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Minto Mine Constructed Wetland Treatment Research Program – Demonstration Scale

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Prepared for

Minto Explorations Ltd.

Capstone Mining Corp.

#13 Calcite Business Centre
151 Industrial Road
Whitehorse, Yukon
Y1A2V3

Prepared by:

Contango Strategies Limited

15-410 Downey Road
Saskatoon, SK
S7N4N1

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Table of Contents

1. Introduction and Background ... 3
2. Design ... 3
 2.1. System layout and dimensions ... 3
 2.2. Soil and Amendments ... 7
 2.3. Plants ... 9
 2.4. Water ... 14
 2.5. Data Collection ... 17
3. Sampling Schedule for 2015 ... 18
4. Long-term conceptual testing plan ... 19
5. Closure ... 21
6. References ... 22
Appendix A – Tables of analytical results for water, soils, and plants

1. Introduction and Background

The Minto mine, operated by Capstone, is located 240 km northwest of Whitehorse on the west side of the Yukon River. The Minto property lies within the eastern part of the Dawson Range, with elevations from 700 to 1000 m; the landscape has rounded mountains intersected by broad valleys and drainages that are part of the Yukon River watershed.

The Minto mine has been in commercial operation since October 2007 and the deposits being mined are copper sulphide mineralized zones. Surface and groundwater water quality is a key consideration in the evaluation of potential effects of mining and mineral development projects and changes to water quality parameters have the potential to affect aquatic and human use of water resources. A Reclamation and Closure Plan (RCP) is required under both the Water Licence and the Quartz Mining Licence. The RCP is intended to address the long-term physical and chemical stability of the site and closure of the proposed features and disturbances associated with the mine. As a part of the RCP, a Constructed Wetland Treatment System (CWTS) is being designed, evaluated, and optimized for water treatment at closure through a phased program (Minto Phase V/VI Expansion Project, YOR Project Number 2013-0100).

Once established, wetlands can become self-sustaining ecosystems with plants providing yearly renewal of carbon to fuel microbial activity. As such, they possess the desirable potential to remediate contaminated mine drainage for as long as it is generated. In order for CWTSs to be effective, they must be designed, piloted, optimized, implemented, and maintained in a site-specific manner. A scaled approach for CWTS implementation allows for improvement, optimization, and flexibility for modifications along each step. Phases include: 1) site assessment and information gathering, 2) technology selection and conceptual design, 3) pilot-scale testing and optimization (controlled environment), 4) on-site demonstration-scale confirmation and optimization, and 5) full-scale implementation. Phases 1-3 have been completed (reports 2013-0100-256 and 2013-0100-257 on YESAB registry, and Contango, 2014) and confirmed plant amenability to transplantation and the CWTS design for further on-site testing. During pilot-scale trials, the selected CWTS design achieved 92% removal of copper (mean influent 146 µg/L, outflow 11.3 µg/L) and 41% removal of selenium (mean influent 10.2 µg/L, outflow 6 µg/L) using synthetic influent designed to mimic the worst-case water chemistry of a long-term closure scenario. Phase 4 of the project is now underway, with the on-site demonstration scale CWTS constructed at the Minto Mine during fall 2014. This document reports on the on-site demonstration scale CWTS design, construction, preliminary data, sampling schedule, and the long-term conceptual closure plan.

2. Design

2.1. System layout and dimensions

The demonstration-scale CWTS includes 2 systems in parallel with 2 cells in each series and a final catchment basin that both systems flow into (Figures 1-3). The location of the system in relation to the Minto site is provided in Figure 1. A stable foundation on waste rock fill was selected for the CWTS and a base of residuum (sandy gravel) material was placed in compacted lifts to allow for shaping of the structure to design specifications. The two parallel systems serve as a replicate for data analysis, but as testing progresses, it is also possible that one of the two systems may be subjected to alternate conditions for comparative purposes.

The four planted cells ranged slightly in width and length. The as built sizing of the cells (at soil surface), after soil and amendments were added, ranged from 2.8 m to 3.8 m in width and 8.7 m to 9.8 m in length (Figure 4, Table 1). This was consistent with the submitted design of the cells being 3 to 4 times longer than wide.

The 4 cells and catchment basin were roughed in and large sharp rocks hand picked and removed prior to final grading and survey. The finished surface was lined with an impermeable 4030 Enviro Liner® that was welded together and sandwiched between two layers of 12 ounce geotextile fabric.

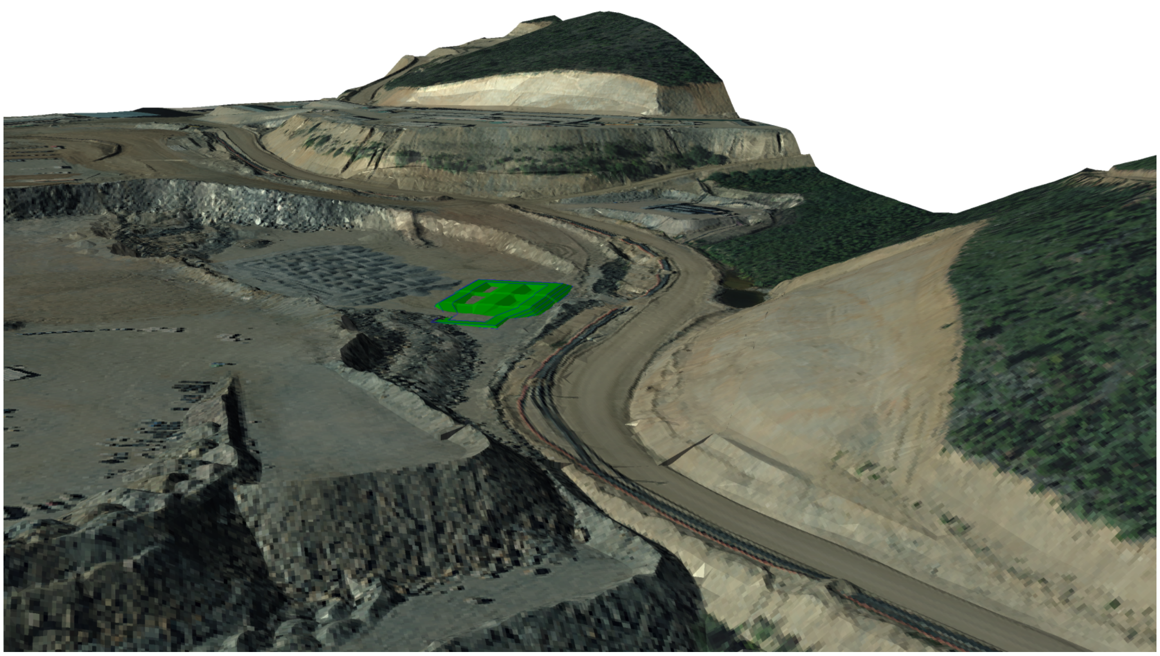

Figure 1. Location of demonstration-scale CWTS at Minto mine.

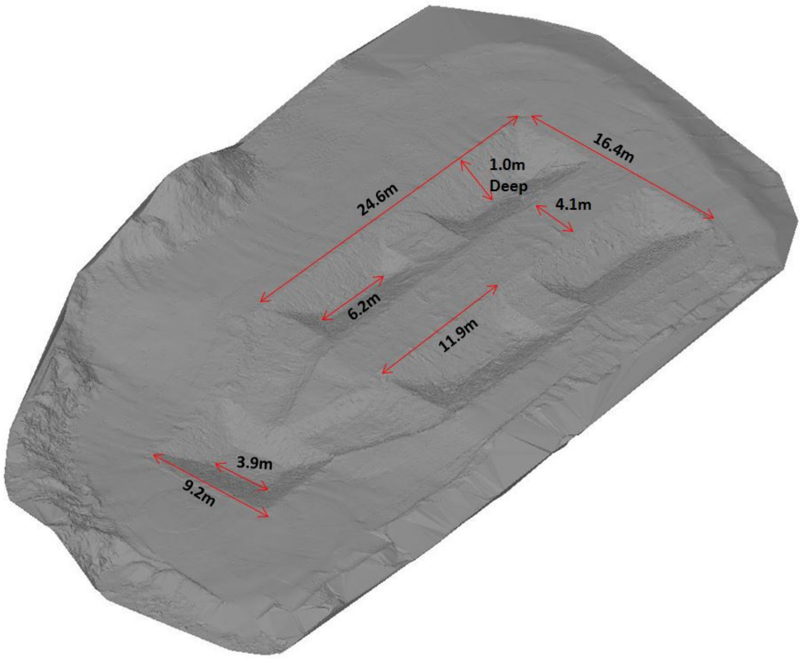

Figure 2. As built schematic of demonstration-scale CWTS.

Figure 3. Demonstration-scale CWTS prior to liner installation.

Table 1. Measurements of demonstration-scale CWTS cells at soil surface and resultant areas of treatment systems.

Measurement		1A	1B	2A	2B
Width (m)	Inflow	3.6	3.8	3.6	2.8
	Outflow	3.3	3.8	3.3	3.6
Length (m)		9.8	9.5	8.7	8.8
Approximate surface area at soil (m^2)		33.8	36.1	30.0	28.2
Total area of System at soil (m^2)		69.9		58.2	

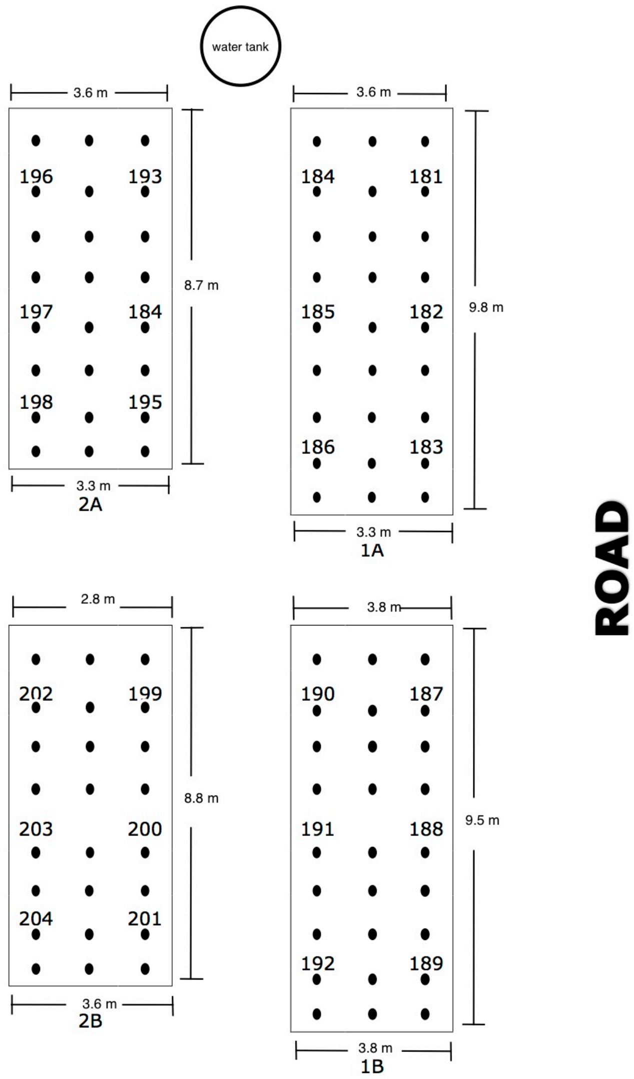

Figure 4. Diagram of demonstration-scale CWTS with dimension measurements at soil surface showing grid (by moss stakes; black dots) and locations of soil redox probes (with identifying numbers; Table 2).

2.2.Soil and Amendments

The recommended soil for the CWTS is sand, with 2-7% by volume as organic material (e.g., woodchips, peat). In the pilot-scale systems, this resulted in a total organic carbon (TOC) content of 0.2-0.6% (the sand itself was at 0.1% TOC prior to adding amendment). In this composition, the sand allows for circulation of water through the root zone of the plants, while the organic matter initiates reductive microbial processes that in future years will be sustained by decaying plant matter. In the case of this demonstration-scale system, the soil added to each of the 4 cells was from a local overburden site. The characteristics of this soil are provided in Appendix A. This borrow site was different than the site that was sampled during the Contango Strategies Ltd. (CSL) assessment in 2013, and also different than that tested in June 2014 (Appendix A, Table A1-A3).

The overburden soil used in the demonstration-scale CWTS was taken from stockpiled material that originated as richly organic soil from stripping of the Area 2 Pit. The calcium, magnesium and sulphate concentrations were higher than those of the pilot-scale tests, but this is not expected to negatively impact the performance of the CWTS. Owing to the general mineralization of the area, the concentration of copper was elevated in all soils tested as potential borrow sources. The synthetic precipitation leaching procedure (SPLP) analysis conducted on the soils used in the demonstration-scale wetland suggested there is between 148-608 µg/L of available copper and 0.35-0.69 µg/L of available selenium in the soil. This should be monitored and taken into consideration with wetland performance, and it may be necessary to investigate other sources of soil with lower copper concentration for final full-scale construction.

It was observed that the soil that was used for the demonstration-scale wetlands was higher in organic content and lower in sand than those used in the pilot-scale testing, or tested during the site assessment or June 2014 pre-construction sampling. This higher organic content was also associated with a more loamy texture. Due to the higher organics content in the soil being used for the demonstration-scale CWTS, there was less organic amendment added (by volume) than was initially planned. As the soil was added by the backhoe (Figure 5), there was 1 standard size straw bale (measuring 36 cm x 46 cm x 102 cm) and 50 rounded standard shovels of a 50:50 mix of spruce and pine wood shavings placed in each of the cells and mixed by hand with shovels and rakes (Figures 6 and 7). There was no biochar added as was proposed in the initial design as this was determined to not be required after the piloting phase at the CSL facilities (Contango, 2014).

The high organic content of this soil may actually be beneficial to the treatment of elements, through both sorption and increased microbial reductive processes. The drawback of using this organic material is that it may not facilitate the circulation of water in the root zone the way sand or gravel would, and it is also more difficult to work with for construction purposes. Specifically, the material used in the demonstration-scale CWTS did not support weight as a sandy soil would. For this reason, the wetland was planted while the soils were somewhat dry (before flooding), as the people planting the wetland would sink into the soil if it were wet. This should be taken into consideration if building the full-scale CWTS for the sake of ease of accessing monitoring points within the wetland, or if any revegetation campaigns are needed. Over time, however, the plant roots and moss will grow and provide greater physical stability to the soils.

Upon inspection, there was too much soil placed in the cells by the mini-backhoe; some of the soil was therefore removed to bring the outflow depth to 20 cm and maintain a level grade in each of the 4 cells to a tolerance of +/- 5 cm in order to provide a uniform water depth. A uniform water depth is necessary to prevent future issues such as channeling of water, open water spots due to plants being unable to grow because of excessive water depth, or conversely, drying out.

Figure 5. Soil being added to demonstration-scale CWTS cells.

Figure 6. Organic soil amendments used in demonstration-scale CWTS. Left, wood shavings 50:50 pine and spruce mixture; Right, straw.

Figure 7. Mixing organic amendments into soil in demonstration-scale CWTS cell 2A.

2.3. Plants

The demonstration-scale CWTS was planted with *Carex aquatilis* (Sedge) and mosses, as was determined by pilot-scale testing as being the best design for this site and application (Contango, 2014). These plant species were harvested for the demonstration scale CWTS from a location that was identified during the August/September 2013 site assessments in the vicinity of the W10 monitoring point (reports 2013-0100-256 and 2013-0100-257 on the YESAB registry). This site had *C. aquatilis* and aquatic mosses growing together as is desired for the CWTS design (Figures 8 and 9). Plant tissues were sent for analytical testing to determine initial concentrations (Appendix A, Table A4).

All 4 cells of the demonstration-scale CWTS were measured and the center of the width marked at both the inflow and outflow ends of each of the cells. The tape measure was then placed on the center axis down the length of each cell to start laying the center grid. The grid was created using wooden gardening stakes (50 cm in height), with aquatic moss tied to one end and inserted into the soil so that the moss was just above the soil (Figure 10; eventually to be submerged in the water). The grid for planting the *C. aquatilis* was created with these stakes, starting on the inflow end of each cell, with stake placement every 1 m progressing to the outflow (Figure 11). The final grid near the outflow of the cell was therefore sometimes less than 1 m of soil, but may look like a greater size due to the overlaying water. This was repeated moving outward from the center line, creating a grid of 1 m square areas for planting *C. aquatilis* to facilitate future monitoring of plant density. Depending on the varying width and length of the cells, along the sides of the length of the cells and the outflow of the cells the grids varied from 1 m squared to smaller than 1 m squared (Table 2).

Table 2. Number of planted grids in each demonstration-scale CWTS cell.

Item	Cell			
	1A	1B	2A	2B
Moss stakes	3*9=27	3*9=27	3*8=24	3*8=24
1 m squares	18	18	16	16
< 1 m squares (perimeter of CWTS cells)	22	22	20	20

Using the 4 stakes marking the edges of the grid, 5 *C. aquatilis* were planted into the soil inside each 1 m by 1 m grids, with one in the middle and 4 others approximately equidistant from the stakes to create an even distribution of 5 sedge per square meter (Figure 12). This placement and grid system was used to ensure even distribution of plants through the demonstration-scale CWTS, with the foresight of future monitoring for plant establishment and density. As the grids at the perimeter of each wetland cell varied and were often smaller than 1 m by 1 m, it was estimated based on the size of the grid how many sedge should be planted to maintain a consistent density of plants.

Figure 8. Harvesting plants from W10 location (top), and transporting back to demonstration-scale CWTS (bottom).

Figure 9. Images of *Carex aquatilis* and aquatic mosses harvested at W10 for planting the demonstration-scale CWTS. Left, aquatic mosses growing at water surface at edge of *C. aquatilis*; top right, underwater photograph of aquatic moss; bottom right, *C. aquatilis* and aquatic mosses growing together.

Figure 10. Example of moss tide to stakes, which then were used to make grid in each demonstration-scale CWTS (Figure 4, 11, 12 and Table2).

Figure 11. Moss stakes placed in demonstration-scale CWTS cell 2A, looking towards cell 2B.

Figure 12. *C. aquatilis* planted within grid of moss stakes in demonstration-scale CWTS cell 2A, and influent perforated pipe being laid in place.

2.4.Water

Water from the W36 area receiving seepage from the toe of the MVFE (Figure 13) was selected for the demonstration-scale CWTS testing as the leachate is similar to that expected upon closure in the Mill Valley Fill Extension (MVFE) area. The chemistry of this water at the time of bringing the demonstration-scale CWTS online (September 18, 2014) is provided in Appendix A, Table A5. A Grundfos CR1S-6 stage pump was selected to maintain the appropriate head of water in the holding tank to provide a range of flows between 0.1-1.1 m^3/hr on a 4-inch line with 30 m of head (Figure 13). The 3,000 Liter holding tank sits above and between the inflow of cells 1A and 2A and is kept at a constant head via pumping from the W36 sump (Figure 14). Overflow water is returned by gravity flow in a pipe to the W36 area. Meanwhile, water within the holding tank is gravity fed through control valves and flow meters prior to entering the parallel treatment cells (Figure 14). The tank was initially rinsed twice with the W36 water before releasing water into the demonstration CWTS because it had originally contained road dust suppressant (Envirobind). Water is constantly pumped from W36 to the tank that has been modified to maintain a constant head (and therefore pressure) to keep flow rate consistent when set using the manual valves. Flow rates are measured using ultra low flow and high accuracy/totalizer meters from GPI (Figure 14).

A flexible 1-inch braided rubber hose with perforations was attached to each of the flow meters and run to the inflow of cells 1A and 2A (Figure 12 and 14). The placement of these perforated hoses was adjusted to promote even flow across the width of the A cells. The system then operates by gravity flow, with Cell 1A and 2A flowing into 1B and 2B, respectively, before flowing into the catchment basin and returning by pipe to W36 (Figure 15).

Sandbags were used at the outflow of each cell to correct for unevenness in grade and prevent channeling to the lowest point. The average height of water in the cells above the soil was approximately 20 cm (Figure 16).

The flow rates for the systems were set to have a 10 day nominal hydraulic retention time (HRT), meaning water entering the wetland takes 10 days to exit. This is referred to as a nominal HRT because it is a calculation based on the size of the wetland and the amount of water entering, and not confirmed empirically using tracing dyes. The HRT was calculated based on the size of the CWTS at the soil, with a 20 cm overlay of water, but not adjusting for pore water because without dense vegetation, the pore spaces in the soil will only have minimal hydraulic relationship to the overlaying water. This HRT is much longer than what is necessary to achieve treatment based on the pilot-scale systems (~3 days), however, this was chosen to facilitate plant establishment and maturation. Because the sizes of the CWTS systems were slightly different, Series 1 (closer to the road) and Series 2 (further from road) were set with inflow rates of 13,928 L/day and 11,635L/day, respectively, both corresponding to an approximate 10 day HRT. As the flow meters record in US gal/min, this corresponds to 2.6 and 2.13 US gal/min.

Figure 13. Water source for demonstration-scale CWTS. Left, Grundfos CR1S-6 stage pump; Right, water source at W36.

Figure 14. Clockwise from left: holding tank, splitting control valve, and flow meters.

Figure 15. Demonstration-scale CWTS immediately after planting and filling with water (August 29, 2014). Top, photograph taken from camp behind kitchen looking down at inflow of CWTS; bottom, photograph taken from outflow holding pond looking towards camp in background.

2.5. Data Collection

Explanatory parameters are quantifiable aspects of a CWTS that can be used to assess the feasibility of treatment for a range of constituents, and therefore 'explain' the performance of a CWTS. These parameters, which often include acidity, alkalinity, conductivity, dissolved oxygen (DO), pH, oxidation reduction potential (ORP), ion balance, available electrons donors (e.g., organic carbon, reduced elements), and temperature, can be used to predict, promote, and/or optimize the ability of the system to treat different constituents.

The relative oxidation-reduction (redox) potential of the soil will be measured using inert electrodes (copper wire probes with platinum tips) permanently installed in the soil of the cells for the duration of the project (Faulkner et al., 1989; Figure 16). To take a reading of the relative redox potential between the soil and water, a reference electrode (Accumet Calomel) is suspended in the water column above the inert electrode and measured in millivolts by a voltmeter. There were 6 platinum tip probes distributed throughout each of the 4 demonstration-scale cells to try and achieve even distribution based on the varying cell sizes. The probes were inserted to cover the epoxy on the end of the probe and secured with flagging tape to the bamboo poles for visibility. The locations of each probe are provided in Figure 4 and Table 3.

Figure 16. Series 2 (cell 2B in foreground, cell 2A in background), showing sandbags used at inflows and outflows between cells.

Table 3. List of location and probe number for inert electrodes permanently installed in the soil of cells. General location also provided in Figure 4.

Stake - Row	Cell 1A	Cell 1B	Stake - Row	Cell 2A	Cell 2B
2nd - Inside	#181	#187	2nd - Inside	#193	#199
5th - Inside	#182	#188	5th - Inside	#194	#200
8th - Inside	#183	#189	7th - Inside	#195	#201
2nd - Outside	#184	#190	2nd - Outside	#196	#202
5th - Outside	#185	#191	5th - Outside	#197	#203
8th - Outside	#186	#192	7th - Outside	#198	#204

Probe numbers 205 to 209 were left as spares, in case of probe failure.

3. Sampling Schedule for 2015

The sampling schedule for 2015 was conceptually developed prior to beginning construction of the demonstration-scale CWTS (Table 4) and the analytical testing refined and summarized in Table 5. Actual dates of sampling will depend on timing of spring thaw and ability to bring the pumps online at the W36 pond to supply water to the demonstration-scale CWTS.

Table 4. Conceptual sampling parameters, locations, and frequencies.

Frequency	Parameter	Location	Sample Type
Weekly	Temperature (by data logger)	All Cells + Inflow to CWTS	Water
	pH		
	Dissolved Oxygen		
	Conductivity		
	ORP		
	Inflow rates/outflow rates (by meter)		
	Regulated Metals (ICP) (Total and dissolved)		
	Relative redox potential	All Cells	Soil
Monthly	Alkalinity	Outflow All cells + Inflow to CWTS	Water
	Hardness		
	Sulfate		
	Chemical Oxygen Demand		
	Total Organic Carbon		
	Ammonia		
	Nitrate/Nitrite		
	Total Kjeldahl Nitrogen		
	Biological Oxygen Demand	Outflow + Inflow of CWTS	
	Total Suspended Solids		

	Stem counts (and height)	All cells	Plant
Seasonally	Available NPKS	All cells	Soil
	Regulated Metals (ICP)		
	Total Organic Carbon		
	Cation Exchange Capacity (CEC)		
	Sodium Adsorption Ratio		
	Conductivity		
	Sequential Leaching		
	MPN for SeIV, NO_3, and sulphate reducing microbes, and total heterotrophs		
	Genetic microbial community profiles		
Twice per year	Detritus depth/accretion measurement	All Cells	Soil
	Regulated Metals (ICP)		Plant
	Available NPK and Sulphur		

Table 5. Summary of analytical sampling types, frequencies and locations

Water samples	
routine package: Ca, Mg, Na, K, Cl, SO_4, NO_3, NO_2, hardness, alkalinity, pH, EC, TDS	Monthly, outflow of each cell and inflow water
Chemical oxygen demand (COD)	Monthly, outflow of each cell and inflow water
Total organic carbon	Monthly, outflow of each cell and inflow water
Ammonia	Monthly, outflow of each cell and inflow water
Total Kjeldahl Nitrogen (TKN)	Monthly, outflow of each cell and inflow water
Total suspended solids	Monthly, outflow of series, and inflow water
Biological Oxygen Demand (BOD)	Monthly, outflow of series, and inflow water
Regulated metals water package (dissolved and total)	Weekly, outflow of each cell and inflow water
In-situ water testing (pH, DO, ORP, Conductivity)	Weekly, all cells and inflow water
Hydrosoil samples	
Relative soil redox	Weekly, all probes (6 per cell)
Cation exchange capacity (CEC)	Seasonally (3x per year), 3 places per cell
SAR, pH, EC, %sat, Ca, Mg, Na, K, Cl, SO4	Seasonally (3x per year), 3 places per cell
Available NPK and sulphur	Seasonally (3x per year), 3 places per cell
Total organic carbon	Seasonally (3x per year), 3 places per cell
Sequential Leaching	Seasonally (3x per year), 3 places per cell
Plant tissue samples	
ICP	2 plant types in triplicate (pre-planting in 2014)
Available NPK and sulphur	2 plant types in triplicate (pre-planting in 2014)
TOC	2 plant types in triplicate (pre-planting in 2014)

4. Long-term conceptual testing plan

A conceptual long-term testing plan has been developed for the demonstration-scale CWTS

(Table 6), which will be refined and adapted based on performance and scientific findings as the trials are conducted. The demonstration-scale wetlands will run for a minimum of 2 more years, until the end of 2016, but ideally longer in order to assess performance under a wider range of conditions. The conditions that could eventually be tested include both natural/environmental and selected influenced pressures, and can be imposed on the systems to mimic peak flow rates or droughts. In 2015 the systems will be allowed to continue to mature, with plants becoming more established and abundant, and microbial communities accordingly acclimating to the targeted conditions. Once plants are well established and showing signs of colonizing through the wetland, the water depth may be increased to 30 cm and the flow rate may also be increased. First, a 5 day HRT (i.e., twice as fast as currently) may be tested, and then fluctuations will be tested based on anticipated seasonal variation.

Table 6. Schedule as per proposed scope of work:

Item		Proposed	Actual
Identify potential location for demonstration scale CWTS (CSL site visit – 1 scientist)		June 1-14 2014	Completed
Engineering and geotechnical (Minto)		June - July 2014	Completed
Construction (Minto)		July 2014	Completed
Planting and bringing system online (CSL site visit – 1 scientist, 1 technologist), coordinate for local students to assist.		August 2014	Completed (no students available, brought 2 technologists)
Monitoring	2014	Acclimation and maturation at constant flow rate of 10 d HRT	Completed
		September - CSL site visit/checkup (1 technologist, 1 scientist)	Did not occur because constructed was last week of August.
	2015	Continued maturation/acclimation. Operation at constant flow rate of 5-10 d HRT	On Schedule
		Spring – CSL site visit/checkup (1 technologist, 1 scientist), includes micro sampling	
		Summer - Increase depth from 10 cm to 20 cm (1 technologist), includes micro sampling	
		Fall – CSL site visit/checkup (1 technologist), includes micro	

		sampling	
	2016	Operation with weekly flow variations based on seasonal variations	
		Spring – CSL site visit/checkup (1 technologist), includes micro sampling	
		Summer - CSL site visit/checkup (1 technologist, 1 scientist), switch to hybrid bioreactor phase if appropriate, includes micro sampling	
		Fall - CSL site visit/checkup (1 technologist), includes micro sampling	
	2017	Hybrid Bioreactor/CWTS phase, late in operation 2016 or 2017, exact timing to be determined based on results from initial operations of the demo scale and results of hybrid CWTS/bioreactor pilot testing. This will involve adding solid organic matter (such as alfalfa hay, straw) to the CWTS cell(s).	
Reporting	2014-2016	Reporting will be performed twice annually, in the form of an interim update and comprehensive (all data to date) report.	On Schedule

5. Closure

We trust the information herein satisfies your present requirements. Should you have any questions, please contact the persons listed below. We appreciate the opportunity to provide the services detailed in this report, and look forward to discussing any comments you may have.

Respectfully submitted,
Contango Strategies Ltd

Monique Haakensen, PhD, RPBio, PBiol, EP
President & Principal Scientist

Vanessa Pittet, PhD, EPt
Principal Scientist

6. References

Contango Strategies. Minto Mine Constructed Wetland Treatment Research Program – Pilot Scale Report, November 3, 2014.

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Table A1. Analytical results from initial soil sampled August 28, 2014

Parameter	Units	Rep1	Rep2	Rep3	Rep4	Wood Shavings	Straw	RDL
Calculated Parameters								
Anion Sum	meq/L	5.0	3.1	0.89	0.81	1.0	14	N/A
Cation Sum	meq/L	8.1	6.5	13	5.4	2.2	24	N/A
Cation/EC Ratio	N/A	11	11	10	11	10	9.4	0.10
Ion Balance	N/A	1.6	2.1	15	6.7	2.2	1.7	0.010
Cation exchange capacity	cmol+/Kg	22	20	18	20	<10	50	10
Soluble Parameters								
Soluble Chloride (Cl)	mg/L	41	16	240	26	12	310	5.0
Soluble Conductivity	dS/m	0.72	0.61	1.3	0.51	0.21	2.5	0.020
Soluble (CaCl2) pH	pH	6.46	6.44	6.56	6.47	3.95		N/A
Sodium Adsorption Ratio	N/A	0.55	0.53	2.0	0.65	0.30	0.63	0.10
Soluble Calcium (Ca)	mg/L	110	92	150	71	11	20	1.5
Soluble Magnesium (Mg)	mg/L	14	11	16	8.8	4.0	47	1.0
Soluble Sodium (Na)	mg/L	23	20	97	22	4.6	22	2.5
Soluble Potassium (K)	mg/L	7.6	7.4	8.5	7.1	39	710	1.3
Saturation %	%	47	48	47	44	620	1400	N/A
Soluble Sulphate (SO4)	mg/L	210	180	190	140	<5.0	210	5.0
Nutrients								
Available (NH4F) Nitrogen (N)	mg/kg	8.0	8.1	6.0	5.3	<10	<10	10
Available (NH4F) Phosphorus (P)	mg/kg	5.1	5.7	5.6	3.9	16	200	5.0
Available (NH4OAc) Potassium (K)	mg/kg	55	53	48	61	260	7700	10
Available (CaCl2) Sulphur (S)	mg/kg	29	24	27	24	<20	850	20
Nitrite (N)	mg/L	0.0165	0.0216	0.0156	0.0623	0.0127	<0.50	0.50
Nitrate (N)	mg/L	0.315	0.445	0.332	0.150	0.252	<2.0	2.0
Total Ammonia (N)	mg/L	<0.0050	0.0076	0.0086	0.0090	0.0428	0.067	0.050
Misc. Inorganics								
Fluoride (F)	mg/L	0.220	0.350	0.250	0.210	0.041	0.089	0.010

Parameter	Units	Rep1	Rep2	Rep3	Rep4	Wood Shavings	Straw	RDL
Dissolved Organic Carbon (C)	mg/L	6.55	5.91	4.96	6.85	355	815	50
Total Organic Carbon (C)	%	1.9	1.8	3.1	1.8	48	45	0.10
Alkalinity (Total as CaCO3)	mg/L	33.5	126	36.7	34.8	30.7	304	0.50
Alkalinity (PP as CaCO3)	mg/L	<0.50	13.2	2.49	8.01	<0.50	<0.50	0.50
Bicarbonate (HCO3)	mg/L	40.9	121	38.7	22.9	37.5	371	0.50
Carbonate (CO3)	mg/L	<0.50	15.9	2.99	9.61	<0.50	<0.50	0.50
Hydroxide (OH)	mg/L	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	0.50
Physical Properties								
% sand by hydrometer	%	59	60	55	57			
% silt by hydrometer	%	26	25	28	27			
Clay Content	%	15	16	17	16			
Texture	N/A	SANDY LOAM	SANDY LOAM	SANDY LOAM	SANDY LOAM			
Total Dissolved Solids	mg/L	80	200	104	222	692	2360	10
Dissolved Metals by ICPMS								
SPLP Aluminum (Al)	ug/L	6540	3640	4840	34400	145	151	2.5
SPLP Antimony (Sb)	ug/L	0.242	0.208	0.243	0.48	0.042	<0.10	0.10
SPLP Arsenic (As)	ug/L	3.24	2.19	2.67	15.0	0.446	1.57	0.10
SPLP Barium (Ba)	ug/L	141	79.9	102	476	46.8	396	0.10
SPLP Beryllium (Be)	ug/L	0.133	0.091	0.142	0.629	0.015	<0.050	0.050
SPLP Bismuth (Bi)	ug/L	0.0440	0.0240	0.0270	0.193	<0.0050	0.039	0.025
SPLP Boron (B)	ug/L	519	233	90	<250	127	<250	250
SPLP Cadmium (Cd)	ug/L	0.0470	0.0410	0.0740	0.158	0.137	0.484	0.025
SPLP Cesium (Cs)	ug/L	0.347	0.206	0.290	1.42	<0.050	0.29	0.25
SPLP Chromium (Cr)	ug/L	10.7	7.80	6.12	43.1	0.62	0.94	0.50
SPLP Cobalt (Co)	ug/L	2.53	1.44	2.13	10.5	0.106	0.291	0.025
SPLP Copper (Cu)	ug/L	248	148	186	608	11.0	116	0.25
SPLP Iron (Fe)	ug/L	8900	4950	7040	47400	49.4	308	5.0
SPLP Lanthanum (La)	ug/L	5.72	4.16	4.81	17.9	<0.050	0.27	0.25

Parameter	Units	Rep1	Rep2	Rep3	Rep4	Wood Shavings	Straw	RDL
SPLP Lead (Pb)	ug/L	3.00	1.79	2.21	12.4	1.10	14.7	0.025
SPLP Lithium (Li)	ug/L	2.90	1.66	2.00	12.6	1.05	3.5	2.5
SPLP Manganese (Mn)	ug/L	125	76.0	103	372	272	597	0.25
SPLP Molybdenum (Mo)	ug/L	1.75	1.46	1.94	1.86	0.230	2.52	0.25
SPLP Nickel (Ni)	ug/L	5.93	3.76	5.39	26.5	0.693	2.22	0.10
SPLP Phosphorus (P)	ug/L	132	84.6	107	503	416	1460	10
SPLP Rubidium (Rb)	ug/L	7.05	4.56	5.97	27.7	13.7	241	0.25
SPLP Selenium (Se)	ug/L	0.487	0.355	0.360	0.69	<0.040	1.09	0.20
SPLP Silicon (Si)	ug/L	14900	8970	11200	67100	425	24000	500
SPLP Silver (Ag)	ug/L	0.123	0.0950	0.123	0.325	0.0560	0.446	0.025
SPLP Strontium (Sr)	ug/L	14.2	12.7	12.2	35.6	11.3	156	0.25
SPLP Tellurium (Te)	ug/L	<0.020	0.024	0.021	<0.10	<0.020	<0.10	0.10
SPLP Thallium (Tl)	ug/L	0.0500	0.0310	0.0410	0.184	0.0110	0.103	0.010
SPLP Thorium (Th)	ug/L	1.44	1.06	1.25	4.56	0.0140	0.151	0.025
SPLP Tin (Sn)	ug/L	0.32	<0.20	0.22	1.1	<0.20	<1.0	1.0
SPLP Titanium (Ti)	ug/L	237	129	176	1280	1.28	4.7	2.5
SPLP Tungsten (W)	ug/L	0.093	0.080	0.086	0.203	0.054	<0.050	0.050
SPLP Uranium (U)	ug/L	0.176	0.134	0.151	0.865	0.0110	0.057	0.010
SPLP Vanadium (V)	ug/L	22.0	11.9	16.2	92.1	1.24	2.3	1.0
SPLP Zinc (Zn)	ug/L	19.9	13.2	15.4	74.4	16.0	84.5	0.50
SPLP Zirconium (Zr)	ug/L	1.72	1.42	1.49	5.77	0.12	<0.50	0.50
SPLP Calcium (Ca)	ug/L	3040	3290	3090	7240	3960	18000	250
SPLP Magnesium (Mg)	ug/L	1420	954	1110	6150	1670	38300	250
SPLP Potassium (K)	ug/L	1250	1010	1440	5780	14100	499000	250
SPLP Sodium (Na)	ug/L	43900	33900	22100	26900	8550	20500	250
SPLP Mercury (Hg)	ug/L	<0.050	<0.050	<0.050	<0.25	0.096	<0.25	0.25
SPLP Sulphur (S)	ug/L	<10000	<10000	<10000	<50000	<10000	<50000	50000

Table A2. Sequentially extracted ICP-MS analytical results from initial soil sampled August 28, 2014

mg/kg	Extraction 1				Extraction 2				Extraction 3				Extraction 4				Extraction 5				RDL
	R1	R2	R3	R4	R1	R2	R3	R4	R1	R2	R3	R4	R1	R2	R3	R4	R1	R2	R3	R4	
Al	-	-	-	-	34	28	30	34	800	640	890	720	920	1500	1300	1300	17000	17000	16000	15000	10
Sb	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2.0
As	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	6.5	6.7	6.7	6.3	2.0
Ba	45	24	39	46	91	51	80	76	120	100	120	110	46	150	63	65	540	620	510	530	5.0
Be	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2.0
B	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5.0
Cd	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.30
Cr	-	-	-	-	-	-	-	-	-	-	-	-	2.5	6.2	3.4	3.5	21	31	19	19	2.0
Co	-	-	-	-	-	-	-	-	2.6	2.4	2.4	2.2	-	-	-	-	12	11	11	11	1.0
Cu	2.9	4.9	2.8	3.7	93	35	67	120	270	180	240	290	480	380	630	650	1500	960	1400	1300	2.0
Fe	-	-	-	-	-	85	-	-	5000	4400	5300	4700	340	610	440	550	35000	31000	34000	33000	50
Pb	-	-	-	-	-	-	-	-	1.4	1.3	1.5	1.4	-	1.1	0.60	0.74	6.0	8.4	5.3	5.3	0.50
Mn	-	-	-	2.3	140	76	120	130	160	110	150	150	19	21	23	28	750	490	670	700	2.0
Mo	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2.9	2.0
Ni	-	-	-	-	-	-	-	-	3.7	5.9	3.7	3.4	-	3.3	-	-	18	28	17	17	2.0
Se	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2.0
Ag	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.50
Ar	14	13	12	14	7.7	7.3	6.9	6.2	-	5.8	-	-	-	-	-	-	48	58	45	47	5.0
Tl	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.22	0.16	0.20	0.20	0.10
U	-	-	-	-	0.19	0.46	0.17	0.15	0.17	0.38	0.17	0.15	-	0.45	0.10	0.11	0.87	2.1	0.78	0.77	0.10
V	-	-	-	-	-	-	-	-	10	12	11	9.3	-	3.8	-	-	80	79	75	74	2.0
Zn	-	-	-	-	-	-	-	-	11	9.1	12	10	-	6.1	5.2	5.5	89	70	83	82	5.0

Table A3. Sequentially extracted ICP-MS analytical results from initial wood shavings and straw amendments sampled August 28, 2014

mg/kg	Wood Shavings					Straw					RDL
	E1	E 2	E3	E4	E5	E1	E2	E3	E4	E5	
Al	-	-	-	-	-	-	-	-	-	35	10
Sb	-	-	-	-	-	-	-	-	-	-	2.0
As	-	-	-	-	-	-	-	-	-	-	2.0
Ba	-	-	-	-	10	-	11	10	-	55	5.0
Be	-	-	-	-	-	-	-	-	-	-	2.0
B	-	-	-	-	-	-	-	-	-	-	5.0
Cd	-	-	-	-	-	-	-	-	-	-	0.30
Cr	-	-	-	-	-	-	-	-	-	-	2.0
Co	-	-	-	-	-	-	-	-	-	-	1.0
Cu	-	-	-	-	-	-	-	-	-	3.5	2.0
Fe	-	-	-	-	-	-	-	-	-	140	50
Pb	-	-	-	-	-	-	-	-	-	2.6	0.50
Mn	21	13	5.4	-	86	3.5	14	7.5	-	70	2.0
Mo	-	-	-	-	-	-	-	-	-	-	2.0
Ni	-	-	-	-	-	-	-	-	-	7.1	2.0
Se	-	-	-	-	-	-	-	-	-	-	2.0
Ag	-	-	-	-	-	-	-	-	-	-	0.50
Ar	-	-	-	-	-	-	-	-	-	13	5.0
Tl	-	-	-	-	-	-	-	-	-	-	0.10
U	-	-	-	-	-	-	-	-	-	-	0.10
V	-	-	-	-	-	-	-	-	-	-	2.0
Zn	-	-	-	-	9.0	-	-	-	-	15	5.0

Table A4. Analytical results from plants sampled August 27, 2014

Parameter	Units	Carex						Moss			RDL
		Roots			Leaves						
		Rep 1	Rep 2	Rep 3	Rep 1	Rep 2	Rep 3	Rep 1	Rep 2	Rep 3	
Nutrients											
Available Nitrogen (N)	mg/kg	<10	<10	<10	<10	<10	<10	<10	<10	<10	10
Available Phosphorus (P)	mg/kg	240	48	91	640	520	810	470	340	150	5.0
Available Potassium (K)	mg/kg	8100	1400	3200	9100	8100	11000	4000	5400	2700	10
Available Sulphur (S)	mg/kg	210	670	700	170	340	530	290	400	220	20
Misc. Inorganics											
Total Organic Carbon (C)	%	39	36	37	38	38	43	43	45	40	0.10
Total Carbon	%	41	37	38	45	40	44	41	45	44	0.20
Inorganics											
Moisture	%	87	88	86	74	77	75	90	94	92	1.0
Metals											
Antimony (Sb)	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.05
Arsenic (As)	mg/kg	1.7	1.0	0.4	0.3	0.1	<0.1	0.2	0.1	<0.1	0.1
Barium (Ba)	mg/kg	53.9	34.3	28.2	31.0	23.3	17.9	29.9	22.3	10.5	0.3
Beryllium (Be)	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.05
Bismuth (Bi)	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.05
Boron (B)	mg/kg	<0.5	0.6	0.8	1.0	0.8	1.1	0.5	<0.5	<0.5	0.5
Cadmium (Cd)	mg/kg	0.02	<0.01	0.01	<0.01	<0.01	<0.01	0.01	<0.01	0.01	0.01
Calcium (Ca)	mg/kg	973	648	752	1160	944	743	1460	1210	1160	50
Chromium (Cr)	mg/kg	1.4	1.2	0.6	1.3	0.5	0.4	<0.3	<0.3	<0.3	0.3
Cobalt (Co)	mg/kg	1.45	0.864	0.965	0.594	0.333	0.164	0.645	0.464	0.166	0.005
Copper (Cu)	mg/kg	93.7	47.0	15.1	20.5	21.9	6.8	13.8	18.3	11.2	0.5
Iron (Fe)	mg/kg	7870	4540	2560	2080	1140	540	1190	1020	404	3
Lead (Pb)	mg/kg	0.27	0.11	0.11	0.08	0.06	<0.03	0.04	0.04	0.03	0.03
Magnesium (Mg)	mg/kg	910	477	327	653	321	325	293	229	190	100
Manganese (Mn)	mg/kg	98.3	128	151	116	282	141	272	179	27.1	0.3
Molybdenum (Mo)	mg/kg	0.18	0.21	0.15	0.31	0.41	0.17	0.29	0.09	0.25	0.05
Nickel (Ni)	mg/kg	0.87	0.41	0.37	0.32	0.20	0.11	0.36	0.49	0.13	0.05
Phosphorus (P)	mg/kg	<500	<500	<500	<1000	<1000	<1000	<500	<500	<500	500
Potassium (K)	mg/kg	1180	1070	1440	2860	3620	3430	674	363	315	100
Selenium (Se)	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	0.2
Silver (Ag)	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.05
Sodium (Na)	mg/kg	509	512	508	222	149	180	94	54	<50	50
Strontium (Sr)	mg/kg	5.8	4.4	5.7	5.7	5.4	4.7	10.1	8.2	7.1	0.5
Thallium (Tl)	mg/kg	0.007	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	0.003
Tin (Sn)	mg/kg	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	0.3
Titanium (Ti)	mg/kg	109	49	24.3	42	22.8	8.0	6.0	5.9	4.6	0.5
Uranium (U)	mg/kg	0.049	0.025	0.035	0.016	0.016	0.012	0.014	0.015	0.007	0.005
Vanadium (V)	mg/kg	11.8	4.9	3.2	3.5	1.8	0.7	0.7	0.8	0.4	0.3
Zinc (Zn)	mg/kg	12	6	4	7	7	4	5	4	2	2

Table A5. Analytical results from water sampled September 18, 2014

Parameter	Units	CWTS LINE 1	CWTS 1A	CWTS 1B	CWTS LINE 2	CWTS 2A	CWTS 2B	CWTS FINAL	RDL
Elements									
Total Aluminum (Al)	mg/L	0.13	0.031	0.044	0.011	0.021	0.016	0.026	0.0030
Dissolved Aluminum (Al)	mg/L	0.0062	0.0093	0.015	0.0091	0.0097	0.013	0.017	0.0030
Total Antimony (Sb)	mg/L	<0.00060	<0.00060	<0.00060	<0.00060	<0.00060	<0.00060	<0.00060	0.00060
Dissolved Antimony (Sb)	mg/L	<0.00060	<0.00060	<0.00060	<0.00060	<0.00060	<0.00060	<0.00060	0.00060
Total Arsenic (As)	mg/L	0.00041	0.00041	0.00044	0.00034	0.00039	0.00038	0.00039	0.00020
Dissolved Arsenic (As)	mg/L	0.00038	0.00038	0.00040	0.00034	0.00034	0.00039	0.00042	0.00020
Total Barium (Ba)	mg/L	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.010
Dissolved Barium (Ba)	mg/L	0.12	0.12	0.13	0.12	0.12	0.13	0.13	0.010
Total Beryllium (Be)	mg/L	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.0010
Dissolved Beryllium (Be)	mg/L	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.0010
Total Boron (B)	mg/L	<0.020	<0.020	<0.020	<0.020	0.024	0.020	<0.020	0.020
Dissolved Boron (B)	mg/L	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	0.020
Total Cadmium (Cd)	ug/L	0.048	0.045	0.039	0.046	0.040	0.029	0.021	0.020
Dissolved Cadmium (Cd)	ug/L	0.046	0.036	0.030	0.041	0.038	0.022	<0.020	0.020
Total Calcium (Ca)	mg/L	130	130	130	130	130	130	130	0.30
Dissolved Calcium (Ca)	mg/L	130	120	120	130	120	120	120	0.30
Total Chromium (Cr)	mg/L	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.0010
Dissolved Chromium (Cr)	mg/L	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.0010
Total Cobalt (Co)	mg/L	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030	0.00030
Dissolved Cobalt (Co)	mg/L	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030	0.00030
Total Copper (Cu)	mg/L	0.088	0.047	0.046	0.053	0.047	0.041	0.041	0.00020
Dissolved Copper (Cu)	mg/L	0.046	0.041	0.039	0.047	0.042	0.036	0.034	0.00020
Total Iron (Fe)	mg/L	0.50	0.20	0.20	0.19	0.18	0.15	0.15	0.060
Dissolved Iron (Fe)	mg/L	0.13	0.11	0.12	0.15	0.12	0.10	0.10	0.060
Total Lead (Pb)	mg/L	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	0.00020
Dissolved Lead (Pb)	mg/L	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	0.00020

Parameter	Units	CWTS LINE 1	CWTS 1A	CWTS 1B	CWTS LINE 2	CWTS 2A	CWTS 2B	CWTS FINAL	RDL
Total Lithium (Li)	mg/L	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	0.020
Dissolved Lithium (Li)	mg/L	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	0.020
Total Magnesium (Mg)	mg/L	37	38	37	38	37	37	38	0.20
Dissolved Magnesium (Mg)	mg/L	37	36	37	37	36	36	36	0.20
Total Manganese (Mn)	mg/L	0.26	0.19	0.16	0.26	0.19	0.14	0.094	0.0040
Dissolved Manganese (Mn)	mg/L	0.25	0.18	0.15	0.25	0.20	0.14	0.090	0.0040
Total Molybdenum (Mo)	mg/L	0.0083	0.0082	0.0083	0.0084	0.0083	0.0081	0.0082	0.00020
Dissolved Molybdenum (Mo)	mg/L	0.0079	0.0076	0.0078	0.0077	0.0078	0.0079	0.0076	0.00020
Total Nickel (Ni)	mg/L	0.0013	0.0012	0.0015	0.0012	0.0012	0.0011	0.0012	0.00050
Dissolved Nickel (Ni)	mg/L	0.00075	0.00079	0.00079	0.00072	0.00074	0.00081	0.00068	0.00050
Total Phosphorus (P)	mg/L	0.12	<0.10	<0.10	<0.10	0.14	0.11	<0.10	0.10
Dissolved Phosphorus (P)	mg/L	<0.10	0.13	0.12	<0.10	<0.10	<0.10	<0.10	0.10
Total Potassium (K)	mg/L	4.5	4.5	4.4	4.5	4.5	4.4	4.6	0.30
Dissolved Potassium (K)	mg/L	4.3	4.3	4.4	4.3	4.3	4.3	4.4	0.30
Total Selenium (Se)	mg/L	0.0064	0.0065	0.0064	0.0066	0.0063	0.0063	0.0062	0.00020
Dissolved Selenium (Se)	mg/L	0.0063	0.0061	0.0061	0.0063	0.0061	0.0063	0.0059	0.00020
Total Silicon (Si)	mg/L	7.8	7.2	7.0	7.6	7.2	7.1	7.2	0.10
Dissolved Silicon (Si)	mg/L	7.3	6.9	6.8	7.3	6.9	6.9	6.8	0.10
Total Silver (Ag)	mg/L	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	0.00010
Dissolved Silver (Ag)	mg/L	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	0.00010
Total Sodium (Na)	mg/L	22	22	22	22	22	22	23	0.50
Dissolved Sodium (Na)	mg/L	22	21	22	22	21	22	22	0.50
Total Strontium (Sr)	mg/L	1.3	1.3	1.3	1.4	1.3	1.3	1.3	0.020
Dissolved Strontium (Sr)	mg/L	1.3	1.3	1.3	1.3	1.3	1.3	1.3	0.020
Total Sulphur (S)	mg/L	44	45	43	44	43	44	44	0.20
Dissolved Sulphur (S)	mg/L	42	41	42	42	41	42	42	0.20
Total Thallium (Tl)	mg/L	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	0.00020
Dissolved Thallium (Tl)	mg/L	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	0.00020

Parameter	Units	CWTS LINE 1	CWTS 1A	CWTS 1B	CWTS LINE 2	CWTS 2A	CWTS 2B	CWTS FINAL	RDL
Total Tin (Sn)	mg/L	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.0010
Dissolved Tin (Sn)	mg/L	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.0010
Total Titanium (Ti)	mg/L	0.014	0.0023	0.0038	<0.0010	0.0021	<0.0010	0.0015	0.0010
Dissolved Titanium (Ti)	mg/L	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.0010
Total Uranium (U)	mg/L	0.0031	0.0029	0.0031	0.0031	0.0031	0.0030	0.0031	0.00010
Dissolved Uranium (U)	mg/L	0.0032	0.0032	0.0032	0.0032	0.0032	0.0034	0.0032	0.00010
Total Vanadium (V)	mg/L	0.0011	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.0010
Dissolved Vanadium (V)	mg/L	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.0010
Total Zinc (Zn)	mg/L	0.075	0.055	0.049	0.071	0.059	0.042	0.029	0.0030
Dissolved Zinc (Zn)	mg/L	0.068	0.049	0.037	0.068	0.052	0.038	0.022	0.0030
Misc.									
Dissolved Nitrite (N)	mg/L	0.016	0.020	0.020	0.016	0.020	0.022	0.026	0.010
Dissolved Nitrate (N)	mg/L	12	12	12	12	12	12	12	0.020
Total Ammonia (N)	mg/L	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	0.050
Total Nitrogen (N)	mg/L	13	13	13	13	13	13	13	0.050
Biochemical Oxygen Demand	mg/L	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	2.0
Total Chemical Oxygen Demand	mg/L	27	28	31	26	41	27	27	5.0
Conductivity	uS/cm	920	920	910	930	920	910	900	1.0
pH	pH	8.27	8.23	8.34	8.20	8.32	8.30	8.44	N/A
Total Organic Carbon (C)	mg/L	9.7	9.3	9.7	9.5	10	11	10	0.50
Total Suspended Solids	mg/L	0.67	1.1	1.3	<0.40	0.53	0.67	0.40	0.40
Alkalinity (PP as CaCO3)	mg/L	<0.50	<0.50	0.90	<0.50	<0.50	<0.50	5.0	0.50
Alkalinity (Total as CaCO3)	mg/L	300	300	300	300	300	300	290	0.50
Bicarbonate (HCO3)	mg/L	360	360	360	370	360	360	350	0.50
Carbonate (CO3)	mg/L	<0.50	<0.50	1.1	<0.50	<0.50	<0.50	6.0	0.50
Hydroxide (OH)	mg/L	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	0.50
Dissolved Sulphate (SO4)	mg/L	140	140	140	140	140	140	140	1.0
Dissolved Chloride (Cl)	mg/L	22	21	22	21	22	21	21	1.0