dissolved Sulphate (SO4)	mg/L	213	5.0	631	5.0	125	0.50	639	5.0	7111863
Dissolved Chloride (Cl)	mg/L	4.1	0.50	0.78	0.50	6.0	0.50	0.89	0.50	7111813
Nutrients										
Ammonia (N)	mg/L	0.027	0.0050	0.087	0.0050	4.9	0.050	0.078	0.0050	7117277
Nitrate plus Nitrite (N)	mg/L	42.4	1.0	0.446	0.020	0.579	0.020	0.678	0.020	7112424
Physical Properties										
Conductivity	uS/cm	1240	1.0	1370	1.0	757	1.0	1380	1.0	7107323
pH	pH Units	8.33		7.99		8.35		8.04		7107322
Physical Properties										
Total Suspended Solids	mg/L	1.2	1.0	4.6	1.0	18.2	1.0	3.8	1.0	7112110
Total Dissolved Solids	mg/L	902	10	1100	10	468	10	1110	10	7112182

N/A = Not Applicable
RDL = Reportable Detection Limit

Maxxam Job #: B374541
Report Date: 2013/08/28

MINTO EXPLORATIONS LTD.
Client Project #: MINTO ENV.MONITORING
Site Location: YUKON
Your P.O. #: 204253

CCME DISSOLVED METALS IN WATER (WATER)

Maxxam ID		HH0126	HH0127	HH0128	HH0129		
Sampling Date		2013/08/20 14:00	2013/08/20 15:00	2013/08/20 16:45	2013/08/20 00:00		
	UNITS	**MW-12-07-01**	**MW-12-07-02**	**MW-12-07-03**	**DUP**	**RDL**	**QC Batch**
Misc. Inorganics							
Dissolved Hardness (CaCO3)	mg/L	573	602	339	624	0.50	7102756
Elements							
Dissolved Mercury (Hg)	ug/L	<0.010	<0.010	<0.010	<0.010	0.010	7123147
Dissolved Metals by ICPMS							
Dissolved Aluminum (Al)	ug/L	9.0	7.4	<3.0	7.1	3.0	7108594
Dissolved Antimony (Sb)	ug/L	<0.50	<0.50	<0.50	<0.50	0.50	7108594
Dissolved Arsenic (As)	ug/L	1.54	0.55	0.42	0.50	0.10	7108594
Dissolved Barium (Ba)	ug/L	81.0	29.2	173	28.2	1.0	7108594
Dissolved Beryllium (Be)	ug/L	<0.10	<0.10	<0.10	<0.10	0.10	7108594
Dissolved Bismuth (Bi)	ug/L	<1.0	<1.0	<1.0	<1.0	1.0	7108594
Dissolved Boron (B)	ug/L	478	322	345	386	50	7108594
Dissolved Cadmium (Cd)	ug/L	0.081	<0.010	<0.010	<0.010	0.010	7108594
Dissolved Chromium (Cr)	ug/L	<1.0	<1.0	<1.0	<1.0	1.0	7108594
Dissolved Cobalt (Co)	ug/L	<0.50	<0.50	<0.50	<0.50	0.50	7108594
Dissolved Copper (Cu)	ug/L	28.8	0.39	<0.20	0.60	0.20	7108594
Dissolved Iron (Fe)	ug/L	222	1300	102	1300	5.0	7108594
Dissolved Lead (Pb)	ug/L	<0.20	<0.20	<0.20	<0.20	0.20	7108594
Dissolved Lithium (Li)	ug/L	10.7	23.3	11.2	24.3	5.0	7108594
Dissolved Manganese (Mn)	ug/L	146	253	194	253	1.0	7108594
Dissolved Molybdenum (Mo)	ug/L	22.3	17.6	36.8	18.2	1.0	7108594
Dissolved Nickel (Ni)	ug/L	1.8	<1.0	1.1	<1.0	1.0	7108594
Dissolved Phosphorus (P)	ug/L	13	11	14	<10	10	7108594
Dissolved Selenium (Se)	ug/L	24.8	0.19	0.51	0.26	0.10	7108594
Dissolved Silicon (Si)	ug/L	6400	6620	1650	6880	100	7108594
Dissolved Silver (Ag)	ug/L	<0.020	<0.020	<0.020	<0.020	0.020	7108594
Dissolved Strontium (Sr)	ug/L	7300	9730	2310	9730	1.0	7108594
Dissolved Thallium (Tl)	ug/L	<0.050	<0.050	<0.050	<0.050	0.050	7108594
Dissolved Tin (Sn)	ug/L	<5.0	<5.0	<5.0	<5.0	5.0	7108594
Dissolved Titanium (Ti)	ug/L	<5.0	<5.0	<5.0	<5.0	5.0	7108594
Dissolved Uranium (U)	ug/L	6.06	0.64	<0.10	0.65	0.10	7108594
Dissolved Vanadium (V)	ug/L	<5.0	<5.0	<5.0	<5.0	5.0	7108594
Dissolved Zinc (Zn)	ug/L	23.7	<5.0	<5.0	<5.0	5.0	7108594
Dissolved Zirconium (Zr)	ug/L	<0.50	<0.50	<0.50	<0.50	0.50	7108594
Dissolved Calcium (Ca)	mg/L	186	187	70.0	197	0.050	7104169

RDL = Reportable Detection Limit

Maxxam Job #: B374541
Report Date: 2013/08/28

MINTO EXPLORATIONS LTD.
Client Project #: MINTO ENV.MONITORING
Site Location: YUKON
Your P.O. #: 204253

CCME DISSOLVED METALS IN WATER (WATER)

Maxxam ID		HH0126	HH0127	HH0128	HH0129		
Sampling Date		2013/08/20 14:00	2013/08/20 15:00	2013/08/20 16:45	2013/08/20 00:00		
	UNITS	**MW-12-07-01**	**MW-12-07-02**	**MW-12-07-03**	**DUP**	**RDL**	**QC Batch**
Dissolved Magnesium (Mg)	mg/L	26.3	32.7	39.9	32.2	0.050	7104169
Dissolved Potassium (K)	mg/L	4.16	3.21	5.92	3.19	0.050	7104169
Dissolved Sodium (Na)	mg/L	47.1	67.2	26.8	69.3	0.050	7104169
Dissolved Sulphur (S)	mg/L	71.1	209	41.8	216	3.0	7104169

RDL = Reportable Detection Limit

General Comments

Sample HH0126-01: The BC-MOE and APHA Standard Method require pH to be analysed within 15 minutes of sampling and therefore field analysis is required for compliance. All Laboratory pH analyses in this report are reported past the BC-MOE/APHA Standard Method holding time.

Sample HH0127-01: The BC-MOE and APHA Standard Method require pH to be analysed within 15 minutes of sampling and therefore field analysis is required for compliance. All Laboratory pH analyses in this report are reported past the BC-MOE/APHA Standard Method holding time.

Sample HH0128-01: The BC-MOE and APHA Standard Method require pH to be analysed within 15 minutes of sampling and therefore field analysis is required for compliance. All Laboratory pH analyses in this report are reported past the BC-MOE/APHA Standard Method holding time.

Sample HH0129-01: The BC-MOE and APHA Standard Method require pH to be analysed within 15 minutes of sampling and therefore field analysis is required for compliance. All Laboratory pH analyses in this report are reported past the BC-MOE/APHA Standard Method holding time.

Maxxam Job #: B374541
Report Date: 2013/08/28

MINTO EXPLORATIONS LTD.
Client Project #: MINTO ENV.MONITORING
Site Location: YUKON
Your P.O. #: 204253

QUALITY ASSURANCE REPORT

			Matrix Spike		Spiked Blank		Method Blank		RPD	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits
7107317	Alkalinity (Total as CaCO3)	2013/08/22	99	80 - 120	92	80 - 120	<0.50	mg/L	19.8	20
7107317	Alkalinity (PP as CaCO3)	2013/08/22					<0.50	mg/L		
7107317	Bicarbonate (HCO3)	2013/08/22					<0.50	mg/L		
7107317	Carbonate (CO3)	2013/08/22					<0.50	mg/L		
7107317	Hydroxide (OH)	2013/08/22					<0.50	mg/L		
7107323	Conductivity	2013/08/23			98	80 - 120	<1.0	uS/cm	0	20
7108594	Dissolved Aluminum (Al)	2013/08/23	97	80 - 120	105	80 - 120	<3.0	ug/L	0.2	20
7108594	Dissolved Antimony (Sb)	2013/08/23	103	80 - 120	102	80 - 120	<0.50	ug/L	NC	20
7108594	Dissolved Arsenic (As)	2013/08/23	102	80 - 120	100	80 - 120	<0.10	ug/L	3.3	20
7108594	Dissolved Barium (Ba)	2013/08/23	NC	80 - 120	103	80 - 120	<1.0	ug/L	2.2	20
7108594	Dissolved Beryllium (Be)	2013/08/23	96	80 - 120	102	80 - 120	<0.10	ug/L	NC	20
7108594	Dissolved Bismuth (Bi)	2013/08/23	96	80 - 120	102	80 - 120	<1.0	ug/L	NC	20
7108594	Dissolved Cadmium (Cd)	2013/08/23	100	80 - 120	101	80 - 120	<0.010	ug/L	1.8	20
7108594	Dissolved Chromium (Cr)	2013/08/23	97	80 - 120	97	80 - 120	<1.0	ug/L	NC	20
7108594	Dissolved Cobalt (Co)	2013/08/23	96	80 - 120	100	80 - 120	<0.50	ug/L	NC	20
7108594	Dissolved Copper (Cu)	2013/08/23	93	80 - 120	98	80 - 120	<0.20	ug/L	7.1	20
7108594	Dissolved Iron (Fe)	2013/08/23	106	80 - 120	104	80 - 120	<5.0	ug/L	NC	20
7108594	Dissolved Lead (Pb)	2013/08/23	97	80 - 120	101	80 - 120	<0.20	ug/L	NC	20
7108594	Dissolved Lithium (Li)	2013/08/23	88	80 - 120	98	80 - 120	<5.0	ug/L	NC	20
7108594	Dissolved Manganese (Mn)	2013/08/23	NC	80 - 120	98	80 - 120	<1.0	ug/L	2.8	20
7108594	Dissolved Molybdenum (Mo)	2013/08/23	NC	80 - 120	98	80 - 120	<1.0	ug/L	0.9	20
7108594	Dissolved Nickel (Ni)	2013/08/23	NC	80 - 120	101	80 - 120	<1.0	ug/L	0.7	20
7108594	Dissolved Selenium (Se)	2013/08/23	104	80 - 120	104	80 - 120	<0.10	ug/L	NC	20
7108594	Dissolved Silver (Ag)	2013/08/23	101	80 - 120	87	80 - 120	<0.020	ug/L	NC	20
7108594	Dissolved Strontium (Sr)	2013/08/23	NC	80 - 120	98	80 - 120	<1.0	ug/L	1.1	20
7108594	Dissolved Thallium (Tl)	2013/08/23	101	80 - 120	103	80 - 120	<0.050	ug/L	NC	20
7108594	Dissolved Tin (Sn)	2013/08/23	98	80 - 120	100	80 - 120	<5.0	ug/L	NC	20
7108594	Dissolved Titanium (Ti)	2013/08/23	98	80 - 120	103	80 - 120	<5.0	ug/L	NC	20
7108594	Dissolved Uranium (U)	2013/08/23	102	80 - 120	102	80 - 120	<0.10	ug/L	2.1	20
7108594	Dissolved Vanadium (V)	2013/08/23	99	80 - 120	98	80 - 120	<5.0	ug/L	NC	20
7108594	Dissolved Zinc (Zn)	2013/08/23	91	80 - 120	104	80 - 120	<5.0	ug/L	NC	20
7108594	Dissolved Boron (B)	2013/08/23					<50	ug/L	NC	20
7108594	Dissolved Phosphorus (P)	2013/08/23					<10	ug/L		
7108594	Dissolved Silicon (Si)	2013/08/23					<100	ug/L	0.5	20
7108594	Dissolved Zirconium (Zr)	2013/08/23					<0.50	ug/L	NC	20
7109547	Fluoride (F)	2013/08/23	98	80 - 120	98	80 - 120	<0.010	mg/L	NC	20
7111813	Dissolved Chloride (Cl)	2013/08/23	NC	80 - 120	99	80 - 120	<0.50	mg/L	3.5	20
7111863	Dissolved Sulphate (SO4)	2013/08/23	NC	80 - 120	97	80 - 120	0.88, RDL=0.50	mg/L	3.9	20
7112110	Total Suspended Solids	2013/08/26			103	80 - 120	<1.0	mg/L		

QUALITY ASSURANCE REPORT

			Matrix Spike		Spiked Blank		Method Blank		RPD	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits
7112182	Total Dissolved Solids	2013/08/27	NC	80 - 120	90	80 - 120	<10	mg/L	4.9	20
7112424	Nitrate plus Nitrite (N)	2013/08/23	92	80 - 120	103	80 - 120	<0.020	mg/L	NC	25
7112433	Nitrite (N)	2013/08/23	94	80 - 120	100	80 - 120	<0.0050	mg/L	NC	20
7117277	Ammonia (N)	2013/08/26	98	80 - 120	104	80 - 120	0.0058, RDL=0.0050	mg/L	4.0	20
7123147	Dissolved Mercury (Hg)	2013/08/28	100	80 - 120	101	80 - 120	<0.010	ug/L	NC	20

N/A = Not Applicable

RDL = Reportable Detection Limit

RPD = Relative Percent Difference

Duplicate: Paired analysis of a separate portion of the same sample. Used to evaluate the variance in the measurement.

Matrix Spike: A sample to which a known amount of the analyte of interest has been added. Used to evaluate sample matrix interference.

Spiked Blank: A blank matrix sample to which a known amount of the analyte, usually from a second source, has been added. Used to evaluate method accuracy.

Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.

NC (Matrix Spike): The recovery in the matrix spike was not calculated. The relative difference between the concentration in the parent sample and the spiked amount was not sufficiently significant to permit a reliable recovery calculation.

NC (RPD): The RPD was not calculated. The level of analyte detected in the parent sample and its duplicate was not sufficiently significant to permit a reliable calculation.

D

Maxxam

Burnaby: 4606 Canada Way, Burnaby, BC V5G 1K5 Ph: (604) 734-7276 Fax: (604) 731-2386, Toll Free: (800) 665-8566

CHAIN OF CUSTODY RECORD

Click here to get the COC number

Maxxam Job #: B374541 **COC #:** EB821113 Page: 1 of 1

Invoice To: Require Report? Yes ☑ No ☐		Report To:			
Company Name:	Minto Explorations Ltd	Company Name:	Minto Explorations Ltd	PO #:	204253
Contact Name:	Elvina Wong	Contact Name:	Minto Environment	Quotation #:	
Address:	Suite 900 - 999 West Hastings St	Address:	Suite 900-999 West Hastings St	Project # :	
	Vancouver, B.C. PC: V6C 2W2		Vancouver, B.C. PC: V6C 2W2	Proj. Name:	Minto Env. Monitoring
Phone / Fax#:	Ph: 604-684-8894 Fax: 604-688-2120	Phone / Fax#:	Ph: 604-684-8894 Fax: 604-688-2120	Location:	Yukon
E-mail		E-mail	minto_environment@mintomine.com	Sampled by:	Phil Emerson / Chris Harry

REGULATORY REQUIREMENTS:

- ☐ CSR
- ☑ CCME
- ☐ BC Water Quality
- ☐ Other
- ☐ DRINKING WATER

SERVICE REQUESTED:

- ◉ Regular Turn Around Time (TAT) (5 days for most tests)
- **RUSH** (Please contact the lab) ○ 1 Day ○ 2 Day ○ 3 Day
- Date Required:

SPECIAL INSTRUCTIONS:

Return Cooler ☐ **Ship Sample Bottles (please specify)** ☐

ANALYSIS REQUESTED

#	Sample Identification	Lab Identification (Lab Use Only)	Sample Type	Date/Time(24hr) Sampled	Dissolved Metals (DM) (Field Filtered? Y ☑ N ☐)	Field Acidified? Y ☑ N ☐	Total Metals (Field Acidified? Y ☑ N ☐)	☑ Nitrate ☑ Nitrite ☑ Ammonia	Total Suspended Solids (TSS) ☑ TDS ☑	☑ pH ☑ Conductivity ☑ Alkalinity	☑ Chloride ☑ Fluoride ☑ Sulphate	Phosphate	DOC (Diss'd Organic Carbon)	TOC (Total Organic Carbon)	Ra 226	Number of Containers
1	MW-12-07-01	HH0126	Water	8/20/13 14:00	X	X		X	X	X	X					3
2	MW-12-07-02	HH0127		8/20/13 15:00	X	X		X	X	X	X					3
3	MW-12-07-03	HH0128		8/20/13 16:45	X	X		X	X	X	X					3
4	DUP	HH0129		8/20/13 0:00	X	X		X	X	X	X					3
5																
6																
7																
8																
9																
10																
11																
12																

B374541

Print name and sign / Print name and sign / Laboratory Use Only

*Relinquished By:	Date (yy/mm/dd):	Time (24hr):	Received by	Date (yy/mm/dd)	Time (24 hr)	Time Sensitive	Temperature on Receipt (°C)	Custody Seal	Yes	No
Chris Harry	21-Aug-13	9:30	[signature]	13/08/22	09:20	☑	A: 7 B: 3 C: 4	Present?	☐	☑
							First sampled & rec'd on ice: ☐	Intact?	☐	☐

*IT IS THE RESPONSIBILITY OF THE RELINQUISHER TO ENSURE THE ACCURACY OF THE CHAIN OF CUSTODY RECORDS. AN INCOMPLETE CHAIN OF CUSTODY MAY RESULT IN ANALYTICAL TAT DELAYS.

Maxxam

Success Through Science®

Your P.O. #: 204253
Your Project #: MINTO ENV. MONITORING
Your C.O.C. #: EB821413

Attention: MINTO DISTRIBUTION LIST
MINTO EXPLORATIONS LTD.
Yukon/Whitehorse
2 - 25 Pilgrim Way
Whitehorse, YT
CANADA Y1A 6E6

Report Date: 2013/08/29

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B375266
Received: 2013/08/23, 13:30

Sample Matrix: Water
Samples Received: 5

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Analytical Method
Alkalinity - Water	3	2013/08/24	2013/08/24	BBY6SOP-00026	SM2320B
Alkalinity - Water	1	2013/08/24	2013/08/25	BBY6SOP-00026	SM2320B
Alkalinity - Water	1	2013/08/24	2013/08/26	BBY6SOP-00026	SM2320B
Chloride by Automated Colourimetry	5	N/A	2013/08/26	BBY6SOP-00011	SM-4500-Cl-
Conductance - water	3	N/A	2013/08/24	BBY6SOP-00026	SM-2510B
Conductance - water	1	N/A	2013/08/25	BBY6SOP-00026	SM-2510B
Conductance - water	1	N/A	2013/08/26	BBY6SOP-00026	SM-2510B
Fluoride	5	N/A	2013/08/27	BBY6SOP-00012	SM - 4500 F C
Hardness (calculated as CaCO3)	5	N/A	2013/08/28	BBY7SOP-00002	EPA 6020A
Mercury (Dissolved) by CVAF	5	N/A	2013/08/29	BBY7SOP-00015	EPA 245.7
Na, K, Ca, Mg, S by CRC ICPMS (diss.)	5	N/A	2013/08/28	BBY7SOP-00002	EPA 6020A
Elements by CRC ICPMS (dissolved)	5	N/A	2013/08/28	BBY7SOP-00002	EPA 6020A
Ammonia-N (Preserved)	5	N/A	2013/08/26	BBY6SOP-00009	SM-4500NH3G
Nitrate + Nitrite (N)	5	N/A	2013/08/24	BBY6SOP-00010	SM 4500NO3-I
Nitrite (N) by CFA	5	N/A	2013/08/24	BBY6SOP-00010	EPA 353.2
Nitrogen - Nitrate (as N)	3	N/A	2013/08/26	BBY6SOP-00010	SM 4500NO3-I
Nitrogen - Nitrate (as N)	2	N/A	2013/08/28	BBY6SOP-00010	SM 4500NO3-I
Filter and HNO3 Preserve for Metals	5	N/A	2013/08/23	BBY6WI-00001	EPA 200.2
pH Water	4	N/A	2013/08/24	BBY6SOP-00026	SM-4500H+B
pH Water	1	N/A	2013/08/25	BBY6SOP-00026	SM-4500H+B
Sulphate by Automated Colourimetry	4	N/A	2013/08/26	BBY6SOP-00017	SM4500-SO42- E
Sulphate by Automated Colourimetry	1	N/A	2013/08/27	BBY6SOP-00017	SM4500-SO42- E
Total Dissolved Solids (Filt. Residue)	5	2013/08/26	2013/08/27	BBY6SOP-00033	SM 2540C
Total Suspended Solids	5	N/A	2013/08/27	BBY6SOP-00034	SM - 2540 D

* Results relate only to the items tested.

Encryption Key

Please direct all questions regarding this Certificate of Analysis to your Project Manager.

Ken Pomeroy, Project Manager
Email: KPomeroy@maxxam.ca
Phone# (604) 638-5020

==
Maxxam has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per section

5.10.2 of ISO/IEC 17025:2005(E), signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

Total cover pages: 2

Maxxam Job #: B375266
Report Date: 2013/08/29

MINTO EXPLORATIONS LTD.
Client Project #: MINTO ENV. MONITORING

Your P.O. #: 204253
Sampler Initials: MC

RESULTS OF CHEMICAL ANALYSES OF WATER

Maxxam ID		HH4883		HH4884		
Sampling Date		2013/08/21 15:00		2013/08/21 16:00		
	UNITS	**MW12-05-01**	**QC Batch**	**MW12-05-02**	**RDL**	**QC Batch**
ANIONS						
Nitrite (N)	mg/L	0.0581	7112598	0.0252	0.0050	7121668
Calculated Parameters						
Filter and HNO3 Preservation	N/A	FIELD	ONSITE	FIELD	N/A	ONSITE
Nitrate (N)	mg/L	0.021	7108650	0.035	0.020	7108650
Misc. Inorganics						
Fluoride (F)	mg/L	1.00	7120714	1.10	0.010	7120714
Alkalinity (Total as CaCO3)	mg/L	211	7112592	307	0.50	7112592
Alkalinity (PP as CaCO3)	mg/L	1.80	7112592	<0.50	0.50	7112592
Bicarbonate (HCO3)	mg/L	253	7112592	375	0.50	7112592
Carbonate (CO3)	mg/L	2.16	7112592	<0.50	0.50	7112592
Hydroxide (OH)	mg/L	<0.50	7112592	<0.50	0.50	7112592
Anions						
Dissolved Sulphate (SO4)	mg/L	483	7117684	633	5.0	7117684
Dissolved Chloride (Cl)	mg/L	14	7117667	9.0	0.50	7117667
Nutrients						
Ammonia (N)	mg/L	0.078	7117277	0.051	0.0050	7117277
Nitrate plus Nitrite (N)	mg/L	0.079	7112597	0.060	0.020	7112597
Physical Properties						
Conductivity	uS/cm	1290	7112595	1620	1.0	7112595
pH	pH Units	8.31	7112594	8.16		7112594
Physical Properties						
Total Suspended Solids	mg/L	4.7	7114678	7.3	4.0	7114678
Total Dissolved Solids	mg/L	912	7116413	1240	10	7116413

N/A = Not Applicable
RDL = Reportable Detection Limit

Maxxam Job #: B375266
Report Date: 2013/08/29

MINTO EXPLORATIONS LTD.
Client Project #: MINTO ENV. MONITORING

Your P.O. #: 204253
Sampler Initials: MC

RESULTS OF CHEMICAL ANALYSES OF WATER

Maxxam ID		HH4885		HH4886			HH4887		
Sampling Date		2013/08/21 16:50		2013/08/21 17:45			2013/08/21 00:00		
	UNITS	**MW12-05-03**	**QC Batch**	**MW12-05-04**	**RDL**	**QC Batch**	**DUP**	**RDL**	**QC Batch**
ANIONS									
Nitrite (N)	mg/L	0.122	7112598	0.0427	0.0050	7112598	0.0872	0.0050	7121668
Calculated Parameters									
Filter and HNO3 Preservation	N/A	FIELD	ONSITE	FIELD	N/A	ONSITE	FIELD	N/A	ONSITE
Nitrate (N)	mg/L	0.614	7108650	<0.020	0.020	7108650	0.059	0.020	7108650
Misc. Inorganics									
Fluoride (F)	mg/L	0.560	7120714	0.490	0.010	7120714	1.10	0.010	7120714
Alkalinity (Total as CaCO3)	mg/L	213	7112592	288	0.50	7112592	330	0.50	7112592
Alkalinity (PP as CaCO3)	mg/L	<0.50	7112592	4.31	0.50	7112592	<0.50	0.50	7112592
Bicarbonate (HCO3)	mg/L	260	7112592	340	0.50	7112592	403	0.50	7112592
Carbonate (CO3)	mg/L	<0.50	7112592	5.17	0.50	7112592	<0.50	0.50	7112592
Hydroxide (OH)	mg/L	<0.50	7112592	<0.50	0.50	7112592	<0.50	0.50	7112592
Anions									
Dissolved Sulphate (SO4)	mg/L	40.7	7117684	11.5	0.50	7121797	637	5.0	7117684
Dissolved Chloride (Cl)	mg/L	3.6	7117667	4.2	0.50	7117667	8.6	0.50	7117667
Nutrients									
Ammonia (N)	mg/L	0.013	7117277	0.10	0.0050	7117277	0.11	0.0050	7117277
Nitrate plus Nitrite (N)	mg/L	0.737	7112597	0.045	0.020	7112597	0.146	0.020	7112597
Physical Properties									
Conductivity	uS/cm	476	7112595	497	1.0	7112595	1630	1.0	7112595
pH	pH Units	8.21	7112594	8.40		7112594	8.18		7112594
Physical Properties									
Total Suspended Solids	mg/L	<4.0	7114678	4.0	4.0	7114678	7.5	4.0	7114678
Total Dissolved Solids	mg/L	276	7116413	298	10	7116413	1250	10	7116413

N/A = Not Applicable
RDL = Reportable Detection Limit

Maxxam Job #: B375266
Report Date: 2013/08/29

MINTO EXPLORATIONS LTD.
Client Project #: MINTO ENV. MONITORING

Your P.O. #: 204253
Sampler Initials: MC

CCME DISSOLVED METALS IN WATER (WATER)

Maxxam ID		HH4883	HH4884	HH4885	HH4886	HH4887		
Sampling Date		2013/08/21 15:00	2013/08/21 16:00	2013/08/21 16:50	2013/08/21 17:45	2013/08/21 00:00		
	UNITS	**MW12-05-01**	**MW12-05-02**	**MW12-05-03**	**MW12-05-04**	**DUP**	**RDL**	**QC Batch**
Misc. Inorganics								
Dissolved Hardness (CaCO3)	mg/L	505	726	220	234	733	0.50	7108518
Elements								
Dissolved Mercury (Hg)	ug/L	<0.010	<0.010	<0.010	<0.010	<0.010	0.010	7126815
Dissolved Metals by ICPMS								
Dissolved Aluminum (Al)	ug/L	18.2	23.3	4.1	12.7	14.1	3.0	7119930
Dissolved Antimony (Sb)	ug/L	<0.50	<0.50	<0.50	<0.50	<0.50	0.50	7119930
Dissolved Arsenic (As)	ug/L	0.93	0.44	0.13	0.76	0.30	0.10	7119930
Dissolved Barium (Ba)	ug/L	98.0	82.3	84.7	736	93.4	1.0	7119930
Dissolved Beryllium (Be)	ug/L	<0.10	<0.10	<0.10	<0.10	<0.10	0.10	7119930
Dissolved Bismuth (Bi)	ug/L	<1.0	<1.0	<1.0	<1.0	<1.0	1.0	7119930
Dissolved Boron (B)	ug/L	88	80	<50	<50	122	50	7119930
Dissolved Cadmium (Cd)	ug/L	0.012	<0.010	0.010	<0.010	<0.010	0.010	7119930
Dissolved Chromium (Cr)	ug/L	<1.0	<1.0	<1.0	<1.0	<1.0	1.0	7119930
Dissolved Cobalt (Co)	ug/L	<0.50	<0.50	<0.50	<0.50	<0.50	0.50	7119930
Dissolved Copper (Cu)	ug/L	<0.20	<0.20	1.40	0.65	0.45	0.20	7119930
Dissolved Iron (Fe)	ug/L	32.3	1820	28.4	928	1960	5.0	7119930
Dissolved Lead (Pb)	ug/L	<0.20	<0.20	<0.20	0.55	<0.20	0.20	7119930
Dissolved Lithium (Li)	ug/L	5.8	5.2	<5.0	<5.0	5.4	5.0	7119930
Dissolved Manganese (Mn)	ug/L	94.6	2600	345	484	2580	1.0	7119930
Dissolved Molybdenum (Mo)	ug/L	<1.0	<1.0	5.2	2.0	<1.0	1.0	7119930
Dissolved Nickel (Ni)	ug/L	<1.0	<1.0	1.9	<1.0	<1.0	1.0	7119930
Dissolved Phosphorus (P)	ug/L	<10	<10	<10	68	12	10	7119930
Dissolved Selenium (Se)	ug/L	0.33	<0.10	0.12	0.14	<0.10	0.10	7119930
Dissolved Silicon (Si)	ug/L	6750	8040	6450	7100	8050	100	7119930
Dissolved Silver (Ag)	ug/L	<0.020	<0.020	<0.020	<0.020	<0.020	0.020	7119930
Dissolved Strontium (Sr)	ug/L	4220	7100	755	591	7070	1.0	7119930
Dissolved Thallium (Tl)	ug/L	<0.050	<0.050	<0.050	<0.050	<0.050	0.050	7119930
Dissolved Tin (Sn)	ug/L	<5.0	<5.0	<5.0	<5.0	<5.0	5.0	7119930
Dissolved Titanium (Ti)	ug/L	<5.0	<5.0	<5.0	<5.0	<5.0	5.0	7119930
Dissolved Uranium (U)	ug/L	0.72	0.27	2.53	0.67	0.26	0.10	7119930
Dissolved Vanadium (V)	ug/L	<5.0	<5.0	<5.0	<5.0	<5.0	5.0	7119930
Dissolved Zinc (Zn)	ug/L	<5.0	<5.0	<5.0	<5.0	15.8	5.0	7119930
Dissolved Zirconium (Zr)	ug/L	<0.50	<0.50	<0.50	<0.50	0.53	0.50	7119930
Dissolved Calcium (Ca)	mg/L	160	188	46.4	51.9	187	0.050	7107953

RDL = Reportable Detection Limit

CCME DISSOLVED METALS IN WATER (WATER)

Maxxam ID		HH4883	HH4884	HH4885	HH4886	HH4887		
Sampling Date		2013/08/21 15:00	2013/08/21 16:00	2013/08/21 16:50	2013/08/21 17:45	2013/08/21 00:00		
	UNITS	**MW12-05-01**	**MW12-05-02**	**MW12-05-03**	**MW12-05-04**	**DUP**	**RDL**	**QC Batch**
Dissolved Magnesium (Mg)	mg/L	25.3	62.3	25.3	25.3	64.5	0.050	7107953
Dissolved Potassium (K)	mg/L	2.95	3.82	2.24	1.78	3.82	0.050	7107953
Dissolved Sodium (Na)	mg/L	86.1	95.4	17.1	18.3	96.1	0.050	7107953
Dissolved Sulphur (S)	mg/L	187	209	12.6	4.9	224	3.0	7107953

RDL = Reportable Detection Limit

General Comments

Sample HH4883-01: The BC-MOE and APHA Standard Method require pH to be analysed within 15 minutes of sampling and therefore field analysis is required for compliance. All Laboratory pH analyses in this report are reported past the BC-MOE/APHA Standard Method holding time.

Sample HH4884-01: The BC-MOE and APHA Standard Method require pH to be analysed within 15 minutes of sampling and therefore field analysis is required for compliance. All Laboratory pH analyses in this report are reported past the BC-MOE/APHA Standard Method holding time.

Sample HH4885-01: The BC-MOE and APHA Standard Method require pH to be analysed within 15 minutes of sampling and therefore field analysis is required for compliance. All Laboratory pH analyses in this report are reported past the BC-MOE/APHA Standard Method holding time.

Sample HH4886-01: The BC-MOE and APHA Standard Method require pH to be analysed within 15 minutes of sampling and therefore field analysis is required for compliance. All Laboratory pH analyses in this report are reported past the BC-MOE/APHA Standard Method holding time.

Sample HH4887-01: The BC-MOE and APHA Standard Method require pH to be analysed within 15 minutes of sampling and therefore field analysis is required for compliance. All Laboratory pH analyses in this report are reported past the BC-MOE/APHA Standard Method holding time.

Maxxam Job #: B375266
Report Date: 2013/08/29

MINTO EXPLORATIONS LTD.
Client Project #: MINTO ENV. MONITORING

Your P.O. #: 204253
Sampler Initials: MC

QUALITY ASSURANCE REPORT

			Matrix Spike		Spiked Blank		Method Blank		RPD	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits
7112592	Alkalinity (Total as CaCO3)	2013/08/24	NC	80 - 120	99	80 - 120	<0.50	mg/L	NC	20
7112592	Alkalinity (PP as CaCO3)	2013/08/24					<0.50	mg/L		
7112592	Bicarbonate (HCO3)	2013/08/24					<0.50	mg/L		
7112592	Carbonate (CO3)	2013/08/24					<0.50	mg/L		
7112592	Hydroxide (OH)	2013/08/24					<0.50	mg/L		
7112595	Conductivity	2013/08/25			100	80 - 120	<1.0	uS/cm	0.2	20
7112597	Nitrate plus Nitrite (N)	2013/08/24	103	80 - 120	102	80 - 120	<0.020	mg/L	NC	25
7112598	Nitrite (N)	2013/08/24	98	80 - 120	99	80 - 120	<0.0050	mg/L	NC	20
7114678	Total Suspended Solids	2013/08/27	105	80 - 120	102	80 - 120	<4.0	mg/L	NC	20
7116413	Total Dissolved Solids	2013/08/27	92	80 - 120	90	80 - 120	<10	mg/L	6.9	20
7117277	Ammonia (N)	2013/08/26	98	80 - 120	104	80 - 120	0.0058, RDL=0.0050	mg/L	3.4	20
7117667	Dissolved Chloride (Cl)	2013/08/26	NC	80 - 120	98	80 - 120	0.71, RDL=0.50	mg/L	4.0	20
7117684	Dissolved Sulphate (SO4)	2013/08/26	NC	80 - 120	97	80 - 120	<0.50	mg/L	3.1	20
7119930	Dissolved Aluminum (Al)	2013/08/28	102	80 - 120	106	80 - 120	<3.0	ug/L	NC	20
7119930	Dissolved Antimony (Sb)	2013/08/28	104	80 - 120	103	80 - 120	<0.50	ug/L	NC	20
7119930	Dissolved Arsenic (As)	2013/08/28	NC	80 - 120	100	80 - 120	<0.10	ug/L	1.0	20
7119930	Dissolved Barium (Ba)	2013/08/28	NC	80 - 120	99	80 - 120	<1.0	ug/L	2.8	20
7119930	Dissolved Beryllium (Be)	2013/08/28	88	80 - 120	97	80 - 120	<0.10	ug/L	NC	20
7119930	Dissolved Bismuth (Bi)	2013/08/28	95	80 - 120	95	80 - 120	<1.0	ug/L	NC	20
7119930	Dissolved Cadmium (Cd)	2013/08/28	99	80 - 120	101	80 - 120	<0.010	ug/L	NC	20
7119930	Dissolved Chromium (Cr)	2013/08/28	98	80 - 120	101	80 - 120	<1.0	ug/L	NC	20
7119930	Dissolved Cobalt (Co)	2013/08/28	96	80 - 120	101	80 - 120	<0.50	ug/L	NC	20
7119930	Dissolved Copper (Cu)	2013/08/28	94	80 - 120	100	80 - 120	<0.20	ug/L	NC	20
7119930	Dissolved Iron (Fe)	2013/08/28	NC	80 - 120	107	80 - 120	<5.0	ug/L	4.1	20
7119930	Dissolved Lead (Pb)	2013/08/28	95	80 - 120	97	80 - 120	<0.20	ug/L	NC	20
7119930	Dissolved Lithium (Li)	2013/08/28	NC	80 - 120	98	80 - 120	<5.0	ug/L	7.1	20
7119930	Dissolved Manganese (Mn)	2013/08/28	NC	80 - 120	99	80 - 120	<1.0	ug/L	1.6	20
7119930	Dissolved Molybdenum (Mo)	2013/08/28	NC	80 - 120	101	80 - 120	<1.0	ug/L	0.6	20
7119930	Dissolved Nickel (Ni)	2013/08/28	95	80 - 120	102	80 - 120	<1.0	ug/L	NC	20
7119930	Dissolved Selenium (Se)	2013/08/28	105	80 - 120	103	80 - 120	<0.10	ug/L	NC	20
7119930	Dissolved Silver (Ag)	2013/08/28	88	80 - 120	87	80 - 120	<0.020	ug/L	NC	20
7119930	Dissolved Strontium (Sr)	2013/08/28	NC	80 - 120	97	80 - 120	<1.0	ug/L	1.6	20
7119930	Dissolved Thallium (Tl)	2013/08/28	97	80 - 120	97	80 - 120	<0.050	ug/L	NC	20
7119930	Dissolved Tin (Sn)	2013/08/28	101	80 - 120	102	80 - 120	<5.0	ug/L	NC	20
7119930	Dissolved Titanium (Ti)	2013/08/28	106	80 - 120	100	80 - 120	<5.0	ug/L	NC	20
7119930	Dissolved Uranium (U)	2013/08/28	100	80 - 120	94	80 - 120	<0.10	ug/L	NC	20
7119930	Dissolved Vanadium (V)	2013/08/28	99	80 - 120	100	80 - 120	<5.0	ug/L	NC	20
7119930	Dissolved Zinc (Zn)	2013/08/28	93	80 - 120	100	80 - 120	<5.0	ug/L	NC	20
7119930	Dissolved Boron (B)	2013/08/28					<50	ug/L	NC	20

Success Through Science®

Maxxam Job #: B375266
Report Date: 2013/08/29

MINTO EXPLORATIONS LTD.
Client Project #: MINTO ENV. MONITORING

Your P.O. #: 204253
Sampler Initials: MC

QUALITY ASSURANCE REPORT

			Matrix Spike		Spiked Blank		Method Blank		RPD	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits
7119930	Dissolved Phosphorus (P)	2013/08/28					<10	ug/L		
7119930	Dissolved Silicon (Si)	2013/08/28					<100	ug/L	4.9	20
7119930	Dissolved Zirconium (Zr)	2013/08/28					<0.50	ug/L	NC	20
7120714	Fluoride (F)	2013/08/27	100	80 - 120	98	80 - 120	<0.010	mg/L	NC	20
7121668	Nitrite (N)	2013/08/27	98	80 - 120	97	80 - 120	<0.0050	mg/L	NC	20
7121797	Dissolved Sulphate (SO4)	2013/08/27	97	80 - 120	102	80 - 120	<0.50	mg/L	0.8	20
7126815	Dissolved Mercury (Hg)	2013/08/29	95	80 - 120	99	80 - 120	<0.010	ug/L	NC	20

N/A = Not Applicable

RDL = Reportable Detection Limit

RPD = Relative Percent Difference

Duplicate: Paired analysis of a separate portion of the same sample. Used to evaluate the variance in the measurement.

Matrix Spike: A sample to which a known amount of the analyte of interest has been added. Used to evaluate sample matrix interference.

Spiked Blank: A blank matrix sample to which a known amount of the analyte, usually from a second source, has been added. Used to evaluate method accuracy.

Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.

NC (Matrix Spike): The recovery in the matrix spike was not calculated. The relative difference between the concentration in the parent sample and the spiked amount was not sufficiently significant to permit a reliable recovery calculation.

NC (RPD): The RPD was not calculated. The level of analyte detected in the parent sample and its duplicate was not sufficiently significant to permit a reliable calculation.

Maxxam

Burnaby: 4606 Canada Way, Burnaby, BC V5G 1K5 Ph: (604) 734-7276 Fax: (604) 731-2386, Toll Free: (800) 665-8566

CHAIN OF CUSTODY RECORD

B375266

Click here to get the COC number

Maxxam Job #:

COC #: EB821413

Page: 1 of 1

Invoice To: Require Report? Yes ☑ No ☐

Company Name:	Minto Explorations Ltd
Contact Name:	Elvina Wong
Address:	Suite 900 - 999 West Hastings St
	Vancouver, B.C. PC: V6C 2W2
Phone / Fax#:	Ph: 604-684-8894 Fax: 604-688-2120
E-mail	

Report To:

Company Name:	Minto Explorations Ltd
Contact Name:	Minto Environment
Address:	Suite 900-999 West Hastings St
	Vancouver, B.C. PC: V6C 2W2
Phone / Fax#:	Ph: 604-684-8894 Fax: 604-688-2120
E-mail	minto_environment@mintomine.com

PO #:	204253
Quotation #:	
Project # :	
Proj. Name:	Minto Env. Monitoring
Location:	Yukon
Sampled by:	Martin Crill / Chris Harry

REGULATORY REQUIREMENTS:

- ☐ CSR
- ☑ CCME
- ☐ BC Water Quality
- ☐ Other
- ☐ DRINKING WATER

SERVICE REQUESTED:

- ◉ Regular Turn Around Time (TAT) (5 days for most tests)
- **RUSH** (Please contact the lab) ○ 1 Day ○ 2 Day ○ 3 Day
- Date Required:

SPECIAL INSTRUCTIONS:

Return Cooler ☐ **Ship Sample Bottles (please specify)** ☐

ANALYSIS REQUESTED

Field Filtered? Y ☑ N ☐ — Field Acidified? Y ☑ N ☐ — Field Acidified? Y ☑ N ☐

	Sample Identification	Lab Identification (Lab Use Only)	Sample Type	Date/Time(24hr) Sampled	Dissolved Metals (DM)	Field Acidified? Total Metals	☑ Nitrate ☑ Nitrite ☑ Ammonia	☑ Total Suspended Solids (TSS) ☑ TDS	☑ pH ☑ Conductivity ☑ Alkalinity	☑ Chloride ☑ Fluoride ☑ Sulphate	Phosphate	DOC (Diss'd Organic Carbon)	TOC (Total Organic Carbon)	Ra 226	Number of Containers
1	MW12-05-01 HH4883		Ground W	8/21/13 15:00	x	x	x	x	x	x					3
2	MW12-05-02 HH4884		Ground W	8/21/13 16:00	x	x	x	x	x	x					3
3	MW12-05-03 HH4885		Ground W	8/21/13 16:50	x	x	x	x	x	x					3
4	MW12-05-04 HH4886		Ground W	8/21/13 17:45	x	x	x	x	x	x					3
5	DUP HH4887		Ground W	8/21/13 0:00	x	x	x	x	x	x					3
6															
7															
8															
9															
10															
11															
12															

B375266

Print name and sign — Print name and sign — Laboratory Use Only

*Relinquished By:	Date (yy/mm/dd):	Time (24hr):	Received by:	Date (yy/mm/dd):	Time (24 hr):	Time Sensitive	Temperature on Receipt (°C)	Custody Seal	Yes	No
Chris Harry	21-Aug-13	7:45	Yolanda Liu	2013/08/23	13:30	☑	A) 6 B) 7 C) 8	Present? NA	☐	☐
							Just sampled & rec'd on ice: ☐	Intact?	☐	☐

*IT IS THE RESPONSIBILITY OF THE RELINQUISHER TO ENSURE THE ACCURACY OF THE CHAIN OF CUSTODY RECORDS. AN INCOMPLETE CHAIN OF CUSTODY MAY RESULT IN ANALYTICAL TAT DELAYS.

Maxxam

Success Through Science®

Your P.O. #: 204253
Your Project #: MINTO ENV. MONITORING
Site Location: YUKON
Your C.O.C. #: EB863113

Attention: MINTO DISTRIBUTION LIST
MINTO EXPLORATIONS LTD.
Yukon/Whitehorse
2 - 25 Pilgrim Way
Whitehorse, YT
CANADA Y1A 6E6

Report Date: 2013/10/22

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B394636
Received: 2013/10/15, 09:10

Sample Matrix: Water
Samples Received: 3

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Analytical Method
Alkalinity - Water	1	2013/10/16	2013/10/17	BBY6SOP-00026	SM2320B
Chloride by Automated Colourimetry	1	N/A	2013/10/16	BBY6SOP-00011	SM-4500-Cl-
Conductance - water	1	N/A	2013/10/17	BBY6SOP-00026	SM-2510B
Fluoride	1	N/A	2013/10/18	BBY6SOP-00012	SM - 4500 F C
Hardness Total (calculated as CaCO3)	3	N/A	2013/10/22	BBY7SOP-00002	EPA 6020A
Mercury (Total) by CVAF	3	2013/10/21	2013/10/21	BBY7SOP-00015	EPA 245.7
Na, K, Ca, Mg, S by CRC ICPMS (total)	3	2013/10/15	2013/10/22	BBY7SOP-00002	EPA 6020A
Elements by CRC ICPMS (total)	3	2013/10/21	2013/10/22	BBY7SOP-00002	EPA 6020A
Ammonia-N (Preserved)	1	N/A	2013/10/16	BBY6SOP-00009	SM-4500NH3G
Nitrate + Nitrite (N)	1	N/A	2013/10/16	BBY6SOP-00010	SM 4500NO3-I
Nitrite (N) by CFA	1	N/A	2013/10/16	BBY6SOP-00010	EPA 353.2
Nitrogen - Nitrate (as N)	1	N/A	2013/10/17	BBY6SOP-00010	SM 4500NO3-I
pH Water	1	N/A	2013/10/17	BBY6SOP-00026	SM-4500H+B
Sulphate by Automated Colourimetry	1	N/A	2013/10/16	BBY6SOP-00017	SM4500-SO42- E
Total Dissolved Solids (Filt. Residue)	1	2013/10/16	2013/10/17	BBY6SOP-00033	SM 2540C
Total Suspended Solids-Low Level	1	2013/10/16	2013/10/17	BBY6SOP-00034	SM-2540 D

* Results relate only to the items tested.

Encryption Key

Please direct all questions regarding this Certificate of Analysis to your Project Manager.

Ken Pomeroy, Project Manager
Email: KPomeroy@maxxam.ca
Phone# (604) 638-5020

==
This report has been generated and distributed using a secure automated process.
Maxxam has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per section 5.10.2 of ISO/IEC 17025:2005(E), signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

Total cover pages: 1

Maxxam Job #: B394636
Report Date: 2013/10/22

MINTO EXPLORATIONS LTD.
Client Project #: MINTO ENV. MONITORING
Site Location: YUKON
Your P.O. #: 204253
Sampler Initials: MC

RESULTS OF CHEMICAL ANALYSES OF WATER

Maxxam ID		HU9962		
Sampling Date		2013/10/09 16:05		
	UNITS	**MW12-DP4**	**RDL**	**QC Batch**
ANIONS				
Nitrite (N)	mg/L	0.0744(1)	0.0050	7232079
Calculated Parameters				
Nitrate (N)	mg/L	3.78	0.10	7227064
Misc. Inorganics				
Fluoride (F)	mg/L	0.310	0.010	7237214
Alkalinity (Total as CaCO3)	mg/L	343	0.50	7230521
Alkalinity (PP as CaCO3)	mg/L	<0.50	0.50	7230521
Bicarbonate (HCO3)	mg/L	418	0.50	7230521
Carbonate (CO3)	mg/L	<0.50	0.50	7230521
Hydroxide (OH)	mg/L	<0.50	0.50	7230521
Anions				
Dissolved Sulphate (SO4)	mg/L	89.3	0.50	7232016
Dissolved Chloride (Cl)	mg/L	15	0.50	7231993
Nutrients				
Ammonia (N)	mg/L	0.043	0.0050	7231997
Nitrate plus Nitrite (N)	mg/L	3.85(1)	0.10	7232075
Physical Properties				
Conductivity	uS/cm	839	1.0	7230609
pH	pH Units	8.07		7230556
Physical Properties				
Total Suspended Solids	mg/L	60.8	1.0	7229448
Total Dissolved Solids	mg/L	506	10	7229690

RDL = Reportable Detection Limit
(1) - Sample arrived to laboratory past recommended hold time.

Maxxam Job #: B394636
Report Date: 2013/10/22

MINTO EXPLORATIONS LTD.
Client Project #: MINTO ENV. MONITORING
Site Location: YUKON
Your P.O. #: 204253
Sampler Initials: MC

CCME TOTAL METALS IN WATER (WATER)

Maxxam ID		HU9960	HU9961	HU9962		
Sampling Date		2013/10/08 15:35	2013/10/08 16:20	2013/10/09 16:05		
	UNITS	**MW12-DP1**	**MW12-DP3**	**MW12-DP4**	**RDL**	**QC Batch**
Calculated Parameters						
Total Hardness (CaCO3)	mg/L	210	655	416	0.50	7228076
Elements						
Total Mercury (Hg)	ug/L	0.108	<0.010	<0.010	0.010	7239529

RDL = Reportable Detection Limit

Maxxam Job #: B394636
Report Date: 2013/10/22

MINTO EXPLORATIONS LTD.
Client Project #: MINTO ENV. MONITORING
Site Location: YUKON
Your P.O. #: 204253
Sampler Initials: MC

CCME TOTAL METALS IN WATER (WATER)

Maxxam ID		HU9960	HU9961	HU9962		
Sampling Date		2013/10/08 15:35	2013/10/08 16:20	2013/10/09 16:05		
	UNITS	**MW12-DP1**	**MW12-DP3**	**MW12-DP4**	**RDL**	**QC Batch**
Total Metals by ICPMS						
Total Aluminum (Al)	ug/L	108	483	1200	3.0	7239281
Total Antimony (Sb)	ug/L	1.02	1.40	<0.50	0.50	7239281
Total Arsenic (As)	ug/L	0.58	5.78	0.92	0.10	7239281
Total Barium (Ba)	ug/L	234	398	226	1.0	7239281
Total Beryllium (Be)	ug/L	<0.10	<0.10	<0.10	0.10	7239281
Total Bismuth (Bi)	ug/L	<1.0	<1.0	<1.0	1.0	7239281
Total Boron (B)	ug/L	515	346	<50	50	7239281
Total Cadmium (Cd)	ug/L	0.115	0.046	0.057	0.010	7239281
Total Chromium (Cr)	ug/L	18.0	50.8	3.6	1.0	7239281
Total Cobalt (Co)	ug/L	6.61	80.1	1.49	0.50	7239281
Total Copper (Cu)	ug/L	69.3	58.1	10.8	0.20	7239281
Total Iron (Fe)	ug/L	2760	126000	2250	5.0	7239281
Total Lead (Pb)	ug/L	69.7	25.9	0.78	0.20	7239281
Total Lithium (Li)	ug/L	<5.0	<5.0	<5.0	5.0	7239281
Total Manganese (Mn)	ug/L	3150	5550	1380	1.0	7239281
Total Molybdenum (Mo)	ug/L	6.8	20.1	8.1	1.0	7239281
Total Nickel (Ni)	ug/L	132	337	6.2	1.0	7239281
Total Phosphorus (P)	ug/L	77	306	174	10	7239281
Total Selenium (Se)	ug/L	0.14	0.72	2.14	0.10	7239281
Total Silicon (Si)	ug/L	3080	12700	8150	100	7239281
Total Silver (Ag)	ug/L	0.047	0.066	0.028	0.020	7239281
Total Strontium (Sr)	ug/L	264	1100	912	1.0	7239281
Total Thallium (Tl)	ug/L	<0.050	<0.050	<0.050	0.050	7239281
Total Tin (Sn)	ug/L	<5.0	<5.0	<5.0	5.0	7239281
Total Titanium (Ti)	ug/L	6.6	27.0	44.9	5.0	7239281
Total Uranium (U)	ug/L	2.53	1.85	4.65	0.10	7239281
Total Vanadium (V)	ug/L	<5.0	10.7	<5.0	5.0	7239281
Total Zinc (Zn)	ug/L	152	112	6.5	5.0	7239281
Total Zirconium (Zr)	ug/L	<0.50	3.37	0.53	0.50	7239281
Total Calcium (Ca)	mg/L	63.4	195	101	0.050	7228077
Total Magnesium (Mg)	mg/L	12.6	40.7	39.4	0.050	7228077
Total Potassium (K)	mg/L	1.76	2.28	4.85	0.050	7228077
Total Sodium (Na)	mg/L	3.96	13.7	26.2	0.050	7228077
Total Sulphur (S)	mg/L	<3.0	11.2	27.7	3.0	7228077

RDL = Reportable Detection Limit

General Comments

Sample HU9962-01: The BC-MOE and APHA Standard Method require pH to be analysed within 15 minutes of sampling and therefore field analysis is required for compliance. All Laboratory pH analyses in this report are reported past the BC-MOE/APHA Standard Method holding time.

Maxxam

Success Through Science®

Maxxam Job #: B394636
Report Date: 2013/10/22

MINTO EXPLORATIONS LTD.
Client Project #: MINTO ENV. MONITORING
Site Location: YUKON
Your P.O. #: 204253
Sampler Initials: MC

QUALITY ASSURANCE REPORT

			Matrix Spike		Spiked Blank		Method Blank		RPD	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits
7229448	Total Suspended Solids	2013/10/17			95	80 - 120	<1.0	mg/L		
7229690	Total Dissolved Solids	2013/10/17	NC	80 - 120	92	80 - 120	<10	mg/L	2.1	20
7230521	Alkalinity (Total as CaCO3)	2013/10/16	NC	80 - 120	100	80 - 120	<0.50	mg/L	1.1	20
7230521	Alkalinity (PP as CaCO3)	2013/10/16					<0.50	mg/L	NC	20
7230521	Bicarbonate (HCO3)	2013/10/16					<0.50	mg/L	1.1	20
7230521	Carbonate (CO3)	2013/10/16					<0.50	mg/L	NC	20
7230521	Hydroxide (OH)	2013/10/16					<0.50	mg/L	NC	20
7230609	Conductivity	2013/10/16			98	80 - 120	1.3, RDL=1.0	uS/cm	0.4	20
7231993	Dissolved Chloride (Cl)	2013/10/16	109	80 - 120			<0.50	mg/L	NC	20
7231997	Ammonia (N)	2013/10/16	110	80 - 120	98	80 - 120	<0.0050	mg/L	NC	20
7232016	Dissolved Sulphate (SO4)	2013/10/16	NC	80 - 120	102	80 - 120	0.84, RDL=0.50	mg/L	0.1	20
7232075	Nitrate plus Nitrite (N)	2013/10/16	102	80 - 120	106	80 - 120	<0.020	mg/L	8.2	25
7232079	Nitrite (N)	2013/10/16	101	80 - 120	102	80 - 120	<0.0050	mg/L	NC	20
7237214	Fluoride (F)	2013/10/18	100	80 - 120	100	80 - 120	<0.010	mg/L	0	20
7239281	Total Aluminum (Al)	2013/10/22	NC	80 - 120	111	80 - 120	<3.0	ug/L	11.4	20
7239281	Total Antimony (Sb)	2013/10/22	116	80 - 120	98	80 - 120	<0.50	ug/L	NC	20
7239281	Total Arsenic (As)	2013/10/22	108	80 - 120	108	80 - 120	<0.10	ug/L	3.4	20
7239281	Total Barium (Ba)	2013/10/22	NC	80 - 120	104	80 - 120	<1.0	ug/L	0.4	20
7239281	Total Beryllium (Be)	2013/10/22	96	80 - 120	99	80 - 120	<0.10	ug/L	NC	20
7239281	Total Bismuth (Bi)	2013/10/22	97	80 - 120	94	80 - 120	<1.0	ug/L	NC	20
7239281	Total Cadmium (Cd)	2013/10/22	102	80 - 120	105	80 - 120	<0.010	ug/L	0.04	20
7239281	Total Chromium (Cr)	2013/10/22	102	80 - 120	103	80 - 120	<1.0	ug/L	NC	20
7239281	Total Cobalt (Co)	2013/10/22	NC	80 - 120	103	80 - 120	<0.50	ug/L	1.6	20
7239281	Total Copper (Cu)	2013/10/22	NC	80 - 120	107	80 - 120	<0.20	ug/L	1.8	20
7239281	Total Iron (Fe)	2013/10/22	NC	80 - 120	115	80 - 120	<5.0	ug/L	1.6	20
7239281	Total Lead (Pb)	2013/10/22	100	80 - 120	101	80 - 120	<0.20	ug/L	NC	20
7239281	Total Lithium (Li)	2013/10/22	NC	80 - 120	98	80 - 120	<5.0	ug/L	4.7	20
7239281	Total Manganese (Mn)	2013/10/22	NC	80 - 120	107	80 - 120	1.2, RDL=1.0	ug/L	1.5	20
7239281	Total Molybdenum (Mo)	2013/10/22	NC	80 - 120	106	80 - 120	<1.0	ug/L	NC	20
7239281	Total Nickel (Ni)	2013/10/22	NC	80 - 120	103	80 - 120	<1.0	ug/L	2.9	20
7239281	Total Selenium (Se)	2013/10/22	111	80 - 120	110	80 - 120	<0.10	ug/L	11.6	20
7239281	Total Silver (Ag)	2013/10/22	86	80 - 120	93	80 - 120	0.031, RDL=0.020	ug/L	NC	20
7239281	Total Strontium (Sr)	2013/10/22	NC	80 - 120	102	80 - 120	<1.0	ug/L	1.9	20
7239281	Total Thallium (Tl)	2013/10/22	110	80 - 120	102	80 - 120	<0.050	ug/L	NC	20
7239281	Total Tin (Sn)	2013/10/22	NC	80 - 120	102	80 - 120	<5.0	ug/L	NC	20
7239281	Total Titanium (Ti)	2013/10/22	NC	80 - 120	109	80 - 120	<5.0	ug/L	NC	20
7239281	Total Uranium (U)	2013/10/22	110	80 - 120	102	80 - 120	<0.10	ug/L	0.3	20
7239281	Total Vanadium (V)	2013/10/22	107	80 - 120	104	80 - 120	<5.0	ug/L	NC	20
7239281	Total Zinc (Zn)	2013/10/22	NC	80 - 120	113	80 - 120	<5.0	ug/L	0.8	20

Success Through Science®

Maxxam Job #: B394636
Report Date: 2013/10/22

MINTO EXPLORATIONS LTD.
Client Project #: MINTO ENV. MONITORING
Site Location: YUKON
Your P.O. #: 204253
Sampler Initials: MC

QUALITY ASSURANCE REPORT

			Matrix Spike		Spiked Blank		Method Blank		RPD	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits
7239281	Total Boron (B)	2013/10/22					<50	ug/L	8.8	20
7239281	Total Phosphorus (P)	2013/10/22					<10	ug/L		
7239281	Total Silicon (Si)	2013/10/22					<100	ug/L	4.8	20
7239281	Total Zirconium (Zr)	2013/10/22					<0.50	ug/L	NC	20
7239529	Total Mercury (Hg)	2013/10/21	85	80 - 120	95	80 - 120	<0.010	ug/L	NC	20

N/A = Not Applicable

RDL = Reportable Detection Limit

RPD = Relative Percent Difference

Duplicate: Paired analysis of a separate portion of the same sample. Used to evaluate the variance in the measurement.

Matrix Spike: A sample to which a known amount of the analyte of interest has been added. Used to evaluate sample matrix interference.

Spiked Blank: A blank matrix sample to which a known amount of the analyte, usually from a second source, has been added. Used to evaluate method accuracy.

Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.

NC (Matrix Spike): The recovery in the matrix spike was not calculated. The relative difference between the concentration in the parent sample and the spiked amount was not sufficiently significant to permit a reliable recovery calculation.

NC (RPD): The RPD was not calculated. The level of analyte detected in the parent sample and its duplicate was not sufficiently significant to permit a reliable calculation.

Validation Signature Page

Maxxam Job #: B394636

The analytical data and all QC contained in this report were reviewed and validated by the following individual(s).

Rob Reinert, Data Validation Coordinator

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Maxxam

Burnaby: 4606 Canada Way, Burnaby, BC V5G 1K5 Ph: (604) 734-7276 Fax: (604) 731-2386, Toll Free: (800) 665-8566

CHAIN OF CUSTODY RECORD

Click here to get the COC number

Maxxam Job #: B394636 **COC #:** EB863113 Page: 1 of 1

Invoice To: Require Report? Yes ☑ No ☐

Company Name:	Minto Explorations Ltd
Contact Name:	Elvina Wong
Address:	Suite 900 - 999 West Hastings St
	Vancouver, B.C. PC: V6C 2W2
Phone / Fax#:	Ph: 604-684-8894 Fax: 604-688-2120
E-mail	

Report To:

Company Name:	Minto Explorations Ltd
Contact Name:	Minto Environment
Address:	Suite 900-999 West Hastings St
	Vancouver, B.C. PC: V6C 2W2
Phone / Fax#:	Ph: 604-684-8894 Fax: 604-688-2120
E-mail	minto_environment@mintomine.com

PO #:	204253
Quotation #:	
Project # :	
Proj. Name:	Minto Env. Monitoring
Location:	Yukon
Sampled by:	MC/PE

REGULATORY REQUIREMENTS:

- ☐ CSR
- ☑ CCME
- ☐ BC Water Quality
- ☐ Other
- ☐ DRINKING WATER

SERVICE REQUESTED:

- ◉ Regular Turn Around Time (TAT) (5 days for most tests)
- **RUSH** (Please contact the lab) ○ 1 Day ○ 2 Day ○ 3 Day
- Date Required:

SPECIAL INSTRUCTIONS:

Return Cooler ☐ **Ship Sample Bottles (please specify)** ☐

ANALYSIS REQUESTED

Field Filtered? Y ☑ N ☐; Field Acidified? Y ☑ N ☐; Field Acidified? Y ☑ N ☐

#	Sample Identification	Lab Identification (Lab Use Only)	Sample Type	Date/Time(24hr) Sampled	Dissolved Metals (DM)	Total Metals	Nitrate ☑ Nitrite ☑ Ammonia ☑	Total Suspended Solids (TSS) ☑ TDS ☑	pH ☑ Conductivity ☑ Alkalinity ☑	Chloride ☑ Fluoride ☑ Sulphate ☑	Phosphate	DOC (Diss'd Organic Carbon)	TOC (Total Organic Carbon)	Ra 226	Number of Containers
1	MW12-DP1	HU0960	Water	10/8/13 15:35		x									1
2	MW12-DP3	HU0961	Water	10/8/13 16:20		x									1
3	MW12-DP4	HU0962	Water	10/9/13 16:05		x	x	x	x	x					4
4															
5															
6															
7															
8															
9															
10															
11															
12															

B394636

Print name and sign

*Relinquished By:	Date (yy/mm/dd):	Time (24hr):	Received by (Print name and sign)	Date (yy/mm/dd)	Time (24 hr)	Time Sensitive
Phil Emerson	10-Oct-13	8:00	WEILBERT PASCUAL	2013/10/15	09:10	☑

Laboratory Use Only: Temperature on Receipt (°C): A: 3 B: 1 C: 1; Just sampled & rec'd on ice ☐; Custody Seal: Present? N/A Yes ☐ No ☐; Intact? N/A Yes ☐ No ☐

*IT IS THE RESPONSIBILITY OF THE RELINQUISHER TO ENSURE THE ACCURACY OF THE CHAIN OF CUSTODY RECORDS. AN INCOMPLETE CHAIN OF CUSTODY MAY RESULT IN ANALYTICAL TAT DELAYS.

1,1,1

Success Through Science®

Your P.O. #: 204023
Your Project #: MINTO ENV. MONITORING
Site Location: YUKON
Your C.O.C. #: 08380122

Attention: MINTO DISTRIBUTION LIST
MINTO EXPLORATIONS LTD.
Yukon/Whitehorse
2 - 25 Pilgrim Way
Whitehorse, YT
CANADA Y1A 6E6

Report Date: 2013/10/21

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B394670
Received: 2013/10/15, 09:10

Sample Matrix: Water
Samples Received: 2

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Analytical Method
Alkalinity - Water	2	2013/10/16	2013/10/16	BBY6SOP-00026	SM2320B
Chloride by Automated Colourimetry	1	N/A	2013/10/16	BBY6SOP-00011	SM-4500-Cl-
Chloride by Automated Colourimetry	1	N/A	2013/10/17	BBY6SOP-00011	SM-4500-Cl-
Conductance - water	2	N/A	2013/10/16	BBY6SOP-00026	SM-2510B
Fluoride	2	N/A	2013/10/21	BBY6SOP-00012	SM - 4500 F C
Hardness (calculated as CaCO3)	2	N/A	2013/10/21	BBY7SOP-00002	EPA 6020A
Mercury (Dissolved) by CVAF	2	N/A	2013/10/18	BBY7SOP-00015	EPA 245.7
Na, K, Ca, Mg, S by CRC ICPMS (diss.)	2	N/A	2013/10/21	BBY7SOP-00002	EPA 6020A
Elements by CRC ICPMS (dissolved)	2	N/A	2013/10/18	BBY7SOP-00002	EPA 6020A
Ammonia-N (Preserved)	2	N/A	2013/10/16	BBY6SOP-00009	SM-4500NH3G
Nitrate + Nitrite (N)	2	N/A	2013/10/16	BBY6SOP-00010	SM 4500NO3-I
Nitrite (N) by CFA	2	N/A	2013/10/16	BBY6SOP-00010	EPA 353.2
Nitrogen - Nitrate (as N)	2	N/A	2013/10/17	BBY6SOP-00010	SM 4500NO3-I
Filter and HNO3 Preserve for Metals	2	N/A	2013/10/15	BBY6WI-00001	EPA 200.2
pH Water	2	N/A	2013/10/16	BBY6SOP-00026	SM-4500H+B
Sulphate by Automated Colourimetry	1	N/A	2013/10/16	BBY6SOP-00017	SM4500-SO42- E
Sulphate by Automated Colourimetry	1	N/A	2013/10/17	BBY6SOP-00017	SM4500-SO42- E
Total Dissolved Solids (Filt. Residue)	2	2013/10/16	2013/10/17	BBY6SOP-00033	SM 2540C
Total Suspended Solids-Low Level	2	2013/10/16	2013/10/17	BBY6SOP-00034	SM-2540 D

* Results relate only to the items tested.

Encryption Key

Please direct all questions regarding this Certificate of Analysis to your Project Manager.

Ken Pomeroy, Project Manager
Email: KPomeroy@maxxam.ca
Phone# (604) 638-5020

==
This report has been generated and distributed using a secure automated process.
Maxxam has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per section 5.10.2 of ISO/IEC 17025:2005(E), signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

Total cover pages: 1

Maxxam

Maxxam Job #: B394670
Report Date: 2013/10/21

MINTO EXPLORATIONS LTD.
Client Project #: MINTO ENV. MONITORING
Site Location: YUKON
Your P.O. #: 204023
Sampler Initials: CH

RESULTS OF CHEMICAL ANALYSES OF WATER

Maxxam ID		HV0128			HV0129		
Sampling Date		2013/10/12 11:30			2013/10/12 12:30		
	UNITS	**MW09-03-01**	**RDL**	**QC Batch**	**MW09-03-02**	**RDL**	**QC Batch**
ANIONS							
Nitrite (N)	mg/L	0.174(1)	0.0050	7232079	0.0805(1)	0.0050	7232079
Calculated Parameters							
Filter and HNO3 Preservation	N/A	FIELD	N/A	ONSITE	FIELD	N/A	ONSITE
Nitrate (N)	mg/L	<0.020	0.020	7227064	<0.020	0.020	7227064
Misc. Inorganics							
Fluoride (F)	mg/L	0.840	0.010	7239926	0.740	0.010	7239926
Alkalinity (Total as CaCO3)	mg/L	130	0.50	7230217	518	0.50	7230217
Alkalinity (PP as CaCO3)	mg/L	<0.50	0.50	7230217	<0.50	0.50	7230217
Bicarbonate (HCO3)	mg/L	159	0.50	7230217	632	0.50	7230217
Carbonate (CO3)	mg/L	<0.50	0.50	7230217	<0.50	0.50	7230217
Hydroxide (OH)	mg/L	<0.50	0.50	7230217	<0.50	0.50	7230217
Anions							
Dissolved Sulphate (SO4)	mg/L	22.1	0.50	7234526	0.98	0.50	7232016
Dissolved Chloride (Cl)	mg/L	0.64	0.50	7234512	4.4	0.50	7231993
Nutrients							
Ammonia (N)	mg/L	0.050	0.0050	7231997	0.21	0.0050	7231997
Nitrate plus Nitrite (N)	mg/L	0.192(1)	0.020	7232075	0.082(1)	0.020	7232075
Physical Properties							
Conductivity	uS/cm	299	1.0	7230273	970	1.0	7230273
pH	pH Units	8.03		7230270	7.92		7230270
Physical Properties							
Total Suspended Solids	mg/L	<1.0	1.0	7229448	60.0(2)	2.0	7229448
Total Dissolved Solids	mg/L	196	10	7229690	598	10	7229690

N/A = Not Applicable
RDL = Reportable Detection Limit
(1) - Sample analysed past hold time: sample was received on the hold time expiry date which did not allow sufficient time for preparation and analysis.
(2) - RDL raised due to matrix interference.

Maxxam Job #: B394670
Report Date: 2013/10/21

MINTO EXPLORATIONS LTD.
Client Project #: MINTO ENV. MONITORING
Site Location: YUKON
Your P.O. #: 204023
Sampler Initials: CH

CCME DISSOLVED METALS IN WATER (WATER)

Maxxam ID		HV0128	HV0129		
Sampling Date		2013/10/12 11:30	2013/10/12 12:30		
	UNITS	**MW09-03-01**	**MW09-03-02**	**RDL**	**QC Batch**
Misc. Inorganics					
Dissolved Hardness (CaCO3)	mg/L	152	519	0.50	7227062
Elements					
Dissolved Mercury (Hg)	ug/L	<0.010	<0.010	0.010	7235361

RDL = Reportable Detection Limit

Maxxam Job #: B394670
Report Date: 2013/10/21

MINTO EXPLORATIONS LTD.
Client Project #: MINTO ENV. MONITORING
Site Location: YUKON
Your P.O. #: 204023
Sampler Initials: CH

CCME DISSOLVED METALS IN WATER (WATER)

Maxxam ID		HV0128	HV0129		
Sampling Date		2013/10/12 11:30	2013/10/12 12:30		
	UNITS	**MW09-03-01**	**MW09-03-02**	**RDL**	**QC Batch**
Dissolved Metals by ICPMS					
Dissolved Aluminum (Al)	ug/L	3.3	7.7	3.0	7233338
Dissolved Antimony (Sb)	ug/L	<0.50	<0.50	0.50	7233338
Dissolved Arsenic (As)	ug/L	<0.10	0.77	0.10	7233338
Dissolved Barium (Ba)	ug/L	47.4	665	1.0	7233338
Dissolved Beryllium (Be)	ug/L	<0.10	<0.10	0.10	7233338
Dissolved Bismuth (Bi)	ug/L	<1.0	<1.0	1.0	7233338
Dissolved Boron (B)	ug/L	152	392	50	7233338
Dissolved Cadmium (Cd)	ug/L	0.018	<0.010	0.010	7233338
Dissolved Chromium (Cr)	ug/L	<1.0	<1.0	1.0	7233338
Dissolved Cobalt (Co)	ug/L	<0.50	1.10	0.50	7233338
Dissolved Copper (Cu)	ug/L	0.28	1.19	0.20	7233338
Dissolved Iron (Fe)	ug/L	<5.0	23800	5.0	7233338
Dissolved Lead (Pb)	ug/L	<0.20	<0.20	0.20	7233338
Dissolved Lithium (Li)	ug/L	<5.0	<5.0	5.0	7233338
Dissolved Manganese (Mn)	ug/L	77.0	20300	1.0	7233338
Dissolved Molybdenum (Mo)	ug/L	3.9	16.8	1.0	7233338
Dissolved Nickel (Ni)	ug/L	2.8	<1.0	1.0	7233338
Dissolved Phosphorus (P)	ug/L	<10	<10	10	7233338
Dissolved Selenium (Se)	ug/L	<0.10	<0.10	0.10	7233338
Dissolved Silicon (Si)	ug/L	4750	10400	100	7233338
Dissolved Silver (Ag)	ug/L	<0.020	<0.020	0.020	7233338
Dissolved Strontium (Sr)	ug/L	764	1530	1.0	7233338
Dissolved Thallium (Tl)	ug/L	<0.050	<0.050	0.050	7233338
Dissolved Tin (Sn)	ug/L	<5.0	<5.0	5.0	7233338
Dissolved Titanium (Ti)	ug/L	<5.0	<5.0	5.0	7233338
Dissolved Uranium (U)	ug/L	1.37	0.25	0.10	7233338
Dissolved Vanadium (V)	ug/L	<5.0	<5.0	5.0	7233338
Dissolved Zinc (Zn)	ug/L	<5.0	7.0	5.0	7233338
Dissolved Zirconium (Zr)	ug/L	<0.50	<0.50	0.50	7233338
Dissolved Calcium (Ca)	mg/L	44.2	166	0.050	7227063
Dissolved Magnesium (Mg)	mg/L	10.2	25.4	0.050	7227063
Dissolved Potassium (K)	mg/L	2.82	4.05	0.050	7227063
Dissolved Sodium (Na)	mg/L	5.74	16.3	0.050	7227063
Dissolved Sulphur (S)	mg/L	8.3	<3.0	3.0	7227063

RDL = Reportable Detection Limit

General Comments

Sample HV0128-01: The BC-MOE and APHA Standard Method require pH to be analysed within 15 minutes of sampling and therefore field analysis is required for compliance. All Laboratory pH analyses in this report are reported past the BC-MOE/APHA Standard Method holding time.

Sample HV0129-01: The BC-MOE and APHA Standard Method require pH to be analysed within 15 minutes of sampling and therefore field analysis is required for compliance. All Laboratory pH analyses in this report are reported past the BC-MOE/APHA Standard Method holding time.

Maxxam Job #: B394670
Report Date: 2013/10/21

MINTO EXPLORATIONS LTD.
Client Project #: MINTO ENV. MONITORING
Site Location: YUKON
Your P.O. #: 204023
Sampler Initials: CH

QUALITY ASSURANCE REPORT

			Matrix Spike		Spiked Blank		Method Blank		RPD	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits
7229448	Total Suspended Solids	2013/10/17			95	80 - 120	<1.0	mg/L		
7229690	Total Dissolved Solids	2013/10/17	NC	80 - 120	92	80 - 120	<10	mg/L	2.1	20
7230217	Alkalinity (Total as CaCO3)	2013/10/16	NC	80 - 120	93	80 - 120	<0.50	mg/L	7.6	20
7230217	Alkalinity (PP as CaCO3)	2013/10/16					<0.50	mg/L	NC	20
7230217	Bicarbonate (HCO3)	2013/10/16					<0.50	mg/L	7.6	20
7230217	Carbonate (CO3)	2013/10/16					<0.50	mg/L	NC	20
7230217	Hydroxide (OH)	2013/10/16					<0.50	mg/L	NC	20
7230273	Conductivity	2013/10/17			98	80 - 120	1.2, RDL=1.0	uS/cm	0.2	20
7231993	Dissolved Chloride (Cl)	2013/10/16	109	80 - 120			<0.50	mg/L	NC	20
7231997	Ammonia (N)	2013/10/16	110	80 - 120	98	80 - 120	<0.0050	mg/L	NC	20
7232016	Dissolved Sulphate (SO4)	2013/10/16	NC	80 - 120	102	80 - 120	0.84, RDL=0.50	mg/L	0.1	20
7232075	Nitrate plus Nitrite (N)	2013/10/16	102	80 - 120	106	80 - 120	<0.020	mg/L	8.2	25
7232079	Nitrite (N)	2013/10/16	101	80 - 120	102	80 - 120	<0.0050	mg/L	NC	20
7233338	Dissolved Aluminum (Al)	2013/10/18	108	80 - 120	106	80 - 120	<3.0	ug/L	NC	20
7233338	Dissolved Antimony (Sb)	2013/10/18	110	80 - 120	107	80 - 120	<0.50	ug/L	NC	20
7233338	Dissolved Arsenic (As)	2013/10/18	106	80 - 120	100	80 - 120	<0.10	ug/L	NC	20
7233338	Dissolved Barium (Ba)	2013/10/18	NC	80 - 120	100	80 - 120	<1.0	ug/L	3.0	20
7233338	Dissolved Beryllium (Be)	2013/10/18	117	80 - 120	108	80 - 120	<0.10	ug/L	NC	20
7233338	Dissolved Bismuth (Bi)	2013/10/18	85	80 - 120	93	80 - 120	<1.0	ug/L	NC	20
7233338	Dissolved Cadmium (Cd)	2013/10/18	100	80 - 120	101	80 - 120	<0.010	ug/L	NC	20
7233338	Dissolved Chromium (Cr)	2013/10/18	99	80 - 120	99	80 - 120	<1.0	ug/L	NC	20
7233338	Dissolved Cobalt (Co)	2013/10/18	97	80 - 120	99	80 - 120	<0.50	ug/L	NC	20
7233338	Dissolved Copper (Cu)	2013/10/18	98	80 - 120	103	80 - 120	<0.20	ug/L	NC	20
7233338	Dissolved Iron (Fe)	2013/10/18	110	80 - 120	114	80 - 120	<5.0	ug/L	NC	20
7233338	Dissolved Lead (Pb)	2013/10/18	95	80 - 120	97	80 - 120	<0.20	ug/L	NC	20
7233338	Dissolved Lithium (Li)	2013/10/18	114	80 - 120	111	80 - 120	<5.0	ug/L	NC	20
7233338	Dissolved Manganese (Mn)	2013/10/18	NC	80 - 120	100	80 - 120	<1.0	ug/L	1.2	20
7233338	Dissolved Molybdenum (Mo)	2013/10/18	NC	80 - 120	92	80 - 120	<1.0	ug/L	NC	20
7233338	Dissolved Nickel (Ni)	2013/10/18	95	80 - 120	100	80 - 120	<1.0	ug/L	NC	20
7233338	Dissolved Selenium (Se)	2013/10/18	106	80 - 120	103	80 - 120	<0.10	ug/L	NC	20
7233338	Dissolved Silver (Ag)	2013/10/18	95	80 - 120	89	80 - 120	<0.020	ug/L	NC	20
7233338	Dissolved Strontium (Sr)	2013/10/18	NC	80 - 120	98	80 - 120	<1.0	ug/L	1.7	20
7233338	Dissolved Thallium (Tl)	2013/10/18	98	80 - 120	97	80 - 120	<0.050	ug/L	NC	20
7233338	Dissolved Tin (Sn)	2013/10/18	97	80 - 120	96	80 - 120	<5.0	ug/L	NC	20
7233338	Dissolved Titanium (Ti)	2013/10/18	106	80 - 120	108	80 - 120	<5.0	ug/L	NC	20
7233338	Dissolved Uranium (U)	2013/10/18	95	80 - 120	95	80 - 120	<0.10	ug/L	1.0	20
7233338	Dissolved Vanadium (V)	2013/10/18	102	80 - 120	98	80 - 120	<5.0	ug/L	NC	20
7233338	Dissolved Zinc (Zn)	2013/10/18	102	80 - 120	103	80 - 120	<5.0	ug/L	NC	20
7233338	Dissolved Boron (B)	2013/10/18					<50	ug/L	NC	20

Success Through Science®

Maxxam Job #: B394670
Report Date: 2013/10/21

MINTO EXPLORATIONS LTD.
Client Project #: MINTO ENV. MONITORING
Site Location: YUKON
Your P.O. #: 204023
Sampler Initials: CH

QUALITY ASSURANCE REPORT

			Matrix Spike		Spiked Blank		Method Blank		RPD	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits
7233338	Dissolved Phosphorus (P)	2013/10/18					<10	ug/L	NC	20
7233338	Dissolved Silicon (Si)	2013/10/18					<100	ug/L	0.09	20
7233338	Dissolved Zirconium (Zr)	2013/10/18					<0.50	ug/L	NC	20
7234512	Dissolved Chloride (Cl)	2013/10/17	NC	80 - 120	99	80 - 120	<0.50	mg/L	NC	20
7234526	Dissolved Sulphate (SO4)	2013/10/17	NC	80 - 120	97	80 - 120	0.99, RDL=0.50	mg/L	3.0	20
7235361	Dissolved Mercury (Hg)	2013/10/18	101	80 - 120	90	80 - 120	<0.010	ug/L	NC	20
7239926	Fluoride (F)	2013/10/21	98	80 - 120	98	80 - 120	<0.010	mg/L	0	20

N/A = Not Applicable

RDL = Reportable Detection Limit

RPD = Relative Percent Difference

Duplicate: Paired analysis of a separate portion of the same sample. Used to evaluate the variance in the measurement.

Matrix Spike: A sample to which a known amount of the analyte of interest has been added. Used to evaluate sample matrix interference.

Spiked Blank: A blank matrix sample to which a known amount of the analyte, usually from a second source, has been added. Used to evaluate method accuracy.

Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.

NC (Matrix Spike): The recovery in the matrix spike was not calculated. The relative difference between the concentration in the parent sample and the spiked amount was not sufficiently significant to permit a reliable recovery calculation.

NC (RPD): The RPD was not calculated. The level of analyte detected in the parent sample and its duplicate was not sufficiently significant to permit a reliable calculation.

Success Through Science®

Validation Signature Page

Maxxam Job #: B394670

The analytical data and all QC contained in this report were reviewed and validated by the following individual(s).

Rob Reinert, Data Validation Coordinator

===

Maxxam has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per section 5.10.2 of ISO/IEC 17025:2005(E), signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

Maxxam

Burnaby: 4606 Canada Way, Burnaby, BC V5G 1K5 Ph: (604) 734-7276 Fax: (604) 731-2386, Toll Free: (800) 665-8566

CHAIN OF CUSTODY RECORD

Maxxam Job #: B394670 **COC #:** 08380122 Page: 1 of 1

Invoice To: Require Report? Yes ☑ No ☐

Invoice To	
Company Name:	Minto Explorations Ltd
Contact Name:	Elvina Wong
Address:	Suite 900 - 999 West Hastings St
	Vancouver, B.C. PC: V6C 2W2
Phone / Fax#:	Ph: 604-684-8894 Fax: 604-688-2120
E-mail	

Report To:

Report To	
Company Name:	Minto Explorations Ltd
Contact Name:	Minto Environment
Address:	Suite 900-999 West Hastings St
	Vancouver, B.C. PC: V6C 2W2
Phone / Fax#:	Ph: 604-684-8894 Fax: 604-688-2120
E-mail	minto_environment@mintomine.com

PO #:	204023
Quotation #:	
Project # :	
Proj. Name:	Minto Env. Monitoring
Location:	Yukon
Sampled by:	CH/MC

REGULATORY REQUIREMENTS:

- ☐ CSR
- ☑ CCME
- ☐ BC Water Quality
- ☐ Other
- ☐ DRINKING WATER

SERVICE REQUESTED:

- ◉ Regular Turn Around Time (TAT) (5 days for most tests)
- **RUSH** (Please contact the lab) ○ 1 Day ○ 2 Day ○ 3 Day
- Date Required:

SPECIAL INSTRUCTIONS:

Return Cooler ☐ **Ship Sample Bottles (please specify)** ☐

ANALYSIS REQUESTED

Field Filtered? ☑ Y ☐ N; Field Acidified? ☑ Y ☐ N; Field Acidified? ☑ Y ☐ N

#	Sample Identification	Lab Identification (Lab Use Only)	Sample Type	Date/Time(24hr) Sampled	Dissolved Metals (DM) (Field Filtered?)	(Field Acidified?)	Total Metals (Field Acidified?)	Nitrate ☑ Nitrite ☑ Ammonia ☑	Total Suspended Solids (TSS) ☑ TDS ☑	pH ☑ Conductivity ☑ Alkalinity ☑	Chloride ☑ Fluoride ☑ Sulphate ☑	Phosphate	DOC (Diss'd Organic Carbon)	TOC (Total Organic Carbon)	Ra 226	Number of Containers
1	MW09-03-01 HV0128		Ground W	10/13/12 11:30	X	X		X	X	X	X					4
2	MW09-03-02 HV0129		Ground W	10/13/12 12:30	X	X		X	X	X	X					4
3																
4																
5																
6																
7																
8																
9																
10																
11																
12																

B394670

Print name and sign

*Relinquished By:	Date (yy/mm/dd):	Time (24hr):	Received by	Date (yy/mm/dd)	Time (24 hr)	Time Sensitive	Temperature on Receipt (°C)	Custody Seal	Yes	No
Martin Crill	13-Oct-14	08:00	WELLBERT PASCUAL	2013/10/15	09:10	☑	A) 1 B) C) 1	Present? N/A	☐	☐
							Just sampled & rec'd on ice ☐	Intact? N/A	☐	☐

*IT IS THE RESPONSIBILITY OF THE RELINQUISHER TO ENSURE THE ACCURACY OF THE CHAIN OF CUSTODY RECORDS. AN INCOMPLETE CHAIN OF CUSTODY MAY RESULT IN ANALYTICAL TAT DELAYS.

Maxxam

Success Through Science®

Your P.O. #: 204253
Your Project #: MINTO ENV. MONITORING
Site Location: YUKON
Your C.O.C. #: EB864413

Attention: MINTO DISTRIBUTION LIST
MINTO EXPLORATIONS LTD.
Yukon/Whitehorse
2 - 25 Pilgrim Way
Whitehorse, YT
CANADA Y1A 6E6

Report Date: 2013/10/21

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B394682
Received: 2013/10/15, 09:10

Sample Matrix: Water
Samples Received: 5

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Analytical Method
Alkalinity - Water	5	2013/10/16	2013/10/17	BBY6SOP-00026	SM2320B
Chloride by Automated Colourimetry	5	N/A	2013/10/16	BBY6SOP-00011	SM-4500-Cl-
Conductance - water	5	N/A	2013/10/17	BBY6SOP-00026	SM-2510B
Fluoride	5	N/A	2013/10/18	BBY6SOP-00012	SM - 4500 F C
Hardness (calculated as CaCO3)	5	N/A	2013/10/21	BBY7SOP-00002	EPA 6020A
Mercury (Dissolved) by CVAF	5	N/A	2013/10/20	BBY7SOP-00015	EPA 245.7
Na, K, Ca, Mg, S by CRC ICPMS (diss.)	5	N/A	2013/10/21	BBY7SOP-00002	EPA 6020A
Elements by CRC ICPMS (dissolved)	5	N/A	2013/10/18	BBY7SOP-00002	EPA 6020A
Ammonia-N (Preserved)	4	N/A	2013/10/16	BBY6SOP-00009	SM-4500NH3G
Ammonia-N (Preserved)	1	N/A	2013/10/18	BBY6SOP-00009	SM-4500NH3G
Nitrate + Nitrite (N)	5	N/A	2013/10/16	BBY6SOP-00010	SM 4500NO3-I
Nitrite (N) by CFA	5	N/A	2013/10/16	BBY6SOP-00010	EPA 353.2
Nitrogen - Nitrate (as N)	5	N/A	2013/10/17	BBY6SOP-00010	SM 4500NO3-I
Filter and HNO3 Preserve for Metals	5	N/A	2013/10/15	BBY6WI-00001	EPA 200.2
pH Water	5	N/A	2013/10/17	BBY6SOP-00026	SM-4500H+B
Sulphate by Automated Colourimetry	4	N/A	2013/10/16	BBY6SOP-00017	SM4500-SO42- E
Sulphate by Automated Colourimetry	1	N/A	2013/10/17	BBY6SOP-00017	SM4500-SO42- E
Total Dissolved Solids (Filt. Residue)	5	2013/10/16	2013/10/17	BBY6SOP-00033	SM 2540C
Total Suspended Solids-Low Level	5	2013/10/16	2013/10/17	BBY6SOP-00034	SM-2540 D

* Results relate only to the items tested.

Encryption Key

Please direct all questions regarding this Certificate of Analysis to your Project Manager.

Ken Pomeroy, Project Manager
Email: KPomeroy@maxxam.ca
Phone# (604) 638-5020

==
This report has been generated and distributed using a secure automated process.
Maxxam has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per section 5.10.2 of ISO/IEC 17025:2005(E), signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

Total cover pages: 1

Maxxam Job #: B394682
Report Date: 2013/10/21

MINTO EXPLORATIONS LTD.
Client Project #: MINTO ENV. MONITORING
Site Location: YUKON
Your P.O. #: 204253
Sampler Initials: PE

RESULTS OF CHEMICAL ANALYSES OF WATER

Maxxam ID		HV0180		HV0181		HV0182		HV0183		HV0184		
Sampling Date		2013/10/11 09:30		2013/10/11 10:30		2013/10/11 12:30		2013/10/11 00:00		2013/10/11 00:00		
	UNITS	**MW12-06-02**	**RDL**	**MW12-06-04**	**QC Batch**	**MW12-06-06**	**QC Batch**	**DUP**	**QC Batch**	**F-BL**	**RDL**	**QC Batch**
ANIONS												
Nitrite (N)	mg/L	0.302(1)	0.0050	0.167(1)	7232079	0.0896(1)	7232079	0.173(1)	7232079	<0.0050(1)	0.0050	7232079
Calculated Parameters												
Filter and HNO3 Preservation	N/A	FIELD	N/A	FIELD	ONSITE	FIELD	ONSITE	FIELD	ONSITE	FIELD	N/A	ONSITE
Nitrate (N)	mg/L	0.052	0.020	0.022	7227064	0.871	7227064	0.030	7227064	<0.020	0.020	7227064
Misc. Inorganics												
Fluoride (F)	mg/L	1.60	0.010	1.20	7236333	0.650	7236333	1.20	7236333	<0.010	0.010	7236333
Alkalinity (Total as CaCO3)	mg/L	340	0.50	395	7230217	309	7230217	390	7230217	0.50	0.50	7230217
Alkalinity (PP as CaCO3)	mg/L	<0.50	0.50	<0.50	7230217	<0.50	7230217	<0.50	7230217	<0.50	0.50	7230217
Bicarbonate (HCO3)	mg/L	415	0.50	482	7230217	377	7230217	476	7230217	0.61	0.50	7230217
Carbonate (CO3)	mg/L	<0.50	0.50	<0.50	7230217	<0.50	7230217	<0.50	7230217	<0.50	0.50	7230217
Hydroxide (OH)	mg/L	<0.50	0.50	<0.50	7230217	<0.50	7230217	<0.50	7230217	<0.50	0.50	7230217
Anions												
Dissolved Sulphate (SO4)	mg/L	227	5.0	161	7232016	158	7234526	159	7232016	0.80	0.50	7232016
Dissolved Chloride (Cl)	mg/L	3.1	0.50	0.94	7231993	<0.50	7231993	0.92	7231993	<0.50	0.50	7231993
Nutrients												
Ammonia (N)	mg/L	0.052	0.0050	0.019	7231997	0.018	7231997	0.018	7231997	0.0065	0.0050	7237257
Nitrate plus Nitrite (N)	mg/L	0.354(1)	0.020	0.190(1)	7232075	0.960(1)	7232075	0.203(1)	7232075	<0.020(1)	0.020	7232075
Physical Properties												
Conductivity	uS/cm	994	1.0	968	7230273	824	7230273	952	7230273	1.7	1.0	7230273
pH	pH Units	8.16		8.12	7230270	8.25	7230270	8.15	7230270	5.87		7230270
Physical Properties												
Total Suspended Solids	mg/L	43.6	1.0	4.4	7229448	1.4	7229448	6.6	7229448	<1.0	1.0	7229448
Total Dissolved Solids	mg/L	686	10	620	7229690	528	7229690	634	7229690	18	10	7229690

N/A = Not Applicable
RDL = Reportable Detection Limit
(1) - Sample arrived to laboratory past recommended hold time.

Maxxam Job #: B394682
Report Date: 2013/10/21

MINTO EXPLORATIONS LTD.
Client Project #: MINTO ENV. MONITORING
Site Location: YUKON
Your P.O. #: 204253
Sampler Initials: PE

CCME DISSOLVED METALS IN WATER (WATER)

Maxxam ID		HV0180	HV0181	HV0182	HV0183	HV0184		
Sampling Date		2013/10/11 09:30	2013/10/11 10:30	2013/10/11 12:30	2013/10/11 00:00	2013/10/11 00:00		
	UNITS	**MW12-06-02**	**MW12-06-04**	**MW12-06-06**	**DUP**	**F-BL**	**RDL**	**QC Batch**
Misc. Inorganics								
Dissolved Hardness ($CaCO_3$)	mg/L	462	506	420	503	<0.50	0.50	7227062
Elements								
Dissolved Mercury (Hg)	ug/L	<0.010	<0.010	<0.010	<0.010	<0.010	0.010	7237933
Dissolved Metals by ICPMS								
Dissolved Aluminum (Al)	ug/L	6.1	<3.0	<3.0	7.9	<3.0	3.0	7234454
Dissolved Antimony (Sb)	ug/L	<0.50	<0.50	<0.50	<0.50	<0.50	0.50	7234454
Dissolved Arsenic (As)	ug/L	6.01	1.99	<0.10	2.14	<0.10	0.10	7234454
Dissolved Barium (Ba)	ug/L	26.3	20.0	14.4	19.9	<1.0	1.0	7234454
Dissolved Beryllium (Be)	ug/L	<0.10	<0.10	<0.10	<0.10	<0.10	0.10	7234454
Dissolved Bismuth (Bi)	ug/L	<1.0	<1.0	<1.0	<1.0	<1.0	1.0	7234454
Dissolved Boron (B)	ug/L	524	145	77	151	<50	50	7234454
Dissolved Cadmium (Cd)	ug/L	0.018	<0.010	<0.010	0.039	<0.010	0.010	7234454
Dissolved Chromium (Cr)	ug/L	<1.0	<1.0	<1.0	<1.0	<1.0	1.0	7234454
Dissolved Cobalt (Co)	ug/L	<0.50	<0.50	<0.50	<0.50	<0.50	0.50	7234454
Dissolved Copper (Cu)	ug/L	0.42	0.38	0.47	0.70	0.37	0.20	7234454
Dissolved Iron (Fe)	ug/L	1670	713	19.7	759	8.9	5.0	7234454
Dissolved Lead (Pb)	ug/L	<0.20	<0.20	<0.20	<0.20	<0.20	0.20	7234454
Dissolved Lithium (Li)	ug/L	12.8	7.7	5.3	8.1	<5.0	5.0	7234454
Dissolved Manganese (Mn)	ug/L	45.6	56.5	55.3	57.8	<1.0	1.0	7234454
Dissolved Molybdenum (Mo)	ug/L	8.2	7.4	5.2	8.1	<1.0	1.0	7234454
Dissolved Nickel (Ni)	ug/L	<1.0	<1.0	<1.0	1.1	<1.0	1.0	7234454
Dissolved Phosphorus (P)	ug/L	19	<10	<10	13	<10	10	7234454
Dissolved Selenium (Se)	ug/L	0.18	<0.10	0.18	0.12	<0.10	0.10	7234454
Dissolved Silicon (Si)	ug/L	10500	8610	7030	8420	<100	100	7234454
Dissolved Silver (Ag)	ug/L	<0.020	<0.020	<0.020	<0.020	<0.020	0.020	7234454
Dissolved Strontium (Sr)	ug/L	11600	2880	1560	2830	<1.0	1.0	7234454
Dissolved Thallium (Tl)	ug/L	<0.050	<0.050	<0.050	<0.050	<0.050	0.050	7234454
Dissolved Tin (Sn)	ug/L	<5.0	<5.0	<5.0	<5.0	<5.0	5.0	7234454
Dissolved Titanium (Ti)	ug/L	<5.0	<5.0	<5.0	<5.0	<5.0	5.0	7234454
Dissolved Uranium (U)	ug/L	1.75	5.83	3.52	5.69	<0.10	0.10	7234454
Dissolved Vanadium (V)	ug/L	<5.0	<5.0	<5.0	<5.0	<5.0	5.0	7234454
Dissolved Zinc (Zn)	ug/L	<5.0	<5.0	5.3	7.1	<5.0	5.0	7234454
Dissolved Zirconium (Zr)	ug/L	<0.50	<0.50	<0.50	<0.50	<0.50	0.50	7234454
Dissolved Calcium (Ca)	mg/L	137	104	82.7	104	<0.050	0.050	7227063

RDL = Reportable Detection Limit

Maxxam Job #: B394682
Report Date: 2013/10/21

MINTO EXPLORATIONS LTD.
Client Project #: MINTO ENV. MONITORING
Site Location: YUKON
Your P.O. #: 204253
Sampler Initials: PE

CCME DISSOLVED METALS IN WATER (WATER)

Maxxam ID		HV0180	HV0181	HV0182	HV0183	HV0184		
Sampling Date		2013/10/11 09:30	2013/10/11 10:30	2013/10/11 12:30	2013/10/11 00:00	2013/10/11 00:00		
	UNITS	**MW12-06-02**	**MW12-06-04**	**MW12-06-06**	**DUP**	**F-BL**	**RDL**	**QC Batch**
Dissolved Magnesium (Mg)	mg/L	29.2	59.7	51.8	59.3	<0.050	0.050	7227063
Dissolved Potassium (K)	mg/L	3.59	3.95	3.55	3.72	<0.050	0.050	7227063
Dissolved Sodium (Na)	mg/L	51.3	36.7	32.0	36.2	<0.050	0.050	7227063
Dissolved Sulphur (S)	mg/L	75.9	58.3	54.6	58.8	<3.0	3.0	7227063

RDL = Reportable Detection Limit

General Comments

Sample HV0180-01: The BC-MOE and APHA Standard Method require pH to be analysed within 15 minutes of sampling and therefore field analysis is required for compliance. All Laboratory pH analyses in this report are reported past the BC-MOE/APHA Standard Method holding time.

Sample HV0181-01: The BC-MOE and APHA Standard Method require pH to be analysed within 15 minutes of sampling and therefore field analysis is required for compliance. All Laboratory pH analyses in this report are reported past the BC-MOE/APHA Standard Method holding time.

Sample HV0182-01: The BC-MOE and APHA Standard Method require pH to be analysed within 15 minutes of sampling and therefore field analysis is required for compliance. All Laboratory pH analyses in this report are reported past the BC-MOE/APHA Standard Method holding time.

Sample HV0183-01: The BC-MOE and APHA Standard Method require pH to be analysed within 15 minutes of sampling and therefore field analysis is required for compliance. All Laboratory pH analyses in this report are reported past the BC-MOE/APHA Standard Method holding time.

Sample HV0184-01: The BC-MOE and APHA Standard Method require pH to be analysed within 15 minutes of sampling and therefore field analysis is required for compliance. All Laboratory pH analyses in this report are reported past the BC-MOE/APHA Standard Method holding time.

Maxxam Job #: B394682
Report Date: 2013/10/21

MINTO EXPLORATIONS LTD.
Client Project #: MINTO ENV. MONITORING
Site Location: YUKON
Your P.O. #: 204253
Sampler Initials: PE

QUALITY ASSURANCE REPORT

			Matrix Spike		Spiked Blank		Method Blank		RPD	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits
7229448	Total Suspended Solids	2013/10/17			95	80 - 120	<1.0	mg/L		
7229690	Total Dissolved Solids	2013/10/17	NC	80 - 120	92	80 - 120	<10	mg/L	2.1	20
7230217	Alkalinity (Total as CaCO3)	2013/10/16	NC	80 - 120	93	80 - 120	<0.50	mg/L	7.6	20
7230217	Alkalinity (PP as CaCO3)	2013/10/16					<0.50	mg/L	NC	20
7230217	Bicarbonate (HCO3)	2013/10/16					<0.50	mg/L	7.6	20
7230217	Carbonate (CO3)	2013/10/16					<0.50	mg/L	NC	20
7230217	Hydroxide (OH)	2013/10/16					<0.50	mg/L	NC	20
7230273	Conductivity	2013/10/17			98	80 - 120	1.2, RDL=1.0	uS/cm	0.2	20
7231993	Dissolved Chloride (Cl)	2013/10/16	109	80 - 120			<0.50	mg/L	NC	20
7231997	Ammonia (N)	2013/10/16	110	80 - 120	98	80 - 120	<0.0050	mg/L	NC	20
7232016	Dissolved Sulphate (SO4)	2013/10/16	NC	80 - 120	102	80 - 120	0.84, RDL=0.50	mg/L	0.1	20
7232075	Nitrate plus Nitrite (N)	2013/10/16	102	80 - 120	106	80 - 120	<0.020	mg/L	9.7	25
7232079	Nitrite (N)	2013/10/16	101	80 - 120	102	80 - 120	<0.0050	mg/L	5.2	20
7234454	Dissolved Aluminum (Al)	2013/10/18	105	80 - 120	107	80 - 120	<3.0	ug/L	NC	20
7234454	Dissolved Antimony (Sb)	2013/10/18	104	80 - 120	100	80 - 120	<0.50	ug/L	NC	20
7234454	Dissolved Arsenic (As)	2013/10/18	105	80 - 120	98	80 - 120	<0.10	ug/L	NC	20
7234454	Dissolved Barium (Ba)	2013/10/18	NC	80 - 120	99	80 - 120	<1.0	ug/L	1.1	20
7234454	Dissolved Beryllium (Be)	2013/10/18	107	80 - 120	104	80 - 120	<0.10	ug/L	NC	20
7234454	Dissolved Bismuth (Bi)	2013/10/18	83	80 - 120	89	80 - 120	<1.0	ug/L	NC	20
7234454	Dissolved Cadmium (Cd)	2013/10/18	98	80 - 120	99	80 - 120	<0.010	ug/L	NC	20
7234454	Dissolved Chromium (Cr)	2013/10/18	97	80 - 120	100	80 - 120	<1.0	ug/L	NC	20
7234454	Dissolved Cobalt (Co)	2013/10/18	93	80 - 120	97	80 - 120	<0.50	ug/L	NC	20
7234454	Dissolved Copper (Cu)	2013/10/18	93	80 - 120	99	80 - 120	<0.20	ug/L	NC	20
7234454	Dissolved Iron (Fe)	2013/10/18	102	80 - 120	113	80 - 120	<5.0	ug/L	NC	20
7234454	Dissolved Lead (Pb)	2013/10/18	94	80 - 120	94	80 - 120	<0.20	ug/L	NC	20
7234454	Dissolved Lithium (Li)	2013/10/18	NC	80 - 120	110	80 - 120	<5.0	ug/L	NC	20
7234454	Dissolved Manganese (Mn)	2013/10/18	NC	80 - 120	101	80 - 120	<1.0	ug/L	1.1	20
7234454	Dissolved Molybdenum (Mo)	2013/10/18	NC	80 - 120	97	80 - 120	<1.0	ug/L	8.3	20
7234454	Dissolved Nickel (Ni)	2013/10/18	92	80 - 120	99	80 - 120	<1.0	ug/L	NC	20
7234454	Dissolved Selenium (Se)	2013/10/18	104	80 - 120	105	80 - 120	<0.10	ug/L	NC	20
7234454	Dissolved Silver (Ag)	2013/10/18	96	80 - 120	96	80 - 120	<0.020	ug/L	NC	20
7234454	Dissolved Strontium (Sr)	2013/10/18	NC	80 - 120	98	80 - 120	<1.0	ug/L	1.7	20
7234454	Dissolved Thallium (Tl)	2013/10/18	97	80 - 120	104	80 - 120	<0.050	ug/L	NC	20
7234454	Dissolved Tin (Sn)	2013/10/18	96	80 - 120	95	80 - 120	<5.0	ug/L	NC	20
7234454	Dissolved Titanium (Ti)	2013/10/18	102	80 - 120	104	80 - 120	<5.0	ug/L	NC	20
7234454	Dissolved Uranium (U)	2013/10/18	95	80 - 120	93	80 - 120	<0.10	ug/L	5.4	20
7234454	Dissolved Vanadium (V)	2013/10/18	99	80 - 120	98	80 - 120	<5.0	ug/L	NC	20
7234454	Dissolved Zinc (Zn)	2013/10/18	NC	80 - 120	100	80 - 120	<5.0	ug/L	NC	20
7234454	Dissolved Boron (B)	2013/10/18					<50	ug/L	NC	20

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Success Through Science®

Maxxam Job #: B394682
Report Date: 2013/10/21

MINTO EXPLORATIONS LTD.
Client Project #: MINTO ENV. MONITORING
Site Location: YUKON
Your P.O. #: 204253
Sampler Initials: PE

QUALITY ASSURANCE REPORT

			Matrix Spike		Spiked Blank		Method Blank		RPD	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits
7234454	Dissolved Phosphorus (P)	2013/10/18					<10	ug/L	NC	20
7234454	Dissolved Silicon (Si)	2013/10/18					<100	ug/L	0.3	20
7234454	Dissolved Zirconium (Zr)	2013/10/18					<0.50	ug/L	NC	20
7234526	Dissolved Sulphate (SO4)	2013/10/17	NC	80 - 120	97	80 - 120	0.99, RDL=0.50	mg/L	NC	20
7236333	Fluoride (F)	2013/10/17	101	80 - 120	96	80 - 120	<0.010	mg/L	NC	20
7237257	Ammonia (N)	2013/10/18	114	80 - 120	99	80 - 120	0.0062, RDL=0.0050	mg/L	3.2	20
7237933	Dissolved Mercury (Hg)	2013/10/20	118	80 - 120	107	80 - 120	<0.010	ug/L	NC	20

N/A = Not Applicable
RDL = Reportable Detection Limit
RPD = Relative Percent Difference
Duplicate: Paired analysis of a separate portion of the same sample. Used to evaluate the variance in the measurement.
Matrix Spike: A sample to which a known amount of the analyte of interest has been added. Used to evaluate sample matrix interference.
Spiked Blank: A blank matrix sample to which a known amount of the analyte, usually from a second source, has been added. Used to evaluate method accuracy.
Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.
NC (Matrix Spike): The recovery in the matrix spike was not calculated. The relative difference between the concentration in the parent sample and the spiked amount was not sufficiently significant to permit a reliable recovery calculation.
NC (RPD): The RPD was not calculated. The level of analyte detected in the parent sample and its duplicate was not sufficiently significant to permit a reliable calculation.

Validation Signature Page

Maxxam Job #: B394682

The analytical data and all QC contained in this report were reviewed and validated by the following individual(s).

Rob Reinert, Data Validation Coordinator

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Maxxam has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per section 5.10.2 of ISO/IEC 17025:2005(E), signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

Maxxam

Burnaby: 4606 Canada Way, Burnaby, BC V5G 1K5 Ph: (604) 734-7276 Fax: (604) 731-2386, Toll Free: (800) 665-8566

CHAIN OF CUSTODY RECORD

Click here to get the COC number

Maxxam Job #: B394682 **COC #:** EB864413 Page: 1 of 1

Invoice To: Require Report? Yes ☑ No ☐

Invoice To	
Company Name:	Minto Explorations Ltd
Contact Name:	Elvina Wong
Address:	Suite 900 - 999 West Hastings St
	Vancouver, B.C. PC: V6C 2W2
Phone / Fax#:	Ph: 604-684-8894 Fax: 604-688-2120
E-mail	

Report To:

Report To	
Company Name:	Minto Explorations Ltd
Contact Name:	Minto Environment
Address:	Suite 900-999 West Hastings St
	Vancouver, B.C. PC: V6C 2W2
Phone / Fax#:	Ph: 604-684-8894 Fax: 604-688-2120
E-mail	minto_environment@mintomine.com

PO #:	204253
Quotation #:	
Project # :	
Proj. Name:	Minto Env. Monitoring
Location:	Yukon
Sampled by:	PE

REGULATORY REQUIREMENTS:

- ☐ CSR
- ☑ CCME
- ☐ BC Water Quality
- ☐ Other
- ☐ DRINKING WATER

SERVICE REQUESTED:

- ◉ Regular Turn Around Time (TAT) (5 days for most tests)
- **RUSH** (Please contact the lab) ○ 1 Day ○ 2 Day ○ 3 Day
- Date Required:

SPECIAL INSTRUCTIONS:

Return Cooler ☐ **Ship Sample Bottles (please specify)** ☐

ANALYSIS REQUESTED

#	Sample Identification	Lab Identification (Lab Use Only)	Sample Type	Date/Time(24hr) Sampled	Dissolved Metals (DM) (Field Filtered? Y ☑ N ☐)	Metals (DM) (Field Acidified? Y ☑ N ☐)	Total Metals (Field Acidified? Y ☑ N ☐)	Nitrate ☑ Nitrite ☑ Ammonia ☑	Total Suspended Solids (TSS) ☑ TDS ☑	pH ☑ Conductivity ☑ Alkalinity ☑	Chloride ☑ Fluoride ☑ Sulphate ☑	Phosphate	DOC (Diss'd Organic Carbon)	TOC (Total Organic Carbon)	Ra 226	Number of Containers
1	MW12-06-02 HV0180		Water	10/11/13 9:30	X	X		X	X	X	X					4
2	MW12-06-04 HV0182	HV0181	Water	10/11/13 10:30	X	X		X	X	X	X					4
3	MW12-06-06 HV0183	HV0182	Water	10/11/13 12:30	X	X		X	X	X	X					4
4	DUP HV0184	HV0183	Water	10/11/13 0:00	X	X		X	X	X	X					4
5	F-BL HV0185	HV0184	Water	10/11/13 0:00	X	X		X	X	X	X					4
6	20131015															
7																
8																
9																
10																
11																
12																

B394682

Print name and sign

*Relinquished By:	Date (yy/mm/dd):	Time (24hr):	Received by (Print name and sign)	Date (yy/mm/dd)	Time (24 hr)	Time Sensitive
Phil Emerson	12-Oct-13	7:00	[signature]	13/10/15	09:10	☑

Laboratory Use Only

Temperature on Receipt (°C)	Custody Seal	Yes	No
A) B) C)	Present?	☐	☒
Just sampled & rec'd on ice ☐	Intact?	☐	☐

*IT IS THE RESPONSIBILITY OF THE RELINQUISHER TO ENSURE THE ACCURACY OF THE CHAIN OF CUSTODY RECORDS. AN INCOMPLETE CHAIN OF CUSTODY MAY RESULT IN ANALYTICAL TAT DELAYS.

Maxxam

Success Through Science®

Your P.O. #: 204253
Your Project #: MINTO ENV.MONITORING
Site Location: YUKON
Your C.O.C. #: EB864113

Attention: MINTO DISTRIBUTION LIST
MINTO EXPLORATIONS LTD.
Yukon/Whitehorse
2 - 25 Pilgrim Way
Whitehorse, YT
CANADA Y1A 6E6

Report Date: 2013/10/22

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B395230
Received: 2013/10/16, 09:30

Sample Matrix: Water
Samples Received: 5

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Analytical Method
Alkalinity - Water	5	2013/10/17	2013/10/17	BBY6SOP-00026	SM2320B
Chloride by Automated Colourimetry	5	N/A	2013/10/17	BBY6SOP-00011	SM-4500-Cl-
Conductance - water	5	N/A	2013/10/17	BBY6SOP-00026	SM-2510B
Fluoride	5	N/A	2013/10/21	BBY6SOP-00012	SM - 4500 F C
Hardness (calculated as CaCO3)	5	N/A	2013/10/18	BBY7SOP-00002	EPA 6020A
Mercury (Dissolved) by CVAF	1	N/A	2013/10/20	BBY7SOP-00015	EPA 245.7
Mercury (Dissolved) by CVAF	4	N/A	2013/10/22	BBY7SOP-00015	EPA 245.7
Na, K, Ca, Mg, S by CRC ICPMS (diss.)	5	N/A	2013/10/18	BBY7SOP-00002	EPA 6020A
Elements by CRC ICPMS (dissolved)	5	N/A	2013/10/18	BBY7SOP-00002	EPA 6020A
Ammonia-N (Preserved)	5	N/A	2013/10/17	BBY6SOP-00009	SM-4500NH3G
Nitrate + Nitrite (N)	5	N/A	2013/10/17	BBY6SOP-00010	SM 4500NO3-I
Nitrite (N) by CFA	5	N/A	2013/10/17	BBY6SOP-00010	EPA 353.2
Nitrogen - Nitrate (as N)	5	N/A	2013/10/18	BBY6SOP-00010	SM 4500NO3-I
Filter and HNO3 Preserve for Metals	5	N/A	2013/10/16	BBY6WI-00001	EPA 200.2
pH Water	5	N/A	2013/10/17	BBY6SOP-00026	SM-4500H+B
Sulphate by Automated Colourimetry	4	N/A	2013/10/17	BBY6SOP-00017	SM4500-SO42- E
Sulphate by Automated Colourimetry	1	N/A	2013/10/18	BBY6SOP-00017	SM4500-SO42- E
Total Dissolved Solids (Filt. Residue)	5	2013/10/17	2013/10/18	BBY6SOP-00033	SM 2540C
Total Suspended Solids-Low Level	5	2013/10/17	2013/10/18	BBY6SOP-00034	SM-2540 D

* Results relate only to the items tested.

Encryption Key

Please direct all questions regarding this Certificate of Analysis to your Project Manager.

Ken Pomeroy, Project Manager
Email: KPomeroy@maxxam.ca
Phone# (604) 638-5020

==
This report has been generated and distributed using a secure automated process.
Maxxam has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per section 5.10.2 of ISO/IEC 17025:2005(E), signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

Total cover pages: 1

Maxxam

Maxxam Job #: B395230
Report Date: 2013/10/22

MINTO EXPLORATIONS LTD.
Client Project #: MINTO ENV.MONITORING
Site Location: YUKON
Your P.O. #: 204253
Sampler Initials: PE

RESULTS OF CHEMICAL ANALYSES OF WATER

Maxxam ID		HV2987	HV2988		HV2989		HV2990			HV2991		
Sampling Date		2013/10/10 12:15	2013/10/10 13:15		2013/10/10 15:30		2013/10/10 16:00			2013/10/10 00:00		
	UNITS	**MW12-05-01**	**MW12-05-02**	**RDL**	**MW12-05-03**	**QC Batch**	**MW12-05-04**	**RDL**	**QC Batch**	**DUP**	**RDL**	**QC Batch**
ANIONS												
Nitrite (N)	mg/L	0.195(1)	0.0565(1)	0.0050	0.160(1)	7235442	<0.0050(1)	0.0050	7235442	0.110(1)	0.0050	7235442
Calculated Parameters												
Filter and HNO3 Preservation	N/A	FIELD	FIELD	N/A	FIELD	ONSITE	FIELD	N/A	ONSITE	FIELD	N/A	ONSITE
Nitrate (N)	mg/L	<0.020	<0.020	0.020	0.467	7229544	<0.020	0.020	7229544	<0.020	0.020	7229544
Misc. Inorganics												
Fluoride (F)	mg/L	1.10	1.10	0.010	0.570	7239926	0.540	0.010	7239926	1.10	0.010	7239926
Alkalinity (Total as CaCO3)	mg/L	210	301	0.50	214	7233914	246	0.50	7233914	303	0.50	7233914
Alkalinity (PP as CaCO3)	mg/L	<0.50	<0.50	0.50	<0.50	7233914	<0.50	0.50	7233914	<0.50	0.50	7233914
Bicarbonate (HCO3)	mg/L	257	367	0.50	261	7233914	300	0.50	7233914	370	0.50	7233914
Carbonate (CO3)	mg/L	<0.50	<0.50	0.50	<0.50	7233914	<0.50	0.50	7233914	<0.50	0.50	7233914
Hydroxide (OH)	mg/L	<0.50	<0.50	0.50	<0.50	7233914	<0.50	0.50	7233914	<0.50	0.50	7233914
Anions												
Dissolved Sulphate (SO4)	mg/L	532	686	5.0	42.5	7234526	18.5	0.50	7236924	692	5.0	7234526
Dissolved Chloride (Cl)	mg/L	13	8.5	0.50	3.7	7234512	3.7	0.50	7234512	8.5	0.50	7234512
Nutrients												
Ammonia (N)	mg/L	0.37	0.066	0.0050	0.014	7234456	0.068	0.0050	7234456	0.10	0.0050	7234456
Nitrate plus Nitrite (N)	mg/L	0.210(1)	0.063(1)	0.020	0.627(1)	7235431	<0.020(1)	0.020	7235431	0.116(1)	0.020	7235431
Physical Properties												
Conductivity	uS/cm	1320	1630	1.0	466	7233959	480	1.0	7233959	1640	1.0	7233959
pH	pH Units	8.23	8.10		8.26	7233958	8.23		7233958	8.14		7233958
Physical Properties												
Total Suspended Solids	mg/L	1.2	5.4	1.0	<1.0	7232641	3.0	1.0	7232641	6.2	1.0	7232641
Total Dissolved Solids	mg/L	1030	1330	10	292	7232846	306	10	7232846	1330	10	7232846

N/A = Not Applicable
RDL = Reportable Detection Limit
(1) - Sample arrived to laboratory past recommended hold time.

Maxxam

Maxxam Job #: B395230
Report Date: 2013/10/22

MINTO EXPLORATIONS LTD.
Client Project #: MINTO ENV.MONITORING
Site Location: YUKON
Your P.O. #: 204253
Sampler Initials: PE

CCME DISSOLVED METALS IN WATER (WATER)

Maxxam ID		HV2987		HV2988	HV2989	HV2990	HV2991		
Sampling Date		2013/10/10 12:15		2013/10/10 13:15	2013/10/10 15:30	2013/10/10 16:00	2013/10/10 00:00		
	UNITS	**MW12-05-01**	**QC Batch**	**MW12-05-02**	**MW12-05-03**	**MW12-05-04**	**DUP**	**RDL**	**QC Batch**
Misc. Inorganics									
Dissolved Hardness (CaCO3)	mg/L	534	7229315	744	219	223	729	0.50	7229315
Elements									
Dissolved Mercury (Hg)	ug/L	<0.010	7237933	<0.010	<0.010	<0.010	<0.010	0.010	7241914
Dissolved Metals by ICPMS									
Dissolved Aluminum (Al)	ug/L	6.4	7234242	4.5	4.1	5.3	13.7	3.0	7234242
Dissolved Antimony (Sb)	ug/L	<0.50	7234242	<0.50	<0.50	<0.50	<0.50	0.50	7234242
Dissolved Arsenic (As)	ug/L	1.85	7234242	0.50	1.22	0.53	0.47	0.10	7234242
Dissolved Barium (Ba)	ug/L	92.8	7234242	76.8	78.9	797	77.2	1.0	7234242
Dissolved Beryllium (Be)	ug/L	<0.10	7234242	<0.10	<0.10	<0.10	<0.10	0.10	7234242
Dissolved Bismuth (Bi)	ug/L	<1.0	7234242	<1.0	<1.0	<1.0	<1.0	1.0	7234242
Dissolved Boron (B)	ug/L	276	7234242	80	84	<50	145	50	7234242
Dissolved Cadmium (Cd)	ug/L	<0.010	7234242	<0.010	<0.010	<0.010	<0.010	0.010	7234242
Dissolved Chromium (Cr)	ug/L	<1.0	7234242	<1.0	<1.0	<1.0	<1.0	1.0	7234242
Dissolved Cobalt (Co)	ug/L	<0.50	7234242	<0.50	<0.50	<0.50	<0.50	0.50	7234242
Dissolved Copper (Cu)	ug/L	<0.20	7234242	0.23	1.19	0.20	<0.20	0.20	7234242
Dissolved Iron (Fe)	ug/L	21.8	7234242	1900	44.0	387	1960	5.0	7234242
Dissolved Lead (Pb)	ug/L	<0.20	7234242	<0.20	<0.20	<0.20	<0.20	0.20	7234242
Dissolved Lithium (Li)	ug/L	6.4	7234242	6.4	<5.0	<5.0	6.3	5.0	7234242
Dissolved Manganese (Mn)	ug/L	101	7234242	2520	311	499	2580	1.0	7234242
Dissolved Molybdenum (Mo)	ug/L	<1.0	7234242	<1.0	4.7	2.2	<1.0	1.0	7234242
Dissolved Nickel (Ni)	ug/L	1.1	7234242	<1.0	1.5	<1.0	<1.0	1.0	7234242
Dissolved Phosphorus (P)	ug/L	18	7234242	18	<10	74	14	10	7234242
Dissolved Selenium (Se)	ug/L	0.90	7234242	<0.10	0.17	0.30	<0.10	0.10	7234242
Dissolved Silicon (Si)	ug/L	7100	7234242	8070	6340	6660	8060	100	7234242
Dissolved Silver (Ag)	ug/L	<0.020	7234242	<0.020	<0.020	<0.020	<0.020	0.020	7234242
Dissolved Strontium (Sr)	ug/L	4710	7234242	7730	757	626	7660	1.0	7234242
Dissolved Thallium (Tl)	ug/L	<0.050	7234242	<0.050	<0.050	<0.050	<0.050	0.050	7234242
Dissolved Tin (Sn)	ug/L	<5.0	7234242	<5.0	<5.0	<5.0	<5.0	5.0	7234242
Dissolved Titanium (Ti)	ug/L	<5.0	7234242	<5.0	<5.0	<5.0	<5.0	5.0	7234242
Dissolved Uranium (U)	ug/L	0.89	7234242	0.36	2.44	0.54	0.35	0.10	7234242
Dissolved Vanadium (V)	ug/L	<5.0	7234242	<5.0	<5.0	<5.0	<5.0	5.0	7234242
Dissolved Zinc (Zn)	ug/L	<5.0	7234242	<5.0	6.8	<5.0	<5.0	5.0	7234242
Dissolved Zirconium (Zr)	ug/L	<0.50	7234242	<0.50	<0.50	<0.50	<0.50	0.50	7234242
Dissolved Calcium (Ca)	mg/L	168	7229542	189	43.9	49.0	183	0.050	7229542

RDL = Reportable Detection Limit

Maxxam

Maxxam Job #: B395230
Report Date: 2013/10/22

MINTO EXPLORATIONS LTD.
Client Project #: MINTO ENV.MONITORING
Site Location: YUKON
Your P.O. #: 204253
Sampler Initials: PE

CCME DISSOLVED METALS IN WATER (WATER)

Maxxam ID		HV2987		HV2988	HV2989	HV2990	HV2991		
Sampling Date		2013/10/10 12:15		2013/10/10 13:15	2013/10/10 15:30	2013/10/10 16:00	2013/10/10 00:00		
	UNITS	**MW12-05-01**	**QC Batch**	**MW12-05-02**	**MW12-05-03**	**MW12-05-04**	**DUP**	**RDL**	**QC Batch**
Dissolved Magnesium (Mg)	mg/L	27.8	7229542	66.1	26.6	24.3	66.3	0.050	7229542
Dissolved Potassium (K)	mg/L	3.10	7229542	4.04	2.19	1.79	4.03	0.050	7229542
Dissolved Sodium (Na)	mg/L	96.3	7229542	101	18.2	18.4	104	0.050	7229542
Dissolved Sulphur (S)	mg/L	222	7229542	246	14.8	8.3	247	3.0	7229542

RDL = Reportable Detection Limit

General Comments

Sample HV2987-01: The BC-MOE and APHA Standard Method require pH to be analysed within 15 minutes of sampling and therefore field analysis is required for compliance. All Laboratory pH analyses in this report are reported past the BC-MOE/APHA Standard Method holding time.

Sample HV2988-01: The BC-MOE and APHA Standard Method require pH to be analysed within 15 minutes of sampling and therefore field analysis is required for compliance. All Laboratory pH analyses in this report are reported past the BC-MOE/APHA Standard Method holding time.

Sample HV2989-01: The BC-MOE and APHA Standard Method require pH to be analysed within 15 minutes of sampling and therefore field analysis is required for compliance. All Laboratory pH analyses in this report are reported past the BC-MOE/APHA Standard Method holding time.

Sample HV2990-01: The BC-MOE and APHA Standard Method require pH to be analysed within 15 minutes of sampling and therefore field analysis is required for compliance. All Laboratory pH analyses in this report are reported past the BC-MOE/APHA Standard Method holding time.

Sample HV2991-01: The BC-MOE and APHA Standard Method require pH to be analysed within 15 minutes of sampling and therefore field analysis is required for compliance. All Laboratory pH analyses in this report are reported past the BC-MOE/APHA Standard Method holding time.

Maxxam

Maxxam Job #: B395230
Report Date: 2013/10/22

MINTO EXPLORATIONS LTD.
Client Project #: MINTO ENV.MONITORING
Site Location: YUKON
Your P.O. #: 204253
Sampler Initials: PE

QUALITY ASSURANCE REPORT

			Matrix Spike		Spiked Blank		Method Blank		RPD	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits
7232641	Total Suspended Solids	2013/10/18			97	80 - 120	<1.0	mg/L		
7232846	Total Dissolved Solids	2013/10/18	NC	80 - 120	98	80 - 120	<10	mg/L	2.1	20
7233914	Alkalinity (Total as CaCO3)	2013/10/18	NC	80 - 120	97	80 - 120	<0.50	mg/L	0.6	20
7233914	Alkalinity (PP as CaCO3)	2013/10/18					<0.50	mg/L	NC	20
7233914	Bicarbonate (HCO3)	2013/10/18					<0.50	mg/L	0.6	20
7233914	Carbonate (CO3)	2013/10/18					<0.50	mg/L	NC	20
7233914	Hydroxide (OH)	2013/10/18					<0.50	mg/L	NC	20
7233959	Conductivity	2013/10/17			99	80 - 120	1.1, RDL=1.0	uS/cm	0.2	20
7234242	Dissolved Aluminum (Al)	2013/10/18	103	80 - 120	106	80 - 120	<3.0	ug/L	NC	20
7234242	Dissolved Antimony (Sb)	2013/10/18	100	80 - 120	98	80 - 120	<0.50	ug/L	NC	20
7234242	Dissolved Arsenic (As)	2013/10/18	103	80 - 120	101	80 - 120	<0.10	ug/L	NC	20
7234242	Dissolved Barium (Ba)	2013/10/18	NC	80 - 120	102	80 - 120	<1.0	ug/L	0	20
7234242	Dissolved Beryllium (Be)	2013/10/18	100	80 - 120	96	80 - 120	<0.10	ug/L	NC	20
7234242	Dissolved Bismuth (Bi)	2013/10/18	98	80 - 120	98	80 - 120	<1.0	ug/L	NC	20
7234242	Dissolved Cadmium (Cd)	2013/10/18	103	80 - 120	103	80 - 120	<0.010	ug/L	0.6	20
7234242	Dissolved Chromium (Cr)	2013/10/18	99	80 - 120	101	80 - 120	<1.0	ug/L	NC	20
7234242	Dissolved Cobalt (Co)	2013/10/18	99	80 - 120	101	80 - 120	<0.50	ug/L	NC	20
7234242	Dissolved Copper (Cu)	2013/10/18	95	80 - 120	101	80 - 120	<0.20	ug/L	NC	20
7234242	Dissolved Iron (Fe)	2013/10/18	99	80 - 120	98	80 - 120	<5.0	ug/L	NC	20
7234242	Dissolved Lead (Pb)	2013/10/18	94	80 - 120	96	80 - 120	<0.20	ug/L	1.3	20
7234242	Dissolved Lithium (Li)	2013/10/18	100	80 - 120	98	80 - 120	<5.0	ug/L	NC	20
7234242	Dissolved Manganese (Mn)	2013/10/18	102	80 - 120	106	80 - 120	<1.0	ug/L	NC	20
7234242	Dissolved Molybdenum (Mo)	2013/10/18	102	80 - 120	99	80 - 120	<1.0	ug/L	NC	20
7234242	Dissolved Nickel (Ni)	2013/10/18	102	80 - 120	102	80 - 120	<1.0	ug/L	NC	20
7234242	Dissolved Selenium (Se)	2013/10/18	105	80 - 120	101	80 - 120	<0.10	ug/L	NC	20
7234242	Dissolved Silver (Ag)	2013/10/18	106	80 - 120	100	80 - 120	<0.020	ug/L	NC	20
7234242	Dissolved Strontium (Sr)	2013/10/18	NC	80 - 120	103	80 - 120	<1.0	ug/L	0.3	20
7234242	Dissolved Thallium (Tl)	2013/10/18	55 (1)	80 - 120	100	80 - 120	<0.050	ug/L	NC	20
7234242	Dissolved Tin (Sn)	2013/10/18	98	80 - 120	99	80 - 120	<5.0	ug/L	NC	20
7234242	Dissolved Titanium (Ti)	2013/10/18	108	80 - 120	102	80 - 120	<5.0	ug/L	NC	20
7234242	Dissolved Uranium (U)	2013/10/18	96	80 - 120	97	80 - 120	<0.10	ug/L	NC	20
7234242	Dissolved Vanadium (V)	2013/10/18	102	80 - 120	101	80 - 120	<5.0	ug/L	NC	20
7234242	Dissolved Zinc (Zn)	2013/10/18	NC	80 - 120	102	80 - 120	<5.0	ug/L	1	20
7234242	Dissolved Boron (B)	2013/10/18					<50	ug/L	NC	20
7234242	Dissolved Phosphorus (P)	2013/10/18					<10	ug/L		
7234242	Dissolved Silicon (Si)	2013/10/18					<100	ug/L	3.7	20
7234242	Dissolved Zirconium (Zr)	2013/10/18					<0.50	ug/L	NC	20
7234456	Ammonia (N)	2013/10/17	100	80 - 120	100	80 - 120	<0.0050	mg/L	NC	20
7234512	Dissolved Chloride (Cl)	2013/10/17	NC	80 - 120	99	80 - 120	<0.50	mg/L	2.5	20

Maxxam Job #: B395230
Report Date: 2013/10/22

MINTO EXPLORATIONS LTD.
Client Project #: MINTO ENV.MONITORING
Site Location: YUKON
Your P.O. #: 204253
Sampler Initials: PE

QUALITY ASSURANCE REPORT

			Matrix Spike		Spiked Blank		Method Blank		RPD	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits
7234526	Dissolved Sulphate (SO4)	2013/10/17	NC	80 - 120	97	80 - 120	0.99, RDL=0.50	mg/L	NC	20
7235431	Nitrate plus Nitrite (N)	2013/10/17	93	80 - 120	103	80 - 120	<0.020	mg/L	0.4	25
7235442	Nitrite (N)	2013/10/17	99	80 - 120	98	80 - 120	<0.0050	mg/L	NC	20
7236924	Dissolved Sulphate (SO4)	2013/10/18	NC	80 - 120	100	80 - 120	0.53, RDL=0.50	mg/L	0.07	20
7237933	Dissolved Mercury (Hg)	2013/10/20	118	80 - 120	107	80 - 120	<0.010	ug/L	NC	20
7239926	Fluoride (F)	2013/10/21	98	80 - 120	98	80 - 120	<0.010	mg/L	0	20
7241914	Dissolved Mercury (Hg)	2013/10/22	85	80 - 120	99	80 - 120	<0.010	ug/L	NC	20

N/A = Not Applicable
RDL = Reportable Detection Limit
RPD = Relative Percent Difference
Duplicate: Paired analysis of a separate portion of the same sample. Used to evaluate the variance in the measurement.
Matrix Spike: A sample to which a known amount of the analyte of interest has been added. Used to evaluate sample matrix interference.
Spiked Blank: A blank matrix sample to which a known amount of the analyte, usually from a second source, has been added. Used to evaluate method accuracy.
Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.
NC (Matrix Spike): The recovery in the matrix spike was not calculated. The relative difference between the concentration in the parent sample and the spiked amount was not sufficiently significant to permit a reliable recovery calculation.
NC (RPD): The RPD was not calculated. The level of analyte detected in the parent sample and its duplicate was not sufficiently significant to permit a reliable calculation.
(1) - Recovery or RPD for this parameter is outside control limits. The overall quality control for this analysis meets acceptability criteria.

Success Through Science®

Validation Signature Page

Maxxam Job #: B395230

The analytical data and all QC contained in this report were reviewed and validated by the following individual(s).

Jennifer Villocero, Burnaby Sample Logins

Rob Reinert, Data Validation Coordinator

==

Maxxam has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per section 5.10.2 of ISO/IEC 17025:2005(E), signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

Burnaby: 4606 Canada Way, Burnaby, BC V5G 1K5 Ph: (604) 734-7276 Fax: (604) 731-2386, Toll Free: (800) 665-8566

Maxxam

CHAIN OF CUSTODY RECORD

Click here to get the COC number

Maxxam Job #: B395230 **COC #:** EB864113 Page: 1 of 1

Invoice To: Require Report? Yes ☑ No ☐

Invoice To		Report To	
Company Name:	Minto Explorations Ltd	Company Name:	Minto Explorations Ltd
Contact Name:	Elvina Wong	Contact Name:	Minto Environment
Address:	Suite 900 - 999 West Hastings St	Address:	Suite 900-999 West Hastings St
	Vancouver, B.C. PC: V6C 2W2		Vancouver, B.C. PC: V6C 2W2
Phone / Fax#:	Ph: 604-684-8894 Fax: 604-688-2120	Phone / Fax#:	Ph: 604-684-8894 Fax: 604-688-2120
E-mail		E-mail	minto_environment@mintomine.com

PO #:	204253
Quotation #:	
Project # :	
Proj. Name:	Minto Env. Monitoring
Location:	Yukon
Sampled by:	Phil Emerson- Chris Harry

REGULATORY REQUIREMENTS:

- ☐ CSR
- ☑ CCME
- ☐ BC Water Quality
- ☐ Other
- ☐ DRINKING WATER

SERVICE REQUESTED:

- ◉ Regular Turn Around Time (TAT) (5 days for most tests)
- **RUSH** (Please contact the lab) ○ 1 Day ○ 2 Day ○ 3 Day
- Date Required:

SPECIAL INSTRUCTIONS:

Return Cooler ☐ **Ship Sample Bottles (please specify)** ☐

ANALYSIS REQUESTED

#	Sample Identification	Lab Use Only: Lab Identification	Sample Type	Date/Time(24hr) Sampled	Field Filtered? Y ☑ N / Dissolved Metals (DM)	Field Acidified? Y ☑ N	Field Acidified? Y ☑ N / Total Metals	Nitrate ☑ Nitrite ☑ Ammonia ☑	Total Suspended Solids (TSS) ☑ TDS ☑	pH ☑ Conductivity ☑ Alkalinity ☑	Chloride ☑ Fluoride ☑ Sulphate ☑	Phosphate	DOC (Diss'd Organic Carbon)	TOC (Total Organic Carbon)	Ra 226	Number of Containers
1	MW12-05-01	HV2987	Ground W	10/10/13 12:15	X	X		X	X	X	X					4
2	MW12-05-02	HV2988	Ground W	10/10/13 13:15	X	X		X	X	X	X					4
3	MW12-05-03	HV2989	Ground W	10/10/13 15:30	X	X		X	X	X	X					4
4	MW12-05-04	HV2990	Ground W	10/10/13 16:00	X	X		X	X	X	X					4
5	DUP	HV2991	Ground W	10/10/13 0:00	X	X		X	X	X	X					4
6																
7																
8																
9																
10																
11																
12																

B395230

Print name and sign / Print name and sign / Laboratory Use Only

*Relinquished By:	Date (yy/mm/dd):	Time (24hr):	Received by:	Date (yy/mm/dd)	Time (24 hr)	Time Sensitive	Temperature on Receipt (°C)	Custody Seal	Yes	No
Chris Harry	11-Oct-13	8:00	[illegible signature]	2013/10/16	09:30	☑	A: 6 B: 6 C: 6	Present? N/A	☐	☐
			lin				Just sampled & cold on ice ☐	Intact?	☐	☐

*IT IS THE RESPONSIBILITY OF THE RELINQUISHER TO ENSURE THE ACCURACY OF THE CHAIN OF CUSTODY RECORDS. AN INCOMPLETE CHAIN OF CUSTODY MAY RESULT IN ANALYTICAL TAT DELAYS.

Success Through Science®

Your P.O. #: 204253
Your Project #: MINTO ENV. MONITORING
Site Location: YUKON
Your C.O.C. #: EB866113

Attention: MINTO DISTRIBUTION LIST
MINTO EXPLORATIONS LTD.
Yukon/Whitehorse
2 - 25 Pilgrim Way
Whitehorse, YT
CANADA Y1A 6E6

Report Date: 2013/10/23

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B395346
Received: 2013/10/16, 14:00

Sample Matrix: Water
Samples Received: 3

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Analytical Method
Alkalinity - Water	3	2013/10/17	2013/10/17	BBY6SOP-00026	SM2320B
Chloride by Automated Colourimetry	2	N/A	2013/10/17	BBY6SOP-00011	SM-4500-Cl-
Conductance - water	3	N/A	2013/10/17	BBY6SOP-00026	SM-2510B
Fluoride	2	N/A	2013/10/23	BBY6SOP-00012	SM - 4500 F C
Hardness (calculated as CaCO3)	3	N/A	2013/10/21	BBY7SOP-00002	EPA 6020A
Mercury (Dissolved) by CVAF	3	N/A	2013/10/20	BBY7SOP-00015	EPA 245.7
Na, K, Ca, Mg, S by CRC ICPMS (diss.)	3	N/A	2013/10/21	BBY7SOP-00002	EPA 6020A
Elements by CRC ICPMS (dissolved)	3	N/A	2013/10/18	BBY7SOP-00002	EPA 6020A
Ammonia-N (Preserved)	3	N/A	2013/10/17	BBY6SOP-00009	SM-4500NH3G
Nitrate + Nitrite (N)	3	N/A	2013/10/17	BBY6SOP-00010	SM 4500NO3-I
Nitrite (N) by CFA	3	N/A	2013/10/17	BBY6SOP-00010	EPA 353.2
Nitrogen - Nitrate (as N)	3	N/A	2013/10/18	BBY6SOP-00010	SM 4500NO3-I
Filter and HNO3 Preserve for Metals	3	N/A	2013/10/16	BBY6WI-00001	EPA 200.2
pH Water	3	N/A	2013/10/17	BBY6SOP-00026	SM-4500H+B
Sulphate by Automated Colourimetry	2	N/A	2013/10/17	BBY6SOP-00017	SM4500-SO42- E
Total Dissolved Solids (Filt. Residue)	3	2013/10/17	2013/10/18	BBY6SOP-00033	SM 2540C

* Results relate only to the items tested.

Encryption Key

Please direct all questions regarding this Certificate of Analysis to your Project Manager.

Ken Pomeroy, Project Manager
Email: KPomeroy@maxxam.ca
Phone# (604) 638-5020

==
This report has been generated and distributed using a secure automated process.
Maxxam has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per section 5.10.2 of ISO/IEC 17025:2005(E), signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

Total cover pages: 1

Maxxam Job #: B395346
Report Date: 2013/10/23

MINTO EXPLORATIONS LTD.
Client Project #: MINTO ENV. MONITORING
Site Location: YUKON
Your P.O. #: 204253
Sampler Initials: RH

RESULTS OF CHEMICAL ANALYSES OF WATER

Maxxam ID		HV3938		HV3939		HV3940		
Sampling Date		2013/10/14 10:45		2013/10/14 15:00		2013/10/14 00:00		
	UNITS	**MW09-03-03**	**RDL**	**MW09-01-03**	**RDL**	**DUP**	**RDL**	**QC Batch**
ANIONS								
Nitrite (N)	mg/L	<0.0050	0.0050	4.99(1)	0.25	<0.0050	0.0050	7235442
Calculated Parameters								
Filter and HNO3 Preservation	N/A	FIELD	N/A	FIELD	N/A	FIELD	N/A	ONSITE
Nitrate (N)	mg/L	0.412	0.020	124	2.0	0.418	0.020	7229544
Misc. Inorganics								
Fluoride (F)	mg/L	0.520	0.010			0.520	0.010	7243947
Alkalinity (Total as CaCO3)	mg/L	80.5	0.50	711	0.50	81.6	0.50	7233914
Alkalinity (PP as CaCO3)	mg/L	<0.50	0.50	<0.50	0.50	<0.50	0.50	7233914
Bicarbonate (HCO3)	mg/L	98.2	0.50	868	0.50	99.6	0.50	7233914
Carbonate (CO3)	mg/L	<0.50	0.50	<0.50	0.50	<0.50	0.50	7233914
Hydroxide (OH)	mg/L	<0.50	0.50	<0.50	0.50	<0.50	0.50	7233914
Anions								
Dissolved Sulphate (SO4)	mg/L	11.2	0.50			10.8	0.50	7234526
Dissolved Chloride (Cl)	mg/L	0.95	0.50			0.66	0.50	7234512
Nutrients								
Ammonia (N)	mg/L	0.063	0.0050	31	0.50	0.0090	0.0050	7234456
Nitrate plus Nitrite (N)	mg/L	0.412	0.020	129	2.0	0.418	0.020	7235431
Physical Properties								
Conductivity	uS/cm	184	1.0	4090	1.0	184	1.0	7233959
pH	pH Units	7.99		7.69		8.06		7233958
Physical Properties								
Total Dissolved Solids	mg/L	128	10	3220	10	120	10	7232846

N/A = Not Applicable
RDL = Reportable Detection Limit
(1) - RDL raised due to sample matrix interference.

Maxxam Job #: B395346
Report Date: 2013/10/23

MINTO EXPLORATIONS LTD.
Client Project #: MINTO ENV. MONITORING
Site Location: YUKON
Your P.O. #: 204253
Sampler Initials: RH

CCME DISSOLVED METALS IN WATER (WATER)

Maxxam ID		HV3938	HV3939	HV3940		
Sampling Date		2013/10/14 10:45	2013/10/14 15:00	2013/10/14 00:00		
	UNITS	**MW09-03-03**	**MW09-01-03**	**DUP**	**RDL**	**QC Batch**
Misc. Inorganics						
Dissolved Hardness (CaCO3)	mg/L	86.9	1730	87.1	0.50	7229315
Elements						
Dissolved Mercury (Hg)	ug/L	<0.010	<0.010	<0.010	0.010	7237933

RDL = Reportable Detection Limit

Maxxam Job #: B395346
Report Date: 2013/10/23

MINTO EXPLORATIONS LTD.
Client Project #: MINTO ENV. MONITORING
Site Location: YUKON
Your P.O. #: 204253
Sampler Initials: RH

CCME DISSOLVED METALS IN WATER (WATER)

Maxxam ID		HV3938	HV3939	HV3940		
Sampling Date		2013/10/14 10:45	2013/10/14 15:00	2013/10/14 00:00		
	UNITS	**MW09-03-03**	**MW09-01-03**	**DUP**	**RDL**	**QC Batch**
Dissolved Metals by ICPMS						
Dissolved Aluminum (Al)	ug/L	<3.0	8.7	<3.0	3.0	7234465
Dissolved Antimony (Sb)	ug/L	<0.50	5.71	<0.50	0.50	7234465
Dissolved Arsenic (As)	ug/L	<0.10	3.12	<0.10	0.10	7234465
Dissolved Barium (Ba)	ug/L	28.2	29.5	27.0	1.0	7234465
Dissolved Beryllium (Be)	ug/L	<0.10	<0.10	<0.10	0.10	7234465
Dissolved Bismuth (Bi)	ug/L	<1.0	<1.0	<1.0	1.0	7234465
Dissolved Boron (B)	ug/L	<50	485	<50	50	7234465
Dissolved Cadmium (Cd)	ug/L	0.100	0.163	0.052	0.010	7234465
Dissolved Chromium (Cr)	ug/L	<1.0	<1.0	<1.0	1.0	7234465
Dissolved Cobalt (Co)	ug/L	<0.50	1.19	<0.50	0.50	7234465
Dissolved Copper (Cu)	ug/L	2.17	5.60	1.49	0.20	7234465
Dissolved Iron (Fe)	ug/L	6.8	24.6	<5.0	5.0	7234465
Dissolved Lead (Pb)	ug/L	<0.20	<0.20	<0.20	0.20	7234465
Dissolved Lithium (Li)	ug/L	<5.0	15.9	<5.0	5.0	7234465
Dissolved Manganese (Mn)	ug/L	14.6	44.5	5.0	1.0	7234465
Dissolved Molybdenum (Mo)	ug/L	4.4	935	4.4	1.0	7234465
Dissolved Nickel (Ni)	ug/L	<1.0	8.0	<1.0	1.0	7234465
Dissolved Phosphorus (P)	ug/L	<10	172	<10	10	7234465
Dissolved Selenium (Se)	ug/L	0.30	14.6	0.35	0.10	7234465
Dissolved Silicon (Si)	ug/L	4300	24600	4370	100	7234465
Dissolved Silver (Ag)	ug/L	<0.020	<0.020	<0.020	0.020	7234465
Dissolved Strontium (Sr)	ug/L	162	7870	160	1.0	7234465
Dissolved Thallium (Tl)	ug/L	<0.050	<0.050	<0.050	0.050	7234465
Dissolved Tin (Sn)	ug/L	<5.0	<5.0	<5.0	5.0	7234465
Dissolved Titanium (Ti)	ug/L	<5.0	<5.0	<5.0	5.0	7234465
Dissolved Uranium (U)	ug/L	0.91	1.35	0.90	0.10	7234465
Dissolved Vanadium (V)	ug/L	<5.0	<5.0	<5.0	5.0	7234465
Dissolved Zinc (Zn)	ug/L	<5.0	18.6	<5.0	5.0	7234465
Dissolved Zirconium (Zr)	ug/L	<0.50	<0.50	<0.50	0.50	7234465
Dissolved Calcium (Ca)	mg/L	28.7	436	28.9	0.050	7229542
Dissolved Magnesium (Mg)	mg/L	3.71	155	3.65	0.050	7229542
Dissolved Potassium (K)	mg/L	1.70	41.3	1.68	0.050	7229542
Dissolved Sodium (Na)	mg/L	3.31	342	3.27	0.050	7229542
Dissolved Sulphur (S)	mg/L	3.8	387	3.4	3.0	7229542

RDL = Reportable Detection Limit

Maxxam Job #: B395346
Report Date: 2013/10/23

MINTO EXPLORATIONS LTD.
Client Project #: MINTO ENV. MONITORING
Site Location: YUKON
Your P.O. #: 204253
Sampler Initials: RH

General Comments

Sample HV3938-01: The BC-MOE and APHA Standard Method require pH to be analysed within 15 minutes of sampling and therefore field analysis is required for compliance. All Laboratory pH analyses in this report are reported past the BC-MOE/APHA Standard Method holding time.

Sample HV3939-01: The BC-MOE and APHA Standard Method require pH to be analysed within 15 minutes of sampling and therefore field analysis is required for compliance. All Laboratory pH analyses in this report are reported past the BC-MOE/APHA Standard Method holding time.

Sample HV3940-01: The BC-MOE and APHA Standard Method require pH to be analysed within 15 minutes of sampling and therefore field analysis is required for compliance. All Laboratory pH analyses in this report are reported past the BC-MOE/APHA Standard Method holding time.

Maxxam Job #: B395346
Report Date: 2013/10/23

MINTO EXPLORATIONS LTD.
Client Project #: MINTO ENV. MONITORING
Site Location: YUKON
Your P.O. #: 204253
Sampler Initials: RH

QUALITY ASSURANCE REPORT

			Matrix Spike		Spiked Blank		Method Blank		RPD	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits
7232846	Total Dissolved Solids	2013/10/18	NC	80 - 120	98	80 - 120	<10	mg/L	NC	20
7233914	Alkalinity (Total as CaCO3)	2013/10/18	NC	80 - 120	97	80 - 120	<0.50	mg/L	0.6	20
7233914	Alkalinity (PP as CaCO3)	2013/10/18					<0.50	mg/L	NC	20
7233914	Bicarbonate (HCO3)	2013/10/18					<0.50	mg/L	0.6	20
7233914	Carbonate (CO3)	2013/10/18					<0.50	mg/L	NC	20
7233914	Hydroxide (OH)	2013/10/18					<0.50	mg/L	NC	20
7233959	Conductivity	2013/10/17			99	80 - 120	1.1, RDL=1.0	uS/cm	0.2	20
7234456	Ammonia (N)	2013/10/17	100	80 - 120	100	80 - 120	<0.0050	mg/L	NC	20
7234465	Dissolved Aluminum (Al)	2013/10/18	106	80 - 120	108	80 - 120	<3.0	ug/L	NC	20
7234465	Dissolved Antimony (Sb)	2013/10/18	108	80 - 120	106	80 - 120	<0.50	ug/L	NC	20
7234465	Dissolved Arsenic (As)	2013/10/18	104	80 - 120	98	80 - 120	<0.10	ug/L	NC	20
7234465	Dissolved Barium (Ba)	2013/10/18	NC	80 - 120	100	80 - 120	<1.0	ug/L	0.5	20
7234465	Dissolved Beryllium (Be)	2013/10/18	104	80 - 120	99	80 - 120	<0.10	ug/L	NC	20
7234465	Dissolved Bismuth (Bi)	2013/10/18	79 (1)	80 - 120	96	80 - 120	<1.0	ug/L	NC	20
7234465	Dissolved Cadmium (Cd)	2013/10/18	103	80 - 120	101	80 - 120	<0.010	ug/L	NC	20
7234465	Dissolved Chromium (Cr)	2013/10/18	100	80 - 120	101	80 - 120	<1.0	ug/L	NC	20
7234465	Dissolved Cobalt (Co)	2013/10/18	98	80 - 120	99	80 - 120	<0.50	ug/L	NC	20
7234465	Dissolved Copper (Cu)	2013/10/18	101	80 - 120	101	80 - 120	<0.20	ug/L	NC	20
7234465	Dissolved Iron (Fe)	2013/10/18	108	80 - 120	112	80 - 120	<5.0	ug/L	NC	20
7234465	Dissolved Lead (Pb)	2013/10/18	96	80 - 120	95	80 - 120	<0.20	ug/L	NC	20
7234465	Dissolved Lithium (Li)	2013/10/18	102	80 - 120	99	80 - 120	<5.0	ug/L	NC	20
7234465	Dissolved Manganese (Mn)	2013/10/18	NC	80 - 120	103	80 - 120	<1.0	ug/L	3.0	20
7234465	Dissolved Molybdenum (Mo)	2013/10/18	NC	80 - 120	96	80 - 120	<1.0	ug/L	NC	20
7234465	Dissolved Nickel (Ni)	2013/10/18	97	80 - 120	102	80 - 120	<1.0	ug/L	NC	20
7234465	Dissolved Selenium (Se)	2013/10/18	111	80 - 120	108	80 - 120	<0.10	ug/L	NC	20
7234465	Dissolved Silver (Ag)	2013/10/18	96	80 - 120	92	80 - 120	<0.020	ug/L	NC	20
7234465	Dissolved Strontium (Sr)	2013/10/18	NC	80 - 120	98	80 - 120	<1.0	ug/L	0.05	20
7234465	Dissolved Thallium (Tl)	2013/10/18	100	80 - 120	103	80 - 120	<0.050	ug/L	NC	20
7234465	Dissolved Tin (Sn)	2013/10/18	85	80 - 120	96	80 - 120	<5.0	ug/L	NC	20
7234465	Dissolved Titanium (Ti)	2013/10/18	102	80 - 120	101	80 - 120	<5.0	ug/L	NC	20
7234465	Dissolved Uranium (U)	2013/10/18	98	80 - 120	95	80 - 120	<0.10	ug/L	0.1	20
7234465	Dissolved Vanadium (V)	2013/10/18	104	80 - 120	100	80 - 120	<5.0	ug/L	NC	20
7234465	Dissolved Zinc (Zn)	2013/10/18	106	80 - 120	105	80 - 120	<5.0	ug/L	NC	20
7234465	Dissolved Boron (B)	2013/10/18					<50	ug/L	NC	20
7234465	Dissolved Phosphorus (P)	2013/10/18					<10	ug/L		
7234465	Dissolved Silicon (Si)	2013/10/18					<100	ug/L	1.4	20
7234465	Dissolved Zirconium (Zr)	2013/10/18					<0.50	ug/L	NC	20
7234512	Dissolved Chloride (Cl)	2013/10/17	NC	80 - 120	99	80 - 120	<0.50	mg/L	2.5	20
7234526	Dissolved Sulphate (SO4)	2013/10/17	NC	80 - 120	97	80 - 120	0.99, RDL=0.50	mg/L	NC	20

Maxxam Job #: B395346
Report Date: 2013/10/23

MINTO EXPLORATIONS LTD.
Client Project #: MINTO ENV. MONITORING
Site Location: YUKON
Your P.O. #: 204253
Sampler Initials: RH

QUALITY ASSURANCE REPORT

			Matrix Spike		Spiked Blank		Method Blank		RPD	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits
7235431	Nitrate plus Nitrite (N)	2013/10/17	93	80 - 120	103	80 - 120	<0.020	mg/L	4.9	25
7235442	Nitrite (N)	2013/10/17	99	80 - 120	98	80 - 120	<0.0050	mg/L	5.3	20
7237933	Dissolved Mercury (Hg)	2013/10/20	118	80 - 120	107	80 - 120	<0.010	ug/L	NC	20
7243947	Fluoride (F)	2013/10/23	NC	80 - 120	98	80 - 120	<0.010	mg/L	3.9	20

N/A = Not Applicable
RDL = Reportable Detection Limit
RPD = Relative Percent Difference
Duplicate: Paired analysis of a separate portion of the same sample. Used to evaluate the variance in the measurement.
Matrix Spike: A sample to which a known amount of the analyte of interest has been added. Used to evaluate sample matrix interference.
Spiked Blank: A blank matrix sample to which a known amount of the analyte, usually from a second source, has been added. Used to evaluate method accuracy.
Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.
NC (Matrix Spike): The recovery in the matrix spike was not calculated. The relative difference between the concentration in the parent sample and the spiked amount was not sufficiently significant to permit a reliable recovery calculation.
NC (RPD): The RPD was not calculated. The level of analyte detected in the parent sample and its duplicate was not sufficiently significant to permit a reliable calculation.
(1) - Recovery or RPD for this parameter is outside control limits. The overall quality control for this analysis meets acceptability criteria.

Validation Signature Page

Maxxam Job #: B395346

The analytical data and all QC contained in this report were reviewed and validated by the following individual(s).

Rob Reinert, Data Validation Coordinator

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Maxxam has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per section 5.10.2 of ISO/IEC 17025:2005(E), signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

Maxxam

Burnaby: 4606 Canada Way, Burnaby, BC V5G 1K5 Ph: (604) 734-7276 Fax: (604) 731-2386, Toll Free: (800) 665-8566

CHAIN OF CUSTODY RECORD

Click here to get the COC number

Maxxam Job #: B395346 **COC #:** EB866113 Page: 1 of 1

Invoice To: Require Report? Yes ☑ No ☐

Company Name: Minto Explorations Ltd
Contact Name: Elvina Wong
Address: Suite 900 - 999 West Hastings St
Vancouver, B.C. PC: V6C 2W2
Phone / Fax#: Ph: 604-684-8894 Fax: 604-688-2120
E-mail:

Report To:

Company Name: Minto Explorations Ltd
Contact Name: Minto Environment
Address: Suite 900-999 West Hastings St
Vancouver, B.C. PC: V6C 2W2
Phone / Fax#: Ph: 604-684-8894 Fax: 604-688-2120
E-mail: minto_environment@mintomine.com

PO #: 204253
Quotation #:
Project # :
Proj. Name: Minto Env. Monitoring
Location: Yukon
Sampled by: Ryan Herbert / Phil Emerson

REGULATORY REQUIREMENTS:

- ☐ CSR
- ☑ CCME
- ☐ BC Water Quality
- ☐ Other
- ☐ DRINKING WATER

SERVICE REQUESTED:

◉ Regular Turn Around Time (TAT) (5 days for most tests)
RUSH (Please contact the lab) ○ 1 Day ○ 2 Day ○ 3 Day
Date Required:

SPECIAL INSTRUCTIONS:
Return Cooler ☐ **Ship Sample Bottles (please specify)** ☐

ANALYSIS REQUESTED

	Sample Identification	Lab Identification (Lab Use Only)	Sample Type	Date/Time(24hr) Sampled	Dissolved Metals (DM) (Field Filtered? Y ☑ N ☐)	Field Acidified? Y ☑ N ☐	Total Metals (Field Acidified? Y ☑ N ☐)	Nitrate ☑ Nitrite ☑ Ammonia ☑	Total Suspended Solids (TSS) ☐ TDS ☑	pH ☑ Conductivity ☑ Alkalinity ☑	Chloride ☑ Fluoride ☑ Sulphate ☑	Phosphate	DOC (Diss'd Organic Carbon)	TOC (Total Organic Carbon)	Ra 226	Number of Containers
1	MW09-03-03	AV3938	Ground W	10/14/13 10:45	x	x		x	x	x	x					4
2	MW09-01-03	AV3939	Ground W	10/14/13 15:00	x	x		x	x	x						3
3	DUP	AV3940	Ground W	10/14/13 0:00	x	x		x	x	x	x					4
4																
5																
6																
7																
8																
9																
10																
11																
12																

B395346

Print name and sign

*Relinquished By:	Date (yy/mm/dd):	Time (24hr):	Received by	Date (yy/mm/dd)	Time (24hr)	Time Sensitive	Temperature on Receipt (°C)	Custody Seal	Yes	No
Chris Harry	15-Oct-13	7:30	Rochelle ROCHELLE PACHECO	2013/10/16	14:00	☑	1: 3 2: 1 3: 3	Present?	☐	☐
							Just sampled & iced on ice ☐	Intact?	☐	☐

*IT IS THE RESPONSIBILITY OF THE RELINQUISHER TO ENSURE THE ACCURACY OF THE CHAIN OF CUSTODY RECORDS. AN INCOMPLETE CHAIN OF CUSTODY MAY RESULT IN ANALYTICAL TAT DELAYS.

CS: N/A

Success Through Science®

Your P.O. #: 204253
Your Project #: MINTO ENV. MONITORING
Site Location: YUKON
Your C.O.C. #: EB868513

Attention: MINTO DISTRIBUTION LIST
MINTO EXPLORATIONS LTD.
Yukon/Whitehorse
2 - 25 Pilgrim Way
Whitehorse, YT
CANADA Y1A 6E6

Report Date: 2013/10/23

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B395808
Received: 2013/10/17, 13:30

Sample Matrix: Water
Samples Received: 6

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Analytical Method
Alkalinity - Water	6	2013/10/18	2013/10/18	BBY6SOP-00026	SM2320B
Chloride by Automated Colourimetry	6	N/A	2013/10/18	BBY6SOP-00011	SM-4500-Cl-
Conductance - water	6	N/A	2013/10/18	BBY6SOP-00026	SM-2510B
Fluoride	6	N/A	2013/10/23	BBY6SOP-00012	SM - 4500 F C
Hardness (calculated as CaCO3)	6	N/A	2013/10/19	BBY7SOP-00002	EPA 6020A
Mercury (Dissolved) by CVAF	6	N/A	2013/10/23	BBY7SOP-00015	EPA 245.7
Na, K, Ca, Mg, S by CRC ICPMS (diss.)	6	N/A	2013/10/19	BBY7SOP-00002	EPA 6020A
Elements by CRC ICPMS (dissolved)	6	N/A	2013/10/19	BBY7SOP-00002	EPA 6020A
Ammonia-N (Preserved)	6	N/A	2013/10/18	BBY6SOP-00009	SM-4500NH3G
Nitrate + Nitrite (N)	6	N/A	2013/10/18	BBY6SOP-00010	SM 4500NO3-I
Nitrite (N) by CFA	6	N/A	2013/10/18	BBY6SOP-00010	EPA 353.2
Nitrogen - Nitrate (as N)	6	N/A	2013/10/19	BBY6SOP-00010	SM 4500NO3-I
Filter and HNO3 Preserve for Metals	6	N/A	2013/10/17	BBY6WI-00001	EPA 200.2
pH Water	6	N/A	2013/10/18	BBY6SOP-00026	SM-4500H+B
Sulphate by Automated Colourimetry	4	N/A	2013/10/18	BBY6SOP-00017	SM4500-SO42- E
Sulphate by Automated Colourimetry	2	N/A	2013/10/19	BBY6SOP-00017	SM4500-SO42- E
Total Dissolved Solids (Filt. Residue)	6	2013/10/18	2013/10/21	BBY6SOP-00033	SM 2540C
Total Suspended Solids-Low Level	6	2013/10/18	2013/10/19	BBY6SOP-00034	SM-2540 D

* Results relate only to the items tested.

Encryption Key

Please direct all questions regarding this Certificate of Analysis to your Project Manager.

Ken Pomeroy, Project Manager
Email: KPomeroy@maxxam.ca
Phone# (604) 638-5020

==
This report has been generated and distributed using a secure automated process.
Maxxam has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per section 5.10.2 of ISO/IEC 17025:2005(E), signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

Total cover pages: 1

Success Through Science®

Maxxam Job #: B395808
Report Date: 2013/10/23

MINTO EXPLORATIONS LTD.
Client Project #: MINTO ENV. MONITORING
Site Location: YUKON
Your P.O. #: 204253
Sampler Initials: PE

RESULTS OF CHEMICAL ANALYSES OF WATER

Maxxam ID		HV6686		HV6687		HV6688		
Sampling Date		2013/10/15 12:00		2013/10/15 14:30		2013/10/15 16:00		
	UNITS	**MW12-07-01**	**RDL**	**MW12-07-02**	**RDL**	**MW11-04A**	**RDL**	**QC Batch**
ANIONS								
Nitrite (N)	mg/L	2.46	0.050	0.652	0.010	0.0111	0.0050	7237310
Calculated Parameters								
Filter and HNO3 Preservation	N/A	FIELD	N/A	FIELD	N/A	FIELD	N/A	ONSITE
Nitrate (N)	mg/L	23.8	1.0	0.271	0.020	1.14	0.020	7232920
Misc. Inorganics								
Fluoride (F)	mg/L	0.800	0.010	1.40	0.010	0.078	0.010	7243947
Alkalinity (Total as CaCO3)	mg/L	347	0.50	139	0.50	126	0.50	7236744
Alkalinity (PP as CaCO3)	mg/L	<0.50	0.50	<0.50	0.50	111	0.50	7236744
Bicarbonate (HCO3)	mg/L	423	0.50	170	0.50	<0.50	0.50	7236744
Carbonate (CO3)	mg/L	<0.50	0.50	<0.50	0.50	17.8	0.50	7236744
Hydroxide (OH)	mg/L	<0.50	0.50	<0.50	0.50	32.7	0.50	7236744
Anions								
Dissolved Sulphate (SO4)	mg/L	256	5.0	633	5.0	4.01	0.50	7236659
Dissolved Chloride (Cl)	mg/L	4.1	0.50	2.1	0.50	1.2	0.50	7236628
Nutrients								
Ammonia (N)	mg/L	0.070	0.0050	0.27	0.0050	0.067	0.0050	7237257
Nitrate plus Nitrite (N)	mg/L	26.3	1.0	0.923	0.020	1.15	0.020	7236259
Physical Properties								
Conductivity	uS/cm	1220	1.0	1350	1.0	463	1.0	7236760
pH	pH Units	8.12		8.06		11.4		7236758
Physical Properties								
Total Suspended Solids	mg/L	1.4	1.0	1.6	1.0	103	1.0	7235096
Total Dissolved Solids	mg/L	868	10	1020	10	194	10	7235191

N/A = Not Applicable
RDL = Reportable Detection Limit

Maxxam

Success Through Science®

Maxxam Job #: B395808
Report Date: 2013/10/23

MINTO EXPLORATIONS LTD.
Client Project #: MINTO ENV. MONITORING
Site Location: YUKON
Your P.O. #: 204253
Sampler Initials: PE

RESULTS OF CHEMICAL ANALYSES OF WATER

Maxxam ID		HV6689			HV6690			HV6691		
Sampling Date		2013/10/15 00:00			2013/10/15 00:00			2013/10/15 00:00		
	UNITS	**F-BL**	**RDL**	**QC Batch**	**DUP**	**RDL**	**QC Batch**	**DUP2**	**RDL**	**QC Batch**
ANIONS										
Nitrite (N)	mg/L	<0.0050	0.0050	7237310	1.32	0.050	7237310	0.0116	0.0050	7237310
Calculated Parameters										
Filter and HNO3 Preservation	N/A	FIELD	N/A	ONSITE	FIELD	N/A	ONSITE	FIELD	N/A	ONSITE
Nitrate (N)	mg/L	<0.020	0.020	7232920	6.99	0.20	7232920	1.16	0.020	7232920
Misc. Inorganics										
Fluoride (F)	mg/L	<0.010	0.010	7243947	0.970	0.010	7243947	0.073	0.010	7243947
Alkalinity (Total as CaCO3)	mg/L	0.54	0.50	7236744	399	0.50	7236744	120	0.50	7236744
Alkalinity (PP as CaCO3)	mg/L	<0.50	0.50	7236744	<0.50	0.50	7236744	103	0.50	7236744
Bicarbonate (HCO3)	mg/L	0.66	0.50	7236744	486	0.50	7236744	<0.50	0.50	7236744
Carbonate (CO3)	mg/L	<0.50	0.50	7236744	<0.50	0.50	7236744	19.7	0.50	7236744
Hydroxide (OH)	mg/L	<0.50	0.50	7236744	<0.50	0.50	7236744	29.5	0.50	7236744
Anions										
Dissolved Sulphate (SO4)	mg/L	<0.50	0.50	7237833	263	5.0	7236659	3.72	0.50	7237833
Dissolved Chloride (Cl)	mg/L	<0.50	0.50	7236628	3.8	0.50	7236628	0.85	0.50	7236628
Nutrients										
Ammonia (N)	mg/L	0.0068	0.0050	7237257	0.32	0.0050	7237257	0.081	0.0050	7237257
Nitrate plus Nitrite (N)	mg/L	<0.020	0.020	7236259	8.31	0.20	7236259	1.17	0.020	7236259
Physical Properties										
Conductivity	uS/cm	1.7	1.0	7236760	1220	1.0	7236760	433	1.0	7236760
pH	pH Units	5.80		7236758	8.24		7236758	11.3		7236758
Physical Properties										
Total Suspended Solids	mg/L	<1.0	1.0	7235096	1.6	1.0	7235096	280	1.0	7235096
Total Dissolved Solids	mg/L	<10	10	7235191	852	10	7235191	200	10	7235191

N/A = Not Applicable
RDL = Reportable Detection Limit

Maxxam

Success Through Science®

Maxxam Job #: B395808
Report Date: 2013/10/23

MINTO EXPLORATIONS LTD.
Client Project #: MINTO ENV. MONITORING
Site Location: YUKON
Your P.O. #: 204253
Sampler Initials: PE

CCME DISSOLVED METALS IN WATER (WATER)

Maxxam ID		HV6686	HV6687	HV6688	HV6689	HV6690	HV6691		
Sampling Date		2013/10/15 12:00	2013/10/15 14:30	2013/10/15 16:00	2013/10/15 00:00	2013/10/15 00:00	2013/10/15 00:00		
	UNITS	**MW12-07-01**	**MW12-07-02**	**MW11-04A**	**F-BL**	**DUP**	**DUP2**	**RDL**	**QC Batch**
Misc. Inorganics									
Dissolved Hardness (CaCO3)	mg/L	543	606	216	<0.50	542	216	0.50	7234198
Elements									
Dissolved Mercury (Hg)	ug/L	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	0.010	7242553
Dissolved Metals by ICPMS									
Dissolved Aluminum (Al)	ug/L	6.2	4.4	292	<3.0	6.8	342	3.0	7236319
Dissolved Antimony (Sb)	ug/L	0.63	<0.50	<0.50	<0.50	<0.50	<0.50	0.50	7236319
Dissolved Arsenic (As)	ug/L	1.02	0.34	0.43	<0.10	0.90	0.50	0.10	7236319
Dissolved Barium (Ba)	ug/L	66.4	25.6	447	<1.0	55.3	443	1.0	7236319
Dissolved Beryllium (Be)	ug/L	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.10	7236319
Dissolved Bismuth (Bi)	ug/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	1.0	7236319
Dissolved Boron (B)	ug/L	583	322	<50	<50	603	<50	50	7236319
Dissolved Cadmium (Cd)	ug/L	0.033	<0.010	<0.010	<0.010	<0.010	<0.010	0.010	7236319
Dissolved Chromium (Cr)	ug/L	<1.0	<1.0	2.3	<1.0	<1.0	2.5	1.0	7236319
Dissolved Cobalt (Co)	ug/L	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	0.50	7236319
Dissolved Copper (Cu)	ug/L	10.7	<0.20	24.8	0.23	4.37	34.5	0.20	7236319
Dissolved Iron (Fe)	ug/L	233	151	<5.0	<5.0	294	5.7	5.0	7236319
Dissolved Lead (Pb)	ug/L	0.20	<0.20	<0.20	<0.20	<0.20	<0.20	0.20	7236319
Dissolved Lithium (Li)	ug/L	14.2	23.0	19.5	<5.0	20.4	19.6	5.0	7236319
Dissolved Manganese (Mn)	ug/L	130	221	<1.0	<1.0	129	<1.0	1.0	7236319
Dissolved Molybdenum (Mo)	ug/L	20.8	9.9	2.1	<1.0	13.0	2.0	1.0	7236319
Dissolved Nickel (Ni)	ug/L	1.5	1.2	<1.0	<1.0	1.8	<1.0	1.0	7236319
Dissolved Phosphorus (P)	ug/L	19	10	<10	<10	11	<10	10	7236319
Dissolved Selenium (Se)	ug/L	13.4	0.41	1.98	<0.10	7.03	2.01	0.10	7236319
Dissolved Silicon (Si)	ug/L	6240	6800	3520	<100	7940	3520	100	7236319
Dissolved Silver (Ag)	ug/L	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	0.020	7236319
Dissolved Strontium (Sr)	ug/L	7230	9150	683	<1.0	7490	695	1.0	7236319
Dissolved Thallium (Tl)	ug/L	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	0.050	7236319
Dissolved Tin (Sn)	ug/L	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	5.0	7236319
Dissolved Titanium (Ti)	ug/L	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	5.0	7236319
Dissolved Uranium (U)	ug/L	6.02	0.34	<0.10	<0.10	3.59	<0.10	0.10	7236319
Dissolved Vanadium (V)	ug/L	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	5.0	7236319
Dissolved Zinc (Zn)	ug/L	27.6	<5.0	<5.0	<5.0	5.0	<5.0	5.0	7236319
Dissolved Zirconium (Zr)	ug/L	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	0.50	7236319
Dissolved Calcium (Ca)	mg/L	176	187	86.7	<0.050	179	86.5	0.050	7232308

RDL = Reportable Detection Limit

Maxxam Job #: B395808
Report Date: 2013/10/23

MINTO EXPLORATIONS LTD.
Client Project #: MINTO ENV. MONITORING
Site Location: YUKON
Your P.O. #: 204253
Sampler Initials: PE

CCME DISSOLVED METALS IN WATER (WATER)

Maxxam ID		HV6686	HV6687	HV6688	HV6689	HV6690	HV6691		
Sampling Date		2013/10/15 12:00	2013/10/15 14:30	2013/10/15 16:00	2013/10/15 00:00	2013/10/15 00:00	2013/10/15 00:00		
	UNITS	**MW12-07-01**	**MW12-07-02**	**MW11-04A**	**F-BL**	**DUP**	**DUP2**	**RDL**	**QC Batch**
Dissolved Magnesium (Mg)	mg/L	25.0	33.9	<0.050	<0.050	22.9	<0.050	0.050	7232308
Dissolved Potassium (K)	mg/L	4.05	3.38	4.65	<0.050	3.65	4.87	0.050	7232308
Dissolved Sodium (Na)	mg/L	57.5	67.9	4.40	<0.050	70.1	4.51	0.050	7232308
Dissolved Sulphur (S)	mg/L	78.5	224	<3.0	<3.0	84.6	<3.0	3.0	7232308

RDL = Reportable Detection Limit

General Comments

Sample HV6686-01: The BC-MOE and APHA Standard Method require pH to be analysed within 15 minutes of sampling and therefore field analysis is required for compliance. All Laboratory pH analyses in this report are reported past the BC-MOE/APHA Standard Method holding time.

Sample HV6687-01: The BC-MOE and APHA Standard Method require pH to be analysed within 15 minutes of sampling and therefore field analysis is required for compliance. All Laboratory pH analyses in this report are reported past the BC-MOE/APHA Standard Method holding time.

Sample HV6688-01: The BC-MOE and APHA Standard Method require pH to be analysed within 15 minutes of sampling and therefore field analysis is required for compliance. All Laboratory pH analyses in this report are reported past the BC-MOE/APHA Standard Method holding time.

Sample HV6689-01: The BC-MOE and APHA Standard Method require pH to be analysed within 15 minutes of sampling and therefore field analysis is required for compliance. All Laboratory pH analyses in this report are reported past the BC-MOE/APHA Standard Method holding time.

Sample HV6690-01: The BC-MOE and APHA Standard Method require pH to be analysed within 15 minutes of sampling and therefore field analysis is required for compliance. All Laboratory pH analyses in this report are reported past the BC-MOE/APHA Standard Method holding time.

Sample HV6691-01: The BC-MOE and APHA Standard Method require pH to be analysed within 15 minutes of sampling and therefore field analysis is required for compliance. All Laboratory pH analyses in this report are reported past the BC-MOE/APHA Standard Method holding time.

Maxxam Job #: B395808
Report Date: 2013/10/23

MINTO EXPLORATIONS LTD.
Client Project #: MINTO ENV. MONITORING
Site Location: YUKON
Your P.O. #: 204253
Sampler Initials: PE

QUALITY ASSURANCE REPORT

			Matrix Spike		Spiked Blank		Method Blank		RPD	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits
7235096	Total Suspended Solids	2013/10/19			95	80 - 120	<1.0	mg/L		
7235191	Total Dissolved Solids	2013/10/21	NC	80 - 120	104	80 - 120	<10	mg/L	1.7	20
7236259	Nitrate plus Nitrite (N)	2013/10/18	96	80 - 120	92	80 - 120	<0.020	mg/L	NC	25
7236319	Dissolved Aluminum (Al)	2013/10/19	99	80 - 120	102	80 - 120	<3.0	ug/L		
7236319	Dissolved Antimony (Sb)	2013/10/19	101	80 - 120	102	80 - 120	<0.50	ug/L		
7236319	Dissolved Arsenic (As)	2013/10/19	106	80 - 120	103	80 - 120	<0.10	ug/L	1.7	20
7236319	Dissolved Barium (Ba)	2013/10/19	NC	80 - 120	101	80 - 120	<1.0	ug/L		
7236319	Dissolved Beryllium (Be)	2013/10/19	99	80 - 120	96	80 - 120	<0.10	ug/L		
7236319	Dissolved Bismuth (Bi)	2013/10/19	99	80 - 120	101	80 - 120	<1.0	ug/L		
7236319	Dissolved Cadmium (Cd)	2013/10/19	101	80 - 120	101	80 - 120	<0.010	ug/L		
7236319	Dissolved Chromium (Cr)	2013/10/19	101	80 - 120	100	80 - 120	<1.0	ug/L		
7236319	Dissolved Cobalt (Co)	2013/10/19	99	80 - 120	100	80 - 120	<0.50	ug/L		
7236319	Dissolved Copper (Cu)	2013/10/19	97	80 - 120	99	80 - 120	<0.20	ug/L		
7236319	Dissolved Iron (Fe)	2013/10/19	NC	80 - 120	105	80 - 120	<5.0	ug/L		
7236319	Dissolved Lead (Pb)	2013/10/19	96	80 - 120	99	80 - 120	<0.20	ug/L		
7236319	Dissolved Lithium (Li)	2013/10/19	95	80 - 120	92	80 - 120	<5.0	ug/L		
7236319	Dissolved Manganese (Mn)	2013/10/19	NC	80 - 120	102	80 - 120	<1.0	ug/L		
7236319	Dissolved Molybdenum (Mo)	2013/10/19	NC	80 - 120	99	80 - 120	<1.0	ug/L		
7236319	Dissolved Nickel (Ni)	2013/10/19	96	80 - 120	101	80 - 120	<1.0	ug/L		
7236319	Dissolved Selenium (Se)	2013/10/19	104	80 - 120	102	80 - 120	<0.10	ug/L		
7236319	Dissolved Silver (Ag)	2013/10/19	104	80 - 120	100	80 - 120	<0.020	ug/L		
7236319	Dissolved Strontium (Sr)	2013/10/19	NC	80 - 120	99	80 - 120	<1.0	ug/L		
7236319	Dissolved Thallium (Tl)	2013/10/19	101	80 - 120	100	80 - 120	<0.050	ug/L		
7236319	Dissolved Tin (Sn)	2013/10/19	99	80 - 120	99	80 - 120	<5.0	ug/L		
7236319	Dissolved Titanium (Ti)	2013/10/19	95	80 - 120	104	80 - 120	<5.0	ug/L		
7236319	Dissolved Uranium (U)	2013/10/19	99	80 - 120	97	80 - 120	<0.10	ug/L		
7236319	Dissolved Vanadium (V)	2013/10/19	101	80 - 120	100	80 - 120	<5.0	ug/L		
7236319	Dissolved Zinc (Zn)	2013/10/19	NC	80 - 120	104	80 - 120	<5.0	ug/L		
7236319	Dissolved Boron (B)	2013/10/19					<50	ug/L		
7236319	Dissolved Phosphorus (P)	2013/10/19					<10	ug/L		
7236319	Dissolved Silicon (Si)	2013/10/19					<100	ug/L		
7236319	Dissolved Zirconium (Zr)	2013/10/19					<0.50	ug/L		
7236628	Dissolved Chloride (Cl)	2013/10/18	98	80 - 120	102	80 - 120	<0.50	mg/L	NC	20
7236659	Dissolved Sulphate (SO4)	2013/10/18	NC	80 - 120	101	80 - 120	0.63, RDL=0.50	mg/L	2.1	20
7236744	Alkalinity (Total as CaCO3)	2013/10/18	94	80 - 120	99	80 - 120	<0.50	mg/L	2.2	20
7236744	Alkalinity (PP as CaCO3)	2013/10/18					<0.50	mg/L		
7236744	Bicarbonate (HCO3)	2013/10/18					<0.50	mg/L		
7236744	Carbonate (CO3)	2013/10/18					<0.50	mg/L		
7236744	Hydroxide (OH)	2013/10/18					<0.50	mg/L		

Maxxam Job #: B395808
Report Date: 2013/10/23

MINTO EXPLORATIONS LTD.
Client Project #: MINTO ENV. MONITORING
Site Location: YUKON
Your P.O. #: 204253
Sampler Initials: PE

QUALITY ASSURANCE REPORT

			Matrix Spike		Spiked Blank		Method Blank		RPD	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits
7236760	Conductivity	2013/10/19			100	80 - 120	1.1, RDL=1.0	uS/cm	0.1	20
7237257	Ammonia (N)	2013/10/18	114	80 - 120	99	80 - 120	0.0062, RDL=0.0050	mg/L	3.2	20
7237310	Nitrite (N)	2013/10/18	96	80 - 120	90	80 - 120	<0.0050	mg/L	NC	20
7237833	Dissolved Sulphate (SO4)	2013/10/19	NC	80 - 120	105	80 - 120	<0.50	mg/L	NC	20
7242553	Dissolved Mercury (Hg)	2013/10/23	102	80 - 120	104	80 - 120	<0.010	ug/L	NC	20
7243947	Fluoride (F)	2013/10/23	NC	80 - 120	98	80 - 120	<0.010	mg/L	3.9	20

N/A = Not Applicable
RDL = Reportable Detection Limit
RPD = Relative Percent Difference
Duplicate: Paired analysis of a separate portion of the same sample. Used to evaluate the variance in the measurement.
Matrix Spike: A sample to which a known amount of the analyte of interest has been added. Used to evaluate sample matrix interference.
Spiked Blank: A blank matrix sample to which a known amount of the analyte, usually from a second source, has been added. Used to evaluate method accuracy.
Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.
NC (Matrix Spike): The recovery in the matrix spike was not calculated. The relative difference between the concentration in the parent sample and the spiked amount was not sufficiently significant to permit a reliable recovery calculation.
NC (RPD): The RPD was not calculated. The level of analyte detected in the parent sample and its duplicate was not sufficiently significant to permit a reliable calculation.

Validation Signature Page

Maxxam Job #: B395808

The analytical data and all QC contained in this report were reviewed and validated by the following individual(s).

Rob Reinert, Data Validation Coordinator

==

Maxxam

Burnaby: 4606 Canada Way, Burnaby, BC V5G 1K5 Ph: (604) 734-7276 Fax: (604) 731-2386, Toll Free: (800) 665-8566

CHAIN OF CUSTODY RECORD

Click here to get the COC number

Maxxam Job #: B395808 **COC #:** EB868513 Page: 1 of 1

Invoice To: Require Report? Yes ☑ No ☐

Company Name:	Minto Explorations Ltd
Contact Name:	Elvina Wong
Address:	Suite 900 - 999 West Hastings St
	Vancouver, B.C. PC: V6C 2W2
Phone / Fax#:	Ph: 604-684-8894 Fax: 604-688-2120
E-mail	

Report To:

Company Name:	Minto Explorations Ltd
Contact Name:	Minto Environment
Address:	Suite 900-999 West Hastings St
	Vancouver, B.C. PC: V6C 2W2
Phone / Fax#:	Ph: 604-684-8894 Fax: 604-688-2120
E-mail	minto_environment@mintomine.com

PO #:	204253
Quotation #:	
Project # :	
Proj. Name:	Minto Env. Monitoring
Location:	Yukon
Sampled by:	Phil Emerson

REGULATORY REQUIREMENTS:

- ☐ CSR
- ☑ CCME
- ☐ BC Water Quality
- ☐ Other
- ☐ DRINKING WATER

SERVICE REQUESTED:

- ◉ Regular Turn Around Time (TAT) (5 days for most tests)
- **RUSH** (Please contact the lab) ○ 1 Day ○ 2 Day ○ 3 Day
- Date Required:

SPECIAL INSTRUCTIONS:

Return Cooler ☐ **Ship Sample Bottles (please specify)** ☐

ANALYSIS REQUESTED

#	Sample Identification	Lab Use Only: Lab Identification	Sample Type	Date/Time(24hr) Sampled	Dissolved Metals (DM) (Field Filtered? ☑Y ☐N)	Total Metals (Field Acidified? ☑Y ☐N)	(Field Acidified? ☐Y ☐N)	Nitrate ☑ Nitrite ☑ Ammonia ☑	Total Suspended Solids (TSS) ☑ TDS ☑	pH ☑ Conductivity ☑ Alkalinity ☑	Chloride ☑ Fluoride ☑ Sulphate ☑	Phosphate	DOC (Diss'd Organic Carbon)	TOC (Total Organic Carbon)	Ra 226	Number of Containers
1	MW12-07-01	HV6686	Water	10/15/13 12:00	X	X		X	X	X	X					4
2	MW12-07-02	HV6687	Water	10/15/13 14:30	X	X		X	X	X	X					4
3	MW11-04A	HV6688	Water	10/15/13 16:00	X	X		X	X	X	X					4
4	F-BL	HV6689	Water	10/15/13 0:00	X	X		X	X	X	X					4
5	DUP	HV6690	Water	10/15/13 0:00	X	X		X	X	X	X					4
6	DUP2	HV6691	Water	10/15/13 0:00	X	X		X	X	X	X					4
7																
8																
9																
10																
11																
12																

B395808

*Relinquished By: (Print name and sign)	Date (yy/mm/dd):	Time (24hr):	Received by (Print name and sign)	Date (yy/mm/dd)	Time (24 hr)	Time Sensitive	Temperature on Receipt (°C)	Custody Seal	Yes	No
Phil Emerson	15-Oct-13	8:00	[signature]	2013/10/17	13:30	☑	A) 1 B) 2 C) 2	Present?	☐	☑
							Just sampled & rec'd on ice ☐	Intact?	☐	☐ N/A

Laboratory Use Only

*IT IS THE RESPONSIBILITY OF THE RELINQUISHER TO ENSURE THE ACCURACY OF THE CHAIN OF CUSTODY RECORDS. AN INCOMPLETE CHAIN OF CUSTODY MAY RESULT IN ANALYTICAL TAT DELAYS.

Appendix E

2013 Annual Biological Monitoring Report

Minto Creek Sediment, Periphyton and Benthic Invertebrate Community Assessment - 2013 FINAL

Report Prepared for:

Capstone Mining Corp.
Minto Mine
13 - 151 Industrial Rd.
Whitehorse, YT
Y1A 2V3

Report Prepared by:

Minnow Environmental Inc.
101 - 1025 Hillside Ave.
Victoria, BC
V8T 2A2

March 2014

Minto Creek Sediment, Periphyton and Benthic Invertebrate Community Assessment - 2013 FINAL

Report Prepared for:

Capstone Mining Corp. Minto Mine

Report Prepared by:

Minnow Environmental Inc.

Lisa Bowron, M.Sc.
Project Manager

Pierre Stecko, M.Sc., EP, RPBio
Project Principal

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1.0 INTRODUCTION

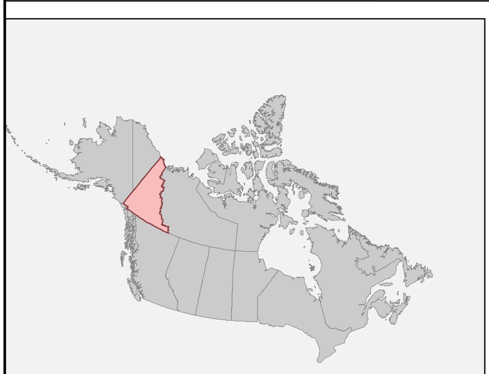
1.1 Site Description

The Minto Mine is a high-grade copper mine located within Selkirk First Nation (SFN) Category A Settlement Land Parcel R-6A approximately 240 km northwest of Whitehorse, Yukon Territory (62°37'N latitude and 137°15'W longitude; Figure 1.1). It is owned and operated by Minto Explorations Ltd. (MintoEx), a wholly owned subsidiary of Capstone Mining Corporation (Capstone). Development of the mine was initiated in 1997, commercial operations started in October 2007 and the anticipated operating life is to the year 2022. The facility is permitted to conduct open pit and underground mining with milling at a rate of 4,200 tonnes of copper/gold/silver ore per day, and produced 35.9 million pounds of copper in 2012. Copper reserves are approximately 440 millions pounds. Mine-impacted seepage from the Tailings Storage Facility and under the Mill Valley Fill Expansion (MVFE) is collected at the Minto Creek Detention Structure at the toe of the MVFE and pumped to the main pit (Figure 1.2). Non-impacted water and treated mine-impacted water are collected in a Water Storage Pond (WSP; Figure 1.2). Effluent from the WSP is periodically discharged to Minto Creek under conditions specified in Water Use Licence (WUL) QZ96-006 (Amendment 7, April 2011 and Amendment 8, September 2012). Minto Creek, in turn, discharges to the Yukon River approximately 12 km south-east of the mine site (Figure 1.2).

1.2 Background

Under the WUL, the Minto Mine implements a routine water quality surveillance program in Minto Creek and reference tributaries at sampling frequencies that vary from weekly to monthly during the ice-free period (typically from April to October or November). In accordance with the WUL, the Minto Mine submits water quality data as original laboratory reports and monthly summary reports within 30-days of month-end. Water quality monitoring data have indicated that total suspended solids concentrations can increase dramatically during high flow events and that concentrations of a number of metals (including aluminum, chromium, copper and iron) are generally concurrently higher than national water quality guidelines for the protection of aquatic life even under background and reference conditions (e.g., HKP 1994; Minnow 2009a, 2010a, 2010b).

Recent interpretations of water quality data have documented an influence of the Minto Mine on Minto Creek even in the absence of mine effluent discharge (Minnow/Access 2012). This influence was evident in conductivity and in concentrations of nitrate, sulphate, chloride, molybdenum and sodium that were greater in Minto Creek than at reference areas. During



MINTO PROJECT

Minto Explorations Ltd.

A SUBSIDIARY OF CAPSTONE MINING LTD.

ACCESS CONSULTING GROUP

Figure 1.1

minnow

Location of the Minto Mine

Ref: 2498
Date: March 2014

Source: Access Consulting Group

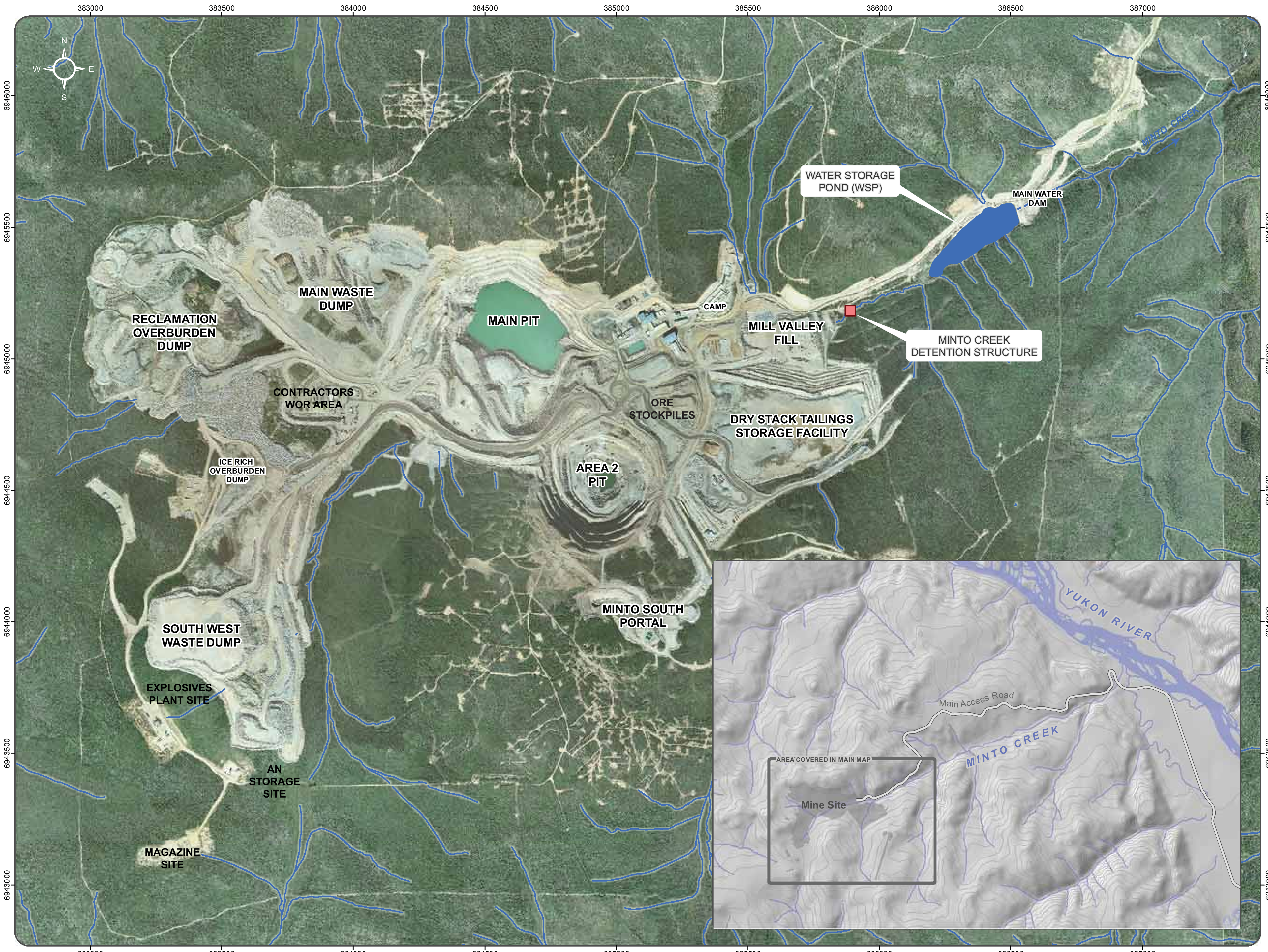
MINTO MINE

Figure 1.2

MINTO MINE SITE AND RECEIVING ENVIRONMENT, MINTO MINE WUL, 2014

MARCH 2014

Ref: 2498



Minto Creek Detention Structure

Watercourse

Dam Discharge

Water Storage Pond

1:14,000

when printed on 11 by 17 inch paper

0 125 250 500 750

Meters

Aerial imagery obtained from Challenger Geomatics. Imagery acquired August 11 th 2013.
Site contours derived from 2012 aerial imagery obtained from Challenger Geomatics.

Hydrology data provided by Minto Explorations Ltd, May 2009.

Datum: NAD 83 Projection: UTM Zone 8N

I:\Minto\gis\mxd\Studies\EEM\2014-EEMCycle3\CurrentConditions__20140120.mxd
(*Last edited by: mducharme;20/01/2014/12:32 PM*)

effluent discharge, concentrations of bromide and nitrite, and to a lesser extent, selenium and Total Kjeldahl Nitrogen (TKN), were also elevated in Minto Creek relative to reference concentrations. Although mean concentrations of a number of analytes were greater than water quality guidelines in Minto Creek over the 2009-2011 period, only nitrate and selenium were consistently greater than both guidelines and reference (Minnow/Access 2012).

The Minto Mine also implements annual biological monitoring under the WUL, which includes monitoring of sediment, periphyton, benthic invertebrates, fish and fish habitat. The biological monitoring program has been modified over time, but data from 1994 (baseline) and 2006-2012 have been reported previously. The sediment and benthic program conducted in September 2012 demonstrated that a few analytes measured in sediments of Minto Creek had concentrations that were greater than Interim Sediment Quality Guidelines (ISGQs) for the protection of aquatic life (Minnow 2013a). However, only copper in upper Minto Creek was elevated to concentrations greater than ISQGs, baseline and reference. In lower Minto Creek, no sediment analytes were elevated to concentrations greater than ISQGs, baseline and reference. The periphyton community of lower Minto Creek differed from that of the reference creek (lower Wolverine Creek), and this was consistent with observations in the field (the available area to collect periphyton samples was much smaller at lower Minto Creek than in Wolverine Creek, and light penetration was lower). Subtle differences in depositional benthic invertebrate community composition between Minto Creek and the reference area (lower Wolverine Creek) were apparent, but interpretation of erosional benthic community composition based on control-impact comparisons indicated no clear evidence of mine-related impact to the erosional benthic invertebrate community of lower Minto Creek.

1.3 Objectives

The objectives of this study and report are to characterize and interpret current sediment quality, the periphyton community and the benthic invertebrate community of Minto Creek relative to reference conditions and conditions documented in previous years. Additional data on the quality of biological tissues (periphyton and benthic invertebrates) are also reported.

1.4 Report Overview

This report is presented in nine sections, the first of which is this introduction. Section 2.0 presents the methods used in sample collection, sample analysis and data analysis. Section 3.0 provides a description of the sampling areas and a summary of supporting physical and chemical data collected in the field. Section 4.0 provides the sediment quality results.

Periphyton community results are presented in Section 5.0. Benthic invertebrate community results are presented in Section 6.0. Tissue chemistry results are presented in Section 7.0. Conclusions and recommendations of the study are provided in Section 8.0. All the references cited throughout this report are listed in Section 9.0.

2.0 METHODS

Minnow Environmental Inc. implemented the Minto Creek sediment, periphyton and benthic invertebrate community assessment from September 9th to 13th, 2013 with the assistance of Minto Mine staff. The study design was consistent with the design submitted to the Yukon Water Board in June 2011 in accordance with the Minto Mine Water Use Licence (QZ06-006 - Amendment 7). Sediment sampling was undertaken in upper Minto Creek, lower Minto Creek and corresponding reference areas (Table 2.1; Figure 2.1). Periphyton and benthic invertebrate community sampling were undertaken in erosional habitat of lower Minto Creek and a corresponding reference area (Table 2.1; Figure 2.1). Tissue sampling (periphyton and benthic invertebrate) was also undertaken in lower Minto Creek and corresponding reference areas (Table 2.1; Figure 2.1). Supporting measures (e.g., habitat characteristics, field meter measures, water quality samples, etc.) were collected at all sampling stations.

2.1 Supporting Measures

2.1.1 Field Collection

A number of environmental variables were measured to support the sediment quality, periphyton and benthic invertebrate community data collected for the Minto Creek assessment. The location of each station was recorded using a Geographic Positioning System (GPS) with coordinates recorded in Universal Transverse Mercator (UTM) units (using the North American Datum of 1983).

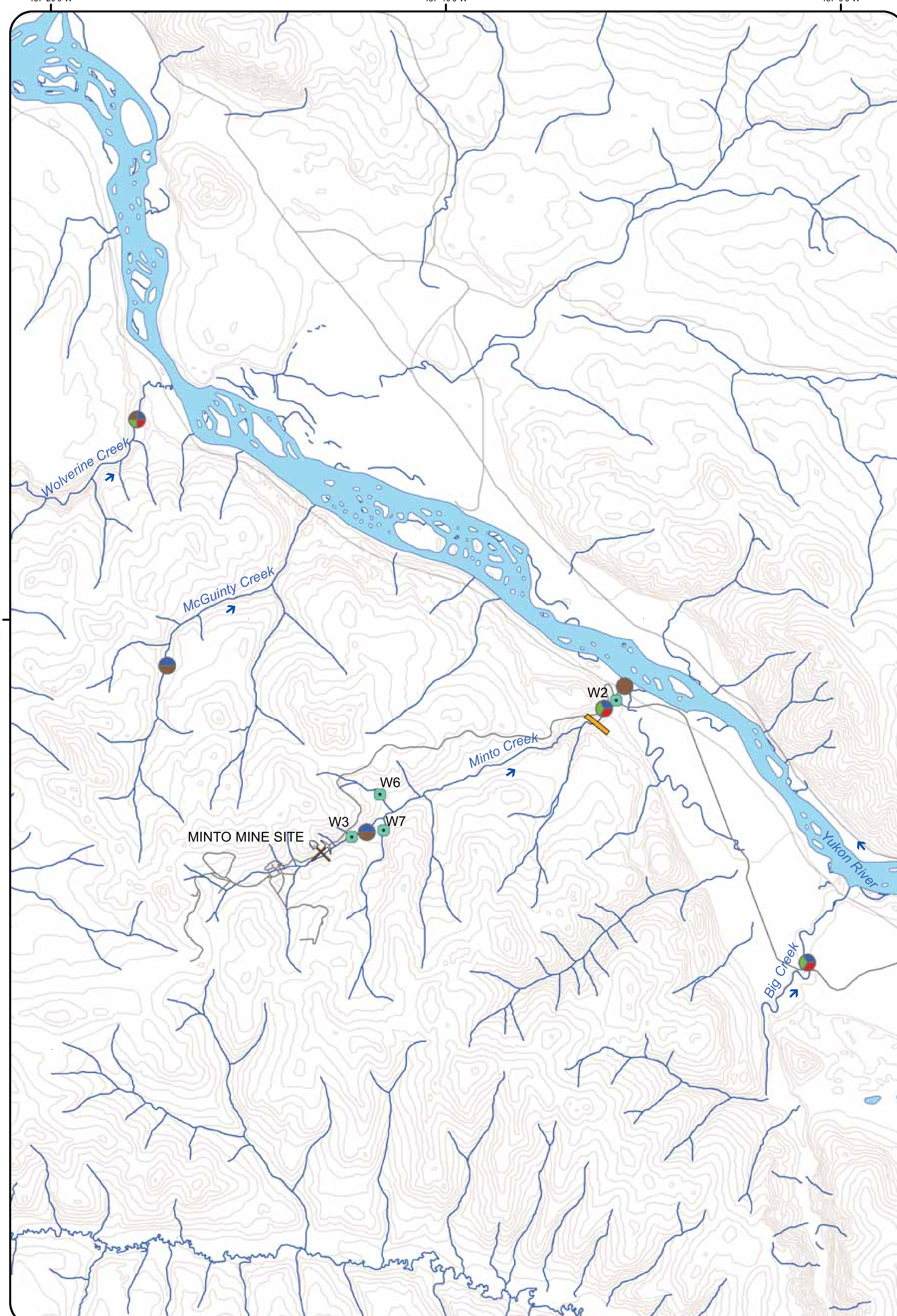
Supporting measures collected concurrent with sediment sampling (i.e., at depositional areas) included core penetration depth (lower creek areas only), sample texture, and the presence or absence of organic detritus. *In situ* measurements of temperature, dissolved oxygen, conductivity, and pH were also taken at each station using either a YSI 650 MDS (Multiparameter Display System) field meter equipped with a YSI 6600 Sonde (Yellow Springs Instruments, Yellow Springs, OH) or a Hanna 4M multiparameter meter (Woonsocket, RI).

At each periphyton and benthic invertebrate community station, *in situ* water quality measurements were taken using a field meter (described above), water depth was measured using a meter stick and water velocity was measured using a Marsh-McBirney Flo-Mate 2000 portable flow meter (Marsh-McBirney Ltd., Frederick, MD). Creek wetted and bankfull widths were measured at each sampling station using a tape measure. Additional data collected to characterize each periphyton and benthic invertebrate sampling station included: elevation, gradient, water appearance, creek morphology, bank condition, substrate texture,

Table 2.1: Minto Mine Water Use Licence sediment, periphyton and benthic invertebrate monitoring program overview - Fall 2013.

Area Type	Area	Station	Minto Mine Water Use Licence (QZ96-006, Amendment 7)						Tissue Chemistry	
			Water	Sediment by Spoon [1]	Sediment by Hand Corer [2]	Periphyton Chlorophyll 'a' [3]	Periphyton Community [4]	Benthic Community by Hess Sampler [5]	Periphyton [6]	Benthic Invertebrate Tissue [7]
Lower Creek Areas	Lower Minto Creek (Exposed)	LMC-1	X		X	X	X	X	X	X
		LMC-2			X	X	X	X	X	X
		LMC-3			X	X	X	X	X	X
		LMC-4			X	X	X	X	X	X
		LMC-5			X	X	X	X	X	X
	Lower Wolverine Creek (Reference)	LWC-1	X		X	X	X	X	X	X
		LWC-2			X	X	X	X	X	X
		LWC-3			X	X	X	X	X	X
		LWC-4			X	X	X	X	X	X
		LWC-5			X	X	X	X	X	X
	Lower Big Creek (Reference)	LBC-1	X						X	X
		LBC-2							X	X
		LBC-3							X	X
		LBC-4							X	X
		LBC-5							X	X
Upper Creek Areas	Upper Minto Creek (Exposed)	UMC-1	X	X						
		UMC-2		X						
		UMC-3		X						
		UMC-4		X						
		UMC-5		X						
	Upper McGuinty Creek (Reference)	URC-1	X	X						
		URC-2		X						
		URC-3		X						
		URC-4		X						
		URC-5		X						

[1] top 2 centimeters collected; minimum 3-grab composite
[2] top 2 centimeters collected; 3-grab composite
[3] collect from a standard area (e.g., 7 cm diameter plunger = 38.5 cm^2), place in sample vial, freeze
[4] collect from a standard area (e.g., 7 cm diameter plunger = 38.5 cm^2), place in sample vial, add water, Lugol's solution, freeze
[5] 500 um mesh; 3-grab composite
[6] scrape and place in sample vials or whirlpak bags, freeze
[7] kick and sweep or hand pick; place in sample vials or whirlpak bags, freeze



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MAP INFORMATION
Map Projection: NAD 1983
Data Source: Department of Natural Resources Canada. All rights reserved.
Created By: J.Wilson
Creation Date: March 2014
Project No.: 2498

Features

Mine Site

SAMPLES COLLECTED

Water
Sediment
Periphyton
Benthos

Other Features

Water Quality Station
Fish Barrier
Water Flow
Contours (30m interval)
Roads

Figure 2.1: Monitoring Areas for the Minto Creek Sediment, Periphyton, and Benthic Invertebrate Community Assessment – 2013

Created by:
minnow environmental inc.

instream cover, residual pool depth, instream features, overhead canopy, aquatic vegetation, riparian vegetation, surrounding land use and anthropogenic disturbance. In addition, at each benthic invertebrate station, the intermediate axis length of 100 rocks that were washed during the benthic invertebrate sampling were measured and recorded, and the percent embeddedness of ten randomly selected rocks was also evaluated and recorded. This type of substrate characterization is similar to the Canadian Aquatic Biomonitoring Network (CABIN) protocol (CABIN 2010) for characterizing benthic invertebrate habitat and provided additional information to assess and standardize habitat conditions among sampling stations. Summary statistics of intermediate axis lengths were calculated for each station including the median and geometric mean as per CABIN protocol.

Water samples for chemical analysis were collected at each periphyton and benthic sampling area. Samples were collected into pre-labeled sample bottles that were triple rinsed and preservatives were added to the sample bottles, as required. Water samples for dissolved organic carbon (DOC) and for dissolved ICP-MS (Inductively Coupled Plasma-Mass Spectrometry) analytes were filtered in the field using 0.45 µm polypropylene filters. Immediately after collection, water samples were placed in a cooler, and later placed in a refrigerator at approximately 4°C until they were submitted to the ALS Group Environmental Laboratory in Whitehorse, YT, for analysis of alkalinity by auto titration, anions by ion chromatography, total and dissolved organic carbon by combustion, total inorganic carbon by CO_2 purge, total cyanide, conductivity, hardness, total and dissolved mercury by CVAFS (low), total and dissolved metals by CCMS and ICPOES, total and dissolved phosphorus by colour, total dissolved and suspended solids by gravimetrics, pH and turbidty by meter and ammonia by fluorescence. One sample from lower Big Creek was detained at the mine causing the holding time to be exceeded. Holding times for turbidity, anions, colour, total suspended solids, total dissolved solids and total phosphorus were exceeded but careful scrutiny of quality control results in the data quality assessment indicated good data quality (Appendix A).

The productivity of lower Minto Creek and lower Wolverine Creek was evaluated through measurements of chlorophyll *a* in periphyton. Chlorophyll *a* is the primary photosynthetic pigment of all oxygen-evolving photosynthetic organisms (Wetzel 2001) and therefore provides an indicator of the standing stock of photosynthetic organisms representing the lowest trophic level. Minto Creek is a lotic system, so measuring chlorophyll *a* in periphyton is considered to be more representative of productivity than in water. A stainless steel razor blade was used to scrape periphyton from rocks and transfer it to labeled sampling jars. The surface area sampled at each station was carefully recorded. All samples were maintained in coolers with ice packs during transportation and then at 4°C in a refrigerator on site until submission to the ALS Group Environmental Laboratory (ALS; Whitehorse, Yukon).

2.1.2 Data Analysis

Water chemistry data quality was assessed prior to data analysis and interpretation, and was judged to be acceptable (Appendix A). Water quality of Minto Creek was evaluated relative to WUL standards, concentrations measured in reference areas, applicable water quality guidelines, and previous water quality (e.g., water quality results included in previous annual reports).

Supporting field measures (temperature, dissolved oxygen, pH and specific conductivity) and chlorophyll *a* results were tested for differences in the lower creek (i.e., lower Minto Creek versus the lower Wolverine Creek reference) by using an ANOVA. Prior to the ANOVA, data were tested for normality and homogeneity of variance (equal variance). Data that were not found to be normal were log transformed. If, after transformation data could not be normalized or if data did not have equal variance, a non-parametric Mann-Whitney U-test was conducted. All tests had alpha set at 0.05. Statistical comparisons were conducted using SPSS software (SPSS 2011). Creek productivity was also characterized by comparing chlorophyll *a* concentration against the Dodds et al. (1998) classification system for temperate streams.

2.2 Sediment Quality

2.2.1 Sample Collection and Laboratory Analysis

Sediment samples were collected for analysis of particle size and for chemical analysis at depositional areas within Minto Creek and reference creeks (Table 2.1; Figure 2.1). At lower Minto Creek and lower Wolverine Creek, sediment samples for particle size analysis were collected using a 15.24 cm x 15.24 cm (6” x 6”) stainless steel ponar grab (0.023 m^2 sampling area). A composite sample was created by collecting the surficial two centimeters of sediment from each of three acceptable grabs (i.e., full to each edge of the sampler) using a stainless steel spoon. Sediment samples for physical characterization were then placed into pre-labeled Ziploc™ bags. Sediment samples for chemical analyses were collected using a 4.7 cm (2”) (inside diameter) Lexan™ core tube, which was carefully inserted into sediment deposits, capped using a fitted plastic cap and retrieved by hand. From each acceptable core (i.e., each core containing an intact, representative sediment-water interface), the surficial two centimeters of sediment was manually extruded upwards into a graded core collar, cut with a stainless steel core knife, and placed into a pre-labeled Ziploc™ bags. Samples from three cores treated in this manner were composited to form a single sample from each station. At upper Minto Creek and upper McGinty Creek, sediment deposits were rare and were typically very shallow (i.e., deposits were less than three centimeters in depth). Accordingly, collection by ponar or by coring, as described above, was not effective in the upper creek areas and sediments were collected using a stainless steel spoon. Specifically, at locations of sediment deposition, surficial sediment was carefully collected by slowly spooning the sediment into a Ziploc™ bag, with care taken to avoid the loss of fine material. In order to be as consistent as possible with the sediment collected in the lower Creek areas, samples included only the top 2 centimeters of deposited sediment. Immediately after collection, sediment samples were placed in a cooler, and later placed in a refrigerator at approximately 4°C until they were submitted to the ALS Group Environmental Laboratory in Burnaby, BC, for analysis of particle size, total organic carbon, metals (by ICP-MS and ICP-OES [Inductively Coupled Plasma-Mass Spectrometry and Inductively Coupled Plasma-Optical Emission Spectroscopy] scans) and mercury.

2.2.2 Data Analysis

Sediment data quality was assessed prior to data analysis and interpretation, and was judged to be acceptable (Appendix A). Sediment quality data were evaluated relative to sediment quality guidelines (SQGs) for the protection of aquatic life (e.g., CCME 1999) and reference concentrations to identify metals with the potential to adversely affect aquatic life and/or whose concentrations were elevated due to mine activity. Sediment quality data were also evaluated by comparison to results obtained in previous years of sampling (1994 and 2006-2012). However, interpretation was conducted with careful consideration of a significant methodological change made in 2010 and carried through to 2013 (sediments collected as described above) relative to previous years. When calculating descriptive statistics and a value was reported as less than method detection limit (i.e., < 0.1 mg/kg), a value of the method detection limit (i.e., 0.1 mg/kg) was used for calculation purposes. Sediments collected in all years previous to 2010 were collected within the active channel of the creek using an aluminum or Teflon scoop. Samples were submitted whole for analysis of particle size distribution, which generally included significant quantities of gravel and sand. Only material passing through a 230 mesh sieve (< 63 µm; silt and clay) was digested and analyzed for metals. While this approach does result in the analysis of geochemically-relevant fine sediment (e.g., Horowitz 1991), it represents an impediment to the interpretation of the biological significance of sediment chemistry as organisms are exposed to whole sediment, and sediment quality guidelines (SQGs) for the protection of aquatic life (e.g., CCME 1999) apply to whole sediment.

2.3 Periphyton Community

2.3.1 Sample Collection and Laboratory Analysis

Periphyton is the assemblage of algae, bacteria, fungi, and meiofauna attached to submerged substrate in freshwaters. However, periphyton communities are generally characterized on the basis of the attached algae community. Attached algal communities are representative of the lowest trophic level and are indicators of productivity. Periphyton was collected from randomly selected rocks at each station with the use of a stainless steel razor blade. The surface area sampled was inversely proportional to the periphyton coverage in order to provide a consistent sample weight for analysis (2-5 grams). Samples were preserved with Lugol's iodine solution and shipped to EcoAnalysts, Inc. (Moscow, Idaho) for analysis to species level.

2.3.2 Data Analysis

Periphyton communities were evaluated using summary metrics including number of organisms per sample, number of taxa, Simpson's Evenness and Bray-Curtis Index (Environment Canada 2012). Additional non-statistical comparisons were made using percent community composition of dominant taxa (calculated as the abundance of each respective taxon group relative to the total number of organisms in the sample).

The diversity metric "number of taxa" (also known as taxon richness) included all separate taxa identified to the species level. Simpson's Evenness ("E") index was computed according to formulae presented by Smith and Wilson (1996) and recommended by Environment Canada (2012). This index takes into account both the relative abundance of taxa, and the number of taxa, with values ranging from 0 (low diversity or evenness) to 1 (high diversity or evenness). Bray-Curtis (B-C) indices were also calculated according to Environment Canada (2012). This metric takes into account the abundance of each taxon at each station compared to the median abundance computed from the reference stations (LWC), to compute an index of the relative "dissimilarity" of each station from the hypothetical reference median station. Larger B-C index values indicate greater dissimilarity from reference.

Periphyton community endpoints were summarized by separately reporting mean, median, minimum, maximum, and standard deviation for each study area. Differences among effluent-exposed and reference areas were tested using ANOVA, with significance set at alpha < 0.10. Prior to ANOVA, data were tested for the assumptions of normality and homogeneity of variance. If data were not found to be normal or variances were not equal, a non-parametric Mann-Whitney U-test was conducted. All statistics were conducted using SPSS (SPSS 2011).

Periphyton data collected in 2013 were compared to data collected in baseline studies (HKP 1994) and in 2011 and 2012. Due to differences in reporting of periphyton community in the 1994 report (e.g., taxa identified as present, common or dominant), a non-statistical comparison was performed using proportional abundances at the taxonomic level of Phylum.

2.4 Benthic Invertebrate Community

2.4.1 Sample Collection and Laboratory Analysis

Benthic invertebrate community samples were collected in erosional habitat of lower Minto Creek and lower Wolverine Creek as required under the WUL. Benthic invertebrate community samples were collected from riffle/run habitat with cobble and gravel substrate using a Hess sampler (0.1 m^2) outfitted with 500 µm mesh. Five replicate samples were collected at each monitoring location and consisted of a three-grab composite (0.3 m^2 of bottom area in total). For each grab, the substrate within the sampler was disturbed and scrubbed (by hand and nail brush) with care taken to ensure that all dislodged organic material was swept into the sampler collection net. The substrate was disturbed to a depth of approximately 10 cm over a period of approximately five minutes. This procedure was repeated for the second and third grab, following which all of the material contained in the collection net was carefully transferred to a pre-labeled 2 litre wide-mouth plastic jar using a stainless steel spoon and a wash bottle while working over a plastic tub to avoid any potential loss of organisms. Any organisms that adhered to the sieve bag were removed by hand and added to the sample. All samples were labeled internally (using wooden sticks) and externally with the station number, area identifier, Minnow project number, date and field personnel in order to ensure correct identification at the laboratory. Samples were preserved within six hours of collection using buffered formalin solution to a nominal concentration of 10% in ambient water.

All benthic invertebrate samples were shipped to Cordillera Consulting in Summerland, BC. Each sample was elutriated to remove sand, gravel and clay, and the remaining organic material was preserved in 70% ethanol. The elutriate was examined for any mollusc or trichopteran cases then each sample was examined to estimate the total number of invertebrates. If the estimated number was greater than 600 individuals and the sample was fine and non-clumping, a subsample was taken using a Folsom Plankton Splitter (Motodo 1959; Van Guelpen et al. 1982). Empty snail or bivalve shells, empty caddisfly cases, invertebrate fragments such as legs, gills, antennae etc. were not removed or counted.

When organism fragments were encountered, only the heads were counted towards the total. Larval and pupa exuviae were not counted while terrestrial stages and terrestrial drop-ins were indicated as such and do not contribute to the total count. Benthic invertebrates were identified to the "lowest practicable taxonomic level" (which in most cases was genus) and counted. Following identification and counting, representative specimens of each taxon were preserved in a museum quality vial with a polyseal lid to create a voucher collection. The interior labels were used to identify the taxa, the client, date collected, site code and the project. Laboratory quality assurance/quality control (QA/QC) included an assessment of sub-sampling error and sorting efficiency on at least 10% of the samples.

2.4.2 Data Analysis

Benthic invertebrate community data quality was assessed prior to data analysis and interpretation, and was judged to be acceptable (Appendix A). Benthic invertebrate communities were evaluated using summary metrics including invertebrate density (number of organisms per m^2 calculated based on a sample area of 0.3 m^2), number of taxa, Simpson's Diversity, Simpson's Evenness and Bray-Curtis Index. For each benthic invertebrate sample, total organism density (individuals/m^2) was calculated. The diversity metric "number of taxa" (also known as taxon richness) included all separate taxa identified to the species/variant level, excluding any organisms that could not be conclusively identified as separate taxa. Simpson's Diversity ("D") and Simpson's Evenness ("E") indices were computed according to formulae presented by Smith and Wilson (1996) and recommended by Environment Canada (2012). These indices take into account both the relative abundance of taxa, and the number of taxa, with values ranging from 0 (low diversity or evenness) to 1 (high diversity or evenness). Bray-Curtis (B-C) index was also calculated according to Environment Canada (2012). This metric takes into account the abundance of each taxon at each station compared to the median abundance computed from the reference stations (lower Wolverine Creek), to compute an index of the relative "dissimilarity" of each station from the hypothetical reference median station. Larger B-C index values indicate greater dissimilarity from reference.

The relative proportions of the most abundant taxa were calculated relative to the total number of organisms in the sample. Dominant taxon groups were defined as those groups representing greater than 10% of total organism abundance in one or more areas or any groups considered to be important indicators of environmental stress. In this study, relative proportions of oligochaetes (worms), chironomids (non-biting midges), nematans (roundworms), and EPT taxa (Ephemeroptera [mayfly], Plecoptera [stonefly], Trichoptera [caddisfly] taxa) were examined. It is often possible to relate low relative abundance of sensitive taxonomic groups (e.g., EPT taxa) to environmental stress (e.g., Taylor and Bailey 1997). Similarly, high relative abundance of tolerant taxonomic groups (e.g., oligochaetes) may indicate higher environmental stress (Chapman et al. 1982a; 1982b).

All benthic invertebrate community endpoints were summarized by reporting mean, median, minimum, maximum, standard deviation, standard error and sample size for each study area. Differences among effluent-exposed and reference areas were tested using ANOVA, with significance set at alpha < 0.10. Prior to ANOVA, all data were transformed as necessary to meet assumptions of normality and homogeneity of variance. If data failed the assumptions of normality and homogeneity of variance than a Mann-Whitney U-test was conducted. All statistical comparisons were conducted using SPSS software (SPSS 2011). Following the statistical comparisons, the magnitude of difference between effluent-exposed and reference area means was calculated for each benthic invertebrate community metric where a significant difference was detected. If a significant difference between areas was not detected, then the minimum effect size that could be detected was calculated.

Benthic invertebrate community data were also evaluated in comparison to results obtained in previous years of sampling (1994, 2006, 2008, 2010-2012). Summary metrics from earlier years were previously re-calculated (Minnow 2011) to ensure consistency and appropriate comparisons over time.

2.5 Tissue Chemistry

2.5.1 Sample Collection and Laboratory Analysis

Periphyton and benthic invertebrate tissue samples were collected from lower Minto Creek (exposed), lower Wolverine Creek (reference) and lower Big Creek (reference; Table 2.1; Figure 2.1). Periphyton samples were collected by scraping submerged cobble-size rocks using a stainless steel razor blade. A total of five samples were collected at each area. Scraped material (periphyton) was placed in pre-labelled sample jars. Benthic invertebrate tissue samples were collected in areas with cobble substrate using a kick-net and by overturning rocks and collecting organisms by hand. A total of five samples were collected at each area. Benthic invertebrate samples were placed into pre-labelled Whirl-Pak™ bags until the desired sample size (2-5 grams) was achieved. Immediately after collection, all tissue samples were placed in a cooler, and later in a freezer until they were submitted to the ALS Laboratory Group in Burnaby, BC. Samples were analyzed for wet weight for metals by High-Resolution ICP-MS and later converted to dry weight using percent moisture.

2.5.2 Data Analysis

The primary objective of the tissue collections was to support a selenium assessment reported under separate cover. Accordingly, data are reported within this report for future reference with limited interpretation. Tissue quality data were interpreted by statistically comparing metal concentrations at the exposed area to those collected at the reference areas using an ANOVA with post-hoc testing. Either the Bonferroni (if equal variance was achieved) or Tamhane (if data had unequal variance) post hoc tests were used. Data were first tested for normality and equality of variance. If normality was not achieved data were transformed by either log or inverse transformations. Some analytes could not be normalized, and a non-parametric Mann-Whitney U-test was conducted instead. Both tests had alpha values of 0.05.

3.0 SUPPORTING MEASURES

3.1 Field Measures

Physico-chemical measurements were taken to support both sediment and benthic invertebrate collections. Mean temperature at the sediment sampling area of lower Minto Creek (4.7°C) was significantly, but modestly lower than in lower Wolverine Creek (5.8°C; Figure 3.1; Appendix Table B.3). Specific conductance followed a gradient from the mine downstream and was slightly greater in upper Minto Creek (485 µS/cm) than in lower Minto Creek (320 µS/cm). In both upper and lower Minto Creek, specific conductance was significantly higher than at the respective reference areas (Figure 3.1). Dissolved oxygen was higher, but not significantly so at lower Minto Creek (84.1%) than at lower Wolverine Creek (46.6%). Even though the differences were not significant there was high variability at lower Wolverine Creek (Appendix Table B.3). Dissolved oxygen was low at sites on the lower Wolverine Creek and this could be attributed to sampling locations occurring in a back eddy where dissolved oxygen might be expected to be low. In all areas, both dissolved oxygen and pH were well within water quality guidelines as well as the WUL standard for pH.

Physico-chemical measurements were also taken in erosional areas of lower Minto Creek and lower Wolverine Creek in support of benthic invertebrate community sampling. As at the depositional areas, temperature was significantly lower at lower Minto Creek (3.1°C) than at lower Wolverine Creek (5.3°C; Figure 3.2; Appendix Table B.4). Both areas were well oxygenated and there was no significant difference between areas for dissolved oxygen (Figure 3.2). Specific conductance and pH were significantly higher at lower Minto Creek (322 µS/cm and 8.38) than at lower Wolverine Creek (187 µS/cm and 8.06).

3.2 Water Chemistry and Chlorophyll *a*

At lower Minto Creek, four analytes (fluoride, phosphorus, aluminum, copper and iron) were present at concentrations that did not meet guidelines or WUL standards (Table 3.1). Of these, only phosphorus was present at a concentration greater than a WUL standard. At upper Minto Creek, two analytes (fluoride and copper) were present at concentrations that did not meet guidelines (Table 3.1). In all cases, elevations of the same analytes were observed at reference areas and at concentrations that were either similar to or greater than in Minto Creek, suggesting that the observed exceedences were not mine-related.

Concentrations of the analytes that were greater than WUL standards and/or guidelines in the receiving environment in 2013 against 2012 data (Minnow 2013a) indicated that concentrations were higher in 2012 (Appendix Table B.7). In 2012, TSS was higher than in

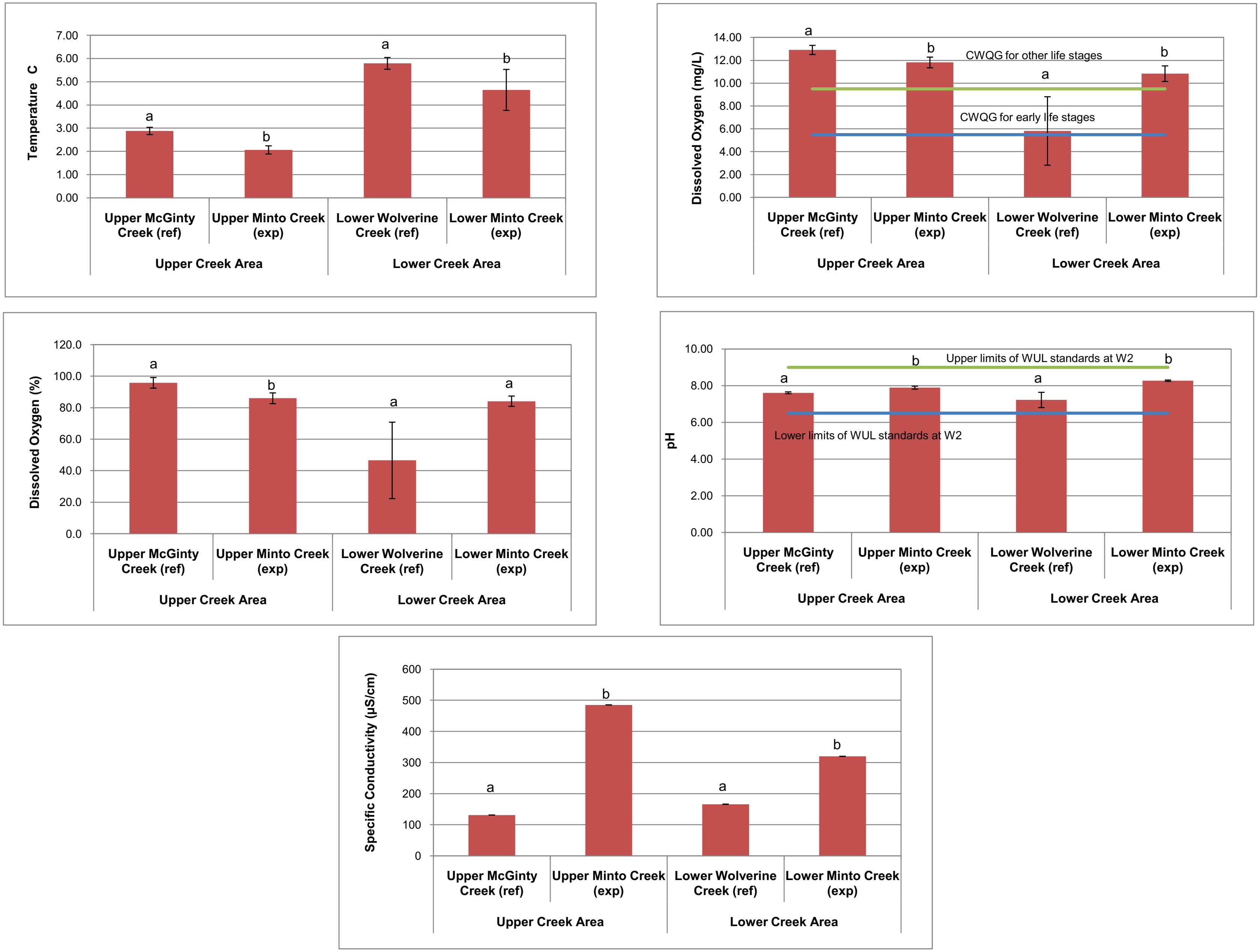

Figure 3.1: Physico-chemical measurements in depositional areas of upper and lower Minto Creek relative to reference areas. Data presented as mean ± standard deviation. Sample sizes were n = 5 in all areas.

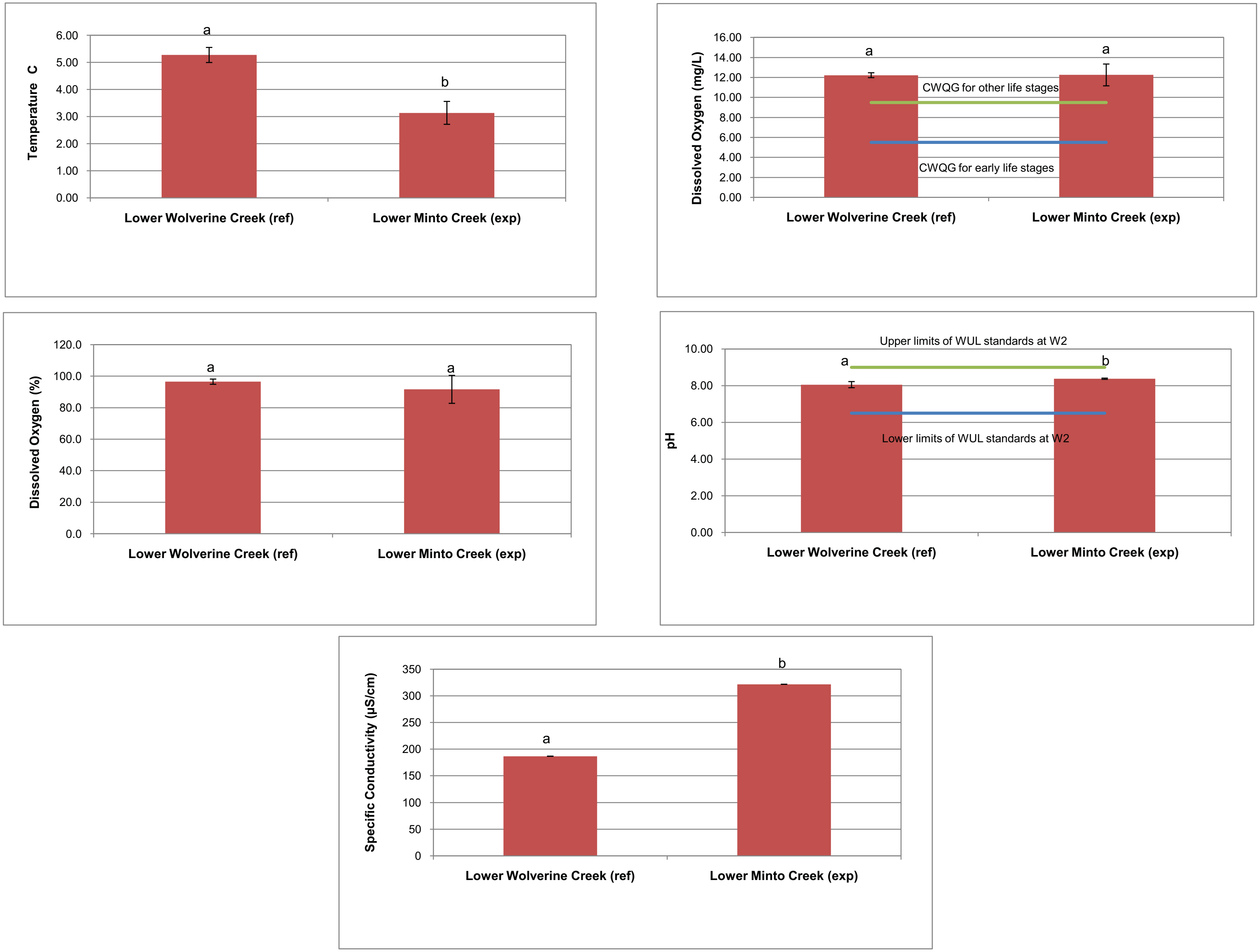

Figure 3.2: Physico-chemical measurements in erosional areas of upper and lower Minto Creek relative to reference areas. Data presented as mean ± standard deviation. Sample sizes were n = 5 at all sites

Table 3.1: Water quality results at exposure and reference, Minto Mine WUL, September 2013.

	Analyte	Units	CCME Water Quality Guidelines[a] 30	CCME Water Quality Guidelines[a] Max	WUL Standards at W2	Lower Minto Creek (exposure)	Lower Wolverine Creek (reference)	Upper Minto Creek (exposure)	Upper McGinty Creek (reference)	Lower Big Creek (reference)
Physical Tests	Conductivity	µS/cm	-	-	-	309	185	484	135	210
	Hardness (as $CaCO_3$)	mg/L	-	-	-	154	87	232	67	92
	pH	ph Units	-	-	6.0 - 9.0	8.22	7.38	7.90	7.15	8.34
	Total Suspended Solids	mg/L	8.0	-	-	5.3	< 3.0	< 3.0	< 3.0	3.1
	Total Dissolved Solids	mg/L	-	-	-	200	152	283	109	146
	Turbidity	NTU	5.43	-	-	4.00	1.75	0.18	4.04	3.43
Anions and Nutrients	Alkalinity, Total	mg/L	-	-		178	97	249	72	106
	Ammonia, Total (as N)	mg/L	0.343		0.35	0.0052	0.0060	0.0053	0.0068	< 0.0050
	Chloride (Cl)	mg/L	120	640	-	1.19	< 0.50	3.95	< 0.50	2.07
	Fluoride (F)	mg/L	0.12	-	-	0.307	0.127	0.544	0.228	0.130
	Nitrate (as N)	mg/L	13	550	2.9	0.0528	< 0.0050	0.2900	0.0238	0.0098
	Nitrite (as N)	mg/L	0.197	-	0.06	0.0012	< 0.0010	< 0.0010	0.0010	< 0.0010
	Phosphorus (P)-Total dissolved	mg/L	-	-	-	0.0154	0.0085	0.0039	0.0236	0.0027
	Phosphorus (P)-Total	mg/L	-	-	0.02	0.0267	0.0129	0.0052	0.0297	0.0073
	Sulfate (SO4)	mg/L	-	-	-	13.0	13.1	43.6	7.4	13.3
Other	Cyanide, Total	mg/L	-	-	-	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005
	Dissolved Organic Carbon	mg/L	-	-	-	13.3	16.4	5.7	15.8	8.88
	Total Organic Carbon	mg/L	-	-	-	13.8	17.8	5.6	16.1	8.4
	Total Inorganic Carbon	mg/L	-	-	-	34.2	17.7	49.9	14.4	21.9
Total Metals	Total Aluminum (Al)	mg/L	0.1	-	0.62	0.154	0.117	0.006	0.085	0.157
	Total Antimony (Sb)	mg/L	-	-	-	< 0.0001	< 0.0001	< 0.0001	< 0.0001	0.0002
	Total Arsenic (As)	mg/L	0.005	-	0.005	0.00093	0.00053	0.00029	0.00091	0.00216
	Total Barium (Ba)	mg/L	-	-	-	0.073	0.039	0.084	0.039	0.065
	Total Beryllium (Be)	mg/L	-	-	-	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001
	Total Bismuth (Bi)	mg/L	-	-	-	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
	Total Boron (B)	mg/L	1.5	2.9	-	< 0.010	0.010	0.023	< 0.010	< 0.010
	Total Cadmium (Cd)	mg/L	0.00002	-	0.00004	< 0.00001	< 0.00001	< 0.00001	< 0.00001	0.00001
	Total Calcium (Ca)	mg/L	-	-	-	44.7	19.6	55.8	18.4	23.2
	Total Chromium (Cr)	mg/L	0.001 Cr(VI)	-	0.002	0.00069	0.00079	0.00016	0.00064	0.00048
	Total Cobalt (Co)	mg/L	-	-	-	0.00027	0.00015	< 0.00010	0.00038	0.00012
	Total Copper (Cu)	mg/L	0.002	-	0.013	0.0019	0.0024	0.0023	0.0017	0.0028
	Total Iron (Fe)	mg/L	0.3	-	1.1	0.832	0.360	0.017	1.210	0.267
	Total Lead (Pb)	mg/L	0.0019	-	0.004	0.00008	< 0.00005	< 0.00005	< 0.00005	0.00015
	Total Lithium (Li)	mg/L	-	-	-	0.0014	0.0014	0.0028	< 0.0005	0.0014
	Total Magnesium (Mg)	mg/L	-	-	-	13.2	9.9	25.2	5.3	9.3
	Total Manganese (Mn)	mg/L	-	-	-	0.040	0.013	0.042	0.095	0.020
	Total Mercury (Hg)	mg/L	0.00003	-	-	< 0.00001	< 0.00001	< 0.00001	< 0.00001	< 0.00001
	Total Molybdenum (Mo)	mg/L	0.073	-	0.073	0.0015	0.0005	0.0053	0.0009	0.0013
	Total Nickel (Ni)	mg/L	0.07	-	0.11	0.0018	0.0021	0.0009	0.0015	0.0013
	Total Phosphorus (P)	mg/L	-	-	-	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
	Total Potassium (K)	mg/L	-	-	-	1.22	0.66	2.25	0.52	0.88
	Total Selenium (Se)	mg/L	0.001	-	0.001	0.0001	0.0001	0.0004	0.0002	< 0.0001
	Total Silicon (Si)	mg/L	-	-	-	6.98	5.33	5.66	6.29	5.87
	Total Silver (Ag)	mg/L	0.0001	-	-	< 0.00001	< 0.00001	< 0.00001	< 0.00001	< 0.00001
	Total Sodium (Na)	mg/L	-	-	-	7.83	6.29	17.50	3.60	6.88
	Total Strontium (Sr)	mg/L	-	-	-	0.353	0.171	0.626	0.122	0.260
	Total Thallium (Tl)	mg/L	0.0008	-	-	< 0.00001	< 0.00001	< 0.00001	< 0.00001	< 0.00001
	Total Tin (Sn)	mg/L	-	-	-	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001
	Total Titanium (Ti)	mg/L	-	-	-	0.011	< 0.010	< 0.010	< 0.010	0.013
	Total Uranium (U)	mg/L	0.015	0.033	-	0.0012	0.0005	0.0026	0.0003	0.0023
	Total Vanadium (V)	mg/L	-	-	-	0.0018	0.0015	< 0.0010	0.0014	0.0014
	Total Zinc (Zn)	mg/L	0.03	-	0.03	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003

Water use licence limits exceeded

Water quality guideline exceeded

[a] CCME (Canadian Council of Ministers of the Environment). 1999. Canadian Environmental Quality Guidelines. 1999 (plus updates), Canadian Council of Ministers of the Environment, Winnipeg. See Appendix Table B.6 for explanatory notes on selected water quality guidelines.

2013 (425 in 2012 compared to 5.3 in 2013) and likely also caused relative elevation in TSS-associated metals such as aluminum and iron.

Concentration of chlorophyll *a* was slightly lower at lower Minto Creek than at lower Wolverine Creek but the difference was not statistically significant (Figure 3.3). The observed difference was likely due to greater light penetration to the substrate at lower Wolverine Creek. Chlorophyll *a* concentrations at both areas were well below the British Columbia Water Quality Guideline of 100 mg/m^2 for the protection of aquatic life (BCMOE 1985). The production of both creeks could be considered low (oligotrophic) based on the classification by Dodds et al. (1998) which sets the oligotrophic-mesotrophic boundary for benthic chlorophyll at 20 mg/m^2. This differs from the classification based on only total phosphorus which would define both areas as mesotrophic (Dodds et al. 1998). The lower concentrations of chlorophyll *a* despite relatively high phosphorus may be due to environmental factors associated with a northern system such as low water temperatures, limited light and a short growing season.

3.3 Summary

Specific conductance and pH were higher in upper and lower Minto Creek than at the reference areas (upper McGinty Creek and lower Wolverine Creek) and specific conductance decreased from upper Minto Creek down to lower Minto Creek. At both the erosional and depositional sampling locations, dissolved oxygen was similar at the exposure and reference areas.

Overall, water quality results demonstrated that five analytes (fluoride, phosphorus aluminum, copper and iron) did not meet WUL standards and/or water quality guidelines in at least one exposure area. In all cases, elevations of the same analytes were observed at reference areas and at concentrations that were either similar to or greater than in Minto Creek, suggesting that the observed exceedances were not mine-related. Chlorophyll *a* concentration on substrates of lower Minto Creek was lower than in Wolverine Creek but the difference was not statistically significant

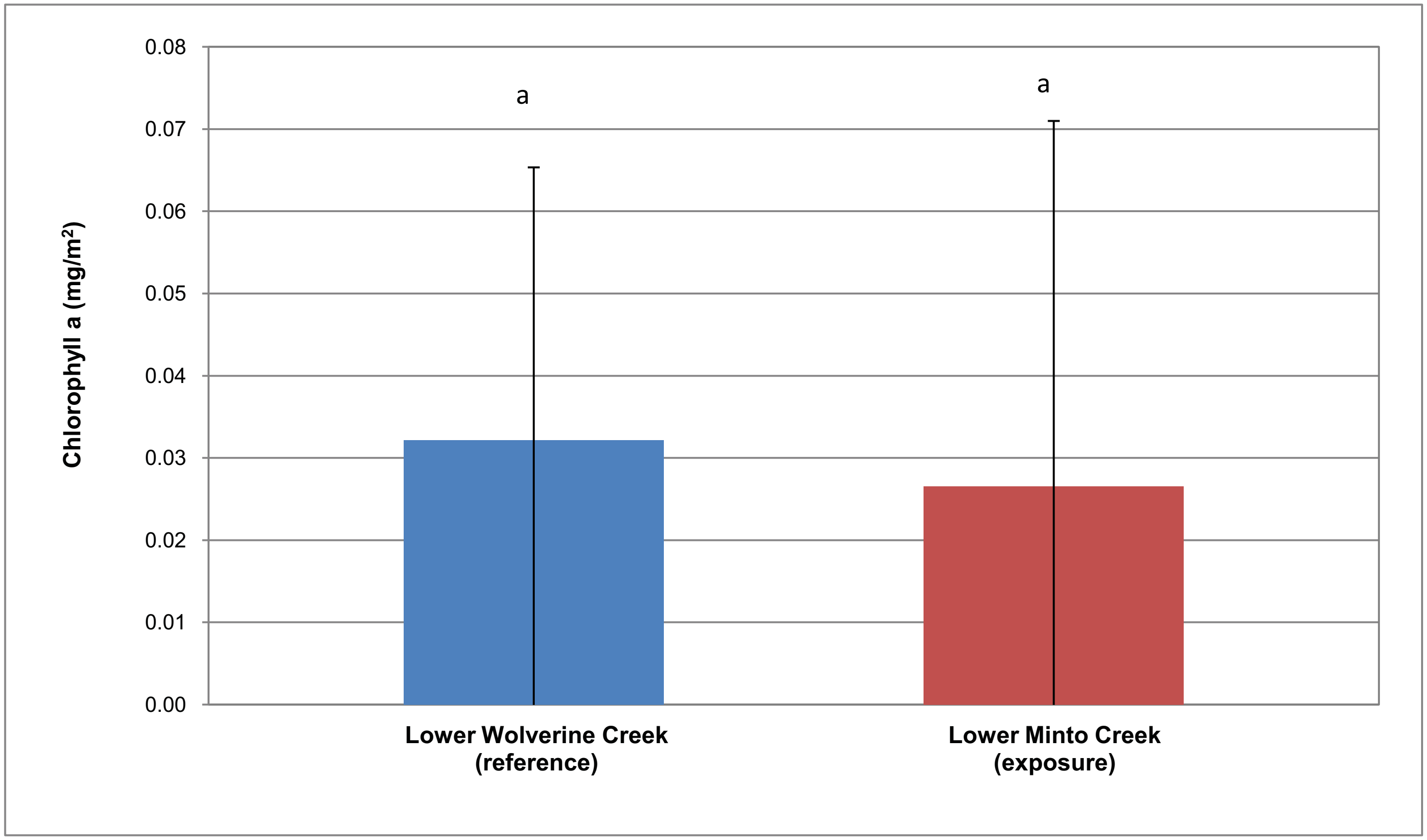

Figure 3.3: Concentrations of chlorophyll *a* in periphyton measured at five benthic stations in lower Wolverine and lower Minto Creeks, Minto Mine WUL, 2013. Data presented as mean ± standard deviation.

4.0 SEDIMENT QUALITY

4.1 Sediment Particle Size and Chemistry

Sediments collected in 2013 were largely composed of fine particles in the silt and sand size categories (Figure 4.1; Appendix Table C.1). Mean total organic carbon (TOC) content of sediment collected from lower Minto Creek and lower Wolverine Creek were similar, whereas sediment collected from upper Minto Creek had somewhat lower TOC than upper McGinty Creek (Table 4.1). Arsenic and copper were the only analytes with mean concentrations greater than Interim Sediment Quality Guidelines for the protection of aquatic life (ISQG; CCME 1999) in an effluent-exposed area (upper and lower Minto Creek; Table 4.1; Appendix Table C.1). However, Minto Creek sediment arsenic concentrations were similar to reference (reference was also greater than ISQG), suggesting that arsenic concentrations above ISQG at Minto Creek were not mine-related. Therefore, only mean copper concentrations were greater than ISQG and reference and require consideration of temporal trends to evaluate potential mine influence (Section 4.2). With progression from upper to lower Minto Creek, 2013 sediment copper concentrations decreased from a mean of 84 to 42 mg/kg, respectively, suggesting some improvement with distance downstream.

Due to the predominantly erosional habitat in upper Minto Creek, there are relatively few areas where sediment is deposited and this only in small quantities that likely wash away each year during freshet. Therefore, elevated sediment copper in fine sediment in the upper reaches of Minto Creek may be of limited importance in terms of exposure and potential toxicity to biota. In lower Minto Creek, fine sediment deposits are more common and therefore more relevant to aquatic life. Previous toxicity testing in 2011 indicated no adverse effects at lower Minto Creek sediment quality conditions that were generally similar to those observed in 2013 (Minnow 2012).

4.2 Temporal Comparisons

Sediment particle size distribution in 2013 was similar to 2010-2012 but was notably different from earlier sample year data (Figure 4.1). The disparity between 2010-2012 and 1994-2009 data reflects the change in sediment sampling methodology initiated in 2010 (Minnow 2011). Mean analyte concentrations higher than guideline in Minto Creek were compared to earlier data to detect any increasing or decreasing trends in sediment quality. Mean arsenic concentrations in 2013 were elevated relative to the guideline at all areas (Minto Creek and reference) and were similar to previous years (Figure 4.2). Mean copper concentration at upper Minto Creek in 2013 was greater than the guideline, but was also greater than

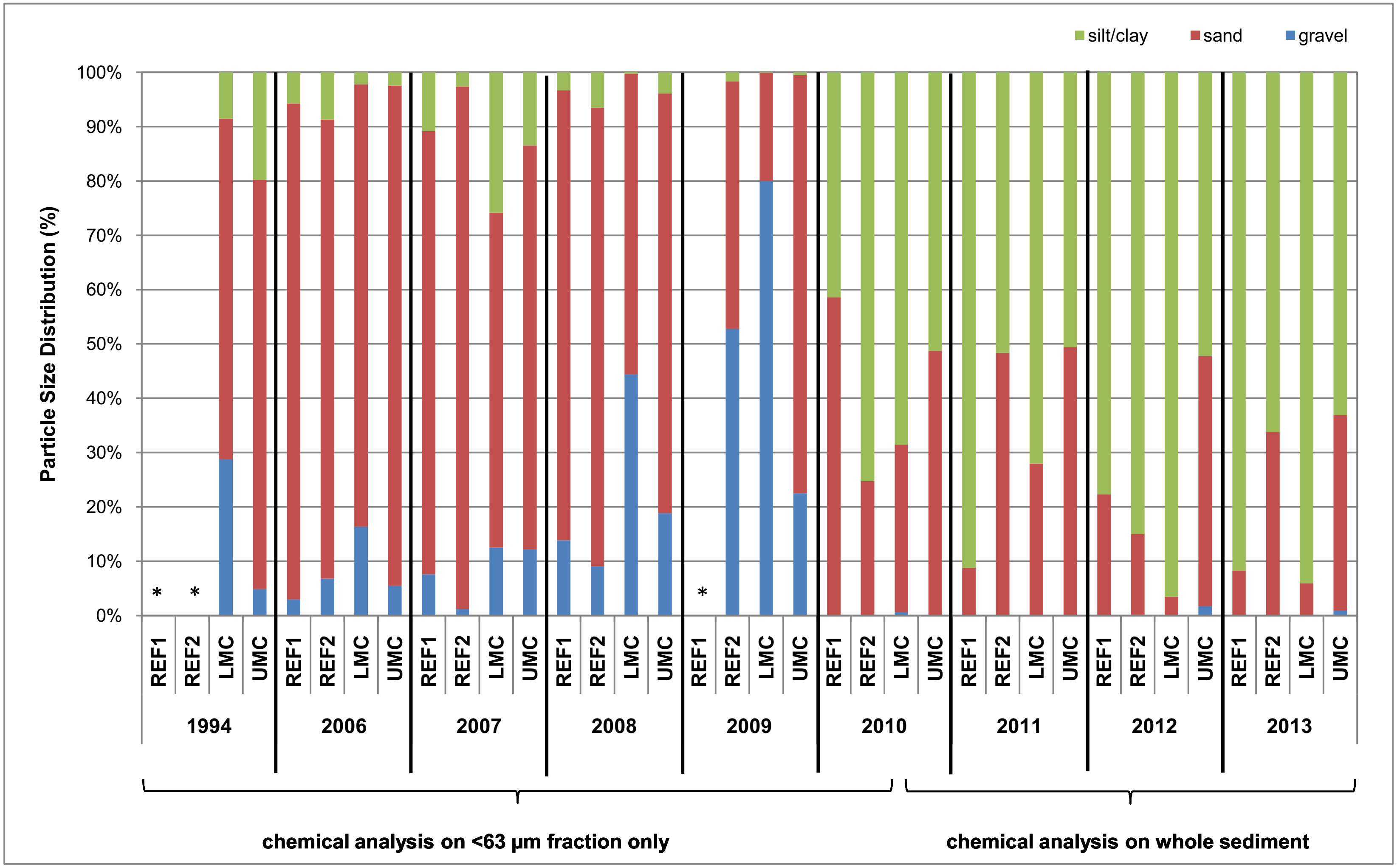

Figure 4.1: Particle size distribution of sediment collected in Minto Creek and reference locations, 1994 - 2013[1]

[1] UMC = Upper Minto Creek; LMC = Lower Minto Creek; REF1 = Station W6 (south-flowing tributary) in 2006 to 2008 and McGinty Creek in 2010 to 2013; REF2 = Station W7 (north-flowing tributary) in 2006 to 2009 and Wolverine Creek in 2010 to 2013; * - no data

Table 4.1: Sediment chemistry data collected at exposed and reference areas, Minto Mine WUL, 2013.

	Analytes	Units	CSQG [a]		Upper McGinty Creek (Reference)				Lower Wolverine Creek (Reference)				Upper Minto Creek (Exposure)				Lower Minto Creek (Exposure)			
			ISQG	PEL	Mean	Standard	Minimum	Maximum	Mean	Standard	Minimum	Maximum	Mean	Standard	Minimum	Maximum	Mean	Standard	Minimum	Maximum
Particle size, TKN, carbon analytes and pH	Loss on Ignition	%			17.4	4.0	13.0	22.0	12.8	4.7	6.0	17.0	9.6	2.9	6.0	14.0	14.4	6.9	4.0	21.0
	pH (1:2 soil:water)	pH units			6.98	0.19	6.67	7.16	7.00	0.11	6.82	7.10	7.76	0.16	7.49	7.88	7.89	0.06	7.82	7.98
	% Gravel (>2mm)	%			< 0.1	0.0	< 0.1	< 0.1	< 0.1	0.0	< 0.1	< 0.1	**0.9**	1.8	0.1	**4.1**	< 0.1	0.0	< 0.1	< 0.1
	% Sand (2.0mm - 0.063mm)	%			8.1	2.6	5.1	11.3	33.7	10.8	26.1	52.3	36.0	12.5	19.2	54.5	5.9	5.9	0.5	13.9
	% Silt (0.063mm - 4um)	%			82.8	2.9	79.5	86.1	59.6	10.3	42.1	66.4	53.3	14.1	32.4	72.1	82.9	4.3	78.2	87.2
	% Clay (<4um)	%			9.1	1.1	8.0	11.0	6.7	1.0	5.6	7.8	9.9	1.1	8.7	11.6	11.3	2.0	8.0	12.8
	Total Kjeldahl Nitrogen	%			0.464	0.082	0.376	0.557	0.332	0.112	0.156	0.449	0.271	0.069	0.170	0.355	0.385	0.181	0.101	0.535
	CaCO3 Equivalent	%			1.06	0.21	0.80	1.26	1.06	0.44	0.80	1.83	0.87	0.10	0.80	1.04	1.30	0.20	1.01	1.52
	Inorganic Carbon	%			0.13	0.02	0.10	0.15	0.13	0.05	0.10	0.22	0.10	0.01	0.10	0.12	0.15	0.02	0.12	0.18
	Inorganic Carbon (as CaCO3 Equivalent)	%			1.05	0.21	0.80	1.25	1.05	0.43	0.80	1.82	0.87	0.10	0.80	1.03	1.30	0.20	1.01	1.52
	Total Carbon by Combustion	%			9.32	2.11	7.10	11.60	6.32	2.25	2.80	8.50	4.94	1.50	2.70	6.80	7.44	3.69	1.90	10.70
	Total Organic Carbon	%			9.21	2.06	7.12	11.40	6.26	2.30	2.62	8.41	4.91	1.51	2.61	6.69	7.27	3.72	1.70	10.50
Total Metals	Aluminum (Al)	mg/kg			14,600	1,196	12,500	15,500	12,400	738	11,500	13,200	12,240	1,240	10,300	13,300	14,100	1,089	12,400	15,100
	Antimony (Sb)	mg/kg			0.52	0.04	0.48	0.57	0.43	0.07	0.32	0.52	0.49	0.07	0.38	0.55	0.66	0.09	0.53	0.76
	Arsenic (As)	mg/kg	5.9	17	7.47	1.29	5.98	8.68	6.25	0.82	4.98	7.10	6.01	0.75	5.15	6.96	8.12	0.92	6.51	8.84
	Barium (Ba)	mg/kg			304	32	258	331	193	36	142	242	200	37	153	255	314	45	239	353
	Beryllium (Be)	mg/kg			0.45	0.05	0.38	0.48	0.72	0.11	0.54	0.83	0.44	0.06	0.34	0.49	0.58	0.08	0.45	0.66
	Bismuth (Bi)	mg/kg			< 0.2	0.0	< 0.2	< 0.2	< 0.2	0.0	< 0.2	< 0.2	< 0.2	0.0	< 0.2	< 0.2	< 0.2	0.0	< 0.2	< 0.2
	Cadmium (Cd)	mg/kg	0.6	3.5	0.205	0.035	0.169	0.258	0.199	0.066	0.106	0.281	0.180	0.027	0.138	0.207	0.276	0.081	0.149	0.354
	Calcium (Ca)	mg/kg			10,504	1,705	8,720	12,800	9,090	1,802	6,420	11,200	8,768	1,131	6,800	9,610	15,740	2,141	12,200	17,700
	Chromium (Cr)	mg/kg	37.3	90	29.4	2.4	25.4	31.7	39.1	3.2	34.6	42.7	29.1	2.9	24.8	31.8	32.9	2.5	28.8	35.6
	Cobalt (Co)	mg/kg			11.7	1.3	10.1	13.0	12.9	0.8	11.7	13.5	10.1	0.8	8.8	10.9	11.6	0.9	10.1	12.4
	Copper (Cu)	mg/kg	35.7	197	28.8	3.6	24.4	33.9	25.0	5.3	16.8	31.3	**84.1**	19.6	**59.7**	**104.0**	41.6	5.9	32.0	46.5
	Iron (Fe)	mg/kg			25,980	2,720	21,800	28,100	25,520	1,064	24,000	26,400	22,840	1,552	20,700	24,500	26,100	1,997	22,800	28,200
	Lead (Pb)	mg/kg	35	91.3	5.67	0.47	4.91	6.08	5.79	0.46	5.06	6.24	5.84	0.49	5.04	6.32	6.62	0.49	5.81	7.05
	Lithium (Li)	mg/kg			8.62	0.62	7.60	9.20	9.10	0.42	8.50	9.70	8.36	1.00	6.70	9.20	10.90	0.63	10.20	11.90
	Magnesium (Mg)	mg/kg			5,086	385	4,440	5,390	8,798	288	8,460	9,150	6,968	679	5,830	7,540	7,598	457	7,150	8,330
	Manganese (Mn)	mg/kg			1,086	291	705	1,440	510	116	372	634	641	130	443	787	832	225	477	1,060
	Mercury (Hg)	mg/kg	0.17	0.49	0.069	0.018	0.056	0.100	0.042	0.012	0.023	0.055	0.029	0.007	0.017	0.034	0.072	0.019	0.050	0.103
	Molybdenum (Mo)	mg/kg			0.68	0.21	0.50	1.01	0.57	0.04	0.51	0.62	1.04	0.22	0.68	1.28	0.70	0.15	0.55	0.96
	Nickel (Ni)	mg/kg			21.0	1.8	18	22.8	35.5	2.4	32.0	37.8	29.3	3.6	23.6	33.5	30.9	2.8	27.1	34.0
	Phosphorus (P)	mg/kg			908	108	717	973	1,012	53	961	1,100	871	76	795	970	865	48	804	921
	Potassium (K)	mg/kg			782	92	640	860	822	38	770	870	1,246	167	990	1,420	1,012	111	900	1,190
	Selenium (Se)	mg/kg			0.56	0.13	0.42	0.71	0.36	0.12	0.20	0.51	0.38	0.06	0.31	0.47	0.54	0.13	0.34	0.66
	Silver (Ag)	mg/kg			0.11	0.01	0.10	0.12	0.11	0.02	0.10	0.15	< 0.10	0.00	< 0.10	< 0.10	0.13	0.01	0.11	0.14
	Sodium (Na)	mg/kg			230	27	190	260	344	18	320	370	332	24	300	360	250	30	220	300
	Strontium (Sr)	mg/kg			86	16	69	106	89	15	67	105	95	15	71	106	133	24	92	153
	Thallium (Tl)	mg/kg			0.082	0.014	0.058	0.094	0.067	0.012	0.052	0.085	0.090	0.013	0.072	0.106	0.092	0.008	0.082	0.101
	Tin (Sn)	mg/kg			< 2.0	0.0	< 2.0	< 2.0	< 2.0	0.0	< 2.0	< 2.0	< 2.0	0.0	< 2.0	< 2.0	< 2.0	0.0	< 2.0	< 2.0
	Titanium (Ti)	mg/kg			757	81	618	832	741	25	708	776	696	51	636	747	595	96	481	746
	Uranium (U)	mg/kg			1.53	0.27	1.24	1.83	2.35	0.80	1.14	3.30	0.98	0.24	0.72	1.34	1.35	0.25	0.94	1.59
	Vanadium (V)	mg/kg			55.0	5.2	46.8	59.8	63.3	3.5	57.8	67.0	51.3	4.2	46.0	55.1	55.7	4.5	48.3	59.3
	Zinc (Zn)	mg/kg	123	315	52.4	4.0	45.7	55.8	56.5	2.5	53.7	59.9	57.4	4.2	51.0	61.9	62.1	3.7	57.1	66.9

[a] Canadian Sediment Quality Guidelines - ISQG = interim sediment quality guideline; PEL = probable effect level (CCME 1999).

Indicates sediment concentration exceeding CSQG ISQG.

Indicates sediment concentration exceeding CSQG PEL.

bold Indicates sediment concentration exceeding the higher reference mean by more than 2 times

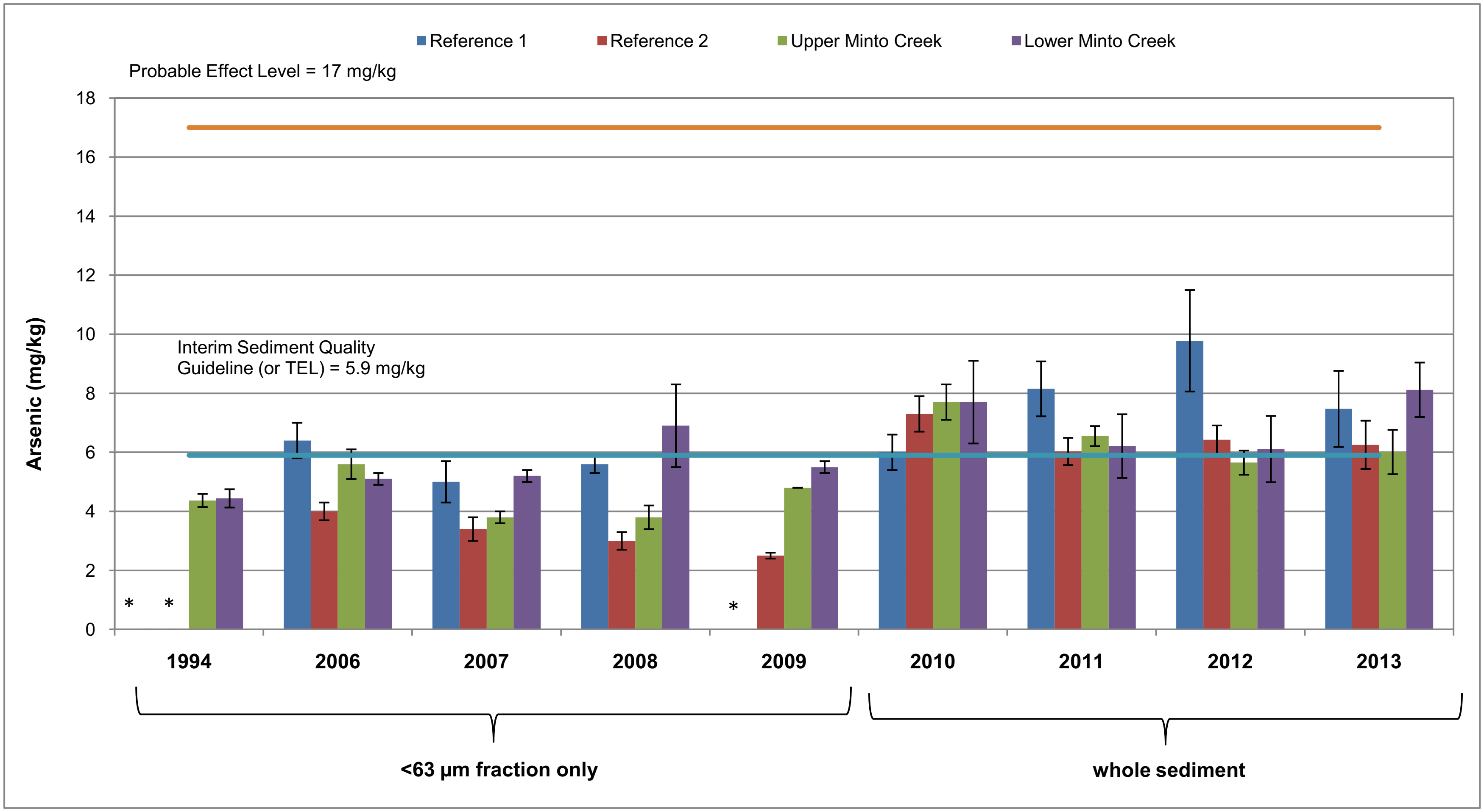

Figure 4.2: Mean arsenic concentrations in sediment collected in Minto Creek and reference locations, 1994-2013 (mean ± standard deviation)

Note: Reference 1 = Station W6 (south-flowing tributary) in 2006 to 2008 and McGinty Creek in 2010 to 2013; Reference 2 = Station W7 (north-flowing tributary) in 2006 to 2009 and Wolverine Creek in 2010 to 2013; * = no data. TEL: Threshold Effect Levels guideline in all previous years including the 1994 baseline (Figure 4.3). At lower Minto Creek, mean copper concentrations have been greater than guidelines in roughly half the sampling events, and the mean concentration observed in 2013 was similar to a number of previous years but greater than in the 1994 baseline (Figure 4.3; Table 4.1; Appendix Table C.1). This is not necessarily indicative of a Minto Mine influence as inter-annual variation is high.

4.3 Summary

Overall, concentrations of metals in Minto Creek sediments were lower than reference and/or sediment quality guidelines with the exception of copper. Arsenic concentration was greater than the sediment quality guideline in Minto Creek and at reference areas (as it was in previous sampling years), indicating naturally elevated arsenic concentrations. Copper concentrations in Minto Creek (both upper and lower) were greater than the sediment quality guideline and reference, but were similar to concentrations observed in several previous years. Minto Creek sediment quality has not shown any consistent trends over time.

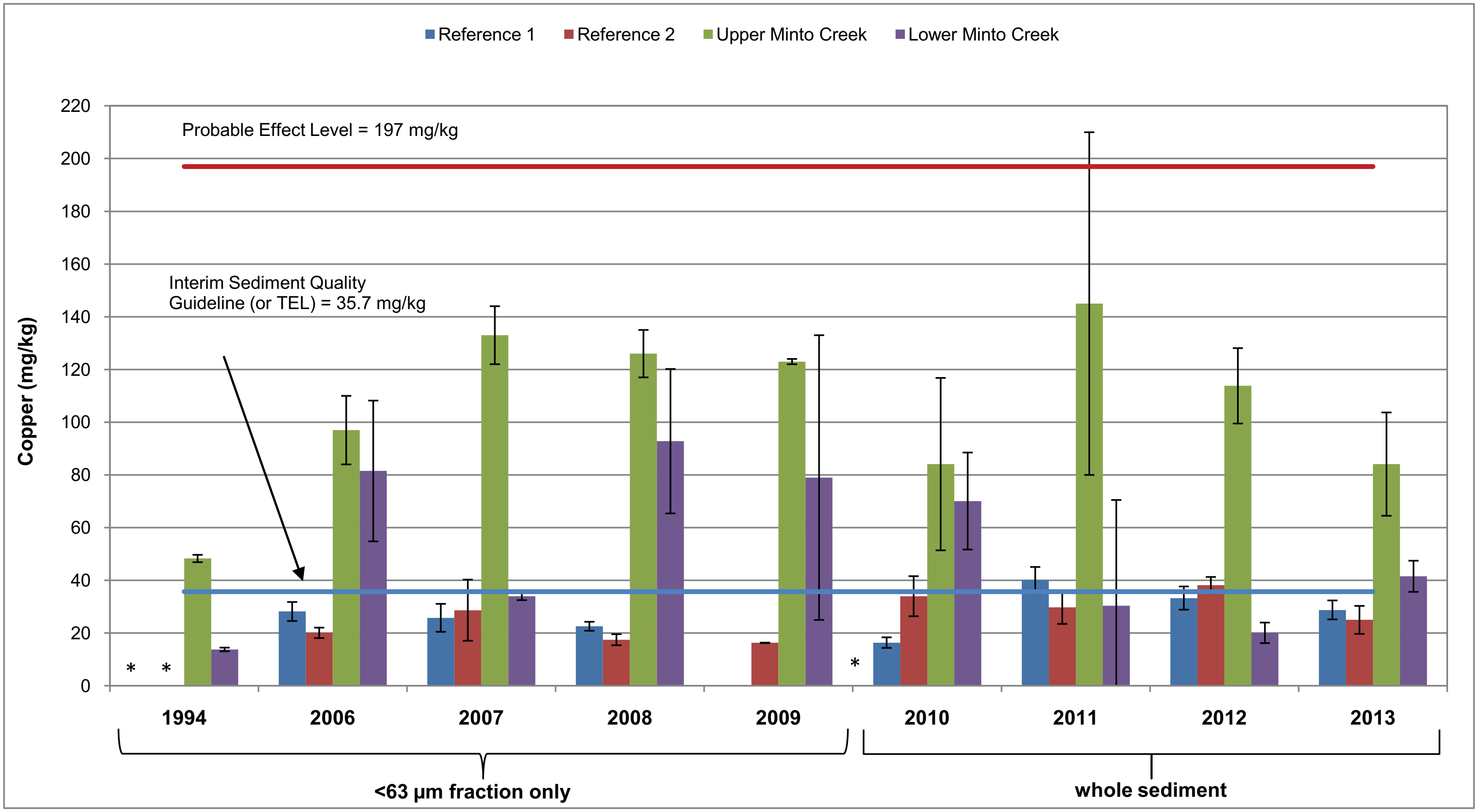

Figure 4.3: Mean copper concentrations in sediment collected in Minto Creek and reference locations, 1994-2013 (mean ± standard deviation)[1]

[1]Reference 1 = Station W6 (south-flowing tributary) in 2006 to 2008 and McGinty Creek in 2010 to 2013; Reference 2 = Station W7 (north-flowing tributary) in 2006 to 2009 and Wolverine Creek in 2010 to 2013; * = no data. TEL: Threshold Effect Levels

5.0 PERIPHYTON COMMUNITY

5.1 Primary Metrics and Community Composition

Three of the four periphyton community metrics (taxon richness, Simpson's Evenness and Bray-Curtis distance) differed between study areas (lower Minto Creek and lower Wolverine Creek; Appendix Table D.4). Only Simpson's Diversity did not differ significantly between sites. Lower Minto Creek had significantly lower taxon richness (23.8 taxa) than lower Wolverine Creek (34.8 taxa; Appendix Table D.1 - D.4). Both Simpson's Evenness and Bray-Curtis distance were significantly higher at lower Minto Creek than at lower Wolverine Creek (Appendix Table D.4). Lower taxon richness (and a related higher evenness) in Minto Creek relative to Wolverine Creek may be due to habitat differences (more cobble in Wolverine Creek) and greater light penetration to the Wolverine Creek substrate.

Dominant phyla in lower Minto and Wolverine creeks were Bacillariophycae (diatoms) and Cyanophyta (blue-green algae). Bacillariophycae were the dominant taxa at lower Minto Creek making up 75% of the community, whereas at lower Wolverine Creek, Cyanophyta were the dominant taxa making up 68% of the community (Figure 5.1). Despite these clear differences in taxonomic composition, little information is available regarding specific periphyton species sensitivities and tolerances to mining activities (Deniseger et al. 1986; De Jonge et al. 2008) to assist in interpretation.

5.2 Temporal Comparisons

Differences in community composition were evident among samples taken in 1994, 2011, 2012 and 2013. However, there was high temporal variability in periphyton community composition. For example, at lower Minto Creek, Bacillariophycae were dominant in 1994, Cyanophyta in 2011, Rhodophyta and Cyanophyta in 2012 and Bacillariophycae in 2013 (Figure 5.1). This lack of consistency was also observed at lower Wolverine Creek, with Cyanophyta dominant in 2011 and 2013 and Bacillariophycae in 2012.

5.3 Summary

The periphyton community of lower Minto Creek was significantly different from that of lower Wolverine Creek in terms of taxon richness (lower), Simpson's Eveness (higher) and Bray-Curtis distance (higher). These differences are most likely due to differences in substrate and light penetration between the two areas. Lower light penetration at lower Minto Creek can lead to decreased periphyton growth. Differences among years were apparent in lower

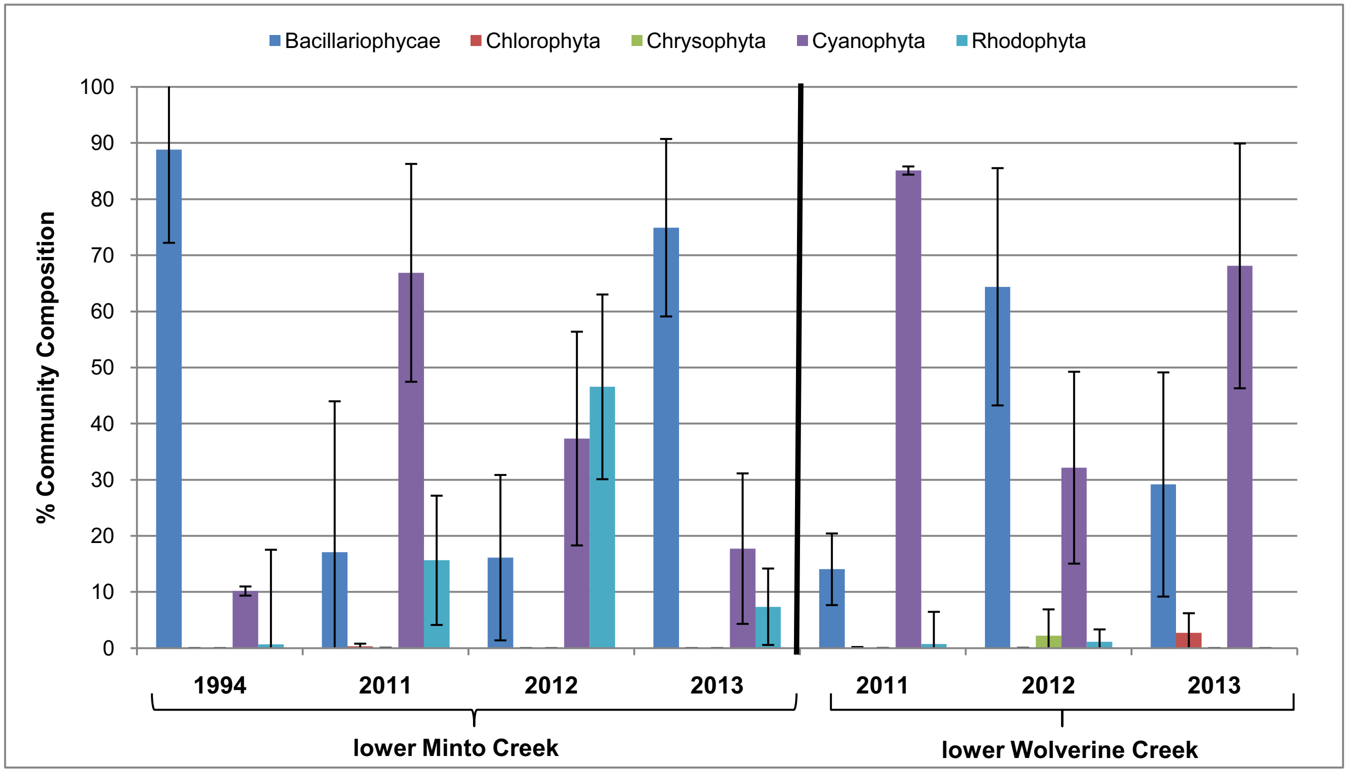

Figure 5.1: Periphyton community composition in lower Minto Creek (1994, 2011 - 2013) and lower Wolverine Creek (2011 - 2013). Data presented as mean ± standard deviation.

Minto Creek but also at the reference area, lower Wolverine Creek, indicating natural variation over time.

6.0 BENTHIC INVERTEBRATE COMMUNITY

6.1 Primary Metrics and Community Composition

Lower Minto Creek had significantly lower benthic invertebrate density than lower Wolverine Creek (individuals/m^2; 182 versus 460; Figure 6.1a; Table 6.1) but there was no difference between areas in number of benthic invertebrate taxa (16.2 versus 15.2; Figure 6.1b; Table 6.1). Simpson's Evenness was significantly higher at lower Minto Creek than lower Wolverine Creek indicating a more even abundance of the taxa present (Figure 6.1c; Table 6.1). Bray-Curtis index (distance from the reference median) was significantly higher at lower Minto Creek than at lower Wolverine Creek (Figure 6.1d; Table 6.1), indicating some differences in community composition.

Dominant taxonomic groups in lower Minto and Wolverine creeks included EPT taxa (Ephemeroptera, Plecoptera and Trichoptera or mayflies, stoneflies and caddisflies, respectively), Chironomids (non-biting midges), Oligochaetes (worms) and Nematodes (roundworms). The relative abundances of Nematodes and organisms from the pollution and enrichment intolerant orders of EPT (Ephemeroptera, Plecoptera, Trichoptera) were significantly greater at lower Minto Creek than at lower Wolverine Creek (Figure 6.2a,b; Table 6.1, Appendix Table E.2, E.3). Conversely, the relative abundances of Chironomids and Oligochaetes were significantly lower at lower Minto Creek than at lower Wolverine Creek (Figure 6.2c,d; Table 6.1, Appendix Table E.2, E.3). Given the known sensitivity of EPT taxa and the tolerance of most Chironomid and Oligochaete taxa to elevated concentrations of metals and nutrients (Chapman et al. 1982a; 1982b; Rosenberg and Resh 1993; Taylor and Bailey 1999), the observed taxonomic dominances in Minto Creek relative to Wolverine Creek suggest no adverse influence of the mine on the benthic invertebrate community of lower Minto Creek.

6.2 Correlation Analysis

Most significant correlations between benthic invertebrate community metrics and physical-chemical conditions were related to temperature and specific conductivity (Table 6.2). Only three correlations were significant following Bonferroni correction for 99 comparisons - Bray-Curtis distance, which was significantly greater in lower Minto Creek, was negatively correlated with temperature and positively correlated with specific conductance, and Simpson's Diversity (also greater in lower Minto Creek) was positively correlated with specific conductance (Table 6.2; Figure 6.3). A number of additional correlations had p-values < 0.01 and suggested that lower temperature and higher specific conductivity at lower

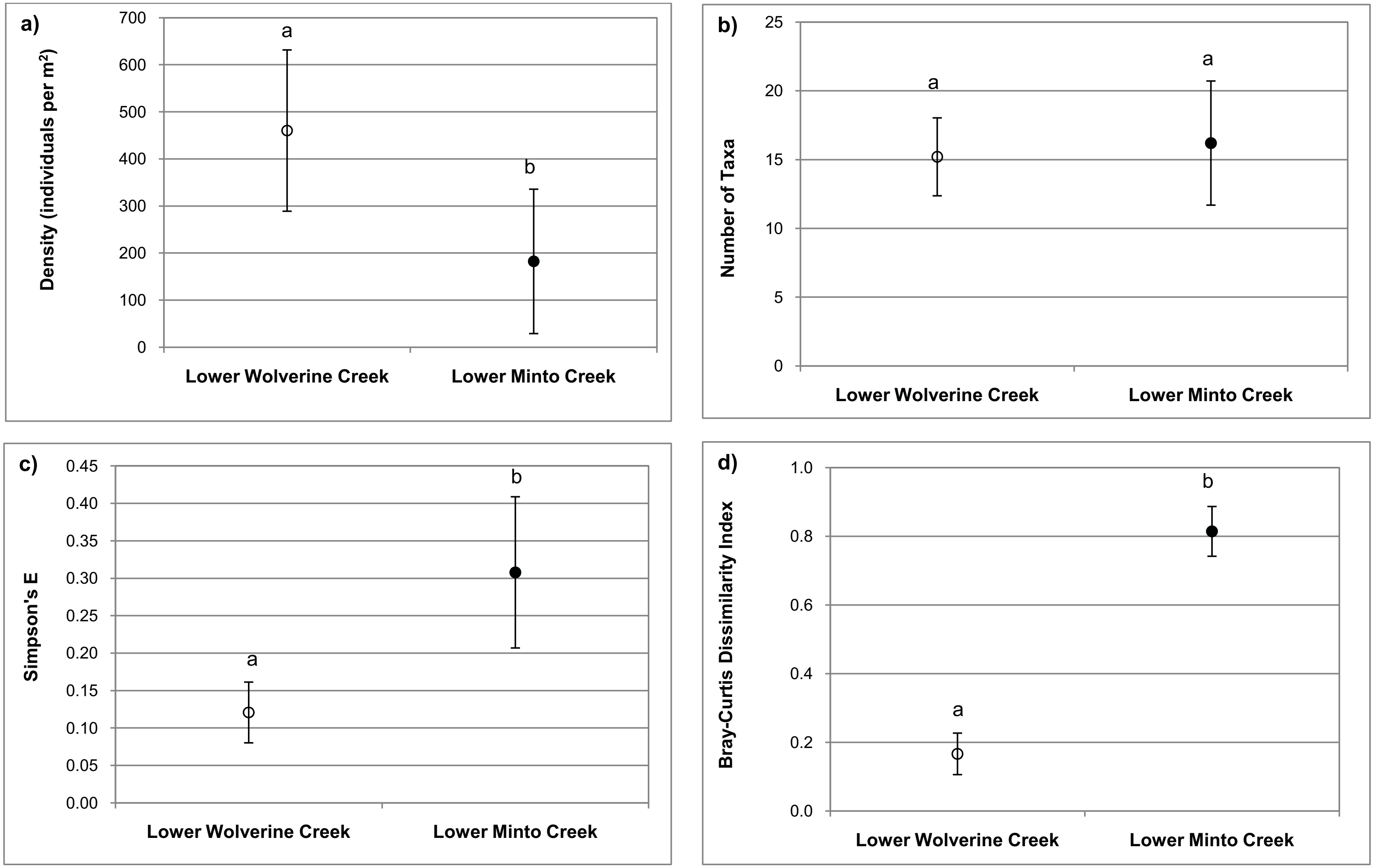

Figure 6.1: Comparison of a) benthic invertebrate density, b) number of taxa, c) Simpson's Eveness and d) Bray-Curtis, Minto Mine WUL, 2013. Dissimilarity at the lower Minto Creek exposure area compared to the lower Wolverine Creek reference area (500 µm mesh). Data represents area means and 95% confidence intervals (n = 5 in all areas). Different letters above data points indicate areas that were significantly different (p < 0.1).

Table 6.1: Summary of benthic invertebrate community metrics and statistical comparisons, Minto Mine WUL, 2013.

Metric	Area Means		Statistical Contrasts		
	Lower Wolverine Creek (Reference)	Lower Minto Creek (Exposed)	Significant Difference between areas?	Direction	p-value
Density (organisms/m^2)	460	182	Yes	Minto < Wolverine	0.010
Number of Taxa	15.2	16.2	No	-	0.616
Simpson's Diversity [1]	0.36	0.77	Yes	Minto > Wolverine	< 0.001
Simpson's Evenness [1]	0.12	0.31	Yes	Minto > Wolverine	0.001
Bray-Curtis Distance	0.17	0.81	Yes	Minto > Wolverine	0.009
EPT (%) [2]	3.9	22.2	Yes	Minto > Wolverine	< 0.001
Chironomidae (%)	77.7	53.8	Yes	Minto < Wolverine	0.003
Oligochaetae (%)	15.6	4.4	Yes	Minto < Wolverine	0.051
Nemata (%)	0.2	11.2	Yes	Minto > Wolverine	0.009

indicates a statistically significant difference between exposed and reference areas

[1] Calculated as recommended by Environment Canada 2012

[2] Percent Ephemeroptera, Plecoptera, Trichoptera

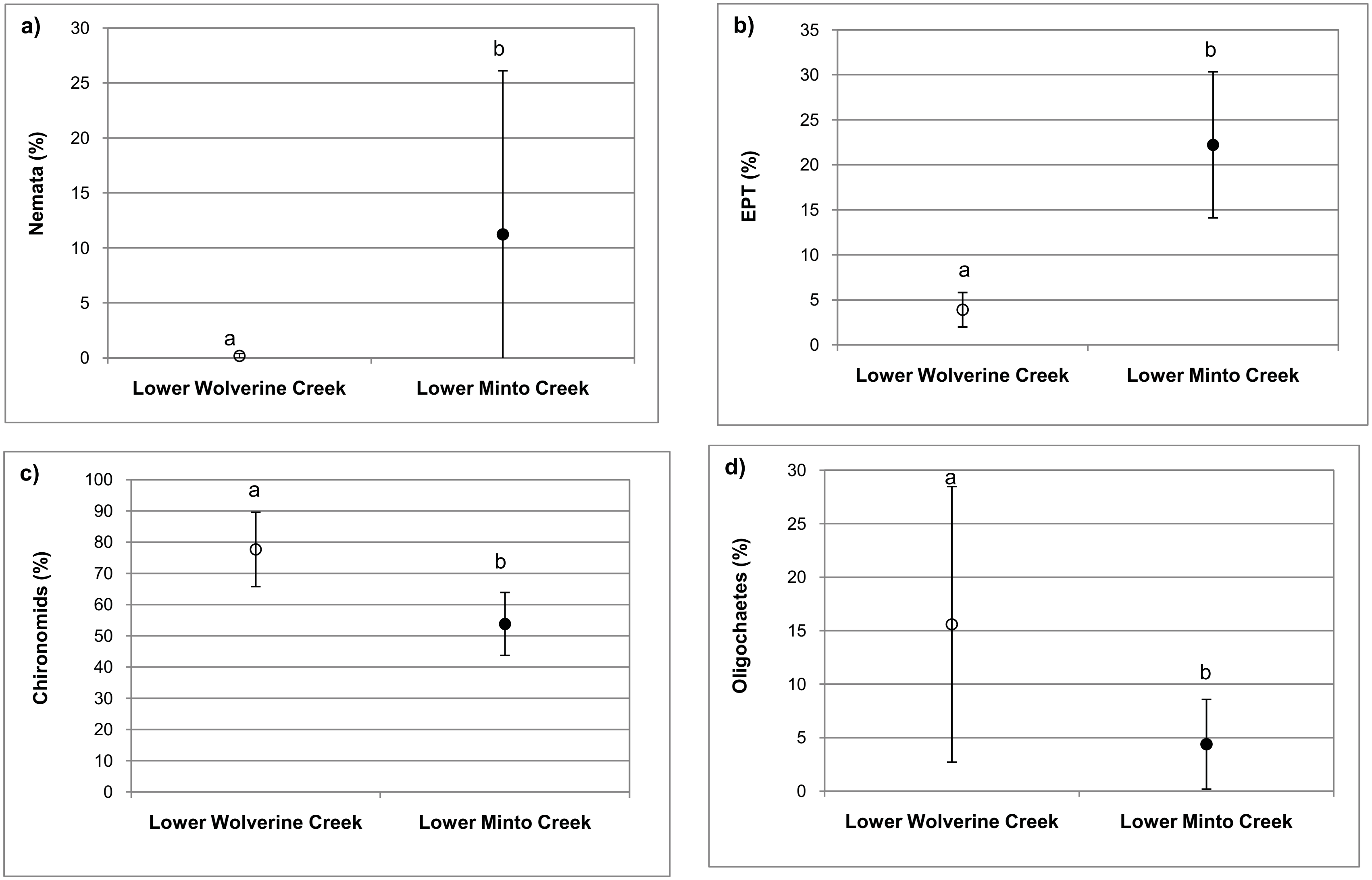

Figure 6.2: The relative abundance as percent of total organisms in an area for a) Nemata, b) EPT, c) Chironomids and d) Oligochaetes, Minto Mine WUL, 2013. Data represents area means and 95% confidence intervals (n = 5 in all areas). Different letters above 95% confidence interval bars indicate areas that were significantly different ($p < 0.1$).

Table 6.2: Correlations between benthic metrics and environmental supporting measurements at Minto Mine WUL, 2013.

		Median Intermediate Axis Length (cm)	Median Embeddedness (%)	Water Velocity (m/s)	Depth (m)	Temperature (°C)	DO (%)	Specific Conductivity (µS/cm)	pH	% cobble	% gravel	% sand and finer
Density (organisms/m^2)	Pearson Correlation	-0.70	-0.17	0.51	0.25	0.64	0.32	-0.76	-0.69	-0.08	0.05	0.12
	Sig. (2-tailed)	0.023	0.634	0.132	0.487	0.045	0.364	0.011	0.027	0.825	0.896	0.748
	N	10	10	10	10	10	10	10	10	10	10	10
Number of Taxa	Pearson Correlation	0.09	0.44	-0.69	0.19	-0.35	-0.36	0.21	0.00	0.07	0.00	-0.19
	Sig. (2-tailed)	0.812	0.202	0.027	0.593	0.329	0.307	0.561	0.992	0.851	0.989	0.605
	N	10	10	10	10	10	10	10	10	10	10	10
Simpson's Diversity	Pearson Correlation	0.45	0.16	-0.47	-0.41	-0.89	-0.35	0.93	0.83	0.06	-0.09	0.01
	Sig. (2-tailed)	0.192	0.650	0.170	0.240	0.001	0.321	0.000	0.003	0.861	0.802	0.978
	N	10	10	10	10	10	10	10	10	10	10	10
Simpson's Evenness	Pearson Correlation	0.45	0.02	-0.12	-0.38	-0.74	-0.12	0.84	0.76	-0.02	0.00	0.05
	Sig. (2-tailed)	0.189	0.952	0.751	0.283	0.015	0.741	0.002	0.010	0.959	0.993	0.882
	N	10	10	10	10	10	10	10	10	10	10	10
Bray-Curtis Distance	Pearson Correlation	0.58	0.22	-0.44	-0.34	-0.91	-0.35	0.99	0.86	0.08	-0.10	-0.01
	Sig. (2-tailed)	0.077	0.534	0.208	0.333	0.000	0.318	0.000	0.001	0.831	0.785	0.979
	N	10	10	10	10	10	10	10	10	10	10	10
EPT (%) [1]	Pearson Correlation	0.47	0.15	-0.20	-0.23	-0.80	-0.19	0.89	0.76	-0.01	0.04	-0.04
	Sig. (2-tailed)	0.167	0.675	0.571	0.531	0.006	0.601	0.001	0.011	0.975	0.918	0.905
	N	10	10	10	10	10	10	10	10	10	10	10
Chironomidae (%)	Pearson Correlation	-0.26	-0.28	0.45	0.30	0.84	0.51	-0.83	-0.72	-0.04	0.05	0.01
	Sig. (2-tailed)	0.476	0.429	0.195	0.401	0.002	0.135	0.003	0.019	0.915	0.893	0.985
	N	10	10	10	10	10	10	10	10	10	10	10
Oligochaetae (%)	Pearson Correlation	-0.49	-0.44	0.15	0.01	0.63	0.38	-0.63	-0.39	-0.08	0.12	-0.02
	Sig. (2-tailed)	0.152	0.199	0.675	0.986	0.050	0.277	0.053	0.267	0.817	0.738	0.965
	N	10	10	10	10	10	10	10	10	10	10	10
Nemata (%)	Pearson Correlation	0.14	0.65	-0.51	-0.05	-0.73	-0.88	0.60	0.42	0.12	-0.16	0.00
	Sig. (2-tailed)	0.697	0.040	0.135	0.883	0.017	0.001	0.069	0.228	0.743	0.654	0.990
	N	10	10	10	10	10	10	10	10	10	10	10

correlation scatterplot inspected: $p < 0.0500$

significant after Bonferroni correction; $p < 0.00051$ ($p = 0.05$ adjusted for 99 comparisons)

[1] Percent Ephemeroptera, Plecoptera, Trichoptera

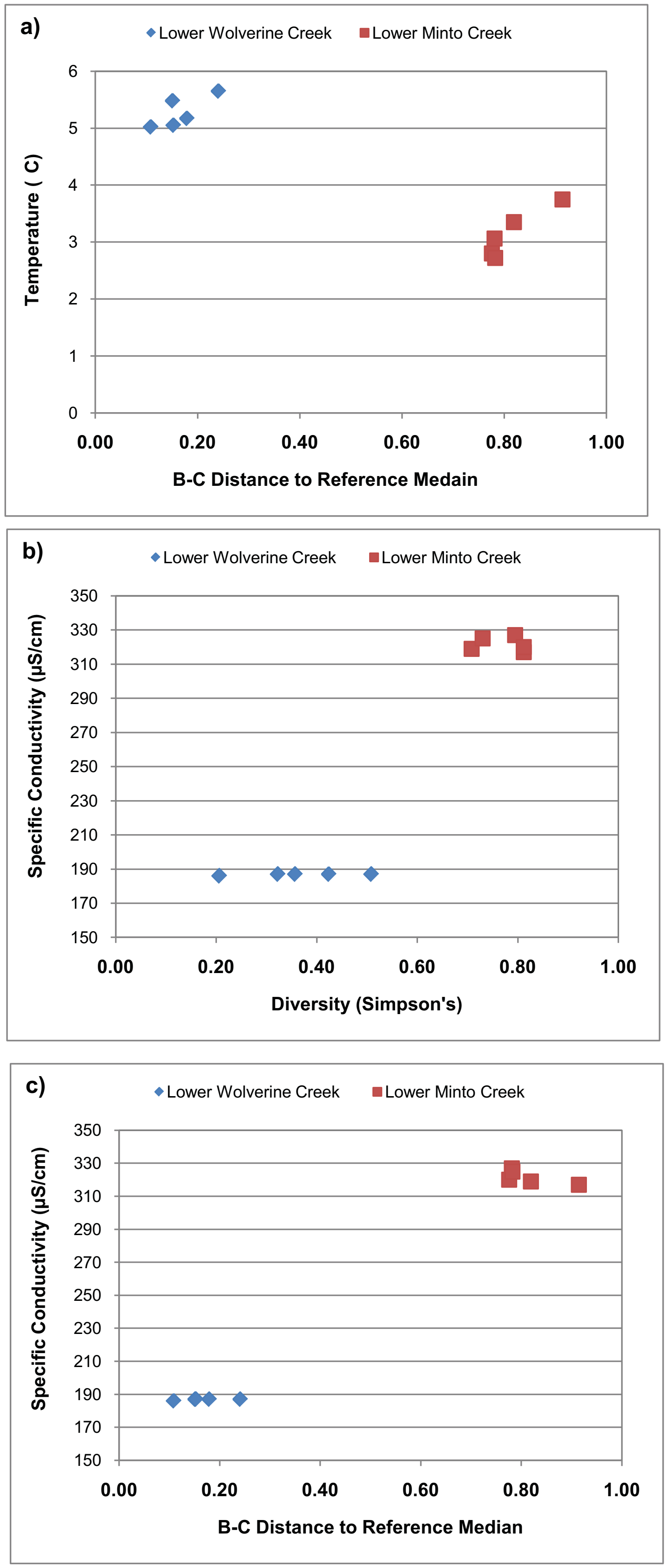

Figure 6.3: Scatterplots of significant relationships (after Bonferroni correction) between selected benthic invertebrate community metrics and temperature and conductivity, Minto Mine WUL, 2013.

Minto Creek relative to reference was also associated with higher Simpson's Evenness, higher percent EPT, lower percent Chironomidae (Table 6.2, Appendix Figure E.2). Despite the observed correlations, it must be noted that correlation is not causation and inference of cause is not strong due to observed leveraging. Other significant correlations are presented in Appendix E (Appendix Figures E.3, E.4).

6.3 Temporal Comparisons

Temporal comparisons of the benthic invertebrate community condition of lower Minto Creek were made in order to augment data interpretation, but their power is tempered by temporal changes in sampling location, sampling methodology, level of replication and analytical processing techniques. For example, 1994 baseline data were collected near the mouth of Minto Creek as three single grab samples, 2006 data were collected at Station W2 in the same manner, 2008 and 2010 data were collected at Station W2 as three-grab composites whereas 2011 - 2013 data were collected as five replicate three-grab samples from a large area upstream of Station W2. Only in the later years (2011 - 2013) do data represent an area (i.e., lower Minto Creek) rather than a station. In addition, data collected in 2013 were based collected in 500 µm mesh, whereas all years prior to 2011 used smaller mesh (both 250 µm and 500 µm were used in 2012 to assist in transition).

Benthic invertebrate density in 2013 was lower than in 2012 (the only year to which it can be compared due to a mesh size change), but it showed the same trend, lower density at lower Minto Creek compared to lower Wolverine Creek (Figure 6.4). Conversely, some differences in the exposure:reference comparisons were observed between 2013 and 2012. Specifically, taxon richness did not differ in 2013 but was significantly greater in lower Minto Creek (16.2 taxa) than in lower Wolverine Creek (15.2 taxa) in 2012 (Figure 6.4). Similarly, Simpson's Evenness was higher at lower Minto Creek in 2013 but did not differ from lower Wolverine Creek in 2012 (Figure 6.4). Differences in density, number of taxa and evenness over time likely reflected high temporal variability of benthic invertebrate communities in the region, also evident at reference areas (Minnow 2009b; 2011). High inter-annual variability in environmental conditions such as flow, deep freezing, and occasional pulses of very high sediment loads can, in turn, influence benthic invertebrate community composition features among years.

6.4 Summary

The erosional benthic invertebrate community of lower Minto Creek differed from that of lower Wolverine Creek on the basis of density (lower), Simpson's Diversity (higher), Simpson's Evenness (higher), Bray-Curtis dissimilarity (greater) and percent EPT (higher),

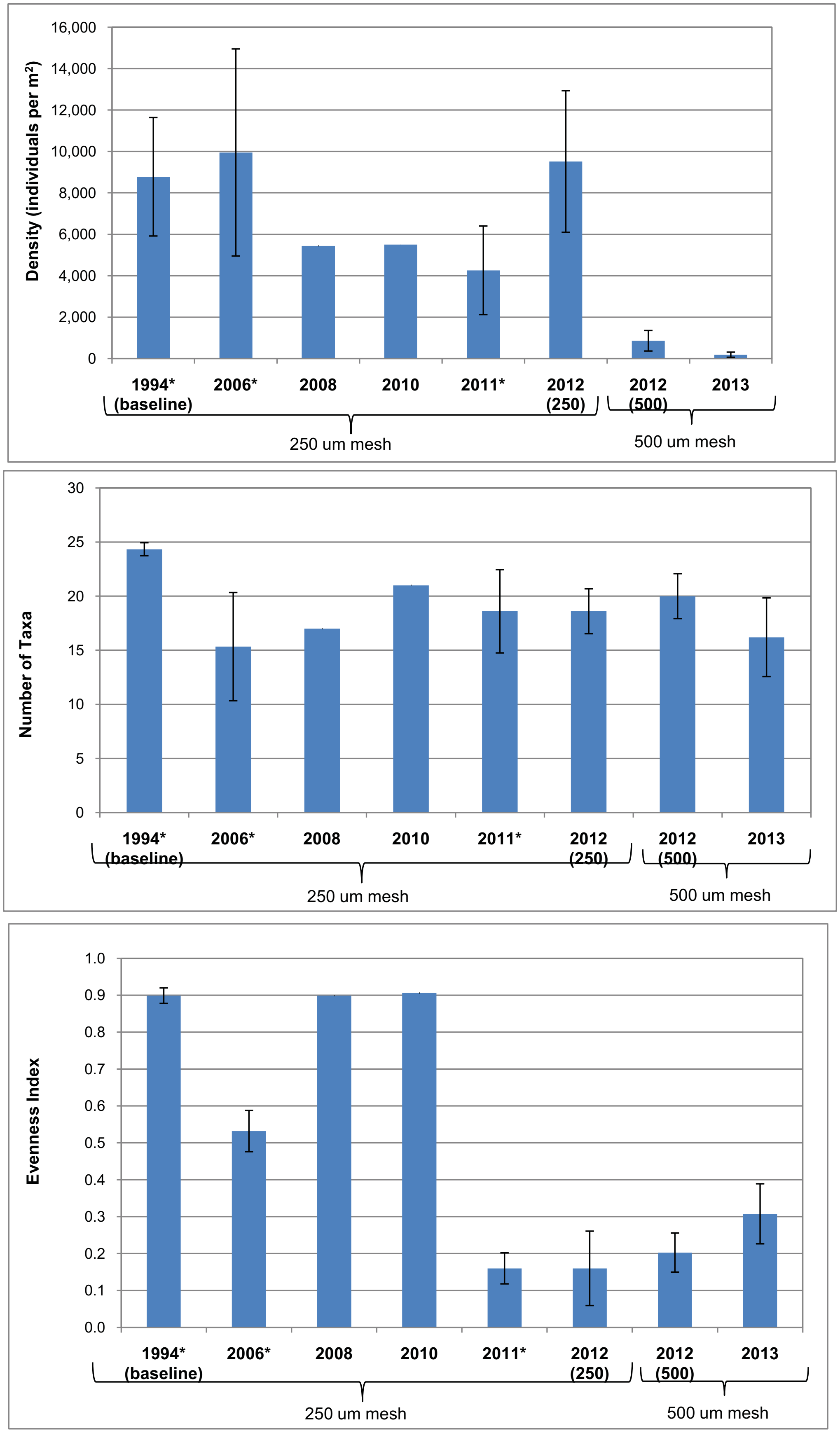

Figure 6.4: Primary benthic invertebrate community metrics at lower Minto Creek, 1994 - 2013. Data presented as mean ± standard deviation where replicated. Asterisk (*) indicates a year the mine was not discharging.

Chironomids (lower), Oligochaetae (lower) and Nemata (higher). Greater diversity, greater dominance of EPT taxa and lower dominance of Chironomids are typically considered indicative of a healthy erosional benthic invertebrate community, whereas lower density can be equivocal particularly when associated with high evenness. Therefore, the benthic invertebrate community condition of lower Minto Creek suggests limited influence of the mine. High temporal variability has been observed at the exposure and reference area (Minnow 2009b; 2011, 2012a, 2013a), presumably due to inter-annual variability in environmental conditions (e.g., flow, ice scour).

7.0 TISSUE CHEMISTRY

As indicated in Section 2.5, tissue chemistry data are provided here simply to report the ancillary data that were collected along with the selenium data reported under separate cover. Data interpretation is therefore limited to basic comparisons of metal concentrations in tissue collected at the exposure area (lower Minto Creek) to those collected at reference creeks.

7.1 Periphyton Tissue

Metal concentrations in periphyton tissue collected from lower Minto Creek were generally lower than in periphyton tissue collected from lower Wolverine Creek or lower Big Creek (Table 7.1; Appendix Table C.2). Of the analytes measured, none were found to be significantly different in periphyton tissue from lower Minto Creek than in tissue from both reference areas. Analytes of concern, copper and selenium did not differ significantly different among areas.

7.2 Benthic Invertebrate Tissue

Metal concentrations in benthic invertebrate tissue collected from lower Minto Creek were significantly greater than in those collected from both reference areas (lower Wolverine Creek and lower Big Creek) for only five analytes, barium, boron, calcium, manganese and strontium (Table 7.1; Appendix Table C.3). Copper concentrations at lower Minto Creek were significantly elevated relative to lower Wolverine Creek but not lower Big Creek. Selenium was only significantly different relative to lower Big Creek but not to lower Wolverine Creek.

Table 7.1: Tissue chemistry results, Minto Mine WUL, September 2013.

Analyte	Units	Periphyton						Benthic Invertebrates					
		Lower Wolverine Creek (Reference)		Lower Big Creek (Reference)		Lower Minto Creek (Exposed)		Lower Wolverine Creek (Reference)		Lower Big Creek (Reference)		Lower Minto Creek (Exposed)	
		n = 5		n = 5		n = 5		n = 5		n = 5		n = 5	
		Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation
Aluminum (Al)	mg/kg dwt	22,637	2,495	15,575	3,602	20,361	899	5,237	2,462	4,068	422	7,327	1,763
Antimony (Sb)	mg/kg dwt	0.0257	0.0026	0.0558	0.0109	0.0258	0.0032	0.0307	0.0061	0.0996	0.0233	0.0631	0.0082
Arsenic (As)[a]	mg/kg dwt	5.32	0.65	26.43	7.69	5.17	0.37	2.82	1.14	10.01	2.32	3.57	0.57
Barium (Ba)	mg/kg dwt	274	37	228	65	268	11	84	38	75	19	170	69
Beryllium (Be)	mg/kg dwt	0.688	0.059	0.531	0.120	0.501	0.014	0.213	0.097	0.173	0.021	0.210	0.056
Bismuth (Bi)	mg/kg dwt	0.1144	0.0157	0.7916	0.6228	0.1172	0.0052	0.0210	0.0089	0.1360	0.0398	0.0417	0.0134
Boron (B)[b]	mg/kg dwt	4.93	1.09	3.63	0.84	4.02	0.15	1.75	0.55	1.62	0.28	3.71	0.63
Cadmium (Cd)[a]	mg/kg dwt	0.2147	0.0287	0.2246	0.0805	0.1483	0.0099	0.6121	0.2673	1.2734	0.3866	0.3428	0.0533
Calcium (Ca)	mg/kg dwt	11,786	759	9,463	1,857	13,337	211	3,619	1,502	3,237	692	7,414	2,070
Chromium (Cr)	mg/kg dwt	58.1	3.5	34.0	7.5	41.8	2.1	15.7	8.0	9.9	2.3	16.6	4.1
Cobalt (Co)	mg/kg dwt	14.07	0.87	9.45	2.19	11.06	0.48	5.33	2.49	3.01	0.19	4.91	0.74
Copper (Cu)	mg/kg dwt	28.2	2.7	28.4	8.8	24.6	4.0	17.9	1.6	24.2	4.0	27.8	3.5
Iron (Fe)	mg/kg dwt	30,961	3,013	22,927	4,814	26,080	1,150	10,644	5,112	8,323	1,929	12,484	3,214
Lead (Pb)[c]	mg/kg dwt	7.13	0.75	8.61	2.25	6.46	0.21	1.46	0.65	2.41	1.03	2.03	0.58
Lithium (Li)	mg/kg dwt	13.09	1.46	9.01	2.14	13.52	0.47	3.21	1.52	2.57	0.21	4.41	1.26
Magnesium (Mg)[b]	mg/kg dwt	10,282	637	7,137	1,510	8,223	198	3,684	1,192	2,313	209	3,625	696
Manganese (Mn)	mg/kg dwt	829	125	667	209	819	165	378	141	267	54	867	174
Mercury (Hg)[d]	mg/kg dwt	0.043	0.020	0.033	0.010	0.027	0.004	0.039	0.005	0.041	0.007	0.034	0.009
Molybdenum (Mo)[b]	mg/kg dwt	0.359	0.033	0.868	0.202	0.338	0.031	0.602	0.502	0.773	0.169	0.780	0.085
Nickel (Ni)[b]	mg/kg dwt	40.9	2.3	25.7	7.0	27.9	1.0	13.7	8.0	7.2	0.8	11.9	2.2
Phosphorus (P)	mg/kg dwt	1,252	146	992	104	971	40	5,748	1,538	4,171	854	6,642	731
Potassium (K)	mg/kg dwt	2,345	399	2,691	512	2,008	90	7,471	3,605	8,752	3,138	9,052	2,845
Selenium (Se)	mg/kg dwt	0.484	0.111	0.347	0.133	0.311	0.029	1.297	0.376	0.844	0.120	1.370	0.153
Sodium (Na)[e]	mg/kg dwt	562	11	572	88	510	35	7,099	3,365	8,752	3,138	6,892	2,595
Strontium (Sr)[b]	mg/kg dwt	108.0	8.1	90.1	22.9	108.3	4.6	32.2	16.9	31.5	7.8	54.7	9.3
Thallium (Tl)	mg/kg dwt	0.1585	0.0244	0.1559	0.0447	0.1504	0.0097	0.0322	0.0127	0.0470	0.0127	0.0617	0.0184
Tin (Sn)	mg/kg dwt	0.428	0.063	0.314	0.081	0.357	0.018	0.107	0.026	0.109	0.028	0.146	0.032
Uranium (U)	mg/kg dwt	1.432	0.050	1.695	0.548	1.055	0.045	0.409	0.160	0.567	0.240	0.426	0.103
Vanadium (V)	mg/kg dwt	85.9	5.6	64.4	11.2	74.0	3.0	29.6	14.8	21.7	6.7	29.0	6.6
Yttrium (Y)[b]	mg/kg dwt	12.84	1.14	10.79	2.58	12.95	0.45	3.58	1.55	3.10	0.55	4.74	1.35
Zinc (Zn)	mg/kg dwt	70.8	5.9	61.2	13.2	61.1	2.8	93.3	17.1	116.1	19.3	157.5	69.7

Indicates a mean concentration in lower Minto Creek that is significantly different than the mean concentration in lower Wolverine Creek (ANOVA; p = 0.05)

Indicates a mean concentration in lower Minto Creek that is significantly different than the mean concentration in lower Big Creek (ANOVA; p = 0.05)

[a] For periphyton calculations, data was not normal or equal variance not met, therefore a non-parametric Mann-Whitney U-test was conducted instead, p = 0.05

[b] For benthic calculations, data was not normal or equal variance not met, therefore a non-parametric Mann-Whitney U-test was conducted instead, p = 0.05

[c] For benthic, data was normalized by log transformation (ANOVA, p = 0.05)

[d] For periphyton, data was normalized by log transformation (ANOVA, p = 0.05)

[e] For benthic, data was normalized by inverse transformation (ANOVA, p = 0.05)

8.0 CONCLUSIONS AND RECOMMENDATIONS

8.1 Conclusions

The Minto Mine sediment, periphyton and benthic assessment undertaken from September 9th to 13th, 2013 served to quantitatively compare water quality (field measures and chemistry), sediment quality and benthic invertebrate community condition of Minto Creek relative to reference creeks and also drew on previous data for interpretation.

Specific conductance and pH were higher at Minto Creek than at reference areas, and specific conductance decreased in Minto Creek with distance from the mine. At total of five analytes in Minto Creek water samples (fluoride, phosphorus aluminum, copper and iron) did not meet WUL standards and/or water quality guidelines. However, in all cases, elevations of the same analytes were observed at reference areas and at concentrations that were either similar to or greater than in Minto Creek, suggesting that the observed exceedences were not mine-related. Lastly, Chlorophyll *a* concentration on substrates of lower Minto Creek was lower than in Wolverine Creek but the difference was not statistically significant. Chlorophyll a concentrations in both creeks indicate low productivity.

Concentrations of metals in Minto Creek sediments were lower than reference and/or sediment quality guidelines with the exception of copper. Arsenic concentration was greater than the sediment quality guideline in Minto Creek and at reference areas (as it was in previous sampling years), indicating naturally elevated arsenic concentrations. Copper concentrations in Minto Creek (both upper and lower) were greater than the sediment quality guideline and reference, but were similar to concentrations observed in several previous years. Minto Creek sediment quality has not shown any consistent trends over time.

The periphyton community of lower Minto Creek was significantly different from that of lower Wolverine Creek in terms of taxon richness (lower), Simpson's Eveness (higher) and Bray-Curtis distance (higher). These differences could be due to differences in substrate and light penetration between the two areas. Lower light penetration at lower Minto Creek can lead to decreased periphyton growth. Differences among years were apparent in lower Minto Creek but also at the reference area, lower Wolverine Creek, indicating natural variation over time.

The erosional benthic invertebrate community of lower Minto Creek differed from that of lower Wolverine Creek on the basis of density (lower), Simpson's Diversity (higher), Simpson's Evenness (higher), Bray-Curtis dissimilarity (greater) and percent EPT (higher), Chironomids (lower), Oligochaetae (lower) and Nemata (higher). Greater diversity, greater dominance of EPT taxa and lower dominance of Chironomids are typically considered indicative of a healthy erosional benthic invertebrate community, whereas lower density can be equivocal particularly when associated with high evenness. Therefore, the benthic invertebrate community condition of lower Minto Creek suggests limited influence of the mine. High temporal variability has been observed at the exposure and reference area (Minnow 2009b; 2011, 2012a, 2013a), presumably due to inter-annual variability in environmental conditions (e.g., flow, ice scour). This variability may also be related to changes in sampling method/replication, making it difficult to distinguish any mine-related influences.

The chemical quality of biological tissues (periphyton and benthic invertebrates) collected at mine-exposed lower Minto Creek and reference areas was reported. There were no analytes measured in periphyton tissue that were found to be significantly different than both references areas. Only five metals, barium, boron, calcium, manganese and strontium measured in benthic invertebrate tissue from lower Minto Creek were significantly greater than both reference areas (lower Wolverine Creek and lower Big Creek). Analytes of concern, copper and selenium were not significantly greater in lower Minto Creek than both reference areas.

8.2 Recommendations

Based on the results and conclusions of the 2013 Minto Mine sediment, periphyton and benthic assessment, it is recommended that the program is repeated in 2014 with the sole modification being that consideration is given to adding one or more benthic invertebrate community reference areas to better characterize reference area variability. This would provide better perspective on whether any of the observed differences in the benthic invertebrate community of Minto Creek relative to Wolverine Creek are actually due to mine influence or simply due to natural variability.

9.0 REFERENCES

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APPENDIX A

DATA QUALITY ASSESSMENT

APPENDIX A: DATA QUALITY ASSESSMENT

LIST OF TABLES

After Page…

A1.0 INTRODUCTION

Data Quality Assessment (DQA) was conducted on data collected as part of the 2013 Minto Creek Sediment, Periphyton and Benthic Invertebrate Community Assessment Report. The objective of DQA is to define the overall quality of the data presented in the report, and, by extension, the confidence with which the data can be used to derive conclusions.

A1.1 Background

A variety of factors can influence the chemical and biological measurements made in an environmental study and thus affect the accuracy and/or precision of the data. Inconsistencies in sampling or laboratory methods, use of instruments that are inadequately calibrated or which cannot measure to the desired level of accuracy or precision, and contamination of samples in the field or laboratory are just some of the potential factors that can lead to the reporting of data that do not accurately reflect actual environmental conditions. Depending on the magnitude of the problem, inaccuracy or imprecision have the potential to affect the reliability of any conclusions made from the data. Therefore, it is important to ensure that monitoring programs incorporate appropriate steps to control the non-natural sources of data variability (i.e., minimize the variability that does not reflect natural spatial and temporal variability in the environment) and thus assure the quality of the data.

Data quality as a concept is meaningful only when it relates to the intended use of the data. That is, one must know the context in which the data will be interpreted in order to establish a relevant basis for judging whether or not the data set is adequate. DQA involves comparison of actual field and laboratory measurement performance to data quality objectives (DQOs) established for a particular study, such as evaluation of method detection limits, blank sample data, data precision (based on field and laboratory duplicate samples), and data accuracy (based on matrix spike recoveries and/or analysis of standards or certified reference materials).

DQOs were established by the laboratory (ALS Group Environmental Laboratory), which reflect reasonable and achievable performance expectations. The method detection limit (MDL) and the blank analysis were set at the outset of the field program for water, sediment and tissue quality. The MDL for each variable should be at least as low as applicable guidelines, ideally ≤ 1/10th guidelines values. For the blank analysis the laboratory blanks should be ≤ two times the laboratory MDL. Programs involving a large amount of samples and analytes usually result in some results that exceed the DQOs. This is particularly so for multi-element scans (e.g., ICP scans for metals) since the analytical conditions are not necessarily optimal for every element included in the scan. Generally, scan results may be considered acceptable if no more than 20% of the parameters fail to meet the DQOs. Overall, the intent of comparing data to DQOs was not to reject any measurement that did not meet the DQO, but to ensure that any questionable data received more scrutiny to determine what effect, if any, this had on interpretation of results within the context of this project.

A1.2 Types of Quality Control Samples

Several types of quality control (QC) samples were assessed based on samples collected (or prepared) in the field and laboratory. These samples, and a description of each, include the following:

- **Blanks** are samples of de-ionized water and/or appropriate reagent(s) that are handled and analyzed the same way as regular samples. These samples will reflect any contamination of samples occurring in the field (in the case of field or travel blanks) or the laboratory (in the case of laboratory or method blanks). Analyte concentrations should be non-detectable although a data quality objective of twice the method detection limit allows for slight "noise" around the detection limit.

- **Laboratory Duplicates** are replicate sub-samples created in the laboratory from randomly selected field samples which are sub-sampled and then analyzed independently using identical analytical methods. The laboratory duplicate sample results reflect any variability introduced during laboratory sample handling and analysis and thus provide a measure of laboratory precision.

- **Spike Recovery Samples** are created in the laboratory by adding a known amount/concentration of a given analyte (or mixture of analytes) to a randomly selected test sample previously divided to create two sub-samples. The spiked and regular sub-samples are then analyzed in an identical manner. The spike recovery represents the difference between the measured spike amount (total amount in spiked sample minus amount in original sample) relative to the known spike amount (as a percentage). Two types of spike recovery samples are commonly analyzed. Spiked blanks (or blank spikes) are created using laboratory control materials whereas matrix spikes are created using field-collected samples. The analysis of spiked samples provides an indication of the accuracy of analytical results.

- **Certified Reference Materials** are samples containing known chemical concentrations that are processed and analyzed along with batches of environmental samples. The sample results are then compared to target results to provide a measure of analytical accuracy. The results are reported as the percent of the known amount that was recovered in the analysis.

The following QC was applied to benthic invertebrate community samples as follows:

- **Organism Recovery Checks** for benthic invertebrate community samples involve the re-processing of previously sorted material from a randomly selected sample to determine the number of invertebrates that were not recovered during the original sample processing. The reprocessing is conducted by an analyst not involved during the original processing to reduce any bias. This check allows the determination of accuracy through assessment of recovery efficiency.

A2.0 WATER SAMPLES

One sample from lower Big Creek was detained at the mine causing the holding time to be exceeded. Close attention was given to this sample in the DQA and the following analytes were of concern due to short holding times: turbidity, anions, colour, total suspended solids, total dissolved solids and total phosphorus.

A2.1 Method Detection Limits

Most reported MDLs were at or below the target concentrations with the exception of those for five analytes: total suspended solids, cadmium, copper, mercury, and fluoride (Table A.1). Even though these MDLs were higher than targeted concentrations, they were all lower than guideline levels. Therefore, data for this project can be reliably interpreted relative to guidelines.

A2.2 Laboratory Blank Sample Analysis

All blank samples contained non-detectable analyte concentrations indicating no inadvertent contamination of samples within the laboratory during analysis (Appendix B).

A2.3 Data Precision

Close agreement was achieved between laboratory duplicate samples (Appendix B). This indicates that reported sample results were associated with good analytical precision.

A2.4 Data Accuracy

A2.4.1 Blank Spike Recovery Samples

Analyte recoveries for spiked blanks all met the data quality objectives indicating excellent analytical accuracy for the water sample analyses (Appendix B).

A2.4.1 Matrix Spike Recovery Samples

All analytes met the data quality objective for matrix spike recovery, but recoveries of some analytes were not calculated by the analytical laboratory (Appendix B). The laboratory reported a qualifier (MS-B) for matrix spike results for total phosphorus, sulfate, total organic carbon and the following dissolved analytes: cadmium, iron, manganese, sodium, strontium and zinc. The qualifier MS-B indicated analyses for which recoveries could not be calculated as the spike used had concentrations much lower than the concentration in the sample. These samples were higher in

Table A.1: Laboratory method detection limits (MDLs) relative to targets and water quality guidelines, Minto Mine, 2013.

Analyte		Units	Method Detection Limit		Water Use Licence	CCME Water Quality[a]	
			Target	Achieved	Limits	30 Day	Max
Physical Tests	Conductivity	μS/cm	-	2.0	-	-	-
	Hardness (as CaCO3)	mg/L	-	0.5	-	-	-
	pH	pH units	-	0.1	6.0 - 9.0	-	-
	Total Suspended Solids	mg/L	0.8	3.0	-	8.0[b]	-
	Total Dissolved Solids	mg/L	-	10.0	-	-	-
	Turbidity	NTU	0.543	0.1	-	5.43[c]	-
Anions and Nutrients	Alkalinity, Total	mg/L	-	-	-	-	-
	Ammonia, Total (as N)	mg/L	0.03	0.005	0.35	0.343[d]	
	Chloride (Cl)	mg/L	12	0.5	-	120	640
	Fluoride (F)	mg/L	0.012	0.02	-	0.12	
	Nitrate (as N)	mg/L	0.29	0.005	2.90	13	550
	Nitrite (as N)	mg/L	0.006	0.001	0.06	0.197	-
	Phosphorus (P)-Total dissolved	mg/L	-	0.00	0.02	-	-
	Phosphorus (P)-Total	mg/L	-	0.00	-	-	-
	Sulfate (SO4)	mg/L	-	0.5	-	-	-
Cyanides	Cyanide, Total	mg/L	-	0.005	-	-	-
Organic / Inorganic Carbon	Dissolved Organic Carbon	mg/L	-	0.5 - 1.0	-	-	-
	Total Organic Carbon	mg/L	-	0.5 - 1.0	-	-	-
	Total Inorganic Carbon	mg/L	-	1.0 - 2.5	-	-	-
Total Metals	Total Aluminum (Al)	mg/L	0.01	0.003	0.62	0.1[e]	-
	Total Antimony (Sb)	mg/L	-	0.0001	-	-	-
	Total Arsenic (As)	mg/L	0.0005	0.0001	0.005	0.005	-
	Total Barium (Ba)	mg/L	-	0.00005	-	-	-
	Total Beryllium (Be)	mg/L	-	0.0001	-	-	-
	Total Bismuth (Bi)	mg/L	-	0.0005	-	-	-
	Total Boron (B)	mg/L	0.15	0.01	-	1.5	2.9
	Total Cadmium (Cd)	mg/L	0.000002	0.00001	0.00004	0.00002[f]	-
	Total Calcium (Ca)	mg/L	-	0.05	-	-	-
	Total Chromium (Cr)	mg/L	0.0001	0.0001	0.002	0.001 Cr(VI)	-
	Total Cobalt (Co)	mg/L	-	0.0001	-	-	-
	Total Copper (Cu)	mg/L	0.0002	0.0005	0.013	0.002[f]	-
	Total Iron (Fe)	mg/L	0.03	0.01	1.1	0.3	-
	Total Lead (Pb)	mg/L	0.00019	0.00005	0.004	0.0019[f]	-
	Total Lithium (Li)	mg/L	-	0.0005	-	-	-
	Total Magnesium (Mg)	mg/L	-	0.1	-	-	-
	Total Manganese (Mn)	mg/L	-	0.00005	-	-	-
	Total Mercury (Hg)	mg/L	0.000003	0.00001	-	0.00003	-
	Total Molybdenum (Mo)	mg/L	0.007	0.00005	0.073	0.073	-
	Total Nickel (Ni)	mg/L	0.007	0.0005	0.11	0.07[f]	-
	Total Phosphorus (P)	mg/L	-	0.30	-	-	-
	Total Potassium (K)	mg/L		0.05	-	-	-
	Total Selenium (Se)	mg/L	0.0001	0.0001	0.001	0.001	-
	Total Silicon (Si)	mg/L	-	0.05	-	-	-
	Total Silver (Ag)	mg/L	0.00001	0.00001	-	0.0001	
	Total Sodium (Na)	mg/L	-	0.05	-	-	-
	Total Strontium (Sr)	mg/L	-	0.0002	-	-	-
	Total Thallium (Tl)	mg/L	0.00008	0.00001	-	0.0008	-
	Total Tin (Sn)	mg/L	-	0.0001	-	-	-
	Total Titanium (Ti)	mg/L	-	0.01	-	-	-
	Total Uranium (U)	mg/L	0.0015	0.00001	-	0.015	0.033
	Total Vanadium (V)	mg/L	-	0.001	-	-	-
	Total Zinc (Zn)	mg/L	0.003	0.003	0.03	0.03	-

* Working guideline

[a] CCME (Canadian Council of Ministers of the Environment). 1999. Canadian Environmental Quality Guidelines. 1999 (plus updates), Canadian Council of Ministers of the Environment, Winnipeg.

[b] Based on the median of background levels plus 5 mg/L

[c] Based on the median of background levels plus 2 NTU

[d] Based on lowest guideline using highest temperature and pH

[e] Based on lowest guideline using highest pH

[f] Based on lowest guideline using lowest hardness

value greater than DQO

concentrations but results for those samples with lower concentrations did not have the qualifier. All other samples passed the DQO except for strontium, both samples that were analyzed failed the DQO.

A2.4.3 Certified Reference Materials

Analyte recoveries from certified reference materials all met the data quality objectives indicating excellent analytical accuracy (Appendix B).

A3.0 SEDIMENT SAMPLES

A3.1 Method Detection Limits

All analytes had reported MDLs that were lower than the target MDLs indicating that the data can be reliably interpreted relative to the guidelines (Table A.2).

A3.2 Laboratory Blank Sample Analysis

All blank samples contained non-detectable analyte concentrations indicating no inadvertent contamination of samples within the laboratory during analysis (Appendix C).

A3.3 Data Precision

The laboratory duplicate sediment samples showed good agreement in most analyte concentrations. The relative percent difference for percent gravel and inorganic carbon were not available as the results were below method detection limits (Appendix C).

A3.4 Data Accuracy

Recoveries of all analytes in certified reference materials met the data quality objective (Appendix C). These data indicated excellent analytical accuracy associated with the analysis of sediment samples.

Table A.2: Laboratory method detection limits (MDL) for sediment samples relative to targets and to guidelines, Minto Mine, 2013.

Analytes		Units	Target MDL	Achieved MDL	CCME Sediment Quality Guidelines[a]	
					ISQG[b]	PEL[c]
Physical Tests	Loss on Ignition @ 420 C	%	-	1.0	-	-
	pH (1:2 soil:water)	pH units	-	0.1	-	-
Particle Size	% Gravel (> 2 mm)	%	-	0.1	-	-
	% Sand (2.0 mm - 0.063 mm)	%	-	0.1	-	-
	% Silt (0.063 mm - 4 μm)	%	-	0.1	-	-
	% Clay (< 4 μm)	%	-	0.1	-	-
Non-metal	Total Kjeldahl Nitrogen (TKN)	%	-	0.02	-	-
	Inorganic Carbon	%	-	0.1	-	-
	Inorganic Carbon (as $CaCO_3$ Equivalent)	%	-	0.8	-	-
	Total Carbon by Combustion	%	-	0.1	-	-
	Total Organic Carbon	%	-	0.1	-	-
Metals	Total Aluminum (Al)	mg/kg	-	50	-	-
	Total Antimony (Sb)	mg/kg	-	0.1	-	-
	Total Arsenic (As)	mg/kg	0.59	0.05	5.9	17
	Total Barium (Ba)	mg/kg	-	0.5	-	-
	Total Beryllium (Be)	mg/kg	-	0.2	-	-
	Total Bismuth (Bi)	mg/kg	-	0.2	-	-
	Total Cadmium (Cd)	mg/kg	0.06	0.05	0.6	3.5
	Total Calcium (Ca)	mg/kg	-	50	-	-
	Total Chromium (Cr)	mg/kg	3.73	0.5	37.3	90
	Total Cobalt (Co)	mg/kg	-	0.1	-	-
	Total Copper (Cu)	mg/kg	3.57	0.5	35.7	197
	Total Iron (Fe)	mg/kg	-	50	-	-
	Total Lead (Pb)	mg/kg	3.50	0.5	35.0	91.3
	Total Lithium (Li)	mg/kg	-	5.0	-	-
	Total Magnesium (Mg)	mg/kg	-	20	-	-
	Total Manganese (Mn)	mg/kg	-	1.0	-	-
	Total Mercury (Hg)	mg/kg	0.017	0.005	0.170	0.486
	Total Molybdenum (Mo)	mg/kg	-	0.5	-	-
	Total Nickel (Ni)	mg/kg	-	0.5	-	-
	Total Phosphorus (P)	mg/kg	-	50	-	-
	Total Potassium (K)	mg/kg	-	100	-	-
	Total Selenium (Se)	mg/kg	-	0.2	-	-
	Total Silver (Ag)	mg/kg	-	0.1	-	-
	Total Sodium (Na)	mg/kg	-	100	-	-
	Total Strontium (Sr)	mg/kg	-	0.5	-	
	Total Thallium (Tl)	mg/kg	-	0.05	-	-
	Total Tin (Sn)	mg/kg	-	2.0	-	-
	Total Titanium (Ti)	mg/kg	-	1.0	-	-
	Total Uranium (U)	mg/kg	-	0.05	-	-
	Total Vanadium (V)	mg/kg	-	0.2	-	-
	Total Zinc (Zn)	mg/kg	12.3	1.0	123	315

[a] CCME (Canadian Council of Ministers of the Environment). 1999. Canadian Environmental Quality Guidelines. 1999 plus updates, Winnipeg, MB.)

[b] Interim sediment quality guideline

[c] Probable effect level

value greater than DQO

A4.0 PERIPHYTON COMMUNITY

Two samples were selected for quality control (QC) analysis and an original and QC sub-sample abundance were compared. Samples achieved excellent similarity (86% and 96%) between the original and QC sub-sample (Appendix D). Dominant species found in the original community sub-sample abundance were also found to be dominant in the QC sub-sample (Appendix D). This indicates that the data can be reliably interpreted.

A5.0 BENTHIC MACROINVERTEBRATE COMMUNITY

The objective for percent organism recovery was met for each of the three re-sorted samples, with an average percent recovery of approximately 98% (Table A.3). Records of percent sampled for each station were maintained (Table A.4). This indicates that the data can be reliably interpreted.

Table A.3: Percent recovery of benthic invertebrates, Minto Mine, 2013.

Site	Initial Sort	Re-sort	Percent sorting efficiency[a]
LMC-2, 500 µm	121	6	95%
LWC-1, 500 µm	288	1	100%
LWC-5, 500 µm	595	5	99%

[a] percent sorting efficiency = (1-(# in QA/AC re-sort / (# sorted originally + # in QA/QC resort)))* 100

value less than 90%

Table A.4: Percent of benthic sample analyzed for each station.

Area	Station				
	1	2	3	4	5
LMC, 500 µm	100%	100%	100%	100%	100%
LWC, 500 µm	100%	100%	100%	100%	100%

A6.0 TISSUE SAMPLES

A6.1 Method Detection Limits

Most analytes measured in periphyton and benthic invertebrate tissue had reported MDLs that were at or below the target concentrations, except for total calcium, magnesium, phosphorus and sodium (Table A.5). Both phosphorus and sodium samples had low initial volume and this could affect the MDLs that the laboratory was able to achieve.

There are no regulatory guidelines in place for tissue samples so target MDLs were based on values the laboratory could achieve. Even though samples did exceed the target MDL they may not be of any biological concern.

A6.2 Laboratory Blank Sample Analysis

Periphyton and benthic invertebrate tissue blank samples contained non-detectable analyte concentrations, except for aluminum, iron and manganese (periphyton samples) and lithium (benthic invertebrate samples) which had the qualifier MB-LOR. This indicates that the sample exceeds the DQO and that the detection limit was adjusted, this is done for samples that are less than five times blank levels. These data indicate no inadvertent contamination of samples within the laboratory during analysis (Appendix B).

A6.3 Data Precision

Periphyton tissue samples showed that close agreement was generally achieved between laboratory duplicate samples, except for rhenium, for which the relative percent difference was not available as the result was below method detection limits (Appendix C). Only six samples that were measured in benthic invertebrate tissue did not fail the laboratory DQO (percent moisture, antimony, mercury, phosphorus, potassium and selenium). Bismuth showed close agreement between absolute differences as well, only expressed in this way as replicate 1 was less than 10 times detection limit. Relative percent differences for rhenium, sodium, tellurium and tin were not available as results were below method detection limits. All other analytes (28 analytes) were above the acceptable laboratory relative percent difference due to heterogeneity in the sample (Appendix C). Tissue samples need to be homogenized before metal analysis. Since this can be a difficult process for some tissue samples,

Table A.5: Laboratory method detection limits (MDL) for periphyton tissue samples relative to targets, Minto Mine, 2013.

Analyte	Units	Target MDL	Achieved MDL
Physical Tests			
% Moisture	%	0.1	0.1
Metals			
Total Aluminum (Al)	mg/kg wwt	0.4	0.4
Total Antimony (Sb)	mg/kg wwt	0.002	0.002
Total Arsenic (As)	mg/kg wwt	0.004	0.004
Total Barium (Ba)	mg/kg wwt	0.01	0.01
Total Beryllium (Be)	mg/kg wwt	0.002	0.002
Total Bismuth (Bi)	mg/kg wwt	0.002	0.002
Total Boron (B)	mg/kg wwt	0.2	0.2
Total Cadmium (Cd)	mg/kg wwt	0.002	0.002
Total Calcium (Ca)	mg/kg wwt	4	5 - 75
Total Cesium (Cs)	mg/kg wwt	0.001	0.001
Total Chromium (Cr)	mg/kg wwt	0.01	0.01
Total Cobalt (Co)	mg/kg wwt	0.004	0.004
Total Copper (Cu)	mg/kg wwt	0.01	0.01
Total Gallium (Ga)	mg/kg wwt	0.004	0.004
Total Iron (Fe)	mg/kg wwt	0.2	0.2
Total Lead (Pb)	mg/kg wwt	0.004	0.004
Total Lithium (Li)	mg/kg wwt	0.02	0.02
Total Magnesium (Mg)	mg/kg wwt	0.4	10 - 150
Total Manganese (Mn)	mg/kg wwt	0.004	0.004
Total Mercury (Hg)	mg/kg wwt	0.001	0.001
Total Molybdenum (Mo)	mg/kg wwt	0.004	0.004
Total Nickel (Ni)	mg/kg wwt	0.01	0.01
Total Phosphorus (P)	mg/kg wwt	0.2	50 - 500
Total Potassium (K)	mg/kg wwt	-	200 - 3,000
Total Rhenium (Re)	mg/kg wwt	0.002	0.002
Total Rubidium (Rb)	mg/kg wwt	0.01	0.01
Total Selenium (Se)	mg/kg wwt	0.02	0.02
Total Sodium (Na)	mg/kg wwt	4	200 - 3,000
Total Strontium (Sr)	mg/kg wwt	0.01	0.01
Total Tellurium (Te)	mg/kg wwt	0.004	0.004
Total Thallium (Tl)	mg/kg wwt	0.0004	0.0004
Total Thorium (Th)	mg/kg wwt	0.002	0.002
Total Tin (Sn)	mg/kg wwt	0.02	0.02
Total Uranium (U)	mg/kg wwt	0.0004	0.0004
Total Vanadium (V)	mg/kg wwt	0.02	0.02
Total Yttrium (Y)	mg/kg wwt	0.002	0.002
Total Zinc (Zn)	mg/kg wwt	0.1	0.1
Total Zirconium (Zr)	mg/kg wwt	0.04	0.04

the laboratory could not always achieve full homogenization which caused some sample heterogeneity.

Periphyton samples were associated with good analytical precision but benthic invertebrate samples were not. Most analytes measured in benthic invertebrate tissue failed the DQO due to heterogeneity due to incomplete sample homogenization.

A6.4 Data Accuracy

Recoveries of all analytes, for both periphyton and benthic invertebrate tissue samples, in certified reference materials met the data quality objective (Appendix C). Overall, these data indicated excellent analytical accuracy associated with the analysis of tissue samples.

A7.0 DATA QUALITY STATEMENT

After completing the DQA it appears that the holding time of the water sample from lower Big Creek did not affect data interpretability. There was poor lab precision for benthic invertebrate tissue chemistry but there was excellent data accuracy and benthic invertebrate tissue chemistry showed little inadvertent contamination of the sample within the lab. The overall quality of data for this project was adequate to serve the project objectives.

APPENDIX B

SUPPORTING INFORMATION AND DATA

Table B.1: Habitat characteristics for benthic invertebrate areas, Minto Mine, September 2013.

Characteristics		Lower Wolverine Creek (Reference)	Lower Minto Creek (Exposure)
UTM		0382464 6954812	0392198 6948015
Approximate Length of Reach Assessed (m)		60	20
Gradient (%)		3	2
Velocity (m/s)	Mean (min-max)	0.18 - 0.24	0.16 - 0.21
Depth (m)	Mean	0.31	0.18
	Maximum	0.78	0.34
Width (m)	Wetted	17	2.25
	Bankfull	30	3.58
General Morphology	% pool	0	10
	% riffle	20	20
	% run	80	70
Bank Condition		Moderate	Stable
Substrate Coverage	% bedrock	0	0
	% boulder	0	0
	% cobble	80	80
	% gravel	15	10
	% sand and finer	5	10
Instream Cover (% total Surface)	undercut banks	5	5
	boulder	0	0
	woody debris	5	10
	deep pool	0	0
	macrophytes	0	0
	other	10 (overhanging vegetation)	0
Overhead Canopy (%Surface)	Dense	0	0
	Partially Open	10	80
	Open	90	20
Aquatic Vegetation (% areal coverage)	Emergent	0	0
	Submergent	0	0
	Floating	0	0
	Attached Algae	slight coverage	0
Riparian vegetation		willow, alder, spruce, cottonwood	alder, willow, aspen
Surrounding Land Use		forest	forest
Evidence of Anthropogenic Disturbance		None	Minto Mine upstream

Table B.2: Erosional benthic invertebrate grab sample collections, Minto Mine, September 2013.

Characteristics		Lower Wolverine Creek (Reference)				
		LWC-1	LWC-2	LWC-3	LWC-4	LWC-5
Date/Time		11-Sep-13 13:46	11-Sep-13 12:22	11-Sep-13 11:36	11-Sep-13 10:24	11-Sep-13 9:30
UTM		0382433 6954573	0382422 6954736	0382464 6954812	0382556 6955007	0382556 6955125
Sampling Device		Hess	Hess	Hess	Hess	Hess
Sampler Size (m^2)		0.1	0.1	0.1	0.1	0.1
Mesh Size (µm)		500	500	500	500	500
Grabs in Composite		3	3	3	3	3
Water Velocity (m/s)		0.36	0.31	0.41	0.36	0.39
Depth (m)		0.18	0.20	0.24	0.21	0.18
Number of Jars		1	1	1	1	1
Average Depth (cm) (Sampler pushed into substrate)		8	7	8	5	6 - 7
Average Depth (cm) (Substrate is sampled/cleaned)		10	10	10	10	10
Average Sampling Time per Grab (min)		8	-	9	9	10
Macrophytes (in sample)		None	None	None	None	None
Algae (in sample)		Sparse (periphyton)	Sparse (periphyton)	Sparse (periphyton)	Sparse (some periphyton)	Sparse (some periphyton)
Sample Texture	% cobble	80	80	80	70	50
	% gravel	10	15	15	20	30
	% sand and finer	10	5	5	10	20
	% organic	0	0	0	0	0

Table B.2: Erosional benthic invertebrate grab sample collections, Minto Mine, September 2013.

Characteristics		Lower Minto Creek (Exposure)				
		LMC-1	LMC-2	LMC-3	LMC-4	LMC-5
Date/Time		10-Sep-13 13:30	10-Sep-13 12:38	10-Sep-13 11:08	10-Sep-13 9:54	10-Sep-13 8:50
UTM		0392108 6948050	0392128 6948041	0392198 6948015	0392233 6948026	0392246 6948031
Sampling Device		Hess	Hess	Hess	Hess	Hess
Sampler Size (m^2)		0.1	0.1	0.1	0.1	0.1
Mesh Size (µm)		500	500	500	500	500
Grabs in Composite		3	3	3	3	3
Water Velocity (m/s)		0.35	0.37	0.28	0.36	0.21
Depth (m)		0.21	0.17	0.16	0.18	0.21
Number of Jars		1	1	1	1	1
Average Depth (cm) (Sampler pushed into substrate)		8	8	7	10	9
Average Depth (cm) (Substrate is sampled/cleaned)		10	10	10	8	9
Average Sampling Time per Grab (min)		8	9	8	8	8
Macrophytes (in sample)		None	None	None	None	None
Algae (in sample)		None	None	None	None	None
Sample Texture	% cobble	60	80	80	80	70
	% gravel	30	10	10	10	20
	% sand and finer	10	10	10	10	10
	% organic	0	0	0	0	0

Table B.3: *In situ* measures at sediment stations, Minto Mine WUL, September 2013. Shade indicates value does not meet WUL standard or water quality guideline.

Area	Variable	Temperature	Specific Conductance	Dissolved Oxygen	Dissolved Oxygen	pH
	Unit	°C	µS/cm	mg/L	%	pH units
	Water Quality Guidelines	-	-	7	54	6.5-9.0[a]
Lower Wolverine Creek (Reference)	LWC-1	5.97	187	10.89	87.5	7.96
	LWC-2	6.15	118	6.17	49.7	7.11
	LWC-3	5.58	127	4.36	34.6	7.00
	LWC-4	5.61	192	4.01	31.8	7.04
	LWC-5	5.65	206	3.65	29.2	7.00
	Mean	5.79	166	5.82	46.56	7.22
	Standard Deviation	0.25	40	3.00	24.23	0.41
Lower Minto Creek (Exposure)	LMC-1	4.88	321	10.8	84.4	8.26
	LMC-2	5.00	321	10.53	82.6	8.28
	LMC-3	5.12	320	10.62	83.6	8.31
	LMC-4	5.16	318	10.22	80.5	8.29
	LMC-5	3.08	319	11.99	89.3	8.21
	Mean	4.65	320	10.83	84.08	8.27
	Standard Deviation	0.88	1	0.68	3.26	0.04
Upper McGinty Creek (Reference)	LWC-1	3	125	12.97	96.5	7.67
	LWC-2	2.97	125	13.13	97.7	7.66
	LWC-3	2.90	130	13.08	96.9	7.58
	LWC-4	2.92	133	13.17	97.8	7.57
	LWC-5	2.61	143	12.21	89.8	7.57
	Mean	2.88	131	12.91	95.74	7.61
	Standard Deviation	0.16	7	0.40	3.36	0.05
Upper Minto Creek (Exposure)	LMC-1	2.33	499	11.39	83.4	-
	LMC-2	2.15	454	12.3	89.6	7.97
	LMC-3	1.91	492	11.32	82.0	7.80
	LMC-4	1.94	491	12.28	89.3	7.85
	LMC-5	1.98	489	11.78	85.4	7.95
	Mean	2.06	485	11.81	85.94	7.89
	Standard Deviation	0.18	18	0.47	3.43	0.08

Table B.4: *In situ* measures at benthic invertebrate stations, Minto Mine WUL, September 2013. Shade indicates value does not meet WUL standard or water quality guideline.

Area	Variable	Temperature	Specific Conductance	Dissolved Oxygen	Dissolved Oxygen	pH	Mean Depth	Mean Velocity
	Unit	**°C**	**µS/cm**	**mg/L**	**%**	**pH units**	**m**	**m/s**
	Water Quality Guidelines	**-**	**-**	**7**	**54**	**6.5-9.0[a]**	**-**	**-**
Lower Wolverine Creek (Reference)	LWC-1	5.65	187	11.9	95.0	8.19	0.18	0.36
	LWC-2	5.17	187	12.08	95.0	8.14	0.20	0.31
	LWC-3	5.48	187	12.44	98.6	8.20	0.24	0.41
	LWC-4	5.02	186	12.24	96.0	7.88	0.21	0.36
	LWC-5	5.05	187	12.48	97.8	7.87	0.18	0.39
	Mean	5.27	187	12.23	96.5	8.06	0.20	0.37
	Standard Deviation	0.28	0	0.24	1.6	0.17	0.02	0.04
Lower Minto Creek (Exposure)	LMC-1	3.75	317	12.72	96.7	8.38	0.21	0.35
	LMC-2	3.35	319	12.93	97.3	8.42	0.17	0.37
	LMC-3	3.06	327	13.29	99.0	8.39	0.16	0.28
	LMC-4	2.80	320	11.73	86.7	8.37	0.18	0.36
	LMC-5	2.72	325	10.6	78.3	8.33	0.21	0.21
	Mean	3.14	322	12.25	91.6	8.38	0.19	0.31
	Standard Deviation	0.42	4	1.09	8.9	0.03	0.02	0.07

[a] Range for the Water Use Licence is 6.0 - 9.0

Table B.5: Water quality results at reference and exposure areas, Minto Mine WUL, September 12th to 13th, 2013.

	Analyte	Units	LWC (reference)	URC (reference)	LBC (reference)	LMC (exposure)	UMC (exposure)
Sampling Dates:			12-Sep-13	12-Sep-13	12-Sep-13	12-Sep-13	13-Sep-13
Physical Tests	Conductivity	µS/cm	185	135	210	309	484
	Hardness (as $CaCO_3$)	mg/L	87	67	92	154	232
	pH	ph Units	7.38	7.15	8.34	8.22	7.90
	Total Suspended Solids	mg/L	< 3.0	< 3.0	3.1	5.3	< 3.0
	Total Dissolved Solids	mg/L	152	109	146	200	283
	Turbidity	NTU	1.75	4.04	3.43	4.00	0.18
Anions and Nutrients	Alkalinity, Total	mg/L	97	72	106	178	249
	Ammonia, Total (as N)	mg/L	0.006	0.007	< 0.005	0.005	0.005
	Chloride (Cl)	mg/L	< 0.50	< 0.50	2.07	1.19	3.95
	Fluoride (F)	mg/L	0.127	0.228	0.130	0.307	0.544
	Nitrate (as N)	mg/L	< 0.005	0.024	0.010	0.053	0.290
	Nitrite (as N)	mg/L	< 0.001	0.001	< 0.001	0.001	< 0.001
	Phosphorus (P)-Total dissolved	mg/L	0.0085	0.0236	0.0027	0.0154	0.0039
	Phosphorus (P)-Total	mg/L	0.013	0.030	0.007	0.027	0.005
	Sulfate (SO4)	mg/L	13.1	7.4	13.3	13.0	43.6
Cyanides	Cyanide, Total	mg/L	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005
Organic/ inorganic carbon	Dissolved Organic Carbon	mg/L	16.4	15.8	8.9	13.3	5.7
	Total Inorganic Carbon	mg/L	17.7	14.4	21.9	34.2	49.9
	Total Organic Carbon	mg/L	17.8	16.1	8.4	13.8	5.56
Total Metals	Total Aluminum (Al)	mg/L	0.12	0.08	0.16	0.15	0.01
	Total Antimony (Sb)	mg/L	< 0.0001	< 0.0001	0.0002	< 0.0001	< 0.0001
	Total Arsenic (As)	mg/L	0.0005	0.0009	0.0022	0.0009	0.0003
	Total Barium (Ba)	mg/L	0.039	0.039	0.065	0.073	0.084
	Total Beryllium (Be)	mg/L	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001
	Total Bismuth (Bi)	mg/L	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
	Total Boron (B)	mg/L	0.01	< 0.01	< 0.01	< 0.01	0.02
	Total Cadmium (Cd)	mg/L	< 0.00001	< 0.00001	0.00001	< 0.00001	< 0.00001
	Total Calcium (Ca)	mg/L	19.6	18.4	23.2	44.7	55.8
	Total Chromium (Cr)	mg/L	0.0008	0.0006	0.0005	0.0007	0.0002
	Total Cobalt (Co)	mg/L	0.0002	0.0004	0.0001	0.0003	< 0.0001
	Total Copper (Cu)	mg/L	0.002	0.002	0.003	0.002	0.002
	Total Iron (Fe)	mg/L	0.36	1.21	0.27	0.83	0.02
	Total Lead (Pb)	mg/L	< 0.00005	< 0.00005	0.00015	0.00008	< 0.00005
	Total Lithium (Li)	mg/L	0.0014	< 0.0005	0.0014	0.0014	0.0028
	Total Magnesium (Mg)	mg/L	9.9	5.3	9.3	13.2	25.2
	Total Manganese (Mn)	mg/L	0.013	0.095	0.020	0.040	0.042
	Total Mercury (Hg)	mg/L	< 0.00001	< 0.00001	< 0.00001	< 0.00001	< 0.00001
	Total Molybdenum (Mo)	mg/L	0.0005	0.0009	0.0013	0.0015	0.0053
	Total Nickel (Ni)	mg/L	0.002	0.001	0.001	0.002	0.001
	Total Phosphorus (P)	mg/L	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
	Total Potassium (K)	mg/L	0.658	0.517	0.884	1.220	2.250
	Total Selenium (Se)	mg/L	0.00013	0.00022	< 0.00010	0.00011	0.00037
	Total Silicon (Si)	mg/L	5.33	6.29	5.87	6.98	5.66
	Total Silver (Ag)	mg/L	< 0.00001	< 0.00001	< 0.00001	< 0.00001	< 0.00001
	Total Sodium (Na)	mg/L	6.29	3.60	6.88	7.83	17.50

Table B.5: Water quality results at reference and exposure areas, Minto Mine WUL, September 12th to 13th, 2013.

Analyte		Units	LWC (reference)	URC (reference)	LBC (reference)	LMC (exposure)	UMC (exposure)
Sampling Dates:			12-Sep-13	12-Sep-13	12-Sep-13	12-Sep-13	13-Sep-13
Total Metals	Total Strontium (Sr)	mg/L	0.171	0.122	0.260	0.353	0.626
	Total Thallium (Tl)	mg/L	< 0.00001	< 0.00001	< 0.00001	< 0.00001	< 0.00001
	Total Tin (Sn)	mg/L	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001
	Total Titanium (Ti)	mg/L	< 0.01	< 0.01	0.01	0.01	< 0.01
	Total Uranium (U)	mg/L	0.0005	0.0003	0.0023	0.0012	0.0026
	Total Vanadium (V)	mg/L	0.0015	0.0014	0.0014	0.0018	< 0.0010
	Total Zinc (Zn)	mg/L	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003
Dissolved Metals	Dissolved Aluminum (Al)	mg/L	0.0277	0.0424	0.0178	0.0146	0.0031
	Dissolved Antimony (Sb)	mg/L	< 0.0001	< 0.0001	0.0001	< 0.0001	< 0.0001
	Dissolved Arsenic (As)	mg/L	0.0005	0.0008	0.0008	0.0008	0.0002
	Dissolved Barium (Ba)	mg/L	0.04	0.04	0.06	0.07	0.08
	Dissolved Beryllium (Be)	mg/L	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001
	Dissolved Bismuth (Bi)	mg/L	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
	Dissolved Boron (B)	mg/L	< 0.01	< 0.01	< 0.01	< 0.01	0.02
	Dissolved Cadmium (Cd)	mg/L	< 0.00001	< 0.00001	< 0.00001	< 0.00001	< 0.00001
	Dissolved Calcium (Ca)	mg/L	18.9	18.1	22.3	41.0	53.4
	Dissolved Chromium (Cr)	mg/L	0.0006	0.0005	0.0002	0.0004	0.0001
	Dissolved Cobalt (Co)	mg/L	< 0.0001	0.0003	< 0.0001	0.0002	< 0.0001
	Dissolved Copper (Cu)	mg/L	0.002	0.002	0.002	0.002	0.002
	Dissolved Iron (Fe)	mg/L	0.225	0.904	0.051	0.476	0.015
	Dissolved Lead (Pb)	mg/L	< 0.00005	< 0.00005	< 0.00005	< 0.00005	< 0.00005
	Dissolved Lithium (Li)	mg/L	0.0014	< 0.0005	0.0012	0.0011	0.0024
	Dissolved Magnesium (Mg)	mg/L	9.6	5.2	8.9	12.5	23.9
	Dissolved Manganese (Mn)	mg/L	0.010	0.090	0.013	0.031	0.048
	Dissolved Mercury (Hg)	mg/L	< 0.00001	< 0.00001	< 0.00001	< 0.00001	< 0.00001
	Dissolved Molybdenum (Mo)	mg/L	0.0005	0.0009	0.0012	0.0013	0.0046
	Dissolved Nickel (Ni)	mg/L	0.0019	0.0014	0.0010	0.0016	0.0009
	Dissolved Phosphorus (P)	mg/L	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
	Dissolved Potassium (K)	mg/L	0.64	0.49	0.74	1.18	2.14
	Dissolved Selenium (Se)	mg/L	0.0001	0.0003	< 0.0001	0.0001	0.0004
	Dissolved Silicon (Si)	mg/L	5.06	6.21	5.28	6.33	5.48
	Dissolved Silver (Ag)	mg/L	< 0.00001	< 0.00001	< 0.00001	< 0.00001	< 0.00001
	Dissolved Sodium (Na)	mg/L	6.3	3.6	6.3	7.6	16.8
	Dissolved Strontium (Sr)	mg/L	0.167	0.117	0.244	0.326	0.565
	Dissolved Thallium (Tl)	mg/L	< 0.00001	< 0.00001	< 0.00001	< 0.00001	< 0.00001
	Dissolved Tin (Sn)	mg/L	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001
	Dissolved Titanium (Ti)	mg/L	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
	Dissolved Uranium (U)	mg/L	0.0005	0.0003	0.0021	0.0011	0.0023
	Dissolved Vanadium (V)	mg/L	0.001	0.001	< 0.001	0.001	< 0.001
	Dissolved Zinc (Zn)	mg/L	< 0.001	< 0.001	< 0.001	0.002	< 0.001

Table B.6: Explanatory notes for selected water quality guidelines, Minto Mine WUL, 2013.

Analyte		Water Quality Guidelines	Unit	CCME[a]
Physical, anion and nutrient analytes	Ammonia (Total)	0.343	mg/L	Ammonia guideline is based on highest field pH of 8.69 and highest temperature of 8.7°C
	Fluoride	0.12	mg/L	Guideline is an interm level
	Total Suspended Solids	8.0	mg/L	Guideline is based on the median of background of 3.0 mg/L plus 5 mg/L
	Turbidity	5.43	NTU	Guideline is based on the median of background of 3.43 NTU plus 2 NTU
Total Metals	Aluminum	0.1	mg/L	Guideline is based on pH of > 6.5
	Cadmium	0.00002	mg/L	Guideline is based on lowest hardness of 67 mg/L.
	Chromium	0.001	mg/L	Guideline is based hexavalent chromium (Cr VI).
	Copper	0.002	mg/L	Guideline is based on lowest hardness of 67 mg/L.
	Lead	0.0019	mg/L	Guideline is based on lowest hardness of 67 mg/L.
	Nickel	0.07	mg/L	Guideline is based on lowest hardness of 67 mg/L.

[a] CCME (Canadian Council of Ministers of the Environment). 1999 (plus updates). Canadian Environmental Quality Guidelines. CCME, Winnipeg.

Table B.7: Comparison of water quality results at reference and exposure areas in 2012 and 2013, Minto Mine WUL.

Analyte		Units	CCME Water Quality[a]		WUL Standards at W2	2012					2013				
			30	Max		Upper McGinty Creek (reference)	Upper Minto Creek (exposure)	Lower Wolverine Creek (reference)	Lower Minto Creek (exposure)	Little Big Creek (reference)	Upper McGinty Creek (reference)	Upper Minto Creek (exposure)	Lower Wolverine Creek (reference)	Lower Minto Creek (exposure)	Little Big Creek (reference)
Physical Tests	Total Suspended Solids	mg/L	8	-	-	4.7	< 3.0	22.0	425.0	12.7	< 3.0	< 3.0	< 3.0	5.3	3.1
Total Metals	Total Aluminum (Al)	mg/L	0.1	-	0.62	0.11	0.01	0.56	6.76	0.30	0.085	0.006	0.117	0.154	0.157
	Total Antimony (Sb)	mg/L	-	-	-	0.0002	< 0.0001	0.0002	0.0003	0.0002	< 0.0001	< 0.0001	< 0.0001	< 0.0001	0.0002
	Total Arsenic (As)	mg/L	0.005	-	0.005	0.0012	0.0003	0.0009	0.0045	0.0014	0.00091	0.00029	0.00053	0.00093	0.00216
	Total Barium (Ba)	mg/L	-	-	-	0.048	0.083	0.053	0.242	0.071	0.039	0.084	0.039	0.073	0.065
	Total Beryllium (Be)	mg/L	-	-	-	< 0.0001	< 0.0001	< 0.0001	0.0003	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001
	Total Bismuth (Bi)	mg/L	-	-	-	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
	Total Boron (B)	mg/L	1.5	2.9	-	< 0.01	0.03	0.01	0.01	0.01	< 0.010	0.023	0.010	< 0.010	< 0.010
	Total Cadmium (Cd)	mg/L	0.00002	-	0.00004	< 0.00001	< 0.00001	0.00002	0.00012	0.00001	< 0.00001	< 0.00001	< 0.00001	< 0.00001	0.00001
	Total Calcium (Ca)	mg/L	-	-	-	20.3	55.7	22.2	45.3	23.6	18.4	55.8	19.6	44.7	23.2
	Total Chromium (Cr)	mg/L	0.001 Cr(VI)	-	0.002	0.0013	0.0002	0.0020	0.0126	0.0008	0.00064	0.00016	0.00079	0.00069	0.00048
	Total Cobalt (Co)	mg/L	-	-	-	0.0005	< 0.0001	0.0005	0.0050	0.0002	0.00038	< 0.00010	0.00015	0.00027	0.00012
	Total Copper (Cu)	mg/L	0.002	-	0.013	0.002	0.002	0.003	0.017	0.003	0.0017	0.0023	0.0024	0.0019	0.0028
	Total Iron (Fe)	mg/L	0.3	-	1.1	1.46	0.02	0.97	11.80	0.49	1.210	0.017	0.360	0.832	0.267
	Total Lead (Pb)	mg/L	0.0019	-	0.004	0.00006	< 0.00005	0.00021	0.00314	0.00018	< 0.00005	< 0.00005	< 0.00005	0.00008	0.00015
	Total Lithium (Li)	mg/L	-	-	-	< 0.0005	0.0025	0.0019	0.0051	0.0013	< 0.0005	0.0028	0.0014	0.0014	0.0014
	Total Magnesium (Mg)	mg/L	-	-	-	5.9	25.1	11.5	14.4	9.5	5.3	25.2	9.9	13.2	9.3
	Total Manganese (Mn)	mg/L	-	-	-	0.14	0.05	0.05	0.42	0.03	0.095	0.042	0.013	0.040	0.020
	Total Mercury (Hg)	mg/L	0.00003	-	-	< 0.00001	< 0.00001	< 0.00001	0.00002	< 0.00001	< 0.00001	< 0.00001	< 0.00001	< 0.00001	< 0.00001
	Total Molybdenum (Mo)	mg/L	0.073	-	0.073	0.0011	0.0049	0.0007	0.0013	0.0011	0.0009	0.0053	0.0005	0.0015	0.0013
	Total Nickel (Ni)	mg/L	0.07	-	0.11	0.002	0.001	0.003	0.014	0.002	0.0015	0.0009	0.0021	0.0018	0.0013
	Total Phosphorus (P)	mg/L	-	-	-	< 0.05	< 0.05	< 0.05	0.41	< 0.05	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
	Total Potassium (K)	mg/L	-	-	-	0.48	2.19	0.90	1.67	0.84	0.52	2.25	0.66	1.22	0.88
	Total Selenium (Se)	mg/L	0.001	-	0.001	0.0003	0.0004	0.0002	0.0003	< 0.0001	0.0002	0.0004	0.0001	0.0001	< 0.0001
	Total Silicon (Si)	mg/L	-	-	-	6.93	5.71	6.77	19.20	7.49	6.29	5.66	5.33	6.98	5.87
	Total Silver (Ag)	mg/L	0.0001	-	-	0.00001	< 0.00001	0.00017	0.00006	< 0.00001	< 0.00001	< 0.00001	< 0.00001	< 0.00001	< 0.00001
	Total Sodium (Na)	mg/L	-	-	-	3.94	18.70	6.98	7.59	7.48	3.60	17.50	6.29	7.83	6.88
	Total Strontium (Sr)	mg/L	-	-	-	0.120	0.611	0.187	0.351	0.250	0.122	0.626	0.171	0.353	0.260
	Total Thallium (Tl)	mg/L	0.0008	-	-	< 0.00001	< 0.00001	< 0.00001	0.00006	< 0.00001	< 0.00001	< 0.00001	< 0.00001	< 0.00001	< 0.00001
	Total Tin (Sn)	mg/L	-	-	-	< 0.0001	< 0.0001	< 0.0001	0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001
	Total Titanium (Ti)	mg/L	-	-	-	< 0.01	< 0.01	0.02	0.22	0.01	< 0.010	< 0.010	< 0.010	0.011	0.013
	Total Uranium (U)	mg/L	0.015	0.033	-	0.0003	0.0028	0.0007	0.0015	0.0019	0.0003	0.0026	0.0005	0.0012	0.0023
	Total Vanadium (V)	mg/L	-	-	-	0.002	< 0.001	0.003	0.023	0.002	0.0014	< 0.0010	0.0015	0.0018	0.0014
	Total Zinc (Zn)	mg/L	0.03	-	0.03	< 0.003	< 0.003	0.003	0.026	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003

Water use licence standard not met

Water quality guideline not met

[a] CCME (Canadian Council of Ministers of the Environment). 1999. Canadian Environmental Quality Guidelines. 1999 (plus updates), Canadian Council of Ministers of the Environment, Winnipeg. See Appendix Table B.6 for explanatory notes on selected water quality guidelines.

Table B.8: Concentration of chlorophyll *a* measured at five benthic stations in lower Wolverine and lower Minto Creeks, Minto Mine WUL, 2013.

Lower Wolverine Creek (reference)		Lower Minto Creek (exposure)	
Station	mg/m^2	Station	mg/m^2
LWC-1	0.0858	LMC-1	0.0213
LWC-2	0.0099	LMC-2	0.0030
LWC-3	0.0424	LMC-3	0.0030
LWC-4	0.0168	LMC-4	0.1047
LWC-5	0.0058	LMC-5	0.0009
Mean	0.0322	Mean	0.0266
Standard Deviation	0.0332	Standard Deviation	0.0444

MINNOW ENVIRONMENTAL INC.
ATTN: Lisa Bowron
101 - 1025 Hillside Ave.
Victoria BC V8T 2A2

Date Received: 14-SEP-13
Report Date: 02-OCT-13 17:47 (MT)
Version: FINAL

Client Phone: 250-595-1627

Certificate of Analysis

Lab Work Order #: **L1363322**
Project P.O. #: 2498
Job Reference: MINNOW PROJECT 2498
C of C Numbers: 1
Legal Site Desc:

Andre Langlais
Account Manager

ALS ENVIRONMENTAL ANALYTICAL REPORT

Grouping	Analyte	L1363322-1	L1363322-2	L1363322-3	L1363322-4	L1363322-5
	Description	Water	Water	Water	Water	Water
	Sampled Date	12-SEP-13	12-SEP-13	12-SEP-13	13-SEP-13	12-SEP-13
	Sampled Time	12:00	12:00	12:00	12:00	12:00
	Client ID	LMC	LWC	LBC	UMC	URC
WATER						
Physical Tests	Conductivity (uS/cm)	309	185	210	484	135
	Hardness (as CaCO3) (mg/L)	154	86.9	92.4	232	66.7
	pH (pH)	8.22	7.38	8.34	7.90	7.15
	Total Suspended Solids (mg/L)	5.3	<3.0	3.1	<3.0	<3.0
	Total Dissolved Solids (mg/L)	200	152	146	283	109
	Turbidity (NTU)	4.00	1.75	3.43	0.18	4.04
Anions and Nutrients	Alkalinity, Bicarbonate (as CaCO3) (mg/L)	178	97.0	95.1	249	72.4
	Alkalinity, Carbonate (as CaCO3) (mg/L)	<1.0	<1.0	11.2	<1.0	<1.0
	Alkalinity, Hydroxide (as CaCO3) (mg/L)	<1.0	<1.0	<1.0	<1.0	<1.0
	Alkalinity, Total (as CaCO3) (mg/L)	178	97.0	106	249	72.4
	Ammonia, Total (as N) (mg/L)	0.0052	0.0060	<0.0050	0.0053	0.0068
	Chloride (Cl) (mg/L)	1.19	<0.50	2.07	3.95	<0.50
	Fluoride (F) (mg/L)	0.307	0.127	0.130	0.544	0.228
	Nitrate (as N) (mg/L)	0.0528	<0.0050	0.0098	0.290	0.0238
	Nitrite (as N) (mg/L)	0.0012	<0.0010	<0.0010	<0.0010	0.0010
	Total Kjeldahl Nitrogen (mg/L)	0.481	0.458	0.263	0.179	0.435
	Phosphorus (P)-Total Dissolved (mg/L)	0.0154	0.0085	0.0027	0.0039	0.0236
	Phosphorus (P)-Total (mg/L)	0.0267	0.0129	0.0073	0.0052	0.0297
	Sulfate (SO4) (mg/L)	13.0	13.1	13.3	43.6	7.41
Cyanides	Cyanide, Total (mg/L)	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Organic / Inorganic Carbon	Dissolved Organic Carbon (mg/L)	13.3	16.4	8.88	5.71	15.8
	Total Inorganic Carbon (mg/L)	34.2	17.7	21.9	49.9	14.4
	Total Organic Carbon (mg/L)	13.8	17.8	8.40	5.56	16.1
Total Metals	Aluminum (Al)-Total (mg/L)	0.154	0.117	0.157	0.0063	0.0849
	Antimony (Sb)-Total (mg/L)	<0.00010	<0.00010	0.00020	<0.00010	<0.00010
	Arsenic (As)-Total (mg/L)	0.00093	0.00053	0.00216	0.00029	0.00091
	Barium (Ba)-Total (mg/L)	0.0726	0.0389	0.0647	0.0839	0.0391
	Beryllium (Be)-Total (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Bismuth (Bi)-Total (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Boron (B)-Total (mg/L)	<0.010	0.010	<0.010	0.023	<0.010
	Cadmium (Cd)-Total (mg/L)	<0.000010	<0.000010	0.000013	<0.000010	<0.000010
	Calcium (Ca)-Total (mg/L)	44.7	19.6	23.2	55.8	18.4
	Chromium (Cr)-Total (mg/L)	0.00069	0.00079	0.00048	0.00016	0.00064
	Cobalt (Co)-Total (mg/L)	0.00027	0.00015	0.00012	<0.00010	0.00038
	Copper (Cu)-Total (mg/L)	0.00189	0.00235	0.00280	0.00234	0.00174
	Iron (Fe)-Total (mg/L)	0.832	0.360	0.267	0.017	1.21

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1363322-1	L1363322-2	L1363322-3	L1363322-4	L1363322-5
	Description	Water	Water	Water	Water	Water
	Sampled Date	12-SEP-13	12-SEP-13	12-SEP-13	13-SEP-13	12-SEP-13
	Sampled Time	12:00	12:00	12:00	12:00	12:00
	Client ID	LMC	LWC	LBC	UMC	URC
Grouping	**Analyte**					
WATER						
Total Metals	Lead (Pb)-Total (mg/L)	0.000077	<0.000050	0.000151	<0.000050	<0.000050
	Lithium (Li)-Total (mg/L)	0.00136	0.00143	0.00135	0.00283	<0.00050
	Magnesium (Mg)-Total (mg/L)	13.2	9.92	9.29	25.2	5.29
	Manganese (Mn)-Total (mg/L)	0.0403	0.0130	0.0200	0.0415	0.0950
	Mercury (Hg)-Total (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Molybdenum (Mo)-Total (mg/L)	0.00147	0.000493	0.00128	0.00526	0.000948
	Nickel (Ni)-Total (mg/L)	0.00178	0.00211	0.00131	0.00093	0.00149
	Phosphorus (P)-Total (mg/L)	<0.30	<0.30	<0.30	<0.30	<0.30
	Potassium (K)-Total (mg/L)	1.22	0.658	0.884	2.25	0.517
	Selenium (Se)-Total (mg/L)	0.00011	0.00013	<0.00010	0.00037	0.00022
	Silicon (Si)-Total (mg/L)	6.98	5.33	5.87	5.66	6.29
	Silver (Ag)-Total (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Sodium (Na)-Total (mg/L)	7.83	6.29	6.88	17.5	3.60
	Strontium (Sr)-Total (mg/L)	0.353	0.171	0.260	0.626	0.122
	Thallium (Tl)-Total (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Tin (Sn)-Total (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Titanium (Ti)-Total (mg/L)	0.011	<0.010	0.013	<0.010	<0.010
	Uranium (U)-Total (mg/L)	0.00120	0.000549	0.00227	0.00262	0.000341
	Vanadium (V)-Total (mg/L)	0.0018	0.0015	0.0014	<0.0010	0.0014
	Zinc (Zn)-Total (mg/L)	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030
Dissolved Metals	Dissolved Mercury Filtration Location	FIELD	FIELD	FIELD	FIELD	FIELD
	Dissolved Metals Filtration Location	FIELD	FIELD	FIELD	FIELD	FIELD
	Aluminum (Al)-Dissolved (mg/L)	0.0146	0.0277	0.0178	0.0031	0.0424
	Antimony (Sb)-Dissolved (mg/L)	<0.00010	<0.00010	0.00014	<0.00010	<0.00010
	Arsenic (As)-Dissolved (mg/L)	0.00076	0.00047	0.00076	0.00022	0.00079
	Barium (Ba)-Dissolved (mg/L)	0.0669	0.0362	0.0554	0.0823	0.0389
	Beryllium (Be)-Dissolved (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Bismuth (Bi)-Dissolved (mg/L)	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Boron (B)-Dissolved (mg/L)	<0.010	<0.010	<0.010	0.018	<0.010
	Cadmium (Cd)-Dissolved (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Calcium (Ca)-Dissolved (mg/L)	41.0	18.9	22.3	53.4	18.1
	Chromium (Cr)-Dissolved (mg/L)	0.00037	0.00055	0.00020	0.00011	0.00054
	Cobalt (Co)-Dissolved (mg/L)	0.00019	<0.00010	<0.00010	<0.00010	0.00032
	Copper (Cu)-Dissolved (mg/L)	0.00160	0.00208	0.00178	0.00220	0.00163
	Iron (Fe)-Dissolved (mg/L)	0.476	0.225	0.051	0.015	0.904
	Lead (Pb)-Dissolved (mg/L)	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
	Lithium (Li)-Dissolved (mg/L)	0.00110	0.00138	0.00121	0.00236	<0.00050

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1363322-1	L1363322-2	L1363322-3	L1363322-4	L1363322-5
	Description	Water	Water	Water	Water	Water
	Sampled Date	12-SEP-13	12-SEP-13	12-SEP-13	13-SEP-13	12-SEP-13
	Sampled Time	12:00	12:00	12:00	12:00	12:00
	Client ID	LMC	LWC	LBC	UMC	URC
Grouping	**Analyte**					
WATER						
Dissolved Metals	Magnesium (Mg)-Dissolved (mg/L)	12.5	9.63	8.91	23.9	5.19
	Manganese (Mn)-Dissolved (mg/L)	0.0312	0.00953	0.0130	0.0480	0.0897
	Mercury (Hg)-Dissolved (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Molybdenum (Mo)-Dissolved (mg/L)	0.00132	0.000475	0.00118	0.00459	0.000903
	Nickel (Ni)-Dissolved (mg/L)	0.00155	0.00186	0.00104	0.00091	0.00137
	Phosphorus (P)-Dissolved (mg/L)	<0.30	<0.30	<0.30	<0.30	<0.30
	Potassium (K)-Dissolved (mg/L)	1.18	0.636	0.743	2.14	0.492
	Selenium (Se)-Dissolved (mg/L)	0.00012	0.00010	<0.00010	0.00037	0.00025
	Silicon (Si)-Dissolved (mg/L)	6.33	5.06	5.28	5.48	6.21
	Silver (Ag)-Dissolved (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Sodium (Na)-Dissolved (mg/L)	7.57	6.29	6.26	16.8	3.63
	Strontium (Sr)-Dissolved (mg/L)	0.326	0.167	0.244	0.565	0.117
	Thallium (Tl)-Dissolved (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Tin (Sn)-Dissolved (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Titanium (Ti)-Dissolved (mg/L)	<0.010	<0.010	<0.010	<0.010	<0.010
	Uranium (U)-Dissolved (mg/L)	0.00114	0.000511	0.00210	0.00228	0.000301
	Vanadium (V)-Dissolved (mg/L)	0.0012	0.0010	<0.0010	<0.0010	0.0011
	Zinc (Zn)-Dissolved (mg/L)	0.0015	<0.0010	<0.0010	<0.0010	<0.0010

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

Reference Information

QC Samples with Qualifiers & Comments:

QC Type Description	Parameter	Qualifier	Applies to Sample Number(s)
Matrix Spike	Phosphorus (P)-Total	MS-B	L1363322-1, -2, -4, -5
Matrix Spike	Total Organic Carbon	MS-B	L1363322-1, -3, -4
Matrix Spike	Cadmium (Cd)-Dissolved	MS-B	L1363322-1, -2, -3, -4, -5
Matrix Spike	Iron (Fe)-Dissolved	MS-B	L1363322-1, -2, -3, -4, -5
Matrix Spike	Manganese (Mn)-Dissolved	MS-B	L1363322-1, -2, -3, -4, -5
Matrix Spike	Strontium (Sr)-Dissolved	MS-B	L1363322-1, -2, -3, -4, -5
Matrix Spike	Zinc (Zn)-Dissolved	MS-B	L1363322-1, -2, -3, -4, -5
Matrix Spike	Sodium (Na)-Dissolved	MS-B	L1363322-1, -2, -3, -4, -5
Matrix Spike	Strontium (Sr)-Dissolved	MS-B	L1363322-1, -2, -3, -4, -5
Matrix Spike	Phosphorus (P)-Total	MS-B	L1363322-3
Matrix Spike	Sulfate (SO4)	MS-B	L1363322-3
Matrix Spike	Sulfate (SO4)	MS-B	L1363322-3

Qualifiers for Individual Parameters Listed:

Qualifier	Description
MS-B	Matrix Spike recovery could not be accurately calculated due to high analyte background in sample.

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
ALK-PCT-VA	Water	Alkalinity by Auto. Titration	APHA 2320 "Alkalinity"

This analysis is carried out using procedures adapted from APHA Method 2320 "Alkalinity". Total alkalinity is determined by potentiometric titration to a pH 4.5 endpoint. Bicarbonate, carbonate and hydroxide alkalinity are calculated from phenolphthalein alkalinity and total alkalinity values.

ALK-PCT-VA	Water	Alkalinity by Auto. Titration	APHA 2320 Alkalinity

This analysis is carried out using procedures adapted from APHA Method 2320 "Alkalinity". Total alkalinity is determined by potentiometric titration to a pH 4.5 endpoint. Bicarbonate, carbonate and hydroxide alkalinity are calculated from phenolphthalein alkalinity and total alkalinity values.

ANIONS-CL-IC-WR	Water	Chloride by Ion Chromatography	EPA 300.1

This analysis is carried out using procedures adapted from EPA Method 300.1, "Determination of Inorganic Anions by Ion Chromatography", Revision 1.0, April 1999 and from "Determination of Inorganic Anions in Environmental Waters Using a Hydroxide-Selective Column", Application Note 154 v.19, Dionex 2003.

ANIONS-F-IC-WR	Water	Fluoride by Ion Chromatography	EPA 300.1

This analysis is carried out using procedures adapted from EPA Method 300.1, "Determination of Inorganic Anions by Ion Chromatography", Revision 1.0, April 1999 and from "Determination of Inorganic Anions in Environmental Waters Using a Hydroxide-Selective Column", Application Note 154 v.19, Dionex 2003.

ANIONS-NO2-IC-WR	Water	Nitrite Nitrogen by Ion Chromatography	EPA 300.1

This analysis is carried out using procedures adapted from EPA Method 300.1, "Determination of Inorganic Anions by Ion Chromatography", Revision 1.0, April 1999 and from "Determination of Inorganic Anions in Environmental Waters Using a Hydroxide-Selective Column", Application Note 154 v.19, Dionex 2003. Nitrate is detected by UV absorbance.

ANIONS-NO3-IC-WR	Water	Nitrate Nitrogen by Ion Chromatography	EPA 300.1

This analysis is carried out using procedures adapted from EPA Method 300.1, "Determination of Inorganic Anions by Ion Chromatography", Revision 1.0, April 1999 and from "Determination of Inorganic Anions in Environmental Waters Using a Hydroxide-Selective Column", Application Note 154 v.19, Dionex 2003. Nitrate is detected by UV absorbance.

ANIONS-SO4-IC-WR	Water	Sulphate by Ion Chromatography	EPA 300.1

This analysis is carried out using procedures adapted from EPA Method 300.1, "Determination of Inorganic Anions by Ion Chromatography", Revision 1.0, April 1999 and from "Determination of Inorganic Anions in Environmental Waters Using a Hydroxide-Selective Column", Application Note 154 v.19, Dionex 2003.

CARBONS-DOC-VA	Water	Dissolved organic carbon by combustion	APHA 5310 TOTAL ORGANIC CARBON (TOC)

This analysis is carried out using procedures adapted from APHA Method 5310 "Total Organic Carbon (TOC)". Dissolved carbon (DOC) fractions are determined by filtering the sample through a 0.45 micron membrane filter prior to analysis.

CARBONS-TIC-VA	Water	Total inorganic carbon by CO2 purge	APHA 5310 TOTAL ORGANIC CARBON (TOC)

This analysis is carried out using procedures adapted from APHA Method 5310 "Total Organic Carbon (TOC)".

CARBONS-TOC-VA	Water	Total organic carbon by combustion	APHA 5310 TOTAL ORGANIC CARBON (TOC)

This analysis is carried out using procedures adapted from APHA Method 5310 "Total Organic Carbon (TOC)".

CN-TOT-WT	Water	Cyanide, Total	APHA 4500CN C E-STRONG ACID DIST COLORIM

Reference Information

Total cyanide is determined by the combination of UV digestion and distillation. Cyanide is converted to cyanogen chloride by reacting with chloramine-T, the cyanogen chloride then reacts with a combination of barbituric acid and isonicotinic acid to form a highly colored complex.

When using this method, high levels of thiocyanate in samples can cause false positives at ~1-2% of the thiocyanate concentration. For samples with detectable cyanide analyzed by this method, ALS recommends analysis for thiocyanate to check for this potential interference

EC-PCT-VA Water Conductivity (Automated) APHA 2510 Auto. Conduc.

This analysis is carried out using procedures adapted from APHA Method 2510 "Conductivity". Conductivity is determined using a conductivity electrode.

HARDNESS-CALC-VA Water Hardness APHA 2340B

Hardness (also known as Total Hardness) is calculated from the sum of Calcium and Magnesium concentrations, expressed in $CaCO_3$ equivalents. Dissolved Calcium and Magnesium concentrations are preferentially used for the hardness calculation.

HG-DIS-LOW-CVAFS-VA Water Dissolved Mercury in Water by CVAFS(Low) EPA SW-846 3005A & EPA 245.7

This analysis is carried out using procedures adapted from "Standard Methods for the Examination of Water and Wastewater" published by the American Public Health Association, and with procedures adapted from "Test Methods for Evaluating Solid Waste" SW-846 published by the United States Environmental Protection Agency (EPA). The procedures may involve preliminary sample treatment by filtration (EPA Method 3005A) and involves a cold-oxidation of the acidified sample using bromine monochloride prior to reduction of the sample with stannous chloride. Instrumental analysis is by cold vapour atomic fluorescence spectrophotometry or atomic absorption spectrophotometry (EPA Method 245.7).

HG-TOT-LOW-CVAFS-VA Water Total Mercury in Water by CVAFS(Low) EPA 245.7

This analysis is carried out using procedures adapted from "Standard Methods for the Examination of Water and Wastewater" published by the American Public Health Association, and with procedures adapted from "Test Methods for Evaluating Solid Waste" SW-846 published by the United States Environmental Protection Agency (EPA). The procedure involves a cold-oxidation of the acidified sample using bromine monochloride prior to reduction of the sample with stannous chloride. Instrumental analysis is by cold vapour atomic fluorescence spectrophotometry or atomic absorption spectrophotometry (EPA Method 245.7).

MET-D-CCMS-VA Water Dissolved Metals in Water by CRC ICPMS APHA 3030 B&E / EPA SW-846 6020A

This analysis is carried out using procedures adapted from "Standard Methods for the Examination of Water and Wastewater" published by the American Public Health Association, and with procedures adapted from "Test Methods for Evaluating Solid Waste" SW-846 published by the United States Environmental Protection Agency (EPA). The procedures may involve preliminary sample treatment by acid digestion, using hotblock, or filtration (APHA 3030B&E). Instrumental analysis is by collision cell inductively coupled plasma - mass spectrometry (modified from EPA Method 6020A).

MET-DIS-ICP-VA Water Dissolved Metals in Water by ICPOES EPA SW-846 3005A/6010B

This analysis is carried out using procedures adapted from "Standard Methods for the Examination of Water and Wastewater" published by the American Public Health Association, and with procedures adapted from "Test Methods for Evaluating Solid Waste" SW-846 published by the United States Environmental Protection Agency (EPA). The procedure involves filtration (EPA Method 3005A) and analysis by inductively coupled plasma - optical emission spectrophotometry (EPA Method 6010B).

MET-T-CCMS-VA Water Total Metals in Water by CRC ICPMS APHA 3030 B&E / EPA SW-846 6020A

This analysis is carried out using procedures adapted from "Standard Methods for the Examination of Water and Wastewater" published by the American Public Health Association, and with procedures adapted from "Test Methods for Evaluating Solid Waste" SW-846 published by the United States Environmental Protection Agency (EPA). The procedures may involve preliminary sample treatment by acid digestion, using hotblock, or filtration (APHA 3030B&E). Instrumental analysis is by collision cell inductively coupled plasma - mass spectrometry (modified from EPA Method 6020A).

MET-TOT-ICP-VA Water Total Metals in Water by ICPOES EPA SW-846 3005A/6010B

This analysis is carried out using procedures adapted from "Standard Methods for the Examination of Water and Wastewater" published by the American Public Health Association, and with procedures adapted from "Test Methods for Evaluating Solid Waste" SW-846 published by the United States Environmental Protection Agency (EPA). The procedures may involve preliminary sample treatment by acid digestion, using either hotblock or microwave oven (EPA Method 3005A). Instrumental analysis is by inductively coupled plasma - optical emission spectrophotometry (EPA Method 6010B).

NH3-F-VA Water Ammonia in Water by Fluorescence J. ENVIRON. MONIT., 2005, 7, 37-42, RSC

This analysis is carried out, on sulfuric acid preserved samples, using procedures modified from J. Environ. Monit., 2005, 7, 37 - 42, The Royal Society of Chemistry, "Flow-injection analysis with fluorescence detection for the determination of trace levels of ammonium in seawater", Roslyn J. Waston et al.

P-T-COL-VA Water Total P in Water by Colour APHA 4500-P Phosphorous

This analysis is carried out using procedures adapted from APHA Method 4500-P "Phosphorus". Total Phosphorous is determined colourimetrically after persulphate digestion of the sample.

P-TD-COL-VA Water Total Dissolved P in Water by Colour APHA 4500-P Phosphorous

This analysis is carried out using procedures adapted from APHA Method 4500-P "Phosphorus". Total Dissolved Phosphorous is determined colourimetrically after persulphate digestion of a sample that has been lab or field filtered through a 0.45 micron membrane filter.

PH-PCT-VA Water pH by Meter (Automated) APHA 4500-H "pH Value"

This analysis is carried out using procedures adapted from APHA Method 4500-H "pH Value". The pH is determined in the laboratory using a pH electrode

Reference Information

It is recommended that this analysis be conducted in the field.

PH-PCT-VA	Water	pH by Meter (Automated)	APHA 4500-H pH Value

This analysis is carried out using procedures adapted from APHA Method 4500-H "pH Value". The pH is determined in the laboratory using a pH electrode

It is recommended that this analysis be conducted in the field.

TDS-VA	Water	Total Dissolved Solids by Gravimetric	APHA 2540 C - GRAVIMETRIC

This analysis is carried out using procedures adapted from APHA Method 2540 "Solids". Solids are determined gravimetrically. Total Dissolved Solids (TDS) are determined by filtering a sample through a glass fibre filter, TDS is determined by evaporating the filtrate to dryness at 180 degrees celsius.

TKN-F-VA	Water	TKN in Water by Fluorescence	APHA 4500-NORG D.

This analysis is carried out using procedures adapted from APHA Method 4500-Norg D. "Block Digestion and Flow Injection Analysis". Total Kjeldahl Nitrogen is determined using block digestion followed by Flow-injection analysis with fluorescence detection.

TSS-VA	Water	Total Suspended Solids by Gravimetric	APHA 2540 D - GRAVIMETRIC

This analysis is carried out using procedures adapted from APHA Method 2540 "Solids". Solids are determined gravimetrically. Total Suspended Solids (TSS) are determined by filtering a sample through a glass fibre filter, TSS is determined by drying the filter at 104 degrees celsius.

TURBIDITY-VA	Water	Turbidity by Meter	APHA 2130 "Turbidity"

This analysis is carried out using procedures adapted from APHA Method 2130 "Turbidity". Turbidity is determined by the nephelometric method.

TURBIDITY-VA	Water	Turbidity by Meter	APHA 2130 Turbidity

This analysis is carried out using procedures adapted from APHA Method 2130 "Turbidity". Turbidity is determined by the nephelometric method.

** ALS test methods may incorporate modifications from specified reference methods to improve performance.

The last two letters of the above test code(s) indicate the laboratory that performed analytical analysis for that test. Refer to the list below:

Laboratory Definition Code	Laboratory Location
WR	ALS ENVIRONMENTAL - WHITEHORSE, YUKON, CANADA
WT	ALS ENVIRONMENTAL - WATERLOO, ONTARIO, CANADA
VA	ALS ENVIRONMENTAL - VANCOUVER, BRITISH COLUMBIA, CANADA

Chain of Custody Numbers:

1

GLOSSARY OF REPORT TERMS

Surrogate - A compound that is similar in behaviour to target analyte(s), but that does not occur naturally in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery.
mg/kg - milligrams per kilogram based on dry weight of sample.
mg/kg wwt - milligrams per kilogram based on wet weight of sample.
mg/kg lwt - milligrams per kilogram based on lipid-adjusted weight of sample.
mg/L - milligrams per litre.
< - Less than.
D.L. - The reported Detection Limit, also known as the Limit of Reporting (LOR).
N/A - Result not available. Refer to qualifier code and definition for explanation.

Test results reported relate only to the samples as received by the laboratory.
UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.
Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.

ALS Environmental

Chain of Custody / Analytical Request Form

Canada Toll Free: 1 800 668 9878

www.alsglobal.com

COC #

Report To	
Company:	Minnow Environmental Inc.
Contact:	Lisa Bowron
Address:	101 - 1025 Hillside Ave. Victoria, BC
Phone:	(250) 595-1627 Fax: (250) 595-1625
Invoice To Same as Report ?	☑ Yes ☐ No
Hardcopy of Invoice with Report?	☑ Yes ☐ No
Company:	
Contact:	
Address:	
Phone:	Fax:
Lab Work Order # (lab use only)	

Report Format / Distribution	
☑ Standard ☐ Other	
☑ PDF ☑ Excel ☐ Digital ☐ Fax	
Email 1:	lbowron@minnow-environmental.com
Email 2:	pstecko@minnow-environmental.com
Email 3:	
Client / Project Information	
Job #:	Minnow Project 2464
PO / AFE:	
LSD:	
Quote #:	
ALS Contact:	Victoria Jung
Sampler:	Pierre Stecko

Service Requested (Rush for routine analysis subject to availability)

- ◉ Regular (Standard Turnaround Times - Business Days)
- ○ Priority (2-4 Business Days) - 50% Surcharge - Contact ALS to Confirm TAT
- ○ Emergency (1-2 Bus. Days) - 100% Surcharge - Contact ALS to Confirm TAT
- ○ Same Day or Weekend Emergency - Contact ALS to Confirm TAT

Analysis Request

Please indicate below Filtered, Preserved or both (F, P, F/P)

Sample #	Sample Identification (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	Metals by CCMS & ICPOES	Mercury by CVAFS (Low)	Alkalinity by Auto Titration	Phosphorus in water by colour	Organic/Inorganic Carbon	Cyanide	Conductivity, Hardness and pH	TDS & TSS by Gravimetric	Turbidity by Meter	Anions by Ion Chromatography	Ammonia by Fluorescence	**See Complete Quote #	Number of Containers
	LMC	12-Sept-13		Water	X	X	X	X	X	X	X	X	X	X	X		6
	LWC	12-Sept-13		Water	X	X	X	X	X	X	X	X	X	X	X		6
	LBC	12-Sept-13		Water	X	X	X	X	X	X	X	X	X	X	X		6
	UMC	13-Sept-13		Water	X	X	X	X	X	X	X	X	X	X	X		6
	URC	12-Sept-13		Water	X	X	X	X	X	X	X	X	X	X	X		6

L1363322-COFC

Special Instructions / Regulations with water or land use (CCME-Freshwater Aquatic Life/BC CSR - Commercial/AB Tier 1 - Natural, etc) / Hazardous Details

Small samples. The critical analyte of interest is selenium; please ensure best possible MDLs.

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY.

By the use of this form the user acknowledges and agrees with the Terms and Conditions as provided on a separate Excel tab.

Also provided on another Excel tab are the ALS location addresses, phone numbers and sample container / preservation / holding time table for common analyses.

SHIPMENT RELEASE (client use)			SHIPMENT RECEPTION (lab use only)				SHIPMENT VERIFICATION (lab use only)			
Released by:	Date (dd-mmm-yy)	Time (hh-mm)	Received by:	Date:	Time:	Temperature:	Verified by:	Date:	Time:	Observations: Yes / No ? If Yes add SIF
Lisa Bowron	14-Sept-13	11-37	[signature]	14-Sept-13	1:30	3.8 °C				

5.2

APPENDIX C

SEDIMENT, PERIPHYTON AND BENTHIC INVERTEBRATE QUALITY DATA

Table C.1: Sediment chemistry data collected at exposed and reference areas, Minto Mine WUL, 2013.

Analytes		Units	CSQG [a]		Upper McGinty Creek (Reference)					Lower Wolverine Creek (Reference)				
					URC-1	URC-2	URC-3	URC-4	URC-5	LWC-1	LWC-2	LWC-3	LWC-4	LWC-5
			ISQG	PEL	12-SEP-13	12-SEP-13	12-SEP-13	12-SEP-13	12-SEP-13	11-SEP-13	11-SEP-13	11-SEP-13	11-SEP-13	11-SEP-13
Particle size, TKN, carbon analytes and pH	Loss on Ignition @ 550 C	%			14	13	17	22	21	17	15	10	16	6
	pH (1:2 soil:water)	pH units			6.99	6.67	6.96	7.13	7.16	7.04	7.07	6.97	6.82	7.1
	% Gravel (>2mm)	%			<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
	% Sand (2.0mm - 0.063mm)	%			10.1	11.3	5.06	7.75	6.49	26.1	33.6	29.4	27.1	52.3
	% Silt (0.063mm - 4um)	%			81.4	79.5	86.1	81.3	85.5	66.2	58.7	64.5	66.4	42.1
	% Clay (<4um)	%			8.49	9.21	8.85	11	7.99	7.62	7.78	6.06	6.59	5.58
	Total Kjeldahl Nitrogen (TKN)	%			0.40	0.38	0.45	0.54	0.56	0.45	0.38	0.30	0.37	0.16
	Inorganic Carbon	%			0.13	<0.10	0.15	0.11	0.15	0.12	<0.10	0.11	<0.10	0.22
	Inorganic Carbon (as $CaCO_3$ Equivalent)	%			1.09	<0.80	1.25	0.88	1.25	0.96	<0.80	0.88	<0.80	1.82
	Total Carbon by Combustion	%			7.50	7.10	9.00	11.40	11.60	8.50	6.70	5.70	7.90	2.80
	Total Organic Carbon	%			7.39	7.12	8.84	11.3	11.4	8.41	6.72	5.63	7.91	2.62
Total Metals	Aluminum (Al)	mg/kg			12,500	14,900	15,500	15,000	15,100	13,000	11,800	12,500	13,200	11,500
	Antimony (Sb)	mg/kg			0.48	0.49	0.54	0.53	0.57	0.52	0.42	0.45	0.44	0.32
	Arsenic (As)	mg/kg	5.9	17	5.98	6.18	8.48	8.68	8.01	7.1	5.97	6.70	6.51	4.98
	Barium (Ba)	mg/kg			258	283	326	321	331	242	188	201	190	142
	Beryllium (Be)	mg/kg			0.38	0.41	0.48	0.48	0.48	0.83	0.7	0.78	0.73	0.54
	Bismuth (Bi)	mg/kg			<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
	Cadmium (Cd)	mg/kg	0.6	3.5	0.18	0.17	0.22	0.20	0.26	0.28	0.18	0.24	0.19	0.11
	Calcium (Ca)	mg/kg			8,720	8,900	11,000	11,100	12,800	11,200	8,700	10,200	8,930	6,420
	Chromium (Cr)	mg/kg	37.3	90	25.4	29.1	30.8	30.1	31.7	41.3	37.3	39.6	42.7	34.6
	Cobalt (Co)	mg/kg			10.1	10.7	12.3	13	12.6	13.5	12.5	13.3	13.5	11.7
	Copper (Cu)	mg/kg	35.7	197	24	27	30	29	34	31	24	27	26	17
	Iron (Fe)	mg/kg			21,800	24,700	28,100	28,100	27,200	26,400	24,800	26,200	26,200	24,000
	Lead (Pb)	mg/kg	35	91.3	4.91	5.59	6.08	5.72	6.05	6.24	5.69	5.83	6.11	5.06
	Lithium (Li)	mg/kg			7.6	8.9	9.2	8.9	8.5	9.1	8.5	9.1	9.7	9.1
	Magnesium (Mg)	mg/kg			4,440	5,060	5,360	5,180	5,390	8,790	8,580	9,010	9,150	8,460
	Manganese (Mn)	mg/kg			895	705	1,130	1,440	1,260	634	372	560	580	402
	Mercury (Hg)	mg/kg	0.17	0.49	0.100	0.056	0.063	0.059	0.070	0.055	0.040	0.047	0.045	0.023
	Molybdenum (Mo)	mg/kg			<0.50	<0.50	0.72	0.65	1.01	0.62	0.59	0.56	0.58	0.51
	Nickel (Ni)	mg/kg			18	20	22	22	23	38	34	37	37	32
	Phosphorus (P)	mg/kg			717	929	960	960	973	1010	961	1100	1010	981
	Potassium (K)	mg/kg			640	740	860	820	850	870	770	830	840	800
	Selenium (Se)	mg/kg			0.42	0.42	0.6	0.63	0.71	0.51	0.32	0.43	0.34	<0.20
	Silver (Ag)	mg/kg			<0.10	<0.10	0.11	0.1	0.12	0.11	<0.10	<0.10	<0.10	0.15
	Sodium (Na)	mg/kg			190	220	260	230	250	350	320	340	370	340
	Strontium (Sr)	mg/kg			69.3	70.1	92	90	106	105	85.5	101	89.2	66.6
	Thallium (Tl)	mg/kg			0.058	0.082	0.089	0.094	0.086	0.085	0.061	0.068	0.068	0.052
	Tin (Sn)	mg/kg			<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
	Titanium (Ti)	mg/kg			618	769	832	783	783	745	708	728	776	746
	Uranium (U)	mg/kg			1.27	1.24	1.57	1.75	1.83	3.3	2.23	2.8	2.28	1.14
	Vanadium (V)	mg/kg			47	53	58	57	60	67	62	64	65	58
	Zinc (Zn)	mg/kg	123	315	46	53	56	53	55	57	54	58	60	55

[a] Canadian Sediment Quality Guidelines - ISQG = interim sediment quality guideline;
PEL = probable effect level (CCME 1999).

Indicates sediment concentration exceeding CSQG ISQG.

Indicates sediment concentration exceeding CSQG PEL.

Table C.1: Sediment chemistry data collected at exposed and reference areas, Minto Mine WUL, 2013.

	Analytes	Units	CSQG [a]		Upper Minto Creek (Exposure)					Lower Minto Creek (Exposure)				
					UMC-1	UMC-2	UMC-3	UMC-4	UMC-5	LMC-1	LMC-2	LMC-3	LMC-4	LMC-5
			ISQG	PEL	13-SEP-13	13-SEP-13	13-SEP-13	13-SEP-13	13-SEP-13	09-SEP-13	09-SEP-13	09-SEP-13	09-SEP-13	10-SEP-13
Particle size, TKN, carbon analytes and pH	Loss on Ignition @ 550 C	%			6	9	9	14	10	11	21	4	17	19
	pH (1:2 soil:water)	pH units			7.82	7.86	7.76	7.49	7.88	7.93	7.82	7.98	7.88	7.86
	% Gravel (>2mm)	%			4.12	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
	% Sand (2.0mm - 0.063mm)	%			54.5	36.6	34.3	35.4	19.2	10.0	4.2	13.9	0.8	0.5
	% Silt (0.063mm - 4um)	%			32.4	53.2	54.1	54.8	72.1	79	83	78.2	87.1	87.2
	% Clay (<4um)	%			9	10.2	11.6	9.83	8.71	11	12.8	7.95	12.2	12.4
	Total Kjeldahl Nitrogen (TKN)	%			0.17	0.24	0.29	0.36	0.30	0.31	0.50	0.10	0.48	0.54
	Inorganic Carbon	%			0.12	<0.10	<0.10	0.10	<0.10	0.15	0.18	0.15	0.17	0.12
	Inorganic Carbon (as CaCO3 Equivalent)	%			1.03	<0.80	<0.80	0.87	0.83	1.26	1.52	1.28	1.45	1.01
	Total Carbon by Combustion	%			2.70	4.60	5.00	6.80	5.60	5.50	10.70	1.90	9.00	10.10
	Total Organic Carbon	%			2.61	4.64	4.98	6.69	5.64	5.3	10.5	1.7	8.87	9.98
Total Metals	Aluminum (Al)	mg/kg			10,300	13,300	13,300	11,900	12,400	15,000	14,100	12,400	15,100	13,900
	Antimony (Sb)	mg/kg			0.38	0.55	0.52	0.53	0.45	0.62	0.76	0.53	0.72	0.68
	Arsenic (As)	mg/kg	5.9	17	5.15	6.96	6.36	6.24	5.34	8.5	8.84	6.51	8.48	8.26
	Barium (Ba)	mg/kg			153	255	208	200	182	309	353	239	342	328
	Beryllium (Be)	mg/kg			0.34	0.49	0.47	0.46	0.42	0.57	0.58	0.45	0.66	0.62
	Bismuth (Bi)	mg/kg			<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
	Cadmium (Cd)	mg/kg	0.6	3.5	0.14	0.20	0.18	0.21	0.18	0.25	0.35	0.15	0.30	0.33
	Calcium (Ca)	mg/kg			6,800	9,130	8,910	9,390	9,610	15,500	17,700	12,200	17,000	16,300
	Chromium (Cr)	mg/kg	37.3	90	24.8	31.8	31.7	29.1	28.1	32.9	33.8	28.8	35.6	33.6
	Cobalt (Co)	mg/kg			8.8	10.9	10.6	10.4	9.8	11.7	12.3	10.1	12.4	11.6
	Copper (Cu)	mg/kg	35.7	197	104	67	90.5	99.1	59.7	40	47	32	46	43
	Iron (Fe)	mg/kg			20,700	24,500	24,100	22,900	22,000	26,800	26,200	22,800	28,200	26,500
	Lead (Pb)	mg/kg	35	91.3	5.04	6.32	6.15	5.88	5.8	6.53	6.9	5.81	7.05	6.79
	Lithium (Li)	mg/kg			6.7	9.1	9.2	8.3	8.5	11	10.8	10.2	11.9	10.6
	Magnesium (Mg)	mg/kg			5,830	7,540	7,430	7,000	7,040	7,510	7,690	7,150	8,330	7,310
	Manganese (Mn)	mg/kg			717	646	787	612	443	941	1060	477	921	761
	Mercury (Hg)	mg/kg	0.17	0.49	0.017	0.032	0.029	0.034	0.031	0.050	0.073	0.103	0.064	0.070
	Molybdenum (Mo)	mg/kg			1.06	1.03	1.28	1.15	0.68	0.67	0.96	0.55	0.68	0.66
	Nickel (Ni)	mg/kg			24	34	30	30	29	29	32	27	34	32
	Phosphorus (P)	mg/kg			918	795	970	874	799	804	921	830	873	895
	Potassium (K)	mg/kg			1,190	1,350	1,420	1,280	990	1190	1010	940	1020	900
	Selenium (Se)	mg/kg			0.31	0.37	0.4	0.47	0.33	0.51	0.66	0.34	0.61	0.6
	Silver (Ag)	mg/kg			<0.10	<0.10	<0.10	<0.10	<0.10	0.11	0.14	<0.10	0.14	0.13
	Sodium (Na)	mg/kg			300	360	350	330	320	300	250	240	240	220
	Strontium (Sr)	mg/kg			71	106	104	91	105	132	153	92	147	142
	Thallium (Tl)	mg/kg			0.072	0.106	0.096	0.092	0.085	0.098	0.088	0.082	0.101	0.093
	Tin (Sn)	mg/kg			<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
	Titanium (Ti)	mg/kg			657	747	746	692	636	746	591	564	593	481
	Uranium (U)	mg/kg			0.72	0.97	1.08	1.34	0.81	1.30	1.59	0.94	1.50	1.42
	Vanadium (V)	mg/kg			48	55	55	53	46	59	58	48	58	55
	Zinc (Zn)	mg/kg	123	315	51	60	62	59	56	60	63	57	67	63

[a] Canadian Sediment Quality Guidelines - ISQG = interim sediment quality guideline;
PEL = probable effect level (CCME 1999).

Indicates sediment concentration exceeding CSQG ISQG.

Indicates sediment concentration exceeding CSQG PEL.

Table C.2: Periphyton tissue quality results at reference and exposure areas, Minto Mine WUL, 2013.

Analyte		Units	Lowre Wolverine Creek (Reference)							Lower Big Creek (Reference)							Lower Minto Creek (Exposure)						
			LWC-1	LWC-2	LWC-3	LWC-4	LWC-5	Mean	Standard Deviation	LBC-1	LBC-2	LBC-3	LBC-4	LBC-5	Mean	Standard Deviation	LMC-1	LMC-2	LMC-3	LMC-4	LMC-5	Mean	Standard Deviation
Physical Tests	Moisture	%	58.3	60.3	64.6	55.2	49.9	57.7	5.5	55.9	55.8	67.7	60.4	50.8	58.1	6.3	36.0	36.2	40.9	42.0	50.2	41.1	5.8
Total Metals	Total Aluminum (Al)	mg/kg dw	24,221	21,637	25,763	22,321	19,242	22,637	2,495	14,558	16,131	16,192	20,505	10,488	15,575	3,602	20,156	20,063	19,120	21,379	21,084	20,361	899
	Total Antimony (Sb)	mg/kg dw	0.0257	0.0254	0.0299	0.0241	0.0234	0.0257	0.0026	0.0492	0.0525	0.0712	0.0624	0.0439	0.0558	0.0109	0.0238	0.0221	0.0303	0.0253	0.02751	0.0258	0.0032
	Total Arsenic (As)	mg/kg dw	5.76	5.26	6.13	4.96	4.47	5.32	0.65	23.13	25.79	33.75	33.84	15.63	26.43	7.69	5.28	4.51	5.26	5.41	5.38	5.17	0.37
	Total Barium (Ba)	mg/kg dw	302	267	314	268	220	274	37	229	211	246	316	137	228	65	278	251	262	272	275	268	11
	Total Beryllium (Be)	mg/kg dw	0.727	0.685	0.754	0.676	0.599	0.688	0.059	0.490	0.529	0.567	0.699	0.370	0.531	0.120	0.503	0.480	0.499	0.517	0.506	0.501	0.014
	Total Bismuth (Bi)	mg/kg dw	0.1269	0.1063	0.1333	0.1109	0.0946	0.1144	0.0157	0.4376	1.8688	0.6378	0.7071	0.3069	0.7916	0.6228	0.1155	0.1108	0.1152	0.1245	0.1199	0.1172	0.0052
	Total Boron (B)	mg/kg dw	5.90	4.51	6.27	4.06	3.89	4.93	1.09	3.22	3.48	4.21	4.70	2.56	3.63	0.84	4.09	3.81	3.91	4.07	4.20	4.02	0.15
	Total Cadmium (Cd)	mg/kg dw	0.2278	0.2144	0.2508	0.2083	0.1725	0.2147	0.0287	0.1971	0.2127	0.2471	0.3434	0.1226	0.2246	0.0805	0.1503	0.1309	0.1557	0.1534	0.1510	0.1483	0.0099
	Total Calcium (Ca)	mg/kg dw	12,158	11,285	12,627	12,121	10,739	11,786	759	8,866	9,367	9,969	12,121	6,992	9,463	1,857	13,109	13,527	13,147	13,569	13,333	13,337	211
	Total Cesium (Cs)	mg/kg dw	2.76	2.27	2.88	2.41	2.00	2.46	0.36	2.88	3.10	3.65	4.22	1.92	3.15	0.86	1.45	1.38	1.49	1.51	1.70	1.51	0.12
	Total Chromium (Cr)	mg/kg dw	60.0	58.4	62.1	57.4	52.7	58.1	3.5	32.7	36.0	35.3	43.4	22.6	34.0	7.5	41.4	40.8	39.1	42.9	44.6	41.8	2.1
	Total Cobalt (Co)	mg/kg dw	14.44	14.51	15.03	13.53	12.85	14.07	0.87	9.05	9.66	9.81	12.45	6.30	9.45	2.19	11.25	10.34	10.91	11.66	11.14	11.06	0.48
	Total Copper (Cu)	mg/kg dw	29.3	29.2	31.6	25.9	25.1	28.2	2.7	24.7	26.9	33.1	40.2	16.9	28.4	8.8	22.7	21.3	23.7	24.0	31.5	24.6	4.0
	Total Gallium (Ga)	mg/kg dw	7.48	6.65	7.80	6.83	5.87	6.93	0.75	4.81	5.23	5.29	6.41	3.48	5.04	1.06	6.36	6.30	6.11	6.72	6.67	6.43	0.26
	Total Iron (Fe)	mg/kg dw	32,614	31,738	34,463	29,241	26,747	30,961	3,013	21,837	23,756	24,644	28,788	15,610	22,927	4,814	25,781	25,392	24,704	27,414	27,108	26,080	1,150
	Total Lead (Pb)	mg/kg dw	7.82	6.52	7.85	7.23	6.21	7.13	0.75	7.91	8.19	10.03	11.41	5.51	8.61	2.25	6.39	6.38	6.19	6.71	6.65	6.46	0.21
	Total Lithium (Li)	mg/kg dw	14.58	12.47	14.41	12.95	11.04	13.09	1.46	8.75	9.19	9.10	12.02	5.98	9.01	2.14	13.78	13.13	12.94	14.07	13.69	13.52	0.47
	Total Magnesium (Mg)	mg/kg dw	10,647	9,899	11,017	10,446	9,401	10,282	637	6,780	7,308	7,245	9,293	5,061	7,137	1,510	8,188	8,386	8,003	8,466	8,072	8,223	198
	Total Manganese (Mn)	mg/kg dw	887	849	994	688	725	829	125	612	640	734	962	386	667	209	1,053	597	761	855	827	819	165
	Total Mercury (Hg)	mg/kg dw	0.077	0.034	0.042	0.033	0.028	0.043	0.020	0.027	0.029	0.036	0.048	0.025	0.033	0.010	0.029	0.022	0.026	0.032	0.026	0.027	0.004
	Total Molybdenum (Mo)	mg/kg dw	0.386	0.348	0.401	0.330	0.329	0.359	0.033	0.830	0.821	1.028	1.086	0.573	0.868	0.202	0.320	0.296	0.354	0.347	0.376	0.338	0.031
	Total Nickel (Ni)	mg/kg dw	41.2	42.1	43.8	39.7	37.7	40.9	2.3	23.6	26.2	27.1	35.6	16.1	25.7	7.0	27.7	26.8	27.4	29.3	28.5	27.9	1.0
	Total Phosphorus (P)	mg/kg dw	1,403	1,199	1,412	1,129	1,114	1,252	146	1,039	1,052	1,068	990	813	992	104	1,016	995	910	960	972	971	40
	Total Potassium (K)	mg/kg dw	2,566	2,418	2,825	2,121	1,796	2,345	399	2,630	2,692	3,437	2,702	1,992	2,691	512	2,016	1,928	1,929	2,017	2,149	2,008	90
	Total Rhenium (Re)[a,b]	mg/kg dw	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	0	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	0	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003	0
	Total Rubidium (Rb)	mg/kg dw	20.31	18.41	21.47	18.46	15.67	18.86	2.21	14.81	15.79	17.74	20.58	10.02	15.79	3.91	14.88	14.14	15.14	15.50	17.19	15.37	1.13
	Total Selenium (Se)	mg/kg dw	0.604	0.456	0.593	0.417	0.351	0.484	0.111	0.245	0.337	0.498	0.462	0.191	0.347	0.133	0.356	0.293	0.321	0.303	0.283	0.311	0.029
	Total Sodium (Na)[a]	mg/kg dw	552	554	< 565	580	559	562	11	567	588	< 619	657	427	572	88	516	549	491	534	462	510	35
	Total Strontium (Sr)	mg/kg dw	112.5	107.1	116.9	108.0	95.4	108.0	8.1	80.7	87.1	97.8	123.5	61.4	90.1	22.9	105.9	102.0	108.5	114.0	111.2	108.3	4.6
	Total Tellurium (Te)	mg/kg dw	0.0192	0.0171	0.0206	0.0167	0.0134	0.0174	0.0028	0.0463	0.0493	0.0690	0.0742	0.0321	0.0542	0.0173	0.0156	0.0157	0.0178	0.0179	0.0177	0.0169	0.0012
	Total Thallium (Tl)	mg/kg dw	0.1753	0.1496	0.1887	0.1536	0.1255	0.1585	0.0244	0.1404	0.1511	0.1759	0.2167	0.0957	0.1559	0.0447	0.1475	0.1382	0.1484	0.1534	0.1647	0.1504	0.0097
	Total Thorium (Th)	mg/kg dw	5.83	4.61	5.96	5.22	4.93	5.31	0.58	5.42	5.48	5.91	7.30	7.58	6.34	1.03	5.16	5.13	5.06	5.43	5.78	5.31	0.30
	Total Tin (Sn)	mg/kg dw	0.494	0.378	0.486	0.429	0.351	0.428	0.063	0.290	0.333	0.365	0.396	0.187	0.314	0.081	0.372	0.346	0.362	0.374	0.331	0.357	0.018
	Total Uranium (U)	mg/kg dw	1.470	1.390	1.494	1.426	1.379	1.432	0.050	1.449	1.468	1.706	2.626	1.226	1.695	0.548	1.036	0.991	1.078	1.060	1.110	1.055	0.045
	Total Vanadium (V)	mg/kg dw	89.7	86.1	92.4	82.8	78.2	85.9	5.6	62.6	68.6	68.4	76.3	46.3	64.4	11.2	73.6	71.3	71.1	76.0	77.9	74.0	3.0
	Total Yttrium (Y)	mg/kg dw	13.76	11.94	14.18	12.77	11.54	12.84	1.14	10.41	10.61	11.30	14.42	7.20	10.79	2.58	12.77	12.63	12.50	13.31	13.55	12.95	0.45
	Total Zinc (Zn)	mg/kg dw	72.9	72.3	76.6	71.2	60.9	70.8	5.9	59.4	62.4	65.3	77.5	41.1	61.2	13.2	61.6	59.7	58.0	65.5	60.6	61.1	2.8
	Total Zirconium (Zr)	mg/kg dw	17.00	14.81	18.36	15.04	13.23	15.69	2.01	9.39	9.77	11.05	14.22	6.50	10.19	2.80	10.19	9.97	11.49	10.71	12.57	10.98	1.06

bold Indicates periphyton tissue concentration exceeding the higher reference mean by more than 2 times

[a] If value was < method detection limit, statistics were calculated using detection limit, i.e. if value was < 0.0048, statistics were run using the value 0.0048

[b] If all values at an area was < method detection limit than the average moisture was taken to calculate dry weight

Table C.3: Benthic tissue quality results at reference and exposure areas, Minto Mine WUL, 2013.

	Analyte	Units	Lowre Wolverine Creek (Reference)							Lower Big Creek (Reference)							Lower Minto Creek (Exposure)						
			LWC-1	LWC-2	LWC-3	LWC-4	LWC-5	Mean	Standard Deviation	LBC-1	LBC-2	LBC-3	LBC-4	LBC-5	Mean	Standard Deviation	LMC-1	LMC-2	LMC-3	LMC-4	LMC-5	Mean	Standard Deviation
Physical Tests	Moisture	%	71.4	60.2	81.9	56.0	54.4	64.8	11.6	82.2	85.5	84.6	67.9	68.8	77.8	8.7	86.9	73.5	81.0	76.0	78.2	71.4	5.2
Total Metals	Total Aluminum (Al)	mg/kg dw	2,934	4,497	3,094	8,250	7,412	5,237	2,462	4438	4262	3481	3769	4391	4,068	422	9,237	6,075	9,158	6,708	5,459	2,934	1,763
	Total Antimony (Sb)	mg/kg dw	0.0259	0.0397	0.0343	0.0259	0.0279	0.0307	0.0061	0.0955	0.1234	0.1240	0.0754	0.0795	0.0996	0.0233	0.0695	0.0509	0.0632	0.0717	0.0601	0.0259	0.0082
	Total Arsenic (As)	mg/kg dw	1.643	3.995	1.547	3.591	3.311	2.82	1.14	11.18	12.97	10.45	7.13	8.30	10.01	2.32	3.695	3.472	4.463	3.275	2.936	1.64	0.57
	Total Barium (Ba)	mg/kg dw	58.7	60.1	53.4	136.6	112.5	84	38	75.3	91.7	96.1	52.0	59.6	75	19	267.9	100.4	165.3	112.1	203.2	59	69
	Total Beryllium (Be)	mg/kg dw	0.1315	0.1791	0.1227	0.3250	0.3070	0.213	0.097	0.1646	0.2048	0.1766	0.1474	0.1715	0.173	0.021	0.2817	0.1592	0.2558	0.1913	0.1601	0.131	0.056
	Total Bismuth (Bi)	mg/kg dw	0.0119	0.0166	0.0155	0.0298	0.0314	0.0210	0.0089	0.1657	0.1814	0.1416	0.0885	0.1029	0.1360	0.0398	0.0595	0.0306	0.0521	0.0367	0.0298	0.0119	0.0134
	Total Boron (B)	mg/kg dw	1.12	1.18	2.04	2.20	2.19	1.75	0.55	1.57	1.66	1.62	1.25	2.02	1.62	0.28	4.05	3.06	3.53	3.29	4.63	1.12	0.63
	Total Cadmium (Cd)	mg/kg dw	0.5385	0.5729	0.2381	0.9568	0.7544	0.6121	0.2673	1.360	1.828	1.370	0.938	0.872	1.2734	0.3866	0.3878	0.2849	0.4005	0.2917	0.3491	0.5385	0.0533
	Total Calcium (Ca)	mg/kg dw	2,350	2,965	2,343	5,568	4,868	3,619	1,502	2590	3800	3097	2595	4103	3,237	692	8,092	5,358	7,842	5,458	10,321	2,350	2,070
	Total Cesium (Cs)	mg/kg dw	0.3185	0.4322	0.3243	0.7977	0.7807	0.53	0.24	1.034	1.131	0.760	0.857	0.657	0.89	0.19	0.8702	0.5698	0.8368	0.5875	0.4307	0.32	0.19
	Total Chromium (Cr)	mg/kg dw	9.48	11.93	8.29	23.18	25.44	15.7	8.0	12.81	9.66	6.95	11.43	8.49	9.9	2.3	20.92	13.47	21.16	14.58	12.80	9.5	4.1
	Total Cobalt (Co)	mg/kg dw	3.26	4.77	2.83	8.57	7.21	5.33	2.49	2.803	2.986	2.909	3.037	3.30	3.01	0.19	5.82	4.19	5.42	4.16	4.95	3.26	0.74
	Total Copper (Cu)	mg/kg dw	20.03	15.65	17.57	17.82	18.53	17.9	1.6	24.33	29.38	26.36	18.94	21.89	24.2	4.0	30.23	22.08	29.21	26.92	30.55	20.0	3.5
	Total Gallium (Ga)	mg/kg dw	1.087	1.633	0.989	2.909	2.588	1.84	0.87	1.534	1.538	1.195	1.623	1.728	1.52	0.20	3.198	2.185	3.158	2.338	1.821	1.09	0.61
	Total Iron (Fe)	mg/kg dw	6,364	9,045	5,746	16,932	15,132	10,644	5,112	7360	6731	6818	11028	9679	8,323	1,929	15,038	10,528	16,684	11,042	9,128	6,364	3,214
	Total Lead (Pb)	mg/kg dw	0.888	1.312	0.829	2.264	2.024	1.46	0.65	2.219	1.993	1.903	4.24	1.721	2.41	1.03	2.718	1.657	2.579	1.742	1.436	0.89	0.58
	Total Lithium (Li)	mg/kg dw	1.860	3.015	1.652	4.977	4.561	3.21	1.52	2.860	2.628	2.325	2.651	2.397	2.57	0.21	5.664	3.419	5.789	4.075	3.092	1.86	1.26
	Total Magnesium (Mg)	mg/kg dw	2,762	3,417	2,431	5,227	4,583	3,684	1,192	2079	2159	2273	2492	2564	2,313	209	4,405	3,132	4,368	3,154	3,064	2,762	696
	Total Manganese (Mn)	mg/kg dw	250	307	293	591	450	378	141	222.5	344.8	264.3	212.8	292.9	267	54	1,099	728	989	692	826	250	174
	Total Mercury (Hg)	mg/kg dw	0.0371	0.0309	0.0403	0.0452	0.0419	0.039	0.005	0.0449	0.0510	0.0383	0.0333	0.0362	0.041	0.007	0.0420	0.0370	0.0411	0.0279	0.0225	0.037	0.009
	Total Molybdenum (Mo)	mg/kg dw	0.320	0.397	1.497	0.375	0.421	0.602	0.502	0.904	0.841	0.929	0.651	0.542	0.773	0.169	0.749	0.743	0.932	0.742	0.734	0.320	0.085
	Total Nickel (Ni)	mg/kg dw	6.75	10.15	7.24	24.3	19.85	13.7	8.0	7.81	7.79	6.416	6.26	7.95	7.2	0.8	14.66	9.58	13.63	10.29	11.56	6.7	2.2
	Total Phosphorus (P)	mg/kg dw	7,832	5,528	6,740	4,386	4,254	5,748	1,538	3483	3517	3766	4642	5449	4,171	854	5,573	7,434	6,526	7,208	6,468	7,832	731
	Total Potassium (K)[a,b]	mg/kg dw	< 10,490	5,779	12,155	< 4,545	< 4,386	7,471	3,605	< 9,009	< 4,505	< 9,009	< 9,009	< 9,009	< 8,108	< 2,014	< 7,634	< 7,547	< 10,526	6,250	13,303	10,490	2,845
	Total Rhenium (Re)[a,b]	mg/kg dw	< 0.006	< 0.006	< 0.006	< 0.006	< 0.006	< 0.006	0	< 0.009	< 0.009	< 0.009	< 0.009	< 0.009	< 0.009	0	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.006	0
	Total Rubidium (Rb)	mg/kg dw	4.79	6.51	3.74	9.41	9.14	6.72	2.54	6.80	7.66	5.435	6.45	5.61	6.39	0.91	10.92	7.36	10.79	9.04	6.24	4.79	2.07
	Total Selenium (Se)	mg/kg dw	1.552	1.663	0.707	1.377	1.186	1.297	0.376	0.826	0.966	0.831	0.660	0.939	0.844	0.120	1.458	1.211	1.442	1.204	1.537	1.552	0.153
	Total Sodium (Na)[a,b]	mg/kg dw	< 8,518	< 5,679	< 5,679	< 5,679	< 5,679	< 6,246	< 1,270	< 9,009	< 4,505	< 9,009	< 9,009	< 9,009	< 8,108	< 2,014	< 4,789	< 9,579	< 9,579	< 4,789	< 4,789	< 8,518	< 2,623
	Total Strontium (Sr)	mg/kg dw	18.60	22.51	19.45	55.2	45.2	32.2	16.9	22.47	36.48	37.99	23.55	36.9	31.5	7.8	60.69	47.9	65.3	42.5	57.3	18.6	9.3
	Total Tellurium (Te)[a,b]	mg/kg dw	< 0.014	< 0.010	< 0.022	< 0.009	0.011	0.0133	0.0053	0.0236	0.0303	0.0266	0.0134	0.0167	0.0221	0.0070	< 0.019	< 0.019	< 0.019	< 0.019	< 0.019	< 0.014	0
	Total Thallium (Tl)	mg/kg dw	0.0200	0.0256	0.0237	0.0480	0.0436	0.0322	0.0127	0.05438	0.06538	0.04182	0.0399	0.0337	0.0470	0.0127	0.0855	0.0468	0.0763	0.0563	0.0436	0.0200	0.0184
	Total Thorium (Th)	mg/kg dw	0.720	1.078	0.547	1.793	1.693	1.17	0.56	1.174	1.262	1.656	1.287	0.869	1.25	0.28	1.969	1.260	1.942	1.217	1.133	0.72	0.41
	Total Tin (Sn)	mg/kg dw	0.080	0.080	0.110	0.136	0.127	0.107	0.026	0.118	< 0.14	< 0.13	0.078	0.080	0.109	0.028	0.168	0.113	0.179	0.158	0.110	0.080	0.032
	Total Uranium (U)	mg/kg dw	0.2287	0.2889	0.3796	0.5750	0.5746	0.409	0.160	0.4848	0.876	0.747	0.2798	0.449	0.567	0.240	0.5519	0.3343	0.5195	0.3379	0.3862	0.229	0.103
	Total Vanadium (V)	mg/kg dw	17.41	24.62	15.80	49.09	41.01	29.6	14.8	18.26	17.38	16.75	32.7	23.62	21.7	6.7	33.89	24.68	38.05	26.08	22.52	17.4	6.6
	Total Yttrium (Y)	mg/kg dw	2.077	2.739	2.575	5.364	5.154	3.58	1.55	2.843	3.759	3.448	2.343	3.093	3.10	0.55	6.160	3.728	6.263	3.883	3.670	2.08	1.35
	Total Zinc (Zn)	mg/kg dw	90.9	82.4	72.9	115.5	104.8	93.3	17.1	131.5	135.9	119.5	104.7	89.1	116.1	19.3	158.8	99.2	133.2	120.4	276.1	90.9	69.7
	Total Zirconium (Zr)	mg/kg dw	2.97	3.17	2.96	6.84	6.64	4.52	2.04	3.028	2.979	3.519	2.785	3.30	3.12	0.29	5.53	3.10	5.74	3.55	2.93	2.97	1.36

bold Indicates periphyton tissue concentration exceeding the higher reference mean by more than 2 times

[a] If value was < method detection limit, statistics were calculated using detection limit, i.e. if value was < 0.0048, statistics were run using the value 0.0048

[b] If all values at an area was < method detection limit than the average moisture was taken to calculate dry weight

MINNOW ENVIRONMENTAL INC.
ATTN: Lisa Bowron
101 - 1025 Hillside Ave.
Victoria BC V8T 2A2

Date Received: 17-SEP-13
Report Date: 25-SEP-13 14:49 (MT)
Version: FINAL

Client Phone: 250-595-1627

Certificate of Analysis

Lab Work Order #: L1364205

Project P.O. #: NOT SUBMITTED
Job Reference: MINNOW PROJECT 2498
C of C Numbers: 1 OF 2, 2 OF 2
Legal Site Desc:

Andre Langlais
Account Manager

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID Description Sampled Date Sampled Time Client ID	L1364205-1 SEDIMENT 09-SEP-13 LMC-1	L1364205-2 SEDIMENT 09-SEP-13 LMC-2	L1364205-3 SEDIMENT 09-SEP-13 LMC-3	L1364205-4 SEDIMENT 09-SEP-13 LMC-4	L1364205-5 SEDIMENT 10-SEP-13 LMC-5
Grouping	**Analyte**					
SOIL						
Physical Tests	Loss On Ignition @ 420 C (%)	11	21	4	17	19
	pH (1:2 soil:water) (pH)	7.93	7.82	7.98	7.88	7.86
Particle Size	% Gravel (>2mm) (%)	<0.10	<0.10	<0.10	<0.10	<0.10
	% Sand (2.0mm - 0.063mm) (%)	9.95	4.24	13.9	0.77	0.49
	% Silt (0.063mm - 4um) (%)	79.0	83.0	78.2	87.1	87.2
	% Clay (<4um) (%)	11.0	12.8	7.95	12.2	12.4
	Texture	Silt	Silt	Silt loam	Silt	Silt
Leachable Anions & Nutrients	Total Kjeldahl Nitrogen (%)	0.312	0.499	0.101	0.480	0.535
Organic / Inorganic Carbon	CaCO3 Equivalent (%)	1.26	1.52	1.28	1.45	1.01
	Inorganic Carbon (%)	0.15	0.18	0.15	0.17	0.12
	Inorganic Carbon (as CaCO3 Equivalent) (%)	1.26	1.52	1.28	1.45	1.01
	Total Carbon by Combustion (%)	5.5	10.7	1.9	9.0	10.1
	Total Organic Carbon (%)	5.30	10.5	1.70	8.87	9.98
Metals	Aluminum (Al) (mg/kg)	15000	14100	12400	15100	13900
	Antimony (Sb) (mg/kg)	0.62	0.76	0.53	0.72	0.68
	Arsenic (As) (mg/kg)	8.50	8.84	6.51	8.48	8.26
	Barium (Ba) (mg/kg)	309	353	239	342	328
	Beryllium (Be) (mg/kg)	0.57	0.58	0.45	0.66	0.62
	Bismuth (Bi) (mg/kg)	<0.20	<0.20	<0.20	<0.20	<0.20
	Cadmium (Cd) (mg/kg)	0.251	0.354	0.149	0.296	0.330
	Calcium (Ca) (mg/kg)	15500	17700	12200	17000	16300
	Chromium (Cr) (mg/kg)	32.9	33.8	28.8	35.6	33.6
	Cobalt (Co) (mg/kg)	11.7	12.3	10.1	12.4	11.6
	Copper (Cu) (mg/kg)	40.3	46.5	32.0	46.1	42.9
	Iron (Fe) (mg/kg)	26800	26200	22800	28200	26500
	Lead (Pb) (mg/kg)	6.53	6.90	5.81	7.05	6.79
	Lithium (Li) (mg/kg)	11.0	10.8	10.2	11.9	10.6
	Magnesium (Mg) (mg/kg)	7510	7690	7150	8330	7310
	Manganese (Mn) (mg/kg)	941	1060	477	921	761
	Mercury (Hg) (mg/kg)	0.0501	0.0732	0.103	0.0635	0.0695
	Molybdenum (Mo) (mg/kg)	0.67	0.96	0.55	0.68	0.66
	Nickel (Ni) (mg/kg)	29.1	32.3	27.1	34.0	32.0
	Phosphorus (P) (mg/kg)	804	921	830	873	895
	Potassium (K) (mg/kg)	1190	1010	940	1020	900
	Selenium (Se) (mg/kg)	0.51	0.66	0.34	0.61	0.60
	Silver (Ag) (mg/kg)	0.11	0.14	<0.10	0.14	0.13

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1364205-6	L1364205-7	L1364205-8	L1364205-9	L1364205-10
	Description	SEDIMENT	SEDIMENT	SEDIMENT	SEDIMENT	SEDIMENT
	Sampled Date	11-SEP-13	11-SEP-13	11-SEP-13	11-SEP-13	11-SEP-13
	Sampled Time					
	Client ID	LWC-1	LWC-2	LWC-3	LWC-4	LWC-5
Grouping	**Analyte**					
SOIL						
Physical Tests	Loss On Ignition @ 420 C (%)	17	15	10	16	6
	pH (1:2 soil:water) (pH)	7.04	7.07	6.97	6.82	7.10
Particle Size	% Gravel (>2mm) (%)	<0.10	<0.10	<0.10	<0.10	<0.10
	% Sand (2.0mm - 0.063mm) (%)	26.1	33.6	29.4	27.1	52.3
	% Silt (0.063mm - 4um) (%)	66.2	58.7	64.5	66.4	42.1
	% Clay (<4um) (%)	7.62	7.78	6.06	6.59	5.58
	Texture	Silt loam	Silt loam	Silt loam	Silt loam	Sandy loam
Leachable Anions & Nutrients	Total Kjeldahl Nitrogen (%)	0.449	0.384	0.298	0.374	0.156
Organic / Inorganic Carbon	CaCO3 Equivalent (%)	0.96	<0.80	0.89	<0.80	1.83
	Inorganic Carbon (%)	0.12	<0.10	0.11	<0.10	0.22
	Inorganic Carbon (as CaCO3 Equivalent) (%)	0.96	<0.80	0.88	<0.80	1.82
	Total Carbon by Combustion (%)	8.5	6.7	5.7	7.9	2.8
	Total Organic Carbon (%)	8.41	6.72	5.63	7.91	2.62
Metals	Aluminum (Al) (mg/kg)	13000	11800	12500	13200	11500
	Antimony (Sb) (mg/kg)	0.52	0.42	0.45	0.44	0.32
	Arsenic (As) (mg/kg)	7.10	5.97	6.70	6.51	4.98
	Barium (Ba) (mg/kg)	242	188	201	190	142
	Beryllium (Be) (mg/kg)	0.83	0.70	0.78	0.73	0.54
	Bismuth (Bi) (mg/kg)	<0.20	<0.20	<0.20	<0.20	<0.20
	Cadmium (Cd) (mg/kg)	0.281	0.184	0.239	0.186	0.106
	Calcium (Ca) (mg/kg)	11200	8700	10200	8930	6420
	Chromium (Cr) (mg/kg)	41.3	37.3	39.6	42.7	34.6
	Cobalt (Co) (mg/kg)	13.5	12.5	13.3	13.5	11.7
	Copper (Cu) (mg/kg)	31.3	24.3	27.2	25.5	16.8
	Iron (Fe) (mg/kg)	26400	24800	26200	26200	24000
	Lead (Pb) (mg/kg)	6.24	5.69	5.83	6.11	5.06
	Lithium (Li) (mg/kg)	9.1	8.5	9.1	9.7	9.1
	Magnesium (Mg) (mg/kg)	8790	8580	9010	9150	8460
	Manganese (Mn) (mg/kg)	634	372	560	580	402
	Mercury (Hg) (mg/kg)	0.0546	0.0402	0.0468	0.0449	0.0228
	Molybdenum (Mo) (mg/kg)	0.62	0.59	0.56	0.58	0.51
	Nickel (Ni) (mg/kg)	37.8	34.3	36.6	36.9	32.0
	Phosphorus (P) (mg/kg)	1010	961	1100	1010	981
	Potassium (K) (mg/kg)	870	770	830	840	800
	Selenium (Se) (mg/kg)	0.51	0.32	0.43	0.34	<0.20
	Silver (Ag) (mg/kg)	0.11	<0.10	<0.10	<0.10	0.15

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1364205-11	L1364205-12	L1364205-13	L1364205-14	L1364205-15
	Description	SEDIMENT	SEDIMENT	SEDIMENT	SEDIMENT	SEDIMENT
	Sampled Date	13-SEP-13	13-SEP-13	13-SEP-13	13-SEP-13	13-SEP-13
	Sampled Time					
	Client ID	UMC-1	UMC-2	UMC-3	UMC-4	UMC-5
Grouping	**Analyte**					
SOIL						
Physical Tests	Loss On Ignition @ 420 C (%)	6	9	9	14	10
	pH (1:2 soil:water) (pH)	7.82	7.86	7.76	7.49	7.88
Particle Size	% Gravel (>2mm) (%)	4.12	<0.10	<0.10	<0.10	<0.10
	% Sand (2.0mm - 0.063mm) (%)	54.5	36.6	34.3	35.4	19.2
	% Silt (0.063mm - 4um) (%)	32.4	53.2	54.1	54.8	72.1
	% Clay (<4um) (%)	9.00	10.2	11.6	9.83	8.71
	Texture	Sandy loam	Silt loam	Silt loam	Silt loam	Silt loam
Leachable Anions & Nutrients	Total Kjeldahl Nitrogen (%)	0.170	0.244	0.286	0.355	0.301
Organic / Inorganic Carbon	CaCO3 Equivalent (%)	1.04	<0.80	<0.80	0.87	0.83
	Inorganic Carbon (%)	0.12	<0.10	<0.10	0.10	<0.10
	Inorganic Carbon (as CaCO3 Equivalent) (%)	1.03	<0.80	<0.80	0.87	0.83
	Total Carbon by Combustion (%)	2.7	4.6	5.0	6.8	5.6
	Total Organic Carbon (%)	2.61	4.64	4.98	6.69	5.64
Metals	Aluminum (Al) (mg/kg)	10300	13300	13300	11900	12400
	Antimony (Sb) (mg/kg)	0.38	0.55	0.52	0.53	0.45
	Arsenic (As) (mg/kg)	5.15	6.96	6.36	6.24	5.34
	Barium (Ba) (mg/kg)	153	255	208	200	182
	Beryllium (Be) (mg/kg)	0.34	0.49	0.47	0.46	0.42
	Bismuth (Bi) (mg/kg)	<0.20	<0.20	<0.20	<0.20	<0.20
	Cadmium (Cd) (mg/kg)	0.138	0.200	0.177	0.207	0.177
	Calcium (Ca) (mg/kg)	6800	9130	8910	9390	9610
	Chromium (Cr) (mg/kg)	24.8	31.8	31.7	29.1	28.1
	Cobalt (Co) (mg/kg)	8.76	10.9	10.6	10.4	9.80
	Copper (Cu) (mg/kg)	104	67.3	90.5	99.1	59.7
	Iron (Fe) (mg/kg)	20700	24500	24100	22900	22000
	Lead (Pb) (mg/kg)	5.04	6.32	6.15	5.88	5.80
	Lithium (Li) (mg/kg)	6.7	9.1	9.2	8.3	8.5
	Magnesium (Mg) (mg/kg)	5830	7540	7430	7000	7040
	Manganese (Mn) (mg/kg)	717	646	787	612	443
	Mercury (Hg) (mg/kg)	0.0171	0.0318	0.0294	0.0340	0.0310
	Molybdenum (Mo) (mg/kg)	1.06	1.03	1.28	1.15	0.68
	Nickel (Ni) (mg/kg)	23.6	33.5	30.3	30.3	28.6
	Phosphorus (P) (mg/kg)	918	795	970	874	799
	Potassium (K) (mg/kg)	1190	1350	1420	1280	990
	Selenium (Se) (mg/kg)	0.31	0.37	0.40	0.47	0.33
	Silver (Ag) (mg/kg)	<0.10	<0.10	<0.10	<0.10	<0.10

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1364205-16	L1364205-17	L1364205-18	L1364205-19	L1364205-20
	Description	SEDIMENT	SEDIMENT	SEDIMENT	SEDIMENT	SEDIMENT
	Sampled Date	12-SEP-13	12-SEP-13	12-SEP-13	12-SEP-13	12-SEP-13
	Sampled Time					
	Client ID	URC-1	URC-2	URC-3	URC-4	URC-5
Grouping	**Analyte**					
SOIL						
Physical Tests	Loss On Ignition @ 420 C (%)	14	13	17	22	21
	pH (1:2 soil:water) (pH)	6.99	6.67	6.96	7.13	7.16
Particle Size	% Gravel (>2mm) (%)	<0.10	<0.10	<0.10	<0.10	<0.10
	% Sand (2.0mm - 0.063mm) (%)	10.1	11.3	5.06	7.75	6.49
	% Silt (0.063mm - 4um) (%)	81.4	79.5	86.1	81.3	85.5
	% Clay (<4um) (%)	8.49	9.21	8.85	11.0	7.99
	Texture	Silt	Silt	Silt	Silt	Silt
Leachable Anions & Nutrients	Total Kjeldahl Nitrogen (%)	0.401	0.376	0.447	0.541	0.557
Organic / Inorganic Carbon	CaCO3 Equivalent (%)	1.09	<0.80	1.25	0.88	1.26
	Inorganic Carbon (%)	0.13	<0.10	0.15	0.11	0.15
	Inorganic Carbon (as CaCO3 Equivalent) (%)	1.09	<0.80	1.25	0.88	1.25
	Total Carbon by Combustion (%)	7.5	7.1	9.0	11.4	11.6
	Total Organic Carbon (%)	7.39	7.12	8.84	11.3	11.4
Metals	Aluminum (Al) (mg/kg)	12500	14900	15500	15000	15100
	Antimony (Sb) (mg/kg)	0.48	0.49	0.54	0.53	0.57
	Arsenic (As) (mg/kg)	5.98	6.18	8.48	8.68	8.01
	Barium (Ba) (mg/kg)	258	283	326	321	331
	Beryllium (Be) (mg/kg)	0.38	0.41	0.48	0.48	0.48
	Bismuth (Bi) (mg/kg)	<0.20	<0.20	<0.20	<0.20	<0.20
	Cadmium (Cd) (mg/kg)	0.182	0.169	0.218	0.198	0.258
	Calcium (Ca) (mg/kg)	8720	8900	11000	11100	12800
	Chromium (Cr) (mg/kg)	25.4	29.1	30.8	30.1	31.7
	Cobalt (Co) (mg/kg)	10.1	10.7	12.3	13.0	12.6
	Copper (Cu) (mg/kg)	24.4	26.7	30.3	28.6	33.9
	Iron (Fe) (mg/kg)	21800	24700	28100	28100	27200
	Lead (Pb) (mg/kg)	4.91	5.59	6.08	5.72	6.05
	Lithium (Li) (mg/kg)	7.6	8.9	9.2	8.9	8.5
	Magnesium (Mg) (mg/kg)	4440	5060	5360	5180	5390
	Manganese (Mn) (mg/kg)	895	705	1130	1440	1260
	Mercury (Hg) (mg/kg)	0.0996	0.0560	0.0630	0.0587	0.0695
	Molybdenum (Mo) (mg/kg)	<0.50	<0.50	0.72	0.65	1.01
	Nickel (Ni) (mg/kg)	18.3	20.3	21.7	22.0	22.8
	Phosphorus (P) (mg/kg)	717	929	960	960	973
	Potassium (K) (mg/kg)	640	740	860	820	850
	Selenium (Se) (mg/kg)	0.42	0.42	0.60	0.63	0.71
	Silver (Ag) (mg/kg)	<0.10	<0.10	0.11	0.10	0.12

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1364205-21	L1364205-22			
	Description	SEDIMENT	SEDIMENT			
	Sampled Date	13-SEP-13	12-SEP-13			
	Sampled Time					
	Client ID	UMC	URC			
Grouping	**Analyte**					
SOIL						
Physical Tests	Loss On Ignition @ 420 C (%)					
	pH (1:2 soil:water) (pH)					
Particle Size	% Gravel (>2mm) (%)	0.17	<0.10			
	% Sand (2.0mm - 0.063mm) (%)	39.2	11.3			
	% Silt (0.063mm - 4um) (%)	50.7	79.4			
	% Clay (<4um) (%)	9.97	9.31			
	Texture	Loam	Silt			
Leachable Anions & Nutrients	Total Kjeldahl Nitrogen (%)					
Organic / Inorganic Carbon	CaCO3 Equivalent (%)					
	Inorganic Carbon (%)					
	Inorganic Carbon (as CaCO3 Equivalent) (%)					
	Total Carbon by Combustion (%)					
	Total Organic Carbon (%)					
Metals	Aluminum (Al) (mg/kg)					
	Antimony (Sb) (mg/kg)					
	Arsenic (As) (mg/kg)					
	Barium (Ba) (mg/kg)					
	Beryllium (Be) (mg/kg)					
	Bismuth (Bi) (mg/kg)					
	Cadmium (Cd) (mg/kg)					
	Calcium (Ca) (mg/kg)					
	Chromium (Cr) (mg/kg)					
	Cobalt (Co) (mg/kg)					
	Copper (Cu) (mg/kg)					
	Iron (Fe) (mg/kg)					
	Lead (Pb) (mg/kg)					
	Lithium (Li) (mg/kg)					
	Magnesium (Mg) (mg/kg)					
	Manganese (Mn) (mg/kg)					
	Mercury (Hg) (mg/kg)					
	Molybdenum (Mo) (mg/kg)					
	Nickel (Ni) (mg/kg)					
	Phosphorus (P) (mg/kg)					
	Potassium (K) (mg/kg)					
	Selenium (Se) (mg/kg)					
	Silver (Ag) (mg/kg)					

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1364205-1	L1364205-2	L1364205-3	L1364205-4	L1364205-5
	Description	SEDIMENT	SEDIMENT	SEDIMENT	SEDIMENT	SEDIMENT
	Sampled Date	09-SEP-13	09-SEP-13	09-SEP-13	09-SEP-13	10-SEP-13
	Sampled Time					
	Client ID	LMC-1	LMC-2	LMC-3	LMC-4	LMC-5
Grouping	**Analyte**					
SOIL						
Metals	Sodium (Na) (mg/kg)	300	250	240	240	220
	Strontium (Sr) (mg/kg)	132	153	92.3	147	142
	Thallium (Tl) (mg/kg)	0.098	0.088	0.082	0.101	0.093
	Tin (Sn) (mg/kg)	<2.0	<2.0	<2.0	<2.0	<2.0
	Titanium (Ti) (mg/kg)	746	591	564	593	481
	Uranium (U) (mg/kg)	1.30	1.59	0.937	1.50	1.42
	Vanadium (V) (mg/kg)	59.3	58.3	48.3	57.8	54.9
	Zinc (Zn) (mg/kg)	60.0	63.4	57.1	66.9	63.1

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1364205-6	L1364205-7	L1364205-8	L1364205-9	L1364205-10
	Description	SEDIMENT	SEDIMENT	SEDIMENT	SEDIMENT	SEDIMENT
	Sampled Date	11-SEP-13	11-SEP-13	11-SEP-13	11-SEP-13	11-SEP-13
	Sampled Time					
	Client ID	LWC-1	LWC-2	LWC-3	LWC-4	LWC-5
Grouping	**Analyte**					
SOIL						
Metals	Sodium (Na) (mg/kg)	350	320	340	370	340
	Strontium (Sr) (mg/kg)	105	85.5	101	89.2	66.6
	Thallium (Tl) (mg/kg)	0.085	0.061	0.068	0.068	0.052
	Tin (Sn) (mg/kg)	<2.0	<2.0	<2.0	<2.0	<2.0
	Titanium (Ti) (mg/kg)	745	708	728	776	746
	Uranium (U) (mg/kg)	3.30	2.23	2.80	2.28	1.14
	Vanadium (V) (mg/kg)	67.0	62.4	64.4	64.9	57.8
	Zinc (Zn) (mg/kg)	57.1	53.7	57.5	59.9	54.5

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1364205-11	L1364205-12	L1364205-13	L1364205-14	L1364205-15
	Description	SEDIMENT	SEDIMENT	SEDIMENT	SEDIMENT	SEDIMENT
	Sampled Date	13-SEP-13	13-SEP-13	13-SEP-13	13-SEP-13	13-SEP-13
	Sampled Time					
	Client ID	UMC-1	UMC-2	UMC-3	UMC-4	UMC-5
Grouping	**Analyte**					
SOIL						
Metals	Sodium (Na) (mg/kg)	300	360	350	330	320
	Strontium (Sr) (mg/kg)	70.8	106	104	91.2	105
	Thallium (Tl) (mg/kg)	0.072	0.106	0.096	0.092	0.085
	Tin (Sn) (mg/kg)	<2.0	<2.0	<2.0	<2.0	<2.0
	Titanium (Ti) (mg/kg)	657	747	746	692	636
	Uranium (U) (mg/kg)	0.719	0.968	1.08	1.34	0.813
	Vanadium (V) (mg/kg)	47.9	55.0	55.1	52.6	46.0
	Zinc (Zn) (mg/kg)	51.0	59.7	61.9	58.6	55.7

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1364205-16	L1364205-17	L1364205-18	L1364205-19	L1364205-20
	Description	SEDIMENT	SEDIMENT	SEDIMENT	SEDIMENT	SEDIMENT
	Sampled Date	12-SEP-13	12-SEP-13	12-SEP-13	12-SEP-13	12-SEP-13
	Sampled Time					
	Client ID	URC-1	URC-2	URC-3	URC-4	URC-5
Grouping	**Analyte**					
SOIL						
Metals	Sodium (Na) (mg/kg)	190	220	260	230	250
	Strontium (Sr) (mg/kg)	69.3	70.1	91.9	90.3	106
	Thallium (Tl) (mg/kg)	0.058	0.082	0.089	0.094	0.086
	Tin (Sn) (mg/kg)	<2.0	<2.0	<2.0	<2.0	<2.0
	Titanium (Ti) (mg/kg)	618	769	832	783	783
	Uranium (U) (mg/kg)	1.27	1.24	1.57	1.75	1.83
	Vanadium (V) (mg/kg)	46.8	53.2	57.9	57.1	59.8
	Zinc (Zn) (mg/kg)	45.7	52.7	55.8	53.2	54.8

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1364205-21	L1364205-22				
	Description	SEDIMENT	SEDIMENT				
	Sampled Date	13-SEP-13	12-SEP-13				
	Sampled Time						
	Client ID	UMC	URC				
Grouping	**Analyte**						
SOIL							
Metals	Sodium (Na) (mg/kg)						
	Strontium (Sr) (mg/kg)						
	Thallium (Tl) (mg/kg)						
	Tin (Sn) (mg/kg)						
	Titanium (Ti) (mg/kg)						
	Uranium (U) (mg/kg)						
	Vanadium (V) (mg/kg)						
	Zinc (Zn) (mg/kg)						

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

Reference Information

QC Samples with Qualifiers & Comments:

QC Type Description	Parameter	Qualifier	Applies to Sample Number(s)
Duplicate	Copper (Cu)	DUP-H	L1364205-1, -11, -12, -13, -14, -15, -16, -17, -18, -19, -20

Qualifiers for Individual Parameters Listed:

Qualifier	Description
DUP-H	Duplicate results outside ALS DQO, due to sample heterogeneity.

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
C-INORG-ORG-SK	Soil	Inorganic and Organic Carbon	SSSA (1996) P455-456

When carbonates are decomposed with acid in an open system, carbon dioxide is released to the atmosphere. The decrease in sample weight resulting from CO_2 loss is proportional to the carbonate content of the soil.

Reference:
Loeppert, R.H. and Suarez, D.L. 1996. Gravimetric Method for Loss of Carbon Dioxide. P. 455-456 In: J.M. Bartels et al. (ed.) Methods of soil analysis: Part 3 Chemical methods. (3rd ed.) ASA and SSSA, Madison, WI. Book series no. 5

C-INORG-SK	Soil	Inorganic Carbon / Calcium Carbonate	SSSA (1996) P455-456

When carbonates are decomposed with acid in an open system, carbon dioxide is released to the atmosphere. The decrease in sample weight resulting from CO_2 loss is proportional to the carbonate content of the soil.

Reference:
Loeppert, R.H. and Suarez, D.L. 1996. Gravimetric Method for Loss of Carbon Dioxide. P. 455-456 In: J.M. Bartels et al. (ed.) Methods of soil analysis: Part 3 Chemical methods. (3rd ed.) ASA and SSSA, Madison, WI. Book series no. 5

C-TOT-LECO-SK	Soil	Total Carbon by combustion method	SSSA (1996) P. 973-974

The sample is ignited in a combustion analyzer where carbon in the reduced CO_2 gas is determined using a thermal conductivity detector.

HG-200.2-CVAF-VA	Soil	Mercury in Soil by CVAFS	EPA 200.2/245.7

This analysis is carried out using procedures from CSR Analytical Method: "Strong Acid Leachable Metals (SALM) in Soil", BC Ministry of Environment, 26 June 2009, and procedures adapted from EPA Method 200.2. The sample is manually homogenized, dried at 60 degrees Celsius, sieved through a 2 mm (10 mesh) sieve (this sieve step is omitted for international soil samples), and a representative subsample of the dry material is weighed. The sample is then digested at 95 degrees Celsius for 2 hours by block digester using concentrated nitric and hydrochloric acids. Instrumental analysis is by atomic fluorescence spectrophotometry or atomic absorption spectrophotometry(EPA Method 245.7).

Method Limitation: This method is not a total digestion technique. It is a very strong acid digestion that is intended to dissolve those metals that may be environmentally available. By design, elements bound in silicate structures are not normally dissolved by this procedure as they are not usually mobile in the environment.

IC-CACO3-CALC-SK	Soil	Inorganic Carbon as $CaCO_3$ Equivalent	Calculation
LOI-420-SK	Soil	Loss on Ignition @ 420 C	CSSS (1978) METHOD 3.81

The dry-ash method involves the removal of organic matter by combustion at 420OC for 2 hours. Samples are dried prior to combustion.

Reference: McKeague, J.A. Soil Sampling and Methods of Analysis. Can. Soc. Soil Sci.(1978) method 3.81

MET-200.2-CCMS-VA	Soil	Metals in Soil by CRC ICPMS	EPA 200.2/6020A

This analysis is carried out using procedures from CSR Analytical Method: "Strong Acid Leachable Metals (SALM) in Soil", BC Ministry of Environment, 26 June 2009, and procedures adapted from EPA Method 200.2. The sample is manually homogenized, dried at 60 degrees Celsius, sieved through a 2 mm (10 mesh) sieve (this sieve step is omitted for international soil samples), and a representative subsample of the dry material is weighed. The sample is then digested at 95 degrees Celsius for 2 hours by block digester using concentrated nitric and hydrochloric acids. Instrumental analysis of the digested extract is by collision cell inductively coupled plasma - mass spectrometry (modifed from EPA Method 6020A).

Method Limitation: This method is not a total digestion technique. It is a very strong acid digestion that is intended to dissolve those metals that may be environmentally available. By design, elements bound in silicate structures are not normally dissolved by this procedure as they are not usually mobile in the environment.

N-TOTKJ-COL-SK	Soil	Total Kjeldahl Nitrogen	CSSS (1993) 22.2.3

The soil is digested with sulfuric acid in the presence of $CuSO_4$ and K_2SO_4 catalysts. Ammonia in the soil extract is determined colrimetrically at 660 nm.

PH-1:2-VA	Soil	pH in Soil (1:2 Soil:Water Extraction)	BC WLAP METHOD: PH, ELECTROMETRIC, SOIL

Reference Information

This analysis is carried out in accordance with procedures described in the pH, Electrometric in Soil and Sediment method - Section B Physical/Inorganic and Misc. Constituents, BC Environmental Laboratory Manual 2007. The procedure involves mixing the dried (at <60C) and sieved (No. 10 / 2mm) sample with deionized/distilled water at a 1:2 ratio of sediment to water. The pH of the solution is then measured using a standard pH probe.

PSA-PIPET+GRAVEL-SK Soil Particle size - Sieve and Pipette SSIR-51 METHOD 3.2.1

Particle size distribution is determined by a combination of techniques. Dry sieving is performed for coarse particles, wet sieving for sand particles and the pipette sedimentation method for clay particles.

Reference:

Burt, R. (2009). Soil Survey Field and Laboratory Methods Manual. Soil Survey Investigations Report No. 5. Method 3.2.1.2.2. United States Department of Agriculture Natural Resources Conservation Service.

** ALS test methods may incorporate modifications from specified reference methods to improve performance.

The last two letters of the above test code(s) indicate the laboratory that performed analytical analysis for that test. Refer to the list below:

Laboratory Definition Code	Laboratory Location
SK	ALS ENVIRONMENTAL - SASKATOON, SASKATCHEWAN, CANADA
VA	ALS ENVIRONMENTAL - VANCOUVER, BRITISH COLUMBIA, CANADA

Chain of Custody Numbers:

1 OF 2 2 OF 2

GLOSSARY OF REPORT TERMS

Surrogate - A compound that is similar in behaviour to target analyte(s), but that does not occur naturally in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery.
mg/kg - milligrams per kilogram based on dry weight of sample.
mg/kg wwt - milligrams per kilogram based on wet weight of sample.
mg/kg lwt - milligrams per kilogram based on lipid-adjusted weight of sample.
mg/L - milligrams per litre.
< - Less than.
D.L. - The reported Detection Limit, also known as the Limit of Reporting (LOR).
N/A - Result not available. Refer to qualifier code and definition for explanation.

Test results reported relate only to the samples as received by the laboratory.
UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.
Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.

ALS Environmental

L1364205-COFC

Chain of Custody / Analytical Request Form
Canada Toll Free: 1 800 668 9878
www.alsglobal.com

COC #

Page 1 of 2

Report To	
Company:	Minnow Environmental Inc.
Contact:	Lisa Bowron
Address:	101 - 1025 Hillside Ave. Victoria, BC
Phone:	(250) 595-1627 Fax: (250) 595-1625
Invoice To	Same as Report ? ☑ Yes ☐ No
Hardcopy of Invoice with Report?	☑ Yes ☐ No
Company:	
Contact:	
Address:	
Phone:	Fax:
Lab Work Order # (lab use only)	

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Client / Project Information	
Job #:	Minnow Project 2464
PO / AFE:	
LSD:	
Quote #:	
ALS Contact:	Victoria Jung
Sampler:	Pierre Stecko

Service Requested (Rush for routine analysis subject to availability)

- ◉ Regular (Standard Turnaround Times - Business Days)
- ○ Priority (2-4 Business Days) - 50% Surcharge - Contact ALS to Confirm TAT
- ○ Emergency (1-2 Bus. Days) - 100% Surcharge - Contact ALS to Confirm TAT
- ○ Same Day or Weekend Emergency - Contact ALS to Confirm TAT

Analysis Request

Please indicate below Filtered, Preserved or both (F, P, F/P)

Sample #	Sample Identification (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	Rescan Low Level Sediments	Inorganic Carbon	Total Carbon by combustion	Mercury by CVAFS	Loss on Ignition	pH in soil	Particle Size	Total Organic Carbon		**See Complete Quote #			Number of Containers
1	LMC-1	9-Sept-11		Sediment	X	X	X	X	X	X	X	X					2
2	LMC-2	9-Sept-11		Sediment	X	X	X	X	X	X	X	X					2
3	LMC-3	9-Sept-11		Sediment	X	X	X	X	X	X	X	X					2
4	LMC-4	9-Sept-11		Sediment	X	X	X	X	X	X	X	X					2
5	LMC-5	10-Sept-11		Sediment	X	X	X	X	X	X	X	X					2
6	LWC-1	11-Sept-13		Sediment	X	X	X	X	X	X	X	X					2
7	LWC-2	11-Sept-13		Sediment	X	X	X	X	X	X	X	X					2
8	LWC-3	11-Sept-13		Sediment	X	X	X	X	X	X	X	X					2
9	LWC-4	11-Sept-13		Sediment	X	X	X	X	X	X	X	X					2
10	LWC-5	11-Sept-13		Sediment	X	X	X	X	X	X	X	X					2
11	UMC-1	13-Sept-13		Sediment	X	X	X	X	X	X	X	X					1
12	UMC-2	13-Sept-13		Sediment	X	X	X	X	X	X	X	X					1

Special Instructions / Regulations with water or land use (CCME-Freshwater Aquatic Life/BC CSR - Commercial/AB Tier 1 - Natural, etc) / Hazardous Details

Small samples. The critical analyte of interest is selenium; please ensure best possible MDLs.

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY.
By the use of this form the user acknowledges and agrees with the Terms and Conditions as provided on a separate Excel tab.
Also provided on another Excel tab are the ALS location addresses, phone numbers and sample container / preservation / holding time table for common analyses.

SHIPMENT RELEASE (client use)			SHIPMENT RECEPTION (lab use only)				SHIPMENT VERIFICATION (lab use only)			
Released by:	Date (dd-mmm-yy)	Time (hh-mm)	Received by:	Date:	Time:	Temperature:	Verified by:	Date:	Time:	Observations: Yes / No ? If Yes add SIF
Lisa Bowron	14-Sept-13	11:37		14-Sept-13	1:30	3.8, 5.2 °C				

Paige Sept 17 14:30 3°C

GENF 20.00 Front

L1364205-COFC

Chain of Custody / Analytical Request Form
Canada Toll Free: 1 800 668 9878
www.alsglobal.com

COC #

Report To	
Company:	Minnow Environmental Inc.
Contact:	Lisa Bowron
Address:	101 - 1025 Hillside Ave.
	Victoria, BC
Phone:	(250) 595-1627 Fax: (250) 595-1625
Invoice To	Same as Report ? ☑ Yes ☐ No
Hardcopy of Invoice with Report?	☑ Yes ☐ No
Company:	
Contact:	
Address:	
Phone:	Fax:
Lab Work Order # (lab use only)	

Report Format / Distribution	
☑ Standard ☐ Other	
☑ PDF ☑ Excel ☐ Digital ☐ Fax	
Email 1:	lbowron@minnow-environmental.com
Email 2:	pstecko@minnow-environmental.com
Email 3:	
Client / Project Information	
Job #:	Minnow Project 2464
PO / AFE:	
LSD:	
Quote #:	
ALS Contact:	Victoria Jung
Sampler:	Pierre Stecko

Service Requested (Rush for routine analysis subject to availability)
- (●) Regular (Standard Turnaround Times - Business Days)
- ( ) Priority (2-4 Business Days) - 50% Surcharge - Contact ALS to Confirm TAT
- ( ) Emergency (1-2 Bus. Days) - 100% Surcharge - Contact ALS to Confirm TAT
- ( ) Same Day or Weekend Emergency - Contact ALS to Confirm TAT

Analysis Request
Please indicate below Filtered, Preserved or both (F, P, F/P)

Sample #	Sample Identification (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	Rescan Low Level Sediments	Inorganic Carbon	Total Carbon by combustion	Mercury by CVAFS	Loss on Ignition	pH in soil	Particle Size	Total Organic Carbon		**See Complete Quote #			Number of Containers
13	UMC-3	13-Sept-13		Sediment	X	X	X	X	X	X	X	X					1
14	UMC-4	13-Sept-13		Sediment	X	X	X	X	X	X	X	X					1
15	UMC-5	13-Sept-13		Sediment	X	X	X	X	X	X	X	X					1
16	URC-1	12-Sept-13		Sediment	X	X	X	X	X	X	X	X					1
17	URC-2	12-Sept-13		Sediment	X	X	X	X	X	X	X	X					1
18	URC-3	12-Sept-13		Sediment	X	X	X	X	X	X	X	X					1
19	URC-4	12-Sept-13		Sediment	X	X	X	X	X	X	X	X					1
20	URC-5	12-Sept-13		Sediment	X	X	X	X	X	X	X	X					1
21	UMC	13-Sept-13		Sediment							X						1
22	URC	12-Sept-13		Sediment							X						1

Special Instructions / Regulations with water or land use (CCME-Freshwater Aquatic Life/BC CSR - Commercial/AB Tier 1 - Natural, etc) / Hazardous Details

Small samples. The critical analyte of interest is selenium; please ensure best possible MDLs.

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY.
By the use of this form the user acknowledges and agrees with the Terms and Conditions as provided on a separate Excel tab.
Also provided on another Excel tab are the ALS location addresses, phone numbers and sample container / preservation / holding time table for common analyses.

SHIPMENT RELEASE (client use)			SHIPMENT RECEPTION (lab use only)				SHIPMENT VERIFICATION (lab use only)			
Released by: Lisa Bowron	Date (dd-mmm-yy) 14-Sept-13	Time (hh-mm) 11-37	Received by:	Date: 14-Sept-13	Time: 1:30	Temperature: 3.8, 5.2 °C	Verified by:	Date:	Time:	Observations: Yes / No ? If Yes add SIF

MINNOW ENVIRONMENTAL INC.
ATTN: Lisa Bowron
101 - 1025 Hillside Ave.
Victoria BC V8T 2A2

Date Received: 17-SEP-13
Report Date: 01-NOV-13 15:04 (MT)
Version: FINAL

Client Phone: 250-595-1627

Certificate of Analysis

Lab Work Order #: L1364174

Project P.O. #: NOT SUBMITTED
Job Reference: MINNOW PROJECT 2498
C of C Numbers: 1 of 2, 2 of 2
Legal Site Desc:

Andre Langlais
Account Manager

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1364174-1	L1364174-2	L1364174-3	L1364174-4	L1364174-5
	Description	TISSUE	TISSUE	TISSUE	TISSUE	TISSUE
	Sampled Date	13-SEP-13	13-SEP-13	13-SEP-13	10-SEP-13	10-SEP-13
	Sampled Time					
	Client ID	LMC-1	LMC-2	LMC-3	LMC-4	LMC-5
Grouping	**Analyte**					
TISSUE						
Physical Tests	% Moisture (%)	86.9	73.5	81.0	76.0	78.2
Metals	Aluminum (Al)-Total (mg/kg wwt)	1210	1610	1740	1610	1190
	Antimony (Sb)-Total (mg/kg wwt)	0.0091	0.0135	0.0120	0.0172	0.0131
	Arsenic (As)-Total (mg/kg wwt)	0.484	0.920	0.848	0.786	0.640
	Barium (Ba)-Total (mg/kg wwt)	35.1	26.6	31.4	26.9	44.3
	Beryllium (Be)-Total (mg/kg wwt)	0.0369	0.0422	0.0486	0.0459	0.0349
	Bismuth (Bi)-Total (mg/kg wwt)	0.0078	0.0081	0.0099	0.0088	0.0065
	Boron (B)-Total (mg/kg wwt)	0.53	0.81	0.67	0.79	1.01
	Cadmium (Cd)-Total (mg/kg wwt)	0.0508	0.0755	0.0761	0.0700	0.0761
	Calcium (Ca)-Total (mg/kg wwt)	1060	1420	1490	1310	2250
	Cesium (Cs)-Total (mg/kg wwt)	0.114	0.151	0.159	0.141	0.0939
	Chromium (Cr)-Total (mg/kg wwt)	2.74	3.57	4.02	3.50	2.79
	Cobalt (Co)-Total (mg/kg wwt)	0.763	1.11	1.03	0.998	1.08
	Copper (Cu)-Total (mg/kg wwt)	3.96	5.85	5.55	6.46	6.66
	Gallium (Ga)-Total (mg/kg wwt)	0.419	0.579	0.600	0.561	0.397
	Iron (Fe)-Total (mg/kg wwt)	1970	2790	3170	2650	1990
	Lead (Pb)-Total (mg/kg wwt)	0.356	0.439	0.490	0.418	0.313
	Lithium (Li)-Total (mg/kg wwt)	0.742	0.906	1.10	0.978	0.674
	Magnesium (Mg)-Total (mg/kg wwt)	577	830	830	757	668
	Manganese (Mn)-Total (mg/kg wwt)	144	193	188	166	180
	Mercury (Hg)-Total (mg/kg wwt)	0.0055	0.0098	0.0078	0.0067	0.0049
	Molybdenum (Mo)-Total (mg/kg wwt)	0.0981	0.197	0.177	0.178	0.160
	Nickel (Ni)-Total (mg/kg wwt)	1.92	2.54	2.59	2.47	2.52
	Phosphorus (P)-Total (mg/kg wwt)	730	1970	1240	1730	1410
	Potassium (K)-Total (mg/kg wwt)	<1000 DLIV	<2000 DLIV	<2000 DLIV	1500	2900
	Rhenium (Re)-Total (mg/kg wwt)	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
	Rubidium (Rb)-Total (mg/kg wwt)	1.43	1.95	2.05	2.17	1.36
	Selenium (Se)-Total (mg/kg wwt)	0.191	0.321	0.274	0.289	0.335
	Sodium (Na)-Total (mg/kg wwt)	<1000 DLIV	<2000 DLIV	<2000 DLIV	<1000 DLIV	<1000 DLIV
	Strontium (Sr)-Total (mg/kg wwt)	7.95	12.7	12.4	10.2	12.5
	Tellurium (Te)-Total (mg/kg wwt)	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040
	Thallium (Tl)-Total (mg/kg wwt)	0.0112	0.0124	0.0145	0.0135	0.00950
	Thorium (Th)-Total (mg/kg wwt)	0.258	0.334	0.369	0.292	0.247
	Tin (Sn)-Total (mg/kg wwt)	0.022	0.030	0.034	0.038	0.024
	Uranium (U)-Total (mg/kg wwt)	0.0723	0.0886	0.0987	0.0811	0.0842
	Vanadium (V)-Total (mg/kg wwt)	4.44	6.54	7.23	6.26	4.91
	Yttrium (Y)-Total (mg/kg wwt)	0.807	0.988	1.19	0.932	0.800

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID Description Sampled Date Sampled Time Client ID	L1364174-6 TISSUE 12-SEP-13 LWC-1	L1364174-7 TISSUE 12-SEP-13 LWC-2	L1364174-8 TISSUE 12-SEP-13 LWC-3	L1364174-9 TISSUE 12-SEP-13 LWC-4	L1364174-10 TISSUE 12-SEP-13 LWC-5
Grouping	**Analyte**					
TISSUE						
Physical Tests	% Moisture (%)	71.4	60.2	81.9	56.0	54.4
Metals	Aluminum (Al)-Total (mg/kg wwt)	839	1790	560	3630	3380
	Antimony (Sb)-Total (mg/kg wwt)	0.0074	0.0158	0.0062	0.0114	0.0127
	Arsenic (As)-Total (mg/kg wwt)	0.470	1.59	0.280	1.58	1.51
	Barium (Ba)-Total (mg/kg wwt)	16.8	23.9	9.66	60.1	51.3
	Beryllium (Be)-Total (mg/kg wwt)	0.0376	0.0713	0.0222	0.143	0.140
	Bismuth (Bi)-Total (mg/kg wwt)	0.0034	0.0066	0.0028	0.0131	0.0143
	Boron (B)-Total (mg/kg wwt)	0.32	0.47	0.37	0.97	1.00
	Cadmium (Cd)-Total (mg/kg wwt)	0.154	0.228	0.0431	0.421	0.344
	Calcium (Ca)-Total (mg/kg wwt)	672	1180	424	2450	2220
	Cesium (Cs)-Total (mg/kg wwt)	0.0911	0.172	0.0587	0.351	0.356
	Chromium (Cr)-Total (mg/kg wwt)	2.71	4.75	1.50	10.2	11.6
	Cobalt (Co)-Total (mg/kg wwt)	0.933	1.90	0.513	3.77	3.29
	Copper (Cu)-Total (mg/kg wwt)	5.73	6.23	3.18	7.84	8.45
	Gallium (Ga)-Total (mg/kg wwt)	0.311	0.650	0.179	1.28	1.18
	Iron (Fe)-Total (mg/kg wwt)	1820	3600	1040	7450	6900
	Lead (Pb)-Total (mg/kg wwt)	0.254	0.522	0.150	0.996	0.923
	Lithium (Li)-Total (mg/kg wwt)	0.532	1.20	0.299	2.19	2.08
	Magnesium (Mg)-Total (mg/kg wwt)	790	1360	440	2300	2090
	Manganese (Mn)-Total (mg/kg wwt)	71.6	122	53.0	260	205
	Mercury (Hg)-Total (mg/kg wwt)	0.0106	0.0123	0.0073	0.0199	0.0191
	Molybdenum (Mo)-Total (mg/kg wwt)	0.0916	0.158	0.271	0.165	0.192
	Nickel (Ni)-Total (mg/kg wwt)	1.93	4.04	1.31	10.7	9.05
	Phosphorus (P)-Total (mg/kg wwt)	2240	2200	1220	1930	1940
	Potassium (K)-Total (mg/kg wwt)	<3000 DLIV	2300	2200	<2000 DLIV	<2000 DLIV
	Rhenium (Re)-Total (mg/kg wwt)	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
	Rubidium (Rb)-Total (mg/kg wwt)	1.37	2.59	0.677	4.14	4.17
	Selenium (Se)-Total (mg/kg wwt)	0.444	0.662	0.128	0.606	0.541
	Sodium (Na)-Total (mg/kg wwt)	<3000 DLIV	<2000 DLIV	<2000 DLIV	<2000 DLIV	<2000 DLIV
	Strontium (Sr)-Total (mg/kg wwt)	5.32	8.96	3.52	24.3	20.6
	Tellurium (Te)-Total (mg/kg wwt)	<0.0040	<0.0040	<0.0040	<0.0040	0.0051
	Thallium (Tl)-Total (mg/kg wwt)	0.00572	0.0102	0.00429	0.0211	0.0199
	Thorium (Th)-Total (mg/kg wwt)	0.206	0.429	0.0990	0.789	0.772
	Tin (Sn)-Total (mg/kg wwt)	0.023	0.032	<0.020	0.060	0.058
	Uranium (U)-Total (mg/kg wwt)	0.0654	0.115	0.0687	0.253	0.262
	Vanadium (V)-Total (mg/kg wwt)	4.98	9.80	2.86	21.6	18.7
	Yttrium (Y)-Total (mg/kg wwt)	0.594	1.09	0.466	2.36	2.35

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1364174-11	L1364174-12	L1364174-13	L1364174-14	L1364174-15
	Description	TISSUE	TISSUE	TISSUE	TISSUE	TISSUE
	Sampled Date	13-SEP-13	13-SEP-13	13-SEP-13	13-SEP-13	13-SEP-13
	Sampled Time					
	Client ID	LBC-1	LBC-2	LBC-3	LBC-4	LBC-5
Grouping	**Analyte**					
TISSUE						
Physical Tests	% Moisture (%)	82.2	85.5	84.6	67.9	68.8
Metals	Aluminum (Al)-Total (mg/kg wwt)	790	618	536	1210	1370
	Antimony (Sb)-Total (mg/kg wwt)	0.0170	0.0179	0.0191	0.0242	0.0248
	Arsenic (As)-Total (mg/kg wwt)	1.99	1.88	1.61	2.29	2.59
	Barium (Ba)-Total (mg/kg wwt)	13.4	13.3	14.8	16.7	18.6
	Beryllium (Be)-Total (mg/kg wwt)	0.0293	0.0297	0.0272	0.0473	0.0535
	Bismuth (Bi)-Total (mg/kg wwt)	0.0295	0.0263	0.0218	0.0284	0.0321
	Boron (B)-Total (mg/kg wwt)	0.28	0.24	0.25	0.40	0.63
	Cadmium (Cd)-Total (mg/kg wwt)	0.242	0.265	0.211	0.301	0.272
	Calcium (Ca)-Total (mg/kg wwt)	461	551	477	833	1280
	Cesium (Cs)-Total (mg/kg wwt)	0.184	0.164	0.117	0.275	0.205
	Chromium (Cr)-Total (mg/kg wwt)	2.28	1.40	1.07	3.67	2.65
	Cobalt (Co)-Total (mg/kg wwt)	0.499	0.433	0.448	0.975	1.03
	Copper (Cu)-Total (mg/kg wwt)	4.33	4.26	4.06	6.08	6.83
	Gallium (Ga)-Total (mg/kg wwt)	0.273	0.223	0.184	0.521	0.539
	Iron (Fe)-Total (mg/kg wwt)	1310	976	1050	3540	3020
	Lead (Pb)-Total (mg/kg wwt)	0.395	0.289	0.293	1.36	0.537
	Lithium (Li)-Total (mg/kg wwt)	0.509	0.381	0.358	0.851	0.748
	Magnesium (Mg)-Total (mg/kg wwt)	370	313	350	800	800
	Manganese (Mn)-Total (mg/kg wwt)	39.6	50.0	40.7	68.3	91.4
	Mercury (Hg)-Total (mg/kg wwt)	0.0080	0.0074	0.0059	0.0107	0.0113
	Molybdenum (Mo)-Total (mg/kg wwt)	0.161	0.122	0.143	0.209	0.169
	Nickel (Ni)-Total (mg/kg wwt)	1.39	1.13	0.988	2.01	2.48
	Phosphorus (P)-Total (mg/kg wwt)	620	510	580	1490	1700
	Potassium (K)-Total (mg/kg wwt)	<2000 DLIV	<1000 DLIV	<2000 DLIV	<2000 DLIV	<2000 DLIV
	Rhenium (Re)-Total (mg/kg wwt)	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
	Rubidium (Rb)-Total (mg/kg wwt)	1.21	1.11	0.837	2.07	1.75
	Selenium (Se)-Total (mg/kg wwt)	0.147	0.140	0.128	0.212	0.293
	Sodium (Na)-Total (mg/kg wwt)	<2000 DLIV	<1000 DLIV	<2000 DLIV	<2000 DLIV	<2000 DLIV
	Strontium (Sr)-Total (mg/kg wwt)	4.00	5.29	5.85	7.56	11.5
	Tellurium (Te)-Total (mg/kg wwt)	0.0042	0.0044	0.0041	0.0043	0.0052
	Thallium (Tl)-Total (mg/kg wwt)	0.00968	0.00948	0.00644	0.0128	0.0105
	Thorium (Th)-Total (mg/kg wwt)	0.209	0.183	0.255	0.413	0.271
	Tin (Sn)-Total (mg/kg wwt)	0.021	<0.020	<0.020	0.025	0.025
	Uranium (U)-Total (mg/kg wwt)	0.0863	0.127	0.115	0.0898	0.140
	Vanadium (V)-Total (mg/kg wwt)	3.25	2.52	2.58	10.5	7.37
	Yttrium (Y)-Total (mg/kg wwt)	0.506	0.545	0.531	0.752	0.965

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1364174-1	L1364174-2	L1364174-3	L1364174-4	L1364174-5
	Description	TISSUE	TISSUE	TISSUE	TISSUE	TISSUE
	Sampled Date	13-SEP-13	13-SEP-13	13-SEP-13	10-SEP-13	10-SEP-13
	Sampled Time					
	Client ID	LMC-1	LMC-2	LMC-3	LMC-4	LMC-5
Grouping	**Analyte**					
TISSUE						
Metals	Zinc (Zn)-Total (mg/kg wwt)	20.8	26.3	25.3	28.9	60.2
	Zirconium (Zr)-Total (mg/kg wwt)	0.724	0.821	1.09	0.852	0.639

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1364174-6	L1364174-7	L1364174-8	L1364174-9	L1364174-10
	Description	TISSUE	TISSUE	TISSUE	TISSUE	TISSUE
	Sampled Date	12-SEP-13	12-SEP-13	12-SEP-13	12-SEP-13	12-SEP-13
	Sampled Time					
	Client ID	LWC-1	LWC-2	LWC-3	LWC-4	LWC-5
Grouping	**Analyte**					
TISSUE						
Metals	Zinc (Zn)-Total (mg/kg wwt)	26.0	32.8	13.2	50.8	47.8
	Zirconium (Zr)-Total (mg/kg wwt)	0.850	1.26	0.535	3.01	3.03

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1364174-11	L1364174-12	L1364174-13	L1364174-14	L1364174-15
	Description	TISSUE	TISSUE	TISSUE	TISSUE	TISSUE
	Sampled Date	13-SEP-13	13-SEP-13	13-SEP-13	13-SEP-13	13-SEP-13
	Sampled Time					
	Client ID	LBC-1	LBC-2	LBC-3	LBC-4	LBC-5
Grouping	**Analyte**					
TISSUE						
Metals	Zinc (Zn)-Total (mg/kg wwt)	23.4	19.7	18.4	33.6	27.8
	Zirconium (Zr)-Total (mg/kg wwt)	0.539	0.432	0.542	0.894	1.03

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

Reference Information

QC Samples with Qualifiers & Comments:

QC Type Description	Parameter	Qualifier	Applies to Sample Number(s)
Duplicate	Aluminum (Al)-Total	DUP-H	L1364174-1, -10, -11, -12, -13, -14, -15, -2, -3, -4, -5, -6, -7, -8, -9
Duplicate	Arsenic (As)-Total	DUP-H	L1364174-1, -10, -11, -12, -13, -14, -15, -2, -3, -4, -5, -6, -7, -8, -9
Duplicate	Barium (Ba)-Total	DUP-H	L1364174-1, -10, -11, -12, -13, -14, -15, -2, -3, -4, -5, -6, -7, -8, -9
Duplicate	Beryllium (Be)-Total	DUP-H	L1364174-1, -10, -11, -12, -13, -14, -15, -2, -3, -4, -5, -6, -7, -8, -9
Duplicate	Boron (B)-Total	DUP-H	L1364174-1, -10, -11, -12, -13, -14, -15, -2, -3, -4, -5, -6, -7, -8, -9
Duplicate	Cadmium (Cd)-Total	DUP-H	L1364174-1, -10, -11, -12, -13, -14, -15, -2, -3, -4, -5, -6, -7, -8, -9
Duplicate	Cesium (Cs)-Total	DUP-H	L1364174-1, -10, -11, -12, -13, -14, -15, -2, -3, -4, -5, -6, -7, -8, -9
Duplicate	Chromium (Cr)-Total	DUP-H	L1364174-1, -10, -11, -12, -13, -14, -15, -2, -3, -4, -5, -6, -7, -8, -9
Duplicate	Cobalt (Co)-Total	DUP-H	L1364174-1, -10, -11, -12, -13, -14, -15, -2, -3, -4, -5, -6, -7, -8, -9
Duplicate	Copper (Cu)-Total	DUP-H	L1364174-1, -10, -11, -12, -13, -14, -15, -2, -3, -4, -5, -6, -7, -8, -9
Duplicate	Gallium (Ga)-Total	DUP-H	L1364174-1, -10, -11, -12, -13, -14, -15, -2, -3, -4, -5, -6, -7, -8, -9
Duplicate	Iron (Fe)-Total	DUP-H	L1364174-1, -10, -11, -12, -13, -14, -15, -2, -3, -4, -5, -6, -7, -8, -9
Duplicate	Lead (Pb)-Total	DUP-H	L1364174-1, -10, -11, -12, -13, -14, -15, -2, -3, -4, -5, -6, -7, -8, -9
Duplicate	Lithium (Li)-Total	DUP-H	L1364174-1, -10, -11, -12, -13, -14, -15, -2, -3, -4, -5, -6, -7, -8, -9
Duplicate	Manganese (Mn)-Total	DUP-H	L1364174-1, -10, -11, -12, -13, -14, -15, -2, -3, -4, -5, -6, -7, -8, -9
Duplicate	Molybdenum (Mo)-Total	DUP-H	L1364174-1, -10, -11, -12, -13, -14, -15, -2, -3, -4, -5, -6, -7, -8, -9
Duplicate	Nickel (Ni)-Total	DUP-H	L1364174-1, -10, -11, -12, -13, -14, -15, -2, -3, -4, -5, -6, -7, -8, -9
Duplicate	Rubidium (Rb)-Total	DUP-H	L1364174-1, -10, -11, -12, -13, -14, -15, -2, -3, -4, -5, -6, -7, -8, -9
Duplicate	Strontium (Sr)-Total	DUP-H	L1364174-1, -10, -11, -12, -13, -14, -15, -2, -3, -4, -5, -6, -7, -8, -9
Duplicate	Thallium (Tl)-Total	DUP-H	L1364174-1, -10, -11, -12, -13, -14, -15, -2, -3, -4, -5, -6, -7, -8, -9
Duplicate	Thorium (Th)-Total	DUP-H	L1364174-1, -10, -11, -12, -13, -14, -15, -2, -3, -4, -5, -6, -7, -8, -9
Duplicate	Uranium (U)-Total	DUP-H	L1364174-1, -10, -11, -12, -13, -14, -15, -2, -3, -4, -5, -6, -7, -8, -9
Duplicate	Vanadium (V)-Total	DUP-H	L1364174-1, -10, -11, -12, -13, -14, -15, -2, -3, -4, -5, -6, -7, -8, -9
Duplicate	Yttrium (Y)-Total	DUP-H	L1364174-1, -10, -11, -12, -13, -14, -15, -2, -3, -4, -5, -6, -7, -8, -9
Duplicate	Zinc (Zn)-Total	DUP-H	L1364174-1, -10, -11, -12, -13, -14, -15, -2, -3, -4, -5, -6, -7, -8, -9
Duplicate	Zirconium (Zr)-Total	DUP-H	L1364174-1, -10, -11, -12, -13, -14, -15, -2, -3, -4, -5, -6, -7, -8, -9
Duplicate	Calcium (Ca)-Total	DUP-H	L1364174-1, -10, -11, -12, -13, -14, -15, -2, -3, -4, -5, -6, -7, -8, -9
Duplicate	Magnesium (Mg)-Total	DUP-H	L1364174-1, -10, -11, -12, -13, -14, -15, -2, -3, -4, -5, -6, -7, -8, -9
Method Blank	Lithium (Li)-Total	MB-LOR	L1364174-1, -10, -11, -12, -13, -14, -15, -2, -3, -4, -5, -6, -7, -8, -9

Qualifiers for Individual Parameters Listed:

Qualifier	Description
DLIV	Detection Limit Adjusted: Lower Initial Volume
DUP-H	Duplicate results outside ALS DQO, due to sample heterogeneity.

Reference Information

MB-LOR	Method Blank exceeds ALS DQO. Limits of Reporting have been adjusted for samples with positive hits below 5x blank level.

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
HG-WET-CVAFS-VA	Tissue	Mercury in Tissue by CVAFS (WET)	EPA 200.3, EPA 245.7

This method is adapted from US EPA Method 200.3 "Sample Procedures for Spectrochemical Determination of Total Recoverable Elements in Biological Tissues" (1996). Tissue samples are homogenized and sub-sampled prior to hotblock digestion with nitric and hydrochloric acids, in combination with repeated additions of hydrogen peroxide. Analysis is by atomic fluorescence spectrophotometry or atomic absorption spectrophotometry, adapted from US EPA Method 245.7. This digestion procedure was implemented on October 5, 2009.

ALS Test Code	Matrix	Test Description	Method Reference**
MET-WET-HRMS-VA	Tissue	Metals in Tissue by HR-ICPMS (WET)	EPA 200.3/200.8

Trace metals in tissue are analyzed by high resolution inductively coupled plasma mass spectrometry (HR-ICPMS) modified from US EPA Method 200.8, (Revision 5.5). The sample preparation procedure is modified from US EPA 200.3. Analytical results are reported on wet weight basis.

ALS Test Code	Matrix	Test Description	Method Reference**
MET-WET-ICP-VA	Tissue	Metals in Tissue by ICPOES (WET)	EPA 200.3, EPA 6010B

This method is adapted from US EPA Method 200.3 "Sample Procedures for Spectrochemical Determination of Total Recoverable Elements in Biological Tissues" (1996). Tissue samples are homogenized and sub-sampled prior to hotblock digestion with nitric and hydrochloric acids, in combination with repeated additions of hydrogen peroxide. Analysis is by Inductively Coupled Plasma - Optical Emission Spectrophotometry, adapted from US EPA Method 6010B. This digestion procedure was implemented on October 5, 2009.

ALS Test Code	Matrix	Test Description	Method Reference**
MOISTURE-TISS-VA	Tissue	% Moisture in Tissues	ASTM D2974-00 Method A

This analysis is carried out gravimetrically by drying the sample at 105 C for a minimum of six hours.

** ALS test methods may incorporate modifications from specified reference methods to improve performance.

The last two letters of the above test code(s) indicate the laboratory that performed analytical analysis for that test. Refer to the list below:

Laboratory Definition Code	Laboratory Location
VA	ALS ENVIRONMENTAL - VANCOUVER, BRITISH COLUMBIA, CANADA

Chain of Custody Numbers:

1 of 2 2 of 2

GLOSSARY OF REPORT TERMS

Surrogate - A compound that is similar in behaviour to target analyte(s), but that does not occur naturally in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery.
mg/kg - milligrams per kilogram based on dry weight of sample.
mg/kg wwt - milligrams per kilogram based on wet weight of sample.
mg/kg lwt - milligrams per kilogram based on lipid-adjusted weight of sample.
mg/L - milligrams per litre.
< - Less than.
D.L. - The reported Detection Limit, also known as the Limit of Reporting (LOR).
N/A - Result not available. Refer to qualifier code and definition for explanation.

Test results reported relate only to the samples as received by the laboratory.
UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.
Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.

ALS Environmental

L1364174-COFC

Custody / Analytical Request Form
ada Toll Free: 1 800 668 9878
www.alsglobal.com

COC #

Report To	
Company:	Minnow Environmental Inc.
Contact:	Lisa Bowron
Address:	101 - 1025 Hillside Ave.
	Victoria, BC
Phone:	(250) 595-1627 Fax: (250) 595-1625
Invoice To	Same as Report ? ☑ Yes ☐ No
Hardcopy of Invoice with Report?	☑ Yes ☐ No
Company:	
Contact:	
Address:	
Phone:	Fax:
Lab Work Order # (lab use only)	L1364174

/ Distribution

☑ Standard ☐ Other
☑ PDF ☑ Excel ☐ Digital ☐ Fax
Email 1: lbowron@minnow-environmental.com
Email 2: pstecko@minnow-environmental.com
Email 3:

Client / Project Information
Job #: Minnow Project 2464
PO / AFE:
LSD:
Quote #:
ALS Contact: Victoria Jung
Sampler: Pierre Stecko

Service Requested (Rush for routine analysis subject to availability)
◉ Regular (Standard Turnaround Times - Business Days)
○ Priority (2-4 Business Days) - 50% Surcharge - Contact ALS to Confirm TAT
○ Emergency (1-2 Bus. Days) - 100% Surcharge - Contact ALS to Confirm TAT
○ Same Day or Weekend Emergency - Contact ALS to Confirm TAT

Analysis Request
Please indicate below Filtered, Preserved or both (F, P, F/P)

Short Holding Time
Rush Processing

Sample #	Sample Identification (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	Moisture (%)	Se High Resolution ICP-MS scan	Number of Containers
1	LMC-1	13-Sept-13		Tissue	X	X	1
2	LMC-2	13-Sept-13		Tissue	X	X	1
3	LMC-3	13-Sept-13		Tissue	X	X	1
4	LMC-4	10-Sept-13		Tissue	X	X	1
5	LMC-5	10-Sept-13		Tissue	X	X	1
6	LWC-1	12-Sept-13		Tissue	X	X	1
7	LWC-2	12-Sept-13		Tissue	X	X	1
8	LWC-3	12-Sept-13		Tissue	X	X	1
9	LWC-4	12-Sept-13		Tissue	X	X	1
10	LWC-5	12-Sept-13		Tissue	X	X	1
11	LBC-1	13-Sept-13		Tissue	X	X	1
12	LBC-2	13-Sept-13		Tissue	X	X	1

Special Instructions / Re[...]er or land use (CCME-Freshwater Aquatic Life/BC CSR - Commercial/AB Tier 1 - Natural, etc) / Hazardous Details

Small samples. The critical analyte of interest is selenium; please ensure best possible MDLs.

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY.
By the use of this form the user acknowledges and agrees with the Terms and Conditions as provided on a separate Excel tab.
Also provided on another Excel tab are the ALS location addresses, phone numbers and sample container / preservation / holding time table for common analyses.

SHIPMENT RELEASE (client use)			SHIPMENT RECEPTION (lab use only)				SHIPMENT VERIFICATION (lab use only)			
Released by: Lisa Bowron	Date (dd-mmm-yy): 14-Sept-13	Time (hh-mm): 11-37	Received by:	Date: 1:30	Time: 14-Sept-13	Temperature: 3.8, 5.2°C	Verified by:	Date:	Time:	Observations: Yes / No ? If Yes add SIF

Paige Sept. 17 14:30 7°C

ALS Environment

L1364174-COFC

Custody / Analytical Request Form
ıada Toll Free: 1 800 668 9878
www.alsglobal.com

COC #

Report To		Report Format / Distribution		Service Requested (Rush for routine analysis subject to availability)
Company:	Minnow Environmental Inc.	☑ Standard ☐ Other		○ Regular (Standard Turnaround Times - Business Days)
Contact:	Lisa Bowron	☑ PDF ☑ Excel ☐ Digital ☐ Fax		○ Priority (2-4 Business Days) - 50% Surcharge - Contact ALS to Confirm TAT
Address:	101 - 1025 Hillside Ave.	Email 1:	lbowron@minnow-environmental.com	○ Emergency (1-2 Bus. Days) - 100% Surcharge - Contact ALS to Confirm TAT
	Victoria, BC	Email 2:	pstecko@minnow-environmental.com	◉ Same Day or Weekend Emergency - Contact ALS to Confirm TAT
Phone:	(250) 595-1627 Fax: (250) 595-1625	Email 3:		**Analysis Request**
Invoice To	Same as Report ? ☑ Yes ☐ No	**Client / Project Information**		Please indicate below Filtered, Preserved or both (F, P, F/P)
Hardcopy of Invoice with Report?	☑ Yes ☐ No	Job #:	Minnow Project 2464	
Company:		PO / AFE:		
Contact:		LSD:		
Address:				
Phone:	Fax:	Quote #:		
Lab Work Order # (lab use only)	L1364174	ALS Contact:	Victoria Jung	Sampler: Pierre Stecko

Sample #	Sample Identification (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	Moisture (%)	Se High Resolution ICP-MS sca											Number of Containers
13	LBC-3	13-Sept-13		Tissue	X	X											1
14	LBC-4	13-Sept-13		Tissue	X	X											1
15	LBC-5	13-Sept-13		Tissue	X	X											1

Special Instructions / Regulations with water or land use (CCME-Freshwater Aquatic Life/BC CSR - Commercial/AB Tier 1 - Natural, etc) / Hazardous Details

Small samples. The critical analyte of interest is selenium; please ensure best possible MDLs.

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY.
By the use of this form the user acknowledges and agrees with the Terms and Conditions as provided on a separate Excel tab.
Also provided on another Excel tab are the ALS location addresses, phone numbers and sample container / preservation / holding time table for common analyses.

SHIPMENT RELEASE (client use)			SHIPMENT RECEPTION (lab use only)				SHIPMENT VERIFICATION (lab use only)			
Released by: Lisa Bowron	Date (dd-mmm-yy) 14-Sept-13	Time (hh-mm) 11:37	Received by:	Date: 14-Sept-13	Time: 1:30	Temperature: 3.8, 5.2°C	Verified by:	Date:	Time:	Observations: Yes / No ? If Yes add SIF

GENF 20.00 Front

MINNOW ENVIRONMENTAL INC.
ATTN: Lisa Bowron
101 - 1025 Hillside Ave.
Victoria BC V8T 2A2

Date Received: 17-SEP-13
Report Date: 03-FEB-14 09:58 (MT)
Version: FINAL REV. 2

Client Phone: 250-595-1627

Certificate of Analysis

Lab Work Order #: **L1364215**

Project P.O. #: NOT SUBMITTED
Job Reference: MINNOW PROJECT 2498
C of C Numbers: 1 OF 2, 2 OF 2
Legal Site Desc:

Comments: ADDITIONAL 29-JAN-14 11:48
30-JAN-2014 Revised report.
Chlorophyll a results are now reported as micrograms for each rock scraping.
3-FEB-2014 Finalized report

Andre Langlais
Account Manager

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1364215-1	L1364215-2	L1364215-3	L1364215-4	L1364215-5
	Description	TISSUE	TISSUE	TISSUE	TISSUE	TISSUE
	Sampled Date	13-SEP-13	13-SEP-13	13-SEP-13	09-SEP-13	09-SEP-13
	Sampled Time					
	Client ID	LMC-1	LMC-2	LMC-3	LMC-4	LMC-5
Grouping	**Analyte**					
BIOTA						
Field Tests	Area Sampled (cm2)	0	0	0	0	0
Plant Pigments	Chlorophyll a (ug)	15.3	2.85	0.944	31.4	0.587

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1364215-6	L1364215-7	L1364215-8	L1364215-9	L1364215-10
	Description	TISSUE	TISSUE	TISSUE	TISSUE	TISSUE
	Sampled Date	12-SEP-13	12-SEP-13	12-SEP-13	12-SEP-13	12-SEP-13
	Sampled Time					
	Client ID	LWC-1	LWC-2	LWC-3	LWC-4	LWC-5
Grouping	**Analyte**					
BIOTA						
Field Tests	Area Sampled (cm2)	0	0	0	0	0
Plant Pigments	Chlorophyll a (ug)	85.8	6.26	29.7	14.1	6.06

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1364215-1	L1364215-2	L1364215-3	L1364215-4	L1364215-5
	Description	TISSUE	TISSUE	TISSUE	TISSUE	TISSUE
	Sampled Date	13-SEP-13	13-SEP-13	13-SEP-13	09-SEP-13	09-SEP-13
	Sampled Time					
	Client ID	LMC-1	LMC-2	LMC-3	LMC-4	LMC-5
Grouping	**Analyte**					
TISSUE						
Physical Tests	% Moisture (%)	36.0	36.2	40.9	42.0	50.2
Metals	Aluminum (Al)-Total (mg/kg wwt)	12900	12800	11300	12400	10500
	Antimony (Sb)-Total (mg/kg wwt)	0.0152	0.0141	0.0179	0.0147	0.0137
	Arsenic (As)-Total (mg/kg wwt)	3.38	2.88	3.11	3.14	2.68
	Barium (Ba)-Total (mg/kg wwt)	178	160	155	158	137
	Beryllium (Be)-Total (mg/kg wwt)	0.322	0.306	0.295	0.300	0.252
	Bismuth (Bi)-Total (mg/kg wwt)	0.0739	0.0707	0.0681	0.0722	0.0597
	Boron (B)-Total (mg/kg wwt)	2.62	2.43	2.31	2.36	2.09
	Cadmium (Cd)-Total (mg/kg wwt)	0.0962	0.0835	0.0920	0.0890	0.0752
	Calcium (Ca)-Total (mg/kg wwt)	8390	8630	7770	7870	6640
	Cesium (Cs)-Total (mg/kg wwt)	0.931	0.878	0.880	0.878	0.845
	Chromium (Cr)-Total (mg/kg wwt)	26.5	26.0	23.1	24.9	22.2
	Cobalt (Co)-Total (mg/kg wwt)	7.20	6.60	6.45	6.76	5.55
	Copper (Cu)-Total (mg/kg wwt)	14.5	13.6	14.0	13.9	15.7
	Gallium (Ga)-Total (mg/kg wwt)	4.07	4.02	3.61	3.90	3.32
	Iron (Fe)-Total (mg/kg wwt)	16500	16200	14600	15900	13500
	Lead (Pb)-Total (mg/kg wwt)	4.09	4.07	3.66	3.89	3.31
	Lithium (Li)-Total (mg/kg wwt)	8.82	8.38	7.65	8.16	6.82
	Magnesium (Mg)-Total (mg/kg wwt)	5240	5350	4730	4910	4020
	Manganese (Mn)-Total (mg/kg wwt)	674	381	450	496	412
	Mercury (Hg)-Total (mg/kg wwt)	0.0185	0.0143	0.0156	0.0187	0.0131
	Molybdenum (Mo)-Total (mg/kg wwt)	0.205	0.189	0.209	0.201	0.187
	Nickel (Ni)-Total (mg/kg wwt)	17.7	17.1	16.2	17.0	14.2
	Phosphorus (P)-Total (mg/kg wwt)	650	635	538	557	484
	Potassium (K)-Total (mg/kg wwt)	1290	1230	1140	1170	1070
	Rhenium (Re)-Total (mg/kg wwt)	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
	Rubidium (Rb)-Total (mg/kg wwt)	9.52	9.02	8.95	8.99	8.56
	Selenium (Se)-Total (mg/kg wwt)	0.228	0.187	0.190	0.176	0.141
	Sodium (Na)-Total (mg/kg wwt)	330	350	290	310	230
	Strontium (Sr)-Total (mg/kg wwt)	67.8	65.1	64.1	66.1	55.4
	Tellurium (Te)-Total (mg/kg wwt)	0.0100	0.0100	0.0105	0.0104	0.0088
	Thallium (Tl)-Total (mg/kg wwt)	0.0944	0.0882	0.0877	0.0890	0.0820
	Thorium (Th)-Total (mg/kg wwt)	3.30	3.27	2.99	3.15	2.88
	Tin (Sn)-Total (mg/kg wwt)	0.238	0.221	0.214	0.217	0.165
	Uranium (U)-Total (mg/kg wwt)	0.663	0.632	0.637	0.615	0.553
	Vanadium (V)-Total (mg/kg wwt)	47.1	45.5	42.0	44.1	38.8
	Yttrium (Y)-Total (mg/kg wwt)	8.17	8.06	7.39	7.72	6.75

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1364215-6	L1364215-7	L1364215-8	L1364215-9	L1364215-10
	Description	TISSUE	TISSUE	TISSUE	TISSUE	TISSUE
	Sampled Date	12-SEP-13	12-SEP-13	12-SEP-13	12-SEP-13	12-SEP-13
	Sampled Time					
	Client ID	LWC-1	LWC-2	LWC-3	LWC-4	LWC-5
Grouping	**Analyte**					
TISSUE						
Physical Tests	% Moisture (%)	58.3	60.3	64.6	55.2	49.9
Metals	Aluminum (Al)-Total (mg/kg wwt)	10100	8590	9120	10000	9640
	Antimony (Sb)-Total (mg/kg wwt)	0.0107	0.0101	0.0106	0.0108	0.0117
	Arsenic (As)-Total (mg/kg wwt)	2.40	2.09	2.17	2.22	2.24
	Barium (Ba)-Total (mg/kg wwt)	126	106	111	120	110
	Beryllium (Be)-Total (mg/kg wwt)	0.303	0.272	0.267	0.303	0.300
	Bismuth (Bi)-Total (mg/kg wwt)	0.0529	0.0422	0.0472	0.0497	0.0474
	Boron (B)-Total (mg/kg wwt)	2.46	1.79	2.22	1.82	1.95
	Cadmium (Cd)-Total (mg/kg wwt)	0.0950	0.0851	0.0888	0.0933	0.0864
	Calcium (Ca)-Total (mg/kg wwt)	5070	4480	4470	5430	5380
	Cesium (Cs)-Total (mg/kg wwt)	1.15	0.901	1.02	1.08	1.00
	Chromium (Cr)-Total (mg/kg wwt)	25.0	23.2	22.0	25.7	26.4
	Cobalt (Co)-Total (mg/kg wwt)	6.02	5.76	5.32	6.06	6.44
	Copper (Cu)-Total (mg/kg wwt)	12.2	11.6	11.2	11.6	12.6
	Gallium (Ga)-Total (mg/kg wwt)	3.12	2.64	2.76	3.06	2.94
	Iron (Fe)-Total (mg/kg wwt)	13600	12600	12200	13100	13400
	Lead (Pb)-Total (mg/kg wwt)	3.26	2.59	2.78	3.24	3.11
	Lithium (Li)-Total (mg/kg wwt)	6.08	4.95	5.10	5.80	5.53
	Magnesium (Mg)-Total (mg/kg wwt)	4440	3930	3900	4680	4710
	Manganese (Mn)-Total (mg/kg wwt)	370	337	352	308	363
	Mercury (Hg)-Total (mg/kg wwt)	0.0321	0.0135	0.0148	0.0149	0.0140
	Molybdenum (Mo)-Total (mg/kg wwt)	0.161	0.138	0.142	0.148	0.165
	Nickel (Ni)-Total (mg/kg wwt)	17.2	16.7	15.5	17.8	18.9
	Phosphorus (P)-Total (mg/kg wwt)	585	476	500	506	558
	Potassium (K)-Total (mg/kg wwt)	1070	960	1000	950	900
	Rhenium (Re)-Total (mg/kg wwt)	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
	Rubidium (Rb)-Total (mg/kg wwt)	8.47	7.31	7.60	8.27	7.85
	Selenium (Se)-Total (mg/kg wwt)	0.252	0.181	0.210	0.187	0.176
	Sodium (Na)-Total (mg/kg wwt)	230	220	<200 DLIV	260	280
	Strontium (Sr)-Total (mg/kg wwt)	46.9	42.5	41.4	48.4	47.8
	Tellurium (Te)-Total (mg/kg wwt)	0.0080	0.0068	0.0073	0.0075	0.0067
	Thallium (Tl)-Total (mg/kg wwt)	0.0731	0.0594	0.0668	0.0688	0.0629
	Thorium (Th)-Total (mg/kg wwt)	2.43	1.83	2.11	2.34	2.47
	Tin (Sn)-Total (mg/kg wwt)	0.206	0.150	0.172	0.192	0.176
	Uranium (U)-Total (mg/kg wwt)	0.613	0.552	0.529	0.639	0.691
	Vanadium (V)-Total (mg/kg wwt)	37.4	34.2	32.7	37.1	39.2
	Yttrium (Y)-Total (mg/kg wwt)	5.74	4.74	5.02	5.72	5.78

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Grouping	Analyte	L1364215-11	L1364215-12	L1364215-13	L1364215-14	L1364215-15
	Description	TISSUE	TISSUE	TISSUE	TISSUE	TISSUE
	Sampled Date	13-SEP-13	13-SEP-13	13-SEP-13	13-SEP-13	13-SEP-13
	Sampled Time					
	Client ID	LBC-1	LBC-2	LBC-3	LBC-4	LBC-5
TISSUE						
Physical Tests	% Moisture (%)	55.9	55.8	67.7	60.4	50.8
Metals	Aluminum (Al)-Total (mg/kg wwt)	6420	7130	5230	8120	5160
	Antimony (Sb)-Total (mg/kg wwt)	0.0217	0.0232	0.0230	0.0247	0.0216
	Arsenic (As)-Total (mg/kg wwt)	10.2	11.4	10.9	13.4	7.69
	Barium (Ba)-Total (mg/kg wwt)	101	93.4	79.5	125	67.2
	Beryllium (Be)-Total (mg/kg wwt)	0.216	0.234	0.183	0.277	0.182
	Bismuth (Bi)-Total (mg/kg wwt)	0.193	0.826	0.206	0.280	0.151
	Boron (B)-Total (mg/kg wwt)	1.42	1.54	1.36	1.86	1.26
	Cadmium (Cd)-Total (mg/kg wwt)	0.0869	0.0940	0.0798	0.136	0.0603
	Calcium (Ca)-Total (mg/kg wwt)	3910	4140	3220	4800	3440
	Cesium (Cs)-Total (mg/kg wwt)	1.27	1.37	1.18	1.67	0.947
	Chromium (Cr)-Total (mg/kg wwt)	14.4	15.9	11.4	17.2	11.1
	Cobalt (Co)-Total (mg/kg wwt)	3.99	4.27	3.17	4.93	3.10
	Copper (Cu)-Total (mg/kg wwt)	10.9	11.9	10.7	15.9	8.32
	Gallium (Ga)-Total (mg/kg wwt)	2.12	2.31	1.71	2.54	1.71
	Iron (Fe)-Total (mg/kg wwt)	9630	10500	7960	11400	7680
	Lead (Pb)-Total (mg/kg wwt)	3.49	3.62	3.24	4.52	2.71
	Lithium (Li)-Total (mg/kg wwt)	3.86	4.06	2.94	4.76	2.94
	Magnesium (Mg)-Total (mg/kg wwt)	2990	3230	2340	3680	2490
	Manganese (Mn)-Total (mg/kg wwt)	270	283	237	381	190
	Mercury (Hg)-Total (mg/kg wwt)	0.0119	0.0130	0.0115	0.0192	0.0121
	Molybdenum (Mo)-Total (mg/kg wwt)	0.366	0.363	0.332	0.430	0.282
	Nickel (Ni)-Total (mg/kg wwt)	10.4	11.6	8.75	14.1	7.94
	Phosphorus (P)-Total (mg/kg wwt)	458	465	345	392	400
	Potassium (K)-Total (mg/kg wwt)	1160	1190	1110	1070	980
	Rhenium (Re)-Total (mg/kg wwt)	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
	Rubidium (Rb)-Total (mg/kg wwt)	6.53	6.98	5.73	8.15	4.93
	Selenium (Se)-Total (mg/kg wwt)	0.108	0.149	0.161	0.183	0.094
	Sodium (Na)-Total (mg/kg wwt)	250	260	DLIV <200	260	210
	Strontium (Sr)-Total (mg/kg wwt)	35.6	38.5	31.6	48.9	30.2
	Tellurium (Te)-Total (mg/kg wwt)	0.0204	0.0218	0.0223	0.0294	0.0158
	Thallium (Tl)-Total (mg/kg wwt)	0.0619	0.0668	0.0568	0.0858	0.0471
	Thorium (Th)-Total (mg/kg wwt)	2.39	2.42	1.91	2.89	3.73
	Tin (Sn)-Total (mg/kg wwt)	0.128	0.147	0.118	0.157	0.092
	Uranium (U)-Total (mg/kg wwt)	0.639	0.649	0.551	1.04	0.603
	Vanadium (V)-Total (mg/kg wwt)	27.6	30.3	22.1	30.2	22.8
	Yttrium (Y)-Total (mg/kg wwt)	4.59	4.69	3.65	5.71	3.54

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1364215-1	L1364215-2	L1364215-3	L1364215-4	L1364215-5
	Description	TISSUE	TISSUE	TISSUE	TISSUE	TISSUE
	Sampled Date	13-SEP-13	13-SEP-13	13-SEP-13	09-SEP-13	09-SEP-13
	Sampled Time					
	Client ID	LMC-1	LMC-2	LMC-3	LMC-4	LMC-5
Grouping	**Analyte**					
TISSUE						
Metals	Zinc (Zn)-Total (mg/kg wwt)	39.4	38.1	34.3	38.0	30.2
	Zirconium (Zr)-Total (mg/kg wwt)	6.52	6.36	6.79	6.21	6.26

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1364215-6	L1364215-7	L1364215-8	L1364215-9	L1364215-10
	Description	TISSUE	TISSUE	TISSUE	TISSUE	TISSUE
	Sampled Date	12-SEP-13	12-SEP-13	12-SEP-13	12-SEP-13	12-SEP-13
	Sampled Time					
	Client ID	LWC-1	LWC-2	LWC-3	LWC-4	LWC-5
Grouping	**Analyte**					
TISSUE						
Metals	Zinc (Zn)-Total (mg/kg wwt)	30.4	28.7	27.1	31.9	30.5
	Zirconium (Zr)-Total (mg/kg wwt)	7.09	5.88	6.50	6.74	6.63

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1364215-11	L1364215-12	L1364215-13	L1364215-14	L1364215-15
	Description	TISSUE	TISSUE	TISSUE	TISSUE	TISSUE
	Sampled Date	13-SEP-13	13-SEP-13	13-SEP-13	13-SEP-13	13-SEP-13
	Sampled Time					
	Client ID	LBC-1	LBC-2	LBC-3	LBC-4	LBC-5
Grouping	**Analyte**					
TISSUE						
Metals	Zinc (Zn)-Total (mg/kg wwt)	26.2	27.6	21.1	30.7	20.2
	Zirconium (Zr)-Total (mg/kg wwt)	4.14	4.32	3.57	5.63	3.20

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

Reference Information

QC Samples with Qualifiers & Comments:

QC Type Description	Parameter	Qualifier	Applies to Sample Number(s)
Method Blank	Aluminum (Al)-Total	MB-LOR	L1364215-1, -10, -11, -12, -13, -14, -15, -2, -3, -4, -5, -6, -7, -8, -9
Method Blank	Iron (Fe)-Total	MB-LOR	L1364215-1, -10, -11, -12, -13, -14, -15, -2, -3, -4, -5, -6, -7, -8, -9
Method Blank	Manganese (Mn)-Total	MB-LOR	L1364215-1, -10, -11, -12, -13, -14, -15, -2, -3, -4, -5, -6, -7, -8, -9

Qualifiers for Individual Parameters Listed:

Qualifier	Description
DLIV	Detection Limit Adjusted: Lower Initial Volume
MB-LOR	Method Blank exceeds ALS DQO. Limits of Reporting have been adjusted for samples with positive hits below 5x blank level.

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
CHLOROA-F-VA	Biota	Chlorophyll a in Biota by Fluorometer	EPA 445.0

This analysis is done using procedures adapted from EPA Method 445.0. Chlorophyll-a is determined by a routine acetone extraction followed with analysis by fluorometry using the non-acidification procedure. This method is not subject to interferences from chlorophyll b. Note: Biota samples are typically submitted as scrapings on a filter.

ALS Test Code	Matrix	Test Description	Method Reference**
CHLOROA-VA	Water	Chlorophyll a by Fluorometer	EPA 445.0

This analysis is done using procedures modified from EPA Method 445.0. Chlorophyll-a is determined by a routine acetone extraction followed with analysis by fluorometry using the non-acidification procedure. This method is not subject to interferences from chlorophyll b.

ALS Test Code	Matrix	Test Description	Method Reference**
HG-WET-CVAFS-VA	Tissue	Mercury in Tissue by CVAFS (WET)	EPA 200.3, EPA 245.7

This method is adapted from US EPA Method 200.3 "Sample Procedures for Spectrochemical Determination of Total Recoverable Elements in Biological Tissues" (1996). Tissue samples are homogenized and sub-sampled prior to hotblock digestion with nitric and hydrochloric acids, in combination with repeated additions of hydrogen peroxide. Analysis is by atomic fluorescence spectrophotometry or atomic absorption spectrophotometry, adapted from US EPA Method 245.7. This digestion procedure was implemented on October 5, 2009.

ALS Test Code	Matrix	Test Description	Method Reference**
MET-WET-HRMS-VA	Tissue	Metals in Tissue by HR-ICPMS (WET)	EPA 200.3/200.8

Trace metals in tissue are analyzed by high resolution inductively coupled plasma mass spectrometry (HR-ICPMS) modified from US EPA Method 200.8, (Revision 5.5). The sample preparation procedure is modified from US EPA 200.3. Analytical results are reported on wet weight basis.

ALS Test Code	Matrix	Test Description	Method Reference**
MET-WET-ICP-VA	Tissue	Metals in Tissue by ICPOES (WET)	EPA 200.3, EPA 6010B

This method is adapted from US EPA Method 200.3 "Sample Procedures for Spectrochemical Determination of Total Recoverable Elements in Biological Tissues" (1996). Tissue samples are homogenized and sub-sampled prior to hotblock digestion with nitric and hydrochloric acids, in combination with repeated additions of hydrogen peroxide. Analysis is by Inductively Coupled Plasma - Optical Emission Spectrophotometry, adapted from US EPA Method 6010B. This digestion procedure was implemented on October 5, 2009.

ALS Test Code	Matrix	Test Description	Method Reference**
MOISTURE-TISS-VA	Tissue	% Moisture in Tissues	ASTM D2974-00 Method A

This analysis is carried out gravimetrically by drying the sample at 105 C for a minimum of six hours.

** ALS test methods may incorporate modifications from specified reference methods to improve performance.

The last two letters of the above test code(s) indicate the laboratory that performed analytical analysis for that test. Refer to the list below:

Laboratory Definition Code	Laboratory Location
VA	ALS ENVIRONMENTAL - VANCOUVER, BRITISH COLUMBIA, CANADA

Chain of Custody Numbers:

1 OF 2	2 OF 2

Reference Information

GLOSSARY OF REPORT TERMS

Surrogate - A compound that is similar in behaviour to target analyte(s), but that does not occur naturally in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery.
mg/kg - milligrams per kilogram based on dry weight of sample.
mg/kg wwt - milligrams per kilogram based on wet weight of sample.
mg/kg lwt - milligrams per kilogram based on lipid-adjusted weight of sample.
mg/L - milligrams per litre.
< - Less than.
D.L. - The reported Detection Limit, also known as the Limit of Reporting (LOR).
N/A - Result not available. Refer to qualifier code and definition for explanation.

Test results reported relate only to the samples as received by the laboratory.
UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.
Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.

ALS Environmental

L1364215-COFC

Chain of Custody / Analytical Request Form

Canada Toll Free: 1 800 668 9878

www.alsglobal.com

COC #

Page 1 of 2

Report To		Report Format / Distribution		Service Requested (Rush for routine analysis subject to availability)
Company:	Minnow Environmental Inc.	☑ Standard ☐ Other		◉ Regular (Standard Turnaround Times - Business Days)
Contact:	Lisa Bowron	☑ PDF ☑ Excel ☐ Digital ☐ Fax		○ Priority (2-4 Business Days) - 50% Surcharge - Contact ALS to Confirm TAT
Address:	101 - 1025 Hillside Ave.	Email 1:	lbowron@minnow-environmental.com	○ Emergency (1-2 Bus. Days) - 100% Surcharge - Contact ALS to Confirm TAT
	Victoria, BC	Email 2:	pstecko@minnow-environmental.com	○ Same Day or Weekend Emergency - Contact ALS to Confirm TAT
Phone:	(250) 595-1627 Fax: (250) 595-1625	Email 3:		Analysis Request
Invoice To	Same as Report ? ☑ Yes ☐ No	Client / Project Information		Please indicate below Filtered, Preserved or both (F, P, F/P)
Hardcopy of Invoice with Report?	☑ Yes ☐ No	Job #:	Minnow Project 2464	
Company:		PO / AFE:		
Contact:		LSD:		
Address:				
Phone:	Fax:	Quote #:		
Lab Work Order # (lab use only)	L1364215	ALS Contact: Victoria Jung	Sampler: Pierre Stecko	

Short Holding Time

Rush Processing

Sample #	Sample Identification (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	Moisture (%)	Se High Resolution ICP-MS scan	Chlorophyll a		**See Complete Quote #								Number of Containers
1	LMC-1	13-Sept-13		Tissue	X	X	X										1
2	LMC-2	13-Sept-13		Tissue	X	X	X										1
3	LMC-3	13-Sept-13		Tissue	X	X	X										1
4	LMC-4	9-Sept-13		Tissue	X	X	X										1
5	LMC-5	9-Sept-13		Tissue	X	X	X										1
6	LWC-1	12-Sept-13		Tissue	X	X	X										1
7	LWC-2	12-Sept-13		Tissue	X	X	X										1
8	LWC-3	12-Sept-13		Tissue	X	X	X										1
9	LWC-4	12-Sept-13		Tissue	X	X	X										1
10	LWC-5	12-Sept-13		Tissue	X	X	X										1
11	LBC-1	13-Sept-13		Tissue	X	X											1
12	LBC-2	13-Sept-13		Tissue	X	X											1

Special Instructions / Regulations with water or land use (CCME-Freshwater Aquatic Life/BC CSR - Commercial/AB Tier 1 - Natural, etc) / Hazardous Details

Small samples. The critical analyte of interest is selenium; please ensure best possible MDLs.

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY.

By the use of this form the user acknowledges and agrees with the Terms and Conditions as provided on a separate Excel tab.

Also provided on another Excel tab are the ALS location addresses, phone numbers and sample container / preservation / holding time table for common analyses.

SHIPMENT RELEASE (client use)			SHIPMENT RECEPTION (lab use only)				SHIPMENT VERIFICATION (lab use only)			
Released by: Lisa Bowron	Date (dd-mmm-yy) 14-Sept-13	Time (hh-mm) 11:37	Received by: [signature]	Date: 14-Sept-13	Time: 1:30	Temperature: 3.8, 5.2 °C	Verified by:	Date:	Time:	Observations: Yes / No ? If Yes add SIF

Paige Sept. 17 14:30 7°C

ALS Environmental

L1364215-COFC

Chain of Custody / Analytical Request Form
Canada Toll Free: 1 800 668 9878
www.alsglobal.com

COC #

Report To	
Company:	Minnow Environmental Inc.
Contact:	Lisa Bowron
Address:	101 - 1025 Hillside Ave. Victoria, BC
Phone:	(250) 595-1627 Fax: (250) 595-1625
Invoice To	Same as Report ? ☑ Yes ☐ No
Hardcopy of Invoice with Report?	☑ Yes ☐ No
Company:	
Contact:	
Address:	
Phone:	Fax:
Lab Work Order # (lab use only)	L1364215

Report Format / Distribution	
☑ Standard ☐ Other	
☑ PDF ☑ Excel ☐ Digital ☐ Fax	
Email 1:	lbowron@minnow-environmental.com
Email 2:	pstecko@minnow-environmental.com
Email 3:	
Client / Project Information	
Job #:	Minnow Project 2464
PO / AFE:	
LSD:	
Quote #:	
ALS Contact:	Victoria Jung
Sampler:	Pierre Stecko

Service Requested (Rush for routine analysis subject to availability)

- ○ Regular (Standard Turnaround Times - Business Days)
- ○ Priority (2-4 Business Days) - 50% Surcharge - Contact ALS to Confirm TAT
- ○ Emergency (1-2 Bus. Days) - 100% Surcharge - Contact ALS to Confirm TAT
- ◉ Same Day or Weekend Emergency - Contact ALS to Confirm TAT

Analysis Request

Please indicate below Filtered, Preserved or both (F, P, F/P)

Sample #	Sample Identification (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	Moisture (%)	Se High Resolution ICP-MS scal	Number of Containers
13	LBC-3	13-Sept-13		Tissue	X	X	1
14	LBC-4	13-Sept-13		Tissue	X	X	1
15	LBC-5	13-Sept-13		Tissue	X	X	1

Special Instructions / Regulations with water or land use (CCME-Freshwater Aquatic Life/BC CSR - Commercial/AB Tier 1 - Natural, etc) / Hazardous Details

Small samples. The critical analyte of interest is selenium; please ensure best possible MDLs.

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY.

By the use of this form the user acknowledges and agrees with the Terms and Conditions as provided on a separate Excel tab.

Also provided on another Excel tab are the ALS location addresses, phone numbers and sample container / preservation / holding time table for common analyses.

SHIPMENT RELEASE (client use)			SHIPMENT RECEPTION (lab use only)				SHIPMENT VERIFICATION (lab use only)			
Released by:	Date (dd-mmm-yy)	Time (hh-mm)	Received by:	Date:	Time:	Temperature:	Verified by:	Date:	Time:	Observations: Yes / No ? If Yes add SIF
Lisa Bowron	14-Sept-13	11-37	[signature]	14-Sept-13	1:30	3.8, 5.2°C				

APPENDIX D

PERIPHYTON COMMUNITY DATA

Table D.1: Periphyton community sampled at lower Minto Creek (exposure) and lower Wolverine Creek (reference), Minto Mine WUL, 2013. All data are presented in number/sample.

				Lower Minto Creek (Exposure)					Lower Wolverine Creek (Reference)				
Sample Site				LMC-1	LMC-2	LMC-3	LMC-4	LMC-5	LWC-1	LWC-2	LWC-3	LWC-4	LWC-5
Sampling Date				5-Sep-12	5-Sep-12	5-Sep-12	5-Sep-12	5-Sep-12	7-Sep-12	7-Sep-12	7-Sep-12	7-Sep-12	7-Sep-12
Class	Order	Family	Genera and Species										
Bacillariophyceae	Centrales	Melosiraceae	*Melosira varians*						10,113	24,586	15,629	18,452	102,933
	Pennales	Achnanthaceae	*Cocconeis placentula*						10,113	36,878	7,814	9,226	37,430
			Karayevia amoena									9,226	
			Planothidium frequentissimum			29,601		7,749	30,338	73,757	62,515	83,036	84,218
			Planothidium haynaldii	7,722									
		Achnanthidiaceae	*Achnanthidium minutissimum*						60,676	135,221	78,143	119,940	93,575
			Eucocconeis laevis						50,563	12,293	62,515	64,583	
		Amphipleuraceae	*Frustulia rhomboides*										9,358
			Frustulia vulgaris	19,306		17,760	9,850	46,492		12,293		18,452	
		Bacillariaceae	*Nitzschia acicularis*								15,629		
			Nitzschia acula	3,861			39,400	23,246		24,586	15,629		
			Nitzschia aequorea		20,253			247,957					
			Nitzschia bergii	15,445	105,316	41,441		77,487	40,451			18,452	37,430
			Nitzschia dissipata						2,710,195	1,585,771	789,248	904,164	851,533
			Nitzschia homburgiensis							122,928	15,629		
			Nitzschia incognita						91,014	98,342	187,544	92,262	28,073
			Nitzschia linearis	154,448			551,600	325,444		36,878			
			Nitzschia paleaeformis	324,341	56,708	53,281	236,400	193,717	30,338	49,171			
			Nitzschia perminuta						10,113	73,757	62,515	18,452	65,503
			Nitzschia pusilla	38,612	129,619	41,441	19,700	46,492		24,586	31,257	83,036	
			Nitzschia sublinearis		174,176	59,201			111,239	159,806	312,573	258,333	233,938
		Cymbellaceae	*Cymbella gracilis*						80,901			18,452	9,358
			Cymbopleura linearis	7,722	8,101		9,850	19,372					
			Encyonema minutum	11,584	16,202	11,840		19,372	222,479	319,613	343,831	249,107	364,943
		Diadesmidaceae	*Luticola goeppertiana*	706,600	765,563	2,054,276	3,871,050	418,428	121,352	49,171	31,257	92,262	
			Luticola mutica		81,012		9,850	11,623	121,352	12,293	85,958	1,291,663	215,223
		Eunotiaceae	*Eunotia arculus*					3,874					
			Eunotia praerupta	7,722	4,051	11,840	9,850						
			Eunotia rhomboidea	11,584	12,152	11,840		11,623					
		Fragilariaceae	*Diatoma moniliformis*			23,680			1,162,957	2,052,898	1,461,280	608,927	1,356,838
			Fragilaria alpestris		40,506	23,680	9,850	54,241	20,225	98,342	15,629	46,131	84,218
			Fragilaria capucina	3,861				3,874	20,225	24,586	15,629	9,226	
			Fragilaria vaucheriae	15,445		23,680					7,814		
			Hannaea arcus						30,338	73,757	23,443	36,905	112,290
			Meridion circulare		32,405	17,760	19,700	11,623	40,451	233,563	78,143	129,166	233,938
			Ulnaria acus			5,920		3,874	70,789	61,464	7,814	9,226	
			Ulnaria ulna						455,070	1,106,352	382,902	313,690	851,533

Table D.1: Periphyton community sampled at lower Minto Creek (exposure) and lower Wolverine Creek (reference), Minto Mine WUL, 2013. All data are presented in number/sample.

				Lower Minto Creek (Exposure)					Lower Wolverine Creek (Reference)				
Sample Site				LMC-1	LMC-2	LMC-3	LMC-4	LMC-5	LWC-1	LWC-2	LWC-3	LWC-4	LWC-5
Sampling Date				5-Sep-12	5-Sep-12	5-Sep-12	5-Sep-12	5-Sep-12	7-Sep-12	7-Sep-12	7-Sep-12	7-Sep-12	7-Sep-12
Class	Order	Family	Genera and Species										
Bacillariophyceae	Pennales	Gomphonemataceae	*Gomphoneis olivaceum*						10,113		31,257	9,226	74,860
			Gomphonema angustatum	19,306									
			Gomphonema lagerheimii		522,527	100,642	39,400	58,115	80,901	110,635	117,215	147,619	168,435
			Gomphonema minutum							62,515	101,488	93,575	
			Reimeria sinuata	7,722	20,253				10,113			36,905	
		Naviculaceae	*Adlafia minuscula*			17,760			10,113		7,814	27,679	18,715
			Eolimna minima							4,051			
			Mayamaea permitis							24,586	15,629		
			Navicula aquaedurae	393,842	141,771	367,046	285,650	278,952	111,239				18,715
			Navicula capitatoradiata							24,586			
			Navicula gregaria	223,950	85,063	402,567	344,750	34,869	131,465	196,685	140,658	239,880	243,295
			Navicula phylleptosoma	46,334	48,607	71,041	49,250	50,366	30,338		15,629	27,679	
			Navicula veneta						80,901	49,171	7,814		
			Navicula wiesneri							98,342	31,257	83,036	
		Pinnulariaceae	*Caloneis silicula*					7,749	20,225	24,586			
			Pinnularia borealis			5,920							
			Pinnularia subrostrata	3,861									
		Surirellaceae	*Surirella angusta*	146,726	36,455	71,041	29,550	116,230					
			Surirella brebissonii	119,697	125,568	88,802	364,450	197,591	80,901	282,734	125,029	304,464	224,580
			Surirella minuta	27,028			9,850	38,743					
		Tabellariaceae	*Tabellaria fenestrata*						12,293			9,226	
			(undifferentiated)	291,560	41,474	109,108	98,500	173,360	210,133	157,600	78,800	137,900	59,100
Chlorophyceae	Chlorococcales	Microsporaceae	*Microspora pachyderma*						945,600	1,985,760			847,100
Myxophyceae	Chroococcales	Chamaesiphonaceae	*Chamaesiphon sp.*							1,765,120			
	Oscillatoriales	Phormidiaceae	*Phormidium sp.*	1,063,800		157,600			4,281,467	1,670,560	610,700		
			Phormidium uncinatum		1,235,916	1,115,323		126,080				2,580,700	
		Pseudanabaenaceae	*Leptolyngbya sp.*						43,681,467	41,574,880	17,651,200	3,999,100	3,723,300
			Pseudanabaena catenata								1,477,500		
Rhodophyceae	Nemalionales	Chantransiacea	*Audouinella pygmaea*		439,621	715,262		425,520					
			Taxa Total	25	23	27	19	29	37	40	38	37	27

Table D.2: Summary statistics for periphyton collected at lower Minto Creek and lower Wolverine Creek stations, Minto Mine WUL, 2013. All data are presented in number/sample.

				Lower Minto Creek (Exposure)					Lower Wolverine Creek (Reference)				
Class	Order	Family	Genera and Species	Mean	Median	Minimum	Maximum	Standard Deviation	Mean	Median	Minimum	Maximum	Standard Deviation
Bacillariophyceae	Centrales	Melosiraceae	*Melosira varians*						34,342	18,452	10,113	102,933	38,696
	Pennales	Achnanthaceae	*Cocconeis placentula*						20,292	10,113	7,814	37,430	15,416
			Karayevia amoena						1,845	0	0	9,226	4,126
			Planothidium frequentissimum	7,470	0	0	29,601	12,818	66,772	73,757	30,338	84,218	22,154
			Planothidium haynaldii	1,544	0	0	7,722	3,454					
		Achnanthidiaceae	*Achnanthidium minutissimum*						97,511	93,575	60,676	135,221	30,301
			Eucocconeis laevis						37,991	50,563	0	64,583	29,876
		Amphipleuraceae	*Frustulia rhomboides*						1,872	0	0	9,358	4,185
			Frustulia vulgaris	18,682	17,760	0	46,492	17,332	6,149	0	0	18,452	8,697
		Bacillariaceae	*Nitzschia acicularis*						3,126	0	0	15,629	6,989
			Nitzschia acula	13,301	3,861	0	39,400	17,486	8,043	0	0	24,586	11,459
			Nitzschia aequorea	53,642	0	0	247,957	108,979					
			Nitzschia bergii	47,938	41,441	0	105,316	43,478	19,267	18,452	0	40,451	19,505
			Nitzschia dissipata						1,368,182	904,164	789,248	2,710,195	816,356
			Nitzschia homburgiensis						27,711	0	0	122,928	53,656
			Nitzschia incognita						99,447	92,262	28,073	187,544	56,964
			Nitzschia linearis	206,298	154,448	0	551,600	235,178	7,376	0	0	36,878	16,493
			Nitzschia paleaeformis	172,889	193,717	53,281	324,341	117,483	15,902	0	0	49,171	22,770
			Nitzschia perminuta						46,068	62,515	10,113	73,757	29,455
			Nitzschia pusilla	55,173	41,441	19,700	129,619	42,833	27,776	24,586	0	83,036	33,981
			Nitzschia sublinearis	46,675	0	0	174,176	75,745	215,178	233,938	111,239	312,573	79,952
		Cymbellaceae	*Cymbella gracilis*						21,742	9,358	0	80,901	33,946
			Cymbopleura linearis	9,009	8,101	0	19,372	6,923					
			Encyonema minutum	11,800	11,840	0	19,372	7,348	299,994	319,613	222,479	364,943	61,488
		Diadesmidaceae	*Luticola goeppertiana*	1,563,183	765,563	418,428	3,871,050	1,435,951	58,808	49,171	0	121,352	48,325
			Luticola mutica	20,497	9,850	0	81,012	34,258	345,298	121,352	12,293	1,291,663	534,048
		Eunotiaceae	*Eunotia arculus*	775	0	0	3,874	1,733					
			Eunotia praerupta	6,693	7,722	0	11,840	4,725					
			Eunotia rhomboidea	9,440	11,623	0	12,152	5,282					
		Fragilariaceae	*Diatoma moniliformis*	4,736	0	0	23,680	10,590	1,328,580	1,356,838	608,927	2,052,898	521,626
			Fragilaria alpestris	25,655	23,680	0	54,241	22,077	52,909	46,131	15,629	98,342	37,244
			Fragilaria capucina	1,547	0	0	3,874	2,118	13,933	15,629	0	24,586	9,647
			Fragilaria vaucheriae	7,825	0	0	23,680	11,103	1,563	0	0	7,814	3,495
			Hannaea arcus						55,346	36,905	23,443	112,290	37,299
			Meridion circulare	16,298	17,760	0	32,405	11,839	143,052	129,166	40,451	233,938	88,580
			Ulnaria acus	1,959	0	0	5,920	2,778	29,859	9,226	0	70,789	33,457
			Ulnaria ulna						621,909	455,070	313,690	1,106,352	341,823

Table D.2: Summary statistics for periphyton collected at lower Minto Creek and lower Wolverine Creek stations, Minto Mine WUL, 2013. All data are presented in number/sample.

				Lower Minto Creek (Exposure)					Lower Wolverine Creek (Reference)				
Class	Order	Family	Genera and Species	Mean	Median	Minimum	Maximum	Standard Deviation	Mean	Median	Minimum	Maximum	Standard Deviation
Bacillariophyceae	Pennales	Gomphonemataceae	*Gomphoneis olivaceum*						25,091	10,113	0	74,860	30,086
			Gomphonema angustatum	3,861	0	0	19,306	8,634					
			Gomphonema lagerheimii	144,137	58,115	0	522,527	214,602	124,961	117,215	80,901	168,435	33,948
			Gomphonema minutum						51,516	62,515	0	101,488	49,231
			Reimeria sinuata	5,595	0	0	20,253	8,850	9,403	0	0	36,905	15,985
		Naviculaceae	*Adlafia minuscula*	3,552	0	0	17,760	7,943	12,864	10,113	0	27,679	10,633
			Eolimna minima						810	0	0	4,051	1,811
			Mayamaea permitis						8,043	0	0	24,586	11,459
			Navicula aquaedurae	293,452	285,650	141,771	393,842	98,454	25,991	0	0	111,239	48,339
			Navicula capitatoradiata						4,917	0	0	24,586	10,995
			Navicula gregaria	218,240	223,950	34,869	402,567	159,197	190,397	196,685	131,465	243,295	52,994
			Navicula phylleptosoma	53,120	49,250	46,334	71,041	10,126	14,729	15,629	0	30,338	14,543
			Navicula veneta						27,577	7,814	0	80,901	36,129
			Navicula wiesneri						42,527	31,257	0	98,342	46,099
		Pinnulariaceae	*Caloneis silicula*	1,550	0	0	7,749	3,465	8,962	0	0	24,586	12,368
			Pinnularia borealis	1,184	0	0	5,920	2,648					
			Pinnularia subrostrata	772	0	0	3,861	1,727					
		Surirellaceae	*Surirella angusta*	80,000	71,041	29,550	146,726	50,711					
			Surirella brebissonii	179,222	125,568	88,802	364,450	110,956	203,542	224,580	80,901	304,464	97,601
			Surirella minuta	15,124	9,850	0	38,743	17,211					
		Tabellariaceae	*Tabellaria fenestrata*						4,304	0	0	12,293	5,992
			(undifferentiated)	142,800	109,108	41,474	291,560	95,431	128,707	137,900	59,100	210,133	61,003
Chlorophyceae	Chlorococcales	Microsporaceae	*Microspora pachyderma*						755,692	847,100	0	1,985,760	821,527
Myxophyceae	Chroococcales	Chamaesiphonaceae	*Chamaesiphon sp.*						353,024	0	0	1,765,120	789,386
	Oscillatoriales	Phormidiaceae	*Phormidium sp.*	244,280	0	0	1,063,800	463,180	1,312,545	610,700	0	4,281,467	1,794,492
			Phormidium uncinatum	495,464	126,080	0	1,235,916	624,481	516,140	0	0	2,580,700	1,154,124
		Pseudanabaenaceae	*Leptolyngbya sp.*						22,125,989	17,651,200	3,723,300	43,681,467	19,558,660
			Pseudanabaena catenata						295,500	0	0	1,477,500	660,758
Rhodophyceae	Nemalionales	Chantransiacea	*Audouinella pygmaea*	316,081	425,520	0	715,262	310,805					

Table D.3: Presence/absence of periphyton taxa at lower Minto Creek (exposure) and lower Wolverine Creek (reference), Minto Mine WUL, 2013.

				Lower Minto Creek (Exposure)					Lower Wolverine Creek (Reference)				
Sample Site				LMC-1	LMC-2	LMC-3	LMC-4	LMC-5	LWC-1	LWC-2	LWC-3	LWC-4	LWC-5
Sampling Date				5-Sep-12	5-Sep-12	5-Sep-12	5-Sep-12	5-Sep-12	7-Sep-12	7-Sep-12	7-Sep-12	7-Sep-12	7-Sep-12
Class	Order	Family	Genera and Species										
Bacillariophyceae	Centrales	Melosiraceae	*Melosira varians*	0	0	0	0	0	1	1	1	1	1
	Pennales	Achnanthaceae	*Cocconeis placentula*	0	0	0	0	0	1	1	1	1	1
			Karayevia amoena	0	0	0	0	0	0	0	0	1	0
			Planothidium frequentissimum	0	0	1	0	1	1	1	1	1	1
			Planothidium haynaldii	1	0	0	0	0	0	0	0	0	0
		Achnanthidiaceae	*Achnanthidium minutissimum*	0	0	0	0	0	1	1	1	1	1
			Eucocconeis laevis	0	0	0	0	0	1	1	1	1	0
		Amphipleuraceae	*Frustulia rhomboides*	0	0	0	0	0	0	0	0	0	1
			Frustulia vulgaris	1	0	1	1	1	0	1	0	1	0
		Bacillariaceae	*Nitzschia acicularis*	0	0	0	0	0	0	0	1	0	0
			Nitzschia acula	1	0	0	1	1	0	1	1	0	0
			Nitzschia aequorea	0	1	0	0	1	0	0	0	0	0
			Nitzschia bergii	1	1	1	0	1	1	0	0	1	1
			Nitzschia dissipata	0	0	0	0	0	1	1	1	1	1
			Nitzschia homburgiensis	0	0	0	0	0	0	1	1	0	0
			Nitzschia incognita	0	0	0	0	0	1	1	1	1	1
			Nitzschia linearis	1	0	0	1	1	0	1	0	0	0
			Nitzschia paleaeformis	1	1	1	1	1	1	1	0	0	0
			Nitzschia perminuta	0	0	0	0	0	1	1	1	1	1
			Nitzschia pusilla	1	1	1	1	1	0	1	1	1	0
			Nitzschia sublinearis	0	1	1	0	0	1	1	1	1	1
		Cymbellaceae	*Cymbella gracilis*	0	0	0	0	0	1	0	0	1	1
			Cymbopleura linearis	1	1	0	1	1	0	0	0	0	0
			Encyonema minutum	1	1	1	0	1	1	1	1	1	1
		Diadesmidaceae	*Luticola goeppertiana*	1	1	1	1	1	1	1	1	1	0
			Luticola mutica	0	1	0	1	1	1	1	1	1	1
		Eunotiaceae	*Eunotia arculus*	0	0	0	0	1	0	0	0	0	0
			Eunotia praerupta	1	1	1	1	0	0	0	0	0	0
			Eunotia rhomboidea	1	1	1	0	1	0	0	0	0	0
		Fragilariaceae	*Diatoma moniliformis*	0	0	1	0	0	1	1	1	1	1
			Fragilaria alpestris	0	1	1	1	1	1	1	1	1	1
			Fragilaria capucina	1	0	0	0	1	1	1	1	1	0
			Fragilaria vaucheriae	1	0	1	0	0	0	0	1	0	0
			Hannaea arcus	0	0	0	0	0	1	1	1	1	1
			Meridion circulare	0	1	1	1	1	1	1	1	1	1
			Ulnaria acus	0	0	1	0	1	1	1	1	1	0
			Ulnaria ulna	0	0	0	0	0	1	1	1	1	1

Table D.3: Presence/absence of periphyton taxa at lower Minto Creek (exposure) and lower Wolverine Creek (reference), Minto Mine WUL, 2013.

				Lower Minto Creek (Exposure)					Lower Wolverine Creek (Reference)				
			Sample Site	LMC-1	LMC-2	LMC-3	LMC-4	LMC-5	LWC-1	LWC-2	LWC-3	LWC-4	LWC-5
			Sampling Date	5-Sep-12	5-Sep-12	5-Sep-12	5-Sep-12	5-Sep-12	7-Sep-12	7-Sep-12	7-Sep-12	7-Sep-12	7-Sep-12
Class	Order	Family	Genera and Species										
Bacillariophyceae	Pennales	Gomphonemataceae	*Gomphoneis olivaceum*	0	0	0	0	0	1	0	1	1	1
			Gomphonema angustatum	1	0	0	0	0	0	0	0	0	0
			Gomphonema lagerheimii	0	1	1	1	1	1	1	1	1	1
			Gomphonema minutum	0	0	0	0	0	0	1	1	1	0
			Reimeria sinuata	1	1	0	0	0	1	0	0	1	0
		Naviculaceae	*Adlafia minuscula*	0	0	1	0	0	1	0	1	1	1
			Eolimna minima	0	0	0	0	0	0	1	0	0	0
			Mayamaea permitis	0	0	0	0	0	0	1	1	0	0
			Navicula aquaedurae	1	1	1	1	1	1	0	0	0	1
			Navicula capitatoradiata	0	0	0	0	0	0	1	0	0	0
			Navicula gregaria	1	1	1	1	1	1	1	1	1	1
			Navicula phylleptosoma	1	1	1	1	1	1	0	1	1	0
			Navicula veneta	0	0	0	0	0	1	1	1	0	0
			Navicula wiesneri	0	0	0	0	0	0	1	1	1	0
		Pinnulariaceae	*Caloneis silicula*	0	0	0	0	1	1	1	0	0	0
			Pinnularia borealis	0	0	1	0	0	0	0	0	0	0
			Pinnularia subrostrata	1	0	0	0	0	0	0	0	0	0
		Surirellaceae	*Surirella angusta*	1	1	1	1	1	0	0	0	0	0
			Surirella brebissonii	1	1	1	1	1	1	1	1	1	1
			Surirella minuta	1	0	0	1	1	0	0	0	0	0
		Tabellariaceae	*Tabellaria fenestrata*	0	0	0	0	0	1	0	0	1	0
			(undifferentiated)	1	1	1	1	1	1	1	1	1	1
Chlorophyceae	Chlorococcales	Microsporaceae	*Microspora pachyderma*	0	0	0	0	0	1	1	0	0	1
Myxophyceae	Chroococcales	Chamaesiphonaceae	*Chamaesiphon sp.*	0	0	0	0	0	0	1	0	0	0
	Oscillatoriales	Phormidiaceae	*Phormidium sp.*	1	0	1	0	0	1	1	1	0	0
			Phormidium uncinatum	0	1	1	0	1	0	0	0	1	0
		Pseudanabaenaceae	*Leptolyngbya sp.*	0	0	0	0	0	1	1	1	1	1
			Pseudanabaena catenata	0	0	0	0	0	0	0	1	0	0
Rhodophyceae	Nemalionales	Chantransiacea	*Audouinella pygmaea*	0	1	1	0	1	0	0	0	0	0
			Taxa Total	25	23	27	19	29	37	40	38	37	27

Table D.4: ANOVA test between lower Minto Ceek (exposure) and lower Wolverine Creek (reference) areas, Minto Mine WUL, 2013.

Metric	Significant Difference Between Areas? ($p<0.1$)	p-value	Mean Lower Minto Creek	Mean Lower Wolverine Creek	Mean Difference (LWC-LMC)	Power[a]	Magnitude of Difference (# of SDs)[b]	Minimum Detectable Effect Size[a] (# of SDs)[b]
Number of Taxa[c]	Yes	0.006/0.021[c]	23.8	34.8	11	1.000	-2.170	-
Simpson's Diversity	No	0.105	0.795	0.579	-0.216	1.000	-	1.599
Simpson's Evenness	Yes	0.035	0.264	0.103	-0.161	1.000	2.014	-
Bray-Curtis Distance	Yes	0.000	0.940	0.384	-0.557	1.000	2.979	-

[a] power and minimum detectable effect size were calculated using alpha = 0.10

[b] relative to number of reference standard deviations

[c] data were not found to be normal so an ANOVA and a Mann-Whitney U test values were presented

Note: all data were used to calculate densities. Data used to calculate other metrics were reduced to exclude unidentified Pennales which were cells not clearly visible under the microscope,

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EcoAnalysts Sample ID	Sample ID	Collection Date	Collection Area (m²)	Volume Received (mL)	Percent Counted	Taxon	Class	Order	Family	Genus	Species
6622.01-01	LMC-1	13-Sep-13		20	0.01269%	(undifferentiated) diatoms> (dead)	Bacillariophyceae			(undifferentiated)	diatoms>
6622.01-01	LMC-1	13-Sep-13		20	0.01269%	Phormidium sp.	Myxophyceae	Oscillatoriales	Phormidiaceae	Phormidium	sp.
6622.01-01	LMC-1	13-Sep-13		20	0.01269%	Cymbopleura linearis	Bacillariophyceae	Pennales	Cymbellaceae	Cymbopleura	linearis
6622.01-01	LMC-1	13-Sep-13		20	0.01269%	Encyonema minutum	Bacillariophyceae	Pennales	Cymbellaceae	Encyonema	minutum
6622.01-01	LMC-1	13-Sep-13		20	0.01269%	Eunotia praerupta	Bacillariophyceae	Pennales	Eunotiaceae	Eunotia	praerupta
6622.01-01	LMC-1	13-Sep-13		20	0.01269%	Eunotia rhomboidea	Bacillariophyceae	Pennales	Eunotiaceae	Eunotia	rhomboidea
6622.01-01	LMC-1	13-Sep-13		20	0.01269%	Fragilaria capucina var. gracilis	Bacillariophyceae	Pennales	Fragilariaceae	Fragilaria	capucina
6622.01-01	LMC-1	13-Sep-13		20	0.01269%	Fragilaria vaucheriae	Bacillariophyceae	Pennales	Fragilariaceae	Fragilaria	vaucheriae
6622.01-01	LMC-1	13-Sep-13		20	0.01269%	Frustulia vulgaris	Bacillariophyceae	Pennales	Amphipleuraceae	Frustulia	vulgaris
6622.01-01	LMC-1	13-Sep-13		20	0.01269%	Gomphonema angustatum	Bacillariophyceae	Pennales	Gomphonemataceae	Gomphonema	angustatum
6622.01-01	LMC-1	13-Sep-13		20	0.01269%	Luticola goeppertiana	Bacillariophyceae	Pennales	Diadesmidaceae	Luticola	goeppertiana
6622.01-01	LMC-1	13-Sep-13		20	0.01269%	Navicula aquaedurae	Bacillariophyceae	Pennales	Naviculaceae	Navicula	aquaedurae
6622.01-01	LMC-1	13-Sep-13		20	0.01269%	Navicula gregaria	Bacillariophyceae	Pennales	Naviculaceae	Navicula	gregaria
6622.01-01	LMC-1	13-Sep-13		20	0.01269%	Navicula phylleptosoma	Bacillariophyceae	Pennales	Naviculaceae	Navicula	phylleptosoma
6622.01-01	LMC-1	13-Sep-13		20	0.01269%	Nitzschia acula	Bacillariophyceae	Pennales	Bacillariaceae	Nitzschia	acula
6622.01-01	LMC-1	13-Sep-13		20	0.01269%	Nitzschia bergii	Bacillariophyceae	Pennales	Bacillariaceae	Nitzschia	bergii
6622.01-01	LMC-1	13-Sep-13		20	0.01269%	Nitzschia linearis	Bacillariophyceae	Pennales	Bacillariaceae	Nitzschia	linearis
6622.01-01	LMC-1	13-Sep-13		20	0.01269%	Nitzschia paleaeformis	Bacillariophyceae	Pennales	Bacillariaceae	Nitzschia	paleaeformis
6622.01-01	LMC-1	13-Sep-13		20	0.01269%	Nitzschia pusilla	Bacillariophyceae	Pennales	Bacillariaceae	Nitzschia	pusilla
6622.01-01	LMC-1	13-Sep-13		20	0.01269%	Pinnularia subrostrata	Bacillariophyceae	Pennales	Pinnulariaceae	Pinnularia	subrostrata
6622.01-01	LMC-1	13-Sep-13		20	0.01269%	Planothidium haynaldii	Bacillariophyceae	Pennales	Achnanthaceae	Planothidium	haynaldii
6622.01-01	LMC-1	13-Sep-13		20	0.01269%	Reimeria sinuata	Bacillariophyceae	Pennales	Gomphonemataceae	Reimeria	sinuata
6622.01-01	LMC-1	13-Sep-13		20	0.01269%	Surirella angusta	Bacillariophyceae	Pennales	Surirellaceae	Surirella	angusta
6622.01-01	LMC-1	13-Sep-13		20	0.01269%	Surirella brebissonii	Bacillariophyceae	Pennales	Surirellaceae	Surirella	brebissonii
6622.01-01	LMC-1	13-Sep-13		20	0.01269%	Surirella minuta	Bacillariophyceae	Pennales	Surirellaceae	Surirella	minuta
6622.01-02	LMC-2	13-Sep-13		20	0.01206%	(undifferentiated) diatoms> (dead)	Bacillariophyceae			(undifferentiated)	diatoms>
6622.01-02	LMC-2	13-Sep-13		20	0.01206%	Audouinella pygmaea	Rhodophyceae	Nemalionales	Chantransiacea	Audouinella	pygmaea
6622.01-02	LMC-2	13-Sep-13		20	0.01206%	Phormidium uncinatum	Myxophyceae	Oscillatoriales	Phormidiaceae	Phormidium	uncinatum
6622.01-02	LMC-2	13-Sep-13		20	0.01206%	Cymbopleura linearis	Bacillariophyceae	Pennales	Cymbellaceae	Cymbopleura	linearis
6622.01-02	LMC-2	13-Sep-13		20	0.01206%	Encyonema minutum	Bacillariophyceae	Pennales	Cymbellaceae	Encyonema	minutum
6622.01-02	LMC-2	13-Sep-13		20	0.01206%	Eolimna minima	Bacillariophyceae	Pennales	Naviculaceae	Eolimna	minima
6622.01-02	LMC-2	13-Sep-13		20	0.01206%	Eunotia praerupta	Bacillariophyceae	Pennales	Eunotiaceae	Eunotia	praerupta
6622.01-02	LMC-2	13-Sep-13		20	0.01206%	Eunotia rhomboidea	Bacillariophyceae	Pennales	Eunotiaceae	Eunotia	rhomboidea
6622.01-02	LMC-2	13-Sep-13		20	0.01206%	Fragilaria alpestris	Bacillariophyceae	Pennales	Fragilariaceae	Fragilaria	alpestris
6622.01-02	LMC-2	13-Sep-13		20	0.01206%	Gomphonema lagerheimii	Bacillariophyceae	Pennales	Gomphonemataceae	Gomphonema	lagerheimii
6622.01-02	LMC-2	13-Sep-13		20	0.01206%	Luticola goeppertiana	Bacillariophyceae	Pennales	Diadesmidaceae	Luticola	goeppertiana
6622.01-02	LMC-2	13-Sep-13		20	0.01206%	Luticola mutica	Bacillariophyceae	Pennales	Diadesmidaceae	Luticola	mutica
6622.01-02	LMC-2	13-Sep-13		20	0.01206%	Meridion circulare	Bacillariophyceae	Pennales	Fragilariaceae	Meridion	circulare
6622.01-02	LMC-2	13-Sep-13		20	0.01206%	Navicula aquaedurae	Bacillariophyceae	Pennales	Naviculaceae	Navicula	aquaedurae
6622.01-02	LMC-2	13-Sep-13		20	0.01206%	Navicula gregaria	Bacillariophyceae	Pennales	Naviculaceae	Navicula	gregaria
6622.01-02	LMC-2	13-Sep-13		20	0.01206%	Navicula phylleptosoma	Bacillariophyceae	Pennales	Naviculaceae	Navicula	phylleptosoma
6622.01-02	LMC-2	13-Sep-13		20	0.01206%	Nitzschia aequorea	Bacillariophyceae	Pennales	Bacillariaceae	Nitzschia	aequorea
6622.01-02	LMC-2	13-Sep-13		20	0.01206%	Nitzschia bergii	Bacillariophyceae	Pennales	Bacillariaceae	Nitzschia	bergii
6622.01-02	LMC-2	13-Sep-13		20	0.01206%	Nitzschia paleaeformis	Bacillariophyceae	Pennales	Bacillariaceae	Nitzschia	paleaeformis
6622.01-02	LMC-2	13-Sep-13		20	0.01206%	Nitzschia pusilla	Bacillariophyceae	Pennales	Bacillariaceae	Nitzschia	pusilla
6622.01-02	LMC-2	13-Sep-13		20	0.01206%	Nitzschia sublinearis	Bacillariophyceae	Pennales	Bacillariaceae	Nitzschia	sublinearis
6622.01-02	LMC-2	13-Sep-13		20	0.01206%	Reimeria sinuata	Bacillariophyceae	Pennales	Gomphonemataceae	Reimeria	sinuata
6622.01-02	LMC-2	13-Sep-13		20	0.01206%	Surirella angusta	Bacillariophyceae	Pennales	Surirellaceae	Surirella	angusta
6622.01-02	LMC-2	13-Sep-13		20	0.01206%	Surirella brebissonii	Bacillariophyceae	Pennales	Surirellaceae	Surirella	brebissonii

Minnow Environmental Yukon Algae 2013
Taxa Report

EcoAnalysts, Inc.

EcoAnalysts Sample ID	Sample ID	Collection Date	Collection Area (m²)	Volume Received (mL)	Percent Counted	Taxon	Class	Order	Family	Genus	Species
6622.01-03	LMC-3	13-Sep-13		20	0.00825%	(undifferentiated) diatoms> (dead)	Bacillariophyceae			(undifferentiated)	diatoms>
6622.01-03	LMC-3	13-Sep-13		20	0.00825%	Audouinella pygmaea	Rhodophyceae	Nemalionales	Chantransiacea	Audouinella	pygmaea
6622.01-03	LMC-3	13-Sep-13		20	0.00825%	Phormidium sp.	Myxophyceae	Oscillatoriales	Phormidiaceae	Phormidium	sp.
6622.01-03	LMC-3	13-Sep-13		20	0.00825%	Phormidium uncinatum	Myxophyceae	Oscillatoriales	Phormidiaceae	Phormidium	uncinatum
6622.01-03	LMC-3	13-Sep-13		20	0.00825%	Adlafia minuscula	Bacillariophyceae	Pennales	Naviculaceae	Adlafia	minuscula
6622.01-03	LMC-3	13-Sep-13		20	0.00825%	Diatoma moniliformis	Bacillariophyceae	Pennales	Fragilariaceae	Diatoma	moniliformis
6622.01-03	LMC-3	13-Sep-13		20	0.00825%	Encyonema minutum	Bacillariophyceae	Pennales	Cymbellaceae	Encyonema	minutum
6622.01-03	LMC-3	13-Sep-13		20	0.00825%	Eunotia praerupta	Bacillariophyceae	Pennales	Eunotiaceae	Eunotia	praerupta
6622.01-03	LMC-3	13-Sep-13		20	0.00825%	Eunotia rhomboidea	Bacillariophyceae	Pennales	Eunotiaceae	Eunotia	rhomboidea
6622.01-03	LMC-3	13-Sep-13		20	0.00825%	Fragilaria alpestris	Bacillariophyceae	Pennales	Fragilariaceae	Fragilaria	alpestris
6622.01-03	LMC-3	13-Sep-13		20	0.00825%	Fragilaria vaucheriae	Bacillariophyceae	Pennales	Fragilariaceae	Fragilaria	vaucheriae
6622.01-03	LMC-3	13-Sep-13		20	0.00825%	Frustulia vulgaris	Bacillariophyceae	Pennales	Amphipleuraceae	Frustulia	vulgaris
6622.01-03	LMC-3	13-Sep-13		20	0.00825%	Gomphonema lagerheimii	Bacillariophyceae	Pennales	Gomphonemataceae	Gomphonema	lagerheimii
6622.01-03	LMC-3	13-Sep-13		20	0.00825%	Luticola goeppertiana	Bacillariophyceae	Pennales	Diadesmidaceae	Luticola	goeppertiana
6622.01-03	LMC-3	13-Sep-13		20	0.00825%	Meridion circulare	Bacillariophyceae	Pennales	Fragilariaceae	Meridion	circulare
6622.01-03	LMC-3	13-Sep-13		20	0.00825%	Navicula aquaedurae	Bacillariophyceae	Pennales	Naviculaceae	Navicula	aquaedurae
6622.01-03	LMC-3	13-Sep-13		20	0.00825%	Navicula gregaria	Bacillariophyceae	Pennales	Naviculaceae	Navicula	gregaria
6622.01-03	LMC-3	13-Sep-13		20	0.00825%	Navicula phylleptosoma	Bacillariophyceae	Pennales	Naviculaceae	Navicula	phylleptosoma
6622.01-03	LMC-3	13-Sep-13		20	0.00825%	Nitzschia bergii	Bacillariophyceae	Pennales	Bacillariaceae	Nitzschia	bergii
6622.01-03	LMC-3	13-Sep-13		20	0.00825%	Nitzschia paleaeformis	Bacillariophyceae	Pennales	Bacillariaceae	Nitzschia	paleaeformis
6622.01-03	LMC-3	13-Sep-13		20	0.00825%	Nitzschia pusilla	Bacillariophyceae	Pennales	Bacillariaceae	Nitzschia	pusilla
6622.01-03	LMC-3	13-Sep-13		20	0.00825%	Nitzschia sublinearis	Bacillariophyceae	Pennales	Bacillariaceae	Nitzschia	sublinearis
6622.01-03	LMC-3	13-Sep-13		20	0.00825%	Pinnularia borealis	Bacillariophyceae	Pennales	Pinnulariaceae	Pinnularia	borealis
6622.01-03	LMC-3	13-Sep-13		20	0.00825%	Planothidium frequentissimum	Bacillariophyceae	Pennales	Achnanthaceae	Planothidium	frequentissimum
6622.01-03	LMC-3	13-Sep-13		20	0.00825%	Surirella angusta	Bacillariophyceae	Pennales	Surirellaceae	Surirella	angusta
6622.01-03	LMC-3	13-Sep-13		20	0.00825%	Surirella brebissonii	Bacillariophyceae	Pennales	Surirellaceae	Surirella	brebissonii
6622.01-03	LMC-3	13-Sep-13		20	0.00825%	Ulnaria acus	Bacillariophyceae	Pennales	Fragilariaceae	Ulnaria	acus
6622.01-04	LMC-4	10-Sep-13		20	0.00508%	(undifferentiated) diatoms> (dead)	Bacillariophyceae			(undifferentiated)	diatoms>
6622.01-04	LMC-4	10-Sep-13		20	0.00508%	Cymbopleura linearis	Bacillariophyceae	Pennales	Cymbellaceae	Cymbopleura	linearis
6622.01-04	LMC-4	10-Sep-13		20	0.00508%	Eunotia praerupta	Bacillariophyceae	Pennales	Eunotiaceae	Eunotia	praerupta
6622.01-04	LMC-4	10-Sep-13		20	0.00508%	Fragilaria alpestris	Bacillariophyceae	Pennales	Fragilariaceae	Fragilaria	alpestris
6622.01-04	LMC-4	10-Sep-13		20	0.00508%	Frustulia vulgaris	Bacillariophyceae	Pennales	Amphipleuraceae	Frustulia	vulgaris
6622.01-04	LMC-4	10-Sep-13		20	0.00508%	Gomphonema lagerheimii	Bacillariophyceae	Pennales	Gomphonemataceae	Gomphonema	lagerheimii
6622.01-04	LMC-4	10-Sep-13		20	0.00508%	Luticola goeppertiana	Bacillariophyceae	Pennales	Diadesmidaceae	Luticola	goeppertiana
6622.01-04	LMC-4	10-Sep-13		20	0.00508%	Luticola mutica	Bacillariophyceae	Pennales	Diadesmidaceae	Luticola	mutica
6622.01-04	LMC-4	10-Sep-13		20	0.00508%	Meridion circulare	Bacillariophyceae	Pennales	Fragilariaceae	Meridion	circulare
6622.01-04	LMC-4	10-Sep-13		20	0.00508%	Navicula aquaedurae	Bacillariophyceae	Pennales	Naviculaceae	Navicula	aquaedurae
6622.01-04	LMC-4	10-Sep-13		20	0.00508%	Navicula gregaria	Bacillariophyceae	Pennales	Naviculaceae	Navicula	gregaria
6622.01-04	LMC-4	10-Sep-13		20	0.00508%	Navicula phylleptosoma	Bacillariophyceae	Pennales	Naviculaceae	Navicula	phylleptosoma
6622.01-04	LMC-4	10-Sep-13		20	0.00508%	Nitzschia acula	Bacillariophyceae	Pennales	Bacillariaceae	Nitzschia	acula
6622.01-04	LMC-4	10-Sep-13		20	0.00508%	Nitzschia linearis	Bacillariophyceae	Pennales	Bacillariaceae	Nitzschia	linearis
6622.01-04	LMC-4	10-Sep-13		20	0.00508%	Nitzschia paleaeformis	Bacillariophyceae	Pennales	Bacillariaceae	Nitzschia	paleaeformis
6622.01-04	LMC-4	10-Sep-13		20	0.00508%	Nitzschia pusilla	Bacillariophyceae	Pennales	Bacillariaceae	Nitzschia	pusilla
6622.01-04	LMC-4	10-Sep-13		20	0.00508%	Surirella angusta	Bacillariophyceae	Pennales	Surirellaceae	Surirella	angusta
6622.01-04	LMC-4	10-Sep-13		20	0.00508%	Surirella brebissonii	Bacillariophyceae	Pennales	Surirellaceae	Surirella	brebissonii
6622.01-04	LMC-4	10-Sep-13		20	0.00508%	Surirella minuta	Bacillariophyceae	Pennales	Surirellaceae	Surirella	minuta

Minnow Environmental Yukon Algae 2013
Taxa Report

EcoAnalysts, Inc.

EcoAnalysts Sample ID	Sample ID	Collection Date	Collection Area (m^2)	Volume Received (mL)	Percent Counted	Taxon	Class	Order	Family	Genus	Species
6622.01-05	LMC-5	10-Sep-13		20	0.01269%	(undifferentiated) diatoms> (dead)	Bacillariophyceae			(undifferentiated)	diatoms>
6622.01-05	LMC-5	10-Sep-13		20	0.01269%	Audouinella pygmaea	Rhodophyceae	Nemalionales	Chantransiacea	Audouinella	pygmaea
6622.01-05	LMC-5	10-Sep-13		20	0.01269%	Leptolyngbya sp.	Myxophyceae	Oscillatoriales	Pseudanabaenaceae	Leptolyngbya	sp.
6622.01-05	LMC-5	10-Sep-13		20	0.01269%	Phormidium uncinatum	Myxophyceae	Oscillatoriales	Phormidiaceae	Phormidium	uncinatum
6622.01-05	LMC-5	10-Sep-13		20	0.01269%	Caloneis silicula	Bacillariophyceae	Pennales	Pinnulariaceae	Caloneis	silicula
6622.01-05	LMC-5	10-Sep-13		20	0.01269%	Cymbopleura linearis	Bacillariophyceae	Pennales	Cymbellaceae	Cymbopleura	linearis
6622.01-05	LMC-5	10-Sep-13		20	0.01269%	Encyonema minutum	Bacillariophyceae	Pennales	Cymbellaceae	Encyonema	minutum
6622.01-05	LMC-5	10-Sep-13		20	0.01269%	Encyonema silesiacum	Bacillariophyceae	Pennales	Cymbellaceae	Encyonema	silesiacum
6622.01-05	LMC-5	10-Sep-13		20	0.01269%	Eunotia arculus	Bacillariophyceae	Pennales	Eunotiaceae	Eunotia	arculus
6622.01-05	LMC-5	10-Sep-13		20	0.01269%	Eunotia rhomboidea	Bacillariophyceae	Pennales	Eunotiaceae	Eunotia	rhomboidea
6622.01-05	LMC-5	10-Sep-13		20	0.01269%	Fragilaria alpestris	Bacillariophyceae	Pennales	Fragilariaceae	Fragilaria	alpestris
6622.01-05	LMC-5	10-Sep-13		20	0.01269%	Fragilaria capucina var. gracilis	Bacillariophyceae	Pennales	Fragilariaceae	Fragilaria	capucina
6622.01-05	LMC-5	10-Sep-13		20	0.01269%	Frustulia vulgaris	Bacillariophyceae	Pennales	Amphipleuraceae	Frustulia	vulgaris
6622.01-05	LMC-5	10-Sep-13		20	0.01269%	Gomphonema lagerheimii	Bacillariophyceae	Pennales	Gomphonemataceae	Gomphonema	lagerheimii
6622.01-05	LMC-5	10-Sep-13		20	0.01269%	Luticola goeppertiana	Bacillariophyceae	Pennales	Diadesmidaceae	Luticola	goeppertiana
6622.01-05	LMC-5	10-Sep-13		20	0.01269%	Luticola mutica	Bacillariophyceae	Pennales	Diadesmidaceae	Luticola	mutica
6622.01-05	LMC-5	10-Sep-13		20	0.01269%	Meridion circulare	Bacillariophyceae	Pennales	Fragilariaceae	Meridion	circulare
6622.01-05	LMC-5	10-Sep-13		20	0.01269%	Navicula aquaedurae	Bacillariophyceae	Pennales	Naviculaceae	Navicula	aquaedurae
6622.01-05	LMC-5	10-Sep-13		20	0.01269%	Navicula gregaria	Bacillariophyceae	Pennales	Naviculaceae	Navicula	gregaria
6622.01-05	LMC-5	10-Sep-13		20	0.01269%	Navicula phylleptosoma	Bacillariophyceae	Pennales	Naviculaceae	Navicula	phylleptosoma
6622.01-05	LMC-5	10-Sep-13		20	0.01269%	Nitzschia acula	Bacillariophyceae	Pennales	Bacillariaceae	Nitzschia	acula
6622.01-05	LMC-5	10-Sep-13		20	0.01269%	Nitzschia aequorea	Bacillariophyceae	Pennales	Bacillariaceae	Nitzschia	aequorea
6622.01-05	LMC-5	10-Sep-13		20	0.01269%	Nitzschia bergii	Bacillariophyceae	Pennales	Bacillariaceae	Nitzschia	bergii
6622.01-05	LMC-5	10-Sep-13		20	0.01269%	Nitzschia linearis	Bacillariophyceae	Pennales	Bacillariaceae	Nitzschia	linearis
6622.01-05	LMC-5	10-Sep-13		20	0.01269%	Nitzschia paleaeformis	Bacillariophyceae	Pennales	Bacillariaceae	Nitzschia	paleaeformis
6622.01-05	LMC-5	10-Sep-13		20	0.01269%	Nitzschia pusilla	Bacillariophyceae	Pennales	Bacillariaceae	Nitzschia	pusilla
6622.01-05	LMC-5	10-Sep-13		20	0.01269%	Planothidium frequentissimum	Bacillariophyceae	Pennales	Achnanthaceae	Planothidium	frequentissimum
6622.01-05	LMC-5	10-Sep-13		20	0.01269%	Surirella angusta	Bacillariophyceae	Pennales	Surirellaceae	Surirella	angusta
6622.01-05	LMC-5	10-Sep-13		20	0.01269%	Surirella brebissonii	Bacillariophyceae	Pennales	Surirellaceae	Surirella	brebissonii
6622.01-05	LMC-5	10-Sep-13		20	0.01269%	Surirella minuta	Bacillariophyceae	Pennales	Surirellaceae	Surirella	minuta
6622.01-05	LMC-5	10-Sep-13		20	0.01269%	Ulnaria acus	Bacillariophyceae	Pennales	Fragilariaceae	Ulnaria	acus
6622.01-06	LWC-1	12-Sep-13		20	0.00381%	(undifferentiated) diatoms> (dead)	Bacillariophyceae			(undifferentiated)	diatoms>
6622.01-06	LWC-1	12-Sep-13		20	0.00381%	Leptolyngbya sp.	Myxophyceae	Oscillatoriales	Pseudanabaenaceae	Leptolyngbya	sp.
6622.01-06	LWC-1	12-Sep-13		20	0.00381%	Microspora pachyderma	Chlorophyceae	Chlorococcales	Microsporaceae	Microspora	pachyderma
6622.01-06	LWC-1	12-Sep-13		20	0.00381%	Phormidium sp.	Myxophyceae	Oscillatoriales	Phormidiaceae	Phormidium	sp.
6622.01-06	LWC-1	12-Sep-13		20	0.00381%	Achnanthidium minutissimum	Bacillariophyceae	Pennales	Achnanthidiaceae	Achnanthidium	minutissimum
6622.01-06	LWC-1	12-Sep-13		20	0.00381%	Adlafia minuscula	Bacillariophyceae	Pennales	Naviculaceae	Adlafia	minuscula
6622.01-06	LWC-1	12-Sep-13		20	0.00381%	Caloneis silicula	Bacillariophyceae	Pennales	Pinnulariaceae	Caloneis	silicula
6622.01-06	LWC-1	12-Sep-13		20	0.00381%	Cocconeis placentula	Bacillariophyceae	Pennales	Achnanthaceae	Cocconeis	placentula
6622.01-06	LWC-1	12-Sep-13		20	0.00381%	Cymbella gracilis	Bacillariophyceae	Pennales	Cymbellaceae	Cymbella	gracilis
6622.01-06	LWC-1	12-Sep-13		20	0.00381%	Diatoma moniliformis	Bacillariophyceae	Pennales	Fragilariaceae	Diatoma	moniliformis
6622.01-06	LWC-1	12-Sep-13		20	0.00381%	Encyonema minutum	Bacillariophyceae	Pennales	Cymbellaceae	Encyonema	minutum
6622.01-06	LWC-1	12-Sep-13		20	0.00381%	Eucocconeis laevis	Bacillariophyceae	Pennales	Achnanthidiaceae	Eucocconeis	laevis
6622.01-06	LWC-1	12-Sep-13		20	0.00381%	Fragilaria alpestris	Bacillariophyceae	Pennales	Fragilariaceae	Fragilaria	alpestris
6622.01-06	LWC-1	12-Sep-13		20	0.00381%	Fragilaria capucina var. gracilis	Bacillariophyceae	Pennales	Fragilariaceae	Fragilaria	capucina
6622.01-06	LWC-1	12-Sep-13		20	0.00381%	Gomphonema lagerheimii	Bacillariophyceae	Pennales	Gomphonemataceae	Gomphonema	lagerheimii
6622.01-06	LWC-1	12-Sep-13		20	0.00381%	Gomphoneis olivaceum	Bacillariophyceae	Pennales	Gomphonemataceae	Gomphoneis	olivaceum
6622.01-06	LWC-1	12-Sep-13		20	0.00381%	Hannaea arcus	Bacillariophyceae	Pennales	Fragilariaceae	Hannaea	arcus
6622.01-06	LWC-1	12-Sep-13		20	0.00381%	Luticola goeppertiana	Bacillariophyceae	Pennales	Diadesmidaceae	Luticola	goeppertiana
6622.01-06	LWC-1	12-Sep-13		20	0.00381%	Luticola mutica	Bacillariophyceae	Pennales	Diadesmidaceae	Luticola	mutica
6622.01-06	LWC-1	12-Sep-13		20	0.00381%	Melosira varians	Bacillariophyceae	Centrales	Melosiraceae	Melosira	varians
6622.01-06	LWC-1	12-Sep-13		20	0.00381%	Meridion circulare	Bacillariophyceae	Pennales	Fragilariaceae	Meridion	circulare
6622.01-06	LWC-1	12-Sep-13		20	0.00381%	Navicula aquaedurae	Bacillariophyceae	Pennales	Naviculaceae	Navicula	aquaedurae
6622.01-06	LWC-1	12-Sep-13		20	0.00381%	Navicula gregaria	Bacillariophyceae	Pennales	Naviculaceae	Navicula	gregaria
6622.01-06	LWC-1	12-Sep-13		20	0.00381%	Navicula phylleptosoma	Bacillariophyceae	Pennales	Naviculaceae	Navicula	phylleptosoma
6622.01-06	LWC-1	12-Sep-13		20	0.00381%	Navicula veneta	Bacillariophyceae	Pennales	Naviculaceae	Navicula	veneta
6622.01-06	LWC-1	12-Sep-13		20	0.00381%	Nitzschia bergii	Bacillariophyceae	Pennales	Bacillariaceae	Nitzschia	bergii
6622.01-06	LWC-1	12-Sep-13		20	0.00381%	Nitzschia dissipata	Bacillariophyceae	Pennales	Bacillariaceae	Nitzschia	dissipata
6622.01-06	LWC-1	12-Sep-13		20	0.00381%	Nitzschia incognita	Bacillariophyceae	Pennales	Bacillariaceae	Nitzschia	incognita
6622.01-06	LWC-1	12-Sep-13		20	0.00381%	Nitzschia paleaeformis	Bacillariophyceae	Pennales	Bacillariaceae	Nitzschia	paleaeformis
6622.01-06	LWC-1	12-Sep-13		20	0.00381%	Nitzschia perminuta	Bacillariophyceae	Pennales	Bacillariaceae	Nitzschia	perminuta
6622.01-06	LWC-1	12-Sep-13		20	0.00381%	Nitzschia sublinearis	Bacillariophyceae	Pennales	Bacillariaceae	Nitzschia	sublinearis
6622.01-06	LWC-1	12-Sep-13		20	0.00381%	Planothidium frequentissimum	Bacillariophyceae	Pennales	Achnanthaceae	Planothidium	frequentissimum
6622.01-06	LWC-1	12-Sep-13		20	0.00381%	Reimeria sinuata	Bacillariophyceae	Pennales	Gomphonemataceae	Reimeria	sinuata
6622.01-06	LWC-1	12-Sep-13		20	0.00381%	Surirella brebissonii	Bacillariophyceae	Pennales	Surirellaceae	Surirella	brebissonii
6622.01-06	LWC-1	12-Sep-13		20	0.00381%	Ulnaria acus	Bacillariophyceae	Pennales	Fragilariaceae	Ulnaria	acus
6622.01-06	LWC-1	12-Sep-13		20	0.00381%	Ulnaria ulna	Bacillariophyceae	Pennales	Fragilariaceae	Ulnaria	ulna

Minnow Environmental Yukon Algae 2013
Taxa Report

ECOANALYSTS, INC.

EcoAnalysts Sample ID	Sample ID	Collection Date	Collection Area (m²)	Volume Received (mL)	Percent Counted	Taxon	Class	Order	Family	Genus	Species
6622.01-07	LWC-2	12-Sep-13		20	0.00317%	(undifferentiated) diatoms> (dead)	Bacillariophyceae			(undifferentiated)	diatoms>
6622.01-07	LWC-2	12-Sep-13		20	0.00317%	Chamaesiphon sp.	Myxophyceae	Chroococcales	Chamaesiphonaceae	Chamaesiphon	sp.
6622.01-07	LWC-2	12-Sep-13		20	0.00317%	Leptolyngbya sp.	Myxophyceae	Oscillatoriales	Pseudanabaenaceae	Leptolyngbya	sp.
6622.01-07	LWC-2	12-Sep-13		20	0.00317%	Microspora pachyderma	Chlorophyceae	Chlorococcales	Microsporaceae	Microspora	pachyderma
6622.01-07	LWC-2	12-Sep-13		20	0.00317%	Phormidium sp.	Myxophyceae	Oscillatoriales	Phormidiaceae	Phormidium	sp.
6622.01-07	LWC-2	12-Sep-13		20	0.00317%	Achnanthidium minutissimum	Bacillariophyceae	Pennales	Achnanthidiaceae	Achnanthidium	minutissimum
6622.01-07	LWC-2	12-Sep-13		20	0.00317%	Caloneis silicula	Bacillariophyceae	Pennales	Pinnulariaceae	Caloneis	silicula
6622.01-07	LWC-2	12-Sep-13		20	0.00317%	Cocconeis placentula	Bacillariophyceae	Pennales	Achnanthaceae	Cocconeis	placentula
6622.01-07	LWC-2	12-Sep-13		20	0.00317%	Diatoma moniliformis	Bacillariophyceae	Pennales	Fragilariaceae	Diatoma	moniliformis
6622.01-07	LWC-2	12-Sep-13		20	0.00317%	Encyonema minutum	Bacillariophyceae	Pennales	Cymbellaceae	Encyonema	minutum
6622.01-07	LWC-2	12-Sep-13		20	0.00317%	Encyonema silesiacum	Bacillariophyceae	Pennales	Cymbellaceae	Encyonema	silesiacum
6622.01-07	LWC-2	12-Sep-13		20	0.00317%	Eucocconeis laevis	Bacillariophyceae	Pennales	Achnanthidiaceae	Eucocconeis	laevis
6622.01-07	LWC-2	12-Sep-13		20	0.00317%	Fragilaria alpestris	Bacillariophyceae	Pennales	Fragilariaceae	Fragilaria	alpestris
6622.01-07	LWC-2	12-Sep-13		20	0.00317%	Fragilaria capucina var. gracilis	Bacillariophyceae	Pennales	Fragilariaceae	Fragilaria	capucina
6622.01-07	LWC-2	12-Sep-13		20	0.00317%	Frustulia vulgaris	Bacillariophyceae	Pennales	Amphipleuraceae	Frustulia	vulgaris
6622.01-07	LWC-2	12-Sep-13		20	0.00317%	Gomphonema lagerheimii	Bacillariophyceae	Pennales	Gomphonemataceae	Gomphonema	lagerheimii
6622.01-07	LWC-2	12-Sep-13		20	0.00317%	Hannaea arcus	Bacillariophyceae	Pennales	Fragilariaceae	Hannaea	arcus
6622.01-07	LWC-2	12-Sep-13		20	0.00317%	Luticola goeppertiana	Bacillariophyceae	Pennales	Diadesmidaceae	Luticola	goeppertiana
6622.01-07	LWC-2	12-Sep-13		20	0.00317%	Luticola mutica	Bacillariophyceae	Pennales	Diadesmidaceae	Luticola	mutica
6622.01-07	LWC-2	12-Sep-13		20	0.00317%	Mayamaea permitis	Bacillariophyceae	Pennales	Naviculaceae	Mayamaea	permitis
6622.01-07	LWC-2	12-Sep-13		20	0.00317%	Melosira varians	Bacillariophyceae	Centrales	Melosiraceae	Melosira	varians
6622.01-07	LWC-2	12-Sep-13		20	0.00317%	Meridion circulare	Bacillariophyceae	Pennales	Fragilariaceae	Meridion	circulare
6622.01-07	LWC-2	12-Sep-13		20	0.00317%	Navicula capitatoradiata	Bacillariophyceae	Pennales	Naviculaceae	Navicula	capitatoradiata
6622.01-07	LWC-2	12-Sep-13		20	0.00317%	Navicula gregaria	Bacillariophyceae	Pennales	Naviculaceae	Navicula	gregaria
6622.01-07	LWC-2	12-Sep-13		20	0.00317%	Navicula veneta	Bacillariophyceae	Pennales	Naviculaceae	Navicula	veneta
6622.01-07	LWC-2	12-Sep-13		20	0.00317%	Navicula wiesneri	Bacillariophyceae	Pennales	Naviculaceae	Navicula	wiesneri
6622.01-07	LWC-2	12-Sep-13		20	0.00317%	Nitzschia acula	Bacillariophyceae	Pennales	Bacillariaceae	Nitzschia	acula
6622.01-07	LWC-2	12-Sep-13		20	0.00317%	Nitzschia dissipata	Bacillariophyceae	Pennales	Bacillariaceae	Nitzschia	dissipata
6622.01-07	LWC-2	12-Sep-13		20	0.00317%	Nitzschia homburgiensis	Bacillariophyceae	Pennales	Bacillariaceae	Nitzschia	homburgiensis
6622.01-07	LWC-2	12-Sep-13		20	0.00317%	Nitzschia incognita	Bacillariophyceae	Pennales	Bacillariaceae	Nitzschia	incognita
6622.01-07	LWC-2	12-Sep-13		20	0.00317%	Nitzschia linearis	Bacillariophyceae	Pennales	Bacillariaceae	Nitzschia	linearis
6622.01-07	LWC-2	12-Sep-13		20	0.00317%	Nitzschia paleaeformis	Bacillariophyceae	Pennales	Bacillariaceae	Nitzschia	paleaeformis
6622.01-07	LWC-2	12-Sep-13		20	0.00317%	Nitzschia perminuta	Bacillariophyceae	Pennales	Bacillariaceae	Nitzschia	perminuta
6622.01-07	LWC-2	12-Sep-13		20	0.00317%	Nitzschia pusilla	Bacillariophyceae	Pennales	Bacillariaceae	Nitzschia	pusilla
6622.01-07	LWC-2	12-Sep-13		20	0.00317%	Nitzschia sublinearis	Bacillariophyceae	Pennales	Bacillariaceae	Nitzschia	sublinearis
6622.01-07	LWC-2	12-Sep-13		20	0.00317%	Planothidium frequentissimum	Bacillariophyceae	Pennales	Achnanthaceae	Planothidium	frequentissimum
6622.01-07	LWC-2	12-Sep-13		20	0.00317%	Surirella brebissonii	Bacillariophyceae	Pennales	Surirellaceae	Surirella	brebissonii
6622.01-07	LWC-2	12-Sep-13		20	0.00317%	Ulnaria acus	Bacillariophyceae	Pennales	Fragilariaceae	Ulnaria	acus
6622.01-07	LWC-2	12-Sep-13		20	0.00317%	Ulnaria ulna	Bacillariophyceae	Pennales	Fragilariaceae	Ulnaria	ulna
6622.01-07	LWC-2	12-Sep-13		20	0.00317%	Tabellaria fenestrata	Bacillariophyceae	Pennales	Tabellariaceae	Tabellaria	fenestrata

Minnow Environmental Yukon Algae 2013
Taxa Report
EcoAnalysts, Inc.

EcoAnalysts Sample ID	Sample ID	Collection Date	Collection Area (m²)	Volume Received (mL)	Percent Counted	Taxon	Class	Order	Family	Genus	Species
6622.01-08	LWC-3	12-Sep-13		20	0.00508%	(undifferentiated) diatoms> (dead)	Bacillariophyceae			(undifferentiated)	diatoms>
6622.01-08	LWC-3	12-Sep-13		20	0.00508%	Leptolyngbya sp.	Myxophyceae	Oscillatoriales	Pseudanabaenaceae	Leptolyngbya	sp.
6622.01-08	LWC-3	12-Sep-13		20	0.00508%	Phormidium sp.	Myxophyceae	Oscillatoriales	Phormidiaceae	Phormidium	sp.
6622.01-08	LWC-3	12-Sep-13		20	0.00508%	Pseudanabaena catenata	Myxophyceae	Oscillatoriales	Pseudanabaenaceae	Pseudanabaena	catenata
6622.01-08	LWC-3	12-Sep-13		20	0.00508%	Achnanthidium minutissimum	Bacillariophyceae	Pennales	Achnanthidiaceae	Achnanthidium	minutissimum
6622.01-08	LWC-3	12-Sep-13		20	0.00508%	Adlafia minuscula	Bacillariophyceae	Pennales	Naviculaceae	Adlafia	minuscula
6622.01-08	LWC-3	12-Sep-13		20	0.00508%	Cocconeis placentula	Bacillariophyceae	Pennales	Achnanthaceae	Cocconeis	placentula
6622.01-08	LWC-3	12-Sep-13		20	0.00508%	Diatoma moniliformis	Bacillariophyceae	Pennales	Fragilariaceae	Diatoma	moniliformis
6622.01-08	LWC-3	12-Sep-13		20	0.00508%	Encyonema minutum	Bacillariophyceae	Pennales	Cymbellaceae	Encyonema	minutum
6622.01-08	LWC-3	12-Sep-13		20	0.00508%	Encyonema silesiacum	Bacillariophyceae	Pennales	Cymbellaceae	Encyonema	silesiacum
6622.01-08	LWC-3	12-Sep-13		20	0.00508%	Eucocconeis laevis	Bacillariophyceae	Pennales	Achnanthidiaceae	Eucocconeis	laevis
6622.01-08	LWC-3	12-Sep-13		20	0.00508%	Fragilaria alpestris	Bacillariophyceae	Pennales	Fragilariaceae	Fragilaria	alpestris
6622.01-08	LWC-3	12-Sep-13		20	0.00508%	Fragilaria capucina var. gracilis	Bacillariophyceae	Pennales	Fragilariaceae	Fragilaria	capucina
6622.01-08	LWC-3	12-Sep-13		20	0.00508%	Fragilaria vaucheriae	Bacillariophyceae	Pennales	Fragilariaceae	Fragilaria	vaucheriae
6622.01-08	LWC-3	12-Sep-13		20	0.00508%	Gomphonema lagerheimii	Bacillariophyceae	Pennales	Gomphonemataceae	Gomphonema	lagerheimii
6622.01-08	LWC-3	12-Sep-13		20	0.00508%	Gomphonema minutum	Bacillariophyceae	Pennales	Gomphonemataceae	Gomphonema	minutum
6622.01-08	LWC-3	12-Sep-13		20	0.00508%	Gomphoneis olivaceum	Bacillariophyceae	Pennales	Gomphonemataceae	Gomphoneis	olivaceum
6622.01-08	LWC-3	12-Sep-13		20	0.00508%	Hannaea arcus	Bacillariophyceae	Pennales	Fragilariaceae	Hannaea	arcus
6622.01-08	LWC-3	12-Sep-13		20	0.00508%	Luticola goeppertiana	Bacillariophyceae	Pennales	Diadesmidaceae	Luticola	goeppertiana
6622.01-08	LWC-3	12-Sep-13		20	0.00508%	Luticola mutica	Bacillariophyceae	Pennales	Diadesmidaceae	Luticola	mutica
6622.01-08	LWC-3	12-Sep-13		20	0.00508%	Mayamaea permitis	Bacillariophyceae	Pennales	Naviculaceae	Mayamaea	permitis
6622.01-08	LWC-3	12-Sep-13		20	0.00508%	Melosira varians	Bacillariophyceae	Centrales	Melosiraceae	Melosira	varians
6622.01-08	LWC-3	12-Sep-13		20	0.00508%	Meridion circulare	Bacillariophyceae	Pennales	Fragilariaceae	Meridion	circulare
6622.01-08	LWC-3	12-Sep-13		20	0.00508%	Navicula gregaria	Bacillariophyceae	Pennales	Naviculaceae	Navicula	gregaria
6622.01-08	LWC-3	12-Sep-13		20	0.00508%	Navicula phylleptosoma	Bacillariophyceae	Pennales	Naviculaceae	Navicula	phylleptosoma
6622.01-08	LWC-3	12-Sep-13		20	0.00508%	Navicula veneta	Bacillariophyceae	Pennales	Naviculaceae	Navicula	veneta
6622.01-08	LWC-3	12-Sep-13		20	0.00508%	Navicula wiesneri	Bacillariophyceae	Pennales	Naviculaceae	Navicula	wiesneri
6622.01-08	LWC-3	12-Sep-13		20	0.00508%	Nitzschia acicularis	Bacillariophyceae	Pennales	Bacillariaceae	Nitzschia	acicularis
6622.01-08	LWC-3	12-Sep-13		20	0.00508%	Nitzschia acula	Bacillariophyceae	Pennales	Bacillariaceae	Nitzschia	acula
6622.01-08	LWC-3	12-Sep-13		20	0.00508%	Nitzschia dissipata	Bacillariophyceae	Pennales	Bacillariaceae	Nitzschia	dissipata
6622.01-08	LWC-3	12-Sep-13		20	0.00508%	Nitzschia homburgiensis	Bacillariophyceae	Pennales	Bacillariaceae	Nitzschia	homburgiensis
6622.01-08	LWC-3	12-Sep-13		20	0.00508%	Nitzschia incognita	Bacillariophyceae	Pennales	Bacillariaceae	Nitzschia	incognita
6622.01-08	LWC-3	12-Sep-13		20	0.00508%	Nitzschia perminuta	Bacillariophyceae	Pennales	Bacillariaceae	Nitzschia	perminuta
6622.01-08	LWC-3	12-Sep-13		20	0.00508%	Nitzschia pusilla	Bacillariophyceae	Pennales	Bacillariaceae	Nitzschia	pusilla
6622.01-08	LWC-3	12-Sep-13		20	0.00508%	Nitzschia sublinearis	Bacillariophyceae	Pennales	Bacillariaceae	Nitzschia	sublinearis
6622.01-08	LWC-3	12-Sep-13		20	0.00508%	Planothidium frequentissimum	Bacillariophyceae	Pennales	Achnanthaceae	Planothidium	frequentissimum
6622.01-08	LWC-3	12-Sep-13		20	0.00508%	Surirella brebissonii	Bacillariophyceae	Pennales	Surirellaceae	Surirella	brebissonii
6622.01-08	LWC-3	12-Sep-13		20	0.00508%	Ulnaria acus	Bacillariophyceae	Pennales	Fragilariaceae	Ulnaria	acus
6622.01-08	LWC-3	12-Sep-13		20	0.00508%	Ulnaria ulna	Bacillariophyceae	Pennales	Fragilariaceae	Ulnaria	ulna
6622.01-09	LWC-4	12-Sep-13		20	0.00508%	(undifferentiated) diatoms> (dead)	Bacillariophyceae			(undifferentiated)	diatoms>
6622.01-09	LWC-4	12-Sep-13		20	0.00508%	Leptolyngbya sp.	Myxophyceae	Oscillatoriales	Pseudanabaenaceae	Leptolyngbya	sp.
6622.01-09	LWC-4	12-Sep-13		20	0.00508%	Phormidium uncinatum	Myxophyceae	Oscillatoriales	Phormidiaceae	Phormidium	uncinatum
6622.01-09	LWC-4	12-Sep-13		20	0.00508%	Achnanthidium minutissimum	Bacillariophyceae	Pennales	Achnanthidiaceae	Achnanthidium	minutissimum
6622.01-09	LWC-4	12-Sep-13		20	0.00508%	Adlafia minuscula	Bacillariophyceae	Pennales	Naviculaceae	Adlafia	minuscula
6622.01-09	LWC-4	12-Sep-13		20	0.00508%	Cocconeis placentula	Bacillariophyceae	Pennales	Achnanthaceae	Cocconeis	placentula
6622.01-09	LWC-4	12-Sep-13		20	0.00508%	Cymbella gracilis	Bacillariophyceae	Pennales	Cymbellaceae	Cymbella	gracilis
6622.01-09	LWC-4	12-Sep-13		20	0.00508%	Diatoma moniliformis	Bacillariophyceae	Pennales	Fragilariaceae	Diatoma	moniliformis
6622.01-09	LWC-4	12-Sep-13		20	0.00508%	Encyonema minutum	Bacillariophyceae	Pennales	Cymbellaceae	Encyonema	minutum
6622.01-09	LWC-4	12-Sep-13		20	0.00508%	Encyonema silesiacum	Bacillariophyceae	Pennales	Cymbellaceae	Encyonema	silesiacum
6622.01-09	LWC-4	12-Sep-13		20	0.00508%	Eucocconeis laevis	Bacillariophyceae	Pennales	Achnanthidiaceae	Eucocconeis	laevis
6622.01-09	LWC-4	12-Sep-13		20	0.00508%	Fragilaria alpestris	Bacillariophyceae	Pennales	Fragilariaceae	Fragilaria	alpestris
6622.01-09	LWC-4	12-Sep-13		20	0.00508%	Fragilaria capucina var. gracilis	Bacillariophyceae	Pennales	Fragilariaceae	Fragilaria	capucina
6622.01-09	LWC-4	12-Sep-13		20	0.00508%	Frustulia vulgaris	Bacillariophyceae	Pennales	Amphipleuraceae	Frustulia	vulgaris
6622.01-09	LWC-4	12-Sep-13		20	0.00508%	Gomphonema lagerheimii	Bacillariophyceae	Pennales	Gomphonemataceae	Gomphonema	lagerheimii
6622.01-09	LWC-4	12-Sep-13		20	0.00508%	Gomphonema minutum	Bacillariophyceae	Pennales	Gomphonemataceae	Gomphonema	minutum
6622.01-09	LWC-4	12-Sep-13		20	0.00508%	Gomphoneis olivaceum	Bacillariophyceae	Pennales	Gomphonemataceae	Gomphoneis	olivaceum
6622.01-09	LWC-4	12-Sep-13		20	0.00508%	Hannaea arcus	Bacillariophyceae	Pennales	Fragilariaceae	Hannaea	arcus
6622.01-09	LWC-4	12-Sep-13		20	0.00508%	Karayevia amoena	Bacillariophyceae	Pennales	Achnanthaceae	Karayevia	amoena
6622.01-09	LWC-4	12-Sep-13		20	0.00508%	Luticola goeppertiana	Bacillariophyceae	Pennales	Diadesmidaceae	Luticola	goeppertiana
6622.01-09	LWC-4	12-Sep-13		20	0.00508%	Luticola mutica	Bacillariophyceae	Pennales	Diadesmidaceae	Luticola	mutica
6622.01-09	LWC-4	12-Sep-13		20	0.00508%	Melosira varians	Bacillariophyceae	Centrales	Melosiraceae	Melosira	varians
6622.01-09	LWC-4	12-Sep-13		20	0.00508%	Meridion circulare	Bacillariophyceae	Pennales	Fragilariaceae	Meridion	circulare
6622.01-09	LWC-4	12-Sep-13		20	0.00508%	Navicula gregaria	Bacillariophyceae	Pennales	Naviculaceae	Navicula	gregaria
6622.01-09	LWC-4	12-Sep-13		20	0.00508%	Navicula phylleptosoma	Bacillariophyceae	Pennales	Naviculaceae	Navicula	phylleptosoma
6622.01-09	LWC-4	12-Sep-13		20	0.00508%	Navicula wiesneri	Bacillariophyceae	Pennales	Naviculaceae	Navicula	wiesneri
6622.01-09	LWC-4	12-Sep-13		20	0.00508%	Nitzschia bergii	Bacillariophyceae	Pennales	Bacillariaceae	Nitzschia	bergii
6622.01-09	LWC-4	12-Sep-13		20	0.00508%	Nitzschia dissipata	Bacillariophyceae	Pennales	Bacillariaceae	Nitzschia	dissipata
6622.01-09	LWC-4	12-Sep-13		20	0.00508%	Nitzschia incognita	Bacillariophyceae	Pennales	Bacillariaceae	Nitzschia	incognita
6622.01-09	LWC-4	12-Sep-13		20	0.00508%	Nitzschia perminuta	Bacillariophyceae	Pennales	Bacillariaceae	Nitzschia	perminuta
6622.01-09	LWC-4	12-Sep-13		20	0.00508%	Nitzschia pusilla	Bacillariophyceae	Pennales	Bacillariaceae	Nitzschia	pusilla
6622.01-09	LWC-4	12-Sep-13		20	0.00508%	Nitzschia sublinearis	Bacillariophyceae	Pennales	Bacillariaceae	Nitzschia	sublinearis
6622.01-09	LWC-4	12-Sep-13		20	0.00508%	Planothidium frequentissimum	Bacillariophyceae	Pennales	Achnanthaceae	Planothidium	frequentissimum
6622.01-09	LWC-4	12-Sep-13		20	0.00508%	Reimeria sinuata	Bacillariophyceae	Pennales	Gomphonemataceae	Reimeria	sinuata
6622.01-09	LWC-4	12-Sep-13		20	0.00508%	Surirella brebissonii	Bacillariophyceae	Pennales	Surirellaceae	Surirella	brebissonii
6622.01-09	LWC-4	12-Sep-13		20	0.00508%	Ulnaria acus	Bacillariophyceae	Pennales	Fragilariaceae	Ulnaria	acus
6622.01-09	LWC-4	12-Sep-13		20	0.00508%	Ulnaria ulna	Bacillariophyceae	Pennales	Fragilariaceae	Ulnaria	ulna
6622.01-09	LWC-4	12-Sep-13		20	0.00508%	Tabellaria fenestrata	Bacillariophyceae	Pennales	Tabellariaceae	Tabellaria	fenestrata

Minnow Environmental Yukon Algae 2013
Taxa Report

EcoAnalysts, Inc.

EcoAnalysts Sample ID	Sample ID	Collection Date	Collection Area (m^2)	Volume Received (mL)	Percent Counted	Taxon	Class	Order	Family	Genus	Species
6622.01-10	LWC-5	12-Sep-13		20	0.00508%	(undifferentiated) diatoms> (dead)	Bacillariophyceae			(undifferentiated)	diatoms>
6622.01-10	LWC-5	12-Sep-13		20	0.00508%	Leptolyngbya sp.	Myxophyceae	Oscillatoriales	Pseudanabaenaceae	Leptolyngbya	sp.
6622.01-10	LWC-5	12-Sep-13		20	0.00508%	Microspora pachyderma	Chlorophyceae	Chlorococcales	Microsporaceae	Microspora	pachyderma
6622.01-10	LWC-5	12-Sep-13		20	0.00508%	Achnanthidium minutissimum	Bacillariophyceae	Pennales	Achnanthidiaceae	Achnanthidium	minutissimum
6622.01-10	LWC-5	12-Sep-13		20	0.00508%	Adlafia minuscula	Bacillariophyceae	Pennales	Naviculaceae	Adlafia	minuscula
6622.01-10	LWC-5	12-Sep-13		20	0.00508%	Cocconeis placentula	Bacillariophyceae	Pennales	Achnanthaceae	Cocconeis	placentula
6622.01-10	LWC-5	12-Sep-13		20	0.00508%	Cymbella gracilis	Bacillariophyceae	Pennales	Cymbellaceae	Cymbella	gracilis
6622.01-10	LWC-5	12-Sep-13		20	0.00508%	Diatoma moniliformis	Bacillariophyceae	Pennales	Fragilariaceae	Diatoma	moniliformis
6622.01-10	LWC-5	12-Sep-13		20	0.00508%	Encyonema minutum	Bacillariophyceae	Pennales	Cymbellaceae	Encyonema	minutum
6622.01-10	LWC-5	12-Sep-13		20	0.00508%	Fragilaria alpestris	Bacillariophyceae	Pennales	Fragilariaceae	Fragilaria	alpestris
6622.01-10	LWC-5	12-Sep-13		20	0.00508%	Frustulia rhomboides	Bacillariophyceae	Pennales	Amphipleuraceae	Frustulia	rhomboides
6622.01-10	LWC-5	12-Sep-13		20	0.00508%	Gomphonema lagerheimii	Bacillariophyceae	Pennales	Gomphonemataceae	Gomphonema	lagerheimii
6622.01-10	LWC-5	12-Sep-13		20	0.00508%	Gomphonema minutum	Bacillariophyceae	Pennales	Gomphonemataceae	Gomphonema	minutum
6622.01-10	LWC-5	12-Sep-13		20	0.00508%	Gomphoneis olivaceum	Bacillariophyceae	Pennales	Gomphonemataceae	Gomphoneis	olivaceum
6622.01-10	LWC-5	12-Sep-13		20	0.00508%	Hannaea arcus	Bacillariophyceae	Pennales	Fragilariaceae	Hannaea	arcus
6622.01-10	LWC-5	12-Sep-13		20	0.00508%	Luticola mutica	Bacillariophyceae	Pennales	Diadesmidaceae	Luticola	mutica
6622.01-10	LWC-5	12-Sep-13		20	0.00508%	Melosira varians	Bacillariophyceae	Centrales	Melosiraceae	Melosira	varians
6622.01-10	LWC-5	12-Sep-13		20	0.00508%	Meridion circulare	Bacillariophyceae	Pennales	Fragilariaceae	Meridion	circulare
6622.01-10	LWC-5	12-Sep-13		20	0.00508%	Navicula aquaedurae	Bacillariophyceae	Pennales	Naviculaceae	Navicula	aquaedurae
6622.01-10	LWC-5	12-Sep-13		20	0.00508%	Navicula gregaria	Bacillariophyceae	Pennales	Naviculaceae	Navicula	gregaria
6622.01-10	LWC-5	12-Sep-13		20	0.00508%	Nitzschia bergii	Bacillariophyceae	Pennales	Bacillariaceae	Nitzschia	bergii
6622.01-10	LWC-5	12-Sep-13		20	0.00508%	Nitzschia dissipata	Bacillariophyceae	Pennales	Bacillariaceae	Nitzschia	dissipata
6622.01-10	LWC-5	12-Sep-13		20	0.00508%	Nitzschia incognita	Bacillariophyceae	Pennales	Bacillariaceae	Nitzschia	incognita
6622.01-10	LWC-5	12-Sep-13		20	0.00508%	Nitzschia perminuta	Bacillariophyceae	Pennales	Bacillariaceae	Nitzschia	perminuta
6622.01-10	LWC-5	12-Sep-13		20	0.00508%	Nitzschia sublinearis	Bacillariophyceae	Pennales	Bacillariaceae	Nitzschia	sublinearis
6622.01-10	LWC-5	12-Sep-13		20	0.00508%	Planothidium frequentissimum	Bacillariophyceae	Pennales	Achnanthaceae	Planothidium	frequentissimum
6622.01-10	LWC-5	12-Sep-13		20	0.00508%	Surirella brebissonii	Bacillariophyceae	Pennales	Surirellaceae	Surirella	brebissonii
6622.01-10	LWC-5	12-Sep-13		20	0.00508%	Ulnaria ulna	Bacillariophyceae	Pennales	Fragilariaceae	Ulnaria	ulna

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EcoAnalysts Sample ID	Sample ID	Taxonomic Authority	Number of Natural Units	Number of Cells	Cells/ sample	Cells per mL (in sample received)
6622.01-01	LMC-1		37	37	291560.00	14578.00
6622.01-01	LMC-1	Kützing ex Gomont	6	135	1063800.00	53190.00
6622.01-01	LMC-1	(Foged) K.Krammer	1	1	7722.40	386.12
6622.01-01	LMC-1	(Hilse) Mann	1	1	11583.60	579.18
6622.01-01	LMC-1	Ehrenberg	1	1	7722.40	386.12
6622.01-01	LMC-1	Hustedt	1	1	11583.60	579.18
6622.01-01	LMC-1	(Østrup) Hustedt	0	0	3861.20	193.06
6622.01-01	LMC-1	(Kützing) Petersen	2	2	15444.80	772.24
6622.01-01	LMC-1	(Thwaites) De Toni	2	2	19306.00	965.30
6622.01-01	LMC-1	(Kützing) Rabenhorst	2	2	19306.00	965.30
6622.01-01	LMC-1	(Bleisch) Mann	90	90	706599.60	35329.98
6622.01-01	LMC-1	Lange-Bertalot	50	50	393842.40	19692.12
6622.01-01	LMC-1	Donkin	28	28	223949.60	11197.48
6622.01-01	LMC-1	Lange-Bertalot	6	6	46334.40	2316.72
6622.01-01	LMC-1	(Kützing) Hantzsch	0	0	3861.20	193.06
6622.01-01	LMC-1	Cleve-Euler	2	2	15444.80	772.24
6622.01-01	LMC-1	(Agardh) Smith	20	20	154448.00	7722.40
6622.01-01	LMC-1	Hustedt	41	41	324340.80	16217.04
6622.01-01	LMC-1	Grunow	5	5	38612.00	1930.60
6622.01-01	LMC-1	(Cleve) Cleve-Euler	0	0	3861.20	193.06
6622.01-01	LMC-1	(Schaarschmidt) Lange-Bertalot	1	1	7722.40	386.12
6622.01-01	LMC-1	(Gregory) Kociolek and Stoermer	1	1	7722.40	386.12
6622.01-01	LMC-1	Kützing	19	19	146725.60	7336.28
6622.01-01	LMC-1	Krammer and Lange-Bertalot	15	15	119697.20	5984.86
6622.01-01	LMC-1	Brébisson	3	3	27028.40	1351.42
6622.01-02	LMC-2		5	5	41473.68	2073.68
6622.01-02	LMC-2	(Kützing) Weber-van Bosse	2	53	439621.05	21981.05
6622.01-02	LMC-2	(C. A. Agardh) Gomont	4	149	1235915.79	61795.79
6622.01-02	LMC-2	(Foged) K.Krammer	1	1	8101.19	405.06
6622.01-02	LMC-2	(Hilse) Mann	2	2	16202.39	810.12
6622.01-02	LMC-2	(Grunow) Lange-Bertalot	0	0	4050.60	202.53
6622.01-02	LMC-2	Ehrenberg	0	0	4050.60	202.53
6622.01-02	LMC-2	Hustedt	1	1	12151.79	607.59
6622.01-02	LMC-2	Krasske	5	5	40505.96	2025.30
6622.01-02	LMC-2	Cleve-Euler	63	63	522526.95	26126.35
6622.01-02	LMC-2	(Bleisch) Mann	92	92	765562.74	38278.14
6622.01-02	LMC-2	(Kützing) Mann	10	10	81011.93	4050.60
6622.01-02	LMC-2	(Greville) Agardh	4	4	32404.77	1620.24
6622.01-02	LMC-2	Lange-Bertalot	17	17	141770.88	7088.54
6622.01-02	LMC-2	Donkin	10	10	85062.53	4253.13
6622.01-02	LMC-2	Lange-Bertalot	6	6	48607.16	2430.36
6622.01-02	LMC-2	Hustedt	2	2	20252.98	1012.65
6622.01-02	LMC-2	Cleve-Euler	13	13	105315.51	5265.78
6622.01-02	LMC-2	Hustedt	7	7	56708.35	2835.42
6622.01-02	LMC-2	Grunow	16	16	129619.09	6480.95
6622.01-02	LMC-2	Hustedt	21	21	174175.65	8708.78
6622.01-02	LMC-2	(Gregory) Kociolek and Stoermer	2	2	20252.98	1012.65
6622.01-02	LMC-2	Kützing	4	4	36455.37	1822.77
6622.01-02	LMC-2	Krammer and Lange-Bertalot	15	15	125568.49	6278.42

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EcoAnalysts Sample ID	Sample ID	Taxonomic Authority	Number of Natural Units	Number of Cells	Cells/ sample	Cells per mL (in sample received)
6622.01-03	LMC-3		9	9	109107.69	5455.38
6622.01-03	LMC-3	(Kützing) Weber-van Bosse	5	59	715261.54	35763.08
6622.01-03	LMC-3	Kützing ex Gomont	1	13	157600.00	7880.00
6622.01-03	LMC-3	(C. A. Agardh) Gomont	1	92	1115323.08	55766.15
6622.01-03	LMC-3	(Grunow) Lange-Bertalot	1	1	17760.31	888.02
6622.01-03	LMC-3	Kützing	2	2	23680.41	1184.02
6622.01-03	LMC-3	(Hilse) Mann	1	1	11840.21	592.01
6622.01-03	LMC-3	Ehrenberg	1	1	11840.21	592.01
6622.01-03	LMC-3	Hustedt	1	1	11840.21	592.01
6622.01-03	LMC-3	Krasske	2	2	23680.41	1184.02
6622.01-03	LMC-3	(Kützing) Petersen	2	2	23680.41	1184.02
6622.01-03	LMC-3	(Thwaites) De Toni	1	1	17760.31	888.02
6622.01-03	LMC-3	Cleve-Euler	8	8	100641.74	5032.09
6622.01-03	LMC-3	(Bleisch) Mann	169	169	2054275.59	102713.78
6622.01-03	LMC-3	(Greville) Agardh	1	1	17760.31	888.02
6622.01-03	LMC-3	Lange-Bertalot	30	30	367046.36	18352.32
6622.01-03	LMC-3	Donkin	33	33	402566.97	20128.35
6622.01-03	LMC-3	Lange-Bertalot	6	6	71041.23	3552.06
6622.01-03	LMC-3	Cleve-Euler	3	3	41440.72	2072.04
6622.01-03	LMC-3	Hustedt	4	4	53280.92	2664.05
6622.01-03	LMC-3	Grunow	3	3	41440.72	2072.04
6622.01-03	LMC-3	Hustedt	5	5	59201.03	2960.05
6622.01-03	LMC-3	Ehrenberg	0	0	5920.10	296.01
6622.01-03	LMC-3	(Lange-Bertalot) Lange-Bertalot	2	2	29600.51	1480.03
6622.01-03	LMC-3	Kützing	6	6	71041.23	3552.06
6622.01-03	LMC-3	Krammer and Lange-Bertalot	7	7	88801.54	4440.08
6622.01-03	LMC-3	(Kützing) Aboal	0	0	5920.10	296.01
6622.01-04	LMC-4		5	5	98500.00	4925.00
6622.01-04	LMC-4	(Foged) K.Krammer	1	1	9850.00	492.50
6622.01-04	LMC-4	Ehrenberg	1	1	9850.00	492.50
6622.01-04	LMC-4	Krasske	1	1	9850.00	492.50
6622.01-04	LMC-4	(Thwaites) De Toni	1	1	9850.00	492.50
6622.01-04	LMC-4	Cleve-Euler	2	2	39400.00	1970.00
6622.01-04	LMC-4	(Bleisch) Mann	197	197	3871050.00	193552.50
6622.01-04	LMC-4	(Kützing) Mann	1	1	9850.00	492.50
6622.01-04	LMC-4	(Greville) Agardh	1	1	19700.00	985.00
6622.01-04	LMC-4	Lange-Bertalot	15	15	285650.00	14282.50
6622.01-04	LMC-4	Donkin	18	18	344750.00	17237.50
6622.01-04	LMC-4	Lange-Bertalot	3	3	49250.00	2462.50
6622.01-04	LMC-4	(Kützing) Hantzsch	2	2	39400.00	1970.00
6622.01-04	LMC-4	(Agardh) Smith	28	28	551600.00	27580.00
6622.01-04	LMC-4	Hustedt	12	12	236400.00	11820.00
6622.01-04	LMC-4	Grunow	1	1	19700.00	985.00
6622.01-04	LMC-4	Kützing	2	2	29550.00	1477.50
6622.01-04	LMC-4	Krammer and Lange-Bertalot	19	19	364450.00	18222.50
6622.01-04	LMC-4	Brébisson	1	1	9850.00	492.50

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EcoAnalysts Sample ID	Sample ID	Taxonomic Authority	Number of Natural Units	Number of Cells	Cells/ sample	Cells per mL (in sample received)
6622.01-05	LMC-5		22	22	173360.00	8668.00
6622.01-05	LMC-5	(Kützing) Weber-van Bosse	3	54	425520.00	21276.00
6622.01-05	LMC-5		1	13	102440.00	5122.00
6622.01-05	LMC-5	(C. A. Agardh) Gomont	1	16	126080.00	6304.00
6622.01-05	LMC-5	(Ehrenberg) Cleve	1	1	7748.67	387.43
6622.01-05	LMC-5	(Foged) K.Krammer	2	2	19371.67	968.58
6622.01-05	LMC-5	(Hilse) Mann	2	2	19371.67	968.58
6622.01-05	LMC-5	(Bleisch) Mann	2	2	15497.33	774.87
6622.01-05	LMC-5	(Grunow) Lange-Bertalot and Nörp	0	0	3874.33	193.72
6622.01-05	LMC-5	Hustedt	1	1	11623.00	581.15
6622.01-05	LMC-5	Krasske	7	7	54240.67	2712.03
6622.01-05	LMC-5	(Østrup) Hustedt	0	0	3874.33	193.72
6622.01-05	LMC-5	(Thwaites) De Toni	6	6	46492.00	2324.60
6622.01-05	LMC-5	Cleve-Euler	7	7	58115.00	2905.75
6622.01-05	LMC-5	(Bleisch) Mann	53	53	418428.00	20921.40
6622.01-05	LMC-5	(Kützing) Mann	1	1	11623.00	581.15
6622.01-05	LMC-5	(Greville) Agardh	1	1	11623.00	581.15
6622.01-05	LMC-5	Lange-Bertalot	35	35	278952.00	13947.60
6622.01-05	LMC-5	Donkin	4	4	34869.00	1743.45
6622.01-05	LMC-5	Krasske	6	6	50366.33	2518.32
6622.01-05	LMC-5	(Kützing) Hantzsch	3	3	23246.00	1162.30
6622.01-05	LMC-5	Hustedt	31	31	247957.33	12397.87
6622.01-05	LMC-5	Cleve-Euler	10	10	77486.67	3874.33
6622.01-05	LMC-5	(Agardh) Smith	41	41	325444.00	16272.20
6622.01-05	LMC-5	Hustedt	25	25	193716.67	9685.83
6622.01-05	LMC-5	Grunow	6	6	46492.00	2324.60
6622.01-05	LMC-5	(Lange-Bertalot) Lange-Bertalot	1	1	7748.67	387.43
6622.01-05	LMC-5	Kützing	15	15	116230.00	5811.50
6622.01-05	LMC-5	Krammer and Lange-Bertalot	25	25	197591.00	9879.55
6622.01-05	LMC-5	Brébisson	5	5	38743.33	1937.17
6622.01-05	LMC-5	(Kützing) Aboal	0	0	3874.33	193.72
6622.01-06	LWC-1		8	8	210133.33	10506.67
6622.01-06	LWC-1		39	1663	43681466.67	2184073.33
6622.01-06	LWC-1	(Wille) Lagerheim	1	36	945600.00	47280.00
6622.01-06	LWC-1	Kützing ex Gomont	21	163	4281466.67	214073.33
6622.01-06	LWC-1	(Kützing) Czarnecki	2	2	60676.00	3033.80
6622.01-06	LWC-1	(Grunow) Lange-Bertalot	0	0	10112.67	505.63
6622.01-06	LWC-1	(Ehrenberg) Cleve	1	1	20225.33	1011.27
6622.01-06	LWC-1	Ehrenberg	0	0	10112.67	505.63
6622.01-06	LWC-1	(Ehrenberg) Kützing	3	3	80901.33	4045.07
6622.01-06	LWC-1	Kützing	44	44	1162956.67	58147.83
6622.01-06	LWC-1	(Hilse) Mann	8	8	222478.67	11123.93
6622.01-06	LWC-1	(Østrup) Lange-Bertalot	2	2	50563.33	2528.17
6622.01-06	LWC-1	Krasske	1	1	20225.33	1011.27
6622.01-06	LWC-1	(Østrup) Hustedt	1	1	20225.33	1011.27
6622.01-06	LWC-1	Cleve-Euler	3	3	80901.33	4045.07
6622.01-06	LWC-1	(Hornemann) Dawson ex Ross anc	0	0	10112.67	505.63
6622.01-06	LWC-1	(Ehrenberg) Patrick	1	1	30338.00	1516.90
6622.01-06	LWC-1	(Bleisch) Mann	5	5	121352.00	6067.60
6622.01-06	LWC-1	(Kützing) Mann	5	5	121352.00	6067.60
6622.01-06	LWC-1	Agardh	0	0	10112.67	505.63
6622.01-06	LWC-1	(Greville) Agardh	2	2	40450.67	2022.53
6622.01-06	LWC-1	Lange-Bertalot	4	4	111239.33	5561.97
6622.01-06	LWC-1	Donkin	5	5	131464.67	6573.23
6622.01-06	LWC-1	Lange-Bertalot	1	1	30338.00	1516.90
6622.01-06	LWC-1	Kützing	3	3	80901.33	4045.07
6622.01-06	LWC-1	Cleve-Euler	2	2	40450.67	2022.53
6622.01-06	LWC-1	(Kützing) Rabenhorst	103	103	2710194.67	135509.73
6622.01-06	LWC-1	Legler and Krasske	3	3	91014.00	4550.70
6622.01-06	LWC-1	Hustedt	1	1	30338.00	1516.90
6622.01-06	LWC-1	(Grunow) Peragallo	0	0	10112.67	505.63
6622.01-06	LWC-1	Hustedt	4	4	111239.33	5561.97
6622.01-06	LWC-1	(Lange-Bertalot) Lange-Bertalot	1	1	30338.00	1516.90
6622.01-06	LWC-1	(Gregory) Kociolek and Stoermer	0	0	10112.67	505.63
6622.01-06	LWC-1	Krammer and Lange-Bertalot	3	3	80901.33	4045.07
6622.01-06	LWC-1	(Kützing) Aboal	3	3	70788.67	3539.43
6622.01-06	LWC-1	(Nitzsch) Compére	17	17	455070.00	22753.50

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EcoAnalysts Sample ID	Sample ID	Taxonomic Authority	Number of Natural Units	Number of Cells	Cells/ sample	Cells per mL (in sample received)
6622.01-07	LWC-2		5	5	157600.00	7880.00
6622.01-07	LWC-2		1	56	1765120.00	88256.00
6622.01-07	LWC-2		62	1319	41574880.00	2078744.00
6622.01-07	LWC-2	(Wille) Lagerheim	2	63	1985760.00	99288.00
6622.01-07	LWC-2	Kützing ex Gomont	1	53	1670560.00	83528.00
6622.01-07	LWC-2	(Kützing) Czarnecki	4	4	135220.80	6761.04
6622.01-07	LWC-2	(Ehrenberg) Cleve	1	1	24585.60	1229.28
6622.01-07	LWC-2	Ehrenberg	1	1	36878.40	1843.92
6622.01-07	LWC-2	(Ehrenberg) Kützing	65	65	2052897.60	102644.88
6622.01-07	LWC-2	(Hilse) Mann	10	10	319612.80	15980.64
6622.01-07	LWC-2	(Bleisch) Mann	2	2	49171.20	2458.56
6622.01-07	LWC-2	(Østrup) Lange-Bertalot	0	0	12292.80	614.64
6622.01-07	LWC-2	Krasske	3	3	98342.40	4917.12
6622.01-07	LWC-2	(Østrup) Hustedt	1	1	24585.60	1229.28
6622.01-07	LWC-2	(Thwaites) De Toni	0	0	12292.80	614.64
6622.01-07	LWC-2	Cleve-Euler	4	4	110635.20	5531.76
6622.01-07	LWC-2	(Ehrenberg) Patrick	2	2	73756.80	3687.84
6622.01-07	LWC-2	(Bleisch) Mann	2	2	49171.20	2458.56
6622.01-07	LWC-2	(Kützing) Mann	0	0	12292.80	614.64
6622.01-07	LWC-2	(Hustedt) Bruder and Medlin	1	1	24585.60	1229.28
6622.01-07	LWC-2	Agardh	1	1	24585.60	1229.28
6622.01-07	LWC-2	(Greville) Agardh	7	7	233563.20	11678.16
6622.01-07	LWC-2	Germain	1	1	24585.60	1229.28
6622.01-07	LWC-2	Donkin	6	6	196684.80	9834.24
6622.01-07	LWC-2	Kützing	2	2	49171.20	2458.56
6622.01-07	LWC-2	Lange-Bertalot	3	3	98342.40	4917.12
6622.01-07	LWC-2	(Kützing) Hantzsch	1	1	24585.60	1229.28
6622.01-07	LWC-2	(Kützing) Rabenhorst	50	50	1585771.20	79288.56
6622.01-07	LWC-2	Lange-Bertalot	4	4	122928.00	6146.40
6622.01-07	LWC-2	Legler and Krasske	3	3	98342.40	4917.12
6622.01-07	LWC-2	(Agardh) Smith	1	1	36878.40	1843.92
6622.01-07	LWC-2	Hustedt	2	2	49171.20	2458.56
6622.01-07	LWC-2	(Grunow) Peragallo	2	2	73756.80	3687.84
6622.01-07	LWC-2	Grunow	1	1	24585.60	1229.28
6622.01-07	LWC-2	Hustedt	5	5	159806.40	7990.32
6622.01-07	LWC-2	(Lange-Bertalot) Lange-Bertalot	2	2	73756.80	3687.84
6622.01-07	LWC-2	Krammer and Lange-Bertalot	9	9	282734.40	14136.72
6622.01-07	LWC-2	(Kützing) Aboal	2	2	61464.00	3073.20
6622.01-07	LWC-2	(Nitzsch) Compére	35	35	1106352.00	55317.60
6622.01-07	LWC-2	(Lyngbye) Kützing	0	0	12292.80	614.64

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EcoAnalysts Sample ID	Sample ID	Taxonomic Authority	Number of Natural Units	Number of Cells	Cells/ sample	Cells per mL (in sample received)
6622.01-08	LWC-3		4	4	78800.00	3940.00
6622.01-08	LWC-3		51	896	17651200.00	882560.00
6622.01-08	LWC-3	Kützing ex Gomont	2	31	610700.00	30535.00
6622.01-08	LWC-3	Lauterborn	9	75	1477500.00	73875.00
6622.01-08	LWC-3	(Kützing) Czarnecki	4	4	78143.33	3907.17
6622.01-08	LWC-3	(Grunow) Lange-Bertalot	0	0	7814.33	390.72
6622.01-08	LWC-3	Ehrenberg	0	0	7814.33	390.72
6622.01-08	LWC-3	Kützing	74	74	1461280.33	73064.02
6622.01-08	LWC-3	(Hilse) Mann	17	17	343830.67	17191.53
6622.01-08	LWC-3	(Bleisch) Mann	1	1	23443.00	1172.15
6622.01-08	LWC-3	(Østrup) Lange-Bertalot	3	3	62514.67	3125.73
6622.01-08	LWC-3	Krasske	1	1	15628.67	781.43
6622.01-08	LWC-3	(Østrup) Hustedt	1	1	15628.67	781.43
6622.01-08	LWC-3	(Kützing) Petersen	0	0	7814.33	390.72
6622.01-08	LWC-3	Cleve-Euler	6	6	117215.00	5860.75
6622.01-08	LWC-3	(Agardh) Agardh	3	3	62514.67	3125.73
6622.01-08	LWC-3	(Hornemann) Dawson ex Ross and	2	2	31257.33	1562.87
6622.01-08	LWC-3	(Ehrenberg) Patrick	1	1	23443.00	1172.15
6622.01-08	LWC-3	(Bleisch) Mann	2	2	31257.33	1562.87
6622.01-08	LWC-3	(Kützing) Mann	4	4	85957.67	4297.88
6622.01-08	LWC-3	(Hustedt) Bruder and Medlin	1	1	15628.67	781.43
6622.01-08	LWC-3	Agardh	1	1	15628.67	781.43
6622.01-08	LWC-3	(Greville) Agardh	4	4	78143.33	3907.17
6622.01-08	LWC-3	Donkin	7	7	140658.00	7032.90
6622.01-08	LWC-3	Lange-Bertalot	1	1	15628.67	781.43
6622.01-08	LWC-3	Kützing	0	0	7814.33	390.72
6622.01-08	LWC-3	Lange-Bertalot	2	2	31257.33	1562.87
6622.01-08	LWC-3	(Kützing) Smith	1	1	15628.67	781.43
6622.01-08	LWC-3	(Kützing) Hantzsch	1	1	15628.67	781.43
6622.01-08	LWC-3	(Kützing) Rabenhorst	40	40	789247.67	39462.38
6622.01-08	LWC-3	Lange-Bertalot	1	1	15628.67	781.43
6622.01-08	LWC-3	Legler and Krasske	10	10	187544.00	9377.20
6622.01-08	LWC-3	(Grunow) Peragallo	3	3	62514.67	3125.73
6622.01-08	LWC-3	Grunow	2	2	31257.33	1562.87
6622.01-08	LWC-3	Hustedt	16	16	312573.33	15628.67
6622.01-08	LWC-3	(Lange-Bertalot) Lange-Bertalot	3	3	62514.67	3125.73
6622.01-08	LWC-3	Krammer and Lange-Bertalot	6	6	125029.33	6251.47
6622.01-08	LWC-3	(Kützing) Aboal	0	0	7814.33	390.72
6622.01-08	LWC-3	(Nitzsch) Compére	19	19	382902.33	19145.12
6622.01-09	LWC-4		7	7	137900.00	6895.00
6622.01-09	LWC-4		12	203	3999100.00	199955.00
6622.01-09	LWC-4	(C. A. Agardh) Gomont	7	131	2580700.00	129035.00
6622.01-09	LWC-4	(Kützing) Czarnecki	6	6	119940.17	5997.01
6622.01-09	LWC-4	(Grunow) Lange-Bertalot	1	1	27678.50	1383.93
6622.01-09	LWC-4	Ehrenberg	0	0	9226.17	461.31
6622.01-09	LWC-4	(Ehrenberg) Kützing	1	1	18452.33	922.62
6622.01-09	LWC-4	Kützing	31	31	608927.00	30446.35
6622.01-09	LWC-4	(Hilse) Mann	13	13	249106.50	12455.33
6622.01-09	LWC-4	(Bleisch) Mann	2	2	46130.83	2306.54
6622.01-09	LWC-4	(Østrup) Lange-Bertalot	3	3	64583.17	3229.16
6622.01-09	LWC-4	Krasske	2	2	46130.83	2306.54
6622.01-09	LWC-4	(Østrup) Hustedt	0	0	9226.17	461.31
6622.01-09	LWC-4	(Thwaites) De Toni	1	1	18452.33	922.62
6622.01-09	LWC-4	Cleve-Euler	7	7	147618.67	7380.93
6622.01-09	LWC-4	(Agardh) Agardh	5	5	101487.83	5074.39
6622.01-09	LWC-4	(Hornemann) Dawson ex Ross and	0	0	9226.17	461.31
6622.01-09	LWC-4	(Ehrenberg) Patrick	2	2	36904.67	1845.23
6622.01-09	LWC-4	(Hustedt) Bukhtiyarova	0	0	9226.17	461.31
6622.01-09	LWC-4	(Bleisch) Mann	5	5	92261.67	4613.08
6622.01-09	LWC-4	(Kützing) Mann	66	66	1291663.33	64583.17
6622.01-09	LWC-4	Agardh	1	1	18452.33	922.62
6622.01-09	LWC-4	(Greville) Agardh	7	7	129166.33	6458.32
6622.01-09	LWC-4	Donkin	12	12	239880.33	11994.02
6622.01-09	LWC-4	Lange-Bertalot	1	1	27678.50	1383.93
6622.01-09	LWC-4	Lange-Bertalot	4	4	83035.50	4151.78
6622.01-09	LWC-4	Cleve-Euler	1	1	18452.33	922.62
6622.01-09	LWC-4	(Kützing) Rabenhorst	46	46	904164.33	45208.22
6622.01-09	LWC-4	Legler and Krasske	5	5	92261.67	4613.08
6622.01-09	LWC-4	(Grunow) Peragallo	1	1	18452.33	922.62
6622.01-09	LWC-4	Grunow	4	4	83035.50	4151.78
6622.01-09	LWC-4	Hustedt	13	13	258332.67	12916.63
6622.01-09	LWC-4	(Lange-Bertalot) Lange-Bertalot	4	4	83035.50	4151.78
6622.01-09	LWC-4	(Gregory) Kociolek and Stoermer	2	2	36904.67	1845.23
6622.01-09	LWC-4	Krammer and Lange-Bertalot	15	15	304463.50	15223.18
6622.01-09	LWC-4	(Kützing) Aboal	0	0	9226.17	461.31
6622.01-09	LWC-4	(Nitzsch) Compére	16	16	313689.67	15684.48
6622.01-09	LWC-4	(Lyngbye) Kützing	0	0	9226.17	461.31

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ECOANALYSTS, INC.

EcoAnalysts Sample ID	Sample ID	Taxonomic Authority	Number of Natural Units	Number of Cells	Cells/ sample	Cells per mL (in sample received)
6622.01-10	LWC-5		3	3	59100.00	2955.00
6622.01-10	LWC-5		13	189	3723300.00	186165.00
6622.01-10	LWC-5	(Wille) Lagerheim	2	43	847100.00	42355.00
6622.01-10	LWC-5	(Kützing) Czarnecki	5	5	93575.00	4678.75
6622.01-10	LWC-5	(Grunow) Lange-Bertalot	1	1	18715.00	935.75
6622.01-10	LWC-5	Ehrenberg	2	2	37430.00	1871.50
6622.01-10	LWC-5	(Ehrenberg) Kützing	0	0	9357.50	467.88
6622.01-10	LWC-5	Kützing	69	69	1356837.50	67841.88
6622.01-10	LWC-5	(Hilse) Mann	19	19	364942.50	18247.13
6622.01-10	LWC-5	Krasske	4	4	84217.50	4210.88
6622.01-10	LWC-5	(Ehrenberg) De Toni	0	0	9357.50	467.88
6622.01-10	LWC-5	Cleve-Euler	9	9	168435.00	8421.75
6622.01-10	LWC-5	(Agardh) Agardh	5	5	93575.00	4678.75
6622.01-10	LWC-5	(Hornemann) Dawson ex Ross and	4	4	74860.00	3743.00
6622.01-10	LWC-5	(Ehrenberg) Patrick	6	6	112290.00	5614.50
6622.01-10	LWC-5	(Kützing) Mann	11	11	215222.50	10761.13
6622.01-10	LWC-5	Agardh	5	5	102932.50	5146.63
6622.01-10	LWC-5	(Greville) Agardh	12	12	233937.50	11696.88
6622.01-10	LWC-5	Lange-Bertalot	1	1	18715.00	935.75
6622.01-10	LWC-5	Donkin	12	12	243295.00	12164.75
6622.01-10	LWC-5	Cleve-Euler	2	2	37430.00	1871.50
6622.01-10	LWC-5	(Kützing) Rabenhorst	43	43	851532.50	42576.63
6622.01-10	LWC-5	Legler and Krasske	1	1	28072.50	1403.63
6622.01-10	LWC-5	(Grunow) Peragallo	3	3	65502.50	3275.13
6622.01-10	LWC-5	Hustedt	12	12	233937.50	11696.88
6622.01-10	LWC-5	(Lange-Bertalot) Lange-Bertalot	4	4	84217.50	4210.88
6622.01-10	LWC-5	Krammer and Lange-Bertalot	11	11	224580.00	11229.00
6622.01-10	LWC-5	(Nitzsch) Compère	43	43	851532.50	42576.63

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QC Report

ECOANALYSTS, INC.

6622.02-03		Original Abundance	Relative Abundance	Dominance Rank	QC Abundance	Relative Abundance	Dominance Rank	Percent Similarity
Adlafia minuscula		3	0.50%		8	1.33%	4	0.50%
Aulacoseira alpigena		0	0.00%		1	0.17%	5	0.00%
Diatoma moniliformis		4	0.67%		4	0.67%		0.67%
Encyonema minutum		2	0.33%		2	0.33%		0.33%
Eunotia praerupta		2	0.33%		2	0.33%		0.33%
Eunotia rhomboidea		2	0.33%		0	0.00%		0.00%
Fragilaria alpestris		4	0.67%		0	0.00%		0.00%
Fragilaria vaucheriae		4	0.67%		10	1.67%		0.67%
Frustulia vulgaris		3	0.50%		2	0.33%		0.33%
Gomphonema angustatum		0	0.00%		8	1.33%		0.00%
Gomphonema lagerheimii		17	2.83%		0	0.00%		0.00%
Gomphonema parvulum		0	0.00%		2	0.33%		0.00%
Luticola goeppertiana		347	57.83%		385	64.17%		57.83%
Luticola mutica		0	0.00%		2	0.33%		0.00%
Meridion circulare		3	0.50%		0	0.00%		0.00%
Navicula aquaedurae		62	10.33%		64	10.67%		10.33%
Navicula capitatoradiata		0	0.00%		2	0.33%		0.00%
Navicula gregaria		68	11.33%		60	10.00%		10.00%
Navicula phylleptosoma		12	2.00%		8	1.33%		1.33%
Nitzschia bergii		7	1.17%		0	0.00%		0.00%
Nitzschia linearis		0	0.00%		8	1.33%		0.00%
Nitzschia paleaeformis		9	1.50%		0	0.00%		0.00%
Nitzschia pusilla		7	1.17%		4	0.67%		0.67%
Nitzschia spp.		0	0.00%		4	0.67%		0.00%
Nitzschia sublinearis		10	1.67%		2	0.33%		0.33%
Pinnularia borealis		1	0.17%		0	0.00%		0.00%
Planothidium frequentissimum		5	0.83%		0	0.00%		0.00%
Surirella angusta		12	2.00%		6	1.00%		1.00%
Surirella brebissonii		15	2.50%		8	1.33%		1.33%
Ulnaria acus		1	0.17%		0	0.00%		0.00%
Ulnaria ulna		0	0.00%		2	0.33%		0.00%
Unknown pennales sp.		0	0.00%		6	1.00%		0.00%
TOTAL		**600**			**600**			**85.67%**

6622.01-03		Original Abundance	Relative Abundance	Dominance Rank	QC Abundance	Relative Abundance	Dominance Rank	Percent Similarity
(undifferentiated) diatoms> (dead)		9	2.91%		4	1.31%		1.31%
(undifferentiated) diatoms> (live)		293	94.82%		299	97.71%		94.82%
Audouinella pygmaea		5	1.62%		0	0.00%		0.00%
Phormidium sp.		1	0.32%		0	0.00%		0.00%
Phormidium uncinatum		1	0.32%		0	0.00%		0.00%
Stigeoclonium sp.		0	0.00%		3	0.98%	3	0.00%
TOTAL		**309**			**306**			**96.13%**

Photos
Achnanthidium_minutissimum_6622.02-06_100x.tif
Adlafia_minuscula_6622.02-02_100x.tif
Audouinella_pygmaea_40x_6622.01.02.tif
Audouinella_pygmaea_40x_6622.01.06.tif
Caloneis_silicula_6622.02-05_100x.tif
Chamaesiphon_sp_40x_6622.01.07.tif
Cocconeis_placentula_6622.02-07_100x.tif
Cymbella_gracilis_6622.02-06_100x.tif
Cymbopleura_linearis_6622.02-01_100x.tif
Diatoma_moniliformis_6622.02-02_100x.tif
Encyonema_cf_minutum_6622.02-01_100x.tif
Encyonema_silesiacum_6622.02-05_100x.tif
Eolimna_minima_6622.02-01_100x.tif
Eucocconeis_laevis_6622.02-06_100x.tif
Eunotia_arculus_6622.02-05_100x.tif
Eunotia_praerupta_6622.02-01_100x.tif
Eunotia_rhomboidea_6622.02-01_100x.tif
Fragilaria_alpestris_6622.02-01_100x.tif
Fragilaria_capucina_var_gracilis_6622.02-01_100x.tif
Fragilaria_vaucheriae_6622.02-01_100x.tif
Frustulia_rhomboides_6622.02-10_100x.tif
Frustulia_vulgaris_6622.02-01_100x.tif
Frustulia_vulgaris_6622.02-03_100x.tif
Gomphoneis_olivaceum_6622.02-06_100x.tif
Gomphonema_angustatum_6622.02-01_100x.tif
Gomphonema_lagerheimii_6622.02-02_100x.tif
Gomphonema_minutum_6622.02-08_100x.tif
Hannaea_arcus_6622.02-06_100x.tif
Karayevia_amoena_6622.02-07_100x.tif
Leptolyngbya_sp_40x_6622.01.05.tif
Luticola_goeppertiana_6622.02-01_100x.tif
Luticola_mutica_6622.02-02_100x.tif
Mayamaea_permitis_6622.02-07_100x.tif
Melosira_varians_6622.02-10_100x.tif
Meridion_circulare_6622.02-01_100x.tif
Microspora_pachyderma_40x_6622.01.06.tif
Navicula_aquaedurae_6622.02-01_100x.tif
Navicula_capitatoradiata_6622.02-07_100x.tif
Navicula_gregaria_6622.02-01_100x.tif
Navicula_phylleptosoma_6622.02-01_100x.tif
Navicula_veneta_6622.02-06_100x.tif
Navicula_wiesneri_6622.02-07_100x.tif
Nitzschia_acicularis_6622.02-08_100x.tif
Nitzschia_acula_6622.02-01_100x.tif
Nitzschia_aequorea_6622.02-01_100x.tif
Nitzschia_bergii_6622.02-01_100x.tif
Nitzschia_dissipata_6622.02-06_100x.tif
Nitzschia_homburgiensis_6622.02-07_100x.tif
Nitzschia_incognita_6622.02-06_100x.tif
Nitzschia_linearis_6622.02-01_100x.tif
Nitzschia_paleaeformis_6622.02-01_100x.tif
Nitzschia_perminuta_6622.02-06_100x.tif
Nitzschia_pusilla_6622.02-01_100x.tif
Nitzschia_sublinearis_6622.02-01_100x.tif
Phormidium_sp_63x_6622.01.01.tif
Phormidium_uncinatum_40x_6622.01.02.tif
Pinnularia_borealis_6622.02-03_100x.tif
Pinnularia_subrostrata_6622.02-01_100x.tif
Planothidium_frequentissimum_6622.02-03_100x.tif
Planothidium_haynaldii_6622.02-01_100x.tif
Pseudanabaena_catenata_40x_6622.01.08.tif
Reimeria_sinuata_6622.02-01_100x.tif
Surirella_angusta_6622.02-01_100x.tif
Surirella_brebissonii_6622.02-01_100x.tif
Surirella_minuta_6622.02-01_100x.tif
Tabellaria_fenestrata_6622.02-07_100x.tif
Ulnaria_acus_6622.02-03_100x.tif
Ulnaria_ulna_6622.02-06_100x.tif

APPENDIX E

BENTHIC INVERTEBRATE COMMUNITY DATA

Table E.1: Benthic Invertebrates collected by Hess sampler and screened through a 500 μM sieve. Values reported as number of organisms per sample, Minto Mine WUL, 2013.

Invertebrate	Exposure					Reference				
	LMC-1	LMC-2	LMC-3	LMC-4	LMC-5	LWC-1	LWC-2	LWC-3	LWC-4	LWC-5
Phylum: Arthropoda										
Subphylum: Hexapoda										
Class: Insecta										
Order: Ephemeroptera										
Family: Ameletidae										
Ameletus sp.									1	
Family: Baetidae										
Baetis bicaudatus	1			2						
Baetis sp.			3	4	3	1				
Baetis tricaudatus group			1		1					
Family: Ephemerellidae										
Drunella grandis group									1	
Ephemerella dorothea/exrucians							4			2
Family: Heptageniidae						4	4	6	2	4
Cinygmula sp.	1									
Heptagenia sp.								2	4	2
Order: Plecoptera										
Family: Capniidae				1	1		2	2	4	
Family: Chloroperlidae							1			1
Suwallia sp.							1	4		
Sweltsa sp.									1	
Family: Leuctridae							1			
Family: Nemouridae		8	14	11	2		1	1		
Ostrocerca sp.	8	5	3	11	3					
Podmosta sp.	2	10	21	48	3					
Zapada cinctipes					1					
Zapada sp.									1	
Family: Perlodidae							1		3	5
Isoperla sp.							1	2	4	2
Order: Trichoptera										
Family: Limnephilidae	2	5	3	2	6		3	1		
Dicosmoecus obsuripennis		1		2						
Ecclisomyia sp.						2	3	2		
Family: Rhyacophilidae										
Rhyacophila brunnea/vemna group							1		1	
Order: Coleoptera										
Family: Elmidae										
Optioservus sp.						1				
Order: Diptera				1	1					
Family: Ceratopogonidae										
Ceratopogon sp.								1	1	
Family: Chironomidae										
Subfamily: Chironominae										
Tribe: Chironomini										
Chironomus sp.					1					
Tribe: Tanytarsini										
Paratanytarsus sp.					1					
Tanytarsus sp.	1									
Subfamily: Diamesinae										
Tribe: Diamesini										
Diamesa sp.			1							
Pagastia sp.			1				1			
Potthastia sp.						1				
Subfamily: Orthocladiinae										
Brillia sp.			2							
Diplocladius sp.	2				1					
Eukiefferiella sp.	4	29	83	64	12	6	4	1		
Hydrobaenus sp.			1							
Limnophyes sp.			2							
Orthocladius complex	1	3	2	1		214	254	486		
Orthocladius lignicola									1	
Orthocladius sp.	14	44	63	80	54	13	8	7	348	434
Paraphaenocladius sp.				1	1					
Tvetenia sp.	1									
Subfamily: Tanypodinae										
Tribe: Pentaneurini										
Ablabesmyia sp.			1							
Family: Empididae							1	1		
Chelifera/ Metachela			3			1	2		3	2
Clinocera sp.			3		1					
Neoplasta sp.				1		1	1	5	5	13
Family: Simuliidae		3	10	10	1					2
Helodon sp.				2						
Simulium sp.		2	3							
Family: Tipulidae										

Table E.1: Benthic Invertebrates collected by Hess sampler and screened through a 500 µM sieve. Values reported as number of organisms per sample, Minto Mine WUL, 2013.

Invertebrate	Exposure					Reference				
	LMC-1	LMC-2	LMC-3	LMC-4	LMC-5	LWC-1	LWC-2	LWC-3	LWC-4	LWC-5
Dicranota sp.			3	3	1		1	7	2	2
Epiphragma sp.				1						
Hesperoconopa sp.								1	2	
Rhabdomastix sp.									1	
Tipula sp.								1		
Order: Hemiptera										
Family: Corixidae										
Sigara sp.						1				
Order: Lepidoptera	1									
Class: Entognatha										
Order: Collembola	2	1								
Subphylum: Crustacea										
Class: Ostracoda					3					1
Subphylum: Chelicerata										
Class: Arachnida										
Order: Trombidiformes										
Family: Hygrobatidae										
Hygrobates sp.										1
Family: Lebertiidae										
Lebertia sp.										1
Family: Sperchontidae										
Sperchon sp.		3	4	10	1	1		1	1	
Order: Sarcoptiformes										
Family: Hydrozetidae		2	1		1					
Phylum: Mollusca										
Class: Bivalvia										
Order: Veneroida										
Family: Pisidiidae		1								
Phylum: Annelida										
Subphylum: Clitellata										
Class: Oligochaeta										
Order: Lumbriculida										
Family: Lumbriculidae	1				2	42	122	72	5	121
Order: Tubificida										
Family: Enchytraeidae										
Enchytraeus	2	3					1	3		
Family: Tubificidae										
Subfamily: Tubificinae immature			24	7						
Phylum: Nemata	1	1	12	90	30			2	1	2
Totals:	**44**	**121**	**264**	**352**	**131**	**288**	**418**	**608**	**392**	**595**

Table E.2: Benthic invertebrate community metrics by station for samples collected by Hess sampler, Minto Mine WUL, 2013.

Area	Station	Density	Number of Taxa	BC Dissimilarity to LWC Median	Simpson's D	Simpson's E[a]	Ephemeroptera (%)	Plecoptera (%)	Trichoptera (%)	EPT (%)	Chironomids (%)	Oligochaetes (%)	Nemata (%)
Lower Minto Creek (Exposure)	LMC-1	44	14	0.91	0.81	0.41	5	23	5	32	52	7	2
	LMC-2	121	12	0.82	0.71	0.31	0	19	5	24	63	2	1
	LMC-3	264	20	0.78	0.79	0.27	2	14	1	17	59	9	5
	LMC-4	352	15	0.78	0.81	0.35	2	20	1	23	41	2	26
	LMC-5	131	20	0.78	0.73	0.19	3	8	5	15	53	2	23
Lower Wolverine Creek (Reference)	LWC-1	288	12	0.24	0.36	0.14	2	0	1	2	81	15	0
	LWC-2	418	16	0.18	0.51	0.15	2	2	2	6	64	29	0
	LWC-3	608	16	0.15	0.32	0.10	1	1	0	3	81	12	0
	LWC-4	392	18	0.11	0.21	0.07	2	3	0	6	89	1	0
	LWC-5	595	14	0.15	0.42	0.14	1	1	0	3	73	20	0

[a] calculated as recommended by Environment Canada 2012.

Table E.3: Summary of Benthic Invertebrate Community Characteristics, and Statistical Comparisons Among Areas Minto Mine WUL, 2013.

	Comparison	2-group ANOVA for Estimation of Effect Size						
Metric	**Planned Comparison**	**Mean Square**	**F (ANOVA)**	**Significant Difference Among Areas? (p-value)[a]**		**Power**	**Magnitude of Difference (# of SDs)[b]**	**Minimum Detectable Effect Size (# of SDs)[c]**
Density (Ind./m2)	Wolverine Creek Reference vs. Minto Creek Exposure	17,136	11.3	YES	0.010	1.00	-2.0	~
Number of Taxa	Wolverine Creek Reference vs. Minto Creek Exposure	9.2	0.3	NO	0.616	1.00	~	2.6
EPT (%)	Wolverine Creek Reference vs. Minto Creek Exposure	23	37.2	YES	0.000	1.00	11.9	~
Chironomids (%)	Wolverine Creek Reference vs. Minto Creek Exposure	79	18.0	YES	0.003	1.00	-1.1	~
Oligochaetes (%)	Wolverine Creek Reference vs. Minto Creek Exposure	60	5.3	YES	0.051	0.98	-1.1	~
Nemata (%)	Wolverine Creek Reference vs. Minto Creek Exposure	72	4.2	YES	0.009	0.73	64.6	~
BC Distance to Median Ref.	Wolverine Creek Reference vs. Minto Creek Exposure	0.003	364	YES	0.009	1.00	13.3	~
Simpson's D	Wolverine Creek Reference vs. Minto Creek Exposure	0.008	54.8	YES	0.000	1.00	3.6	~
Simpson's E[d]	Wolverine Creek Reference vs. Minto Creek Exposure	0.004	22.8	YES	0.001	1.00	5.7	~

[a] p-value obtained from 1-way ANOVA

[b] Magnitude calculated by comparing the difference between the reference and exposure area means to the reference area standard deviation (SD) [(exposure mean - reference mean) / standard deviation of the reference mean]

[c] Minimum effect size detectable calculated based on variance as square root of MSE from ANOVA and alpha = beta = 0.10. Minimum effect size reported as the minimum number of standard deviations detectable based on reference area standard deviation.

[d] Calculated as recommended by Environment Canada 2012

Table E.4: Benthic Analyses - ANOVA results, Minto Mine WUL, 2013.

Dependent Variable	Mean Square	F (ANOVA)	p-value	Observed Power
Number of Taxa	9.20	0.27	0.62	1.00
EPT Pct.	22.55	37.19	0.00	1.00
Chironomids Pct.	78.85	18.04	0.00	1.00
Oligochaetes Pct.	59.51	5.28	0.05	0.98
Nemata Pct.	71.88	4.24	0.01	0.73
Simpson's D	0.01	54.8	0.00	1.00
Simpson's E	0.00	22.8	0.00	1.00
BC Distance to Median Ref.	0.00	364	0.01	1.00
Median Intermediate Axis Length (cm)	0.28	3.90	0.08	1.00
Median Embeddedness (%)	65.00	0.62	0.46	1.00
Water Velocity (m/s)	0.00	2.23	0.17	1.00
Depth (m)	0.00	1.11	0.32	1.00
Temperature (°C)	0.13	89.29	0.00	1.00
DO (%)	40.63	1.47	0.75	1.00
Specific Conductivity (µS/cm)	9.00	5,048	0.01	1.00
pH	0.01	17.94	0.01	1.00
% cobble	125.00	0.08	0.91	1.00
% gravel	68.75	0.15	0.51	1.00
% sand and finer	18.75	0.00	1.00	1.00

Indicates p value < 0.1

Table E.5: Intermediate axis length and embededdness of 100 cobble washed during Hess sampling at benthic invertebrate stations, Minto Mine WUL, 2013.

Cobble Number	LWC-1		LWC-2		LWC-3		LWC-4	
	Intermediate Axis Length (cm)	Embeddedness (%)	Intermediate Axis Length (cm)	Embeddedness (%)	Intermediate Axis Length (cm)	Embeddedness (%)	Intermediate Axis Length (cm)	Embeddedness (%)
1	12.5		10.1		7.6		6.3	
2	4.4		6.9		4.3		4.5	
3	3.2		3.0		8.1		2.0	
4	5.1		3.9		2.2		5.0	
5	4.0		3.6		3.0		5.5	
6	2.1		3.3		1.6		4.0	
7	4.5		3.0		3.6		4.3	
8	5.0		3.7		2.7		11.4	
9	5.6		3.0		2.7		1.5	
10	8.3	10	3.0	10	1.2	10	1.8	10
11	4.7		2.2		3.3		1.5	
12	3.7		2.1		2.7		9.6	
13	3.5		3.1		2.2		3.4	
14	3.7		2.3		2.2		1.4	
15	3.3		2.6		2.9		2.6	
16	3.1		12.4		4.9		5.4	
17	5.3		4.9		2.3		3.4	
18	2.4		5.5		5.3		2.5	
19	6.4		2.4		1.7		1.6	
20	7.0	10	5.4	10	2.6	30	3.7	20
21	3.6		4.9		1.9		8.6	
22	1.7		2.9		2.1		3.2	
23	4.0		5.6		1.4		7.6	
24	4.2		3.1		3.0		3.3	
25	3.3		2.1		4.1		1.2	
26	3.4		2.7		3.5		3.2	
27	2.7		2.5		2.4		7.4	
28	4.1		2.8		3.4		3.8	
29	5.5		4.0		2.3		9.5	
30	11.0	30	3.7	10	2.0	10	3.9	10
31	11.0		3.2		2.2		4.8	
32	9.8		2.4		2.0		5.5	
33	5.0		3.3		3.0		6.4	
34	7.8		6.3		3.0		7.9	
35	5.6		6.5		3.3		9.4	
36	8.3		8.2		2.5		7.7	
37	7.0		10.7		2.7		8.1	
38	4.7		9.7		1.4		4.0	
39	3.7		5.4		3.3		4.6	
40	6.5	20	4.8	20	1.8	20	3.6	20
41	5.0		3.0		6.6		7.4	
42	5.3		5.9		2.2		5.3	
43	5.0		4.8		4.1		6.0	
44	2.4		4.7		2.3		2.9	
45	5.5		3.8		3.0		3.1	
46	9.2		4.6		3.0		12.8	
47	10.4		5.0		2.9		5.6	
48	4.7		4.2		1.7		4.7	
49	7.1		3.8		5.9		9.6	
50	4.2	10	3.3	10	6.0	20	5.3	10
51	4.9		9.1		2.5		5.7	
52	5.3		5.4		1.9		6.8	
53	2.7		6.6		1.8		6.0	
54	3.4		4.1		3.2		6.1	
55	3.4		3.9		2.3		3.4	
56	2.7		6.6		7.4		5.2	
57	3.4		3.4		8.1		3.3	
58	1.1		5.0		8.2		4.0	
59	3.6		4.8		6.2		2.7	
60	3.0	30	4.5	20	3.5	10	2.5	20
61	3.0		4.2		5.2		3.3	
62	1.7		3.4		9.2		3.0	
63	8.8		4.2		3.5		4.8	
64	6.3		6.7		6.4		5.5	
65	4.7		9.0		5.9		5.9	
66	9.6		9.8		5.4		7.2	
67	7.3		5.0		9.1		2.9	
68	5.3		5.6		4.5		3.8	
69	10.4		4.0		5.4		2.5	
70	3.4	10	4.9	10	3.5	10	2.9	20
71	4.6		4.8		7.1		2.6	
72	8.5		3.9		4.6		2.4	
73	5.5		3.2		6.1		2.0	
74	1.9		2.9		3.7		2.6	
75	4.3		3.1		6.8		2.0	
76	3.2		4.4		7.2		2.4	
77	4.1		3.1		6.1		1.9	
78	5.0		4.2		3.6		5.0	
79	5.7		3.1		4.6		4.3	
80	7.3	20	3.9	10	11.4	10	2.5	30
81	6.3		3.1		3.8		6.0	
82	5.4		4.0		6.0		10.0	
83	7.1		3.6		3.7		5.2	
84	4.1		3.3		5.1		8.1	
85	6.1		3.1		4.5		4.5	
86	6.7		4.1		6.0		3.8	
87	5.7		3.0		5.6		3.6	
88	5.0		3.5		3.9		5.7	
89	2.9		3.1		4.1		7.3	
90	7.9	10	3.5	10	4.4	30	5.9	30
91	4.0		5.8		4.6		3.4	
92	5.2		4.6		4.1		2.7	
93	4.8		3.4		4.8		5.6	
94	5.5		7.4		3.5		7.0	
95	10.3		5.5		6.3		5.7	
96	4.1		9.5		4.0		5.4	
97	7.2		5.8		2.9		10.6	
98	7.3		2.0		4.8		5.5	
99	10.0		4.7		4.2		2.2	
100	8.1	10	4.1	30	3.8	20	4.7	10
Minimum	**1.1**		**2.0**		**1.2**		**1.2**	
Maximum	**12.5**		**12.4**		**11.4**		**12.8**	
Mean	**5.4**		**4.6**		**4.1**		**4.9**	
Geometric mean	**4.9**		**4.2**		**3.7**		**4.3**	
Median	**5.0**	**10**	**4.0**	**10**	**3.6**	**15**	**4.6**	**20**

Note: intermediate axis length is the second longest axis on a cobble. Embeddedness refers to how deeply the cobble is surrounded or buried by other substrate.

Table E.5: Intermediate axis length and embededdness of 100 cobble washed during Hess sampling at benthic invertebrate stations, Minto Mine WUL, 2013.

Cobble Number	LWC-5		LMC-1		LMC-2	
	Intermediate Axis Length (cm)	Embeddedness (%)	Intermediate Axis Length (cm)	Embeddedness (%)	Intermediate Axis Length (cm)	Embeddedness (%)
1	6.3		7.9		12.7	
2	7.6		6.2		7.6	
3	6.9		5.8		9.5	
4	1.3		8.3		7.0	
5	4.0		4.4		5.3	
6	12.2		5.6		6.7	
7	4.8		7.1		2.5	
8	6.1		7.4		5.1	
9	3.7		8.4		8.6	
10	1.0	20	5.8	10	3.9	10
11	2.0		4.4		2.6	
12	6.1		5.2		3.0	
13	4.3		5.1		2.4	
14	8.3		4.1		1.3	
15	4.4		4.6		0.6	
16	2.6		3.8		3.2	
17	1.3		5.0		6.8	
18	1.6		3.5		4.2	
19	1.2		4.2		1.6	
20	1.6	10	5.1	40	3.7	10
21	2.2		3.2		4.1	
22	5.8		2.3		5.0	
23	4.2		4.0		3.5	
24	2.1		4.1		3.9	
25	3.1		9.4		2.3	
26	3.1		6.7		3.3	
27	3.1		5.1		2.4	
28	5.2		2.1		13.5	
29	3.3		4.0		15.2	
30	4.5	20	6.5	30	8.3	20
31	1.7		2.7		5.5	
32	3.0		2.9		5.9	
33	3.2		9.0		3.9	
34	1.8		3.0		3.5	
35	9.6		3.1		5.6	
36	8.6		3.5		3.4	
37	6.1		6.4		4.0	
38	5.3		2.5		1.9	
39	5.9		3.5		5.7	
40	4.1	20	4.2	10	6.1	20
41	5.3		3.3		11.4	
42	6.6		1.7		4.3	
43	4.1		7.2		4.9	
44	3.5		3.8		4.2	
45	3.5		1.2		4.6	
46	3.7		7.5		4.0	
47	2.7		3.4		4.7	
48	3.1		1.7		3.8	
49	3.6		2.5		3.1	
50	2.8	30	4.2		2.2	
51	2.4		4.1		3.7	
52	1.9		4.0		8.3	
53	2.4		4.5		2.0	
54	13.4		3.5		1.9	
55	8.1		8.4		6.2	
56	2.6		2.5		2.1	
57	8.6		4.2		5.4	
58	6.2		5.2		2.7	
59	8.3		1.8		2.6	
60	5.1	10	5.3	20	11.7	5
61	3.4		6.9		2.8	
62	2.4		7.4		2.0	
63	3.3		4.6		7.5	
64	2.9		5.3		1.9	
65	2.4		7.2		13.0	
66	4.0		5.5		11.7	
67	3.4		6.3		6.4	
68	3.5		4.7		6.2	
69	2.9		5.1		4.3	
70	1.8	10	3.6	10	2.9	0
71	3.3		3.9		6.3	
72	2.5		3.2		8.9	
73	11.5		5.4		5.7	
74	2.6		5.6		12.6	
75	2.9		2.6		6.4	
76	2.5		3.4		6.2	
77	8.3		3.9		5.9	
78	3.3		2.4		8.1	
79	3.0		3.3		3.2	
80	5.0	10	5.7	30	4.4	10
81	1.9		2.9		9.7	
82	3.9		3.0		3.9	
83	2.3		2.3		5.2	
84	8.7		5.7		10.5	
85	2.0		5.0		7.6	
86	2.4		4.1		12.2	
87	7.5		7.0		9.8	
88	7.3		6.2		5.4	
89	2.2		6.3		3.3	
90	3.2	20	9.0	20	3.2	20
91	4.6		8.1		7.4	
92	5.9		5.4		4.3	
93	13.0		5.3		6.2	
94	6.5		8.0		9.4	
95	10.2		8.4		5.0	
96	3.4		3.2		9.1	
97	3.3		5.4		4.0	
98	4.5		4.6		4.8	
99	3.0		4.1		12.4	
100	6.0	20	3.1	30	5.9	10
Minimum	**1.0**		**1.2**		**0.6**	
Maximum	**13.4**		**9.4**		**15.2**	
Mean	**4.5**		**4.8**		**5.6**	
Geometric mean	**3.8**		**4.5**		**4.8**	
Median	**3.5**	**20**	**4.6**	**20**	**5.0**	**10**

Note: intermediate axis length is the second longest axis on a cobble. Embeddedness refers to how deeply the cobble is surrounde by other substrate.

Table E.5: Intermediate axis length and embeddedness of 100 cobble washed during Hess sampling at benthic invertebrate stations, Minto Mine WUL, 2013.

Cobble Number	LMC-3		LMC-4		LMC-5	
	Intermediate Axis Length (cm)	Embeddedness (%)	Intermediate Axis Length (cm)	Embeddedness (%)	Intermediate Axis Length (cm)	Embeddedness (%)
1	5.0		5.8		10.3	
2	5.6		4.7		4.4	
3	8.0		5.8		3.0	
4	4.3		3.9		13.3	
5	5.7		12.1		4.4	
6	4.0		4.6		3.8	
7	3.3		3.8		2.7	
8	7.1		4.1		5.0	
9	6.5		6.2		4.4	
10	6.2	10	4.9	20	5.2	50
11	5.2		6.8		9.3	
12	3.8		9.5		2.9	
13	3.7		3.3		7.6	
14	14.2		3.3		2.9	
15	3.6		5.9		3.9	
16	3.1		5.6		4.2	
17	4.0		3.5		5.5	
18	5.3		4.4		4.2	
19	5.1		5.8		4.4	
20	5.0	10	5.5	10	3.8	40
21	3.2		1.1		5.7	
22	6.8		4.3		6.7	
23	8.2		3.4		3.2	
24	10.5		2.6		3.6	
25	8.3		3.2		10.8	
26	7.3		6.9		16.2	
27	5.7		9.3		8.2	
28	5.0		6.0		3.5	
29	6.6		9.4		6.3	
30	4.2	0	4.4	10	3.3	20
31	6.5		4.6		4.7	
32	3.3		7.0		4.4	
33	11.4		4.5		4.6	
34	5.7		6.1		4.9	
35	6.8		5.2		4.9	
36	12.4		7.4		4.7	
37	11.5		3.6		4.2	
38	4.8		5.2		4.9	
39	6.6		4.9		5.0	
40	9.3	10	3.9	20	3.7	10
41	7.1		3.7		4.5	
42	3.9		4.3		3.0	
43	6.6		4.6		2.6	
44	4.0		2.9		3.1	
45	4.7		2.3		2.1	
46	4.5		3.7		2.4	
47	6.1		3.4		2.3	
48	3.2		4.1		2.2	
49	3.7		3.8		4.6	
50	3.9	10	2.6	20	3.8	10
51	4.6		2.4		5.7	
52	3.9		1.8		3.4	
53	4.0		10.2		9.4	
54	7.0		5.9		3.5	
55	12.5		8.4		8.1	
56	7.3		3.9		2.9	
57	5.2		9.1		9.4	
58	7.5		4.2		7.3	
59	5.4		15.0		5.2	
60	9.0	0	4.3	30	5.3	50
61	9.3		12.2		5.7	
62	3.0		5.9		4.6	
63	4.0		3.1		3.0	
64	3.4		3.4		3.4	
65	4.6		5.7		2.8	
66	4.3		3.4		3.2	
67	5.4		7.5		2.0	
68	3.4		9.7		5.6	
69	12.4		7.0		2.6	
70	8.3	10	4.6	20	3.1	30
71	10.3		4.2		1.0	
72	6.2		9.2		2.3	
73	13.7		4.8		7.1	
74	3.1		3.3		4.9	
75	7.9		5.6		8.0	
76	7.1		3.2		10.1	
77	12.3		2.9		2.7	
78	3.1		7.1		6.1	
79	6.5		2.5		8.5	
80	4.1	20	3.0	30	4.2	80
81	7.9		2.9		8.6	
82	4.3		3.7		7.6	
83	6.3		2.7		7.0	
84	3.8		3.4		6.4	
85	7.7		6.5		2.5	
86	5.4		7.8		4.0	
87	5.1		2.2		7.5	
88	4.5		2.5		5.6	
89	5.4		4.7		3.8	
90	4.3	30	7.6	40	2.2	10
91	12.0		6.4		8.5	
92	4.8		2.3		12.4	
93	4.7		3.1		1.3	
94	7.5		5.3		5.2	
95	9.0		6.3		8.7	
96	4.6		3.5		3.7	
97	2.6		8.4		2.0	
98	5.0		6.2		5.6	
99	6.4		6.5		3.3	
100	6.9	10	11.0	20	9.2	40
Minimum	**2.6**		**1.1**		**1.0**	
Maximum	**14.2**		**15.0**		**16.2**	
Mean	**6.2**		**5.2**		**5.2**	
Geometric mean	**5.7**		**4.7**		**4.5**	
Median	**5.4**	**10**	**4.6**	**20**	**4.5**	**35**

Note: intermediate axis length is the second longest axis on a cobble. Embeddedness refers to how deeply the cobble is surrounde by other substrate.

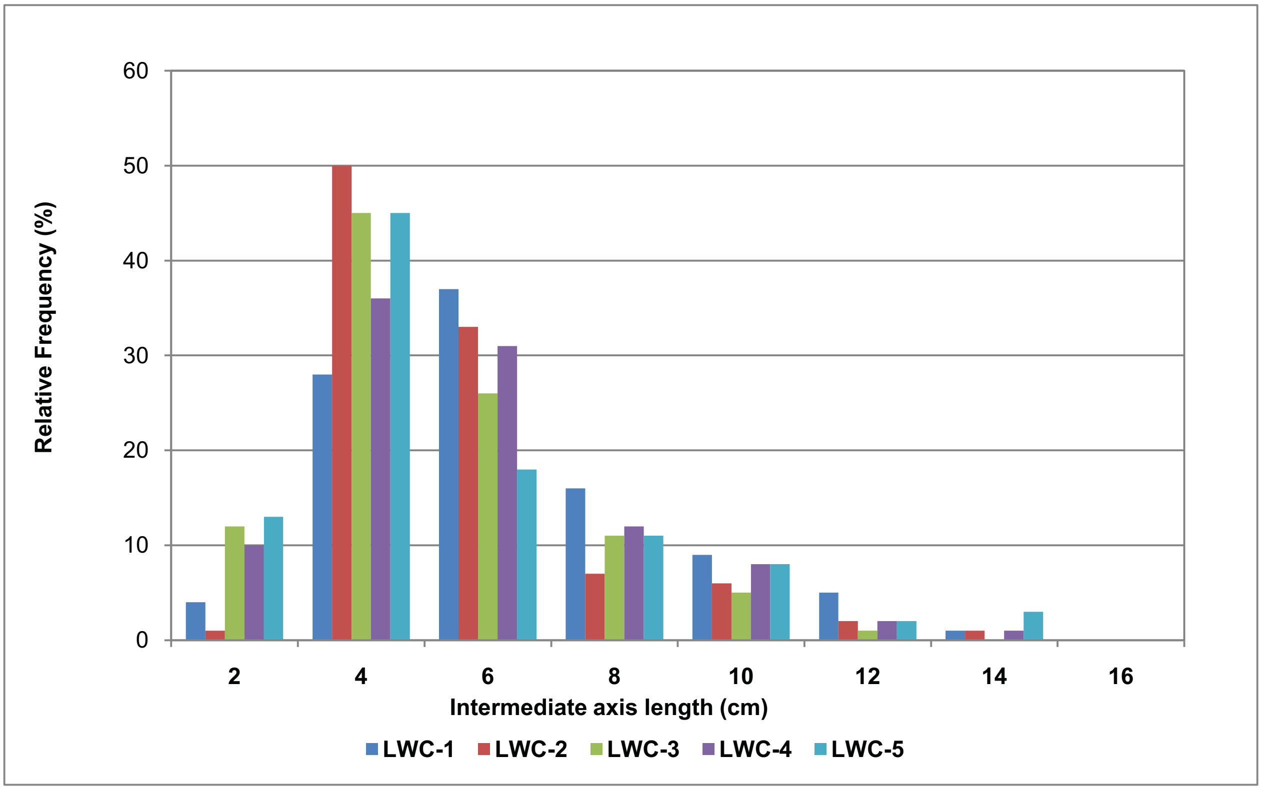


Figure E.1a: Intermediate axis length of 100 rocks measured at five benthic stations in Lower Wolverine Creek.

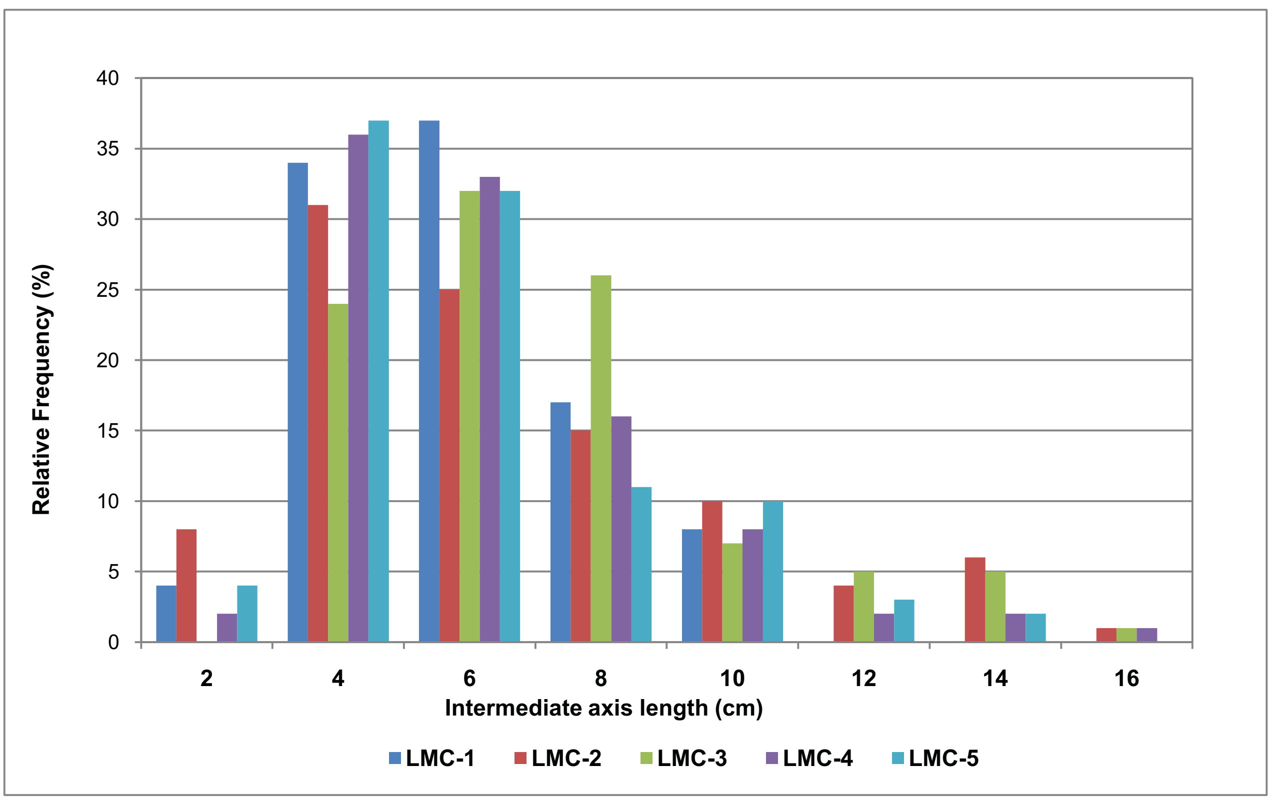


Figure E.1b: Intermediate axis length of 100 rocks measured at five benthic stations in Lower Minto Creek.

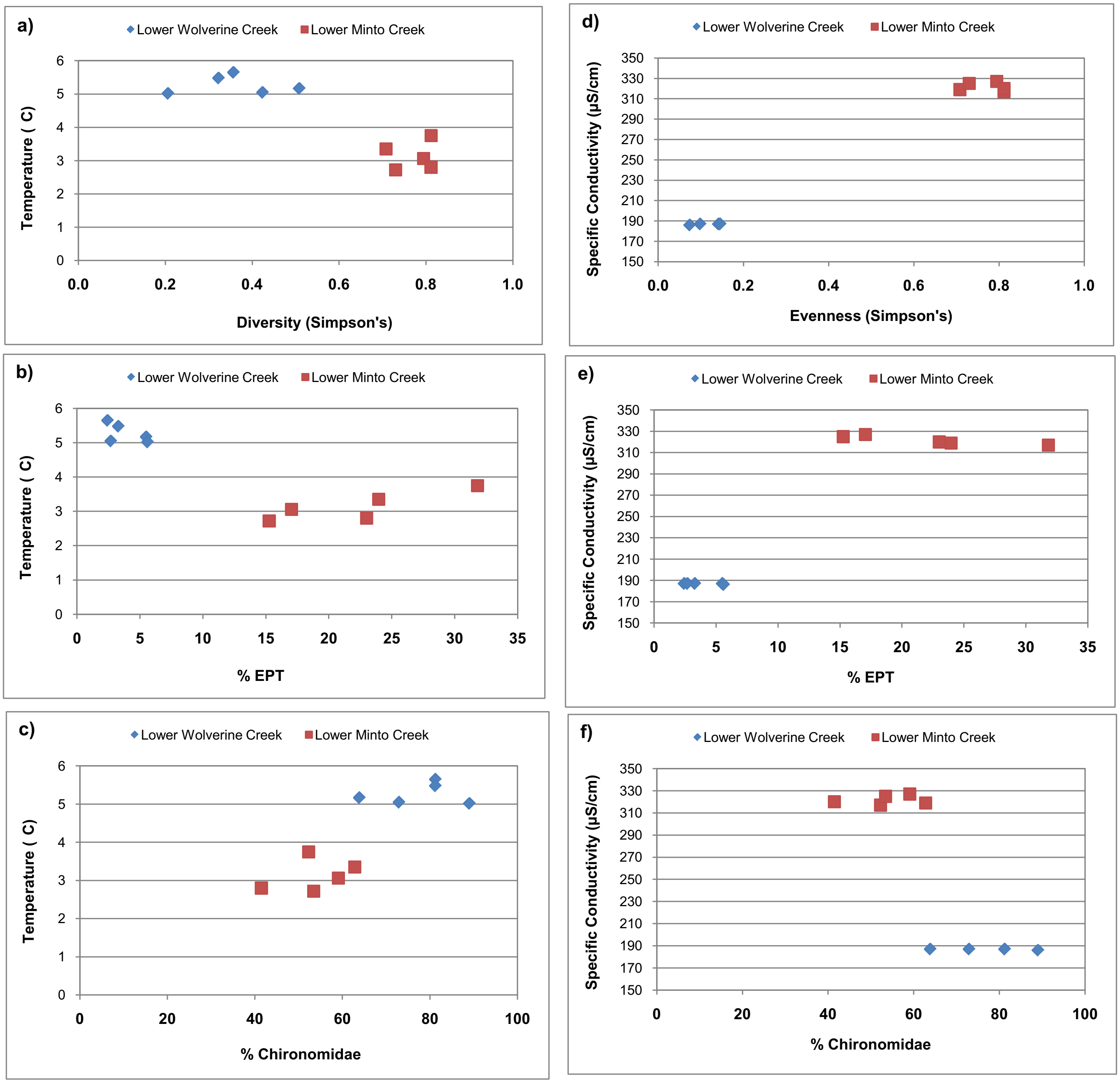
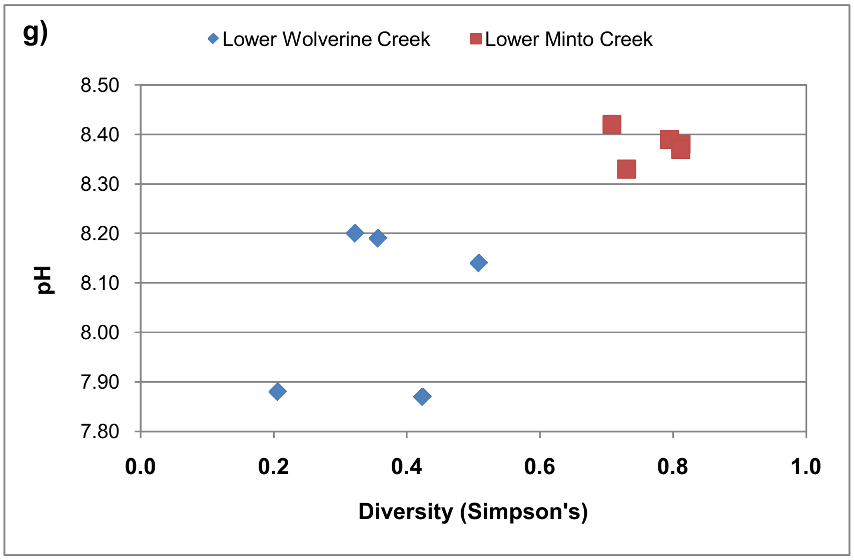
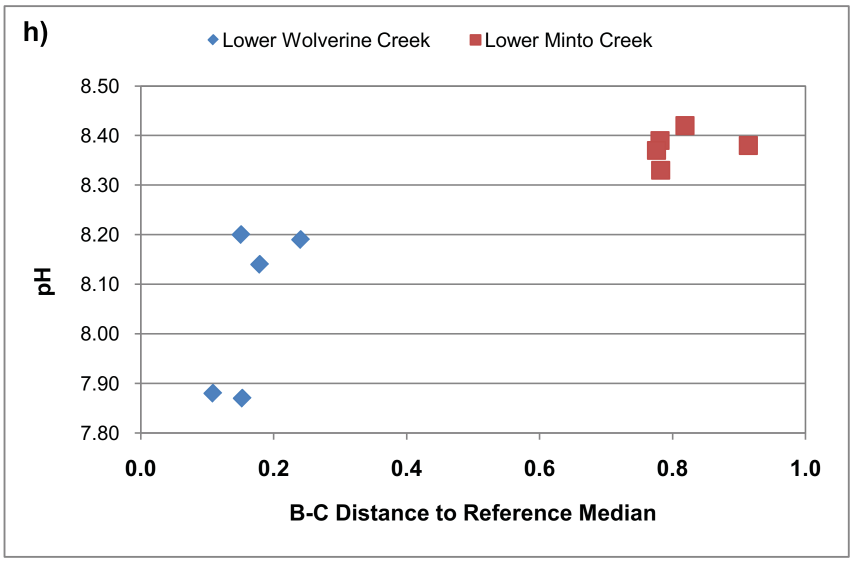


Figure E.2: Scatterplots of significant relationships between selected benthic invertebrate community metrics and a - c) temperature, d - f) specific conductivity, g - h) pH and i) DO %, Minto Mine WUL, 2013.





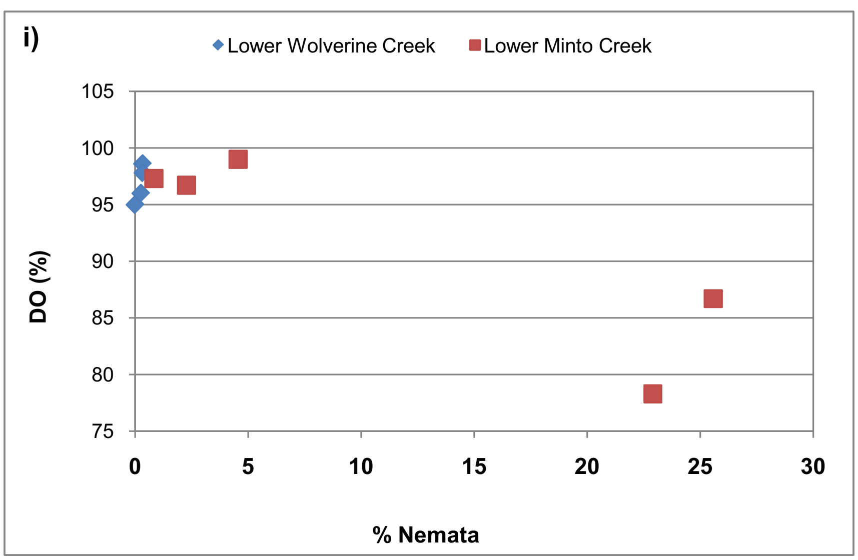


Figure E.2: Scatterplots of significant relationships between selected benthic invertebrate community metrics and a - c) temperature, d - f) specific conductivity, g - h) pH and i) DO %, Minto Mine WUL, 2013.

Cordillera Consulting

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Site:	LMC	LMC	LMC	LMC	LMC	LWC	LWC	LWC	LWC	LWC
Sample:	1	2	3	4	5	1	2	3	4	5
CC#:	CC140931	CC140932	CC140933	CC140934	CC140935	CC140936	CC140937	CC140938	CC140939	CC140940
EMS:										
Phylum: Arthropoda	0		0		0		0		0	
Subphylum: Hexapoda	0		0		0		0		0	
| Class: Insecta	0		0		0		0		0	
| Order: Ephemeroptera	0		0		0		0		0	
| Family: Ameletidae	0		0		0		0		0	
Ameletus	0		0		0		0		1	
| Family: Baetidae	0		0		0		0		0	
Baetis bicaudatus	1		0	2	0		0		0	
Baetis sp.	0		3	4	3	1	0		0	
Baetis tricaudatus group	0		1		1		0		0	
| Family: Ephemerellidae	0		0		0		0		0	
Drunella grandis group	0		0		0		0		1	
Ephemerella dorothea/excrucians	0		0		0		4		0	2
| Family: Heptageniidae	0		0		0	4	4	6	2	4
Cinygmula sp.	1		0		0		0		0	
Heptagenia sp.	0		0		0		0	2	4	2
	0		0		0		0		0	
| Order: Plecoptera	0		0		0		0		0	
| Family: Capniidae	0		0	1	1		2	2	4	
| Family: Chloroperlidae	0		0		0		1		0	1
Suwallia sp.	0		0		0		1	4	0	
Sweltsa sp.	0		0		0		0		1	
| Family: Leuctridae	0		0		0		1		0	
| Family: Nemouridae	0	8	14	11	2		1	1	0	
Ostrocerca sp.	8	5	3	11	3		0		0	
Podmosta sp.	2	10	21	48	3		0		0	
Zapada cinctipes	0		0		1		0		0	
Zapada sp.	0		0		0		0		1	
| Family: Perlodidae	0		0		0		1		3	5
Isoperla sp.	0		0		0		1	2	4	2
	0		0		0		0		0	
| Order: Trichoptera	0		0		0		0		0	
| Family: Limnephilidae	2	5	3	2	6		3	1	0	
Dicosmoecus obscuripennis	0	1	0	2	0		0		0	
Ecclisomyia sp.	0		0		0	2	3	2	0	
| Family: Rhyacophilidae	0		0		0		0		0	
Rhyacophila brunnea/vemna group	0		0		0		1		1	
	0		0		0		0		0	
| Order: Coleoptera	0		0		0		0		0	
| Family: Elmidae	0		0		0		0		0	
Optioservus sp.	0		0		0	1	0		0	
	0		0		0		0		0	
| Order: Diptera	0		0	1	1		0		0	
| Family: Ceratopogonidae	0		0		0		0		0	
Ceratopogon sp.	0		0		0		0	1	1	
| Family: Chironomidae	0		0		0		0		0	
| Subfamily: Chironominae	0		0		0		0		0	
| Tribe: Chironomini	0		0		0		0		0	
Chironomus sp.	0		0		1		0		0	
| Tribe: Tanytarsini	0		0		0		0		0	
Paratanytarsus sp.	0		0		1		0		0	
Tanytarsus sp.	1		0		0		0		0	
| Subfamily: Diamesinae	0		0		0		0		0	
| Tribe: Diamesini	0		0		0		0		0	
Diamesa sp.	0		1		0		0		0	
Pagastia sp.	0		1		0		1		0	
Potthastia sp.	0		0		0	1	0		0	

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Sample:	1	2	3	4	5	1	2	3	4	5
CC#:	CC140931	CC140932	CC140933	CC140934	CC140935	CC140936	CC140937	CC140938	CC140939	CC140940
EMS:										
| Subfamily: Orthocladiinae	0		0		0		0		0	
Brillia sp.	0		2		0		0		0	
Diplocladius sp.	2		0		1		0		0	
Eukiefferiella sp.	4	29	83	64	12	6	4	1	0	
Hydrobaenus sp.	0		1		0		0		0	
Limnophyes sp.	0		2		0		0		0	
Orthocladius complex	1	3	2	1	0	214	254	486	0	
Orthocladius lignicola	0		0		0		0		1	
Orthocladius sp.	14	44	63	80	54	13	8	7	348	434
Paraphaenocladius sp.	0		0	1	1		0		0	
Tvetenia sp.	1		0		0		0		0	
| Subfamily: Tanypodinae	0		0		0		0		0	
| Tribe: Pentaneurini	0		0		0		0		0	
Ablabesmyia sp.	0		1		0		0		0	
| Family: Empididae	0		0		0		1	1	0	
Chelifera/ Metachela	0		3		0	1	2		3	2
Clinocera sp.	0		3		1		0		0	
Neoplasta sp.	0		0	1	0	1	1	5	5	13
| Family: Simuliidae	0	3	10	10	1		0		0	2
Helodon sp.	0		0	2	0		0		0	
Simulium sp.	0	2	3		0		0		0	
| Family: Tipulidae	0		0		0		0		0	
Dicranota sp.	0		3	3	1		1	7	2	2
Epiphragma sp.	0		0	1	0		0		0	
Hesperoconopa sp.	0		0		0		0	1	2	
Rhabdomastix sp.	0		0		0		0		1	
Tipula sp.	0		0		0		0	1	0	
	0		0		0		0		0	
| Order: Hemiptera	0		0		0		0		0	
| Family: Corixidae	0		0		0		0		0	
Sigara sp.	0		0		0	1	0		0	
	0		0		0		0		0	
| Order: Lepidoptera	1		0		0		0		0	
	0		0		0		0		0	
Subphylum: Chelicerata	0		0		0		0		0	
| Class: Arachnida	0		0		0		0		0	
| Order: Trombidiformes	0		0		0		0		0	
| Family: Hygrobatidae	0		0		0		0		0	
Hygrobates sp.	0		0		0		0		0	1
| Family: Lebertiidae	0		0		0		0		0	
Lebertia sp.	0		0		0		0		0	1
| Family: Sperchontidae	0		0		0		0		0	
Sperchon sp.	0	3	4	10	1	1	0	1	1	
	0		0		0		0		0	
| Order: Sarcoptiformes	0		0		0		0		0	
| Family: Hydrozetidae	0	2	1		1		0		0	
	0		0		0		0		0	
Phylum: Mollusca	0		0		0		0		0	
| Class: Bivalvia	0		0		0		0		0	
| Order: Veneroida	0		0		0		0		0	
| Family: Pisidiidae	0	1	0		0		0		0	
	0		0		0		0		0	
Phylum: Annelida	0		0		0		0		0	
Subphylum: Clitellata	0		0		0		0		0	
| Class: Oligochaeta	0		0		0		0		0	
| Order: Lumbriculida	0		0		0		0		0	
| Family: Lumbriculidae	1		0		2	42	122	72	5	121
	0		0		0		0		0	
| Order: Tubificida	0		0		0		0		0	
| Family: Enchytraeidae	0		0		0		0		0	
Enchytraeus	2	3	0		0		1	3	0	
| Family: Tubificidae	0		0		0		0		0	
| Subfamily: Tubificinae immatu	0		24	7	0		0		0	
Totals:	**41**	**119**	**252**	**262**	**98**	**288**	**418**	**606**	**391**	**592**

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Sample:	1	2	3	4	5	1	2	3	4	5
CC#:	CC140931	CC140932	CC140933	CC140934	CC140935	CC140936	CC140937	CC140938	CC140939	CC140940
EMS:										
Taxa present but not included:										
Phylum: Arthropoda	0		0		0		0		0	
| Class: Entognatha	0		0		0		0		0	
| Order: Collembola	2	1	0		0		0		0	
	0		0		0		0		0	
Subphylum: Crustacea	0		0		0		0		0	
| Class: Ostracoda	0		0		3		0		0	1
	0		0		0		0		0	
Phylum: Nemata	1	1	12	90	30		0	2	1	2
Totals:	**3**	**2**	**12**	**90**	**33**	**0**	**0**	**2**	**1**	**3**

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Sample:	1	2	3	4	5	1	2	3	4	5
CC#:	CC140931	CC140932	CC140933	CC140934	CC140935	CC140936	CC140937	CC140938	CC140939	CC140940
EMS:										
Richness Measures										
Species Richness	14	14	23	20	21	13	22	20	20	14
EPT Richness	5	5	6	8	8	3	12	8	10	6
Ephemeroptera Richness	2		2	2	2	2	2	2	4	3
Plecoptera Richness	2	3	3	4	5		7	4	5	3
Trichoptera Richness	1	2	1	2	1	1	3	2	1	
Chironomidae Richness	6	3	9	4	6	4	4	3	2	1
Oligochaeta Richness	2	1	1	1	1	1	2	2	1	1
Non-Chiro. Non-Olig. Richness										
Abundance Measures										
Corrected Abundance	41	119	252	262	98	288	418	606	391	592
EPT Abundance	14	29	45	81	20	7	23	20	22	16
Dominance Measures										
1st Dominant Taxon	Orthocladius sp.	Orthocladius sp.	Eukiefferiella sp.	Orthocladius sp.	Orthocladius sp.	Orthocladius complex	Orthocladius complex	Orthocladius complex	Orthocladius sp.	Orthocladius sp.
1st Dominant Abundance	14	44	83	80	54	214	254	486	348	434
2nd Dominant Taxon	Ostrocerca sp.	Eukiefferiella sp.	Orthocladius sp.	Eukiefferiella sp.	Eukiefferiella sp.	Lumbriculidae	Lumbriculidae	Lumbriculidae	Lumbriculidae	Lumbriculidae
2nd Dominant Abundance	8	29	63	64	12	42	122	72	5	121
3rd Dominant Taxon	Eukiefferiella sp.	Podmosta sp.	Tubificinae immature	Podmosta sp.	Limnephilidae	Orthocladius sp.	Orthocladius sp.	Dicranota sp.	Neoplasta sp.	Neoplasta sp.
3rd Dominant Abundance	4	10	24	48	6	13	8	7	5	13
% 1 Dominant Taxon	34.15%	36.97%	32.94%	30.53%	55.10%	74.31%	60.77%	80.20%	89.00%	73.31%
% 2 Dominant Taxa	19.51%	24.37%	25.00%	24.43%	12.24%	14.58%	29.19%	11.88%	1.28%	20.44%
% 3 Dominant Taxa	9.76%	8.40%	9.52%	18.32%	6.12%	4.51%	1.91%	1.16%	1.28%	2.20%
Community Composition										
% Ephemeroptera	4.88%		1.59%	2.29%	4.08%	1.74%	1.91%	1.32%	2.05%	1.35%
% Plecoptera	24.39%	19.33%	15.08%	27.10%	10.20%		1.91%	1.49%	3.32%	1.35%
% Trichoptera	4.88%	5.04%	1.19%	1.53%	6.12%	0.69%	1.67%	0.50%	0.26%	
% EPT	34.15%	24.37%	17.86%	30.92%	20.41%	2.43%	5.50%	3.30%	5.63%	2.70%
% Diptera	56.10%	68.07%	70.63%	62.60%	75.51%	81.94%	65.07%	84.16%	92.84%	76.52%
% Oligochaeta	7.32%	2.52%	9.52%	2.67%	2.04%	14.58%	29.43%	12.38%	1.28%	20.44%
% Baetidae	2.44%		1.59%	2.29%	4.08%	0.35%				
% Chironomidae	56.10%	63.87%	61.90%	55.73%	71.43%	81.25%	63.88%	81.52%	89.26%	73.31%
% Odonata										

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Sample:	1	2	3	4	5	1	2	3	4	5
CC#:	CC140931	CC140932	CC140933	CC140934	CC140935	CC140936	CC140937	CC140938	CC140939	CC140940
EMS:										
Functional Group Composition										
% Predators		4.20%	5.56%	5.34%	4.08%	1.39%	1.91%	3.47%	4.86%	3.55%
% Shredder-Herbivores	24.39%	12.61%	10.32%	22.52%	7.14%				0.26%	
% Collector-Gatherers	53.66%	42.02%	39.29%	36.26%	64.29%	94.10%	93.30%	93.89%	91.56%	94.09%
% Scrapers	2.44%					0.35%		0.33%	1.02%	0.34%
% MH										
% CF	2.44%	2.52%	1.19%	0.76%	1.02%					
% OM	9.76%	25.21%	32.94%	25.19%	12.24%	2.78%	1.67%	0.66%		
% PA										
% Piercer-Herbivore										
% Gatherer										
% Unclassified	7.32%	13.45%	10.71%	9.92%	11.22%	1.39%	3.11%	1.65%	2.30%	2.03%
Functional Group Richness										
Predators Richness		2	5	3	4	4	7	7	9	6
Shredder-Herbivores Richness	2	2	3	2	3				1	
Collector-Gatherers Richness	7	3	10	6	7	5	6	5	6	3
Scrapers Richness	1					1		1	1	1
MH Richness										
CF Richness	1	2	1	1	1					
OM Richness	1	2	1	2	1	2	2	3		
PA Richness										
Piercer-Herbivore Richness										
Gatherer Richness										
Unclassified	2	3	3	6	5	1	7	4	3	4
Diversity/Evenness Measures										
Shannon-Weiner H' (log 10)	0.93	0.85	0.92	0.88	0.80	0.41	0.51	0.36	0.28	0.37
Shannon-Weiner H' (log 2)	3.08	2.82	3.05	2.92	2.66	1.38	1.68	1.21	0.94	1.24
Shannon-Weiner H' (log e)	2.14	1.96	2.11	2.02	1.84	0.95	1.17	0.84	0.65	0.86
Simpson's Index (D)	0.16	0.21	0.19	0.19	0.32	0.57	0.45	0.66	0.79	0.58
Simpson's Index of Diversity (1 - D)	0.84	0.79	0.81	0.81	0.68	0.43	0.55	0.34	0.21	0.42
Simpson's Reciprocal Index (1/D)	6.36	4.81	5.26	5.23	3.12	1.74	2.20	1.52	1.26	1.73
Biotic Indices										
Hilsenhoff Biotic Index	4.61	5.21	5.02	4.74	5.17	6.21	6.30	6.05	5.72	6.25

Cordillera Consulting

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Site:	LMC	LMC	LMC	LMC	LMC	LWC	LWC	LWC	LWC	LWC
Sample:	1	2	3	4	5	1	2	3	4	5
CC#:	CC140931	CC140932	CC140933	CC140934	CC140935	CC140936	CC140937	CC140938	CC140939	CC140940
EMS:										
Sieve Size:	500	500	500	500	500	500	500	500	500	500
SubSample %:	100	100	100	100	100	100	100	100	100	100
Phylum: Arthropoda	0		0		0		0		0	
Subphylum: Hexapoda	0		0		0		0		0	
| Class: Insecta	0		0		0		0		0	
| Order: Ephemeroptera	0		0		0		0		0	
| Family: Ameletidae	0		0		0		0		0	
Ameletus	0		0		0		0		1	
| Family: Baetidae	0		0		0		0		0	
Baetis bicaudatus	1		0	2	0		0		0	
Baetis sp.	0		3	4	3	1	0		0	
Baetis tricaudatus group	0		1		1		0		0	
| Family: Ephemerellidae	0		0		0		0		0	
Drunella grandis group	0		0		0		0		1	
Ephemerella dorothea/excrucians	0		0		0		4		0	2
| Family: Heptageniidae	0		0		0	4	4	6	2	4
Cinygmula sp.	1		0		0		0		0	
Heptagenia sp.	0		0		0		0	2	4	2
	0		0		0		0		0	
| Order: Plecoptera	0		0		0		0		0	
| Family: Capniidae	0		0	1	1		2	2	4	
| Family: Chloroperlidae	0		0		0		1		0	1
Suwallia sp.	0		0		0		1	4	0	
Sweltsa sp.	0		0		0		0		1	
| Family: Leuctridae	0		0		0		1		0	
| Family: Nemouridae	0	8	14	11	2		1	1	0	
Ostrocerca sp.	8	5	3	11	3		0		0	
Podmosta sp.	2	10	21	48	3		0		0	
Zapada cinctipes	0		0		1		0		0	
Zapada sp.	0		0		0		0		1	
| Family: Perlodidae	0		0		0		1		3	5
Isoperla sp.	0		0		0		1	2	4	2
	0		0		0		0		0	
| Order: Trichoptera	0		0		0		0		0	
| Family: Limnephilidae	2	5	3	2	6		3	1	0	
Dicosmoecus obscuripennis	0	1	0	2	0		0		0	
Ecclisomyia sp.	0		0		0	2	3	2	0	
| Family: Rhyacophilidae	0		0		0		0		0	
Rhyacophila brunnea/vemna grou	0		0		0		1		1	
	0		0		0		0		0	
| Order: Coleoptera	0		0		0		0		0	
| Family: Elmidae	0		0		0		0		0	
Optioservus sp.	0		0		0	1	0		0	
	0		0		0		0		0	
| Order: Diptera	0		0	1	1		0		0	
| Family: Ceratopogonidae	0		0		0		0		0	
Ceratopogon sp.	0		0		0		0	1	1	
| Family: Chironomidae	0		0		0		0		0	
| Subfamily: Chironominae	0		0		0		0		0	
| Tribe: Chironomini	0		0		0		0		0	
Chironomus sp.	0		0		1		0		0	
| Tribe: Tanytarsini	0		0		0		0		0	
Paratanytarsus sp.	0		0		1		0		0	
Tanytarsus sp.	1		0		0		0		0	
| Subfamily: Diamesinae	0		0		0		0		0	
| Tribe: Diamesini	0		0		0		0		0	
Diamesa sp.	0		1		0		0		0	
Pagastia sp.	0		1		0		1		0	
Potthastia sp.	0		0		0	1	0		0	

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Site:	LMC	LMC	LMC	LMC	LMC	LWC	LWC	LWC	LWC	LWC
Sample:	1	2	3	4	5	1	2	3	4	5
CC#:	CC140931	CC140932	CC140933	CC140934	CC140935	CC140936	CC140937	CC140938	CC140939	CC140940
EMS:										
Sieve Size:	500	500	500	500	500	500	500	500	500	500
SubSample %:	100	100	100	100	100	100	100	100	100	100
| Subfamily: Orthocladiinae	0		0		0		0		0	
Brillia sp.	0		2		0		0		0	
Diplocladius sp.	2		0		1		0		0	
Eukiefferiella sp.	4	29	83	64	12	6	4	1	0	
Hydrobaenus sp.	0		1		0		0		0	
Limnophyes sp.	0		2		0		0		0	
Orthocladius complex	1	3	2	1	0	214	254	486	0	
Orthocladius lignicola	0		0		0		0		1	
Orthocladius sp.	14	44	63	80	54	13	8	7	348	434
Paraphaenocladius sp.	0		0	1	1		0		0	
Tvetenia sp.	1		0		0		0		0	
| Subfamily: Tanypodinae	0		0		0		0		0	
| Tribe: Pentaneurini	0		0		0		0		0	
Ablabesmyia sp.	0		1		0		0		0	
| Family: Empididae	0		0		0		1	1	0	
Chelifera/ Metachela	0		3		0	1	2		3	2
Clinocera sp.	0		3		1		0		0	
Neoplasta sp.	0		0	1	0	1	1	5	5	13
| Family: Simuliidae	0	3	10	10	1		0		0	2
Helodon sp.	0		0	2	0		0		0	
Simulium sp.	0	2	3		0		0		0	
| Family: Tipulidae	0		0		0		0		0	
Dicranota sp.	0		3	3	1		1	7	2	2
Epiphragma sp.	0		0	1	0		0		0	
Hesperoconopa sp.	0		0		0		0	1	2	
Rhabdomastix sp.	0		0		0		0		1	
Tipula sp.	0		0		0		0	1	0	
	0		0		0		0		0	
| Order: Hemiptera	0		0		0		0		0	
| Family: Corixidae	0		0		0		0		0	
Sigara sp.	0		0		0	1	0		0	
	0		0		0		0		0	
| Order: Lepidoptera	1		0		0		0		0	
	0		0		0		0		0	
Subphylum: Chelicerata	0		0		0		0		0	
| Class: Arachnida	0		0		0		0		0	
| Order: Trombidiformes	0		0		0		0		0	
| Family: Hygrobatidae	0		0		0		0		0	
Hygrobates sp.	0		0		0		0		0	1
| Family: Lebertiidae	0		0		0		0		0	
Lebertia sp.	0		0		0		0		0	1
| Family: Sperchontidae	0		0		0		0		0	
Sperchon sp.	0	3	4	10	1	1	0	1	1	
	0		0		0		0		0	
| Order: Sarcoptiformes	0		0		0		0		0	
| Family: Hydrozetidae	0	2	1		1		0		0	
	0		0		0		0		0	
Phylum: Mollusca	0		0		0		0		0	
| Class: Bivalvia	0		0		0		0		0	
| Order: Veneroida	0		0		0		0		0	
| Family: Pisidiidae	0	1	0		0		0		0	
	0		0		0		0		0	
Phylum: Annelida	0		0		0		0		0	
Subphylum: Clitellata	0		0		0		0		0	
| Class: Oligochaeta	0		0		0		0		0	
| Order: Lumbriculida	0		0		0		0		0	
| Family: Lumbriculidae	1		0		2	42	122	72	5	121
	0		0		0		0		0	
| Order: Tubificida	0		0		0		0		0	
| Family: Enchytraeidae	0		0		0		0		0	
Enchytraeus	2	3	0		0		1	3	0	
| Family: Tubificidae	0		0		0		0		0	
| Subfamily: Tubificinae immatu	0		24	7	0		0		0	
Totals:	**41**	**119**	**252**	**262**	**98**	**288**	**418**	**606**	**391**	**592**

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Site:	LMC	LMC	LMC	LMC	LMC	LWC	LWC	LWC	LWC	LWC
Sample:	1	2	3	4	5	1	2	3	4	5
CC#:	CC140931	CC140932	CC140933	CC140934	CC140935	CC140936	CC140937	CC140938	CC140939	CC140940
EMS:										
Sieve Size:	500	500	500	500	500	500	500	500	500	500
SubSample %:	100	100	100	100	100	100	100	100	100	100
Taxa present but not included:										
Phylum: Arthropoda	0		0		0		0		0	
| Class: Entognatha	0		0		0		0		0	
| Order: Collembola	2	1	0		0		0		0	
	0		0		0		0		0	
Subphylum: Crustacea	0		0		0		0		0	
| Class: Ostracoda	0		0		3		0		0	1
	0		0		0		0		0	
Phylum: Nemata	1	1	12	90	30		0	2	1	2
Totals:	**3**	**2**	**12**	**90**	**33**	**0**	**0**	**2**	**1**	**3**

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Site - LMC Sample - 1, CC# - CC140931, Percent sampled = 100, Sieve size = 500		
Baetis bicaudatus	Larvae	1
Cinygmula sp.	Larvae	1
Ostrocerca sp.	Larvae	8
Podmosta sp.	Larvae	2
Enchytraeus	None	2
Lumbriculidae	None	1
Lepidoptera	Larvae	1
Orthocladius sp.	Pupa	14
Orthocladius complex	Larvae	1
Tvetenia sp.	Larvae	1
Diplocladius sp.	Larvae	2
Tanytarsus sp.	Larvae	1
Eukiefferiella sp.	Larvae	4
Limnephilidae	Juvenile/Dam	2
	Total:	**41**

Site - LMC Sample - 2, CC# - CC140932, Percent sampled = 100, Sieve size = 500			
Limnephilidae	Juvenile/Dam	5	
Nemouridae	Juvenile/Dam	8	
Orthocladius sp.	Pupa	44	
Eukiefferiella sp.	Larvae	29	
Orthocladius complex	Larvae	3	
Hydrozetidae	Adult	2	
Dicosmoecus obscuripennis	Larvae	1	not quite sure
Sperchon sp.	Adult	3	
Enchytraeus	None	3	
Podmosta sp.	Larvae	10	
Ostrocerca sp.	Larvae	5	
Pisidiidae	None	1	
Simulium sp.	Larvae	2	
Simuliidae	Pupa	3	
	Total:	**119**	

Site - LMC Sample - 3, CC# - CC140933, Percent sampled = 100, Sieve size = 500		
Simuliidae	Pupa	10
Limnephilidae	Juvenile/Dam	3
Nemouridae	Juvenile/Dam	14
Podmosta sp.	Larvae	21
Ostrocerca sp.	Larvae	3
Simulium sp.	Larvae	3
Dicranota sp.	Larvae	3
Clinocera sp.	Larvae	3
Chelifera/ Metachela	Larvae	3
Baetis sp.	Larvae	3
Baetis tricaudatus group	Larvae	1
Sperchon sp.	Adult	4
Hydrozetidae	Adult	1
Tubificinae immature	None	24
Orthocladius sp.	Pupa	63
Eukiefferiella sp.	Larvae	83
Ablabesmyia sp.	Larvae	1
Orthocladius complex	Larvae	2
Brillia sp.	Larvae	2
Limnophyes sp.	Larvae	2
Hydrobaenus sp.	Larvae	1
Pagastia sp.	Larvae	1
Diamesa sp.	Larvae	1
	Total:	**252**

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Site - LMC Sample - 4, CC# - CC140934, Percent sampled = 100, Sieve size = 500		
Orthocladius sp.	Pupa	80
Eukiefferiella sp.	Larvae	64
Orthocladius complex	Larvae	1
Paraphaenocladius sp.	Larvae	1
Podmosta sp.	Larvae	48
Ostrocerca sp.	Larvae	11
Helodon sp.	Larvae	2
Dicranota sp.	Larvae	3
Neoplasta sp.	Larvae	1
Sperchon sp.	Adult	10
Baetis bicaudatus	Larvae	2
Baetis sp.	Larvae	4
Tubificinae immature	None	7
Dicosmoecus obscuripennis	Larvae	2
Epiphragma sp.	Larvae	1
Limnephilidae	Juvenile/Dam	2
Nemouridae	Juvenile/Dam	11
Simuliidae	Pupa	10
Diptera	Juvenile/Dam	1
Capniidae	Juvenile/Dam	1
	Total:	**262**

Site - LMC Sample - 5, CC# - CC140935, Percent sampled = 100, Sieve size = 500		
Diptera	Juvenile/Dam	1
Simuliidae	Pupa	1
Capniidae	Juvenile/Dam	1
Nemouridae	Juvenile/Dam	2
Zapada cinctipes	Larvae	1
Podmosta sp.	Larvae	3
Ostrocerca sp.	Larvae	3
Baetis sp.	Larvae	3
Baetis tricaudatus group	Larvae	1
Sperchon sp.	Adult	1
Hydrozetidae	Adult	1
Dicranota sp.	Larvae	1
Clinocera sp.	Larvae	1
Lumbriculidae	None	2
Orthocladius sp.	Pupa	54
Eukiefferiella sp.	Larvae	12
Diplocladius sp.	Larvae	1
Chironomus sp.	Larvae	1
Paraphaenocladius sp.	Larvae	1
Paratanytarsus sp.	Larvae	1
Limnephilidae	Juvenile/Dam	6
	Total:	**98**

Site - LWC Sample - 1, CC# - CC140936, Percent sampled = 100, Sieve size = 500		
Orthocladius sp.	Pupa	13
Potthastia sp.	Larvae	1
Eukiefferiella sp.	Larvae	6
Orthocladius complex	Larvae	214
Baetis sp.	Larvae	1
Sperchon sp.	Adult	1
Ecclisomyia sp.	Larvae	2
Optioservus sp.	Larvae	1
Chelifera/ Metachela	Larvae	1
Neoplasta sp.	Larvae	1
Sigara sp.	Larvae	1
Lumbriculidae	None	42
Heptageniidae	Juvenile/Dam	4
	Total:	**288**

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Site - LWC Sample - 2, CC# - CC140937, Percent sampled = 100, Sieve size = 500		
Empididae	Juvenile/Dam	1
Heptageniidae	Juvenile/Dam	4
Perlodidae	Juvenile/Dam	1
Chloroperlidae	Juvenile/Dam	1
Isoperla sp.	Larvae	1
Suwallia sp.	Larvae	1
Rhyacophila brunnea/vemna group	Larvae	1
Ecclisomyia sp.	Larvae	3
Dicranota sp.	Larvae	1
Chelifera/ Metachela	Larvae	2
Neoplasta sp.	Larvae	1
Ephemerella dorothea/excrucians	Larvae	4
Lumbriculidae	None	122
Enchytraeus	None	1
Orthocladius sp.	Pupa	8
Pagastia sp.	Larvae	1
Eukiefferiella sp.	Larvae	4
Orthocladius complex	Larvae	254
Capniidae	Juvenile/Dam	2
Leuctridae	Juvenile/Dam	1
Nemouridae	Juvenile/Dam	1
Limnephilidae	Juvenile/Dam	3
	Total:	**418**

Site - LWC Sample - 3, CC# - CC140938, Percent sampled = 100, Sieve size = 500		
Capniidae	Juvenile/Dam	2
Orthocladius sp.	Pupa	7
Eukiefferiella sp.	Larvae	1
Orthocladius complex	Larvae	486
Isoperla sp.	Larvae	2
Suwallia sp.	Larvae	4
Tipula sp.	Larvae	1
Dicranota sp.	Larvae	7
Hesperoconopa sp.	Larvae	1
Ceratopogon sp.	Larvae	1
Neoplasta sp.	Larvae	5
Heptagenia sp.	Larvae	2
Sperchon sp.	Adult	1
Ecclisomyia sp.	Larvae	2
Enchytraeus	None	3
Lumbriculidae	None	72
Nemouridae	Juvenile/Dam	1
Limnephilidae	Juvenile/Dam	1
Empididae	Juvenile/Dam	1
Heptageniidae	Juvenile/Dam	6
	Total:	**606**

Site - LWC Sample - 4, CC# - CC140939, Percent sampled = 100, Sieve size = 500		
Ameletus	Larvae	1
Orthocladius sp.	Larvae	337
Heptageniidae	Juvenile/Dam	2
Perlodidae	Juvenile/Dam	3
Capniidae	Juvenile/Dam	4
Isoperla sp.	Larvae	4
Zapada sp.	Larvae	1
Sweltsa sp.	Larvae	1
Hesperoconopa sp.	Larvae	2
Rhabdomastix sp.	Larvae	1
Dicranota sp.	Larvae	2
Ceratopogon sp.	Larvae	1
Neoplasta sp.	Larvae	5
Chelifera/ Metachela	Larvae	3
Rhyacophila brunnea/vemna group	Larvae	1
Drunella grandis group	Larvae	1
Heptagenia sp.	Larvae	4
Sperchon sp.	Adult	1
Lumbriculidae	None	5
Orthocladius lignicola	Larvae	1
Orthocladius sp.	Pupa	11
	Total:	**391**

Site - LWC Sample - 5, CC# - CC140940, Percent sampled = 100, Sieve size = 500		
Orthocladius sp.	Pupa	18
Orthocladius sp.	Larvae	416
Dicranota sp.	Larvae	2
Neoplasta sp.	Larvae	13
Chelifera/ Metachela	Larvae	2
Ephemerella dorothea/excrucians	Larvae	2
Heptagenia sp.	Larvae	2
Isoperla sp.	Larvae	2
Hygrobates sp.	Adult	1
Lebertia sp.	Adult	1
Lumbriculidae	None	121
Simuliidae	Pupa	2
Heptageniidae	Juvenile/Dam	4
Chloroperlidae	Juvenile/Dam	1
Perlodidae	Juvenile/Dam	5
	Total:	**592**

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Client	Project	Site	Sample	EMS	CC#	500 micron fraction	
						% Sampled	# Invertebrates
Minnow (Victoria)	Minto	LMC	1		CC140931	100%	44
Minnow (Victoria)	Minto	LMC	2		CC140932	100%	121
Minnow (Victoria)	Minto	LMC	3		CC140933	100%	264
Minnow (Victoria)	Minto	LMC	4		CC140934	100%	352
Minnow (Victoria)	Minto	LMC	5		CC140935	100%	131
Minnow (Victoria)	Minto	LWC	1		CC140936	100%	288
Minnow (Victoria)	Minto	LWC	2		CC140937	100%	418
Minnow (Victoria)	Minto	LWC	3		CC140938	100%	608
Minnow (Victoria)	Minto	LWC	4		CC140939	100%	392
Minnow (Victoria)	Minto	LWC	5		CC140940	100%	595

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	Functional Feeding Groups	ITIS Number	Tolerance
Phylum: Arthropoda	Unclassified	82696	
Subphylum: Hexapoda	Unclassified	563886	
| Class: Insecta	Unclassified	99208	
| Order: Ephemeroptera	Unclassified	100502	
| Family: Ameletidae	Unclassified	568544	
Ameletus	Collector-Gatherer	100996	
| Family: Baetidae	Unclassified	100755	4
Baetis bicaudatus	Collector-Gatherer	100823	4
Baetis sp.	Collector-Gatherer	100800	5
Baetis tricaudatus group	Collector-Gatherer	100817	
| Family: Ephemerellidae	Unclassified	101232	
Drunella grandis group	Collector-Gatherer	101365	
Ephemerella dorothea/excrucians	Collector-Gatherer	101233	1
| Family: Heptageniidae	Unclassified	100504	
Cinygmula sp.	Scraper	100557	4
Heptagenia sp.	Scraper	100602	4
| Order: Plecoptera	Unclassified	102467	
| Family: Capniidae	Unclassified	102643	
| Family: Chloroperlidae	Unclassified	103202	
Suwallia sp.	Predator	103254	1
Sweltsa sp.	Predator	103273	1
| Family: Leuctridae	Unclassified	102840	
| Family: Nemouridae	Unclassified	102517	
Ostrocerca sp.	Shredder-Herbivore	102622	2
Podmosta sp.	Shredder-Herbivore	102605	2
Zapada cinctipes	Shredder-Herbivore	102594	2
Zapada sp.	Shredder-Herbivore	102591	2
| Family: Perlodidae	Unclassified	102994	
Isoperla sp.	Predator	102995	2
| Order: Trichoptera	Unclassified	115095	
| Family: Limnephilidae	Unclassified	115933	
Dicosmoecus obscuripennis	Omnivore	116273	
Ecclisomyia sp.	Omnivore	116025	2
| Family: Rhyacophilidae	Unclassified	115096	1
Rhyacophila brunnea/vemna group	Predator	115097	1
| Order: Coleoptera	Unclassified	109216	4
| Family: Elmidae	Unclassified	114093	4
Optioservus sp.	Scraper	114177	4
| Order: Diptera	Unclassified	118831	
| Family: Ceratopogonidae	Unclassified	127076	6
Ceratopogon sp.	Predator	127564	6
| Family: Chironomidae	Collector-Gatherer	127917	10
| Subfamily: Chironominae	Collector-Gatherer	129228	10
| Tribe: Chironomini	Collector-Gatherer	129229	10
Chironomus sp.	Collector-Gatherer	129254	10
| Tribe: Tanytarsini	Collector-Gatherer	129872	6
Paratanytarsus sp.	Collector-Filterer	129935	6
Tanytarsus sp.	Collector-Filterer	129978	6
| Subfamily: Diamesinae	Collector-Gatherer	128341	5
| Tribe: Diamesini	Unclassified	128351	5
Diamesa sp.	Collector-Gatherer	128355	5
Pagastia sp.	Collector-Gatherer	128401	1
Potthastia sp.	Collector-Gatherer	128408	2
| Subfamily: Orthocladiinae	Unclassified	128457	5
Brillia sp.	Shredder-Herbivore	128477	5
Diplocladius sp.	Collector-Gatherer	128670	
Eukiefferiella sp.	Omnivore	128689	8
Hydrobaenus sp.	Collector-Gatherer	128750	8
Limnophyes sp.	Collector-Gatherer	128776	8
Orthocladius complex	Collector-Gatherer	128874	6
Orthocladius lignicola	Collector-Gatherer	128913	6
Orthocladius sp.	Collector-Gatherer	128874	6
Paraphaenocladius sp.	Collector-Gatherer	128989	4
Tvetenia sp.	Collector-Gatherer	129197	5

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Project: Minto
Minnow (Victoria), Shari Weech Pierre Stecko; Lisa Bowron
Taxonomist: Sue Salter
suesalter@shaw.ca
250-494-7553

	Functional Feeding Groups	ITIS Number	Tolerance
| Subfamily: Tanypodinae	Predator	127917	8
| Tribe: Pentaneurini	Predator	128078	8
Ablabesmyia sp.	Collector-Gatherer	128079	8
| Family: Empididae	Predator	135830	6
Chelifera/ Metachela	Predator	135830	6
Clinocera sp.	Predator	135849	6
Neoplasta sp.	Predator	136352	6
| Family: Simuliidae	Unclassified	126640	
Helodon sp.	Collector-Filterer	126640	
Simulium sp.	Collector-Filterer	126774	6
| Family: Tipulidae	Unclassified	118840	3
Dicranota sp.	Predator	121027	3
Epiphragma sp.	Unclassified	120081	
Hesperoconopa sp.	Collector-Gatherer	120732	1
Rhabdomastix sp.	Predator	120968	3
Tipula sp.	Omnivore	119037	4
| Order: Hemiptera	Unclassified	103359	8
| Family: Corixidae	Predator	103364	8
Sigara sp.	Predator	103369	8
| Order: Lepidoptera	Unclassified	117232	
Subphylum: Chelicerata	Unclassified	82697	8
| Class: Arachnida	Predator	82708	8
| Order: Trombidiformes	Predator	82769	8
| Family: Hygrobatidae	Unclassified	83281	8
Hygrobates sp.	Predator	83297	8
| Family: Lebertiidae	Predator	83033	8
Lebertia sp.	Predator	83034	8
| Family: Sperchontidae	Unclassified	895710	8
Sperchon sp.	Predator	83006	8
| Order: Sarcoptiformes	Predator	83538	5
| Family: Hydrozetidae	Predator	553091	5
Phylum: Mollusca	Unclassified	69458	
| Class: Bivalvia	Unclassified	79118	
| Order: Veneroida	Unclassified	80384	
| Family: Pisidiidae	Collector-Filterer	81388	
Phylum: Annelida	Unclassified	64357	8
Subphylum: Clitellata	Unclassified	568832	8
| Class: Oligochaeta	Collector-Gatherer	68422	8
| Order: Lumbriculida	Unclassified	68439	8
| Family: Lumbriculidae	Collector-Gatherer	68440	8
| Order: Tubificida	Unclassified	68498	10
| Family: Enchytraeidae	Collector-Gatherer	68510	10
Enchytraeus	Collector-Gatherer	68531	10
| Family: Tubificidae	Collector-Gatherer	68585	
| Subfamily: Tubificinae immature	Collector-Gatherer	68585	

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Project: Minto
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			Total from Sample	Percent Efficiency
Site - QC Sample - QC 1, CC# - CC140932, Percent sampled = 100, Sieve size = 500				
Arachnida	None	1		
Chironomidae	None	3		
Diptera	None	1		
Plecoptera	None	1		
Total:		**6**	**121**	**95%**
Site - QC Sample - QC 2, CC# - CC140936, Percent sampled = 100, Sieve size = 500				
No Invertebrates Found	None	1		
Total:		**1**	**288**	**100%**
Site - QC Sample - QC 3, CC# - CC140940, Percent sampled = 100, Sieve size = 500				
Oligochaeta	None	3		
Chironomidae	None	2		
Total:		**5**	**595**	**99%**

Appendix F

Fisheries Monitoring Program, Minto Creek, 2013 Summary Report

FISHERIES MONITORING PROGRAM, MINTO CREEK

2013 SUMMARY REPORT

February 2014

Prepared for:

MINTO EXPLORATIONS LTD

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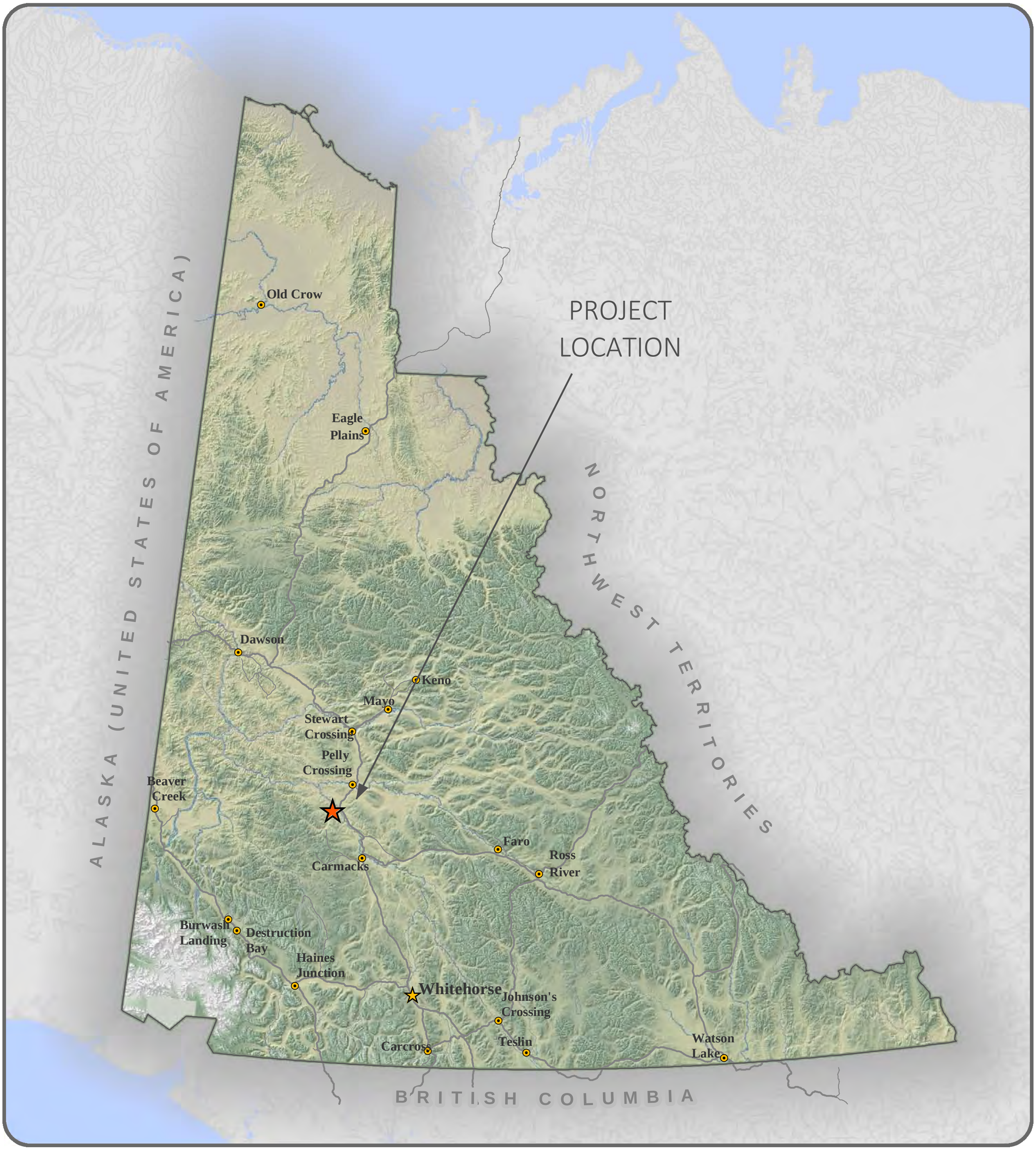
1 INTRODUCTION

Minto Explorations Ltd. (MintoEx), a wholly owned subsidiary of Capstone Mining Corp. (Capstone), owns and operates the Minto Mine, a high-grade copper mine, located approximately 240 km northwest of Whitehorse, Yukon Territory (Figure 1-1). The project is located within Selkirk First Nation (Selkirk) Category A Settlement Land Parcel R6A, and is centered at approximately 62°37'N latitude and 137°15'W longitude. The Minto Mine commenced commercial operation in October 2007 and is permitted to conduct mining and milling operations at a rate of 4,200 tonnes of ore per day (tpd). The Minto orebody (copper/gold/silver) currently being mined is located in the upper reaches of the Minto Creek watershed approximately 12 km to the west of the Minto Creek confluence with the Yukon River (Figure 1-2). MintoEx is required, under the terms of its water use license #QZ96-006 (Amendment 8), to conduct an annual biological monitoring program, of which this fisheries monitoring program in Minto Creek is a component. This program was carried out under DFO Scientific Collection Licence number XR 109 2013.

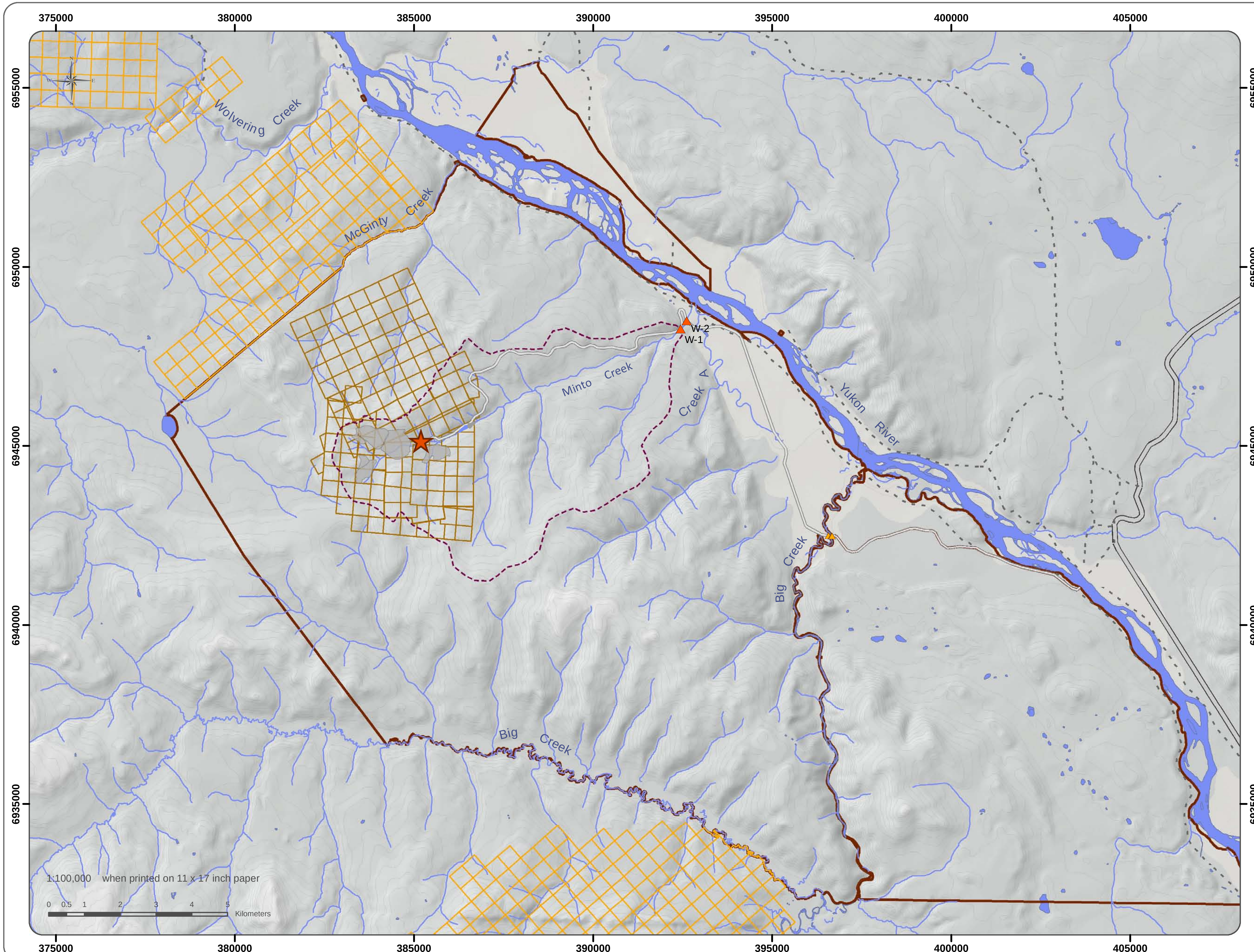


MINTO MINE

FISHERIES MONITORING PROGRAM
MINTO CREEK 2013
SUMMARY REPORT

FIGURE 1-1

PROJECT LOCATION



MINTO MINE

FISHERIES MONITORING PROGRAM, MINTO CREEK 2013 SUMMARY REPORT

FIGURE 1-2
AREA OVERVIEW

- Minto Mine Site
- Fish Monitoring Station
- Water Quality Station
- Mine Access Road
- Road
- Trail
- Watercourse
- Waterbody
- Existing Minto Mine Footprints
- Minto Creek Catchment
- Other Quartz Claims
- Minto Explorations Ltd. Quartz Claims
- First Nation Settlement Land

Quartz claims data obtained from Energy, Mines and Ressources, YTG. Data currrent as of August 1st 2011.

NAD 83 UTM Zone 8N

capstone MINTO MINE

ACCESS

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(*Last edited by: jpan;2/20/2014/11:44 AM*)

2 PREVIOUS STUDIES

Attempts to collect fish in lower Minto Creek while conducting the Phase 1 Metal Mining Effluent Regulation, Environmental Effects Monitoring (EEM) study in 2008 resulted in the capture of no fish during the month of June and very few fish during the month of September. This is consistent with the findings of previous fish investigations conducted in the creek (HKP 1994; R&D 2006, 2007). Fish use of Minto Creek is transient and likely short-lived as has been found in other non-natal Chinook rearing creeks (Walker 1976; Scrivener et al. 1994). Minto Creek does not provide preferred spawning habitat for fish and the fact that it completely freezes during winter months, with no winter flow in lower Minto Creek, negates its suitability for spawning by Chinook salmon. Accordingly, there is no evidence of spawning in Minto Creek (HKP 1994; R&D 2006, 2007), nor is there traditional knowledge indicating spawning occurring in the system (HKP 1994).

Although water flows are adequate to support fish during the spring it appears that fish do not enter Minto Creek until early summer (late June to early July), once water temperature in the creek rises and equilibrates with that of the Yukon River. Lower Minto Creek is also subject to low or zero flow conditions during periods in the summer when a portion (or all) of the flow sometimes infiltrates the ground following passage through a canyon located approximately 2.0 km upstream of the Yukon River.

In the past, when fish have been captured in the creek, the majority of them tended to be juvenile Chinook salmon (Onchoryhnchus tshawytscha). Other species that have been found in the creek in low numbers include round whitefish (Prosopium cylindraceum), Arctic grayling (Thymallus arcticus), slimy sculpin (Cottus cognatus) and burbot (Lota lota). Fish sampling events conducted in 1994, 2006, 2007 (summarized in the Phase 1 EEM study design; Minnow/Access 2007) and as part of the Phase II EEM study design in 2008 (Minnow/Access 2009; Table 2.6) yielded both low numbers of fish and catch-per-unit-effort (CPUE).

During the summer of 2009, the Minto Mine was given authorization to discharge effluent from the site under an amendment to its Water Use License. This resulted in a substantial increase in water flow rate in Minto Creek for a sustained period from June 26th through October 30th. Fish sampling conducted during this discharge period indicated that fish (juvenile Chinook salmon in particular), were possibly being attracted by the higher flow in Minto Creek and/or the temperature differential between Minto Creek and the Yukon River resulting from the discharge. This was apparent in a marked increase in CPUE using minnow traps. The numbers of fish entering Minto Creek as a result of the discharge were substantial enough for Fisheries and Oceans Canada (DFO), Whitehorse Office, to direct the company to undertake a fish re-location program on lower Minto Creek and establish a fish barrier near the Yukon River confluence in order to prevent additional fish from moving into Minto Creek. DFO was concerned that the fish could become stranded in Minto Creek following cessation of the discharge. The fish re-location project was undertaken from late September through early October and resulted in the capture of 987 juvenile Chinook salmon. At the beginning of the relocation, some minnow traps were yielding catches as high as 80 individuals per minnow trap in an overnight set. Prior to this, the most salmon captured in a sampling event (excluding those captured at the Yukon River confluence), including the application of both electrofishing and multiple minnow trapping effort was 17 (Minnow/Access 2009).

In 2010, a mark-recapture study was undertaken to better understand the dynamics of the juvenile Chinook salmon (JCS) population using Minto Creek. The study was developed to determine how use of the system by JCS changes throughout the open-water season and to determine how long individual fish may stay in the creek system (i.e. residency time). No juvenile Chinook salmon or other species were encountered in Minto Creek during a late June sampling event. This is consistent with previous studies in that few fish if any have been encountered in the creek prior to July. During this study fish were still present in the system in early November. Numbers of JCS increased on subsequent events from July 14 until August 11 when the peak number were captured. The estimated population of JCS in the creek at this time was 1,500 after what the numbers declined. The number of fish captured in 2009 and 2010 were much higher on a "catch per unit effort" basis than in years previous to 2009. As in 2009 Minto Mine was influencing the flow regime in Minto Creek through a controlled water discharge from the mine site throughout much of the summer until early November 2010. This likely influenced an increased use of the system by juvenile Chinook salmon. Analysis of marked fish recaptured indicates that much of the population does not remain in the creek for an extended period of time and that there is a high degree of immigration and emigration of the population in the creek. The data suggests that 90% of the population may only spend up to approximately two weeks in the system. Only a few individuals (1%) spent an extended period of time (> 12 weeks) in the system. JCS growth leveled off towards the end of August, likely a reflection of cooling water temperatures. Overall, the growth of individuals in the system is consistent with JCS populations in other tributaries of the Yukon River.

In 2011 and 2012, Minnow trapping was conducted at the same sites as in 2010, from July to October in 2011 and June to September in 2012. The 2012 sampling program also included electrofishing in Minto Creek in June, as well as the use of Big Creek as a reference site. In comparison to 2010 when some trapping events returned over 400 juvenile Chinook salmon in Minto Creek, a very small number of fish were captured in 2011 and 2012. The 2011 and 2012 capture numbers are consistent with fish usage numbers in the creek during the years the mine was not discharging into the creek, and prior to mine operations (no mine water discharge occurred in 2011 and discharge occurred only during freshet in 2012). Very few fish (3 out of total of 29) were captured during the first 2011 sampling event in mid-July indicating, as determined in previous studies, that fish do not likely enter the creek until after June. A total of 13 fish were captured in Minto Creek in 2012, including three juvenile Chinook salmon, which were all were captured in September, nine slimy sculpins and one Arctic grayling. No fish were captured upstream of the natural barrier identified in Minto Creek during the 2010 assessment work. No adult fish were observed spawning in the vicinity of the Minto Creek/Yukon River confluence during 2011 or 2012. Bottom substrate in the confluence area consists primarily of silt and mud which is not considered suitable substrate for salmon spawning.

Table 2-1 Summary of Fish captures in Minto Creek between 2008 and 2012.

Year	Method	Effort	Summary Statistics	Units	Juvenile Chinook Salmon	All Other Species
2008	Backpack Electrofishing	796 s	Catch	#	1	0
			CPUE	Fish/min	0.075	0
	Baited Gee Minnow Trapping	28.6 days	Catch	#	18	0
			CPUE	Fish/day	0.63	0
2009*	Baited Gee Minnow Trapping	28.6 days	Catch	#	136	142
			CPUE	Fish/day	4.76	4.97
2010	Baited Gee Minnow Trapping	145.9 days	Catch	#	2293	2307
			CPUE	Fish/day	15.72	15.81
2011	Baited Gee Minnow Trapping	71 days	Catch	#	12	29
			CPUE	Fish/day	0.17	0.41
2012	Backpack Electrofishing	1051 s	Catch	#	0	4
			CPUE	Fish/min	0	0.23
	Baited Gee Minnow Trapping	43.0 days	Catch	#	3	6
			CPUE	Fish/day	0.07	0.14

**Does not include the fish relocation program*

Past observations have indicated that the area at the confluence of Minto Creek and the Yukon River is not used by spawning salmon or other species. The annual fisheries program however, continues to involve monitoring of the confluence zone for spawning salmon and other species.

A total of 33 fish were caught during the 2012 Big Creek fisheries investigations, most of which were captured by electrofishing in July.

3 OBJECTIVES

The objectives of the 2013 Fisheries Monitoring Program were to monitor, assess and characterize fish usage in Minto Creek during open water season, and to provide data allowing interpretation of the potential role and influence of the Minto Mine on the fish community. The 2013 fisheries program was a continuation of the previous year's components, and targeted on all species that have previously been encountered as well as any new species. As part of the 2013 monitoring program, assessments at Big Creek were made concurrently with sampling in Minto Creek, to compare fish use in a neighbouring system relative to Minto Creek. Fish monitoring studies were conducted in support of the requirements of Water Use License QZ096-006.

4 METHODOLOGY

4.1 FISH MONITORING

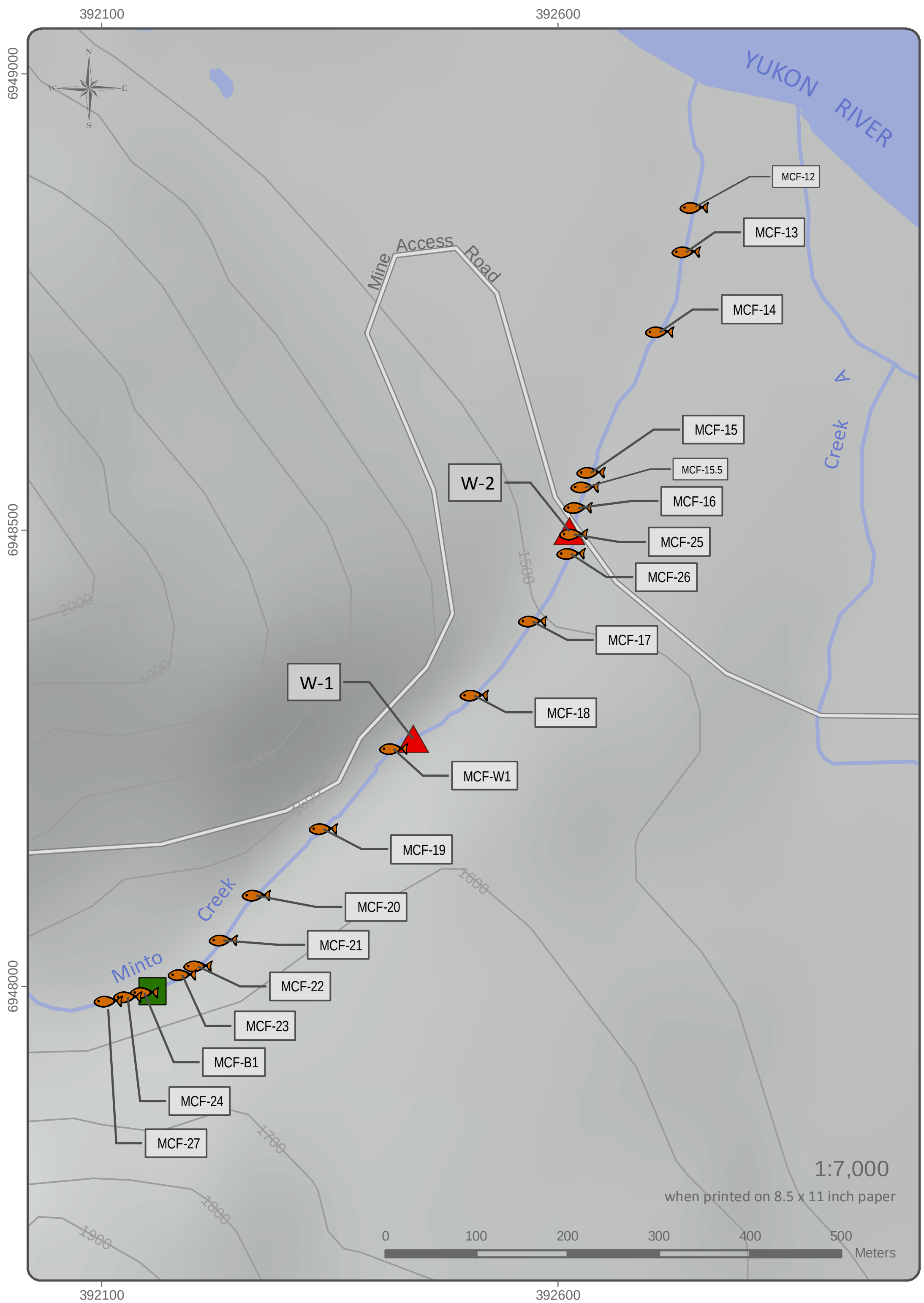
Fish monitoring of Minto Creek and Big Creek was conducted monthly during open water season, from May to October 2013, at trapping sites consistent with the 2010 mark-recapture study and the 2011 and 2012 fish monitoring programs(Figure 4-1). Capture effort included the use of Gee-type Minnow traps with 0.635 cm wire mesh size baited with Yukon River origin Chinook salmon roe or fish food pellets. Between 9 and 17 minnow traps were set in Minto Creek, depending on water levels and availability of pools and backwater areas. Approximately four traps were set each time in Big Creek, in the vicinity of the Minto road bridge.

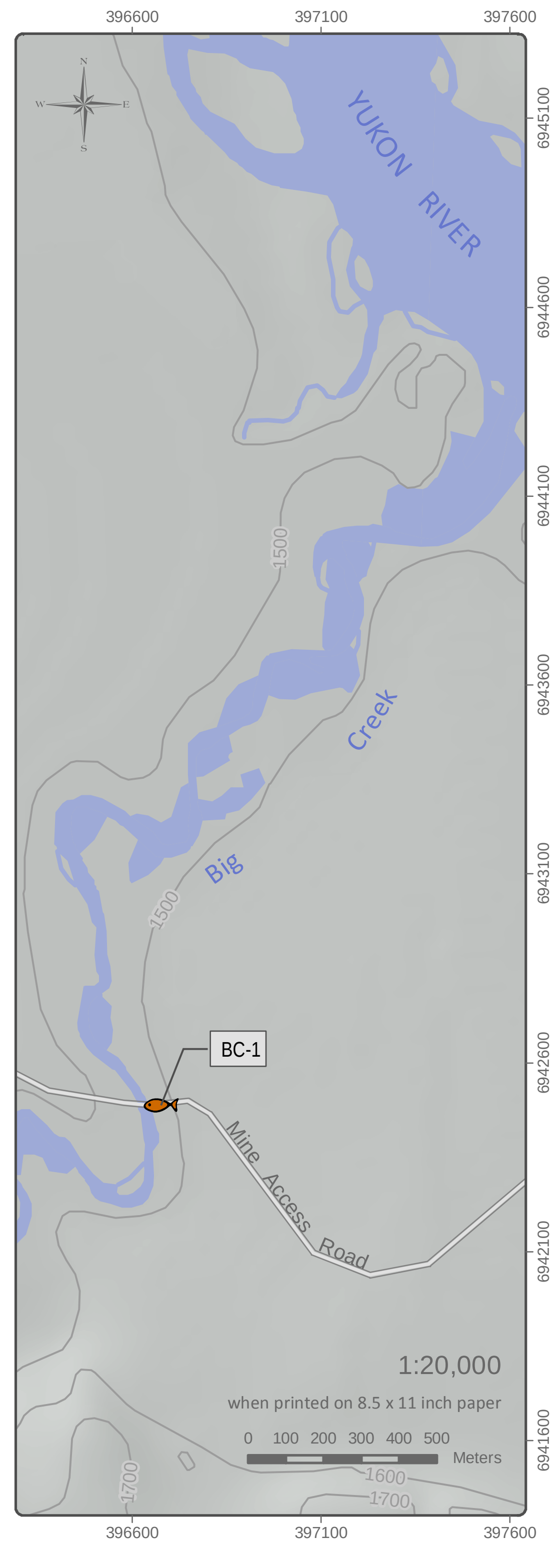
In addition, electrofishing was conducted in Minto Creek downstream of W2 and between W2 and W1 over approximately 1 km in May and June 2013. Electrofishing was conducted in Big Creek in June only.

All fish captured were identified, enumerated and measured for fork length or total length ($\pm$ 1 mm), inspected for abnormalities, and released in the vicinity of their trapping location. Juvenile Chinook Salmon were also weighed ($\pm$ 0.1g) prior to being released.

Additional supporting information collected included photo documentation of the creek, water level readings at W1 staff gauge, in situ water parameters in Minto Creek, Big Creek and the Yukon River (temperature, dissolved oxygen, conductivity, pH, ORP), discharge at W2, as well as weather conditions at time of sampling. Supporting variables also included monitoring of the previously identified fish barrier (1.2 km upstream of the Yukon River confluence) and/or any new barriers that may have developed, as well as a fish habitat assessment of the lower reach of Minto Creek (from the confluence with Yukon River to approximately 50m upstream).

Aerial reconnaissance survey for potential fish spawning activity was conducted by ACG on August 28th, 2013 for approximately 21 minutes. The survey was completed from a helicopter and included the mouth of McGinty Creek, Minto Creek, and the Yukon River between the barge landing and McGinty Creek, including the Ingersoll Islands located downstream of the mine area.





MINTO MINE

FISHERIES MONITORING PROGRAM
2013 SUMMARY REPORT

FIGURE 4-1
MINTO CREEK AND BIG CREEK FISHERIES MONITORING STATIONS

- Observed Fish Barrier
- Fish Monitoring Station
- Water Quality Monitoring Station
- Mine Access Road
- Contours (ft)
- Watercourse
- Waterbody

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5 RESULTS

The following sections present the fisheries statistics and effort in Minto Creek and Big Creek between May and October 2013.

5.1 MINTO CREEK

Minto Creek was assessed monthly between May and October 2013. A total of 132 fish were captured in Minto Creek, including 121 juvenile Chinook salmon (JCS), which were all were captured in August, September and October. In addition, nine slimy sculpins, one burbot and one arctic grayling were also captured. The average catch per unit effort (CPUE) for JCS was 1.247 fish/trap-day throughout the open water season, but was as high as 5.005 fish/trap-day in October. The following table (Table 5-1) presents the effort applied and the summary of fish capture in Minto Creek in 2013.

Table 5-1 Summary statistics of Fish Monitoring Program in Minto Creek in 2013.

Month	Method*	Effort	Juvenile Chinook Salmon		Slimy Sculpin		Arctic Grayling		Burbot	
			Results	CPUE**	Results	CPUE**	Results	CPUE*	Results	CPUE**
May	EF	1624 s. (27.1 min.)	0	0.000	0	0.000	1	0.037	0	0.000
	MT	121 trap-hours (5.0 trap-days)	0	0.000	1	0.198	0	0.000	0	0.000
June	EF	1778 s. (29.6 min.)	0	0.000	2	0.067	0	0.000	1	0.034
	MT	241.3 trap-hours (10.1 trap-days)	0	0.000	0	0.000	0	0.000	0	0.000
July	MT	244 trap-hours (10.2 trap-days)	0	0.000	0	0.000	0	0.000	0	0.000
August	MT	372.6 trap-hours (15.5 trap-days)	19	1.224	6	0.386	0	0.000	0	0.000
September	MT	363.6 trap-hours (15.2 trap-days)	19	1.254	0	0.000	0	0.000	0	0.000
October	MT	398.0 trap-hours (16.6 trap-days)	83	5.005	0	0.000	0	0.000	0	0.000
TOTAL	**EF**	**3402 s. (56.7 min.)**	**0**	**0.000**	**2**	**0.034**	**1**	**0.018**	**1**	**0.017**
	MT	**1499.2 trap-hours (62.5 trap-days)**	**121**	**1.247**	**7**	**0.097**	**0**	**0.000**	**0**	**0.000**

** EF=Electrofishing, MT=Minnow Trapping*
*** CPUE = fish/minute for EF and fish/trap-day for MT*

5.2 BIG CREEK

Fisheries effort in Big Creek was initiated in June, and conducted monthly until October, resulting in the capture of 48 fish, 19 of which were juvenile Chinook salmon. As for Minto Creek, all the JCS were captured in August, September and October. In addition, 28 slimy sculpins and one burbot were also captured. 27 out of the 28 slimy sculpins were captured via electrofishing in June. The catch per unit effort for JCS in Big Creek was on average lower than in Minto Creek at 0.998 JCS/trap-day and was highest in September (1.39 fish/trap-day). The following table (Table 5-2) presents the effort undertaken and the resulting fish capture in Big Creek in 2013.

Table 5-2 Fisheries data in Big Creek in 2013.

Month	Method*	Effort	Juvenile Chinook Salmon		Slimy Sculpin		Burbot	
			Results	CPUE**	Results	CPUE**	Results	CPUE**
June	EF	911 s. (15.2 min.)	0	0.000	27	1.778	0	0.000
	MT	65.3 trap-hours (2.7 trap-days)	0	0.000	0	0.000	0	0.000
July	MT	74.0 trap-hours (3.1 trap-days)	0	0.000	0	0.000	0	0.000
August	MT	90.9 trap-hours (3.8 trap-days)	11	2.904	0	0.000	1	0.264
September	MT	86.3 trap-hours (3.6 trap-days)	5	1.390	1	0.278	0	0.000
October	MT	103.2 trap-hours (4.3 trap-days)	3	0.698	0	0.000	0	0.000
TOTAL	**EF**	**911 s. (15.2 min.)**	**0**	**0**	**27**	**1.778**	**0**	**0**
	MT	**354.4 trap-hours (14.8 trap-days)**	**19**	**0.998**	**1**	**0.056**	**1**	**0.053**

** EF=Electrofishing, MT=Minnow Trapping*
*** CPUE = fish/minute for EF and fish/trap-day for MT*

Figure 5-1 presents a comparison between monthly JCS capture and CPUE in Minto Creek and Big Creek.

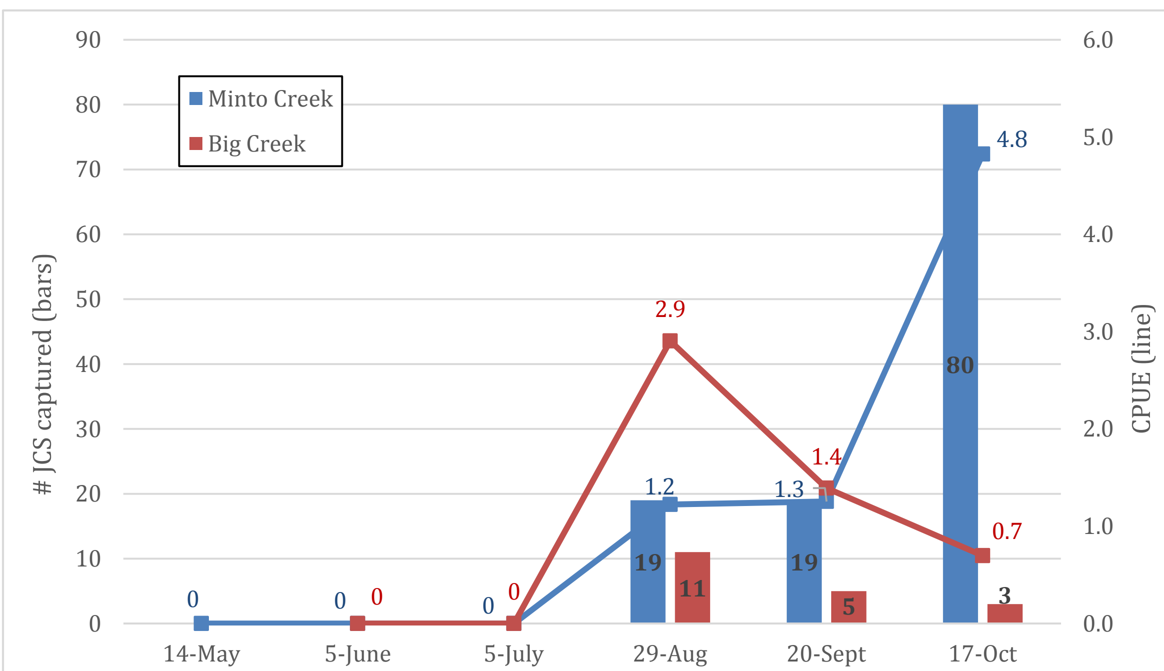


Figure 5-1 Monthly JCS capture in Minto Creek and Big Creek, 2013.

The average fork length of JCS captured in Minto Creek was 70.2 mm and the average weight was 4.0 g while the average fork length of JCS captured in Big Creek was 71.9 mm and the average weight was 4.3 g. Figure 5-2 presents the monthly averages for both Creeks. Individual results for all fish captured are presented in Appendix A.

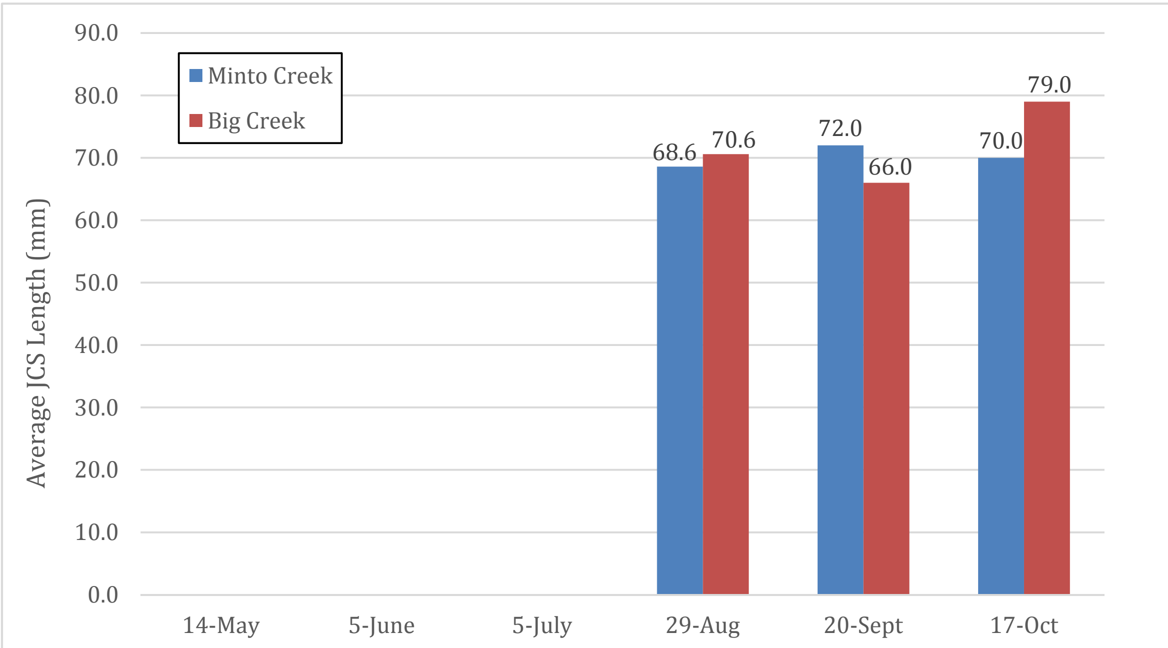


Figure 5-2 Average JCS length (fork) in Minto Creek and Big Creek, 2013.

5.3 WATER QUALITY PARAMETERS

In situ data was collected in Minto Creek (W2), Big Creek (bridge) and the Yukon River (barge landing) during each site visit and results are summarized in Table 5-3. In situ parameters were collected with a YSI Professional Plus multimeter, which was calibrated prior to each trip.

Table 5-3 In situ and stream discharge data in Minto Creek, Big Creek and Yukon River, 2013.

Site	Date	Time	Temperature (°C)	Dissolved Oxygen (%)	Dissolved Oxygen (m/L)	Specific Conductance (µS/cm)	pH	Oxidation Reduction Potential (mV)**
Minto Creek	13-05-2013	n/a	0.8	101	13.6	66.4	8.23	89.4
	14-05-2013	n/a	0.3	100	13.5	70.4	8.44	102.2
	05-06-2013	12:25	3.9	96	11.8	183.9	8.17	214.8
	04-07-2013	16:16	7.0	110	12.4	225.5	7.81	68.9
	05-07-2013	7:20	5.1	101	12.0	239.7	8.15	32.8
	29-08-2013	9:33	6.2	100	13.0	271.0	8.20	-97.8
	20-09-2013	13:15	3.6	108	14.5	290.0	7.90	91.7
	17-10-2013	8:51	0.0	101	14.8	268.5	7.89	-53.2
Big Creek	04-07-2013	n/a	10.4	106	11.2	167.7	7.84	43.8
	29-08-2013	12:36	8.0	107	11.9	168.8	8.12	-73.9
	19-09-2013	12:43	3.6	105.2	13.91	183.6	7.63	-47.2
	17-10-2013	12:10	0.3	101.5	14.75	185.0	7.97	-53.7
Yukon River	06-06-2013	11:53	7.2	99	11.3	8.08	116.5	244.3
	29-08-2013	12:56	13.6	99	9.7	8.06	122.4	-97.0
	19-09-2013	15:52	10.8	99.6	11.15	121.7	7.8-	-58.9
	17-10-2013	12:26	5.2	94.3	12.04	117.6	7.97	-50.9

** DO (%) values above 100% are considered suspicious*
***Negative ORP values are considered suspicious*

A water temperature logger was deployed in the Yukon River between the barge landing and the mouth of Minto Creek during the open water season, while a continuous logger located at W1 records the water temperature of lower Minto Creek. Figure 5-3 present the two temperature curves, together with manual measurements (markers only) presented in Table 5-3 above. This figure shows that the temperatures of Minto Creek and of the Yukon River equilibrated for a short period between late June and early July, but that water temperature in Minto creek is generally colder than in the Yukon River and that the diurnal cycle is greater in Minto Creek. Even though no logger was deployed in Big Creek, manual measurements (yellow markers in Figure 5-3) indicate that water temperature in Big Creek was generally between that of Minto Creek and that of the Yukon River.

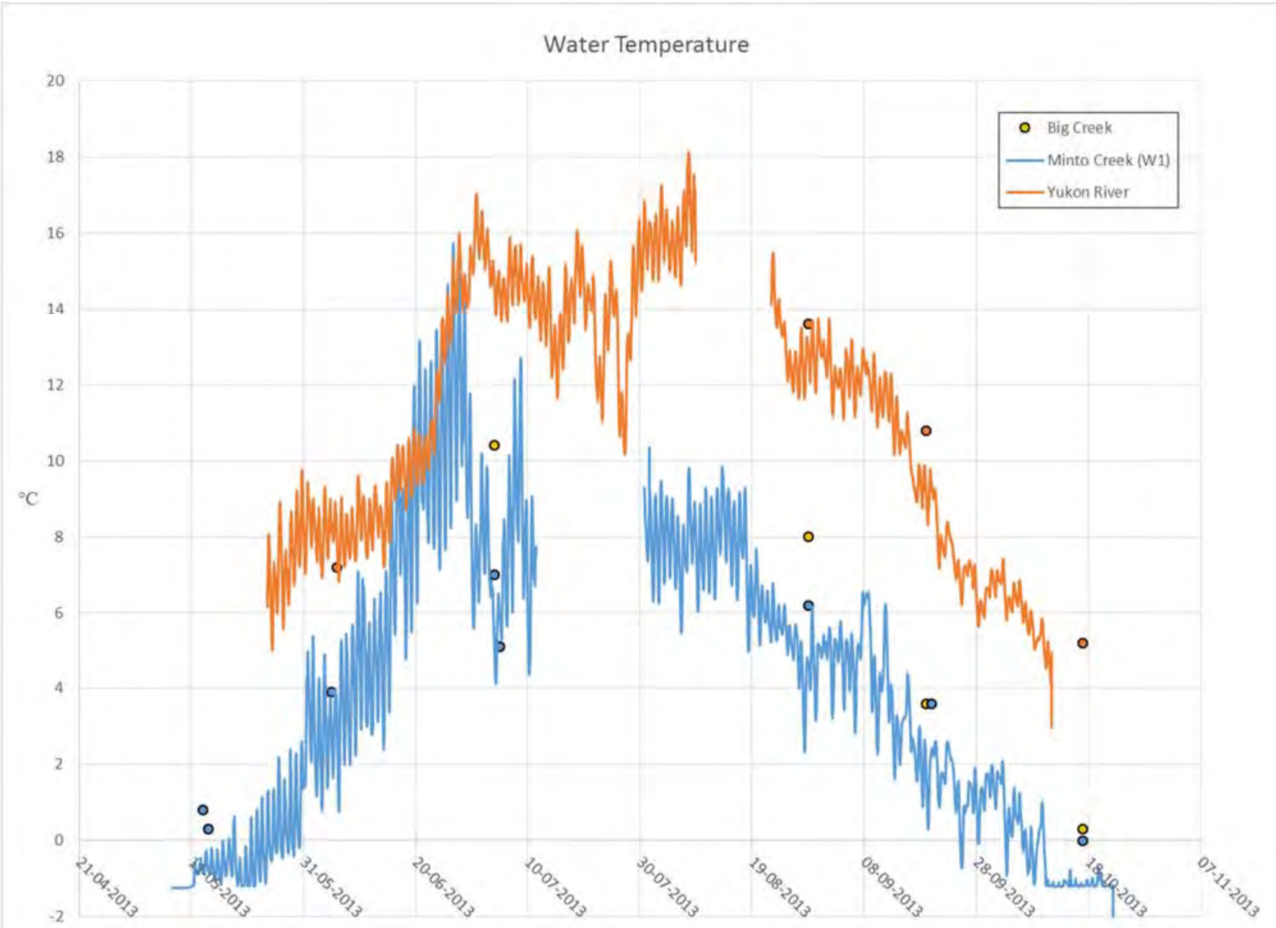


Figure 5-3 Water Temperature, Minto Creek and Yukon River, 2013

Turbidity in Minto Creek was noted to be moderate and showed a decreasing trend throughout the season. Figure 5-4 presents Total Suspended Solids (TSS) values measured at W2 from May 1st to October 31st, 2013; the dotted line indicates the trend. W2 TSS records for the open water season from 2011 to 2013 are presented in Appendix B for comparison.

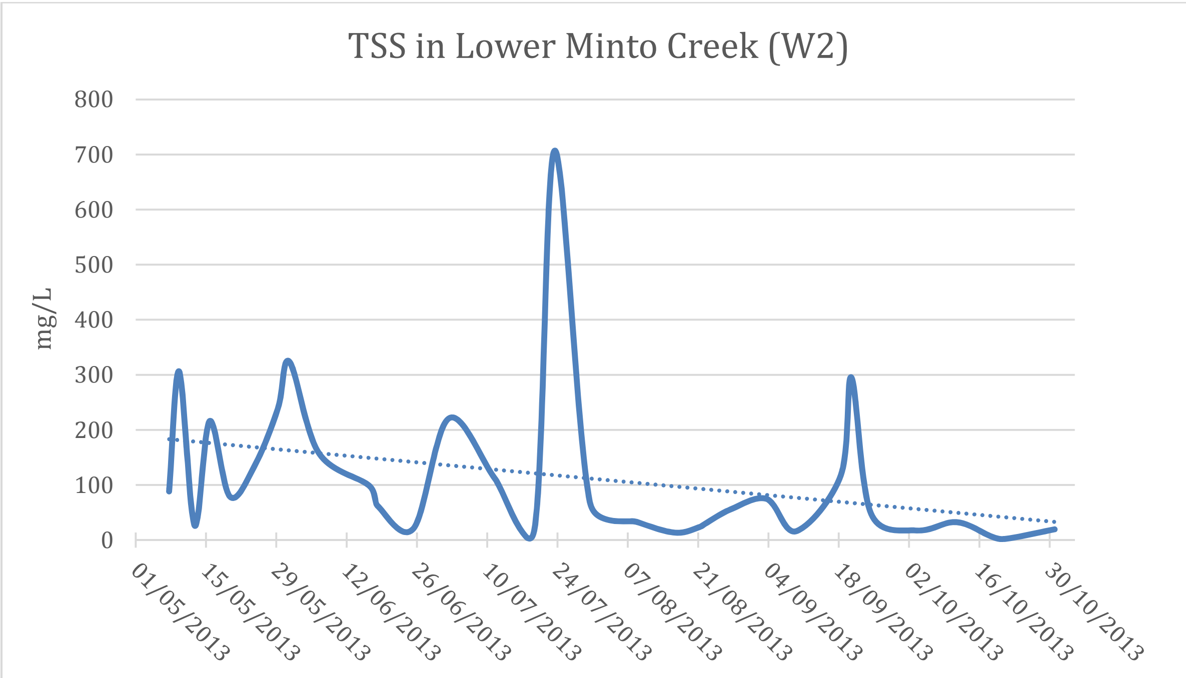


Figure 5-4 Total Suspended Solids (mg/L) measured at W2 in 2013

5.4 STAGE AND DISCHARGE

The staff gauge located at W1 in Minto Creek was read during each trip and discharge was measured at W2 with a Marsh McBirney electromagnetic flow meter on two occasions. A continuously logging water level recorder is also located at W1 where Minto staff regularly measure discharge to construct a continuous discharge record. Water levels and discharge for Minto Creek and Big Creek are presented in Table 5-4 below for occasions when fisheries surveys occurred. Big Creek values were obtained through the Water Survey of Canada on-line database (Water Survey Canada, 2013) and are subject to change as they have not yet be validated by WSC.

Table 5-4 Stage and Discharge in Minto Creek and Big Creek, 2013.

Date	Time (PDT)	Minto Creek		Big Creek	
		Stage (m)	Discharge (m^3/s)	Stage (m)	Discharge (m^3/s)
13-05-2013	12:00	Over staff gauge at W1	0.452	7.564	143.108
14-05-2013	12:00	Over staff gauge at W1	0.563	7.454	127.675
05-06-2013	15:45	0.228	0.083	6.47	22.993
06-06-2013	8:51	0.194	0.075	6.479	23.581
04-07-2013	16:16	0.219*	0.089	6.35	13.982
05-07-2013	7:20	0.187*	0.064	6.318	12.29
28-08-2013	11:26	0.167	0.049	6.333	14.054
29-08-2013	11:19	0.163	0.046	6.303	12.521
19-09-2013	14:40	0.218	ND	6.288	12.835
20-09-2013	12:35	0.307	ND	6.313	14.211
20-09-2013	13:30		0.129†	6.318	14.472
16-10-2013	14:40	0.338	ND	6.177	8.188
17-10-2013	11:30	0.378	ND	6.162	7.584
17-10-2013	13:30		0.0713†	6.161	7.544

** Taken from corrected continuous stage record. †Measured in the field @ W2.*

Figure 5-5 shows the continuous record available from May to early October. The discharge record ends where ice dams begin forming and the level can no longer be used to calculate discharge (Figure 5-5). ACG processes those data gathered by Minto Staff. Spot level and discharge measurements are also included from both Minto Mine's Environmental Monitoring team and ACG fisheries trips.

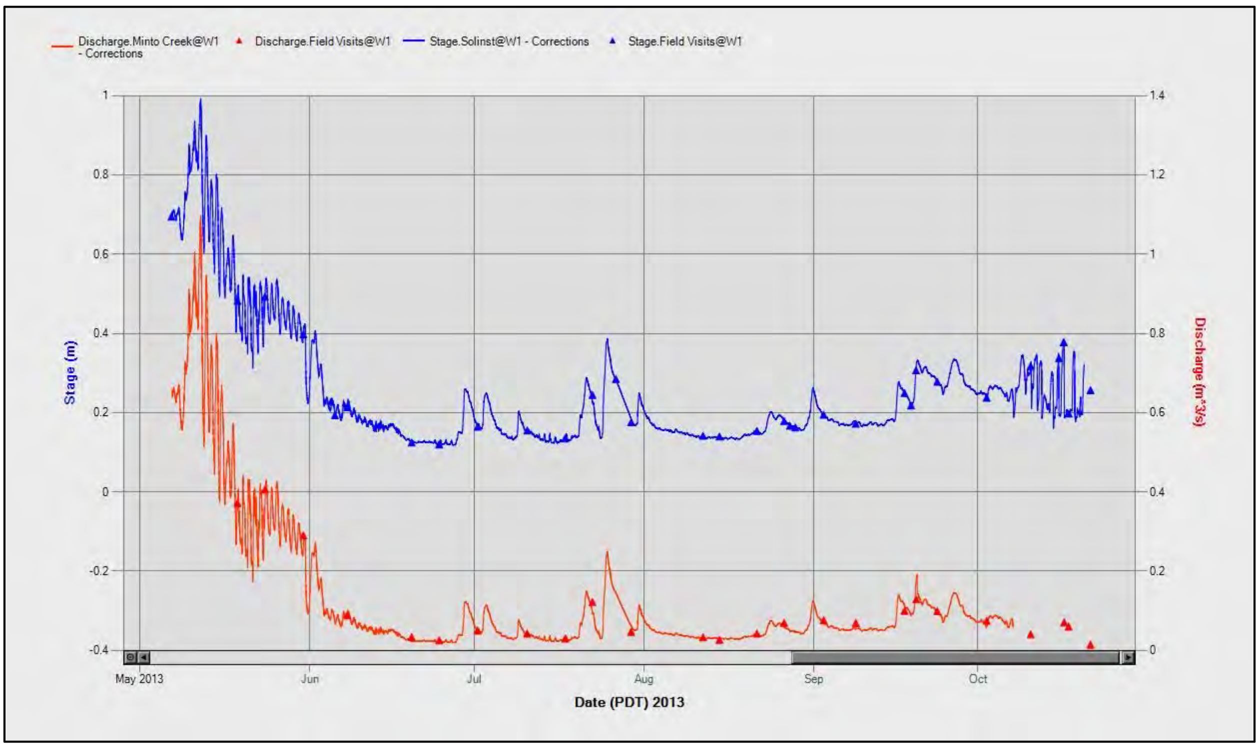


Figure 5-5 Stage and discharge in Minto Creek at monitoring station W1

The Big Creek hydrometric station (Water Survey of Canada station ID # 09AH003) is located downstream of the Minto road bridge, near its confluence with the Yukon River, at the following coordinates: 62° 34' 07'' N; 137° 00' 58'' W. It records continuous water level and discharge. Figure 5-6 presents data from May to October 2013.

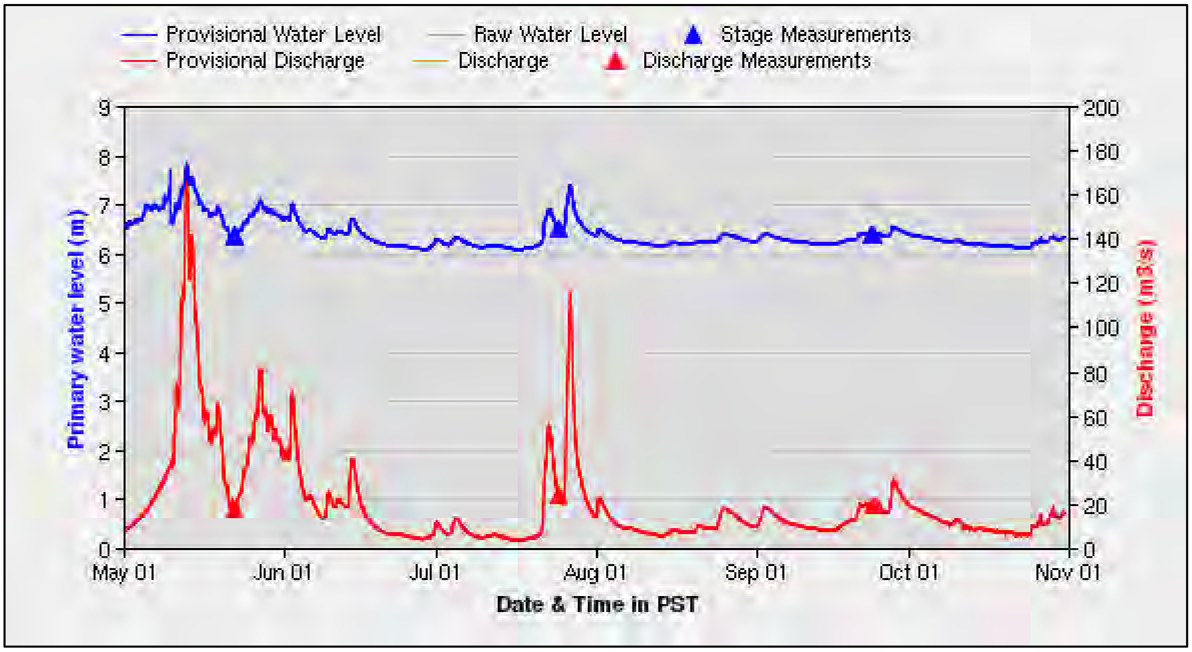


Figure 5-6 Water Level and Discharge in Big Creek 2013 *(Source: Water Survey of Canada, 2013).*

5.5 FISH BARRIER

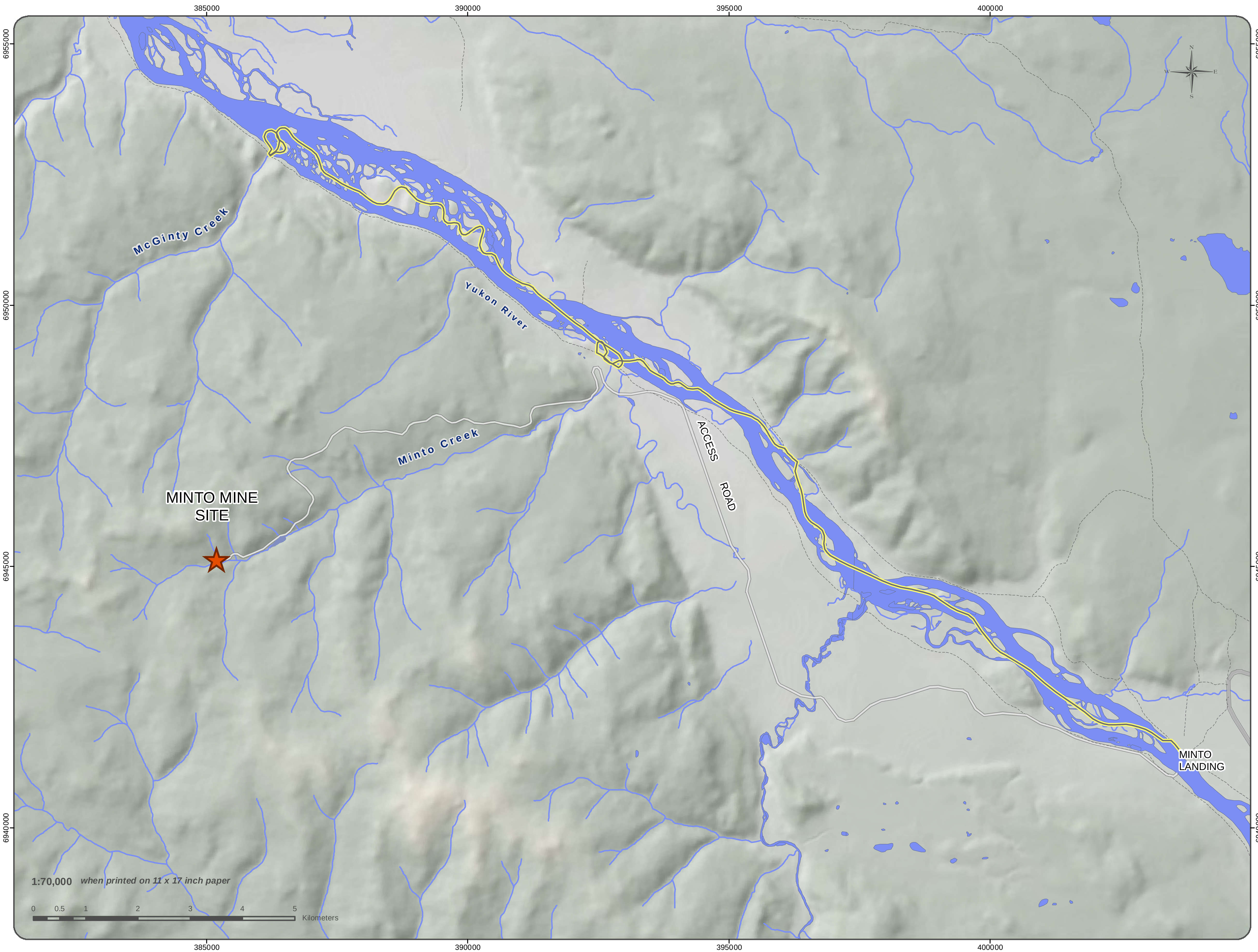
The fish barrier located approximately 1.2 km upstream of the Yukon River (MCF-B1 on Figure 4-1), which was documented in previous years, was re-confirmed in 2013. Fish use upstream of the barrier, which consists of a log jam (Figure 5-7), was assessed by setting traps upstream of it during each sampling event. No fish were captured upstream of the barrier during 2013.

Figure 5-7 Fish Barrier on August 28, 2013.

5.6 AERIAL SURVEY

An aerial survey was conducted on August 28th, between 18:27 and 18:48, to investigate for spawning salmon on the Yukon River in the vicinity of the Minto Mine. Weather was generally calm with high clouds. Height of the helicopter was maintained between 15 and 25 m (agl). The visibility was relatively good in the Yukon River and in McGinty creek, while the water was more turbid in Minto Creek.

Focus was given on habitat such as backwater, sloughs and side channels on the Yukon River, including the Ingersoll Islands, as well as on the mouths of McGinty and Minto creeks. Figure 5-8 below shows the track followed. Although the Ingersoll Islands represent a known spawning salmon habitat, no live fish or carcasses were observed at the time of this survey.



MINTO MINE

capstone MINTO MINE

AQUATIC MONITORING PROGRAM

Figure 5-8

AUGUST 2013

Aerial Fish Survey 2013

Minto Mine Site

Mine Access Road

Road

Trail

ACCESS

Datum: NAD 83 Projection: UTM Zone 8N

I:\Minto\gis\mxd\Studies\Fisheries_Benthic_Studies\2013\AerialFisheriesStudy_20130830.mxd
(*Last edited by: mducharme;30/08/2013/14:59 PM*)

5.7 FISH HABITAT ASSESSMENT

A fish habitat assessment was conducted at the lower reach of Minto Creek from the confluence with Yukon River to 50m upstream. The data was collected according to the B.C. Fish and Fish Habitat Inventory: Standards and Procedures (2001). The filled out site card is presented in Appendix C followed by excerpts from the above mentioned reference to explain the coding used to describe fish habitat parameters.

Overall, this assessment confirmed that the mouth of Minto Creek represents poor rearing and spawning habitat. Average gradient is 3%, and bed material and bank substrate consist of deep silts deposits, which constitutes poor rearing and spawning habitat. Mixing with the Yukon River occurs in a side channel of the river which immediately joins the main stem (see Figures 5-9 and 5-10 below). At the time of the assessment, the average wetted width was 1.5m and average depth 0.5m and the mixing zone extended over about 1 m from the mouth of Minto creek, but these are known to vary throughout the year as discharge in the Yukon River rises and falls.

Figure 5-9 Mixing of Minto creek (to the right) with Yukon River, September 2013

Figure 5-10 Minto Creek – Yukon River confluence, August 2013 (Minto Creek on right side of the photo)

6 DISCUSSION

In 2013, no JCS were captured in Minto Creek or Big Creek before August. In general this is consistent with previous findings that JCS do not tend to enter Minto Creek until the water temperature has equilibrated with that of the Yukon River, however in previous years JCS had entered the creeks by mid-July. Contrary to 2012 however, the average CPUE for JCS was found to be slightly higher in Minto Creek than in Big Creek, and much higher in October. The CPUE for JCS showed a decreasing trend in Big Creek from August to October, while the trend was increasing in Minto Creek over the same period. The CPUE in both Minto Creek and Big Creek was on average higher than in 2012 and was also higher than in 2011 in the case of Minto Creek. In 2010 however, the average CPUE in Minto Creek was 16.7 fish/trap-day and some trapping events returned over 400 JCS. In 2010, the mine was discharging water in Minto Creek, causing higher and more consistent flows and temperature regimes in lower Minto Creek, conditions which may have been more attractive to JCS, while mine water discharge only occurred during freshet in 2012 and 2013 and no discharge occurred in 2011. Also, following a forest fire in 2010, more sediment entered Minto Creek through runoff in 2011 and 2012 increasing water turbidity. A small landslide was also documented by Minto personnel in an upstream tributary in May 2012, possibly contributing to high TSS levels observed downstream. The elevated turbidity may have deterred fish from entering Minto Creek. Average TSS values at W2 in 2013 were similar to those of 2011, and much lower than those of 2012 (see Appendix B for details). A decreasing trend in turbidity was observed throughout the 2013 season, as confirmed by the TSS results presented in section 5.3; this may have created more favourable conditions for JCS towards the end of 2013 the season.

No adult fish were observed spawning in the vicinity of the Minto Creek/Yukon River confluence during 2013 or in the area downstream and upstream of Minto Creek. Bottom substrate in the confluence area consists primarily of silt and mud which is not suitable substrate for salmon spawning. The natural barrier identified in previous years was confirmed in 2013. Therefore the area of usable fish habitat in Minto Creek is limited to the lower 1.2 km of the creek.

7 REFERENCES

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APPENDIX A

FISH DATA, MINTO CREEK AND BIG CREEK, 2013

MINTO CREEK

Date	Method	Location of capture	Species*	Length (mm)**	Weight (g)	Fate
14-05-2013	MT	Outlet of Minto Creek	SS	59	n/a	Released
14-05-2013	EF	D/S of W2	AG	n/a	n/a	Released
05-06-2013	EF	n/a	BB	290	88	Released
05-06-2013	EF	n/a	SS	107.55	14.06	Retained for Selenium Study
05-06-2013	EF	n/a	SS	73.1	4.71	Retained for Selenium Study
29-08-2013	MT	MCF-16	SS	84	n/a	Released
29-08-2013	MT	MCF-15	SS	74	n/a	Released
29-08-2013	MT	MCF-15	SS	71	n/a	Released
29-08-2013	MT	MCF-15	JCS	65	3.22	Released
29-08-2013	MT	MCF-15	JCS	68	2.68	Released
29-08-2013	MT	MCF-15	JCS	71	3.10	Released
29-08-2013	MT	MCF-15	JCS	72	3.54	Released
29-08-2013	MT	MCF-15	JCS	63	2.25	Released
29-08-2013	MT	MCF-15	JCS	62	2.46	Released
29-08-2013	MT	MCF-14	SS	89	n/a	Released
29-08-2013	MT	MCF-14	JCS	67	3.06	Released
29-08-2013	MT	MCF-14	JCS	68	3.10	Released
29-08-2013	MT	MCF-14	JCS	64	2.62	Released
29-08-2013	MT	MCF-14	JCS	65	2.74	Released
29-08-2013	MT	MCF-14	JCS	78	4.81	Released
29-08-2013	MT	MCF-14	JCS	65	3.00	Released
29-08-2013	MT	MCF-13	SS	65	n/a	Released
29-08-2013	MT	MCF-13	SS	69	n/a	Released
29-08-2013	MT	MCF-26	JCS	73	3.85	Released
29-08-2013	MT	MCF-26	JCS	63	2.34	Released
29-08-2013	MT	MCF-17	JCS	84	n/a	Released
29-08-2013	MT	MCF-W1	JCS	66	3.00	Released
29-08-2013	MT	MCF-W1	JCS	65	2.66	Released
29-08-2013	MT	MCF-W1	JCS	68	3.98	Released
29-08-2013	MT	MCF-21	JCS	76	n/a	Released
20-09-2013	MT	MCF-14	JCS	67	3.41	Released
20-09-2013	MT	MCF-14	JCS	63	3.45	Released
20-09-2013	MT	MCF-14	JCS	64	3.1	Released
20-09-2013	MT	MCF-17	JCS	83	6.69	Released
20-09-2013	MT	MCF-W1	JCS	75	5.15	Released
20-09-2013	MT	MCF-W1	JCS	63	3.08	Released
20-09-2013	MT	MCF-W1	JCS	70	3.74	Released
20-09-2013	MT	MCF-W1	JCS	79	4.94	Released
20-09-2013	MT	MCF-W1	JCS	70	3.72	Released
20-09-2013	MT	MCF-W1	JCS	65	3.48	Released
20-09-2013	MT	MCF-W1	JCS	76	5.39	Released
20-09-2013	MT	MCF-19	JCS	58	2.72	Released
20-09-2013	MT	MCF-19	JCS	73	5.28	Released
20-09-2013	MT	MCF-19	JCS	65	3.39	Released
20-09-2013	MT	MCF-19	JCS	79	4.77	Released
20-09-2013	MT	MCF-21	JCS	76	5.46	Released
20-09-2013	MT	MCF-21	JCS	78	5.45	Released
20-09-2013	MT	MCF-22	JCS	75	7.85	Released
20-09-2013	MT	MCF-B1	JCS	89	8.75	Released
17-10-2013	MT	MCF-15	JCS	66	3.36	Released
17-10-2013	MT	MCF-15	JCS	72	4.21	Released

17-10-2013	MT	MCF-15	JCS	77	4.72	Released
17-10-2013	MT	MCF-15	JCS	78	4.7	Released
17-10-2013	MT	MCF-15	JCS	71	3.79	Released
17-10-2013	MT	MCF-15	JCS	80	6.81	Released
17-10-2013	MT	MCF-15	JCS	57	3.08	Released
17-10-2013	MT	MCF-15	JCS	64	5.13	Released
17-10-2013	MT	MCF-15	JCS	64	3.7	Released
17-10-2013	MT	MCF-15	JCS	56	2.26	Released
17-10-2013	MT	MCF-15	JCS	67	3.67	Released
17-10-2013	MT	MCF-15	JCS	66	4.55	Released
17-10-2013	MT	MCF-15	JCS	56	4.22	Released
17-10-2013	MT	MCF-15	JCS	59	2.71	Released
17-10-2013	MT	MCF-15	JCS	55	3.08	Released
17-10-2013	MT	MCF-15	JCS	69	4.3	Released
17-10-2013	MT	MCF-15	JCS	72	5.17	Released
17-10-2013	MT	MCF-15	JCS	65	4.02	Released
17-10-2013	MT	MCF-14	JCS	70	3.81	Released
17-10-2013	MT	MCF-14	JCS	61	3.09	Released
17-10-2013	MT	MCF-14	JCS	78	4.83	Released
17-10-2013	MT	MCF-14	JCS	67	3.44	Released
17-10-2013	MT	MCF-14	JCS	62	3.5	Released
17-10-2013	MT	MCF-14	JCS	58	2.62	Released
17-10-2013	MT	MCF-14	JCS	62	3.36	Released
17-10-2013	MT	MCF-14	JCS	70	4.04	Released
17-10-2013	MT	MCF-14	JCS	71	3.83	Released
17-10-2013	MT	MCF-14	JCS	69	3.69	Released
17-10-2013	MT	MCF-14	JCS	65	2.85	Released
17-10-2013	MT	MCF-14	JCS	61	2.34	Released
17-10-2013	MT	MCF-14	JCS	70	3.56	Released
17-10-2013	MT	MCF-14	JCS	60	3.42	Released
17-10-2013	MT	MCF-13	JCS	66	3.65	Released
17-10-2013	MT	MCF-17	JCS	73	4.7	Released
17-10-2013	MT	MCF-17	JCS	74	4.65	Released
17-10-2013	MT	MCF-W1	JCS	60	2.57	Released
17-10-2013	MT	MCF-W1	JCS	66	2.75	Released
17-10-2013	MT	MCF-W1	JCS	71	3.95	Released
17-10-2013	MT	MCF-W1	JCS	72	3.82	Released
17-10-2013	MT	MCF-W1	JCS	74	4.22	Released
17-10-2013	MT	MCF-W1	JCS	63	2.87	Released
17-10-2013	MT	MCF-W1	JCS	81	5.78	Released
17-10-2013	MT	MCF-W1	JCS	75	4.67	Released
17-10-2013	MT	MCF-19	JCS	72	3.22	Released
17-10-2013	MT	MCF-19	JCS	75	4.49	Released
17-10-2013	MT	MCF-19	JCS	72	3.34	Released
17-10-2013	MT	MCF-19	JCS	66	4.12	Released
17-10-2013	MT	MCF-19	JCS	71	3.3	Released
17-10-2013	MT	MCF-19	JCS	76	6.24	Released
17-10-2013	MT	MCF-19	JCS	77	5.14	Released
17-10-2013	MT	MCF-19	JCS	61	3.7	Released
17-10-2013	MT	MCF-19	JCS	62	3.4	Released
17-10-2013	MT	MCF-19	JCS	71	4.79	Released
17-10-2013	MT	MCF-19	JCS	69	3.05	Released
17-10-2013	MT	MCF-19	JCS	71	4.15	Released
17-10-2013	MT	MCF-19	JCS	71	3.84	Released

17-10-2013	MT	MCF-19	JCS	75	6.31	Released
17-10-2013	MT	MCF-19	JCS	67	3.7	Released
17-10-2013	MT	MCF-19	JCS	77	4.9	Released
17-10-2013	MT	MCF-19	JCS	71	3.98	Released
17-10-2013	MT	MCF-19	JCS	76	4.66	Released
17-10-2013	MT	MCF-19	JCS	86	6.76	Released
17-10-2013	MT	MCF-19	JCS	66	3.4	Released
17-10-2013	MT	MCF-19	JCS	70	4.04	Released
17-10-2013	MT	MCF-19	JCS	75	4.17	Released
17-10-2013	MT	MCF-19	JCS	68	3.56	Released
17-10-2013	MT	MCF-19	JCS	71	4.5	Released
17-10-2013	MT	MCF-19	JCS	72	4.07	Released
17-10-2013	MT	MCF-19	JCS	74	3.88	Released
17-10-2013	MT	MCF-19	JCS	69	3.3	Released
17-10-2013	MT	MCF-19	JCS	75	4.23	Released
17-10-2013	MT	MCF-19	JCS	73	5.72	Released
17-10-2013	MT	MCF-19	JCS	75	6.07	Released
17-10-2013	MT	MCF-19	JCS	84	6.34	Released
17-10-2013	MT	MCF-19	JCS	66	3.84	Released
17-10-2013	MT	MCF-19	JCS	74	4.03	Released
17-10-2013	MT	MCF-19	JCS	76	4.44	Released
17-10-2013	MT	MCF-19	JCS	65	3.75	Released
17-10-2013	MT	MCF-19	JCS	71	3.81	Released
17-10-2013	MT	MCF-19	JCS	63	2.9	Released
17-10-2013	MT	MCF-19	JCS	73	4.95	Released
17-10-2013	MT	MCF-22	JCS	76	4.79	Released
17-10-2013	MT	MCF-B1	JCS	89	7.99	Released

* SS=Slimy Sculpin, JCS=Juvenile Chinook Salmon, BB=Burbot, AG=Arctic grayling
**Fish length refers to fork length for JCS and to totla length for other species

BIG CREEK

Date	Method	Location of capture	Species*	Length (mm)**	Weight (g)	Fate
06-06-2013	EF	Near Bridge	SS	64	2.33	Released
06-06-2013	EF	Near Bridge	SS	71	3.11	Released
06-06-2013	EF	Near Bridge	SS	72	3.6	Released
06-06-2013	EF	Near Bridge	SS	78.85	4.36	Retained for Selenium Study
06-06-2013	EF	Near Bridge	SS	76.49	4.46	Retained for Selenium Study
06-06-2013	EF	Near Bridge	SS	62	3.14	Released
06-06-2013	EF	Near Bridge	SS	70	4.18	Released
06-06-2013	EF	Near Bridge	SS	59	1.92	Released
06-06-2013	EF	Near Bridge	SS	55	2.02	Released
06-06-2013	EF	Near Bridge	SS	60	2.61	Released
06-06-2013	EF	Near Bridge	SS	69	2.7	Released
06-06-2013	EF	Near Bridge	SS	<30	n/a	Released
06-06-2013	EF	Near Bridge	SS	<30	n/a	Released
06-06-2013	EF	Near Bridge	SS	<30	n/a	Released
06-06-2013	EF	Near Bridge	SS	<30	n/a	Released
06-06-2013	EF	Near Bridge	SS	<30	n/a	Released
06-06-2013	EF	Near Bridge	SS	<30	n/a	Released
06-06-2013	EF	Near Bridge	SS	<30	n/a	Released
06-06-2013	EF	Near Bridge	SS	<30	n/a	Released
06-06-2013	EF	Near Bridge	SS	<30	n/a	Released

06-06-2013	EF	Near Bridge	SS	<30	n/a	Released
06-06-2013	EF	Near Bridge	SS	<30	n/a	Released
06-06-2013	EF	Near Bridge	SS	<30	n/a	Released
06-06-2013	EF	Near Bridge	SS	<30	n/a	Released
06-06-2013	EF	Near Bridge	SS	<30	n/a	Released
06-06-2013	EF	Near Bridge	SS	<30	n/a	Released
06-06-2013	EF	Near Bridge	SS	<30	n/a	Released
29-08-2013	MT	DS of bridge	JCS	82	4.9	Released
29-08-2013	MT	US bridge	BB	124	n/a	Released
29-08-2013	MT	US bridge	JCS	68	3	Released
29-08-2013	MT	US bridge	JCS	78	4.8	Released
29-08-2013	MT	US bridge	JCS	72	4.3	Released
29-08-2013	MT	US bridge	JCS	65	2.81	Released
29-08-2013	MT	US bridge	JCS	65	5.14	Released
29-08-2013	MT	US bridge	JCS	76	4.71	Released
29-08-2013	MT	US bridge	JCS	69	3.62	Released
29-08-2013	MT	US bridge	JCS	66	3.05	Released
29-08-2013	MT	US bridge	JCS	67	3.09	Released
29-08-2013	MT	US bridge	JCS	68	3.33	Released
20-09-2013	MT	DS bridge	SS	50	n/a	Released
20-09-2013	MT	US bridge	JCS	74	4.88	Released
20-09-2013	MT	US bridge	JCS	65	4.04	Released
20-09-2013	MT	US bridge	JCS	66	5.39***	Released
20-09-2013	MT	US bridge	JCS	57	2.16	Released
20-09-2013	MT	US bridge	JCS	68	4.56	Released
17-10-2013	MT	DS bridge	JCS	78	4.72	Released
17-10-2013	MT	US bridge	JCS	80	5.22	Released
17-10-2013	MT	US bridge	JCS	79	5.21	Released

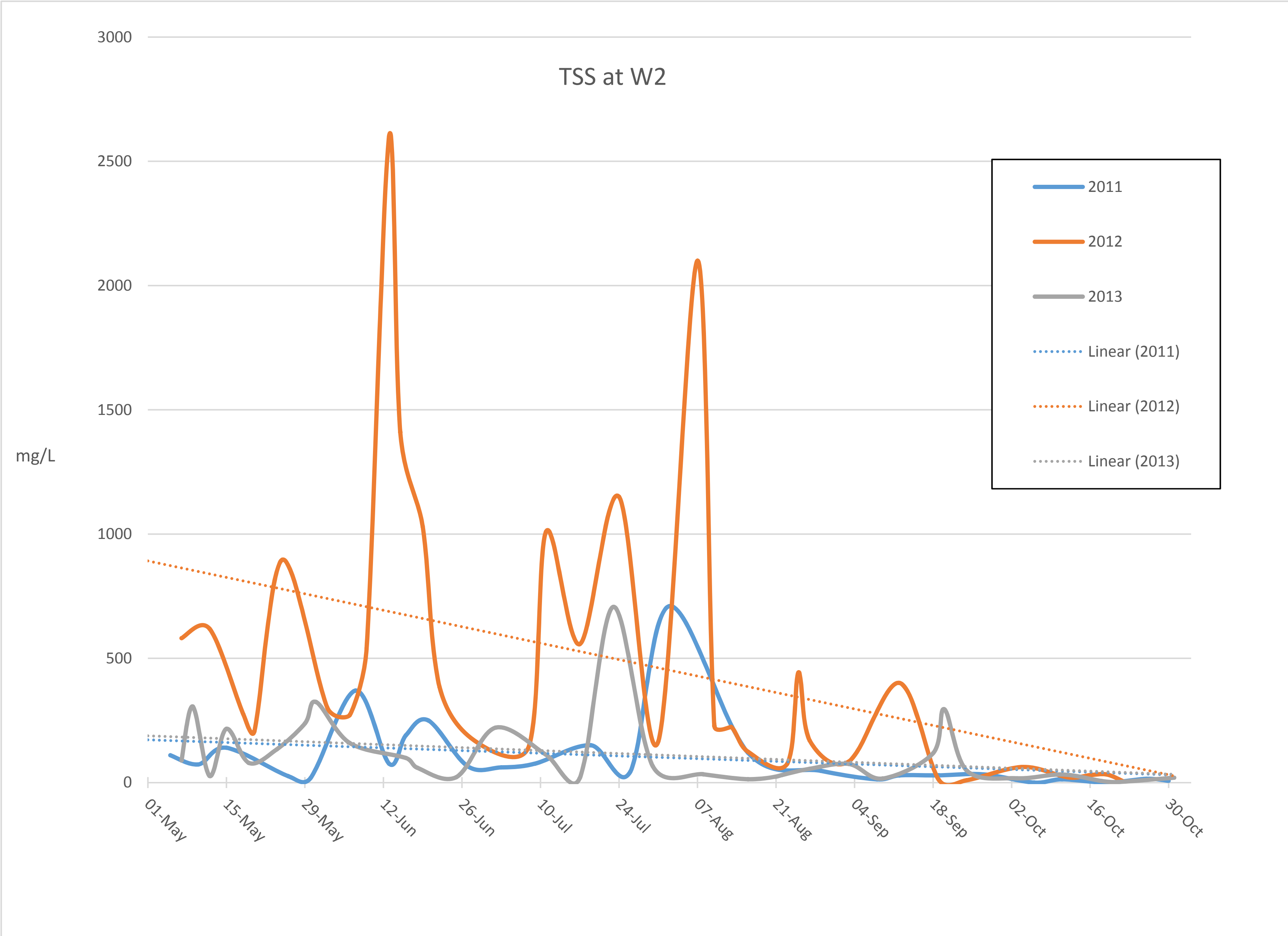
*SS=Slimy Sculpin, JCS=Juvenile Chinook Salmon, BB=Burbot, AG=Arctic grayling

**Fish length refers to fork length for JCS and to totla length for other species

***Suspicious value, possible scale malfunction

APPENDIX B

TSS RESULTS AT W2, 2011-2013



TSS at W2
mg/L
3000
2500
2000
1500
1000
500
0
01-May
15-May
29-May
12-Jun
26-Jun
10-Jul
24-Jul
07-Aug
21-Aug
04-Sep
18-Sep
02-Oct
16-Oct
30-Oct
2011
2012
2013
Linear (2011)
Linear (2012)
Linear (2013)

TSS @ W2 (mg/L)			
Date	2011	2012	2013
01-May			
02-May			
03-May			
04-May			
05-May	110		
06-May			
07-May		581	88.3
08-May			
09-May			306
10-May	73		
11-May			
12-May		619	26.5
13-May			
14-May			
15-May	140		216
16-May			
17-May			
18-May		276	
19-May			79
20-May		207	
21-May			
22-May			
23-May			
24-May			134
25-May		897	
26-May	26		
27-May			
28-May			
29-May			238
30-May	18		
31-May			324
01-Jun			
02-Jun		301	
03-Jun			
04-Jun			
05-Jun			
06-Jun		272	159
07-Jun	370		
08-Jun			
09-Jun		540	
10-Jun			
11-Jun			
12-Jun			
13-Jun	76	2600	
14-Jun			

TSS @ W2 (mg/L)			
Date	2011	2012	2013
15-Jun		1410	
16-Jun	190		99
17-Jun			
18-Jun			60
19-Jun		1030	
20-Jun	250		
21-Jun			
22-Jun		385	
23-Jun			
24-Jun			
25-Jun			21.8
26-Jun			
27-Jun	66		
28-Jun			
29-Jun		157	
30-Jun			
01-Jul			
02-Jul			221
03-Jul	61		
04-Jul			
05-Jul			
06-Jul			
07-Jul			
08-Jul		150	
09-Jul	76		
10-Jul			
11-Jul		1010	112
12-Jul			
13-Jul			
14-Jul			
15-Jul			
16-Jul			
17-Jul		557	17.4
18-Jul			
19-Jul	150		
20-Jul			
21-Jul			
22-Jul			
23-Jul			707
24-Jul		1150	
25-Jul			
26-Jul	43		
27-Jul			
28-Jul			
29-Jul			

TSS @ W2 (mg/L)			
Date	2011	2012	2013
30-Jul			66.7
31-Jul		165	
01-Aug			
02-Aug	710		
03-Aug			
04-Aug			
05-Aug			
06-Aug			
07-Aug		2100	
08-Aug			33.5
09-Aug			
10-Aug		228	
11-Aug			
12-Aug			
13-Aug		224	
14-Aug			
15-Aug			
16-Aug	120	124	13.4
17-Aug			
18-Aug			
19-Aug			
20-Aug			
21-Aug			23.9
22-Aug			30
23-Aug		75.8	
24-Aug			
25-Aug		443	
26-Aug			
27-Aug		169	55.5
28-Aug			
29-Aug	47		
30-Aug			
31-Aug			
01-Sep			
02-Sep			
03-Sep		85.1	74.7
04-Sep			
05-Sep			
06-Sep			
07-Sep			
08-Sep	13		
09-Sep			16.1
10-Sep			
11-Sep			
12-Sep	29	401	

TSS @ W2 (mg/L)			
Date	2011	2012	2013
13-Sep			
14-Sep			
15-Sep			
16-Sep			
17-Sep			
18-Sep			118
19-Sep	29	11.7	
20-Sep			295
21-Sep			
22-Sep			
23-Sep			
24-Sep		9.3	48.2
25-Sep			
26-Sep			
27-Sep	33		
28-Sep			
29-Sep			
30-Sep			
01-Oct			
02-Oct			
03-Oct			17.3
04-Oct		62.8	
05-Oct			
06-Oct	<4		
07-Oct			
08-Oct			
09-Oct			
10-Oct			
11-Oct	13		32.6
12-Oct		21	
13-Oct			
14-Oct			
15-Oct			
16-Oct		30	
17-Oct			
18-Oct			6.5
19-Oct	<4	32.4	
20-Oct			
21-Oct			2.3
22-Oct		4.1	
23-Oct			
24-Oct			
25-Oct			
26-Oct	15		
27-Oct			

TSS @ W2 (mg/L)			
Date	2011	2012	2013
28-Oct			
29-Oct			
30-Oct	7		
31-Oct			19.5
Average	103	480.2	114.4
Count	26	34	32
Minimum	2	4.1	2.3
Maximum	710	2600	707
Geometric Mean	45	205.6	58.3
Count <DL	2	0	0
Standard Deviation	151	599.9	143.4
1st Quartile	20	94.8	23.4
Median	54	250	63.4
3rd Quartile	118	575	140.2

APPENDIX C

HABITAT ASSESSMENT SITE CARD, AUGUST 2013

Open silty bars + floodplain Poa pal. Cala can, Carex ross terrace Salix Alnus Popubal
Mixing @ 1m from outlet Sw ~ 30m upstream

SITE CARD

STREAM NAME (gaz.) Minto Cr @ Yukon R. confluence (local)

WATERSHED CODE

ILP MAP # | ILP # | NID MAP # | NID #

REACH # 1 | SITE # | FIELD UTM 08V 0392650 6949066 N | SITE LG ~200m | ACCESS Foot

DATE 20 13 09 19 | TIME 13 57 | AGENCY ACG | CREW CH LK | FISH FORM Y N

CHANNEL	mthd
	E
CHANNEL WIDTH (m)	15
WETTED WIDTH (m)	1.5
RES. POOL DEPTH (m)	0.5

GRADIENT %: 3 C

W_b Dp (m) 15 / 1.4 | STAGE L M H | No Vis. Ch. DW | Dry/Int. Tribs. 0

WATER: EMS | TEMP °C | pH | REQ. # | COND. µS/cm | TURB. T M L C

COVER Total

Type	SWD	LWD	B	U	DP	OV	IV
AMT	T	N	N	N	M	T	N
LOC	P	P	P	P	P	P	P

CROWN CLOSURE

0	1-20%	21-40%	41-70%	71-90%	> 90%
0	1	2	3	4	5

LWD FNC. N F A | DIST C E | INSTREAM VEG N A M V

LB SHP U V S O | RB SHP U V S O

TEXTURE F G C B R A | TEXTURE F G C B R A

RIP. VEG. N G S C D M W | RIP. VEG. N G S C D M W

STAGE INIT SHR PS YF MF NA | STAGE INIT SHR PS YF MF NA

FLD SNS

BED MATERIAL Dominant Silt | Subdom.

D95 (cm) | D (cm) | Morph. LC

DISTURBANCE INDICATORS

beavdam	aban ch	erdbk	avul	SWD	LWD	jam
O1	B1	B2	B3	D1	D2	D3

ex nf	no pl	elev br	mult ch	dis line	nom bf	finger	lg wdg	ex bar	ex bd scr
C1	C2	C3	C4	C5	S1	S2	S3	S4	S5

PATTERN TM ME IM IR SI ST

ISLANDS N O I F S AN

BARS N SIDE DIAG MID SPAN BR

COUPLING DC PC CO

CONFINEMENT EN CO FC OC UN N/A

MORPHOLOGY

FEATURES

C	NID MAP #	NID #	TYPE	HT / LG (m)	mthd	PHOTO	COMMENTS	UTM
						R F		
						R F		
						R F		
						R F		

HABITAT QUALITY

Poor spawning habitat very silty, no gravel in creek bottom
High turbidity along lower reach at confluence w Yukon R
Mixing w Yukon R is occurring ~1m from cr. mouth
Exposed w lush growth of grasses + sedges on either side.
Several grass covered islands in Yukon River ~10m from
cr. mouth.

FSZ

PHOTO DOCUMENTATION

ROLL #	#	FOC LG	DIR	COMMENTS

WILDLIFE

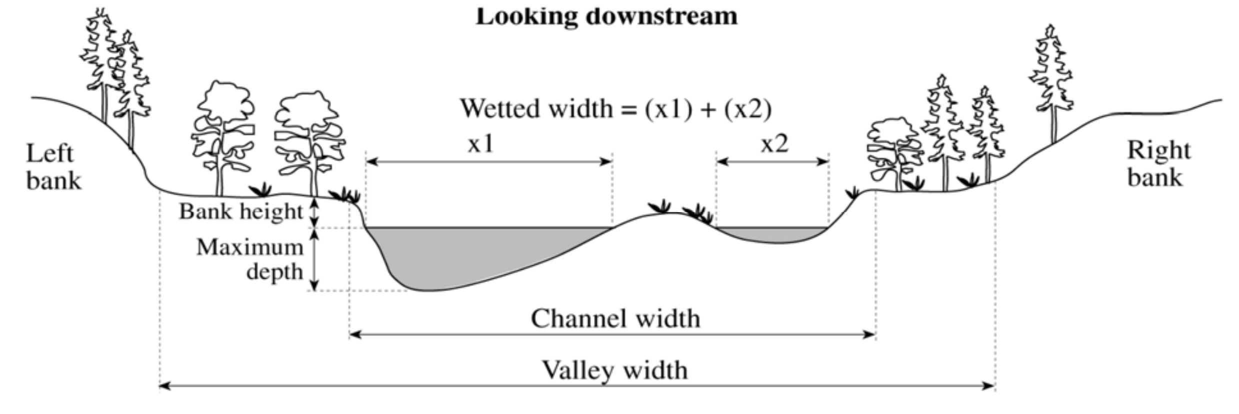
GROUP	WILDLIFE OBSERVATIONS	GROUP	WILDLIFE OBSERVATIONS
Grizzly	Bear track ♀ + cub Raven tracks		
Wolf	tracks - one individual		

COMMENTS

C		C	

Rev. Apr. 1998

Channel Measurements



The “wetted width” is the width of the wetted portion of the stream channel. There was only one channel to be measured at Minto Creek, so 2X in above diagram is not applicable.

The residual pool depth is the difference between the maximum pool depth and the riffle crest depth.

WbDp is Wetted bankfull over average depth to determine the relative percentage of water flow at the time of assessment. In this case is 0.5m (Dp) is divided by 1.4m (Wb) = 0.36 x 100% = 36% of channel is flowing.

This gives the Stage of flow as Low, where Low (L) is 0-35%, Medium (M) is 36%-90% and High (H) is 90% to 100%.

Please refer to photographs at the end of this memo report.

Cover Codes

Cover is any structure in the wetted channel or within 1 m above the water surface that provides hiding, resting, or feeding places for fish. Examples are boulders, woody debris, in channel vegetation. There was no in channel cover observed in the lower reach of Minto Creek.

Bank characteristics Left bank, Right bank (LB, RB)

The left and the right bank refer to the stream bank being described when the observer is facing downstream.

Shape (Shp)

Shape refers to the shape or form of the identified channel bank according to the following selections:

- V – v-shaped (steep sloping or vertical);
- S – sloping (gradual or shallow slope);
- O – overhanging bank; and
- U – undercut (similar to overhanging, but undercut has water or "wetted channel" underneath the overhanging portion of the bank).

This reach of Minto Creek had sloping banks on both sides.

Texture

Texture refers to the dominant size class of material of the identified channel bank. These are defined as: fines (F); gravels (G); cobbles (C); boulders (B); bedrock (R); and anthropogenic

(A) (Includes rip-rap, dikes, etc.). See section 4.2.6.1, *Bed material* for size-class descriptions. Choose up to two dominant bank materials.

Minto Creek's channel bed and bank substrate was composed of deep silt deposits which are classified as fines.

Riparian zones (Rip)

Riparian zones are defined as the land adjacent to the normal high water line in a stream, river, lake or pond and extending to the portion of land that is influenced by the presence of the adjacent ponded or channeled water.

Riparian vegetation code recorded is for the dominant vegetative cover adjacent to the creek channel. The codes are defined as follows:

N – none D – deciduous forest G – grass M – mixed forest S – shrub W – wetland C – coniferous forest

Grass and sedges are the dominant vegetation cover on the lower Minto Creek reach.

Vegetation Stage (Stg)

Stage refers to the level of maturity and structure of the dominant riparian vegetative cover adjacent to the sampled waterbody.

Riparian stages include:

Initial (INIT) – non-vegetated or initial stage following disturbance (less than 5% cover);

Shrub (SHR) – shrub/herb stage, less than 10% tree cover;

Pole-sapling stage (PS) – pole-sapling stage, with trees overtopping shrubs. The standard age is usually less than 15–20 years;

Young forest (YF) – young forest, self thinning is evident and the forest canopy is differentiated into distinct layers, stand age is 30–80 years; and

Mature forest (MF) – mature forest with canopy gaps and a well-developed understory.

Not applicable (NA) – use when riparian vegetation is absent, grass, or wetland.

Vegetation on the lower portion of Minto Creek is in the Shrub stage. Vegetation adjacent to stream and along flood plain is grasses and sedges with no tree or shrub cover. On the upper banks is tall shrub cover is dominant, primarily willow.

Turbidity (Turb.)

Turbidity indicates the concentration of suspended sediments and particulate matter in water. It is subjective and is estimated visually. Turbidity may be defined as:

Turbid (T) – muddy, brown water with visibility restricted to a few centimetres;

Moderately turbid (M) – 'muddy,' water with increased visibility in shallow areas; general shapes on bed surface can be discerned, but deeper areas are not visible;

Lightly turbid (L) – features can be distinguish in shallow areas, and limited visibility in slightly deeper pools (~>1.5 m); and

Clear water (C) – excellent visibility except in very deep areas.

The lower Minto Creek was turbid at the time of the assessment.

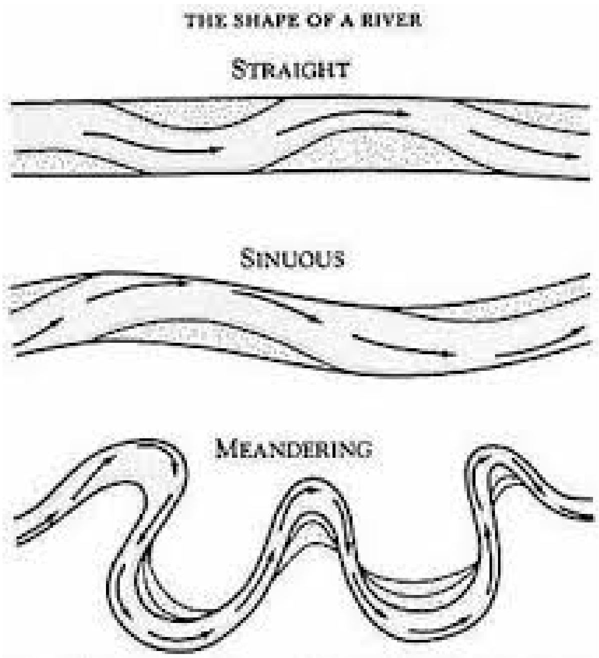
Disturbance Indicators

Banks	**Large woody debris**
B1 – Abandoned channels	D1 – Small woody debris
B2 – Eroding banks	D2 – Large woody debris
B3 – Avulsions	D3 – Recently formed LWD jams
Sedimentation	**Morphology**
S1 – Homogeneous bed texture	C1 – Extensive riffles or cascades
S2 – Sediment fingers	C2 – Minimal pool area
S3 – Sediment wedges	C3 – Elevated mid-channel bars
S4 – Extensive bars	C4 – Multiple channel or braids
S5 – Extensively scoured zones (stream bed)	C5 – Disturbed stone lines

The lower reach of Minto Creek had deposits of fine sediments (Silt) that created extensive bars or sidelong muddy shores.

Channel

Channel pattern for the lower reach of Minto Creek is Sinuous (SI).

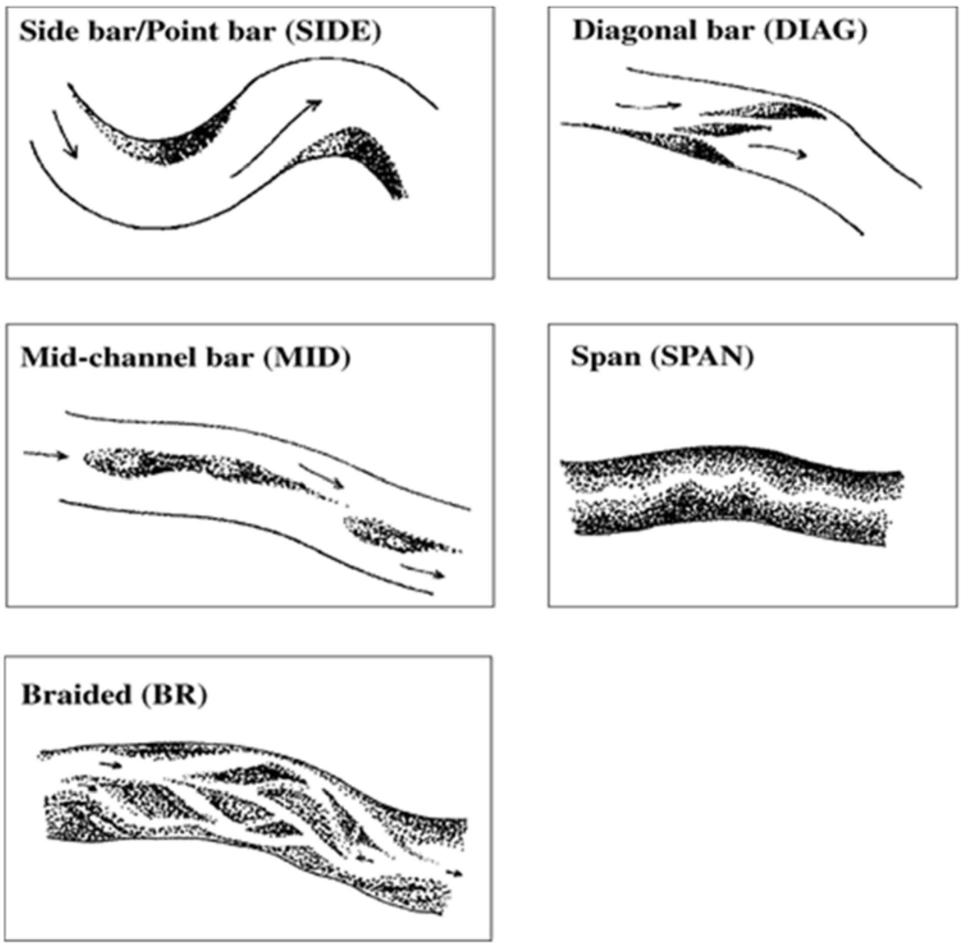


Islands

There were no islands within the Minto Creek channel; there were islands about 10 to 30 meters beyond the creek mouth in the Yukon River.

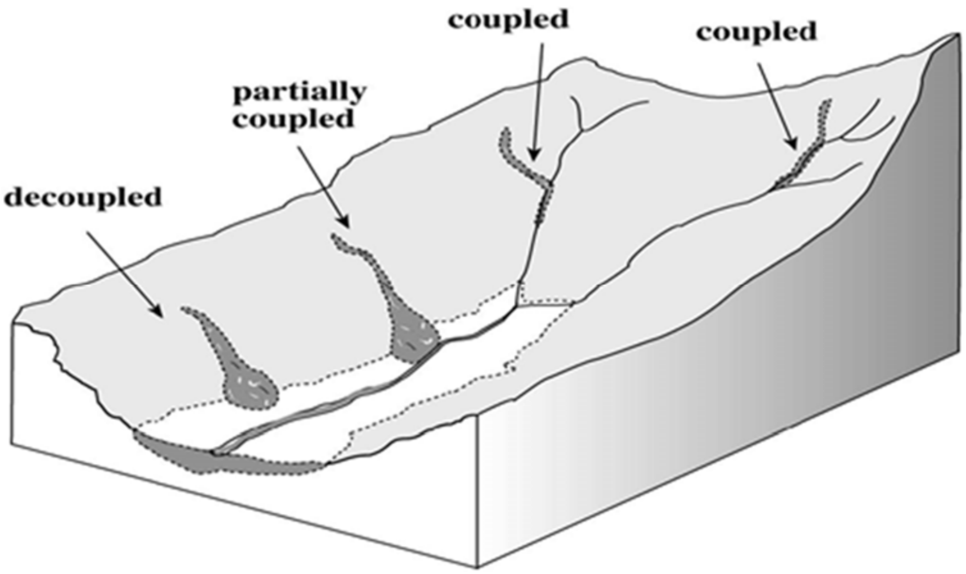
Bars

Stream bars consist of exposed bed materials deposited by stream flow within the stream channel.



Minto Creek lower reach had a span type channel with silt deposits along the sides.

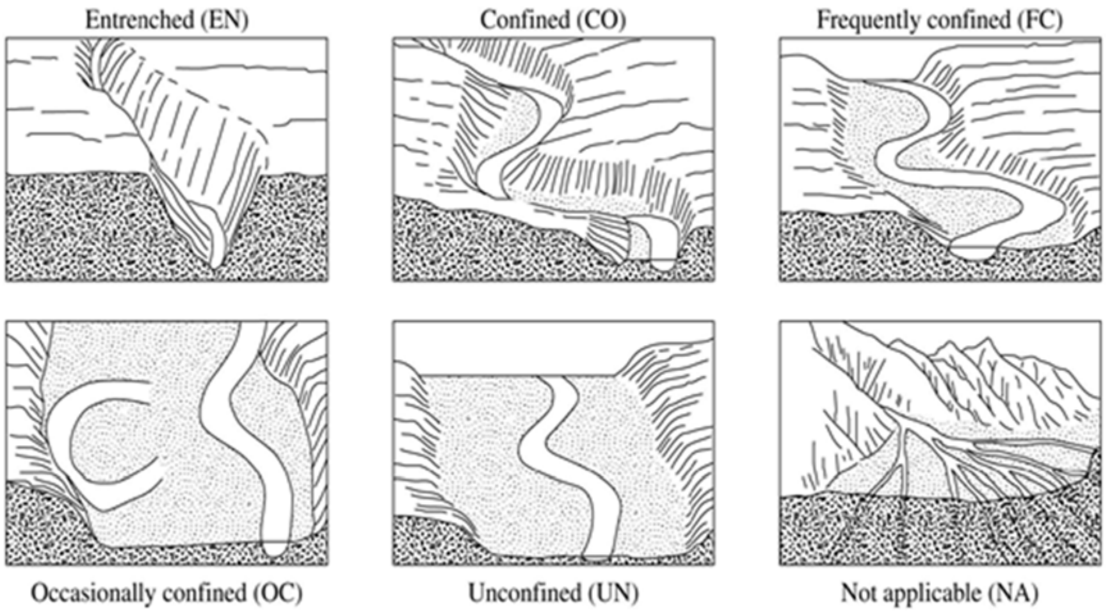
Coupling



Decoupled (DC) – A channel is considered decoupled from a hill slope when sediment mobilized on the hillslope by a landslide would not normally enter the stream channel (at any point—either side). This was the case at the lower reach of Minto Creek.

Confinement

Confinement is a visual assessment of the degree to which the lateral movement of a river channel is limited.



Lower Minto Creek is occasionally confined during high water flow as evidenced by the 90cm banks on either side of a definitive flood plain.

Appendix G

July- December 2013 ABA Semi-annual Report

Minto Mine

Water Licence QZ96-006

July- December 2013 ABA Semi-annual Report

Prepared by:

Capstone Mining Corp.

Minto Mine

March, 2014

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Tables

Figures

Table of Appendices

1.0 Objectives

This report is submitted to meet requirements under Capstone Mining Corporation, Minto Mine (Minto) Type “A” Water Use License QZ96-006, specifically Clause 87 and Appendix 6 – ABA Test Program. This program requires submission of sampling results and interpretation semi-annually.

The objective of this program is to determine the Neutralization Potential Ratio, otherwise referred to as the NPR (Neutralizing Potential divided by Acid Potential [NP/AP]) for overburden and waste rock. An NPR value of 3 or greater generally indicates non-acid generating material. Between July and December 2013 (reporting period) 358 waste rock and overburden samples (including 16 underground samples) were collected and 232 were analyzed in time for this report (126 results pending). In 2013 a total of 689 samples were collected from the Area 2 Pit and 28 samples were collected from the Area 118 underground workings. A total of 591 samples (including 15 underground samples) were analyzed in time for this report.

A separate, parallel program was run to determine the NPR of the tailings solids. In this reporting period 6 monthly tailings composites (July - December) were collected and 3 were analyzed in time for this report leaving 3 results pending. In March 2013 Minto finalized a sampling procedure which resulted in the first slurry tailings ABA sample collected in April 2013. Although an NPR value of 3 or greater is generally considered to indicate non-acid generating material in tailings solids, Appendix 6 states that the monitoring objective is to confirm that the NPR of tailings solids is greater than 4. In 2013 a total of 9 samples were collected and 6 were analyzed in time for this report.

2.0 Waste Rock and Overburden

2.1 Frequency of Sampling

In general, for open pit, a sample of drill cuttings was collected from waste blasts with a frequency of approximately 1 sample for every 7 holes drilled. The composite sample is generally made up of 4-5 individual samples. The underground ABA sampling procedure is to make a composite sample every 3300 tonnes (equivalent to approximately 50 m of development) using a grab sample technique.

Sampling locations during this reporting period were the Area 2 Pit and the Area 118 underground mine development.

2.2 Sample Preparation

All composite samples were reduced to 1-2 kg in mass using a riffle splitter. The resulting split sample was labeled according to the ABA sample naming standards and shipped to an accredited laboratory (SGS Canada Inc. [SGS], 6927 Antrim Avenue, Burnaby, BC, V5J 4M5). This labeling methodology is consistent with the Mine Environmental Database.

2.3 Test Work and Evaluation

SGS conducted ABA analysis by the BC Research Standard Method as required by the Water Use License (WUL). Reported results were entered into the Mine Environmental Database.

Waste rock and overburden composite samples were also analyzed for total metals for the entire duration of the reporting period. The results obtained from SGS were entered into the Mine Environmental Database.

In order to confirm that the predominant neutralizing mineral is calcite, the residual liquid phase from one out of approximately every ten NP determinations was submitted for multi-element ICP analysis (included calcium, magnesium, aluminium and iron after filtration at 0.45 μm). Calcium values for the residual liquid phase and inorganic carbon values for the sample were compared with values reported in *An Assessment of the Results of Acid Base Accounting (ABA) and Mineralogical Test work of Eight Samples for the Proposed Minto, Yukon Territory, Minesite* (Mills, C. (1997), Report to The Selkirk First Nation, Pelly Crossing, Yukon Territory, 30p.) [The Mills report]. Visible calcite has been noted on fracture faces and small veinlets within the current mining area.

The results obtained from SGS have been compared against those in the Mine Environmental Database and will also be used for future comparisons.

2.4 Discussion

Blasts are numbered by bench (denoted by the toe elevation) and by the sequential blast number for that bench (e.g. 784-01 being the first blast of the bench with 784 as the toe elevation).

The primary lithology of the deposit is granodiorite. This lithology is further classified as equigranular granodiorite (eG), porphyroblastic granodiorite (pG), and foliated granodiorite (fG). Locally, very highly-weathered granodiorite near the surface is described as residuum. Other lithological units are overburden (Ovb), pegmatite (Peg), Andesite (And) and Aplite (Ap).

2.5 Results

The 591 samples analyzed for the 2013 were analyzed by SGS and results were reported according to the BC Research Standard Method. The NPR values range for 2013 were between 0.4 and 406 with a mean NP/mean AP of 5.8 and a median of 20. A summary of the results for ABA analysis are attached as Appendix A (including results from April 2013 to June 30, 2013 which were not analyzed in time for the prior reporting period); as well the raw lab result files are attached as Appendix B.

2.5.1 NPR

The 2013 NPR results for the 2013 semi-annual reporting periods are comparable to the results from 2012 in Table 1.

Table 1. NPR Results Summary for 2012 and January to October 29, 2013.

NPR Values from SGS				
Period Ending	Min (NPR)	Max (NPR)	(Mean NP)/(Mean AP)	Median (NPR)
2012 (January 1 to December 31, 2012)	0.3	232	4.2	15.9
2013 (January 1 to October 29, 2013)	0.4	406	5.8	20

During the reporting period from July to October 29th 2013, 32 samples returned NPR values below the threshold of 3.0. The low NPR is not due to the lack of NP but rather an increase in sulphide sulphur (and therefore AP) found in these samples. Only 3 of the 32 samples represented areas of Low Grade Waste. The other 29 samples were from zones determined to be Medium Grade and High Grade Waste. With the exception of 6 samples, all waste associated with the samples reading below a NPR of 3 (as determined by onsite analysis) were sent to the Main Pit and disposed over below the closure high water level. All waste associated with samples above a NPR of 3 were dispatched based on Minto's Waste Rock and Overburden Management Plan.

Samples analyzed in 2013, resulted in a total of 59 samples with NPR values below the threshold of 3.0. A total of 5 of the 59 samples represented areas of Low Grade Waste. Of those 5 samples low grade samples, 2 were disposed outside of the Main Pit. Including Mid-Grade Waste, material represented by 7 samples were disposed outside of the Main Pit. The disposal of the material with a NP/AP below 3 outside of the Main Pit is not thought to be a short or long term issue in regards to acid rock drainage as it is surrounded by large volumes of material with NP/AP above 3.

All samples collected and analyzed in 2013 are displayed by coordinates with sample number and corresponding NPR value in bench maps found in Appendix C

2.5.2 Paste pH

The paste pH results for the 2013 period of January 1st to October 29th, 2013, were between 7.57 and 9.63 with a mean value of 8.71 and a median value of 8.74. The results are all well above the minimum required value of 5.0. The paste pH results for this reporting period are displayed in Table 2 with 2012 results.

Table 2. Paste pH Results Summary for 2012 and July to October 29, 2013.

Paste pH from SGS				
Period Ending	Min (pH)	Max (pH)	Mean (pH)	Median (pH)
2012 (January 1 to December 31, 2012)	7.5	9.7	8.73	8.73
2013 (January 1 to October 29, 2013)	7.57	9.63	8.71	8.74

2.5.3 Sulphide Sulphur

The sulphide sulphur content "$S(S^2)$%" results for the 2013 reporting period of January 1st to October 29th, 2013, ranged from <0.01 to 6.58%, with a mean value of 0.22% and a median value of 0.09% as summarized in Table 3.

Table 3. Sulphide Sulphur Results Summary for 2012 and January to October 29, 2013.

Sulphide-Sulphur % from SGS				
Period Ending	Min ($S(S^{2-})$)	Max ($S(S^{2-})$)	Mean ($S(S^{2-})$)	Median ($S(S^{2-})$)
2012 (January 1 to December 31, 2012)	<0.01%	2.83%	0.22%	0.05%
2013 (January 1 to April 9, 2013)	<0.01%	6.58%	0.22%	0.09%

A total of 45 samples exceeded the sulphide sulphur threshold for construction rock of 0.3% during the reporting period from July to October. 15 of the 29 samples also had NPR less than 3. The material that had sulphide sulphur greater than 0.3% and NPR greater than 3 were mined and placed according to the Waste Rock and Overburden Management Plan in either the Low Grade waste, Medium Grade waste or High Grade waste areas of the Southwest Waste Dump. As stated above all material with the exception of material represented by 6 samples was placed in the Main Pit below the closure high water level.

Samples analyzed in 2013, resulted in a total of 98 samples returned sulphide sulphur values above 0.3%. A total 55 of the 98 samples returned NPR values below 3.

Figure 1 is a plot of sulphide sulphur vs NPR for all samples analyzed in 2013. This plot illustrates that 98 samples had sulphide sulphur higher than 0.30% and 55 samples did not meet the NPR threshold of 3.

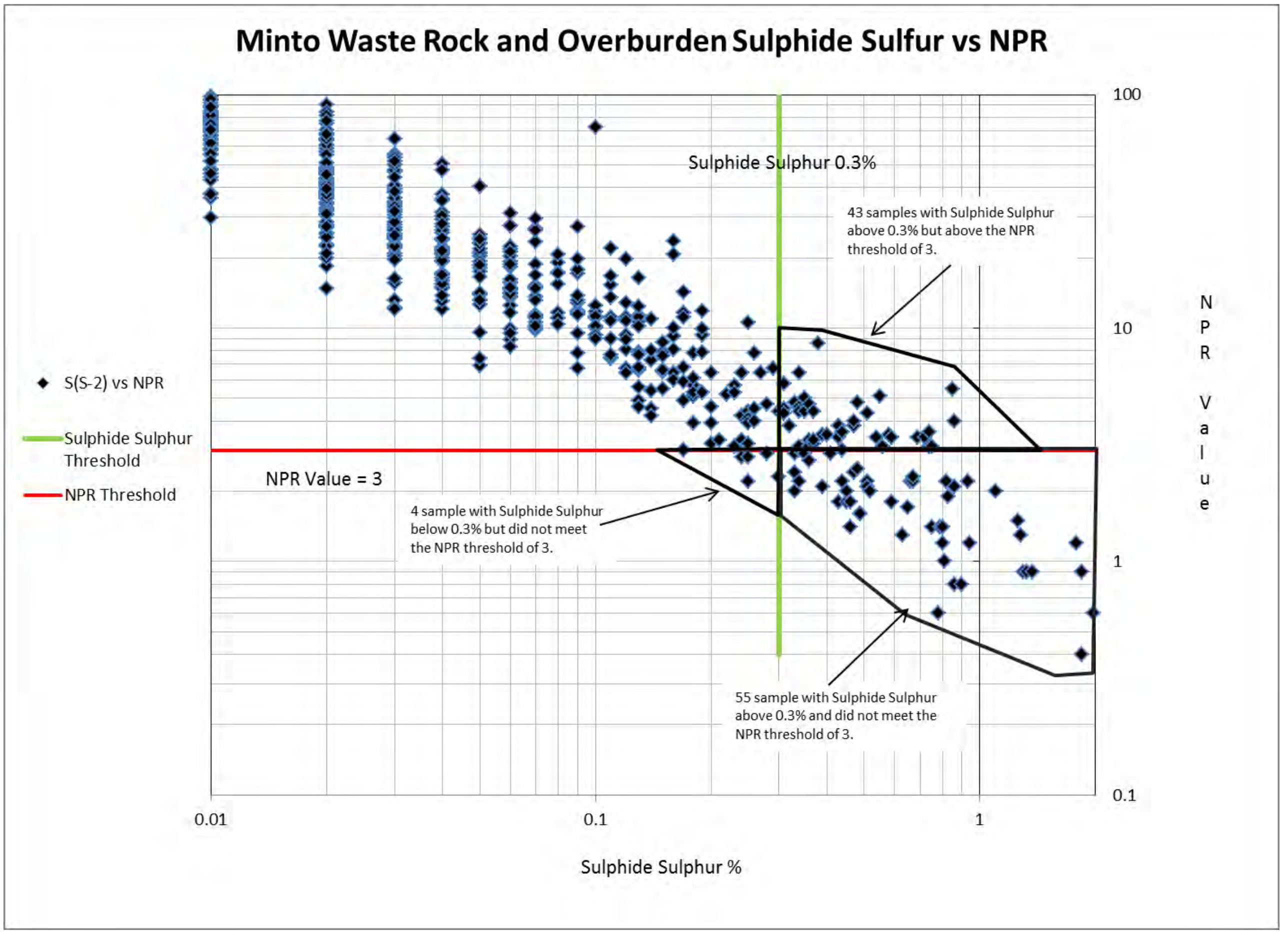

Figure 1. NPR vs. Sulphide Sulphur of the waste rock samples.

2.6 NP Leachate Analyses

During the period of January 1st to October 29th, 2013, a total of 62 samples had ICP-OES analyses done on the residual liquid phase following NP determinations in accordance with the BC Research NP Procedure. Using Table 2.4 from the Mills report as the basis of comparison for calcium (Ca) content:

- The range of the Ca content of the liquid residue from the NP determination on the Mills report samples was 36.1 to 479.4 ppm with a mean of 272.38 ppm and a median of 285.25 ppm:

- In comparison, the Ca content of the liquid residue from the NP determination for the samples in this reporting period ranged from 227 to 816 mg/L (equivalent to ppm) with a mean of 583.4 mg/L (ppm) and a median of 571 mg/L (ppm).

Using Table 2.1 from the Mills report as a basis for comparison of inorganic carbon values:

- The TIC (Total Inorganic Carbon) for the Mills Report samples ranged from 0.30% to 0.33% with a mean of 0.31% and a median of 0.31%.
- In comparison, the TIC for the 62 samples submitted for leachate analysis during January 1st to October 29th ranged from 0.07 to 2.20% with a mean of 0.37% and a median of 0.285%
- See Figure 2 for the comparison between January and October 2013 Ca ICP results and Mills Report Ca ICP results. Figure 2 illustrates that Ca is greater on average during this reporting period than the results found in the Mills Report.

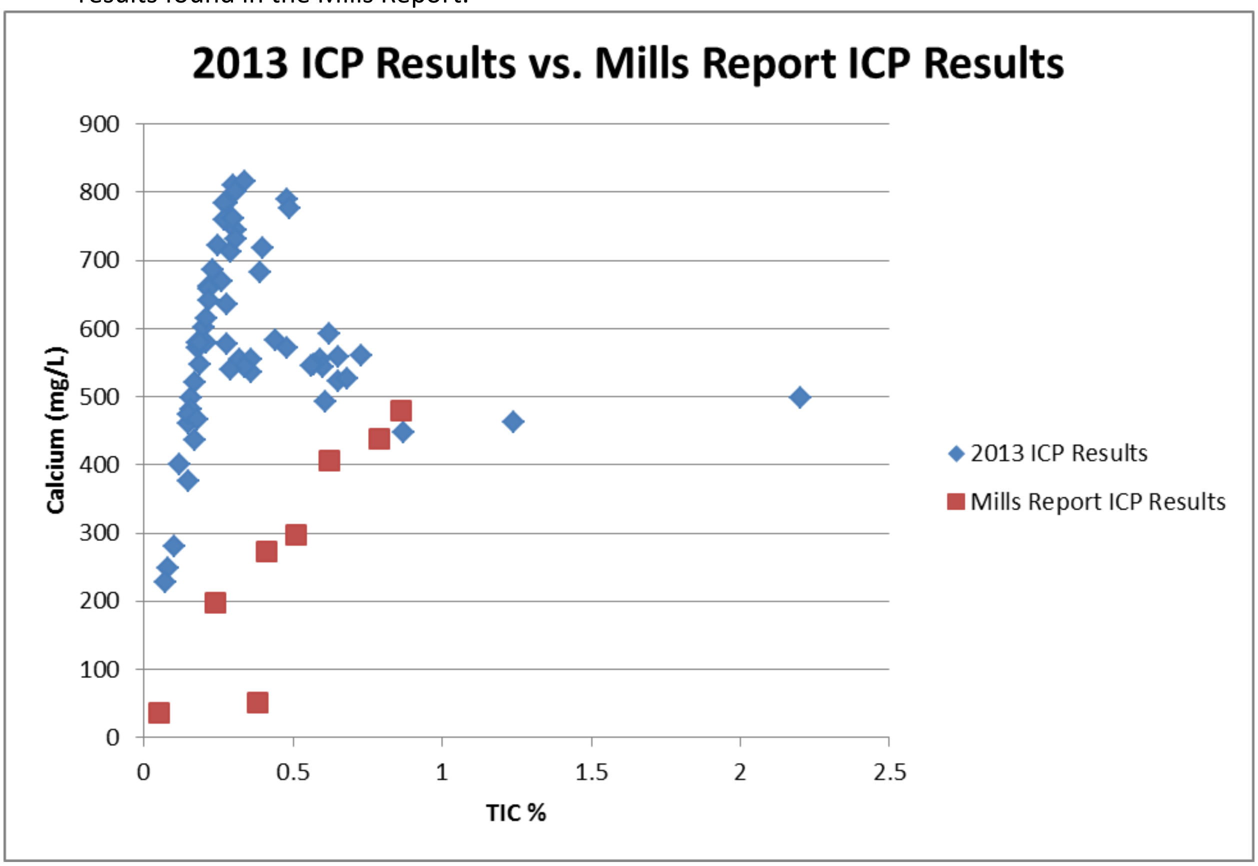

Figure 2. 2013 ICP Results vs. Mills Report ICP Results

The minimum carbonate equivalent value was higher than the minimum from Mills (5.7 compared to <1.1). The maximum was on par with Mills (20.4 compared to 19.5).

The Mills report compared calcium (Ca) and magnesium (Mg) concentrations in the NP test leachate (by way of a ratio (Ca/Mg) and found that, for the eight samples tested, the leachates had a mean Ca/Mg ratio of 19.7. From the high Ca/ low Mg concentrations in the NP test leachate, Mills concluded that the dominant mineral providing acid neutralization potential was calcite (calcium carbonate, $CaCO_3$). For the current (January to October 2013) period, calculation of the Ca/Mg ratio yields an average value of 9.7. On this basis, the 2013 results for NP test leachate analysis indicate that calcite continues to be the predominant neutralizing mineral. For a summary of NP test leachate results for Ca, Mg, Al, and Fe see Table 4. For complete NP test leachate results see Appendix D. For raw lab results see Appendix B.

Table 4. **Select ICP results from SGS.**

January 2013 to April 2013 Leachate ICP results					
Sample Number	Ca (mg/L)	Mg (mg/L)	Al (mg/L)	Fe (mg/L)	TIC (%)
48397	554	9.47	23.8	52.5	0.32
48389	662	12.1	25.8	63.6	0.22
48061	636	5.24	28.0	60.5	0.28
48059	719	18.4	26.5	320	0.4
30115	784	10.6	39.4	96.1	0.28
48069	281	4.91	38.3	116	0.1
53815	722	17.3	42.2	197	0.25
53808	790	16.9	29.9	342	0.48
54756	554	16.8	29.3	182	0.59
54763	554	16.8	29.3	182	0.36
54353	498	12.4	8.08	84.4	0.16
52003	522	18.3	59.2	624	0.65
54418	461	7.28	39.4	203	0.15
52013	745	26.5	36.0	150	0.31
52009	481	10.9	92.8	479	0.16
52008	463	35.4	46.6	462	1.24
51029	535	19.9	102	427	0.36
51049	548	25.3	48.2	372	0.19
51039	499	31.8	47.1	310	2.2
50986	777	17.6	77.1	690	0.49
47825	578	38.1	37.8	229	0.28
50993	544	11.5	47.7	503	0.34

3.0 TAILINGS

3.1 Frequency of Sampling and Sample Preparation

Starting in April 2013 a sample of final tailings was taken daily, filtered and sent to the onsite lab for drying. These daily samples are then combined into a monthly sample and riffled down to produce a 1-2 kg composite. The labeling methodology used is consistent with the labeling protocol established in the Mine Environmental Database.

3.2 Test work and Evaluation

The monthly composites were sent to SGS where ABA analysis was conducted according to the BC Research Standard Method. The Acid Potential (AP) is determined from percent sulphide sulphur (obtained by subtracting percent sulphate sulphur from percent total sulphur). Additionally, paste pH and total inorganic carbon (TIC) were determined.

3.3 Results

The results from the laboratory test show that all of the tailings samples were within the threshold of NPR >4 and lower sulphide sulphur as presented in Figure 3. The results of those tests are summarized in Appendix E with the raw lab results attached as Appendix B.

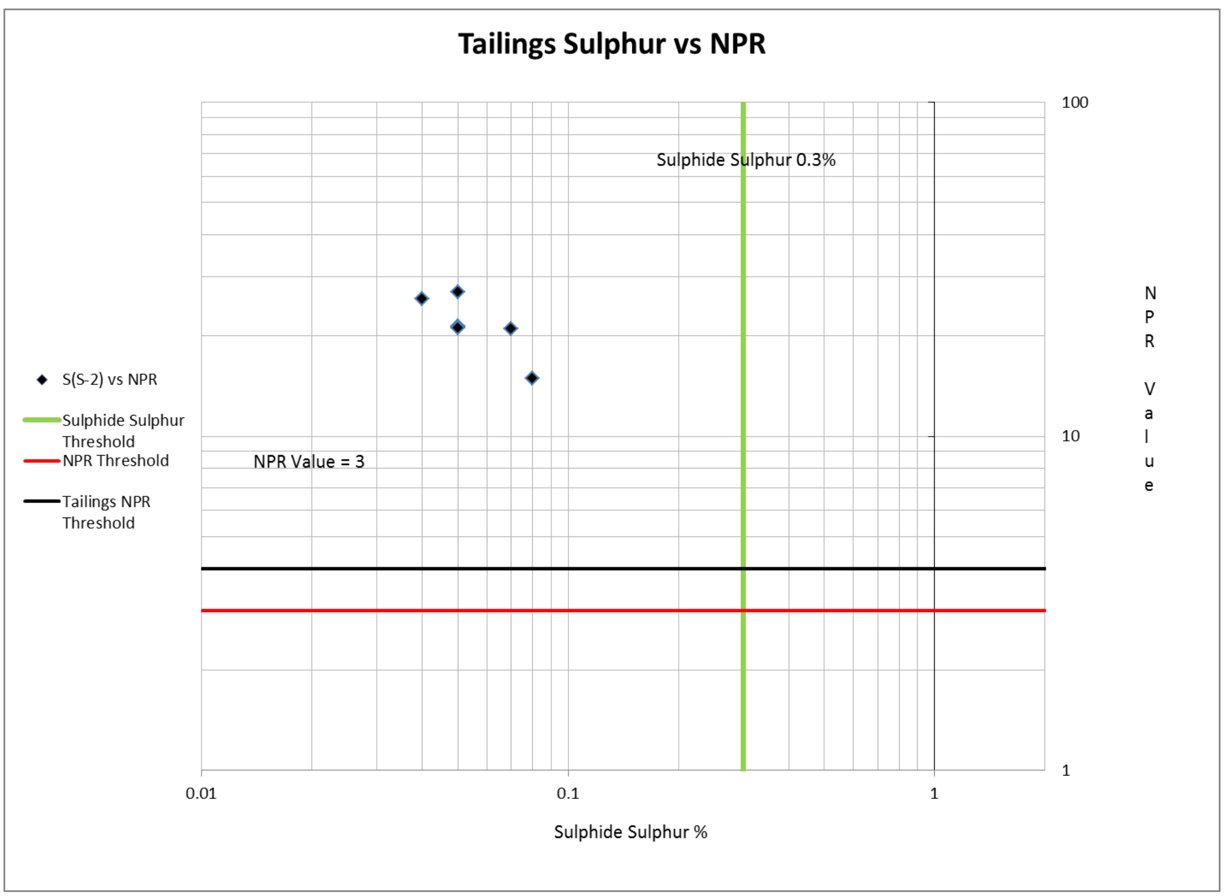

Figure 3. NPR vs. Sulphide Sulphur of tailings samples.

4.0 Conclusion

The results displayed in this report combined with the previous reporting periods are the foundation for the Mine Environmental ABA Database. Preliminary assessment indicates that values > 0.30% sulphide sulphur mainly occurs in Medium and High Grade Waste areas and also corresponds with NPR values below 3. Overburden and waste rock development will continue through the subsequent phases of mining and milling and will be sampled, analyzed and reported as required by the licence.

Appendix A: BC Research Method ABA Results for Waste Rock and Overburden in January 2013 to October 2013

Appendix A. Summary Area 2 Pit ABA Analysis Results from SGS for 2013.														
Sample Date	ABA ID	Waste Type	Paste pH	TIC %	$CaCO_3$ NP	S(T) %	$S(SO_4)$ %	$S(S^{2-})$ %	AP $CaCO_3$ kg / tonne	NP H_2SO_4 kg / tonne	NP $CaCO_3$ kg / tonne	Net NP	NP:AP Ratio (NP/AP)	Fizz Test
1/9/2013	48051	MGW NAG	8.93	0.4	33.3	0.38	0.02	0.36	11.3	36.8	37.5	26.3	3.3	Slight
1/9/2013	48052	HGW NAG	8.79	0.52	43.3	0.44	<0.01	0.44	13.8	48	49	35.3	3.6	Slight
1/9/2013	48053	MGW NAG	8.86	0.42	35	0.15	0.02	0.13	4.1	42.1	43	38.9	10.6	Slight
1/9/2013	48054	MGW NAG	9.07	0.39	32.5	0.13	0.02	0.11	3.4	37.5	38.3	34.8	11.1	Slight
1/9/2013	48389	LGW NAG	9.05	0.22	18.3	0.03	<0.01	0.03	0.9	24	24.5	23.6	26.1	Slight
1/9/2013	48390	LGW NAG	9.01	0.2	16.7	0.04	<0.01	0.04	1.3	23.5	24	22.8	19.2	Slight
1/9/2013	48391	MGW PAG	9	0.38	31.7	0.41	<0.01	0.41	12.8	36.3	37	24.2	2.9	Slight
1/9/2013	48392	MGW NAG	8.87	0.32	26.7	0.25	<0.01	0.25	7.8	31.4	32	24.2	4.1	Slight
1/9/2013	48393	ZGW NAG	8.74	0.46	38.3	0.03	<0.01	0.03	0.9	36	36.8	35.8	39.2	Slight
1/9/2013	48394	MGW NAG	8.32	0.32	26.7	0.28	0.03	0.25	7.8	34.1	34.8	26.9	4.4	Slight
1/9/2013	48397	LGW NAG	8.5	0.32	26.7	0.03	<0.01	0.03	0.9	31.6	32.3	31.3	34.4	Slight
1/9/2013	48398	LGW NAG	8.33	0.19	15.8	0.04	<0.01	0.04	1.3	21.1	21.5	20.3	17.2	Slight
1/9/2013	48399	LGW NAG	7.84	0.02	1.7	0.05	<0.01	0.05	1.6	14.7	15	13.4	9.6	None
1/9/2013	48400	MGW NAG	9.06	0.16	13.3	0.06	<0.01	0.06	1.9	16.4	16.8	14.9	8.9	Slight
1/21/2013	30115	LGW NAG	8.8	0.28	23.3	0.02	<0.01	0.02	0.6	29.6	30.3	29.6	48.4	Slight
1/21/2013	30116	MGW NAG	8.82	0.27	22.5	0.06	<0.01	0.06	1.9	25.7	26.3	24.4	14	Slight
1/21/2013	30117	LGW NAG	8.93	0.15	12.5	0.05	0.01	0.04	1.3	20.8	21.3	20	17	Slight
1/21/2013	30118	MGW PAG	8.96	0.25	20.8	0.33	<0.01	0.33	10.3	29.2	29.8	19.4	2.9	Slight
1/21/2013	30119	MGW NAG	9.03	0.1	8.3	0.06	<0.01	0.06	1.9	15.2	15.5	13.6	8.3	Slight
1/21/2013	30120	HGW PAG	8.78	0.18	15	0.39	<0.01	0.39	12.2	24.7	25.3	13.1	2.1	Slight
1/21/2013	30121	LGW NAG	8.21	0.2	16.7	0.02	<0.01	0.02	0.6	21.8	22.3	21.6	35.6	Slight
1/21/2013	30122	MGW NAG	7.99	0.25	20.8	0.09	<0.01	0.09	2.8	26.2	26.8	23.9	9.5	Slight
1/21/2013	30123	MGW PAG	8.15	0.37	30.8	0.03	<0.01	0.03	0.9	35.3	36	35.1	38.4	Slight
1/21/2013	30124	LGW NAG	8.25	0.29	24.2	0.02	<0.01	0.02	0.6	28.9	29.5	28.9	47.2	Slight
1/21/2013	30125	LGW NAG	9.02	0.15	12.5	0.06	<0.01	0.06	1.9	18.1	18.5	16.6	9.9	Slight
1/21/2013	48057	MGW PAG	8.82	0.36	30	0.59	<0.01	0.59	18.4	33.3	34	15.6	1.8	Slight

Appendix A. Summary Area 2 Pit ABA Analysis Results from SGS for 2013.														
Sample Date	ABA ID	Waste Type	Paste pH	TIC %	$CaCO_3$ NP	S(T) %	$S(SO_4)$ %	$S(S^{2-})$ %	AP $CaCO_3$kg / tonne	NP H_2SO_4kg / tonne	NP $CaCO_3$kg / tonne	Net NP	NP:AP Ratio (NP/AP)	Fizz Test
1/21/2013	48058	LGW NAG	8.74	0.5	41.7	0.03	<0.01	0.03	0.9	43.6	44.5	43.6	47.5	Slight
1/21/2013	48059	MGW NAG	9.26	0.4	33.3	0.11	0.01	0.1	3.1	34.3	35	31.9	11.2	Slight
1/21/2013	48060	LGW NAG	9.1	0.25	20.8	0.03	<0.01	0.03	0.9	27.2	27.8	26.8	29.6	Slight
1/21/2013	48061	MGW PAG	8.52	0.28	23.3	0.18	<0.01	0.18	5.6	31.4	32	26.4	5.7	Slight
1/21/2013	48062	LGW NAG	8.39	0.53	44.2	0.06	<0.01	0.06	1.9	50.2	51.3	49.4	27.3	Slight
1/21/2013	48063	MGW NAG	8.53	0.43	35.8	0.12	<0.01	0.12	3.8	40.2	41	37.3	10.9	Slight
1/21/2013	48064	LGW NAG	9.23	0.15	12.5	0.02	<0.01	0.02	0.6	17.4	17.8	17.1	28.4	Slight
1/21/2013	48065	LGW NAG	8.89	0.23	19.2	0.04	<0.01	0.04	1.3	25.2	25.8	24.5	20.6	Slight
1/21/2013	48066	LGW NAG	8.79	0.34	28.3	0.02	<0.01	0.02	0.6	35	35.8	35.1	57.2	Slight
1/22/2013	48067	LGW NAG	8.89	0.14	11.7	0.04	<0.01	0.04	1.3	20.1	20.5	19.3	16.4	Slight
1/22/2013	48068	LGW PAG	8.48	0.47	39.2	0.67	<0.01	0.67	20.9	44.6	45.5	24.6	2.2	Slight
2/4/2013	48069	LGW NAG	9.19	0.1	8.3	0.02	<0.01	0.02	0.6	14	14.3	13.6	22.8	Slight
2/4/2013	48070	LGW NAG	8.77	0.58	48.3	0.03	<0.01	0.03	0.9	45.8	46.8	45.8	49.9	Slight
2/4/2013	48071	MGW NAG	8.67	1.24	103.3	0.16	<0.01	0.16	5	100.7	102.8	97.8	20.6	Slight
2/4/2013	48072	MGW PAG	8.42	0.88	73.3	0.34	<0.01	0.34	10.6	66.4	67.8	57.1	6.4	Slight
2/5/2013	48074	LGW NAG	8.24	0.09	7.5	0.02	<0.01	0.02	0.6	12.3	12.5	11.9	20	None
2/5/2013	48075	MGW NAG	8.36	0.13	10.8	0.04	<0.01	0.04	1.3	18.1	18.5	17.3	14.8	Slight
2/5/2013	53801	LGW NAG	8.64	0.32	26.7	0.36	<0.01	0.36	11.3	34.3	35	23.8	3.1	Slight
2/5/2013	53802	LGW NAG	9.03	0.12	10	0.02	<0.01	0.02	0.6	16.7	17	16.4	27.2	Slight
2/5/2013	53803	MGW NAG	8.73	0.5	41.7	0.19	<0.01	0.19	5.9	46.1	47	41.1	7.9	Slight
2/5/2013	53804	LGW NAG	8.98	0.39	32.5	0.09	<0.01	0.09	2.8	35.3	36	33.2	12.8	Slight
2/5/2013	53805	LGW NAG	8.79	1.18	98.3	0.38	<0.01	0.38	11.9	99.7	101.8	89.9	8.6	Moderate
2/5/2013	53806	LGW NAG	9.16	0.18	15	0.02	<0.01	0.02	0.6	26.5	27	26.4	43.2	Slight
2/5/2013	53807	LGW NAG	8.87	0.39	32.5	0.02	<0.01	0.02	0.6	39.2	40	39.4	64	Slight
2/5/2013	53808	MGW NAG	8.98	0.48	40	0.28	<0.01	0.28	8.8	40.4	41.3	32.5	4.7	Slight
2/5/2013	53809	MGW NAG	8.85	0.29	24.2	0.02	<0.01	0.02	0.6	31.1	31.8	31.1	50.8	Slight

Appendix A. Summary Area 2 Pit ABA Analysis Results from SGS for 2013.														
Sample Date	ABA ID	Waste Type	Paste pH	TIC %	$CaCO_3$ NP	S(T) %	$S(SO_4)$ %	$S(S^{2-})$ %	AP $CaCO_3$kg / tonne	NP H_2SO_4kg / tonne	NP $CaCO_3$kg / tonne	Net NP	NP:AP Ratio (NP/AP)	Fizz Test
2/5/2013	53810	LGW NAG	9.19	0.23	19.2	0.01	<0.01	0.01	0.3	24.7	25.3	24.9	80.8	Slight
2/5/2013	53811	MGW NAG	9.05	0.38	31.7	0.13	<0.01	0.13	4.1	45.1	46	41.9	11.3	Slight
2/5/2013	53812	MGW NAG	8.75	0.58	48.3	0.04	<0.01	0.04	1.3	45.8	46.8	45.5	37.4	Slight
2/5/2013	53813	MGW NAG	9.01	0.35	29.2	0.03	<0.01	0.03	0.9	35	35.8	34.8	38.1	Slight
2/5/2013	53814	LGW NAG	8.29	0.31	25.8	0.08	<0.01	0.08	2.5	37.7	38.5	36	15.4	Slight
2/5/2013	53815	LGW NAG	8.95	0.25	20.8	0.07	<0.01	0.07	2.2	29.2	29.8	27.6	13.6	Slight
2/5/2013	53816	MGW NAG	8.87	0.58	48.3	0.43	<0.01	0.43	13.4	50	51	37.6	3.8	Slight
2/5/2013	53817	MGW NAG	9.39	0.13	10.8	0.04	<0.01	0.04	1.3	18.4	18.8	17.5	15	Slight
2/5/2013	53819	MGW NAG	8.94	0.25	20.8	0.34	<0.01	0.34	10.6	31.6	32.3	21.6	3	Slight
2/5/2013	53820	LGW NAG	9.53	0.17	14.2	0.03	<0.01	0.03	0.9	22.8	23.3	22.3	24.8	Slight
2/14/2013	53821	LGW NAG	8.31	0.29	24.2	0.09	<0.01	0.09	2.8	32.6	33.3	30.4	11.8	Slight
2/14/2013	53822	LGW NAG	8.38	0.35	29.2	0.11	<0.01	0.11	3.4	36	36.8	33.3	10.7	Slight
2/14/2013	53823	MGW PAG	8.35	0.27	22.5	0.8	<0.01	0.8	25	33.6	34.3	9.3	1.4	Slight
2/14/2013	53824	MGW NAG	8.64	0.44	36.7	0.34	<0.01	0.34	10.6	48.3	49.3	38.6	4.6	Slight
2/14/2013	54751	LGW OVB	8.78	0.27	22.5	0.03	<0.01	0.03	0.9	31.9	32.5	31.6	34.7	Slight
2/14/2013	54752	MGW NAG	8.58	0.14	11.7	0.2	<0.01	0.2	6.3	24	24.5	18.3	3.9	Slight
2/14/2013	54753	HGW NAG	8.08	0.06	5	0.09	0.04	0.05	1.6	10.5	10.8	9.2	6.9	None
2/14/2013	54754	MGW NAG	8.5	0.11	9.2	0.03	<0.01	0.03	0.9	19.1	19.5	18.6	20.8	Slight
2/14/2013	54755	LGW NAG	8.89	0.2	16.7	0.01	<0.01	0.01	0.3	23.5	24	23.7	76.8	Slight
2/14/2013	58325	LGW OVB	7.86	0.24	20	0.08	0.02	0.06	1.9	27	27.5	25.6	14.7	Slight
2/15/2013	54756	MGW PAG	8.41	0.59	49.2	1.84	<0.01	1.84	57.5	53.2	54.3	-3.3	0.9	Slight
2/15/2013	54757	LGW NAG	8.84	0.2	16.7	0.03	<0.01	0.03	0.9	26.2	26.8	25.8	28.5	Slight
2/15/2013	54758	MGW PAG	8.88	0.19	15.8	0.28	<0.01	0.28	8.8	24.7	25.3	16.5	2.9	Slight
2/15/2013	54759	LGW NAG	9.21	0.41	34.2	0.01	<0.01	0.01	0.3	40.4	41.3	40.9	132	Slight
2/15/2013	54760	LGW NAG	9.2	0.21	17.5	0.02	<0.01	0.02	0.6	23.3	23.8	23.1	38	Slight
2/15/2013	54761	MGW NAG	8.85	0.29	24.2	0.22	<0.01	0.22	6.9	35.3	36	29.1	5.2	Slight

Appendix A. Summary Area 2 Pit ABA Analysis Results from SGS for 2013.														
Sample Date	ABA ID	Waste Type	Paste pH	TIC %	$CaCO_3$ NP	S(T) %	$S(SO_4)$ %	$S(S^{2-})$ %	AP $CaCO_3$kg / tonne	NP H_2SO_4kg / tonne	NP $CaCO_3$kg / tonne	Net NP	NP:AP Ratio (NP/AP)	Fizz Test
2/15/2013	54762	MGW NAG	8.78	0.42	35	0.43	<0.01	0.43	13.4	44.8	45.8	32.3	3.4	Slight
2/19/2013	54763	MGW PAG	8.93	0.36	30	0.33	0.01	0.32	10	36.8	37.5	27.5	3.8	Slight
2/19/2013	54764	LGW NAG	9.23	0.51	42.5	0.02	<0.01	0.02	0.6	45.8	46.8	46.1	74.8	Slight
2/19/2013	54765	LGW NAG	9.14	0.23	19.2	0.11	<0.01	0.11	3.4	25	25.5	22.1	7.4	Slight
2/19/2013	54766	LGW NAG	8.88	0.21	17.5	0.07	<0.01	0.07	2.2	28.2	28.8	26.6	13.1	Slight
2/19/2013	54767	MGW NAG	8.93	0.54	45	0.24	<0.01	0.24	7.5	47	48	40.5	6.4	Slight
2/19/2013	54768	MGW NAG	8.85	0.29	24.2	0.12	<0.01	0.12	3.8	34.3	35	31.3	9.3	Slight
2/19/2013	54769	OVB LGW	8.51	0.34	28.3	0.04	<0.01	0.04	1.3	35.8	36.5	35.3	29.2	Slight
2/19/2013	54770	MGW NAG	9.09	0.09	7.5	0.04	<0.01	0.04	1.3	18.9	19.3	18	15.4	Slight
2/19/2013	54771	LGW NAG	8.88	0.17	14.2	0.04	<0.01	0.04	1.3	25.2	25.8	24.5	20.6	Slight
2/19/2013	54772	MGW PAG	8.69	0.43	35.8	0.67	0.01	0.66	20.6	44.3	45.3	24.6	2.2	Slight
3/5/2013	52002	ZGW NAG	8.09	0.27	22.5	0.05	<0.01	0.05	1.6	37.2	38	36.4	24.3	Slight
3/5/2013	52003	MGW PAG	8.23	0.65	54.2	1.12	0.02	1.1	34.4	66.6	68	33.6	2	Moderate
3/5/2013	54351	MGW NAG	8.46	0.23	19.2	0.19	0.01	0.18	5.6	28.2	28.8	23.1	5.1	Slight
3/5/2013	54352	LGW NAG	8.39	0.48	40	0.08	0.01	0.07	2.2	50	51	48.8	23.3	Slight
3/5/2013	54353	LGW NAG	8.58	0.16	13.3	0.02	<0.01	0.02	0.6	18.6	19	18.4	30.4	Slight
3/5/2013	54354	MGW NAG	8.68	0.97	80.8	0.48	<0.01	0.48	15	69.8	71.3	56.3	4.8	Slight
3/5/2013	54355	LGW NAG	8.73	0.7	58.3	0.03	0.01	0.02	0.6	55.4	56.5	55.9	90.4	Slight
3/5/2013	54356	MGW NAG	8.84	0.47	39.2	0.12	<0.01	0.12	3.8	40.9	41.8	38	11.1	Slight
3/5/2013	54357	MGW PAG	9.05	0.25	20.8	0.24	<0.01	0.24	7.5	30.6	31.3	23.8	4.2	Slight
3/5/2013	54358	MGW NAG	8.76	0.22	18.3	0.12	0.02	0.1	3.1	30.6	31.3	28.1	10	Slight
3/5/2013	54361	LGW NAG	8.73	0.31	25.8	0.04	<0.01	0.04	1.3	33.3	34	32.8	27.2	Slight
3/5/2013	54362	MGW NAG	8.72	0.52	43.3	0.32	0.02	0.3	9.4	40.7	41.5	32.1	4.4	Slight
3/5/2013	54363	MGW PAG	8.74	0.17	14.2	0.04	0.01	0.03	0.9	24.7	25.3	24.3	26.9	Slight
3/5/2013	54364	LGW NAG	8.73	0.35	29.2	0.21	0.03	0.18	5.6	43.1	44	38.4	7.8	Slight
3/5/2013	54365	MGW NAG	8.94	0.25	20.8	0.16	<0.01	0.16	5	31.4	32	27	6.4	Slight

Appendix A. Summary Area 2 Pit ABA Analysis Results from SGS for 2013.														
Sample Date	ABA ID	Waste Type	Paste pH	TIC %	$CaCO_3$ NP	S(T) %	$S(SO_4)$ %	$S(S^{2-})$ %	AP $CaCO_3$kg / tonne	NP H_2SO_4kg / tonne	NP $CaCO_3$kg / tonne	Net NP	NP:AP Ratio (NP/AP)	Fizz Test
3/5/2013	54366	LGW NAG	8.96	0.13	10.8	0.05	<0.01	0.05	1.6	19.4	19.8	18.2	12.6	Slight
3/5/2013	54367	MGW PAG	8.71	0.26	21.7	0.65	<0.01	0.65	20.3	34.3	35	14.7	1.7	Slight
3/5/2013	54368	MGW NAG	8.69	0.37	30.8	0.23	<0.01	0.23	7.2	39.9	40.8	33.6	5.7	Slight
3/5/2013	54369	LGW NAG	8.65	0.21	17.5	0.05	0.01	0.04	1.3	29.4	30	28.8	24	Slight
3/5/2013	54372	MGW NAG	8.68	0.3	25	0.12	0.02	0.1	3.1	35.8	36.5	33.4	11.7	Slight
3/5/2013	54373	LGW NAG	8.67	0.23	19.2	0.08	<0.01	0.08	2.5	28.4	29	26.5	11.6	Slight
3/5/2013	54374	MGW NAG	8.67	0.23	19.2	0.03	<0.01	0.03	0.9	30.6	31.3	30.3	33.3	Slight
3/5/2013	54773	MGW NAG	8.77	0.52	43.3	0.57	0.01	0.56	17.5	52.4	53.5	36	3.1	Slight
3/5/2013	54774	MGW NAG	8.69	0.23	19.2	0.12	<0.01	0.12	3.8	29.9	30.5	26.8	8.1	Slight
3/5/2013	54775	LGW NAG	8.72	0.14	11.7	0.15	0.02	0.13	4.1	19.6	20	15.9	4.9	Slight
3/11/2013	52004	LGW NAG	8.43	0.24	20	0.03	0.01	0.02	0.6	37	37.8	37.1	60.4	Slight
3/11/2013	54411	LGW NAG	8.1	0.23	19.2	0.07	<0.01	0.07	2.2	31.9	32.5	30.3	14.9	Slight
3/11/2013	54412	MGW NAG	8.81	0.62	51.7	0.09	0.02	0.07	2.2	57.3	58.5	56.3	26.7	Slight
3/11/2013	54413	LGW NAG	8.66	0.19	15.8	0.03	<0.01	0.03	0.9	22.8	23.3	22.3	24.8	Slight
3/11/2013	54414	MGW NAG	8.58	0.45	37.5	0.13	0.02	0.11	3.4	51.5	52.5	49.1	15.3	Slight
3/11/2013	54415	LGW NAG	8.58	0.17	14.2	0.05	0.01	0.04	1.3	26.5	27	25.8	21.6	Slight
3/11/2013	54416	MGW PAG	8.8	0.3	25	0.17	0.02	0.15	4.7	36.3	37	32.3	7.9	Slight
3/11/2013	54417	LGW NAG	8.77	0.18	15	0.05	0.02	0.03	0.9	24	24.5	23.6	26.1	Slight
3/11/2013	54418	LGW NAG	8.99	0.15	12.5	0.09	0.02	0.07	2.2	21.1	21.5	19.3	9.8	Slight
3/11/2013	54419	ZGW NAG	8.9	0.08	6.7	0.04	0.02	0.02	0.6	18.6	19	18.4	30.4	None
3/11/2013	54420	OVB LGW	8.38	0.32	26.7	0.06	<0.01	0.06	1.9	35.3	36	34.1	19.2	Slight
3/11/2013	54421	MGW PAG	8.4	1.26	105	3.98	0.03	3.95	123.4	96.5	98.5	-24.9	0.8	Slight
3/11/2013	54422	ZGW NAG	8.59	0.48	40	0.09	<0.01	0.09	2.8	47.3	48.3	45.4	17.2	Slight
3/11/2013	54423	MGW NAG	8.64	0.66	55	0.16	0.03	0.13	4.1	65.2	66.5	62.4	16.4	Slight
3/11/2013	54424	MGW NAG	8.83	0.63	52.5	0.33	0.02	0.31	9.7	42.6	43.5	33.8	4.5	Slight
3/11/2013	54425	MGW PAG	8.77	0.78	65	0.3	0.01	0.29	9.1	59.8	61	51.9	6.7	Slight

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Sample Date	ABA ID	Waste Type	Paste pH	TIC %	$CaCO_3$ NP	S(T) %	S(SO_4) %	S(S^{2-}) %	AP $CaCO_3$kg / tonne	NP H_2SO_4kg / tonne	NP $CaCO_3$kg / tonne	Net NP	NP:AP Ratio (NP/AP)	Fizz Test
3/17/2013	52005	ZGW NAG	8.53	0.31	25.8	0.09	0.02	0.07	2.2	40.2	41	38.8	18.7	Slight
3/17/2013	52006	ZGW NAG	8.51	0.55	45.8	0.03	<0.01	0.03	0.9	59.3	60.5	59.6	64.5	Slight
3/17/2013	52007	MGW PAG	8.54	0.83	69.2	0.25	<0.01	0.25	7.8	80.4	82	74.2	10.5	Slight
3/17/2013	52008	LGW NAG	8.51	1.24	103.3	0.03	<0.01	0.03	0.9	100.5	102.5	101.6	109.3	Moderate
3/17/2013	52009	MGW NAG	8.57	0.16	13.3	0.05	<0.01	0.05	1.6	31.9	32.5	30.9	20.8	Slight
3/17/2013	52010	LGW NAG	8.22	0.46	38.3	0.04	0.01	0.03	0.9	50.7	51.8	50.8	55.2	Slight
3/17/2013	52011	LGW NAG	8.48	0.38	31.7	0.24	0.01	0.23	7.2	37	37.8	30.6	5.3	Slight
3/17/2013	52012	MGW NAG	8.33	0.89	74.2	0.76	0.02	0.74	23.1	81.1	82.8	59.6	3.6	Moderate
3/17/2013	52013	OVB LGW	7.86	0.31	25.8	0.09	<0.01	0.09	2.8	36.5	37.3	34.4	13.2	Slight
3/17/2013	52014	HGW PAG	8.27	0.12	10	0.5	0.01	0.49	15.3	24	24.5	9.2	1.6	Slight
3/17/2013	52015	MGW NAG	8.67	0.56	46.7	0.19	<0.01	0.19	5.9	54.1	55.3	49.3	9.3	Slight
3/17/2013	52016	MGW PAG	8.64	0.23	19.2	0.13	<0.01	0.13	4.1	26.2	26.8	22.7	6.6	Slight
3/17/2013	52017	LGW NAG	8.59	0.18	15	0.02	<0.01	0.02	0.6	22.5	23	22.4	36.8	Slight
3/17/2013	52018	ZGW NAG	8.17	0.52	43.3	0.03	<0.01	0.03	0.9	51	52	51.1	55.5	Moderate
3/17/2013	52019	ZGW NAG	8.52	0.13	10.8	0.03	<0.01	0.03	0.9	20.8	21.3	20.3	22.7	Slight
3/17/2013	52020	LGW NAG	8.43	0.21	17.5	0.03	<0.01	0.03	0.9	24	24.5	23.6	26.1	Slight
3/17/2013	52021	MGW NAG	8.45	0.83	69.2	0.17	<0.01	0.17	5.3	74	75.5	70.2	14.2	Moderate
3/17/2013	52022	MGW NAG	8.63	0.42	35	0.04	<0.01	0.04	1.3	38.2	39	37.8	31.2	Slight
3/20/2013	51026	MGW NAG	8.55	0.31	25.8	0.17	0.02	0.15	4.7	39.9	40.8	36.1	8.7	Slight
3/20/2013	52023	MGW NAG	8.77	0.62	51.7	0.32	0.01	0.31	9.7	55.1	56.3	46.6	5.8	Slight
3/20/2013	52024	MGW NAG	8.97	0.55	45.8	0.28	0.02	0.26	8.1	61.7	63	54.9	7.8	Slight
3/20/2013	52025	LGW NAG	8.89	0.3	25	0.05	0.01	0.04	1.3	32.1	32.8	31.5	26.2	Slight
4/1/2013	51027	LGW NAG	8.03	0.38	31.7	0.09	<0.01	0.09	2.8	49	50	47.2	17.8	Slight
4/1/2013	51028	LGW NAG	8.53	0.09	7.5	0.04	0.02	0.02	0.6	29.9	30.5	29.9	48.8	Slight
4/1/2013	51029	MGW NAG	8.34	0.36	30	0.37	<0.01	0.37	11.6	50	51	39.4	4.4	Slight
4/1/2013	51030	LGW NAG	8.52	0.06	5	0.03	<0.01	0.03	0.9	18.1	18.5	17.6	19.7	None

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Sample Date	ABA ID	Waste Type	Paste pH	TIC %	$CaCO_3$ NP	S(T) %	$S(SO_4)$ %	$S(S^{2-})$ %	AP $CaCO_3$ kg / tonne	NP H_2SO_4 kg / tonne	NP $CaCO_3$ kg / tonne	Net NP	NP:AP Ratio (NP/AP)	Fizz Test
4/1/2013	51031	ZGW NAG	8.75	0.32	26.7	0.02	<0.01	0.02	0.6	43.4	44.3	43.6	70.8	Slight
4/1/2013	51032	LGW NAG	8.13	0.36	30	0.36	<0.01	0.36	11.3	51.5	52.5	41.3	4.7	Slight
4/2/2013	51033	LGW NAG	8.9	0.09	7.5	0.03	<0.01	0.03	0.9	23.3	23.8	22.8	25.3	Slight
4/2/2013	51034	ZGW NAG	7.79	0.2	16.7	0.05	<0.01	0.05	1.6	27.7	28.3	26.7	18.1	Slight
4/2/2013	51035	MGW PAG	8.27	0.61	50.8	0.82	<0.01	0.82	25.6	55.9	57	31.4	2.2	Slight
4/2/2013	51036	LGW NAG	8.31	0.45	37.5	0.17	<0.01	0.17	5.3	60.5	61.8	56.4	11.6	Slight
4/2/2013	51037	LGW NAG	8.79	0.19	15.8	0.02	<0.01	0.02	0.6	34.8	35.5	34.9	56.8	Slight
4/2/2013	51038	MGW NAG	8.39	0.39	32.5	0.02	<0.01	0.02	0.6	41.9	42.8	42.1	68.4	Slight
4/2/2013	51039	HGW PAG	7.87	2.2	183.3	6.58	0.04	6.54	204.4	139.2	142	-62.4	0.7	Moderate
4/2/2013	51040	MGW NAG	8.09	0.27	22.5	0.09	<0.01	0.09	2.8	37.7	38.5	35.7	13.7	Slight
4/2/2013	51041	LGW NAG	7.99	0.31	25.8	0.09	<0.01	0.09	2.8	54.6	55.8	52.9	19.8	Slight
4/2/2013	51042	MGW NAG	8.52	1.05	87.5	0.55	<0.01	0.55	17.2	86.2	88	70.8	5.1	Slight
4/2/2013	51043	MGW NAG	8.64	0.71	59.2	0.19	<0.01	0.19	5.9	57.3	58.5	52.6	9.9	Slight
4/2/2013	51044	LGW NAG	8.45	0.84	70	0.19	<0.01	0.19	5.9	68.6	70	64.1	11.8	Slight
4/2/2013	51045	MGW NAG	8.23	0.31	25.8	0.17	<0.01	0.17	5.3	35.5	36.3	30.9	6.8	Slight
4/2/2013	51046	LGW NAG	8.38	0.22	18.3	0.02	<0.01	0.02	0.6	37.2	38	37.4	60.8	Slight
4/2/2013	51047	MGW NAG	8.53	0.28	23.3	0.1	<0.01	0.1	3.1	38.2	39	35.9	12.5	Slight
4/2/2013	51048	LGW NAG	8.3	0.31	25.8	0.16	<0.01	0.16	5	39.4	40.3	35.3	8.1	Slight
4/2/2013	51049	OVB LGW	8.04	0.19	15.8	0.04	<0.01	0.04	1.3	31.4	32	30.8	25.6	Slight
4/2/2013	51050	LGW NAG	9.1	0.06	5	<0.01	<0.01	<0.01	<0.3	18.6	19	19	63.3	Slight
4/9/2013	47824	OVB LGW	8.13	0.38	31.7	0.06	<0.01	0.06	1.9	39.9	40.8	38.9	21.7	Slight
4/9/2013	47825	OVB LGW	7.87	0.28	23.3	0.11	<0.01	0.11	3.4	45.3	46.3	42.8	13.5	Slight
4/9/2013	50982	OVB LGW	7.79	0.45	37.5	0.14	<0.01	0.14	4.4	46.6	47.5	43.1	10.9	Slight
4/9/2013	50983	OVB LGW	8.34	0.36	30	0.02	<0.01	0.02	0.6	39	39.8	39.1	63.6	Slight
4/9/2013	50984	OVB LGW	7.57	0.16	13.3	0.06	<0.01	0.06	1.9	26	26.5	24.6	14.1	Slight
4/9/2013	50985	MGW NAG	8.41	0.63	52.5	0.11	<0.01	0.11	3.4	56.1	57.3	53.8	16.7	Slight

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Sample Date	ABA ID	Waste Type	Paste pH	TIC %	$CaCO_3$ NP	S(T) %	$S(SO_4)$ %	$S(S^{2-})$ %	AP $CaCO_3$kg / tonne	NP H_2SO_4kg / tonne	NP $CaCO_3$kg / tonne	Net NP	NP:AP Ratio (NP/AP)	Fizz Test
4/9/2013	50986	MGW NAG	8.43	0.49	40.8	0.44	<0.01	0.44	13.8	40.4	41.3	27.5	3	Slight
4/9/2013	50987	LGW NAG	8.28	0.5	41.7	0.04	<0.01	0.04	1.3	62	63.3	62	50.6	Slight
4/9/2013	50988	LGW PAG	8.65	0.15	12.5	0.43	<0.01	0.43	13.4	23.5	24	10.6	1.8	Slight
4/9/2013	50989	MGW NAG	8.74	0.17	14.2	0.06	<0.01	0.06	1.9	28.4	29	27.1	15.5	Slight
4/9/2013	50990	ZGW NAG	8.52	0.36	30	0.02	<0.01	0.02	0.6	50	51	50.4	81.6	Slight
4/9/2013	50991	LGW NAG	8.37	0.41	34.2	0.02	<0.01	0.02	0.6	51.7	52.8	52.1	84.4	Slight
4/9/2013	50992	MGW NAG	9.29	0.15	12.5	0.01	<0.01	0.01	0.3	23.8	24.3	23.9	77.6	Slight
4/9/2013	50993	HGW NAG	9.03	0.34	28.3	0.26	<0.01	0.26	8.1	35.5	36.3	28.1	4.5	Slight
4/15/2013	50994	MGW NAG	9	0.18	15	0.02	<0.01	0.02	0.6	21.1	21.5	20.9	34.4	Slight
4/15/2013	50995	LGW NAG	8.63	0.27	22.5	0.03	<0.01	0.03	0.9	27.9	28.5	27.6	30.4	Slight
4/15/2013	50996	LGW NAG	8.96	0.18	15	<0.01	<0.01	<0.01	<0.30	22.3	22.8	22.8	75.8	Slight
4/15/2013	50997	LGW NAG	8.48	1.05	87.5	<0.01	<0.01	<0.01	<0.30	58.3	59.5	59.5	198.3	Slight
4/15/2013	50998	MGW NAG	8.55	0.23	19.2	0.45	<0.01	0.45	14.1	24.3	24.8	10.7	1.8	Slight
4/15/2013	50999		8.51	0.91	75.8	1.8	0.01	1.79	55.9	63.5	64.8	8.8	1.2	Slight
4/15/2013	51000	LGW PAG	8.8	0.19	15.8	<0.01	<0.01	<0.01	<0.30	20.8	21.3	21.3	70.8	Slight
4/15/2013	58401	MGW NAG	8.86	0.26	21.7	0.06	<0.01	0.06	1.9	26.7	27.3	25.4	14.5	Slight
4/15/2013	58402	LGW NAG	8.72	0.29	24.2	<0.01	<0.01	<0.01	<0.30	29.6	30.3	30.3	100.8	Slight
4/15/2013	58403	LGW NAG	8.88	0.37	30.8	<0.01	<0.01	<0.01	<0.30	30.9	31.5	31.5	105	Slight
4/15/2013	58404	MGW PAG	8.79	0.44	36.7	0.51	<0.01	0.51	15.9	34.8	35.5	19.6	2.2	Slight
4/15/2013	58405	LGW NAG	8.6	0.42	35	<0.01	<0.01	<0.01	<0.30	39.7	40.5	40.5	135	Slight
4/15/2013	58406	MGW PAG	9.51	0.06	5	0.03	<0.01	0.03	0.9	12	12.3	11.3	13.1	Slight
4/15/2013	58407	ZGW NAG	9.08	0.37	30.8	<0.01	<0.01	<0.01	<0.30	35	35.8	35.8	119.2	Slight
4/15/2013	58408	LGW NAG	8.87	0.6	50	<0.01	<0.01	<0.01	<0.30	52.2	53.3	53.3	177.5	Slight
4/15/2013	58409	OVB MGW NAG	8.01	0.33	27.5	0.2	<0.01	0.2	6.3	28.2	28.8	22.5	4.6	Slight
4/17/2013	58410	LGW NAG	8.64	0.4	33.3	<0.01	<0.01	<0.01	<0.30	38	38.8	38.8	129.2	Slight
4/17/2013	58411	MGW NAG	8.59	0.3	25	0.05	<0.01	0.05	1.6	31.1	31.8	30.2	20.3	Slight

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4/17/2013	58412	LGW NAG	8.83	0.21	17.5	0.02	<0.01	0.02	0.6	22.8	23.3	22.6	37.2	Slight
4/17/2013	58414	MGW NAG	8.77	1.04	86.7	0.11	<0.01	0.11	3.4	74	75.5	72.1	22	Slight
4/17/2013	58415	LGW NAG	8.71	0.41	34.2	0.06	<0.01	0.06	1.9	37.2	38	36.1	20.3	Slight
4/17/2013	58416	HGW PAG	8.74	0.57	47.5	0.35	<0.01	0.35	10.9	47.3	48.3	37.3	4.4	Slight
4/17/2013	58417	MGW NAG	8.75	0.46	38.3	0.01	<0.01	0.01	0.3	46.1	47	46.7	150.4	Slight
4/17/2013	58418	MGW PAG	8.86	0.68	56.7	0.17	<0.01	0.17	5.3	57.8	59	53.7	11.1	Slight
4/22/2013	58419	LGW	8.52	0.57	47.5	<0.01	<0.01	<0.01	<0.3	51	52	52	173.3	Slight
4/22/2013	58420	OVB	8.4	0.23	19.2	<0.01	<0.01	<0.01	<0.3	22.8	23.3	23.3	77.5	Slight
4/23/2013	58421	MGW PAG	8.61	0.69	57.5	0.83	<0.01	0.83	25.9	48	49	23.1	1.9	Slight
4/23/2013	58422	MGW	8.73	0.66	55	0.07	<0.01	0.07	2.2	55.9	57	54.8	26.1	Slight
4/23/2013	58423	LGW	8.67	0.61	50.8	0.06	<0.01	0.06	1.9	50.2	51.3	49.4	27.3	Slight
4/23/2013	58424	LGW PAG	8.74	0.43	35.8	0.13	<0.01	0.13	4.1	44.3	45.3	41.2	11.1	Slight
4/23/2013	58425	LGW	8.81	0.25	20.8	0.02	<0.01	0.02	0.6	26.7	27.3	26.6	43.6	Slight
4/30/2013	55751	OVB/LGW NAG	8.12	0.26	21.7	0.05	<0.01	0.05	1.6	33.3	34	32.4	21.8	Slight
4/30/2013	55752	LGW NAG	8.5	0.22	18.3	0.16	<0.01	0.16	5	29.4	30	25	6	Slight
4/30/2013	55753	MGW PAG	8.64	0.22	18.3	0.04	<0.01	0.04	1.3	23.5	24	22.8	19.2	Slight
4/30/2013	55754	OVB/LGW NAG	8.13	0.25	20.8	0.02	<0.01	0.02	0.6	24.7	25.3	24.6	40.4	Slight
4/30/2013	55755	MGW NAG	8.93	0.17	14.2	<0.01	<0.01	<0.01	<0.30	21.3	21.8	21.8	72.5	Slight
4/30/2013	55756	LGW NAG	8.79	0.72	60	0.06	<0.01	0.06	1.9	50.5	51.5	49.6	27.5	Slight
4/30/2013	55757	HGW PAG	8.6	0.23	19.2	0.17	<0.01	0.17	5.3	25.5	26	20.7	4.9	Slight
4/30/2013	55758	MGW PAG	8.61	0.1	8.3	0.04	<0.01	0.04	1.3	14.7	15	13.8	12	Slight
4/30/2013	55759	MGW NAG	8.65	0.15	12.5	0.1	<0.01	0.1	<0.3	21.3	21.8	21.8	72.5	Slight
4/30/2013	55760	OVB/LGW NAG	8.18	0.31	25.8	0.05	<0.01	0.05	1.6	32.3	33	31.4	21.1	Slight
4/30/2013	55761	MGW NAG	8.49	0.63	52.5	0.06	<0.01	0.06	1.9	56.8	58	56.1	30.9	Slight
4/30/2013	55762	MGW PAG	8.65	0.71	59.2	0.24	<0.01	0.24	7.5	47	48	40.5	6.4	Slight
4/30/2013	55763	ZGW NAG	8.76	0.35	29.2	<0.01	<0.01	<0.01	<0.30	35.8	36.5	36.5	121.7	Slight

Appendix A. Summary Area 2 Pit ABA Analysis Results from SGS for 2013.														
Sample Date	ABA ID	Waste Type	Paste pH	TIC %	$CaCO_3$ NP	S(T) %	$S(SO_4)$ %	$S(S^{2-})$ %	AP $CaCO_3$kg / tonne	NP H_2SO_4kg / tonne	NP $CaCO_3$kg / tonne	Net NP	NP:AP Ratio (NP/AP)	Fizz Test
4/30/2013	55764	LGW NAG	8.83	0.47	39.2	<0.01	<0.01	<0.01	<0.30	41.4	42.3	42.3	140.8	Slight
4/30/2013	55765	MGW NAG	8.79	0.38	31.7	0.13	<0.01	0.13	4.1	26.7	27.3	23.2	6.7	Slight
4/30/2013	55766	MGW PAG	8.56	0.93	77.5	0.75	<0.01	0.75	23.4	70.6	72	48.6	3.1	Slight
4/30/2013	55767	OVB/LGW NAG	8.04	0.32	26.7	0.03	<0.01	0.03	0.9	31.1	31.8	30.8	33.9	Slight
4/30/2013	55768	LGW NAG	8.78	0.36	30	<0.01	<0.01	<0.01	<0.30	36.3	37	37	123.3	Slight
4/30/2013	55769	ZGW NAG	8.76	0.43	35.8	0.01	<0.01	0.01	0.3	32.3	33	32.7	105.6	Slight
4/30/2013	55770	MGW NAG	9.09	0.39	32.5	0.12	<0.01	0.12	3.8	32.8	33.5	29.8	8.9	Slight
5/4/2013	55771	LGW NAG	9.02	0.27	22.5	0.01	<0.01	0.01	<0.3	27	27.5	27.5	91.7	Slight
5/9/2013	55772	LGW NAG	8.99	0.34	28.3	0.01	<0.01	0.01	0.3	33.3	34	33.7	108.8	Slight
5/9/2013	55773	MGW PAG	8.76	0.43	35.8	0.31	<0.01	0.31	9.7	42.9	43.8	34.1	4.5	Slight
5/14/2013	55774	LGW NAG	8.38	0.25	20.8	0.04	<0.01	0.04	1.3	25.7	26.3	25	21	Slight
5/14/2013	57001	LGW NAG	8.8	0.7	58.3	0.09	<0.01	0.09	<0.3	64.4	65.8	65.8	219.2	Slight
5/14/2013	57002	LGW NAG	8.98	0.33	27.5	<0.01	<0.01	<0.01	<0.30	27.7	28.3	28.3	94.2	Slight
5/14/2013	57004	MGW NAG	8.85	0.65	54.2	0.13	<0.01	0.13	4.1	49.2	50.3	46.2	12.4	Slight
5/14/2013	57005	MGW NAG	9.09	0.64	53.3	0.12	<0.01	0.12	3.8	47	48	44.3	12.8	Slight
5/14/2013	57006	OVB/LGW NAG	8.37	0.31	25.8	0.03	<0.01	0.03	0.9	28.7	29.3	28.3	31.2	Slight
5/14/2013	57007	LGW NAG	8.61	0.19	15.8	<0.01	<0.01	<0.01	<0.30	20.6	21	21	70	Slight
5/14/2013	57008	MGW PAG	8.94	0.46	38.3	0.04	<0.01	0.04	1.3	43.9	44.8	43.5	35.8	Slight
5/14/2013	57009	LGW NAG	8.98	0.44	36.7	<0.01	<0.01	<0.01	<0.30	39	39.8	39.8	132.5	Slight
5/14/2013	57010	MGW NAG	8.8	0.22	18.3	<0.01	<0.01	<0.01	<0.30	22.5	23	23	76.7	Slight
5/14/2013	57011	LGW NAG	8.65	0.22	18.3	<0.01	<0.01	<0.01	<0.30	23.5	24	24	80	Slight
5/14/2013	57012	MGW NAG	8.92	0.12	10	<0.01	<0.01	<0.01	<0.30	16.2	16.5	16.5	55	Slight
5/14/2013	57013	MGW NAG	9.12	0.96	80	0.09	<0.01	0.09	2.8	75	76.5	73.7	27.2	Slight
5/14/2013	57014	LGW NAG	8.82	0.93	77.5	0.02	<0.01	0.02	0.6	68.1	69.5	68.9	111.2	Slight
5/15/2013	57015	LGW NAG	8.94	0.26	21.7	0.02	<0.01	0.02	0.6	26.2	26.8	26.1	42.8	Slight
5/15/2013	57016	MGW PAG	8.85	0.39	32.5	0.2	<0.01	0.2	6.3	39	39.8	33.5	6.4	Slight

Appendix A. Summary Area 2 Pit ABA Analysis Results from SGS for 2013.														
Sample Date	ABA ID	Waste Type	Paste pH	TIC %	$CaCO_3$ NP	S(T) %	$S(SO_4)$ %	$S(S^{2-})$ %	AP $CaCO_3$ kg / tonne	NP H_2SO_4 kg / tonne	NP $CaCO_3$ kg / tonne	Net NP	NP:AP Ratio (NP/AP)	Fizz Test
5/20/2013	57017	OVB/LGW NAG	8.26	0.14	11.7	0.02	<0.01	0.02	0.6	16.4	16.8	16.1	26.8	Slight
5/20/2013	57018	ZGW NAG	8.55	0.38	31.7	0.02	<0.01	0.02	0.6	36	36.8	36.1	58.8	Slight
5/20/2013	57019	LGW NAG	8.89	0.26	21.7	<0.01	<0.01	<0.01	<0.30	25	25.5	25.5	85	Slight
5/20/2013	57020	MGW NAG	8.83	1.46	121.7	0.16	<0.01	0.16	5	115.4	117.8	112.8	23.6	Slight
5/21/2013	57021	LGW NAG	9.13	0.43	35.8	<0.01	<0.01	<0.01	<0.30	39.2	40	40	133.3	Slight
5/21/2013	57022	MGW NAG	8.6	0.51	42.5	0.08	<0.01	0.08	2.5	46.8	47.8	45.3	19.1	Slight
5/21/2013	57023	MGW PAG	8.74	0.62	51.7	0.67	<0.01	0.67	20.9	47.8	48.8	27.8	2.3	Slight
5/21/2013	57024	OVB/LGW NAG	8.53	0.35	29.2	0.03	<0.01	0.03	0.9	33.1	33.8	32.8	36	Slight
5/22/2013	55329	LGW NAG	8.71	0.34	28.3	<0.01	<0.01	<0.01	<0.30	32.6	33.3	33.3	110.8	Slight
5/22/2013	55330	MGW NAG	8.72	0.93	77.5	0.12	<0.01	0.12	3.8	72.3	73.8	70	19.7	Slight
5/22/2013	57025	LGW NAG	8.9	0.32	26.7	<0.01	<0.01	<0.01	<0.30	30.1	30.8	30.8	102.5	Slight
5/27/2013	55331	ZGW NAG	9.04	0.18	15	<0.01	<0.01	<0.01	<0.30	20.6	21	21	70	Slight
5/27/2013	55332	MGW PAG	8.54	0.73	60.8	0.86	<0.01	0.86	26.9	54.9	56	29.1	2.1	Slight
5/27/2013	55333	LGW NAG	8.92	0.25	20.8	0.11	<0.01	0.11	3.4	25.2	25.8	22.3	7.5	Slight
5/27/2013	55334	MGW NAG	8.64	0.06	5	0.02	<0.01	0.02	0.6	9.1	9.3	8.6	14.8	None
5/27/2013	55335	MGW PAG	8.43	0.06	5	0.03	0.02	0.01	0.3	11	11.3	10.9	36	None
5/27/2013	55336	LGW NAG	8.45	0.1	8.3	0.01	<0.01	0.01	0.3	13.5	13.8	13.4	44	Slight
5/27/2013	55337	LGW NAG	8.51	0.18	15	<0.01	<0.01	<0.01	<0.30	18.9	19.3	19.3	64.2	Slight
5/27/2013	55338	ZGW NAG	8.54	0.28	23.3	<0.01	<0.01	<0.01	<0.30	27.9	28.5	28.5	95	Slight
5/27/2013	55339	LGW NAG	8.63	0.4	33.3	0.02	<0.01	0.02	0.6	37.2	38	37.4	60.8	Slight
5/27/2013	55340	MGW PAG	8.61	0.34	28.3	0.11	<0.01	0.11	3.4	30.4	31	27.6	9	Slight
5/27/2013	55341	LGW NAG	8.89	0.23	19.2	0.01	<0.01	0.01	0.3	25.5	26	25.7	83.2	Slight
5/27/2013	55342	ZGW NAG	8.82	0.29	24.2	<0.01	<0.01	<0.01	<0.30	31.6	32.3	32.3	107.5	Slight
5/28/2013	55343	MGW NAG	8.52	0.17	14.2	0.04	<0.01	0.04	1.3	19.6	20	18.8	16	Slight
5/30/2013	50388	LGW NAG	9.09	0.16	13.3	0.01	<0.01	0.01	0.3	19.8	20.3	19.9	64.8	Slight
5/30/2013	50389	LGW NAG	8.78	0.43	35.8	0.04	<0.01	0.04	1.3	43.1	44	42.8	35.2	Slight

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Sample Date	ABA ID	Waste Type	Paste pH	TIC %	$CaCO_3$ NP	S(T) %	$S(SO_4)$ %	$S(S^{2-})$ %	AP $CaCO_3$kg / tonne	NP H_2SO_4kg / tonne	NP $CaCO_3$kg / tonne	Net NP	NP:AP Ratio (NP/AP)	Fizz Test
5/30/2013	50390	MGW PAG	9.07	0.16	13.3	<0.01	<0.01	<0.01	<0.30	19.6	20	20	66.7	Slight
6/1/2013	50391	LGW	8.65	1.54	128.3	0.01	<0.01	0.01	0.3	124.5	127	126.7	406.4	Slight
6/1/2013	50392	LGW	8.72	0.45	37.5	0.12	<0.01	0.12	3.8	39.4	40.3	36.5	10.7	Slight
6/3/2013	50395	LGW	8.79	0.12	10	<0.01	<0.01	<0.01	<0.30	14	14.3	14.3	47.5	Slight
6/4/2013	50396	LGW	8.55	0.15	12.5	<0.01	<0.01	<0.01	<0.30	18.1	18.5	18.5	61.7	Slight
6/4/2013	50397	LGW	8.68	0.57	47.5	<0.01	<0.01	<0.01	<0.30	49.5	50.5	50.5	168.3	Slight
6/11/2013	55344	LGW	8.64	0.08	6.7	0.03	<0.01	0.03	0.9	14.2	14.5	13.6	15.5	Slight
6/11/2013	55345	LGW	8.37	0.17	14.2	0.03	<0.01	0.03	0.9	18.6	19	18.1	20.3	Slight
6/11/2013	55346	LGW	8.69	0.27	22.5	0.06	<0.01	0.06	1.9	28.9	29.5	27.6	15.7	Slight
6/11/2013	55347	HGW PAG	9.02	0.15	12.5	0.05	<0.01	0.05	1.6	21.3	21.8	20.2	13.9	Slight
6/11/2013	55348	LGW	8.48	0.05	4.2	0.02	<0.01	0.02	0.6	11.3	11.5	10.9	18.4	None
6/11/2013	55349	LGW	8.66	0.19	15.8	0.01	<0.01	0.01	0.3	24.7	25.3	24.9	80.8	Slight
6/11/2013	55350	MGW PAG	8.79	0.15	12.5	0.02	<0.01	0.02	0.6	20.1	20.5	19.9	32.8	Slight
6/12/2013	56097	LGW	8.7	0.16	13.3	0.03	<0.01	0.03	0.9	20.6	21	20.1	22.4	Slight
6/12/2013	61266	LGW NAG	8.82	0.17	14.2	0.01	<0.01	0.01	0.3	17.6	18	17.7	57.6	Slight
6/12/2013	61267	LGW PAG	8.64	0.2	16.7	0.01	<0.01	0.01	0.3	21.1	21.5	21.2	68.8	Slight
6/12/2013	62176	LGW	8.95	0.34	28.3	0.03	<0.01	0.03	0.9	37.2	38	37.1	40.5	Slight
6/12/2013	62177	HGW PAG	8.88	0.47	39.2	0.16	<0.01	0.16	5	44.8	45.8	40.8	9.2	Slight
6/12/2013	62178	MGW	8.64	0.34	28.3	0.05	<0.01	0.05	1.6	38.5	39.3	37.7	25.1	Slight
6/15/2013	62179	LGW NAG	8.79	0.35	29.2	0.05	<0.01	0.05	1.6	35.5	36.3	34.7	23.2	Slight
6/15/2013	62180	LGW PAG	8.55	0.81	67.5	0.54	<0.01	0.54	16.9	55.6	56.8	39.9	3.4	Slight
6/16/2013	62181	MGW PAG	8.52	0.87	72.5	0.74	<0.01	0.74	23.1	70.1	71.5	48.4	3.1	Slight
6/16/2013	62182	LGW NAG	8.76	0.31	25.8	0.04	<0.01	0.04	1.3	27.2	27.8	26.5	22.2	Slight
6/16/2013	62183	ZGW NAG	8.82	0.36	30	0.01	<0.01	0.01	0.3	35.5	36.3	35.9	116	Slight
6/16/2013	62184	LGW NAG	8.74	0.23	19.2	0.03	<0.01	0.03	0.9	22.3	22.8	21.8	24.3	Slight
6/16/2013	62185	ZGW NAG	8.86	0.23	19.2	0.02	<0.01	0.02	0.6	26.7	27.3	26.6	43.6	Slight

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Sample Date	ABA ID	Waste Type	Paste pH	TIC %	$CaCO_3$ NP	S(T) %	$S(SO_4)$ %	$S(S^{2-})$ %	AP $CaCO_3$kg / tonne	NP H_2SO_4kg / tonne	NP $CaCO_3$kg / tonne	Net NP	NP:AP Ratio (NP/AP)	Fizz Test
6/16/2013	62186	MGW PAG	8.36	0.76	63.3	1.28	<0.01	1.28	40	51	52	12	1.3	Slight
6/16/2013	62187	LGW NAG	8.59	0.54	45	0.03	<0.01	0.03	0.9	49.2	50.3	49.3	53.6	Slight
6/16/2013	62188	ZGW NAG	8.7	0.48	40	0.02	<0.01	0.02	0.6	47	48	47.4	76.8	Slight
6/16/2013	62189	LGW NAG	8.99	0.13	10.8	0.01	<0.01	0.01	0.3	17.9	18.3	17.9	58.4	Slight
6/16/2013	62190	ZGW NAG	8.74	0.23	19.2	0.01	<0.01	0.01	0.3	27	27.5	27.2	88	Slight
6/16/2013	62191	ZGW PAG	9.11	0.09	7.5	0.01	<0.01	0.01	0.3	9.1	9.3	8.9	29.6	Slight
6/19/2013	62192	ZGW NAG	9.08	0.21	17.5	0.01	<0.01	0.01	0.3	21.8	22.3	21.9	71.2	Slight
6/19/2013	62193	LGW NAG	9	0.27	22.5	0.02	<0.01	0.02	0.6	28.2	28.8	28.1	46	Slight
6/19/2013	62194	MGW NAG	8.89	0.33	27.5	0.01	<0.01	0.01	0.3	32.6	33.3	32.9	106.4	Slight
6/19/2013	62195	LGW NAG	8.72	0.22	18.3	0.03	<0.01	0.03	0.9	24.7	25.3	24.3	26.9	Slight
6/19/2013	62196	ZGW NAG	8.9	0.23	19.2	0.03	<0.01	0.03	0.9	25.5	26	25.1	27.7	Slight
6/21/2013	62197	LGW NAG	8.99	0.2	16.7	0.05	<0.01	0.05	1.6	21.6	22	20.4	14.1	Slight
6/21/2013	62198	MGW NAG	8.95	0.44	36.7	0.06	<0.01	0.06	1.9	40.9	41.8	39.9	22.3	Slight
6/21/2013	62199	ZGW NAG	8.73	0.33	27.5	0.01	<0.01	0.01	0.3	37	37.8	37.4	120.8	Slight
6/24/2013	61251	LGW NAG	8.96	0.48	40	0.03	<0.01	0.03	0.9	42.6	43.5	42.6	46.4	Slight
6/24/2013	61252	MGW NAG	8.91	0.34	28.3	0.1	<0.01	0.1	3.1	33.8	34.5	31.4	11	Slight
6/24/2013	61253	LGW NAG	8.95	0.25	20.8	0.02	<0.01	0.02	0.6	26	26.5	25.9	42.4	Slight
6/24/2013	61254	ZGW NAG	8.93	0.3	25	0.02	<0.01	0.02	0.6	29.6	30.3	29.6	48.4	Slight
6/24/2013	61255	MGW NAG	8.99	0.26	21.7	0.02	<0.01	0.02	0.6	27.9	28.5	27.9	45.6	Slight
6/24/2013	61256	MGW PAG	8.96	0.37	30.8	0.07	<0.01	0.07	<0.3	37.2	38	38	126.7	Slight
6/24/2013	62200	ZGW NAG	9.03	0.28	23.3	0.01	<0.01	0.01	0.3	29.9	30.5	30.2	97.6	Slight
6/25/2013	61257	LGW NAG	9.2	0.07	5.8	0.03	<0.01	0.03	0.9	11.3	11.5	10.6	12.3	Slight
6/25/2013	61258	ZGW NAG	8.87	0.15	12.5	0.01	<0.01	0.01	0.3	17.9	18.3	17.9	58.4	Slight
6/25/2013	61259	ZGW NAG	9.05	0.31	25.8	0.02	<0.01	0.02	0.6	29.9	30.5	29.9	48.8	Slight
6/25/2013	61260	LGW NAG	9.23	0.28	23.3	0.02	<0.01	0.02	0.6	28.2	28.8	28.1	46	Slight
6/25/2013	61261	MGW PAG	9.03	0.23	19.2	0.15	<0.01	0.15	4.7	29.9	30.5	25.8	6.5	Slight

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Sample Date	ABA ID	Waste Type	Paste pH	TIC %	$CaCO_3$ NP	S(T) %	$S(SO_4)$ %	$S(S^{2-})$ %	AP $CaCO_3$kg / tonne	NP H_2SO_4kg / tonne	NP $CaCO_3$kg / tonne	Net NP	NP:AP Ratio (NP/AP)	Fizz Test
6/25/2013	61262	MGW NAG	8.89	0.65	54.2	0.07	<0.01	0.07	2.2	62.7	64	61.8	29.3	Slight
6/25/2013	61263	MGW NAG	8.95	0.21	17.5	0.15	<0.01	0.15	4.7	25.5	26	21.3	5.5	Slight
6/25/2013	61264	LGW PAG	8.93	0.21	17.5	0.02	<0.01	0.02	0.6	23.5	24	23.4	38.4	Slight
6/25/2013	61265	MGW PAG	8.87	0.22	18.3	0.34	<0.01	0.34	10.6	23.3	23.8	13.1	2.2	Slight
6/30/2013	61268	LGW NAG	9.19	0.12	10	<0.01	<0.01	<0.01	<0.3	16.4	16.8	16.8	55.8	Slight
6/30/2013	61269	LGW NAG	9.05	0.46	38.3	0.02	<0.01	0.02	0.6	41.2	42	41.4	67.2	Slight
6/30/2013	61270	MGW PAG	8.88	0.44	36.7	0.08	<0.01	0.08	2.5	42.4	43.3	40.8	17.3	Slight
6/30/2013	61271	MGW PAG	8.62	0.95	79.2	1.26	<0.01	1.26	39.4	57.8	59	19.6	1.5	Slight
6/30/2013	61272	LGW NAG	9.23	0.33	27.5	<0.01	<0.01	<0.01	<0.3	32.8	33.5	33.5	111.7	Slight
6/30/2013	61273	HGW PAG	9.03	0.24	20	0.18	<0.01	0.18	5.6	29.4	30	24.4	5.3	Slight
7/5/2013	60576	MGW PAG	8.32	1.26	105	2.3	0.01	2.29	71.6	82.8	84.5	12.9	1.2	Slight
7/5/2013	60577	MGW PAG	8.83	0.6	50	0.16	<0.01	0.16	5	49	50	45	10	Slight
7/5/2013	60578	LGW NAG	8.95	0.14	11.7	0.02	<0.01	0.02	0.6	20.1	20.5	19.9	32.8	Slight
7/5/2013	60579	LGW NAG	8.7	0.44	36.7	0.94	<0.01	0.94	29.4	35	35.8	6.4	1.2	Slight
7/5/2013	60580	MGW PAG	9.09	0.15	12.5	0.02	<0.01	0.02	0.6	20.8	21.3	20.6	34	Slight
7/5/2013	60581	LGW NAG	8.73	0.36	30	0.18	<0.01	0.18	5.6	33.6	34.3	28.6	6.1	Slight
7/5/2013	60582	LGW NAG	8.94	0.29	24.2	0.15	<0.01	0.15	4.7	30.1	30.8	26.1	6.6	Slight
7/5/2013	60583	MGW PAG	8.96	0.29	24.2	0.13	<0.01	0.13	4.1	31.6	32.3	28.2	7.9	Slight
7/5/2013	60584	HGW PAG	9.06	0.13	10.8	0.13	<0.01	0.13	4.1	27	27.5	23.4	6.8	Slight
7/5/2013	60585	MGW NAG	8.75	0.5	41.7	0.08	<0.01	0.08	2.5	50.5	51.5	49	20.6	Slight
7/5/2013	60586	LGW NAG	8.87	0.21	17.5	0.02	<0.01	0.02	0.6	25.5	26	25.4	41.6	Slight
7/5/2013	60587	LGW PAG	8.73	0.22	18.3	0.63	<0.01	0.63	19.7	24.3	24.8	5.1	1.3	Slight
7/5/2013	61274	LGW NAG	9.1	0.51	42.5	0.01	<0.01	0.01	0.3	49.7	50.8	50.4	162.4	Slight
7/5/2013	61275	MGW PAG	9.12	0.32	26.7	0.01	<0.01	0.01	0.3	35.8	36.5	36.2	116.8	Slight
7/7/2013	60588	LGW NAG	9.33	0.19	15.8	0.02	<0.01	0.02	0.6	19.6	20	19.4	32	Slight
7/7/2013	60589	MGW NAG	9.03	0.32	26.7	0.1	<0.01	0.1	3.1	34.3	35	31.9	11.2	Slight

Appendix A. Summary Area 2 Pit ABA Analysis Results from SGS for 2013.														
Sample Date	ABA ID	Waste Type	Paste pH	TIC %	$CaCO_3$ NP	S(T) %	$S(SO_4)$ %	$S(S^{2-})$ %	AP $CaCO_3$kg / tonne	NP H_2SO_4kg / tonne	NP $CaCO_3$kg / tonne	Net NP	NP:AP Ratio (NP/AP)	Fizz Test
7/7/2013	60590	MGW NAG	8.89	0.22	18.3	0.07	<0.01	0.07	2.2	23.5	24	21.8	11	Slight
7/7/2013	60591	MGW PAG	8.68	0.26	21.7	0.25	<0.01	0.25	7.8	21.1	21.5	13.7	2.8	Slight
7/7/2013	60592	LGW NAG	8.94	0.09	7.5	0.02	<0.01	0.02	0.6	12.3	12.5	11.9	20	Slight
7/7/2013	60593	LGW NAG	8.81	0.08	6.7	0.03	<0.01	0.03	0.9	11	11.3	10.3	12	Slight
7/7/2013	60594	MGW NAG	8.68	0.29	24.2	0.06	0.01	0.05	1.6	29.4	30	28.4	19.2	Slight
7/24/2013	60595	LGW NAG	8.92	0.16	13.3	0.02	<0.01	0.02	0.6	19.4	19.8	19.1	31.6	Slight
7/24/2013	60596	LGW NAG	9.02	0.11	9.2	0.02	<0.01	0.02	0.6	16.9	17.3	16.6	27.6	Slight
7/24/2013	60597	MGW NAG	8.9	0.2	16.7	0.01	<0.01	0.01	0.3	21.6	22	21.7	70.4	Slight
7/24/2013	60598	LGW NAG	8.84	0.2	16.7	0.02	<0.01	0.02	0.6	22.5	23	22.4	36.8	Slight
7/24/2013	60599	MGW PAG	8.62	0.58	48.3	0.47	<0.01	0.47	14.7	54.1	55.3	40.6	3.8	Slight
7/24/2013	60600	MGW NAG	8.9	0.67	55.8	0.35	<0.01	0.35	10.9	53.9	55	44.1	5	Slight
7/24/2013	74751	MGW NAG	8.71	0.41	34.2	0.03	<0.01	0.03	0.9	43.6	44.5	43.6	47.5	Slight
7/24/2013	74752	LGW NAG	8.82	0.2	16.7	0.03	<0.01	0.03	0.9	24.7	25.3	24.3	26.9	Slight
7/24/2013	74753	MGW PAG	8.84	0.31	25.8	0.44	<0.01	0.44	13.8	30.1	30.8	17	2.2	Slight
7/24/2013	74754	LGW NAG	8.91	0.29	24.2	0.02	<0.01	0.02	0.6	33.8	34.5	33.9	55.2	Slight
7/24/2013	74755	ZGW NAG	8.8	0.37	30.8	0.04	<0.01	0.04	1.3	37	37.8	36.5	30.2	Slight
7/24/2013	74756	LGW NAG	8.68	0.16	13.3	0.03	<0.01	0.03	0.9	22.1	22.5	21.6	24	Slight
7/24/2013	74757	ZGW NAG	8.81	0.1	8.3	0.01	<0.01	0.01	0.3	16.9	17.3	16.9	55.2	Slight
7/24/2013	74758	HGW PAG	8.4	0.32	26.7	0.52	<0.01	0.52	16.3	32.6	33.3	17	2	Slight
7/24/2013	74759	LGW NAG	8.67	0.39	32.5	0.06	<0.01	0.06	1.9	39	39.8	37.9	21.2	Slight
7/24/2013	74760	ZGW NAG	8.76	0.26	21.7	0.02	<0.01	0.02	0.6	27.9	28.5	27.9	45.6	Slight
7/24/2013	74761	LGW NAG	8.91	0.17	14.2	0.21	<0.01	0.21	6.6	21.3	21.8	15.2	3.3	Slight
7/24/2013	74762	LGW NAG	8.92	0.22	18.3	0.05	<0.01	0.05	1.6	26.7	27.3	25.7	17.4	Slight
7/24/2013	74763	ZGW NAG	8.87	0.22	18.3	0.02	<0.01	0.02	0.6	26.5	27	26.4	43.2	Slight
7/24/2013	74764	LGW NAG	8.76	0.18	15	0.02	<0.01	0.02	0.6	23.8	24.3	23.6	38.8	Slight
7/24/2013	74765	ZGW NAG	8.84	0.12	10	0.01	<0.01	0.01	0.3	14.7	15	14.7	48	Slight

Appendix A. Summary Area 2 Pit ABA Analysis Results from SGS for 2013.														
Sample Date	ABA ID	Waste Type	Paste pH	TIC %	$CaCO_3$ NP	S(T) %	$S(SO_4)$ %	$S(S^{2-})$ %	AP $CaCO_3$kg / tonne	NP H_2SO_4kg / tonne	NP $CaCO_3$kg / tonne	Net NP	NP:AP Ratio (NP/AP)	Fizz Test
7/24/2013	74766	ZGW NAG	8.8	0.2	16.7	<0.01	<0.01	<0.01	<0.3	23.3	23.8	23.8	79.2	Slight
7/24/2013	74767	LGW NAG	8.65	0.17	14.2	<0.01	<0.01	<0.01	<0.3	20.3	20.8	20.8	69.2	Slight
7/24/2013	74768	MGW NAG	8.57	0.35	29.2	0.01	<0.01	0.01	0.3	35.3	36	35.7	115.2	Slight
7/24/2013	74769	LGW NAG	8.85	0.22	18.3	<0.01	<0.01	<0.01	<0.3	24.3	24.8	24.8	82.5	Slight
7/24/2013	74770	ZGW NAG	8.7	0.75	62.5	0.05	<0.01	0.05	1.6	62	63.3	61.7	40.5	Slight
7/24/2013	74771	MGW NAG	9.04	0.29	24.2	0.09	<0.01	0.09	2.8	31.9	32.5	29.7	11.6	Slight
7/24/2013	74772	ZGW NAG	9.3	0.17	14.2	0.02	<0.01	0.02	0.6	23	23.5	22.9	37.6	Slight
7/24/2013	74773	LGW NAG	9.01	0.19	15.8	0.02	<0.01	0.02	0.6	26	26.5	25.9	42.4	Slight
7/24/2013	74774	LGW NAG	8.91	0.27	22.5	0.03	<0.01	0.03	0.9	29.4	30	29.1	32	Slight
7/24/2013	74775	MGW PAG	8.36	0.08	6.7	0.81	0.03	0.78	24.4	14.9	15.3	-9.1	0.6	Slight
7/24/2013	74776	ZGW NAG	8.71	0.14	11.7	0.02	<0.01	0.02	0.6	19.8	20.3	19.6	32.4	Slight
7/24/2013	74777	LGW NAG	9.06	0.13	10.8	0.06	<0.01	0.06	1.9	17.4	17.8	15.9	9.5	Slight
7/24/2013	74778	ZGW NAG	8.99	0.12	10	0.04	<0.01	0.04	1.3	18.9	19.3	18	15.4	Slight
7/24/2013	74779	LGW NAG	8.78	0.26	21.7	0.02	<0.01	0.02	0.6	29.9	30.5	29.9	48.8	Slight
7/24/2013	74780	ZGW NAG	9.28	0.18	15	0.02	<0.01	0.02	0.6	22.3	22.8	22.1	36.4	Slight
7/25/2013	74781	LGW NAG	8.53	0.21	17.5	0.02	<0.01	0.02	0.6	26.5	27	26.4	43.2	Slight
7/25/2013	74782	MGW NAG	8.37	0.15	12.5	0.17	<0.01	0.17	5.3	15.7	16	10.7	3	Slight
7/25/2013	74783	MGW PAG	8.26	0.03	2.5	0.09	0.04	0.05	1.6	11.3	11.5	9.9	7.4	None
7/28/2013	74784	MGW PAG	8.72	0.33	27.5	0.37	<0.01	0.37	11.6	36	36.8	25.2	3.2	Slight
7/28/2013	74785	MGW NAG	9.13	0.23	19.2	0.02	<0.01	0.02	0.6	29.2	29.8	29.1	47.6	Slight
7/28/2013	74786	LGW NAG	9.17	0.14	11.7	0.03	<0.01	0.03	0.9	22.3	22.8	21.8	24.3	Slight
7/28/2013	74787	MGW NAG	9.39	0.06	5	0.02	<0.01	0.02	0.6	13.7	14	13.4	22.4	Slight
7/28/2013	74788	LGW NAG	8.88	0.22	18.3	0.02	<0.01	0.02	0.6	25	25.5	24.9	40.8	Slight
7/28/2013	74789	ZGW NAG	9.05	0.12	10	0.02	<0.01	0.02	0.6	17.4	17.8	17.1	28.4	Slight
7/28/2013	74790	MGW NAG	8.84	0.27	22.5	0.03	<0.01	0.03	0.9	30.4	31	30.1	33.1	Slight
8/5/2013	70001	MGW PAG	8.58	0.25	20.8	0.45	<0.01	0.45	14.1	27.9	28.5	14.4	2	Slight

Appendix A. Summary Area 2 Pit ABA Analysis Results from SGS for 2013.														
Sample Date	ABA ID	Waste Type	Paste pH	TIC %	$CaCO_3$ NP	S(T) %	$S(SO_4)$ %	$S(S^{2-})$ %	AP $CaCO_3$ kg / tonne	NP H_2SO_4 kg / tonne	NP $CaCO_3$ kg / tonne	Net NP	NP:AP Ratio (NP/AP)	Fizz Test
8/5/2013	74791	MGW PAG	8.8	0.33	27.5	1.33	<0.01	1.33	41.6	36	36.8	-4.8	0.9	Slight
8/5/2013	74792	MGW NAG	8.6	0.26	21.7	0.05	<0.01	0.05	1.6	28.4	29	27.4	18.6	Slight
8/5/2013	74793	LGW NAG	9.11	0.26	21.7	0.14	<0.01	0.14	4.4	19.4	19.8	15.4	4.5	Slight
8/5/2013	74794	MGW PAG	8.6	0.41	34.2	1.98	<0.01	1.98	61.9	36.8	37.5	-24.4	0.6	Slight
8/5/2013	74795	LGW NAG	9.18	0.25	20.8	0.04	<0.01	0.04	1.3	25.2	25.8	24.5	20.6	Slight
8/5/2013	74796	LGW PAG	8.71	0.19	15.8	0.03	<0.01	0.03	0.9	23	23.5	22.6	25.1	Slight
8/5/2013	74797	MGW PAG	8.77	0.68	56.7	0.93	<0.01	0.93	29.1	61.5	62.8	33.7	2.2	Slight
8/5/2013	74798	LGW NAG	9.01	0.31	25.8	0.03	<0.01	0.03	0.9	37.5	38.3	37.3	40.8	Slight
8/5/2013	74799	LGW NAG	9.27	0.18	15	0.02	<0.01	0.02	0.6	22.1	22.5	21.9	36	Slight
8/5/2013	74800	LGW PAG	9.63	0.1	8.3	0.02	<0.01	0.02	0.6	14.9	15.3	14.6	24.4	Slight
8/6/2013	70002	LGW NAG	9.08	0.17	14.2	0.04	<0.01	0.04	1.3	24.5	25	23.8	20	Slight
8/6/2013	70003	ZGW NAG	8.99	0.18	15	0.02	<0.01	0.02	0.6	22.8	23.3	22.6	37.2	Slight
8/18/2013	6377	MGW NAG	8.45	0.31	25.8	0.8	<0.01	0.8	25	29.2	29.8	4.8	1.2	Slight
8/18/2013	6379	LGW NAG	8.89	0.13	10.8	0.02	<0.01	0.02	0.6	15.7	16	15.4	25.6	Slight
8/18/2013	6380	MGW SAT	8.43	0.2	16.7	0.9	<0.01	0.9	28.1	22.3	22.8	-5.4	0.8	Slight
8/18/2013	70004	LGW NAG	9.06	0.34	28.3	0.04	<0.01	0.04	1.3	32.1	32.8	31.5	26.2	Slight
8/18/2013	70005	MGW NAG	9.12	0.26	21.7	0.03	<0.01	0.03	0.9	24	24.5	23.6	26.1	Slight
8/18/2013	70009	ZGW NAG	8.81	0.25	20.8	0.02	<0.01	0.02	0.6	27.7	28.3	27.6	45.2	Slight
8/18/2013	70010	LGW NAG	9.11	0.24	20	0.02	<0.01	0.02	0.6	25.7	26.3	25.6	42	Slight
8/18/2013	70011	MGW NAG	8.97	0.25	20.8	0.06	<0.01	0.06	1.9	29.6	30.3	28.4	16.1	Slight
8/18/2013	70012	LGW NAG	9.17	0.12	10	0.03	<0.01	0.03	0.9	17.9	18.3	17.3	19.5	Slight
8/18/2013	70013	LGW NAG	8.99	0.22	18.3	0.01	<0.01	0.01	0.3	20.3	20.8	20.4	66.4	Slight
8/18/2013	70014	MGW SAT	8.24	0.2	16.7	1.84	<0.01	1.84	57.5	24	24.5	-33	0.4	Slight
8/18/2013	70015	LGW NAG	9.01	0.18	15	0.09	<0.01	0.09	2.8	18.4	18.8	15.9	6.7	Slight
8/18/2013	70016	LGW NAG	8.79	0.17	14.2	0.12	<0.01	0.12	3.8	24.5	25	21.3	6.7	Slight
8/18/2013	70017	LGW NAG	9.21	0.16	13.3	0.03	<0.01	0.03	0.9	20.6	21	20.1	22.4	Slight

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Sample Date	ABA ID	Waste Type	Paste pH	TIC %	$CaCO_3$ NP	S(T) %	$S(SO_4)$ %	$S(S^{2-})$ %	AP $CaCO_3$kg / tonne	NP H_2SO_4kg / tonne	NP $CaCO_3$kg / tonne	Net NP	NP:AP Ratio (NP/AP)	Fizz Test
8/18/2013	70018	LGW SAT	8.83	0.27	22.5	0.1	<0.01	0.1	3.1	31.1	31.8	28.6	10.2	Slight
8/18/2013	70022	MGW SAT	8.75	0.57	47.5	0.33	<0.01	0.33	10.3	48.3	49.3	38.9	4.8	Slight
8/18/2013	70023	MGW NAG	8.52	0.24	20	0.19	<0.01	0.19	5.9	30.9	31.5	25.6	5.3	Slight
8/18/2013	70024	LGW NAG	9.1	0.12	10	0.02	<0.01	0.02	0.6	12.7	13	12.4	20.8	Slight
8/18/2013	70025	LGW NAG	8.69	0.18	15	0.03	<0.01	0.03	0.9	20.1	20.5	19.6	21.9	Slight
8/19/2013	6381	LGW NAG	8.68	0.29	24.2	0.02	<0.01	0.02	0.6	31.1	31.8	31.1	50.8	Slight
8/20/2013	6382	LGW NAG	8.9	0.15	12.5	0.01	<0.01	0.01	0.3	22.5	23	22.7	73.6	Slight
8/20/2013	6383	MGW NAG	8.77	0.3	25	0.02	<0.01	0.02	0.6	31.1	31.8	31.1	50.8	Slight
8/29/2013	6384	MGW NAG	8.83	0.17	14.2	0.19	0.01	0.18	5.6	21.6	22	16.4	3.9	Slight
8/29/2013	6385	LGW CON	8.82	0.19	15.8	0.01	<0.01	0.01	0.3	23.3	23.8	23.4	76	Slight
8/29/2013	6386	LGW NAG	9	0.09	7.5	0.01	<0.01	0.01	0.3	14.7	15	14.7	48	Slight
8/29/2013	6387	LGW CON	8.88	0.13	10.8	0.02	<0.01	0.02	0.6	15.4	15.8	15.1	25.2	Slight
8/29/2013	6388	MGW SAT	8.23	0.36	30	1.37	<0.01	1.37	42.8	38.2	39	-3.8	0.9	Slight
8/29/2013	6389	ZGW CON	8.93	0.18	15	<0.01	<0.01	<0.01	<0.3	20.6	21	21	>70	Slight
8/29/2013	6390	MGW NAG	8.87	0.21	17.5	0.04	<0.01	0.04	1.3	23.8	24.3	23	19.4	Slight
9/2/2013	6391	MGW SAT	8.41	0.21	17.5	0.49	<0.01	0.49	15.3	23.5	24	8.7	1.6	Slight
9/2/2013	6392	LGW NAG	9.01	0.09	7.5	<0.01	<0.01	<0.01	<0.3	12.7	13	13	>43	Slight
9/2/2013	6393	MGW NAG	8.63	0.17	14.2	0.24	<0.01	0.24	7.5	20.3	20.8	13.3	2.8	Slight
9/2/2013	6394	LGW CON	8.81	0.22	18.3	0.05	<0.01	0.05	1.6	25.2	25.8	24.2	16.5	Slight
9/2/2013	6395	LGW SAT	8.53	0.29	24.2	0.25	<0.01	0.25	7.8	29.6	30.3	22.4	3.9	Slight
9/2/2013	6396	LGW CON	8.88	0.25	20.8	0.07	<0.01	0.07	2.2	24.5	25	22.8	11.4	Slight
9/2/2013	6397	LGW CON	8.94	0.24	20	<0.01	<0.01	<0.01	<0.3	24	24.5	24.5	>81	Slight
9/2/2013	6398	LGW CON	9.02	0.22	18.3	0.01	<0.01	0.01	0.3	24.3	24.8	24.4	79.2	Slight
9/2/2013	6399	LGW CON	8.78	0.25	20.8	0.1	<0.01	0.1	3.1	28.4	29	25.9	9.3	Slight
9/2/2013	6400	LGW CON	8.63	0.39	32.5	0.02	<0.01	0.02	0.6	39.7	40.5	39.9	64.8	Slight
9/2/2013	70501	MGW NAG	8.66	0.57	47.5	<0.01	<0.01	<0.01	<0.3	59.3	60.5	60.5	>201	Slight

Appendix A. Summary Area 2 Pit ABA Analysis Results from SGS for 2013.														
Sample Date	ABA ID	Waste Type	Paste pH	TIC %	$CaCO_3$ NP	S(T) %	$S(SO_4)$ %	$S(S^{2-})$ %	AP $CaCO_3$ kg / tonne	NP H_2SO_4 kg / tonne	NP $CaCO_3$ kg / tonne	Net NP	NP:AP Ratio (NP/AP)	Fizz Test
9/2/2013	70502	LGW NAG	8.82	0.54	45	0.03	<0.01	0.03	0.9	45.8	46.8	45.8	49.9	Slight
9/3/2013	70503	LGW CON	8.79	0.29	24.2	0.02	<0.01	0.02	0.6	28.4	29	28.4	46.4	Slight
9/3/2013	70504	LGW NAG	8.86	0.32	26.7	0.24	<0.01	0.24	7.5	30.9	31.5	24	4.2	Slight
9/3/2013	70505	LGW CON	8.89	0.21	17.5	0.07	<0.01	0.07	2.2	22.5	23	20.8	10.5	Slight
9/3/2013	70506	MGW NAG	8.73	0.31	25.8	0.07	<0.01	0.07	2.2	32.3	33	30.8	15.1	Slight
9/3/2013	70507	MGW SAT	8.55	0.21	17.5	0.46	<0.01	0.46	14.4	19.4	19.8	5.4	1.4	Slight
9/3/2013	70508	LGW CON	8.84	0.22	18.3	0.11	<0.01	0.11	3.4	26	26.5	23.1	7.7	Slight
9/22/2013	70521	MGW NAG	8.16	0.2	16.7	0.455	<0.01	0.46	14.2	25	25.5	11.3	1.8	Slight
9/27/2013	65001	LGW NAG	8.83	0.2	16.7	0.01	<0.01	0.01	0.3	22.8	23.3	22.9	74.4	Slight
9/27/2013	65005	LGW SAT	8.73	0.12	10	0.13	<0.01	0.13	4.1	18.4	18.8	14.7	4.6	Slight
9/27/2013	65006	LGW NAG	8.69	0.14	11.7	0.04	<0.01	0.04	1.3	29.2	29.8	28.5	23.8	Slight
9/27/2013	65007	LGW CON	8.59	0.27	22.5	0.01	<0.01	0.01	0.3	28.2	28.8	28.4	92	Slight
9/27/2013	65010	LGW NAG	8.6	0.26	21.7	0.15	<0.01	0.15	4.7	30.4	31	26.3	6.6	Slight
9/27/2013	65011	MGW NAG	8.22	0.31	25.8	0.14	<0.01	0.14	4.4	31.1	31.8	27.4	7.3	Slight
9/27/2013	65014	MGW NAG	8.63	0.38	31.7	0.25	<0.01	0.25	7.8	24.7	25.3	17.4	3.2	Slight
9/27/2013	70509	MGW SAT	8.11	0.14	11.7	0.86	<0.01	0.86	26.9	20.6	21	-5.9	0.8	Slight
9/27/2013	70510	LGW CON	9.02	0.15	12.5	0.01	<0.01	0.01	0.3	18.6	19	18.7	60.8	Slight
9/27/2013	70511	LGW NAG	9.07	0.09	7.5	0.02	<0.01	0.02	0.6	14.9	15.3	14.6	24.4	Slight
9/27/2013	70512	HGW SAT	8.85	0.14	11.7	0.2	<0.01	0.2	6.3	19.8	20.3	14	3.2	Slight
9/27/2013	70513	MGW SAT	8.79	0.18	15	0.07	<0.01	0.07	2.2	21.6	22	19.8	10.1	Slight
9/27/2013	70514	LGW NAG	8.7	0.45	37.5	0.03	<0.01	0.03	0.9	40.7	41.5	40.6	44.3	Slight
9/27/2013	70515	MGW SAT	7.93	0.37	30.8	1.3	<0.01	1.3	40.6	34.5	35.3	-5.4	0.9	Slight
9/27/2013	70516	LGW SAT	8.8	0.18	15	0.01	<0.01	0.01	0.3	20.3	20.8	20.4	66.4	Slight
9/27/2013	70517	LGW NAG	9.03	0.19	15.8	0.03	<0.01	0.03	0.9	22.5	23	22.1	24.5	Slight
9/27/2013	70518	LGW CON	8.89	0.25	20.8	<0.01	<0.01	<0.01	<0.3	26	26.5	26.5	88.3	Slight
9/27/2013	70519	LGW CON	8.97	0.33	27.5	<0.01	<0.01	<0.01	<0.3	33.3	34	34	113.3	Slight

Appendix A. Summary Area 2 Pit ABA Analysis Results from SGS for 2013.														
Sample Date	ABA ID	Waste Type	Paste pH	TIC %	$CaCO_3$ NP	S(T) %	$S(SO_4)$ %	$S(S^{2-})$ %	AP $CaCO_3$kg / tonne	NP H_2SO_4kg / tonne	NP $CaCO_3$kg / tonne	Net NP	NP:AP Ratio (NP/AP)	Fizz Test
9/27/2013	70520	LGW NAG	8.84	0.36	30	0.06	<0.01	0.06	1.9	33.6	34.3	32.4	18.3	Slight
9/27/2013	70522	MGW NAG	8.84	0.31	25.8	0.13	<0.01	0.13	4.1	30.6	31.3	27.2	7.7	Slight
9/27/2013	70523	LGW CON	8.39	0.78	65	0.01	<0.01	0.01	0.3	69.1	70.5	70.2	225.6	Moderate
9/27/2013	70524	LGW NAG	9.11	0.1	8.3	<0.01	<0.01	<0.01	<0.3	15.2	15.5	15.5	51.7	Slight
9/27/2013	70525	LGW CON	8.92	0.18	15	<0.01	<0.01	<0.01	<0.3	21.8	22.3	22.3	74.2	Slight
9/29/2013	65008	LGW NAG	8.74	0.19	15.8	0.018	<0.01	0.02	0.6	23	23.5	22.9	41.8	Slight
9/29/2013	65009	MGW SAT	8.25	0.23	19.2	0.227	<0.01	0.23	7.1	21.8	22.3	15.2	3.1	Slight
9/29/2013	65020	LGW NAG	8.59	0.18	15	0.049	<0.01	0.05	1.5	19.8	20.3	18.7	13.2	Slight
9/29/2013	65022	LGW CON	8.72	0.15	12.5	0.019	<0.01	0.02	0.6	17.9	18.3	17.7	30.7	Slight
9/29/2013	65023	MGW NAG	8.43	0.27	22.5	0.089	<0.01	0.09	2.8	31.1	31.8	29	11.4	Slight
9/30/2013	65002	LGW NAG	8.45	0.43	35.8	<0.01	<0.01	<0.01	<0.3	40.9	41.8	41.8	139.2	Slight
9/30/2013	65003	LGW CON	8.78	0.31	25.8	<0.01	<0.01	<0.01	<0.3	30.6	31.3	31.3	104.2	Slight
9/30/2013	65004	LGW NAG	8.76	0.3	25	0.03	<0.01	0.03	0.9	28.9	29.5	28.6	31.5	Slight
9/30/2013	65012	LGW NAG	8.82	0.14	11.7	0.04	<0.01	0.04	1.3	16.9	17.3	16	13.8	Slight
9/30/2013	65013	MGW NAG	8.9	0.13	10.8	0.04	<0.01	0.04	1.3	15.9	16.3	15	13	Slight
9/30/2013	65015	MGW SAT	8.51	0.32	26.7	0.34	<0.01	0.34	10.6	32.6	33.3	22.6	3.1	Slight
9/30/2013	65016	HGW SAT	8.6	0.13	10.8	0.25	<0.01	0.25	7.8	16.9	17.3	9.4	2.2	Slight
9/30/2013	65017	MGW NAG	8.5	0.28	23.3	0.08	<0.01	0.08	2.5	27	27.5	25	11	Slight
9/30/2013	65151	MGW SAT	8.98	0.34	28.3	0.26	<0.01	0.26	8.1	31.9	32.5	24.4	4	Slight
9/30/2013	65154	LGW NAG	8.43	0.27	22.5	0.361	<0.01	0.36	11.3	29.6	30.3	19	2.7	Slight
9/30/2013	65155	MGW NAG	8.58	0.27	22.5	0.169	<0.01	0.17	5.3	30.6	31.3	26	5.9	Slight
9/30/2013	65158	LGW NAG	8.58	0.27	22.5	0.021	<0.01	0.02	0.7	25.5	26	25.3	39.6	Slight
9/30/2013	65159	MGW NAG	8.6	0.43	35.8	0.029	<0.01	0.03	0.9	34.1	34.8	33.8	38.3	Slight
10/1/2013	65018	MGW SAT	8.09	0.3	25	0.48	<0.01	0.48	15	37	37.8	22.8	2.5	Slight
10/1/2013	65019	HGW SAT	8.01	0.21	17.5	0.81	<0.01	0.81	25.3	24.5	25	-0.3	1	Slight
10/1/2013	65021	MGW SAT	8.56	0.18	15	0.24	<0.01	0.24	7.5	24	24.5	17	3.3	Slight

Appendix A. Summary Area 2 Pit ABA Analysis Results from SGS for 2013.														
Sample Date	ABA ID	Waste Type	Paste pH	TIC %	$CaCO_3$ NP	S(T) %	$S(SO_4)$ %	$S(S^{2-})$ %	AP $CaCO_3$kg / tonne	NP H_2SO_4kg / tonne	NP $CaCO_3$kg / tonne	Net NP	NP:AP Ratio (NP/AP)	Fizz Test
10/1/2013	65024	MGW NAG	8.66	0.27	22.5	0.01	<0.01	0.01	0.3	27	27.5	27.2	88	Slight
10/1/2013	65025	LGW NAG	8.5	0.31	25.8	0.05	<0.01	0.05	1.6	35.3	36	34.4	23	Slight
10/1/2013	65152	LGW NAG	8.59	0.21	17.5	0.02	<0.01	0.02	0.6	25	25.5	24.9	40.8	Slight
10/1/2013	65153	MGW NAG	8.74	0.23	19.2	0.04	<0.01	0.04	1.3	26.7	27.3	26	21.8	Slight
10/1/2013	65156	LGW NAG	8.86	0.12	10	0.02	<0.01	0.02	0.6	16.7	17	16.4	27.2	Slight
10/1/2013	65157	MGW NAG	8.6	0.21	17.5	0.13	<0.01	0.13	4.1	22.3	22.8	18.7	5.6	Slight
10/8/2013	65167	HGW SAT	7.96	1.22	101.7	0.864	<0.01	0.86	27	104.6	106.8	79.8	4	Moderate
10/9/2013	65160	LGW NAG	8.49	0.33	27.5	0.07	<0.01	0.07	2.2	36.3	37	34.8	16.9	Slight
10/9/2013	65161	LGW NAG	8.84	0.18	15	<0.01	<0.01	<0.01	<0.3	20.8	21.3	21.3	70.8	Slight
10/9/2013	65162	MGW SAT	8.62	0.19	15.8	0.12	<0.01	0.12	3.8	23.5	24	20.3	6.4	Slight
10/9/2013	65163	MGW NAG	8.75	0.17	14.2	0.04	<0.01	0.04	1.3	20.6	21	19.8	16.8	Slight
10/9/2013	65164	LGW NAG	8.44	0.4	33.3	0.13	<0.01	0.13	4.1	40.7	41.5	37.4	10.2	Slight
10/9/2013	65165	MGW SAT	8.26	0.77	64.2	0.51	<0.01	0.51	15.9	67.9	69.3	53.3	4.3	Moderate
10/9/2013	65166	HGW SAT	8.57	0.2	16.7	0.3	<0.01	0.3	9.4	21.6	22	12.6	2.3	Slight
10/9/2013	65168	MGW SAT	8.28	0.48	40	0.39	<0.01	0.39	12.2	42.4	43.3	31.1	3.5	Slight
10/9/2013	65169	MGW NAG	8.38	0.79	65.8	0.04	<0.01	0.04	1.3	58.3	59.5	58.3	47.6	Slight
10/9/2013	65170	LGW NAG	8.53	0.22	18.3	0.06	<0.01	0.06	1.9	23	23.5	21.6	12.5	Slight
10/9/2013	65171	MGW SAT	8.86	0.43	35.8	0.4	<0.01	0.4	12.5	43.1	44	31.5	3.5	Slight
10/9/2013	65172	LGW NAG	9.39	0.08	6.7	0.01	<0.01	0.01	0.3	11.5	11.8	11.4	37.6	Slight
10/9/2013	65173	MGW SAT	9.06	0.24	20	0.06	<0.01	0.06	1.9	24.7	25.3	23.4	13.5	Slight
10/9/2013	65174	LGW NAG	8.96	0.22	18.3	0.03	<0.01	0.03	0.9	26	26.5	25.6	28.3	Slight
10/9/2013	65175	MGW SAT	8.82	0.39	32.5	0.47	<0.01	0.47	14.7	35	35.8	21.1	2.4	Slight
10/9/2013	84501	LGW NAG	8.52	0.25	20.8	0.034	<0.01	0.03	1.1	26	26.5	25.4	24.9	Slight
10/13/2013	84502	LGW NAG	8.34	0.19	15.8	0.14	<0.01	0.14	4.4	23.3	23.8	19.4	5.4	Slight
10/13/2013	84503	HGW SAT	8.07	0.33	27.5	0.746	<0.01	0.75	23.3	30.9	31.5	8.2	1.4	Slight
10/13/2013	84504	MGW SAT	8.73	0.21	17.5	0.094	<0.01	0.09	2.9	22.5	23	20.1	7.8	Slight

Appendix A. Summary Area 2 Pit ABA Analysis Results from SGS for 2013.

Sample Date	ABA ID	Waste Type	Paste pH	TIC %	$CaCO_3$ NP	S(T) %	$S(SO_4)$ %	$S(S^{2-})$ %	AP $CaCO_3$kg / tonne	NP H_2SO_4kg / tonne	NP $CaCO_3$kg / tonne	Net NP	NP:AP Ratio (NP/AP)	Fizz Test
10/13/2013	84505	MGW SAT	8.19	0.7	58.3	0.584	<0.01	0.58	18.3	63.2	64.5	46.3	3.5	Slight
10/13/2013	84506	LGW NAG	8.52	0.36	30	0.05	<0.01	0.05	1.6	36.8	37.5	35.9	24	Slight
10/13/2013	84507	MGW NAG	8.24	0.66	55	0.27	<0.01	0.27	8.4	52.7	53.8	45.3	6.4	Slight
10/13/2013	84508	LGW NAG	8.29	0.24	20	0.07	<0.01	0.07	2.2	24	24.5	22.3	11.2	Slight
10/13/2013	84509	ZGW NAG	8.54	0.25	20.8	0.01	<0.01	0.01	0.3	26	26.5	26.2	84.8	Slight
10/13/2013	84510	LGW NAG	8.6	0.26	21.7	0.042	<0.01	0.04	1.3	27.4	28	26.7	21.3	Slight
10/13/2013	84511	LGW NAG	8.45	0.44	36.7	0.081	<0.01	0.08	2.5	42.6	43.5	41	17.2	Slight
10/13/2013	84512	MGW NAG	8.59	0.3	25	0.071	<0.01	0.07	2.2	32.1	32.8	30.5	14.8	Slight
10/16/2013	84513	LGW NAG	8.2	0.36	30	0.06	<0.01	0.06	1.9	34.3	35	33.1	18.7	Slight
10/16/2013	84514	MGW NAG	8.49	0.22	18.3	0.06	<0.01	0.06	1.9	25	25.5	23.6	13.6	Slight
10/16/2013	84515	MGW NAG	8.35	0.29	24.2	0.33	<0.01	0.33	10.3	24.3	24.8	14.4	2.4	Slight
10/16/2013	84516	LGW NAG	8.46	0.3	25	0.02	<0.01	0.02	0.6	27.7	28.3	27.6	45.2	Slight
10/16/2013	84517	MGW SAT	8.22	0.52	43.3	0.51	<0.01	0.51	15.9	32.1	32.8	16.8	2.1	Slight
10/16/2013	84518	LGW NAG	8.77	0.19	15.8	0.06	<0.01	0.06	1.9	21.3	21.8	19.9	11.6	Slight
10/16/2013	84519	MGW SAT	8.8	0.12	10	0.03	<0.01	0.03	0.9	14.9	15.3	14.3	16.3	Slight
10/16/2013	84520	LGW NAG	8.58	0.23	19.2	0.02	<0.01	0.02	0.6	24	24.5	23.9	39.2	Slight
10/26/2013	78501	HGW SAT	8.82	0.68	56.7	0.47	<0.01	0.47	14.7	57.6	58.8	44.1	4	Slight
10/26/2013	78502	LGW CON	9.41	0.31	25.8	0.04	<0.01	0.04	1.3	29.6	30.3	29	24.2	Slight
10/26/2013	78503	MGW NAG	8.91	0.51	42.5	0.34	<0.01	0.34	10.6	46.3	47.3	36.6	4.4	Slight
10/26/2013	78504	MGW SAT	8.53	1.72	143.3	0.86	0.01	0.85	26.6	142.3	145.3	118.7	5.5	Slight
10/26/2013	78505	MGW NAG	8.63	0.83	69.2	0.72	<0.01	0.72	22.5	74.7	76.3	53.8	3.4	Slight
10/26/2013	78506	MGW SAT	8.93	0.47	39.2	0.31	<0.01	0.31	9.7	40.4	41.3	31.6	4.3	Slight
10/26/2013	78507	MGW SAT	9.05	0.17	14.2	0.33	<0.01	0.33	10.3	20.3	20.8	10.4	2	Slight
10/26/2013	78508	LGW NAG	9.18	0.25	20.8	0.06	<0.01	0.06	1.9	25.7	26.3	24.4	14	Slight
10/26/2013	84524	MGW NAG	8.57	0.41	34.2	0.02	<0.01	0.02	0.6	39.4	40.3	39.6	64.4	Slight
10/26/2013	84525	MGW SAT	8.56	0.42	35	0.04	<0.01	0.04	1.3	34.3	35	33.8	28	Slight

Appendix A. Summary Area 2 Pit ABA Analysis Results from SGS for 2013.														
Sample Date	ABA ID	Waste Type	Paste pH	TIC %	$CaCO_3$ NP	S(T) %	$S(SO_4)$ %	$S(S^{2-})$ %	AP $CaCO_3$kg / tonne	NP H_2SO_4kg / tonne	NP $CaCO_3$kg / tonne	Net NP	NP:AP Ratio (NP/AP)	Fizz Test
10/29/2013	78515	LGW CON	9.01	0.56	46.7	0.03	<0.01	0.03	0.9	47.8	48.8	47.8	52	Slight
10/29/2013	78516	MGW SAT	9.53	0.15	12.5	0.14	<0.01	0.14	4.4	17.9	18.3	13.9	4.2	Slight
10/29/2013	78518	LGW NAG	9.35	0.22	18.3	0.07	<0.01	0.07	2.2	21.8	22.3	20.1	10.2	Slight
10/29/2013	78520	MGW SAT	8.99	0.28	23.3	0.35	<0.01	0.35	10.9	30.9	31.5	20.6	2.9	Slight
10/29/2013	78521	MGW NAG	8.6	0.89	74.2	0.69	<0.01	0.69	21.6	72.3	73.8	52.2	3.4	Slight

Summary Area 118 Underground ABA Analysis Results from SGS for 2013.															
Sample Date	ABA ID	Waste Type	Sample Elevation	Paste pH	TIC %	$CaCO_3$ NP	S(T) %	$S(SO_4)$ %	$S(S^{2-})$ %	AP $CaCO_3$kg / tonne	NP H_2SO_4kg / tonne	NP $CaCO_3$kg / tonne	Net NP	NP:AP Ratio (NP/AP)	Fizz Test
2/1/2013	72815	LGW NAG	823.314	8.35	0.39	32.5	0.14	<0.01	0.14	4.4	34.3	35	30.6	8	Slight
3/1/2013	72814	LGW NAG	812.451	8.3	0.35	29.2	0.1	<0.01	0.1	3.1	27.4	28	24.9	9	Slight
4/1/2013	72809	SAT	787.553	8.22	0.84	70	0.01	<0.01	0.01	0.3	74.5	76	75.7	243.2	Slight
4/1/2013	72808	SAT	788.427	8.35	0.38	31.7	0.15	<0.01	0.15	4.7	35	35.8	31.1	7.6	Slight
4/1/2013	72807	LGW NAG	793.269	9.02	0.07	5.8	<0.01	<0.01	<0.01	<0.3	11	11.3	11.3	37.5	Slight
5/1/2013	72819	LGW NAG	786.049	9.01	0.09	7.5	<0.01	<0.01	<0.01	<0.3	13.5	13.8	13.8	45.8	Slight
6/1/2013	72806	SAT	765.833	8.22	0.4	33.3	0.37	<0.01	0.37	11.6	37.7	38.5	26.9	3.3	Slight
6/1/2013	72805	SAT	763.915	8.71	0.41	34.2	0.79	<0.01	0.79	24.7	34.3	35	10.3	1.4	Slight
6/1/2013	72804	SAT	763.465	8.18	0.68	56.7	0.59	<0.01	0.59	18.4	60.8	62	43.6	3.4	Slight
6/1/2013	72803	SAT	763.183	8.36	0.35	29.2	0.51	<0.01	0.51	15.9	32.6	33.3	17.3	2.1	Slight
6/1/2013	72802	LGW NAG	762.327	8.33	0.23	19.2	0.06	<0.01	0.06	1.9	27.4	28	26.1	14.9	Slight
7/1/2013	72801	LGW NAG	750.64	8.44	0.25	20.8	0.08	<0.01	0.08	2.5	25.5	26	23.5	10.4	Slight
8/1/2013	72820	LGW NAG	745.855	8.58	0.49	40.8	0.02	<0.01	0.02	0.6	41.4	42.3	41.6	67.6	Slight
8/8/2013	72821	LGW NAG	741.689	8.56	0.31	25.8	0.03	<0.01	0.03	0.9	29.2	29.8	28.8	31.7	Slight
10/1/2013	72823	LGW NAG	726.27	9.35	0.31	25.8	0.01	<0.01	0.01	0.3	27.4	28	27.7	89.6	Slight

Appendix B: SGS Raw Lab Results

CLIENT : **Minto Mines**
PROJECT : **Minto Mines**
SGS PROJECT # : **0643**
Test : **BC Research NP and Modified NP Procedures**
Date : **March 27 - April 15, 2013**

Sample ID	**Paste pH**	**TIC %**	**CaCO3 NP**	**C(T) %**	**S(T) %**	**S(SO4) %**	**S(S-2) %**	**AP**	**NP**	**NP H2SO4/tonne**	**NP CaCO3/tonne**	**Net NP**	**NP:AP Ratio (NP/AP)**	**Fizz Test**
Method Code	Sobek	CSB02V	Calc	CSA01V	CSA06V	CSA07V	Calc	Calc	Modified	BC Research	Calc	Calc	Calc	Sobek
LOD	0.2	0.01	#N/A	0.01	0.01	0.01	#N/A	#N/A	0.5	0.5	#N/A	#N/A	#N/A	#N/A
38253	9.00	0.23	19.2	0.64	0.02	0.02	<0.01	<0.3	19.4	24.0	24.5	24.5	81.7	Slight
38254	8.95	0.51	42.5	0.86	0.01	0.01	<0.01	<0.3	34.8	42.1	43.0	43.0	143.3	Slight
38255	8.95	0.47	39.2	0.92	0.32	0.02	0.3	9.4	34.6	39.2	40.0	30.6	4.3	Slight
38256	9.06	0.19	15.8	0.48	0.01	<0.01	0.01	0.3	18.4	23.0	23.5	23.2	75.2	Slight
38257	9.20	0.21	17.5	0.74	0.02	0.02	<0.01	<0.3	20.3	21.6	22.0	22.0	73.3	Slight
38258	8.43	0.69	57.5	0.95	0.01	<0.01	0.01	0.3	54.1	57.3	58.5	58.5	195.0	Slight
38259	9.10	0.31	25.8	0.41	0.11	<0.01	0.11	3.4	26.4	31.9	32.5	29.1	9.5	Slight
38260	9.03	0.26	21.7	0.97	0.1	0.03	0.07	2.2	21.9	28.2	28.8	28.8	95.8	Slight
38261	8.58	0.17	14.2	0.84	0.04	0.03	0.01	0.3	16.4	19.8	20.3	20.3	67.5	Slight
38262	8.34	0.52	43.3	1.27	2.44	0.03	2.41	75.3	34.4	41.2	42.0	-33.3	0.6	Slight
38263	8.82	0.35	29.2	0.64	0.07	0.01	0.06	1.9	28.3	33.3	34.0	34.0	113.3	Slight
38264	9.30	0.68	56.7	1.44	0.15	0.03	0.12	3.8	57.6	60.8	62.0	58.3	16.5	Slight
38265	8.96	0.34	28.3	0.56	0.7	<0.01	0.7	21.9	29.0	33.8	34.5	12.6	1.6	Slight
38266	8.87	0.25	20.8	0.36	<0.01	<0.01	<0.01	<0.3	19.2	23.8	24.3	24.3	80.8	Slight
38267	9.12	0.52	43.3	0.56	0.06	<0.01	0.06	1.9	41.9	46.6	47.5	45.6	25.3	Slight
38268	9.03	0.32	26.7	0.36	0.01	<0.01	0.01	0.3	27.4	30.9	31.5	31.2	100.8	Slight
38269	9.32	0.19	15.8	0.23	0.02	<0.01	0.02	0.6	18.4	23.5	24.0	23.4	38.4	Slight
38270	9.07	0.31	25.8	0.34	0.02	<0.01	0.02	0.6	25.9	32.1	32.8	32.1	52.4	Slight
38271	9.39	0.37	30.8	0.41	0.05	<0.01	0.05	1.6	31.4	34.8	35.5	35.5	118.3	Slight
38272	9.11	0.2	16.7	0.22	0.26	<0.01	0.26	8.1	21.6	21.1	21.5	13.4	2.6	Slight
38273	8.61	0.47	39.2	0.49	0.58	<0.01	0.58	18.1	39.6	45.3	46.3	28.1	2.6	Slight
45802	8.72	0.34	28.3	0.55	<0.01	<0.01	<0.01	<0.3	31.6	34.3	35.0	35.0	116.7	Slight
45803	8.20	0.21	17.5	0.7	0.04	0.02	0.02	0.6	22.4	26.5	27.0	26.4	43.2	Slight
45804	9.03	0.18	15.0	0.2	0.04	<0.01	0.04	1.3	17.7	20.3	20.8	19.5	16.6	Slight
45805	9.31	0.18	15.0	0.37	0.01	<0.01	0.01	0.3	16.3	19.6	20.0	19.7	64.0	Slight
45806	9.28	0.27	22.5	0.36	0.02	<0.01	0.02	0.6	20.6	27.0	27.5	26.9	44.0	Slight
45807	8.94	0.39	32.5	0.53	<0.01	<0.01	<0.01	<0.3	29.6	39.9	40.8	40.8	135.8	Slight
45808	9.39	0.14	11.7	0.26	0.01	<0.01	0.01	0.3	15.2	17.4	17.8	17.4	56.8	Slight
45809	9.13	0.18	15.0	0.29	0.02	<0.01	0.02	0.6	18.6	20.8	21.3	20.6	34.0	Slight
45810	9.37	0.17	14.2	0.24	<0.01	<0.01	<0.01	<0.3	19.1	22.1	22.5	22.5	75.0	Slight
45811	8.51	0.38	31.7	0.6	0.03	<0.01	0.03	0.9	33.6	34.8	35.5	34.6	37.9	Slight
45812	9.02	0.29	24.2	0.4	0.02	<0.01	0.02	0.6	28.9	32.6	33.3	32.6	53.2	Slight
45813	8.23	0.07	5.8	0.21	0.04	<0.01	0.04	1.3	10.4	14.9	15.3	14.0	12.2	None
45814	8.47	0.16	13.3	0.19	0.02	<0.01	0.02	0.6	13.8	18.9	19.3	18.6	30.8	Slight
Duplicates														
38253	9.03								19.7					Slight
38261						0.03								
38265				0.56	0.72									
38269		0.19												
38272	9.00								21.7					Slight
38273	8.65								39.3					Slight
45804						<0.01								
45809		0.18												
45813				0.2	0.04									
QC														
GTS-2A				2.04	0.34									
PD-1						4.19								
SY4		0.92												
NBM-1									41.9					Slight
Expected Values		0.95		2.01	0.35	4.27			42.0					
Tolerance +/-		0.06		0.15	0.03	0.3			3.0					Slight

Note:

AP = Acid potential in tonnes CaCO3 equivalent per 1000 tonnes of material. AP is determined from calculated sulphide sulphur content: S(T) - S(SO4).

NP = Neutralization potential in tonnes CaCO3 equivalent per 1000 tonnes of material.

NET NP = NP - AP

Carbonate NP is calculated from TIC originating from carbonate minerals and is expressed in kg CaCO3/tonne.

CLIENT : Minto Mines
PROJECT : Minto Project
SGS Project # : 0643
Test : Metals by Aqua Regia Digestion with ICP-MS Finish
Date : February 7, 2013

Sample ID	Al %	B ppm	Ba ppm	Ca %	Cr ppm	Cu ppm	Fe %	K %	Li ppm	Mg %	Mn ppm	Na %	Ni ppm	P ppm	S %	Sr ppm	Ti %	V ppm	Zn ppm	Zr ppm	Ag ppm	As ppm	Be ppm	Bi ppm	Cd ppm	Ce ppm
Method Code	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B
LOD	0.01	10	5	0.01	1	0.5	0.01	0.01	1	0.01	2	0.01	0.5	50	0.01	0.5	0.01	1	1	0.5	0.01	1	0.1	0.02	0.01	0.05
38253	1.03	50	201	1.02	113	128	2.26	0.38	6	0.82	534	0.08	3.4	700	<0.01	49.5	0.09	49	60	1.7	0.02	1	0.3	<0.02	0.03	16.9
38254	1	50	318	1.38	107	199	2.49	0.64	4	0.73	662	0.06	3	640	<0.01	77.1	0.09	53	70	1.7	0.16	2	0.2	<0.02	0.05	25.9
38255	0.91	60	195	1.49	110	284	2.6	0.36	4	0.69	631	0.07	2.4	760	0.36	64.7	0.06	45	126	1.7	0.1	1	0.3	0.08	0.26	20.1
38256	1.07	40	291	0.85	111	293	2.53	0.67	5	0.67	576	0.07	3	670	<0.01	41	0.11	52	73	1.4	0.03	1	0.2	<0.02	0.03	20.6
38257	1.04	40	272	0.98	103	154	2.4	0.59	5	0.68	649	0.07	2.9	750	<0.01	45	0.1	50	72	1.9	0.03	<1	0.2	0.03	0.04	20.5
38258	0.9	50	294	2.15	74	190	2.67	0.38	4	0.66	972	0.04	2.6	740	<0.01	95.8	0.05	49	82	1.9	0.08	3	0.4	0.14	0.1	26.9
38259	1.19	50	343	1.09	94	156	2.57	0.76	5	0.78	643	0.06	2.7	690	<0.01	65.9	0.11	54	76	1.4	0.2	2	0.2	<0.02	0.06	22.6
38260	1.22	50	549	0.99	130	196	2.55	0.82	6	0.74	544	0.08	2.8	750	0.03	55.6	0.14	54	61	1.3	0.1	2	0.2	0.03	0.04	21.4
38261	1.28	40	545	0.72	128	59.1	2.6	0.89	6	0.73	564	0.08	3	720	<0.01	44	0.15	56	63	1.4	0.01	<1	0.2	<0.02	0.02	16.8
38262	1.11	50	207	1.4	105	2110	4.7	0.64	5	0.71	384	0.06	3.4	790	2.52	72.3	0.1	62	48	2.5	0.24	1	0.4	0.04	0.09	37.6
38263	1.19	50	324	1.24	100	532	2.49	0.59	5	0.69	502	0.06	2.7	630	0.02	93.2	0.09	48	72	1.3	0.16	<1	0.3	0.08	0.06	35.3
38264	1.38	50	458	2.35	110	1310	2.69	0.98	6	0.79	589	0.08	3.2	660	0.12	120	0.17	73	99	1.7	0.3	<1	0.2	0.1	1.24	30.7
38265	1.38	60	450	1.25	101	4350	2.8	0.93	6	0.83	485	0.06	3.7	700	0.76	80.2	0.16	89	60	2.2	0.71	<1	0.2	0.12	0.29	52.3
38266	1.11	50	268	0.86	87	59.2	2.4	0.49	6	0.64	556	0.06	2.7	710	<0.01	63.7	0.06	47	60	1.2	0.01	<1	0.2	<0.02	0.04	53
38267	1.36	40	684	1.75	84	531	2.63	0.9	6	0.79	616	0.06	2.8	750	0.01	112	0.15	60	59	1.2	0.1	<1	0.2	0.02	0.05	25.5
38268	1.16	50	207	1.32	79	101	2.58	0.41	6	0.74	617	0.06	2.5	670	<0.01	81.1	0.08	50	74	1.5	0.04	1	0.3	0.02	0.04	23.6
38269	1.14	50	235	0.97	80	23.3	2.38	0.5	6	0.73	593	0.08	2.5	670	<0.01	73.8	0.11	48	69	1.6	<0.01	1	0.2	<0.02	0.02	19.6
38270	1.09	40	317	1.12	83	162	2.41	0.53	6	0.66	585	0.05	2.7	570	<0.01	73.9	0.09	49	66	1.3	0.1	1	0.3	0.02	0.04	23.9
38271	1.19	50	469	1.28	93	557	2.04	0.73	6	0.76	462	0.06	3.3	670	<0.01	85	0.12	53	50	1.2	0.24	<1	0.1	0.04	0.04	19.4
38272	1.72	50	298	1.15	82	2650	2.44	0.64	10	0.93	438	0.07	3.3	1070	0.23	67.5	0.12	69	59	1.5	0.93	1	0.2	0.14	0.11	13.5
38273	1.23	50	291	1.79	74	4890	2.94	0.2	9	0.75	487	0.04	3	810	0.6	63.5	0.02	63	82	2.3	1.27	1	0.2	0.08	0.41	49.8
45802	1.28	50	91	1.55	83	56.1	2.46	0.14	7	0.77	612	0.05	2.5	700	<0.01	68.3	0.03	44	68	1.5	0.02	1	0.4	<0.02	0.04	19
45803	1.79	40	99	1.27	67	3050	2.77	0.16	9	0.86	396	0.05	2.4	1090	<0.01	56.6	<0.01	35	73	1.8	0.31	2	0.4	0.16	0.08	16
45804	1.16	40	209	0.96	96	47.1	2.11	0.47	6	0.77	546	0.06	7.7	730	<0.01	45.4	0.09	49	67	2.5	<0.01	<1	0.2	<0.02	0.04	17.2
45805	1.1	50	299	0.81	100	231	2.39	0.69	5	0.74	593	0.08	2.8	680	<0.01	44.8	0.13	53	75	1.7	0.04	<1	0.2	<0.02	0.04	19.2
45806	1.19	50	361	0.89	92	49	2.53	0.86	5	0.8	675	0.07	2.5	710	<0.01	54.3	0.14	56	71	1.7	<0.01	1	0.2	<0.02	0.04	27.6
45807	1.29	50	344	1.41	84	126	2.6	0.71	5	0.76	715	0.08	3.8	760	<0.01	97.2	0.11	56	67	2.7	0.07	2	0.2	<0.02	0.05	25.5
45808	1.12	40	285	0.82	93	52.8	2.44	0.68	5	0.8	569	0.08	3.1	750	<0.01	39.6	0.13	56	64	1.8	0.01	<1	0.2	<0.02	0.02	17.7
45809	1.16	50	232	1.04	89	62.4	2.11	0.47	7	0.87	551	0.08	16.3	680	<0.01	43.1	0.12	51	57	5.1	0.01	<1	0.3	<0.02	0.03	18
45810	1.1	50	216	0.97	89	43.2	2.16	0.54	6	0.78	574	0.08	3	720	<0.01	37	0.11	53	56	2	<0.01	<1	0.2	<0.02	0.03	18.3
45811	1.25	50	280	1.63	103	71.6	2.58	0.23	8	0.82	532	0.05	25	900	<0.01	72	0.09	52	63	8.8	0.07	6	0.4	0.08	0.21	26.6
45812	1.22	40	103	1.34	84	167	2.43	0.18	7	0.74	693	0.05	2.5	710	<0.01	52.6	0.03	42	71	1.7	0.04	1	0.4	<0.02	0.04	19
45813	1.77	50	220	0.71	69	3380	3.6	0.22	10	0.86	375	0.04	10.1	810	<0.01	66.1	0.05	65	67	5.5	0.36	4	0.4	0.12	0.13	25.3
45814	1.39	30	74	0.76	76	3910	2.28	0.12	9	0.75	379	0.03	3.3	600	<0.01	47	<0.01	36	68	1.7	0.25	<1	0.3	0.15	0.18	19.9
Duplicates																										
38267	1.35	50	703	1.73	86	521	2.63	0.9	6	0.79	605	0.06	2.5	750	0.02	112	0.15	60	61	1.3	0.11	1	0.2	0.02	0.04	25.5
45808	1.13	50	294	0.81	95	49.2	2.53	0.68	5	0.73	556	0.08	2.8	760	<0.01	40	0.14	56	68	1.9	<0.01	<1	0.2	<0.02	0.03	20.7
QC																										
CH4	1.84	50	317	0.58	111	1970	4.82	1.43	12	1.19	303	0.06	51.5	610	0.58	10	0.22	79	207	18.1	1.95	7	<0.1	0.46	1.05	29.6
Certified Values	1.85	#N/A	293	0.61	103.8	2000	4.79	1.43	12.6	1.18	324	0.06	49.57	719	0.73	9.38	0.21	79.27	189.4	9	2.13	8.14	0.11	0.51	1.17	28.18
Tolerance (%)	11.35	#N/A	14.3	14.1	12.4	10.1	10.52	11.74	29.84	12.3	11.5	50.3	12.52	27.4	13.4	23.3	23.3	13.2	11.3	17.7	10.9	13.1	241.3	19.7	12.1	10.4

Sample ID	Co	Cs	Ga	Ge	Hf	Hg	In	La	Lu	Mo	Nb	Pb	Rb	Sb	Sc	Se	Sn	Ta	Tb	Te	Th	Tl	U	W	Y	Yb
	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Method Code	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B
LOD	0.1	0.05	0.1	0.1	0.05	0.01	0.02	0.1	0.01	0.05	0.05	0.2	0.2	0.05	0.1	1	0.3	0.05	0.02	0.05	0.1	0.02	0.05	0.1	0.05	0.1
38253	6.2	0.27	5.2	0.1	0.15	0.01	0.03	9	0.1	2.3	1	2.3	15.5	<0.05	4.4	<1	0.6	<0.05	0.24	<0.05	1.6	0.09	0.24	2.3	6.93	0.7
38254	7.4	0.54	4.9	<0.1	0.08	0.03	0.04	13.9	0.11	2.4	0.46	2.2	26.2	<0.05	5.6	<1	0.6	<0.05	0.31	<0.05	2.4	0.16	0.34	6.7	8.77	0.8
38255	71.5	0.31	5.1	<0.1	0.07	2.68	0.07	10.4	0.13	6.11	0.68	5	15.9	<0.05	4.5	<1	0.6	<0.05	0.33	0.08	2.7	0.1	0.33	711	9.7	0.8
38256	6.3	0.56	5.3	<0.1	0.05	<0.01	0.03	10.8	0.1	2.45	0.58	2.1	27.5	<0.05	4.8	<1	0.6	<0.05	0.26	<0.05	1.8	0.16	0.2	2.3	7.45	0.7
38257	6.3	0.45	5	0.1	0.08	<0.01	0.03	10.6	0.13	2.39	0.78	3.5	24.5	<0.05	4.4	<1	0.6	<0.05	0.31	<0.05	1.9	0.14	0.27	0.8	8.98	0.9
38258	7.1	0.51	4.9	0.1	0.05	<0.01	0.04	14	0.16	3.66	0.18	16.7	17.6	0.11	5.5	<1	0.7	<0.05	0.41	<0.05	2.2	0.1	0.35	0.4	12.3	1.1
38259	7.3	0.53	5.5	0.1	0.05	<0.01	0.03	12.1	0.11	1.89	0.31	1.9	30.8	<0.05	5.4	<1	0.6	<0.05	0.29	<0.05	2	0.19	0.3	1	8.27	0.7
38260	6.4	0.41	5.6	<0.1	<0.05	<0.01	0.03	10.7	0.13	3.94	1.85	2.2	32.7	<0.05	4.8	<1	1	<0.05	0.34	<0.05	2.2	0.23	0.3	0.7	9.51	0.9
38261	6.3	0.46	5.8	0.1	<0.05	<0.01	0.03	8.2	0.12	2.34	2.03	1.9	35.2	<0.05	5	<1	0.9	<0.05	0.31	<0.05	1.5	0.24	0.22	0.9	8.96	0.8
38262	31.1	0.48	5.6	<0.1	0.05	<0.01	0.04	20.4	0.16	79.8	1.25	4.6	28.8	<0.05	4.5	4	2	<0.05	0.49	0.07	3	0.26	0.46	0.7	13.3	1.1
38263	6.3	0.36	6.1	<0.1	<0.05	<0.01	0.03	19	0.07	4.37	0.83	3	26.8	<0.05	3.1	<1	0.7	<0.05	0.27	<0.05	4.2	0.18	0.34	0.4	6.57	0.5
38264	7	0.51	6.6	<0.1	<0.05	<0.01	0.07	16.9	0.08	72.1	2.54	8	43.8	<0.05	4.1	1	1.2	<0.05	0.31	0.1	2.2	0.34	1.98	0.9	7.67	0.6
38265	9.3	0.58	7	0.1	<0.05	<0.01	0.15	28.1	0.14	36.2	0.75	4.4	38.9	<0.05	6.1	4	2.2	<0.05	0.57	0.12	3	0.3	0.65	0.7	13.6	1
38266	5.9	0.28	6.2	<0.1	<0.05	<0.01	0.04	28.4	0.1	1.89	0.37	4.9	20.8	<0.05	6.3	<1	1	<0.05	0.4	<0.05	8.8	0.16	0.36	0.3	8.74	0.7
38267	6.4	0.46	6	<0.1	<0.05	<0.01	0.04	12.3	0.14	8.27	0.65	3	34.4	<0.05	6	<1	1.1	<0.05	0.43	<0.05	2.5	0.28	0.28	0.5	11.1	1
38268	6.1	0.28	5.8	<0.1	<0.05	<0.01	0.03	12.9	0.1	2.47	0.32	2.7	17.9	<0.05	4.5	<1	0.6	<0.05	0.26	<0.05	2.7	0.11	0.26	0.3	7.38	0.7
38269	5.9	0.26	5.6	0.1	<0.05	<0.01	<0.02	10.6	0.09	2.01	0.39	2.3	19.9	<0.05	4.2	<1	0.6	<0.05	0.24	<0.05	2	0.12	0.2	0.4	6.65	0.6
38270	5.8	0.33	5.5	<0.1	<0.05	<0.01	0.02	12.8	0.08	3.83	0.31	2.2	23.8	<0.05	3.6	<1	0.6	<0.05	0.24	<0.05	3	0.15	0.26	0.5	6.51	0.5
38271	5.2	0.41	5.4	<0.1	<0.05	<0.01	0.03	9.7	0.1	6.93	0.6	2.4	29.6	<0.05	5.1	<1	0.9	<0.05	0.29	0.05	2	0.21	0.15	0.5	7.78	0.7
38272	6.9	0.38	7.2	<0.1	<0.05	<0.01	0.05	6.7	0.1	19.1	0.32	3.4	27	<0.05	4	2	1.2	<0.05	0.28	0.18	0.9	0.19	0.21	0.3	8.43	0.7
38273	9	0.23	6.9	0.1	<0.05	<0.01	0.16	27	0.13	82.7	0.08	4.6	9.7	<0.05	3.7	4	1.8	<0.05	0.53	0.46	2.8	0.06	0.32	0.3	13.3	1
45802	6.2	0.22	6.8	<0.1	<0.05	<0.01	0.02	10.3	0.1	1.78	0.37	4.3	6.3	<0.05	4.2	<1	0.5	<0.05	0.23	<0.05	2.1	0.03	0.28	0.2	6.91	0.7
45803	6.6	0.32	7.1	<0.1	<0.05	<0.01	0.12	9.8	0.09	2.86	0.08	6.9	8.1	<0.05	2.7	1	0.9	<0.05	0.26	0.07	1.7	0.04	0.4	0.1	8.33	0.6
45804	6.8	0.29	5.6	<0.1	0.09	<0.01	0.02	9.3	0.1	2.12	0.37	2.2	19.7	<0.05	4.5	<1	0.6	<0.05	0.23	<0.05	1.6	0.11	0.24	0.5	6.9	0.7
45805	6.2	0.51	5.2	<0.1	0.06	<0.01	0.03	10.1	0.1	1.89	0.63	1.4	27.9	<0.05	4.4	<1	0.6	<0.05	0.27	<0.05	1.7	0.17	0.3	0.8	7.66	0.7
45806	6.7	0.67	5.7	0.1	<0.05	<0.01	0.03	14.9	0.11	1.6	0.41	1.4	35.8	<0.05	5.5	<1	0.7	<0.05	0.29	<0.05	2.5	0.22	0.29	0.4	8.04	0.7
45807	7	0.45	5.3	<0.1	0.08	<0.01	0.03	13.7	0.13	1.75	0.29	1.9	27.4	<0.05	5.6	<1	0.6	<0.05	0.33	<0.05	2.3	0.18	0.31	0.2	9.35	0.8
45808	6.6	0.32	5.3	0.1	0.07	<0.01	0.02	9.8	0.09	1.71	0.58	1.3	27.4	<0.05	4.4	<1	0.5	<0.05	0.23	<0.05	1.7	0.16	0.23	0.9	6.78	0.6
45809	7.3	0.27	5.4	0.1	0.15	<0.01	<0.02	9.7	0.09	1.53	0.54	2.7	19.3	<0.05	4.1	<1	0.5	<0.05	0.23	<0.05	1.6	0.11	0.33	0.1	6.69	0.6
45810	6.3	0.31	5.5	0.1	0.08	<0.01	<0.02	9.9	0.11	1.92	0.65	1.8	22.2	<0.05	4.3	<1	0.5	<0.05	0.23	<0.05	1.5	0.13	0.25	0.5	7.18	0.7
45811	9.5	0.95	4.7	<0.1	0.21	<0.01	0.02	13.3	0.12	2.51	0.5	5.7	11.4	0.68	5	<1	0.5	<0.05	0.38	<0.05	3.4	0.11	0.72	0.3	9.87	0.8
45812	5.9	0.19	6.3	<0.1	<0.05	<0.01	0.02	10.7	0.09	4.96	0.16	4.9	8.3	<0.05	3.9	<1	0.4	<0.05	0.21	<0.05	3.1	0.04	0.34	<0.1	6.04	0.5
45813	9.4	0.54	7.1	<0.1	0.1	<0.01	0.13	14	0.12	8.44	0.46	6.4	10.7	0.1	4.1	2	1.1	<0.05	0.36	0.11	2.4	0.08	0.79	0.1	10.1	0.8
45814	6.3	0.23	6.3	<0.1	<0.05	<0.01	0.11	9.8	0.08	4.06	<0.05	6.3	7	<0.05	2.2	1	0.9	<0.05	0.25	0.09	1.9	0.03	0.38	0.2	7.37	0.6
Duplicates																										
38267	6.4	0.46	6	<0.1	<0.05	<0.01	0.04	12.4	0.14	6.9	0.69	2.9	34.3	<0.05	5.9	<1	1.1	<0.05	0.43	<0.05	2.6	0.27	0.29	0.4	11.2	1
45808	6.4	0.32	5.4	0.1	0.07	<0.01	0.02	11.9	0.1	1.69	0.61	1.3	27.8	<0.05	4.3	<1	0.5	<0.05	0.24	<0.05	2.1	0.16	0.23	0.9	6.91	0.7
QC																										
CH4	21.7	2.5	8.7	0.3	0.36	<0.01	0.09	15.3	0.06	2.73	0.21	7.4	64.7	0.29	7.6	2	0.6	<0.05	0.29	0.38	2	0.39	0.31	2.1	5.79	0.4
Certified Values	22.8	2.6	8.72	0.21	0.29	#N/A	0.1	14	#N/A	3.05	0.19	8.24	67	0.34	7.99	1.57	0.6	0.3	0.27	0.42	2.2	0.4	0.29	2.15	5.66	#N/A
Tolerance (%)	11.1	14.8	12.9	127.4	52.8	#N/A	62.1	11.8	#N/A	14.1	75	16.1	10.7	47.3	13.1	169.6	134.5	51.7	28.4	39.6	21.2	22.6	52.9	21.6	12.2	#N/A

CLIENT : **Minto Mines**
PROJECT : **Minto Project**
SGS PROJECT # : **0643**
Test : **Leachate Analysis by ICP-OES**
Date : **April 3, 2013**

Sample ID		38253	NP Contribution	38260	NP Contribution	38267	NP Contribution	45802	NP Contribution	45811	NP Contribution
Al	mg/L	34.2		37.5		30.4		32.5		27.2	
Sb	mg/L	0.02		0.06		< 0.01		0.01		< 0.01	
As	mg/L	0.017		0.038		0.035		0.009		0.018	
Ba	mg/L	0.0928		0.0792		0.0804		0.0771		0.0738	
Be	mg/L	0.0067		0.0060		0.0046		0.0094		0.0070	
Bi	mg/L	0.26		0.42		0.23		0.13		0.18	
B	mg/L	3.04		1.67		3.15		2.28		4.23	
Cd	mg/L	0.0096		0.0138		0.0120		0.0064		0.0153	
Ca	mg/L	554	13.8	719	17.9	546	13.6	573	14.3	635	15.8
Cr	mg/L	1.36		3.37		0.462		0.476		0.315	
Co	mg/L	0.063		0.054		0.041		0.053		0.032	
Cu	mg/L	0.951		1.39		1.17		0.636		0.616	
Fe	mg/L	149		210		167		78.2		82.1	
Pb	mg/L	0.011		0.014		0.016		0.007		0.027	
Li	mg/L	< 0.1		< 0.1		< 0.1		< 0.1		< 0.1	
Mg	mg/L	41.6	1.7	37.7	1.6	71.3	2.9	35.5	1.5	126	5.2
Mn	mg/L	12.4		14.0		13.3		18.0		19.7	
Mo	mg/L	< 0.01		0.01		< 0.01		< 0.01		< 0.01	
Ni	mg/L	0.147		0.178		0.082		0.102		0.231	
P	mg/L	0.884		0.933		0.104		0.128		0.133	
K	mg/L	51.0	1.3	58.1	1.5	57.3	1.5	33.5	0.9	39.9	1.0
Se	mg/L	< 0.01		< 0.01		< 0.01		< 0.01		< 0.01	
Si	mg/L	64.2		63.9		67.5		74.4		77.6	
Ag	mg/L	< 0.08		< 0.08		< 0.08		< 0.08		< 0.08	
Na	mg/L	36.8	1.6	44.0	1.9	22.7	1.0	27.4	1.2	23.7	1.0
Sr	mg/L	1.95		3.11		4.78		1.84		2.58	
S	mg/L	735		928		778		706		850	
Tl	mg/L	0.01		0.02		< 0.005		0.02		0.02	
Sn	mg/L	< 0.03		< 0.03		< 0.03		< 0.03		< 0.03	
Ti	mg/L	0.015		0.014		0.014		0.003		0.006	
U	mg/L	< 0.2		< 0.2		< 0.2		< 0.2		< 0.2	
V	mg/L	0.116		0.088		0.038		0.028		0.010	
Zn	mg/L	0.305		0.292		0.572		0.202		0.323	
Zr	mg/L	< 0.007		< 0.007		< 0.007		< 0.007		< 0.007	
NP from Ca, Mg, Na & K (kg CaCO3 Equiv./tonne)			**18.4**		**22.9**		**19.0**		**17.8**		**23.1**

CLIENT : **Minto Mines**
PROJECT : **Minto Mines**
SGS PROJECT # : **0643**
Test : **BC Research NP and Modified NP Procedures**
Date : **March 20 - May 23, 2013**

Sample ID	Paste pH	TIC %	CaCO3 NP	C(T) %	S(T) %	S(SO4) %	S(S-2) %	AP	NP	NP H2SO4/tonne	NP CaCO3/tonne	Net NP	NP:AP Ratio (NP/AP)	Fizz Test
Method Code	Sobek	CSB02V	Calc	CSA01V	CSA06V	CSA07V	Calc	Calc	Modified	BC Research	Calc	Calc	Calc	Sobek
LOD	0.2	0.01	#N/A	0.01	0.01	0.01	#N/A	#N/A	0.5	0.5	#N/A	#N/A	#N/A	#N/A
30115	8.80	0.28	23.3	0.46	0.02	<0.01	0.02	0.6	25.4	29.6	30.3	29.6	48.4	Slight
30116	8.82	0.27	22.5	0.48	0.06	<0.01	0.06	1.9	20.9	25.7	26.3	24.4	14.0	Slight
30117	8.93	0.15	12.5	0.6	0.05	0.01	0.04	1.3	15.9	20.8	21.3	20.0	17.0	Slight
30118	8.96	0.25	20.8	0.6	0.33	<0.01	0.33	10.3	22.6	29.2	29.8	19.4	2.9	Slight
30119	9.03	0.1	8.3	0.34	0.06	<0.01	0.06	1.9	11.8	15.2	15.5	13.6	8.3	Slight
30120	8.78	0.18	15.0	0.53	0.39	<0.01	0.39	12.2	17.7	24.7	25.3	13.1	2.1	Slight
30121	8.21	0.2	16.7	0.25	0.02	<0.01	0.02	0.6	19.7	21.8	22.3	21.6	35.6	Slight
30122	7.99	0.25	20.8	0.31	0.09	<0.01	0.09	2.8	23.3	26.2	26.8	23.9	9.5	Slight
30123	8.15	0.37	30.8	0.42	0.03	<0.01	0.03	0.9	33.8	35.3	36.0	35.1	38.4	Slight
30124	8.25	0.29	24.2	0.31	0.02	<0.01	0.02	0.6	25.9	28.9	29.5	28.9	47.2	Slight
30125	9.02	0.15	12.5	0.19	0.06	<0.01	0.06	1.9	15.0	18.1	18.5	16.6	9.9	Slight
38274	8.63	0.24	20.0	0.28	0.11	<0.01	0.11	3.4	21.3	35.3	36.0	32.6	10.5	Slight
38275	8.58	0.3	25.0	0.33	0.06	<0.01	0.06	1.9	27.6	33.3	34.0	32.1	18.1	Slight
45801	8.54	0.3	25.0	0.36	0.04	<0.01	0.04	1.3	25.9	29.4	30.0	28.8	24.0	Slight
45815	8.57	0.2	16.7	0.25	0.03	<0.01	0.03	0.9	20.9	23.3	23.8	22.8	25.3	Slight
45816	8.46	0.22	18.3	0.31	0.02	<0.01	0.02	0.6	20.3	26.0	26.5	25.9	42.4	Slight
45817	8.96	0.16	13.3	0.31	0.02	<0.01	0.02	0.6	16.5	22.1	22.5	21.9	36.0	Slight
45818	8.65	0.3	25.0	0.39	0.12	<0.01	0.12	3.8	28.4	31.4	32.0	28.3	8.5	Slight
45819	8.63	0.31	25.8	0.45	0.03	<0.01	0.03	0.9	27.9	32.8	33.5	32.6	35.7	Slight
45820	8.65	0.55	45.8	0.97	1.98	0.02	1.96	61.3	39.2	50.0	51.0	-10.3	0.8	Slight
45821	8.86	0.19	15.8	0.52	0.03	<0.01	0.03	0.9	19.3	23.0	23.5	22.6	25.1	Slight
45822	8.46	0.38	31.7	0.46	0.02	<0.01	0.02	0.6	30.1	39.7	40.5	39.9	64.8	Slight
45823	8.58	0.5	41.7	0.59	0.13	<0.01	0.13	4.1	39.3	46.1	47.0	42.9	11.6	Slight
45824	8.56	0.21	17.5	0.33	0.02	<0.01	0.02	0.6	19.0	25.0	25.5	24.9	40.8	Slight
45825	9.07	0.3	25.0	0.91	0.04	0.02	0.02	0.6	24.0	28.9	29.5	28.9	47.2	Slight
48051	8.93	0.4	33.3	0.82	0.38	0.02	0.36	11.3	31.3	36.8	37.5	26.3	3.3	Slight
48052	8.79	0.52	43.3	0.57	0.44	<0.01	0.44	13.8	44.0	48.0	49.0	35.3	3.6	Slight
48053	8.86	0.42	35.0	1.03	0.15	0.02	0.13	4.1	36.8	42.1	43.0	38.9	10.6	Slight
48054	9.07	0.39	32.5	0.93	0.13	0.02	0.11	3.4	35.5	37.5	38.3	34.8	11.1	Slight
48057	8.82	0.36	30.0	0.42	0.59	<0.01	0.59	18.4	28.5	33.3	34.0	15.6	1.8	Slight
48058	8.74	0.5	41.7	0.72	0.03	<0.01	0.03	0.9	36.3	43.6	44.5	43.6	47.5	Slight
48059	9.26	0.4	33.3	0.73	0.11	0.01	0.1	3.1	27.6	34.3	35.0	31.9	11.2	Slight
48060	9.10	0.25	20.8	0.49	0.03	<0.01	0.03	0.9	21.8	27.2	27.8	26.8	29.6	Slight
48061	8.52	0.28	23.3	0.32	0.18	<0.01	0.18	5.6	26.7	31.4	32.0	26.4	5.7	Slight
48062	8.39	0.53	44.2	0.69	0.06	<0.01	0.06	1.9	46.2	50.2	51.3	49.4	27.3	Slight
48063	8.53	0.43	35.8	0.61	0.12	<0.01	0.12	3.8	38.4	40.2	41.0	37.3	10.9	Slight
48064	9.23	0.15	12.5	0.34	0.02	<0.01	0.02	0.6	16.3	17.4	17.8	17.1	28.4	Slight
48065	8.89	0.23	19.2	0.26	0.04	<0.01	0.04	1.3	21.2	25.2	25.8	24.5	20.6	Slight
48066	8.79	0.34	28.3	0.41	0.02	<0.01	0.02	0.6	19.1	35.0	35.8	35.1	57.2	Slight
48067	8.89	0.14	11.7	0.2	0.04	<0.01	0.04	1.3	15.2	20.1	20.5	19.3	16.4	Slight
48068	8.48	0.47	39.2	0.53	0.67	<0.01	0.67	20.9	38.4	44.6	45.5	24.6	2.2	Slight
48069	9.19	0.1	8.3	0.11	0.02	<0.01	0.02	0.6	11.3	14.0	14.3	13.6	22.8	Slight

Sample ID	Paste	TIC	CaCO3	C(T)	S(T)	S(SO4)	S(S-2)	AP	NP	NP	NP	Net	NP:AP Ratio	Fizz Test
	pH	%	NP	%	%	%	%			H2SO4/tonne	CaCO3/tonne	NP	(NP/AP)	
Method Code	Sobek	CSB02V	Calc	CSA01V	CSA06V	CSA07V	Calc	Calc	Modified	BC Research	Calc	Calc	Calc	Sobek
LOD	0.2	0.01	#N/A	0.01	0.01	0.01	#N/A	#N/A	0.5	0.5	#N/A	#N/A	#N/A	#N/A
48070	8.77	0.58	48.3	0.62	0.03	<0.01	0.03	0.9	35.8	45.8	46.8	45.8	49.9	Slight
48071	8.67	1.24	103.3	1.31	0.16	<0.01	0.16	5.0	79.6	100.7	102.8	97.8	20.6	Slight
48072	8.42	0.88	73.3	0.93	0.34	<0.01	0.34	10.6	52.0	66.4	67.8	57.1	6.4	Slight
48074	8.24	0.09	7.5	0.18	0.02	<0.01	0.02	0.6	11.7	12.3	12.5	11.9	20.0	None
48075	8.36	0.13	10.8	0.21	0.04	<0.01	0.04	1.3	14.4	18.1	18.5	17.3	14.8	Slight
48376	8.99	0.21	17.5	0.37	0.02	<0.01	0.02	0.6	18.7	24.5	25.0	24.4	40.0	Slight
48377	9.04	0.4	33.3	0.51	0.81	<0.01	0.81	25.3	28.5	39.7	40.5	15.2	1.6	Slight
48378	7.50	0.31	25.8	0.53	0.03	<0.01	0.03	0.9	30.4	30.6	31.3	30.3	33.3	Slight
48379	8.56	0.71	59.2	0.92	0.87	<0.01	0.87	27.2	50.6	61.0	62.3	35.1	2.3	Slight
48380	8.82	0.38	31.7	0.78	0.18	0.01	0.17	5.3	31.2	35.8	36.5	31.2	6.9	Slight
48381	8.41	0.44	36.7	0.66	0.33	<0.01	0.33	10.3	37.3	40.2	41.0	30.7	4.0	Slight
48382	8.54	0.41	34.2	0.63	0.03	<0.01	0.03	0.9	35.2	39.0	39.8	38.8	42.4	Slight
48385	8.83	0.39	32.5	0.56	0.06	<0.01	0.06	1.9	27.2	36.0	36.8	34.9	19.6	Slight
48386	8.76	0.68	56.7	0.83	0.22	<0.01	0.22	6.9	41.7	53.9	55.0	48.1	8.0	Slight
48387	8.61	0.48	40.0	0.51	0.08	<0.01	0.08	2.5	41.3	43.6	44.5	42.0	17.8	Slight
48388	8.98	0.26	21.7	0.46	0.13	<0.01	0.13	4.1	21.2	25.0	25.5	21.4	6.3	Slight
48389	9.05	0.22	18.3	0.51	0.03	<0.01	0.03	0.9	21.4	24.0	24.5	23.6	26.1	Slight
48390	9.01	0.2	16.7	0.5	0.04	<0.01	0.04	1.3	18.2	23.5	24.0	22.8	19.2	Slight
48391	9.00	0.38	31.7	0.42	0.41	<0.01	0.41	12.8	33.0	36.3	37.0	24.2	2.9	Slight
48392	8.87	0.32	26.7	0.4	0.25	<0.01	0.25	7.8	28.1	31.4	32.0	24.2	4.1	Slight
48393	8.74	0.46	38.3	0.52	0.03	<0.01	0.03	0.9	34.9	36.0	36.8	35.8	39.2	Slight
48394	8.32	0.32	26.7	0.38	0.28	0.03	0.25	7.8	26.0	34.1	34.8	26.9	4.4	Slight
48397	8.50	0.32	26.7	0.4	0.03	<0.01	0.03	0.9	30.0	31.6	32.3	31.3	34.4	Slight
48398	8.33	0.19	15.8	0.36	0.04	<0.01	0.04	1.3	18.3	21.1	21.5	20.3	17.2	Slight
48399	7.84	0.02	1.7	0.04	0.05	<0.01	0.05	1.6	11.3	14.7	15.0	13.4	9.6	None
48400	9.06	0.16	13.3	0.25	0.06	<0.01	0.06	1.9	13.7	16.4	16.8	14.9	8.9	Slight
53801	8.64	0.32	26.7	0.37	0.36	<0.01	0.36	11.3	25.5	34.3	35.0	23.8	3.1	Slight
53802	9.03	0.12	10.0	0.15	0.02	<0.01	0.02	0.6	13.4	16.7	17.0	16.4	27.2	Slight
53803	8.73	0.5	41.7	0.55	0.19	<0.01	0.19	5.9	43.8	46.1	47.0	41.1	7.9	Slight
53804	8.98	0.39	32.5	0.41	0.09	<0.01	0.09	2.8	32.0	35.3	36.0	33.2	12.8	Slight
Duplicates														
30115	8.84								25.3					Slight
45820	8.69								38.6					Slight
45821	8.84								19.3					Slight
45823						<0.01								
45824				0.33	0.02									
48057		0.36												
48067	8.88								15.2					Slight
48068	8.62								37.5					Slight
48071				1.32	0.16									
48380						0.01								
48382		0.42												
48390	8.98								18.5					Slight
48391	8.99								32.0					Slight
48397		0.32		0.4	0.02									
53803						<0.01								
QC														
GTS-2A				2.04	0.34									
GTS-2A				2.03	0.34									
PD-1						4.42								
PD-1						4.29								
SY4		0.91												
SY4		0.92												
NBM-1									39.6					Slight
NBM-1									39.7					Slight
Expected Values		0.95		2.01	0.35	4.27			42.0					Slight
Tolerance +/-		0.06		0.15	0.03	0.3			3.0					

Note:

AP = Acid potential in tonnes CaCO3 equivalent per 1000 tonnes of material. AP is determined from calculated sulphide sulphur content: S(T) - S(SO4).

NP = Neutralization potential in tonnes CaCO3 equivalent per 1000 tonnes of material.

NET NP = NP - AP

Carbonate NP is calculated from TIC originating from carbonate minerals and is expressed in kg CaCO3/tonne.

CLIENT : **Minto Mines**
PROJECT : **Minto Project**
SGS Project # : **0643**
Test : **Metals by Aqua Regia Digestion with ICP-MS Finish**
Date : **April 4, 2013**

Sample ID	Al	B	Ba	Ca	Cr	Cu	Fe	K	Li	Mg	Mn	Na	Ni	P	S	Sr	Ti	V	Zn	Zr	Ag	As	Be	Bi	Cd	Ce
	%	ppm	ppm	%	ppm	ppm	%	%	ppm	%	ppm	%	ppm	ppm	%	ppm	%	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Method Code	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B
LOD	0.01	10	5	0.01	1	0.5	0.01	0.01	1	0.01	2	0.01	0.5	50	0.01	0.5	0.01	1	1	0.5	0.01	1	0.1	0.02	0.01	0.05
30115	0.9	30	119	1.35	122	27.3	1.97	0.25	6	0.62	451	0.06	4.1	610	0.01	52.1	0.08	42	55	1.2	0.01	<1	0.2	<0.02	0.04	16.7
30116	1.09	30	326	0.92	148	698	2.45	0.77	5	0.73	515	0.06	4.5	800	0.06	53.2	0.12	58	74	1.1	<0.01	<1	<0.1	<0.02	<0.01	<0.05
30117	1.15	30	243	0.72	187	305	2.42	0.68	7	0.7	526	0.06	4.8	690	0.04	73.4	0.11	49	72	0.9	0.1	<1	0.2	0.05	0.06	26.6
30118	1.58	30	470	1.02	127	3040	3.32	1.14	8	1.03	626	0.06	6.1	660	0.36	111	0.18	85	102	1.1	0.66	<1	0.2	0.09	0.13	28.4
30119	1.18	30	304	0.6	115	591	2.33	0.81	6	0.72	524	0.07	7.3	670	0.06	55	0.15	55	73	0.8	0.16	<1	0.2	0.06	0.39	29.5
30120	1.32	30	212	0.79	112	5130	3.57	0.89	7	0.79	527	0.06	7.4	710	0.41	49.9	0.14	60	95	1.1	1.1	<1	0.2	0.59	0.27	30.7
30121	1.08	30	332	0.89	98	147	2.49	0.6	6	0.61	424	0.04	7.9	660	<0.01	29.1	0.1	52	64	1.4	0.04	1	0.2	<0.02	0.06	16.9
30122	1.07	30	351	1.03	116	2210	2.65	0.49	5	0.55	484	0.03	3.8	680	0.08	29.3	0.08	58	71	1.9	0.37	<1	0.2	0.06	0.12	20.7
30123	1.08	30	149	1.54	102	309	2.13	0.15	8	0.6	483	0.04	3.4	670	0.02	40.8	0.01	40	58	0.8	0.05	<1	0.4	<0.02	0.07	26.8
30124	1.2	20	110	1.32	107	106	1.95	0.11	10	0.73	432	0.05	3.3	540	0.01	57.3	0.02	32	59	0.7	0.03	1	0.4	<0.02	0.03	23.6
30125	1.26	30	450	0.75	130	876	2.68	0.9	7	0.8	550	0.06	4.6	710	0.06	50.1	0.16	62	75	1	0.42	<1	0.1	0.18	0.03	25.5
38274	1.33	30	445	0.96	94	673	2.5	0.9	7	0.8	528	0.05	6.2	850	0.13	48	0.15	62	59	0.7	0.15	<1	0.2	0.09	0.06	23.4
38275	1.32	30	376	1.21	85	137	2.43	0.54	8	0.8	556	0.04	6.1	830	0.05	76.5	0.08	51	57	0.8	0.03	2	0.3	0.04	0.02	25.6
45801	1.43	30	485	1.18	92	66.8	2.81	0.98	7	0.76	550	0.05	6.3	970	0.03	48.7	0.15	60	64	0.7	<0.01	1	0.2	<0.02	<0.01	30.4
45815	1.29	30	68	1.29	82	184	1.9	0.1	8	0.68	450	0.09	7.2	590	0.01	64.9	0.05	37	54	1.5	0.07	1	0.4	<0.02	0.02	14.2
45816	1.09	30	141	1.18	96	125	2.07	0.27	6	0.73	484	0.07	5.9	570	<0.01	60.5	0.08	42	59	1.1	0.04	<1	0.4	<0.02	0.02	15.9
45817	1.02	30	196	0.83	100	72.1	2.13	0.5	6	0.67	544	0.07	6.6	640	0.02	69.9	0.09	43	66	1	0.02	<1	0.2	<0.02	0.06	20
45818	1.17	30	124	1.25	127	1710	2.61	0.32	8	0.8	531	0.05	3.6	860	0.12	86.1	0.04	50	81	1.3	0.67	<1	0.3	0.14	0.15	29.3
45819	1.08	30	227	1.1	91	228	2.34	0.57	6	0.66	567	0.04	6	540	0.02	69.6	0.09	45	70	0.6	0.06	<1	0.1	0.03	0.02	31.6
45820	0.93	30	181	1.46	102	1150	3.92	0.53	5	0.68	455	0.04	7.8	680	2.24	77.5	0.08	44	58	1.6	0.19	<1	0.2	0.06	0.1	29
45821	1.16	30	182	1.1	104	125	2.53	0.42	7	0.76	548	0.07	8.9	820	0.03	41.9	0.1	54	72	1.8	0.05	<1	0.2	<0.02	0.15	19.6
45822	0.96	30	214	1.27	100	137	2.21	0.4	6	0.7	572	0.05	6.2	660	0.02	65.6	0.06	45	69	1.1	0.05	<1	0.3	<0.02	0.06	23.6
45823	1.04	30	318	1.58	98	2980	2.5	0.55	6	0.73	593	0.05	6.3	820	0.15	74.8	0.09	60	71	1.3	0.6	1	0.3	0.09	0.26	23.1
45824	0.94	30	212	0.9	91	142	2.05	0.48	5	0.63	494	0.05	5.8	580	0.01	37.5	0.08	42	63	1	0.04	<1	0.2	<0.02	0.03	15
45825	0.99	30	257	1.01	107	69.6	2.22	0.57	5	0.64	565	0.06	6.7	690	0.03	47.5	0.09	48	76	1.1	0.08	<1	0.2	<0.02	0.05	20.3
48051	1.38	30	495	1.31	120	2360	2.83	0.92	6	0.85	490	0.06	3.8	1040	0.41	101	0.15	78	68	1.2	0.38	<1	0.2	0.06	0.16	36.1
48052	1.32	30	592	1.66	113	3250	2.45	0.93	6	0.97	451	0.05	3.5	880	0.51	103	0.16	78	96	1.7	0.66	<1	0.2	0.08	1.39	33.9
48053	1.32	30	207	1.5	96	766	2.6	0.5	8	0.72	706	0.05	6.2	970	0.14	153	0.07	53	97	1.6	0.22	<1	0.4	0.09	0.25	30.7
48054	1.16	30	300	1.51	94	740	2.18	0.64	6	0.74	375	0.06	6	1040	0.12	103	0.11	53	48	0.9	0.1	<1	0.1	0.02	0.09	15
48057	0.9	30	223	1.2	99	4580	2.46	0.56	5	0.62	409	0.04	7.3	640	0.64	51.2	0.09	54	69	1.4	1.19	<1	0.2	0.5	0.22	25.7
48058	1.04	30	299	1.43	82	195	2.54	0.56	6	0.75	694	0.05	5.8	760	0.02	83.9	0.08	51	73	1.4	0.06	2	0.2	<0.02	0.06	26.3
48059	0.95	30	273	1.02	163	2190	2.23	0.7	4	0.69	506	0.06	4	680	0.11	61.7	0.11	54	68	1.1	0.28	2	0.2	0.05	0.06	29.4
48060	1.02	30	225	1.06	158	125	2.26	0.52	5	0.72	587	0.07	4.5	710	0.02	57.1	0.09	46	68	1.3	0.03	<1	0.2	<0.02	0.04	18.4
48061	1.15	20	125	1.2	109	3140	2.19	0.12	11	0.71	392	0.03	3.4	580	0.17	75.9	<0.01	34	58	<0.5	<0.01	2	<0.1	0.02	<0.01	<0.05
48062	1.13	30	118	2	81	301	2.19	0.12	9	0.68	473	0.04	5.1	750	0.05	58.8	<0.01	40	51	0.9	0.06	1	0.4	<0.02	0.04	23.1
48063	1.97	30	245	2.06	107	1140	2.33	0.48	8	0.75	468	0.12	3.9	720	0.11	138	0.06	51	66	1.1	0.24	1	0.6	0.08	0.12	23.9
48064	0.98	30	186	0.84	157	36.5	2.16	0.42	6	0.69	478	0.07	4.5	600	0.01	44.8	0.11	46	62	1	0.01	<1	0.2	<0.02	0.01	14.4
48065	0.99	30	142	1.05	87	301	2	0.3	7	0.67	469	0.05	5.5	550	0.04	68.4	0.06	37	62	1	0.09	1	0.4	<0.02	0.07	17.2
48066	1.05	40	145	1.34	119	30.1	2.17	0.35	7	0.69	590	0.07	3.8	610	<0.01	115	0.07	40	63	0.9	0.01	1	0.4	<0.02	0.07	18.9
48067	1	40	188	0.78	104	426	2.11	0.46	6	0.66	512	0.06	6.3	540	0.04	52	0.09	43	67	1	0.11	1	0.3	0.05	0.05	14.1
48068	1	40	71	1.63	71	8160	2.88	0.09	8	0.67	544	0.04	5.1	790	0.7	110	<0.01	40	83	1.7	1.62	2	0.5	0.53	0.84	20.6
48069	1.02	40	263	0.68	102	81.2	2.13	0.51	6	0.67	503	0.07	6.9	680	<0.01	62.8	0.13	46	61	1.1	0.06	1	0.2	<0.02	0.02	19.5
48070	0.68	30	139	1.29	88	399	2.02	0.29	3	0.57	468	0.05	5.6	640	0.02	61.9	0.04	37	60	1.2	0.22	1	0.4	0.03	0.05	15.2
48071	0.56	40	168	2.46	71	2060	2.23	0.26	2	0.79	416	0.04	5.3	680	0.17	174	0.03	53	63	2.3	0.41	6	0.5	0.08	0.16	24.9
48072	0.57	30	50	1.75	64	3330	2.65	0.11	3	0.66	336	0.03	4.9	1070	0.36	146	<0.01	48	65	2.6	0.48	3	0.7	0.1	0.34	38.7
48074	1.09	40	229	0.63	94	277	2.12	0.32	8	0.64	435	0.04	11.2	790	<0.01	36.7	0.08	45	54	3.7	0.05	3	0.3	0.03	0.1	17.8

Sample ID	Al %	B ppm	Ba ppm	Ca %	Cr ppm	Cu ppm	Fe %	K %	Li ppm	Mg %	Mn ppm	Na %	Ni ppm	P ppm	S %	Sr ppm	Ti %	V ppm	Zn ppm	Zr ppm	Ag ppm	As ppm	Be ppm	Bi ppm	Cd ppm	Ce ppm
Method Code	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B
LOD	0.01	10	5	0.01	1	0.5	0.01	0.01	1	0.01	2	0.01	0.5	50	0.01	0.5	0.01	1	1	0.5	0.01	1	0.1	0.02	0.01	0.05
48075	1.18	30	148	0.81	106	1530	2.41	0.26	8	0.65	423	0.04	7.4	770	0.03	49.4	0.05	48	61	1.6	0.21	2	0.4	0.1	0.09	20.3
48278	1.22	40	167	1.54	92	218	2.41	0.23	8	0.71	532	0.04	15.9	770	0.01	58.3	0.06	45	71	5	0.07	6	0.5	0.06	0.15	23.6
48376	0.99	40	253	0.96	103	51.2	2.14	0.55	5	0.66	555	0.07	6.5	690	<0.01	40.3	0.1	48	65	1.2	<0.01	<1	0.3	<0.02	0.03	16.1
48377	0.92	40	354	0.92	100	8350	2.68	0.7	4	0.77	534	0.05	6.9	760	0.84	69	0.12	73	83	1.7	0.68	3	0.2	0.06	0.26	26.4
48379	1.73	40	556	1.9	106	1500	4.44	1.13	8	1.13	851	0.05	4.7	880	0.93	118	0.2	105	118	1.6	0.32	2	0.4	0.14	0.16	31.7
48380	1.26	40	423	1.28	113	1660	3.05	0.78	7	0.71	639	0.06	6.8	560	0.2	88.9	0.14	59	107	0.9	0.46	<1	0.2	0.37	0.16	20.2
48381	1.15	40	137	1.64	98	2090	2.53	0.14	10	0.75	475	0.04	3.5	820	0.32	66.8	0.02	46	75	1.1	0.56	2	0.4	0.12	0.07	22.4
48382	1.08	30	114	1.72	87	91.2	2.11	0.15	8	0.66	493	0.06	5.5	620	0.01	76.8	0.04	39	53	1.3	0.03	2	0.4	<0.02	0.04	18.8
48385	0.91	40	218	1.05	99	610	2.25	0.5	5	0.71	495	0.06	5.9	610	0.05	63	0.08	50	62	1.2	0.12	2	0.3	0.04	0.07	22
48386	0.85	40	235	1.41	93	2660	2.43	0.48	4	0.7	410	0.05	5.9	930	0.23	72.1	0.07	58	68	1.6	0.49	2	0.3	0.13	0.17	28.9
48387	1.03	40	124	1.67	103	471	2.45	0.23	8	0.68	636	0.04	3.4	650	0.08	134	0.03	45	78	1	0.09	2	0.4	<0.02	0.11	22.9
48388	1.35	40	515	0.94	144	1250	2.87	0.97	6	0.79	605	0.05	4	790	0.12	53.9	0.18	72	89	1	0.34	1	0.2	0.1	0.07	24.4
48389	1.33	40	453	1.01	140	94.4	2.36	0.89	7	0.79	587	0.06	3.9	800	0.03	49.8	0.15	60	52	0.8	0.02	1	0.2	<0.02	0.04	19.7
48390	1.21	40	367	0.79	104	183	2.37	0.72	7	0.71	454	0.06	6.4	710	0.03	80.5	0.12	54	65	0.6	0.04	<1	0.2	<0.02	0.02	29.7
48391	1.15	40	433	1.35	121	2950	2.89	0.75	6	0.7	479	0.05	4	600	0.43	85.9	0.14	70	71	1.2	0.76	<1	0.2	0.32	0.25	15.5
48392	1.27	40	342	1.19	122	1960	2.55	0.82	6	0.78	486	0.05	3.8	650	0.26	87.8	0.13	62	69	1.3	0.43	<1	0.3	0.16	0.06	29.1
48393	0.67	30	179	1.42	144	145	1.89	0.28	3	0.41	493	0.04	3.9	500	0.03	54.1	0.04	39	50	1	0.03	2	0.3	<0.02	0.03	17.7
48394	0.46	30	515	1.08	140	2210	3.58	0.2	<1	0.09	442	0.03	4.6	470	0.28	34.6	<0.01	46	70	2	0.28	4	0.5	0.02	0.1	26.8
48397	1.2	30	99	1.43	111	152	2.06	0.12	8	0.69	461	0.05	3.7	580	<0.01	68	0.01	33	61	0.7	0.02	3	0.5	0.03	0.04	17.4
48398	1.31	40	295	1.01	119	229	2.53	0.43	9	0.74	470	0.05	14.9	880	0.02	46	0.11	56	62	5.5	0.05	5	0.3	0.05	0.14	19.9
48399	2.47	30	137	1.12	120	4770	4.22	0.25	6	0.46	298	0.03	5.4	210	0.02	137	<0.01	68	59	2.9	0.57	4	0.6	0.08	0.06	9.55
48400	1.39	40	464	0.66	121	340	2.45	0.96	7	0.84	507	0.06	4.1	690	0.06	55.2	0.18	71	55	0.7	0.05	<1	0.2	<0.02	0.03	19.9
53801	1.55	40	296	1.2	93	4910	4.46	0.75	9	1.02	697	0.05	10.3	850	0.37	90.8	0.15	78	115	1.6	1.11	2	0.4	0.44	0.26	18.6
53802	1.12	40	221	0.85	114	77.6	2.32	0.5	7	0.73	531	0.07	7.2	700	<0.01	65	0.14	52	66	1.3	0.03	1	0.3	<0.02	0.02	20.3
53803	1.27	40	134	1.94	70	1980	2.37	0.21	10	0.73	523	0.05	5.1	670	0.19	211	0.03	44	78	1	0.63	1	0.5	0.08	0.21	18.2
53804	1.16	30	378	1.31	87	693	2.35	0.71	6	0.66	501	0.05	5.9	550	0.09	96.1	0.12	53	69	0.9	0.16	1	0.3	0.04	0.07	29.6
Duplicates																										
48053	1.32	30	212	1.52	93	791	2.63	0.52	8	0.73	718	0.05	6.1	940	0.14	155	0.07	53	99	1.5	0.23	<1	0.3	0.09	0.24	30.2
48380	1.25	40	421	1.31	119	1710	3.04	0.76	7	0.76	643	0.06	7.2	580	0.2	92.6	0.13	58	107	0.9	0.48	1	0.3	0.39	0.16	21.7
48393	0.67	40	177	1.41	138	144	1.89	0.27	3	0.42	496	0.04	3.6	490	0.03	54.3	0.04	39	52	1	0.03	2	0.3	<0.02	0.04	17.3
QC																										
CH4	1.79	40	292	0.6	108	2020	4.54	1.33	13	1.16	323	0.06	49.7	660	0.63	9.1	0.21	78	200	15.3	2.06	8	0.1	0.42	1.08	26
CH4	1.81	40	299	0.6	112	2020	4.58	1.36	13	1.17	330	0.06	50.8	660	0.72	9.1	0.21	78	205	15.8	2.13	7	0.1	0.53	1.07	27.4
Certified Values	1.85	#N/A	293	0.61	103.8	2000	4.79	1.43	12.6	1.18	324	0.06	49.57	719	0.73	9.38	0.21	79.27	189.4	9	2.13	8.14	0.11	0.51	1.17	28.18
Tolerance (%)	11.35	#N/A	14.3	14.1	12.4	10.1	10.52	11.74	29.84	12.3	11.5	50.3	12.52	27.4	13.4	23.3	23.3	13.2	11.3	17.7	10.9	13.1	241.3	19.7	12.1	10.4

Sample ID	Co ppm	Cs ppm	Ga ppm	Ge ppm	Hf ppm	Hg ppm	In ppm	La ppm	Lu ppm	Mo ppm	Nb ppm	Pb ppm	Rb ppm	Sb ppm	Sc ppm	Se ppm	Sn ppm	Ta ppm	Tb ppm	Te ppm	Th ppm	Tl ppm	U ppm	W ppm	Y ppm	Yb ppm
Method Code	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B
LOD	0.1	0.05	0.1	0.1	0.05	0.01	0.02	0.1	0.01	0.05	0.05	0.2	0.2	0.05	0.1	1	0.3	0.05	0.02	0.05	0.1	0.02	0.05	0.1	0.05	0.1
30115	5.3	0.19	5	<0.1	0.08	1.17	<0.02	8.8	0.1	3.41	0.6	2.8	11.1	0.1	3.2	<1	0.4	0.05	0.23	<0.05	1.6	0.07	0.23	0.2	6.91	0.7
30116	<0.1	<0.05	<0.1	<0.1	<0.05	0.04	<0.02	<0.1	<0.01	<0.05	<0.05	<0.2	<0.2	<0.05	<0.1	<1	<0.3	<0.05	<0.02	<0.05	<0.1	<0.02	<0.05	<0.1	<0.05	<0.1
30117	5.9	0.41	5.8	<0.1	0.05	1.5	<0.02	14.2	0.06	5.48	1.44	2.2	31.7	0.07	3.3	<1	0.6	<0.05	0.2	<0.05	4.3	0.21	0.31	0.9	4.75	0.4
30118	8.9	0.7	7.2	0.1	<0.05	0.71	0.11	15.2	0.06	25.9	1.27	2.4	50	0.07	4.3	1	1.2	<0.05	0.26	0.09	2.5	0.33	0.24	0.4	5.94	0.4
30119	5.6	0.46	5.9	0.1	<0.05	0.25	0.02	15.5	0.07	6.39	0.93	2.5	37.7	0.07	3	<1	0.6	<0.05	0.22	<0.05	3.9	0.25	0.19	1.2	5.29	0.4
30120	6.5	0.76	7.7	<0.1	<0.05	1.01	0.09	16.6	0.05	22.5	1.85	4	41.2	0.06	4.3	3	0.8	<0.05	0.22	0.26	9.6	0.29	0.19	2.5	5.24	0.4
30121	6.6	0.4	5.5	<0.1	<0.05	<0.01	0.04	8.6	0.08	4.57	0.68	4.6	26.9	0.11	4.8	<1	0.8	<0.05	0.22	<0.05	1.8	0.19	0.22	0.3	6.37	0.6
30122	7.4	0.35	5.1	<0.1	0.06	0.36	0.09	10.8	0.08	4.27	0.5	3	23.1	0.05	3.2	<1	0.8	<0.05	0.29	0.08	0.8	0.15	0.3	0.2	7.46	0.6
30123	5.6	0.27	5.8	<0.1	<0.05	<0.01	0.03	14.5	0.07	3.02	0.11	4.1	8.4	0.15	3.2	<1	0.6	<0.05	0.25	<0.05	2.9	0.04	0.25	<0.1	6.28	0.5
30124	5.1	0.23	5.7	<0.1	<0.05	<0.01	<0.02	12.7	0.05	3	0.13	4.9	6.8	0.08	2.5	<1	0.4	<0.05	0.18	<0.05	2.7	0.04	0.22	<0.1	4.13	0.4
30125	6.8	0.44	5.9	<0.1	<0.05	0.57	0.02	13.9	0.07	3.92	0.67	1.9	40.4	0.39	5.3	<1	0.6	<0.05	0.21	0.11	2.9	0.25	0.19	0.4	5.35	0.4
38274	7.1	0.44	6.2	<0.1	<0.05	1.4	0.04	12	0.12	4.65	0.58	2.8	38.1	0.06	6.2	<1	1.3	<0.05	0.33	<0.05	2.6	0.29	0.25	0.3	8.87	0.8
38275	10.7	0.31	6.9	<0.1	<0.05	<0.01	0.03	13	0.11	9.85	0.34	4.7	22.6	0.05	6.4	<1	1.2	<0.05	0.34	<0.05	2.9	0.16	0.33	0.4	9.07	0.8
45801	6.9	0.51	6.6	<0.1	<0.05	0.62	0.03	16.2	0.12	4.61	0.76	2.8	42	0.06	6.8	<1	1.3	<0.05	0.32	<0.05	3.5	0.33	0.24	0.3	8.97	0.8
45815	5.1	0.22	6.3	<0.1	0.07	<0.01	0.02	7.4	0.09	3.28	0.25	4.6	4.6	<0.05	3.3	<1	0.5	<0.05	0.21	<0.05	1.5	0.02	0.26	0.2	6.29	0.6
45816	5.7	0.28	5.5	<0.1	<0.05	0.04	<0.02	8.6	0.09	4	0.38	3.2	11.8	<0.05	3.6	<1	0.4	<0.05	0.21	<0.05	1.6	0.07	0.21	0.2	6.49	0.6
45817	12.6	0.29	5.1	<0.1	0.05	0.04	<0.02	10.6	0.09	4.29	0.51	2.5	21.7	<0.05	4.2	<1	0.5	<0.05	0.24	<0.05	2.4	0.14	0.26	37.4	6.66	0.6
45818	7.7	0.28	6.3	<0.1	<0.05	<0.01	0.03	15.9	0.1	10.9	0.2	3.6	15.1	<0.05	3.6	<1	0.5	<0.05	0.28	<0.05	5.6	0.09	0.67	0.4	7.65	0.6
45819	5.4	0.32	5.7	<0.1	<0.05	<0.01	0.02	17.1	0.07	3.95	0.43	3.5	25.8	<0.05	3.9	<1	0.5	<0.05	0.23	<0.05	4.5	0.17	0.3	0.4	5.49	0.4
45820	28.4	0.34	4.6	<0.1	0.05	<0.01	0.03	15.6	0.12	27.9	1.34	5.8	23.5	<0.05	3.5	2	1.2	<0.05	0.33	0.06	3.2	0.19	0.74	1	9.06	0.8
45821	6.7	0.29	5.9	<0.1	0.1	<0.01	0.02	10.9	0.09	4.97	0.89	2.8	18.4	<0.05	4	<1	0.5	<0.05	0.21	<0.05	2.8	0.11	0.35	0.3	6.23	0.6
45822	6.5	0.36	5.2	<0.1	0.06	0.61	0.03	12.9	0.12	4.26	0.26	6	17.7	0.05	5.3	<1	0.5	<0.05	0.29	<0.05	2.3	0.11	0.24	0.2	8.67	0.8
45823	6.9	0.4	5.5	<0.1	0.05	<0.01	0.05	12.4	0.11	52.5	0.29	2.8	25.1	<0.05	4.8	<1	0.6	<0.05	0.3	<0.05	2.5	0.14	0.4	0.2	8.53	0.7
45824	5.8	0.37	4.6	<0.1	<0.05	<0.01	0.02	7.9	0.08	4.5	0.29	2.5	20.5	<0.05	3.4	<1	0.5	<0.05	0.2	<0.05	1.4	0.11	0.2	0.2	6.12	0.6
45825	6.2	0.38	4.8	<0.1	0.06	<0.01	0.03	10.9	0.11	4.6	0.74	2.1	24.1	<0.05	5.4	<1	0.6	<0.05	0.26	<0.05	1.9	0.14	0.3	0.4	7.69	0.7
48051	8.8	0.58	6.5	<0.1	<0.05	<0.01	0.11	19.9	0.13	45.9	1.38	4.2	41.1	<0.05	6.3	1	1.8	<0.05	0.4	0.06	2.9	0.31	0.66	0.5	10.5	0.9
48052	7.1	0.47	6.4	<0.1	<0.05	<0.01	0.13	17.7	0.1	42.3	0.37	5.2	44.3	<0.05	5.9	2	1.7	<0.05	0.37	0.06	1.4	0.36	0.63	0.6	8.63	0.7
48053	8.2	0.4	6.8	<0.1	0.05	<0.01	0.05	17.1	0.12	15.3	1.31	11.9	26.5	<0.05	5.3	<1	1	<0.05	0.33	<0.05	5.6	0.23	0.4	0.6	9.15	0.8
48054	5.4	0.36	5.7	<0.1	<0.05	<0.01	0.04	7.2	0.09	7.48	1.7	2.9	30.1	0.06	4.3	<1	1.6	<0.05	0.25	<0.05	0.6	0.23	0.32	0.7	7.22	0.6
48057	38	0.36	4.8	<0.1	<0.05	0.03	0.12	13.8	0.08	15.2	0.61	3.6	27	<0.05	3.6	2	1.1	<0.05	0.28	0.26	2.6	0.18	0.45	267	6.97	0.6
48058	7.2	0.42	4.9	<0.1	0.07	<0.01	0.03	13.9	0.13	3.78	0.39	2.2	23.7	<0.05	6	<1	0.6	<0.05	0.35	<0.05	2.8	0.14	0.28	1.9	9.73	0.9
48059	6.1	0.56	4.7	<0.1	<0.05	<0.01	0.04	15.9	0.1	11.9	0.74	2.7	33.1	<0.05	6	<1	0.6	<0.05	0.29	<0.05	4	0.2	0.36	0.7	7.73	0.7
48060	6.4	0.35	5	<0.1	0.06	<0.01	0.03	9.9	0.1	4.82	0.57	1.8	22.1	0.06	4.6	<1	0.5	<0.05	0.27	<0.05	1.9	0.13	0.29	0.7	7.86	0.7
48061	3.6	<0.05	<0.1	<0.1	<0.05	<0.01	<0.02	<0.1	<0.01	<0.05	<0.05	<0.2	<0.2	<0.05	<0.1	<1	<0.3	<0.05	<0.02	<0.05	<0.1	<0.02	<0.05	<0.1	<0.05	<0.1
48062	6	0.2	6.3	<0.1	<0.05	0.28	0.03	11.7	0.1	3.63	0.1	4.7	6.1	<0.05	4.3	<1	0.8	<0.05	0.31	<0.05	2.4	0.04	0.36	0.1	8.64	0.7
48063	6.6	0.64	7.5	<0.1	0.05	0.02	0.04	12.8	0.12	5.05	0.3	3.3	23	<0.05	5.2	<1	0.6	<0.05	0.31	0.05	3.5	0.15	0.28	0.4	9.03	0.8
48064	5.9	0.27	5.1	<0.1	0.05	0.39	<0.02	7.9	0.06	4.53	0.68	2.3	19.1	<0.05	2.9	<1	0.5	<0.05	0.18	<0.05	1.5	0.12	0.38	0.8	4.96	0.5
48065	5.4	0.25	5.4	<0.1	<0.05	<0.01	0.02	8.8	0.09	3.81	0.46	2.6	15.8	<0.05	2.3	<1	0.5	<0.05	0.21	<0.05	2.3	0.09	0.38	0.2	6.03	0.5
48066	5.5	0.33	5.2	<0.1	0.06	<0.01	<0.02	9.7	0.1	4.29	0.35	3.1	16.2	<0.05	3.1	<1	0.5	<0.05	0.27	<0.05	2.5	0.1	0.26	0.4	7.99	0.7
48067	5.9	0.3	4.8	<0.1	0.06	<0.01	<0.02	7.1	0.08	6.22	0.44	2	21.8	<0.05	1.9	<1	0.5	<0.05	0.18	<0.05	1.6	0.14	0.33	2.5	5.5	0.5
48068	5	0.13	6.1	<0.1	0.07	<0.01	0.14	11.2	0.09	3.87	0.08	7	4.8	<0.05	2.9	5	0.7	<0.05	0.25	0.31	4.7	0.03	0.25	0.5	6.81	0.6
48069	5.6	0.31	5	<0.1	0.07	<0.01	<0.02	10.4	0.08	4.21	0.62	4.1	23.4	0.09	2.8	<1	0.5	<0.05	0.23	<0.05	2.6	0.14	0.32	0.7	6.26	0.6
48070	5.3	0.4	3.1	<0.1	0.05	<0.01	0.03	8	0.11	4.4	0.22	2.2	13.3	<0.05	3.5	<1	0.5	<0.05	0.27	<0.05	1.6	0.07	0.18	0.3	7.98	0.7
48071	6.3	0.32	2.9	<0.1	0.08	<0.01	0.05	13.7	0.1	7.8	0.26	4.5	13.2	0.09	4.9	1	0.5	<0.05	0.31	0.06	5.5	0.08	0.55	0.4	8.67	0.7
48072	7.4	0.35	3	<0.1	0.09	<0.01	0.09	21.1	0.13	36.1	0.05	8	6.5	<0.05	4.9	2	0.8	<0.05	0.44	0.06	6	0.03	0.44	0.2	11.2	0.9
48074	6.5	0.54	5	<0.1	0.11	<0.01	0.02	9	0.09	4.6	0.62	3.5	16.2	0.14	3.4	<1	0.8	<0.05	0.24	<0.05	2.8	0.12	0.33	0.4	6.68	0.6

Sample ID	Co ppm	Cs ppm	Ga ppm	Ge ppm	Hf ppm	Hg ppm	In ppm	La ppm	Lu ppm	Mo ppm	Nb ppm	Pb ppm	Rb ppm	Sb ppm	Sc ppm	Se ppm	Sn ppm	Ta ppm	Tb ppm	Te ppm	Th ppm	Tl ppm	U ppm	W ppm	Y ppm	Yb ppm
Method Code	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B
LOD	0.1	0.05	0.1	0.1	0.05	0.01	0.02	0.1	0.01	0.05	0.05	0.2	0.2	0.05	0.1	1	0.3	0.05	0.02	0.05	0.1	0.02	0.05	0.1	0.05	0.1
48075	6.2	0.3	6	<0.1	0.06	<0.01	0.09	11.4	0.07	6.37	0.3	3.2	13.2	<0.05	2.2	<1	0.9	<0.05	0.24	0.07	2.2	0.09	0.34	0.5	6.37	0.5
48278	10.7	0.7	5.1	<0.1	0.15	<0.01	0.03	12.5	0.11	4.33	0.44	4.9	12.3	0.29	3.6	<1	0.5	<0.05	0.34	<0.05	3.4	0.1	0.47	0.3	9.06	0.8
48376	5.9	0.48	4.7	<0.1	0.07	<0.01	0.02	8.5	0.1	4.47	0.56	1.3	24.4	<0.05	3.2	<1	0.5	<0.05	0.23	<0.05	1.7	0.14	0.28	0.5	7.19	0.7
48377	11.5	0.38	4.5	<0.1	0.05	<0.01	0.12	14.2	0.08	35	0.52	2.6	32.3	<0.05	3.4	3	0.9	<0.05	0.28	<0.05	2.6	0.22	1.12	0.6	6.74	0.6
48379	18.7	0.87	8.9	0.1	0.05	<0.01	0.06	16.5	0.14	23.9	1.47	6.6	55.6	<0.05	5.8	3	1.7	<0.05	0.45	0.07	2.6	0.42	0.61	0.6	12.6	1
48380	7.2	0.47	6.6	<0.1	<0.05	<0.01	0.05	10.7	0.08	5.57	1.71	7.6	37.2	<0.05	4.1	1	1.1	<0.05	0.26	0.09	3	0.3	0.19	0.7	7.34	0.5
48381	7.1	0.23	6.4	<0.1	0.06	0.03	0.05	12.1	0.08	8.35	0.29	5.1	7.6	0.07	2.9	2	0.8	<0.05	0.27	0.12	2.1	0.05	0.25	0.4	7.18	0.6
48382	5.6	0.21	5.9	<0.1	0.07	0.01	0.02	9.7	0.1	3.57	0.48	2.4	7.6	0.08	3.6	<1	0.5	<0.05	0.26	<0.05	1.9	0.04	0.2	0.2	7.97	0.7
48385	6	0.51	4.7	<0.1	0.07	<0.01	0.04	11.8	0.11	5.41	0.58	0.5	23.5	0.05	5.5	<1	0.6	<0.05	0.29	<0.05	3	0.15	0.23	0.5	7.87	0.7
48386	6.8	0.63	4.3	<0.1	0.07	<0.01	0.06	15.6	0.1	13.6	0.54	1.7	27.1	<0.05	4.5	1	0.6	<0.05	0.31	0.06	4.9	0.18	0.45	0.5	8.23	0.6
48387	6.7	0.23	6.1	<0.1	0.06	<0.01	0.04	12.1	0.11	5.61	0.14	1	11.6	<0.05	3.7	<1	0.6	<0.05	0.34	<0.05	2.5	0.07	0.47	0.2	9.9	0.8
48388	7.1	0.63	6.6	<0.1	<0.05	<0.01	0.05	12.8	0.09	7.61	0.79	0.7	45.9	<0.05	4.1	1	0.8	<0.05	0.28	0.09	3.4	0.29	0.21	0.5	7.37	0.6
48389	6.5	0.52	6	<0.1	0.05	<0.01	0.03	9.1	0.14	5.06	1.19	1.2	38.2	<0.05	6.4	<1	1.1	<0.05	0.43	<0.05	2.4	0.29	0.2	0.9	11.6	1
48390	6	0.39	6.1	<0.1	<0.05	0.02	0.03	15.6	0.07	5.14	1.49	1.4	34.9	<0.05	4.9	<1	0.8	<0.05	0.25	<0.05	4.1	0.24	0.25	0.7	6.06	0.5
48391	7.2	0.38	6	<0.1	<0.05	<0.01	0.08	7.8	0.07	8.26	0.52	2.1	36	<0.05	3.7	2	1	<0.05	0.24	0.16	1	0.25	0.24	0.5	6.77	0.5
48392	7	0.57	5.9	<0.1	0.06	0.02	0.09	15.8	0.09	10.9	0.75	1.7	39.1	<0.05	4.4	2	1.1	<0.05	0.28	0.12	3.5	0.32	0.58	0.3	6.93	0.6
48393	5.1	0.39	3.5	<0.1	0.06	<0.01	0.02	9.3	0.12	5.84	0.28	1.3	12.5	<0.05	3.8	<1	0.5	<0.05	0.3	<0.05	1.7	0.07	0.25	0.2	9.21	0.8
48394	14.5	0.33	1.9	<0.1	0.06	<0.01	0.03	12.5	0.1	50.6	0.08	5.2	10	<0.05	3.1	2	0.5	<0.05	0.44	<0.05	0.8	0.06	0.51	0.2	10.7	0.7
48397	7.5	0.29	6.1	<0.1	<0.05	<0.01	<0.02	9.5	0.07	3.33	0.18	2.6	6.8	<0.05	2.7	<1	0.4	<0.05	0.19	<0.05	1.9	0.03	0.23	0.1	5.34	0.5
48398	8	0.79	5.4	<0.1	0.16	0.01	0.02	10.2	0.1	3.96	0.69	2.7	21	0.24	4.3	<1	0.6	<0.05	0.28	<0.05	2.7	0.16	0.45	0.4	7.83	0.7
48399	16.6	0.5	8.2	<0.1	0.08	0.03	0.03	5.4	0.08	6.87	0.13	2.6	6.5	0.06	0.7	2	0.4	<0.05	0.22	0.28	0.3	0.03	0.49	0.2	8.27	0.5
48400	6.5	0.56	6.4	<0.1	<0.05	<0.01	0.04	10.4	0.1	3.9	0.95	0.9	42	<0.05	7.1	<1	1.3	<0.05	0.29	<0.05	2.7	0.31	0.19	0.5	7.69	0.7
53801	8.4	0.51	9.5	<0.1	0.08	0.01	0.09	10.3	0.09	4.23	0.6	1.9	35.2	<0.05	4.9	4	0.8	<0.05	0.24	0.3	3.3	0.25	0.3	0.5	6.8	0.6
53802	6.3	0.3	5.7	<0.1	0.06	0.01	<0.02	11.2	0.07	4.37	0.66	0.9	23.7	0.05	3.6	<1	0.5	<0.05	0.18	<0.05	2.6	0.16	0.25	0.4	5.26	0.5
53803	6.8	0.29	6.7	<0.1	<0.05	0.02	0.03	9.5	0.06	5.21	0.22	1.8	10.6	0.06	3.2	1	0.5	<0.05	0.2	0.11	1.9	0.06	0.88	0.1	5.27	0.4
53804	6.1	0.4	5.8	<0.1	<0.05	<0.01	0.04	15.5	0.07	6.25	0.79	1.1	34.5	<0.05	3.9	<1	0.7	<0.05	0.26	<0.05	3.7	0.23	0.7	0.3	6.85	0.5
Duplicates																										
48053	7.3	0.4	6.5	<0.1	0.05	<0.01	0.05	17	0.12	16	1.38	12	26.3	<0.05	5.2	<1	1	<0.05	0.33	0.06	5.6	0.22	0.41	0.6	8.94	0.8
48380	7.2	0.47	6.6	<0.1	<0.05	<0.01	0.04	11.5	0.07	5.77	1.76	7.3	36.8	<0.05	4.1	2	1.1	<0.05	0.27	0.07	3.3	0.3	0.23	0.7	7.45	0.5
48393	5.1	0.38	3.4	<0.1	0.05	<0.01	0.02	9	0.12	5.73	0.27	1.4	12.7	<0.05	3.7	<1	0.4	<0.05	0.29	<0.05	1.7	0.07	0.24	0.2	9.13	0.8
QC																										
CH4	21.9	2.55	8.4	0.2	0.35	<0.01	0.09	13.3	0.06	2.91	0.29	8	65.5	0.31	7	2	0.6	<0.05	0.27	0.35	2.2	0.4	0.31	2.7	5.45	0.4
CH4	23.3	2.55	8.7	0.2	0.34	<0.01	0.09	14.1	0.06	2.37	0.27	7.4	65.7	0.28	7.9	2	0.6	<0.05	0.29	0.55	2.2	0.39	0.31	2.3	5.63	0.4
Certified Values	22.8	2.6	8.72	0.21	0.29	#N/A	0.1	14	#N/A	3.05	0.19	8.24	67	0.34	7.99	1.57	0.6	0.3	0.27	0.42	2.2	0.4	0.29	2.15	5.66	#N/A
Tolerance (%)	11.1	14.8	12.9	127.4	52.8	#N/A	62.1	11.8	#N/A	14.1	75	16.1	10.7	47.3	13.1	169.6	134.5	51.7	28.4	39.6	21.2	22.6	52.9	21.6	12.2	#N/A

CLIENT : **Minto Mines**
PROJECT : **Minto Project**
SGS PROJECT # : **0643**
Test : **Leachate Analysis by ICP-OES**
Date : **April 3, 2013**

Sample ID		30115	NP Contribution	38274	NP Contribution	45825	NP Contribution	48059	NP Contribution	48061	NP Contribution	48069	NP Contribution	48381	NP Contribution	48389	NP Contribution	48397	NP Contribution
Al	mg/L	39.4		31.4		35.4		26.5		28.0		38.3		22.3		25.8		23.8	
Sb	mg/L	0.02		0.04		0.05		0.02		< 0.01		0.02		0.03		0.02		0.01	
As	mg/L	0.021		0.041		0.068		0.093		0.033		0.018		0.030		0.059		0.023	
Ba	mg/L	0.101		0.0730		0.0803		0.0830		0.0588		0.0957		0.0641		0.0864		0.0633	
Be	mg/L	0.0077		0.0052		0.0074		0.0091		0.0151		0.0044		0.0092		0.0043		0.0122	
Bi	mg/L	0.18		0.25		0.39		0.46		0.07		0.19		0.14		0.14		0.08	
B	mg/L	4.10		1.02		2.67		0.733		2.52		2.96		2.41		0.576		0.924	
Cd	mg/L	0.0064		0.0102		0.0139		0.0237		0.0084		0.0063		0.0090		0.0052		0.0048	
Ca	mg/L	784	19.6	653	16.3	709	17.7	719	17.9	636	15.9	281	7.0	529	13.2	662	16.5	554	13.8
Cr	mg/L	0.246		0.857		1.83		0.362		0.147		0.553		0.158		0.328		0.197	
Co	mg/L	0.037		0.046		0.068		0.121		0.003		0.002		0.008		0.002		0.009	
Cu	mg/L	0.342		3.62		0.946		13.8		12.6		0.307		9.17		0.110		5.20	
Fe	mg/L	96.1		158		198		320		60.5		116		86.8		63.6		52.5	
Pb	mg/L	0.008		0.017		0.015		0.036		0.019		0.010		0.029		0.026		0.026	
Li	mg/L	< 0.1		< 0.1		< 0.1		< 0.1		< 0.1		< 0.1		< 0.1		< 0.1		< 0.1	
Mg	mg/L	29.3	1.2	35.1	1.4	53.3	2.2	107	4.4	52.2	2.1	22.7	0.9	48.5	2.0	26.2	1.1	43.4	1.8
Mn	mg/L	10.6		11.3		20.2		18.4		5.24		4.91		10.1		12.1		9.47	
Mo	mg/L	< 0.01		0.01		0.03		< 0.01		< 0.01		0.01		< 0.01		< 0.01		< 0.01	
Ni	mg/L	0.059		0.317		0.387		0.080		0.030		0.295		0.049		0.050		0.042	
P	mg/L	0.220		0.064		1.01		0.299		0.053		0.111		0.105		0.384		0.044	
K	mg/L	47.0	1.2	54.5	1.4	62.9	1.6	59.7	1.5	29.2	0.7	45.3	1.2	30.2	0.8	52.6	1.3	24.2	0.6
Se	mg/L	< 0.01		< 0.01		< 0.01		< 0.01		< 0.01		< 0.01		< 0.01		< 0.01		< 0.01	
Si	mg/L	84.2		44.9		65.5		38.2		65.8		71.3		52.3		39.4		39.8	
Ag	mg/L	< 0.08		< 0.08		< 0.08		< 0.08		< 0.08		< 0.08		< 0.08		< 0.08		< 0.08	
Na	mg/L	32.9	1.4	20.3	0.9	42.3	1.8	28.5	1.2	23.6	1.0	26.9	1.2	25.8	1.1	25.9	1.1	20.2	0.9
Sr	mg/L	2.57		2.75		2.68		3.68		3.80		3.17		2.68		2.73		2.51	
S	mg/L	891		805		934		1070		754		425		641		729		629	
Tl	mg/L	0.01		0.02		0.02		0.02		0.01		0.01		0.01		0.02		0.02	
Sn	mg/L	< 0.03		< 0.03		< 0.03		< 0.03		< 0.03		< 0.03		< 0.03		< 0.03		< 0.03	
Ti	mg/L	0.032		0.012		0.020		0.015		0.005		0.030		0.002		0.018		0.002	
U	mg/L	< 0.2		< 0.2		< 0.2		< 0.2		< 0.2		< 0.2		< 0.2		< 0.2		< 0.2	
V	mg/L	0.072		0.050		0.096		0.347		0.047		0.061		0.024		0.038		0.014	
Zn	mg/L	0.297		0.323		1.21		1.29		0.425		0.257		0.440		0.185		0.472	
Zr	mg/L	0.011		< 0.007		< 0.007		0.008		< 0.007		< 0.007		< 0.007		< 0.007		< 0.007	
NP from Ca, Mg, Na & K (kg CaCO3 Equiv./tonne)			**23.4**		**20.0**		**23.3**		**25.1**		**19.8**		**10.3**		**17.1**		**20.1**		**17.1**

CLIENT **: Minto Mines**
PROJECT **: Minto Mines**
SGS PROJECT # **: 0643**
Test **: BC Research NP and Modified NP Procedures**
Date **: July 9- July 22, 2013**

Sample ID	**Paste pH**	**TIC %**	**CaCO3 NP**	**C(T) %**	**S(T) %**	**S(SO4) %**	**S(S-2) %**	**AP**	**NP**	**NP H2SO4/tonne**	**NP CaCO3/tonne**	**Net NP**	**NP:AP Ratio (NP/AP)**	**Fizz Test**
Method Code	Sobek	CSB02V	Calc	CSA01V	CSA06V	CSA07V	Calc	Calc	Modified	BC Research	Calc	Calc	Calc	Sobek
LOD	0.2	0.01	#N/A	0.01	0.01	0.01	#N/A	#N/A	0.5	0.5	#N/A	#N/A	#N/A	#N/A
47824	8.13	0.38	31.7	0.66	0.06	<0.01	0.06	1.9	34.2	39.9	40.8	38.9	21.7	Slight
47825	7.87	0.28	23.3	0.95	0.11	<0.01	0.11	3.4	26.4	45.3	46.3	42.8	13.5	Slight
50982	7.79	0.45	37.5	1.06	0.14	<0.01	0.14	4.4	39.7	46.6	47.5	43.1	10.9	Slight
50983	8.34	0.36	30.0	0.47	0.02	<0.01	0.02	0.6	32.8	39.0	39.8	39.1	63.6	Slight
50984	7.57	0.16	13.3	1.37	0.06	<0.01	0.06	1.9	17.7	26.0	26.5	24.6	14.1	Slight
50985	8.41	0.63	52.5	0.63	0.11	<0.01	0.11	3.4	41.3	56.1	57.3	53.8	16.7	Slight
50986	8.43	0.49	40.8	0.57	0.44	<0.01	0.44	13.8	31.5	40.4	41.3	27.5	3.0	Slight
50987	8.28	0.5	41.7	0.5	0.04	<0.01	0.04	1.3	45.6	62.0	63.3	62.0	50.6	Slight
50988	8.65	0.15	12.5	0.17	0.43	<0.01	0.43	13.4	17.1	23.5	24.0	10.6	1.8	Slight
50989	8.74	0.17	14.2	0.2	0.06	<0.01	0.06	1.9	16.4	28.4	29.0	27.1	15.5	Slight
50990	8.52	0.36	30.0	0.38	0.02	<0.01	0.02	0.6	33.1	50.0	51.0	50.4	81.6	Slight
50991	8.37	0.41	34.2	0.42	0.02	<0.01	0.02	0.6	38.5	51.7	52.8	52.1	84.4	Slight
50992	9.29	0.15	12.5	0.17	0.01	<0.01	0.01	0.3	16.1	23.8	24.3	23.9	77.6	Slight
50993	9.03	0.34	28.3	0.36	0.26	<0.01	0.26	8.1	22.5	35.5	36.3	28.1	4.5	Slight
51026	8.55	0.31	25.8	0.75	0.17	0.02	0.15	4.7	20.5	39.9	40.8	36.1	8.7	Slight
51027	8.03	0.38	31.7	0.7	0.09	<0.01	0.09	2.8	33.7	49.0	50.0	47.2	17.8	Slight
51028	8.53	0.09	7.5	0.69	0.04	0.02	0.02	0.6	11.1	29.9	30.5	29.9	48.8	Slight
51029	8.34	0.36	30.0	0.47	0.37	<0.01	0.37	11.6	34.2	50.0	51.0	39.4	4.4	Slight
51030	8.52	0.06	5.0	0.11	0.03	<0.01	0.03	0.9	8.3	18.1	18.5	17.6	19.7	None
51031	8.75	0.32	26.7	0.33	0.02	<0.01	0.02	0.6	28.8	43.4	44.3	43.6	70.8	Slight
51032	8.13	0.36	30.0	0.43	0.36	<0.01	0.36	11.3	30.9	51.5	52.5	41.3	4.7	Slight
51033	8.90	0.09	7.5	0.17	0.03	<0.01	0.03	0.9	10.8	23.3	23.8	22.8	25.3	Slight
51034	7.79	0.2	16.7	0.45	0.05	<0.01	0.05	1.6	21.1	27.7	28.3	26.7	18.1	Slight
51035	8.27	0.61	50.8	0.63	0.82	<0.01	0.82	25.6	42.4	55.9	57.0	31.4	2.2	Slight
51036	8.31	0.45	37.5	0.48	0.17	<0.01	0.17	5.3	36.4	60.5	61.8	56.4	11.6	Slight
51037	8.79	0.19	15.8	0.22	0.02	<0.01	0.02	0.6	19.8	34.8	35.5	34.9	56.8	Slight
51038	8.39	0.39	32.5	0.44	0.02	<0.01	0.02	0.6	35.7	41.9	42.8	42.1	68.4	Slight
51039	7.87	2.2	183.3	2.31	6.58	0.04	6.54	204.4	130.8	139.2	142.0	-62.4	0.7	Moderate
51040	8.09	0.27	22.5	0.43	0.09	<0.01	0.09	2.8	24.8	37.7	38.5	35.7	13.7	Slight
51041	7.99	0.31	25.8	0.65	0.09	<0.01	0.09	2.8	27.4	54.6	55.8	52.9	19.8	Slight
51042	8.52	1.05	87.5	1.09	0.55	<0.01	0.55	17.2	59.9	86.2	88.0	70.8	5.1	Slight
51043	8.64	0.71	59.2	0.77	0.19	<0.01	0.19	5.9	45.6	57.3	58.5	52.6	9.9	Slight
51044	8.45	0.84	70.0	0.87	0.19	<0.01	0.19	5.9	55.9	68.6	70.0	64.1	11.8	Slight
51045	8.23	0.31	25.8	0.34	0.17	<0.01	0.17	5.3	27.0	35.5	36.3	30.9	6.8	Slight
51046	8.38	0.22	18.3	0.28	0.02	<0.01	0.02	0.6	20.9	37.2	38.0	37.4	60.8	Slight
51047	8.53	0.28	23.3	0.36	0.1	<0.01	0.10	3.1	26.1	38.2	39.0	35.9	12.5	Slight
51048	8.30	0.31	25.8	0.34	0.16	<0.01	0.16	5.0	28.2	39.4	40.3	35.3	8.1	Slight
51049	8.04	0.19	15.8	0.45	0.04	<0.01	0.04	1.3	20.1	31.4	32.0	30.8	25.6	Slight
51050	9.10	0.06	5.0	0.07	<0.01	<0.01	<0.01	<0.3	8.3	18.6	19.0	19.0	63.3	Slight
52002	8.09	0.27	22.5	0.48	0.05	<0.01	0.05	1.6	26.3	37.2	38.0	36.4	24.3	Slight
52003	8.23	0.65	54.2	1.03	1.12	0.02	1.10	34.4	54.5	66.6	68.0	33.6	2.0	Moderate
52004	8.43	0.24	20.0	0.63	0.03	0.01	0.02	0.6	23.2	37.0	37.8	37.1	60.4	Slight
52005	8.53	0.31	25.8	0.85	0.09	0.02	0.07	2.2	24.6	40.2	41.0	38.8	18.7	Slight
52006	8.51	0.55	45.8	0.78	0.03	<0.01	0.03	0.9	38.3	59.3	60.5	59.6	64.5	Slight
52007	8.54	0.83	69.2	1.03	0.25	<0.01	0.25	7.8	44.7	80.4	82.0	74.2	10.5	Slight
52008	8.51	1.24	103.3	1.44	0.03	<0.01	0.03	0.9	84.9	100.5	102.5	101.6	109.3	Moderate
52009	8.57	0.16	13.3	0.32	0.05	<0.01	0.05	1.6	16.3	31.9	32.5	30.9	20.8	Slight
52010	8.22	0.46	38.3	0.63	0.04	0.01	0.03	0.9	39.6	50.7	51.8	50.8	55.2	Slight
52011	8.48	0.38	31.7	0.68	0.24	0.01	0.23	7.2	32.2	37.0	37.8	30.6	5.3	Slight
52012	8.33	0.89	74.2	1.3	0.76	0.02	0.74	23.1	74.8	81.1	82.8	59.6	3.6	Moderate
52013	7.86	0.31	25.8	0.73	0.09	<0.01	0.09	2.8	28.6	36.5	37.3	34.4	13.2	Slight
52014	8.27	0.12	10.0	0.17	0.5	0.01	0.49	15.3	14.9	24.0	24.5	9.2	1.6	Slight
52015	8.67	0.56	46.7	0.62	0.19	<0.01	0.19	5.9	46.8	54.1	55.3	49.3	9.3	Slight
52016	8.64	0.23	19.2	0.26	0.13	<0.01	0.13	4.1	46.0	26.2	26.8	22.7	6.6	Slight
52017	8.59	0.18	15.0	0.2	0.02	<0.01	0.02	0.6	20.4	22.5	23.0	22.4	36.8	Slight
52018	8.17	0.52	43.3	0.65	0.03	<0.01	0.03	0.9	48.2	51.0	52.0	51.1	55.5	Moderate
52019	8.52	0.13	10.8	0.47	0.03	<0.01	0.03	0.9	15.9	20.8	21.3	20.3	22.7	Slight
52020	8.43	0.21	17.5	0.59	0.03	<0.01	0.03	0.9	20.7	24.0	24.5	23.6	26.1	Slight
52021	8.45	0.83	69.2	0.84	0.17	<0.01	0.17	5.3	70.9	74.0	75.5	70.2	14.2	Moderate
52022	8.63	0.42	35.0	0.46	0.04	<0.01	0.04	1.3	30.7	38.2	39.0	37.8	31.2	Slight
52023	8.77	0.62	51.7	1.01	0.32	0.01	0.31	9.7	35.9	55.1	56.3	46.6	5.8	Slight
52024	8.97	0.55	45.8	1.05	0.28	0.02	0.26	8.1	38.2	61.7	63.0	54.9	7.8	Slight
52025	8.89	0.3	25.0	0.82	0.05	0.01	0.04	1.3	25.9	32.1	32.8	31.5	26.2	Slight
53805	8.79	1.18	98.3	1.22	0.38	<0.01	0.38	11.9	94.9	99.7	101.8	89.9	8.6	Moderate
53806	9.16	0.18	15.0	0.24	0.02	<0.01	0.02	0.6	17.8	26.5	27.0	26.4	43.2	Slight
53807	8.87	0.39	32.5	0.4	0.02	<0.01	0.02	0.6	33.8	39.2	40.0	39.4	64.0	Slight
53808	8.98	0.48	40.0	0.51	0.28	<0.01	0.28	8.8	32.4	40.4	41.3	32.5	4.7	Slight
53809	8.85	0.29	24.2	0.31	0.02	<0.01	0.02	0.6	28.1	31.1	31.8	31.1	50.8	Slight
53810	9.19	0.23	19.2	0.25	0.01	<0.01	0.01	0.3	20.5	24.7	25.3	24.9	80.8	Slight
53811	9.05	0.38	31.7	0.66	0.13	<0.01	0.13	4.1	26.1	45.1	46.0	41.9	11.3	Slight
53812	8.75	0.58	48.3	0.65	0.04	<0.01	0.04	1.3	34.9	45.8	46.8	45.5	37.4	Slight
53813	9.01	0.35	29.2	0.37	0.03	<0.01	0.03	0.9	25.0	35.0	35.8	34.8	38.1	Slight
53814	8.29	0.31	25.8	0.51	0.08	<0.01	0.08	2.5	27.8	37.7	38.5	36.0	15.4	Slight
53815	8.95	0.25	20.8	0.25	0.07	<0.01	0.07	2.2	22.8	29.2	29.8	27.6	13.6	Slight
53816	8.87	0.58	48.3	0.61	0.43	<0.01	0.43	13.4	44.6	50.0	51.0	37.6	3.8	Slight
53817	9.39	0.13	10.8	0.16	0.04	<0.01	0.04	1.3	13.7	18.4	18.8	17.5	15.0	Slight
53819	8.94	0.25	20.8	0.26	0.34	<0.01	0.34	10.6	24.1	31.6	32.3	21.6	3.0	Slight
53820	9.53	0.17	14.2	0.18	0.03	<0.01	0.03	0.9	16.8	22.8	23.3	22.3	24.8	Slight
53821	8.31	0.29	24.2	0.52	0.09	<0.01	0.09	2.8	27.4	32.6	33.3	30.4	11.8	Slight
53822	8.38	0.35	29.2	0.52	0.11	<0.01	0.11	3.4	32.9	36.0	36.8	33.3	10.7	Slight
53823	8.35	0.27	22.5	0.3	0.8	<0.01	0.80	25.0	20.7	33.6	34.3	9.3	1.4	Slight
53824	8.64	0.44	36.7	0.49	0.34	<0.01	0.34	10.6	40.0	48.3	49.3	38.6	4.6	Slight
58325	7.86	0.24	20.0	0.59	0.08	0.02	0.06	1.9	21.9	27.0	27.5	25.6	14.7	Slight
54351	8.46	0.23	19.2	0.54	0.19	0.01	0.18	5.6	23.3	28.2	28.8	23.1	5.1	Slight
54352	8.39	0.48	40.0	0.79	0.08	0.01	0.07	2.2	42.3	50.0	51.0	48.8	23.3	Slight
54353	8.58	0.16	13.3	0.19	0.02	<0.01	0.02	0.6	17.9	18.6	19.0	18.4	30.4	Slight
54354	8.68	0.97	80.8	1.08	0.48	<0.01	0.48	15.0	45.0	69.8	71.3	56.3	4.8	Slight
54355	8.73	0.7	58.3	1.03	0.03	0.01	0.02	0.6	44.7	55.4	56.5	55.9	90.4	Slight
54356	8.84	0.47	39.2	0.49	0.12	<0.01	0.12	3.8	28.0	40.9	41.8	38.0	11.1	Slight
54357	9.05	0.25	20.8	0.38	0.24	<0.01	0.24	7.5	23.5	30.6	31.3	23.8	4.2	Slight
54358	8.76	0.22	18.3	0.65	0.12	0.02	0.10	3.1	20.3	30.6	31.3	28.1	10.0	Slight
54361	8.73	0.31	25.8	0.33	0.04	<0.01	0.04	1.3	28.3	33.3	34.0	32.8	27.2	Slight
54362	8.72	0.52	43.3	1.08	0.32	0.02	0.30	9.4	27.8	40.7	41.5	32.1	4.4	Slight
54363	8.74	0.17	14.2	0.51	0.04	0.01	0.03	0.9	17.1	24.7	25.3	24.3	26.9	Slight
54364	8.73	0.35	29.2	0.96	0.21	0.03	0.18	5.6	31.7	43.1	44.0	38.4	7.8	Slight
54365	8.94	0.25	20.8	0.37	0.16	<0.01	0.16	5.0	25.1	31.4	32.0	27.0	6.4	Slight
54366	8.96	0.13	10.8	0.31	0.05	<0.01	0.05	1.6	14.1	19.4	19.8	18.2	12.6	Slight
54367	8.71	0.26	21.7	0.29	0.65	<0.01	0.65	20.3	26.4	34.3	35.0	14.7	1.7	Slight
54368	8.69	0.37	30.8	0.52	0.23	<0.01	0.23	7.2	32.7	39.9	40.8	33.6	5.7	Slight
54369	8.65	0.21	17.5	0.63	0.05	0.01	0.04	1.3	22.5	29.4	30.0	28.8	24.0	Slight
54372	8.68	0.3	25.0	0.75	0.12	0.02	0.10	3.1	27.2	35.8	36.5	33.4	11.7	Slight
54373	8.67	0.23	19.2	0.34	0.08	<0.01	0.08	2.5	22.4	28.4	29.0	26.5	11.6	Slight
54374	8.67	0.23	19.2	0.45	0.03	<0.01	0.03	0.9	23.1	30.6	31.3	30.3	33.3	Slight
54411	8.10	0.23	19.2	0.65	0.07	<0.01	0.07	2.2	21.8	31.9	32.5	30.3	14.9	Slight
54412	8.81	0.62	51.7	0.85	0.09	0.02	0.07	2.2	51.6	57.3	58.5	56.3	26.7	Slight
54413	8.66	0.19	15.8	0.43	0.03	<0.01	0.03	0.9	19.2	22.8	23.3	22.3	24.8	Slight
54414	8.58	0.45	37.5	0.74	0.13	0.02	0.11	3.4	37.7	51.5	52.5	49.1	15.3	Slight
54415	8.58	0.17	14.2	0.66	0.05	0.01	0.04	1.3	19.0	26.5	27.0	25.8	21.6	Slight
54416	8.80	0.3	25.0	0.79	0.17	0.02	0.15	4.7	28.8	36.3	37.0	32.3	7.9	Slight
54417	8.77	0.18	15.0	0.65	0.05	0.02	0.03	0.9	18.7	24.0	24.5	23.6	26.1	Slight
54418	8.99	0.15	12.5	0.57	0.09	0.02	0.07	2.2	15.6	21.1	21.5	19.3	9.8	Slight

Sample ID	Paste pH	TIC %	CaCO3 NP	C(T) %	S(T) %	S(SO4) %	S(S-2) %	AP	NP	NP H2SO4/tonne	NP CaCO3/tonne	Net NP	NP:AP Ratio (NP/AP)	Fizz Test
Method Code	Sobek	CSB02V	Calc	CSA01V	CSA06V	CSA07V	Calc	Calc	Modified	BC Research	Calc	Calc	Calc	Sobek
LOD	0.2	0.01	#N/A	0.01	0.01	0.01	#N/A	#N/A	0.5	0.5	#N/A	#N/A	#N/A	#N/A
54419	8.90	0.08	6.7	0.62	0.04	0.02	0.02	0.6	10.4	18.6	19.0	18.4	30.4	None
54420	8.38	0.32	26.7	0.57	0.06	<0.01	0.06	1.9	31.1	35.3	36.0	34.1	19.2	Slight
54421	8.40	1.26	105.0	1.42	3.98	0.03	3.95	123.4	81.8	96.5	98.5	-24.9	0.8	Slight
54422	8.59	0.48	40.0	0.73	0.09	<0.01	0.09	2.8	39.2	47.3	48.3	45.4	17.2	Slight
54423	8.64	0.66	55.0	1.29	0.16	0.03	0.13	4.1	53.8	65.2	66.5	62.4	16.4	Slight
54424	8.83	0.63	52.5	0.98	0.33	0.02	0.31	9.7	42.8	42.6	43.5	33.8	4.5	Slight
54425	8.77	0.78	65.0	1.19	0.3	0.01	0.29	9.1	47.1	59.8	61.0	51.9	6.7	Slight
54751	8.78	0.27	22.5	0.51	0.03	<0.01	0.03	0.9	25.0	31.9	32.5	31.6	34.7	Slight
54752	8.58	0.14	11.7	0.17	0.2	<0.01	0.20	6.3	14.4	24.0	24.5	18.3	3.9	Slight
54753	8.08	0.06	5.0	0.15	0.09	0.04	0.05	1.6	6.7	10.5	10.8	9.2	6.9	None
54754	8.50	0.11	9.2	0.16	0.03	<0.01	0.03	0.9	12.4	19.1	19.5	18.6	20.8	Slight
54755	8.89	0.20	16.7	0.23	0.01	<0.01	0.01	0.3	18.7	23.5	24.0	23.7	76.8	Slight
54756	8.41	0.59	49.2	0.67	1.84	<0.01	1.84	57.5	47.8	53.2	54.3	-3.3	0.9	Slight
54757	8.84	0.20	16.7	0.33	0.03	<0.01	0.03	0.9	20.7	26.2	26.8	25.8	28.5	Slight
54758	8.88	0.19	15.8	0.2	0.28	<0.01	0.28	8.8	18.9	24.7	25.3	16.5	2.9	Slight
54759	9.21	0.41	34.2	0.4	0.01	<0.01	0.01	0.3	36.1	40.4	41.3	40.9	132.0	Slight
54760	9.20	0.21	17.5	0.24	0.02	<0.01	0.02	0.6	21.3	23.3	23.8	23.1	38.0	Slight
54761	8.85	0.29	24.2	0.3	0.22	<0.01	0.22	6.9	27.7	35.3	36.0	29.1	5.2	Slight
54762	8.78	0.42	35.0	0.43	0.43	<0.01	0.43	13.4	37.2	44.8	45.8	32.3	3.4	Slight
54763	8.93	0.36	30.0	0.4	0.33	0.01	0.32	10.0	33.5	36.8	37.5	27.5	3.8	Slight
54764	9.23	0.51	42.5	0.63	0.02	<0.01	0.02	0.6	38.2	45.8	46.8	46.1	74.8	Slight
54765	9.14	0.23	19.2	0.3	0.11	<0.01	0.11	3.4	21.7	25.0	25.5	22.1	7.4	Slight
54766	8.88	0.21	17.5	0.25	0.07	<0.01	0.07	2.2	23.0	28.2	28.8	26.6	13.1	Slight
54767	8.93	0.54	45.0	0.57	0.24	<0.01	0.24	7.5	40.9	47.0	48.0	40.5	6.4	Slight
54768	8.85	0.29	24.2	0.31	0.12	<0.01	0.12	3.8	27.0	34.3	35.0	31.3	9.3	Slight
54769	8.51	0.34	28.3	0.49	0.04	<0.01	0.04	1.3	33.6	35.8	36.5	35.3	29.2	Slight
54770	9.09	0.09	7.5	0.32	0.04	<0.01	0.04	1.3	12.5	18.9	19.3	18.0	15.4	Slight
54771	8.88	0.17	14.2	0.49	0.04	<0.01	0.04	1.3	18.9	25.2	25.8	24.5	20.6	Slight
54772	8.69	0.43	35.8	0.71	0.67	0.01	0.66	20.6	38.8	44.3	45.3	24.6	2.2	Slight
54773	8.77	0.52	43.3	0.81	0.57	0.01	0.56	17.5	43.8	52.4	53.5	36.0	3.1	Slight
54774	8.69	0.23	19.2	0.52	0.12	<0.01	0.12	3.8	22.3	29.9	30.5	26.8	8.1	Slight
54775	8.72	0.14	11.7	0.91	0.15	0.02	0.13	4.1	13.7	19.6	20.0	15.9	4.9	Slight
Duplicates														
47824	8.14								34.0					Slight
47825		0.29												
50992			0.17	0.02										
51031	8.66								29.2					Slight
51032	8.25								31.0					Slight
51036						<0.01								
52002	8.07								25.8					Slight
52003	8.23								54.5					Moderate
52004		0.24												
52006						<0.01								
52007			1.03	0.26										
52022	8.57								30.5					Slight
52023	8.85								34.9					Slight
53812		0.58												
53821			0.52	0.09										
53822	8.36								33.0					Slight
53823	8.54								20.4					Slight
54352						0.01								
54369	8.66								21.0					Slight
54372	8.66	0.29							26.7					Slight
54418						0.02								
54422			0.71	0.08										
54752	8.62								14.3					Slight
54753	8.20								5.5					None
54759		0.39												
54772	8.69					0.01			38.3					Slight
54773	8.88								43.5					Slight
54774			0.52	0.11										
QC														
GTS-2A				2.02	0.35									
GTS-2A				2.01	0.34									
GTS-2A				2.03	0.35									
GTS-2A				2.02	0.35									
PD-1						4.42								
PD-1						4.45								
PD-1						4.43								
PD-1						4.41								
PD-1						4.42								
SY4		0.92												
SY4		0.92												
NBM-1									40.6					Slight
NBM-1									41.2					Slight
NBM-1									40.3					Slight
NBM-1									40.7					Slight
NBM-1									41.5					Slight
Expected Values		0.95		2.01	0.35	4.27			42.0					Slight
Tolerance +/-		0.06		0.15	0.03	0.3			3.0					

Note:

AP = Acid potential in tonnes CaCO3 equivalent per 1000 tonnes of material. AP is determined from calculated sulphide sulphur content: S(T) - S(SO4).

NP = Neutralization potential in tonnes CaCO3 equivalent per 1000 tonnes of material.

NET NP = NP - AP

Carbonate NP is calculated from TIC originating from carbonate minerals and is expressed in kg CaCO3/tonne.

CLIENT : **Minto Mines**
PROJECT : **Minto Project**
SGS Project # : **0643**
Test : **Metals by Aqua Regia Digestion with ICP-MS Finish**
Date : **July 12, 2013**

Sample ID	**Al**	**B**	**Ba**	**Ca**	**Cr**	**Cu**	**Fe**	**K**	**Li**	**Mg**	**Mn**	**Na**	**Ni**	**P**	**S**	**Sr**	**Ti**	**V**	**Zn**	**Zr**	**Ag**	**As**	**Be**	**Bi**	**Cd**	**Ce**
	%	**ppm**	**ppm**	**%**	**ppm**	**ppm**	**%**	**%**	**ppm**	**%**	**ppm**	**%**	**ppm**	**ppm**	**%**	**ppm**	**%**	**ppm**	**ppm**	**ppm**	**ppm**	**ppm**	**ppm**	**ppm**	**ppm**	**ppm**
Method Code	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B
LOD	0.01	10	5	0.01	1	0.5	0.01	0.01	1	0.01	2	0.01	0.5	50	0.01	0.5	0.01	1	1	0.5	0.01	1	0.1	0.02	0.01	0.05
47824	1.38	30	395	1.66	38	178	3.16	0.25	11	0.82	622	0.07	36.6	960	0.03	76.1	0.07	56	78	11	0.14	8	0.6	0.14	0.33	27.7
47825	1.72	20	470	1.2	42	139	3.71	0.31	16	1.07	849	0.05	48.7	870	0.06	71.3	0.05	60	112	12.9	0.18	9	0.9	0.21	0.43	33.9
50982	1.99	30	414	1.64	47	73.3	4.12	0.35	18	1.39	864	0.05	57.3	1070	0.09	84	0.06	66	137	14.6	0.21	12	1.1	0.23	0.57	38.1
50983	1	40	206	1.52	18	71.4	2.35	0.19	7	0.63	441	0.05	15	860	0.01	67.4	0.06	46	52	6.7	0.06	3	0.4	0.06	0.17	20.8
50984	1.41	30	310	1.15	32	177	3.12	0.18	10	0.67	536	0.06	27.7	820	0.03	57.5	0.09	60	72	8	0.13	6	0.5	0.15	0.21	25.4
50985	1.26	40	184	1.69	5	1190	2.99	0.38	8	0.86	587	0.08	3.9	990	0.11	87.8	0.05	62	82	2.6	1.27	1	0.5	0.07	0.13	34.2
50986	1.08	30	144	1.19	7	4320	2.75	0.59	5	0.75	400	0.08	4.8	770	0.44	92.5	0.08	68	71	2.1	0.63	<1	0.4	0.22	0.36	28.4
50987	1.93	30	93	2.3	7	120	2.5	0.19	13	0.81	552	0.14	6	670	0.02	191	<0.01	38	63	1.5	0.04	2	0.9	<0.02	0.03	20
50988	1.35	40	109	1.03	7	697	2.59	0.19	14	0.79	386	0.09	3.5	680	0.45	61.5	0.06	46	47	1	0.11	<1	0.5	<0.02	0.05	11.8
50989	1.27	50	383	0.73	7	1650	2.96	0.77	5	0.6	464	0.09	4.5	650	0.05	38.3	0.14	67	73	1.7	0.27	<1	0.2	0.16	0.07	21.1
50990	1.28	30	114	1.67	7	10	2.67	0.18	10	0.71	634	0.09	3.7	730	<0.01	84.7	0.02	42	65	1.5	0.01	<1	0.5	<0.02	0.02	18.2
50991	1.63	30	125	2.06	6	11.4	2.86	0.2	11	0.82	623	0.07	3.9	870	<0.01	158	0.01	45	64	2.4	0.01	1	0.8	<0.02	0.04	21.5
50992	1.29	40	402	0.7	7	31.1	2.6	0.8	7	0.69	482	0.11	4	660	0.01	42.4	0.14	57	56	1.1	0.02	<1	0.2	<0.02	0.02	26.7
50993	1.15	40	288	0.8	6	3280	2.64	0.8	4	0.74	398	0.09	3.5	750	0.26	78.4	0.12	71	80	1.9	0.76	<1	0.3	0.24	0.32	28.1
51026	0.8	50	243	0.8	9	1800	2.64	0.46	3	0.45	492	0.1	5.6	500	0.17	50.1	0.07	45	64	1.8	0.34	<1	0.2	0.07	0.12	14.8
51027	1.42	40	354	1.68	35	302	3.15	0.27	11	0.87	612	0.08	33.5	990	0.07	79.2	0.09	59	76	11.4	0.15	6	0.6	0.13	0.33	28.9
51028	1.11	30	227	0.73	12	110	2.82	0.53	6	0.66	587	0.12	6.6	590	0.04	74.2	0.13	46	67	1.3	0.04	<1	0.2	<0.02	0.01	20.8
51029	1.42	30	146	1.66	7	3180	2.93	0.33	11	0.79	686	0.07	4.4	840	0.37	66	0.04	55	82	2.1	0.81	<1	0.5	0.07	0.26	22.3
51030	1.19	30	314	0.44	8	1330	3.25	0.65	6	0.6	485	0.08	4.6	700	0.01	33.9	0.11	61	84	1.8	0.29	<1	0.3	0.07	0.09	27.3
51031	1.22	40	154	1.35	12	59	3.08	0.26	8	0.69	635	0.08	8.9	640	<0.01	65.3	0.03	41	64	1.4	0.03	1	0.4	<0.02	0.03	22.9
51032	1.25	40	257	1.51	8	2480	2.84	0.3	9	0.69	482	0.08	3.9	670	0.37	79.6	0.06	50	67	1.7	0.51	<1	0.4	0.06	0.37	18.6
51033	1.25	50	283	0.65	9	221	2.5	0.64	7	0.73	506	0.1	4.7	560	0.02	80.7	0.14	46	66	1.1	0.06	<1	0.2	0.02	0.02	16.7
51034	1.39	30	382	1.07	30	135	2.95	0.28	10	0.7	607	0.07	29.9	840	0.03	67.3	0.07	51	71	13.4	0.12	6	0.7	0.11	0.27	27.4
51035	1.18	30	251	1.72	7	3370	2.98	0.64	5	0.73	415	0.07	3.9	740	0.83	82.1	0.1	62	51	2	0.5	<1	0.3	0.11	0.14	35.5
51036	1.27	40	276	1.64	8	1200	2.82	0.41	8	0.75	524	0.08	3.9	760	0.17	99.7	0.06	55	66	1.7	0.31	<1	0.4	0.08	0.08	24.1
51037	1.38	40	474	0.95	7	62.9	2.39	0.85	7	0.78	421	0.1	4.3	910	<0.01	55.4	0.15	72	55	0.9	0.05	<1	0.1	<0.02	0.09	16.1
51038	1.18	30	63	1.6	6	17.3	2.24	0.11	11	0.74	475	0.06	3.1	600	<0.01	165	<0.01	37	54	1	0.02	<1	0.6	<0.02	0.03	19
51039	1.71	<10	68	5.09	7	7900	10.9	1.05	7	1.12	1040	0.04	6.7	890	>5	206	0.16	138	68	5.2	1.1	1	0.5	0.14	0.24	76.2
51040	1.3	30	328	1.12	16	1720	3.66	0.47	7	0.6	524	0.07	14.3	870	0.08	54.5	0.07	73	78	5.8	0.29	3	0.5	0.09	0.3	31.4
51041	1.36	40	252	1.34	27	545	2.91	0.25	9	0.77	540	0.07	23.6	790	0.08	72.7	0.07	49	67	9	0.21	4	0.5	0.11	0.25	23.2
51042	0.56	30	216	2.07	7	3530	2.91	0.2	2	0.64	517	0.06	4	560	0.58	103	0.02	54	65	2.3	0.78	2	0.3	0.12	0.26	27.6
51043	0.9	40	245	1.66	6	1130	2.57	0.39	4	0.66	475	0.08	4.1	580	0.21	97.7	0.05	49	59	1.6	0.34	<1	0.3	0.03	0.2	23.9
51044	1.14	40	387	2.24	8	941	2.77	0.42	6	0.67	528	0.07	4.1	660	0.19	116	0.05	54	53	1.6	0.31	<1	0.5	<0.02	0.05	37.9
51045	1.19	40	234	1.29	5	1680	2.37	0.38	7	0.6	454	0.06	3.5	600	0.17	52	0.05	45	69	1.4	0.37	<1	0.3	0.07	0.12	27.1
51046	1.19	30	323	1.05	8	96.8	2.84	0.59	6	0.6	540	0.08	4.7	630	<0.01	51.8	0.09	53	67	1.6	0.02	<1	0.4	<0.02	0.05	22.5
51047	1.19	20	305	1.19	8	1380	2.68	0.6	5	0.56	494	0.08	4.3	620	0.11	47.3	0.09	52	67	1.5	0.41	<1	0.3	0.09	0.21	25.1
51048	1.25	40	266	1.31	7	1560	2.54	0.41	7	0.59	484	0.08	4.4	620	0.16	57.6	0.06	47	65	1.5	0.34	<1	0.3	0.06	0.12	26.5
51049	1.24	30	264	0.94	25	377	2.91	0.31	9	0.67	520	0.06	22.8	720	0.02	51.6	0.07	55	72	8.2	0.13	4	0.5	0.1	0.22	29
51050	1.15	40	237	0.7	5	8.5	2.22	0.46	5	0.62	487	0.12	3.5	540	<0.01	69.3	0.13	44	58	1.4	0.02	<1	0.3	<0.02	0.01	17.6
52002	1.2	30	321	1.31	32	52	2.76	0.17	8	0.63	490	0.07	25.5	840	0.03	61.9	0.09	51	55	10.5	0.1	6	0.4	0.1	0.22	23.6
52003	1.37	30	362	2.38	11	2990	4.33	0.87	7	0.76	578	0.1	6.2	700	1.12	182	0.15	65	80	1.8	0.53	<1	0.3	0.14	0.43	30.1
52004	1.25	30	245	1.04	10	63.9	2.74	0.58	7	0.69	561	0.1	5.8	550	0.02	107	0.09	44	63	1.1	0.03	<1	0.2	<0.02	0.05	26.9
52005	1.06	40	268	1.05	10	324	2.81	0.49	6	0.68	596	0.1	5.8	650	0.07	70.7	0.08	48	66	1.5	0.06	<1	0.3	<0.02	0.04	17
52006	0.96	30	227	1.63	8	102	2.59	0.36	5	0.6	638	0.08	4.6	580	0.03	93.7	0.05	41	62	1.7	0.11	<1	0.3	<0.02	0.05	17.6
52007	0.65	30	164	1.43	9	2270	3.03	0.32	3	0.64	475	0.07	7.9	750	0.25	104	0.04	48	63	2	0.46	1	0.4	0.08	0.18	25.3
52008	0.43	30	161	2.91	6	8.9	2.22	0.08	1	0.54	587	0.07	4.1	570	0.01	167	<0.01	40	54	2.1	0.02	<1	0.6	<0.02	0.05	22.7
52009	1.15	20	269	0.71	9	305	2.61	0.5	9	0.72	487	0.09	5.1	480	0.03	109	0.09	41	67	0.9	0.09	<1	0.2	0.04	0.04	19.1
52010	1.29	20	508	1.78	6	90.8	2.66	0.21	8	0.74	608	0.07	4	850	0.03	264	0.02	42	73	1.5	0.05	<1	0.5	0.02	0.02	34.2
52011	1.18	30	282	1.45	6	935	2.53	0.71	6	0.73	452	0.07	3.5	710	0.24	120	0.12	58	66	1.1	0.16	<1	0.2	0.02	0.17	19.5
52012	1.83	40	501	3.12	6	5180	3.93	1.32	7	1.25	798	0.06	3.4	1230	0.75	280	0.22	107	122	2	0.78	<1	0.3	0.09	0.3	25.3
52013	1.35	20	336	1.36	34	131	3.03	0.23	12	0.88	601	0.04	37	870	0.06	70.3	0.06	53	88	11.8	0.13	7	0.7	0.16	0.37	31
52014	1.44	30	561	0.66	8	3200	4.61	1.02	6	0.92	331	0.04	6	1190	0.52	49.4	0.19	119	76	3.5	0.47	3	0.2	0.06	0.11	49.9
52015	1.38	30	666	1.81	8	3540	3.98	1.05	6	0.87	680	0.05	4.5	840	0.19	65.3	0.19	96	99	2.6	1.12	<1	0.3	0.22	0.26	32.6
52016	1.05	30	648	0.86	7	1180	2.81	0.73	5	0.66	521	0.05	3.3	700	0.12	32	0.13	65	78	1.6	0.25	<1	0.2	0.12	0.23	21.4
52017	1.56	30	88	1.53	4	5.8	2.21	0.09	12	0.86	512	0.06	2.6	670	<0.01	118	0.06	44	55	1.6	0.02	2	0.8	<0.02	0.02	10.5
52018	1.38	30	66	2.26	6	11.4	2.25	0.11	10	0.83	560	0.05	7.4	670	<0.01	175	<0.01	33	62	1.3	0.02	2	0.7	<0.02	0.03	20.6
52019	1.24	40	225	0.93	6	49.1	2.6	0.53	7	0.85	529	0.1	4.6	820	0.03	56.7	0.13	57	70	1.6	0.04	<1	0.2	<0.02	0.03	14.2
52020	1	40	107	1.04	5	78.4	2.16	0.22	7	0.71	458	0.07	3.5	660	0.02	72.5	0.07	43	54	1.3	0.04	<1	0.3	<0.02	0.03	18.1
52021	1.01	20	68	3.04	3	1660	2.04	0.12	8	0.58	442	0.03	2.6	630	0.17	94.8	<0.01	28	61	0.9	0.73	<1	0.4	0.37	0.04	19.6
52022	0.94	30	158	1.49	4	304	2.11	0.29	5	0.66	503	0.05	3.1	660	0.04	97.2	0.05	39	58	1.3	0.07	<1	0.4	0.03	0.05	20
52023	0.79	40	205	1.18	4	4170	2.43	0.5	3	0.7	415	0.06	3.1	910	0.33	76.7	0.07	64	73	2	0.59	1	0.3	0.12	0.36	26
52024	1.39	30	455	1.52	4	4570	3.33	1.12	6	0.93	490	0.07	3.3	1020	0.29	71.3	0.19	83	75	1.8	1.38	2	0.2	0.43	0.22	27.6
52025	1.05	40	237	1.17	5	262	2.39	0.53	5	0.66	606	0.08	3.8	650	0.04	66.7	0.08	46	68	1.2	0.08	<1	0.3	<0.02	0.06	17.6
53805	1.48	30	662	3.92	6	4640	3.37	0.94	8	0.97	587	0.05	3.7	550	0.39	191	0.19	79	85	1.9	1.04	<1	0.3	0.24	0.21	29.7
53806	1.09	40	203	1.04	7	97.3	2.24	0.36	6	0.69	495	0.07	3.9	670	0.01	50.4	0.11	48	59	1.3	0.04	<1	0.2	<0.02	0.04	14.3

Sample ID	Al	B	Ba	Ca	Cr	Cu	Fe	K	Li	Mg	Mn	Na	Ni	P	S	Sr	Ti	V	Zn	Zr	Ag	As	Be	Bi	Cd	Ce
	%	ppm	ppm	%	ppm	ppm	%	%	ppm	%	ppm	%	ppm	ppm	%	ppm	%	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
53807	1.04	40	77	1.58	6	29.1	2.17	0.14	7	0.72	505	0.05	5.4	610	<0.01	82.2	0.03	37	56	1.2	0.03	<1	0.5	<0.02	0.02	16.5
53808	1.25	40	373	1.16	8	3990	3.41	0.99	6	0.96	561	0.05	4.6	910	0.29	78.6	0.16	97	112	1.8	0.97	<1	0.4	0.18	0.35	32.1
53809	1.25	30	66	1.49	5	22.9	2.21	0.09	8	0.73	509	0.06	4.3	650	<0.01	68.9	0.05	36	56	1.5	0.02	<1	0.5	<0.02	0.03	12.7
53810	1.01	50	247	0.93	5	74.8	2.26	0.54	5	0.69	550	0.06	3.3	560	<0.01	47.3	0.09	47	65	1.3	0.03	<1	0.3	<0.02	0.03	13.6
53811	1.11	30	294	1.14	5	2510	2.74	0.8	5	0.8	601	0.06	3.4	900	0.13	73.2	0.12	66	81	1.4	0.49	<1	0.3	0.12	0.14	29.2
53812	0.78	30	144	1.29	4	513	2.42	0.33	4	0.64	572	0.05	3	760	0.03	91.3	0.04	44	66	1.8	0.09	2	0.4	0.05	0.1	22.2
53813	0.93	50	171	1.12	4	219	2.2	0.34	5	0.72	488	0.06	2.8	640	0.02	68.5	0.05	39	65	1.2	0.04	<1	0.4	0.02	0.07	21.2
53814	1.18	30	260	1.33	22	459	2.68	0.27	9	0.74	558	0.05	23.4	820	0.07	63.4	0.07	50	74	8.4	0.16	4	0.5	0.11	0.29	23.4
53815	1.11	40	217	1.02	5	1100	2.35	0.51	7	0.67	597	0.05	3	610	0.07	125	0.09	45	68	1	0.41	<1	0.3	0.38	0.1	18.6
53816	1.53	70	620	1.86	5	2710	3.47	1.07	6	0.89	781	0.07	1.6	910	0.38	119	0.19	79	98	1.1	0.51	<1	0.3	0.08	0.39	32.6
53817	1.17	60	285	0.72	6	415	2.31	0.66	6	0.67	527	0.08	2.1	610	<0.01	84.8	0.12	53	65	0.8	0.18	<1	0.2	0.07	0.09	13.5
53819	1.61	60	438	1.03	5	2110	3.01	1.09	7	0.94	499	0.07	1.6	830	0.27	119	0.19	83	72	0.8	0.42	<1	0.2	0.09	0.14	23.7
53820	1.42	50	396	0.73	6	54.5	2.45	0.85	7	0.77	481	0.08	2	770	<0.01	102	0.14	59	59	<0.5	0.02	<1	0.2	<0.02	0.01	14.3
53821	1.64	80	357	1.37	29	1250	3.38	0.33	11	0.88	669	0.07	27.6	1070	<0.01	79.9	0.1	67	101	9.6	0.43	7	0.6	0.22	0.42	31.5
53822	1.56	70	331	1.56	25	890	3.14	0.34	10	0.86	699	0.09	21.6	1060	<0.01	87	0.1	63	231	10.2	0.42	7	0.6	0.17	0.77	30.8
53823	1.23	70	279	0.83	4	>10000	4.59	0.65	6	0.74	633	0.06	0.7	440	0.87	84.2	0.11	67	170	<0.5	3.71	<1	0.2	1.82	0.9	29.8
53824	1.64	80	359	1.72	5	2360	3	0.86	8	1.07	531	0.07	1.8	1460	0.28	155	0.14	85	92	1.1	0.47	<1	0.2	0.11	0.88	32.9
58325	1.49	70	391	1.14	28	310	2.97	0.34	10	0.73	658	0.06	26.1	870	<0.01	66.7	0.09	59	77	10.2	0.16	6	0.5	0.15	0.29	29.4
54351	1.34	70	197	1.04	6	2450	3	0.38	8	0.74	549	0.06	3.1	910	0.1	52.5	0.06	60	69	1.3	0.6	<1	0.3	0.16	0.19	28
54352	1.42	50	212	1.9	6	888	2.46	0.16	10	0.7	445	0.05	2	680	<0.01	97.3	<0.01	39	58	<0.5	0.33	<1	0.7	0.25	0.02	32.3
54353	1.68	60	368	0.97	6	111	2.9	0.43	15	0.92	668	0.06	2.5	910	<0.01	63.8	0.07	59	67	0.9	0.02	<1	0.4	<0.02	0.05	19.8
54354	0.55	60	87	1.61	4	2470	2.69	0.16	2	0.65	371	0.05	1.4	910	0.52	104	<0.01	46	55	1.2	0.37	<1	0.5	0.09	0.1	28.1
54355	0.96	40	154	1.68	5	78.8	2.53	0.23	6	0.65	629	0.07	3	790	0.02	91.1	0.03	48	76	1.2	0.03	<1	0.5	<0.02	0.04	24.8
54356	1.12	60	184	1.14	5	1450	2.69	0.64	4	0.66	535	0.07	1.5	930	0.02	78.9	0.09	72	73	2.2	0.29	<1	0.4	0.12	0.15	35.7
54357	1.29	60	502	0.99	8	1810	2.89	0.91	6	0.68	555	0.07	2.8	580	0.2	105	0.16	60	82	<0.5	0.51	<1	0.1	0.06	0.17	15
54358	1.01	80	241	0.97	7	1030	2.28	0.51	4	0.55	522	0.1	2.9	590	0.05	116	0.09	52	62	0.9	0.3	<1	0.2	0.06	0.35	16.2
54361	1.55	70	53	1.44	10	216	2.23	0.13	12	0.79	472	0.06	12.4	770	<0.01	136	0.03	41	66	2.2	0.08	6	0.7	0.06	0.02	28.1
54362	1.04	80	178	1.05	5	3620	3.07	0.63	3	0.74	528	0.08	2	1280	0.28	68.4	0.09	73	98	1.7	0.64	<1	0.4	0.29	0.23	33.4
54363	1.05	70	176	0.98	5	209	2.22	0.34	6	0.65	548	0.09	2.3	610	<0.01	86.1	0.09	46	64	1.1	0.08	<1	0.3	0.1	0.08	17.5
54364	1.37	80	455	1.39	5	1610	2.8	0.75	6	0.7	526	0.11	2.5	650	0.15	110	0.12	62	73	0.7	0.38	<1	0.2	0.07	0.93	23.9
54365	1.36	70	395	1.26	6	1530	2.86	0.72	6	0.8	627	0.1	2.9	770	0.06	110	0.14	70	80	1.1	0.46	<1	0.3	0.06	0.12	31.3
54366	1.34	60	405	0.78	5	331	2.92	0.83	6	0.76	653	0.1	2.2	750	<0.01	59.5	0.15	61	75	0.8	0.13	<1	0.2	0.06	0.12	27.4
54367	1.45	70	186	1.19	4	8440	3.5	0.57	8	0.82	750	0.08	1.2	710	0.65	72.8	0.09	51	165	0.8	1.65	<1	0.3	0.6	0.48	18.4
54368	1.54	70	388	1.42	6	1150	3.12	0.86	7	0.81	632	0.08	2.3	960	0.16	141	0.14	71	84	0.6	0.27	<1	0.3	0.04	0.1	23.2
54369	1.28	70	180	1.15	6	196	2.66	0.42	8	0.81	676	0.1	2.6	950	<0.01	113	0.08	53	73	0.9	0.08	<1	0.4	0.03	0.08	26.7
54372	1.22	80	344	1.24	9	942	2.82	0.62	5	0.62	513	0.09	5	880	0.02	57.2	0.11	61	57	2.1	0.22	1	0.3	0.05	0.11	37.5
54373	1.19	70	277	0.98	9	511	2.46	0.4	7	0.66	576	0.07	3.9	640	<0.01	45.5	0.06	49	65	0.6	0.1	<1	0.2	0.03	0.04	33
54374	1.43	70	306	0.99	8	71.5	3.14	0.56	9	0.84	568	0.08	2.7	730	<0.01	60.8	0.1	68	75	<0.5	0.04	<1	0.3	<0.02	0.02	8.91
54411	1.4	70	379	1.11	32	131	2.93	0.31	9	0.69	559	0.06	27.9	860	<0.01	62.5	0.07	57	72	8.7	0.16	6	0.5	0.12	0.25	30.7
54412	0.67	60	257	2.1	19	1080	2.12	0.31	1	0.27	525	0.06	7.3	720	0.05	42.5	0.04	43	46	1.4	0.2	1	0.4	0.07	0.32	28.4
54413	1.16	60	292	0.83	6	1020	2.83	0.56	5	0.58	493	0.07	2.6	700	<0.01	37.3	0.09	57	72	0.9	0.16	<1	0.3	0.03	0.05	25.1
54414	1.38	70	604	1.66	5	4890	3.49	0.65	4	0.69	643	0.06	2.4	710	0.04	50.7	0.11	78	88	2.2	0.93	<1	0.2	0.18	0.49	42.7
54415	1.55	70	177	1.1	6	158	2.74	0.26	13	0.9	622	0.1	2.3	780	<0.01	64.7	0.09	55	68	0.6	0.06	<1	0.5	<0.02	0.07	23.4
54416	1.63	60	554	1.27	8	1350	3.29	1.03	7	0.81	620	0.1	3.7	930	0.07	145	0.18	76	96	0.6	0.33	<1	0.3	0.03	0.24	28.3
54417	1.21	70	220	0.96	6	160	2.59	0.54	7	0.73	634	0.11	2.9	670	<0.01	133	0.1	54	68	1	0.05	<1	0.3	<0.02	0.05	24.1
54418	1.26	70	320	0.89	6	423	2.59	0.76	6	0.71	535	0.13	2.5	830	<0.01	72.8	0.14	59	63	0.9	0.11	<1	0.2	0.04	0.18	31.8
54419	1.3	40	244	0.89	7	70.6	2.68	0.6	6	0.77	618	0.15	4.5	740	0.03	58.1	0.17	57	66	1.9	0.04	<1	0.3	<0.02	0.04	16.4
54420	1.47	40	358	1.51	37	62.6	2.93	0.24	11	0.81	575	0.07	33.4	1030	0.04	72.7	0.09	59	75	11.1	0.11	7	0.6	0.13	0.33	30.5
54421	1.44	10	95	3.33	7	4680	7.14	0.68	6	0.77	735	0.05	5.5	500	4.68	124	0.12	96	67	3.1	0.44	1	0.4	0.04	0.2	43.5
54422	1.43	40	79	1.8	10	514	2.53	0.16	14	0.74	443	0.07	5	590	0.08	93	<0.01	40	60	0.9	0.19	<1	0.5	0.09	0.06	9.53
54423	1.25	50	59	2.33	5	1460	2.35	0.13	11	0.71	502	0.08	3.9	830	0.17	107	<0.01	45	72	1.3	0.38	1	0.4	0.1	0.12	27.6
54424	0.91	40	350	1.78	5	2400	2.28	0.33	4	0.56	349	0.07	3.4	800	0.39	69.1	0.04	47	57	2.1	0.47	1	0.3	0.09	0.15	32.4
54425	0.99	40	182	1.64	5	1790	2.65	0.33	4	0.78	479	0.08	3.4	940	0.35	94.1	0.04	56	65	2.4	0.35	<1	0.4	0.05	0.2	29.8
54751	0.97	50	291	1.18	6	186	2.21	0.49	4	0.41	415	0.07	4.3	540	0.02	33.8	0.08	44	49	1.8	0.04	<1	0.3	<0.02	0.05	22.3
54752	1.46	40	386	0.74	6	3720	3.57	0.88	5	0.78	362	0.05	4	1170	0.22	27.9	0.15	93	70	2	0.49	<1	0.3	0.08	0.17	42.9
54753	0.84	40	129	0.32	5	4240	3.87	0.26	2	0.22	287	0.05	3.8	780	0.08	39.7	0.03	56	64	2.5	0.63	<1	0.2	0.12	0.21	41.1
54754	0.95	50	228	0.6	5	2260	2.43	0.36	3	0.31	420	0.06	3.1	680	0.03	24.7	0.05	47	59	2	0.43	<1	0.2	0.1	0.14	16.2
54755	0.91	50	270	0.87	8	41.5	1.83	0.43	4	0.42	334	0.06	4	470	<0.01	27.4	0.07	33	47	0.8	0.01	<1	0.2	<0.02	0.02	10.2
54756	1.09	40	161	2.24	6	5750	4.09	0.22	6	0.53	419	0.05	4.9	830	2.2	133	0.02	64	69	2.6	0.6	<1	0.3	0.16	0.32	45.5
54757	1.33	50	390	1.05	6	223	2.75	0.61	7	0.78	652	0.09	3.7	680	0.03	94.3	0.12	57	73	1.4	0.1	<1	0.3	0.05	1	27.9
54758	1.59	50	428	0.9	8	2900	3.39	0.89	8	0.88	646	0.08	4.4	810	0.32	119	0.15	66	106	1.3	0.58	<1	0.3	0.08	0.26	36.4
54759	1.18	50	110	1.69	7	14.9	2.18	0.19	8	0.64	527	0.07	3.6	500	<0.01	88.4	0.02	35	58	1.1	0.01	<1	0.4	<0.02	0.04	24.9
54760	1.19	50	253	1.18	7	119	2.37	0.49	6	0.69	536	0.08	5.4	640	0.01	89.3	0.13	53	66	1.5	0.04	<1	0.3	<0.02	0.03	19.1
54761	1.38	30	279	1.36	7	2390	2.92	0.58	7	0.8	624	0.08	3.8	710	0.27	148	0.11	65	91	1.5	0.71	<1	0.3	0.08	0.2	19.1
54762	1.47	40	87	1.81	5	4980	3.05	0.19	10	0.84	604	0.08	3.8	730	0.48	247	0.02	52	102	1.1	1.54	<1	0.4	0.35	0.42	29.8
54763	1.14	40	613	1.48	5	1280	2.36	0.43	6	0.58	498	0.06	3.3	670	0.39	84.7	0.07	44	58	1.2	0.21	<1	0.3	0.02	0.13	32.2
54764	1.05	50	217	1.54	5	41.5	2.41	0.49	5	0.7	668	0.08	3.3	570	0.01	144	0.08	47	63	1.3	0.02	<1	0.2	<0.02	0.04	22.4
54765	1.19	40	185	1.12	6	1410	2.5	0.43	6	0.72	571	0.09	3.5	630	0.11	86.9	0.09	45	67	1.3	0.34	<1	0.3	0.13	1.05	18.8
54766	1.53	50	160	1.15	5	474	2.55	0.25	12	0.89	501	0.06	3.3	760	0.06	61.9	0.05	49	65	0.8	0.12	<1	0.4	<0.02	0.04	32.6
54767	1.08	50	197	1.71	6	1930	2.25	0.35	5	0.66	366	0.06	4	710	0.29	121	0.05	51	56	1.3	0.52	<1	0.3	0.13	0.13	23.1
54768	1.3	40	115	1.28	5	733	2.42	0.16	12	0.77	520	0.06	2.8	630	0.13	70.2	0.01	42	55	1.2	0.2	<1	0.4	0.08	0.06	26.7
54769	1.27	50	316	1.67	26	382	2.73	0.27	8	0.74	530	0.07	23.5	950	0.03	71.8	0.1	56	64	8.4	0.15	6	0.4	0.09	0.23	25.4
54770	1.32	50	329	0.74	7	299	2.75	0.85	7	0.83	641	0.11	4.4	750	0.04	83.5	0.17	57	82	1.4	0.07	<1	0.2	<0.02	0.02	22
54771	1.32	40	314	0.94	7	221	2.67	0.73	6	0.76	564	0.09	4.3	780	0.04	111	0.12	53	73	1.1	0.06	<1	0.2	<0.02	0.08	27
54772	1.46	50	368	1.79	7	2530	3.29	0.94	7	0.91	510	0.08	4.1	840	0.79	117	0.15	84	68	1.5	0.29	<1	0.2	0.06	0.23	32.2
54773	1.27	50	423	2	6	3780	2.98	0.76	6	0.76	464	0.07	4.1	740	0.69	179	0.13	67	67	1.4	0.81	<1	0.2	0.31	0.34	22.1
54774	1.49	40	257	1.09	6	955	2.49	0.64	11	0.9	433	0.08	3.8	1010	0.13	150	0.11	62	64	0.9	0.23	<1	0.3	0.08	0.05	7.28
54775	1.31	40	348	0.63	7	269	2.32	0.8	6	0.67	340	0.11	3.6	510	0.15	91.8	0.16	57	39	0.8	0.05	<1	0.2	<0.02	0.02	20
Duplicates																										
51028	1.2	50	228	0.74	12	113	2.84	0.54	6	0.71	589	0.12	6.4	600	0.04	74.3	0.13	46	67	1.3	0.04	<1	0.2	<0.02	0.02	21.4
51048	1.17	30	251	1.24	7	1520	2.44	0.38	7	0.56	465	0.07	4.3	610	0.15	53.9	0.06	43	64	1.5	0.3	<1	0.3	0.06	0.11	25.4
54369	1.28	60	180	1.15	6	189	2.64	0.41	8	0.8	673	0.1	2.3	970	<0.01	113	0.08	53	72	0.9	0.06	<1	0.3	0.03	0.07	29.4
54757	1.33	50	396	1.07	6	232	2.76	0.61	7	0.78	657	0.08	3.9	700	0.02	95.5	0.12	57	74	1.4	0.09	<1	0.3	0.06	1.11	27.7
QC																										
CH4	1.84	30	316	0.6	113	2110	4.77	1.42	13	1.22	308	0.05	52.6	710	0.65	9	0.21	83	202	10.2	1.98	8	<0.1	0.56	1.02	27
CH4	1.82	30	298	0.58	109	2130	4.71	1.42	13	1.19	303	0.05	50.1	690	0.68	8.7	0.2	79	206	8.8	1.95	7	0.1	0.47	1.02	27.4
CH4	1.89	80	309	0.6	112	2000	4.91	1.47	13	1.22	340	0.07	49.7	750	0.57	10.5	0.22	82	215	16	2.46	9	<0.1	0.56	1.17	30.6
CH4	1.92	40	326	0.64	117	2100	4.8	1.45	13	1.24	321	0.08	51.8	730	0.68	10.3	0.23	86	199	18.4	1.98	8	<0.1	0.65	1.09	28.2
Certified Values	1.85	#N/A	293	0.61	103.8	2000	4.79	1.43	12.6	1.18	324	0.06	49.57	719	0.73	9.38	0.21	79.27	189.4	9	2.13	8.14	0.11	0.51	1.17	28.18
Tolerance (%)	11.35	#N/A	14.3	14.1	12.4	10.1	10.52	11.74	29.84	12.3	11.5	50.3	12.52	27.4	13.4	23.3	23.3	13.2	11.3	17.7	10.9	13.1	241.3	19.7	12.1	10.4

Sample ID	Co ppm	Cs ppm	Ga ppm	Ge ppm	Hf ppm	Hg ppm	In ppm	La ppm	Lu ppm	Mo ppm	Nb ppm	Pb ppm	Rb ppm	Sb ppm	Sc ppm	Se ppm	Sn ppm	Ta ppm	Tb ppm	Te ppm	Th ppm	Tl ppm	U ppm	W ppm	Y ppm	Yb ppm
Method Co	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B
LOD	0.1	0.05	0.1	0.1	0.05	0.01	0.02	0.1	0.01	0.05	0.05	0.2	0.2	0.05	0.1	1	0.3	0.05	0.02	0.05	0.1	0.02	0.05	0.1	0.05	0.1
47824	12.1	1.07	4.6	<0.1	0.3	0.05	0.03	13.7	0.13	2.68	0.66	7.4	13.2	0.47	5.9	<1	0.5	<0.05	0.39	<0.05	4.3	0.15	0.84	0.3	10.3	0.9
47825	15.3	1.66	5.7	<0.1	0.31	0.07	0.04	16.8	0.16	2.47	0.6	14.5	17.4	0.55	7.1	<1	0.7	<0.05	0.47	<0.05	5.9	0.2	1.29	0.2	11.8	1
50982	17.7	2.06	6.4	<0.1	0.36	0.1	0.04	18.8	0.18	2.56	0.54	13	19.6	0.68	8	<1	0.7	<0.05	0.54	<0.05	6.5	0.22	1.66	0.2	13.7	1.1
50983	7.9	0.48	3.7	<0.1	0.19	0.03	<0.02	11.1	0.1	1.69	0.4	10.8	9.2	0.22	4.2	<1	0.4	<0.05	0.26	<0.05	3.4	0.08	0.5	0.1	7.47	0.7
50984	10.1	0.59	4.7	<0.1	0.15	0.03	0.03	12.9	0.12	2.75	1.75	9.8	10.5	0.34	5.6	<1	0.5	<0.05	0.36	<0.05	3.4	0.1	0.82	0.3	9.2	0.8
50985	7.8	0.45	6	<0.1	0.08	0.01	0.04	18.4	0.15	10.5	0.14	4.2	19.8	<0.05	5.9	<1	0.6	<0.05	0.38	<0.05	5.4	0.15	0.38	0.1	10.6	0.9
50986	7.6	0.65	5.6	<0.1	0.06	<0.01	0.09	15.3	0.14	21.4	0.32	4.8	33	<0.05	6.7	2	0.8	<0.05	0.37	0.07	6.5	0.28	0.55	0.6	10	0.9
50987	6.3	0.24	7.8	<0.1	<0.05	<0.01	0.03	10.5	0.11	2.46	0.07	3.5	7.6	<0.05	4.8	<1	0.5	<0.05	0.28	<0.05	1.9	0.04	0.3	<0.1	8.19	0.7
50988	6.8	0.22	6.4	<0.1	<0.05	<0.01	<0.02	6.1	0.06	2.17	0.23	6.1	8.5	<0.05	4.3	<1	0.8	<0.05	0.18	<0.05	1.5	0.05	0.24	0.2	4.77	0.4
50989	6.7	0.48	5.4	<0.1	<0.05	0.01	0.06	11.6	0.08	4.01	0.52	2.5	35.5	<0.05	4.8	<1	0.8	<0.05	0.22	<0.05	3.2	0.24	0.28	0.2	6.03	0.5
50990	6.6	0.22	6.8	<0.1	<0.05	<0.01	0.02	9.6	0.12	1.47	0.12	3.5	7.4	<0.05	4.9	<1	0.5	<0.05	0.27	<0.05	1.7	0.04	0.31	<0.1	8.64	0.8
50991	7.6	0.26	7.9	<0.1	0.05	<0.01	<0.02	10.5	0.18	1.6	<0.05	4.8	7.2	<0.05	4.6	<1	0.5	<0.05	0.41	<0.05	1.9	0.04	0.28	<0.1	12.6	1.2
50992	5.9	0.4	6	<0.1	<0.05	<0.01	0.02	15	0.06	1.69	0.42	1.8	33.5	<0.05	5.5	<1	0.7	<0.05	0.23	<0.05	3.6	0.22	0.18	0.3	4.98	0.4
50993	6.4	0.75	5.8	<0.1	0.06	0.04	0.08	14.8	0.09	6.56	0.26	2.3	39.9	<0.05	6.3	2	0.8	<0.05	0.37	0.13	5.6	0.29	0.33	0.2	8.08	0.6
51026	5.8	0.35	4.2	<0.1	0.05	<0.01	0.06	7.9	0.06	6.27	1.26	2.4	20	<0.05	3.1	<1	0.6	<0.05	0.18	<0.05	2.4	0.13	0.43	0.8	4.63	0.4
51027	11.3	1.13	4.9	<0.1	0.29	0.05	0.03	14.3	0.13	2.81	0.54	7.3	13.8	0.45	5.8	<1	0.6	<0.05	0.41	<0.05	4.3	0.14	0.95	0.4	10.8	0.9
51028	6.6	0.28	5.1	<0.1	<0.05	<0.01	<0.02	10.8	0.05	3.75	1.82	14.1	20.8	<0.05	3.3	<1	0.5	<0.05	0.17	<0.05	2.8	0.14	0.2	0.9	4.19	0.4
51029	7.1	0.34	7.2	<0.1	<0.05	<0.01	0.1	12	0.08	14.7	0.19	3.9	15.7	<0.05	4.2	2	1.1	<0.05	0.24	0.07	2	0.13	0.27	0.1	6.42	0.5
51030	7.9	0.49	6	<0.1	<0.05	<0.01	0.06	15	0.1	3.31	0.5	2.7	32	<0.05	5	<1	0.9	<0.05	0.3	<0.05	2.9	0.2	0.27	0.2	8.15	0.6
51031	7.7	0.22	6.3	<0.1	<0.05	<0.01	0.02	12.3	0.09	1.86	0.21	4.2	11.7	<0.05	5.1	<1	0.5	<0.05	0.23	<0.05	2.7	0.07	0.32	<0.1	6.38	0.6
51032	8.2	0.27	5.8	<0.1	<0.05	<0.01	0.06	9.8	0.07	12.4	0.25	3.2	12.5	<0.05	3.4	2	0.7	<0.05	0.24	0.07	1.3	0.08	0.21	<0.1	6.56	0.5
51033	5.8	0.29	5.4	<0.1	<0.05	<0.01	<0.02	9.1	0.04	2.17	0.57	2.3	26.7	<0.05	2.8	<1	0.4	<0.05	0.13	<0.05	2.1	0.17	0.22	0.5	3.32	0.3
51034	10.5	1.09	4.7	<0.1	0.31	0.03	0.03	13.4	0.13	3.22	0.48	6.7	13.9	0.39	5.6	<1	0.6	<0.05	0.37	<0.05	4.1	0.13	0.81	0.3	9.69	0.8
51035	9.8	0.42	5.2	<0.1	<0.05	<0.01	0.12	19.9	0.12	31.3	0.31	4.2	27.4	<0.05	5.1	2	1.4	<0.05	0.38	<0.05	3.5	0.22	0.57	0.3	9.9	0.8
51036	7.3	0.31	6.3	<0.1	<0.05	<0.01	0.05	12.9	0.11	10.1	0.24	3.4	17.6	<0.05	4.9	<1	0.8	<0.05	0.31	<0.05	2.1	0.11	0.3	<0.1	8.5	0.7
51037	6	0.39	5.8	<0.1	<0.05	<0.01	<0.02	8.4	0.06	1.89	0.3	2.3	34.8	<0.05	3.6	<1	0.8	<0.05	0.2	<0.05	1.3	0.21	0.12	0.4	5.38	0.4
51038	5.6	0.23	6.1	<0.1	<0.05	<0.01	<0.02	9.5	0.09	1.33	0.06	3.1	5.6	<0.05	3.8	<1	0.4	<0.05	0.24	<0.05	2	0.03	0.28	<0.1	7.22	0.6
51039	64.1	0.62	8.3	0.2	0.12	<0.01	0.04	40.1	0.29	251	0.49	6	41.4	<0.05	7.9	11	2.6	<0.05	1.19	0.36	1.4	0.3	0.99	0.3	33.9	2
51040	11.1	0.79	5.3	<0.1	0.14	0.02	0.07	15.9	0.15	8.65	0.55	5.6	22.7	0.14	6.7	1	1	<0.05	0.43	<0.05	2.8	0.17	0.68	0.2	11.9	1
51041	9.6	0.77	4.6	<0.1	0.23	0.03	0.03	12	0.11	3.69	0.88	6	12.2	0.3	5.1	<1	0.5	<0.05	0.31	<0.05	3.5	0.11	0.8	0.2	8.28	0.7
51042	8.5	0.23	2.7	<0.1	0.05	<0.01	0.14	14.4	0.1	21.2	0.17	4.2	9.5	<0.05	4	2	0.8	<0.05	0.38	0.09	1.9	0.06	0.53	0.2	9.85	0.7
51043	6.7	0.35	4.1	<0.1	<0.05	<0.01	0.05	12.6	0.1	5.76	0.3	3.6	16	<0.05	4.8	<1	0.7	<0.05	0.31	<0.05	2.3	0.1	0.26	0.2	8.7	0.7
51044	7.5	0.5	5.6	<0.1	<0.05	<0.01	0.06	20.3	0.11	12.4	0.28	3.1	18.7	<0.05	7.3	1	0.8	<0.05	0.39	<0.05	2.9	0.12	0.28	<0.1	9.63	0.7
51045	6	0.25	5.4	<0.1	<0.05	<0.01	0.04	14.3	0.07	7.47	0.15	3.2	17.5	0.26	3.1	1	0.7	<0.05	0.22	<0.05	3	0.11	0.28	0.1	5.53	0.4
51046	7	0.39	5.6	<0.1	0.05	<0.01	0.03	11.8	0.13	2.43	0.26	2.1	25	<0.05	5.4	<1	0.6	<0.05	0.32	<0.05	2.3	0.15	0.26	<0.1	9.22	0.9
51047	6.2	0.35	5.6	<0.1	<0.05	<0.01	0.04	13.3	0.09	5.04	0.26	2.3	25.7	<0.05	4.2	<1	0.6	<0.05	0.25	0.06	3	0.16	0.33	0.3	6.68	0.6
51048	6.4	0.26	5.6	<0.1	<0.05	<0.01	0.05	13.9	0.06	6.86	0.17	3	18.2	<0.05	3.1	<1	0.7	<0.05	0.22	<0.05	2.7	0.11	0.29	0.1	5.62	0.4
51049	10	0.94	4.9	<0.1	0.23	0.02	0.03	15.1	0.12	4	1.06	5.8	16.3	0.33	4.9	<1	0.6	<0.05	0.34	<0.05	3.9	0.14	1.17	0.4	8.98	0.8
51050	5	0.19	4.9	<0.1	0.06	<0.01	<0.02	9.6	0.07	1.32	0.76	2.2	18.5	<0.05	4.1	<1	0.5	<0.05	0.18	<0.05	2.3	0.12	0.2	0.6	4.9	0.4
52002	9.4	0.84	3.9	<0.1	0.3	0.04	0.02	12	0.11	2.92	1.06	8.5	9.5	0.55	4.6	<1	0.5	<0.05	0.35	<0.05	3.5	0.1	0.77	0.5	8.98	0.8
52003	16.8	0.42	6.3	<0.1	<0.05	<0.01	0.03	16.2	0.08	24.9	1.97	2.3	37.3	<0.05	3.5	2	0.6	<0.05	0.28	0.09	3.5	0.24	0.45	1	6.81	0.5
52004	6.1	0.33	5.6	<0.1	<0.05	<0.01	<0.02	14.7	0.06	3.21	1.14	2.3	24.8	<0.05	3.1	<1	0.5	<0.05	0.19	<0.05	3.7	0.16	0.35	0.9	4.57	0.4
52005	6.8	0.43	5	<0.1	0.05	<0.01	0.03	9.2	0.09	3.6	0.98	1.8	21.6	<0.05	3.6	<1	0.5	<0.05	0.22	<0.05	1.5	0.13	0.28	0.5	6.44	0.6
52006	6.7	0.58	4.6	<0.1	0.07	<0.01	0.03	9.1	0.13	2.72	0.51	1.8	15.6	<0.05	4.6	<1	0.5	<0.05	0.32	<0.05	1.5	0.09	0.38	0.5	9.88	0.9
52007	7.8	0.37	3.4	<0.1	<0.05	0.01	0.07	13.6	0.1	11.2	0.63	3.9	16.3	<0.05	4.3	1	0.6	<0.05	0.33	<0.05	3.5	0.11	0.28	0.6	8.62	0.7
52008	5.5	0.41	2.3	<0.1	0.06	<0.01	0.03	11.1	0.17	1.93	0.23	3.8	3.9	<0.05	5.3	<1	0.6	<0.05	0.41	<0.05	1.5	0.02	0.22	0.3	12.3	1.1
52009	6.2	0.29	5.6	<0.1	<0.05	<0.01	<0.02	10.2	0.03	2.32	1	1.8	22.8	<0.05	1.5	<1	0.4	<0.05	0.11	<0.05	2.5	0.14	0.15	1.1	2.45	0.2
52010	6.2	0.31	6.8	<0.1	<0.05	<0.01	0.03	18.3	0.09	1.72	0.42	4.8	10	<0.05	3.6	<1	0.5	<0.05	0.3	<0.05	6.1	0.05	0.24	0.2	7.5	0.6
52011	6.6	0.39	5.7	<0.1	<0.05	<0.01	0.05	10.3	0.07	4.32	1.59	2.6	32.6	0.35	3.3	<1	0.9	<0.05	0.23	<0.05	1.7	0.23	0.29	0.5	6.19	0.5
52012	10.2	0.62	8.2	<0.1	<0.05	<0.01	0.18	12.7	0.11	20.5	3.13	2.4	57.9	0.31	3.4	3	1.3	<0.05	0.4	0.1	0.7	0.39	0.27	0.5	10.2	0.7
52013	12.4	1.7	4.4	<0.1	0.3	0.06	0.03	15.6	0.13	3.16	0.75	8.9	14.1	1.18	5.5	<1	0.6	<0.05	0.42	<0.05	5	0.17	1.18	0.3	10.8	0.9
52014	14.1	0.76	6.7	<0.1	0.09	<0.01	0.28	26.7	0.14	19.3	1.19	3.3	47.9	0.3	7.5	1	2	<0.05	0.56	0.14	4.6	0.38	0.58	0.3	12.6	0.9
52015	10.6	0.63	6.3	<0.1	0.06	<0.01	0.18	19.3	0.09	63.2	1.23	4.2	47.1	0.47	4.6	2	0.8	<0.05	0.28	0.14	3.1	0.29	0.58	0.4	7.84	0.5
52016	7.2	0.54	5	<0.1	<0.05	<0.01	0.08	11.8	0.12	8.09	1.31	2.6	38.1	0.41	5.6	<1	1	<0.05	0.3	0.07	1.9	0.25	0.45	0.4	9.62	0.7
52017	5.5	0.16	7.7	<0.1	0.07	<0.01	<0.02	5.9	0.08	1.22	0.4	5.4	3.7	0.52	3.6	<1	0.5	<0.05	0.17	<0.05	1	<0.02	0.2	0.2	5.4	0.5
52018	6.2	0.18	6.4	<0.1	<0.05	<0.01	0.02	10.6	0.14	1.04	0.17	4.8	4.9	0.41	3.5	<1	0.4	<0.05	0.33	<0.05	2	0.03	0.41	0.2	9.99	0.9
52019	7.1	0.3	5.7	<0.1	0.07	<0.01	<0.02	7.9	0.08	1.6	1.09	2.2	23.1	0.37	4.5	<1	0.5	<0.05	0.18	<0.05	1.4	0.14	0.24	1.3	5.38	0.5
52020	5.6	0.17	5	<0.1	0.06	<0.01	<0.02	10.3	0.09	3.41	0.76	2.7	9.6	0.64	3.7	<1	0.5	<0.05	0.21	<0.05	2.5	0.05	0.19	0.8	5.95	0.5
52021	4.6	0.43	5.5	<0.1	<0.05	<0.01	0.03	11.6	0.06	1.42	0.08	5.5	7.3	0.47	2.3	1	0.5	<0.05	0.15	0.12	2	0.03	0.16	0.2	4.48	0.4
52022	5.8	0.26	4.6	<0.1	0.05	<0.01	0.03	10.3	0.14	4.74	0.34	2.5	13.3	0.52	4.2	<1	0.5	<0.05	0.36	<0.05	2.6	0.08	0.27	0.2	10.4	0.9
52023	6.6	0.55	4.1	<0.1	0.06	0.01	0.07	14.1	0.12	14.9	0.58	3.3	26.7	0.26	5.7	2	0.7	<0.05	0.34	<0.05	5.2	0.18	0.47	1	9.13	0.8
52024	8.3	0.7	6.3	<0.1	<0.05	<0.01	0.07	14.5	0.09	3.04	3.01	2.9	50.4	0.74	5.9	3	0.7	<0.05	0.31	0.18	6.5	0.29	0.75	1.5	8.34	0.6
52025	6.5	0.33	4.8	<0.1	0.05	<0.01	0.03	9.3	0.11	2.61	0.67	2.1	22.5	0.87	4.2	<1	0.6	<0.05	0.27	<0.05	1.7	0.13	0.26	0.6	7.93	0.7
53805	9.7	0.56	7.3	<0.1	<0.05	<0.01	0.11	15.4	0.1	3.64	0.98	6.4	41.2	0.57	4.8	4	1.5	<0.05	0.4	0.24	0.7	0.28	2.85	0.3	10.3	0.7
53806	5.9	0.24	5	<0.1	<0.05	<0.01	<0.02	7.9	0.07	1.94	0.56	2.8	15.2	0.5	3.6	<1	0.5	<0.05	0.18	<0.05	1.5	0.09	0.22	0.4	5.28	0.5

Sample ID	Co ppm	Cs ppm	Ga ppm	Ge ppm	Hf ppm	Hg ppm	In ppm	La ppm	Lu ppm	Mo ppm	Nb ppm	Pb ppm	Rb ppm	Sb ppm	Sc ppm	Se ppm	Sn ppm	Ta ppm	Tb ppm	Te ppm	Th ppm	Tl ppm	U ppm	W ppm	Y ppm	Yb ppm
53807	5.6	0.14	5.7	<0.1	0.05	<0.01	0.02	8.6	0.11	1.44	0.16	3.5	6.4	0.55	3.5	<1	0.5	<0.05	0.25	<0.05	1.6	0.04	0.37	0.1	8	0.7
53808	9.6	0.7	6.8	<0.1	<0.05	0.01	0.09	17.4	0.09	18.3	0.53	3.3	46.3	0.44	6.3	2	1	<0.05	0.32	0.1	5.3	0.28	0.46	0.5	8.28	0.6
53809	5.4	0.17	6.8	<0.1	0.06	<0.01	0.02	6.7	0.09	1.04	0.41	4.5	3.4	0.41	3.5	<1	0.4	<0.05	0.21	<0.05	1.3	<0.02	0.19	0.2	6.61	0.6
53810	5.9	0.4	4.9	<0.1	0.07	<0.01	0.03	6.8	0.09	1.35	0.35	1.5	22.8	0.44	3.9	<1	0.6	<0.05	0.23	<0.05	1.4	0.13	0.27	0.2	6.99	0.6
53811	6.7	0.49	5.4	<0.1	0.07	0.01	0.06	15.6	0.13	2.21	0.62	2.2	35.1	0.31	7.1	<1	0.7	<0.05	0.36	<0.05	4.4	0.2	0.38	0.4	10.3	0.9
53812	6.4	0.66	4.1	<0.1	0.07	0.01	0.04	10.8	0.15	3.56	0.3	3.2	15.9	0.4	6.8	<1	0.6	<0.05	0.42	<0.05	3.5	0.09	0.39	0.3	11.7	1.1
53813	5.8	0.31	4.7	<0.1	<0.05	<0.01	0.03	11.1	0.1	1.7	0.3	3.5	15.4	0.67	4.6	<1	0.5	<0.05	0.27	<0.05	3.1	0.09	0.32	0.1	7.96	0.7
53814	9	1.02	4.8	<0.1	0.23	0.03	0.03	11.8	0.11	2.76	0.67	6.1	14.7	0.76	4.5	<1	0.5	<0.05	0.32	<0.05	3.6	0.14	0.84	0.4	8.77	0.7
53815	5.5	0.29	5.4	<0.1	0.05	<0.01	0.03	9.7	0.08	1.57	0.42	3.3	22.9	0.48	4.9	<1	0.5	<0.05	0.22	0.09	2.4	0.14	0.22	0.2	6.02	0.5
53816	10.2	0.55	7.3	0.1	0.06	0.01	0.09	16.9	0.09	23.5	0.46	2.4	48.4	0.7	3.6	2	0.9	<0.05	0.37	0.06	2	0.32	1.02	0.3	9.42	0.6
53817	6	0.37	5.9	<0.1	<0.05	<0.01	0.02	6.7	0.09	1.41	0.44	2.7	29.2	0.49	4.1	<1	0.8	<0.05	0.2	<0.05	1.3	0.18	0.23	0.3	5.76	0.5
53819	7.9	0.56	7.7	0.1	<0.05	<0.01	0.13	12.3	0.07	10.1	0.35	2.6	50.3	0.46	4.7	2	1.7	<0.05	0.3	0.06	1.4	0.35	0.27	0.3	7.53	0.5
53820	6.3	0.44	6.8	<0.1	<0.05	<0.01	0.03	6.6	0.08	1.25	0.33	2.6	38.8	0.35	5.8	<1	1.4	<0.05	0.23	<0.05	1.6	0.3	0.46	0.2	6.02	0.5
53821	12	1.33	6.3	<0.1	0.23	0.04	0.05	15.6	0.18	2.44	0.39	18.7	17.5	0.69	6.2	1	0.7	<0.05	0.44	0.06	4.5	0.15	0.91	0.1	11	0.9
53822	11	1.12	6.4	<0.1	0.2	0.06	0.04	15.4	0.34	2.26	0.35	17.7	18	0.69	6.1	<1	0.7	<0.05	0.38	<0.05	4.4	0.15	0.79	0.2	10.6	0.8
53823	7.5	0.37	9	<0.1	<0.05	0.01	0.18	15.5	0.06	1.28	0.39	8.3	32.5	0.38	4.4	10	1.2	<0.05	0.19	0.54	4.4	0.24	0.24	0.4	4.03	0.3
53824	8.2	0.47	8.4	0.1	<0.05	<0.01	0.09	17	0.14	43.1	0.17	5.7	40.4	0.37	6.7	2	2.1	<0.05	0.42	<0.05	2.2	0.3	0.55	0.1	11.1	0.9
58325	11.2	1.17	5.7	<0.1	0.26	0.04	0.04	15.2	0.16	3.01	1.07	7.2	18.3	0.68	6.8	<1	0.7	<0.05	0.4	<0.05	4.3	0.16	1.38	0.2	10.7	0.9
54351	7.8	0.34	6.9	0.1	<0.05	<0.01	0.1	15.5	0.1	4.91	0.24	3.4	17.7	0.29	4.3	2	1.1	<0.05	0.33	0.13	3.8	0.12	0.49	0.1	8.61	0.6
54352	5.7	0.32	8.2	<0.1	<0.05	<0.01	0.02	17.7	0.05	1.15	<0.05	3.3	8.3	0.26	3.3	<1	0.6	<0.05	0.19	<0.05	3.4	0.04	0.2	<0.1	4.33	0.3
54353	7.8	0.29	7.9	<0.1	<0.05	<0.01	<0.02	10	0.1	1.63	0.16	3	17.1	0.33	4.2	<1	0.8	<0.05	0.3	<0.05	2.2	0.11	0.35	<0.1	8.02	0.7
54354	8	0.31	3.5	<0.1	<0.05	0.02	0.08	15.1	0.13	13	<0.05	5.7	8.9	0.33	4.7	2	0.8	<0.05	0.38	0.06	4	0.05	0.34	<0.1	10.1	0.9
54355	7.1	0.59	5.9	<0.1	<0.05	<0.01	0.03	13	0.14	2.74	0.09	3.7	12.1	0.36	5.5	<1	0.7	<0.05	0.34	<0.05	2.4	0.06	0.35	<0.1	9.75	0.8
54356	6.8	1.02	5.9	0.1	0.06	<0.01	0.05	19	0.18	7.49	0.29	3.8	36.2	0.34	6.5	1	0.8	<0.05	0.44	<0.05	6.5	0.25	0.41	<0.1	12.3	1.2
54357	9.1	0.42	6.4	<0.1	<0.05	<0.01	0.04	7.9	0.05	3.94	0.36	1.9	40.4	0.37	2.8	1	0.7	<0.05	0.17	0.06	1.3	0.26	0.21	0.3	4.36	0.3
54358	5.8	0.26	5.4	<0.1	<0.05	<0.01	0.04	8.2	0.09	3.01	0.71	3	22.5	0.62	5.9	1	0.8	<0.05	0.23	0.07	1.6	0.14	0.24	0.5	6.76	0.6
54361	6.7	0.22	8.7	<0.1	<0.05	<0.01	<0.02	15	0.07	1.48	0.12	2.6	6.7	0.48	2.7	<1	0.5	<0.05	0.2	<0.05	2.9	0.03	0.25	<0.1	4.73	0.4
54362	8.3	0.75	6.1	<0.1	0.05	0.02	0.09	17.7	0.18	8.13	0.48	5	36.3	0.44	7.4	3	0.9	<0.05	0.45	0.1	7.5	0.27	0.44	0.6	13.1	1.1
54363	6	0.2	5.9	0.1	<0.05	<0.01	0.02	9.1	0.1	3.97	0.65	10.7	15.5	1.8	4.1	<1	0.7	<0.05	0.25	<0.05	1.9	0.09	0.32	0.2	7.37	0.6
54364	8	0.38	6.8	<0.1	<0.05	<0.01	0.05	12.5	0.07	4.09	0.88	12.7	34	0.45	3.4	<1	1.1	<0.05	0.24	0.07	2.1	0.22	0.38	0.4	6.11	0.5
54365	8.5	0.34	7.1	<0.1	<0.05	<0.01	0.05	16.6	0.12	2.58	0.33	2.8	31.1	0.68	4.2	1	0.7	<0.05	0.28	<0.05	3.3	0.19	0.36	0.3	7.38	0.6
54366	7.6	0.47	7	0.1	<0.05	<0.01	0.03	15.1	0.09	1.62	0.51	2.6	38.7	0.24	4	<1	0.7	<0.05	0.25	<0.05	3.7	0.26	0.31	0.4	6.91	0.6
54367	6.8	0.52	8	<0.1	<0.05	<0.01	0.12	9.4	0.07	1.16	0.28	4.7	28.1	0.36	3.7	6	0.9	<0.05	0.21	0.3	3.4	0.23	0.35	0.2	5.58	0.4
54368	8.3	0.49	7.8	<0.1	<0.05	<0.01	0.05	11.5	0.09	2.9	0.44	2.7	40.4	0.35	3.6	1	0.9	<0.05	0.29	<0.05	2	0.26	0.5	0.3	7.69	0.6
54369	6.7	0.26	6.9	0.1	<0.05	<0.01	0.03	14.5	0.11	1.28	0.56	3.1	17.6	0.26	7.3	<1	0.8	<0.05	0.3	<0.05	3.3	0.11	0.35	0.4	8.01	0.7
54372	7.7	0.51	6	<0.1	0.06	<0.01	0.07	19.1	0.11	3.25	1.12	3.4	29.7	0.38	5.8	<1	1.1	<0.05	0.41	<0.05	4.6	0.21	0.49	0.3	9.51	0.8
54373	6.2	0.31	6.4	<0.1	<0.05	<0.01	0.04	17.4	0.07	11.4	0.23	3.7	19.3	0.43	3.9	<1	0.8	<0.05	0.26	<0.05	3.5	0.12	0.27	<0.1	6.26	0.5
54374	7.9	0.36	7.9	<0.1	<0.05	<0.01	<0.02	4.6	0.06	1.8	0.23	2.5	26.9	0.27	3.1	<1	0.8	<0.05	0.14	<0.05	0.7	0.16	0.17	0.3	4.29	0.3
54411	11.4	1.31	5.6	<0.1	0.22	0.03	0.03	15.5	0.13	2.53	0.93	7.1	17.7	0.58	6.3	<1	0.8	<0.05	0.4	<0.05	4.3	0.16	0.88	0.2	10.1	0.8
54412	5	0.33	3.6	<0.1	<0.05	<0.01	0.07	15.1	0.14	4.2	0.28	4.5	14.4	0.37	5.5	1	0.8	<0.05	0.34	<0.05	3.2	0.11	0.73	0.2	10.6	0.9
54413	7.4	0.41	6.3	<0.1	<0.05	<0.01	0.06	13.2	0.08	2.06	0.49	2.8	26.6	0.28	3.7	<1	0.8	<0.05	0.24	<0.05	2.4	0.17	0.25	0.2	6.5	0.5
54414	10.2	0.45	6.9	<0.1	0.05	<0.01	0.2	22.5	0.12	10.8	0.45	3.5	30	0.26	5.3	3	1.4	<0.05	0.43	0.18	2.4	0.19	1.03	0.3	10.7	0.7
54415	7.1	0.27	8	<0.1	<0.05	<0.01	<0.02	12.6	0.06	2.12	0.37	4.4	13	0.4	3.3	<1	0.7	<0.05	0.21	<0.05	2.6	0.07	0.31	0.2	5.27	0.4
54416	9.2	0.45	8	0.1	<0.05	<0.01	0.05	14.8	0.08	5.95	0.7	3.2	45.2	0.44	3.9	1	0.9	<0.05	0.27	<0.05	2.7	0.29	0.27	0.7	6.76	0.5
54417	6.5	0.32	6.4	0.1	<0.05	<0.01	0.03	12.9	0.09	2.33	0.58	2.8	23.5	0.56	5.9	<1	0.7	<0.05	0.25	<0.05	2.8	0.14	0.31	0.5	6.87	0.6
54418	6.6	0.4	6.4	0.1	<0.05	<0.01	0.03	17.7	0.09	9.51	0.77	2.8	33.6	0.51	4.4	<1	0.8	<0.05	0.25	<0.05	3.7	0.23	0.29	0.8	6.83	0.6
54419	6.4	0.31	5.9	0.1	0.1	<0.01	<0.02	8.8	0.09	2.1	1.09	2.9	24.2	0.62	4.3	<1	0.6	<0.05	0.23	<0.05	1.8	0.17	0.21	0.8	7.02	0.7
54420	11.3	1.32	4.7	<0.1	0.27	0.05	0.02	15.3	0.14	2.26	0.46	17.2	13.1	0.85	5.7	<1	0.6	<0.05	0.43	<0.05	4.5	0.13	1	0.3	11.1	0.9
54421	33.4	0.61	6.5	0.1	0.08	0.02	0.03	21.9	0.19	42.9	0.68	4.9	27.8	0.22	6.3	6	1.6	<0.05	0.65	0.16	1.6	0.19	0.5	0.3	17.9	1.3
54422	5.9	0.27	7.1	<0.1	<0.05	<0.01	<0.02	4.9	0.05	1.3	<0.05	3.7	8.9	0.38	2.6	<1	0.7	<0.05	0.16	<0.05	0.5	0.04	0.23	<0.1	4.8	0.4
54423	5.7	0.2	6.4	<0.1	<0.05	0.01	0.06	14.8	0.1	25.8	0.09	3.4	7	0.38	4.1	1	0.8	<0.05	0.33	0.07	2	0.03	0.28	0.1	9.04	0.7
54424	6	0.25	4.4	<0.1	0.06	<0.01	0.07	17.8	0.1	38.3	0.38	4.2	14.5	0.31	4	2	1	<0.05	0.33	0.07	6.4	0.1	0.61	0.5	8.7	0.7
54425	7.3	0.49	4.6	<0.1	0.07	0.01	0.07	16.2	0.12	26.7	0.19	4.1	16.5	0.26	5.3	1	0.8	<0.05	0.35	<0.05	3.7	0.1	0.34	0.4	10.2	0.9
54751	5.1	0.34	4.2	<0.1	<0.05	<0.01	0.02	11.8	0.08	3.06	0.71	3.3	21	0.27	4.5	<1	0.6	<0.05	0.24	<0.05	3	0.14	0.33	0.2	6.31	0.5
54752	8.7	0.59	6.8	0.1	<0.05	<0.01	0.19	24	0.13	6.99	0.58	3.2	37.4	0.31	6.7	2	2.4	<0.05	0.48	0.09	4.2	0.31	0.36	0.1	12.3	0.9
54753	8	0.25	3.7	<0.1	0.05	0.02	0.18	22.3	0.13	9.16	0.19	4	11.8	0.2	5.6	3	1.4	<0.05	0.48	0.15	2.5	0.08	0.75	0.1	12.8	1
54754	6	0.28	3.9	<0.1	<0.05	<0.01	0.08	7.9	0.07	3.08	0.21	2.9	16.5	0.18	2.4	<1	0.7	<0.05	0.24	0.12	1.1	0.1	0.38	<0.1	6.79	0.5
54755	4.2	0.28	3.9	<0.1	<0.05	<0.01	<0.02	5.2	0.04	1.27	0.21	2.5	18.5	0.24	1.2	<1	0.4	<0.05	0.1	<0.05	1.1	0.11	0.17	0.2	3.06	0.3
54756	21.8	0.19	6.5	<0.1	0.07	<0.01	0.16	25.1	0.14	66	0.1	3.8	8.7	0.2	5.7	3	4	<0.05	0.49	<0.05	3.4	0.05	0.7	0.4	12.3	1
54757	6.4	0.32	6.3	<0.1	<0.05	<0.01	0.02	15.3	0.08	1.23	0.4	2.5	26.2	0.2	4.6	<1	0.7	<0.05	0.25	<0.05	4.1	0.17	0.37	0.3	6.68	0.6
54758	7.9	0.49	7.2	0.1	<0.05	<0.01	0.07	19.7	0.08	2.12	0.29	2.9	36.4	0.27	4.5	2	0.7	<0.05	0.3	0.12	5.3	0.24	0.17	0.1	7.09	0.6
54759	5.1	0.24	5.4	<0.1	<0.05	<0.01	<0.02	13.4	0.06	1.03	0.11	2.9	8.9	0.25	4.1	<1	0.5	<0.05	0.22	<0.05	3.6	0.05	0.26	<0.1	5.44	0.4
54760	5.8	0.28	5.7	<0.1	0.06	<0.01	<0.02	10.1	0.09	1.84	0.38	7.1	21.2	0.19	3.5	<1	0.5	<0.05	0.22	<0.05	2	0.13	0.31	0.2	6.63	0.6
54761	8.2	0.31	6.2	<0.1	<0.05	<0.01	0.05	10.1	0.09	1.1	0.29	2.7	23.8	0.23	5.9	2	0.7	<0.05	0.24	0.13	2	0.15	0.32	<0.1	6.88	0.6
54762	7.9	0.31	7.3	<0.1	<0.05	<0.01	0.06	16	0.06	0.85	0.06	3.8	9.3	0.22	4.4	6	0.6	<0.05	0.22	0.58	3.5	0.05	1.08	<0.1	5.38	0.5
54763	6.4	0.31	5.4	<0.1	<0.05	<0.01	0.05	16.7	0.08	3.54	0.17	2.8	19.2	0.21	2.2	1	0.6	<0.05	0.32	<0.05	2.5	0.12	0.22	0.1	7.56	0.6
54764	5.6	0.32	4.8	<0.1	<0.05	<0.01	0.02	11.5	0.1	1.08	0.2	2.6	20.6	0.21	4.9	<1	0.6	<0.05	0.31	<0.05	2.6	0.13	0.22	0.1	8.72	0.8
54765	5.3	0.31	5.4	<0.1	<0.05	<0.01	0.03	9.9	0.08	1.17	0.25	3.1	18.1	0.21	3.3	1	0.6	<0.05	0.25	0.07	2.6	0.12	0.23	0.2	6.89	0.6
54766	5.9	0.25	7.2	<0.1	<0.05	<0.01	<0.02	17.6	0.05	0.86	0.1	4	12.3	0.22	2.1	<1	0.8	<0.05	0.21	<0.05	4.4	0.07	0.27	<0.1	4.42	0.3
54767	5.4	0.24	4.9	<0.1	<0.05	<0.01	0.05	12.7	0.08	17.3	0.21	3.7	14.9	0.18	3.8	1	1	<0.05	0.29	0.08	1.3	0.09	0.29	<0.1	7.76	0.6
54768	6.3	0.25	6.3	<0.1	<0.05	<0.01	0.02	14.1	0.08	12	<0.05	4	8	0.17	4.2	<1	0.7	<0.05	0.28	<0.05	3.5	0.04	0.27	<0.1	7.09	0.5
54769	9	0.85	4.5	<0.1	0.2	0.03	0.03	12.9	0.11	1.83	0.36	5.8	13	0.53	5	<1	0.6	<0.05	0.35	<0.05	3.5	0.12	0.66	0.3	9.36	0.8
54770	6.3	0.46	5.9	<0.1	<0.05	<0.01	<0.02	11.8	0.07	1.42	0.57	2.3	34.9	0.39	4.7	<1	0.6	<0.05	0.21	<0.05	2.7	0.23	0.27	0.6	5.51	0.5
54771	6.3	0.33	6	<0.1	<0.05	<0.01	<0.02	13.8	0.07	1.96	0.67	2.3	29.1	0.27	4.7	<1	0.6	<0.05	0.22	<0.05	3.3	0.19	0.27	0.6	5.79	0.5
54772	9.1	0.46	6.7	<0.1	<0.05	<0.01	0.13	17.4	0.1	44	0.61	2.8	40.2	0.6	5.2	2	1.8	<0.05	0.35	<0.05	2	0.31	0.31	0.6	9.3	0.7
54773	8.9	0.42	6.1	<0.1	<0.05	0.04	0.09	11.6	0.07	12.2	0.82	3.1	34	0.31	3.6	2	1.5	<0.05	0.25	0.12	2.1	0.23	0.46	4.4	6.61	0.5
54774	6.3	0.31	6.7	<0.1	<0.05	<0.01	0.02	3.5	0.07	3.07	0.7	4	28.6	0.21	2.8	<1	1.1	<0.05	0.17	<0.05	0.3	0.21	0.18	0.5	5.25	0.5
54775	5.2	0.44	5.8	<0.1	<0.05	<0.01	<0.02	10.3	0.05	2.66	1.45	2.6	34.9	0.49	3.3	<1	1.4	<0.05	0.19	<0.05	1.8	0.27	0.23	0.7	4.39	0.3
Duplicates																										
51028	6.6	0.29	5.1	<0.1	<0.05	<0.01	<0.02	11.4	0.06	3.71	1.82	11.8	21	<0.05	3.3	<1	0.5	<0.05	0.17	<0.05	2.9	0.14	0.19	0.8	4.16	0.4
51048	6.1	0.27	5.4	<0.1	<0.05	<0.01	0.04	13.5	0.06	6.62	0.44	3.3	17.6	<0.05	2.6	1	0.7	<0.05	0.21	<0.05	2.7	0.11	0.28	0.3	5.26	0.4
54369	6.5	0.26	6.8	0.1	<0.05	<0.01	0.03	15.8	0.11	1.35	0.53	2.7	17.6	0.26	7.2	<1	0.8	<0.05	0.31	<0.05	3.6	0.11	0.39	0.3	8.17	0.7
54757	6.4	0.33	6.3	0.1	<0.05	<0.01	0.02	15.2	0.08	1.16	0.43	2.6	25.9	0.2	4.5	<1	0.7	<0.05	0.25	<0.05	4.1	0.17	0.3	0.3	6.73	0.6
QC																										
CH4	22.8	2.44	8.8	0.2	0.28	0.01	0.09	14	0.05	2.7	0.23	7.4	65.9	0.26	8	2	0.6	<0.05	0.27	0.46	2	0.37	0.27	2.1	5.33	0.4
CH4	22.6	2.45	8.5	0.2	0.22	<0.01	0.09	14.3	0.06	2.53	0.23	7.8	65.2	0.23	7.8	2	0.5	<0.05	0.27	0.35	2	0.38	0.25	2.3	5.04	0.4
CH4	24.8	2.66	9.4	0.3	0.36	0.01	0.1	15.6	0.07	3.48	0.15	8.1	69.3	0.27	8.7	2	0.7	<0.05	0.31	0.59	2.2	0.41	0.35	2.2	6.5	0.5
CH4	22.7	2.61	8.8	0.2	0.35	0.02	0.1	14.8	0.06	2.49	0.12	7.9	64.7	0.24	8.1	2	0.7	<0.05	0.29	0.53	2.1	0.39	0.32	2.4	6.04	0.5
Certified Va	22.8	2.6	8.72	0.21	0.29	#N/A	0.1	14	#N/A	3.05	0.19	8.24	67	0.34	7.99	1.57	0.6	0.3	0.27	0.42	2.2	0.4	0.29	2.15	5.66	#N/A
Tolerance (	11.1	14.8	12.9	127.4	52.8	#N/A	62.1	11.8	#N/A	14.1	75	16.1	10.7	47.3	13.1	169.6	134.5	51.7	28.4	39.6	21.2	22.6	52.9	21.6	12.2	#N/A

CLIENT : **Minto Mines**
PROJECT : **Minto Project**
SGS PROJECT # : **0643**
Test : **Leachate Analysis by ICP-OES**
Date : **July 5, 2013**

To Be Repeated

Sample ID		47825	NP Contribution	50986	NP Contribution	50993	NP Contribution	51029	NP Contribution	51039	NP Contribution	51049	NP Contribution	52003	NP Contribution	52008
Al	mg/L	37.8		77.1		47.7		102		47.1		48.2		59.2		46.6
Sb	mg/L	< 0.01		0.03		0.02		0.02		< 0.01		0.02		0.04		0.02
As	mg/L	0.014		0.056		0.054		0.036		0.101		0.026		0.040		0.031
Ba	mg/L	0.0361		0.0851		0.0669		0.0743		0.0487		0.0664		0.0720		0.0510
Be	mg/L	0.0149		0.0154		0.0083		0.0133		0.0115		0.0105		0.0085		0.0149
Bi	mg/L	0.35		1.06		0.71		0.64		0.37		0.53		0.94		0.66
B	mg/L	1.75		2.28		3.39		2.84		2.25		1.52		3.40		2.14
Cd	mg/L	0.0154		0.0156		0.0142		0.0032		0.0065		0.0086		0.0092		0.0027
Ca	mg/L	578	14.4	777	19.4	544	13.6	535	13.3	499	12.5	548	13.7	522	13.0	463
Cr	mg/L	0.025		0.236		0.033		0.258		0.002		0.042		0.232		0.045
Co	mg/L	0.169		0.188		0.141		0.113		0.139		0.242		0.139		0.148
Cu	mg/L	1.50		9.47		8.91		7.35		32.4		6.74		10.2		0.180
Fe	mg/L	229		690		503		427		310		372		624		462
Pb	mg/L	0.028		0.049		0.021		0.028		0.037		0.024		0.026		0.024
Li	mg/L	< 0.1		< 0.1		< 0.1		< 0.1		< 0.1		< 0.1		< 0.1		< 0.1
Mg	mg/L	170	7.0	170	7.0	145	6.0	59.5	2.4	90.9	3.7	99.7	4.1	35.0	1.4	300
Mn	mg/L	38.1		17.6		11.5		19.9		31.8		25.3		18.3		35.4
Mo	mg/L	< 0.01		< 0.01		< 0.01		< 0.01		< 0.01		< 0.01		0.02		< 0.01
Ni	mg/L	0.417		0.241		0.183		0.207		0.146		0.468		0.279		0.203
P	mg/L	< 0.009		0.014		0.024		0.250		0.020		0.032		0.158		0.034
K	mg/L	60.0	1.5	99.5	2.5	124	3.2	65.8	1.7	120	3.1	58.8	1.5	90.4	2.3	35.5
Se	mg/L	0.01		< 0.01		< 0.01		< 0.01		< 0.01		< 0.01		< 0.01		< 0.01
Si	mg/L	86.2		98.1		91.5		134		79.8		98.5		102		82.9
Ag	mg/L	< 0.08		< 0.08		< 0.08		< 0.08		< 0.08		< 0.08		< 0.08		< 0.08
Na	mg/L	19.3	0.8	33.5	1.5	42.9	1.9	41.2	1.8	20.9	0.9	27.3	1.2	52.7	2.3	42.1
Sr	mg/L	2.00		4.63		3.73		2.14		4.29		1.79		7.04		4.74
S	mg/L	996		1560		1140		1050		977		1010		1060		1270
Tl	mg/L	0.04		0.01		< 0.005		0.02		0.03		0.02		0.01		0.03
Sn	mg/L	< 0.03		< 0.03		< 0.03		< 0.03		< 0.03		< 0.03		< 0.03		< 0.03
Ti	mg/L	0.020		0.020		0.010		0.027		0.019		0.050		0.025		0.001
U	mg/L	< 0.3		< 0.3		< 0.3		< 0.3		< 0.3		< 0.3		< 0.3		< 0.3
V	mg/L	0.005		0.621		0.108		0.226		< 0.001		0.009		0.048		0.006
Zn	mg/L	0.885		1.78		1.27		0.667		0.799		0.572		0.693		1.10
Zr	mg/L	< 0.007		0.016		0.010		0.010		< 0.007		0.008		0.016		0.009
NP from Ca, Mg, Na & K (kg CaCO3 Equiv./tonne)			**23.8**		**30.4**		**24.6**		**19.3**		**20.2**		**20.5**		**19.1**	

Sample ID	NP Contribution	52009	NP Contribution	52013	NP Contribution	53808	NP Contribution	53815	NP Contribution	54353	NP Contribution	54418	NP Contribution	54756	NP Contribution	54763	NP Contribution
Al		92.8		36.0		29.9		42.2		8.08		39.4		29.3		29.3	
Sb		0.04		< 0.01		0.02		0.02		0.02		0.02		0.01		0.01	
As		0.024		0.018		0.059		0.024		0.010		0.041		0.072		0.072	
Ba		0.0762		0.0491		0.0791		0.0978		0.0798		0.0882		0.0695		0.0695	
Be		0.0084		0.0142		0.0067		0.0080		0.0024		0.0037		0.0059		0.0059	
Bi		0.74		0.23		0.46		0.27		0.14		0.30		0.25		0.25	
B		2.25		1.58		2.91		2.37		1.60		1.96		1.31		1.31	
Cd		0.0008		0.0194		0.0193		0.0006		0.0018		0.0005		0.0054		0.0054	
Ca	11.6	481	12.0	745	18.6	790	19.7	722	18.0	498	12.4	461	11.5	554	13.8	554	13.8
Cr		0.272		0.038		0.022		0.061		0.003		0.046		0.008		0.008	
Co		0.112		0.147		1.15		0.049		0.075		0.070		0.068		0.068	
Cu		3.21		0.661		20.2		6.60		0.631		1.42		4.17		4.17	
Fe		479		150		342		197		84.4		203		182		182	
Pb		0.031		0.028		0.025		0.016		0.015		0.012		0.020		0.020	
Li		< 0.1		< 0.1		< 0.1		< 0.1		< 0.1		< 0.1		< 0.1		< 0.1	
Mg	12.3	42.3	1.7	156	6.4	174	7.2	32.5	1.3	38.7	1.6	22.5	0.9	26.3	1.1	26.3	1.1
Mn		10.9		26.5		16.9		17.3		12.4		7.28		16.8		16.8	
Mo		0.02		< 0.01		< 0.01		< 0.01		< 0.01		< 0.01		< 0.01		< 0.01	
Ni		0.291		0.328		0.372		0.114		0.130		0.194		0.130		0.130	
P		1.46		0.030		0.031		0.313		< 0.009		0.261		< 0.009		< 0.009	
K	0.9	65.6	1.7	43.8	1.1	86.0	2.2	60.0	1.5	23.2	0.6	63.5	1.6	43.4	1.1	43.4	1.1
Se		< 0.01		0.01		< 0.01		< 0.01		< 0.01		< 0.01		< 0.01		< 0.01	
Si		106		80.2		72.8		64.2		49.9		59.3		46.7		46.7	
Ag		< 0.08		< 0.08		< 0.08		< 0.08		< 0.08		< 0.08		< 0.08		< 0.08	
Na	1.8	49.9	2.2	17.7	0.8	25.4	1.1	25.2	1.1	20.8	0.9	49.3	2.1	21.0	0.9	21.0	0.9
Sr		7.25		2.24		4.14		9.02		1.45		3.18		4.87		4.87	
S		1030		1070		1250		927		585		673		711		711	
Tl		0.01		0.03		0.01		0.02		0.02		0.01		0.02		0.02	
Sn		< 0.03		< 0.03		< 0.03		< 0.03		< 0.03		< 0.03		< 0.03		< 0.03	
Ti		0.027		0.009		0.011		0.022		0.013		0.043		0.003		0.003	
U		< 0.3		< 0.3		< 0.3		< 0.3		< 0.3		< 0.3		< 0.3		< 0.3	
V		0.233		0.030		0.046		0.083		0.004		0.005		< 0.001		< 0.001	
Zn		0.398		1.45		1.54		0.305		0.156		0.252		0.364		0.364	
Zr		0.011		0.007		0.007		< 0.007		< 0.007		< 0.007		< 0.007		< 0.007	
NP from Ca, Mg	**26.6**		**17.6**		**26.9**		**30.2**		**22.0**		**15.5**		**16.2**		**16.9**		**16.9**

CLIENT : **Minto Mines**
PROJECT : **Minto Mines**
SGS PROJECT # : **0643**
Test : **BC Research NP and Modified NP Procedures**
Date : **July 24- October 29, 2013**

Sample ID	Paste pH	TIC %	CaCO3 NP	C(T) %	S(T) %	S(SO4) %	S(S-2) %	AP	NP	NP H2SO4/tonne	NP CaCO3/tonne	Net NP	NP:AP Ratio (NP/AP)	Fizz Test
Method Code	Sobek	CSB02V	Calc	CSA01V	CSA06V	CSA07V	Calc	Calc	Modified	BC Research	Calc	Calc	Calc	Sobek
LOD	0.2	0.01	#N/A	0.01	0.01	0.01	#N/A	#N/A	0.5	0.5	#N/A	#N/A	#N/A	#N/A
50388	9.09	0.16	13.3	0.25	0.01	<0.01	0.01	0.3	16.7	19.8	20.3	19.9	64.8	Slight
50389	8.78	0.43	35.8	0.53	0.04	<0.01	0.04	1.3	35.0	43.1	44.0	42.8	35.2	Slight
50390	9.07	0.16	13.3	0.23	<0.01	<0.01	<0.01	<0.30	15.5	19.6	20.0	20.0	66.7	Slight
50391	8.65	1.54	128.3	1.38	0.01	<0.01	0.01	0.3	100.8	124.5	127.0	126.7	406.4	Slight
50392	8.72	0.45	37.5	0.61	0.12	<0.01	0.12	3.8	36.6	39.4	40.3	36.5	10.7	Slight
50395	8.79	0.12	10.0	0.17	<0.01	<0.01	<0.01	<0.30	13.1	14.0	14.3	14.3	47.5	Slight
50396	8.55	0.15	12.5	0.24	<0.01	<0.01	<0.01	<0.30	15.3	18.1	18.5	18.5	61.7	Slight
50397	8.68	0.57	47.5	0.62	<0.01	<0.01	<0.01	<0.30	43.5	49.5	50.5	50.5	168.3	Slight
50994	9.00	0.18	15.0	0.21	0.02	<0.01	0.02	0.6	19.0	21.1	21.5	20.9	34.4	Slight
50995	8.63	0.27	22.5	0.31	0.03	<0.01	0.03	0.9	24.6	27.9	28.5	27.6	30.4	Slight
50996	8.96	0.18	15.0	0.2	<0.01	<0.01	<0.01	<0.30	17.5	22.3	22.8	22.8	75.8	Slight
50997	8.48	1.05	87.5	1.06	<0.01	<0.01	<0.01	<0.30	59.2	58.3	59.5	59.5	198.3	Slight
50998	8.55	0.23	19.2	0.25	0.45	<0.01	0.45	14.1	23.8	24.3	24.8	10.7	1.8	Slight
50999	8.51	0.91	75.8	0.92	1.8	0.01	1.79	55.9	58.4	63.5	64.8	8.8	1.2	Slight
51000	8.80	0.19	15.8	0.2	<0.01	<0.01	<0.01	<0.30	18.0	20.8	21.3	21.3	70.8	Slight
55329	8.71	0.34	28.3	0.45	<0.01	<0.01	<0.01	<0.30	29.1	32.6	33.3	33.3	110.8	Slight
55330	8.72	0.93	77.5	0.98	0.12	<0.01	0.12	3.8	61.2	72.3	73.8	70.0	19.7	Slight
55331	9.04	0.18	15.0	0.26	<0.01	<0.01	<0.01	<0.30	17.5	20.6	21.0	21.0	70.0	Slight
55332	8.54	0.73	60.8	0.76	0.86	<0.01	0.86	26.9	43.9	54.9	56.0	29.1	2.1	Slight
55333	8.92	0.25	20.8	0.3	0.11	<0.01	0.11	3.4	21.6	25.2	25.8	22.3	7.5	Slight
55334	8.64	0.06	5.0	0.13	0.02	<0.01	0.02	0.6	8.6	9.1	9.3	8.6	14.8	None
55335	8.43	0.06	5.0	0.12	0.03	0.02	0.01	0.3	7.4	11.0	11.3	10.9	36.0	None
55336	8.45	0.1	8.3	0.16	0.01	<0.01	0.01	0.3	11.1	13.5	13.8	13.4	44.0	Slight
55337	8.51	0.18	15.0	0.2	<0.01	<0.01	<0.01	<0.30	17.8	18.9	19.3	19.3	64.2	Slight
55338	8.54	0.28	23.3	0.33	<0.01	<0.01	<0.01	<0.30	28.5	27.9	28.5	28.5	95.0	Slight
55339	8.63	0.4	33.3	0.46	0.02	<0.01	0.02	0.6	33.5	37.2	38.0	37.4	60.8	Slight
55340	8.61	0.34	28.3	0.38	0.11	<0.01	0.11	3.4	33.0	30.4	31.0	27.6	9.0	Slight
55341	8.89	0.23	19.2	0.36	0.01	<0.01	0.01	0.3	23.4	25.5	26.0	25.7	83.2	Slight
55342	8.82	0.29	24.2	0.4	<0.01	<0.01	<0.01	<0.30	27.4	31.6	32.3	32.3	107.5	Slight
55343	8.52	0.17	14.2	0.23	0.04	<0.01	0.04	1.3	15.3	19.6	20.0	18.8	16.0	Slight
55751	8.12	0.26	21.7	0.63	0.05	<0.01	0.05	1.6	30.7	33.3	34.0	32.4	21.8	Slight
55752	8.50	0.22	18.3	0.29	0.16	<0.01	0.16	5.0	26.7	29.4	30.0	25.0	6.0	Slight
55753	8.64	0.22	18.3	0.25	0.04	<0.01	0.04	1.3	21.8	23.5	24.0	22.8	19.2	Slight
55754	8.13	0.25	20.8	0.54	0.02	<0.01	0.02	0.6	25.4	24.7	25.3	24.6	40.4	Slight
55755	8.93	0.17	14.2	0.26	<0.01	<0.01	<0.01	<0.30	17.7	21.3	21.8	21.8	72.5	Slight
55756	8.79	0.72	60.0	0.77	0.06	<0.01	0.06	1.9	44.1	50.5	51.5	49.6	27.5	Slight
55757	8.60	0.23	19.2	0.27	0.17	<0.01	0.17	5.3	22.8	25.5	26.0	20.7	4.9	Slight
55758	8.61	0.1	8.3	0.13	0.04	<0.01	0.04	1.3	12.2	14.7	15.0	13.8	12.0	Slight
55759	8.65	0.15	12.5	0.23	0.1	<0.01	0.10	<0.3	15.1	21.3	21.8	21.8	72.5	Slight
55760	8.18	0.31	25.8	0.59	0.05	<0.01	0.05	1.6	29.5	32.3	33.0	31.4	21.1	Slight
55761	8.49	0.63	52.5	0.7	0.06	<0.01	0.06	1.9	55.0	56.8	58.0	56.1	30.9	Slight
55762	8.65	0.71	59.2	0.74	0.24	<0.01	0.24	7.5	42.5	47.0	48.0	40.5	6.4	Slight
55763	8.76	0.35	29.2	0.44	<0.01	<0.01	<0.01	<0.30	34.9	35.8	36.5	36.5	121.7	Slight
55764	8.83	0.47	39.2	0.5	<0.01	<0.01	<0.01	<0.30	33.3	41.4	42.3	42.3	140.8	Slight
55765	8.79	0.38	31.7	0.5	0.13	<0.01	0.13	4.1	27.2	26.7	27.3	23.2	6.7	Slight
55766	8.56	0.93	77.5	0.97	0.75	<0.01	0.75	23.4	61.9	70.6	72.0	48.6	3.1	Slight
55767	8.04	0.32	26.7	0.7	0.03	<0.01	0.03	0.9	30.0	31.1	31.8	30.8	33.9	Slight
55768	8.78	0.36	30.0	0.4	<0.01	<0.01	<0.01	<0.30	31.2	36.3	37.0	37.0	123.3	Slight
55769	8.76	0.43	35.8	0.49	0.01	<0.01	0.01	0.3	34.8	32.3	33.0	32.7	105.6	Slight
55770	9.09	0.39	32.5	0.43	0.12	<0.01	0.12	3.8	25.5	32.8	33.5	29.8	8.9	Slight
55771	9.02	0.27	22.5	0.33	0.01	<0.01	0.01	<0.3	25.2	27.0	27.5	27.5	91.7	Slight
55772	8.99	0.34	28.3	0.41	0.01	<0.01	0.01	0.3	29.0	33.3	34.0	33.7	108.8	Slight
55773	8.76	0.43	35.8	0.52	0.31	<0.01	0.31	9.7	35.2	42.9	43.8	34.1	4.5	Slight
55774	8.38	0.25	20.8	0.49	0.04	<0.01	0.04	1.3	22.6	25.7	26.3	25.0	21.0	Slight
57001	8.80	0.7	58.3	0.75	0.09	<0.01	0.09	<0.3	50.4	64.4	65.8	65.8	219.2	Slight
57002	8.98	0.33	27.5	0.41	<0.01	<0.01	<0.01	<0.30	28.0	27.7	28.3	28.3	94.2	Slight
57004	8.85	0.65	54.2	0.74	0.13	<0.01	0.13	4.1	42.8	49.2	50.3	46.2	12.4	Slight
57005	9.09	0.64	53.3	0.72	0.12	<0.01	0.12	3.8	40.9	47.0	48.0	44.3	12.8	Slight
57006	8.37	0.31	25.8	0.55	0.03	<0.01	0.03	0.9	26.0	28.7	29.3	28.3	31.2	Slight
57007	8.61	0.19	15.8	0.29	<0.01	<0.01	<0.01	<0.30	20.7	20.6	21.0	21.0	70.0	Slight
57008	8.94	0.46	38.3	0.49	0.04	<0.01	0.04	1.3	38.3	43.9	44.8	43.5	35.8	Slight
57009	8.98	0.44	36.7	0.56	<0.01	<0.01	<0.01	<0.30	33.6	39.0	39.8	39.8	132.5	Slight
57010	8.80	0.22	18.3	0.28	<0.01	<0.01	<0.01	<0.30	22.4	22.5	23.0	23.0	76.7	Slight
57011	8.65	0.22	18.3	0.3	<0.01	<0.01	<0.01	<0.30	22.4	23.5	24.0	24.0	80.0	Slight
57012	8.92	0.12	10.0	0.2	<0.01	<0.01	<0.01	<0.30	13.3	16.2	16.5	16.5	55.0	Slight
57013	9.12	0.96	80.0	0.99	0.09	<0.01	0.09	2.8	60.4	75.0	76.5	73.7	27.2	Slight
57014	8.82	0.93	77.5	0.93	0.02	<0.01	0.02	0.6	59.9	68.1	69.5	68.9	111.2	Slight
57015	8.94	0.26	21.7	0.3	0.02	<0.01	0.02	0.6	23.7	26.2	26.8	26.1	42.8	Slight
57016	8.85	0.39	32.5	0.42	0.2	<0.01	0.20	6.3	34.0	39.0	39.8	33.5	6.4	Slight
57017	8.26	0.14	11.7	0.51	0.02	<0.01	0.02	0.6	14.6	16.4	16.8	16.1	26.8	Slight
57018	8.55	0.38	31.7	0.46	0.02	<0.01	0.02	0.6	34.4	36.0	36.8	36.1	58.8	Slight
57019	8.89	0.26	21.7	0.36	<0.01	<0.01	<0.01	<0.30	24.3	25.0	25.5	25.5	85.0	Slight
57020	8.83	1.46	121.7	1.51	0.16	<0.01	0.16	5.0	86.2	115.4	117.8	112.8	23.6	Slight
57021	9.13	0.43	35.8	0.49	<0.01	<0.01	<0.01	<0.30	39.3	39.2	40.0	40.0	133.3	Slight
57022	8.60	0.51	42.5	0.54	0.08	<0.01	0.08	2.5	44.2	46.8	47.8	45.3	19.1	Slight
57023	8.74	0.62	51.7	0.63	0.67	<0.01	0.67	20.9	42.3	47.8	48.8	27.8	2.3	Slight
57024	8.53	0.35	29.2	0.52	0.03	<0.01	0.03	0.9	27.2	33.1	33.8	32.8	36.0	Slight
57025	8.90	0.32	26.7	0.42	<0.01	<0.01	<0.01	<0.30	28.1	30.1	30.8	30.8	102.5	Slight
57026	8.80	0.22	18.3	0.28	0.11	<0.01	0.11	3.4	20.3	24.0	24.5	21.1	7.1	Slight
57027	9.15	0.2	16.7	0.26	<0.01	<0.01	<0.01	<0.30	19.0	24.7	25.3	25.3	84.2	Slight
57028	8.64	0.14	11.7	0.18	0.13	<0.01	0.13	4.1	13.6	19.4	19.8	15.7	4.9	Slight
58401	8.86	0.26	21.7	0.41	0.06	<0.01	0.06	1.9	21.3	26.7	27.3	25.4	14.5	Slight
58402	8.72	0.29	24.2	0.32	<0.01	<0.01	<0.01	<0.30	27.7	29.6	30.3	30.3	100.8	Slight
58403	8.88	0.37	30.8	0.42	<0.01	<0.01	<0.01	<0.30	28.0	30.9	31.5	31.5	105.0	Slight
58404	8.79	0.44	36.7	0.51	0.51	<0.01	0.51	15.9	30.6	34.8	35.5	19.6	2.2	Slight
58405	8.60	0.42	35.0	0.44	<0.01	<0.01	<0.01	<0.30	40.6	39.7	40.5	40.5	135.0	Slight
58406	9.51	0.06	5.0	0.07	0.03	<0.01	0.03	0.9	10.0	12.0	12.3	11.3	13.1	Slight
58407	9.08	0.37	30.8	0.4	<0.01	<0.01	<0.01	<0.30	29.1	35.0	35.8	35.8	119.2	Slight
58408	8.87	0.6	50.0	0.64	<0.01	<0.01	<0.01	<0.30	41.8	52.2	53.3	53.3	177.5	Slight
58409	8.01	0.33	27.5	0.9	0.2	<0.01	0.20	6.3	25.5	28.2	28.8	22.5	4.6	Slight
58410	8.64	0.4	33.3	0.41	<0.01	<0.01	<0.01	<0.30	38.3	38.0	38.8	38.8	129.2	Slight
58411	8.59	0.3	25.0	0.31	0.05	<0.01	0.05	1.6	29.7	31.1	31.8	30.2	20.3	Slight
58412	8.83	0.21	17.5	0.21	0.02	<0.01	0.02	0.6	20.4	22.8	23.3	22.6	37.2	Slight
58414	8.77	1.04	86.7	1.03	0.11	<0.01	0.11	3.4	62.8	74.0	75.5	72.1	22.0	Slight
58415	8.71	0.41	34.2	0.45	0.06	<0.01	0.06	1.9	31.6	37.2	38.0	36.1	20.3	Slight

Sample ID	Paste pH	TIC %	CaCO3 NP	C(T) %	S(T) %	S(SO4) %	S(S-2) %	AP	NP	NP H2SO4/tonne	NP CaCO3/tonne	Net NP	NP:AP Ratio (NP/AP)	Fizz Test
Method Code	Sobek	CSB02V	Calc	CSA01V	CSA06V	CSA07V	Calc	Calc	Modified	BC Research	Calc	Calc	Calc	Sobek
LOD	0.2	0.01	#N/A	0.01	0.01	0.01	#N/A	#N/A	0.5	0.5	#N/A	#N/A	#N/A	#N/A
58416	8.74	0.57	47.5	0.61	0.35	<0.01	0.35	10.9	36.2	47.3	48.3	37.3	4.4	Slight
58417	8.75	0.46	38.3	0.44	0.01	<0.01	0.01	0.3	44.4	46.1	47.0	46.7	150.4	Slight
58418	8.86	0.68	56.7	0.7	0.17	<0.01	0.17	5.3	42.9	57.8	59.0	53.7	11.1	Slight
58419	8.52	0.57	47.5	0.59	<0.01	<0.01	<0.01	<0.3	49.3	51.0	52.0	52.0	173.3	Slight
58420	8.40	0.23	19.2	0.35	<0.01	<0.01	<0.01	<0.3	20.9	22.8	23.3	23.3	77.5	Slight
58421	8.61	0.69	57.5	0.72	0.83	<0.01	0.83	25.9	43.0	48.0	49.0	23.1	1.9	Slight
58422	8.73	0.66	55.0	0.68	0.07	<0.01	0.07	2.2	49.1	55.9	57.0	54.8	26.1	Slight
58423	8.67	0.61	50.8	0.63	0.06	<0.01	0.06	1.9	43.6	50.2	51.3	49.4	27.3	Slight
58424	8.74	0.43	35.8	0.44	0.13	<0.01	0.13	4.1	33.1	44.3	45.3	41.2	11.1	Slight
58425	8.81	0.25	20.8	0.27	0.02	<0.01	0.02	0.6	23.8	26.7	27.3	26.6	43.6	Slight
Final Tails April	8.41	0.35	29.2	0.34	0.05	<0.01	0.05	1.6	26.5	32.6	33.3	31.7	21.3	Slight
Duplicates														
50388	9.19								17.5					Slight
55329		0.34												
55334	8.58								8.5					None
55335	8.53								5.6					None
55337			0.2	<0.01										
55338						<0.01								
55761	8.53								52.8					Slight
55762	8.67								43.0					Slight
55766		0.93												
57008	8.90								38.3					Slight
57009	8.99								33.4					Slight
57011			0.3	<0.01										
57026						<0.01								
57028	8.69	0.14							13.5					Slight
58401	8.83								21.6					Slight
58421	8.60								41.5					Slight
58422	8.76								48.7					Slight
58424			0.44	0.12										
Final Tails April						<0.01								
QC														
GTS-2A				1.92	0.32									
GTS-2A				1.95	0.31									
Expected Values GTS-2A				2.01	0.35									
Tolerance +/-				0.15	0.03									
502-491_1001				11	11.4									
Expected Values 502-491_1001				11.44	11.16									
RTS-3A						1.03								
Expected Values RTS-3A						1.1								
Tolerance +/-						0.11								
PD-1						4.55								
PD-1						4.46								
Expected Values PD-1						4.27								
Tolerance +/-						0.3								
SY4		0.91												
SY4		0.92												
Expected Values SY4		0.95												
Tolerance +/-		0.06												
TIC-L1		0.13												
Expected Values TIC-L1		0.1325												
Tolerance +/-		0.02												
NBM-1									40.6					Slight
NBM-1									40.5					Slight
Expected Values NBM-1									42.0					Slight
Tolerance +/-									3.0					

Note:

AP = Acid potential in tonnes CaCO3 equivalent per 1000 tonnes of material. AP is determined from calculated sulphide sulphur content: S(T) - S(SO4).

NP = Neutralization potential in tonnes CaCO3 equivalent per 1000 tonnes of material.

NET NP = NP - AP

Carbonate NP is calculated from TIC originating from carbonate minerals and is expressed in kg CaCO3/tonne.

CLIENT : Minto Mines
PROJECT : Minto Project
SGS Project # : 0643
Test : Metals by Aqua Regia Digestion with ICP-MS Finish
Date : July 25, 2013

Sample ID	Al	B	Ba	Ca	Cr	Cu	Fe	K	Li	Mg	Mn	Na	Ni	P	S	Sr	Ti	V	Zn	Zr	Ag	As	Be	Bi	Cd	Ce
	%	ppm	ppm	%	ppm	ppm	%	%	ppm	%	ppm	%	ppm	ppm	%	ppm	%	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Method Code	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B
LOD	0.01	10	5	0.01	1	0.5	0.01	0.01	1	0.01	2	0.01	0.5	50	0.01	0.5	0.01	1	1	0.5	0.01	1	0.1	0.02	0.01	0.05
50388	0.69	40	121	0.67	133	122	1.51	0.24	5	0.48	349	0.05	3.4	420	0.02	42.9	0.07	30	43	0.9	0.05	<1	0.2	<0.02	0.04	11.6
50389	0.95	40	163	1.33	126	388	2.19	0.24	6	0.64	545	0.05	3.8	650	0.05	80.6	0.05	43	62	1.3	0.17	1	0.4	0.05	0.08	25.2
50390	0.95	40	190	0.65	136	240	1.9	0.39	6	0.59	408	0.05	3.5	480	0.02	45.7	0.07	39	53	0.9	0.15	<1	0.2	0.04	0.04	19.5
50391	0.58	30	140	3.31	97	252	2.21	0.09	4	0.87	661	0.05	3	590	0.02	255	<0.01	39	61	1.6	0.09	2	0.7	0.02	0.14	24.6
50392	1.06	30	165	1.5	116	2670	2.23	0.19	8	0.7	537	0.04	3.7	650	0.14	98.5	0.03	41	66	1.1	0.43	1	0.5	0.1	0.13	16.8
50395	0.86	30	147	0.58	129	47.2	1.81	0.28	5	0.54	408	0.04	5.5	500	<0.01	44.7	0.05	34	51	1.5	0.02	1	0.2	<0.02	0.06	25
50396	1.01	40	270	0.64	128	133	2.12	0.48	5	0.58	469	0.04	5.7	620	<0.01	37.3	0.09	46	57	1.9	0.04	1	0.2	<0.02	0.07	18.1
50397	0.9	20	180	1.71	110	110	2.07	0.15	7	0.59	537	0.04	3.7	580	0.02	103	0.02	35	60	1.2	0.05	1	0.4	<0.02	0.05	21
50994	1.26	40	478	0.7	123	127	2.6	0.8	6	0.78	583	0.05	4.8	470	0.03	51.3	0.13	56	62	0.9	0.05	<1	0.2	<0.02	0.04	25.2
50995	1.01	30	377	1.05	121	448	1.99	0.3	7	0.57	468	0.04	4	510	0.05	47.2	0.05	41	55	1.1	0.27	<1	0.3	0.03	0.12	20
50996	1.35	30	664	0.74	117	17.8	2.57	0.91	7	0.77	556	0.05	4	800	<0.01	53.2	0.15	63	60	0.7	0.03	<1	0.2	<0.02	0.04	24
50997	0.52	30	98	2.15	97	60.7	2.5	0.07	3	0.54	571	0.03	3.2	670	<0.01	155	<0.01	44	65	1.6	0.02	2	0.6	0.04	0.06	28.5
50998	1.59	40	357	1.01	109	1680	3.27	0.94	8	1.01	517	0.05	3.5	990	0.48	44.1	0.16	89	67	2.6	0.3	<1	0.3	0.05	0.07	34
50999	0.74	20	238	2.05	126	1390	3.87	0.41	3	0.5	522	0.02	4.1	460	1.83	84.4	0.06	51	47	2	0.24	<1	0.2	0.05	0.1	28.9
51000	1.06	30	67	0.89	109	56.1	1.96	0.09	8	0.65	433	0.04	3.7	460	<0.01	66.1	0.02	32	58	0.9	0.04	<1	0.4	<0.02	0.06	16.9
55329	0.94	40	161	1.23	137	38.6	2.07	0.28	6	0.64	543	0.05	3.9	560	0.01	82	0.05	38	57	1.3	0.03	<1	0.4	<0.02	0.05	15.8
55330	0.62	30	147	2.15	113	1010	2.14	0.25	3	0.53	501	0.03	3.3	600	0.12	119	0.03	40	60	1.3	0.27	1	0.5	0.05	0.13	21.1
55331	1.13	30	461	0.71	141	15.1	2.35	0.78	6	0.68	528	0.05	4.1	550	<0.01	40.5	0.12	55	60	1	0.02	<1	0.3	<0.02	0.04	25.5
55332	1.17	30	440	1.6	117	2580	4.19	0.73	6	0.77	638	0.04	4.8	810	0.98	76.1	0.12	85	74	1.7	0.61	<1	0.3	0.32	0.13	40.5
55333	1.15	20	413	0.9	133	142	2.58	0.75	5	0.65	470	0.04	3.9	560	0.13	49.2	0.13	58	54	1	0.04	<1	0.2	<0.02	0.04	22.2
55334	1.34	30	366	0.36	132	2500	3.15	0.86	7	0.79	461	0.04	5.7	780	0.04	27.6	0.16	76	64	1.9	0.27	1	0.2	0.08	0.09	25.5
55335	1.28	30	527	0.27	135	3060	3.08	0.85	6	0.69	508	0.04	4.3	480	0.03	25.4	0.16	72	61	1.8	0.17	<1	0.3	0.04	0.13	25.4
55336	1.16	40	820	0.45	118	997	2.52	0.62	6	0.64	511	0.04	3.9	570	0.02	34	0.11	55	67	1.3	0.11	<1	0.3	0.03	0.1	27.8
55337	1.33	30	339	0.83	128	624	3.24	0.69	8	0.81	774	0.04	4.9	800	<0.01	49	0.13	73	96	1.5	0.19	1	0.3	<0.02	0.09	28.6
55338	0.85	30	188	1.19	130	80.4	2.14	0.38	5	0.48	583	0.04	3.8	570	<0.01	54.6	0.06	45	55	1.1	0.02	<1	0.3	<0.02	0.1	20.2
55339	1.1	30	146	1.36	116	192	2.21	0.2	7	0.7	524	0.04	3.9	610	0.03	82.5	0.02	36	65	0.9	0.05	<1	0.4	0.02	0.07	21.1
55340	1.44	30	57	1.44	110	1080	1.92	0.1	11	0.68	453	0.27	3.6	670	0.12	168	0.02	33	59	1.5	0.17	2	0.7	0.06	0.04	23.4
55341	1.27	40	77	1.02	109	85.3	2.25	0.09	11	0.81	602	0.19	3.7	600	0.03	94.9	0.02	36	76	1	0.05	2	0.6	<0.02	0.03	21.2
55342	1.07	40	169	1.17	125	150	2.4	0.3	7	0.82	629	0.05	4.4	740	0.02	71.9	0.07	50	66	1.4	0.06	<1	0.4	0.02	0.05	18.8
55343	0.99	30	132	0.64	122	2090	2.74	0.41	6	0.55	578	0.03	3.8	660	0.06	27.5	0.06	48	110	1.5	0.43	<1	0.4	0.13	0.4	21.9
55751	1.2	30	288	1.24	102	388	2.74	0.27	9	0.78	602	0.05	28.4	830	0.07	57.4	0.06	50	74	8.5	0.21	7	0.5	0.15	0.34	27.5
55752	1.73	30	85	1.61	102	3040	3	0.09	14	1.06	565	0.03	4.9	940	0.18	108	0.04	52	80	3.4	2.15	2	0.7	0.28	0.17	15.1
55753	1.2	30	105	1.12	116	337	2.21	0.22	10	0.73	569	0.05	3.8	690	0.05	67.4	0.05	41	141	1.5	0.11	<1	0.5	<0.02	0.28	19.2
55754	1.06	30	290	1.22	122	152	2.45	0.19	8	0.58	516	0.04	22.6	990	0.03	52.7	0.08	51	56	8.2	0.11	6	0.4	0.09	0.2	24.9
55755	0.96	40	94	0.83	126	6.3	1.69	0.16	8	0.61	441	0.06	4.3	420	<0.01	50.6	0.05	33	55	1.1	0.01	<1	0.3	<0.02	0.03	11.2
55756	0.77	40	160	1.52	124	1170	2.16	0.21	6	0.66	512	0.03	4	800	0.09	112	0.03	42	64	1.5	0.4	2	0.6	0.05	0.07	22
55757	1.12	30	147	0.97	126	3040	2.9	0.4	7	0.69	557	0.04	3.7	760	0.2	39	0.06	52	101	1.2	0.81	<1	0.2	0.63	0.25	21.2
55758	1.2	40	157	0.58	128	2110	2.82	0.6	7	0.68	661	0.04	3.8	810	0.06	24.2	0.1	58	128	1.5	0.56	<1	0.3	0.21	0.34	23.8
55759	1.19	30	217	0.68	137	3360	3.51	0.8	5	0.64	771	0.04	4.3	850	0.12	28	0.14	70	169	1.7	0.67	<1	0.2	0.21	0.61	26.1
55760	1.44	40	320	1.37	115	529	3.15	0.37	11	0.9	599	0.04	30.5	860	0.06	70.2	0.08	59	89	9	0.24	6	0.6	0.16	0.34	32.3
55761	1.55	30	111	2.56	104	991	2.07	0.22	11	0.82	458	0.1	12.9	730	0.1	190	0.01	32	67	1.3	0.33	6	0.6	0.08	0.19	24.5
55762	0.75	30	167	1.64	116	1660	2.34	0.19	4	0.64	420	0.04	3.6	830	0.27	81.2	0.02	42	68	1.7	0.26	<1	0.4	0.08	0.2	29.5
55763	1.76	40	92	1.92	118	143	2.32	0.1	13	0.9	553	0.27	6.8	810	0.03	151	0.05	50	62	2.3	0.03	5	0.9	<0.02	0.04	18.1
55764	0.82	40	97	1.26	114	129	1.84	0.17	5	0.63	460	0.06	3.3	540	0.02	110	0.04	34	56	1.1	0.06	<1	0.3	<0.02	0.06	19.3
55765	1.04	30	178	1.24	123	1050	2.53	0.51	6	0.72	529	0.05	4	910	0.15	71.7	0.08	54	63	1.4	0.28	<1	0.3	0.04	0.09	27.4
55766	0.81	30	236	2.35	127	3680	2.87	0.45	3	0.71	617	0.04	4.1	820	0.87	70	0.08	56	75	1.4	0.78	<1	0.2	0.06	0.29	21.3
55767	1.11	40	267	1.44	130	513	2.55	0.24	8	0.68	515	0.04	18.6	920	0.06	54.3	0.07	51	66	6	0.23	5	0.5	0.15	0.2	24.4
55768	0.97	40	197	1.28	133	109	2.43	0.33	6	0.66	520	0.05	3.9	670	0.02	103	0.05	54	58	1.1	0.04	<1	0.3	<0.02	0.05	16.7
55769	1.01	30	170	1.51	130	174	2.27	0.33	9	0.68	585	0.04	3.9	670	0.04	86.8	0.05	42	72	1.1	0.06	<1	0.4	<0.02	0.05	19.8

Sample ID	Al	B	Ba	Ca	Cr	Cu	Fe	K	Li	Mg	Mn	Na	Ni	P	S	Sr	Ti	V	Zn	Zr	Ag	As	Be	Bi	Cd	Ce
	%	ppm	ppm	%	ppm	ppm	%	%	ppm	%	ppm	%	ppm	ppm	%	ppm	%	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Method Code	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B
LOD	0.01	10	5	0.01	1	0.5	0.01	0.01	1	0.01	2	0.01	0.5	50	0.01	0.5	0.01	1	1	0.5	0.01	1	0.1	0.02	0.01	0.05
55770	0.88	50	203	0.95	145	2330	1.98	0.59	3	0.68	435	0.05	3.3	610	0.14	73	0.1	49	62	1	0.37	<1	0.2	0.09	0.12	20.9
55771	1.17	50	373	1.14	142	83.9	2.45	0.6	6	0.71	534	0.05	5.1	740	0.03	61.7	0.1	55	61	1	0.04	<1	0.2	<0.02	0.04	25.5
55772	1.04	50	153	1.34	122	119	2.07	0.29	7	0.71	496	0.06	3.5	640	0.03	75.2	0.06	43	60	1	0.04	<1	0.2	<0.02	0.05	18.3
55773	1.19	60	241	1.63	128	1470	2.67	0.42	8	0.77	449	0.04	4.1	890	0.37	110	0.07	61	57	1.2	0.24	<1	0.3	0.02	0.09	33.3
55774	1.13	30	293	1.11	118	383	2.68	0.28	9	0.71	516	0.04	22.2	810	0.09	60.6	0.08	52	67	7.4	0.11	4	0.5	0.1	0.22	23.9
57001	1.18	30	51	2.09	93	333	2.69	0.11	8	0.79	885	0.14	3.2	800	0.11	226	<0.01	40	103	1.1	0.12	1	0.7	0.03	0.1	26.6
57002	1.08	40	165	1.31	132	271	2.34	0.33	6	0.69	670	0.04	3.9	790	0.03	63.6	0.05	48	77	1.1	0.14	<1	0.3	0.04	0.08	26.1
57004	0.91	30	180	1.66	133	1430	2.83	0.27	5	0.75	785	0.04	3.7	910	0.19	130	0.04	49	93	1.4	0.6	1	0.3	0.17	0.35	24.5
57005	0.64	30	156	1.59	137	1530	1.94	0.32	3	0.47	402	0.04	3.3	510	0.16	97.5	0.05	36	59	1.1	0.48	<1	0.2	0.08	0.18	19.5
57006	1.05	30	244	1.27	117	164	2.38	0.18	8	0.65	452	0.04	19.8	890	0.05	72.2	0.07	47	63	8.1	0.09	5	0.5	0.08	0.22	23.6
57007	1.2	40	354	0.95	127	143	2.69	0.53	7	0.71	551	0.05	12	930	0.03	54.3	0.12	58	75	4.3	0.06	2	0.3	0.04	0.18	24.9
57008	1.23	40	114	1.85	127	196	2.2	0.11	11	0.75	561	0.04	3.6	620	0.06	115	<0.01	35	65	0.9	0.04	<1	0.6	<0.02	0.1	24.8
57009	1.15	40	302	1.47	129	137	2.45	0.4	7	0.74	565	0.05	3.8	810	0.02	87.7	0.07	48	74	1.1	0.08	<1	0.3	<0.02	0.09	22.3
57010	1.13	30	280	0.95	131	1120	2.8	0.63	7	0.72	704	0.03	4.4	840	<0.01	47.4	0.11	62	81	1.3	0.2	2	0.2	0.08	0.16	21
57011	1.08	40	173	1.08	126	259	2.33	0.35	8	0.66	605	0.04	4.9	740	<0.01	45.6	0.07	46	74	1.7	0.06	1	0.4	0.03	0.11	21.6
57012	0.86	40	224	0.63	142	283	2.29	0.5	4	0.47	536	0.04	3.8	680	0.02	27.9	0.09	46	76	1.1	0.07	<1	0.2	0.02	0.16	23.4
57013	0.28	30	44	1.76	117	1600	1.87	0.11	<1	0.69	419	0.04	3.1	530	0.13	174	<0.01	29	60	1.5	0.68	5	0.3	0.08	0.2	15.4
57014	0.76	20	174	2.19	117	348	2.4	0.16	4	0.72	672	0.04	3.3	840	0.04	140	0.02	43	72	1.8	0.19	<1	0.4	0.06	0.1	27.3
57015	1.23	30	184	1.19	137	194	2.42	0.38	8	0.8	567	0.05	3.8	760	0.03	65.4	0.08	50	69	1.6	0.08	<1	0.4	0.05	0.04	15.5
57016	1.28	40	628	1.52	139	3030	2.47	0.85	6	0.74	476	0.03	3.6	860	0.24	77.7	0.15	74	73	1.2	0.99	<1	0.2	0.24	0.1	39.7
57017	1.32	30	287	0.74	108	104	2.81	0.23	11	0.75	493	0.03	32.7	760	0.04	57.1	0.06	54	80	9.1	0.09	8	0.6	0.14	0.32	28.3
57018	1.12	40	165	1.59	128	372	2.4	0.25	8	0.68	555	0.03	5.6	840	0.03	65.7	0.04	47	65	2.5	0.04	2	0.5	0.04	0.06	22.1
57019	0.87	40	206	1.13	128	81.9	1.91	0.2	6	0.56	464	0.03	10.7	780	0.01	65.4	0.06	40	51	4.4	<0.01	3	0.3	0.04	0.13	21.6
57020	0.3	<10	58	2.98	99	2120	2.22	0.08	<1	0.6	494	0.02	2.7	860	0.2	176	<0.01	38	71	1.3	0.56	3	0.5	0.11	0.1	24.5
57021	1.1	40	76	1.72	114	66.1	2.13	0.12	9	0.71	554	0.09	3.1	600	0.01	111	0.04	41	66	1	<0.01	2	0.4	<0.02	0.04	15.6
57022	1.23	30	433	1.92	99	3330	2.11	0.12	8	0.61	469	0.04	3.5	830	0.11	144	0.01	38	63	1.4	1.17	3	0.7	0.47	0.27	29.4
57023	0.92	50	158	1.49	106	2860	2.77	0.26	5	0.71	425	0.02	3.3	960	0.74	106	0.03	47	64	1.7	0.56	1	0.2	0.15	0.29	32.2
57024	1.01	40	248	1.21	136	222	2.16	0.23	7	0.66	449	0.03	14.9	710	0.04	67.4	0.06	45	58	5.4	0.06	4	0.4	0.06	0.15	20.6
57025	1	40	136	1.21	132	235	2.02	0.26	6	0.61	527	0.03	3.4	670	0.02	60.4	0.04	40	73	1	0.05	<1	0.3	0.04	0.1	21.1
57026	1.13	40	138	0.91	135	2540	3.33	0.44	7	0.65	647	0.02	3.9	850	0.14	36.8	0.07	65	110	2	0.53	<1	0.2	0.23	0.2	21.3
57027	1.03	50	309	0.87	144	70.4	2.21	0.69	5	0.63	544	0.04	3.9	570	0.01	67.2	0.12	51	69	0.9	<0.01	<1	0.3	<0.02	0.06	16.4
57028	1.04	40	114	0.59	120	2570	2.46	0.58	5	0.6	661	0.02	3.2	710	0.16	23.1	0.09	48	168	1.7	0.78	<1	0.3	0.19	0.76	25.5
58401	0.61	50	290	0.88	141	2690	2.13	0.39	3	0.3	316	0.02	3.8	320	0.08	37.3	0.07	49	47	1.4	0.41	<1	0.1	0.14	0.14	16.8
58402	1.09	50	176	1.22	120	72.1	2.18	0.33	7	0.65	496	0.03	3.5	810	<0.01	56.8	0.05	42	62	1	<0.01	<1	0.3	<0.02	0.05	21.1
58403	1	40	94	1.11	122	21.9	2.13	0.14	9	0.76	505	0.03	3.3	660	<0.01	89.8	0.03	40	62	0.8	<0.01	<1	0.4	<0.02	0.04	17.6
58404	0.98	20	203	1.2	121	1450	2.58	0.57	6	0.71	366	0.03	3.5	760	0.55	63.7	0.1	61	50	1	0.2	<1	0.3	0.04	0.08	40
58405	1.01	30	145	1.69	119	20.5	2.27	0.3	7	0.6	639	0.04	3.7	760	<0.01	67.3	0.06	50	65	1.4	<0.01	1	0.5	<0.02	0.04	19.7
58406	1.21	30	336	0.53	134	448	2.41	0.83	6	0.75	523	0.06	3.9	770	0.04	36.8	0.18	61	81	1	0.1	<1	0.2	0.02	0.05	28.5
58407	1.05	50	326	1.19	128	62.4	2.26	0.64	5	0.63	616	0.05	3.8	660	0.01	83.1	0.1	52	62	1.3	<0.01	<1	0.2	<0.02	0.08	20.7
58408	0.7	50	122	1.49	114	22	1.97	0.19	5	0.58	524	0.04	3.2	530	<0.01	113	0.02	34	58	1.1	<0.01	1	0.4	<0.02	0.03	21.3
58409	1.17	50	304	1.25	127	1540	2.82	0.36	7	0.67	502	0.04	13	770	0.21	66.5	0.09	57	73	4.4	0.5	3	0.4	0.23	0.36	21.6
58410	1.62	30	54	1.82	102	37.9	2.05	0.12	11	0.79	461	0.07	3.5	640	<0.01	246	<0.01	25	54	0.6	<0.01	<1	0.7	<0.02	0.02	17.3
58411	1.39	40	71	1.45	109	622	1.95	0.11	11	0.74	460	0.06	3.4	610	0.07	132	0.01	30	58	0.7	0.11	1	0.5	<0.02	0.03	19
58412	1.25	40	144	1.02	113	108	2.38	0.2	11	0.84	456	0.04	3.5	720	0.02	53.5	0.04	48	62	1	<0.01	<1	0.2	<0.02	0.04	28.4
58414	0.28	50	234	2.14	122	744	1.66	0.1	1	0.44	355	0.03	3	450	0.12	114	<0.01	34	46	1.3	0.19	1	0.3	0.04	0.08	13.2
58415	1.2	40	158	1.62	116	440	2.62	0.28	10	0.86	641	0.06	3.9	880	0.07	91.7	0.05	53	75	1.4	0.16	<1	0.4	0.04	0.14	25.9
58416	1.09	40	384	1.33	127	1290	2.82	0.64	5	0.74	463	0.05	4.5	540	0.45	75.3	0.12	64	69	1.4	0.32	<1	0.2	0.04	0.13	28.8
58417	1.38	30	181	1.83	116	170	2.65	0.37	9	0.84	633	0.04	3.4	800	0.02	137	0.05	52	80	1.2	0.12	<1	0.4	0.02	0.06	22.9
58418	0.91	40	262	1.45	117	2200	2.51	0.61	3	0.71	413	0.04	3.9	950	0.21	56	0.1	68	70	1.8	0.46	1	0.4	0.11	0.22	26.8
58419	1.19	40	178	2.26	115	173	2.67	0.29	7	0.67	650	0.05	3.7	800	0.01	82.6	0.04	53	74	1.4	0.06	<1	0.4	0.03	0.07	23.1
58420	1.01	30	224	1.08	117	174	2.21	0.28	6	0.6	424	0.04	16	870	0.01	50.6	0.08	46	58	5.6	0.08	3	0.3	0.06	0.16	21.1
58421	1.15	30	431	1.82	121	2680	3.54	0.58	5	0.71	503	0.04	4.4	990	1.01	88.7	0.1	75	61	1.6	0.6	<1	0.2	0.12	0.14	31.5
58422	1.03	30	82	2.09	117	1110	2.25	0.12	8	0.68	517	0.06	3.6	760	0.08	125	0.02	41	66	1.2	0.3	2	0.5	0.05	0.08	19.1
58423	1.16	40	114	1.81	125	1040	2.36	0.25	9	0.75	568	0.04	3.5	780	0.08	116	0.03	46	67	1.2	0.32	<1	0.5	0.08	0.12	23.9
58424	1.25	40	410	1.49	132	875	2.81	0.77	6	0.73	517	0.05	4	740	0.16	58.2	0.14	67	63	1.2	0.22	<1	0.3	0.07	0.09	21.8
58425	1.22	40	243	1.14	126	162	2.45	0.51	7	0.76	530	0.05	4	780	0.02	72.4	0.09	54	66	1.1	0.05	<1	0.3	<0.02	0.05	21.6
Final Tails April	1.26	20	234	1.21	111	1030	4.24	0.69	7	0.81	662	0.05	4.7	870	0.07	72.1	0.13	70	121	1.5	0.46	<1	0.2	0.19	0.28	20.7
Duplicates																										
55756	0.7	40	155	1.45	116	1100	2.16	0.2	5	0.67	493	0.04	3.8	710	0.08	104	0.02	39	61	1.3	0.45	2	0.6	0.05	0.06	24
57008	1.13	40	107	1.73	115	195	2.06	0.1	10	0.7	521	0.04	3	580	0.05	107	<0.01	33	61	0.8	0.03	<1	0.5	<0.02	0.08	22.1
58406	1.12	40	301	0.52	126	406	2.25	0.76	6	0.69	481	0.07	3.4	720	0.04	35.7	0.17	55	74	1	0.14	<1	0.1	0.02	0.07	24
QC																										
CH4	1.86	20	311	0.57	113	2100	4.54	1.46	14	1.18	306	0.06	49.5	710	0.71	9.6	0.21	81	200	10.9	1.76	7	0.1	0.41	1.05	26.6
CH4	1.77	30	300	0.56	110	2030	4.54	1.4	12	1.13	302	0.05	49	610	0.68	8.3	0.2	77	188	10.5	1.97	8	0.1	0.51	1.14	28.8
CH4	1.78	20	293	0.57	105	2030	4.43	1.43	13	1.15	293	0.05	47.6	670	0.67	8.7	0.2	78	195	10.7	2.02	8	0.1	0.43	1.09	28.7
Certified Values	1.85	#N/A	293	0.61	103.8	2000	4.79	1.43	12.6	1.18	324	0.06	49.57	719	0.73	9.38	0.21	79.27	189.4	9	2.13	8.14	0.11	0.51	1.17	28.18
Tolerance (%)	11.35	#N/A	14.3	14.1	12.4	10.1	10.52	11.74	29.84	12.3	11.5	50.3	12.52	27.4	13.4	23.3	23.3	13.2	11.3	17.7	10.9	13.1	241.3	19.7	12.1	10.4

Sample ID	Co ppm	Cs ppm	Ga ppm	Ge ppm	Hf ppm	Hg ppm	In ppm	La ppm	Lu ppm	Mo ppm	Nb ppm	Pb ppm	Rb ppm	Sb ppm	Sc ppm	Se ppm	Sn ppm	Ta ppm	Tb ppm	Te ppm	Th ppm	Tl ppm	U ppm	W ppm	Y ppm	Yb ppm
Method Co	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B
LOD	0.1	0.05	0.1	0.1	0.05	0.01	0.02	0.1	0.01	0.05	0.05	0.2	0.2	0.05	0.1	1	0.3	0.05	0.02	0.05	0.1	0.02	0.05	0.1	0.05	0.1
50388	4.3	0.2	3.6	<0.1	0.06	<0.01	<0.02	6.5	0.06	4.08	0.31	2	10.8	<0.05	2.2	<1	0.3	<0.05	0.13	<0.05	1.2	0.07	0.2	0.5	3.94	0.4
50389	6.3	0.31	5.2	<0.1	0.06	0.01	0.03	13.8	0.1	6.32	0.23	3	12.7	<0.05	3.6	<1	0.5	<0.05	0.27	<0.05	3.8	0.08	0.45	0.6	7.34	0.6
50390	5.3	0.29	4.7	<0.1	<0.05	<0.01	<0.02	10.7	0.07	3.96	0.3	1.8	18	<0.05	3.4	<1	0.4	<0.05	0.18	<0.05	2.7	0.11	0.18	0.2	4.99	0.4
50391	6.1	0.29	3.3	<0.1	<0.05	<0.01	0.04	12.7	0.16	3.7	<0.05	7.2	4.7	<0.05	4.8	<1	0.6	<0.05	0.41	<0.05	2.4	0.02	0.48	<0.1	12.2	1.1
50392	6.4	0.35	5.4	<0.1	<0.05	<0.01	0.05	8.8	0.11	3.54	0.13	3.6	9.9	<0.05	3.6	<1	0.5	<0.05	0.24	0.08	1.7	0.06	0.37	0.3	7.34	0.7
50395	5.7	0.3	4.5	<0.1	<0.05	<0.01	<0.02	13.5	0.07	4.02	0.28	2.4	13	0.05	3.3	<1	0.4	<0.05	0.22	<0.05	3.1	0.09	0.21	0.3	5.29	0.5
50396	6.2	0.38	4.6	<0.1	<0.05	<0.01	<0.02	9.7	0.1	4.04	0.36	2.4	20.3	0.06	3.2	<1	0.5	<0.05	0.24	<0.05	2	0.15	0.23	0.4	7.03	0.7
50397	5.6	0.32	4.9	<0.1	<0.05	<0.01	0.03	11.2	0.11	3.64	0.09	4.7	7.1	<0.05	3.8	<1	0.5	<0.05	0.28	<0.05	2.2	0.04	0.3	0.2	7.83	0.7
50994	7.1	0.44	6.3	<0.1	<0.05	<0.01	<0.02	13.1	0.08	4.72	0.42	1.8	35.3	<0.05	5.9	<1	0.8	<0.05	0.26	<0.05	3.1	0.24	0.21	0.3	6.75	0.6
50995	5.8	0.29	5.3	<0.1	<0.05	<0.01	0.02	10.4	0.1	5.59	0.19	2.5	14.4	<0.05	3.3	<1	0.5	<0.05	0.26	0.05	1.9	0.09	0.23	0.1	7.98	0.7
50996	6.7	0.54	6.4	0.1	<0.05	<0.01	0.03	12.3	0.12	3.76	0.68	2.4	39.2	<0.05	5.9	<1	0.9	<0.05	0.35	<0.05	2.8	0.26	0.21	0.6	9.27	0.8
50997	6.5	0.15	3.4	<0.1	<0.05	<0.01	0.04	14.6	0.15	3.32	<0.05	3.2	4	<0.05	6.8	<1	0.6	<0.05	0.4	<0.05	3.4	<0.02	0.24	0.2	11.3	1
50998	9.2	0.64	7.8	0.1	0.06	<0.01	0.12	17.6	0.1	8.27	0.33	2.6	42	<0.05	6	<1	1.7	<0.05	0.38	0.05	3.5	0.31	0.38	0.2	8.75	0.7
50999	24.9	0.32	4.2	<0.1	<0.05	0.1	0.04	14.7	0.12	20.6	0.65	3.8	19.6	<0.05	3.8	1	0.8	<0.05	0.41	0.07	2.2	0.16	1.35	15.8	10.5	0.8
51000	5.7	0.17	5.7	<0.1	<0.05	<0.01	<0.02	9.2	0.04	3.1	0.12	4.3	4.7	<0.05	1.6	<1	<0.3	<0.05	0.12	<0.05	1.9	0.02	0.32	0.2	3.14	0.2
55329	5.9	0.3	5.1	<0.1	<0.05	<0.01	0.03	8.4	0.1	4.14	0.24	3.3	13	<0.05	4.1	<1	0.5	<0.05	0.26	<0.05	1.4	0.07	0.35	0.7	8.09	0.7
55330	6.3	0.45	3.6	<0.1	<0.05	<0.01	0.05	10.9	0.12	6.17	0.11	3.7	13.1	<0.05	4.6	<1	0.5	<0.05	0.32	<0.05	2	0.07	0.76	0.2	9.41	0.8
55331	6.4	0.43	5.6	<0.1	<0.05	<0.01	0.02	13.6	0.1	4.34	0.43	2.4	33.7	<0.05	4.1	<1	0.6	<0.05	0.27	<0.05	3	0.23	0.24	0.7	7.25	0.6
55332	19.3	0.44	7.1	0.1	<0.05	<0.01	0.08	21.1	0.15	20.3	0.49	2.9	33.6	<0.05	6.6	1	1.7	<0.05	0.51	0.21	3.3	0.29	0.25	0.7	13.7	1
55333	7.3	0.45	6.3	0.1	<0.05	<0.01	0.02	10.8	0.1	4.13	0.58	2.1	35.3	<0.05	5.1	<1	0.9	<0.05	0.31	<0.05	2.4	0.23	0.17	0.8	8.06	0.7
55334	8.2	0.64	6.8	0.1	<0.05	<0.01	0.1	12.3	0.1	17.8	0.71	3	39.3	<0.05	5.1	<1	1.8	<0.05	0.31	0.06	2.6	0.33	0.3	0.6	8.03	0.6
55335	12.3	0.53	6.4	<0.1	<0.05	<0.01	0.07	13.1	0.08	22.4	0.55	3	37.9	<0.05	3.8	<1	1.5	<0.05	0.33	0.06	1.4	0.29	0.46	0.5	7.78	0.5
55336	7.4	0.43	5.9	<0.1	<0.05	<0.01	0.05	15	0.1	7.97	0.49	2.6	26.7	<0.05	3.8	<1	0.9	<0.05	0.33	0.05	2.9	0.19	0.24	0.4	8.67	0.7
55337	8.8	0.58	7.3	<0.1	<0.05	<0.01	0.04	15.3	0.09	4.95	0.3	3.1	33.7	<0.05	4.6	<1	0.8	<0.05	0.3	0.06	3.9	0.24	0.3	0.3	7.66	0.6
55338	5.6	0.29	4.3	<0.1	<0.05	<0.01	0.02	10.4	0.13	4.72	0.16	2.2	17.4	<0.05	3.9	<1	0.5	<0.05	0.32	<0.05	2	0.11	0.23	0.3	9.26	0.8
55339	6.3	0.33	5.7	<0.1	<0.05	<0.01	0.03	11.3	0.08	4.27	0.1	3.8	9.7	<0.05	3.3	<1	0.5	<0.05	0.24	<0.05	2.1	0.05	0.28	0.3	6.74	0.6
55340	5.5	0.35	7.1	<0.1	<0.05	<0.01	0.04	13.8	0.1	12.7	0.08	7.5	6.7	<0.05	3	<1	0.5	<0.05	0.26	<0.05	3.2	0.03	0.34	0.1	7.13	0.6
55341	7	0.82	6.8	<0.1	<0.05	<0.01	0.02	11.7	0.08	3.39	0.1	4.9	5	<0.05	3.4	<1	0.4	<0.05	0.21	<0.05	3.1	0.02	0.31	0.4	5.92	0.5
55342	6.4	0.31	5.5	<0.1	0.05	<0.01	0.03	10.4	0.11	3.93	0.18	3.1	14.5	<0.05	4.4	<1	0.6	<0.05	0.26	<0.05	2	0.09	0.39	0.7	7.62	0.7
55343	6	0.43	5.6	<0.1	<0.05	<0.01	0.06	12.2	0.07	8.02	0.28	7.6	22.1	<0.05	3.9	<1	0.8	<0.05	0.24	0.08	5.4	0.17	0.29	0.3	6.14	0.5
55751	10.9	1.25	4.7	<0.1	0.22	0.03	0.03	13.6	0.12	3.62	0.45	8.6	14.5	0.6	5	<1	0.5	<0.05	0.39	<0.05	4.2	0.15	0.83	0.2	9.65	0.8
55752	9.1	0.19	8.5	<0.1	0.05	<0.01	0.03	8.1	0.08	8.17	0.07	20.8	4.8	<0.05	2.5	1	0.5	<0.05	0.21	0.29	1.6	0.03	0.35	0.2	6.5	0.5
55753	6.2	0.26	5.9	<0.1	<0.05	<0.01	0.02	10.2	0.06	5.17	0.16	9	11.6	<0.05	2.5	<1	0.4	<0.05	0.18	<0.05	3.1	0.07	0.29	0.2	4.43	0.4
55754	9.1	0.75	4.1	<0.1	0.22	0.03	0.02	12.3	0.13	4.25	0.75	5.6	10.8	0.66	4.6	<1	0.5	<0.05	0.37	<0.05	3.4	0.11	0.69	0.6	9.87	0.8
55755	4.4	0.29	5	<0.1	<0.05	<0.01	<0.02	6	0.08	3.59	0.26	3.7	7.5	<0.05	2.6	<1	0.4	<0.05	0.14	<0.05	1	0.04	0.34	0.5	4.71	0.5
55756	5.8	0.32	3.9	<0.1	<0.05	0.01	0.05	11.7	0.1	9.73	0.2	4.6	10.6	0.06	3.6	<1	0.6	<0.05	0.28	0.07	2.8	0.06	0.35	0.5	7.97	0.7
55757	6	0.49	6.6	<0.1	<0.05	<0.01	0.05	11.1	0.1	5.56	0.24	7.2	21.1	<0.05	5	<1	0.7	<0.05	0.26	0.16	5.3	0.17	0.25	0.4	7.71	0.6
55758	5.6	0.84	6.2	0.1	0.08	0.02	0.05	13.2	0.09	11	0.51	12.1	34.2	<0.05	4.5	<1	0.9	<0.05	0.27	0.08	6.2	0.33	0.32	0.5	7.26	0.6
55759	7	0.66	6.7	0.1	0.05	0.01	0.07	14.9	0.08	27.8	0.83	9	41	<0.05	4.8	<1	1.1	<0.05	0.27	0.11	7.1	0.34	0.88	0.6	6.95	0.5
55760	11.5	1.46	5.2	<0.1	0.25	0.05	0.04	16.2	0.13	4.86	0.63	7.4	18.8	0.61	5.4	<1	0.7	<0.05	0.41	<0.05	4.7	0.18	0.76	0.3	10.5	0.9
55761	6.5	0.41	6.1	<0.1	<0.05	<0.01	0.03	13.4	0.11	7.84	<0.05	8.4	10.9	<0.05	3.2	<1	0.4	<0.05	0.28	<0.05	3.5	0.06	0.41	0.2	8.24	0.7
55762	6.4	0.26	3.8	<0.1	0.05	<0.01	0.05	16.3	0.11	16.9	0.09	5.3	9.8	<0.05	4.5	<1	0.6	<0.05	0.31	<0.05	5.4	0.06	0.27	0.2	9.01	0.8
55763	6.4	0.33	8.3	0.1	0.11	<0.01	0.02	10.1	0.1	4.99	0.28	7.9	4.8	<0.05	4	<1	0.5	<0.05	0.23	<0.05	2.5	0.02	0.35	0.2	6.92	0.7
55764	4.6	0.32	3.9	<0.1	<0.05	<0.01	0.03	10.2	0.07	5.8	0.21	3.7	8.4	<0.05	3.4	<1	0.4	<0.05	0.19	<0.05	2.1	0.04	0.22	0.2	5.46	0.5
55765	6.3	0.38	5.2	<0.1	<0.05	<0.01	0.05	14.8	0.1	6.3	0.41	2.5	24.4	<0.05	3.9	<1	0.7	<0.05	0.27	<0.05	4.7	0.16	0.47	0.7	7.2	0.6
55766	9.7	0.32	4	<0.1	<0.05	<0.01	0.15	11	0.07	4.55	0.48	3.6	20.5	<0.05	3.4	1	0.9	<0.05	0.26	0.07	1.2	0.14	0.47	0.3	7.32	0.5
55767	8.5	0.77	4.6	<0.1	0.12	0.03	0.03	12.4	0.12	6.46	0.73	5.2	13	0.44	4.6	<1	0.6	<0.05	0.35	<0.05	3.2	0.1	0.57	0.3	9.45	0.8
55768	5.4	0.35	5.3	<0.1	<0.05	<0.01	0.02	8.4	0.11	4.1	0.17	2.6	15	<0.05	3.5	<1	0.5	<0.05	0.28	<0.05	1.4	0.08	0.41	0.6	8.43	0.7
55769	5.7	0.4	5.3	<0.1	<0.05	<0.01	0.03	10.4	0.11	5.06	0.13	2.3	15.2	0.12	4.1	<1	0.5	<0.05	0.29	<0.05	1.9	0.09	0.3	0.4	8.52	0.8

Sample ID	Co ppm	Cs ppm	Ga ppm	Ge ppm	Hf ppm	Hg ppm	In ppm	La ppm	Lu ppm	Mo ppm	Nb ppm	Pb ppm	Rb ppm	Sb ppm	Sc ppm	Se ppm	Sn ppm	Ta ppm	Tb ppm	Te ppm	Th ppm	Tl ppm	U ppm	W ppm	Y ppm	Yb ppm
Method Co	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B
LOD	0.1	0.05	0.1	0.1	0.05	0.01	0.02	0.1	0.01	0.05	0.05	0.2	0.2	0.05	0.1	1	0.3	0.05	0.02	0.05	0.1	0.02	0.05	0.1	0.05	0.1
55770	4.9	0.47	4	<0.1	<0.05	<0.01	0.05	11.1	0.09	11.2	0.3	2.7	28.1	<0.05	4.5	<1	0.6	<0.05	0.27	0.05	3.1	0.17	0.33	0.3	7.2	0.7
55771	6.5	0.35	5.6	<0.1	<0.05	<0.01	0.02	12.6	0.12	5.14	0.48	2	25.4	<0.05	4.1	<1	0.7	<0.05	0.33	<0.05	2.8	0.17	0.26	0.5	9.12	0.8
55772	5.4	0.27	4.9	<0.1	<0.05	<0.01	0.02	9.6	0.1	3.83	0.27	3.3	12.8	<0.05	3.3	<1	0.5	<0.05	0.24	<0.05	2	0.08	0.3	0.3	7.22	0.7
55773	7	0.38	5.9	0.1	<0.05	<0.01	0.07	17.6	0.12	17	0.15	2.8	19.2	<0.05	4.6	<1	1.1	<0.05	0.37	<0.05	2.6	0.14	0.24	0.5	9.81	0.8
55774	9.8	0.93	4.3	<0.1	0.19	0.04	0.03	12.3	0.11	7.15	0.7	5.3	15	0.38	4.4	<1	0.5	<0.05	0.32	<0.05	3.4	0.14	0.71	0.3	8.95	0.8
57001	6.9	1.02	6.1	<0.1	<0.05	<0.01	0.04	14.5	0.12	3.3	<0.05	5.4	6.2	<0.05	4.4	<1	0.5	<0.05	0.33	<0.05	4.6	0.03	0.35	0.1	9.21	0.8
57002	5.7	0.35	5.4	<0.1	<0.05	<0.01	0.03	13.7	0.09	4.62	0.19	2.5	16.3	<0.05	4.3	<1	0.5	<0.05	0.27	<0.05	4	0.12	0.32	0.6	7.25	0.6
57004	6.9	0.31	4.8	<0.1	<0.05	<0.01	0.05	13.1	0.09	3.77	0.2	3.6	13.1	<0.05	3.9	<1	0.6	<0.05	0.27	0.06	4.4	0.09	0.55	0.7	7.12	0.6
57005	4.7	0.28	3.1	<0.1	<0.05	<0.01	0.06	10.2	0.08	4.2	0.37	2.7	14.6	<0.05	3.7	<1	0.5	<0.05	0.26	0.09	1.6	0.09	0.29	0.6	6.93	0.5
57006	8	0.78	4	<0.1	0.2	0.03	0.02	12	0.12	4.56	0.64	5.6	10	0.41	4.5	<1	0.5	<0.05	0.34	<0.05	3.3	0.1	0.92	0.3	9.47	0.8
57007	7.9	0.59	4.8	<0.1	0.11	0.01	0.02	13.2	0.09	3.79	0.52	3	23.9	0.18	3.2	<1	0.5	<0.05	0.26	<0.05	3.7	0.19	0.35	0.4	6.95	0.6
57008	5.4	0.35	6.2	<0.1	<0.05	<0.01	0.04	13.4	0.11	3.95	<0.05	3.8	5.7	<0.05	3.4	<1	0.5	<0.05	0.29	<0.05	2.5	0.02	0.29	<0.1	8.02	0.7
57009	6.1	0.35	5.3	<0.1	<0.05	<0.01	0.02	11.9	0.1	3.92	0.32	3.4	18.2	<0.05	3.3	<1	0.5	<0.05	0.25	<0.05	2.6	0.11	0.29	0.6	7.18	0.6
57010	7.2	0.45	5.4	<0.1	<0.05	<0.01	0.04	11.3	0.09	4.11	0.37	2.1	26.9	<0.05	3.6	<1	0.6	<0.05	0.25	0.11	3.5	0.19	0.3	0.2	7	0.6
57011	5.8	0.37	5.1	<0.1	<0.05	<0.01	0.03	11.9	0.1	5.16	0.26	3.2	16.3	<0.05	3.9	<1	0.5	<0.05	0.26	<0.05	2.9	0.11	0.24	0.2	7.32	0.7
57012	5.2	0.44	4	<0.1	<0.05	<0.01	0.03	12.3	0.09	5.72	0.29	1.8	24	<0.05	4.7	<1	0.6	<0.05	0.26	<0.05	3.2	0.15	0.2	0.2	6.83	0.6
57013	4.5	0.29	1.3	<0.1	<0.05	<0.01	0.04	8.3	0.04	3.31	<0.05	4.6	6.7	<0.05	1.1	<1	<0.3	<0.05	0.13	0.24	1.5	0.03	0.17	0.2	3.46	0.3
57014	6.1	0.4	3.9	<0.1	<0.05	<0.01	0.03	15	0.13	3.5	0.06	3.3	8.5	<0.05	4.4	<1	0.5	<0.05	0.33	<0.05	4	0.04	0.38	0.1	9.05	0.8
57015	6.6	0.28	5.6	<0.1	<0.05	<0.01	0.03	7.9	0.1	4.24	0.34	2.4	16.7	<0.05	3.8	<1	0.5	<0.05	0.23	<0.05	1.5	0.1	0.3	0.3	7.28	0.7
57016	6.1	0.51	6.4	<0.1	<0.05	<0.01	0.08	21.3	0.09	12.3	0.53	2.3	36.4	<0.05	3.1	2	1	<0.05	0.41	0.22	1.6	0.22	0.26	0.4	9.16	0.6
57017	11.5	1.42	4.6	<0.1	0.25	0.04	0.03	13.9	0.12	3.54	0.66	7.7	13.6	0.63	5.2	<1	0.5	<0.05	0.35	<0.05	4.5	0.15	0.89	0.4	9.07	0.8
57018	6.9	0.36	5.7	<0.1	0.07	<0.01	0.03	11.5	0.12	4.12	0.21	3.3	11.6	0.09	4.5	<1	0.5	<0.05	0.3	<0.05	2.4	0.07	0.3	0.2	8.63	0.8
57019	5.9	0.43	3.5	<0.1	0.11	0.02	<0.02	11.3	0.09	3.88	0.4	3.3	9.4	0.2	3.5	<1	0.4	<0.05	0.27	<0.05	2.8	0.08	0.37	0.4	6.98	0.6
57020	6.3	0.23	1.6	<0.1	<0.05	0.01	0.05	13.1	0.09	24.9	<0.05	5.5	4.9	<0.05	3.1	<1	0.4	<0.05	0.27	0.17	2.9	0.02	0.18	0.1	7.27	0.6
57021	5.1	0.2	5.8	<0.1	<0.05	<0.01	0.03	8.5	0.08	3.14	0.16	3.9	5.8	<0.05	4.1	<1	0.5	<0.05	0.21	<0.05	1.4	0.03	0.18	0.1	6.01	0.6
57022	6.1	0.29	5.7	<0.1	<0.05	0.01	0.06	16.1	0.11	6.73	0.07	5.6	6.8	<0.05	3.7	1	0.6	<0.05	0.31	0.11	3.9	0.04	0.55	0.1	8.82	0.7
57023	10.4	0.26	4.5	<0.1	<0.05	0.01	0.06	17.8	0.11	20.6	0.14	2.8	11.6	<0.05	3.6	1	0.6	<0.05	0.35	0.11	4.8	0.08	0.36	0.2	9.01	0.8
57024	7	0.58	3.8	<0.1	0.13	0.02	0.02	10.5	0.09	6.03	0.54	3.9	11.2	0.23	3.7	<1	0.4	<0.05	0.28	<0.05	2.8	0.1	0.47	0.3	7.26	0.6
57025	5	0.26	4.7	<0.1	<0.05	<0.01	0.02	11.4	0.08	3.51	0.17	2.7	11.3	<0.05	3.5	<1	0.4	<0.05	0.21	<0.05	3	0.07	0.26	0.3	6.07	0.5
57026	6	0.43	6.3	<0.1	<0.05	<0.01	0.05	11.2	0.08	5.99	0.41	5.7	21.3	<0.05	4.5	<1	0.7	<0.05	0.25	0.1	5.4	0.18	0.21	0.3	6.68	0.6
57027	5.8	0.32	4.7	<0.1	<0.05	<0.01	0.03	8.5	0.09	4.37	0.39	1	28.6	<0.05	4.3	<1	0.6	<0.05	0.22	<0.05	1.8	0.17	0.21	0.7	6.57	0.6
57028	5.5	0.96	6	<0.1	<0.05	0.01	0.06	14.2	0.08	19.7	0.68	16.3	36.7	<0.05	4.6	<1	1	<0.05	0.28	0.1	8.3	0.36	0.37	0.6	7.08	0.5
58401	6.1	0.28	2.9	<0.1	<0.05	<0.01	0.08	8.1	0.08	19.4	0.64	2.7	17.7	<0.05	2.6	<1	0.7	<0.05	0.28	0.09	0.3	0.12	0.34	0.3	7.66	0.5
58402	6	0.27	5.2	<0.1	<0.05	<0.01	0.02	11	0.1	3.85	0.19	2.3	14.5	<0.05	4	<1	0.5	<0.05	0.26	<0.05	2.2	0.09	0.23	0.4	7.03	0.6
58403	5.2	0.24	4.5	<0.1	<0.05	<0.01	<0.02	9	0.1	2.82	0.1	2.2	6.2	<0.05	3.2	<1	0.4	<0.05	0.24	<0.05	1.6	0.03	0.19	0.2	6.98	0.7
58404	8.4	0.49	5.7	<0.1	<0.05	<0.01	0.09	21.6	0.11	11.7	0.47	2.3	28.7	<0.05	5.4	<1	1.3	<0.05	0.39	0.11	4.2	0.23	0.24	0.3	9.61	0.7
58405	5.9	0.28	4.8	<0.1	<0.05	<0.01	0.02	10.1	0.11	3.64	0.22	4.3	13.4	<0.05	4.3	<1	0.5	<0.05	0.28	<0.05	2.3	0.08	0.21	0.3	7.9	0.7
58406	5.9	0.41	5.5	0.1	<0.05	<0.01	<0.02	15.3	0.05	3.76	0.74	1.8	37	<0.05	2.9	<1	0.6	<0.05	0.18	<0.05	4.4	0.23	0.33	0.6	3.92	0.4
58407	6.3	0.44	4.7	<0.1	0.06	<0.01	0.03	10.7	0.12	3.97	0.32	1	27.1	<0.05	4.2	<1	0.6	<0.05	0.33	<0.05	2	0.16	0.3	0.5	9.37	0.8
58408	4.6	0.34	3.4	<0.1	<0.05	<0.01	0.02	11.5	0.1	2.97	0.06	2.5	8	<0.05	3.6	<1	0.4	<0.05	0.26	<0.05	1.9	0.04	0.21	0.2	7.37	0.7
58409	8.7	0.46	4.7	<0.1	0.08	0.02	0.03	11.1	0.09	7.88	1.38	5.3	16.4	0.17	3.9	<1	0.6	<0.05	0.28	0.1	2.5	0.12	0.48	0.3	6.99	0.6
58410	5.6	0.3	6.2	<0.1	<0.05	<0.01	<0.02	8.9	0.1	2.57	<0.05	1.5	7	<0.05	2.8	<1	0.3	<0.05	0.25	<0.05	1.7	0.03	0.17	<0.1	7.59	0.7
58411	4.6	0.21	5.7	<0.1	<0.05	<0.01	0.03	10.1	0.08	6.84	0.06	3.2	4.5	<0.05	2.5	<1	0.4	<0.05	0.24	0.07	1.7	<0.02	0.2	0.1	6.33	0.6
58412	5.5	0.18	5.6	<0.1	<0.05	<0.01	<0.02	15.2	0.04	2.82	0.14	2.5	9.1	<0.05	2.5	<1	0.4	<0.05	0.18	<0.05	3.4	0.05	0.22	0.1	3.59	0.3
58414	4.1	0.19	1.5	<0.1	<0.05	<0.01	0.03	6.6	0.06	4.71	<0.05	2.9	5	<0.05	1.9	<1	0.3	<0.05	0.2	<0.05	1.1	0.02	0.36	0.1	5.25	0.4
58415	6.9	0.32	6.1	0.1	<0.05	<0.01	0.04	14	0.11	5.79	0.23	3.2	12.8	<0.05	4.1	<1	0.6	<0.05	0.29	<0.05	3.6	0.07	0.46	0.4	8.33	0.8
58416	8.9	0.47	5.1	<0.1	<0.05	<0.01	0.04	14.7	0.07	6.11	0.7	3.3	28.1	<0.05	2.6	<1	0.8	<0.05	0.32	0.05	1.8	0.19	0.28	1	6.78	0.5
58417	6.6	0.41	6.6	<0.1	<0.05	<0.01	0.02	12.2	0.13	3.38	0.17	3	15.6	<0.05	4.5	<1	0.6	<0.05	0.31	<0.05	3.2	0.1	0.39	0.2	8.94	0.8
58418	6.1	0.52	4.5	<0.1	<0.05	<0.01	0.06	14.6	0.1	13.9	0.48	4.9	29.8	<0.05	3.9	<1	0.7	<0.05	0.32	<0.05	4.7	0.2	0.37	0.7	8.32	0.7
58419	6.8	0.38	5.8	<0.1	<0.05	<0.01	0.03	12.2	0.13	3.66	0.13	3.1	12.4	<0.05	4.5	<1	0.6	<0.05	0.31	<0.05	2.2	0.07	0.27	0.2	9.29	0.9
58420	6.4	0.64	3.7	<0.1	0.13	0.01	<0.02	11.2	0.1	4.06	0.56	4	13.6	0.31	3.5	<1	0.4	<0.05	0.27	<0.05	3.5	0.12	0.45	0.4	7.15	0.7
58421	14.4	0.41	5.4	<0.1	<0.05	<0.01	0.08	16.5	0.13	20.4	0.62	3.4	24.7	<0.05	4.4	<1	1.4	<0.05	0.44	0.08	2	0.18	0.54	0.4	11.4	0.9
58422	5.5	0.25	4.8	<0.1	<0.05	<0.01	0.04	10	0.1	4.26	0.12	4.5	5.9	<0.05	3.8	<1	0.5	<0.05	0.26	<0.05	2.1	0.03	0.36	0.2	7.35	0.7
58423	5.8	0.41	5.8	<0.1	<0.05	<0.01	0.04	12.4	0.12	4.61	0.1	3.6	11.6	<0.05	4.2	<1	0.5	<0.05	0.34	<0.05	3.1	0.06	0.33	0.2	9.8	0.9
58424	8	0.45	6.2	<0.1	<0.05	<0.01	0.04	11.5	0.1	12.3	0.59	25.7	32.3	<0.05	4.3	<1	1.1	<0.05	0.31	<0.05	1.4	0.22	0.22	0.4	8.15	0.6
58425	6.7	0.32	6	0.1	<0.05	<0.01	0.02	11.5	0.1	3.93	0.27	3.9	21.2	<0.05	4.2	<1	0.6	<0.05	0.26	<0.05	2.1	0.13	0.26	0.4	7.31	0.7
Final Tails /	7.1	0.55	8	0.1	<0.05	0.02	0.07	11.3	0.07	5.2	0.48	2.2	31.3	<0.05	3.8	<1	1	<0.05	0.23	0.12	3.5	0.25	0.4	<0.1	6.13	0.5
Duplicates																										
55756	6.1	0.32	4.2	<0.1	<0.05	<0.01	0.05	12.7	0.11	8.08	0.2	4.8	11.3	0.07	4	<1	0.6	<0.05	0.31	0.06	3	0.06	0.35	0.5	8.55	0.7
57008	5.1	0.33	5.8	<0.1	<0.05	<0.01	0.03	12.1	0.1	3.67	<0.05	3.5	5.5	<0.05	3.3	<1	0.5	<0.05	0.27	<0.05	2.1	0.03	0.27	<0.1	7.67	0.6
58406	5.4	0.38	5	<0.1	<0.05	<0.01	<0.02	13.2	0.05	3.49	0.76	2.6	32.7	<0.05	2.7	<1	0.6	<0.05	0.16	<0.05	3.8	0.21	0.31	0.5	3.63	0.3
QC																										
CH4	21.3	2.44	8.5	0.2	0.22	<0.01	0.09	13.7	0.05	2.8	0.19	7.3	62.2	0.32	7.2	<1	0.6	<0.05	0.28	0.38	2	0.38	0.26	1.7	5.52	0.4
CH4	23	2.62	8.8	0.3	0.26	<0.01	0.1	14.5	0.06	3.23	0.24	8.1	65.8	0.38	7.3	<1	0.6	<0.05	0.28	0.43	2.1	0.4	0.29	2	5.55	0.4
CH4	23.5	2.62	8.9	0.3	0.22	0.01	0.1	14.7	0.05	2.64	0.23	7.7	66.5	0.33	7.7	1	0.6	<0.05	0.27	0.3	2	0.38	0.26	1.9	5.43	0.4
Certified Va	22.8	2.6	8.72	0.21	0.29	#N/A	0.1	14	#N/A	3.05	0.19	8.24	67	0.34	7.99	1.57	0.6	0.3	0.27	0.42	2.2	0.4	0.29	2.15	5.66	#N/A
Tolerance (	11.1	14.8	12.9	127.4	52.8	#N/A	62.1	11.8	#N/A	14.1	75	16.1	10.7	47.3	13.1	169.6	134.5	51.7	28.4	39.6	21.2	22.6	52.9	21.6	12.2	#N/A

CLIENT : **Minto Mines**
PROJECT : **Minto Project**
SGS PROJECT # : **0643**
Test : **Leachate Analysis by ICP-OES**
Date : **September 12, 2013**

Sample ID		50995	NP Contribution	55329	NP Contribution	55332	NP Contribution	55343	NP Contribution	55759	NP Contribution	55770	NP Contribution	57009	NP Contribution	57023	NP Contribution	58411	NP Contribution	58423	NP Contribution
Al	mg/L	36.5		35.3		35.8		33.0		34.4		36.9		40.6		40.6		37.6		36.0	
Sb	mg/L	< 0.01		< 0.01		0.03		< 0.01		< 0.01		< 0.01		< 0.01		< 0.01		< 0.01		< 0.01	
As	mg/L	0.018		0.023		0.040		0.027		0.036		0.018		0.022		0.049		0.015		0.024	
Ba	mg/L	0.0715		0.0750		0.0642		0.0829		0.0641		0.0872		0.0634		0.0644		0.0818		0.0745	
Be	mg/L	0.0068		0.0114		0.0090		0.0059		0.0038		0.0086		0.0120		0.0127		0.0179		0.0218	
Bi	mg/L	0.07		0.14		0.61		< 0.02		0.06		0.27		0.21		0.30		0.03		0.23	
B	mg/L	1.88		0.466		1.58		1.85		1.77		2.13		2.22		0.599		0.65		2.71	
Cd	mg/L	0.0059		0.0081		0.0312		0.0241		0.0392		0.0202		0.0102		0.0226		0.0026		0.0163	
Ca	mg/L	783	19.5	816	20.4	560	14.0	437	10.9	376	9.4	683	17.0	582	14.5	593	14.8	810	20.2	492	12.3
Cr	mg/L	0.257		0.465		2.35		0.132		0.099		0.764		0.447		1.40		0.145		0.630	
Co	mg/L	0.022		0.034		0.145		0.094		0.099		0.061		0.047		0.049		0.012		0.056	
Cu	mg/L	1.73		0.292		13.5		102		150		13.3		0.964		16.0		1.73		5.60	
Fe	mg/L	70.3		127		443		70.5		71.0		245		181		232		44		208	
Pb	mg/L	0.012		0.022		0.031		0.044		0.045		0.051		0.012		0.028		0.024		0.030	
Li	mg/L	< 0.1		< 0.1		< 0.1		< 0.1		< 0.1		< 0.1		< 0.1		< 0.1		< 0.1		< 0.1	
Mg	mg/L	31.2	1.3	45.4	1.9	80.3	3.3	29.1	1.2	29.3	1.2	96.8	4.0	77.7	3.2	153	6.3	43.5	1.8	94.7	3.9
Mn	mg/L	16.0		18.3		17.3		18.2		21.9		12.8		14.5		12.9		5.4		15.0	
Mo	mg/L	< 0.01		< 0.01		< 0.01		< 0.01		< 0.01		< 0.01		< 0.01		< 0.01		< 0.01		< 0.01	
Ni	mg/L	0.064		0.061		0.149		0.035		0.040		0.067		0.065		0.078		0.042		0.064	
P	mg/L	0.304		0.206		0.218		0.077		0.058		3.14		0.315		1.98		0.15		1.06	
K	mg/L	38.1	1.0	43.9	1.1	49.4	1.3	52.5	1.3	57.1	1.5	56.8	1.5	42.5	1.1	40.5	1.0	18.3	0.5	44.2	1.1
Se	mg/L	0.01		< 0.01		< 0.01		< 0.01		0.01		< 0.01		< 0.01		< 0.01		< 0.01		< 0.01	
Si	mg/L	52.6		38.9		56.8		57.4		58.4		62.0		65.2		48.3		55		72.4	
Ag	mg/L	< 0.08		< 0.08		< 0.08		< 0.08		< 0.08		< 0.08		< 0.08		< 0.08		< 0.08		< 0.08	
Na	mg/L	20.0	0.9	18.0	0.8	15.1	0.7	17.5	0.8	15.3	0.7	19.3	0.8	22.2	1.0	14.7	0.6	20.3	0.9	21.9	1.0
Sr	mg/L	2.26		4.51		3.35		1.59		1.43		4.30		3.87		5.80		6.84		4.73	
S	mg/L	876		950		983		637		628		1030		845		985		876		877	
Tl	mg/L	0.01		0.02		0.01		0.01		0.02		< 0.005		< 0.005		< 0.005		< 0.005		< 0.005	
Sn	mg/L	< 0.03		< 0.03		< 0.03		< 0.03		< 0.03		< 0.03		< 0.03		< 0.03		< 0.03		< 0.03	
Ti	mg/L	0.006		0.001		0.009		0.020		0.014		0.028		0.012		0.003		< 0.001		0.009	
U	mg/L	< 0.15		< 0.15		< 0.15		< 0.15		< 0.15		< 0.15		< 0.15		< 0.15		< 0.15		< 0.15	
V	mg/L	0.053		0.084		0.302		0.022		0.017		0.506		0.135		0.299		0.036		0.291	
Zn	mg/L	0.234		0.330		0.852		1.83		2.41		0.951		0.684		0.659		0.239		0.632	
Zr	mg/L	< 0.007		< 0.007		0.010		< 0.007		< 0.007		< 0.007		< 0.007		< 0.007		< 0.007		0.009	
NP from Ca, Mg, Na & K (kg CaCO3 Equiv./tonne)			**22.7**		**24.1**		**19.2**		**14.2**		**12.7**		**23.3**		**19.8**		**22.8**		**23.4**		**18.3**

CLIENT : Minto Mines
PROJECT : Minto Mines
SGS PROJECT # : 0643
Test : BC Research NP and Modified NP Procedures
Date : October 31 - December 9, 2013

Sample ID	Sampling Date	Paste pH	TIC %	CaCO3 NP	C(T) %	S(T) %	S(SO4) %	S(S-2) %	AP	NP	NP H2SO4/tonne	NP CaCO3/tonne	Net NP	NP:AP Ratio (NP/AP)	Fizz Test
Method Code		Sobek	CSB02V	Calc	CSA01V	CSA06V	CSA07V	Calc	Calc	Modified	BC Research	Calc	Calc	Calc	Sobek
LOD		0.2	0.01	#N/A	0.01	0.01	0.01	#N/A	#N/A	0.5	0.5	#N/A	#N/A	#N/A	#N/A
55344	12-Jun-13	8.64	0.08	6.7	0.15	0.03	<0.01	0.03	0.9	10.8	14.2	14.5	13.6	15.5	Slight
55345	12-Jun-13	8.37	0.17	14.2	0.41	0.03	<0.01	0.03	0.9	18.0	18.6	19.0	18.1	20.3	Slight
55346	12-Jun-13	8.69	0.27	22.5	0.38	0.06	<0.01	0.06	1.9	26.4	28.9	29.5	27.6	15.7	Slight
55347	12-Jun-13	9.02	0.15	12.5	0.23	0.05	<0.01	0.05	1.6	14.4	21.3	21.8	20.2	13.9	Slight
55348	12-Jun-13	8.48	0.05	4.2	0.14	0.02	<0.01	0.02	0.6	8.0	11.3	11.5	10.9	18.4	None
55349	12-Jun-13	8.66	0.19	15.8	0.29	0.01	<0.01	0.01	0.3	19.8	24.7	25.3	24.9	80.8	Slight
55350	12-Jun-13	8.79	0.15	12.5	0.27	0.02	<0.01	0.02	0.6	17.9	20.1	20.5	19.9	32.8	Slight
56097	12-Jun-13	8.70	0.16	13.3	0.24	0.03	<0.01	0.03	0.9	16.9	20.6	21.0	20.1	22.4	Slight
60576	5-Jul-13	8.32	1.26	105.0	1.34	2.3	0.01	2.29	71.6	86.2	82.8	84.5	12.9	1.2	Slight
60577	5-Jul-13	8.83	0.6	50.0	0.7	0.16	<0.01	0.16	5.0	39.3	49.0	50.0	45.0	10.0	Slight
60578	5-Jul-13	8.95	0.14	11.7	0.21	0.02	<0.01	0.02	0.6	15.8	20.1	20.5	19.9	32.8	Slight
60579	5-Jul-13	8.70	0.44	36.7	0.52	0.94	<0.01	0.94	29.4	31.0	35.0	35.8	6.4	1.2	Slight
60580	5-Jul-13	9.09	0.15	12.5	0.18	0.02	<0.01	0.02	0.6	16.3	20.8	21.3	20.6	34.0	Slight
60581	5-Jul-13	8.73	0.36	30.0	0.46	0.18	<0.01	0.18	5.6	31.0	33.6	34.3	28.6	6.1	Slight
60582	5-Jul-13	8.94	0.29	24.2	0.32	0.15	<0.01	0.15	4.7	27.6	30.1	30.8	26.1	6.6	Slight
60583	5-Jul-13	8.96	0.29	24.2	0.37	0.13	<0.01	0.13	4.1	24.9	31.6	32.3	28.2	7.9	Slight
60584	5-Jul-13	9.06	0.13	10.8	0.17	0.13	<0.01	0.13	4.1	14.5	27.0	27.5	23.4	6.8	Slight
60585	5-Jul-13	8.75	0.5	41.7	0.54	0.08	<0.01	0.08	2.5	44.6	50.5	51.5	49.0	20.6	Slight
60586	5-Jul-13	8.87	0.21	17.5	0.28	0.02	<0.01	0.02	0.6	20.1	25.5	26.0	25.4	41.6	Slight
60587	5-Jul-13	8.73	0.22	18.3	0.29	0.63	<0.01	0.63	19.7	21.4	24.3	24.8	5.1	1.3	Slight
60588	7-Jul-13	9.33	0.19	15.8	0.25	0.02	<0.01	0.02	0.6	18.3	19.6	20.0	19.4	32.0	Slight
60589	7-Jul-13	9.03	0.32	26.7	0.45	0.1	<0.01	0.10	3.1	28.6	34.3	35.0	31.9	11.2	Slight
60590	7-Jul-13	8.89	0.22	18.3	0.28	0.07	<0.01	0.07	2.2	19.0	23.5	24.0	21.8	11.0	Slight
60591	7-Jul-13	8.68	0.26	21.7	0.31	0.25	<0.01	0.25	7.8	16.3	21.1	21.5	13.7	2.8	Slight
60592	8-Jul-13	8.94	0.09	7.5	0.13	0.02	<0.01	0.02	0.6	11.3	12.3	12.5	11.9	20.0	Slight
60593	8-Jul-13	8.81	0.08	6.7	0.13	0.03	<0.01	0.03	0.9	10.7	11.0	11.3	10.3	12.0	Slight
60594	8-Jul-13	8.68	0.29	24.2	0.33	0.06	0.01	0.05	1.6	26.6	29.4	30.0	28.4	19.2	Slight
60595	25-Jul-13	8.92	0.16	13.3	0.24	0.02	<0.01	0.02	0.6	15.8	19.4	19.8	19.1	31.6	Slight
60596	25-Jul-13	9.02	0.11	9.2	0.24	0.02	<0.01	0.02	0.6	12.4	16.9	17.3	16.6	27.6	Slight
60597	25-Jul-13	8.90	0.2	16.7	0.29	0.01	<0.01	0.01	0.3	18.3	21.6	22.0	21.7	70.4	Slight
60598	25-Jul-13	8.84	0.2	16.7	0.22	0.02	<0.01	0.02	0.6	19.5	22.5	23.0	22.4	36.8	Slight
60599	25-Jul-13	8.62	0.58	48.3	0.72	0.47	<0.01	0.47	14.7	42.0	54.1	55.3	40.6	3.8	Slight
60600	25-Jul-13	8.90	0.67	55.8	0.77	0.35	<0.01	0.35	10.9	41.1	53.9	55.0	44.1	5.0	Slight
61251	24-Jun-13	8.96	0.48	40.0	0.52	0.03	<0.01	0.03	0.9	41.2	42.6	43.5	42.6	46.4	Slight
61252	24-Jun-13	8.91	0.34	28.3	0.39	0.1	<0.01	0.10	3.1	30.3	33.8	34.5	31.4	11.0	Slight
61253	25-Jun-13	8.95	0.25	20.8	0.27	0.02	<0.01	0.02	0.6	23.9	26.0	26.5	25.9	42.4	Slight
61254	25-Jun-13	8.93	0.3	25.0	0.33	0.02	<0.01	0.02	0.6	27.1	29.6	30.3	29.6	48.4	Slight
61255	25-Jun-13	8.99	0.26	21.7	0.27	0.02	<0.01	0.02	0.6	23.4	27.9	28.5	27.9	45.6	Slight
61256	25-Jun-13	8.96	0.37	30.8	0.38	0.07	<0.01	0.07	<0.3	30.8	37.2	38.0	38.0	126.7	Slight
61257	25-Jun-13	9.20	0.07	5.8	0.12	0.03	<0.01	0.03	0.9	8.4	11.3	11.5	10.6	12.3	Slight
61258	25-Jun-13	8.87	0.15	12.5	0.24	0.01	<0.01	0.01	0.3	16.0	17.9	18.3	17.9	58.4	Slight
61259	25-Jun-13	9.05	0.31	25.8	0.4	0.02	<0.01	0.02	0.6	25.8	29.9	30.5	29.9	48.8	Slight
61260	25-Jun-13	9.23	0.28	23.3	0.4	0.02	<0.01	0.02	0.6	24.2	28.2	28.8	28.1	46.0	Slight
61261	25-Jun-13	9.03	0.23	19.2	0.3	0.15	<0.01	0.15	4.7	19.8	29.9	30.5	25.8	6.5	Slight
61262	25-Jun-13	8.89	0.65	54.2	0.78	0.07	<0.01	0.07	2.2	51.6	62.7	64.0	61.8	29.3	Slight
61263	25-Jun-13	8.95	0.21	17.5	0.28	0.15	<0.01	0.15	4.7	15.7	25.5	26.0	21.3	5.5	Slight
61264	25-Jun-13	8.93	0.21	17.5	0.29	0.02	<0.01	0.02	0.6	20.2	23.5	24.0	23.4	38.4	Slight
61265	25-Jun-13	8.87	0.22	18.3	0.3	0.34	<0.01	0.34	10.6	28.7	23.3	23.8	13.1	2.2	Slight
61266	27-Jun-13	8.82	0.17	14.2	0.25	0.01	<0.01	0.01	0.3	18.4	17.6	18.0	17.7	57.6	Slight
61267	27-Jun-13	8.64	0.2	16.7	0.24	0.01	<0.01	0.01	0.3	19.9	21.1	21.5	21.2	68.8	Slight
61268	2-Jul-13	9.19	0.12	10.0	0.18	<0.01	<0.01	<0.01	<0.3	12.0	16.4	16.8	16.8	55.8	Slight
61269	2-Jul-13	9.05	0.46	38.3	0.5	0.02	<0.01	0.02	0.6	34.0	41.2	42.0	41.4	67.2	Slight
61270	2-Jul-13	8.88	0.44	36.7	0.5	0.08	<0.01	0.08	2.5	35.4	42.4	43.3	40.8	17.3	Slight
61271	2-Jul-13	8.62	0.95	79.2	1.01	1.26	<0.01	1.26	39.4	62.5	57.8	59.0	19.6	1.5	Slight
61272	2-Jul-13	9.23	0.33	27.5	0.36	<0.01	<0.01	<0.01	<0.3	30.4	32.8	33.5	33.5	111.7	Slight
61273	2-Jul-13	9.03	0.24	20.0	0.3	0.18	<0.01	0.18	5.6	24.2	29.4	30.0	24.4	5.3	Slight
61274	5-Jul-13	9.10	0.51	42.5	0.54	0.01	<0.01	0.01	0.3	42.0	49.7	50.8	50.4	162.4	Slight
61275	5-Jul-13	9.12	0.32	26.7	0.42	0.01	<0.01	0.01	0.3	29.0	35.8	36.5	36.2	116.8	Slight
62176	13-Jun-13	8.95	0.34	28.3	0.47	0.03	<0.01	0.03	0.9	31.6	37.2	38.0	37.1	40.5	Slight
62177	13-Jun-13	8.88	0.47	39.2	0.6	0.16	<0.01	0.16	5.0	39.8	44.8	45.8	40.8	9.2	Slight
62178	13-Jun-13	8.64	0.34	28.3	0.5	0.05	<0.01	0.05	1.6	31.5	38.5	39.3	37.7	25.1	Slight
62179	16-Jun-13	8.79	0.35	29.2	0.46	0.05	<0.01	0.05	1.6	29.0	35.5	36.3	34.7	23.2	Slight
62180	16-Jun-13	8.55	0.81	67.5	0.88	0.54	<0.01	0.54	16.9	44.7	55.6	56.8	39.9	3.4	Slight
62181	16-Jun-13	8.52	0.87	72.5	0.99	0.74	<0.01	0.74	23.1	54.3	70.1	71.5	48.4	3.1	Slight
62182	16-Jun-13	8.76	0.31	25.8	0.38	0.04	<0.01	0.04	1.3	27.3	27.2	27.8	26.5	22.2	Slight
62183	16-Jun-13	8.82	0.36	30.0	0.44	0.01	<0.01	0.01	0.3	32.4	35.5	36.3	35.9	116.0	Slight
62184	16-Jun-13	8.74	0.23	19.2	0.34	0.03	<0.01	0.03	0.9	21.3	22.3	22.8	21.8	24.3	Slight
62185	16-Jun-13	8.86	0.23	19.2	0.31	0.02	<0.01	0.02	0.6	22.1	26.7	27.3	26.6	43.6	Slight
62186	16-Jun-13	8.36	0.76	63.3	0.76	1.28	<0.01	1.28	40.0	46.9	51.0	52.0	12.0	1.3	Slight
62187	16-Jun-13	8.59	0.54	45.0	0.55	0.03	<0.01	0.03	0.9	48.4	49.2	50.3	49.3	53.6	Slight
62188	16-Jun-13	8.70	0.48	40.0	0.51	0.02	<0.01	0.02	0.6	40.7	47.0	48.0	47.4	76.8	Slight
62189	19-Jun-13	8.99	0.13	10.8	0.19	0.01	<0.01	0.01	0.3	13.8	17.9	18.3	17.9	58.4	Slight
62190	19-Jun-13	8.74	0.23	19.2	0.28	0.01	<0.01	0.01	0.3	22.2	27.0	27.5	27.2	88.0	Slight
62191	16-Jun-13	9.11	0.09	7.5	0.09	0.01	<0.01	0.01	0.3	11.9	9.1	9.3	8.9	29.6	Slight
62192	20-Jun-13	9.08	0.21	17.5	0.29	0.01	<0.01	0.01	0.3	20.6	21.8	22.3	21.9	71.2	Slight
62193	20-Jun-13	9.00	0.27	22.5	0.3	0.02	<0.01	0.02	0.6	24.9	28.2	28.8	28.1	46.0	Slight
62194	20-Jun-13	8.89	0.33	27.5	0.32	0.01	<0.01	0.01	0.3	28.1	32.6	33.3	32.9	106.4	Slight
62195	20-Jun-13	8.72	0.22	18.3	0.21	0.03	<0.01	0.03	0.9	20.4	24.7	25.3	24.3	26.9	Slight
62196	20-Jun-13	8.90	0.23	19.2	0.22	0.03	<0.01	0.03	0.9	20.7	25.5	26.0	25.1	27.7	Slight
62197	24-Jun-13	8.99	0.2	16.7	0.25	0.05	<0.01	0.05	1.6	18.5	21.6	22.0	20.4	14.1	Slight
62198	24-Jun-13	8.95	0.44	36.7	0.47	0.06	<0.01	0.06	1.9	37.0	40.9	41.8	39.9	22.3	Slight
62199	24-Jun-13	8.73	0.33	27.5	0.36	0.01	<0.01	0.01	0.3	29.1	37.0	37.8	37.4	120.8	Slight
62200	24-Jun-13	9.03	0.28	23.3	0.29	0.01	<0.01	0.01	0.3	25.0	29.9	30.5	30.2	97.6	Slight
74751	25-Jul-13	8.71	0.41	34.2	0.44	0.03	<0.01	0.03	0.9	39.0	43.6	44.5	43.6	47.5	Slight
74752	25-Jul-13	8.82	0.2	16.7	0.29	0.03	<0.01	0.03	0.9	22.2	24.7	25.3	24.3	26.9	Slight
74753	25-Jul-13	8.84	0.31	25.8	0.36	0.44	<0.01	0.44	13.8	27.1	30.1	30.8	17.0	2.2	Slight
74754	25-Jul-13	8.91	0.29	24.2	0.38	0.02	<0.01	0.02	0.6	27.8	33.8	34.5	33.9	55.2	Slight
74755	25-Jul-13	8.80	0.37	30.8	0.42	0.04	<0.01	0.04	1.3	34.6	37.0	37.8	36.5	30.2	Slight
74756	25-Jul-13	8.68	0.16	13.3	0.21	0.03	<0.01	0.03	0.9	18.1	22.1	22.5	21.6	24.0	Slight
74757	25-Jul-13	8.81	0.1	8.3	0.13	0.01	<0.01	0.01	0.3	13.0	16.9	17.3	16.9	55.2	Slight
74758	25-Jul-13	8.40	0.32	26.7	0.36	0.52	<0.01	0.52	16.3	22.4	32.6	33.3	17.0	2.0	Slight
74759	25-Jul-13	8.67	0.39	32.5	0.45	0.06	<0.01	0.06	1.9	36.2	39.0	39.8	37.9	21.2	Slight
74760	25-Jul-13	8.76	0.26	21.7	0.34	0.02	<0.01	0.02	0.6	25.6	27.9	28.5	27.9	45.6	Slight
74761	25-Jul-13	8.91	0.17	14.2	0.23	0.21	<0.01	0.21	6.6	18.7	21.3	21.8	15.2	3.3	Slight

Sample ID	Sampling Date	Paste pH	TIC %	CaCO3 NP	C(T) %	S(T) %	S(SO4) %	S(S-2) %	AP	NP	NP H2SO4/tonne	NP CaCO3/tonne	Net NP	NP:AP Ratio (NP/AP)	Fizz Test
Method Code		Sobek	CSB02V	Calc	CSA01V	CSA06V	CSA07V	Calc	Calc	Modified	BC Research	Calc	Calc	Calc	Sobek
74762	25-Jul-13	8.92	0.22	18.3	0.29	0.05	<0.01	0.05	1.6	23.5	26.7	27.3	25.7	17.4	Slight
74763	25-Jul-13	8.87	0.22	18.3	0.25	0.02	<0.01	0.02	0.6	22.9	26.5	27.0	26.4	43.2	Slight
74764	25-Jul-13	8.76	0.18	15.0	0.24	0.02	<0.01	0.02	0.6	20.0	23.8	24.3	23.6	38.8	Slight
74765	25-Jul-13	8.84	0.12	10.0	0.15	0.01	<0.01	0.01	0.3	13.9	14.7	15.0	14.7	48.0	Slight
74766	25-Jul-13	8.80	0.2	16.7	0.28	<0.01	<0.01	<0.01	<0.3	21.6	23.3	23.8	23.8	79.2	Slight
74767	25-Jul-13	8.65	0.17	14.2	0.2	<0.01	<0.01	<0.01	<0.3	19.4	20.3	20.8	20.8	69.2	Slight
74768	25-Jul-13	8.57	0.35	29.2	0.39	0.01	<0.01	0.01	0.3	34.5	35.3	36.0	35.7	115.2	Slight
74769	25-Jul-13	8.85	0.22	18.3	0.25	<0.01	<0.01	<0.01	<0.3	21.1	24.3	24.8	24.8	82.5	Slight
74774	25-Jul-13	8.91	0.27	22.5	0.3	0.03	<0.01	0.03	0.9	25.9	29.4	30.0	29.1	32.0	Slight
74775	25-Jul-13	8.36	0.08	6.7	0.12	0.81	0.03	0.78	24.4	10.3	14.9	15.3	-9.1	0.6	Slight
74778	25-Jul-13	8.99	0.12	10.0	0.14	0.04	<0.01	0.04	1.3	14.8	18.9	19.3	18.0	15.4	Slight
74779	25-Jul-13	8.78	0.26	21.7	0.3	0.02	<0.01	0.02	0.6	26.4	29.9	30.5	29.9	48.8	Slight
74781	26-Jul-13	8.53	0.21	17.5	0.28	0.02	<0.01	0.02	0.6	21.5	26.5	27.0	26.4	43.2	Slight
74782	26-Jul-13	8.37	0.15	12.5	0.2	0.17	<0.01	0.17	5.3	18.0	15.7	16.0	10.7	3.0	Slight
74783	26-Jul-13	8.26	0.03	2.5	0.06	0.09	0.04	0.05	1.6	9.1	11.3	11.5	9.9	7.4	None
Final Tails June 2013	20-Jun-13	8.18	0.37	30.8	0.39	0.05	<0.01	0.05	1.6	30.7	41.4	42.3	40.7	27.0	Slight
Final Tails June 2/13	2-Jun-13	8.31	0.39	32.5	0.41	0.08	<0.01	0.08	2.5	30.6	36.5	37.3	34.8	14.9	Slight
Duplicates															
55344		8.67								10.9					Slight
55346			0.27												
55349							<0.01								
60585					0.52	0.08									
60587		8.77								21.7					Slight
60588		9.34								17.9					Slight
60593			0.09												
61257		9.18			0.12	0.03				9.0					Slight
61258		8.99								15.7					Slight
61263			0.21												
61265							<0.01								
61268			0.12												
61272					0.36	0.01									
62177		8.87								39.2					Slight
62178		8.78					<0.01			30.6					Slight
62194			0.34												
62197		9.04								18.8					Slight
62198		8.88								36.8					Slight
74752			0.21												
74756					0.2	0.03									
74764							<0.01								
74767		8.70								19.2					Slight
74768		8.59								34.6					Slight
74774					0.3	0.02									
74779			0.26												
74782							<0.01								
Final Tails June 2/13			0.38												
QC															
GTS-2A					2.03	0.35									
GTS-2A					2	0.36									
Expected Values GTS-2A					2.01	0.35									
Tolerance +/-					0.15	0.03									
502-491_1001					11.5	11.3									
Expected Values 502-491_1001					11.44	11.16									
Tolerance +/-					0.23	0.23									
RTS-3A							1.11								
RTS-3A							1.05								
Expected Values RTS-3A							1.1								
Tolerance +/-							0.11								
PD-1							4.49								
Expected Values PD-1							4.27								
Tolerance +/-							0.3								
SY4			0.9												
SY4			0.92												
Expected Values SY4			0.95												
Tolerance +/-			0.06												
TIC-L1			0.13												
Expected Values TIC-L1			0.1325												
Tolerance +/-			0.02												
NBM-1										42.0					Slight
NBM-1										41.0					Slight
NBM-1										41.2					Slight
Expected Values NBM-1										42.0					Slight
Tolerance +/-										3.0					

Note:

AP = Acid potential in tonnes CaCO3 equivalent per 1000 tonnes of material. AP is determined from calculated sulphide sulphur content: S(T) - S(SO4).

NP = Neutralization potential in tonnes CaCO3 equivalent per 1000 tonnes of material.

NET NP = NP - AP

Carbonate NP is calculated from TIC originating from carbonate minerals and is expressed in kg CaCO3/tonne.

CLIENT : Minto Mines
PROJECT : Minto Project
SGS Project # : 0643
Test : Metals by Aqua Regia Digestion with ICP-MS Finish
Date : August 28, 2013

Sample ID	Al	B	Ba	Ca	Cr	Cu	Fe	K	Li	Mg	Mn	Na	Ni	P	S	Sr	Ti	V	Zn	Zr	Ag	As	Be	Bi	Cd	Ce
	%	ppm	ppm	%	ppm	ppm	%	%	ppm	%	ppm	%	ppm	ppm	%	ppm	%	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Method Code	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B
LOD	0.01	10	5	0.01	1	0.5	0.01	0.01	1	0.01	2	0.01	0.5	50	0.01	0.5	0.01	1	1	0.5	0.01	1	0.1	0.02	0.01	0.05
55344	1.2	40	334	0.51	127	488	2.32	0.62	6	0.69	515	0.04	5.3	570	0.01	31.3	0.11	47	58	0.7	<0.01	<1	0.2	<0.02	0.04	23.3
55345	0.98	50	296	0.91	153	384	2.26	0.33	6	0.61	444	0.05	14.1	780	0.02	45.5	0.09	47	55	4.8	<0.01	3	0.3	0.02	0.13	19.1
55346	1.13	50	222	1.18	135	453	2.39	0.44	7	0.77	542	0.05	5.7	690	0.06	55.6	0.08	49	63	1.2	<0.01	<1	0.3	0.05	0.1	19.1
55347	1.14	50	342	0.68	95	396	2.17	0.69	5	0.67	421	0.05	5.4	490	0.04	52	0.12	51	60	0.7	<0.01	<1	0.2	0.02	0.04	11.9
55348	1.23	40	342	0.43	143	567	2.49	0.6	7	0.71	433	0.04	7.2	660	<0.01	28.8	0.12	50	61	1.5	<0.01	1	0.1	<0.02	0.07	19.3
55349	1.03	30	208	0.96	129	203	2.22	0.51	6	0.63	586	0.05	5.3	650	<0.01	42.5	0.09	45	67	1.1	<0.01	<1	0.3	<0.02	0.1	23.1
55350	1.25	50	274	0.85	128	354	2.77	0.66	7	0.83	612	0.05	5.4	640	<0.01	38.2	0.12	59	82	1.1	<0.01	<1	0.3	<0.02	0.08	20.6
56097	1.31	50	260	0.89	73	194	2.57	0.58	7	0.8	610	0.05	5.5	740	0.02	39.6	0.1	52	102	1.3	<0.01	1	0.3	<0.02	0.07	20.2
60576	1	30	143	3.43	111	5470	4.73	0.48	4	0.76	573	0.03	5.5	870	2.32	108	0.08	78	62	2.2	0.53	<1	0.2	0.04	0.37	53
60577	1.2	40	401	1.59	132	1380	3.34	0.56	6	0.8	540	0.04	5.9	530	0.17	85.2	0.09	62	81	1.2	0.43	<1	0.2	0.17	0.1	21.2
60578	1.19	50	309	0.77	74	58.6	2.31	0.57	5	0.77	522	0.06	4.8	640	0.02	36.2	0.11	50	62	1	<0.01	1	0.2	<0.02	0.04	21.7
60579	1.28	40	356	1.35	74	983	3.39	0.77	6	0.79	511	0.04	4.8	850	0.91	64.3	0.12	59	57	1.5	<0.01	<1	0.2	0.02	0.08	27.1
60580	1.29	50	210	0.97	68	77	2.58	0.55	7	0.94	615	0.07	5.1	870	0.01	63.9	0.12	57	79	1.7	<0.01	<1	0.3	<0.02	0.04	20.8
60581	1.4	50	411	1.38	136	1200	3.03	0.79	7	0.85	584	0.05	5.5	750	0.16	89.1	0.13	68	79	1.1	0.4	<1	0.2	0.19	0.11	26.7
60582	1.16	40	299	1.24	139	1800	2.31	0.48	6	0.7	498	0.05	5	700	0.14	70.5	0.08	45	61	0.8	0.05	<1	0.2	<0.02	0.03	15.7
60583	1.23	50	325	1.12	75	287	2.62	0.63	5	0.72	549	0.05	5.2	810	0.12	53.2	0.1	56	63	1.2	<0.01	<1	0.2	<0.02	0.03	22.9
60584	1.29	50	189	0.86	68	2590	2.92	0.47	7	0.89	578	0.06	4.8	800	0.13	49.1	0.1	58	79	1.1	1.92	<1	0.3	1.06	0.24	18.2
60585	1.05	50	137	2.01	126	993	2.33	0.16	7	0.64	584	0.05	5.1	620	0.07	87	0.03	42	77	1.1	0.34	<1	0.3	0.11	0.18	19.4
60586	1.23	40	430	0.98	81	157	2.42	0.71	6	0.79	554	0.05	4.9	690	0.01	42.3	0.12	54	72	1	<0.01	<1	0.2	<0.02	0.02	24
60587	1.3	50	279	0.94	76	573	3.14	0.72	6	0.81	515	0.05	5	650	0.63	48.1	0.12	61	62	1.2	<0.01	<1	0.2	<0.02	0.03	26.1
60588	1.07	40	154	1.05	129	19.6	1.92	0.29	6	0.65	470	0.1	3.7	560	<0.01	56.6	0.09	41	54	1.2	<0.01	<1	0.3	<0.02	0.04	13.4
60589	1	40	80	1.33	123	1730	2.35	0.13	7	0.72	514	0.05	3.8	660	0.09	73.1	0.03	40	59	1.1	0.6	<1	0.4	0.48	0.11	19
60590	1.15	50	189	0.9	132	929	2.57	0.54	7	0.7	618	0.04	3.9	680	0.06	55.3	0.08	52	87	1.4	0.12	<1	0.2	0.09	0.11	24.7
60591	0.96	50	137	0.73	130	2660	2.73	0.49	5	0.58	564	0.04	3.4	760	0.23	37.6	0.08	47	102	1.9	0.68	<1	0.1	0.07	0.25	21.4
60592	1.42	50	560	0.59	126	78.8	2.54	0.81	7	0.82	538	0.05	4	880	<0.01	31.1	0.15	58	66	1	<0.01	<1	0.2	<0.02	0.04	18.9
60593	1.34	40	473	0.53	135	245	2.48	0.76	6	0.71	562	0.05	3.9	910	0.01	30.3	0.13	58	65	1.2	<0.01	<1	0.2	<0.02	0.04	27.8
60594	0.86	40	238	1.2	119	1230	2.54	0.39	4	0.45	505	0.04	3.6	620	0.05	45.6	0.06	57	63	1.4	0.09	1	0.2	0.06	0.17	24
60595	1.06	50	151	0.91	137	43	1.97	0.37	7	0.63	508	0.05	3.8	620	<0.01	45.8	0.07	41	59	1.2	<0.01	<1	0.3	<0.02	0.07	16.9
60596	1.07	50	122	0.82	81	143	1.97	0.33	7	0.67	482	0.06	3.8	650	<0.01	47.1	0.08	38	64	1.3	<0.01	<1	0.3	<0.02	0.12	20.1
60597	0.93	50	187	0.86	137	123	2.26	0.51	5	0.6	557	0.05	4.3	680	<0.01	57.9	0.09	46	67	1.3	<0.01	<1	0.2	<0.02	0.07	18.7
60598	1.16	50	286	0.95	74	26.6	2.41	0.63	6	0.68	565	0.05	3.4	650	<0.01	45.3	0.1	51	66	1.2	<0.01	1	0.2	<0.02	0.04	28.2
60599	0.95	40	208	1.85	127	2920	2.76	0.24	5	0.55	464	0.04	4.2	940	0.46	88.9	0.03	56	70	1.5	0.59	<1	0.3	0.13	0.19	34.6
60600	1.32	30	411	1.61	88	1420	4.53	0.63	7	0.92	717	0.05	4.4	560	0.35	93.1	0.12	105	87	2	0.06	1	0.2	0.25	0.12	39.7
61251	1.31	50	126	1.98	67	21.1	2.02	0.1	8	0.73	547	0.14	3.1	610	<0.01	123	0.02	36	63	1.1	<0.01	2	0.7	0.03	0.06	21.1
61252	1.13	50	75	1.51	130	1060	2.07	0.11	6	0.67	651	0.05	3.3	620	0.09	105	<0.01	36	74	1.2	0.57	<1	0.5	0.21	0.21	21.5
61253	1.16	60	157	1.19	80	77.7	2.24	0.36	7	0.78	578	0.06	3.7	730	<0.01	86.9	0.07	48	76	1.5	<0.01	1	0.4	0.05	0.07	21.3
61254	1.21	50	139	1.35	80	59.9	2.04	0.25	8	0.72	505	0.06	3.7	630	<0.01	106	0.04	38	59	1.2	<0.01	<1	0.6	0.04	0.02	18.6
61255	1.27	60	321	1.16	139	60.5	2.5	0.66	6	0.77	584	0.07	4.1	670	<0.01	90	0.12	58	72	1.3	<0.01	<1	0.3	0.03	0.04	20.3
61256	1.07	60	201	1.35	125	497	2.06	0.26	6	0.63	388	0.05	3.6	600	0.06	60.3	0.04	43	60	1.1	<0.01	<1	0.3	0.05	0.11	16.8
61257	1.04	50	282	0.45	158	228	1.89	0.59	5	0.58	417	0.06	3.6	540	0.02	28.8	0.1	44	47	1	<0.01	<1	0.2	0.03	0.03	13.1
61258	1.38	50	532	0.82	146	56.4	2.46	0.74	7	0.77	602	0.06	4.3	870	<0.01	42.3	0.13	56	62	1	<0.01	<1	0.2	0.03	0.02	30
61259	1.11	60	144	1.25	139	68	2.12	0.21	7	0.76	549	0.08	3.8	640	0.01	102	0.05	43	65	1.2	<0.01	1	0.5	0.04	0.03	22.1
61260	1.04	50	143	1.24	89	218	1.87	0.22	5	0.61	538	0.08	3.2	570	0.02	82.1	0.05	39	58	1.2	<0.01	1	0.4	0.06	0.07	21.4
61261	1.19	60	117	1.1	88	1710	2.65	0.24	7	0.78	543	0.06	3.7	680	0.15	60.3	0.05	50	74	1.4	0.29	1	0.3	0.19	0.07	21.8
61262	1.67	40	93	2.72	99	708	2.51	0.12	11	0.86	626	0.28	3.6	730	0.05	144	0.01	45	73	1.1	0.44	2	0.9	0.18	0.08	20.2
61263	1.22	50	233	0.85	139	2450	3	0.71	6	0.74	582	0.05	3.9	750	0.14	43.5	0.13	59	96	1.5	0.64	<1	0.2	0.34	0.28	20.7
61264	1.23	50	251	1.03	149	304	2.71	0.53	8	0.76	602	0.05	4.6	690	0.01	52.1	0.1	61	79	1.5	<0.01	<1	0.3	0.06	0.06	30.1
61265	1.45	50	424	0.94	134	4890	3.33	1.03	7	0.88	661	0.05	4.1	860	0.32	41.8	0.19	77	108	1.5	1.55	<1	0.2	0.29	0.28	22.9
61266	1.27	50	272	0.85	134	114	2.47	0.56	7	0.73	589	0.05	4.2	810	<0.01	55.7	0.09	53	71	1.2	<0.01	1	0.2	0.03	0.04	34.8
61267	1.12	50	96	0.95	111	107	2.04	0.14	6	0.51	510	0.04	3.3	580	<0.01	40	<0.01	35	53	0.9	<0.01	1	0.3	0.03	0.11	16.6
61268	1.45	60	399	0.75	146	68.3	2.5	0.77	7	0.84	623	0.07	4.1	650	<0.01	40.4	0.14	57	67	1.2	<0.01	<1	0.3	0.03	0.02	23.6
61269	1.01	60	204	1.53	79	21.7	2.07	0.16	7	0.65	500	0.06	3	530	0.01	103	0.02	36	60	1.1	<0.01	<1	0.5	0.02	0.02	19.9
61270	1.13	60	78	1.63	75	965	2.43	0.1	7	0.75	576	0.05	3.7	710	0.09	138	<0.01	40	71	1.1	0.15	2	0.5	0.24	0.05	24.8
61271	0.75	50	163	2.68	107	3630	3.05	0.35	3	0.49	371	0.04	3.7	930	1.24	114	0.05	68	53	1.9	0.41	<1	0.4	0.08	0.26	49.9
61272	0.98	50	111	1.54	80	48.5	1.92	0.16	6	0.59	510	0.06	3	510	<0.01	71.8	0.04	33	53	1.2	<0.01	<1	0.5	0.03	0.03	15.6
61273	1.4	40	120	1.36	77	3240	2.85	0.15	9	0.87	595	0.07	3.4	770	0.2	85.3	0.04	51	84	1.5	1.42	1	0.4	0.84	0.21	25.7
61274	1.09	50	70	1.81	129	11.1	2.14	0.14	7	0.68	529	0.05	3.2	660	<0.01	105	0.02	42	63	1.1	<0.01	1	0.4	0.03	0.03	22.1

Sample ID	Al %	B ppm	Ba ppm	Ca %	Cr ppm	Cu ppm	Fe %	K %	Li ppm	Mg %	Mn ppm	Na %	Ni ppm	P ppm	S %	Sr ppm	Ti %	V ppm	Zn ppm	Zr ppm	Ag ppm	As ppm	Be ppm	Bi ppm	Cd ppm	Ce ppm
Method Code	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B
LOD	0.01	10	5	0.01	1	0.5	0.01	0.01	1	0.01	2	0.01	0.5	50	0.01	0.5	0.01	1	1	0.5	0.01	1	0.1	0.02	0.01	0.05
61275	1.26	50	74	1.57	75	24.8	2.28	0.11	8	0.86	572	0.08	3.3	730	<0.01	120	0.07	48	67	1.6	<0.01	2	0.5	0.03	0.04	19.8
62176	1.39	50	173	1.47	80	78	2.36	0.3	10	0.85	551	0.05	3.6	690	0.02	106	0.04	45	66	1.3	<0.01	<1	0.5	0.03	0.04	20
62177	1.39	60	236	1.82	82	904	2.83	0.44	8	0.75	465	0.05	3.7	650	0.15	89.3	0.07	64	64	1.3	<0.01	<1	0.4	0.04	0.08	24.7
62178	1.53	60	568	1.43	92	602	2.86	0.81	7	0.84	598	0.06	4.1	690	0.05	78	0.15	71	82	1.4	<0.01	<1	0.3	0.07	0.06	17.6
62179	1.21	60	220	1.37	81	415	2.29	0.31	8	0.81	562	0.07	3.5	610	0.04	85.3	0.07	48	71	1.3	<0.01	<1	0.4	0.05	0.04	23.2
62180	0.42	50	106	1.63	123	1740	2.22	0.09	2	0.42	333	0.04	3.4	460	0.56	88.1	<0.01	34	54	1.1	0.2	<1	0.3	0.05	0.15	16.5
62181	1.04	50	422	2.19	99	2590	3.67	0.46	5	0.73	548	0.04	5.3	770	0.77	90	0.07	78	70	2	0.42	1	0.3	0.32	0.19	32.2
62182	1.36	60	304	1.25	145	142	2.51	0.55	7	0.78	537	0.06	4.2	620	0.03	81.1	0.09	57	67	1.1	<0.01	1	0.3	0.03	0.03	33.4
62183	1.17	60	208	1.52	91	40.4	2.26	0.35	6	0.68	565	0.06	3.6	580	<0.01	67.9	0.06	50	65	1.2	<0.01	1	0.5	0.03	0.03	24.7
62184	1.29	60	305	1.1	93	181	2.62	0.59	7	0.81	597	0.07	4.4	750	0.03	56.7	0.12	62	74	1.5	<0.01	<1	0.3	0.03	0.04	24.5
62185	1.4	50	513	1.05	93	36.2	2.46	0.78	6	0.79	579	0.07	4	820	0.02	52.8	0.14	61	61	1.5	<0.01	<1	0.3	0.03	0.03	23.6
62186	1.42	50	220	1.97	64	2230	5.1	0.7	6	0.82	722	0.05	3.6	930	1.21	80.3	0.12	97	77	2.7	0.25	1	0.3	0.28	0.17	34.2
62187	1.48	60	162	2.21	108	100	2.48	0.18	11	0.88	659	0.05	3.5	820	0.02	127	0.02	44	74	1.3	<0.01	<1	0.7	<0.02	0.05	24.4
62188	0.94	60	173	1.86	76	12.5	1.64	0.12	6	0.46	436	0.06	3.1	490	<0.01	106	<0.01	31	45	1.2	<0.01	<1	0.5	<0.02	0.03	16.8
62189	1.29	60	344	0.79	93	55.1	2.35	0.68	6	0.76	576	0.07	3.8	730	<0.01	42	0.14	55	62	1.4	<0.01	<1	0.2	<0.02	0.05	21.9
62190	1.41	60	369	1.13	91	32.7	2.53	0.65	7	0.78	608	0.07	4.2	650	<0.01	44.6	0.12	57	68	1.4	<0.01	<1	0.3	<0.02	0.04	19.9
62191	1.49	60	600	0.62	148	245	2.44	0.98	6	0.77	490	0.08	3.8	1280	0.01	32.4	0.19	67	61	1	<0.01	<1	0.1	<0.02	0.05	17.9
62192	1.41	60	144	1.29	140	52.3	2.26	0.25	8	0.79	559	0.14	4.5	760	0.01	84	0.1	50	68	1.5	<0.01	1	0.5	<0.02	0.05	20.1
62193	1.29	60	148	1.26	87	79.1	2.28	0.31	7	0.8	647	0.07	3.8	680	0.01	77.9	0.06	49	65	1.4	<0.01	<1	0.4	<0.02	0.04	23
62194	1.34	60	46	1.38	119	33	2.14	0.1	9	0.85	546	0.06	3.3	650	<0.01	127	0.02	41	65	1.1	<0.01	<1	0.5	<0.02	0.04	20.1
62195	1.27	50	248	0.98	74	194	2.38	0.54	6	0.73	527	0.06	3.6	690	0.02	42.1	0.09	51	71	1.4	<0.01	<1	0.3	0.03	0.05	19.2
62196	1.17	60	301	1.03	83	138	2.41	0.54	6	0.72	567	0.07	3.6	740	0.02	49.4	0.1	55	68	1.4	<0.01	<1	0.3	<0.02	0.04	19.3
62197	1.27	60	369	0.86	97	263	2.63	0.72	6	0.76	536	0.07	4.3	710	0.06	54.6	0.12	62	63	1.2	<0.01	<1	0.2	0.07	0.04	25.1
62198	1.11	60	180	1.74	78	931	2.34	0.51	5	0.63	589	0.06	3.3	730	0.06	85.6	0.1	53	76	1.6	0.39	1	0.3	1.18	0.14	20
62199	1.38	60	236	1.4	84	21.2	2.67	0.47	7	0.82	616	0.06	4	680	0.02	60.8	0.09	61	77	1.6	<0.01	1	0.3	<0.02	0.05	20.3
62200	1.25	70	122	1.38	87	26.1	2.2	0.23	7	0.75	549	0.11	3.9	650	<0.01	79.3	0.08	47	67	1.4	<0.01	1	0.4	<0.02	0.04	21.7
74751	1.36	60	127	1.86	131	257	2.34	0.26	8	0.87	674	0.06	3.5	720	0.03	129	0.05	51	74	1.5	<0.01	<1	0.5	<0.02	0.13	27.7
74752	1.45	70	210	1.19	80	243	2.42	0.46	8	0.85	629	0.07	3.8	680	0.02	119	0.1	55	73	1.5	<0.01	1	0.4	0.05	0.06	23
74753	1.23	60	211	1.31	146	518	2.65	0.34	7	0.73	519	0.06	3.9	650	0.46	97.6	0.07	50	61	1.5	<0.01	<1	0.4	<0.02	0.06	25.9
74754	1.18	50	352	1.28	146	144	2.29	0.56	6	0.66	510	0.06	4	620	0.02	84.5	0.09	48	61	1	<0.01	<1	0.3	0.03	0.06	24.3
74755	1.2	60	194	1.6	82	239	2.15	0.41	6	0.68	514	0.06	3.5	580	0.04	95.6	0.08	46	56	1.1	<0.01	<1	0.3	<0.02	0.05	17.3
74756	1.33	60	270	0.91	79	441	2.59	0.65	7	0.76	590	0.06	4	780	0.02	53.5	0.12	61	79	1.5	0.06	<1	0.3	0.04	0.06	21.6
74757	1.32	70	243	0.88	76	13	2.28	0.55	7	0.78	553	0.1	3.8	780	0.01	50.8	0.13	54	68	2.7	<0.01	<1	0.3	<0.02	0.03	16.8
74758	1.26	50	134	0.95	131	6000	4.68	0.31	9	0.79	700	0.05	4	640	0.51	73.9	0.05	82	120	1.5	1.49	<1	0.2	0.24	0.28	19.3
74759	1.31	70	325	1.65	142	72.4	2.44	0.68	6	0.67	577	0.06	3.6	710	0.05	63.1	0.12	60	64	1.6	<0.01	<1	0.2	<0.02	0.05	21.1
74760	1.29	60	347	1.21	148	40.2	2.37	0.66	6	0.72	583	0.06	4.3	710	0.01	55.2	0.12	56	65	1.3	<0.01	<1	0.2	<0.02	0.03	22.3
74761	1.72	60	610	0.88	80	270	3.32	1.23	8	1.05	596	0.08	3.9	1040	0.19	40.8	0.23	89	72	1.3	<0.01	<1	0.2	<0.02	0.04	17.9
74762	1.25	80	153	1.29	143	246	2.32	0.36	6	0.77	555	0.08	4	730	0.05	82.8	0.1	51	87	1.6	<0.01	<1	0.3	0.02	0.14	20.6
74763	1.29	60	216	1.1	90	41.6	2.33	0.49	6	0.75	522	0.07	3.8	610	0.01	96	0.09	52	68	1.2	<0.01	<1	0.3	<0.02	0.04	16.2
74764	1.31	60	375	1.03	76	251	2.26	0.59	6	0.74	525	0.07	3.5	870	0.02	41.6	0.11	51	61	1	<0.01	<1	0.2	<0.02	0.05	20.6
74765	1.44	50	417	0.78	142	18.2	2.48	0.76	6	0.82	658	0.07	4.3	720	<0.01	42.7	0.14	56	68	1.1	<0.01	<1	0.2	<0.02	0.04	24.2
74766	1.36	60	217	1.21	78	25.1	2.48	0.4	8	0.86	584	0.07	5.3	820	<0.01	56.2	0.09	53	65	1.4	<0.01	<1	0.3	<0.02	0.03	18.5
74767	1.16	70	227	0.96	151	518	2.47	0.55	7	0.69	593	0.07	4.2	690	<0.01	61.2	0.11	55	66	1.5	<0.01	<1	0.2	0.04	0.08	20.9
74768	1.18	60	161	1.59	83	695	2.35	0.41	6	0.64	612	0.06	3.3	610	0.01	65.8	0.07	49	70	1.3	<0.01	1	0.3	0.09	0.15	23.6
74769	1.01	60	140	1.02	147	102	2.08	0.4	6	0.64	522	0.07	3.7	580	<0.01	69.3	0.09	44	60	1.4	<0.01	<1	0.2	<0.02	0.11	18.8
74774	1.03	40	165	1.21	133	167	2.1	0.32	6	0.7	513	0.06	5.1	610	0.02	70.1	0.07	40	63	0.8	<0.01	1	0.3	<0.02	0.05	19.1
74775	0.78	40	88	0.54	129	2180	2.07	0.21	5	0.42	232	0.03	5.5	790	0.81	41.6	0.02	24	31	1.7	0.35	<1	0.1	0.09	0.1	26.8
74778	0.99	50	153	0.89	73	394	1.94	0.28	6	0.64	469	0.07	4.8	660	0.04	46.1	0.1	41	57	1.1	0.04	1	0.2	<0.02	0.04	17.2
74779	1.1	40	130	1.32	121	105	1.96	0.28	6	0.68	499	0.07	5	630	0.02	81.4	0.06	38	63	1	<0.01	<1	0.4	<0.02	0.07	17.9
74781	1.09	50	277	1	78	315	2.45	0.66	5	0.63	552	0.06	5.3	780	0.02	48.5	0.11	52	71	1.2	<0.01	<1	0.2	<0.02	0.06	24
74782	1.31	40	290	0.8	121	1990	3.8	0.68	6	0.74	579	0.04	5.7	1100	0.19	34.5	0.13	84	84	2.4	0.17	2	0.4	0.09	0.08	29.3
74783	1.04	40	130	0.4	63	1930	2.53	0.19	7	0.54	490	0.04	5.2	650	0.08	57.5	0.02	38	59	1.6	<0.01	1	0.3	0.02	0.07	23.6
Final Tails June 2013	1.23	40	300	1.23	69	540	3.32	0.68	6	0.83	567	0.05	5.7	880	0.04	66.5	0.12	70	98	1.5	0.07	<1	0.2	0.08	0.21	24.6
Final Tails June 2/13	1.26	30	265	1.25	103	1380	4.05	0.67	7	0.84	668	0.05	6.9	800	0.07	73	0.11	69	116	1.7	0.58	<1	0.3	0.21	0.3	22.1
Duplicates																										
60579	1.26	40	364	1.36	72	960	3.38	0.77	6	0.77	507	0.04	5	830	0.87	64	0.12	59	57	1.5	<0.01	<1	0.2	0.02	0.07	27.7
60590	1.14	50	191	0.89	130	928	2.54	0.53	7	0.69	612	0.04	3.9	720	0.05	54.9	0.08	52	85	1.4	0.08	<1	0.2	0.08	0.14	24.2
61266	1.26	50	266	0.84	134	112	2.42	0.54	7	0.72	566	0.05	4	760	<0.01	54.7	0.09	53	69	1.2	<0.01	2	0.3	0.04	0.04	36.2
62198	1.11	60	175	1.72	79	941	2.32	0.51	5	0.62	588	0.07	3.4	700	0.05	85.6	0.1	51	75	1.6	0.42	1	0.3	1.18	0.16	20.5
74765	1.31	60	425	0.7	137	17.1	2.42	0.75	5	0.76	644	0.07	4.3	690	<0.01	42	0.13	56	67	1.1	<0.01	<1	0.2	<0.02	0.04	23.8
Final Tails Jun 2013	1.26	40	313	1.27	68	560	3.42	0.7	6	0.86	581	0.05	5.5	870	0.04	67.9	0.12	70	101	1.5	0.08	<1	0.2	0.08	0.23	25.3
Reference Materials																										
CH4	1.82	40	296	0.59	107	2070	4.72	1.42	12	1.21	324	0.05	50.2	660	0.64	8.3	0.2	77	209	10.5	2.19	8	<0.1	0.45	1.17	27.7
CH4	1.85	40	305	0.62	108	2100	4.74	1.45	13	1.2	327	0.06	49.9	700	0.65	8.7	0.21	80	201	11.8	2.08	8	<0.1	0.51	1.15	28.7
CH4	1.89	40	302	0.65	110	2110	4.81	1.45	13	1.23	332	0.06	50.1	710	0.64	9.4	0.23	82	198	15	2.02	9	0.1	0.46	1.11	28.6
Certified Values	1.85	#N/A	293	0.61	103.8	2000	4.79	1.43	12.6	1.18	324	0.06	49.57	719	0.73	9.38	0.21	79.27	189.4	9	2.13	8.14	0.11	0.51	1.17	28.18
Tolerance (%)	11.35	#N/A	14.3	14.1	12.4	10.1	10.52	11.74	29.84	12.3	11.5	50.3	12.52	27.4	13.4	23.3	23.3	13.2	11.3	17.7	10.9	13.1	241.3	19.7	12.1	10.4

Sample ID	Co ppm	Cs ppm	Ga ppm	Ge ppm	Hf ppm	Hg ppm	In ppm	La ppm	Lu ppm	Mo ppm	Nb ppm	Pb ppm	Rb ppm	Sb ppm	Sc ppm	Se ppm	Sn ppm	Ta ppm	Tb ppm	Te ppm	Th ppm	Tl ppm	U ppm	W ppm	Y ppm	Yb ppm
Method Co	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B
LOD	0.1	0.05	0.1	0.1	0.05	0.01	0.02	0.1	0.01	0.05	0.05	0.2	0.2	0.05	0.1	1	0.3	0.05	0.02	0.05	0.1	0.02	0.05	0.1	0.05	0.1
55344	7.3	0.37	5.8	<0.1	0.05	<0.01	0.02	12.3	0.07	4.43	0.33	2.2	27.9	<0.05	3.4	<1	1	<0.05	0.23	<0.05	3.2	0.2	0.17	0.3	6.07	0.5
55345	7.4	0.5	4.2	<0.1	0.15	0.02	0.02	10	0.09	12.8	0.5	3.5	15.2	0.2	4	<1	0.5	<0.05	0.25	<0.05	2.5	0.11	0.37	0.3	6.93	0.6
55346	6.9	0.29	5.8	<0.1	0.07	<0.01	0.02	10	0.1	5.13	0.22	2.7	20	<0.05	4.3	<1	0.5	<0.05	0.24	<0.05	1.9	0.12	0.22	0.3	7.51	0.7
55347	6.3	0.39	5.5	<0.1	<0.05	0.01	0.02	6.3	0.05	0.74	0.19	1.5	32.6	<0.05	2.4	<1	0.5	<0.05	0.14	<0.05	1.1	0.18	0.1	0.5	4.29	0.3
55348	7.5	0.36	5.9	<0.1	<0.05	<0.01	0.03	10.6	0.06	8.06	0.86	2.5	27.9	<0.05	2.9	<1	0.8	<0.05	0.19	<0.05	2.1	0.18	0.2	0.5	5.11	0.4
55349	6.1	0.36	5.3	<0.1	<0.05	<0.01	<0.02	12.6	0.08	4.33	0.23	2	24.2	<0.05	3.5	<1	0.5	<0.05	0.24	<0.05	2.9	0.14	0.2	0.5	6.41	0.6
55350	7.2	0.43	6.4	<0.1	<0.05	<0.01	0.02	10.6	0.07	5.25	0.18	2.3	31.8	<0.05	4.3	<1	0.6	<0.05	0.21	<0.05	2.8	0.18	0.19	0.6	5.87	0.5
56097	7.8	0.37	6.1	<0.1	<0.05	<0.01	0.03	11	0.08	1.08	0.29	2.7	26.7	<0.05	3.5	<1	0.6	<0.05	0.21	<0.05	2.8	0.18	0.25	0.4	5.96	0.5
60576	17.1	0.38	4.9	0.1	0.06	<0.01	0.17	28.3	0.19	52.5	0.34	3.7	22.8	<0.05	6.7	5	1.5	<0.05	0.75	0.13	1.8	0.16	0.39	0.3	19	1.4
60577	12.2	0.38	6.9	<0.1	<0.05	<0.01	0.04	10.9	0.08	12.5	0.39	3.5	26.4	<0.05	3.3	1	1	<0.05	0.26	0.09	1.6	0.17	0.15	0.5	7.09	0.5
60578	6.4	0.32	5.6	<0.1	<0.05	<0.01	<0.02	12	0.09	0.62	0.31	2.2	24.8	<0.05	3.3	<1	0.5	<0.05	0.2	<0.05	2.9	0.16	0.29	0.9	5.72	0.5
60579	15.8	0.49	6	<0.1	<0.05	<0.01	0.05	14	0.12	43.7	0.52	2.6	37.9	<0.05	4.8	2	1.8	<0.05	0.36	<0.05	2.8	0.32	0.6	0.6	9.54	0.8
60580	7.7	0.32	6.4	0.1	0.09	<0.01	0.02	11.7	0.08	0.49	0.21	1.9	25.6	<0.05	4.9	<1	0.5	<0.05	0.19	<0.05	3.1	0.14	0.27	0.3	5.92	0.5
60581	8.1	0.48	6.8	<0.1	<0.05	<0.01	0.05	14	0.08	15.3	0.48	2.2	36.5	<0.05	4.4	1	0.8	<0.05	0.27	0.13	2.7	0.22	0.32	0.6	7.04	0.6
60582	6.3	0.29	5.8	<0.1	<0.05	<0.01	0.02	8.2	0.08	3.85	0.2	2.5	22	<0.05	3.8	<1	0.5	<0.05	0.2	<0.05	1.3	0.14	0.22	0.2	6.02	0.5
60583	8.4	0.41	6.3	<0.1	<0.05	<0.01	0.03	11.9	0.12	2.41	0.42	4.5	28.8	<0.05	5	<1	1.1	<0.05	0.32	<0.05	2.3	0.19	0.29	0.5	9.26	0.8
60584	7	0.36	6.9	<0.1	<0.05	<0.01	0.03	10.3	0.07	0.58	0.23	2.9	22.3	<0.05	3.4	3	0.5	<0.05	0.16	0.55	2.1	0.14	0.27	0.3	4.66	0.4
60585	6.1	0.15	6.1	<0.1	<0.05	<0.01	0.04	10.6	0.09	3.58	0.1	3.8	8.2	<0.05	3.1	<1	0.5	<0.05	0.21	0.07	2.5	0.05	0.29	0.2	6.63	0.6
60586	6.4	0.38	5.7	<0.1	<0.05	<0.01	0.02	12.7	0.09	1.07	0.28	2.3	30.1	<0.05	4.2	<1	0.6	<0.05	0.24	<0.05	2.7	0.19	0.23	0.3	6.87	0.6
60587	11.3	0.5	6.7	0.1	0.05	0.01	0.03	13.8	0.1	2.6	0.29	3.2	34.9	<0.05	5.4	<1	1.3	<0.05	0.32	<0.05	2.7	0.22	0.18	0.6	9.08	0.7
60588	5.6	0.22	5.4	<0.1	<0.05	<0.01	<0.02	7.2	0.07	3.79	0.24	3	13.4	<0.05	3	<1	0.4	<0.05	0.17	<0.05	1.4	0.07	0.21	0.4	5.13	0.5
60589	5.9	0.2	5.6	<0.1	<0.05	<0.01	0.03	10	0.12	3.39	0.11	3	6.8	<0.05	3.5	1	0.4	<0.05	0.25	0.11	1.8	0.04	0.38	0.4	7.88	0.8
60590	6.2	0.48	6	<0.1	<0.05	<0.01	0.03	13.5	0.09	5.98	0.28	3.6	27.7	<0.05	5.2	<1	0.6	<0.05	0.26	<0.05	4.4	0.18	0.21	0.3	7.25	0.6
60591	5.3	0.53	5.5	<0.1	<0.05	<0.01	0.06	11.9	0.07	10.1	0.34	4.6	27.3	<0.05	3.5	2	0.7	<0.05	0.22	0.08	7.6	0.22	0.2	0.2	6.21	0.5
60592	7.5	0.39	6.8	<0.1	<0.05	<0.01	<0.02	9.6	0.09	3.84	0.39	2.2	36.7	<0.05	4	<1	1	<0.05	0.23	<0.05	2.1	0.23	0.16	0.3	6.57	0.6
60593	7.6	0.36	6.6	<0.1	<0.05	<0.01	0.03	14.8	0.1	4.51	0.45	2.6	33.9	<0.05	5.3	<1	1.1	<0.05	0.32	<0.05	4.8	0.23	0.18	0.4	8.53	0.7
60594	10.5	0.28	5.2	<0.1	<0.05	<0.01	0.04	12.9	0.07	7.69	0.26	3	19	<0.05	3.5	1	1	<0.05	0.31	0.08	1.7	0.11	0.27	0.2	8.27	0.5
60595	5.6	0.26	5.1	<0.1	<0.05	<0.01	<0.02	9	0.08	4.15	0.16	2.6	17.4	<0.05	3.5	<1	0.4	<0.05	0.2	<0.05	1.9	0.11	0.24	0.4	5.83	0.5
60596	5.6	0.25	5.4	<0.1	<0.05	<0.01	<0.02	11.2	0.06	0.72	0.21	3.6	15.6	<0.05	3.1	<1	0.4	<0.05	0.17	<0.05	2.4	0.09	0.26	0.4	4.74	0.4
60597	5.8	0.43	5	<0.1	<0.05	<0.01	0.02	9.7	0.1	4.51	0.21	2	24.9	<0.05	4.2	<1	0.5	<0.05	0.27	<0.05	2	0.14	0.24	0.6	7.84	0.7
60598	6.7	0.44	6	<0.1	<0.05	<0.01	<0.02	14.9	0.08	0.97	0.25	2	29	<0.05	4.1	<1	0.7	<0.05	0.24	<0.05	3.1	0.18	0.2	0.3	6.36	0.5
60599	8.2	0.21	5.3	<0.1	<0.05	<0.01	0.12	18.5	0.13	8.88	0.11	3.4	11.5	<0.05	4	2	1.2	<0.05	0.44	0.08	2	0.08	0.23	0.3	11.5	0.9
60600	18.5	0.48	8.4	0.1	<0.05	<0.01	0.05	20.8	0.1	15.4	0.55	3.5	30.3	<0.05	5	2	1.3	<0.05	0.43	0.12	3	0.18	0.31	0.6	10.8	0.8
61251	5.2	0.48	6.6	<0.1	0.09	<0.01	0.03	11.3	0.13	0.31	0.11	5.1	5.3	<0.05	4.1	<1	0.5	<0.05	0.3	<0.05	2.3	0.02	0.28	<0.1	8.81	0.8
61252	5.8	0.23	6	<0.1	0.06	<0.01	0.03	11.8	0.09	3.41	0.08	5.4	5.8	<0.05	3.3	<1	0.4	<0.05	0.22	0.1	3.4	0.03	0.35	0.2	6.26	0.6
61253	6.1	0.28	5.7	<0.1	0.07	<0.01	0.02	11.8	0.11	2.47	0.21	2.4	16.9	<0.05	4.2	<1	0.5	<0.05	0.23	<0.05	2.8	0.1	0.27	0.2	6.86	0.6
61254	5.4	0.32	6	<0.1	<0.05	<0.01	0.02	9.5	0.12	0.49	0.19	2.9	11	<0.05	3.7	<1	0.5	<0.05	0.29	<0.05	1.9	0.06	0.29	0.4	8.23	0.7
61255	7.1	0.43	6	<0.1	0.06	<0.01	0.03	10.3	0.15	4.46	0.22	1.6	31.1	0.06	4.9	<1	0.6	<0.05	0.31	<0.05	2	0.18	0.27	0.3	8.56	0.8
61256	5.5	0.31	5.6	<0.1	<0.05	<0.01	0.02	8.7	0.07	4.59	0.13	2.4	13.2	<0.05	3.3	<1	0.6	<0.05	0.2	<0.05	1.5	0.07	0.3	0.2	5.76	0.4
61257	5.2	0.33	4.8	<0.1	<0.05	<0.01	<0.02	6.4	0.07	4.93	0.4	2.2	26.3	<0.05	3.5	<1	1	<0.05	0.19	<0.05	1.4	0.19	0.15	0.5	5.02	0.4
61258	7	0.36	6.5	<0.1	<0.05	<0.01	<0.02	15.6	0.12	4.42	0.47	2.4	30.8	<0.05	5.3	<1	0.9	<0.05	0.35	<0.05	3.7	0.21	0.22	0.8	8.73	0.8
61259	5.6	0.3	5.9	<0.1	<0.05	<0.01	0.03	11.8	0.1	4.26	0.21	3.8	10.8	<0.05	3.9	<1	0.5	<0.05	0.27	<0.05	3.3	0.06	0.27	0.3	7.34	0.7
61260	5.2	0.26	5.4	<0.1	<0.05	<0.01	0.02	12	0.08	5.12	0.21	4	11.7	<0.05	3.4	<1	0.5	<0.05	0.22	<0.05	3.8	0.07	0.36	0.4	6.09	0.5
61261	5.9	0.25	6.6	<0.1	<0.05	<0.01	0.05	11.9	0.09	0.7	0.17	3.2	11.6	<0.05	4.6	1	0.7	<0.05	0.24	0.09	2.8	0.07	0.23	0.3	6.79	0.6
61262	6.8	0.83	8.6	<0.1	<0.05	<0.01	0.03	11.4	0.12	3.17	0.06	7.1	7	<0.05	3.8	<1	0.5	<0.05	0.29	0.05	2.2	0.03	0.36	0.2	8.46	0.7
61263	6.5	0.56	6.4	<0.1	<0.05	<0.01	0.05	11.5	0.08	5.94	0.44	3.7	35.8	<0.05	4.8	2	0.8	<0.05	0.22	0.09	4.3	0.25	0.29	0.5	6.12	0.5
61264	6.9	0.41	6.4	<0.1	<0.05	<0.01	0.03	16.6	0.1	5.12	0.32	2.3	26.2	<0.05	6.1	<1	0.7	<0.05	0.27	<0.05	4.3	0.16	0.31	0.3	6.77	0.6
61265	8.5	0.66	7.5	<0.1	<0.05	<0.01	0.09	12.3	0.09	10.2	0.55	2.9	51.6	<0.05	4.9	3	0.9	<0.05	0.26	0.24	3.8	0.35	0.25	0.7	7.15	0.6
61266	7.1	0.4	6.4	<0.1	<0.05	<0.01	0.02	18.1	0.1	4.21	0.36	2.6	26.5	<0.05	4	<1	0.8	<0.05	0.3	<0.05	4.6	0.18	0.22	0.4	7.29	0.6
61267	6.7	0.19	6.2	<0.1	<0.05	<0.01	<0.02	9.4	0.06	4.41	<0.05	3.9	7.7	<0.05	2.3	<1	0.5	<0.05	0.18	<0.05	1.8	0.04	0.29	<0.1	5.88	0.4
61268	6.9	0.43	6.2	0.1	<0.05	<0.01	0.02	12.4	0.12	4.33	0.48	2	32.1	<0.05	4.4	<1	0.8	<0.05	0.3	<0.05	3.1	0.24	0.3	0.7	8.11	0.8
61269	4.9	0.34	5.4	<0.1	<0.05	<0.01	0.02	10.7	0.09	0.53	0.08	4.4	8.6	<0.05	3.4	<1	0.4	<0.05	0.23	<0.05	2.3	0.05	0.19	0.3	6.11	0.6
61270	6.3	0.3	6.3	<0.1	<0.05	<0.01	0.05	13.4	0.12	0.36	<0.05	4.5	5.7	<0.05	4.7	<1	0.5	<0.05	0.3	0.09	2.9	0.03	0.22	0.1	8.24	0.7
61271	10.6	0.35	4	<0.1	<0.05	<0.01	0.19	27.1	0.18	16	0.13	4.4	17.6	<0.05	7.5	3	2.4	<0.05	0.61	0.11	4.4	0.16	0.48	0.5	15.1	1.2
61272	4.6	0.32	5	<0.1	<0.05	<0.01	0.02	8	0.11	0.49	0.17	4	7.8	<0.05	3.5	<1	0.5	<0.05	0.22	<0.05	1.6	0.04	0.37	0.2	6.69	0.7
61273	6.5	0.26	7.5	<0.1	<0.05	<0.01	0.05	14.4	0.08	0.6	0.17	5.2	8.1	<0.05	3	2	0.6	<0.05	0.2	0.27	3.7	0.04	0.33	0.2	5.48	0.5
61274	5.7	0.27	5.8	<0.1	<0.05	<0.01	0.02	11.7	0.11	3.25	0.06	3.2	7.7	<0.05	4.4	<1	0.5	<0.05	0.28	<0.05	2.2	0.04	0.26	<0.1	7.82	0.7

Sample ID	Co ppm	Cs ppm	Ga ppm	Ge ppm	Hf ppm	Hg ppm	In ppm	La ppm	Lu ppm	Mo ppm	Nb ppm	Pb ppm	Rb ppm	Sb ppm	Sc ppm	Se ppm	Sn ppm	Ta ppm	Tb ppm	Te ppm	Th ppm	Tl ppm	U ppm	W ppm	Y ppm	Yb ppm
Method Co	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B
LOD	0.1	0.05	0.1	0.1	0.05	0.01	0.02	0.1	0.01	0.05	0.05	0.2	0.2	0.05	0.1	1	0.3	0.05	0.02	0.05	0.1	0.02	0.05	0.1	0.05	0.1
61275	6.2	0.18	6.5	<0.1	0.06	<0.01	0.02	10.4	0.16	0.41	0.31	5.1	5.2	<0.05	4.7	<1	0.6	<0.05	0.31	<0.05	1.8	0.03	0.32	0.2	9.12	0.9
62176	6.3	0.33	7.1	<0.1	<0.05	<0.01	0.02	10.6	0.11	0.65	0.15	3.1	14.6	<0.05	4.2	<1	0.6	<0.05	0.26	<0.05	1.9	0.08	0.24	0.2	7.5	0.7
62177	7.5	0.38	7.1	<0.1	<0.05	<0.01	0.05	12.7	0.1	6.06	0.31	2.9	21.6	<0.05	6.1	<1	1	<0.05	0.34	<0.05	2	0.13	0.63	0.3	8.82	0.6
62178	7.7	0.51	7.3	<0.1	<0.05	<0.01	0.04	9.1	0.11	3.58	0.39	2	37.5	<0.05	4.2	<1	0.8	<0.05	0.26	<0.05	1.6	0.22	0.21	0.5	7.53	0.7
62179	6.3	0.32	6	<0.1	<0.05	<0.01	0.03	12.8	0.11	4.21	0.26	3.1	14.8	0.1	4.1	<1	0.5	<0.05	0.27	<0.05	2.7	0.08	0.3	0.4	7.74	0.7
62180	8	0.21	2.5	<0.1	<0.05	<0.01	0.08	8.5	0.08	5.28	<0.05	4.1	5.6	<0.05	2.2	1	0.6	<0.05	0.22	<0.05	1.4	0.03	0.18	0.2	5.6	0.5
62181	13.8	0.37	6	<0.1	<0.05	<0.01	0.11	16.3	0.13	12.9	0.29	2.9	22.5	<0.05	5	2	1.5	<0.05	0.5	0.25	1.3	0.15	0.33	0.4	12.8	0.9
62182	6.7	0.38	6.3	<0.1	<0.05	<0.01	0.02	17.8	0.13	4.57	0.33	2.4	25.3	<0.05	4.5	<1	0.8	<0.05	0.37	<0.05	4.5	0.15	0.21	0.5	9.25	0.8
62183	5.9	0.36	6.1	<0.1	<0.05	<0.01	0.03	13.1	0.11	0.67	0.25	3	16.6	<0.05	4.6	<1	0.6	<0.05	0.26	<0.05	2.7	0.1	0.29	0.3	7.43	0.7
62184	6.9	0.38	6.2	<0.1	<0.05	<0.01	0.03	12.2	0.14	0.74	0.41	2.1	26.6	<0.05	5	<1	0.7	<0.05	0.35	<0.05	3.1	0.17	0.29	0.4	9.82	0.9
62185	7	0.46	6.4	<0.1	<0.05	<0.01	0.03	12.1	0.18	9.98	0.52	2	33.3	0.12	6.5	<1	1	<0.05	0.33	<0.05	2.3	0.22	0.29	0.7	9.41	0.9
62186	19.1	0.67	7.7	0.1	0.07	0.02	0.05	19.2	0.17	15.5	0.47	3.7	32.6	<0.05	5.5	3	2.2	<0.05	0.55	0.21	2.5	0.21	0.34	0.4	15.2	1.1
62187	6.2	0.41	7.5	<0.1	<0.05	<0.01	0.04	13.4	0.16	3.07	<0.05	3.8	9.1	<0.05	4.6	<1	0.6	<0.05	0.37	<0.05	2.5	0.05	0.34	0.1	11	1
62188	3.7	0.29	4.9	<0.1	<0.05	<0.01	0.03	9.1	0.1	0.43	<0.05	2.2	5.8	<0.05	2.9	<1	0.4	<0.05	0.25	<0.05	1.8	0.03	0.4	0.1	7.09	0.6
62189	6.1	0.38	5.6	<0.1	<0.05	0.01	0.02	12.2	0.11	0.66	0.55	2.1	28	<0.05	3.9	<1	0.7	<0.05	0.29	<0.05	2.8	0.18	0.24	0.6	7.92	0.8
62190	6	0.4	6.1	<0.1	<0.05	<0.01	0.02	10.7	0.12	0.65	0.38	2.6	26.2	<0.05	4	<1	0.7	<0.05	0.28	<0.05	2.1	0.18	0.23	0.4	7.81	0.7
62191	5.8	0.48	6.3	<0.1	<0.05	<0.01	0.02	9.4	0.1	4.38	0.53	2.1	41.8	<0.05	3.9	<1	1.2	<0.05	0.29	<0.05	1.8	0.28	0.13	0.6	7.69	0.6
62192	5.8	0.36	6.7	0.1	0.05	<0.01	0.03	11.2	0.11	3.83	0.32	3.8	11.6	<0.05	4	<1	0.6	<0.05	0.27	<0.05	2.2	0.06	0.33	0.4	7.41	0.7
62193	5.7	0.3	6.1	<0.1	<0.05	<0.01	0.03	13.3	0.11	0.92	0.15	3.6	14.6	<0.05	4.3	<1	0.6	<0.05	0.28	<0.05	4	0.09	0.37	0.2	7.69	0.7
62194	5.4	0.32	6.4	<0.1	<0.05	<0.01	0.03	10.8	0.11	3.09	0.07	3.7	4.8	<0.05	3.6	<1	0.5	<0.05	0.24	<0.05	2.3	<0.02	0.27	<0.1	7.02	0.7
62195	6	0.36	5.7	<0.1	<0.05	<0.01	0.02	10.8	0.12	0.77	0.19	2.4	23.5	<0.05	3.7	<1	0.7	<0.05	0.25	<0.05	2.5	0.16	0.25	0.1	7.2	0.7
62196	6.3	0.33	5.8	<0.1	<0.05	<0.01	0.03	10.8	0.11	0.68	0.23	2.4	22.5	<0.05	4.2	<1	0.6	<0.05	0.24	<0.05	1.9	0.15	0.27	0.2	6.96	0.7
62197	7.6	0.38	6.1	<0.1	<0.05	<0.01	0.03	14.3	0.1	2.25	0.41	1.9	31.4	<0.05	4.6	<1	0.9	<0.05	0.27	<0.05	3.3	0.21	0.4	0.5	7.54	0.7
62198	5.6	0.35	5.1	<0.1	0.05	<0.01	0.03	10.9	0.13	0.78	0.43	2.6	23.8	<0.05	3.8	<1	0.5	<0.05	0.29	0.08	3.4	0.14	0.44	0.5	8.33	0.8
62199	6.7	0.34	6.3	<0.1	0.06	<0.01	0.03	10.6	0.16	0.59	0.28	2.2	20.5	<0.05	5.1	<1	0.7	<0.05	0.37	<0.05	1.9	0.12	0.3	0.2	11.1	1.1
62200	5.5	0.32	6	<0.1	<0.05	<0.01	0.03	12	0.12	0.47	0.25	3.4	10.5	<0.05	3.6	<1	0.6	<0.05	0.29	<0.05	2.2	0.06	0.37	0.2	8.27	0.8
74751	5.9	0.22	6.6	<0.1	<0.05	<0.01	0.03	16.2	0.13	3.5	0.12	3.4	12.4	<0.05	4.9	<1	0.6	<0.05	0.31	<0.05	3.3	0.07	0.37	<0.1	9.36	0.8
74752	6.3	0.32	6.7	0.1	<0.05	<0.01	0.02	13.2	0.11	0.97	0.32	3.5	21.4	<0.05	4.1	<1	0.6	<0.05	0.27	<0.05	2.9	0.13	0.31	0.3	7.45	0.7
74753	8.4	0.3	6	<0.1	<0.05	<0.01	0.03	14.6	0.11	19.2	0.22	3.5	16	<0.05	3.9	<1	0.8	<0.05	0.31	<0.05	2.4	0.1	0.26	0.3	8.37	0.7
74754	6	0.37	5.5	<0.1	<0.05	<0.01	0.02	13.7	0.08	4.45	0.3	2.6	24.6	<0.05	4.1	<1	0.5	<0.05	0.22	<0.05	2.6	0.14	0.21	0.6	5.87	0.5
74755	5.2	0.27	5.6	<0.1	<0.05	<0.01	0.02	9.5	0.1	1.1	0.32	2.9	18.8	<0.05	3.7	<1	0.6	<0.05	0.24	<0.05	1.7	0.12	0.21	0.3	6.8	0.6
74756	6.1	0.39	6.1	<0.1	<0.05	<0.01	0.03	12.2	0.09	5.43	0.31	2.4	29.4	<0.05	3.7	<1	0.6	<0.05	0.24	<0.05	3.3	0.19	0.23	0.3	6.41	0.6
74757	6.2	0.35	5.6	0.1	0.07	<0.01	<0.02	9	0.09	0.6	0.32	2	23.4	<0.05	3.8	<1	0.5	<0.05	0.22	<0.05	2.2	0.15	0.39	0.4	6.15	0.6
74758	8.1	0.24	8.3	<0.1	<0.05	<0.01	0.11	11.4	0.05	9.14	0.07	4.1	15.8	<0.05	2.6	4	0.8	<0.05	0.16	0.23	2.5	0.1	0.16	0.2	4.32	0.3
74759	6.3	0.46	6.1	<0.1	<0.05	<0.01	0.03	11.5	0.12	4.31	0.45	2.3	31.4	<0.05	4.7	<1	0.8	<0.05	0.3	<0.05	2.3	0.2	0.34	0.4	8.64	0.8
74760	6	0.4	5.5	<0.1	<0.05	<0.01	0.03	11.5	0.14	4.58	0.43	2.3	27.2	<0.05	4.9	<1	0.7	<0.05	0.38	<0.05	2.3	0.17	0.29	0.5	10.7	1
74761	10.3	0.66	8.6	<0.1	<0.05	<0.01	0.05	9.2	0.1	1.18	0.68	2.1	56	<0.05	7	<1	2.2	<0.05	0.3	<0.05	1.6	0.44	0.19	0.9	7.89	0.6
74762	6.2	0.27	5.9	<0.1	<0.05	<0.01	0.03	11.9	0.1	4.43	0.32	2.7	16.6	<0.05	3.9	<1	0.6	<0.05	0.25	<0.05	2.7	0.09	0.31	0.4	7.26	0.6
74763	6	0.34	5.7	<0.1	<0.05	<0.01	0.02	8.8	0.1	0.5	0.2	1.8	22.4	<0.05	3.9	<1	0.6	<0.05	0.23	<0.05	1.7	0.12	0.22	<0.1	6.95	0.7
74764	5.9	0.32	5.9	<0.1	<0.05	<0.01	0.03	11.3	0.1	0.68	0.34	3.6	25	<0.05	3.4	<1	0.9	<0.05	0.27	<0.05	2.5	0.18	0.24	0.4	7.49	0.7
74765	6.7	0.4	5.8	<0.1	<0.05	<0.01	<0.02	13.1	0.11	4.22	0.32	2.1	30	<0.05	3.8	<1	0.7	<0.05	0.29	<0.05	3.3	0.23	0.25	0.3	7.6	0.7
74766	6.3	0.28	6.1	<0.1	<0.05	<0.01	<0.02	10.2	0.12	1.18	0.29	2.9	16	<0.05	3.9	<1	0.6	<0.05	0.28	<0.05	1.9	0.1	0.29	0.4	8.3	0.8
74767	6	0.38	5.5	<0.1	<0.05	<0.01	0.02	11.5	0.12	4.83	0.2	1.9	24.7	<0.05	4.4	<1	0.5	<0.05	0.29	<0.05	2.3	0.14	0.23	0.2	8.09	0.7
74768	5.8	0.33	5.9	<0.1	<0.05	<0.01	0.03	12.8	0.12	1.11	0.12	2.8	18.9	<0.05	4	<1	0.6	<0.05	0.32	<0.05	2.7	0.11	0.29	<0.1	8.97	0.8
74769	5.3	0.3	4.9	<0.1	<0.05	<0.01	0.02	10.5	0.11	4.49	0.23	2.3	18.4	<0.05	3.5	<1	0.5	<0.05	0.26	<0.05	2.1	0.1	0.28	0.1	7.51	0.7
74774	6.4	0.22	5.1	<0.1	<0.05	<0.01	<0.02	10.6	0.08	4.66	0.15	2.5	14.8	<0.05	2.9	<1	0.4	<0.05	0.2	<0.05	2.2	0.09	0.23	0.4	5.79	0.5
74775	13.8	0.2	3.5	<0.1	<0.05	<0.01	0.07	16.4	0.13	79.6	0.06	6.6	10	<0.05	1.6	3	0.7	<0.05	0.29	<0.05	4.5	0.07	1.56	0.6	8.06	0.8
74778	5.6	0.19	5	<0.1	<0.05	<0.01	<0.02	9.6	0.07	0.95	0.2	2.5	12.8	<0.05	3	<1	0.4	<0.05	0.16	0.07	1.8	0.08	0.24	0.4	4.72	0.5
74779	5.5	0.22	5.4	<0.1	<0.05	<0.01	<0.02	10	0.08	3.73	0.13	2.7	13	<0.05	2.9	<1	0.4	<0.05	0.19	<0.05	2.1	0.08	0.32	0.2	5.8	0.6
74781	7.1	0.43	5.6	<0.1	<0.05	<0.01	0.02	12.4	0.1	2.03	0.29	2.1	31.4	<0.05	4.2	<1	0.6	<0.05	0.27	<0.05	2.4	0.18	0.23	0.8	7.73	0.7
74782	18.2	0.6	7.6	0.1	0.06	0.02	0.06	14.8	0.13	10.7	0.48	3.7	34.3	<0.05	4.9	3	1.5	<0.05	0.4	0.07	2.5	0.2	0.37	0.3	11.2	0.9
74783	15.2	0.21	6	<0.1	<0.05	<0.01	0.03	12.4	0.13	21.7	0.06	4.2	9.8	<0.05	4.4	2	1.1	<0.05	0.37	<0.05	2.8	0.07	0.46	0.1	10.4	0.9
Final Tails .	7.2	0.54	7.4	<0.1	<0.05	<0.01	0.07	13.3	0.09	3.41	0.25	2	34.5	<0.05	4.7	<1	1.1	<0.05	0.29	0.09	3.5	0.24	0.41	<0.1	8.11	0.6
Final Tails .	8	0.6	8.5	<0.1	<0.05	<0.01	0.08	11.7	0.08	5.81	0.26	2.5	34.3	<0.05	4.4	1	1	<0.05	0.27	0.18	3.2	0.25	0.41	<0.1	6.89	0.5
Duplicates																										
60579	16.2	0.51	6.2	<0.1	<0.05	<0.01	0.05	14.2	0.12	42.1	0.56	2.6	38.3	<0.05	5	2	1.9	<0.05	0.36	0.07	2.9	0.32	0.54	0.6	9.86	0.8
60590	6.1	0.48	5.8	<0.1	<0.05	<0.01	0.03	13.3	0.09	5.86	0.28	3.9	27.3	<0.05	5.1	<1	0.6	<0.05	0.25	<0.05	4.4	0.19	0.19	0.3	7.25	0.6
61266	7.9	0.4	6.4	<0.1	<0.05	<0.01	0.02	18.6	0.1	4.35	0.34	2.6	26.3	<0.05	4	<1	0.8	<0.05	0.31	<0.05	4.9	0.18	0.22	0.4	7.48	0.6
62198	5.6	0.35	5.2	<0.1	<0.05	<0.01	0.03	11.3	0.12	0.96	0.45	2.6	23.7	<0.05	3.8	<1	0.5	<0.05	0.28	0.1	3.5	0.14	0.47	0.5	8.43	0.8
74765	6.6	0.39	5.7	<0.1	<0.05	<0.01	0.02	13.3	0.12	4.07	0.32	2	29.8	<0.05	3.7	<1	0.7	<0.05	0.27	<0.05	3.2	0.22	0.24	0.3	7.34	0.7
Final Tails .	7	0.54	7.3	<0.1	<0.05	<0.01	0.07	13.5	0.09	4.11	0.23	2.1	34.5	<0.05	4.5	<1	1.1	<0.05	0.3	0.08	3.4	0.24	0.44	<0.1	8.11	0.6
Reference Materials																										
CH4	24.3	2.66	9.4	0.3	0.25	<0.01	0.1	14.3	0.06	3	0.15	7.9	70.2	0.25	8.1	2	0.6	<0.05	0.27	0.4	2	0.39	0.26	2.3	5.56	0.4
CH4	23.2	2.63	9.2	0.2	0.26	<0.01	0.1	14.8	0.06	2.75	0.16	9.1	69.1	0.29	7.7	2	0.6	<0.05	0.28	0.41	2.1	0.4	0.28	1.6	5.67	0.4
CH4	23	2.7	9.1	0.2	0.34	<0.01	0.1	14.4	0.07	3.24	0.16	7.9	68.9	0.34	8.4	2	0.7	<0.05	0.31	0.4	2.1	0.4	0.3	2.4	6.12	0.5
Certified Va	22.8	2.6	8.72	0.21	0.29	#N/A	0.1	14	#N/A	3.05	0.19	8.24	67	0.34	7.99	1.57	0.6	0.3	0.27	0.42	2.2	0.4	0.29	2.15	5.66	#N/A
Tolerance (	11.1	14.8	12.9	127.4	52.8	#N/A	62.1	11.8	#N/A	14.1	75	16.1	10.7	47.3	13.1	169.6	134.5	51.7	28.4	39.6	21.2	22.6	52.9	21.6	12.2	#N/A

CLIENT : **Minto Mines**
PROJECT : **Minto Project**
SGS PROJECT # : **0643**
Test : **Leachate Analysis by ICP-OES**
Date :

Sample ID		55347	NP Contribution	60577	NP Contribution	60587	NP Contribution	60588	NP Contribution	61262	NP Contribution	62181	NP Contribution	62185	NP Contribution	74754	NP Contribution	74767	NP Contribution
Al	mg/L	40.8		34.3		28.1		26.5		56.9		34.9		38.5		44.3		31.1	
Sb	mg/L	0.05		< 0.01		0.01		< 0.01		< 0.01		0.07		0.04		0.02		< 0.01	
As	mg/L	0.021		0.024		0.039		0.009		0.026		0.037		0.031		0.046		0.026	
Ba	mg/L	0.0818		0.0648		0.0824		0.0792		0.0676		0.0369		0.0743		0.0709		0.0971	
Be	mg/L	0.0064		0.0088		0.0041		0.0056		0.0221		0.0122		0.0067		0.0087		0.0036	
Bi	mg/L	0.38		0.33		0.15		0.08		0.11		0.99		0.31		0.17		0.04	
B	mg/L	1.92		1.49		1.15		1.47		1.79		2.26		1.48		0.974		2.16	
Cd	mg/L	0.0114		0.0197		0.0075		0.0048		0.0070		0.0504		0.0099		0.0091		0.0058	
Ca	mg/L	474	11.8	544	13.6	658	16.4	574	14.3	559	13.9	447	11.2	686	17.1	712	17.8	521	13.0
Cr	mg/L	3.12		0.579		0.600		0.078		0.208		2.55		2.01		0.536		0.116	
Co	mg/L	0.042		0.086		0.032		0.018		0.021		0.260		0.038		0.029		0.040	
Cu	mg/L	2.20		9.44		4.46		0.359		5.11		17.1		0.515		0.916		24.8	
Fe	mg/L	188		264		121		62.2		81.7		719		164		127		46.0	
Pb	mg/L	0.015		0.027		0.017		0.021		0.032		0.043		0.024		0.030		0.023	
Li	mg/L	< 0.1		< 0.1		< 0.1		< 0.1		< 0.1		< 0.1		< 0.1		< 0.1		< 0.1	
Mg	mg/L	27.4	1.1	70.5	2.9	25.1	1.0	23.3	1.0	51.6	2.1	84.9	3.5	32.3	1.3	26.8	1.1	24.9	1.0
Mn	mg/L	7.43		11.6		10.7		6.36		10.4		20.2		14.6		15.0		15.3	
Mo	mg/L	< 0.01		< 0.01		< 0.01		< 0.01		< 0.01		< 0.01		< 0.01		< 0.01		< 0.01	
Ni	mg/L	0.213		0.091		0.162		0.062		0.056		0.235		0.197		0.089		0.039	
P	mg/L	0.470		0.058		0.011		0.244		0.083		< 0.009		0.421		0.175		0.204	
K	mg/L	49.1	1.3	44.6	1.1	57.1	1.5	36.5	0.9	31.1	0.8	53.0	1.4	60.8	1.6	63.6	1.6	54.9	1.4
Se	mg/L	< 0.01		< 0.01		< 0.01		< 0.01		< 0.01		< 0.01		< 0.01		< 0.01		< 0.01	
Si	mg/L	66.1		55.8		46.2		44.5		75.6		67.8		59.9		51.4		59.2	
Ag	mg/L	< 0.08		< 0.08		< 0.08		< 0.08		< 0.08		< 0.08		< 0.08		< 0.08		< 0.08	
Na	mg/L	22.7	1.0	17.5	0.8	19.3	0.8	28.2	1.2	41.7	1.8	14.8	0.6	22.2	1.0	24.6	1.1	23.1	1.0
Sr	mg/L	3.23		3.90		2.81		2.38		4.36		3.20		2.70		4.40		2.90	
S	mg/L	686		831		764		635		748		1120		849		837		622	
Tl	mg/L	< 0.005		0.01		0.01		< 0.005		0.01		0.01		0.01		0.01		0.02	
Sn	mg/L	< 0.03		< 0.03		< 0.03		< 0.03		< 0.03		< 0.03		< 0.03		< 0.03		< 0.03	
Ti	mg/L	0.010		0.004		0.006		0.011		0.005		0.007		0.008		0.010		0.013	
U	mg/L	< 0.2		< 0.2		< 0.2		< 0.2		< 0.2		< 0.2		< 0.2		< 0.2		< 0.2	
V	mg/L	0.127		0.125		0.005		0.008		0.079		0.321		0.085		0.108		0.050	
Zn	mg/L	0.306		1.14		0.227		0.211		0.338		1.54		0.278		0.354		0.415	
Zr	mg/L	< 0.007		< 0.007		< 0.007		< 0.007		< 0.007		0.018		< 0.007		< 0.007		< 0.007	
NP from Ca, Mg, Na & K (kg CaCO3 Equiv./tonne)			**15.2**		**18.4**		**19.7**		**17.4**		**18.7**		**16.6**		**21.0**		**21.6**		**16.4**

CLIENT : **Minto Mines**
PROJECT : **Minto Mines**
SGS PROJECT # : **0643**
Test : **BC Research NP and Modified NP Procedures**
Date : **September 16, 2013**

Sample ID	**Paste pH**	**TIC %**	**CaCO3 NP**	**C(T) %**	**S(T) %**	**S(SO4) %**	**S(S-2) %**	**AP**	**NP**	**NP H2SO4/tonne**	**NP CaCO3/tonne**	**Net NP**	**NP:AP Ratio (NP/AP)**	**Fizz Test**
Method Code	Sobek	CSB02V	Calc	CSA01V	CSA06V	CSA07V	Calc	Calc	Modified	BC Research	Calc	Calc	Calc	Sobek
LOD	0.2	0.01	#N/A	0.01	0.01	0.01	#N/A	#N/A	0.5	0.5	#N/A	#N/A	#N/A	#N/A
70001	8.58	0.25	20.8	0.28	0.45	<0.01	0.45	14.1	22.1	27.9	28.5	14.4	2.0	Slight
70003	8.99	0.18	15.0	0.26	0.02	<0.01	0.02	0.6	20.1	22.8	23.3	22.6	37.2	Slight
74770	8.70	0.75	62.5	0.77	0.05	<0.01	0.05	1.6	56.2	62.0	63.3	61.7	40.5	Slight
74771	9.04	0.29	24.2	0.33	0.09	<0.01	0.09	2.8	26.6	31.9	32.5	29.7	11.6	Slight
74772	9.30	0.17	14.2	0.20	0.02	<0.01	0.02	0.6	16.6	23.0	23.5	22.9	37.6	Slight
74773	9.01	0.19	15.8	0.21	0.02	<0.01	0.02	0.6	20.8	26.0	26.5	25.9	42.4	Slight
74776	8.71	0.14	11.7	0.17	0.02	<0.01	0.02	0.6	16.1	19.8	20.3	19.6	32.4	Slight
74777	9.06	0.13	10.8	0.19	0.06	<0.01	0.06	1.9	15.2	17.4	17.8	15.9	9.5	Slight
74780	9.28	0.18	15.0	0.19	0.02	<0.01	0.02	0.6	17.6	22.3	22.8	22.1	36.4	Slight
74784	8.72	0.33	27.5	0.38	0.37	<0.01	0.37	11.6	25.9	36.0	36.8	25.2	3.2	Slight
74785	9.13	0.23	19.2	0.29	0.02	<0.01	0.02	0.6	23.6	29.2	29.8	29.1	47.6	Slight
74786	9.17	0.14	11.7	0.22	0.03	<0.01	0.03	0.9	15.5	22.3	22.8	21.8	24.3	Slight
74787	9.39	0.06	5.0	0.08	0.02	<0.01	0.02	0.6	9.6	13.7	14.0	13.4	22.4	Slight
74788	8.88	0.22	18.3	0.26	0.02	<0.01	0.02	0.6	20.4	25.0	25.5	24.9	40.8	Slight
74789	9.05	0.12	10.0	0.25	0.02	<0.01	0.02	0.6	13.2	17.4	17.8	17.1	28.4	Slight
74790	8.84	0.27	22.5	0.36	0.03	<0.01	0.03	0.9	26.7	30.4	31.0	30.1	33.1	Slight
74791	8.80	0.33	27.5	0.38	1.33	<0.01	1.33	41.6	27.7	36.0	36.8	-4.8	0.9	Slight
74793	9.11	0.26	21.7	0.37	0.14	<0.01	0.14	4.4	23.9	19.4	19.8	15.4	4.5	Slight
74794	8.60	0.41	34.2	0.49	1.98	<0.01	1.98	61.9	31.4	36.8	37.5	-24.4	0.6	Slight
74795	9.18	0.25	20.8	0.28	0.04	<0.01	0.04	1.3	20.6	25.2	25.8	24.5	20.6	Slight
74797	8.77	0.68	56.7	0.76	0.93	<0.01	0.93	29.1	47.5	61.5	62.8	33.7	2.2	Slight
74798	9.01	0.31	25.8	0.36	0.03	<0.01	0.03	0.9	28.7	37.5	38.3	37.3	40.8	Slight
74799	9.27	0.18	15.0	0.24	0.02	<0.01	0.02	0.6	19.3	22.1	22.5	21.9	36.0	Slight
74800	9.63	0.10	8.3	0.22	0.02	<0.01	0.02	0.6	13.0	14.9	15.3	14.6	24.4	Slight
Final Tails July	8.56	0.47	39.2	0.49	0.07	<0.01	0.07	2.2	34.4	44.8	45.8	43.6	20.9	Slight
Duplicates														
70001	8.67								21.9					Slight
74772				0.20	0.02									
74787						<0.01								
74791		0.33												
74794		0.39												
74795	9.16								21.8					Slight
74797	8.83								46.5					Slight
74798						<0.01								
QC														
GTS-2A				2.01	0.34									
Expected Values GTS-2A				2.01	0.35									
Tolerance +/-				0.15	0.03									
PD-1						4.43								
PD-1						4.29								
Expected Values PD-1						4.27								
Tolerance +/-						0.3								
SY4		0.91												
Expected Values SY4		0.95												
Tolerance +/-		0.06												
TIC-L1		0.13												
Expected Values TIC-L1		0.1325												
Tolerance +/-		0.02												
NBM-1									39.7					Slight
NBM-1									40.5					Slight
Expected Values NBM-1									42.0					Slight
Tolerance +/-									3.0					

Note:

AP = Acid potential in tonnes CaCO3 equivalent per 1000 tonnes of material. AP is determined from calculated sulphide sulphur content: S(T) - S(SO4).

NP = Neutralization potential in tonnes CaCO3 equivalent per 1000 tonnes of material.

NET NP = NP - AP

Carbonate NP is calculated from TIC originating from carbonate minerals and is expressed in kg CaCO3/tonne.

CLIENT : **Minto Mines**
PROJECT : **Minto Project**
SGS Project # : **0643**
Test : **Metals by Aqua Regia Digestion with ICP-MS Finish**
Date : **September 11, 2013**

Sample ID	**Al** %	**B** ppm	**Ba** ppm	**Ca** %	**Cr** ppm	**Cu** ppm	**Fe** %	**K** %	**Li** ppm	**Mg** %	**Mn** ppm	**Na** %	**Ni** ppm	**P** ppm	**S** %	**Sr** ppm	**Ti** %	**V** ppm	**Zn** ppm	**Zr** ppm	**Ag** ppm	**As** ppm	**Be** ppm	**Bi** ppm	**Cd** ppm	**Ce** ppm
Method Code	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B
LOD	0.01	10	5	0.01	1	0.5	0.01	0.01	1	0.01	2	0.01	0.5	50	0.01	0.5	0.01	1	1	0.5	0.01	1	0.1	0.02	0.01	0.05
70001	0.93	40	82	1.07	74	5880	2.81	0.08	8	0.58	489	0.05	2.7	460	0.45	65.4	0.04	43	91	1.1	2.49	<1	0.3	0.29	0.67	11
70003	1.33	50	138	1.14	79	11	1.97	0.35	9	0.76	506	0.07	3.5	700	<0.01	109	0.07	48	55	1.5	<0.01	<1	0.5	<0.02	0.06	15.5
74770	0.67	40	52	2.25	57	217	1.56	0.09	5	0.43	397	0.03	2.1	530	0.04	130	<0.01	31	44	1.4	<0.01	1	0.5	<0.02	0.06	20.5
74771	1.26	40	76	1.37	65	1080	2.51	0.11	9	0.76	615	0.08	3.1	720	0.09	95.7	0.06	45	81	1.1	0.25	<1	0.4	0.1	0.08	22.3
74772	1.09	50	184	0.88	72	16.7	2.2	0.38	6	0.74	509	0.07	3.2	650	0.01	66.4	0.08	47	65	1	<0.01	<1	0.3	<0.02	0.01	20.4
74773	1.18	50	143	0.96	74	20	2.21	0.24	7	0.79	497	0.06	3.6	610	<0.01	69.3	0.05	42	63	1	<0.01	<1	0.4	<0.02	0.01	20.6
74776	1.47	40	471	0.8	72	133	2.78	0.72	8	0.86	517	0.05	4.3	950	0.01	42.1	0.12	61	71	0.9	<0.01	<1	0.2	<0.02	0.04	15.1
74777	1.29	40	452	0.74	85	294	2.26	0.65	7	0.71	462	0.06	3.9	900	0.06	43.5	0.12	55	54	0.9	<0.01	<1	0.2	<0.02	0.03	15.4
74780	1.07	50	130	1	76	101	2.07	0.26	6	0.7	514	0.07	3.7	590	0.02	66.5	0.07	43	63	1.1	<0.01	<1	0.3	0.03	0.04	17
74784	1.32	40	280	1.11	79	4410	4.01	0.65	7	0.72	748	0.05	3.8	800	0.37	62.3	0.11	81	97	1.4	1.06	<1	0.2	0.31	0.38	21.3
74785	1.04	50	114	1.04	78	183	1.95	0.24	7	0.7	476	0.05	3.4	500	0.02	79.5	0.03	39	53	1	<0.01	<1	0.4	0.04	0.05	19.4
74786	1.15	40	249	0.79	83	305	2.29	0.58	5	0.74	530	0.07	4.3	730	0.03	53.3	0.11	51	68	1.4	<0.01	<1	0.2	0.07	0.04	19.9
74787	1.04	50	190	0.68	81	34.1	1.91	0.45	5	0.65	447	0.08	3.4	620	<0.01	50	0.12	42	60	1.1	<0.01	<1	0.2	<0.02	0.02	16.3
74788	1.05	50	174	1.04	77	68.4	2.24	0.4	6	0.67	530	0.07	3.6	720	<0.01	58.5	0.08	47	65	1.5	<0.01	<1	0.3	<0.02	0.03	19.3
74789	0.93	50	142	0.76	163	21.2	1.91	0.33	6	0.62	469	0.06	4.3	650	<0.01	46.2	0.07	39	57	1.2	<0.01	<1	0.3	<0.02	0.02	17.7
74790	1.04	60	170	1.19	88	1440	2.34	0.39	6	0.61	541	0.05	4.1	720	0.02	54.7	0.07	47	67	1.5	0.22	<1	0.3	0.22	0.16	22.1
74791	1.25	40	294	1.15	72	1860	3.67	0.69	6	0.79	464	0.05	3.8	870	1.34	84.3	0.11	65	66	1.5	0.05	<1	0.2	0.08	0.1	37.1
74793	1.24	50	427	1.04	89	111	2.61	0.73	6	0.7	538	0.06	4.1	620	0.14	71.5	0.12	59	62	1.2	<0.01	2	0.3	<0.02	0.03	25.3
74794	1.14	40	226	1.32	71	1600	4.03	0.62	5	0.67	455	0.04	4	970	2.07	60.7	0.09	47	47	2.3	<0.01	<1	0.2	0.13	0.02	34.3
74795	1.08	40	188	1.11	80	314	2.04	0.37	6	0.68	486	0.06	3.7	690	0.03	66.9	0.09	45	60	1.3	<0.01	<1	0.3	0.06	0.04	16.8
74797	1.61	30	484	1.87	64	2430	5.33	1.11	8	0.97	890	0.05	3.7	820	0.9	55.4	0.19	124	105	3.2	0.44	5	0.3	0.24	0.47	44.4
74798	1.19	50	268	1.28	81	24.4	2.29	0.5	6	0.72	569	0.05	3.4	700	0.01	58.1	0.08	51	65	1.2	<0.01	<1	0.3	<0.02	0.02	23.5
74799	1.16	50	93	1.1	80	91.5	2.07	0.16	7	0.76	509	0.08	3.3	680	0.02	70.1	0.08	43	61	1.4	<0.01	<1	0.4	0.02	0.01	20.5
74800	1.1	50	231	0.68	90	28.1	2.15	0.54	6	0.73	499	0.08	4.1	610	<0.01	56.7	0.13	49	64	1.2	<0.01	<1	0.2	<0.02	0.02	22.2
Final Tails July	1.33	50	401	1.44	69	579	3.37	0.64	7	0.8	598	0.05	4.4	870	0.06	80.9	0.11	77	99	1.7	<0.01	<1	0.3	0.1	0.24	27
Duplicates																										
74791	1.32	40	299	1.14	69	1860	3.61	0.7	7	0.78	470	0.05	3.6	880	1.34	86.2	0.11	65	63	2.5	0.1	<1	0.2	0.08	0.1	37.5
74795	1.1	50	194	1.13	79	339	2.07	0.39	6	0.69	503	0.06	3.6	680	0.03	70.6	0.09	45	61	1.3	<0.01	<1	0.3	0.06	0.05	18.8
QC																										
CH4	1.86	40	310	0.62	110	2090	4.72	1.42	13	1.22	333	0.06	50.1	710	0.67	9.5	0.22	82	207	13.9	2.12	9	<0.1	0.49	1.13	27
Certified Values	1.85	#N/A	293	0.61	103.8	2000	4.79	1.43	12.6	1.18	324	0.06	49.57	719	0.73	9.38	0.21	79.27	189.4	9	2.13	8.14	0.11	0.51	1.17	28.18
Tolerance (%)	11.35	#N/A	14.3	14.1	12.4	10.1	10.52	11.74	29.84	12.3	11.5	50.3	12.52	27.4	13.4	23.3	23.3	13.2	11.3	17.7	10.9	13.1	241.3	19.7	12.1	10.4

Sample ID	Co ppm	Cs ppm	Ga ppm	Ge ppm	Hf ppm	Hg ppm	In ppm	La ppm	Lu ppm	Mo ppm	Nb ppm	Pb ppm	Rb ppm	Sb ppm	Sc ppm	Se ppm	Sn ppm	Ta ppm	Tb ppm	Te ppm	Th ppm	Tl ppm	U ppm	W ppm	Y ppm	Yb ppm
Method Code	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B
LOD	0.1	0.05	0.1	0.1	0.05	0.01	0.02	0.1	0.01	0.05	0.05	0.2	0.2	0.05	0.1	1	0.3	0.05	0.02	0.05	0.1	0.02	0.05	0.1	0.05	0.1
70001	5.3	0.19	6.1	<0.1	0.1	<0.01	0.1	6.3	0.05	0.47	0.31	7.1	4.8	<0.05	2.3	3	0.4	<0.05	0.11	0.4	1.8	0.03	0.19	0.4	3.25	0.3
70003	6.1	0.26	6.2	<0.1	0.12	<0.01	<0.02	8.6	0.12	0.96	0.46	2.9	17.4	<0.05	4	<1	0.5	<0.05	0.24	<0.05	1.9	0.11	0.38	0.4	7.53	0.7
74770	4.2	0.22	4.3	<0.1	0.06	<0.01	0.04	11.3	0.12	0.65	0.14	6.3	5.7	<0.05	4	<1	0.6	<0.05	0.29	<0.05	2	0.03	0.25	0.2	8.56	0.7
74771	6.8	0.25	7.5	<0.1	0.06	<0.01	0.04	12.9	0.1	0.55	0.33	4.5	6.7	<0.05	4.1	<1	0.5	<0.05	0.25	0.05	3	0.03	0.25	0.4	7.11	0.6
74772	6.7	0.26	5.9	<0.1	0.05	<0.01	0.02	11.9	0.09	0.63	0.39	2.4	18.9	<0.05	4.2	<1	0.5	<0.05	0.23	<0.05	2.4	0.12	0.22	0.4	6.66	0.5
74773	6.3	0.23	6.3	<0.1	<0.05	<0.01	0.03	12.5	0.09	0.59	0.25	3.2	12.2	<0.05	5.4	<1	0.5	<0.05	0.23	<0.05	2.5	0.07	0.22	0.4	6.92	0.6
74776	9.4	0.46	7.8	<0.1	<0.05	<0.01	0.02	7.8	0.1	0.99	0.51	2.5	32.4	<0.05	5.3	<1	1.4	<0.05	0.24	<0.05	1.8	0.26	0.18	0.3	7.62	0.6
74777	7.4	0.37	5.9	<0.1	<0.05	<0.01	0.02	8.1	0.1	6.1	0.55	2.4	29.4	<0.05	4.2	<1	1	<0.05	0.27	<0.05	1.6	0.21	0.23	0.6	7.95	0.6
74780	6.1	0.24	5.7	<0.1	0.05	<0.01	0.02	9.6	0.09	0.54	0.4	3.3	13.4	<0.05	3.9	<1	0.5	<0.05	0.21	<0.05	2.3	0.08	0.33	0.3	6.24	0.5
74784	8.9	0.46	7.7	<0.1	<0.05	<0.01	0.09	12.6	0.1	8	0.46	3.1	32.1	<0.05	4.3	3	0.9	<0.05	0.25	0.08	3.5	0.26	0.35	0.9	7.2	0.6
74785	5.5	0.21	5.6	<0.1	<0.05	<0.01	0.02	11.5	0.07	0.72	0.19	3.7	12.3	<0.05	4.6	<1	0.4	<0.05	0.18	<0.05	2.6	0.08	0.26	0.5	5.04	0.4
74786	6.6	0.36	5.3	<0.1	0.07	<0.01	0.02	11.5	0.1	1.27	0.43	2.3	26.6	<0.05	4.3	<1	0.5	<0.05	0.24	<0.05	3.1	0.18	0.27	0.9	7.17	0.6
74787	5.6	0.27	5	<0.1	<0.05	<0.01	<0.02	9.2	0.07	0.42	0.45	2.2	20.1	0.07	3.3	<1	0.4	<0.05	0.18	<0.05	2	0.13	0.22	0.5	5.06	0.4
74788	6.6	0.28	5.4	<0.1	0.06	<0.01	0.02	10.8	0.11	0.85	0.39	2.5	18.8	<0.05	4.4	<1	0.5	<0.05	0.27	<0.05	2.5	0.11	0.32	0.5	8.15	0.7
74789	5.7	0.26	4.9	<0.1	0.06	<0.01	0.02	9.8	0.09	4.93	0.43	2.4	16.2	<0.05	4	<1	0.5	<0.05	0.23	<0.05	2.1	0.1	0.28	0.6	6.93	0.6
74790	6.5	0.34	5.4	<0.1	0.07	<0.01	0.03	12.2	0.14	1.81	0.37	2.5	19.4	<0.05	4.5	<1	0.6	<0.05	0.34	0.05	2.9	0.12	0.36	0.5	10.1	0.9
74791	20.5	0.45	6.4	0.1	<0.05	<0.01	0.09	20.3	0.12	48.5	0.47	2.5	33.1	<0.05	5.4	3	1.6	<0.05	0.46	0.06	3.3	0.25	0.45	0.5	11	0.8
74793	9.2	0.44	5.9	<0.1	<0.05	<0.01	0.03	14.3	0.14	4.33	0.73	2.7	32.8	<0.05	5.9	<1	0.9	<0.05	0.36	<0.05	2.7	0.26	0.26	0.7	10.2	0.8
74794	25.3	0.48	5.4	<0.1	0.07	<0.01	0.06	20.4	0.19	41	0.72	3.1	29.2	<0.05	4.2	2	1.5	<0.05	0.47	0.06	6	0.29	1.54	1.1	12.8	1.1
74795	6.3	0.28	5.5	<0.1	<0.05	<0.01	0.02	9.5	0.1	1.98	0.42	2.5	18.4	<0.05	4.2	<1	0.5	<0.05	0.23	<0.05	2.4	0.11	0.34	0.4	6.67	0.6
74797	21	0.83	10.5	<0.1	0.08	<0.01	0.08	24.9	0.17	19.4	1.24	3.6	49.7	<0.05	6.2	2	2.3	<0.05	0.55	0.16	5.4	0.39	1.76	0.8	15.1	1.1
74798	6.8	0.4	5.9	<0.1	0.05	<0.01	0.03	13.2	0.15	0.93	0.44	2.3	23.2	<0.05	6.2	<1	0.7	<0.05	0.41	<0.05	2.9	0.16	0.33	0.4	11.6	1
74799	6.1	0.19	6.1	<0.1	<0.05	<0.01	<0.02	12.1	0.08	0.73	0.36	4	8.3	<0.05	3.4	<1	0.5	<0.05	0.21	<0.05	3	0.05	0.31	0.3	6.11	0.5
74800	6.3	0.31	5.5	<0.1	<0.05	<0.01	<0.02	12.9	0.07	1.23	0.53	2	25.8	<0.05	3.8	<1	0.5	<0.05	0.19	<0.05	2.9	0.17	0.24	1.1	5.46	0.5
Final Tails July	8.5	0.53	7.7	<0.1	<0.05	<0.01	0.09	15.8	0.11	4.65	0.52	2.7	32.4	<0.05	5.2	<1	1.4	<0.05	0.37	0.09	3.3	0.25	0.48	0.3	10	0.7
Duplicates																										
74791	21.1	0.45	6.3	0.1	<0.05	<0.01	0.09	20.5	0.13	49.6	0.49	2.7	33.5	<0.05	5.3	3	1.6	<0.05	0.47	0.06	3.2	0.26	0.35	0.5	10.9	0.8
74795	6.6	0.3	5.6	<0.1	<0.05	<0.01	0.02	10.5	0.1	1.9	0.4	2.5	19.2	<0.05	4.2	<1	0.5	<0.05	0.23	<0.05	2.7	0.12	0.34	0.4	6.75	0.6
QC																										
CH4	24.7	2.87	9.2	<0.1	0.32	<0.01	0.11	15.1	0.07	3.12	0.3	8.2	67.7	0.29	8.8	2	<0.3	<0.05	0.32	0.34	2.4	0.44	0.33	3.1	6.56	0.5
Certified Value	22.8	2.6	8.72	0.21	0.29	#N/A	0.1	14	#N/A	3.05	0.19	8.24	67	0.34	7.99	1.57	0.6	0.3	0.27	0.42	2.2	0.4	0.29	2.15	5.66	#N/A
Tolerance (%)	11.1	14.8	12.9	127.4	52.8	#N/A	62.1	11.8	#N/A	14.1	75	16.1	10.7	47.3	13.1	169.6	134.5	51.7	28.4	39.6	21.2	22.6	52.9	21.6	12.2	#N/A

CLIENT : **Minto Mines**
PROJECT : **Minto Project**
SGS PROJECT # : **0643**
Test : **Leachate Analysis by ICP-OES**
Date : **October 24, 2013**

Sample ID		**70003**	**NP Contribution**	**74790**	**NP Contribution**
Al	mg/L	37.6		30.4	
Sb	mg/L	0.03		0.03	
As	mg/L	0.016		0.026	
Ba	mg/L	0.0997		0.0775	
Be	mg/L	0.0140		0.0055	
Bi	mg/L	0.19		0.11	
B	mg/L	2.23		1.12	
Cd	mg/L	0.0085		0.0184	
Ca	mg/L	571	14.2	759	18.9
Cr	mg/L	1.21		1.34	
Co	mg/L	0.033		0.046	
Cu	mg/L	0.196		81.7	
Fe	mg/L	111		125	
Pb	mg/L	0.015		0.024	
Li	mg/L	< 0.1		< 0.1	
Mg	mg/L	38.9	1.6	26.0	1.1
Mn	mg/L	8.37		16.7	
Mo	mg/L	< 0.01		< 0.01	
Ni	mg/L	0.190		0.190	
P	mg/L	0.042		< 0.009	
K	mg/L	42.3	1.1	53.8	1.4
Se	mg/L	< 0.01		< 0.01	
Si	mg/L	61.2		49.9	
Ag	mg/L	< 0.08		< 0.08	
Na	mg/L	25.7	1.1	19.8	0.9
Sr	mg/L	4.79		2.85	
S	mg/L	718		924	
Tl	mg/L	0.01		0.02	
Sn	mg/L	< 0.03		< 0.03	
Ti	mg/L	0.010		0.009	
U	mg/L	< 0.10		< 0.10	
V	mg/L	0.045		0.049	
Zn	mg/L	0.224		1.07	
Zr	mg/L	< 0.007		< 0.007	
NP from Ca, Mg, Na & K (kg CaCO3 Equiv./tonne)			**18.0**		**22.2**

CLIENT : **Minto Mines**
PROJECT : **Minto Mines**
SGS PROJECT # : **0643**
Test : **BC Research NP and Modified NP Procedures**
Date : **January 13, 2014**

Sample ID	Sampling Date	Paste pH	TIC %	CaCO3 NP	C(T) %	S(T) %	S(SO4) %	S(S-2) %	AP	NP	NP H2SO4/tonne	NP CaCO3/tonne	Net NP	NP:AP Ratio (NP/AP)	Fizz Test
Method Code		Sobek	CSB02V	Calc	CSA01V	CSA06V	CSA07V	Calc	Calc	Modified	BC Research	Calc	Calc	Calc	Sobek
LOD		0.2	0.01	#N/A	0.01	0.01	0.01	#N/A	#N/A	0.5	0.5	#N/A	#N/A	#N/A	#N/A
006377	19-Aug-13	8.45	0.31	25.8	0.46	0.8	<0.01	0.80	25.0	26.8	29.2	29.8	4.8	1.2	Slight
06379	20-Aug-13	8.89	0.13	10.8	0.2	0.02	<0.01	0.02	0.6	15.4	15.7	16.0	15.4	25.6	Slight
06380	20-Aug-13	8.43	0.2	16.7	0.25	0.9	<0.01	0.90	28.1	19.7	22.3	22.8	-5.4	0.8	Slight
06381	20-Aug-13	8.68	0.29	24.2	0.37	0.02	<0.01	0.02	0.6	26.0	31.1	31.8	31.1	50.8	Slight
06382	21-Aug-13	8.90	0.15	12.5	0.22	0.01	<0.01	0.01	0.3	17.9	22.5	23.0	22.7	73.6	Slight
06383	21-Aug-13	8.77	0.3	25.0	0.35	0.02	<0.01	0.02	0.6	28.1	31.1	31.8	31.1	50.8	Slight
070002	6-Aug-13	9.08	0.17	14.2	0.25	0.04	<0.01	0.04	1.3	18.8	24.5	25.0	23.8	20.0	Slight
70004	19-Aug-13	9.06	0.34	28.3	0.46	0.04	<0.01	0.04	1.3	29.4	32.1	32.8	31.5	26.2	Slight
70005	19-Aug-13	9.12	0.26	21.7	0.35	0.03	<0.01	0.03	0.9	19.3	24.0	24.5	23.6	26.1	Slight
70009	19-Aug-13	8.81	0.25	20.8	0.31	0.02	<0.01	0.02	0.6	25.6	27.7	28.3	27.6	45.2	Slight
70010	19-Aug-13	9.11	0.24	20.0	0.37	0.02	<0.01	0.02	0.6	21.9	25.7	26.3	25.6	42.0	Slight
70011	19-Aug-13	8.97	0.25	20.8	0.27	0.06	<0.01	0.06	1.9	22.8	29.6	30.3	28.4	16.1	Slight
70012	19-Aug-13	9.17	0.12	10.0	0.21	0.03	<0.01	0.03	0.9	13.7	17.9	18.3	17.3	19.5	Slight
70013	19-Aug-13	8.99	0.22	18.3	0.33	0.01	<0.01	0.01	0.3	21.6	20.3	20.8	20.4	66.4	Slight
70014	19-Aug-13	8.24	0.2	16.7	0.24	1.84	<0.01	1.84	57.5	20.9	24.0	24.5	-33.0	0.4	Slight
70015	19-Aug-13	9.01	0.18	15.0	0.24	0.09	<0.01	0.09	2.8	19.2	18.4	18.8	15.9	6.7	Slight
70016	19-Aug-13	8.79	0.17	14.2	0.26	0.12	<0.01	0.12	3.8	21.3	24.5	25.0	21.3	6.7	Slight
70017	20-Aug-13	9.21	0.16	13.3	0.25	0.03	<0.01	0.03	0.9	17.0	20.6	21.0	20.1	22.4	Slight
70018	19-Aug-13	8.83	0.27	22.5	0.35	0.1	<0.01	0.10	3.1	23.9	31.1	31.8	28.6	10.2	Slight
70022	20-Aug-13	8.75	0.57	47.5	0.68	0.33	<0.01	0.33	10.3	45.9	48.3	49.3	38.9	4.8	Slight
70023	20-Aug-13	8.52	0.24	20.0	0.35	0.19	<0.01	0.19	5.9	23.0	30.9	31.5	25.6	5.3	Slight
70024	19-Aug-13	9.10	0.12	10.0	0.15	0.02	<0.01	0.02	0.6	11.3	12.7	13.0	12.4	20.8	Slight
70025	20-Aug-13	8.69	0.18	15.0	0.23	0.03	<0.01	0.03	0.9	21.1	20.1	20.5	19.6	21.9	Slight
072801	12-Aug-13	8.44	0.25	20.8	0.29	0.08	<0.01	0.08	2.5	21.4	25.5	26.0	23.5	10.4	Slight
072802	12-Aug-13	8.33	0.23	19.2	0.25	0.06	<0.01	0.06	1.9	20.3	27.4	28.0	26.1	14.9	Slight
072803	12-Aug-13	8.36	0.35	29.2	0.37	0.51	<0.01	0.51	15.9	22.6	32.6	33.3	17.3	2.1	Slight
072804	12-Aug-13	8.18	0.68	56.7	0.69	0.59	<0.01	0.59	18.4	47.8	60.8	62.0	43.6	3.4	Slight
072805	12-Aug-13	8.71	0.41	34.2	0.43	0.79	<0.01	0.79	24.7	29.6	34.3	35.0	10.3	1.4	Slight
072806	12-Aug-13	8.22	0.4	33.3	0.43	0.37	<0.01	0.37	11.6	30.0	37.7	38.5	26.9	3.3	Slight
72807	15-Aug-13	9.02	0.07	5.8	0.08	<0.01	<0.01	<0.01	<0.3	9.4	11.0	11.3	11.3	37.5	Slight
72808	15-Aug-13	8.35	0.38	31.7	0.42	0.15	<0.01	0.15	4.7	33.3	35.0	35.8	31.1	7.6	Slight
72809	15-Aug-13	8.22	0.84	70.0	0.88	0.01	<0.01	0.01	0.3	72.3	74.5	76.0	75.7	243.2	Slight
72814	14-Aug-13	8.30	0.35	29.2	0.37	0.1	<0.01	0.10	3.1	25.4	27.4	28.0	24.9	9.0	Slight
72815	14-Aug-13	8.35	0.39	32.5	0.43	0.14	<0.01	0.14	4.4	27.7	34.3	35.0	30.6	8.0	Slight
72819	15-Aug-13	9.01	0.09	7.5	0.1	<0.01	<0.01	<0.01	<0.3	11.6	13.5	13.8	13.8	45.8	Slight
072820	22-Aug-13	8.58	0.49	40.8	0.51	0.02	<0.01	0.02	0.6	37.3	41.4	42.3	41.6	67.6	Slight
072821	22-Aug-13	8.56	0.31	25.8	0.34	0.03	<0.01	0.03	0.9	23.5	29.2	29.8	28.8	31.7	Slight
074792	6-Aug-13	8.60	0.26	21.7	0.37	0.05	<0.01	0.05	1.6	26.4	28.4	29.0	27.4	18.6	Slight
074796	6-Aug-13	8.71	0.19	15.8	0.28	0.03	<0.01	0.03	0.9	19.9	23.0	23.5	22.6	25.1	Slight
Duplicates															
006377		8.46								25.9					Slight
06380			0.2												
70011							<0.01								
70015			0.15												
70017					0.25	0.03									
70022		8.80								44.3					Slight
70023		8.58								23.1					Slight
072806							<0.01								
72815			0.4												
072821					0.35	0.03									
QC															
GTS-2A					1.99	0.35									
GTS-2A					2.01	0.35									
PD-1							4.57								
SY4			0.92												
NBM-1										42.5					Slight
NBM-1										40.0					Slight
Expected Values			0.95		2.01	0.35	4.27			42.0					Slight
Tolerance +/-			0.06		0.15	0.03	0.3			3.0					

Note:

AP = Acid potential in tonnes CaCO3 equivalent per 1000 tonnes of material. AP is determined from calculated sulphide sulphur content: S(T) - S(SO4).

NP = Neutralization potential in tonnes CaCO3 equivalent per 1000 tonnes of material.

NET NP = NP - AP

Carbonate NP is calculated from TIC originating from carbonate minerals and is expressed in kg CaCO3/tonne.

CLIENT : Minto Mines
PROJECT : Minto Project
SGS Project # : 0643
Test : Metals by Aqua Regia Digestion with ICP-MS Finish
Date : January 13, 2014

Sample ID	Ag	Al	B	Ba	Ca	Cr	Cu	Fe	K	Li	Mg	Mn	Na	Ni	P	S	Sr	Ti	V	Zn	Zr	As	Be	Bi	Cd	Ce
	ppm	%	ppm	ppm	%	ppm	ppm	%	%	ppm	%	ppm	%	ppm	ppm	%	ppm	%	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Method Code	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B
LOD	0.01	0.01	10	5	0.01	1	0.5	0.01	0.01	1	0.01	2	0.01	0.5	50	0.01	0.5	0.01	1	1	0.5	1	0.1	0.02	0.01	0.05
006377	0.89	1.35	20	433	1.05	150	4420	3.45	0.92	5	0.86	465	0.04	5.1	560	0.82	41.9	0.17	93	72	2.2	<1	0.3	0.1	0.13	39.4
06379	0.03	1.05	40	188	0.87	158	94.6	2.15	0.44	5	0.67	498	0.07	5	750	0.02	44	0.1	46	60	1.4	<1	0.3	<0.02	0.05	20.1
06380	0.34	1.08	30	183	0.93	121	2270	3.46	0.23	9	0.67	486	0.04	5.1	730	0.94	37.9	0.05	53	67	2.1	<1	0.3	0.08	0.09	27.8
06381	0.1	1.02	30	194	1.22	151	216	2.23	0.37	5	0.65	554	0.05	4.5	630	0.02	68.6	0.07	45	74	1.3	<1	0.3	0.05	0.06	24.7
06382	0.12	1	30	187	0.98	158	162	2.16	0.39	5	0.68	506	0.07	5.8	710	0.01	48.7	0.09	46	64	1.5	<1	0.3	0.04	0.06	20.6
06383	0.12	1.11	30	262	1.25	167	220	2.42	0.49	6	0.66	582	0.05	4.6	670	0.02	81	0.08	52	70	1.3	<1	0.3	0.09	0.06	26
070002	0.09	1.16	50	136	1.09	147	325	2.07	0.25	7	0.72	496	0.08	4.4	620	0.04	71.3	0.09	41	62	1.1	<1	0.4	<0.02	0.05	19.5
70004	0.12	1.08	40	221	1.28	175	313	2.28	0.54	6	0.73	609	0.06	4.6	700	0.03	113	0.09	49	64	1.2	<1	0.3	0.03	0.07	23.5
70005	0.19	0.94	30	301	0.81	168	375	2.33	0.52	4	0.66	497	0.05	5.2	650	0.03	74.9	0.1	48	65	1.2	<1	0.2	0.04	0.06	24.6
70009	0.04	1.37	30	87	1.51	156	51.8	2.53	0.15	9	0.82	602	0.06	4.4	760	<0.01	66.7	0.03	48	73	1.6	<1	0.6	<0.02	0.05	27.4
70010	0.06	1.06	40	240	1.03	161	113	2.36	0.49	5	0.74	570	0.06	4.6	710	0.01	73.1	0.1	51	77	1.5	<1	0.3	0.02	0.06	26.4
70011	0.17	1.09	50	228	1.01	157	541	2.34	0.46	6	0.75	564	0.06	4.6	690	0.05	85.4	0.08	51	67	1.3	<1	0.3	0.07	0.07	21.7
70012	0.03	1.31	40	455	0.69	166	85.5	2.51	0.71	7	0.81	576	0.06	5.1	720	0.02	35.4	0.13	57	64	1	<1	0.2	<0.02	0.02	22.6
70013	0.05	1.06	30	208	1.1	155	113	2.24	0.45	6	0.68	544	0.06	4.7	650	<0.01	56.4	0.09	48	64	1.4	<1	0.3	0.03	0.06	20.4
70014	0.54	1.58	30	52	0.98	133	4350	4.29	0.12	17	1.16	485	0.03	5.5	900	1.94	56.7	0.01	70	74	3.1	1	0.3	0.05	0.09	29.5
70015	0.06	1.28	40	215	0.96	144	267	2.43	0.38	9	0.78	476	0.06	4.2	720	0.08	46	0.07	46	68	0.9	<1	0.3	<0.02	0.04	25.9
70016	0.6	1.32	40	201	1.15	162	1470	2.51	0.46	8	0.81	615	0.06	4.8	790	0.13	86.8	0.09	54	75	1.6	<1	0.5	0.23	0.15	30.3
70017	0.12	1.08	50	224	0.89	151	284	2.21	0.49	6	0.73	530	0.07	4.8	740	0.02	66.6	0.1	49	66	1.3	<1	0.3	0.05	0.06	24
70018	0.96	1.21	40	436	1.06	136	1810	2.84	0.67	5	0.67	558	0.04	4.1	570	0.1	53.2	0.12	63	69	1.2	<1	0.3	0.52	0.11	22.3
70022	0.28	1.35	40	450	1.64	159	453	3.23	0.75	7	0.92	707	0.05	4.9	510	0.35	109	0.13	70	79	1.4	<1	0.4	0.03	0.15	29.8
70023	1.06	1.17	40	256	1.01	169	2860	2.68	0.49	7	0.7	495	0.05	5.5	710	0.19	83.1	0.09	48	81	0.8	<1	0.2	0.56	0.23	30.9
70024	0.05	1.15	40	371	0.55	174	88.9	2.17	0.69	7	0.66	437	0.06	4.5	450	0.02	82.4	0.12	47	62	0.7	<1	0.2	<0.02	0.04	23.5
70025	0.12	1.06	40	187	0.98	135	248	2.43	0.47	6	0.71	530	0.06	4.7	780	0.03	48.3	0.1	53	69	1.7	<1	0.3	0.06	0.06	24.4
072801	0.16	1.08	40	248	0.96	142	281	2.41	0.58	5	0.75	576	0.05	3.9	750	0.09	58.3	0.09	49	154	1.3	<1	0.3	0.08	0.55	18.2
072802	0.08	1.16	40	251	0.97	194	186	2.47	0.6	5	0.76	606	0.06	5	780	0.05	52.7	0.1	54	105	1.4	<1	0.3	0.02	0.1	23.4
072803	1.18	1.38	40	461	0.87	141	3260	3.37	1.06	5	0.9	494	0.04	4.3	720	0.53	35	0.17	68	116	1.3	<1	0.2	0.18	0.29	18.8
072804	0.1	1.25	40	499	1.86	197	669	3.4	0.82	5	0.89	640	0.06	5.2	890	0.64	78	0.14	71	83	1.5	<1	0.3	<0.02	0.15	28.4
072805	0.09	1.25	20	445	1.17	194	746	3.21	0.93	5	0.8	454	0.06	5.1	700	0.88	45.5	0.17	65	68	1	<1	0.1	<0.02	0.08	27.4
072806	0.84	1.67	40	593	1.17	180	2720	3.78	1.15	6	1.13	662	0.06	5.4	900	0.38	55.8	0.18	84	129	1.6	<1	0.2	0.18	0.27	24.7
72807	0.02	1.02	30	215	0.67	163	9.3	2.1	0.53	5	0.69	503	0.07	4.1	740	<0.01	32	0.11	48	61	1.3	<1	0.3	<0.02	0.03	21.6
72808	2.62	0.98	30	204	1.3	147	4060	2.84	0.4	5	0.67	535	0.04	4	670	0.16	62.3	0.07	56	73	1.4	<1	0.3	0.85	0.13	25.5
72809	0.01	0.76	30	355	2.98	149	13.6	1.83	0.33	6	0.45	598	0.04	3.7	510	0.01	106	0.06	38	50	1.2	<1	0.3	<0.02	0.06	18.3
72814	0.32	1.09	30	407	0.96	170	989	2.54	0.7	5	0.76	612	0.05	4.4	780	0.1	54.7	0.11	56	114	1.4	<1	0.3	0.15	0.15	22.4
72815	0.54	0.94	30	265	1.05	175	1820	2.37	0.57	4	0.73	532	0.05	4.6	750	0.14	67	0.09	50	79	1.3	<1	0.3	0.21	0.16	19
72819	0.03	1.12	30	230	0.7	157	37.4	2.2	0.58	6	0.75	538	0.07	4.2	820	<0.01	38.4	0.11	49	67	1.1	<1	0.3	<0.02	0.05	19.6
072820	0.09	1.01	30	281	1.5	152	151	2.35	0.64	4	0.77	549	0.05	4	790	0.02	88.6	0.1	53	76	1.5	<1	0.3	<0.02	0.06	26.1
072821	0.12	1.02	30	337	0.95	169	309	2.22	0.64	4	0.72	481	0.05	4.4	670	0.03	55.3	0.11	52	71	1.2	<1	0.3	<0.02	0.05	23.3
074792	0.27	1.08	30	187	1.2	166	576	2.25	0.4	6	0.72	551	0.06	4.7	700	0.05	76.9	0.08	45	61	1.3	<1	0.3	0.12	0.05	18.5
074796	0.09	1.13	40	212	1.02	165	316	2.31	0.42	6	0.72	511	0.06	5	680	0.03	62.7	0.1	47	68	1.1	<1	0.4	0.03	0.06	22.3
Duplicates																										
06379	0.02	1.05	50	192	0.86	158	89.8	2.12	0.44	6	0.67	492	0.07	4.5	720	0.02	44	0.1	47	60	1.4	<1	0.3	<0.02	0.06	21.7
072804	0.11	1.24	40	486	1.85	197	665	3.38	0.82	5	0.88	641	0.06	5.2	890	0.63	77.4	0.14	69	84	1.6	<1	0.3	<0.02	0.16	28
QC																										
CH4	2.17	1.82	30	294	0.62	111	2010	4.68	1.39	12	1.2	325	0.06	49.9	650	0.7	9.2	0.2	77	207	11.9	7	0.1	0.49	1.19	30.7
CH4	2.07	1.84	30	302	0.63	115	2020	4.73	1.4	12	1.2	334	0.06	51.6	650	0.7	9	0.21	78	206	12.3	7	0.1	0.5	1.16	29.9
Certified Values	2.13	1.85	#N/A	293	0.61	103.8	2000	4.79	1.43	12.6	1.18	324	0.06	49.57	719	0.73	9.38	0.21	79.27	189.4	9	8.14	0.11	0.51	1.17	28.18
Tolerance (%)	10.9	11.35	#N/A	14.3	14.1	12.4	10.1	10.52	11.74	29.84	12.3	11.5	50.3	12.52	27.4	13.4	23.3	23.3	13.2	11.3	17.7	13.1	241.3	19.7	12.1	10.4

Sample ID	Co ppm	Cs ppm	Ga ppm	Ge ppm	Hf ppm	Hg ppm	In ppm	La ppm	Lu ppm	Mo ppm	Nb ppm	Pb ppm	Rb ppm	Sb ppm	Sc ppm	Se ppm	Sn ppm	Ta ppm	Tb ppm	Te ppm	Th ppm	Tl ppm	U ppm	W ppm	Y ppm	Yb ppm
Method Code	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B
LOD	0.1	0.05	0.1	0.1	0.05	0.01	0.02	0.1	0.01	0.05	0.05	0.2	0.2	0.05	0.1	1	0.3	0.05	0.02	0.05	0.1	0.02	0.05	0.1	0.05	0.1
006377	16.9	0.69	7	0.1	0.2	0.04	0.22	21.9	0.1	124	1.6	3.2	44.1	<0.05	5.2	3	2.3	0.51	0.47	0.16	1.5	0.32	0.34	0.9	9.57	0.7
06379	6.8	0.32	5.4	0.1	0.05	0.02	<0.02	10.7	0.12	5.89	0.65	2.3	21.6	<0.05	4.3	<1	0.6	0.12	0.29	<0.05	2.7	0.13	0.33	0.5	8.5	0.8
06380	21.3	0.2	6.5	<0.1	<0.05	<0.01	0.04	15.5	0.14	50.9	0.35	4.7	12.1	<0.05	3.1	3	1.4	<0.05	0.38	0.07	2.4	0.07	0.47	0.7	11.3	0.9
06381	6.7	0.28	5.5	<0.1	<0.05	0.01	0.03	13.5	0.11	4.95	0.37	3.6	18.6	<0.05	4.8	<1	0.6	<0.05	0.3	<0.05	3.2	0.12	0.28	0.3	8.16	0.7
06382	6.6	0.3	5.3	<0.1	<0.05	<0.01	0.02	11.1	0.12	4.94	0.45	2.5	19.2	<0.05	4.2	<1	0.6	<0.05	0.27	<0.05	2.7	0.12	0.33	0.5	7.59	0.7
06383	6.9	0.37	5.7	<0.1	<0.05	<0.01	0.03	13.5	0.17	4.73	0.25	2.1	24.2	<0.05	5.7	<1	0.7	<0.05	0.43	<0.05	2.8	0.16	0.29	0.3	12.3	1.1
070002	6.4	0.27	5.9	<0.1	<0.05	<0.01	<0.02	10.9	0.08	4.51	0.36	3.4	12.5	<0.05	3.4	<1	0.5	<0.05	0.19	<0.05	2.5	0.08	0.23	0.3	5.67	0.5
70004	6.9	0.38	5.4	<0.1	<0.05	<0.01	0.03	12.8	0.12	5.77	0.36	2.6	26.1	<0.05	4.4	<1	0.6	<0.05	0.29	<0.05	3.3	0.18	0.25	0.7	8.38	0.7
70005	6.5	0.33	4.6	<0.1	<0.05	<0.01	0.03	14.1	0.09	37.8	0.42	2.7	24.1	<0.05	3.6	<1	0.5	<0.05	0.22	<0.05	4.3	0.15	0.21	0.9	5.92	0.5
70009	7.7	0.16	7.6	0.1	<0.05	<0.01	0.03	15.3	0.12	4.52	0.27	4.9	7.4	<0.05	5.5	<1	0.7	<0.05	0.28	<0.05	4.8	0.04	0.37	0.2	7.82	0.7
70010	7.1	0.36	5.6	0.1	<0.05	<0.01	0.03	14.7	0.12	4.93	0.41	5.1	24.2	<0.05	4.6	<1	0.6	<0.05	0.3	<0.05	4	0.15	0.39	0.5	8.52	0.8
70011	7	0.41	5.7	<0.1	<0.05	<0.01	0.03	11.8	0.11	7.05	0.34	2.5	22.9	<0.05	5.6	<1	0.7	<0.05	0.29	<0.05	2.7	0.14	0.28	0.3	8.18	0.7
70012	7.4	0.42	6.1	<0.1	<0.05	<0.01	0.02	11.8	0.11	5.65	0.58	2.3	30.5	<0.05	4.3	<1	0.9	<0.05	0.29	<0.05	3	0.24	0.26	0.7	8.01	0.7
70013	6.9	0.34	5.6	<0.1	<0.05	<0.01	<0.02	10.8	0.11	5.17	0.35	2.4	22.2	<0.05	4.6	<1	0.6	<0.05	0.28	<0.05	2.4	0.14	0.31	0.6	8.28	0.7
70014	21	0.25	8.3	<0.1	<0.05	0.02	0.1	16.3	0.15	117	0.07	7.7	8.9	<0.05	3.7	5	1.9	<0.05	0.42	0.11	4.4	0.05	0.45	0.3	12.4	1
70015	7.7	0.29	6.5	<0.1	<0.05	<0.01	<0.02	14.1	0.06	8.49	0.33	3.3	19.7	<0.05	2	<1	0.6	<0.05	0.2	<0.05	3.4	0.13	0.24	0.3	5.09	0.4
70016	6.9	0.36	6.8	0.1	<0.05	<0.01	0.05	17.2	0.1	6.74	0.4	3.9	23.8	<0.05	4.7	1	0.8	<0.05	0.26	<0.05	5.6	0.18	0.41	0.3	6.99	0.6
70017	6.6	0.33	5.5	0.1	<0.05	<0.01	0.02	13.3	0.1	4.73	0.43	2.8	23	<0.05	4.3	<1	0.6	<0.05	0.24	<0.05	3.6	0.15	0.27	0.7	6.63	0.6
70018	6.7	0.52	6.6	<0.1	<0.05	<0.01	0.05	12.1	0.1	4.81	0.67	3.4	31.7	<0.05	4.9	2	0.9	<0.05	0.29	0.15	3	0.22	0.2	0.6	7.95	0.6
70022	12.1	0.55	7.1	0.1	<0.05	<0.01	0.03	15.5	0.1	13.7	0.68	3.9	35.9	<0.05	5	<1	1.4	<0.05	0.35	<0.05	2.9	0.27	0.21	0.7	9.17	0.7
70023	6.6	0.33	6.4	<0.1	<0.05	<0.01	0.04	17.1	0.08	5.78	0.48	9.8	24.6	<0.05	3.1	2	0.6	<0.05	0.26	0.15	3.8	0.16	0.35	1.2	6.34	0.5
70024	5.7	0.43	5.7	<0.1	<0.05	<0.01	<0.02	13.2	0.05	5.24	0.5	2.6	34.5	<0.05	2.3	<1	0.5	<0.05	0.15	<0.05	2.8	0.24	0.13	1.2	3.6	0.3
70025	7.2	0.37	5.6	<0.1	<0.05	<0.01	0.03	13.5	0.11	6.96	0.42	2.6	25.5	<0.05	4.5	<1	0.6	<0.05	0.26	<0.05	4.5	0.15	0.53	0.6	7.24	0.7
072801	6.8	0.46	5.4	<0.1	<0.05	0.02	0.08	9.9	0.11	3.77	0.24	5.2	27.4	<0.05	4.8	<1	0.6	<0.05	0.27	<0.05	2.4	0.16	0.23	<0.1	7.72	0.7
072802	7.3	0.46	5.6	<0.1	<0.05	<0.01	0.05	12.8	0.11	5.89	0.33	3.9	29.7	<0.05	5	<1	0.6	<0.05	0.28	<0.05	3.4	0.21	0.37	<0.1	8.05	0.7
072803	8.7	0.77	6.3	0.1	<0.05	<0.01	0.17	9.5	0.11	3.93	0.91	3.9	48.1	<0.05	6.3	2	1.1	<0.05	0.28	0.06	3.1	0.39	0.2	<0.1	7.97	0.7
072804	13	0.67	5.9	0.1	<0.05	<0.01	0.04	15	0.14	9.05	0.68	2.9	39.1	<0.05	6.6	<1	1.1	<0.05	0.4	<0.05	2.8	0.29	0.46	<0.1	11	0.8
072805	23.5	0.63	5.6	<0.1	<0.05	<0.01	0.04	14.5	0.08	11.2	0.95	2	43.7	<0.05	5.8	<1	1	<0.05	0.28	<0.05	2.8	0.42	0.19	<0.1	7.26	0.5
072806	9.7	1.13	7.3	0.1	<0.05	<0.01	0.18	13.1	0.17	8.25	0.61	4.8	51.4	<0.05	9.3	2	1.1	<0.05	0.39	0.12	3.8	0.44	0.22	<0.1	11.9	1
72807	6	0.35	5.1	0.1	<0.05	<0.01	0.02	11.7	0.1	4.25	0.31	1.3	24.8	<0.05	4.6	<1	0.6	<0.05	0.24	<0.05	2.9	0.16	0.23	<0.1	6.78	0.6
72808	6.9	0.29	5.7	<0.1	<0.05	<0.01	0.04	13.4	0.1	4.01	0.42	2.7	19.8	<0.05	4.4	4	0.8	<0.05	0.28	0.33	4	0.15	0.38	<0.1	7.08	0.6
72809	5	0.33	4	<0.1	<0.05	<0.01	0.02	9.9	0.15	4.28	0.22	2.2	17.6	<0.05	5	<1	0.5	<0.05	0.33	<0.05	2.3	0.11	0.24	<0.1	10.3	0.9
72814	7.1	0.58	5.3	<0.1	<0.05	<0.01	0.06	12.1	0.09	6.79	0.35	4.1	32.7	<0.05	5.1	<1	0.6	<0.05	0.28	<0.05	3.1	0.22	0.24	<0.1	7.29	0.6
72815	6.3	0.52	4.6	<0.1	<0.05	<0.01	0.07	10	0.1	5.23	0.32	2.8	26	<0.05	4.9	<1	0.6	<0.05	0.27	0.06	2.7	0.16	0.7	<0.1	7.59	0.6
72819	6.3	0.37	5.5	<0.1	<0.05	<0.01	0.02	10.6	0.1	4.05	0.27	1.8	27	<0.05	4.7	<1	0.6	<0.05	0.24	<0.05	2.7	0.18	0.24	<0.1	6.84	0.6
072820	6.5	0.6	4.9	<0.1	<0.05	<0.01	0.03	14.6	0.12	5	0.35	2.2	30.1	<0.05	5	<1	0.6	<0.05	0.31	<0.05	4.1	0.18	0.23	<0.1	8.63	0.7
072821	6.4	0.48	5.1	<0.1	<0.05	<0.01	0.04	12.6	0.09	10	0.32	2.2	30.4	<0.05	4.9	<1	0.6	<0.05	0.28	<0.05	3.2	0.19	0.21	<0.1	7.08	0.6
074792	6.3	0.27	5.5	<0.1	<0.05	<0.01	0.03	10.3	0.1	5.45	0.36	2.7	18.6	<0.05	4.8	<1	0.6	<0.05	0.24	<0.05	2	0.11	0.21	0.5	7.34	0.6
074796	6.6	0.31	5.8	<0.1	<0.05	<0.01	0.02	12.1	0.08	5.17	0.42	2.9	20.1	<0.05	3.7	<1	0.5	<0.05	0.19	<0.05	2.7	0.13	0.26	0.5	5.28	0.4
Duplicates																										
06379	6.8	0.33	5.4	0.1	<0.05	0.02	<0.02	11.4	0.12	5.86	0.56	2.4	21.6	<0.05	4.3	<1	0.6	0.06	0.29	<0.05	2.9	0.13	0.32	0.5	8.55	0.8
072804	12.9	0.68	5.9	<0.1	<0.05	<0.01	0.05	14.9	0.13	7.1	0.63	3	38.9	<0.05	6.7	<1	1.1	<0.05	0.38	<0.05	2.8	0.29	0.45	<0.1	11	0.8
QC																										
CH4	24.2	2.93	9.1	0.3	0.27	<0.01	0.11	16.2	0.07	3.15	0.37	9.1	66.2	0.31	8.6	2	0.7	<0.05	0.32	0.37	2.6	0.45	0.32	2.5	6.47	0.5
CH4	23.1	2.93	8.9	0.3	0.28	<0.01	0.11	15.7	0.07	2.79	0.31	8.2	65.9	0.33	8.5	2	0.7	<0.05	0.32	0.38	2.5	0.44	0.31	2.5	6.38	0.5
Certified Value	22.8	2.6	8.72	0.21	0.29	#N/A	0.1	14	#N/A	3.05	0.19	8.24	67	0.34	7.99	1.57	0.6	0.3	0.27	0.42	2.2	0.4	0.29	2.15	5.66	#N/A
Tolerance (%)	11.1	14.8	12.9	127.4	52.8	#N/A	62.1	11.8	#N/A	14.1	75	16.1	10.7	47.3	13.1	169.6	134.5	51.7	28.4	39.6	21.2	22.6	52.9	21.6	12.2	#N/A

CLIENT : **Minto Mines**
PROJECT : **Minto Project**
SGS PROJECT # : **0643**
Test : **Leachate Analysis by ICP-OES**
Date : **January 13, 2014**

Sample ID		06383	NP Contribution	70014	NP Contribution	70022	NP Contribution	72807	NP Contribution
Al	mg/L	36.0		1.36		36.9		34.6	
Sb	mg/L	< 0.01		< 0.01		0.01		< 0.01	
As	mg/L	< 0.004		< 0.004		0.004		0.006	
Ba	mg/L	0.0878		0.192		0.0790		0.110	
Be	mg/L	0.0069		0.0007		0.0099		0.0034	
Bi	mg/L	0.20		< 0.02		0.38		0.11	
B	mg/L	1.32		0.711		2.32		2.28	
Cd	mg/L	0.0121		0.0019		0.0268		0.0055	
Ca	mg/L	761	19.0	602	15.0	547	13.6	227	5.7
Cr	mg/L	0.228		0.001		0.164		0.245	
Co	mg/L	0.044		0.007		0.066		0.021	
Cu	mg/L	2.22		0.101		2.87		0.017	
Fe	mg/L	149		0.571		293		74.4	
Pb	mg/L	0.036		0.023		0.044		0.021	
Li	mg/L	< 0.1		< 0.1		< 0.1		< 0.1	
Mg	mg/L	37.9	1.6	22.5	0.9	128	5.3	20.8	0.9
Mn	mg/L	17.5		4.59		18.4		5.41	
Mo	mg/L	< 0.01		0.03		< 0.01		< 0.01	
Ni	mg/L	0.052		0.005		0.088		0.034	
P	mg/L	0.026		< 0.009		0.019		0.256	
K	mg/L	55.8	1.4	19.4	0.5	50.9	1.3	39.2	1.0
Se	mg/L	< 0.01		< 0.01		< 0.01		< 0.01	
Si	mg/L	50.2		14.4		55.2		57.2	
Ag	mg/L	< 0.08		< 0.08		< 0.08		< 0.08	
Na	mg/L	23.1	1.0	11.5	0.5	23.0	1.0	22.5	1.0
Sr	mg/L	4.61		2.27		4.80		1.24	
S	mg/L	948		584		983		370	
Tl	mg/L	0.015		< 0.005		0.011		< 0.005	
Sn	mg/L	< 0.03		< 0.03		< 0.03		< 0.03	
Ti	mg/L	0.012		< 0.001		0.018		0.054	
U	mg/L	< 0.1		< 0.1		< 0.1		< 0.1	
V	mg/L	0.051		0.008		0.072		0.077	
Zn	mg/L	0.529		0.031		0.634		0.277	
Zr	mg/L	< 0.007		< 0.007		0.008		< 0.007	
NP from Ca, Mg, Na & K (kg CaCO3 Equiv./tonne)			**23.0**		**16.9**		**21.2**		**8.5**

CLIENT : **Minto Mines**
PROJECT : **Minto Mines**
SGS PROJECT # : **0643**
Test : **BC Research NP and Modified NP Procedures**
Date : **December 18, 2013**

Sample ID	Paste pH	TIC %	CaCO3 NP	C(T) %	S(T) %	S(SO4) %	S(S-2) %	AP	NP	NP H2SO4/tonne	NP CaCO3/tonne	Net NP	NP:AP Ratio (NP/AP)	Fizz Test
Method Code	Sobek	CSB02V	Calc	CSA01V	CSA06V	CSA07V	Calc	Calc	Modified	BC Research	Calc	Calc	Calc	Sobek
LOD	0.2	0.01	#N/A	0.01	0.01	0.01	#N/A	#N/A	0.5	0.5	#N/A	#N/A	#N/A	#N/A
006384	8.83	0.17	14.2	0.19	0.19	0.01	0.18	5.6	17.1	21.6	22.0	16.4	3.9	Slight
006385	8.82	0.19	15.8	0.27	0.01	<0.01	0.01	0.3	18.4	23.3	23.8	23.4	76.0	Slight
006386	9.00	0.09	7.5	0.21	0.01	<0.01	0.01	0.3	12.1	14.7	15.0	14.7	48.0	Slight
006387	8.88	0.13	10.8	0.19	0.02	<0.01	0.02	0.6	13.9	15.4	15.8	15.1	25.2	Slight
006388	8.23	0.36	30.0	0.42	1.37	<0.01	1.37	42.8	30.7	38.2	39.0	-3.8	0.9	Slight
006389	8.93	0.18	15.0	0.21	<0.01	<0.01	<0.01	<0.3	18.3	20.6	21.0	21.0	>70	Slight
006390	8.87	0.21	17.5	0.25	0.04	<0.01	0.04	1.3	20.3	23.8	24.3	23.0	19.4	Slight
006391	8.41	0.21	17.5	0.25	0.49	<0.01	0.49	15.3	21.8	23.5	24.0	8.7	1.6	Slight
006392	9.01	0.09	7.5	0.14	<0.01	<0.01	<0.01	<0.3	11.1	12.7	13.0	13.0	>43	Slight
006393	8.63	0.17	14.2	0.2	0.24	<0.01	0.24	7.5	15.6	20.3	20.8	13.3	2.8	Slight
006394	8.81	0.22	18.3	0.25	0.05	<0.01	0.05	1.6	20.7	25.2	25.8	24.2	16.5	Slight
006395	8.53	0.29	24.2	0.34	0.25	<0.01	0.25	7.8	26.4	29.6	30.3	22.4	3.9	Slight
006396	8.88	0.25	20.8	0.3	0.07	<0.01	0.07	2.2	22.9	24.5	25.0	22.8	11.4	Slight
006397	8.94	0.24	20.0	0.34	<0.01	<0.01	<0.01	<0.3	19.9	24.0	24.5	24.5	>81	Slight
006398	9.02	0.22	18.3	0.28	0.01	<0.01	0.01	0.3	19.6	24.3	24.8	24.4	79.2	Slight
006399	8.78	0.25	20.8	0.34	0.1	<0.01	0.10	3.1	22.5	28.4	29.0	25.9	9.3	Slight
006400	8.63	0.39	32.5	0.42	0.02	<0.01	0.02	0.6	34.8	39.7	40.5	39.9	64.8	Slight
070501	8.66	0.57	47.5	0.59	<0.01	<0.01	<0.01	<0.3	47.9	59.3	60.5	60.5	>201	Slight
070502	8.82	0.54	45.0	0.6	0.03	<0.01	0.03	0.9	42.6	45.8	46.8	45.8	49.9	Slight
070503	8.79	0.29	24.2	0.34	0.02	<0.01	0.02	0.6	26.4	28.4	29.0	28.4	46.4	Slight
070504	8.86	0.32	26.7	0.38	0.24	<0.01	0.24	7.5	27.2	30.9	31.5	24.0	4.2	Slight
070505	8.89	0.21	17.5	0.25	0.07	<0.01	0.07	2.2	19.2	22.5	23.0	20.8	10.5	Slight
070506	8.73	0.31	25.8	0.38	0.07	<0.01	0.07	2.2	28.2	32.3	33.0	30.8	15.1	Slight
070507	8.55	0.21	17.5	0.26	0.46	<0.01	0.46	14.4	20.4	19.4	19.8	5.4	1.4	Slight
070508	8.84	0.22	18.3	0.26	0.11	<0.01	0.11	3.4	19.4	26.0	26.5	23.1	7.7	Slight
Enviro T1	8.47	0.34	28.3	0.39	0.04	<0.01	0.04	1.3	27.5	31.6	32.3	31.0	25.8	Slight
Duplicates														
006384	8.91								16.6					Slight
006388		0.36		0.43	1.41									
006398						<0.01								
070503	8.87								26.1					Slight
070504	8.92								2.1					Slight
070505						<0.01								
070506		0.31												
QC														
GTS-2A				2.01	0.33									
Expected Values GTS-2A				2.01	0.35									
Tolerance +/-				0.15	0.03									
502-491_1001				11.5	11									
Expectec Values 502-491_1001				11.44	11.16									
Tolerance +/-				0.23	0.23									
PD-1						4.05								
Expected Values PD-1						4.27								
Tolerance +/-						0.3								
SY4		0.91												
Expected Values SY4		0.95												
Tolerance +/-		0.06												
TIC-L1		0.13												
Expected Values TIC-L1		0.1325												
Tolerance +/-		0.02												
NBM-1									39.4					Slight
Expected Values NBM-1									42.0					Slight
Tolerance +/-									3.0					

Note:

AP = Acid potential in tonnes CaCO3 equivalent per 1000 tonnes of material. AP is determined from calculated sulphide sulphur content: S(T) - S(SO4).

NP = Neutralization potential in tonnes CaCO3 equivalent per 1000 tonnes of material.

NET NP = NP - AP

Carbonate NP is calculated from TIC originating from carbonate minerals and is expressed in kg CaCO3/tonne.

CLIENT : **Minto Mines**
PROJECT : **Minto Project**
SGS Project # : **0643**
Test : **Metals by Aqua Regia Digestion with ICP-MS Finish**
Date : **November 19, 2013**

Sample ID	Al	B	Ba	Ca	Cr	Cu	Fe	K	Li	Mg	Mn	Na	Ni	P	S	Sr	Ti	V	Zn	Zr	Ag	As	Be	Bi	Cd	Ce
	%	ppm	ppm	%	ppm	ppm	%	%	ppm	%	ppm	%	ppm	ppm	%	ppm	%	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Method Code	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B
LOD	0.01	10	5	0.01	1	0.5	0.01	0.01	1	0.01	2	0.01	0.5	50	0.01	0.5	0.01	1	1	0.5	0.01	1	0.1	0.02	0.01	0.05
006384	1.3	30	1160	0.85	142	2710	2.74	0.79	6	0.82	536	0.06	4.3	750	0.2	72.9	0.14	63	76	1.2	1.27	<1	0.2	0.3	0.3	31.9
006385	1.16	30	125	1.1	81	49.5	2.25	0.24	7	0.72	541	0.06	3	630	0.02	87.4	0.06	42	66	1.2	0.03	<1	0.5	<0.02	0.07	20
006386	1.17	30	251	0.79	145	124	2.31	0.59	5	0.74	517	0.07	4.4	790	0.01	62.5	0.12	51	69	1.2	0.05	<1	0.3	<0.02	0.05	19.6
006387	1.01	30	219	0.77	161	180	2.19	0.42	6	0.64	493	0.06	4.7	610	0.04	43	0.08	43	63	1.1	0.05	<1	0.2	<0.02	0.03	19.1
006388	1.12	20	127	1.5	136	2910	3.24	0.25	9	0.65	423	0.02	4.6	850	1.49	37.6	0.03	41	59	2.4	0.55	<1	0.2	0.16	0.13	41.4
006389	1.05	30	109	1.16	138	91.5	2.05	0.21	6	0.65	484	0.07	4	600	0.01	62.2	0.1	41	58	1.4	0.06	<1	0.4	<0.02	0.04	19.4
006390	1.16	30	184	1.05	144	602	2.46	0.32	6	0.76	593	0.05	4.2	660	0.04	70	0.07	43	73	1.1	0.29	<1	0.4	0.18	0.06	26.2
006391	1.65	20	265	1.16	145	2430	2.94	0.5	9	0.82	449	0.04	4.5	670	0.56	50.5	0.09	65	64	2.1	0.4	<1	0.2	0.04	0.07	19.2
006392	1.28	30	516	0.55	161	39.2	2.36	0.78	6	0.72	501	0.05	4.5	720	0.01	28.1	0.13	51	55	0.7	0.03	<1	0.2	<0.02	0.02	24.2
006393	1.18	20	420	0.7	171	2640	2.49	0.76	4	0.65	462	0.05	4.7	390	0.27	31.4	0.14	52	66	0.9	0.92	<1	0.2	0.04	0.18	7.93
006394	1.19	30	401	0.96	89	136	2.25	0.6	7	0.71	495	0.05	3	660	0.06	39.1	0.1	48	54	0.9	0.04	<1	0.3	<0.02	0.04	19.5
006395	1.35	20	381	1.23	141	1880	2.58	0.64	8	0.84	448	0.04	4.3	1040	0.27	47	0.11	56	57	1.1	0.14	<1	0.3	0.03	<0.01	29.2
006396	1.29	20	366	1.06	157	120	2.59	0.66	6	0.79	539	0.05	4.4	600	0.09	62.5	0.12	54	67	1	0.05	<1	0.3	<0.02	0.03	18.7
006397	1.03	30	195	1.01	91	102	2.27	0.44	6	0.71	533	0.07	3	740	0.01	78.8	0.1	50	74	1.5	0.08	<1	0.3	<0.02	0.04	22.3
006398	1.02	30	166	1	145	141	2.11	0.36	6	0.68	488	0.05	3.9	530	0.02	82	0.08	42	64	1.1	0.06	<1	0.4	0.02	0.04	19
006399	1.21	30	148	1.2	138	560	2.67	0.37	8	0.8	520	0.06	4	810	0.13	63.5	0.09	56	68	2.1	0.18	<1	0.4	0.1	0.05	26.3
006400	1.09	30	193	1.55	130	119	2.58	0.39	6	0.71	584	0.05	4	770	0.03	77.8	0.07	52	70	1.6	0.05	<1	0.4	<0.02	0.05	29.9
070501	1.02	30	113	2.03	123	35.9	2.52	0.22	6	0.65	697	0.04	3.4	660	<0.01	139	0.03	44	63	1.3	0.02	<1	0.5	0.02	0.1	23.4
070502	0.98	30	262	1.5	139	247	2.36	0.58	5	0.77	572	0.05	3.6	590	0.04	144	0.09	50	65	1.1	0.07	<1	0.3	0.02	0.07	28.1
070503	1.14	30	109	1.31	132	180	2.31	0.23	7	0.7	534	0.05	3.8	620	0.03	108	0.05	42	67	1.3	0.07	<1	0.5	0.03	0.06	23.5
070504	1	30	233	1.19	143	609	2.37	0.42	6	0.61	463	0.05	3.7	610	0.25	85.5	0.07	43	56	1.1	0.14	<1	0.3	0.05	0.11	20.7
070505	1	30	144	0.99	129	114	2.2	0.31	7	0.64	467	0.06	3.9	630	0.08	49.9	0.06	40	66	1	0.04	<1	0.3	<0.02	0.04	18.6
070506	1.15	20	260	1.29	142	404	2.49	0.49	6	0.72	593	0.05	4.1	700	0.08	71.9	0.08	51	69	1.3	0.13	<1	0.3	0.06	0.05	28.7
070507	1.44	30	207	1.02	139	1820	2.86	0.38	12	0.83	454	0.04	4.1	760	0.51	53.4	0.07	54	69	1.7	0.46	<1	0.3	0.07	0.05	18.4
070508	1.29	30	342	0.93	140	770	2.69	0.7	6	0.73	540	0.05	4.5	640	0.12	44.1	0.13	62	74	1.4	0.21	<1	0.3	<0.02	0.06	26.3
Enviro T1	1.27	20	246	1.2	116	765	3.53	0.57	9	0.8	638	0.05	4.5	770	0.05	59.7	0.1	70	112	1.6	0.44	<1	0.3	0.22	0.22	24.5
Duplicates																										
006398	1.03	30	165	1.01	141	132	2.1	0.35	6	0.68	491	0.05	3.8	530	0.02	82.5	0.08	41	58	1.1	0.06	<1	0.4	0.02	0.05	19.3
006399	1.23	30	147	1.26	141	535	2.77	0.38	8	0.8	540	0.07	3.9	790	0.12	67.6	0.09	56	69	2.1	0.17	<1	0.5	0.06	0.1	26.8
QC																										
CH4	1.75	20	290	0.58	108	1960	4.7	1.35	12	1.14	311	0.05	48.4	640	0.68	8.5	0.2	77	195	11.4	2.37	7	<0.1	0.49	1.14	28.8
CH4	1.76	20	276	0.59	107	2020	4.73	1.36	13	1.15	316	0.05	48.5	660	0.7	8.6	0.2	75	202	11	2.09	7	0.1	0.62	1.18	29.3
Certified Values	1.85	#N/A	293	0.61	103.8	2000	4.79	1.43	12.6	1.18	324	0.06	49.57	719	0.73	9.38	0.21	79.27	189.4	9	2.13	8.14	0.11	0.51	1.17	28.18
Tolerance (%)	11.35	#N/A	14.3	14.1	12.4	10.1	10.52	11.74	29.84	12.3	11.5	50.3	12.52	27.4	13.4	23.3	23.3	13.2	11.3	17.7	10.9	13.1	241.3	19.7	12.1	10.4

Sample ID	Co ppm	Cs ppm	Ga ppm	Ge ppm	Hf ppm	Hg ppm	In ppm	La ppm	Lu ppm	Mo ppm	Nb ppm	Pb ppm	Rb ppm	Sb ppm	Sc ppm	Se ppm	Sn ppm	Ta ppm	Tb ppm	Te ppm	Th ppm	Tl ppm	U ppm	W ppm	Y ppm	Yb ppm
Method Co	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B
LOD	0.1	0.05	0.1	0.1	0.05	0.01	0.02	0.1	0.01	0.05	0.05	0.2	0.2	0.05	0.1	1	0.3	0.05	0.02	0.05	0.1	0.02	0.05	0.1	0.05	0.1
006384	6.7	0.52	6.3	0.1	0.14	0.03	0.05	19.2	0.08	4.19	0.65	2	37.5	<0.05	5.2	<1	0.8	0.15	0.24	0.22	4.4	0.27	0.25	0.5	6.11	0.5
006385	6.4	0.21	6	<0.1	0.07	<0.01	0.02	10.9	0.09	1.21	0.16	3	12.2	<0.05	4.1	<1	0.5	<0.05	0.21	<0.05	2.7	0.07	0.26	0.1	6.12	0.5
006386	6.2	0.33	5.6	<0.1	0.28	0.03	0.02	10.6	0.09	4.31	1.17	2.2	26.4	<0.05	5	<1	0.6	0.51	0.22	<0.05	2.3	0.17	0.21	0.9	6.1	0.5
006387	6.4	0.26	5	<0.1	0.11	<0.01	<0.02	10	0.08	5.95	0.42	2.1	19.3	<0.05	3.2	<1	0.6	0.06	0.21	<0.05	2.1	0.12	0.21	0.4	5.99	0.5
006388	15.7	0.36	5	<0.1	0.1	0.01	0.13	23.2	0.18	88.4	0.13	7.8	14.5	<0.05	2.9	3	1.4	<0.05	0.53	0.09	6.5	0.17	1.39	0.6	13.4	1.1
006389	5.4	0.21	5.5	<0.1	0.09	<0.01	<0.02	10.8	0.09	4.02	0.37	3.5	10.3	<0.05	3.4	<1	0.5	<0.05	0.2	<0.05	2.5	0.06	0.41	0.3	5.68	0.6
006390	6	0.27	5.9	<0.1	0.08	0.01	0.02	14.2	0.09	5.42	0.3	3.1	16.3	<0.05	3.3	<1	0.5	<0.05	0.24	<0.05	4.1	0.1	0.26	0.2	6.31	0.5
006391	12.6	0.39	7	<0.1	0.08	0.01	0.08	10	0.11	45.3	0.28	3.5	23.8	<0.05	4	2	1.5	<0.05	0.32	<0.05	1.5	0.18	0.21	0.2	9.17	0.7
006392	6.1	0.42	5.9	<0.1	<0.05	<0.01	0.02	12.7	0.1	5.41	0.52	2.3	34.4	<0.05	4.6	<1	1.2	<0.05	0.27	<0.05	3.4	0.29	0.28	0.5	7.21	0.6
006393	7	0.56	5.3	<0.1	<0.05	<0.01	0.09	4	0.05	8.01	0.57	1.8	35	<0.05	2.2	2	0.8	<0.05	0.13	0.26	0.5	0.23	0.12	0.5	3.86	0.3
006394	6.5	0.41	5.8	<0.1	0.06	<0.01	0.02	10	0.12	2.53	0.35	2.5	26.9	<0.05	4.3	<1	0.9	<0.05	0.29	<0.05	2.2	0.21	0.25	<0.1	8.23	0.7
006395	7	0.47	6.3	<0.1	<0.05	<0.01	0.08	16	0.16	49.6	0.39	4.5	29.5	<0.05	5.3	1	1.5	<0.05	0.4	<0.05	3	0.25	0.71	0.3	11.2	1
006396	7.2	0.4	6	<0.1	0.06	0.01	0.03	10	0.1	4.7	0.61	2.3	30.1	<0.05	5.1	<1	0.9	<0.05	0.25	<0.05	2	0.21	0.2	0.4	7.25	0.6
006397	6.5	0.3	5.2	<0.1	0.08	<0.01	0.02	11.9	0.11	1.92	0.36	17	20.3	<0.05	4.2	<1	0.6	<0.05	0.27	<0.05	3.2	0.13	0.29	0.5	7.76	0.7
006398	5.5	0.26	5.6	<0.1	0.06	<0.01	0.02	10.6	0.08	4.62	0.29	3.1	17.8	<0.05	4	<1	0.5	<0.05	0.2	<0.05	2.3	0.11	0.2	0.3	5.55	0.5
006399	8.6	0.32	6.2	<0.1	0.1	<0.01	0.03	14.9	0.11	12.4	0.34	3.3	19.6	<0.05	4	<1	0.7	<0.05	0.26	<0.05	5	0.12	0.55	0.4	7.44	0.7
006400	7.2	0.34	6.1	<0.1	0.08	<0.01	0.03	16.4	0.14	5.24	0.17	2.7	19.8	<0.05	4.6	<1	0.6	<0.05	0.34	<0.05	4.6	0.12	0.42	0.2	9.6	0.8
070501	6.4	0.27	6	<0.1	0.06	<0.01	0.03	11.8	0.18	3.61	0.05	3.1	11.1	<0.05	5.5	<1	0.6	<0.05	0.43	<0.05	2.3	0.06	0.32	0.2	13.1	1.2
070502	6.5	0.4	5.1	<0.1	0.05	<0.01	0.04	15	0.13	30	0.24	2.3	27.8	<0.05	5.8	<1	0.8	<0.05	0.34	<0.05	3.4	0.18	0.27	0.2	9.46	0.8
070503	6.5	0.23	6.3	<0.1	0.07	<0.01	0.02	13	0.1	4.06	0.21	3.8	12	<0.05	4.2	<1	0.5	<0.05	0.24	<0.05	3.8	0.07	0.28	0.2	6.79	0.6
070504	8.5	0.31	5.5	<0.1	0.06	<0.01	0.03	11.2	0.09	7.46	0.32	2.5	20.8	<0.05	3.7	<1	0.6	<0.05	0.23	<0.05	2.5	0.13	0.2	0.2	6.72	0.5
070505	6.2	0.25	5.4	<0.1	0.06	<0.01	<0.02	10.1	0.08	5.85	0.19	2.9	15.5	<0.05	2.9	<1	0.5	<0.05	0.21	<0.05	2.4	0.09	0.22	0.2	6.08	0.5
070506	7	0.4	5.9	<0.1	0.08	<0.01	0.03	16.2	0.11	8.92	0.26	2.6	23.6	<0.05	5.3	<1	0.7	<0.05	0.3	<0.05	3.8	0.15	0.32	0.2	8.24	0.7
070507	10.5	0.35	6.8	<0.1	0.06	<0.01	0.06	9.7	0.12	73.3	0.2	3.6	19.4	0.07	3.5	1	1.1	<0.05	0.28	0.08	2.3	0.13	0.29	0.1	8.81	0.7
070508	8	0.48	6.3	<0.1	0.06	<0.01	0.04	14.1	0.09	27.8	0.53	2.4	33.4	<0.05	4.6	<1	0.9	<0.05	0.3	<0.05	2.7	0.23	0.19	0.4	7.76	0.6
Enviro T1	7.6	0.55	8	0.1	0.06	0.01	0.08	13.3	0.09	5.95	0.44	2.6	30.5	0.14	4.5	<1	1.2	<0.05	0.29	0.11	3.9	0.26	0.3	<0.1	7.91	0.6
Duplicates																										
006398	5.4	0.26	5.6	<0.1	0.07	<0.01	0.02	10.6	0.08	4.28	0.26	3.2	17.4	<0.05	4.1	<1	0.5	<0.05	0.2	<0.05	2.3	0.11	0.22	0.3	5.57	0.5
006399	8.6	0.32	6.3	0.1	0.12	<0.01	0.03	15.1	0.12	10.3	0.32	3.6	19.7	<0.05	4.2	<1	0.7	<0.05	0.27	<0.05	5.1	0.12	0.54	0.3	7.82	0.7
QC																										
CH4	23.4	2.9	8.9	0.3	0.35	<0.01	0.11	15.3	0.07	3.61	0.29	8.2	64.9	0.29	8.4	2	0.7	<0.05	0.31	0.39	2.5	0.44	0.3	2.6	6.27	0.4
CH4	23.4	2.9	8.7	0.3	0.34	<0.01	0.11	15.4	0.07	2.44	0.23	8.5	65.5	0.32	8.3	2	0.7	<0.05	0.31	0.4	2.5	0.44	0.33	2	6.15	0.4
Certified Va	22.8	2.6	8.72	0.21	0.29	#N/A	0.1	14	#N/A	3.05	0.19	8.24	67	0.34	7.99	1.57	0.6	0.3	0.27	0.42	2.2	0.4	0.29	2.15	5.66	#N/A
Tolerance (	11.1	14.8	12.9	127.4	52.8	#N/A	62.1	11.8	#N/A	14.1	75	16.1	10.7	47.3	13.1	169.6	134.5	51.7	28.4	39.6	21.2	22.6	52.9	21.6	12.2	#N/A

CLIENT : **Minto Mines**
PROJECT : **Minto Project**
SGS PROJECT # : **0643**
Test : **Leachate Analysis by ICP-OES**
Date : **December 19, 2013**

Sample ID		006391	NP Contribution	006394	NP Contribution	070507	NP Contribution
Al	mg/L	36.3		36.3		18.4	
Sb	mg/L	< 0.01		0.02		< 0.01	
As	mg/L	0.028		0.025		0.016	
Ba	mg/L	0.0619		0.0632		0.0644	
Be	mg/L	0.0045		0.0054		0.0051	
Bi	mg/L	0.08		0.27		0.06	
B	mg/L	0.578		0.830		0.316	
Cd	mg/L	0.0072		0.0090		0.0046	
Ca	mg/L	614	15.3	641	16.0	579	14.4
Cr	mg/L	0.220		1.76		0.026	
Co	mg/L	0.028		0.035		0.017	
Cu	mg/L	19.4		0.862		3.74	
Fe	mg/L	59.0		125		42.9	
Pb	mg/L	0.018		0.017		0.018	
Li	mg/L	< 0.1		< 0.1		< 0.1	
Mg	mg/L	24.0	1.0	23.9	1.0	25.5	1.0
Mn	mg/L	7.04		8.53		6.71	
Mo	mg/L	< 0.01		< 0.01		< 0.01	
Ni	mg/L	0.040		0.132		0.029	
P	mg/L	0.112		0.207		0.059	
K	mg/L	30.9	0.8	46.4	1.2	27.9	0.7
Se	mg/L	< 0.01		< 0.01		< 0.01	
Si	mg/L	52.1		49.8		35.0	
Ag	mg/L	< 0.08		< 0.08		< 0.08	
Na	mg/L	13.1	0.6	18.7	0.8	15.4	0.7
Sr	mg/L	1.81		1.89		2.33	
S	mg/L	659		712		562	
Tl	mg/L	0.009		< 0.005		0.008	
Sn	mg/L	< 0.03		< 0.03		< 0.03	
Ti	mg/L	0.009		0.008		0.001	
U	mg/L	< 0.05		< 0.05		< 0.05	
V	mg/L	0.051		0.070		0.006	
Zn	mg/L	0.407		0.226		0.450	
Zr	mg/L	< 0.007		< 0.007		< 0.007	
NP from Ca, Mg, Na & K (kg CaCO3 Equiv./tonne)			**17.7**		**19.0**		**16.9**

CLIENT : **Minto Mines**
PROJECT : **Minto Mines**
SGS PROJECT # : **0643**
Test : **BC Research NP and Modified NP Procedures**
Date : **February 14, 2014**

Sample ID	**Sampling Date**	**Paste pH**	**TIC %**	**CaCO3 NP**	**C(T) %**	**S(T) %**	**S(SO4) %**	**S(S-2) %**	**AP**	**NP**	**NP H2SO4/tonne**	**NP CaCO3/tonne**	**Net NP**	**NP:AP Ratio (NP/AP)**	**Fizz Test**
Method Code		Sobek	CSB02V	Calc	CSA01V	CSA06V	CSA0'07V	Calc	Calc	Modified	BC Research	Calc	Calc	Calc	Sobek
LOD		0.2	0.01	#N/A	0.01	0.01	0.01	#N/A	#N/A	0.5	0.5	#N/A	#N/A	#N/A	#N/A
065001	27-Sep-13	8.83	0.2	16.7	0.21	0.01	<0.01	0.01	0.3	19.0	22.8	23.3	22.9	74.4	Slight
65002	30-Sep-13	8.45	0.43	35.8	0.52	<0.01	<0.01	<0.01	<0.3	39.3	40.9	41.8	41.8	139.2	Slight
65003	30-Sep-13	8.78	0.31	25.8	0.38	<0.01	<0.01	<0.01	<0.3	24.8	30.6	31.3	31.3	104.2	Slight
65004	30-Sep-13	8.76	0.3	25.0	0.38	0.03	<0.01	0.03	0.9	26.6	28.9	29.5	28.6	31.5	Slight
65005	27-Sep-13	8.73	0.12	10.0	0.17	0.13	<0.01	0.13	4.1	14.3	18.4	18.8	14.7	4.6	Slight
65006	27-Sep-13	8.69	0.14	11.7	0.19	0.04	<0.01	0.04	1.3	15.9	29.2	29.8	28.5	23.8	Slight
65007	27-Sep-13	8.59	0.27	22.5	0.34	0.01	<0.01	0.01	0.3	25.5	28.2	28.8	28.4	92.0	Slight
65010	27-Sep-13	8.60	0.26	21.7	0.3	0.15	<0.01	0.15	4.7	23.7	30.4	31.0	26.3	6.6	Slight
65011	27-Sep-13	8.22	0.31	25.8	0.34	0.14	<0.01	0.14	4.4	28.2	31.1	31.8	27.4	7.3	Slight
65012	30-Sep-13	8.82	0.14	11.7	0.19	0.04	<0.01	0.04	1.3	16.0	16.9	17.3	16.0	13.8	Slight
65013	30-Sep-13	8.90	0.13	10.8	0.17	0.04	<0.01	0.04	1.3	15.5	15.9	16.3	15.0	13.0	Slight
65014	27-Sep-13	8.63	0.38	31.7	0.49	0.25	<0.01	0.25	7.8	22.8	24.7	25.3	17.4	3.2	Slight
65015	30-Sep-13	8.51	0.32	26.7	0.36	0.34	<0.01	0.34	10.6	29.8	32.6	33.3	22.6	3.1	Slight
65016	30-Sep-13	8.60	0.13	10.8	0.18	0.25	<0.01	0.25	7.8	14.9	16.9	17.3	9.4	2.2	Slight
65017	30-Sep-13	8.50	0.28	23.3	0.32	0.08	<0.01	0.08	2.5	27.0	27.0	27.5	25.0	11.0	Slight
65018	1-Oct-13	8.09	0.3	25.0	0.41	0.48	<0.01	0.48	15.0	34.4	37.0	37.8	22.8	2.5	Slight
65019	1-Oct-13	8.01	0.21	17.5	0.28	0.81	<0.01	0.81	25.3	23.3	24.5	25.0	-0.3	1.0	Slight
65021	1-Oct-13	8.56	0.18	15.0	0.23	0.24	<0.01	0.24	7.5	18.1	24.0	24.5	17.0	3.3	Slight
65024	1-Oct-13	8.66	0.27	22.5	0.35	0.01	<0.01	0.01	0.3	24.6	27.0	27.5	27.2	88.0	Slight
65025	1-Oct-13	8.50	0.31	25.8	0.35	0.05	<0.01	0.05	1.6	31.6	35.3	36.0	34.4	23.0	Slight
65152	1-Oct-13	8.59	0.21	17.5	0.25	0.02	<0.01	0.02	0.6	19.7	25.0	25.5	24.9	40.8	Slight
65153	1-Oct-13	8.74	0.23	19.2	0.27	0.04	<0.01	0.04	1.3	21.8	26.7	27.3	26.0	21.8	Slight
65156	1-Oct-13	8.86	0.12	10.0	0.15	0.02	<0.01	0.02	0.6	13.6	16.7	17.0	16.4	27.2	Slight
65157	1-Oct-13	8.60	0.21	17.5	0.26	0.13	<0.01	0.13	4.1	21.2	22.3	22.8	18.7	5.6	Slight
065160	9-Oct-13	8.49	0.33	27.5	0.35	0.07	<0.01	0.07	2.2	29.6	36.3	37.0	34.8	16.9	Slight
065161	9-Oct-13	8.84	0.18	15.0	0.2	<0.01	<0.01	<0.01	<0.3	17.6	20.8	21.3	21.3	70.8	Slight
065162	9-Oct-13	8.62	0.19	15.8	0.21	0.12	<0.01	0.12	3.8	19.7	23.5	24.0	20.3	6.4	Slight
065163	9-Oct-13	8.75	0.17	14.2	0.19	0.04	<0.01	0.04	1.3	18.7	20.6	21.0	19.8	16.8	Slight
065164	9-Oct-13	8.44	0.4	33.3	0.46	0.13	<0.01	0.13	4.1	36.1	40.7	41.5	37.4	10.2	Slight
065165	9-Oct-13	8.26	0.77	64.2	0.82	0.51	<0.01	0.51	15.9	65.3	67.9	69.3	53.3	4.3	Moderate
065166	9-Oct-13	8.57	0.2	16.7	0.25	0.3	<0.01	0.30	9.4	19.5	21.6	22.0	12.6	2.3	Slight
065168	9-Oct-13	8.28	0.48	40.0	0.52	0.39	<0.01	0.39	12.2	41.7	42.4	43.3	31.1	3.5	Slight
065169	9-Oct-13	8.38	0.79	65.8	0.79	0.04	<0.01	0.04	1.3	54.2	58.3	59.5	58.3	47.6	Slight
065170	9-Oct-13	8.53	0.22	18.3	0.28	0.06	<0.01	0.06	1.9	20.3	23.0	23.5	21.6	12.5	Slight
070509	27-Sep-13	8.11	0.14	11.7	0.21	0.86	<0.01	0.86	26.9	21.3	20.6	21.0	-5.9	0.8	Slight
70510	27-Sep-13	9.02	0.15	12.5	0.21	0.01	<0.01	0.01	0.3	17.0	18.6	19.0	18.7	60.8	Slight
070511	27-Sep-13	9.07	0.09	7.5	0.24	0.02	<0.01	0.02	0.6	12.2	14.9	15.3	14.6	24.4	Slight
070512	27-Sep-13	8.85	0.14	11.7	0.18	0.2	<0.01	0.20	6.3	14.6	19.8	20.3	14.0	3.2	Slight
70513	27-Sep-13	8.79	0.18	15.0	0.23	0.07	<0.01	0.07	2.2	17.0	21.6	22.0	19.8	10.1	Slight
70514	27-Sep-13	8.70	0.45	37.5	0.47	0.03	<0.01	0.03	0.9	38.3	40.7	41.5	40.6	44.3	Slight
70515	27-Sep-13	7.93	0.37	30.8	0.39	1.3	<0.01	1.30	40.6	34.4	34.5	35.3	-5.4	0.9	Slight
70516	27-Sep-13	8.80	0.18	15.0	0.26	0.01	<0.01	0.01	0.3	18.7	20.3	20.8	20.4	66.4	Slight

Sample ID	Sampling Date	Paste pH	TIC %	CaCO3 NP	C(T) %	S(T) %	S(SO4) %	S(S-2) %	AP	NP	NP H2SO4/tonne	NP CaCO3/tonne	Net NP	NP:AP Ratio (NP/AP)	Fizz Test
Method Code		Sobek	CSB02V	Calc	CSA01V	CSA06V	CSA0'07V	Calc	Calc	Modified	BC Research	Calc	Calc	Calc	Sobek
LOD		0.2	0.01	#N/A	0.01	0.01	0.01	#N/A	#N/A	0.5	0.5	#N/A	#N/A	#N/A	#N/A
070517	27-Sep-13	9.03	0.19	15.8	0.24	0.03	<0.01	0.03	0.9	19.6	22.5	23.0	22.1	24.5	Slight
070518	27-Sep-13	8.89	0.25	20.8	0.35	<0.01	<0.01	<0.01	<0.3	23.8	26.0	26.5	26.5	88.3	Slight
70519	27-Sep-13	8.97	0.33	27.5	0.43	<0.01	<0.01	<0.01	<0.3	29.2	33.3	34.0	34.0	113.3	Slight
70520	27-Sep-13	8.84	0.36	30.0	0.43	0.06	<0.01	0.06	1.9	33.8	33.6	34.3	32.4	18.3	Slight
070522	27-Sep-13	8.84	0.31	25.8	0.35	0.13	<0.01	0.13	4.1	29.5	30.6	31.3	27.2	7.7	Slight
070523	27-Sep-13	8.39	0.78	65.0	0.78	0.01	<0.01	0.01	0.3	67.5	69.1	70.5	70.2	225.6	Moderate
070524	27-Sep-13	9.11	0.1	8.3	0.12	<0.01	<0.01	<0.01	<0.3	12.5	15.2	15.5	15.5	51.7	Slight
070525	27-Sep-13	8.92	0.18	15.0	0.2	<0.01	<0.01	<0.01	<0.3	16.8	21.8	22.3	22.3	74.2	Slight
Tailings Comp Sept	9-Oct-13	8.11	0.33	27.5	0.35	0.05	<0.01	0.05	1.6	27.6	32.3	33.0	31.4	21.1	Slight
Duplicates															
65001		8.74								19.1					Slight
65003							<0.01								
65012			0.14												
65016					0.18	0.26									
65025		8.47								31.2					Slight
65152		8.67								19.4					Slight
65157			0.21												
65161							<0.01								
70511			0.1												
70514		8.69								38.2					Slight
70515		7.98	0.37							34.7					Slight
70518							<0.01								
70520					0.43	0.06									
QC															
GTS-2A					1.99	0.33									
GTS-2A					2.01	0.34									
PD-1							4.34								
SY4			0.91												
SY4			0.91												
NBM-1															Slight
Expected Values			0.95		2.01	0.35	4.27			42.0					Slight
Tolerance +/-			0.06		0.15	0.03	0.3			3.0					

Note:

AP = Acid potential in tonnes CaCO3 equivalent per 1000 tonnes of material. AP is determined from calculated sulphide sulphur content: S(T) - S(SO4).

NP = Neutralization potential in tonnes CaCO3 equivalent per 1000 tonnes of material.

NET NP = NP - AP

Carbonate NP is calculated from TIC originating from carbonate minerals and is expressed in kg CaCO3/tonne.

CLIENT : **Minto Mines**
PROJECT : **Minto Project**
SGS Project # : **0643**
Test : **Metals by Aqua Regia Digestion with ICP-MS Finish**
Date : **February 14, 2014**

Sample ID	Ag	Al	B	Ba	Ca	Cr	Cu	Fe	K	Li	Mg	Mn	Na	Ni	P	S	Sr	Ti	V	Zn	Zr	As	Be	Bi	Cd	Ce
	ppm	%	ppm	ppm	%	ppm	ppm	%	%	ppm	%	ppm	%	ppm	ppm	%	ppm	%	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Method Code	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B
LOD	0.01	0.01	10	5	0.01	1	0.5	0.01	0.01	1	0.01	2	0.01	0.5	50	0.01	0.5	0.01	1	1	0.5	1	0.1	0.02	0.01	0.05
65001	0.05	1.1	60	263	0.86	74	73.3	2.2	0.5	7	0.63	481	0.05	1.8	600	<0.01	87.4	0.08	46	66	0.5	1	0.2	0.05	0.05	17.1
65002	0.02	0.97	40	83	1.71	115	34.6	2.21	0.19	6	0.56	556	0.05	2.5	630	<0.01	84.1	0.03	50	54	1.1	1	0.4	0.02	0.07	18.8
65003	0.02	0.98	60	279	1.04	132	35	2.31	0.57	6	0.64	575	0.06	2.6	630	<0.01	94.1	0.1	55	61	0.9	<1	0.3	<0.02	0.05	22.6
65004	0.04	1.13	60	183	1.25	130	255	2.34	0.48	7	0.68	558	0.08	2.6	670	0.01	91.6	0.1	53	64	1.2	1	0.3	0.02	0.11	25.4
65005	0.03	1.39	80	323	0.74	79	149	2.79	0.67	8	0.8	563	0.07	1.5	720	0.12	49	0.15	63	85	0.7	<1	0.2	<0.02	0.05	22.7
65006	0.13	1.07	60	197	0.89	79	340	2.12	0.42	7	0.64	480	0.08	3.5	670	0.02	56	0.1	50	56	1.2	<1	0.3	0.04	0.04	21.9
65007	0.02	0.99	70	286	1.22	84	50.4	2.05	0.45	6	0.57	531	0.07	2	620	<0.01	71.3	0.08	46	57	0.9	1	0.2	<0.02	0.05	21
65010	0.52	1.12	70	171	1.09	78	1700	2.5	0.5	6	0.66	514	0.06	1.3	630	0.15	77.4	0.09	53	70	0.9	<1	0.3	0.36	0.27	19.3
65011	0.32	1.14	70	305	1.28	79	1130	2.34	0.52	6	0.64	629	0.05	4.2	670	0.13	81.5	0.09	53	67	0.9	<1	0.3	0.08	0.15	19.8
65012	0.11	1.19	60	194	0.97	124	339	2.18	0.47	7	0.69	508	0.09	2.7	650	0.02	67.5	0.11	51	58	0.9	<1	0.3	0.04	0.06	17
65013	0.14	1.23	60	250	0.89	118	481	2.49	0.66	8	0.77	572	0.08	2.9	690	0.03	57.3	0.14	57	66	1.1	<1	0.3	0.13	0.04	21.9
65014	1.09	0.79	70	174	0.86	89	3820	2.64	0.51	5	0.54	464	0.06	1.3	620	0.27	82.5	0.08	43	69	0.9	<1	0.2	0.61	0.26	12.8
65015	1.38	1.31	60	363	1.4	117	4240	3.01	0.77	8	0.81	534	0.06	2.4	840	0.35	114	0.14	66	85	0.8	<1	0.2	0.39	0.27	19.2
65016	1.23	1.23	80	222	0.78	121	4960	3.74	0.85	7	0.76	623	0.07	2	780	0.28	54.7	0.15	70	75	1.3	2	0.2	1.18	0.16	20.2
65017	0.29	1.21	60	274	1.38	117	1010	2.4	0.4	9	0.72	537	0.06	2.5	680	0.08	97.4	0.08	50	64	0.9	1	0.3	0.13	0.13	20.4
65018	0.51	1.48	70	137	1.58	70	2740	2.84	0.35	12	0.88	493	0.05	1.7	800	0.51	107	0.05	64	79	1.6	2	0.4	0.1	0.13	23.6
65019	0.62	1.57	60	118	1.29	68	4500	2.53	0.24	13	0.83	298	0.05	2.2	990	0.82	70.5	0.03	47	61	2.9	2	0.3	0.12	0.19	28.9
65021	1	1.18	70	221	0.94	76	3340	2.73	0.57	8	0.77	625	0.06	1.7	750	0.25	52.6	0.11	54	80	0.8	1	0.2	0.55	0.15	23.4
65024	0.01	1.04	70	263	1.22	67	49.5	2.14	0.59	6	0.6	500	0.06	2.2	910	<0.01	103	0.1	50	55	0.9	<1	0.3	<0.02	0.03	17.1
65025	0.04	1.34	60	455	1.44	74	237	2.55	0.71	9	0.73	641	0.05	1.7	810	0.03	84.6	0.1	61	104	0.9	2	0.3	0.03	0.05	25.6
65152	0.08	1.16	60	175	1.15	82	171	2.28	0.34	8	0.71	553	0.07	1.8	640	<0.01	81.1	0.09	50	62	1	<1	0.3	0.03	0.04	18.8
65153	0.15	1.12	70	257	1.08	86	407	2.24	0.44	9	0.65	480	0.06	1.8	560	0.03	91.5	0.09	48	62	0.7	<1	0.2	0.06	0.07	15.6
65156	0.04	0.99	70	200	0.86	74	249	2.06	0.53	7	0.63	499	0.08	1.8	710	0.02	58.3	0.11	49	59	1.1	<1	0.2	0.04	0.03	17
65157	0.25	1.18	60	175	1.25	83	1320	2.29	0.41	8	0.7	551	0.08	1.8	760	0.13	68.1	0.1	54	71	1	1	0.4	0.16	0.09	20.8
65160	0.16	1.22	60	247	1.42	77	325	2.52	0.57	7	0.75	647	0.06	1.9	850	0.07	99.6	0.1	59	82	1.1	1	0.3	0.07	0.21	25.2
65161	<0.01	1.12	60	296	0.9	77	38.5	2.29	0.7	7	0.71	609	0.08	2.1	690	<0.01	77.5	0.12	54	66	0.9	<1	0.2	<0.02	0.03	20.7
65162	0.37	1.31	70	235	1.08	76	1540	2.88	0.66	8	0.81	600	0.08	1.8	830	0.12	67.1	0.13	61	76	1	<1	0.3	0.29	0.15	26.2
65163	0.19	1.33	70	174	0.96	107	505	2.75	0.49	9	0.89	652	0.07	2.4	760	0.02	65.6	0.09	55	77	0.9	<1	0.3	0.17	0.1	15.1
65164	0.11	1.25	70	287	1.69	72	689	2.4	0.56	9	0.73	551	0.06	2	780	0.12	110	0.09	58	71	1	<1	0.3	0.03	0.1	26.6
65165	0.58	1.39	70	359	2.87	73	3670	3.04	0.76	10	0.82	570	0.05	1.9	830	0.53	111	0.13	76	82	1.9	<1	0.3	0.1	0.51	27.6
65166	0.82	1.25	70	250	0.97	126	3680	2.98	0.91	7	0.76	630	0.07	2.3	760	0.33	72.1	0.15	64	99	1.1	<1	0.2	0.56	0.26	21.4
65168	0.48	1.43	70	563	1.83	74	2760	2.74	0.93	8	0.84	470	0.06	1.8	1000	0.4	158	0.15	81	67	1.3	<1	0.3	0.24	0.17	30.3
65169	0.04	0.9	50	206	2.24	110	314	1.92	0.24	7	0.45	396	0.05	2.6	790	0.04	249	0.02	33	47	<0.5	<1	0.4	<0.02	0.05	8.92
65170	0.04	1.34	80	350	0.91	81	360	2.39	0.78	7	0.67	441	0.06	1.8	680	0.05	149	0.12	59	60	0.7	<1	0.3	<0.02	0.05	24
70509	0.83	1.46	40	156	1.21	64	4040	2.66	0.34	10	0.81	434	0.04	2.4	1110	0.99	63.4	0.04	42	83	1.8	3	0.3	0.16	0.51	25.7
70510	0.05	0.96	60	182	0.89	64	69.9	1.96	0.45	6	0.63	519	0.08	2.1	670	<0.01	65.8	0.09	44	63	1	2	0.2	0.02	0.06	18.6
70511	0.07	0.96	50	275	0.73	82	142	1.99	0.54	5	0.61	479	0.08	6.8	660	<0.01	56.9	0.11	46	58	1.1	<1	0.2	0.03	0.06	17.3
70512	0.76	1.32	60	339	0.69	68	3150	3.19	1	6	0.78	512	0.07	1.5	900	0.23	58.4	0.16	67	84	0.7	<1	0.2	0.62	0.11	24.9
70513	0.24	1.2	50	374	0.73	110	749	3.01	0.83	6	0.8	538	0.07	2.7	800	0.06	85.9	0.14	70	74	0.6	<1	0.2	0.06	0.09	25.5
70514	0.05	1.16	50	381	1.63	62	68.7	2.39	0.72	6	0.7	679	0.05	1.6	750	0.03	67	0.1	55	74	0.9	<1	0.3	<0.02	0.05	21.9

Sample ID	Ag ppm	Al %	B ppm	Ba ppm	Ca %	Cr ppm	Cu ppm	Fe %	K %	Li ppm	Mg %	Mn ppm	Na %	Ni ppm	P ppm	S %	Sr ppm	Ti %	V ppm	Zn ppm	Zr ppm	As ppm	Be ppm	Bi ppm	Cd ppm	Ce ppm
Method Code	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B
LOD	0.01	0.01	10	5	0.01	1	0.5	0.01	0.01	1	0.01	2	0.01	0.5	50	0.01	0.5	0.01	1	1	0.5	1	0.1	0.02	0.01	0.05
70515	1.26	1.81	50	147	1.67	83	9280	3.81	0.3	17	1.58	516	0.03	2.7	1460	1.39	76	0.04	104	109	1.6	<1	0.4	0.14	0.26	63.8
70516	0.02	1.43	50	427	0.89	116	48	2.36	1.03	6	0.84	458	0.06	2.9	900	<0.01	80.5	0.15	70	57	0.5	<1	0.2	<0.02	0.03	27.6
70517	0.11	1.13	50	275	0.98	68	266	2.24	0.5	6	0.73	509	0.06	1.9	680	0.02	94.4	0.09	49	69	0.8	<1	0.3	0.03	0.07	18
70518	<0.01	1.01	50	89	1.29	121	19.9	2.04	0.17	5	0.65	496	0.06	3	700	<0.01	71.7	0.06	40	55	0.9	<1	0.3	<0.02	0.04	17.5
70519	<0.01	1.2	70	329	1.25	72	12.6	2.47	0.69	6	0.65	634	0.06	2	690	<0.01	132	0.1	56	74	0.8	1	0.3	<0.02	0.04	19.9
70520	0.08	1.19	60	189	1.45	66	200	2.43	0.42	7	0.7	596	0.05	1.8	760	0.05	125	0.06	49	70	1	<1	0.3	0.03	0.08	28.1
70522	0.54	1.48	70	269	1.41	55	1600	3.02	0.61	9	0.94	671	0.06	1.4	860	0.12	65.3	0.15	66	87	0.8	<1	0.3	0.35	0.09	17.4
70523	0.05	0.95	60	69	2.92	73	93.6	2.44	0.21	6	0.53	602	0.04	3.2	860	<0.01	96.3	0.02	53	52	1.6	1	0.6	0.02	0.06	33.8
70524	<0.01	1.01	70	252	0.65	77	28.5	2.14	0.58	7	0.64	507	0.07	2.2	680	<0.01	48.9	0.11	50	56	1.1	<1	0.2	<0.02	0.03	17.1
70525	0.03	1	60	147	0.96	64	40.2	1.97	0.31	6	0.64	492	0.06	1.6	550	<0.01	72.6	0.09	43	55	0.9	1	0.3	<0.02	0.03	12.7
Tailings Comp Sept	0.37	1.27	70	310	1.24	38	705	3.27	0.62	8	0.79	614	0.05	1.7	920	0.05	78.3	0.1	73	107	1.2	<1	0.3	0.13	0.23	24.1
Duplicates																										
65007	0.05	0.96	60	267	1.15	76	46.4	1.98	0.45	6	0.55	509	0.07	2	560	<0.01	68.2	0.08	43	53	0.8	<1	0.3	<0.02	0.07	20.2
65161	<0.01	1.14	70	293	0.91	75	38.8	2.24	0.7	7	0.71	615	0.09	2	690	<0.01	77.6	0.12	53	64	0.9	<1	0.3	<0.02	0.04	21.1
70515	1.23	1.87	40	136	1.74	83	9500	3.93	0.31	18	1.62	533	0.03	2.7	1470	1.43	78.8	0.04	104	111	1.5	3	0.4	0.16	0.26	69.3
QC																										
CH4	2.43	1.95	80	296	0.62	106	1940	4.64	1.47	12	1.2	309	0.06	45.9	680	0.65	10.1	0.22	88	189	15	8	0.1	0.66	1.18	27.5
CH4	2.14	1.94	70	303	0.65	101	2070	4.49	1.54	13	1.24	317	0.06	46.3	710	0.68	10.1	0.23	85	197	15.3	7	0.1	0.46	1.19	28.7
Certified Values	2.13	1.85	#N/A	293	0.61	103.8	2000	4.79	1.43	12.6	1.18	324	0.06	49.57	719	0.73	9.38	0.21	79.27	189.4	9	8.14	0.11	0.51	1.17	28.18
Tolerance (%)	10.9	11.35	#N/A	14.3	14.1	12.4	10.1	10.52	11.74	29.84	12.3	11.5	50.3	12.52	27.4	13.4	23.3	23.3	13.2	11.3	17.7	13.1	241.3	19.7	12.1	10.4

Sample ID	Co	Cs	Ga	Ge	Hf	Hg	In	La	Lu	Mo	Nb	Pb	Rb	Sb	Sc	Se	Sn	Ta	Tb	Te	Th	Tl	U	W	Y	Yb
	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Method Co	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B
LOD	0.1	0.05	0.1	0.1	0.05	0.01	0.02	0.1	0.01	0.05	0.05	0.2	0.2	0.05	0.1	1	0.3	0.05	0.02	0.05	0.1	0.02	0.05	0.1	0.05	0.1
65001	5.2	0.4	5.5	0.2	0.17	0.05	<0.02	9.2	0.09	1.49	1.35	2.6	23.3	0.07	2.9	<1	0.5	1	0.19	<0.05	1.7	0.15	0.18	0.4	4.67	0.4
65002	5.6	0.29	5.5	0.2	0.09	0.03	0.02	9.4	0.14	3.55	0.4	3.2	8.7	<0.05	4.6	<1	0.6	0.2	0.32	<0.05	1.7	0.05	0.32	0.2	10	1
65003	5.6	0.36	4.8	0.2	0.05	0.02	0.02	11.7	0.09	4.19	0.28	2.2	25.4	<0.05	4.6	<1	0.6	<0.05	0.26	<0.05	2.5	0.15	0.23	0.2	7.86	0.7
65004	5.6	0.31	5.5	0.2	<0.05	<0.01	0.02	13.5	0.09	5.17	0.32	2.8	21.2	<0.05	4.5	<1	0.6	<0.05	0.21	<0.05	3.1	0.13	0.26	0.2	6.5	0.6
65005	7	0.34	6.6	0.2	<0.05	<0.01	<0.02	12.4	0.04	11.5	0.39	2.3	31	<0.05	2.8	<1	0.6	<0.05	0.13	<0.05	2.5	0.17	0.26	0.2	3.65	0.3
65006	5.7	0.24	5.3	0.2	<0.05	<0.01	<0.02	12.1	0.07	4.95	0.27	2.3	18.7	<0.05	3.6	<1	0.5	<0.05	0.18	<0.05	2.7	0.1	0.24	0.3	5.78	0.5
65007	5.2	0.26	4.8	0.2	<0.05	<0.01	<0.02	11.2	0.07	2.16	0.2	2.4	19.8	<0.05	3.8	<1	0.5	<0.05	0.19	<0.05	2.1	0.12	0.19	0.2	6.16	0.5
65010	6	0.37	5.9	0.2	<0.05	<0.01	0.04	10.3	0.07	3.76	0.24	2.6	23	<0.05	4.1	1	0.6	<0.05	0.19	0.1	2.6	0.14	0.25	0.2	5.89	0.5
65011	6.3	0.33	5.4	0.2	<0.05	<0.01	0.04	10.5	0.08	7.21	0.14	2.3	23.4	<0.05	3.9	<1	0.6	<0.05	0.21	<0.05	2.4	0.14	0.23	<0.1	6.89	0.6
65012	5.7	0.28	5.6	0.2	<0.05	<0.01	<0.02	9.3	0.06	5.59	0.18	4	19.9	0.18	3.9	<1	0.5	<0.05	0.16	<0.05	2.1	0.12	0.2	0.2	5.03	0.5
65013	6.2	0.39	6.1	0.2	<0.05	<0.01	0.02	11.8	0.07	6.25	0.22	2.5	28	<0.05	4.5	<1	0.6	<0.05	0.2	<0.05	3	0.17	0.19	0.2	6.06	0.5
65014	4.5	0.36	4.7	0.2	<0.05	<0.01	0.05	6.7	0.05	1.73	0.33	3.4	22.9	<0.05	3.5	3	0.5	<0.05	0.14	0.2	2.9	0.15	0.14	0.6	4.49	0.4
65015	7.5	0.36	6.6	0.2	<0.05	<0.01	0.07	10	0.05	6.35	0.27	2.4	33.1	<0.05	3.8	4	0.6	<0.05	0.16	0.23	2.4	0.2	0.87	0.3	5.05	0.4
65016	7.8	0.53	7.4	0.2	<0.05	<0.01	0.06	10.9	0.07	4.72	0.48	4	39	<0.05	4.8	3	0.6	<0.05	0.17	0.23	4.5	0.28	0.31	1.2	5.35	0.5
65017	5.9	0.27	6.3	0.2	<0.05	<0.01	0.03	10.8	0.06	4.21	0.2	3.5	17.6	<0.05	3.9	<1	0.5	<0.05	0.18	0.06	2.7	0.11	0.27	0.2	5.28	0.5
65018	8.6	0.37	7.2	0.1	<0.05	<0.01	0.09	12.5	0.08	66.2	0.13	4.1	16.8	<0.05	4	2	1.1	<0.05	0.26	0.06	1.7	0.1	0.29	0.2	8.63	0.6
65019	11.4	0.31	5.6	0.1	0.08	<0.01	0.14	16.1	0.13	102	<0.05	8.2	10.5	<0.05	2.5	3	1.3	<0.05	0.31	0.08	3.8	0.07	0.71	0.4	10.8	1
65021	6.1	0.33	6.4	0.2	<0.05	<0.01	0.05	12.5	0.05	1.73	0.21	2.7	25.9	<0.05	3.9	2	0.5	<0.05	0.16	0.17	3.1	0.17	0.19	0.4	4.59	0.4
65024	5.7	0.4	4.8	0.2	<0.05	<0.01	0.02	8.3	0.11	1.75	0.29	1.6	23.3	<0.05	5.2	<1	0.6	<0.05	0.28	<0.05	1.7	0.14	0.22	0.6	9.43	0.8
65025	7.7	0.46	6.6	0.2	<0.05	<0.01	0.04	13.5	0.11	3.79	0.23	4.7	29	<0.05	6	<1	0.8	<0.05	0.28	<0.05	2.4	0.18	0.27	<0.1	9.06	0.8
65152	5.9	0.23	5.8	0.2	<0.05	<0.01	<0.02	10.1	0.08	1.43	0.22	3	15.1	0.18	3.6	<1	0.5	<0.05	0.19	<0.05	1.9	0.09	0.2	0.1	6.19	0.6
65153	5.5	0.25	5.8	0.1	<0.05	<0.01	<0.02	8.1	0.05	2.21	0.31	3.3	20.5	<0.05	3.1	<1	0.6	<0.05	0.15	<0.05	1.6	0.12	0.18	0.3	4.54	0.4
65156	5.4	0.28	5	0.2	0.06	<0.01	<0.02	8.9	0.09	1.93	0.3	2.1	22.6	<0.05	3.5	<1	0.5	<0.05	0.2	<0.05	1.6	0.13	0.26	0.3	6.76	0.6
65157	6	0.25	6	0.2	<0.05	<0.01	0.04	11.3	0.07	4.48	0.24	3.5	17.4	<0.05	3.8	<1	0.5	<0.05	0.17	<0.05	2.6	0.1	0.23	0.1	5.49	0.5
65160	6.5	0.37	6.3	0.2	<0.05	<0.01	0.03	13.5	0.1	310	0.3	2.9	26.3	<0.05	4.9	<1	0.7	<0.05	0.25	<0.05	3.2	0.16	0.27	0.3	8.03	0.7
65161	5.8	0.34	5.4	0.2	<0.05	<0.01	0.02	10.9	0.09	3.13	0.21	1.9	29.3	<0.05	4.9	<1	0.6	<0.05	0.22	<0.05	2.3	0.17	0.22	0.5	7.27	0.7
65162	6.2	0.41	6.9	0.2	<0.05	<0.01	0.03	13.9	0.07	2.26	0.31	3.3	29.3	<0.05	4.6	2	0.7	<0.05	0.21	0.09	3.9	0.19	0.23	0.5	6.11	0.5
65163	7.1	0.29	7.1	0.2	<0.05	<0.01	<0.02	8.1	0.05	3.26	0.13	2.8	21.3	<0.05	2.7	<1	0.5	<0.05	0.14	<0.05	2.4	0.14	0.19	0.3	4.15	0.4
65164	6.5	0.35	6	0.2	<0.05	<0.01	0.04	14	0.07	10.1	0.29	3.3	26.7	<0.05	3.3	<1	0.8	<0.05	0.22	<0.05	2.9	0.16	0.23	0.2	6.78	0.5
65165	9.8	0.47	6.8	0.2	<0.05	<0.01	0.13	14.4	0.09	101	0.57	3	36.2	<0.05	3.2	2	1.1	<0.05	0.31	0.09	1.2	0.23	1.14	0.6	9.51	0.6
65166	5.9	0.77	6.7	0.2	<0.05	<0.01	0.06	11	0.09	4.36	0.44	3.6	43.1	<0.05	5.4	3	0.7	<0.05	0.24	0.2	4.8	0.34	0.22	0.6	7.49	0.7
65168	7.4	0.51	6.8	0.2	<0.05	<0.01	0.12	16.1	0.1	29	0.51	3.5	41.6	<0.05	5.1	2	1.7	<0.05	0.32	0.07	1.9	0.3	1.46	0.4	9.45	0.7
65169	5.3	0.23	4.7	<0.1	<0.05	<0.01	0.03	4.4	0.05	25	<0.05	4.5	12.8	<0.05	2.1	<1	0.6	<0.05	0.14	<0.05	0.4	0.08	0.48	0.2	4.51	0.4
65170	6.2	0.46	6.7	0.2	<0.05	<0.01	0.05	12.1	0.08	19.8	0.58	3	36.3	<0.05	7.2	<1	1.3	<0.05	0.26	<0.05	2.4	0.25	0.25	0.4	7.28	0.6
70509	11	0.42	5.5	0.2	0.21	0.08	0.11	14.3	0.15	103	1.7	10.6	14	0.09	2.6	3	1.1	1.29	0.34	0.21	3	0.13	0.71	0.7	10.8	0.9
70510	5.1	0.29	4.7	0.2	0.1	0.04	<0.02	9.9	0.07	1.82	0.65	2.4	18.7	0.05	3.1	<1	0.4	0.35	0.17	<0.05	2.5	0.12	0.26	0.6	4.92	0.4
70511	5.3	0.3	4.6	0.2	0.07	0.02	<0.02	9.4	0.07	2.75	0.34	2.4	23	0.06	3.8	<1	0.6	0.05	0.18	<0.05	1.9	0.14	0.21	0.6	5.67	0.5
70512	6.2	0.6	7	0.2	<0.05	0.02	0.05	12.9	0.06	1.59	0.44	2.2	44.9	<0.05	4.2	2	0.7	<0.05	0.18	0.15	4.9	0.3	0.15	1	5.31	0.4
70513	6.5	0.4	6.3	0.2	<0.05	0.02	0.03	13.6	0.05	3.83	0.27	2	36.5	<0.05	3.1	<1	0.6	<0.05	0.17	<0.05	2.9	0.22	0.16	0.5	4.69	0.4
70514	6.1	0.56	5.4	0.2	<0.05	<0.01	0.03	11.2	0.11	2.55	0.34	4	31.1	<0.05	5.4	<1	0.8	<0.05	0.3	<0.05	2.5	0.22	0.26	0.3	9.51	0.8

Sample ID	Co ppm	Cs ppm	Ga ppm	Ge ppm	Hf ppm	Hg ppm	In ppm	La ppm	Lu ppm	Mo ppm	Nb ppm	Pb ppm	Rb ppm	Sb ppm	Sc ppm	Se ppm	Sn ppm	Ta ppm	Tb ppm	Te ppm	Th ppm	Tl ppm	U ppm	W ppm	Y ppm	Yb ppm
Method Co	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B
LOD	0.1	0.05	0.1	0.1	0.05	0.01	0.02	0.1	0.01	0.05	0.05	0.2	0.2	0.05	0.1	1	0.3	0.05	0.02	0.05	0.1	0.02	0.05	0.1	0.05	0.1
70515	11	0.33	8.9	0.2	0.05	<0.01	0.29	33.9	0.2	234	<0.05	5.6	14.4	<0.05	5.4	6	2.7	<0.05	0.74	0.17	2.3	0.1	0.26	0.2	21.7	1.5
70516	6.4	0.52	6.6	0.2	<0.05	<0.01	0.02	14.8	0.07	5.32	0.62	3.2	46.7	<0.05	5.1	<1	1.1	<0.05	0.21	<0.05	3.1	0.29	0.15	0.5	6.37	0.5
70517	6.3	0.27	5.6	0.2	<0.05	<0.01	<0.02	9.6	0.05	1.79	0.19	2.6	22	<0.05	3.7	<1	0.5	<0.05	0.15	<0.05	2.1	0.13	0.21	0.2	4.68	0.4
70518	5.6	0.19	5.3	0.2	<0.05	<0.01	<0.02	9.5	0.07	3.93	0.17	3.4	8.1	<0.05	3.7	<1	0.4	<0.05	0.17	<0.05	1.9	0.05	0.23	0.2	5.59	0.5
70519	6.7	0.36	5.5	0.2	0.05	<0.01	0.04	10.2	0.14	1.53	0.22	1.5	29.7	<0.05	6	<1	0.8	<0.05	0.33	<0.05	2	0.18	0.21	0.4	10.9	1.1
70520	6.3	0.3	5.9	0.2	<0.05	<0.01	0.03	15.4	0.09	3.56	0.2	3.7	19.6	<0.05	4.8	<1	0.6	<0.05	0.24	<0.05	4.8	0.12	1.19	0.4	7.31	0.7
70522	7.6	0.34	7.7	0.2	<0.05	<0.01	0.03	9.2	0.05	1.74	0.25	5	29	<0.05	2.7	1	0.5	<0.05	0.15	0.11	2.6	0.18	0.2	0.4	4.47	0.3
70523	6.9	0.23	5.3	0.1	0.08	<0.01	0.03	18.3	0.16	2.22	<0.05	2.3	10.1	<0.05	5.3	<1	0.8	<0.05	0.34	<0.05	5	0.05	0.84	0.1	11.9	1.2
70524	5.7	0.3	4.8	0.2	0.05	<0.01	<0.02	9	0.07	2.11	0.18	1.8	25.1	<0.05	3.1	<1	0.5	<0.05	0.17	<0.05	2.1	0.15	0.2	0.8	5.58	0.5
70525	4.9	0.21	4.8	0.2	<0.05	<0.01	<0.02	7	0.05	1.11	0.15	2.7	13.8	<0.05	3.8	<1	0.4	<0.05	0.13	<0.05	1.3	0.08	0.17	0.2	4.38	0.4
Tailings Co	7.1	0.47	7.4	0.2	<0.05	<0.01	0.07	12.8	0.08	3.54	0.27	2.8	30.5	<0.05	4.4	<1	1.1	<0.05	0.24	0.1	3.4	0.21	0.36	<0.1	7.71	0.6
Duplicates																										
65007	5.2	0.25	4.8	0.2	<0.05	<0.01	<0.02	10.9	0.07	2.42	0.19	2.5	19.5	<0.05	3.6	<1	0.5	<0.05	0.18	<0.05	2.1	0.12	0.19	0.2	5.83	0.5
65161	5.9	0.34	5.6	0.2	<0.05	<0.01	0.03	11.1	0.09	2.49	0.22	1.8	30	<0.05	5	<1	0.6	<0.05	0.23	<0.05	2.4	0.17	0.22	0.7	7.44	0.7
70515	12.3	0.31	9	0.1	<0.05	0.01	0.3	34.7	0.2	251	<0.05	6.2	14.5	<0.05	5.5	7	2.8	<0.05	0.74	0.14	2.4	0.09	0.27	0.2	22.2	1.5
QC																										
CH4	22.9	2.57	8.8	0.4	0.34	0.04	0.1	14	0.06	2.72	0.16	7.8	70.9	0.29	8.2	2	0.7	<0.05	0.25	0.54	2	0.38	0.29	2.6	5.71	0.4
CH4	22.9	2.73	9.3	0.3	0.34	0.01	0.1	14.6	0.06	3.47	0.11	8.1	73.7	0.32	8.5	2	0.7	<0.05	0.26	0.42	2	0.4	0.3	2.2	5.97	0.4
Certified Va	22.8	2.6	8.72	0.21	0.29	#N/A	0.1	14	#N/A	3.05	0.19	8.24	67	0.34	7.99	1.57	0.6	0.3	0.27	0.42	2.2	0.4	0.29	2.15	5.66	#N/A
Tolerance (	11.1	14.8	12.9	127.4	52.8	#N/A	62.1	11.8	#N/A	14.1	75	16.1	10.7	47.3	13.1	169.6	134.5	51.7	28.4	39.6	21.2	22.6	52.9	21.6	12.2	#N/A

CLIENT : **Minto Mines**
PROJECT : **Minto Project**
SGS PROJECT # : **0643**
Test : **Leachate Analysis by ICP-OES**
Date : **February 14, 2014**

Sample ID		65003	NP Contribution	65005	NP Contribution	65011	NP Contribution	065168	NP Contribution	70513	NP Contribution	070525	NP Contribution
Al	mg/L	41.7		53.3		43.7		23.3		50.3		42.3	
Sb	mg/L	0.02		< 0.02		< 0.02		< 0.02		< 0.02		0.03	
As	mg/L	0.04		0.02		0.04		0.04		0.05		0.02	
Ba	mg/L	0.0877		0.0843		0.0708		0.0655		0.0937		0.0816	
Be	mg/L	0.0086		0.0052		0.0077		0.0056		0.0061		0.0077	
Bi	mg/L	0.45		0.29		0.31		0.28		0.30		0.26	
B	mg/L	0.693		1.95		2.40		0.882		2.19		0.624	
Cd	mg/L	0.015		0.009		0.015		0.016		0.012		0.008	
Ca	mg/L	732	18.3	400	10.0	801	20.0	571	14.2	467	11.7	579	14.4
Cr	mg/L	0.707		1.72		1.49		0.433		0.305		1.80	
Co	mg/L	0.059		0.040		0.045		0.044		0.045		0.033	
Cu	mg/L	0.235		1.75		5.37		4.63		2.93		0.464	
Fe	mg/L	190		119		160		141		147		108	
Pb	mg/L	0.024		< 0.007		0.023		0.018		0.014		0.016	
Li	mg/L	< 0.1		< 0.1		< 0.1		< 0.1		< 0.1		< 0.1	
Mg	mg/L	71.3	2.9	25.5	1.0	39.9	1.6	48.4	2.0	42.8	1.8	25.1	1.0
Mn	mg/L	14.3		5.66		17.2		11.6		8.31		7.73	
Mo	mg/L	< 0.01		< 0.01		< 0.01		< 0.01		< 0.01		< 0.01	
Ni	mg/L	0.078		0.110		0.097		0.095		0.052		0.112	
P	mg/L	3.80		1.10		0.195		0.043		1.54		0.531	
K	mg/L	47.5	1.2	38.0	1.0	38.1	1.0	43.1	1.1	48.6	1.2	33.5	0.9
Se	mg/L	< 0.01		< 0.01		< 0.01		< 0.01		< 0.01		< 0.01	
Si	mg/L	51.1		78.4		69.3		42.8		77.2		49.4	
Ag	mg/L	< 0.08		< 0.08		< 0.08		< 0.08		< 0.08		< 0.08	
Na	mg/L	21.1	0.9	29.8	1.3	25.2	1.1	18.3	0.8	29.6	1.3	21.5	0.9
Sr	mg/L	6.03		1.66		3.87		7.78		4.91		3.58	
S	mg/L	1000		598		954		716		707		713	
Tl	mg/L	0.007		< 0.005		0.010		< 0.005		< 0.005		< 0.005	
Sn	mg/L	< 0.03		< 0.03		< 0.03		< 0.03		< 0.03		< 0.03	
Ti	mg/L	0.030		0.049		0.020		0.006		0.058		0.020	
U	mg/L	< 0.03		< 0.03		< 0.03		< 0.03		< 0.03		< 0.03	
V	mg/L	0.248		0.117		0.096		0.015		0.156		0.096	
Zn	mg/L	0.617		0.358		0.461		0.368		0.525		0.242	
Zr	mg/L	< 0.007		< 0.007		< 0.007		< 0.007		< 0.007		< 0.007	
NP from Ca, Mg, Na & K (kg CaCO3 Equiv./tonne)			**23.3**		**13.3**		**23.7**		**18.1**		**15.9**		**17.3**

CLIENT : **Minto Mines**
PROJECT : **Minto Mines**
SGS PROJECT # : **0643**
Test : **BC Research NP and Modified NP Procedures**
Date : **January 20, 2014**

Sample ID	**Sampling Date**	**Paste pH**	**TIC %**	**CaCO3 NP**	**C(T) %**	**S(T) %**	**S(SO4) %**	**S(S-2) %**	**AP**	**NP**	**NP H2SO4/tonne**	**NP CaCO3/tonne**	**Net NP**	**NP:AP Ratio (NP/AP)**	**Fizz Test**
Method Code		Sobek	CSB02V	Calc	CSA01V	CSA06V	CSA07V	Calc	Calc	Modified	BC Research	Calc	Calc	Calc	Sobek
LOD		0.2	0.01	#N/A	0.01	0.01	0.01	#N/A	#N/A	0.5	0.5	#N/A	#N/A	#N/A	#N/A
065008	10-Oct-13	8.74	0.19	15.8	0.274	0.018	<0.01	0.02	0.6	18.1	23.0	23.5	22.9	41.8	Slight
065009	10-Oct-13	8.25	0.23	19.2	0.258	0.227	<0.01	0.23	7.1	21.9	21.8	22.3	15.2	3.1	Slight
065020	10-Oct-13	8.59	0.18	15.0	0.223	0.049	<0.01	0.05	1.5	18.1	19.8	20.3	18.7	13.2	Slight
065022	10-Oct-13	8.72	0.15	12.5	0.212	0.019	<0.01	0.02	0.6	14.8	17.9	18.3	17.7	30.7	Slight
065023	10-Oct-13	8.43	0.27	22.5	0.301	0.089	<0.01	0.09	2.8	24.0	31.1	31.8	29.0	11.4	Slight
065154	10-Oct-13	8.43	0.27	22.5	0.295	0.361	<0.01	0.36	11.3	25.0	29.6	30.3	19.0	2.7	Slight
065155	10-Oct-13	8.58	0.27	22.5	0.307	0.169	<0.01	0.17	5.3	24.9	30.6	31.3	26.0	5.9	Slight
065158	10-Oct-13	8.58	0.27	22.5	0.32	0.021	<0.01	0.02	0.7	22.1	25.5	26.0	25.3	39.6	Slight
065159	10-Oct-13	8.60	0.43	35.8	0.472	0.029	<0.01	0.03	0.9	29.9	34.1	34.8	33.8	38.3	Slight
065167	11-Oct-13	7.96	1.22	101.7	1.27	0.864	<0.01	0.86	27.0	100.2	104.6	106.8	79.8	4.0	Moderate
070521	10-Oct-13	8.16	0.2	16.7	0.317	0.455	<0.01	0.46	14.2	18.1	25.0	25.5	11.3	1.8	Slight
084501	14-Oct-13	8.52	0.25	20.8	0.306	0.034	<0.01	0.03	1.1	23.8	26.0	26.5	25.4	24.9	Slight
084502	14-Oct-13	8.34	0.19	15.8	0.24	0.14	<0.01	0.14	4.4	19.5	23.3	23.8	19.4	5.4	Slight
084503	14-Oct-13	8.07	0.33	27.5	0.362	0.746	<0.01	0.75	23.3	31.5	30.9	31.5	8.2	1.4	Slight
084504	14-Oct-13	8.73	0.21	17.5	0.238	0.094	<0.01	0.09	2.9	19.8	22.5	23.0	20.1	7.8	Slight
084505	14-Oct-13	8.19	0.7	58.3	0.727	0.584	<0.01	0.58	18.3	59.9	63.2	64.5	46.3	3.5	Slight
084506	14-Oct-13	8.52	0.36	30.0	0.387	0.05	<0.01	0.05	1.6	31.7	36.8	37.5	35.9	24.0	Slight
084510	14-Oct-13	8.60	0.26	21.7	0.366	0.042	<0.01	0.04	1.3	22.6	27.4	28.0	26.7	21.3	Slight
084511	14-Oct-13	8.45	0.44	36.7	0.491	0.081	<0.01	0.08	2.5	38.8	42.6	43.5	41.0	17.2	Slight
084512	14-Oct-13	8.59	0.3	25.0	0.365	0.071	<0.01	0.07	2.2	27.8	32.1	32.8	30.5	14.8	Slight
Duplicates															
065008		8.73								17.1					Slight
065023			0.27												
070521					0.314	0.452									
084502							<0.01								
084503			0.33												
084512		8.61								27.7					Slight
QC															
GTS-2A					2.05	0.35									
PD-1							4.59								
SY4			0.92												
NBM-1										40.0					Slight
Expected Values			0.95		2.01	0.35	4.27			42.0					Slight
Tolerance +/-			0.06		0.15	0.03	0.3			3.0					

Note:

AP = Acid potential in tonnes CaCO3 equivalent per 1000 tonnes of material. AP is determined from calculated sulphide sulphur content: S(T) - S(SO4).

NP = Neutralization potential in tonnes CaCO3 equivalent per 1000 tonnes of material.

NET NP = NP - AP

Carbonate NP is calculated from TIC originating from carbonate minerals and is expressed in kg CaCO3/tonne.

CLIENT : **Minto Mines**
PROJECT : **Minto Project**
SGS Project # : **0643**
Test : **Metals by Aqua Regia Digestion with ICP-MS Finish**
Date : **January 20, 2014**

Sample ID	**Ag ppm**	**Al %**	**B ppm**	**Ba ppm**	**Ca %**	**Cr ppm**	**Cu ppm**	**Fe %**	**K %**	**Li ppm**	**Mg %**	**Mn ppm**	**Na %**	**Ni ppm**	**P ppm**	**S %**	**Sr ppm**	**Ti %**	**V ppm**	**Zn ppm**	**Zr ppm**	**As ppm**	**Be ppm**	**Bi ppm**	**Cd ppm**	**Ce ppm**
Method Code	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B
LOD	0.01	0.01	10	5	0.01	1	0.5	0.01	0.01	1	0.01	2	0.01	0.5	50	0.01	0.5	0.01	1	1	0.5	1	0.1	0.02	0.01	0.05
065008	0.04	0.93	40	254	0.92	77	97.9	1.97	0.55	3	0.6	497	0.07	2.1	0.063	<0.01	52	0.1	45	59	0.9	<1	0.2	<0.02	0.04	15.3
065009	0.16	1.18	40	141	1.15	56	679	2.35	0.29	7	0.7	479	0.05	1.3	0.07	0.23	58.5	0.05	44	67	0.9	<1	0.3	0.03	0.08	27.3
065020	0.19	1.18	50	134	1.37	66	559	2.03	0.14	5	0.7	574	0.07	1.4	0.069	0.04	77.2	0.09	44	60	1.4	<1	0.5	0.1	0.07	13.5
065022	0.09	1.04	40	243	0.8	74	140	2.07	0.6	3	0.66	497	0.06	2	0.066	<0.01	52.3	0.11	46	61	0.9	<1	0.2	0.02	0.04	15.9
065023	0.3	1.11	40	242	1.23	73	924	2.35	0.53	5	0.7	545	0.06	1.7	0.075	0.08	68.7	0.1	53	67	1.1	<1	0.3	0.18	0.07	23.6
065154	0.14	1.4	50	366	1.16	73	645	2.98	0.88	5	0.82	600	0.06	1.9	0.086	0.38	88	0.15	71	75	1.2	<1	0.3	0.08	0.08	25.6
065155	1.18	1.19	40	324	1.07	73	2700	2.66	0.74	4	0.69	536	0.05	1.8	0.071	0.17	167	0.12	58	81	0.7	<1	0.2	1.09	0.52	18.4
065158	0.04	1.05	40	258	0.99	74	70.6	2.32	0.65	4	0.71	581	0.06	6.1	0.078	<0.01	87.1	0.11	52	67	0.8	<1	0.2	<0.02	0.04	23.2
065159	0.12	0.95	30	272	1.22	71	333	2.33	0.73	3	0.61	604	0.05	1.3	0.067	0.01	96.8	0.11	51	65	0.8	<1	0.2	0.06	0.06	23.3
065167	1.24	1.61	50	412	4.08	60	6200	3.7	1.1	6	0.99	598	0.04	1.4	0.063	0.89	129	0.19	105	83	2.7	<1	0.4	0.24	0.45	39.7
070521	1.4	1.25	50	288	0.79	82	6350	3.21	0.78	4	0.71	677	0.05	1.5	0.074	0.48	80.8	0.11	58	322	1	<1	0.2	0.49	0.61	25
084501	0.08	1.11	40	326	1.09	74	241	2.08	0.45	5	0.68	493	0.05	1.7	0.062	0.01	111	0.07	44	52	0.6	<1	0.2	0.04	0.03	19.9
084502	0.07	1.34	40	286	0.96	76	423	2.53	0.69	7	0.74	482	0.06	2.1	0.068	0.14	55	0.11	58	68	1	<1	0.2	<0.02	0.08	17.9
084503	0.38	1.5	40	150	1.6	71	3380	2.49	0.34	10	0.81	352	0.06	1.8	0.072	0.81	139	0.05	54	59	2.1	2	0.2	0.08	0.08	21.1
084504	0.52	1.13	40	220	0.98	79	1580	2.46	0.65	4	0.7	533	0.06	1.6	0.071	0.09	54.8	0.11	52	71	0.8	<1	0.2	0.44	0.1	24.9
084505	1.04	1.18	40	340	2.57	66	4030	2.94	0.63	5	0.68	496	0.04	1.8	0.084	0.62	203	0.1	69	80	1	<1	0.2	0.34	0.45	24.4
084506	0.06	0.98	40	111	1.42	68	221	2.09	0.14	5	0.64	441	0.04	2	0.056	0.03	143	0.01	33	61	0.5	<1	0.3	0.02	0.08	19.4
084510	0.09	1.12	40	302	1	79	288	2.42	0.64	5	0.76	601	0.06	2.8	0.068	0.02	81.9	0.11	53	73	0.9	<1	0.2	0.03	0.05	21
084511	0.11	1.33	40	485	1.7	63	460	2.5	0.86	4	0.75	618	0.05	1.6	0.076	0.08	158	0.11	63	60	0.9	<1	0.3	0.07	0.09	26
084512	0.11	1.11	40	509	1.21	77	346	2.17	0.71	3	0.61	501	0.05	1.6	0.076	0.05	115	0.1	53	72	0.8	<1	0.3	0.03	0.1	20.8
Duplicates																										
084504	0.52	1.15	40	233	0.98	73	1560	2.47	0.67	4	0.72	539	0.06	1.6	0.073	0.09	53.6	0.12	55	68	0.8	<1	0.2	0.42	0.08	22.3
084506	0.1	0.99	40	112	1.45	69	230	2.09	0.14	6	0.64	442	0.04	1.6	0.059	0.03	146	0.01	33	61	0.5	<1	0.3	0.02	0.06	20.4
QC																										
CH4	2.23	1.92	60	294	0.63	100	2060	4.7	1.54	11	1.23	312	0.06	44.8	0.073	0.71	9.5	0.21	85	193	13.4	7	<0.1	0.42	1.14	28.6
Certified Values	2.13	1.85	#N/A	293	0.61	103.8	2000	4.79	1.43	12.6	1.18	324	0.06	49.57	719	0.73	9.38	0.21	79.27	189.4	9	8.14	0.11	0.51	1.17	28.18
Tolerance (%)	10.9	11.35	#N/A	14.3	14.1	12.4	10.1	10.52	11.74	29.84	12.3	11.5	50.3	12.52	27.4	13.4	23.3	23.3	13.2	11.3	17.7	13.1	241.3	19.7	12.1	10.4

Sample ID	Co	Cs	Ga	Ge	Hf	Hg	In	La	Lu	Mo	Nb	Pb	Rb	Sb	Sc	Se	Sn	Ta	Tb	Te	Th	Tl	U	W	Y	Yb
	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Method Code	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B
LOD	0.1	0.05	0.1	0.1	0.05	0.01	0.02	0.1	0.01	0.05	0.05	0.2	0.2	0.05	0.1	1	0.3	0.05	0.02	0.05	0.1	0.02	0.05	0.1	0.05	0.1
065008	5	0.24	4.3	0.2	<0.05	0.03	<0.02	8	0.06	2.31	0.13	2.9	21.7	<0.05	3.1	<1	0.4	<0.05	0.16	<0.05	1.6	0.13	0.14	0.4	4.96	0.4
065009	7.1	0.23	5.6	0.2	<0.05	0.03	0.02	14.7	0.06	17.1	0.1	3.6	12.3	<0.05	3.1	<1	0.6	<0.05	0.19	<0.05	3.2	0.08	0.23	<0.1	5.79	0.5
065020	5.1	0.11	5.9	0.2	0.06	0.01	0.03	7.3	0.07	1.28	0.13	4.5	5.8	<0.05	3.4	<1	0.5	<0.05	0.17	<0.05	1.5	0.03	0.17	0.1	5.77	0.5
065022	5.5	0.27	4.8	0.2	<0.05	<0.01	<0.02	8.5	0.05	1.52	0.12	1.7	25.2	<0.05	3.1	<1	0.4	<0.05	0.14	<0.05	1.8	0.15	0.17	0.3	4.84	0.4
065023	6.2	0.29	5.6	0.2	<0.05	0.01	0.03	13.2	0.06	2.66	0.16	3.3	22	<0.05	3.3	<1	0.5	<0.05	0.19	0.06	3.1	0.15	0.22	0.2	5.73	0.5
065154	9.6	0.57	6.3	0.3	0.17	0.08	0.03	14.1	0.1	10.3	1.3	2.7	37.2	0.07	3.9	<1	0.9	0.83	0.25	0.1	3.1	0.26	0.21	0.6	5.74	0.5
065155	6.2	0.44	5.9	0.2	<0.05	0.04	0.04	9.5	0.07	6.66	0.53	3	31.7	<0.05	3.6	2	0.9	0.15	0.2	0.14	2	0.23	0.22	0.4	5.45	0.5
065158	5.9	0.35	5	0.2	<0.05	0.03	<0.02	12.1	0.07	2.65	0.2	2.2	27.1	<0.05	3.6	<1	0.6	<0.05	0.2	<0.05	2.6	0.17	0.17	0.3	6.18	0.5
065159	5.5	0.44	4.6	0.2	<0.05	0.02	0.03	12.2	0.09	1.63	0.23	2.2	31.7	<0.05	4.8	<1	0.6	<0.05	0.24	<0.05	2.9	0.19	0.15	<0.1	7.36	0.7
065167	11.5	0.56	7	0.2	0.07	0.03	0.2	20.6	0.11	31.8	0.33	3.7	47.7	<0.05	5.2	5	1.6	<0.05	0.52	0.23	1.5	0.31	1.74	0.7	16	0.9
070521	5.9	0.42	7.2	0.2	<0.05	0.02	0.19	13.5	0.04	1.64	0.41	10.3	35	<0.05	4.7	4	1.5	<0.05	0.17	0.21	5.2	0.27	0.17	0.9	4.75	0.3
084501	5.1	0.21	5.1	0.2	<0.05	<0.01	<0.02	10.4	0.05	1.5	0.12	2.3	18	<0.05	3.4	<1	0.6	<0.05	0.15	<0.05	2.2	0.12	0.15	0.3	4.41	0.4
084502	7.1	0.41	6	0.2	<0.05	<0.01	<0.02	9.1	0.05	21.5	0.29	2.6	30.4	<0.05	3.1	<1	0.6	<0.05	0.17	<0.05	1.8	0.19	0.3	0.6	5.33	0.4
084503	10	0.31	5.7	0.1	<0.05	<0.01	0.1	11	0.07	91.5	<0.05	3.9	15.4	<0.05	2.5	2	0.9	<0.05	0.25	0.07	1.3	0.1	0.28	0.3	8.49	0.6
084504	5.9	0.34	5.7	0.2	<0.05	<0.01	0.02	13.6	0.05	1.94	0.2	2.8	28	<0.05	3.2	1	0.5	<0.05	0.16	0.11	3.5	0.2	0.23	0.4	4.84	0.4
084505	8.3	0.35	6.3	0.2	<0.05	<0.01	0.12	12.8	0.07	15.3	0.22	4.4	28.9	<0.05	4.1	3	1.3	<0.05	0.24	0.15	1.7	0.19	0.43	<0.1	7.66	0.6
084506	5.4	0.22	5.3	0.1	<0.05	<0.01	<0.02	10.2	0.04	2.47	<0.05	3.4	7.7	<0.05	3.7	<1	0.5	<0.05	0.15	<0.05	2.1	0.04	0.22	0.1	4.57	0.3
084510	6.2	0.31	5.5	0.2	<0.05	<0.01	<0.02	11	0.06	2.54	0.1	2.8	26.9	<0.05	3.3	<1	0.5	<0.05	0.17	<0.05	2.7	0.18	0.28	0.2	5.28	0.5
084511	7.1	0.58	5.8	0.2	<0.05	<0.01	0.05	13.1	0.14	9.4	0.17	2	33.9	<0.05	6.2	<1	0.9	<0.05	0.37	<0.05	2.5	0.22	0.28	0.4	12.2	1.1
084512	5.8	0.48	5.1	0.2	<0.05	<0.01	0.03	10.8	0.1	6.14	0.16	2.5	28.9	<0.05	4.2	<1	0.8	<0.05	0.26	<0.05	2	0.18	0.2	0.2	9.3	0.8
Duplicates																										
084504	5.8	0.35	5.8	0.2	<0.05	<0.01	0.03	12.1	0.05	1.9	0.21	3.4	29.2	<0.05	3.3	1	0.5	<0.05	0.15	0.1	3.1	0.21	0.21	0.4	4.72	0.4
084506	5.3	0.22	5.3	0.1	<0.05	<0.01	<0.02	10.6	0.04	3.12	<0.05	3.4	7.5	<0.05	3.7	<1	0.5	<0.05	0.16	<0.05	2.3	0.04	0.23	0.2	4.71	0.3
QC																										
CH4	22.5	2.63	8.7	0.4	0.28	0.03	0.1	14.4	0.05	2.88	0.11	7.8	70.9	0.3	7.6	2	0.7	<0.05	0.24	0.44	2	0.38	0.26	1.9	5.57	0.4
Certified Values	22.8	2.6	8.72	0.21	0.29	#N/A	0.1	14	#N/A	3.05	0.19	8.24	67	0.34	7.99	1.57	0.6	0.3	0.27	0.42	2.2	0.4	0.29	2.15	5.66	#N/A
Tolerance (%)	11.1	14.8	12.9	127.4	52.8	#N/A	62.1	11.8	#N/A	14.1	75	16.1	10.7	47.3	13.1	169.6	134.5	51.7	28.4	39.6	21.2	22.6	52.9	21.6	12.2	#N/A

CLIENT : **Minto Mines**
PROJECT : **Minto Project**
SGS PROJECT # : **0643**
Test : **Leachate Analysis by ICP-OES**
Date : **January 20, 2014**

Sample ID		065008	NP Contribution	084510	NP Contribution
Al	mg/L	41.8		44.3	
Sb	mg/L	0.04		0.03	
As	mg/L	0.004		< 0.004	
Ba	mg/L	0.0846		0.0986	
Be	mg/L	0.0052		0.0079	
Bi	mg/L	0.33		0.32	
B	mg/L	0.371		3.24	
Cd	mg/L	0.0095		0.0135	
Ca	mg/L	579	14.4	669	16.7
Cr	mg/L	2.35		1.26	
Co	mg/L	0.035		0.048	
Cu	mg/L	0.611		1.81	
Fe	mg/L	148		197	
Pb	mg/L	0.019		0.027	
Li	mg/L	< 0.1		< 0.1	
Mg	mg/L	21.1	0.9	43.8	1.8
Mn	mg/L	11.2		12.9	
Mo	mg/L	< 0.01		< 0.01	
Ni	mg/L	0.144		0.149	
P	mg/L	0.667		0.036	
K	mg/L	43.6	1.1	52.0	1.3
Se	mg/L	< 0.01		< 0.01	
Si	mg/L	39.3		72.3	
Ag	mg/L	< 0.08		< 0.08	
Na	mg/L	18.7	0.8	27.6	1.2
Sr	mg/L	2.56		4.77	
S	mg/L	779		930	
Tl	mg/L	< 0.005		0.006	
Sn	mg/L	< 0.03		< 0.03	
Ti	mg/L	0.014		0.042	
U	mg/L	< 0.1		< 0.1	
V	mg/L	0.103		0.069	
Zn	mg/L	0.312		0.462	
Zr	mg/L	< 0.007		< 0.007	
NP from Ca, Mg, Na & K (kg CaCO3 Equiv./tonne)			**17.2**		**21.0**

CLIENT : **Minto Mines**
PROJECT : **Minto Mines**
SGS PROJECT # : **0643**
Test : **BC Research NP and Modified NP Procedures**
Date : **February 21, 2014**

Sample ID	Sampling Date	Paste pH	TIC %	CaCO3 NP	C(T) %	S(T) %	S(SO4) %	S(S-2) %	AP	NP	NP H2SO4/tonne	NP CaCO3/tonne	Net NP	NP:AP Ratio (NP/AP)	Fizz Test
Method Code		Sobek	CSB02V	Calc	CSA01V	CSA06V	CSA07V	Calc	Calc	Modified	BC Research	Calc	Calc	Calc	Sobek
LOD		0.2	0.01	#N/A	0.005	0.01	0.01	#N/A	#N/A	0.5	0.5	#N/A	#N/A	#N/A	#N/A
065151	31-Oct-13	8.98	0.34	28.3	0.395	0.26	<0.01	0.26	8.1	31.9	31.9	32.5	24.4	4.0	Slight
065171	14-Oct-13	8.86	0.43	35.8	0.501	0.4	<0.01	0.40	12.5	38.6	43.1	44.0	31.5	3.5	Slight
065172	14-Oct-13	9.39	0.08	6.7	0.182	0.01	<0.01	0.01	0.3	10.6	11.5	11.8	11.4	37.6	Slight
065173	14-Oct-13	9.06	0.24	20.0	0.323	0.06	<0.01	0.06	1.9	21.4	24.7	25.3	23.4	13.5	Slight
065174	14-Oct-13	8.96	0.22	18.3	0.291	0.03	<0.01	0.03	0.9	22.3	26.0	26.5	25.6	28.3	Slight
065175	14-Oct-13	8.82	0.39	32.5	0.442	0.47	<0.01	0.47	14.7	31.2	35.0	35.8	21.1	2.4	Slight
072823	18-Oct-13	9.35	0.31	25.8	0.34	0.01	<0.01	0.01	0.3	22.6	27.4	28.0	27.7	89.6	Slight
078501	30-Oct-13	8.82	0.68	56.7	0.683	0.47	<0.01	0.47	14.7	56.7	57.6	58.8	44.1	4.0	Slight
078502	30-Oct-13	9.41	0.31	25.8	0.363	0.04	<0.01	0.04	1.3	27.5	29.6	30.3	29.0	24.2	Slight
078503	30-Oct-13	8.91	0.51	42.5	0.538	0.34	<0.01	0.34	10.6	42.7	46.3	47.3	36.6	4.4	Slight
078504	30-Oct-13	8.53	1.72	143.3	1.74	0.86	0.01	0.85	26.6	140.5	142.3	145.3	118.7	5.5	Slight
078505	30-Oct-13	8.63	0.83	69.2	0.894	0.72	<0.01	0.72	22.5	71.5	74.7	76.3	53.8	3.4	Slight
078506	30-Oct-13	8.93	0.47	39.2	0.557	0.31	<0.01	0.31	9.7	42.0	40.4	41.3	31.6	4.3	Slight
078507	31-Oct-13	9.05	0.17	14.2	0.203	0.33	<0.01	0.33	10.3	19.5	20.3	20.8	10.4	2.0	Slight
078508	31-Oct-13	9.18	0.25	20.8	0.316	0.06	<0.01	0.06	1.9	23.5	25.7	26.3	24.4	14.0	Slight
078515	30-Oct-13	9.01	0.56	46.7	0.572	0.03	<0.01	0.03	0.9	45.4	47.8	48.8	47.8	52.0	Slight
078516	30-Oct-13	9.53	0.15	12.5	0.188	0.14	<0.01	0.14	4.4	15.7	17.9	18.3	13.9	4.2	Slight
078518	31-Oct-13	9.35	0.22	18.3	0.247	0.07	<0.01	0.07	2.2	20.7	21.8	22.3	20.1	10.2	Slight
078520	30-Oct-13	8.99	0.28	23.3	0.309	0.35	<0.01	0.35	10.9	26.4	30.9	31.5	20.6	2.9	Slight
078521	30-Oct-13	8.60	0.89	74.2	0.929	0.69	<0.01	0.69	21.6	76.4	72.3	73.8	52.2	3.4	Slight
084507	14-Oct-13	8.24	0.66	55.0	0.73	0.27	<0.01	0.27	8.4	50.6	52.7	53.8	45.3	6.4	Slight
084508	14-Oct-13	8.29	0.24	20.0	0.274	0.07	<0.01	0.07	2.2	20.3	24.0	24.5	22.3	11.2	Slight
084509	14-Oct-13	8.54	0.25	20.8	0.298	0.01	<0.01	0.01	0.3	23.2	26.0	26.5	26.2	84.8	Slight
084513	17-Oct-13	8.20	0.36	30.0	0.411	0.06	<0.01	0.06	1.9	30.8	34.3	35.0	33.1	18.7	Slight
084514	17-Oct-13	8.49	0.22	18.3	0.258	0.06	<0.01	0.06	1.9	20.1	25.0	25.5	23.6	13.6	Slight
084515	17-Oct-13	8.35	0.29	24.2	0.385	0.33	<0.01	0.33	10.3	20.2	24.3	24.8	14.4	2.4	Slight
084516	17-Oct-13	8.46	0.3	25.0	0.353	0.02	<0.01	0.02	0.6	25.6	27.7	28.3	27.6	45.2	Slight
084517	17-Oct-13	8.22	0.52	43.3	0.578	0.51	<0.01	0.51	15.9	25.0	32.1	32.8	16.8	2.1	Slight
084518	17-Oct-13	8.77	0.19	15.8	0.256	0.06	<0.01	0.06	1.9	18.9	21.3	21.8	19.9	11.6	Slight
084519	17-Oct-13	8.80	0.12	10.0	0.221	0.03	<0.01	0.03	0.9	12.8	14.9	15.3	14.3	16.3	Slight
084520	17-Oct-13	8.58	0.23	19.2	0.276	0.02	<0.01	0.02	0.6	21.9	24.0	24.5	23.9	39.2	Slight
084524	30-Oct-13	8.57	0.41	34.2	0.521	0.02	<0.01	0.02	0.6	34.8	39.4	40.3	39.6	64.4	Slight
084525	30-Oct-13	8.56	0.42	35.0	0.447	0.04	<0.01	0.04	1.3	36.1	34.3	35.0	33.8	28.0	Slight
Duplicates															
065151		8.99								31.3					Slight
065171			0.43												
078503							<0.01								
078508					0.336	0.05									
078521		8.64								75.6					Slight
084507		8.27								50.7					Slight
084508			0.23		0.279	0.07									
084518							<0.01								
QC															
GTS-2A					2	0.35									
PD-1							4.45								
SY4			0.91												
NBM-1															Slight
Expected Values			0.95		2.01	0.35	4.27			42.0					Slight
Tolerance +/-			0.06		0.15	0.03	0.3			3.0					

Note:

AP = Acid potential in tonnes CaCO3 equivalent per 1000 tonnes of material. AP is determined from calculated sulphide sulphur content: S(T) - S(SO4).

NP = Neutralization potential in tonnes CaCO3 equivalent per 1000 tonnes of material.

NET NP = NP - AP

Carbonate NP is calculated from TIC originating from carbonate minerals and is expressed in kg CaCO3/tonne.

CLIENT : **Minto Mines**
PROJECT : **Minto Project**
SGS Project # : **0643**
Test : **Metals by Aqua Regia Digestion with ICP-MS Finish**
Date : **February 21, 2014**

Sample ID	Ag ppm	Al %	B ppm	Ba ppm	Ca %	Cr ppm	Cu ppm	Fe %	K %	Li ppm	Mg %	Mn ppm	Na %	Ni ppm	P ppm	S %	Sr ppm	Ti %	V ppm	Zn ppm	Zr ppm	As ppm	Be ppm	Bi ppm	Cd ppm	Ce ppm
Method Code	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B
LOD	0.01	0.01	10	5	0.01	1	0.5	0.01	0.01	1	0.01	2	0.01	0.5	50	0.01	0.5	0.01	1	1	0.5	1	0.1	0.02	0.01	0.05
065151	0.35	1.26	60	283	1.49	146	966	2.43	0.58	8	0.76	600	0.05	3.4	0.102	0.26	82.8	0.1	60	107	1.1	<1	0.4	0.14	0.23	27.6
065171	0.93	1.56	60	548	1.83	127	4240	3.98	0.97	8	0.94	695	0.06	4.3	0.112	0.39	129	0.2	81	108	1.1	<1	0.2	0.23	0.52	23.9
065172	0.02	1.02	60	199	0.81	162	47.1	2.17	0.48	6	0.67	493	0.08	4.5	0.063	<0.01	52.6	0.15	49	53	1.4	<1	0.3	<0.02	0.02	14.6
065173	0.03	1.25	50	314	1.04	143	313	2.43	0.7	6	0.64	415	0.05	4.2	0.072	0.05	148	0.12	54	54	0.7	<1	0.2	<0.02	0.06	20.1
065174	0.06	1.23	60	166	1.34	130	237	2.23	0.26	8	0.74	556	0.06	3.9	0.069	0.02	126	0.08	44	63	1.2	1	0.5	0.04	0.04	18
065175	1.62	1.11	60	183	1.4	141	6650	3.27	0.4	8	0.66	537	0.04	4.2	0.065	0.49	151	0.07	51	130	0.7	<1	0.3	0.78	0.68	13.5
072823	0.01	1.17	60	481	0.92	149	42.8	2.61	0.9	6	0.75	528	0.05	4.1	0.088	<0.01	39.4	0.17	62	97	0.7	<1	0.2	<0.02	0.03	13.8
078501	1.45	1.06	70	220	2.45	135	5700	2.08	0.69	5	0.74	471	0.04	3.6	0.089	0.48	95	0.12	61	61	2.3	<1	0.3	0.82	0.32	55.4
078502	0.1	1.39	60	478	1.25	150	435	2.62	0.93	7	0.76	435	0.06	4.5	0.066	0.04	134	0.17	64	57	0.8	<1	0.2	0.07	0.04	21.2
078503	0.76	1.26	60	319	2.03	131	3060	2.73	0.64	7	0.77	436	0.05	4.2	0.094	0.36	196	0.11	65	62	0.9	<1	0.3	0.39	0.18	22.2
078504	0.67	1.14	60	452	6.07	106	4510	3.21	0.39	7	0.65	493	0.04	4	0.069	0.89	303	0.07	64	74	1.2	<1	0.3	0.1	0.29	35.3
078505	3.13	1.09	60	76	3.18	125	>10000	4.78	0.2	8	0.74	794	0.04	3.6	0.079	0.73	88	0.04	61	101	1.2	2	0.3	2.08	0.63	20
078506	0.59	1.05	50	271	2.03	142	3280	2.41	0.54	6	0.71	512	0.05	4.1	0.076	0.33	84.9	0.12	58	69	1.2	<1	0.3	0.32	0.77	29.3
078507	1.1	1.22	60	153	0.99	139	4490	3.15	0.39	8	0.76	631	0.05	3.8	0.075	0.33	67.1	0.09	53	210	0.7	<1	0.3	0.81	0.65	22
078508	0.07	1.01	60	218	1.18	148	308	2.26	0.45	6	0.64	515	0.06	4.3	0.066	0.05	98.6	0.09	45	59	1.4	1	0.4	0.09	0.04	18.8
078515	0.09	0.97	50	154	2.1	121	324	2.22	0.11	6	0.61	604	0.05	3.7	0.059	0.03	147	<0.01	34	57	0.7	<1	0.4	0.04	0.1	23.4
078516	0.08	1.07	50	324	0.73	152	431	2.16	0.75	6	0.62	407	0.06	4.3	0.061	0.14	78.2	0.14	47	56	0.6	<1	0.2	<0.02	0.04	17.9
078518	0.11	1.3	50	428	0.97	145	572	2.47	0.88	7	0.69	504	0.06	3.9	0.072	0.07	85.4	0.16	58	65	0.8	<1	0.2	0.04	0.05	26.3
078520	0.33	1.4	70	302	1.33	122	2420	2.82	0.81	7	0.84	444	0.06	4.2	0.14	0.35	188	0.14	75	58	1.2	<1	0.3	0.1	0.05	26.9
078521	0.42	1.2	60	363	3.51	121	3380	2.98	0.36	7	0.66	457	0.04	4	0.07	0.73	215	0.07	57	68	1.3	<1	0.3	0.09	0.2	34.9
084507	0.21	0.84	50	179	2.06	125	1390	2.32	0.35	6	0.6	474	0.04	3.4	0.07	0.28	176	0.06	36	61	0.8	<1	0.2	0.04	0.08	27.2
084508	0.11	1.13	50	223	1.22	146	422	2.41	0.46	7	0.69	542	0.06	3.9	0.075	0.07	66.7	0.1	49	67	1	<1	0.3	0.04	0.05	20.1
084509	0.01	1.08	50	257	1.14	144	43.5	2.44	0.55	6	0.69	616	0.06	3.9	0.069	<0.01	84.4	0.1	52	69	0.8	<1	0.2	<0.02	0.06	20.4
084513	0.21	1.09	50	147	1.4	128	535	2.46	0.31	8	0.7	638	0.04	3.7	0.076	0.07	110	0.05	49	73	1.1	<1	0.4	0.04	0.06	29.6
084514	0.17	1.08	50	216	1.1	149	605	2.28	0.45	6	0.67	556	0.07	4	0.065	0.07	84.9	0.09	45	67	0.9	<1	0.3	0.05	0.06	21.5
084515	1.39	1.14	60	233	0.88	150	5330	4.07	0.72	6	0.75	799	0.06	4	0.066	0.35	72.2	0.14	56	84	0.9	<1	0.2	0.77	0.21	17.3
084516	0.03	1.04	60	235	1.32	146	109	2.31	0.47	6	0.66	560	0.06	4.3	0.074	0.01	72	0.09	48	67	0.8	<1	0.3	<0.02	0.04	27.2
084517	1.87	0.92	70	172	1.02	147	7400	4.54	0.6	4	0.61	818	0.05	4	0.058	0.52	70.7	0.11	55	91	1.1	<1	0.2	0.98	0.39	15.6
084518	0.36	1.14	60	327	0.92	157	663	2.34	0.57	7	0.7	582	0.06	4.1	0.059	0.06	102	0.1	52	54	0.7	<1	0.3	0.27	0.02	19.5
084519	0.27	1.09	50	315	0.69	168	511	2.13	0.45	7	0.7	533	0.05	4.2	0.053	0.02	98.4	0.1	44	61	0.7	<1	0.3	0.1	0.05	20.1
084520	0.03	1.14	60	151	1.2	136	98	2.22	0.27	8	0.71	540	0.05	3.8	0.064	0.01	85.6	0.07	44	63	0.8	<1	0.3	<0.02	0.08	17.2
084524	0.02	1.32	50	528	1.64	146	54.7	2.6	0.86	7	0.68	643	0.05	4.1	0.07	0.01	134	0.15	56	62	0.6	<1	0.4	<0.02	0.04	27.6
084525	0.21	1.14	50	288	1.63	139	587	2.43	0.54	7	0.65	436	0.05	4.1	0.055	0.04	156	0.1	54	52	0.9	<1	0.3	0.16	0.11	20.7
Duplicates																										
078518	0.11	1.3	60	420	0.97	149	594	2.48	0.88	7	0.69	506	0.06	3.9	0.071	0.07	84.5	0.16	58	66	0.8	<1	0.2	0.04	0.07	26.9
084525	0.21	1.17	60	298	1.67	141	599	2.48	0.55	7	0.66	448	0.05	4.4	0.057	0.04	159	0.1	56	54	1	<1	0.3	0.16	0.07	22.2
QC																										
CH4	1.87	1.86	70	311	0.64	116	2100	4.87	1.42	13	1.2	316	0.06	51.9	0.069	0.68	10	0.23	80	199	13.6	8	0.1	0.43	1.11	27.7
Certified Values	2.13	1.85	#N/A	293	0.61	103.8	2000	4.79	1.43	12.6	1.18	324	0.06	49.57	719	0.73	9.38	0.21	79.27	189.4	9	8.14	0.11	0.51	1.17	28.18
Tolerance (%)	10.9	11.35	#N/A	14.3	14.1	12.4	10.1	10.52	11.74	29.84	12.3	11.5	50.3	12.52	27.4	13.4	23.3	23.3	13.2	11.3	17.7	13.1	241.3	19.7	12.1	10.4

Sample ID	Co ppm	Cs ppm	Ga ppm	Ge ppm	Hf ppm	Hg ppm	In ppm	La ppm	Lu ppm	Mo ppm	Nb ppm	Pb ppm	Rb ppm	Sb ppm	Sc ppm	Se ppm	Sn ppm	Ta ppm	Tb ppm	Te ppm	Th ppm	Tl ppm	U ppm	W ppm	Y ppm	Yb ppm
Method Code	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B	ICM14B
LOD	0.1	0.05	0.1	0.1	0.05	0.01	0.02	0.1	0.01	0.05	0.05	0.2	0.2	0.05	0.1	1	0.3	0.05	0.02	0.05	0.1	0.02	0.05	0.1	0.05	0.1
065151	7.1	0.53	6.2	<0.1	0.21	0.04	0.05	15	0.13	35.9	0.88	9.8	29.5	<0.05	5.7	<1	0.9	0.44	0.36	0.09	3.6	0.25	0.5	0.6	9.2	0.8
065171	8.4	0.49	7.7	0.1	0.07	0.04	0.08	12.9	0.09	7.11	0.5	2.1	42.5	<0.05	3.4	3	0.8	0.07	0.26	0.17	2.8	0.28	0.5	0.6	7.09	0.5
065172	5.7	0.31	5.2	0.1	0.09	<0.01	<0.02	7.8	0.1	5.03	0.56	1.8	21.7	<0.05	3.6	<1	0.5	<0.05	0.2	<0.05	1.7	0.14	0.36	1	6.01	0.6
065173	5.9	0.47	6.4	<0.1	<0.05	0.02	0.04	10.1	0.09	7.15	0.58	3.1	33.8	<0.05	6.8	<1	1.3	<0.05	0.27	<0.05	2	0.24	0.29	0.6	7.04	0.5
065174	5.6	0.21	6.4	0.1	<0.05	<0.01	0.02	9.5	0.1	3.49	0.27	4.1	11.9	<0.05	3.8	<1	0.5	<0.05	0.24	<0.05	2.1	0.07	0.32	0.2	7.26	0.7
065175	6.4	0.28	6.5	<0.1	<0.05	0.02	0.13	7.1	0.06	7.26	0.35	7.6	19.6	<0.05	3.3	3	1	<0.05	0.17	0.3	2	0.16	0.22	0.3	4.47	0.4
072823	6.3	0.55	5.5	<0.1	<0.05	0.02	0.03	7.4	0.07	3.76	0.47	2.8	42.2	<0.05	4	<1	0.7	<0.05	0.21	<0.05	2	0.28	0.32	<0.1	5.78	0.4
078501	4.9	0.44	4.7	<0.1	0.06	0.13	0.19	33.1	0.19	70.2	0.17	4.5	31	<0.05	4.3	4	1.5	<0.05	0.59	0.49	7.4	0.23	1.85	0.3	15.3	1.2
078502	6.3	0.47	6.5	<0.1	<0.05	<0.01	0.03	11.1	0.08	5.77	0.86	3	41.3	<0.05	5.9	<1	1.2	<0.05	0.24	<0.05	2.2	0.3	0.35	0.5	6.53	0.5
078503	6.8	0.36	6.5	<0.1	<0.05	0.03	0.1	11.6	0.11	38.2	0.28	4.2	29.3	<0.05	5.5	2	1.6	<0.05	0.31	0.11	1.8	0.2	0.46	0.3	8.57	0.7
078504	9.7	0.25	5.8	<0.1	<0.05	0.02	0.2	18.5	0.14	21.9	0.22	4	19	<0.05	5.6	3	1.4	<0.05	0.51	0.09	1.6	0.13	0.45	0.3	14.8	1
078505	6.4	0.18	8.3	<0.1	<0.05	0.02	0.1	10.6	0.07	4.16	0.1	4.4	10.2	<0.05	3.5	8	0.5	<0.05	0.22	0.65	6	0.06	0.42	0.2	5.9	0.5
078506	5.4	0.36	5.5	<0.1	<0.05	<0.01	0.09	16.8	0.09	43.6	0.29	3	25.8	<0.05	4.1	2	1	<0.05	0.27	0.08	3.6	0.19	1.29	0.5	7.34	0.6
078507	5.7	0.27	6.6	<0.1	<0.05	0.02	0.06	11.8	0.05	5.35	0.21	12.5	18.8	<0.05	3	4	0.5	<0.05	0.18	0.27	4.5	0.14	0.29	0.2	4.18	0.3
078508	6.2	0.28	5	<0.1	<0.05	<0.01	0.03	9.9	0.08	4.4	0.21	2.7	19.9	<0.05	4	<1	0.5	<0.05	0.23	<0.05	2.1	0.13	0.32	0.3	6.13	0.5
078515	5	0.28	5.5	<0.1	<0.05	0.01	0.04	12.5	0.12	2.95	<0.05	3.6	6.9	<0.05	6.2	<1	0.5	<0.05	0.34	<0.05	3	0.03	0.26	<0.1	9.58	0.7
078516	5.2	0.4	5	<0.1	<0.05	<0.01	0.02	9.3	0.05	6.75	0.42	2.1	34.8	<0.05	2.6	<1	0.6	<0.05	0.19	<0.05	2.5	0.23	0.4	0.5	4.54	0.3
078518	5.6	0.49	5.9	<0.1	<0.05	<0.01	0.05	14.1	0.08	7.68	0.66	5	40.6	<0.05	5.8	<1	1	<0.05	0.26	<0.05	4.4	0.31	0.24	0.5	6.7	0.5
078520	6.8	0.47	6.9	<0.1	<0.05	<0.01	0.11	14.2	0.16	9.7	0.37	2.9	38	<0.05	6.6	1	1.8	<0.05	0.39	<0.05	3.2	0.32	0.32	0.9	11.2	1
078521	8.8	0.3	6	<0.1	<0.05	0.02	0.11	18.8	0.12	52.1	0.25	4.7	17.4	<0.05	4.3	3	1.3	<0.05	0.44	0.05	2.3	0.12	0.3	0.3	11.5	0.8
084507	5.4	0.26	4.4	<0.1	<0.05	<0.01	0.04	14.5	0.08	10.8	0.15	2.7	17.2	<0.05	2	1	0.4	<0.05	0.29	<0.05	3	0.1	0.18	0.3	7.22	0.5
084508	6	0.31	5.5	<0.1	<0.05	<0.01	0.02	10.9	0.08	7.62	0.3	2.5	20.9	<0.05	3.6	<1	0.6	<0.05	0.22	<0.05	2.6	0.13	0.27	0.1	6.45	0.5
084509	5.6	0.31	5.3	<0.1	<0.05	<0.01	0.02	10.8	0.09	4.3	0.19	2	24.1	<0.05	3.7	<1	0.5	<0.05	0.26	<0.05	2.3	0.15	0.17	0.3	7.21	0.6
084513	5.8	0.28	5.4	<0.1	<0.05	<0.01	0.04	16.3	0.09	5.27	0.1	3	14.7	<0.05	3.6	<1	0.5	<0.05	0.27	<0.05	5.1	0.09	0.25	<0.1	7.33	0.6
084514	5.5	0.28	5.2	<0.1	<0.05	<0.01	0.03	11.8	0.08	13.1	0.22	2.4	20.7	<0.05	4	<1	0.5	<0.05	0.21	<0.05	2.8	0.13	0.2	0.1	6.01	0.5
084515	5.8	0.52	6.6	<0.1	<0.05	<0.01	0.06	9	0.07	4.04	0.41	2.6	31.8	<0.05	4.3	4	0.7	<0.05	0.21	0.34	2.8	0.25	0.2	1.1	5.38	0.4
084516	5.3	0.3	5.3	<0.1	<0.05	<0.01	<0.02	14.7	0.08	4.17	0.22	2.9	21.5	<0.05	3.6	<1	0.5	<0.05	0.23	<0.05	3.3	0.14	0.23	0.2	5.96	0.5
084517	5.6	0.5	6.4	0.1	<0.05	<0.01	0.08	8.2	0.06	4.26	0.51	3.3	28.7	<0.05	3.9	6	0.6	<0.05	0.16	0.5	3.9	0.24	0.2	0.8	4.38	0.3
084518	5.6	0.39	5.8	<0.1	<0.05	0.01	0.02	9.8	0.1	4.57	0.33	2.2	25.3	<0.05	4.2	1	0.7	<0.05	0.29	0.17	2.5	0.17	0.18	0.1	7.73	0.6
084519	5.2	0.31	5.4	<0.1	<0.05	<0.01	<0.02	10.9	0.06	4.58	0.34	2.5	20.7	<0.05	2.8	<1	0.5	<0.05	0.2	<0.05	2.6	0.13	0.22	0.3	4.76	0.4
084520	5.7	0.22	6	<0.1	<0.05	<0.01	<0.02	9.3	0.06	3.8	0.18	4.4	13.5	<0.05	2.7	<1	0.4	<0.05	0.17	<0.05	1.8	0.08	0.2	<0.1	4.75	0.4
084524	6.2	0.62	6.4	<0.1	<0.05	<0.01	0.03	14.1	0.14	4.14	0.65	3.2	40.8	<0.05	5.2	<1	0.9	<0.05	0.39	<0.05	3.7	0.28	0.2	0.6	10.8	0.9
084525	5.7	0.36	6.2	<0.1	<0.05	<0.01	0.04	10.9	0.08	4.57	0.39	3.6	26.4	<0.05	6.2	<1	0.9	<0.05	0.24	0.06	2.5	0.18	2.16	0.3	6.93	0.5
Duplicates																										
078518	5.6	0.5	6.1	<0.1	<0.05	<0.01	0.05	14.4	0.09	8.27	0.65	5	41.2	<0.05	5.8	<1	1	<0.05	0.27	<0.05	4.4	0.31	0.24	0.5	6.83	0.5
084525	5.9	0.39	6.5	<0.1	<0.05	<0.01	0.04	11.9	0.09	4.66	0.41	3.7	27.2	<0.05	6.3	<1	0.9	<0.05	0.26	<0.05	2.7	0.19	2.91	0.3	7.35	0.5
QC																										
CH4	21.9	2.58	8.6	0.2	0.31	<0.01	0.1	14.4	0.07	3.38	0.19	7.8	65.9	0.32	8.1	2	0.6	<0.05	0.3	0.36	2.3	0.38	0.32	2.5	6.01	0.4
Certified Values	22.8	2.6	8.72	0.21	0.29	#N/A	0.1	14	#N/A	3.05	0.19	8.24	67	0.34	7.99	1.57	0.6	0.3	0.27	0.42	2.2	0.4	0.29	2.15	5.66	#N/A
Tolerance (%)	11.1	14.8	12.9	127.4	52.8	#N/A	62.1	11.8	#N/A	14.1	75	16.1	10.7	47.3	13.1	169.6	134.5	51.7	28.4	39.6	21.2	22.6	52.9	21.6	12.2	#N/A

CLIENT : **Minto Mines**
PROJECT : **Minto Project**
SGS PROJECT # : **0643**
Test : **Leachate Analysis by ICP-OES**
Date : **February 21, 2014**

Sample ID		065172	NP Contribution	078501	NP Contribution	078515	NP Contribution	084515	NP Contribution
Al	mg/L	32.4		29.2		37.8		38.1	
Sb	mg/L	< 0.02		< 0.02		< 0.02		< 0.02	
As	mg/L	< 0.01		0.13		0.04		0.05	
Ba	mg/L	0.104		0.0727		0.0635		0.114	
Be	mg/L	0.0031		0.0062		0.0147		0.0066	
Bi	mg/L	0.11		0.15		0.24		0.34	
B	mg/L	0.766		1.52		1.41		2.38	
Cd	mg/L	< 0.001		0.005		0.002		0.004	
Ca	mg/L	248	6.2	526	13.1	545	13.6	539	13.4
Cr	mg/L	0.233		0.145		0.295		0.202	
Co	mg/L	0.025		0.031		0.040		0.056	
Cu	mg/L	0.154		10.1		2.32		14.1	
Fe	mg/L	65.5		113		135		194	
Pb	mg/L	< 0.007		0.027		0.021		0.016	
Li	mg/L	< 0.1		< 0.1		< 0.1		< 0.1	
Mg	mg/L	18.4	0.8	54.7	2.3	39.2	1.6	43.9	1.8
Mn	mg/L	3.61		18.3		15.8		11.7	
Mo	mg/L	< 0.01		< 0.01		< 0.01		< 0.01	
Ni	mg/L	0.067		0.043		0.070		0.048	
P	mg/L	0.168		0.025		0.020		0.496	
K	mg/L	37.6	1.0	44.8	1.1	28.6	0.7	47.7	1.2
Se	mg/L	< 0.01		0.01		< 0.01		< 0.01	
Si	mg/L	39.8		44.6		46.9		60.8	
Ag	mg/L	< 0.08		< 0.08		< 0.08		< 0.08	
Na	mg/L	19.3	0.8	15.1	0.7	25.3	1.1	24.1	1.0
Sr	mg/L	2.43		3.59		6.67		4.01	
S	mg/L	370		727		726		802	
Tl	mg/L	< 0.005		0.03		0.02		0.01	
Sn	mg/L	< 0.03		< 0.03		< 0.03		< 0.03	
Ti	mg/L	0.019		0.009		0.002		0.020	
U	mg/L	< 0.02		< 0.02		< 0.02		< 0.02	
V	mg/L	0.055		0.061		0.020		0.134	
Zn	mg/L	0.202		0.343		0.421		0.718	
Zr	mg/L	< 0.007		< 0.007		< 0.007		< 0.007	
NP from Ca, Mg, Na & K (kg CaCO3 Equiv./tonne)			**8.7**		**17.2**		**17.0**		**17.5**

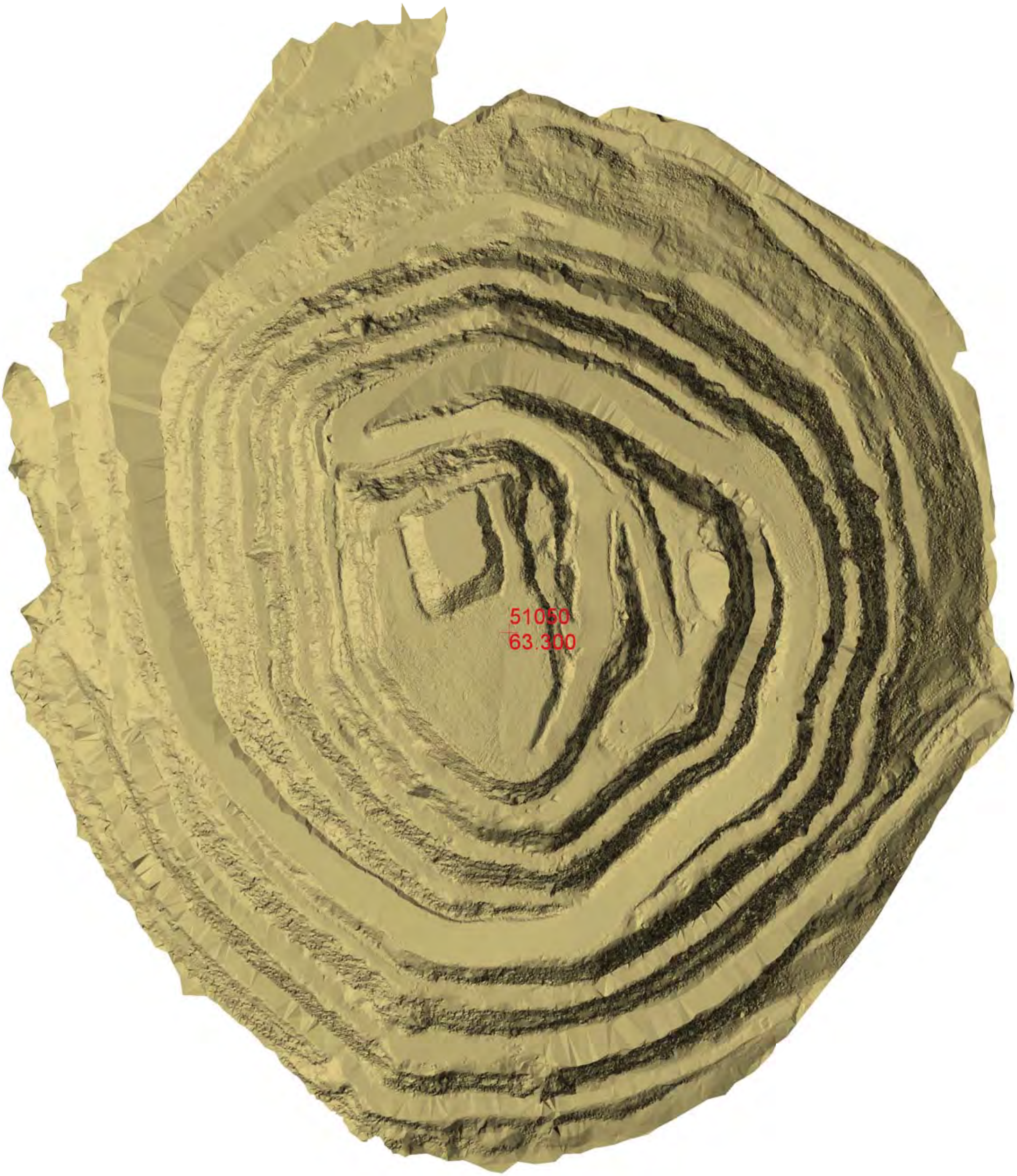
Appendix C: Bench Maps for All Samples Analyzed in 2013

CAPSTONE MINING CORP.
MINTO MINE

N

DRAWN BY: MB	DATE: 03-Mar-2014
CHECKED BY:	DRAWING#:
DESIGNED BY:	SCALE: 1:2500

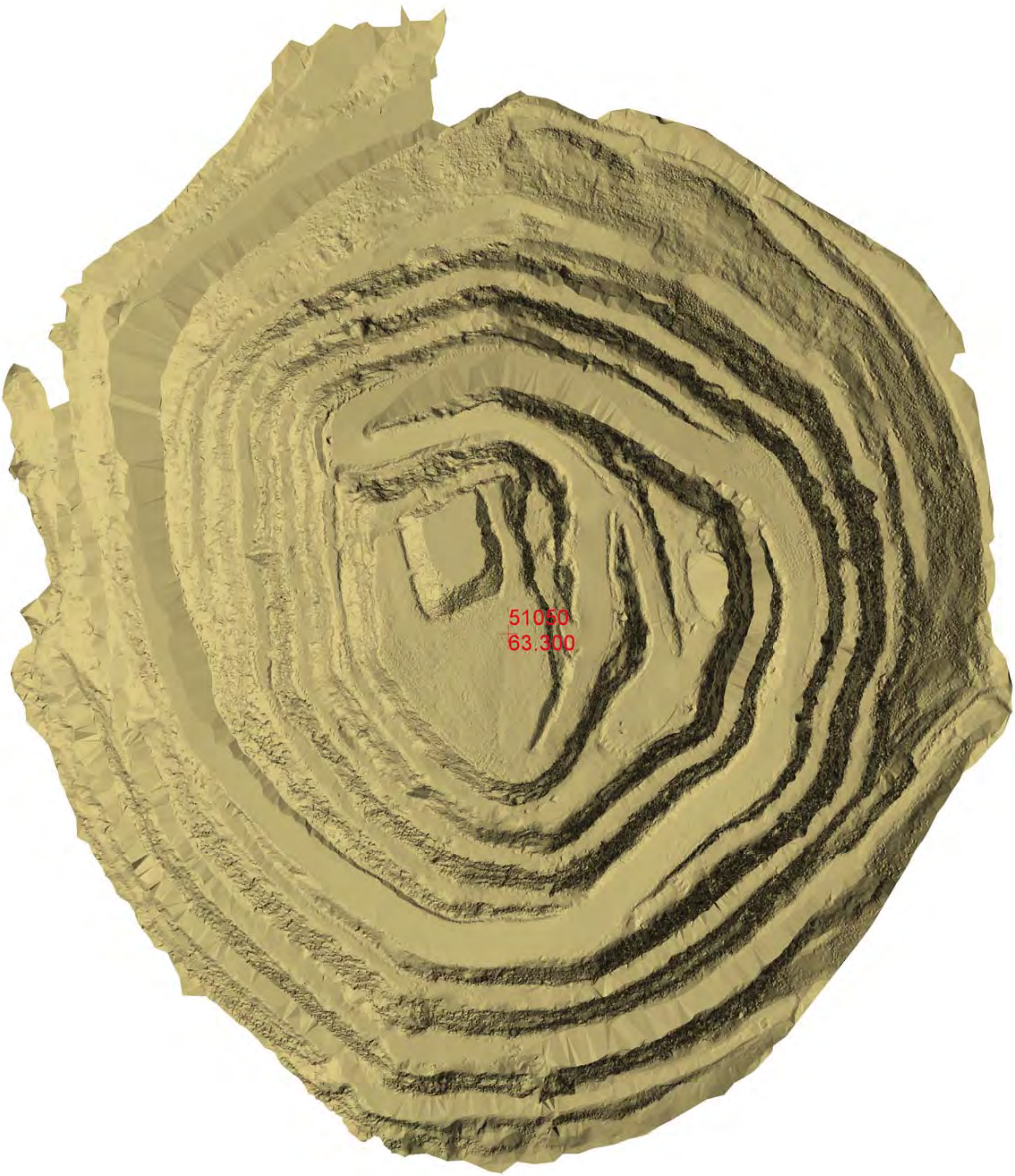
706 ABA



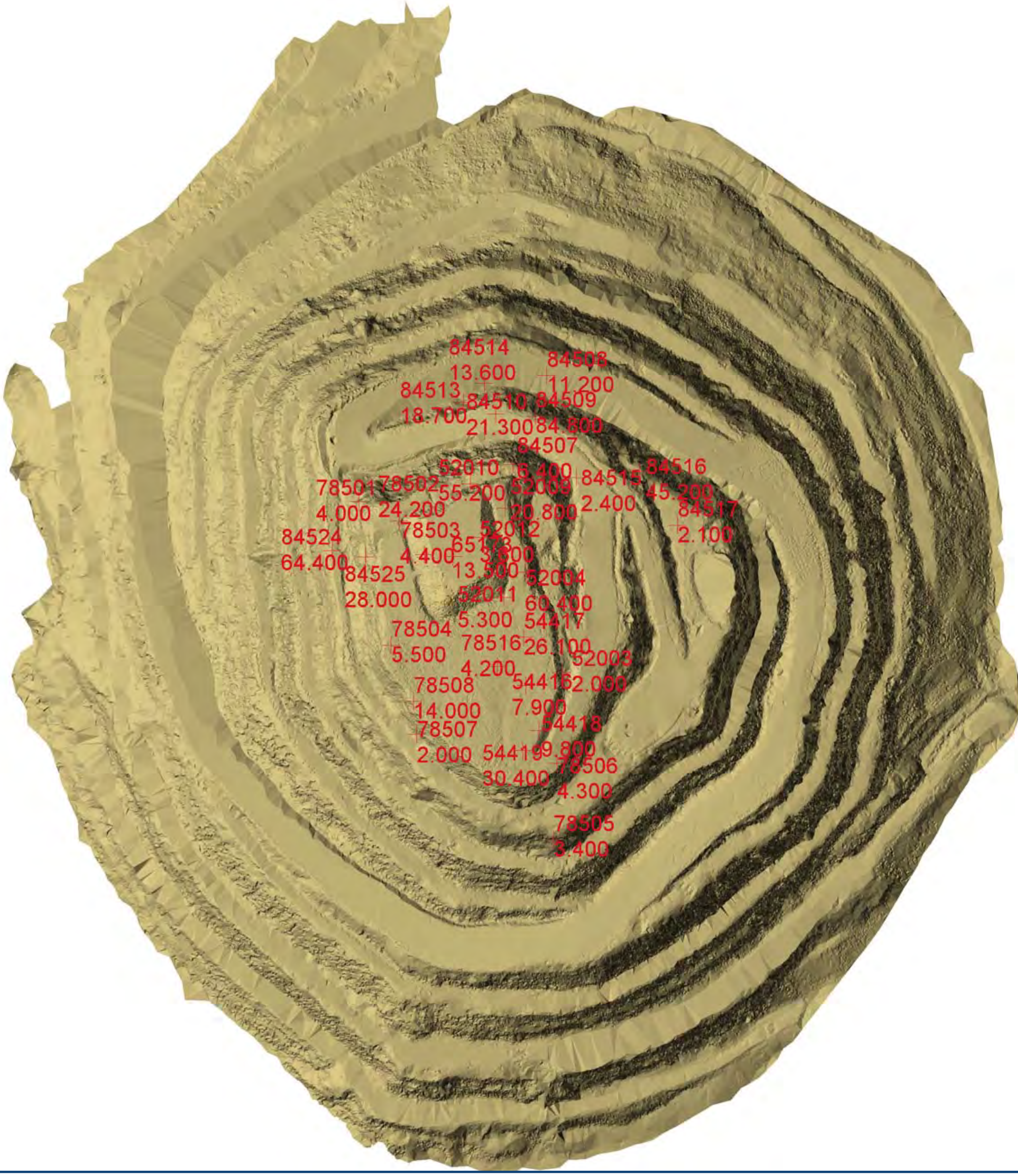
CAPSTONE MINING CORP.
MINTO MINE

N

DRAWN BY:	DATE:	
MB	03-Mar-2014	715 ABA
CHECKED BY:	DRAWING#:	
DESIGNED BY:	SCALE: 1:2500	



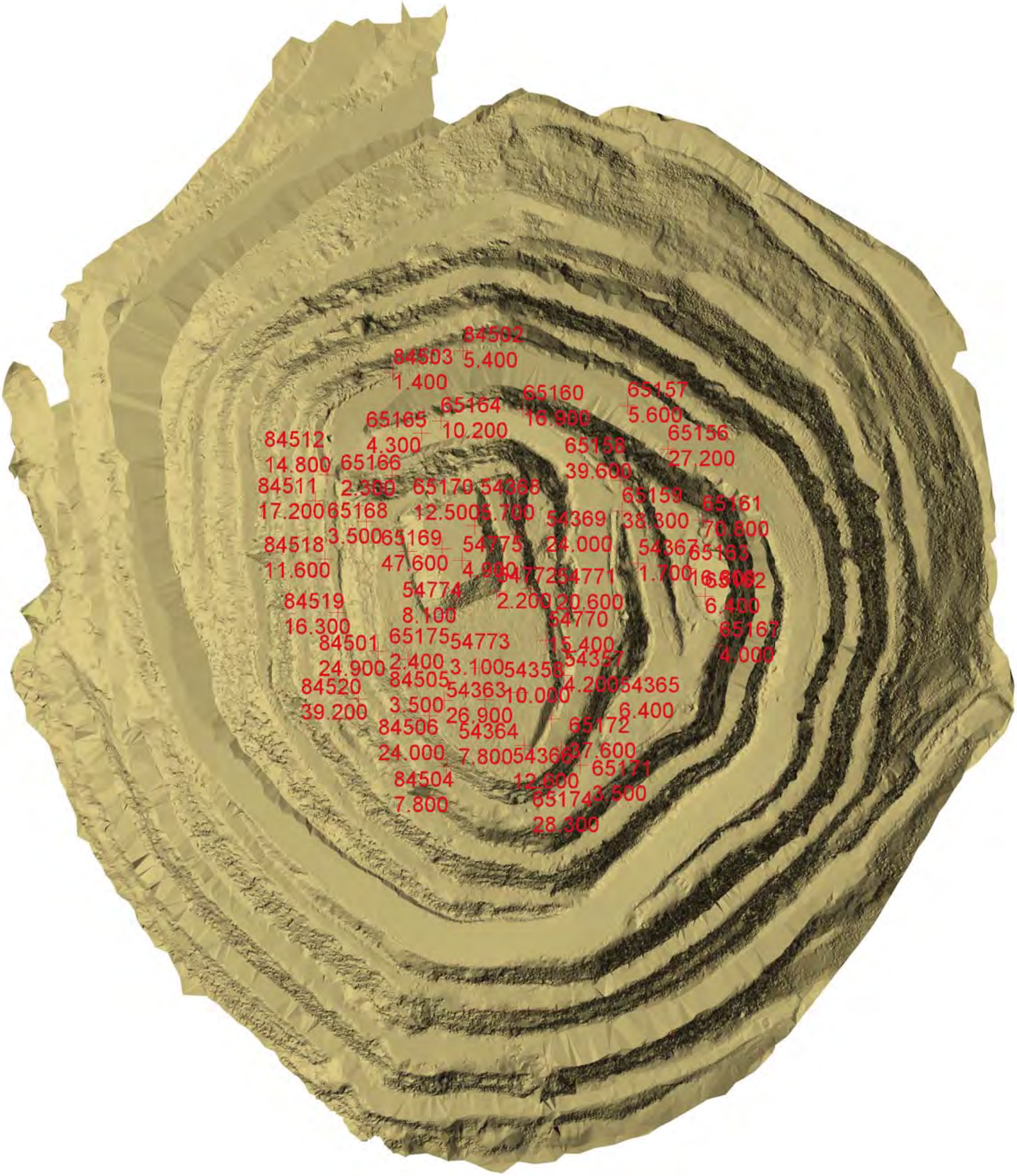
CAPSTONE MINING CORP. MINTO MINE	N	DRAWN BY: MB	DATE: 03-Mar-2014	721 ABA
		CHECKED BY:	DRAWING#:	
		DESIGNED BY:	SCALE: 1:2500	



CAPSTONE MINING CORP.
MINTO MINE

N

DRAWN BY: MB	DATE: 03-Mar-2014	727 ABA
CHECKED BY:	DRAWING#:	
DESIGNED BY:	SCALE: 1:2500	

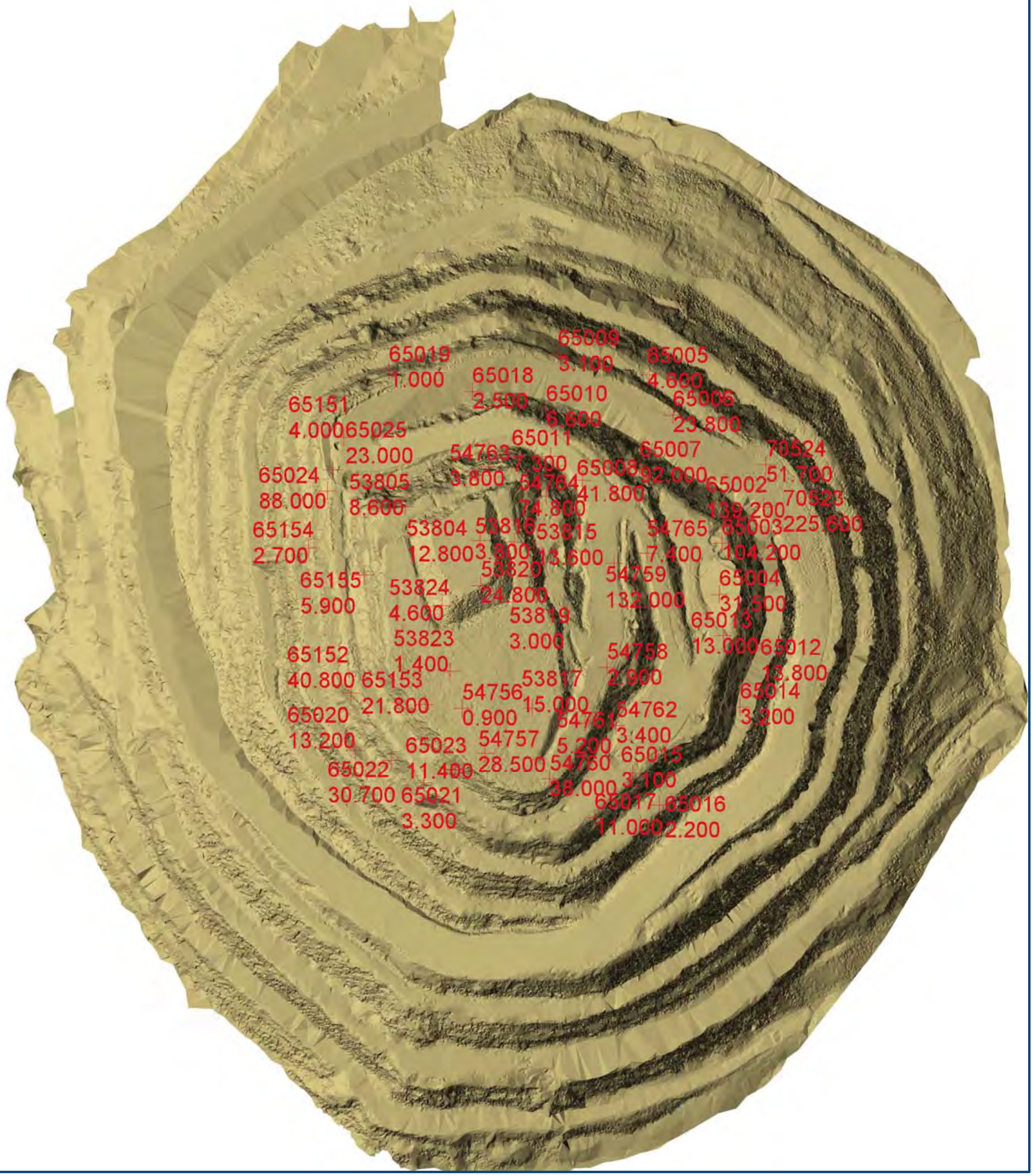


CAPSTONE MINING CORP.
MINTO MINE

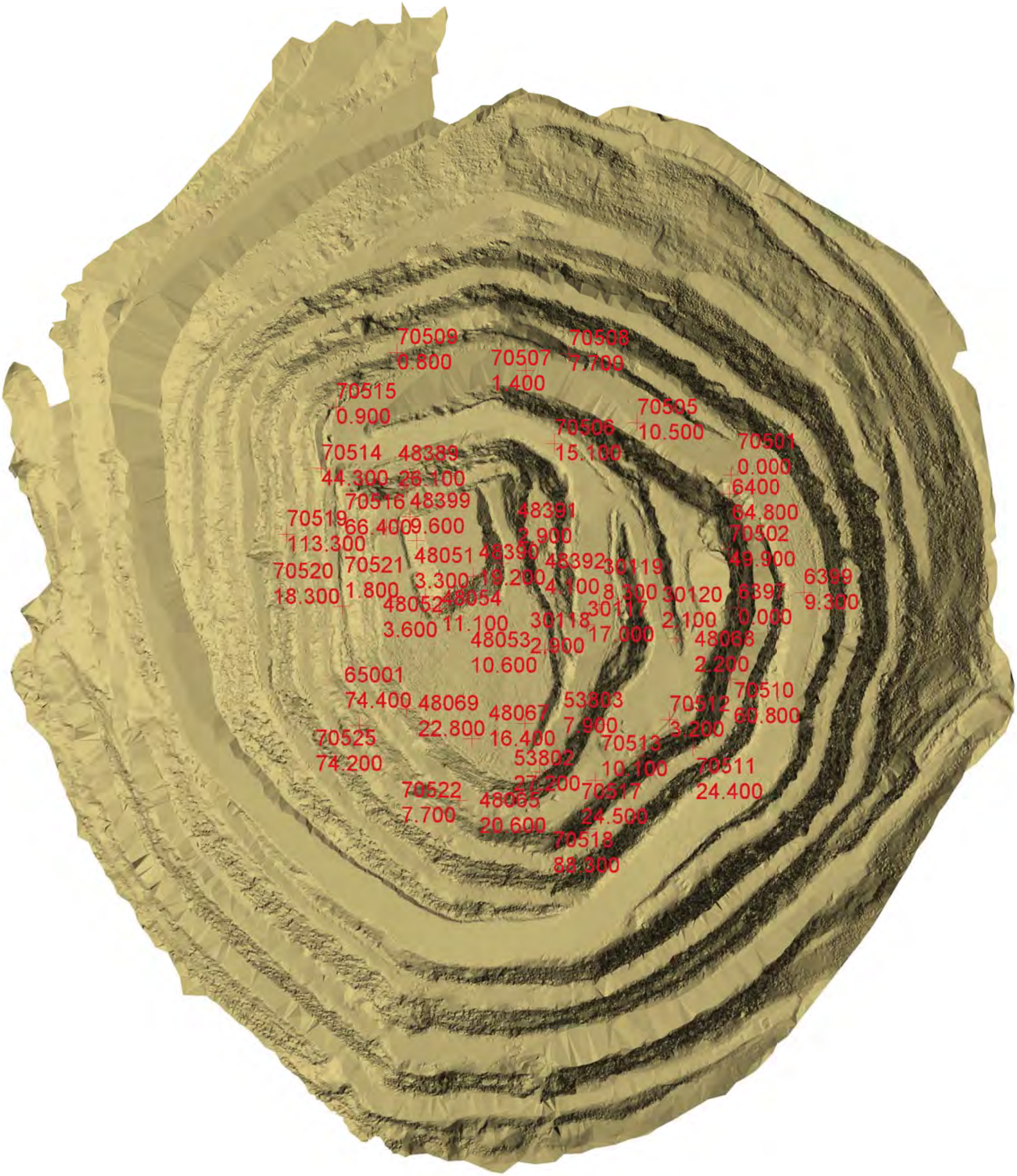
N

DRAWN BY: MB	DATE: 03-Mar-2014
CHECKED BY:	DRAWING#:
DESIGNED BY:	SCALE: 1:2500

733 ABA



CAPSTONE MINING CORP. MINTO MINE	N	DRAWN BY: MB	DATE: 03-Mar-2014	739 ABA
		CHECKED BY:	DRAWING#:	
		DESIGNED BY:	SCALE: 1:2500	

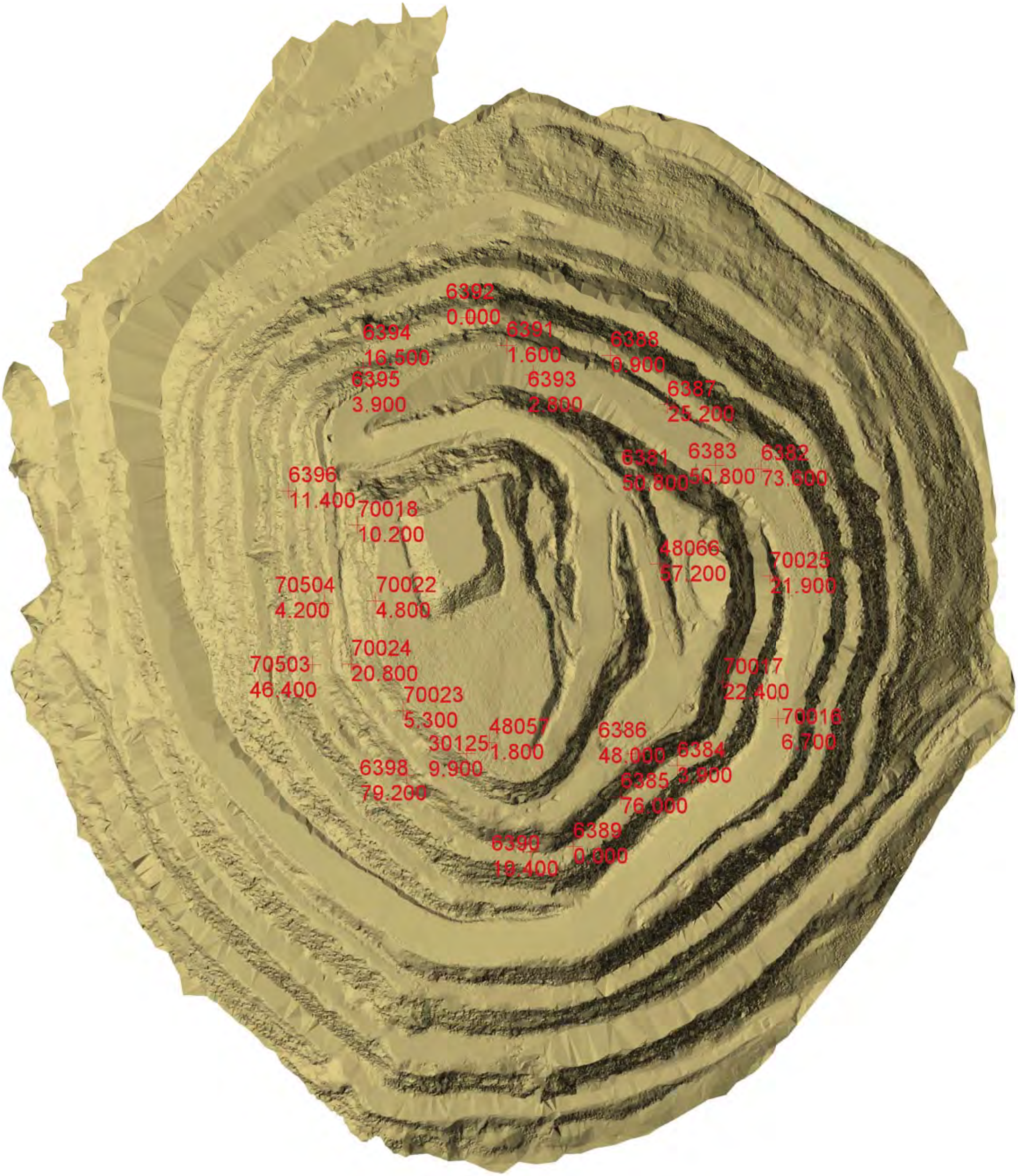


CAPSTONE MINING CORP.
MINTO MINE

N

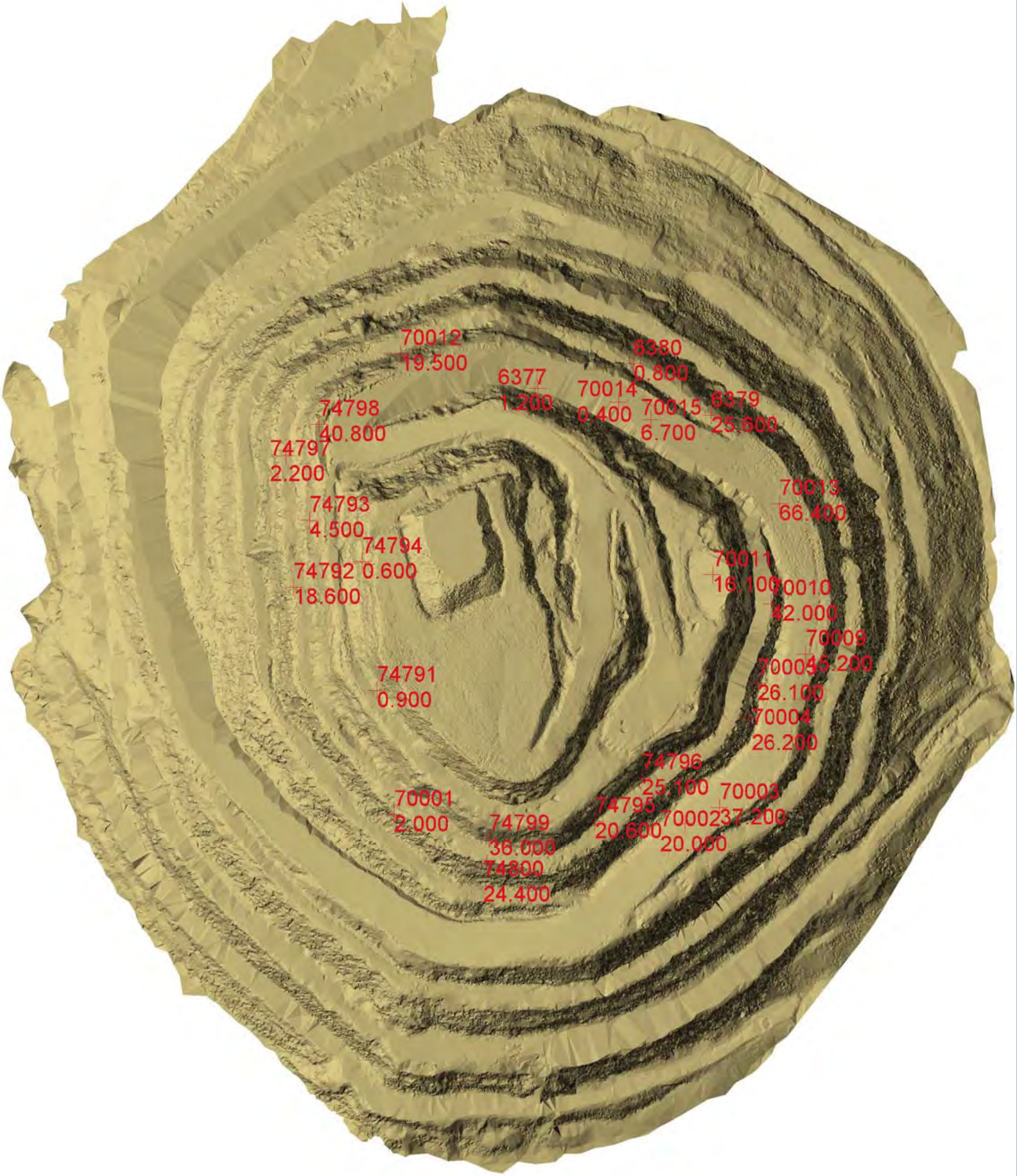
DRAWN BY:	DATE:
MB	03-Mar-2014
CHECKED BY:	DRAWING#:
DESIGNED BY:	SCALE: 1:2500

745 ABA

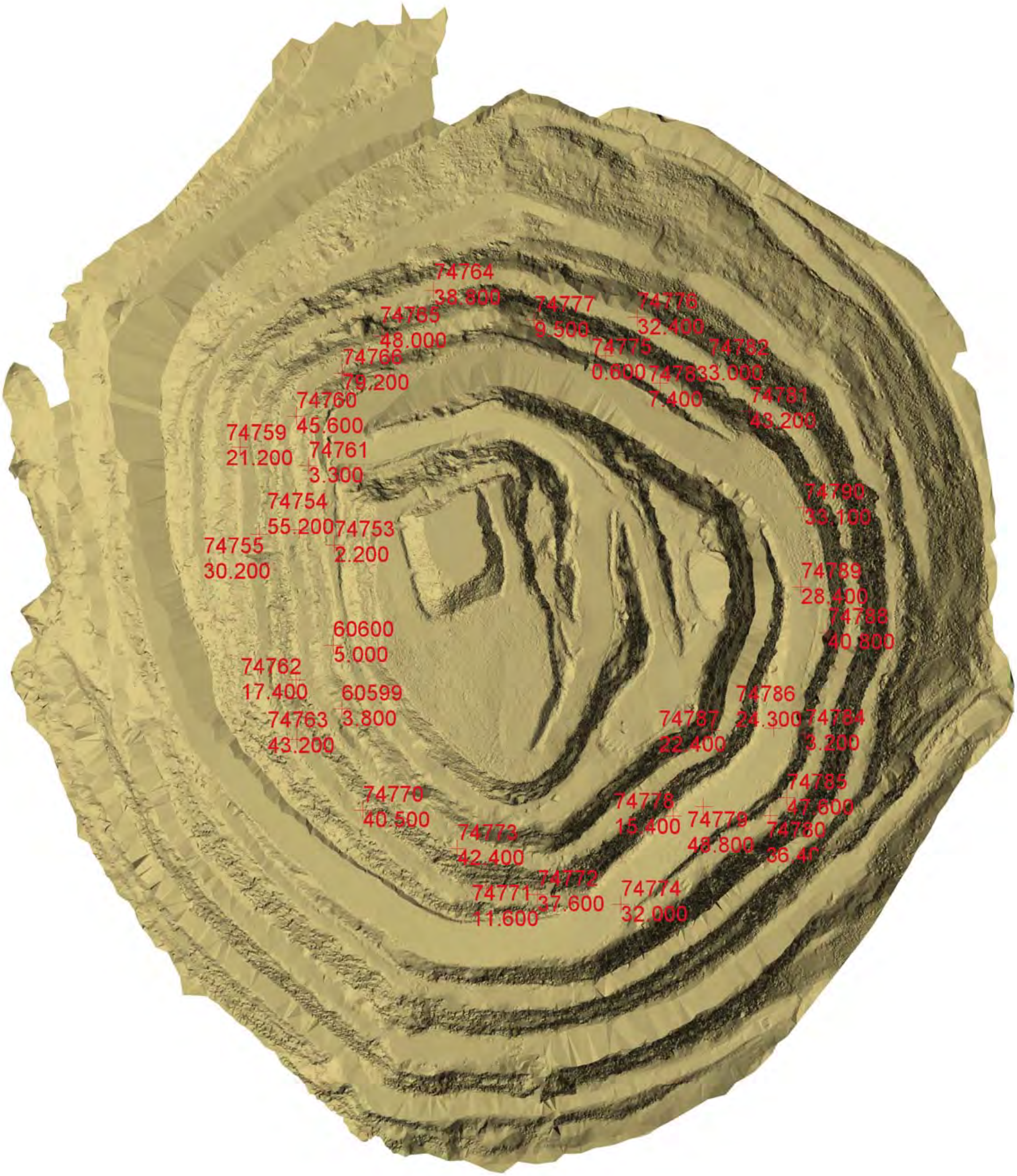


CAPSTONE MINING CORP. MINTO MINE	N	DRAWN BY: MB	DATE: 03-Mar-2014
		CHECKED BY:	DRAWING#:
		DESIGNED BY:	SCALE: 1:2500

751 ABA



CAPSTONE MINING CORP. MINTO MINE	N	DRAWN BY: MB	DATE: 04-Mar-2014	757 ABA
		CHECKED BY:	DRAWING#:	
		DESIGNED BY:	SCALE: 1:2500	

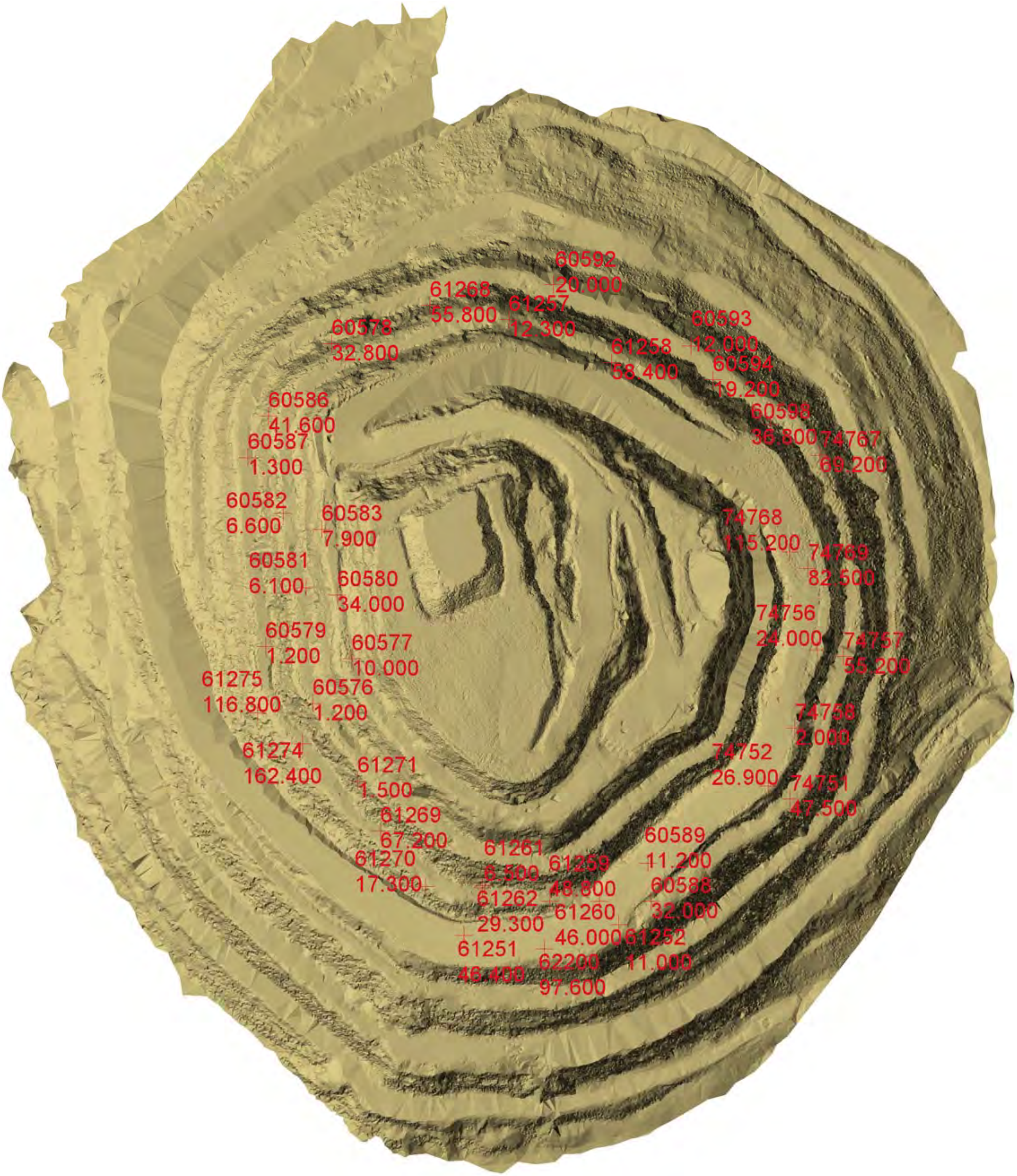


CAPSTONE MINING CORP.
MINTO MINE

N

DRAWN BY:	DATE:
MB	04-Mar-2014
CHECKED BY:	DRAWING#:
DESIGNED BY:	SCALE: 1:2500

763 ABA



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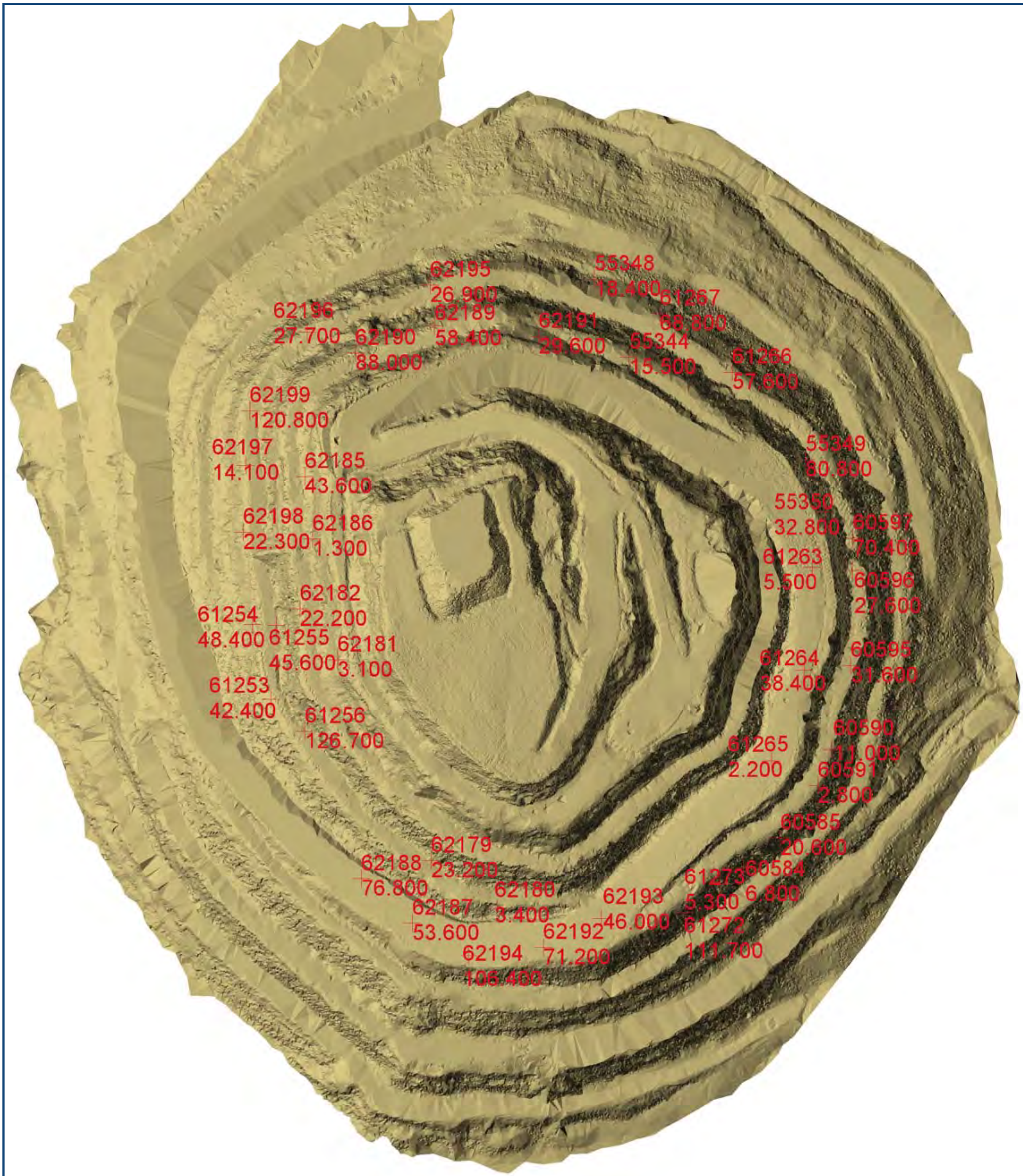
		DESIGNED BY:	SCALE: 1:2500	



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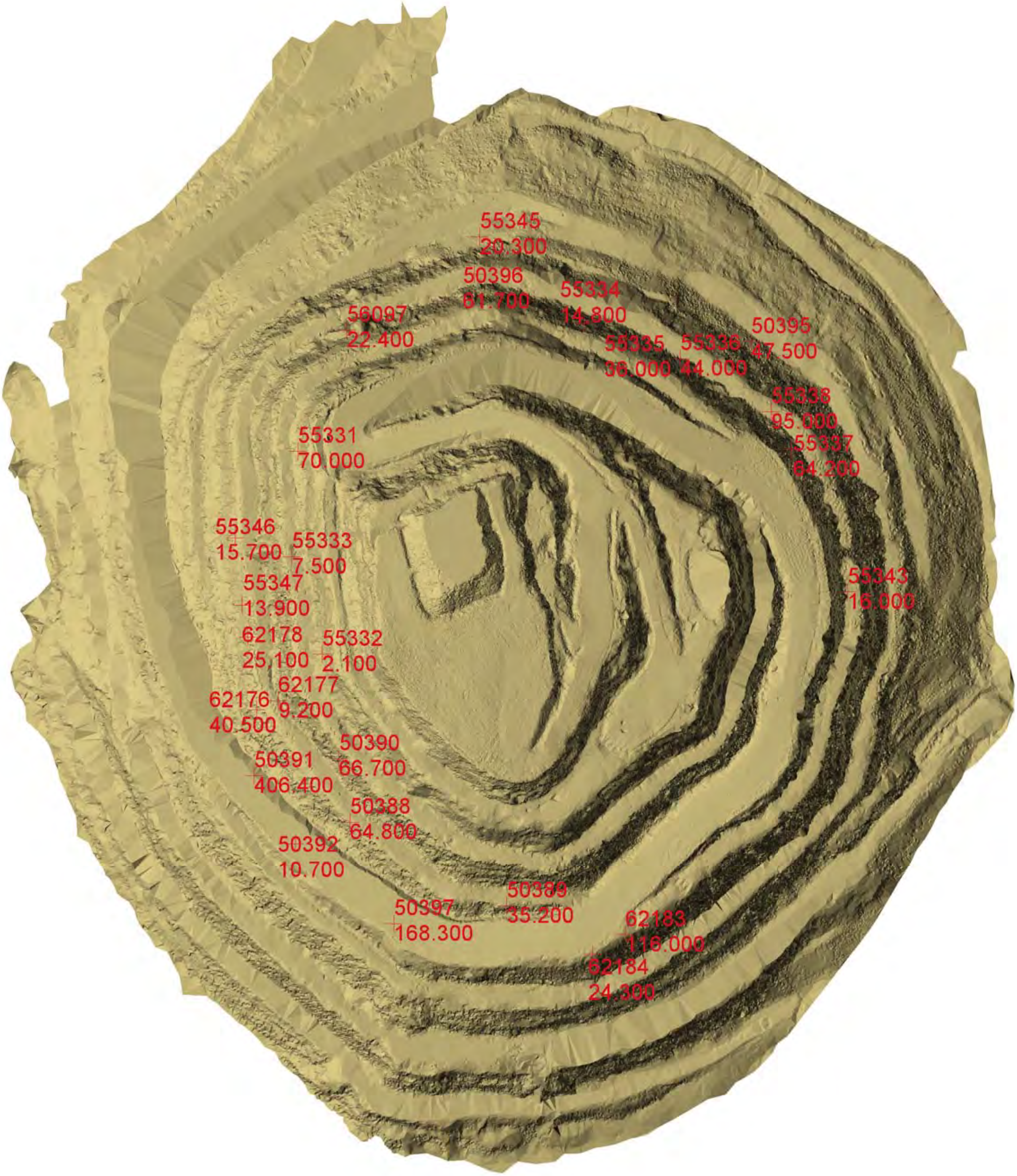
		DESIGNED BY:	SCALE: 1:2500	



CAPSTONE MINING CORP. MINTO MINE	N	DRAWN BY: MB	DATE: 04-Mar-2014	781
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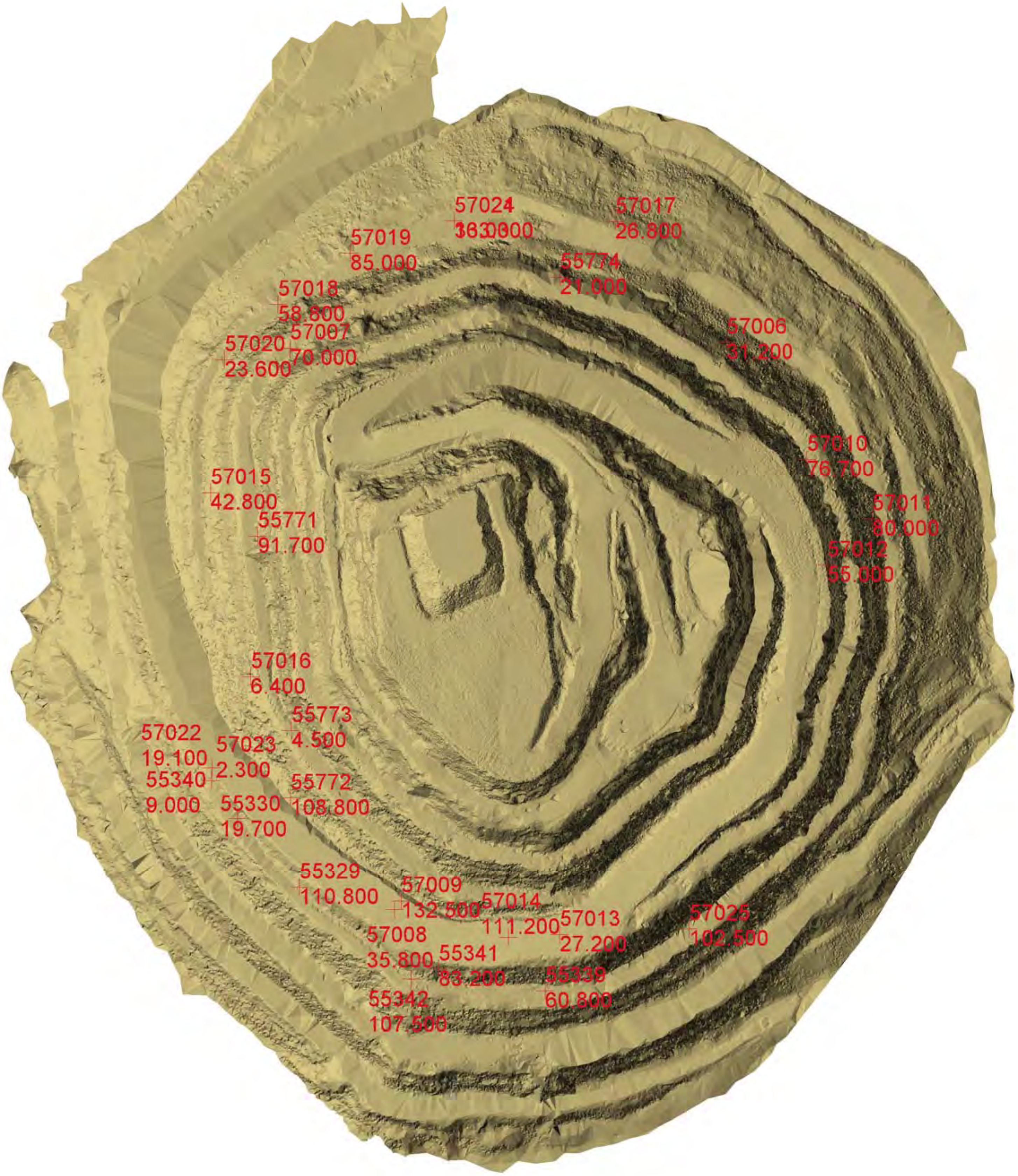

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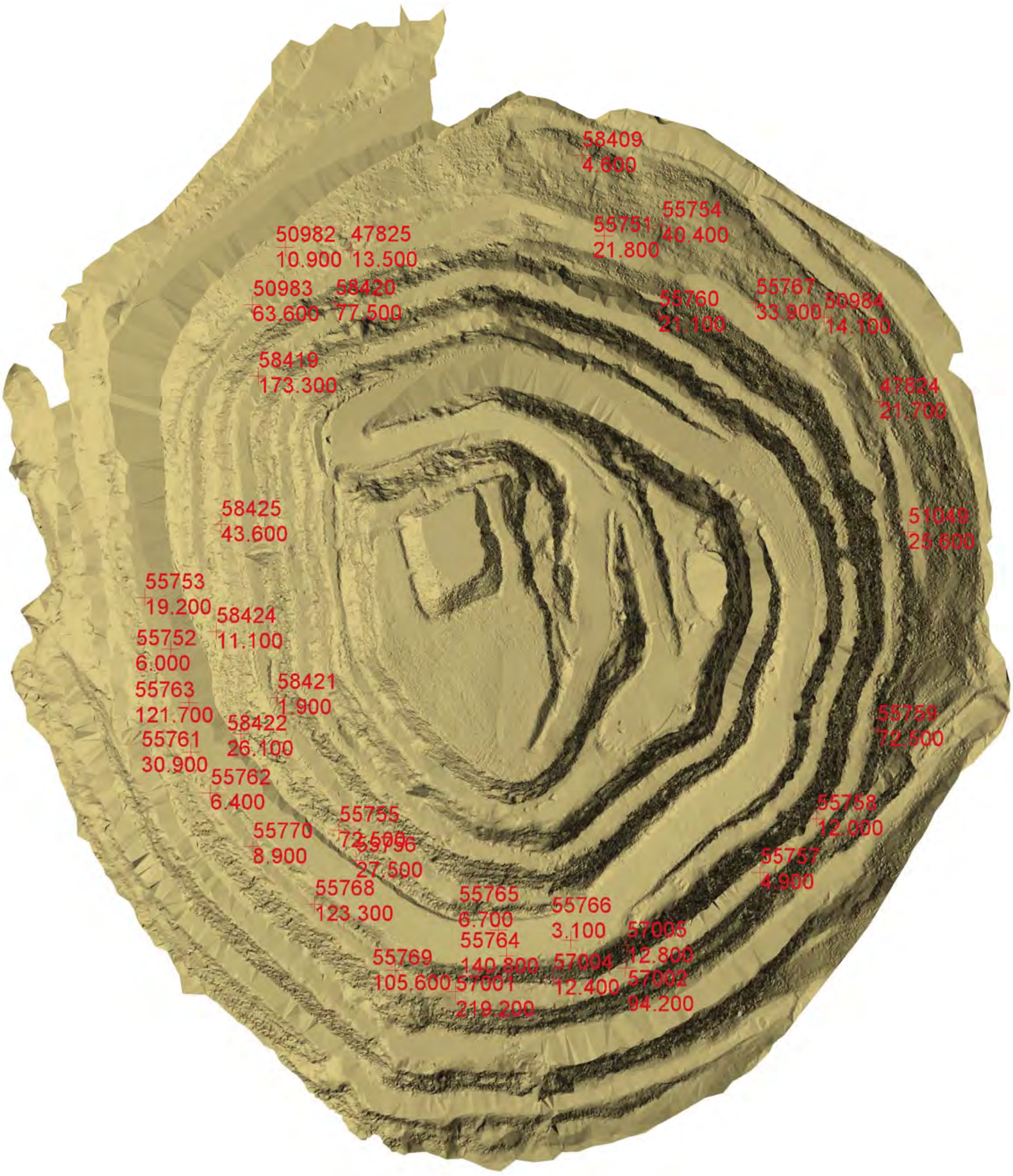
		CHECKED BY:	DRAWING#:
		DESIGNED BY:	SCALE: 1:2500

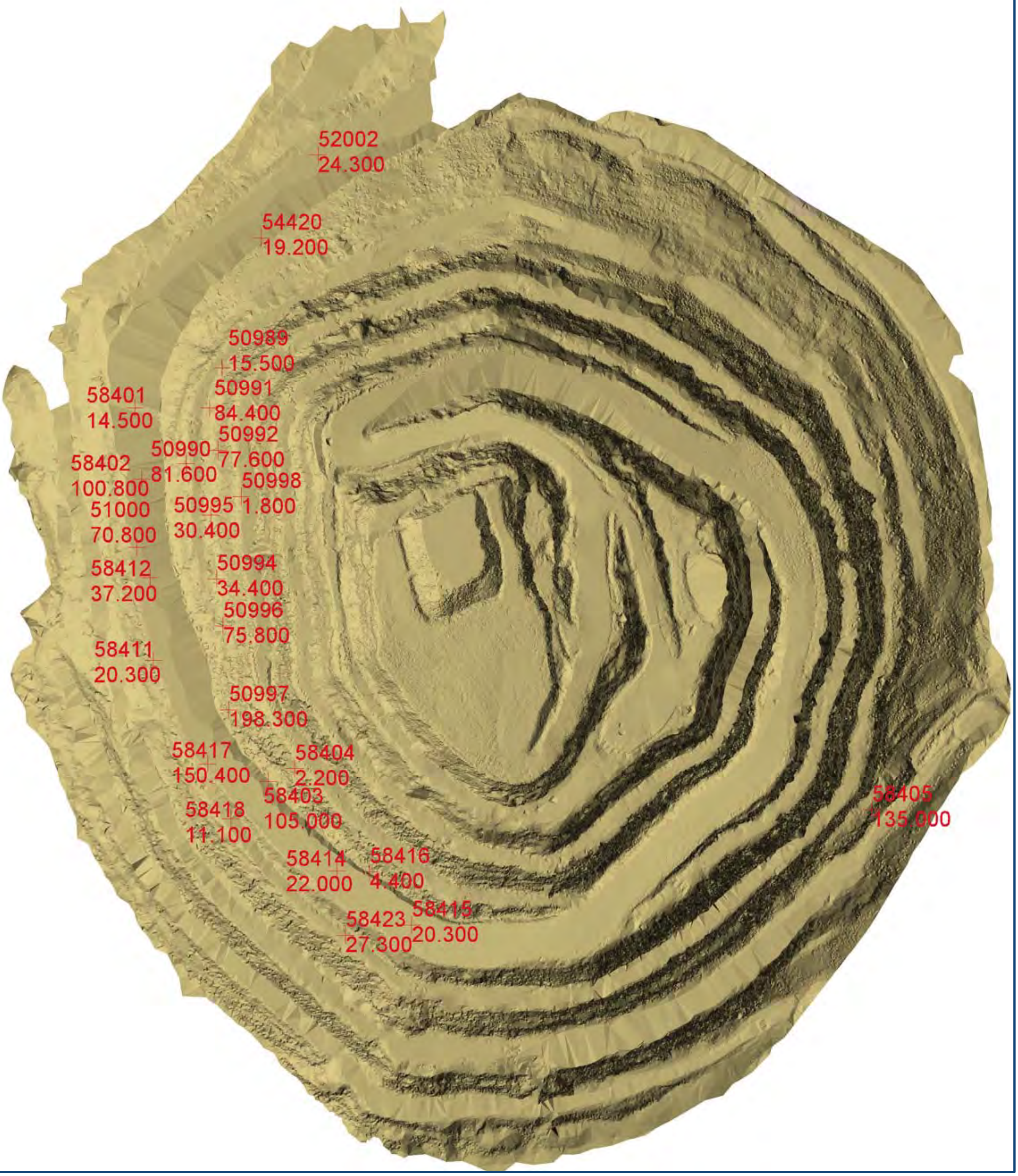
787



CAPSTONE MINING CORP.
MINTO MINE

N

DRAWN BY: MB	DATE: 04-Mar-2014	793
CHECKED BY:	DRAWING#:	
DESIGNED BY:	SCALE: 1:2500	



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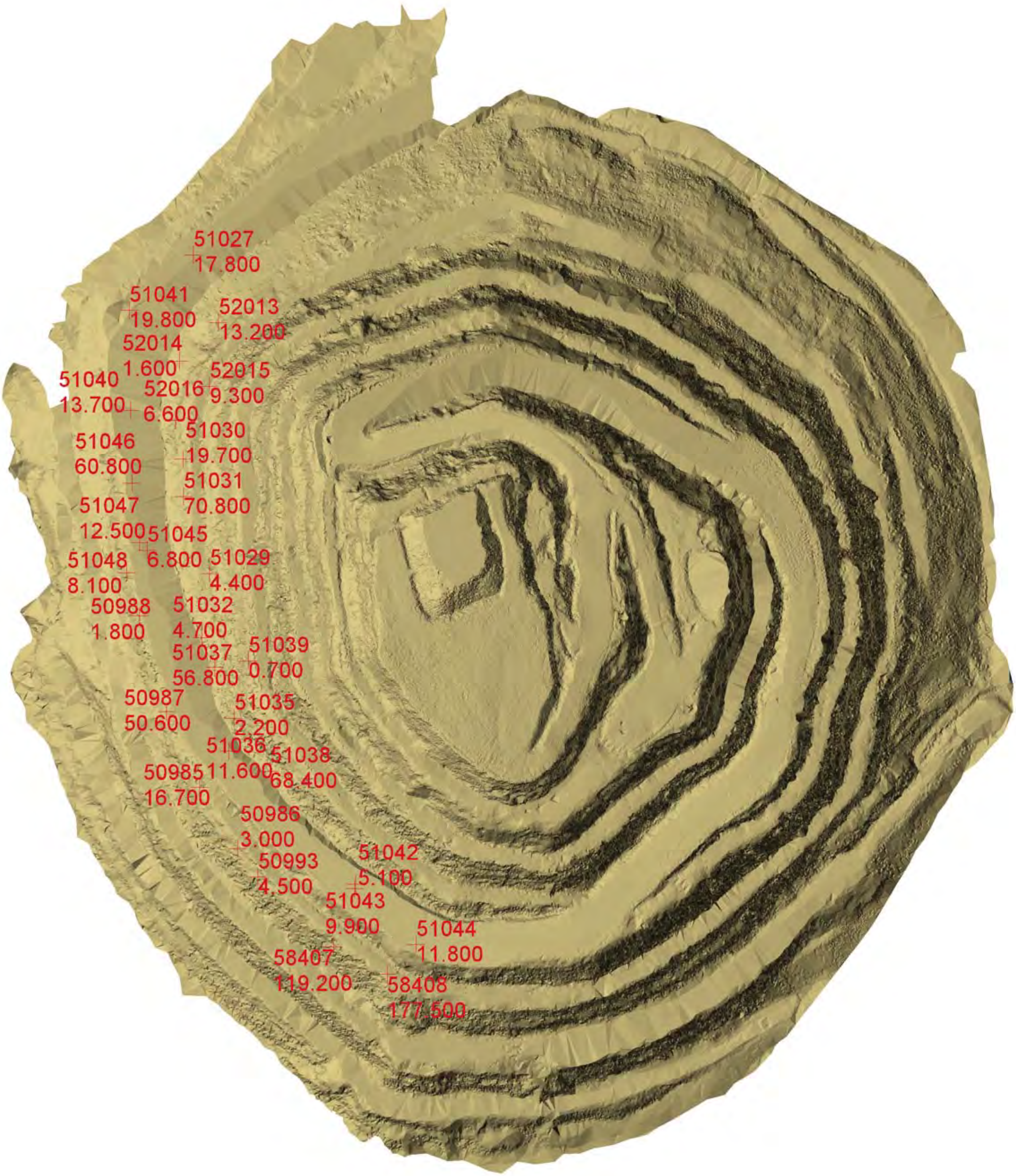
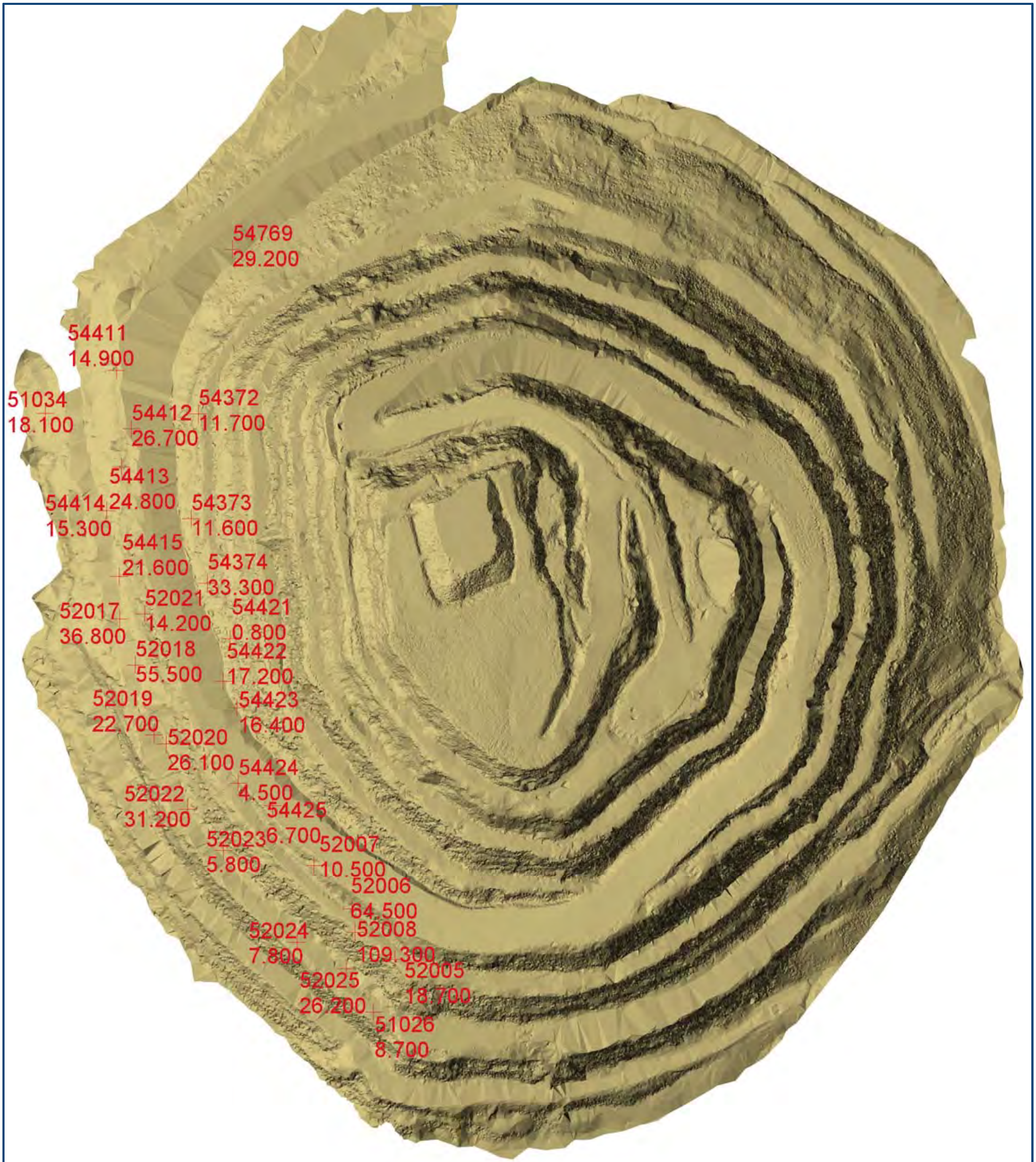


CAPSTONE MINING CORP. MINTO MINE	N	DRAWN BY: MB	DATE: 04-Mar-2014
		CHECKED BY:	DRAWING#:
		DESIGNED BY:	SCALE: 1:2500

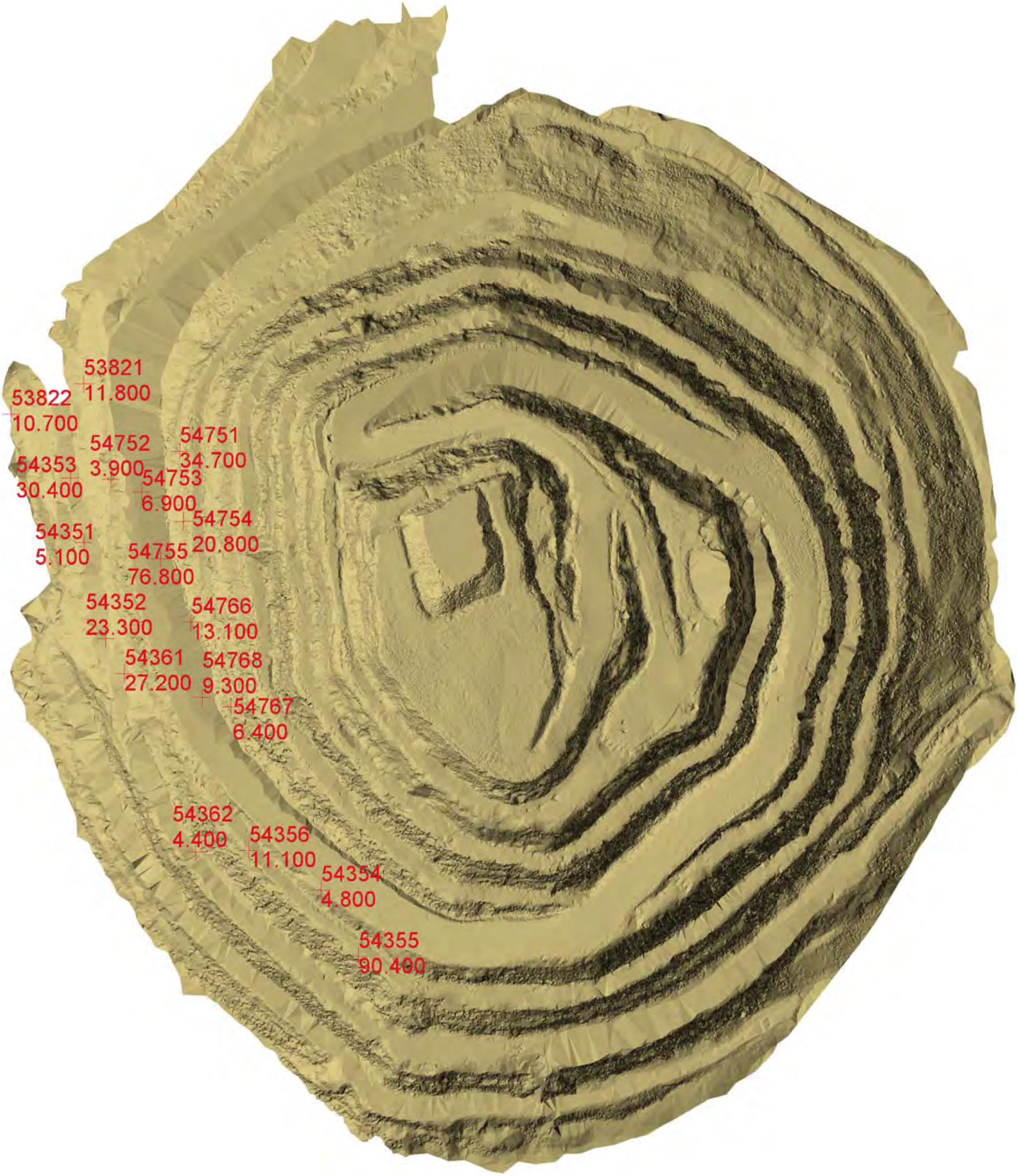


CAPSTONE MINING CORP.
MINTO MINE

N

DRAWN BY: MB	DATE: 04-Mar-2014
CHECKED BY:	DRAWING#:
DESIGNED BY:	SCALE: 1:2500

811



CAPSTONE MINING CORP. MINTO MINE	N	DRAWN BY: MB	DATE: 04-Mar-2014	817
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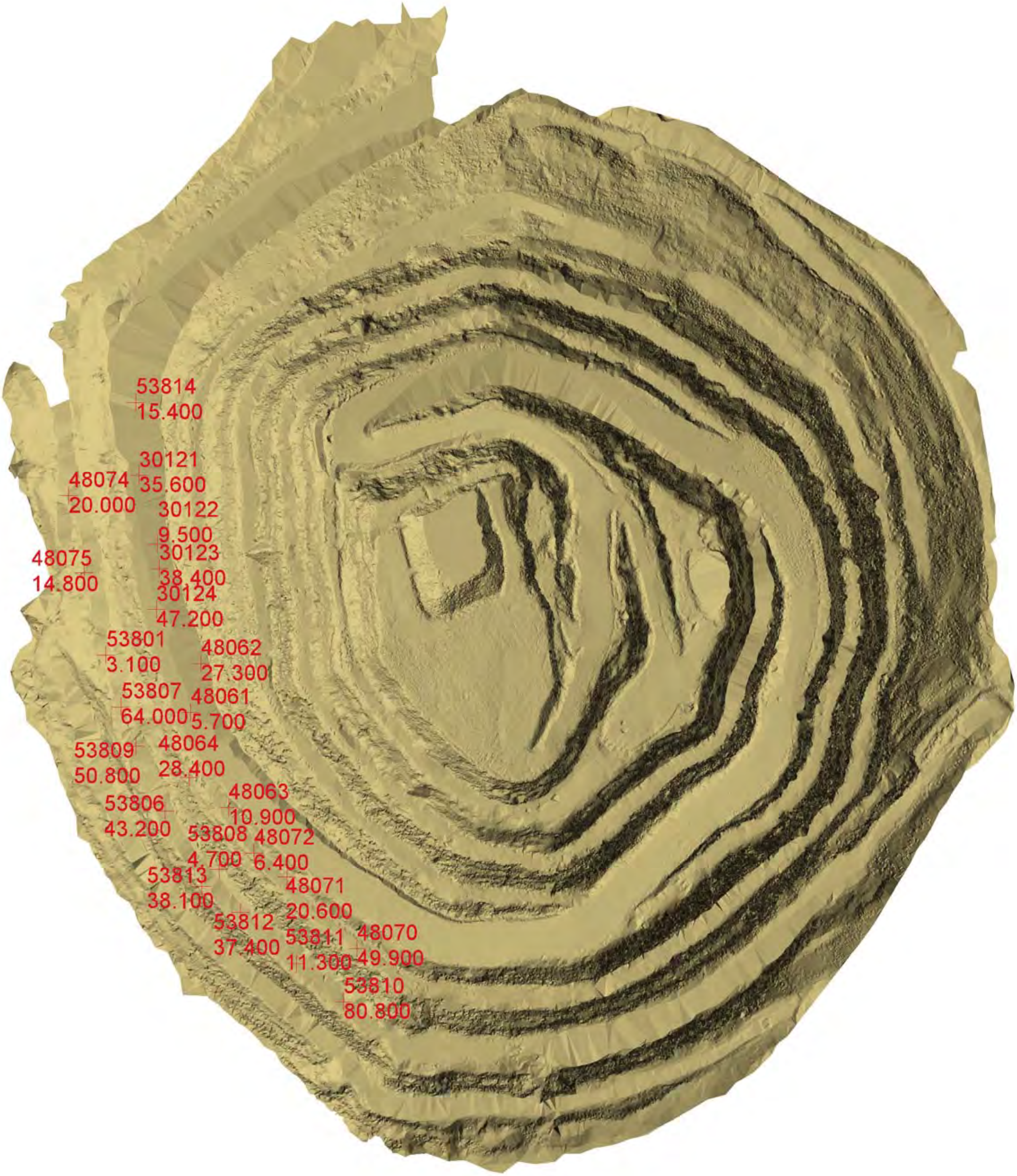

CAPSTONE MINING CORP. MINTO MINE	N	DRAWN BY: MB	DATE: 04-Mar-2014	823
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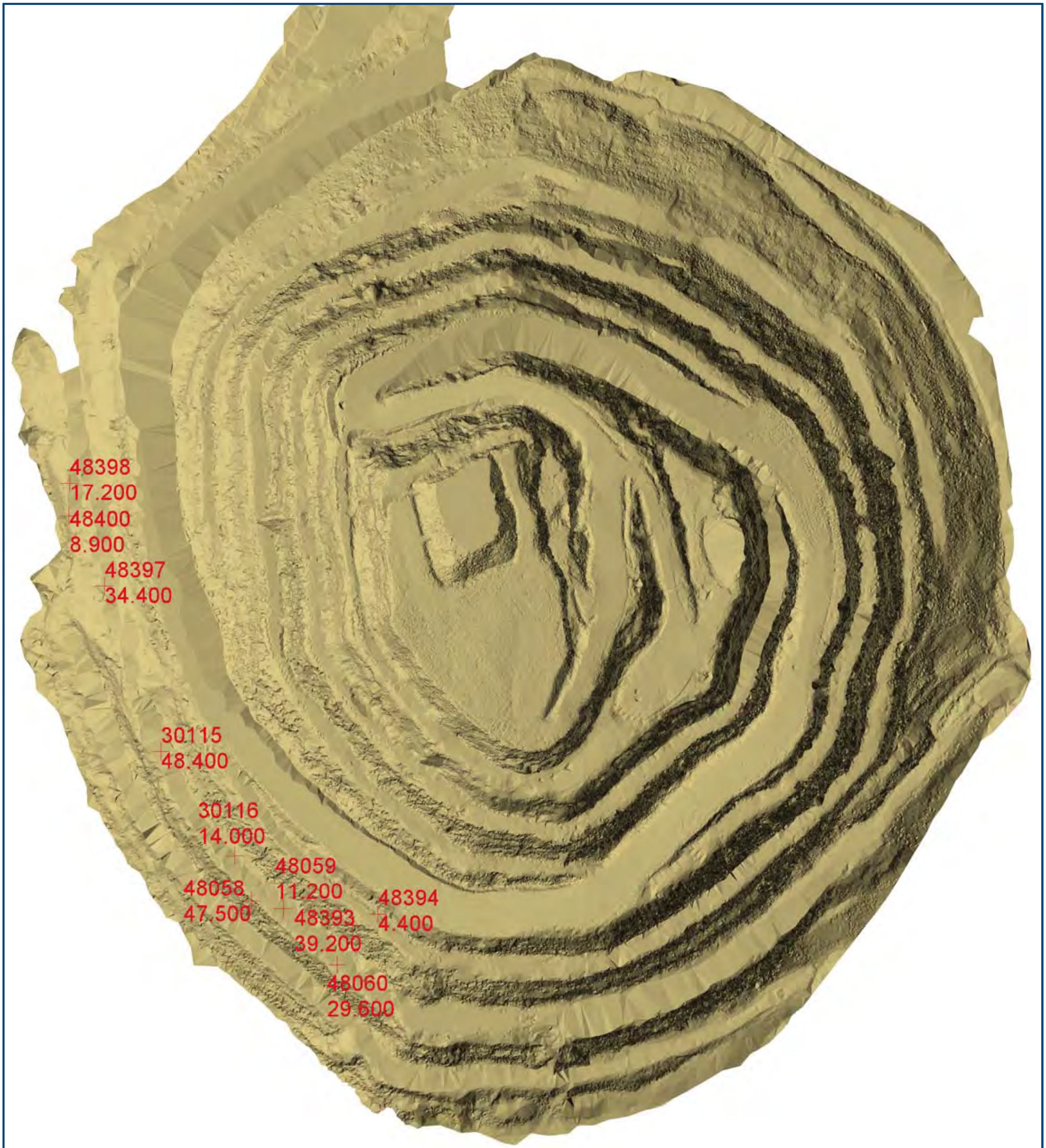

CAPSTONE MINING CORP.
MINTO MINE

N

DRAWN BY:	DATE:
MB	04-Mar-2014
CHECKED BY:	DRAWING#:
DESIGNED BY:	SCALE: 1:2500

829

Appendix D: ICP Results for January to October 2013

Appendix C: Leachate Analysis by ICP-OES

		Sample ID and NP Contribution																											
Sample No.		48397	NP	48389	NP	48061	NP	48059	NP	30115	NP	48069	NP	53815	NP	53808	NP	54756	NP	54763	NP	54353	NP	52003	NP	54418	NP	52013	NP
Al	mg/L	23.8		25.8		28.0		26.5		39.4		38.3		42.2		29.9		29.3		29.3		8.08		59.2		39.4		36.0	
Sb	mg/L	0.01		0.02		<0.01		0.02		0.02		0.02		0.02		0.02		0.01		0.01		0.02		0.04		0.02		<0.01	
As	mg/L	0.023		0.059		0.033		0.093		0.021		0.018		0.024		0.059		0.072		0.072		0.010		0.040		0.041		0.018	
Ba	mg/L	0.0633		0.0864		0.0588		0.0830		0.101		0.0957		0.0978		0.0791		0.0695		0.0695		0.0798		0.0720		0.0882		0.0491	
Be	mg/L	0.0122		0.0043		0.0151		0.0091		0.0077		0.0044		0.0080		0.0067		0.0059		0.0059		0.0024		0.0085		0.0037		0.0142	
Bi	mg/L	0.08		0.14		0.07		0.46		0.18		0.19		0.27		0.46		0.25		0.25		0.14		0.94		0.30		0.23	
B	mg/L	0.924		0.576		2.52		0.733		4.10		2.96		2.37		2.91		1.31		1.31		1.60		3.40		1.96		1.58	
Cd	mg/L	0.0048		0.0052		0.0084		0.0237		0.0064		0.0063		0.0006		0.0193		0.0054		0.0054		0.0018		0.0092		0.0005		0.0194	
Ca	mg/L	554	13.8	662	16.5	636	15.9	719.0	17.9	784	19.6	281	7.0	722	18.0	790	19.7	554	13.8	554	13.8	498	12.4	522	13	461	11.5	745	18.6
Cr	mg/L	0.197		0.328		0.147		0.4		0.246		0.553		0.061		0.022		0.008		0.008		0.003		0.232		0.046		0.038	
Co	mg/L	0.009		0.002		0.003		0.1		0.037		0.002		0.049		1.15		0.068		0.068		0.075		0.139		0.070		0.147	
Cu	mg/L	5.20		0.110		12.6		13.8		0.342		0.307		6.60		20.2		4.17		4.17		0.631		10.2		1.42		0.661	
Fe	mg/L	52.5		63.6		60.5		320.0		96.1		116		197		342		182		182		84.4		624		203		150	
Pb	mg/L	0.026		0.026		0.019		0.0		0.008		0.010		0.016		0.025		0.020		0.020		0.015		0.026		0.012		0.028	
Li	mg/L	<0.1		<0.1		<0.1		<0.1		<0.1		<0.1		<0.1		<0.1		<0.1		<0.1		<0.1		<0.1		<0.1		<0.1	
Mg	mg/L	43.4	1.8	26.2	1.1	52.2	2.1	107.0	4.4	29.3	1.2	22.7	0.9	32.5	1.3	174	7.2	26.3	1.1	26.3	1.1	38.7	1.6	35.0	1.4	22.5	0.9	156	6.4
Mn	mg/L	9.47		12.1		5.24		18.4		10.6		4.91		17.3		16.9		16.8		16.8		12.4		18.3		7.28		26.5	
Mo	mg/L	<0.01		<0.01		<0.01		<0.01		<0.01		0.01		<0.01		<0.01		<0.01		<0.01		<0.01		0.02		<0.01		<0.01	
Ni	mg/L	0.042		0.050		0.030		0.1		0.059		0.295		0.114		0.372		0.130		0.130		0.130		0.279		0.194		0.328	
P	mg/L	0.044		0.384		0.053		0.3		0.220		0.111		0.313		0.031		<0.009		<0.009		<0.009		0.158		0.261		0.030	
K	mg/L	24.2	0.6	52.6	1.3	29.2	0.7	59.7	1.5	47.0	1.2	45.3	1.2	60.0	1.5	86.0	2.2	43.4	1.1	43.4	1.1	23.2	0.6	90.4	2.3	63.5	1.6	43.8	1.1
Se	mg/L	39.8		39.4		65.8		38.2		84.2		71.3		64.2		72.8		46.7		46.7		49.9		102		59.3		80.2	
Si	mg/L	<0.08		<0.08		<0.08		<0.08		<0.08		<0.08		<0.08		<0.08		<0.08		<0.08		<0.08		<0.08		<0.08		<0.08	
Ag	mg/L	<0.01		<0.01		<0.01		<0.01		<0.01		<0.01		<0.01		<0.01		<0.01		<0.01		<0.01		<0.01		<0.01		0.01	
Na	mg/L	20.2	0.9	25.9	1.1	23.6	1.0	28.5	1.2	32.9	1.4	26.9	1.2	25.2	1.1	25.4	1.1	21.0	0.9	21.0	0.9	20.8	0.9	52.7	2.3	49.3	2.1	17.7	0.8
Sr	mg/L	2.51		2.73		3.80		3.68		2.57		3.17		9.02		4.14		4.87		4.87		1.45		7.04		3.18		2.24	
S	mg/L	629		729		754		1070		891		425		927		1250		711		711		585		1060		673		1070	
Tl	mg/L	0.02		0.02		0.01		0.02		0.01		0.01		0.02		0.01		0.02		0.02		0.02		0.01		0.01		0.03	
Sn	mg/L	<0.03		<0.03		<0.03		<0.03		<0.03		<0.03		<0.03		<0.03		<0.03		<0.03		<0.03		<0.03		<0.03		<0.03	
Ti	mg/L	0.002		0.018		0.005		0.015		0.032		0.030		0.022		0.011		0.003		0.003		0.013		0.025		0.043		0.009	
U	mg/L	<0.2		<0.2		<0.2		<0.2		<0.2		<0.2		<0.3		<0.3		<0.3		<0.3		<0.3		<0.3		<0.3		<0.3	
V	mg/L	0.014		0.038		0.047		0.347		0.072		0.061		0.083		0.046		<0.001		<0.001		0.004		0.048		0.005		0.030	
Zn	mg/L	0.472		0.185		0.425		1.29		0.297		0.257		0.305		1.54		0.364		0.364		0.156		0.693		0.252		1.45	
Zr	mg/L	<0.007		<0.007		<0.007		0.008		0.011		<0.007		<0.007		0.007		<0.007		<0.007		<0.007		0.016		<0.007		0.007	
NP from Ca, Mg, Na & K (kg $CaCO_3$ Equiv./tonne)		48397	17.1	48389	20.0	48061	19.7	48059	25.0	30115	23.4	48069	10.3	53815	21.9	53808	30.2	54756	16.9	54763	16.9	54353	15.5	52003	19.0	54418	16.1	52013	26.9

Sample No.		52009	NP	52008	NP	51029	NP	51049	NP	51039	NP	50993	NP	50986	NP	47825	NP	50995	NP	58411	NP	58423	NP	55770	NP	55759	NP	57009	NP
Al	mg/L	92.8		46.6		102		48.2		47.1		47.7		77.1		37.8		36.5		37.6		36.0		36.9		34.4		40.6	
Sb	mg/L	0.04		0.02		0.02		0.02		<0.01		0.02		0.03		<0.01		<0.01		<0.01		<0.01		<0.01		<0.01		<0.01	
As	mg/L	0.024		0.031		0.036		0.026		0.101		0.054		0.056		0.014		0.018		0.015		0.024		0.018		0.036		0.022	
Ba	mg/L	0.0762		0.0510		0.0743		0.0664		0.0487		0.0669		0.0851		0.0361		0.0715		0.0818		0.0745		0.0872		0.0641		0.0634	
Be	mg/L	0.0084		0.0149		0.0133		0.0105		0.0115		0.0083		0.0154		0.0149		0.0068		0.0179		0.0218		0.0086		0.0038		0.0120	
Bi	mg/L	0.74		0.66		0.64		0.53		0.37		0.71		1.06		0.35		0.07		0.03		0.23		0.27		0.06		0.21	
B	mg/L	2.25		2.14		2.84		1.52		2.25		3.39		2.28		1.75		1.88		0.65		2.71		2.13		1.77		2.22	
Cd	mg/L	0.0008		0.0027		0.0032		0.0086		0.0065		0.0142		0.0156		0.0154		0.0059		0.0026		0.0163		0.0202		0.0392		0.0102	
Ca	mg/L	481	12.0	463	11.6	535	13.3	548	13.7	499	12.5	544	13.6	777	19.4	578	14.4	783	19.5	810	20.2	492	12.3	683	17.0	376	9.4	582	14.5
Cr	mg/L	0.272		0.045		0.258		0.042		0.002		0.033		0.236		0.025		0.257		0.145		0.630		0.764		0.099		0.447	
Co	mg/L	0.112		0.148		0.113		0.242		0.139		0.141		0.188		0.169		0.022		0.012		0.056		0.061		0.099		0.047	
Cu	mg/L	3.21		0.180		7.35		6.74		32.4		8.91		9.47		1.50		1.73		1.73		5.60		13.3		150		0.964	
Fe	mg/L	479		462		427		372		310		503		690		229		70.3		44		208		245		71.0		181	
Pb	mg/L	0.031		0.024		0.028		0.024		0.037		0.021		0.049		0.028		0.012		0.024		0.030		0.051		0.045		0.012	
Li	mg/L	<0.1		<0.1		<0.1		<0.1		<0.1		<0.1		<0.1		<0.1		<0.1		<0.1		<0.1		<0.1		<0.1		<0.1	
Mg	mg/L	42.3	1.7	300	12.3	59.5	2.4	99.7	4.1	90.9	3.7	145	6.0	170	7.0	170	7.0	31.2	1.3	43.5	1.8	94.7	3.9	96.8	4.0	29.3	1.2	77.7	3.2
Mn	mg/L	10.9		35.4		19.9		25.3		31.8		11.5		17.6		38.1		16.0		5.4		15.0		12.8		21.9		14.5	
Mo	mg/L	0.02		<0.01		<0.01		<0.01		<0.01		<0.01		<0.01		<0.01		<0.01		<0.01		<0.01		<0.01		<0.01		<0.01	
Ni	mg/L	0.291		0.203		0.207		0.468		0.146		0.183		0.241		0.417		0.064		0.042		0.064		0.067		0.040		0.065	
P	mg/L	1.46		0.034		0.250		0.032		0.020		0.024		0.014		<0.009		0.304		0.15		1.06		3.14		0.058		0.315	
K	mg/L	65.6	1.7	35.5	0.9	65.8	1.7	58.8	1.5	120	3.1	124	3.2	99.5	2.5	60.0	1.5	38.1	1.0	18.3	0.5	44.2	1.1	56.8	1.5	57.1	1.5	42.5	1.1
Se	mg/L	106		82.9		134		98.5		79.8		91.5		98.1		86.2		52.6		55		72.4		62.0		58.4		65.2	
Si	mg/L	<0.08		<0.08		<0.08		<0.08		<0.08		<0.08		<0.08		<0.08		<0.08		<0.08		<0.08		<0.08		<0.08		<0.08	
Ag	mg/L	<0.01		<0.01		<0.01		<0.01		<0.01		<0.01		<0.01		0.01		0.01		<0.01		<0.01		<0.01		0.01		<0.01	
Na	mg/L	49.9	2.2	42.1	1.8	41.2	1.8	27.3	1.2	20.9	0.9	42.9	1.9	33.5	1.5	19.3	0.8	20.0	0.9	20.3	0.9	21.9	1.0	19.3	0.8	15.3	0.7	22.2	1.0
Sr	mg/L	7.25		4.74		2.14		1.79		4.29		3.73		4.63		2.00		2.26		6.84		4.73		4.30		1.43		3.87	
S	mg/L	1030		1270		1050		1010		977		1140		1560		996		876		876		877		1030		628		845	
Tl	mg/L	0.01		0.03		0.02		0.02		0.03		<0.005		0.01		0.04		0.01		<0.005		<0.005		<0.005		0.02		<0.005	
Sn	mg/L	<0.03		<0.03		<0.03		<0.03		<0.03		<0.03		<0.03		<0.03		<0.03		<0.03		<0.03		<0.03		<0.03		<0.03	
Ti	mg/L	0.027		0.001		0.027		0.050		0.019		0.010		0.020		0.020		0.006		<0.001		0.009		0.028		0.014		0.012	
U	mg/L	<0.3		<0.3		<0.3		<0.3		<0.3		<0.3		<0.3		<0.3		<0.15		<0.15		<0.15		<0.15		<0.15		<0.15	
V	mg/L	0.233		0.006		0.226		0.009		<0.001		0.108		0.621		0.005		0.053		0.036		0.291		0.506		0.017		0.135	
Zn	mg/L	0.398		1.10		0.667		0.572		0.799		1.27		1.78		0.885		0.234		0.239		0.632		0.951		2.41		0.684	
Zr	mg/L	0.011		0.009		0.010		0.008		<0.007		0.010		0.016		<0.007		<0.007		<0.007		0.009		<0.007		<0.007		<0.007	
NP from Ca, Mg, Na & K (kg CaCO3 Equiv./tonne)		52009	17.6	52008	26.6	51029	19.2	51049	20.5	51039	20.2	50993	24.7	50986	30.4	47825	23.7	50995	22.7	58411	23.4	58423	18.3	55770	23.3	55759	12.8	57009	19.8

Sample No.		57023	NP	55329	NP	55332	NP	55343	NP	55347	NP	62185	NP	62181	NP	61262	NP	60587	NP	60577	NP	60588	NP	74767	NP	74754	NP	74790	NP
Al	mg/L	40.6		35.3		35.8		33.0		40.8		38.5		34.9		56.9		28.1		34.3		26.5		31.1		44.3		30.4	
Sb	mg/L	<0.01		<0.01		0.03		<0.01		0.05		0.04		0.07		<0.01		0.01		<0.01		<0.01		<0.01		0.02		0.03	
As	mg/L	0.049		0.023		0.040		0.027		0.021		0.031		0.037		0.026		0.039		0.024		0.009		0.026		0.046		0.026	
Ba	mg/L	0.0644		0.0750		0.0642		0.0829		0.0818		0.0743		0.0369		0.0676		0.0824		0.0648		0.0792		0.0971		0.0709		0.0775	
Be	mg/L	0.0127		0.0114		0.0090		0.0059		0.0064		0.0067		0.0122		0.0221		0.0041		0.0088		0.0056		0.0036		0.0087		0.0055	
Bi	mg/L	0.30		0.14		0.61		<0.02		0.38		0.31		0.99		0.11		0.15		0.33		0.08		0.04		0.17		0.11	
B	mg/L	0.599		0.466		1.58		1.85		1.92		1.48		2.26		1.79		1.15		1.49		1.47		2.16		0.974		1.12	
Cd	mg/L	0.0226		0.0081		0.0312		0.0241		0.0114		0.0099		0.0504		0.0070		0.0075		0.0197		0.0048		0.0058		0.0091		0.0184	
Ca	mg/L	593	14.8	816	20.4	560	14.0	437	10.9	474	11.8	686	17.1	447	11.2	559	13.9	658	16.4	544	13.6	574	14.3	521	13.0	712	17.8	759	18.9
Cr	mg/L	1.40		0.465		2.35		0.132		3.12		2.01		2.55		0.208		0.600		0.579		0.078		0.116		0.536		1.34	
Co	mg/L	0.049		0.034		0.145		0.094		0.042		0.038		0.260		0.021		0.032		0.086		0.018		0.040		0.029		0.046	
Cu	mg/L	16.0		0.292		13.5		102		2.20		0.515		17.1		5.11		4.46		9.44		0.359		24.8		0.916		81.7	
Fe	mg/L	232		127		443		70.5		188		164		719		81.7		121		264		62.2		46.0		127		125	
Pb	mg/L	0.028		0.022		0.031		0.044		0.015		0.024		0.043		0.032		0.017		0.027		0.021		0.023		0.030		0.024	
Li	mg/L	<0.1		<0.1		<0.1		<0.1		<0.1		<0.1		<0.1		<0.1		<0.1		<0.1		<0.1		<0.1		<0.1		<0.1	
Mg	mg/L	153	6.3	45.4	1.9	80.3	3.3	29.1	1.2	27.4	1.1	32.3	1.3	84.9	3.5	51.6	2.1	25.1	1.0	70.5	2.9	23.3	1.0	24.9	1.0	26.8	1.1	26.0	1.1
Mn	mg/L	12.9		18.3		17.3		18.2		7.43		14.6		20.2		10.4		10.7		11.6		6.36		15.3		15.0		16.7	
Mo	mg/L	<0.01		<0.01		<0.01		<0.01		<0.01		<0.01		<0.01		<0.01		<0.01		<0.01		<0.01		<0.01		<0.01		<0.01	
Ni	mg/L	0.078		0.061		0.149		0.035		0.213		0.197		0.235		0.056		0.162		0.091		0.062		0.039		0.089		0.190	
P	mg/L	1.98		0.206		0.218		0.077		0.470		0.421		<0.009		0.083		0.011		0.058		0.244		0.204		0.175		<0.009	
K	mg/L	40.5	1.0	43.9	1.1	49.4	1.3	52.5	1.3	49.1	1.3	60.8	1.6	53.0	1.4	31.1	0.8	57.1	1.5	44.6	1.1	36.5	0.9	54.9	1.4	63.6	1.6	53.8	1.4
Se	mg/L	48.3		38.9		56.8		57.4		66.1		59.9		67.8		75.6		46.2		55.8		44.5		59.2		51.4		49.9	
Si	mg/L	<0.08		<0.08		<0.08		<0.08		<0.08		<0.08		<0.08		<0.08		<0.08		<0.08		<0.08		<0.08		<0.08		<0.08	
Ag	mg/L	<0.01		<0.01		<0.01		<0.01		<0.01		<0.01		<0.01		<0.01		<0.01		<0.01		<0.01		<0.01		<0.01		<0.01	
Na	mg/L	14.7	0.6	18.0	0.8	15.1	0.7	17.5	0.8	22.7	1.0	22.2	1.0	14.8	0.6	41.7	1.8	19.3	0.8	17.5	0.8	28.2	1.2	23.1	1.0	24.6	1.1	19.8	0.9
Sr	mg/L	5.80		4.51		3.35		1.59		3.23		2.70		3.20		4.36		2.81		3.90		2.38		2.90		4.40		2.85	
S	mg/L	985		950		983		637		686		849		1120		748		764		831		635		622		837		924	
Tl	mg/L	<0.005		0.02		0.01		0.01		<0.005		0.01		0.01		0.01		0.01		0.01		<0.005		0.02		0.01		0.02	
Sn	mg/L	<0.03		<0.03		<0.03		<0.03		<0.03		<0.03		<0.03		<0.03		<0.03		<0.03		<0.03		<0.03		<0.03		<0.03	
Ti	mg/L	0.003		0.001		0.009		0.020		0.010		0.008		0.007		0.005		0.006		0.004		0.011		0.013		0.010		0.009	
U	mg/L	<0.15		<0.15		<0.15		<0.15		<0.2		<0.2		<0.2		<0.2		<0.2		<0.2		<0.2		<0.2		<0.2		<0.10	
V	mg/L	0.299		0.084		0.302		0.022		0.127		0.085		0.321		0.079		0.005		0.125		0.008		0.050		0.108		0.049	
Zn	mg/L	0.659		0.330		0.852		1.83		0.306		0.278		1.54		0.338		0.227		1.14		0.211		0.415		0.354		1.07	
Zr	mg/L	<0.007		<0.007		0.010		<0.007		<0.007		<0.007		0.018		<0.007		<0.007		<0.007		<0.007		<0.007		<0.007		<0.007	
NP from Ca, Mg, Na & K (kg CaCO3 Equiv./tonne)		57023	22.7	55329	24.2	55332	19.3	55343	14.2	55347	15.2	62185	21.0	62181	16.7	61262	18.6	60587	19.7	60577	18.4	60588	17.4	74767	16.4	74754	21.6	74790	22.3

Sample No.		70003	NP	70022	NP	70014	NP	6383	NP	6394	NP	6391	NP	70507	NP	70525	NP	70513	NP	65011	NP	65005	NP	65008	NP	65003	NP	65172	NP
Al	mg/L	37.6		36.9		1.36		36.0		36.3		36.3		18.4		42.3		50.3		43.7		53.3		41.8		41.7		32.4	
Sb	mg/L	0.03		0.01		<0.01		<0.01		0.02		<0.01		<0.01		0.03		<0.02		<0.02		<0.02		0.04		0.02		<0.02	
As	mg/L	0.016		0.004		<0.004		<0.004		0.025		0.028		0.016		0.02		0.05		0.04		0.02		0.004		0.04		<0.01	
Ba	mg/L	0.0997		0.0790		0.192		0.0878		0.0632		0.0619		0.0644		0.0816		0.0937		0.0708		0.0843		0.0846		0.0877		0.104	
Be	mg/L	0.0140		0.0099		0.0007		0.0069		0.0054		0.0045		0.0051		0.0077		0.0061		0.0077		0.0052		0.0052		0.0086		0.0031	
Bi	mg/L	0.19		0.38		<0.02		0.20		0.27		0.08		0.06		0.26		0.30		0.31		0.29		0.33		0.45		0.11	
B	mg/L	2.23		2.32		0.711		1.32		0.830		0.578		0.316		0.624		2.19		2.40		1.95		0.371		0.693		0.766	
Cd	mg/L	0.0085		0.0268		0.0019		0.0121		0.0090		0.0072		0.0046		0.008		0.012		0.015		0.009		0.0095		0.015		<0.001	
Ca	mg/L	571	14.2	547	13.6	602	15.0	761	19.0	641	16.0	614	15.3	579	14.4	579	14.4	467	11.7	801	20.0	400	10.0	579	14.4	732	18.3	248	6.2
Cr	mg/L	1.21		0.164		0.001		0.228		1.76		0.220		0.026		1.80		0.305		1.49		1.72		2.35		0.707		0.233	
Co	mg/L	0.033		0.066		0.007		0.044		0.035		0.028		0.017		0.033		0.045		0.045		0.040		0.035		0.059		0.025	
Cu	mg/L	0.196		2.87		0.101		2.22		0.862		19.4		3.74		0.464		2.93		5.37		1.75		0.611		0.235		0.154	
Fe	mg/L	111		293		0.571		149		125		59.0		42.9		108		147		160		119		148		190		65.5	
Pb	mg/L	0.015		0.044		0.023		0.036		0.017		0.018		0.018		0.016		0.014		0.023		<0.007		0.019		0.024		<0.007	
Li	mg/L	<0.1		<0.1		<0.1		<0.1		<0.1		<0.1		<0.1		<0.1		<0.1		<0.1		<0.1		<0.1		<0.1		<0.1	
Mg	mg/L	38.9	1.6	128	5.3	22.5	0.9	37.9	1.6	23.9	1.0	24.0	1.0	25.5	1.0	25.1	1.0	42.8	1.8	39.9	1.6	25.5	1.0	21.1	0.9	71.3	2.9	18.4	0.8
Mn	mg/L	8.37		18.4		4.59		17.5		8.53		7.04		6.71		7.73		8.31		17.2		5.66		11.2		14.3		3.61	
Mo	mg/L	<0.01		<0.01		0.03		<0.01		<0.01		<0.01		<0.01		<0.01		<0.01		<0.01		<0.01		<0.01		<0.01		<0.01	
Ni	mg/L	0.190		0.088		0.005		0.052		0.132		0.040		0.029		0.112		0.052		0.097		0.110		0.144		0.078		0.067	
P	mg/L	0.042		0.019		<0.009		0.026		0.207		0.112		0.059		0.531		1.54		0.195		1.10		0.667		3.80		0.168	
K	mg/L	42.3	1.1	50.9	1.3	19.4	0.5	55.8	1.4	46.4	1.2	30.9	0.8	27.9	0.7	33.5	0.9	48.6	1.2	38.1	1.0	38.0	1.0	43.6	1.1	47.5	1.2	37.6	1.0
Se	mg/L	61.2		55.2		14.4		50.2		49.8		52.1		35.0		49.4		77.2		69.3		78.4		39.3		51.1		39.8	
Si	mg/L	<0.08		<0.08		<0.08		<0.08		<0.08		<0.08		<0.08		<0.08		<0.08		<0.08		<0.08		<0.08		<0.08		<0.08	
Ag	mg/L	<0.01		<0.01		<0.01		<0.01		<0.01		<0.01		<0.01		<0.01		<0.01		<0.01		<0.01		<0.01		<0.01		<0.01	
Na	mg/L	25.7	1.1	23.0	1.0	11.5	0.5	23.1	1.0	18.7	0.8	13.1	0.6	15.4	0.7	21.5	0.9	29.6	1.3	25.2	1.1	29.8	1.3	18.7	0.8	21.1	0.9	19.3	0.8
Sr	mg/L	4.79		4.80		2.27		4.61		1.89		1.81		2.33		3.58		4.91		3.87		1.66		2.56		6.03		2.43	
S	mg/L	718		983		584		948		712		659		562		713		707		954		598		779		1000		370	
Tl	mg/L	0.01		0.011		<0.005		0.015		<0.005		0.009		0.008		<0.005		<0.005		0.010		<0.005		<0.005		0.007		<0.005	
Sn	mg/L	<0.03		<0.03		<0.03		<0.03		<0.03		<0.03		<0.03		<0.03		<0.03		<0.03		<0.03		<0.03		<0.03		<0.03	
Ti	mg/L	0.010		0.018		<0.001		0.012		0.008		0.009		0.001		0.020		0.058		0.020		0.049		0.014		0.030		0.019	
U	mg/L	<0.10		<0.1		<0.1		<0.1		<0.05		<0.05		<0.05		<0.03		<0.03		<0.03		<0.03		<0.1		<0.03		<0.02	
V	mg/L	0.045		0.072		0.008		0.051		0.070		0.051		0.006		0.096		0.156		0.096		0.117		0.103		0.248		0.055	
Zn	mg/L	0.224		0.634		0.031		0.529		0.226		0.407		0.450		0.242		0.525		0.461		0.358		0.312		0.617		0.202	
Zr	mg/L	<0.007		0.008		<0.007		<0.007		<0.007		<0.007		<0.007		<0.007		<0.007		<0.007		<0.007		<0.007		<0.007		<0.007	
NP from Ca, Mg, Na & K (kg $CaCO_3$ Equiv./tonne)		70003	18.0	70022	21.2	70014	16.9	6383	23.0	6394	19.0	6391	17.7	70507	16.8	70525	17.2	70513	16.0	65011	23.7	65005	13.3	65008	17.2	65003	23.3	65172	8.8

Sample No.		65168	NP	84510	NP	84515	NP	78501	NP	78515	NP	72807	NP
Al	mg/L	23.3		44.3		38.1		29.2		37.8		34.6	
Sb	mg/L	<0.02		0.03		<0.02		<0.02		<0.02		<0.01	
As	mg/L	0.04		<0.004		0.05		0.13		0.04		0.006	
Ba	mg/L	0.0655		0.0986		0.114		0.0727		0.0635		0.110	
Be	mg/L	0.0056		0.0079		0.0066		0.0062		0.0147		0.0034	
Bi	mg/L	0.28		0.32		0.34		0.15		0.24		0.11	
B	mg/L	0.882		3.24		2.38		1.52		1.41		2.28	
Cd	mg/L	0.016		0.0135		0.004		0.005		0.002		0.0055	
Ca	mg/L	571	14.2	669	16.7	539	13.4	526	13.1	545	13.6	227	5.7
Cr	mg/L	0.433		1.26		0.202		0.145		0.295		0.245	
Co	mg/L	0.044		0.048		0.056		0.031		0.040		0.021	
Cu	mg/L	4.63		1.81		14.1		10.1		2.32		0.017	
Fe	mg/L	141		197		194		113		135		74.4	
Pb	mg/L	0.018		0.027		0.016		0.027		0.021		0.021	
Li	mg/L	<0.1		<0.1		<0.1		<0.1		<0.1		<0.1	
Mg	mg/L	48.4	2.0	43.8	1.8	43.9	1.8	54.7	2.3	39.2	1.6	20.8	0.9
Mn	mg/L	11.6		12.9		11.7		18.3		15.8		5.41	
Mo	mg/L	<0.01		<0.01		<0.01		<0.01		<0.01		<0.01	
Ni	mg/L	0.095		0.149		0.048		0.043		0.070		0.034	
P	mg/L	0.043		0.036		0.496		0.025		0.020		0.256	
K	mg/L	43.1	1.1	52.0	1.3	47.7	1.2	44.8	1.1	28.6	0.7	39.2	1.0
Se	mg/L	42.8		72.3		60.8		44.6		46.9		57.2	
Si	mg/L	<0.08		<0.08		<0.08		<0.08		<0.08		<0.08	
Ag	mg/L	<0.01		<0.01		<0.01		0.01		<0.01		<0.01	
Na	mg/L	18.3	0.8	27.6	1.2	24.1	1.0	15.1	0.7	25.3	1.1	22.5	1.0
Sr	mg/L	7.78		4.77		4.01		3.59		6.67		1.24	
S	mg/L	716		930		802		727		726		370	
Tl	mg/L	<0.005		0.006		0.01		0.03		0.02		<0.005	
Sn	mg/L	<0.03		<0.03		<0.03		<0.03		<0.03		<0.03	
Ti	mg/L	0.006		0.042		0.020		0.009		0.002		0.054	
U	mg/L	<0.03		<0.1		<0.02		<0.02		<0.02		<0.1	
V	mg/L	0.015		0.069		0.134		0.061		0.020		0.077	
Zn	mg/L	0.368		0.462		0.718		0.343		0.421		0.277	
Zr	mg/L	<0.007		<0.007		<0.007		<0.007		<0.007		<0.007	
NP from Ca, Mg, Na & K (kg CaCO3 Equiv./tonne)		65168	18.1	84510	21.0	84515	17.4	78501	17.2	78515	17.0	72807	8.6

Appendix E: BC Research Method ABA Results for Tailings in January 2013 to October 2013

Appendix C. Summary Tailings Analysis Results from SGS Cemi												
Monthly Tails Sample ID	Paste pH	TIC %	CaCO3 NP	S(T) %	S(SO4) %	S(S-2) %	AP	NP H2SO4/tonne	NP CaCO3/tonne	Net NP	NP:AP Ratio (NP/AP)	Fizz Test
Final Tails Monthly Composite April 2013	8.41	0.35	29.2	0.05	<0.01	0.05	1.6	32.6	33.3	31.7	21.3	Slight
Final Tails Monthly Composite May 2013	8.31	0.39	32.5	0.08	<0.01	0.08	2.5	36.5	37.3	34.8	14.9	Slight
Final Tails Monthly Composite June 2013	8.18	0.37	30.8	0.05	<0.01	0.05	1.6	41.4	42.3	40.7	27.0	Slight
Final Tails Monthly Composite July 2013	8.56	0.47	39.2	0.07	<0.01	0.07	2.2	44.8	45.8	43.6	20.9	Slight
Final Tails Monthly Composite August 2013	8.47	0.34	28.3	0.04	<0.01	0.04	1.3	31.6	32.3	31.0	25.8	Slight
Final Tails Monthly Composite September 2013	8.11	0.33	27.5	0.05	<0.01	0.05	1.6	32.3	33.0	31.4	21.1	Slight

Appendix H

2013 Water Balance and Water Quality Predictions

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Memo

To:	James Spencer	**Client:**	Minto Explorations Ltd.
From:	Soren Jensen	**Project No:**	1CM002.024
Cc:	Jennie Gjertsen, Ryan Herbert (Minto), Dylan MacGregor (SRK)	**Date:**	March 21, 2014
Subject:	2013 Water Balance and Water Quality Model Summary for the Minto Mine Site		

1 Introduction and Background

This memorandum provides a summary of the 2013 water balance and water quality model updates for the Minto Mine site. The update covers the period January 1 2013 through December 31 2013.

The water balance update includes a review and summary of precipitation, flow and water inventory data for the site. The water quality update includes a comparison of water quality data collected in 2013 to water quality model predictions for Phase IV of the mine development.

2 Water Balance Update

2.1 Precipitation

Table 1 shows a summary of monthly precipitation measured at the Minto Mine site in 2012 and 2013 along with precipitation data from the regional station at Pelly Ranch (Climate ID: 2100880)[1]. Minto Explorations Ltd. (Minto) operates two meteorological stations on the Minto Mine site: a HOBO Weather Station and a Campbell Scientific meteorological station. The stations are located east of the airstrip in relatively close proximity to one another.

Only the Campbell Scientific station measures total precipitation. Total precipitation is measured using a tipping bucket rain gauge. From October through May, the rain gauge is equipped with a snowfall conversion adaptor, which allows it to measure snowfall as snow water equivalent. The Pelly Ranch meteorological station located approximately 25 km north of Minto and is the closest regional station with a long-term data record, including total precipitation measurements.

Rainfall measurements collected on site and at the regional station were generally not in good agreement in 2013. The accuracy and reliability of the site's precipitation measurements will be reviewed in the summer of 2014.

[1] Pelly Ranch Data: obtained from Meteorological Service of Canada, Environment Canada.

Table 1 Precipitation Records for Minto Mine and Pelly Ranch

		Total Precipitation	
Year	Month	Campbell Scientific	Pelly Ranch (Climate ID 2100880)
		mm/month	mm/month
2012	Oct	16.5	25.6
2012	Nov	17.1	n/a
2012	Dec	18.4	23.5*
2013	Jan	4.4	26.5
2013	Feb	73.8	12.5
2013	Mar	7.4	n/a
2013	Apr	0.0	26
2013	May	7.9	36
2013	Jun	21.0	32
2013	Jul	113.5	40
2013	Aug	46.8	58.1
2013	Sept	59.7	n/a
2013	Oct	13.6	n/a
2013	Nov	36.6	n/a
2013	Dec	27.0	n/a
SUM Hydrological Year, Nov. 2012 to Oct. 2013		383.6	n/a

Source: Minto Site Data: X:\01_SITES\Minto\1CM002.011_OperationalSupport_Environmental_2013\Main_Pit_Water_Balance_for_Area_2_UG_Development\Data\Met Station 1 and 2 Data Summary_REV00_SRJ Pelly Ranch Data: obtained from Meteorological Service of Canada, Environment Canada.

Notes:

* - based on incomplete data set.
n/a – not available.

2.2 Snow Course Data

Snow course surveys were completed at three snow survey stations at the Minto site in 2013. Table 2 shows a summary of the snow survey data from 2009 to 2013. The depth and water equivalent of the snow pack provides an indication of the volume of surface runoff that could be expected the following freshet. Between January and late May 2013 approximately 700,000 m^3 of surface runoff flowed from catchments at the Minto Mine site upstream of the Water Storage Dam (see Table 3). This volume corresponds to roughly 67 mm of runoff, or about 65% of the snow pack water equivalent measured in April 2013.

Table 2 Summary of Snow Survey Data for the Minto Mine Site

Year	February			March			April		
	Snow Depth (cm)	Snow Density (%)	Water Equivalent (mm)	Snow Depth (cm)	Snow Density (%)	Water Equivalent (mm)	Snow Depth (cm)	Snow Density (%)	Water Equivalent (mm)
2009	55.6	16.6	92.7	70.2	15.7	110.0	67.4	22.3	150.7
2010	60.5	17.8	107.7	58.1	20.7	120.7	40.4	[A]13.9	56.0
2011	57.2	18.7	106.0	70.3	20.1	141.7	52.3	22.8	111.7
2012	54.7	20.3	111.0	64.6	19.6	127.0	61.3	21.5	132.7
2013	n/a	n/a	n/a	58.7	15.7	91.3	45.8	22.6	103.0

Source: SRK: X:\01_SITES\Minto\1CM002.024_Water_Balance_Support\2013_Water_Balance_Update\ MINTOSNOW Master multiyear.xls.

Note:

n/a – not available.
[A]zero snow at #3, density is an average of snowpack at #1 and #2, average depth and water-equivalent is average of all three sites

2.3 Water Management

Figure 1 shows a schematic of operational water conveyance at Minto in 2013. Water that is suitable for release to Minto Creek is generally conveyed to the Water Storage Pond (WSP) while water collected from active mine areas is routed to the Main Pit. Since November 2012 the Main Pit has also been used for subaqueous deposition of tailings.

Water management features on the Minto Site include:

- Main Pit: the repository for mine water and tailings.
- W15 sump: collects surface runoff and seepage from:
  - The Southwest Waste Dump,
  - Part of the Main Waste Dump, and
  - Adjacent undisturbed catchments.

Water collected at W15 is generally routed to the Main Pit but can be diverted to the WSP.

- W35a sump: collects surface runoff from the minimally disturbed southern catchments. Water collected at W35a is generally piped to the WSP but could be routed to the Main Pit, if required.
- W36 sump (formerly known as W37 sump): collects surface runoff and seepage from the mill valley, including contributions from the Dry Stack Tailings Storage Facility. Water collected at the W36 sump is pumped to the Main Pit.
- South Diversion Ditch: diverts water from minimally disturbed southern catchments to the WSP.
- WSP: repository for water that meets discharge criteria and is destined for discharge to Minto Creek.

2.4 2013 Water Balance

Table 3 and Figure 2 summarize monthly water and tailings inventory in Minto's Main Pit and water inventory in the WSP. In 2013, the Main Pit gained approximately 1,080,000 m^3 of water while the water inventory of the WSP was reduced by approximately 80,000 m^3 (January 1 to December 31, 2013). In 2013, approximately 530,000 BCM[2] of tailings were deposited in the Main Pit.

Table 4 shows a summary of the 2013 water balance for the Minto site. The total surface runoff collected on site was estimated to be 1,250,000 m^3 based on the change in the water inventory and the known volume of water released to Minto Creek. The total catchment upstream of the Water Storage Dam measures approximately 1040 ha. Approximately 1,250,000 m^3 of runoff from 1040 ha gives a unit yield of approximately 120 mm/year.

Table 3 2013 Water Inventory and Release to Minto Creek

Month/ Year	Main Pit Volume Occupied (Water + Tailings)	Change in Main Pit Water Inventory	Tailings Solids	WSP Volume	Change in WSP Water Inventory
	m^3	m^3/month	BCM/month	m^3	m^3/month
Jan 2013	1,945,150	44,539	45,038	239,353	-27,917
Feb 2013	2,034,727	64,412	40,679	211,436	-7,463
Mar 2013	2,139,818	102,265	45,038	203,973	-7,288
Apr 2013	2,287,120	12,500	43,585	196,685	-48,941
May 2013	2,343,204	239,179	45,038	147,744	-43,641
Jun 2013	2,627,421	68,987	43,585	104,103	7,721
Jul 2013	2,739,993	101,057	45,038	111,824	23,944
Aug 2013	2,886,089	125,868	45,038	135,768	8,222
Sep 2013	3,056,995	96,470	43,585	143,990	17,605
Oct 2013	3,197,049	101,212	45,038	161,595	4,107
Nov 2013	3,343,299	67,087	43,585	165,702	-5,605
Dec 2013	3,453,971	54,416	45,038	160,097	-742
SUM		**1,077,992**	**530,283**		**-79,998**

Source: X:\01_SITES\Minto\1CM002.011_OperationalSupport_Environmental_2013\Main_Pit_Water_Balance_for_Area_2_UG_Development\Data\Minto_Tails_and_Waste_Placement_1CM002_003_REV13_SRJ_DBM_S2A2_Portal.xlsx

[2] Bank Cubic Meters

Table 4 Water Balance Summary of the Minto Mine Site, 2013 (Jan to Dec)

	Units	
Pit Volume Increase 2013 (765.1 m to 780.8 m Level)	m^3	1,600,000
Tailings to Main Pit, total	BCM	530,000
PAG, deposited sub-aqueously in Main Pit	BCM	0
Main Pit Water Volume Increase 2013	m^3	1,080,000
WSP Net Water Volume Increase 2013	m^3	-80,000
Water stored in DSTSF tailings	m^3	0
Water Discharged to Minto Creek in 2013	m^3	385,000
Estimated groundwater inflow to Area 2 Pit	m^3	130,000
Total Surface Runoff Above WSP in 2013	**m^3**	**1,250,000**

Source: X:\01_SITES\Minto\1CM002.011_OperationalSupport_Environmental_2013\Main_Pit_Water_Balance_for_Area_2_UG_Development\Data\ Minto_Tails_and_Waste_Placement_1CM002_003_REV13_SRJ_DBM_S2A2_Portal.xlsx

The water and load balance model that is used for forecasting surface runoff volumes uses a site-wide annual average runoff coefficient of 0.30, which has been derived based on previous years' water balance results. Using this runoff coefficient, the total annual precipitation can be estimated as:

$$\textit{Annual Yield/Runoff Coefficient} = \textit{Total Annual Precipitation} \rightarrow \quad 120\ mm/\ 0.30 = 400\ mm$$

The calculated annual total precipitation value of 400 mm is similar to the annual total precipitation measured at Minto (385.6 mm for the hydrological year 2012/2013, Table 1). Therefore, the results of the 2013 water balance indicate that a site-wide runoff coefficient of 0.30 likely produces reasonable estimates of annual runoff volumes.

In 2013, Minto and ACG monitored surface runoff at several hydrometric stations in Minto Creek and McGinty Creek. Results from the surface hydrology monitoring program are reported in the Minto Creek 2013 Hydrology Update, by Access Consulting Group.

3 Water Quality Model Update

Table 5 shows model predictions of water quality for the Main Pit at Minto for the Phase IV operational phase (2012 to 2017) along with maximum concentrations measured in Main Pit in 2013. Main Pit represents the primary repository of mine water collected on site. Therefore, a comparison of measured Main Pit water quality with concentrations predicted for pit water during pre-production environmental assessment provides a good measure of actual vs. expected geochemical performance of the site.

The majority sources of chemical loading at Minto are the DSTSF and the upland waste rock. Seepage chemistry was used as a basis for both tailings and waste rock source terms in the pre-production water quality prediction. For this update, the 2013 tailings and waste rock seepage chemistry data were reviewed, and concentrations were found to be similar to the concentrations previously adopted as source terms. As a result, the water quality model was not updated, as the mid-2012 prediction remains the most appropriate prediction of future reasonable worst case conditions.

As expected, all measured maximum concentrations are well below predicted maximum concentrations. The model predictions of maximum concentrations were developed as conservative estimates that are unlikely to be exceeded at any time during the Phase IV operation. Measured concentrations of arsenic, cadmium, copper, molybdenum, nickel, selenium and zinc are factors of 3 to 23 times less than predicted maximum concentrations. Measured dissolved aluminum and iron concentrations, which are sensitive to the pH of the mine water, are factors of 107 and 120 times less than predicted maximum concentrations.

Subaqueous deposition of tailings began in November 2012. Tailings deposition did not appear to significantly affect the chemistry of the water in the Main Pit in terms of water quality parameters included in the water license.

Table 5 Water Quality Model Predictions and Measured Concentrations in 2012

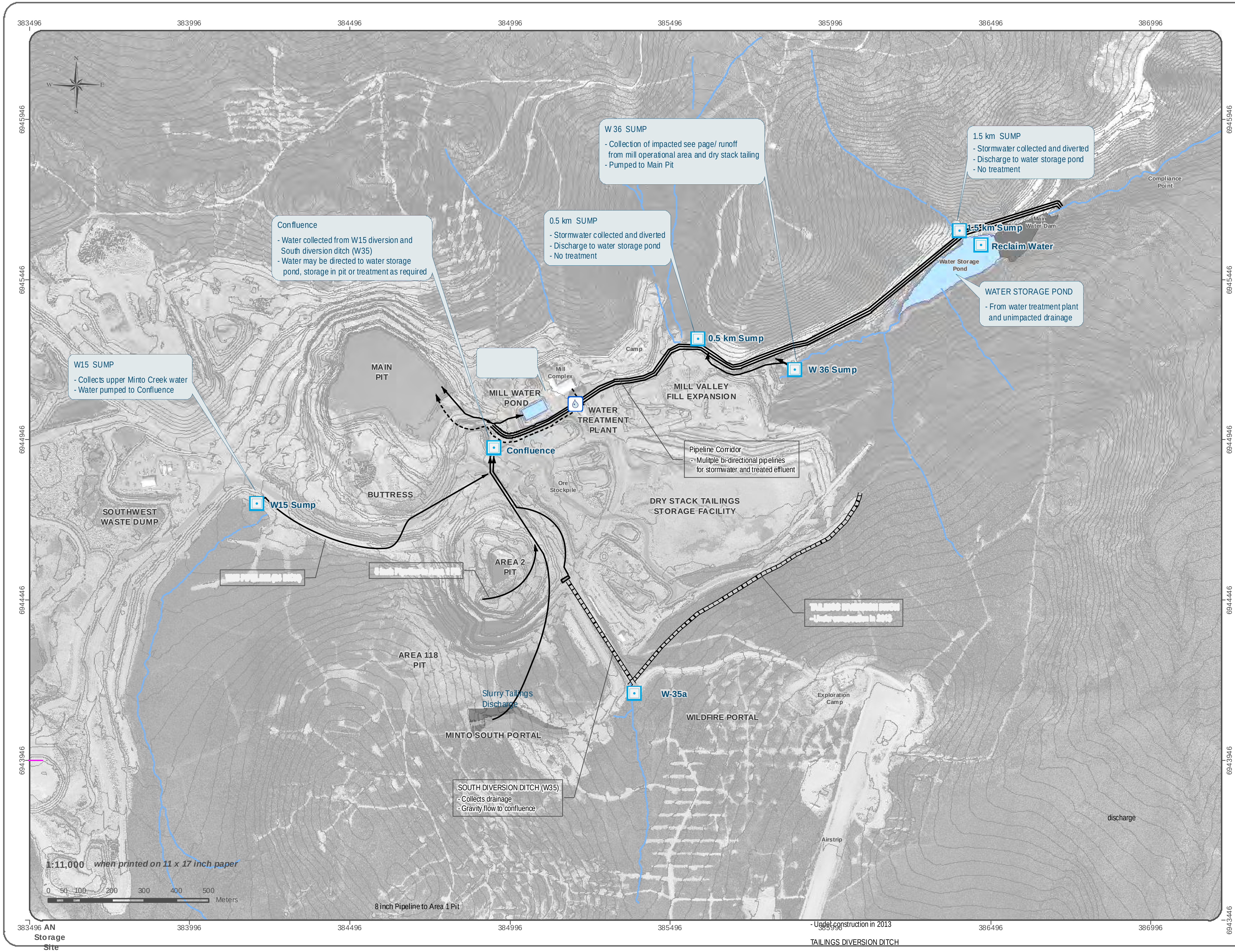
		Water Use Licence QZ96-006				Modelling Predictions of Main Pit Water Quality[B, C] Maximum Values (2012 to 2017)	Main Pit Concentrations Measured in 2013[D]
Parameter		From WTP to Minto Creek	Freshet[A] at W50 and W17	Non-Freshet at W50 and W17	Non-Freshet at W2	Max Concentration	Max Dissolved
Ammonia	mg/L	0.89	0.89	0.89	0.35	-	4.5
N-NO2	mg/L	0.15	0.15	0.15	0.06	-	0.94
N-NO3	mg/L	7.65	7.65	7.65	2.9	>15	32.2
P		-	-	-	0.02	-	0.017
Al	mg/L	2.7	2.7	2.7	0.62	3.1	0.029
As	mg/L	-	-	-	0.005	0.0055	0.0021
Cd	mg/L	0.00015	0.00015	0.00015	0.00004	0.00065	0.000029
Cr	mg/L	0.008	0.008	0.008	0.002	0.0056	<DL
Cu	mg/L	0.05	0.08	0.05	0.013	0.40	0.035
Fe	mg/L	3.5	3.5	3.5	1.1	3.60	0.030
Pb	mg/L	0.02	0.02	0.02	0.004	0.0030	<DL
Mo	mg/L	0.4	0.4	0.4	0.073	0.13	0.053
Ni	mg/L	0.5	0.5	0.5	0.11	0.012	0.0032
Se	mg/L	0.003	0.003	0.003	0.001	0.057	0.0059
Zn	mg/L	0.15	0.15	0.15	0.03	0.065	0.052

Source: SRK, X:\01_SITES\Minto\1CM002.024_Water_Balance_Support\2013_Water_Balance_Update\All_Model_Results_for_WQ_Model_Comparison_for_2013_An_Report_1CM002_011_SRJ_Rev00.xlsx

Notes:

[A] April 1 to May 31
[B] Operational Predictions are for dissolved phases only. Effluent from the Minto Mine is assumed to be sourced from the Main Pit in the operational period from 2012 to 2017.
[C] Model Results from: X:\01_SITES\Minto\!020_Site_Wide_Data\Water_and_Load_Balance_Files\01_Project_Phases\04_Amendment_8_Support\01_Goldsim_Model\MintoAmend8Support_1CM002.003_Rev34_TC_SRJ_500.gsm
[D] Analytical data from Minto’s water quality monitoring program.

Figures



MINTO MINE

ANNUAL REPORT

FIGURE 1
OPERATIONAL WATER MANAGEMENT

MARCH 2014

capstone
MINTO MINE

ACCESS

Aerial imagery obtained from Challenger Geomatics. Imagery acquired August 11th 2013.
Site contours derived from 2012 aerial imagery obtained from Challenger Geomatics.

Hydrology data provided by Minto Explorations Ltd, May 2009.

Datum: NAD 83 Projection: UTM Zone 8N

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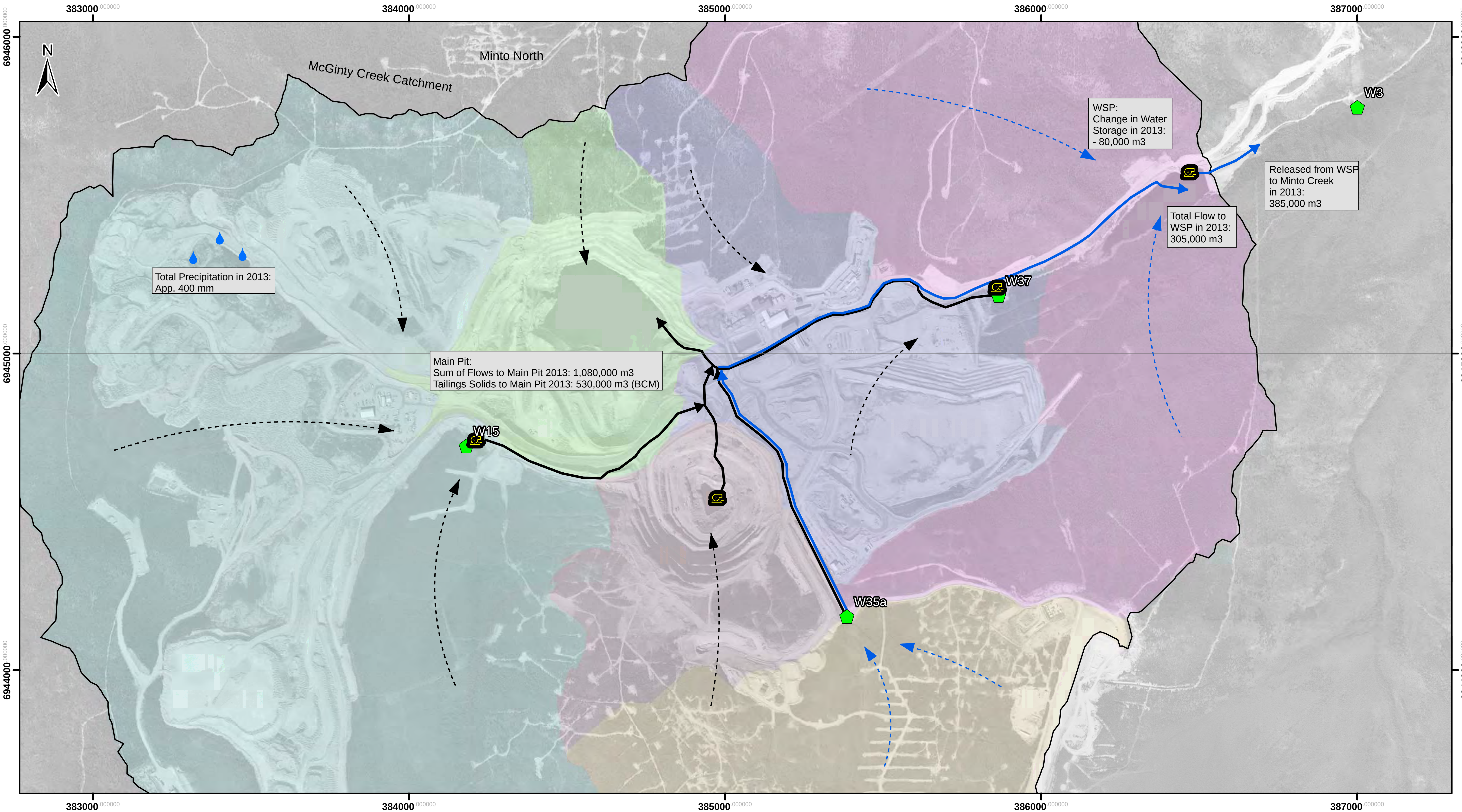

Legend

To Area 2 Pit
To Main Pit
To W15
To W35a
To W36
To WSP
to Main Pit (Piped)
to Main Pit (Runoff)
to WSP (Piped)
to WSP (Runoff)
Pump Location

Notes: catchment delineation by Access Consulting Group (2013)
Datum: NAD 83 Projection: UTM Zone 8N
Aerial imagery obtained from Challenger Geomatics.
Imagery acquired August 11 th 2013.
Document Path:
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Minto Mine Annual Report

Minto Mine
2013 Water Balance Summary

Date:	Approved:	Figure:
11 March 2014	SRJ	2