Appendix 32

Whale Tail 2018 Mercury monitoring report

AGNICO EAGLE

MEADOWBANK GOLD PROJECT

2018 Mercury Monitoring Report

In Accordance with NIRB Project Certificate No.008

Prepared by:
Agnico Eagle Mines Limited – Meadowbank Division

March, 2019

EXECUTIVE SUMMARY

During construction and operation of Whale Tail Pit, the diversion of Whale Tail Lake will cause flooding in the Whale Tail Lake sub-watershed, potentially resulting in increased concentrations of mercury in water and biota.

In accordance with Condition 63 of NIRB Project Certificate No. 008 and NWB Water License 2AM WTP1826 Part I, Condition 5, a Mercury Monitoring Plan (MMP) was developed to define the sampling methods and data evaluation that will are used to assess impacts of the Project on concentrations of mercury in the Whale Tail South flooded area.

The MMP includes analysis of mercury and methylmercury concentrations in surface water, sediment, and fish tissue for locations impacted by flooding, as well as reference locations. Measured concentrations of mercury are compared to FEIS predictions to understand whether impacts of the project were accurately identified.

Baseline monitoring for mercury was conducted in 2016-2017 (Appendix A). In 2018, construction of the Whale Tail Dike began in July, but no flooding occurred prior to mercury monitoring in August. Therefore based on the objectives of the Mercury Monitoring Plan, 2018 was considered a baseline year for all sampling locations.

In 2018, supplemental baseline samples of surface water, sediment, and fish tissue were collected. Surface water samples were collected for all sampling locations in August (Whale Tail Lake South, Lake A20, Lake A63, Lake A65, Lake A76, Mammoth Lake, Nemo Lake, Lake 8). Results of the water quality analyses are not yet available and will be reported in the 2019 Annual Report.

Sediment chemistry was assessed for one location (3 replicates) in Whale Tail Lake (South Basin). Results were similar to baseline samples collected in 2016-2017 (Appendix A), and indicate that total mercury in sediment in Whale Tail Lake (South Basin) is below the Canadian Sediment Quality Guideline for the Protection of Aquatic Life.

Supplemental baseline analysis of mercury in fish tissue was also conducted on tissue samples collected during the fishout of Whale Tail Lake (North Basin) and for small bodied fish in conjunction with productivity research studies. Results of this analysis are not yet available and will be reported in the 2019 Annual Report.

This information will provide a foundation for evaluation of mercury monitoring data to be collected from flooded areas, beginning in 2019.

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SECTION 1 • INTRODUCTION

1.1 BACKGROUND AND OBJECTIVES

In 2018, Agnico Eagle Mines Ltd. (Agnico) was issued NIRB Project Certificate No. 008 for development of the Whale Tail site, a satellite deposit at the Meadowbank Mine. The diversion of Whale Tail Lake during construction and operation of Whale Tail Pit will cause flooding of the Whale Tail Lake sub-watershed, potentially resulting in increased concentrations of mercury in water and biota, largely due to the decomposition of newly flooded vegetation.

In accordance with Condition 63 of NIRB Project Certificate No. 008 and NWB Water License 2AM WTP1826 Part I, Condition 5, a Mercury Monitoring Plan (MMP) was developed to define the sampling methods and data evaluation that are used to assess impacts of the Project on concentrations of mercury in the Whale Tail South flooded area.

The objectives of this report are to describe monitoring events for surface water, sediment chemistry and fish tissue that have been implemented under the MMP as part of the Core Receiving Environment Monitoring Program (CREMP) to track concentrations of mercury in the aquatic environment. Results are compared with FEIS predictions of mercury concentrations to understand if impacts of the project were accurately predicted.

SECTION 2 • MONITORING FREQUENCY & LOCATIONS

2.1.1 Environmental Media

The MMP includes analysis of mercury concentrations in surface water, sediment, and fish tissue. Analysis of mercury in benthic invertebrate and zooplankton tissue was conducted as a component of baseline studies, and will be assessed post-flooding following similar methods in the event that impact assessment predictions for water quality, sediment quality and fish tissue are exceeded or increase more rapidly than anticipated (see MMP, July, 2018).

Other relevant water quality parameters (e.g., pH, temperature, dissolved organic carbon, total suspended solids, chlorophyll – see CREMP, Azimuth, 2016) are monitored concurrently with mercury sample collection, and will be used as necessary to support interpretation of mercury monitoring results.

2.1.2 Monitoring Frequency

Once flooding begins (2019), analysis of mercury in surface water is planned to occur monthly during April/May (except FF locations), June, July, August, and November/December (except FF locations).

Sampling for mercury in sediment is planned to occur annually, in August.

Analyses of fish tissue in large-bodied fish are planned in conjunction with Environmental Effects Monitoring under the Metal and Diamond Mining Effluent Regulations, which will begin in 2020. Small-bodied fish tissue will be sampled in 2019 and 2020 in conjunction with research studies on lake productivity (see Portt, 2018).

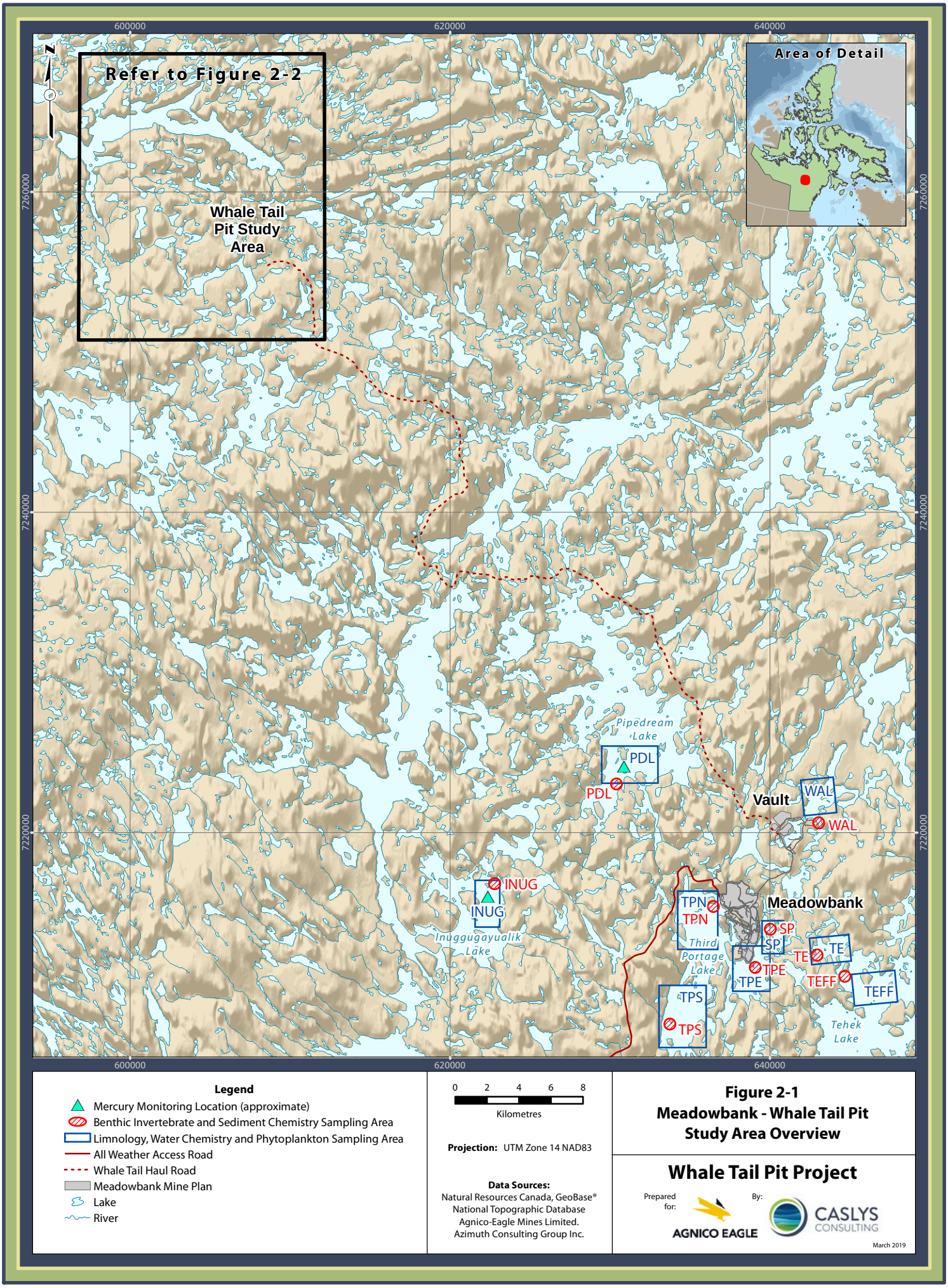
In 2018, no flooding had yet occurred and baseline samples for water quality were collected in August only. These supplement baseline samples collected previously for Whale Tail Lake and Mammoth Lake (see Appendix A). Baseline samples for sediment were also collected in previous years (Appendix A) and one supplemental station in Whale Tail Lake was assessed in 2018 to fill a data gap. Supplemental

baseline analysis of mercury in fish tissue was conducted as part of the 2018 fishout of Whale Tail Lake (North Basin) and small bodied fish were sampled in conjunction with a research study on aquatic ecosystem productivity (see Portt, 2018).

2.1.3 Monitoring Locations

General sampling areas are fully described in the CREMP: 2015 Plan Update – Whale Tail Pit Addendum (Agnico Eagle, 2018). Planned sampling locations for mercury monitoring are shown along with regular CREMP stations in Figure 2-1 and 2-2, and status in 2018 is described in Table 2-1. Locations of fish tissue sampling in 2018 are described in Section 3.3. Stations include most near-field (NF), mid-field (MF), and far-field (FF) areas of the CREMP, as well as an additional location (Lake A65) that will be impacted by flooding. For water and sediment, samples are collected at two (water) or three (sediment) locations within the natural lake areas. Following flooding, samples will also be collected in newly flooded areas (i.e. former terrestrial zones in Whale Tail Lake, A20 and A65).

In 2018, reference locations in the Whale Tail area (Nemo Lake, A8) were sampled, rather than the larger, further afield CREMP reference lakes as described in the MMP. Supplemental samples were collected at near field lake A63, and mid-field lake A76. These lakes are not part of the Version 1 2018 Mercury Monitoring Plan, but in response to comments from Environment and Climate Change Canada (October 17, 2018), the mid-field station will be added to the updated Version 2 of the plan for ongoing sampling.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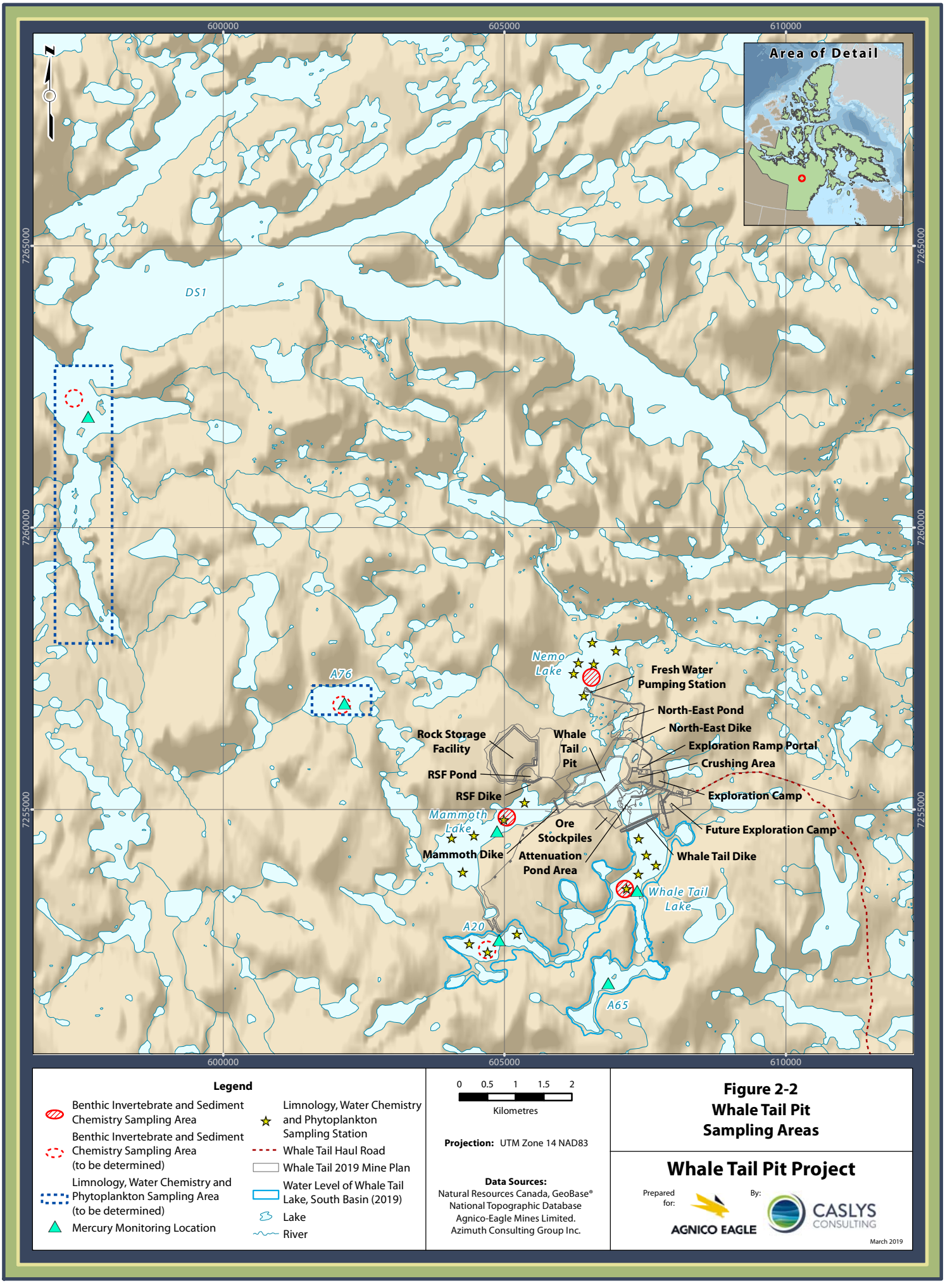
Refer to Figure 2-2
Whale Tail
Pit Study
Area
Area of Detail
Pipedream
Lake
PDL
PDL
Vault
WAL
WAL
INUG
INUG
Inuggugayualik
Lake
TPN
TPN
Meadowbank
SP
SP
TE
TE
Third
Portage
Lake
TPE
TPE
TEFF
TEFF
TPS
TPS
Tehek
Lake
Legend
Mercury Monitoring Location (approximate)
Benthic Invertebrate and Sediment Chemistry Sampling Area
Limnology, Water Chemistry and Phytoplankton Sampling Area
All Weather Access Road
Whale Tail Haul Road
Meadowbank Mine Plan
Lake
River
0 2 4 6 8
Kilometres
Projection: UTM Zone 14 NAD83
Data Sources:
Natural Resources Canada, GeoBase®
National Topographic Database
Agnico-Eagle Mines Limited.
Azimuth Consulting Group Inc.
Figure 2-1
Meadowbank - Whale Tail Pit
Study Area Overview
Whale Tail Pit Project
Prepared for:
AGNICO EAGLE
By:
CASLYS CONSULTING
March 2019



Legend

- Benthic Invertebrate and Sediment Chemistry Sampling Area
- Benthic Invertebrate and Sediment Chemistry Sampling Area (to be determined)
- Limnology, Water Chemistry and Phytoplankton Sampling Area (to be determined)
- Mercury Monitoring Location
- Limnology, Water Chemistry and Phytoplankton Sampling Station
- Whale Tail Haul Road
- Whale Tail 2019 Mine Plan
- Water Level of Whale Tail Lake, South Basin (2019)
- Lake
- River

0 0.5 1 1.5 2

Kilometres

Projection: UTM Zone 14 NAD83

Data Sources:
Natural Resources Canada, GeoBase®
National Topographic Database
Agnico-Eagle Mines Limited.
Azimuth Consulting Group Inc.

Figure 2-2
Whale Tail Pit
Sampling Areas

Whale Tail Pit Project

Prepared for: AGNICO EAGLE

By: CASLYS CONSULTING

March 2019

Table 2-1. Sample types and GPS coordinates for sample locations in 2018 (NAD 83; zone 14). *Construction of the dewatering dike separating Whale Tail Lake North and South basins began in July, 2018 prior to water sample collection. However, no flooding had yet occurred, so 2018 is considered a baseline year for mercury monitoring objectives. Italics indicate supplemental station in 2018. See Section 3.3 for fish tissue sample locations.

Location	Station Type	Area Type	2018 Status	Media Sampled	Station ID	Easting	Northing
Whale Tail Lake South Basin	Near field	Natural lake area	Baseline*	Surface water	WTL-WQ01	607499	7254184
					WTL-WQ02	607161	7253581
				Sediment	WTS-SC-01	607160	7253623
					WTS-SC-02	607185	7253538
					WTS-SC-03	607125	7253563
		Flood zone	N/A	N/A	N/A	N/A	N/A
Mammoth Lake	Near field	Natural lake area	Baseline	Surface water	MMT-WQ01	604111	7254499
					MMT-WQ02	604995	7254789
Lake A20	Near field	Natural lake area	Baseline	Surface water	A20-WQ01	605202	7252750
					A20-WQ02	604700	7252468
		Flood zone	N/A	N/A	A20-WQ01	605202	7252750
Lake A63	Near field	Natural lake area	Baseline	Surface water	A63-WQ01	606121	7253547
					A63-WQ02	606209	7253434
		Flood zone	N/A	N/A	N/A	N/A	N/A
Lake A65	Near field	Natural lake area	Baseline	Surface water	A65-WQ01	607153	7252029
					A65-WQ02	606753	7252186
		Flood zone	N/A	N/A	N/A	N/A	N/A
A76	Mid-field	Natural lake area	Baseline	Surface water	A76-WQ01	602615	7257212
					A76-WQ02	601937	7256931
Nemo Lake	Reference	Reference	Reference	Surface water	NEM-WQ01	606590	7257575
					NEM-WQ02	606991	7257814
Lake 8	Reference	Reference	Reference	Surface water	LK8-WQ01	611043	7258575
					LK8-WQ02	611786	7258428
DS1	Far field	Natural lake area	Baseline	NS	-	-	-
Inuggugayualik Lake	Reference	Reference	Reference	NS	-	-	-
Pipedream Lake	Reference	Reference	Reference	NS	-	-	-

SECTION 3 • MONITORING METHODS

3.1 SURFACE WATER

3.1.1 Sampling Methods

Surface water samples are collected following the standard operating procedure (SOP) described for the Meadowbank and Whale Tail Pit CREMP programs (Azimuth, 2016), with some exceptions as described here. Detailed guidance from the analytical laboratory on field sampling protocols for ultra-trace mercury are followed (see Appendix A). Samples are collected as surface level grabs rather than 3 m depth using a pump and tubing, which is the protocol for regular CREMP samples. For dissolved mercury and dissolved methylmercury analyses, surface water are filtered in the field using a single-use syringe and 0.45 um syringe filtered provided by the analytical laboratory, or a peristaltic pump with muffled filters. All samples are placed in sterile Nalgene bottles and double bagged.

The sample collection team follows a “clean hands/dirty hands” method, with one team member designated the “clean hands” to handle inner bag and sample container, and the second team member designated “dirty hands” will handle the outer bag and filtering, but never contact the sample container or inner bag.

Four 125 mL laboratory-supplied bottles were collected at each sampling event/location, one bottle for each mercury analysis (total and dissolved methylmercury, and total and dissolved ultra-low mercury).

3.1.2 Analytical Methods

In 2018, water samples were collected by a research team from the University of Waterloo (lead by Dr. Heidi Swanson) and analyzed at Biotron, at the University of Western Ontario. This is a CALA-accredited laboratory, with detection limits for mercury that are lower than those available from commercial analytical labs.

The samples were transported in coolers with ice packs and shipped to Biotron at the earliest convenience to minimize the possibility of exceeding the recommended hold-times between collection and analysis. Samples were analyzed using ultra-low detection methods for total mercury (Cold Vapour Atomic Fluorescence – Digestion, Method Ref. modified from EPA 1631, Lab Method ID - TM.0811) and methyl mercury (Cold Vapour Atomic Fluorescence Spectrophotometry, Method Ref. modified from EPA 1630, Lab Method ID - TM.0812).

3.2 SEDIMENT

3.2.1 Sampling Methods

In 2018, sediment samples were collected by Azimuth Consulting Group. Sediment sampling methods follow the standard operating procedure (SOP) for sediment core sampling described in the CREMP: 2015 Plan Update (Azimuth, 2016).

Briefly, sediment core samples are collected concurrently from up to ten replicate locations in each sampling area. These sampling locations are selected in the field within a defined area using a target depth range of 6.5-9.5 m. For natural lake areas, the depth zone is limited to this fairly narrow range to reduce the influence of depth-related variability on the analyses. For newly flooded zones, sample

locations are planned to correspond with soil sampling locations (see Appendix A, Figure 1-1), and this depth range may not be possible.

Sediment cores are collected using a hand-operated gravity corer (barrel diameter of 7 cm). The top 1.5 cm of sediment from one independent core per replicate is sampled. Sediment is transferred into a glass sample jar for analysis.

In 2018, following these procedures, sediment cores were collected from 3 replicate stations in Whale Tail Lake South (WTS-1, WTS-2, and WTS-3). Three sediment samples were collected from each core from the 0-1 cm, 5-6 cm, and 10-11 cm horizons.

In accordance with Version 2 of the Mercury Monitoring Plan (March, 2019), grab samples will be collected annually for mercury analysis, while cores will be collected every three years moving forward.

3.2.2 Analytical Methods

Sediment samples were submitted to ALS (Burnaby, BC) for analysis. The samples were transported in coolers with ice packs and shipped to ALS at the earliest convenience to minimize the possibility of exceeding the recommended hold-times between collection and analysis. Analysis of methylmercury in sediment was completed by ALS following methodology prepared for the US Geological Survey; methylmercury is extracted from the sample and analyzed by cold vapour atomic fluorescence spectrophotometry. Total mercury in sediment is also analyzed by cold vapour atomic fluorescence spectrophotometry, following US EPA methods.

3.3 FISH TISSUE

3.3.1 Sampling Methods

Ongoing sampling of fish tissue for mercury analysis will be conducted in conjunction with EEM Biological Monitoring (beginning in 2020). Briefly, samples of skinless, boneless dorsal muscle will be collected from 20+ Lake Trout from each study lake and analyzed for total mercury. The muscle samples will be removed from each fish using a standard filleting knife and individually sealed in Whirl-Pak or Ziploc bags. The sealed bags will be sealed inside larger Ziploc bags and frozen in a -20°C freezer prior to shipment to the analytical laboratory.

Following similar methods, samples will be collected from small-bodied fish captured through electrofishing in conjunction with a University of Waterloo study on productivity in the flooded area. In 2018, approximately 30 – 50 slimy sculpin (*Cottus cognatus*) were caught and preserved for mercury analysis for each of the following lakes: Whale Tail Lake – South Basin, Mammoth Lake, A20, A65, A63, Lake 8.

Finally, in accordance with the MMP, additional baseline samples were collected during the 2018 fishout of Whale Tail Lake North Basin, following the above methodology. Samples of muscle tissue were collected from of 32 Arctic char, 31 lake trout and 33 round whitefish.

3.3.2 Analytical Methods

Muscle tissue concentrations of total mercury will be analyzed at Biotron at the University of Western Ontario using a Milestone® DMA-80 Direct Mercury Analyzer in accordance with U.S. EPA method 7473 (U.S. EPA, 2007).

SECTION 4 • DATA EVALUATION

4.1 SURFACE WATER

For water quality, the yearly mean measured concentration of total mercury in each study lake is compared to the FEIS maximum predicted value of 0.1 µg/L.

4.2 SEDIMENT

No specific data evaluation criteria are identified for sediment because sediment concentrations of mercury were not predicted as a component of the FEIS. Measured concentrations will be compared to baseline values, where available and the CCME Sediment Quality Guidelines for the Protection of Aquatic Life for total mercury (interim sediment quality guideline (ISQG) of 0.17 mg/kg dry wt; concentration below which adverse biological effects will rarely occur) for surficial sediment samples (0 – 5 cm).

4.3 FISH TISSUE

The FEIS for Whale Tail Pit (June, 2016) assumed that maximum total mercury in Lake Trout could range from 4.4 to 19.7 µg/g ww, with an average ranging from 1.0 to 4.41 µg/g ww. Further detailed modeling by Azimuth (2017) predicted an expected range of 0.9 – 1.75 µg/g ww (95% CI) for a 550 mm Lake Trout. Tissue concentrations measured through this monitoring program will be compared to these predicted values.

SECTION 5 • 2018 MONITORING RESULTS

5.1 SURFACE WATER

Analytical results for baseline surface water samples collected in August 2018 are not yet available, and will be reported as part of the 2019 Annual Report.

5.2 SEDIMENT

Sediment mercury results are presented in Table 5-1. Consistent with baseline data collected in 2016 – 2017 (Appendix A), results from the 2018 supplemental samples indicate that total mercury in sediment in Whale Tail South Lake is below the ISQG.

5.3 FISH TISSUE

Analytical results for baseline fish tissue samples collected during the 2018 fishout of Whale Tail Lake North Basin are not yet available, and will be reported as part of the 2019 Annual Report, along with detailed biological data for each fish.

Table 5-1. Concentrations of mercury in sediment for the Whale Tail Lake study area. ISQG = Interim Sediment Quality Guideline. PEL = Probable Effect Level.

Parameter	CCME (2002) Guideline		Lake	Whale Tail Lake South Basin								
			Sample ID	WTS-1			WTS-2			WTS-3		
			Sample Type	core	core	core	core	core	core	core	core	core
			Depth (cm)	0-1	5-6	10-11	0-1	5-6	10-11	0-1	5-6	10-11
	ISQG	PEL	Date	18-Aug-2018	18-Aug-2018	18-Aug-2018	18-Aug-2018	18-Aug-2018	18-Aug-2018	18-Aug-2018	18-Aug-2018	18-Aug-2018
Total mercury (mg/kg dw)	0.17	0.486		0.0861	0.0515	0.0421	0.0704	0.0523	0.0486	0.0743	0.0445	0.0412
Methyl mercury (mg/kg dw)	-	-		0.00126	0.000304	0.00135	0.000358	0.000294	0.000084	0.000664	0.000196	0.000295

SECTION 6 • CONCLUSION

Baseline data collected in 2016, 2017 (Appendix A) and 2018 indicate that naturally occurring concentrations of mercury in water and sediment are below CCME Guidelines for the Protection of Aquatic Life.

Baseline fish tissue concentrations were collected as part of the 2018 fishout of Whale Tail Lake (North Basin) and productivity research studies, will be available in the 2019 Annual Report.

This information will provide a foundation for evaluation of mercury monitoring data to be collected from flooded areas, beginning in 2019.

REFERENCES

Agnico Eagle (Agnico Eagle Mines Ltd.), 2018. Whale Tail Pit: Cremp Addendum – Appendix A: Mercury Monitoring Plan for Whale Tail South Area. Version1. July, 2018.

Azimuth (Azimuth Consulting Group Partnership). 2017. Whale Tail Pit Project: Predicted Changes in Fish Mercury Concentrations in the Flooded Area of Whale Tail Lake (South Basin). Prepared for Agnico Eagle Mines Ltd., Meadowbank Division. February 2017.

Azimuth (Azimuth Consulting Group Partnership), 2016. Core Receiving Environment Monitoring Program (CREMP): 2015 Plan Update – Whale Tail Pit Addendum. Prepared for Agnico-Eagle Mines Ltd. Meadowbank Division. May, 2016. In: Final Environmental Impact Statement for the Whale Tail Pit and Whale Tail Haul Road Project. Appendix 8-E: Addendums for Environmental Protection and Monitoring Plans. Golder Associates. June 2016.

C. Portt and Associates, 2018. Fish Habitat Offsetting Plan for Whale Tail Pit. Appendix C: Complementary Measures. March, 2018.

APPENDIX A

Mercury Data Compendium and Memorandum (June, 2018)

FINAL

Whale Tail Pit Project: Mercury Data Compendium and Memorandum

Prepared for:

Agnico Eagle Mines Ltd.

Meadowbank Division
Baker Lake, NU
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June 2018

Azimuth Consulting Group Partnership

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Project No. AEM-17-04

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ACKNOWLEDGMENTS

Azimuth would like to thank Agnico Eagle Mines for their support of this program and for facilitating our work by providing logistical assistance and help whenever needed. Key personnel conducting this project were as follows:

- Gary Mann (Azimuth) – Gary was responsible for overall management of this project. He also provided oversight and logistical support for the field crew, collaborated on the study design, directed data analysis and interpretation, and reviewed the report.
- Meara Crawford (Azimuth) – Meara participated in data analysis and was the principal author of the report.
- Eric Franz (Azimuth) – Eric was responsible for overall coordination of the baseline programs in 2015, 2016, and 2017. He coordinated field sampling logistics and led field sampling. Eric assisted in preparing the report.
- Field Assistants – We want to recognize the exceptional support provided by the various field assistants who have assisted with sample collection. Their knowledge, work ethic, and enthusiasm were instrumental to successfully completing the program.

PROFESSIONAL LIABILITY STATEMENT

This report has been prepared by Azimuth Consulting Group Partnership (Azimuth; managing partner Azimuth Consulting Group Inc.), for the use of Agnico Eagle Mines Ltd. (Agnico Eagle), who has been party to the development of the scope of work for this project and understands its limitations. The extent to which previous investigations were relied on is detailed in the report.

In providing this report and performing the services in preparation of this report Azimuth accepts no responsibility in respect of the site described in this report or for any business decisions relating to the site, including decisions in respect of the management, purchase, sale or investment in the site.

This report and the assessments and recommendations contained in it are intended for the sole and exclusive use of Agnico Eagle.

Any use of, reliance on, or decision made by a third party based on this report, or the services performed by Azimuth in preparation of this report is expressly prohibited, without prior written authorization from Azimuth. Without such prior written authorization, Azimuth accepts no liability or responsibility for any loss, damage, or liability of any kind that may be suffered or incurred by any third party as a result of that third party's use of, reliance on, or any decision made based on this report or the services performed by Azimuth in preparation of this report.

The findings contained in this report are based, in part, upon information provided by others. In preparing this report, Azimuth has assumed that the data or other information provided by others is factual and accurate. If any of the information is inaccurate, site conditions change, new information is discovered, and/or unexpected conditions are encountered in future work, then modifications by Azimuth to the findings, conclusions and recommendations of this report may be necessary.

In addition, the conclusions and recommendations of this report are based upon applicable legislation existing at the time the report was drafted. Changes to legislation, such as an alteration in acceptable limits of contamination, may alter conclusions and recommendations.

This report is time-sensitive and pertains to a specific site and a specific scope of work. It is not applicable to any other site, development or remediation other than that to which it specifically refers. Any change in the site, remediation or proposed development may necessitate a supplementary investigation and assessment.

ACRONYMS

CCME	Canadian Council of Ministers of the Environment
CREMP	Core Receiving Environment Monitoring Program
CRM	Certified Reference Material
DQO(s)	Data Quality Objective(s)
dw	dry weight
FEIS	Final Environmental Impact Statement
FLPE	Fluorinated high-density polyethylene
GCDWQ	Guidelines for Canadian Drinking Water Quality
GPS	Global Positioning System
HEPH	Heavy extractable petroleum hydrocarbons
ISQG	Interim sediment quality guidelines (CCME sediment quality guidelines)
KIA	Kivalliq Inuit Association
LEPH	Light extractable petroleum hydrocarbons
MAM	Mammoth Lake
MB	Method blank
MDL	Method detection limit
MS	Matrix spike
NEM	Nemo Lake
NIRB	Nunavut Impact Review Board
NTI	Nunavut Tunngavik Incorporated
NWB	Nunavut Water Board
PEL	Probable effect level (CCME sediment quality guidelines)
QA/QC	Quality Assurance / Quality Control
RPD	Relative percent difference
SOP	Standard Operating Procedure
TSS	Total suspended solids
US EPA	United States Environmental Protection Agency
WTS	Whale Tail Lake South Basin
ww	wet weight

1. INTRODUCTION

1.1. Background

The Amaruq Exploration Property is a 408-square kilometer area located on Inuit Owned Land, approximately 150 kilometers north of Baker Lake and approximately 50 kilometers northwest of the Meadowbank mine. Agnico Eagle Mines Limited (Agnico Eagle) leased exploration rights to the Amaruq Exploration Property from Nunavut Tunngavik Incorporated (NTI) in April 2013. Exploration activities have been conducted under a land use permit issued by the Kivalliq Inuit Association (KIA) and a water license issued by the Nunavut Water Board (NWB). The Final Environmental Impact Statement (FEIS) and Type A Water Licence Applications were submitted as Amendments to the existing FEIS (Cumberland 2005) and Type A Water Licence 2AM-MEA1525. The Whale Tail Pit Project was given approval by the Nunavut Impact Review Board (NIRB) on November 6th, 2017 to proceed to the regulatory stage with construction expected to begin in 2018. Agnico Eagle intends to pursue development of the Whale Tail satellite open pit located on the Amaruq site as an extension to the operational Meadowbank Mine.

1.2. Mercury Monitoring Program Overview

This report presents a compendium and description of the data that has been collected to-date on concentrations of mercury in the environment around the South Basin of Whale Tail Lake (hereafter referred to as the "WTS") and Mammoth Lake (MAM), collected prior to the planned temporary flooding of WTS (Figure 1-1). This report documents the field and laboratory methods used to collect and analyze surface water, sediment, benthic invertebrate tissue, zooplankton tissue, and soil for mercury, including methylmercury as well as total mercury (which includes both inorganic and organic forms of the element). Fish studies are reported elsewhere (Portt and Associates 2015). Interpretation of these environmental mercury data, including fish tissue chemistry, has been conducted elsewhere (Azimuth 2017, 2018). This memorandum is a compendium of baseline mercury concentration data intended to provide context to support future further analyses and research.

Background information on mercury in the environment, and the physical, chemical and ecological factors that drive mercury methylation dynamics in aquatic environments following flooding and soil inundation, is described in Azimuth (2017).

1.3. Report Structure

This memorandum is organized by the following sections:

Section 1: Introduction

Section 2: Water concentrations of mercury

Section 3: Sediment concentrations of mercury

Section 4: Benthic invertebrate tissue concentrations of mercury

Section 5: Zooplankton tissue concentrations of mercury

Section 6: Soil concentrations of mercury from terrestrial environment within floodplain

Table 1-1. Summary of available mercury-related data, Whale Tail Lake South Basin.

Sampling Media	Year	Mercury parameters (MeHg = methylmercury; Hg = mercury)	Whale Tail Lake - South Basin (WTS)	Mammoth Lake (MAM)	Terrestrial Flood Zone around Whale Tail Lake South Basin	Data location
Surface Water	2016	MeHg and	n=1	-	-	This report
	2017	Ultra-low DL total Hg	n=1	n=1	-	This report
	2014-2017	Regular DL total Hg	✓	✓	-	Azimuth (2018)
Sediment	2016	MeHg and	n=5 (grab samples)	-	-	This report
	2017	total Hg	n=3 (core[1] samples)	-	-	This report
	2014-2017	Total Hg	✓	✓	-	Azimuth (2018)
Benthic Invertebrate Tissue	2017	MeHg and total Hg	n=3	-	-	This report
Zooplankton Tissue	2017	MeHg and total Hg	n=1	n=1	-	This report
Soil	2016	MeHg and total Hg	-	-	n = 4	Data included in this report; discussed in Azimuth (2017)
Fish Tissue	2015	MeHg	✓	✓	-	Portt and Associates (2015)

Notes:

✓ = methods and data available; cited elsewhere

"DL" = detection limit

"-" = data do not exist

"n = " = number of samples collected/analyzed.

1. Samples were planned to be collected with a core sampler; however, due to core sampler being lost in the field, core sampling methods were simulated by collecting the top 1.5 cm from a Petite Ponar grab.

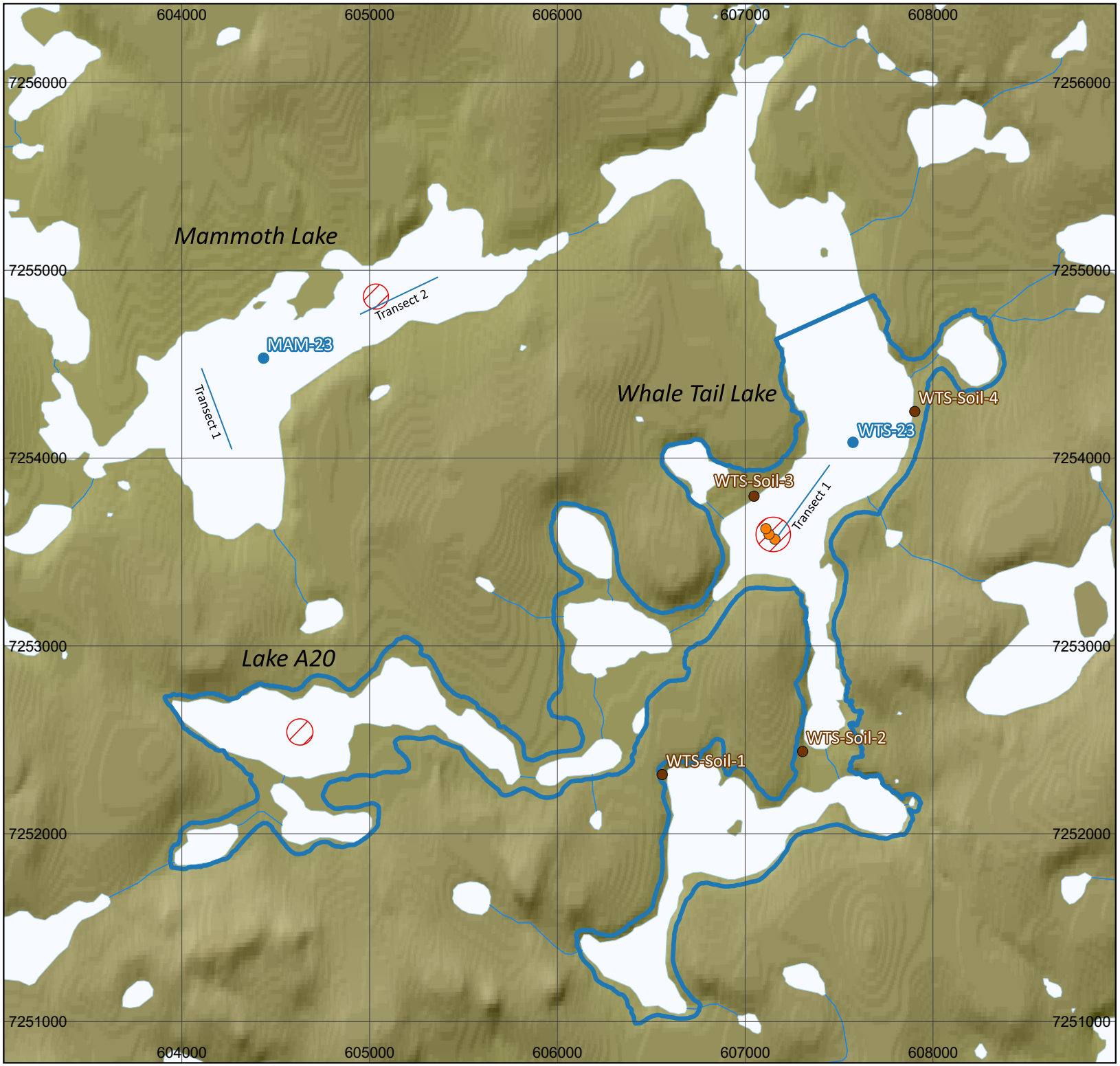

Figure 1-1: Water, sediment, soil, and tissue sampling locations for the Whale Tail Pit Mercury Program.

Version Date: May 1, 2018

Legend

- Max Impoundment Area
- Sediment/Benthos Area
- Soil
- Surface water
- Sediment and benthos chemistry
- Zooplankton transects

0 250 500 750 1000 m

Projection: UTM 14 NAD83

Whale Tail Pit Project
Mercury Data Compendium and Memorandum

AZIMUTH

2. WATER CHEMISTRY

2.1. Methods Overview

Surface water collected in 2016 and 2017 for the analysis of methylmercury and total mercury followed the standard operating procedure (SOP) used for the Meadowbank and Whale Tail Pit (WTP) CREMP programs[1]. This section describes any departures from the original recommended SOP that are specific to the collection and analysis of surface water for methylmercury and total mercury.

Sample Collection

Surface water samples were collected from Whale Tail Lake South Basin and Mammoth Lake for analysis of methylmercury and total[2] mercury using an ultra-low detection limit. Mercury sampling locations were synoptic with surface water samples collected for the routine WTP Baseline CREMP program. Surface water samples were collected for mercury analysis at WTS-12 (August 2016), WTS-23 (August 2017), and MAM-23 (August 2017). Mercury samples collected in 2017 at WTS-23 and MAM-23 were initially collected synoptically on the same day as the water samples for the WTP Baseline CREMP; samples for MAM-23 did not arrive at the laboratory, so repeat sampling was done at both WTS-23 and MAM-23 on August 28th.

Detailed guidance from ALS Environmental (Burnaby, BC) on field-sampling protocol for ultra-trace dissolved mercury (**Appendix A**) was followed by sampling crews. Methylmercury and ultra-low mercury surface water samples were collected as surface level-grabs as opposed to routine surface water monitoring samples that are collected from 3 m using the pump and tubing method described in the SOP. For dissolved mercury and methylmercury analyses, surface water was filtered in the field using a single-use syringe and 0.45µm syringe filter provided by ALS. Sample bottles were double-bagged from the lab and returned to lab in the same double-bags. Samples were collected by a sampling team of two people, one team member designated the "clean hands" to handle inner bag, sample container, and filtering, and the second team member designated the "dirty hands" to handle the outer bag, but never contact the sample container or inner bag. Samples for total and dissolved methylmercury analysis were preserved with HCl in the field. Samples for total and dissolved ultra-low mercury were preserved by ALS in the laboratory as recommended in the sample handling guide.

Four 125 mL bottles were collected at each sampling event/location, one bottle for each mercury analysis (total and dissolved methylmercury, and total and dissolved ultra-low mercury). In 2017, methylmercury and ultra-low mercury samples were collected in 125mL amber glass bottles, due to a supply shortage of the standard FLPE Nalgene bottles for mercury samples. There are no concerns about the analytical results resulting from use of these amber glass bottles (Brent Mack, pers. comm. June 26th, 2017).

Laboratory Methods

All water samples were submitted to ALS (Burnaby, BC) for analysis. The samples were transported in coolers with ice packs and shipped to ALS at the earliest convenience to minimize the possibility of exceeding the recommended hold-times between collection and analysis. Ultra-low detection limits for total mercury were completed by ALS according to method reference from the American Public Health

[1] Refer to the 2015 Meadowbank CREMP Plan Update report (Azimuth 2015) for the SOP details.

[2] Total mercury includes both inorganic and organic forms of mercury; as opposed to "total" where it refers to unfiltered sample.

Association[3], and with procedures adapted from methods published by the United States Environmental Protection Agency (US EPA). Total and dissolved mercury analyses with ultra-low detection limits were conducted by cold vapour atomic fluorescence spectrophotometry. Methylmercury analyses involved first isolating the methylmercury species through distillation under inert gas, then proceeding to cold vapour atomic fluorescence spectrophotometry.

2.2. Quality Assurance/Quality Control

QA/QC Methods

The objective of quality assurance / quality control (QA/QC) is to assure that the chemical data collected are representative of the material or populations being sampled, are of known quality, have sufficient laboratory precision to be highly repeatable, are properly documented, and are scientifically defensible. Data quality was assured throughout the collection and analysis of samples using specified standardized procedures, by the employment of laboratories that have been certified for all applicable methods, and by staffing the program with experienced technicians.

There are five main components of the water chemistry laboratory QC program to assess analytical precision, bias, and completeness:

- *Sample Integrity* – documentation of any abnormal conditions for a sample/batch of samples. This represents the first step in the QC assessment where samples may be flagged for reliability/usability. Results are flagged as potentially unreliable for one of three reasons: (1) samples were damaged during transport, (2) the temperature inside the cooler was above 10°C when received by the laboratory, or (3) the recommend hold-time was exceeded prior to analysis.
- *Laboratory Duplicate* – a new aliquot from the same sample is analyzed from the start in the same manner as the original aliquot taken from the bottle/jar. The difference between the two analyses is a measure of the variability associated with duplicate analyses of the same sample in the laboratory.
- *Laboratory Control Sample (LCS)*[4] – a well-characterized sample of known analytes and concentration. A reference material (i.e., certified reference material) containing certified amounts of target analytes, may be used as an LCS. Percent recovery of the target analytes in the LCS is compared to established control limits and assists in determining whether the methodology is in control and whether the laboratory is capable of making accurate and precise measurements at the required reporting limit.
- *Method Blank (MB)* – an analyte-free matrix (e.g., water) subjected to the entire analytical process to demonstrate that the analytical system itself does not introduce contamination.
- *Matrix Spike (MS) / Matrix Duplicate (MD)* – a known amount of a compound similar chemically to the target analyte is added to samples to ascertain any matrix effects on recoveries and to determine the accuracy and precision of the method in this matrix.

[3] American Public Health Association procedures followed for dissolved mercury in water.

[4] Descriptions of the various QC sample types are found on the ALS Environmental website (Link)

Laboratory QC results are included in each laboratory report for CREMP water quality samples. The ALS analytical reports for 2017 water, sediment, and tissue samples collected for mercury analysis are presented in **Appendix B**.

QA/QC Results

QA/QC results for methylmercury and ultra-low trace mercury are included in (**Appendix B**). There were no laboratory duplicate samples analyzed for methylmercury or ultra-low trace mercury because only three samples (two standard samples and one travel blank) were submitted for analysis.

There were no flags on quality control results from ALS. Total methylmercury and total ultra-low mercury were both less than detection limits in the travel blank from August 2017 (**Table 2-1**).

QA/QC results for mercury analyzed in surface water as part of the WTP Baseline CREMP are provided in Azimuth (2018, Appendix A-1).

2.3. Water Mercury Data

Methylmercury and total mercury with ultra-low detection limits that were measured in 2016 and 2017 in WTS and MAM are presented in **Table 2-1**; all results were less than or near detection limit. *In situ* water quality parameters were collected in the field on August 14th (WTS) and August 16th (MAM) with the routine water chemistry samples. Additional water chemistry data collected from 2014 to 2017, including mercury (standard detection limits) and other metals, are presented in the Whale Tail Baseline Report (see Appendix C in Azimuth 2018 for surface water quality data); total and dissolved mercury in surface water measured in WTS as part of the WTP Baseline CREMP were also less than detection limits in all samples from WTS.

Table 2-1. Water chemistry data for the Lake stations, Whale Tail Pit Baseline mercury assessment, 2016-2017.

Chemical Parameter	Aquatic Life Guidelines CCME[1]	Human Health Guidelines GCDWQ[2]	Lake	Whale Tail Lake South Basin (WTS)			Mammoth Lake (MAM)		QA/QC data	
			Year	2016	2017		2017	2017	QA/QC Sample	Blanks
			Area-Replicate ID	WTS-12	WTS-23	WTS-23	MAM-23	MAM-23	Lab ID	Travel Blank
			Depth (m)	3	3	0 - 0.25	3	0 - 0.25		
			Date	17-Aug-16	14-Aug-17	28-Aug-17	16-Aug-17	28-Aug-17		August 2017
Physical Tests (mg/L)										
Conductivity (µS/cm)				26.8	30.1	-	39.0	-		-
Hardness				9.8	10.5	-	13.8	-		-
pH (Laboratory)	6.5 - 9.0	7.0 - 10.5		6.82	6.78	-	6.95	-		-
Total Suspended Solids				*<1.0*	*<1.0*	-	*<1.0*	-		-
Total Dissolved Solids				20	25.00	-	31	-		-
Turbidity (NTU)				0.28	0.24	-	0.23	-		-
Organic / Inorganic Carbon (mg/L)										
Dissolved Organic Carbon				2.1	2.0	-	1.7	-		-
Total Organic Carbon				2.4	1.9	-	1.8	-		-
Methyl Mercury (µg/L)										
Total[3]	0.004			*<0.00005*	-	*<0.00005*	-	*<0.00005*		*<0.00005*
Dissolved[4]				*<0.00005*	-	*<0.00005*	-	*<0.00005*		-
Total[5] Mercury (µg/L)										
Total[3]	0.026	1		*<0.0050*	*<0.0050*	-	*<0.0050*	-		-
Total[3] (ultra low DL)	0.026	1		*<0.00050*	-	0.00052	-	*<0.0005*		*<0.0005*
Dissolved[4]				-	*<0.0050*	-	*<0.0050*	*<0.0005*		-
Dissolved[4] (ultra low DL)				-	-	*<0.0005*	-	*<0.0005*		-

Notes:

1. CCME (Canadian Council of Ministers of the Environment) Canadian Water Quality Guidelines for the Protection of Aquatic Life, 1999; updated up to 2018.

2. GCDWG (Guidelines for Canadian Drinking Water Quality; Federal-Provincial-Territorial Committee on Health and the Environment). Standard for pH is set to maximize treatment effectiveness, control corrosion and reduce leaching from distribution system and plumbing components.

123 Shaded concentrations exceed the CCME aquatic life guidelines.

123 Bordered concentrations exceed the GCDWQ.

3. "Total" indicates analytical result is for unfiltered sample.

4. "Dissolved" indicates analytical result is for a filtered sample.

5. "Total Mercury" includes both inorganic and organic forms of mercury.

Italicized numbers are below detection limits.

"-" not collected.

DL = detection limit

3. SEDIMENT CHEMISTRY

3.1. Methods Overview

Sediment collected in 2016 and 2017 from WTS for the analysis of methylmercury and total mercury followed the SOP used for the Meadowbank and WTP CREMP programs[5]. This section provides an overview of the collection methods and analysis of sediment for methylmercury and total mercury in WTS.

Sediment samples were collected from WTS for methylmercury and total mercury analysis in 2016 and 2017. Sediment samples for total and methylmercury analysis were co-located with the sediment sampling locations for the routine baseline WTP Baseline CREMP (**Figure 1-1**). In 2016, sediment grab samples were collected for total mercury and methylmercury analysis from five replicate stations where benthic invertebrate samples were collected for taxonomy. Roughly the same locations were sampled again in 2017 for total mercury analysis in bulk grab samples. The 2017 sediment sampling program also included core sampling at 10 locations in WTS (and the other lakes). Within WTS, three replicate stations were randomly chosen (WTS-1, WTS-5, and WTS-9) for methylmercury analysis in addition to the core suite of metals submitted for analysis.

Sample Collection

All sediment samples were collected using a Petite Ponar grab sampler (6" by 6"). Each sample was a composite of two grabs. Sediment was collected by lowering the grab to within 1 m of the sediment, at which point the rate of descent was slowed to minimize disruption of the surficial layer of sediment. Upon retrieval, the grab was placed in a large stainless-steel bowl and inspected according to the acceptability criteria outlined in the SOP, namely: the absence of large foreign objects, adequate penetration depth, the grab is not overfilled, the jaws closed completely (i.e., well-sealed), and the sediment surface in the grab is undisturbed. Grabs that failed the acceptability criteria were discarded into a 20-L bucket and retained until sampling was completed at the station.

For sediment grab samples collected in 2016 and 2017, the top 3 to 5 cm was collected, consistent with Meadowbank and WTP CREMP protocols and analyzed for metals (including total mercury), TOC, and particle size. A single composite sample from all five replicate stations was also collected for mineral oil and grease, LEPHs/HEPHs, and PAHs.

Sediment core sampling was planned for the 0-1 cm, 5-6 cm, and 10-11 cm horizons at three replicate stations in WTS in 2017. The coring program was intended to be completed using a gravity sediment corer, but that sampling equipment was accidentally lost prior to the field program. In order to continue with the program, surface sediment cores were obtained from sediment grab samples collected with the Petite Ponar. Sediment grabs were collected as described above, but instead of spooning out the top 3 to 5 cm of sediment, a polycarbonate ring measuring 1.5 cm in height by 68 mm (inner diameter [ID]) was used to collect an undisturbed core from within the grab. The Ponar coring method was not suitable for collecting the deeper 5-6 cm and 10-11 cm core horizons, so those were not collected. The surface sediment core samples were analyzed for methylmercury, total mercury and moisture.

[5] Refer to the 2015 Meadowbank CREMP Plan Update report (Azimuth 2015) for the SOP details.

Laboratory Methods

Sediment samples were submitted to ALS (Burnaby, BC) for analysis. The samples were transported in coolers with ice packs and shipped to ALS at the earliest convenience to minimize the possibility of exceeding the recommended hold-times between collection and analysis.

Analysis of methylmercury in sediment was completed by ALS following methodology prepared for the US Geological Survey; methylmercury is extracted from the sample and analyzed by cold vapour atomic fluorescence spectrophotometry. Total mercury in sediment is also analyzed by cold vapour atomic fluorescence spectrophotometry, following US EPA methods. Moisture content was determined gravimetrically.

3.2. Quality Assurance / Quality Control

A complete list of the sediment parameters, detection limits, data quality objectives, and method references is present in Table 1 of the SOP (Azimuth 2015). This QA/QC assessment is limited to the sediment samples collected in 2016 and 2017 for methylmercury and total mercury analysis. Refer to Azimuth (2018) for a QA/QC assessment of sediment collected as part of the WTP Baseline CREMP from 2014 to 2017.

QA/QC Methods

Field QA/QC

Field QA to avoid cross-contamination consisted of taking precautions between sampling areas by rinsing and cleaning the sampling gear for sediment grabs (Petite Ponar grab, stainless steel compositing bowls and spoons) and using site water and phosphate-free cleaning detergent.

Field QC measures for sediment grab and core sampling conducted as part of the regular WTP Baseline CREMP were conducted on approximately 10% of original samples. These measures included field duplicates to characterize spatial heterogeneity and assess consistency in field methodology, and also filter swipes of the sampling equipment or coring tube to assess cleaning procedures. Methods and results of QA/QC samples collected as part of regular WTP Baseline CREMP are described in Azimuth (2018).

Laboratory QC

The laboratory QC program for the methylmercury analysis in sediment consisted of method blanks and CRM/LCS. One laboratory duplicate of 2017 sediment mercury samples was analyzed.

QA/QC Results

QA/QC results for the laboratory duplicate of the methylmercury/mercury sample are included in the lab data report in **Appendix B**; this lab duplicate was analyzed for moisture only and its RPD met the DQO.

QA/QC results for mercury analyzed in sediment as part of the WTP Baseline CREMP are provided in Azimuth (2018, Appendix A-2). These results include one DQO exceedance for mercury in sediment from WTS in one set of 2017 grab sample field duplicate: RPD was -68% in sample WTS-2 in 2017. Original and field duplicate concentrations for these samples were between 10 and 22-times higher than MDL.

3.3. Sediment Mercury Data

Methylmercury and total mercury sediment concentrations measured in 2016 and 2017 are presented in **Table 3-1**. Additional sediment chemistry data collected from 2014 to 2017, including total mercury and other metals, are presented in the Whale Tail Baseline Report (see Appendix D in Azimuth 2018 for sediment quality data). Sediment chemistry results from the WTP Baseline CREMP show that total mercury in sediment at WTS is below federal interim sediment quality guidelines (ISQGs) and probable effect level (PEL) concentrations in CCME (2018b), in all sediment grab and core samples collected between 2014 and 2017.

Table 3-1. Sediment chemistry data for the Lake stations, Whale Tail Pit Baseline mercury assessment, 2016-2017.

			Lake	Whale Tail Lake South Basin (WTS)												
			Year	2016					2017							
			Sample ID	WTS-1	WTS-2	WTS-3	WTS-4	WTS-5	WTS-1	WTS-2	WTS-3	WTS-4	WTS-5	WTS-SC-1	WTS-SC-5	WTS-SC-9
	CCME (2002)		Sample Type	grab	grab	grab	grab	grab	grab	grab	grab	grab	grab	core	core	core
	Guideline[1]		Depth (cm)	3 to 5	3 to 5	3 to 5	3 to 5	3 to 5	3 to 5	3 to 5	3 to 5	3 to 5	3 to 5	top 1.5	top 1.5	top 1.5
Parameter	**ISQG**	**PEL**	**Date**	12-Aug-16	12-Aug-16	12-Aug-16	12-Aug-16	12-Aug-16	12-Aug-16	12-Aug-16	12-Aug-16	12-Aug-16	12-Aug-16	15-Aug-17	15-Aug-17	15-Aug-17
Physical & Organic Parameters																
Moisture (%)				84	85	88	89	86	88	84	87	88	85	87	89	89
pH				6.3	5.9	5.8	5.9	6.4	5.6	5.1	5.6	5.8	5.6	6.2	5.9	6.0
Total Organic Carbon (% dw)				4.9	4.3	6.8	7.9	4.7	6.1	4.2	6.7	7.3	4.8	5.9	10	9.2
Particle Size																
% Gravel (>2mm)				*<0.10*	*<0.10*	*<0.10*	*<0.10*	*<0.10*	*<1.0*	*<1.0*	*<1.0*	*<1.0*	*<1.0*	-	-	-
% Sand (2.00mm - 0.063mm)				3.3	4.4	4.2	2.2	4.0	3.2	7.7	3.3	3.2	4.3	-	-	-
% Silt (0.063mm - 4µm)				80	79	78	78	76	82	77	77	77	74	-	-	-
% Clay (<4µm)				17	17	18	20	20	15	15	20	20	22	-	-	-
Plant Available Nutrients (mg/kg dw)																
Available Sulfate-S				32	22	26	21	44	-	-	-	-	-	-	-	-
Speciated Metals (mg/kg dw)																
Methyl Mercury				0.00059	0.00033	0.00100	0.00046	0.00061	-	-	-	-	-	0.0010	0.0011	0.0011
Total Metals (mg/kg dw)																
Aluminum				14500	15100	16100	17200	17800	14,900	13,100	16,100	15,200	14,800	16500	13800	14300
Antimony				0.22	0.20	0.19	0.21	0.32	0.24	0.20	0.22	0.19	0.20	0.21	0.17	0.17
Arsenic*	5.9	17		***115***	***112***	***14***	***8.5***	***93***	***145***	***310***	***14***	***7.9***	***286***	17	13	8.1
Barium				99	104	108	132	111	139	85	102	109	83	118	90	104
Cadmium*	0.6	3.5		0.23	0.24	0.23	0.35	0.30	0.58	0.20	0.36	0.36	0.15	0.19	0.23	0.20
Calcium				1980	1960	3290	3480	3080	2,560	1,790	2,740	2,940	1,640	2650	3330	3410
Chromium*	37.3	90		***57***	***61***	***64***	***69***	***149***	***61***	***57***	***65***	***64***	***63***	67	58	57
Cobalt				24	20	7.6	8.0	12	23	17	8.0	7.7	12	8.2	6.7	6.6
Copper*	35.7	197		35	35	***37***	***39***	***59***	***39***	32	***39***	***36***	***40***	35	32	30
Iron				88000	82700	25200	20600	36500	85,800	111,000	23,700	19,000	96,200	28500	23500	18000
Lead	35	91.3		12	12	13	12	17	14	11	13	12	12	12	12	11
Magnesium				5300	5640	6060	6750	8600	5,440	5,060	6,010	6,030	5,000	6210	5470	5710
Manganese				3860	2850	278	286	339	3,240	1,400	261	283	978	378	272	265
Mercury	0.17	0.486		0.079	0.068	0.082	0.068	0.093	0.089	0.053	0.072	0.066	0.057	0.069	0.096	0.081
Molybdenum				4.0	5.0	2.2	1.5	3.6	3.6	5.2	2.2	1.4	6.5	2.5	1.4	1.0
Nickel				64	61	58	59	100	114	51	66	55	46	52	46	46
Phosphorus				913	873	706	762	811	1,990	1,740	671	664	1,380	820	903	746
Potassium				2030	2120	2300	2490	2610	2,170	1,790	2,240	2,170	1,820	2370	2190	2190
Selenium				0.78	0.66	0.54	0.51	0.66	0.73	0.68	0.55	0.45	0.80	0.58	0.55	0.50
Sodium				137	157	169	197	150	172	116	141	142	96	163	174	163
Strontium				21	21	26	28	23	25	19	26	26	17	25	29	30
Vanadium				22	24	23	24	37	23	21	23	22	23	26	21	20
Zinc*	123	315		75	75	79	85	117	104	72	88	75	88	80	67	62

Notes:

1. CCME (Canadian Council of Ministers of the Environment) Canadian Sediment Quality Guidelines for the Protection of Aquatic Life, 1999; updated up to 2018.

ISQG = Interim freshwater Sediment Quality Guideline. ISQG = Interim sediment quality guideline; PEL = probable effect level.

123 Bold italicized concentrations exceed the ISQG guideline.

123 Bordered concentrations exceed the PEL guideline.

Italicized numbers are below detection limits.

4. BENTHIC INVERTEBRATES

4.1. Methods Overview

Benthic invertebrates were collected in August 2017 for the analysis of methylmercury, total mercury, and percent moisture in tissue. Collection of benthic invertebrates for tissue chemistry followed the SOP in the Meadowbank and WTP CREMP programs[6] used to collect benthic invertebrates for taxonomy. This section describes any departures from the original recommended SOP for benthic invertebrate taxonomy field collection, and also the methodology that are specific to the collection and analysis of benthic invertebrates tissue for methylmercury and total mercury.

Sample collection

Benthic invertebrate samples collected for tissue chemistry analysis were co-located with three sediment chemistry sampling locations in Whale Tail Lake South Basin in 2017: WTS-1, WTS-5, and WTS-9. Samples were collected during August sampling events using a Petite Ponar grab of benthic sediment. Sediment was then sieved through a 500-µm stainless steel sieve to isolate the benthic invertebrates. Organisms were also collected by hand-picking from the sieved sediment in order to obtain sufficient mass for chemistry analysis. The goal of these sample collections was to obtain sufficient mass required for chemistry analysis, and not for taxonomic analysis. The laboratory recommended a minimum of two grams of tissue (wet weight) be collected at each station. Benthic invertebrates were collected in a 120 mL glass jar, one jar per sample. Samples were sent to ALS where they were homogenized and then analyzed for methylmercury, total mercury, and moisture.

Laboratory Methods

The mass of benthic invertebrates collected at the three stations was between 0.3 g and 0.5 g. The limited amount of tissue required micro-digestion prior to analysis. Analysis of total mercury in tissue was completed by ALS following US EPA methodology and analysis by atomic fluorescence or absorption spectrophotometry. Methylmercury in homogenized tissue was analyzed by first isolating the methylmercury, and then quantifying with cold vapour fluorescence spectroscopy. Moisture content of tissues was determined gravimetrically.

4.2. Quality Assurance/Quality Control

QA/QC Methods

Samples were collected according to standard care and QA/QC procedures:

- Samples were labelled with sample ID and date and placed in a cooler with ice in the field. Samples were refrigerated until shipping to ALS laboratory in an ice-filled cooler.
- Tweezers were used for hand-picking invertebrates from the sediment and care was taken to avoid introducing sediment particles with the organisms.
- The tweezers and sampling equipment were washed with phosphate-free cleaning detergent and site water and wiped dry with paper towel between samples. Nitrile gloves were also changed between samples.

[6] Refer to the 2015 Meadowbank CREMP Plan Update report (Azimuth 2015) for the SOP details.

For the 2017 tissue mercury sampling program, a total of five tissue samples were collected (three benthic invertebrates, and two zooplankton samples). Lab duplicate samples were conducted on approximately one of these five tissue samples, a zooplankton sample (**Section** Error! Reference source not found.). This laboratory duplicate was tested for moisture and total mercury. Laboratory QC methods also included method blanks, laboratory control samples and certified reference material for tissue analyses.

QA/QC Results

The zooplankton laboratory duplicate sample met laboratory DQOs; these results also apply to the QC of benthic invertebrate tissue analysis. All laboratory QC tests for tissue analyses met DQOs.

4.3. Benthic Invertebrate Tissue Mercury Data

Methylmercury and total mercury tissue concentrations measured in 2017 are presented in **Table 4-1**. Detection limits for total mercury and moisture were elevated, but all results were above these elevated detection limits. Co-located sediment chemistry data from 2017 are presented in **Table 3-1** (sample IDs are WTS-SC-1, WTS-SC-5, and WTS-SC-9). Benthic invertebrate taxonomy data were collected in August 2017, a few days prior to collecting the benthic invertebrates collected for tissue analysis. Taxonomy data from the baseline program are presented in Azimuth (2018, Appendix F).

Table 4-1. Benthic invertebrate tissue mercury concentrations, Whale Tail Lake, 2017.

Lake	**Whale Tail Lake South Basin (WTS)**		
Sample ID	WTS-BN-1	WTS-BN-5	WTS-BN-9
Date	20-Aug-17	20-Aug-17	21-Aug-17
Sample weight (g ww)	0.30	0.51	0.52
Physical & Organic Parameters			
Moisture (%)	80.7	83.9	84.9
Speciated Metals (mg/kg ww)			
Methyl Mercury	0.0062	0.0028	0.0020
Detection Limit	*0.0010*	*0.0010*	*0.0010*
Total Metals (mg/kg ww)			
Mercury	0.101	0.037	0.021
Detection Limit	*0.011*	*0.012*	*0.010*

Notes:
ww = wet weight

5. ZOOPLANKTON

5.1. Methods Overview

Zooplankton samples were collected in August 2017 for the analysis of methylmercury, total mercury, and moisture in tissue. This section describes the field sampling and analytical methods used to collect zooplankton for tissue chemistry analysis.

Sample Collection

Zooplankton samples were collected with a net measuring 2.4 m in length, 30 cm in diameter (at the opening), and a mesh size of 80 µm (74 µm mesh size on the cod end); this was the same net used for zooplankton taxonomy sample collection in the WTP Baseline CREMP. Zooplankton samples collected for tissue analyses were collected using horizontal tows, in contrast to zooplankton taxonomy samples which are collected in one stationary location using a vertical tow in the water column. This difference is because the primary goal of sampling zooplankton for tissue chemistry analysis is to ensure that sufficient mass required for laboratory analytical analysis is collected; the more mass collected the better. This collection method is in contrast to zooplankton sampling for taxonomic analysis, which requires normalizing taxonomic results to the volume of water that the net ran through, and also is targeting representation in species diversity across the whole water column.

To collect the zooplankton samples for tissue chemistry, the net was lowered to approximately 1 to 2 m below the water surface. A weight was tied to both the opening end and the cod end of the net to keep the net submerged and horizontally oriented in the top one to two meters of the water during the tow. Once the net was deployed in the water, it was trolled behind the boat moving at a slow speed in as straight a line as possible until the cod end was anticipated to be as full as possible. The sample collected in Mammoth Lake was a composite of two horizontal tows. One tow was taken for the sample in the south basin of Whale Tail Lake.

Once the horizontal tow was complete, the net was pulled into the boat while simultaneously rinsing the net with a squirt bottle by spraying the outside of the net. Zooplankton were carefully transferred from the cod end into a 500 mL HDPE jar. Samples were further processed once back at basecamp to remove as much water as possible. Any overlying water that had settled at the top of the sample jar was carefully decanted. The sample was then re-sieved through the 80 µm mesh of the zooplankton net, and then screened again through a 0.45 µm filter to remove more water. The final zooplankton tissue samples retained after sieving were weighed, placed into a labelled glass jar, and frozen for storage before sending to ALS laboratory on ice, where they were homogenized and then analyzed for methylmercury, total mercury, and moisture.

Laboratory Methods

Analytical methods for analysis of total mercury, methylmercury, and moisture in homogenized zooplankton tissue were the same as those used for benthic invertebrate tissues (**Section 4.1**): total mercury analyzed by atomic fluorescence or absorption spectrophotometry; methylmercury quantified by cold vapour fluorescence spectroscopy; and, moisture content determined gravimetrically.

5.2. Quality Assurance/Quality Control

QA/QC Methods

Samples were collected according to standard care and QA/QC procedures:

- Samples jars were labelled with sample ID and date and stored in freezer until shipping to ALS laboratory in an ice-filled cooler.
- Nitrile gloves were worn during sample collection and changed between sites.

One lab duplicate samples was conducted on a zooplankton sample (a frequency of one in five tissue samples overall). This laboratory duplicate was tested for moisture and total mercury. Laboratory QC methods also included method blanks, laboratory control samples and certified reference material for tissue analyses.

QA/QC Results

The RPDs of the one zooplankton laboratory duplicate sample is included in **Table 5-1**; both were well below laboratory DQOs of 20% for moisture and 40% for total mercury. All laboratory QC tests for tissue analyses (method blanks, laboratory control samples and certified reference material) also met DQOs.

5.3. Zooplankton Tissue Mercury Data

Methylmercury, total mercury, and moisture concentrations in zooplankton tissues from WTS and MAM, as well as sample weights, are presented in **Table 5-1**. Methylmercury concentrations in zooplankton at both locations are less than three-times the detection limit, and total mercury concentrations in zooplankton are less than six-times the detection limit.

Table 5-1. Zooplankton tissue mercury concentrations, Whale Tail Lake, 2017.

Lake	Whale Tail Lake South Basin (WTS)	Mammoth Lake (MAM)	QA/QC samples	
Sample ID	WTS-ZP-1	MAM-ZP-1	Laboratory Duplicate	
Date	20-Aug-17	16-Aug-17	(Dup of MAM-ZP-1)	RPD (%)
Sample weight (g ww)	17.93	36.70		
Physical & Organic Parameters				
Moisture (%)	93.9	94.4	94.5	0.1
Speciated Metals (mg/kg ww)				
Methyl Mercury	0.0028	0.0027	-	-
Detection Limit	*0.0010*	*0.0010*		
Total Metals (mg/kg ww)				
Mercury	0.0058	0.0049	0.0050	2.6
Detection Limit	*0.0010*	*0.0010*		

Notes:
1. RPD = Relative Percent Difference; RPD = (Difference / Mean expressed as a percent), as reported by ALS.
"-" = not analyzed

6. SOIL

6.1. Methods Overview

This section describes the field sampling and analytical methods used to collect soils for chemistry analysis. These soil chemistry data are interpreted in Azimuth (2017). The original ALS laboratory reports for soil chemistry analyses are also appended to Azimuth (2017).

Sample collection

Four soil samples were collected from representative habitat around the south basin of Whale Tail Lake within the proposed inundation zone (**Figure 1-1**). At each sampling location, the top organic layer was scraped away from three subsampling areas located within approximately a 10 m radius of each other to reveal the underlying soil. Small test pits were dug to a depth of approximately 3 inches at each subsampling area using a stainless-steel trowel. Wearing nitrile gloves, several scoops of soil were place in a stainless-steel mixing bowl and initially homogenized by hand to remove any large stones and woody debris. The sample was then mixed further with a stainless-steel spoon. Three 125 mL glass jars per sampling location were filled with homogenized soil to minimize head-space, labelled, and sent to ALS laboratory for analysis.

Laboratory Methods

Soil samples were analyzed for organic carbon content (%), total metals concentration including total mercury and methylmercury, moisture and pH. ALS laboratory following established methodologies, including methods published by the USEPA for methylmercury and total metals including mercury. Total mercury and methylmercury in soil was analyzed by cold vapour atomic fluorescence spectrometry, all other total metals were analyzed by inductively coupled plasma-mass spectrometry (ICP-MS). Moisture was determined gravimetrically. TOC was calculated based on combustion analysis.

6.2. Quality Assurance/Quality Control

QA/QC methods

Samples were collected according to standard care and QA/QC procedures to avoid cross-contamination between sampling areas:

- Samples jars were labelled with sample ID and date and stored in fridge until shipping to ALS laboratory in an ice-filled cooler.
- Nitrile gloves were worn during sample collection and changed between sites.
- The mixing bowl, spoon and shovel were washed with phosphate-free cleaning detergent and wiped dry with paper towel between samples.

No field duplicate QC samples were collected for soil. One laboratory duplicate soil sample was analyzed for total metals, methylmercury, and pH. Laboratory DQOs are included in **Table 6-1**. Analysis of method blanks, lab control samples and certified reference material are also included as part of ALS's QC program.

QA/QC results

QC results for the one soil laboratory duplicate sample are presented in (**Table 6-1**); RPDs for all analytes met their respective DQOs. All four soil samples from WTS exceeded the recommended hold

time for TOC analysis by 8 days. but this is not considered to dramatically affect the quality of TOC results. Soil samples were collected August 18, 2016, and analyzed on September 23, 2016, an actual hold time of 36 days, exceeding the lab-recommended hold time of 28 days. There were no other flags on quality control results from the analyzing laboratory.

6.3. Soil Mercury Data

Soil chemistry data collected in 2016, including total metals, methylmercury, TOC, pH and moisture, are included in **Table 6-1**. Methylmercury and total mercury concentrations in soil were less than the DL in three samples of the four soil samples. There was one soil sample (WTS-SOIL-4) with detectable methylmercury (0.000053 mg/kg dw) and total mercury (0.007 mg/kg dw) concentrations (**Table 6-1**).

Table 6-1. Soil chemistry results from the 2016 sampling program, Whale Tail Pit Mercury Assessment (as reported in Azimuth 2017).

	CCME Soil Quality Guideline[1]	2016 Soil Samples - Whale Tail Pit Flood Zone				QA/QC data			
		WTS-SOIL-1	WTS-SOIL-2	WTS-SOIL-3	WTS-SOIL-4	**QA/QC Sample type**	Laboratory Duplicate		
		18-Aug-16	18-Aug-16	18-Aug-16	18-Aug-16	**Lab ID**	L1822218-1	RPD	Laboratory
						Duplicate of	WTS-SOIL-1	(%)	DQO for RPD
Physical & Organic Parameters									
Moisture (%)		8.8	9.9	9.7	11				
pH		6.7	6.1	6.4	5.8		6.7	-	-
Total Organic Carbon (% dw)		0.30	0.27	0.17	0.49				
Speciated Metals (mg/kg dw)									
Methyl Mercury		*<0.000050*	*<0.000050*	*<0.000050*	0.000053		*<0.000050*	-	30
Total Metals (mg/kg dw)									
Aluminum		6380	7860	7470	6660		6710	5.0	40
Antimony	20	*<0.10*	*<0.10*	*<0.10*	*<0.10*		*<0.10*	-	30
Arsenic	12	2.9	3.8	3.2	3.5		3.1	6.2	30
Barium		34	35	33	27		36	6.4	40
Beryllium		0.34	0.44	0.40	0.32		0.39	14	30
Bismuth		0.21	0.21	*<0.20*	*<0.20*		0.43	-	
Boron		*<5.0*	*<5.0*	*<5.0*	*<5.0*		*<5.0*	-	30
Cadmium	10	0.034	0.041	0.031	0.039		0.034	1.4	30
Calcium		2830	2860	2710	2580		2880	1.8	30
Chromium (total)	64	25	37	37	29		25	0.20	30
Cobalt	50	5.2	7.5	6.6	5.8		5.2	0.50	30
Copper	63	4.6	7.6	6.5	4.5		4.7	1.8	30
Iron		14300	16900	15700	15700		14300	0.10	30
Lead	140	5.7	6.3	5.6	6.0		6.2	8.9	40
Lithium		7.7	9.4	9.1	8.6		8.2	6.5	30
Magnesium		3670	4870	4700	3610		3950	7.5	30
Manganese		219	270	239	243		229	4.4	30
Mercury	6.6	*<0.0050*	*<0.0050*	*<0.0050*	0.007		*<0.0050*	-	40
Molybdenum	10	0.27	0.39	0.50	0.40		0.29	7.2	40
Nickel	45	15	24	23	18		15	0.70	30
Phosphorus		525	539	505	542		489	7.2	30
Potassium		1000	1090	1010	940		990	1.1	40
Selenium	1	*<0.20*	*<0.20*	*<0.20*	*<0.20*		*<0.20*	-	30
Silver		*<0.10*	*<0.10*	*<0.10*	*<0.10*		*<0.10*	N/A	40
Sodium		107	108	197	79		119	10	40
Strontium		27	28	27	23		31	13	40
Thallium		0.068	0.078	0.064	0.076		0.068	1.0	30
Tin		*<2.0*	*<2.0*	*<2.0*	*<2.0*		*<2.0*	-	40
Titanium		560	598	554	555		577	2.9	40
Uranium		2.1	2.4	2.1	2.1		2.3	9.8	30
Vanadium		15	19	17	12		14	3.7	30
Zinc	200	26	33	27	28		26	0.50	30
Zirconium		8.1	7.5	8.8	3.9		9.0	11	30

Notes:

1. CCME (Canadian Council of Ministers of the Environment) Canadian Soil Quality Guidelines for the Protection of Environmental and Human Health (Residential/Parkland)

Bold italicized concentrations exceed the soil quality guideline.

Italicized numbers are below detection limits.

"-" = not measured or not calculated

7. REFERENCES

Azimuth (Azimuth Consulting Group). 2018. Whale Tail Pit Core Receiving Environment Monitoring Program (CREMP): 2014-2017 Baseline Studies. Report prepared by Azimuth Consulting Group, Vancouver, BC for Agnico Eagle Mines Ltd., Baker Lake, NU. February 2018.

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Health Canada. 2014. Guidelines for Canadian Drinking Water Quality – Summary Table. Water and Air Quality Bureau, Healthy Environments and Consumer Safety Branch, Health Canada, Ottawa, Ontario.

Portt and Associates (C. Portt and Associates). 2015. Whale Tail Pit 2015 Fish and Fish Habitat Field Investigations, AEM, Meadowbank Division. 58 pp. + appendices.

APPENDICES

APPENDIX A – *ULTRA-TRACE MERCURY SAMPLING GUIDE (FROM ALS)*

Ultra-Trace Mercury Sampling

Step-by-step guide on how to collect an ultra-trace mercury sample

Revised: April 2014

Ultra-Trace Dissolved Mercury – Field Filtered

In 2012, the US Federal Register changed the rule for a sample collected for Ultra-Trace Dissolved Mercury. "A sample collected for dissolved ultra-trace level mercury should be filtered in the laboratory within 24 hours of the time of collection."[1]

1. Designate one member of the sampling team as "dirty hands" and the other as "clean hands".
2. "Clean hands" puts on a clean pair of gloves (as supplied by ALS) for each sample. These gloves can be used for other trace metals.
3. "Dirty hands" removes double-bagged sample container from cooler and opens the outer bag. "Dirty hands" should only be involved in operation of sampling devices, pumps, etc., but should not contact the sample container or inner bag.
4. "Clean hands" opens inner bag and removes the sample container.
5. "Clean hands" takes a clean and sealed (unopened) 60 mL plastic syringe (as supplied by ALS), removes the plunger (do not put the plunger down) and attaches a clean (unused) 0.45um syringe filter (as supplied by ALS) to the end of the syringe. The syringe filter requires a gentle twist to lock onto the syringe tip.
6. Fill the syringe with about 15 mL of the sample, and push this volume through the syringe filter as a rinse and discard. For the field blank, use the DI water provided by ALS.
7. Fill the syringe with sample and filter this volume through the same syringe filter into the 250 mL FLPE Nalgene™ or 120 mL glass bottle.
8. Rinse the bottle with 15 mL of filtered sample and discard sample. Repeat this step two more times.
9. Fill the bottle with filtered sample until almost full (for dirty samples or sample locations with limited volume, 50 mL is the minimum sample volume required – no duplicate analysis would be possible for this sample location).
10. "Clean hands" closes the bottle tight with the cap.
11. "Dirty hands" opens the outer bag while "clean hands" returns the sample container to the inner bag and reseals.
12. Repeat this procedure for each sample location being sampled, including using a new syringe, syringe filter and gloves for each new sample.
13. Submit sample(s) for analysis. Holding time 28 days.

Ultra-Trace Total Mercury and Dissolved Mercury – Lab Filtered

A. Follow steps 1 -4 from the Ultra-Trace Dissolved Mercury - Field Filtered instructions above.
B. Rinse the bottle 3 times with 15 mL sample and discard.
C. Fill the 250 mL FLPE Nalgene™ or 120 mL glass bottle with sample until almost full (for dirty samples or sample locations with limited volume, 50 mL is the minimum sample volume required – no duplicate analysis would be possible for this sample location).
D. Follow steps 10-13 from the Ultra-Trace Dissolved Mercury - Field Filtered instructions above.
E. Holding time for Dissolved Mercury (not filtered in the field) is 48 hours. ALS recommends field filtration for Ultra-Trace Dissolved Mercury due to the short sample collection period recently updated in US EPA Method 1631 (Holding time is 24 hours). Holding time for Ultra-Trace Total Mercury is 28 days.

Notes:

Due to the ultra-trace nature of these tests in water samples, field blanks are imperative to the interpretation of test data. Field blanks should incorporate all aspects of sampling operations, including filtration. All field sampling equipment (including filters) should be tested for suitability prior to use in sampling for mercury. Mercury free water will be provided for the field filter blanks.

We highly recommend that EPA Method 1669 "Sampling Ambient Water for Trace Metals at EPA Water Quality Criteria Levels" (July 1996) be consulted for detailed instructions regarding ultra-trace level sampling guidelines for mercury. EPA Method 1669 is available on the internet at or by clicking on the link below:
EPA Method 1669: http://www.epa.gov/caddis/pdf/Metals_Sampling_EPA_method_1669.pdf

[1] US EPA Federal Register/ VOL 77, No. 97 Page 29808 / Friday, May 18, 2012 / Rules and Regulations.

APPENDIX B – ALS LAB CERTIFICATIONS

AZIMUTH CONSULTING GROUP INC.
ATTN: Eric Franz
218 - 2902 West Broadway
Vancouver BC V6K 2G8

Date Received: 25-AUG-17
Report Date: 10-OCT-17 18:00 (MT)
Version: FINAL

Client Phone: 604-730-1220

Certificate of Analysis

Lab Work Order #: L1981162

Project P.O. #: NOT SUBMITTED
Job Reference: WTP MERCURY BASELINE
C of C Numbers:
Legal Site Desc:

Brent Mack, B.Sc.
Account Manager

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1981162-1	L1981162-2	L1981162-3		
	Description	SEDIMENT	SEDIMENT	SEDIMENT		
	Sampled Date	15-AUG-17	15-AUG-17	15-AUG-17		
	Sampled Time	09:25	09:40	10:30		
	Client ID	WTS-SC-1 (0-1)	WTS-SC-5 (0-1)	WTS-SC-9 (0-1)		
Grouping	**Analyte**					
SOIL						
Physical Tests	Moisture (%)	87.2	88.9	89.3		
Metals	Mercury (Hg) (mg/kg)	0.0690	0.0957	0.0806		
Speciated Metals	Methylmercury (as MeHg) (mg/kg)	0.00104	0.00114	0.00114		

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1981162-4	L1981162-5	L1981162-6	L1981162-7	L1981162-8
	Description	TISSUES	TISSUES	TISSUES	TISSUES	TISSUES
	Sampled Date	20-AUG-17	20-AUG-17	21-AUG-17	20-AUG-17	16-AUG-17
	Sampled Time	15:35	17:45	16:00	11:30	18:30
	Client ID	WTS-BN-1	WTS-BN-5	WTS-BN-9	WTS-ZP-1	MAM-ZP-1
Grouping	**Analyte**					
TISSUE						
Physical Tests	% Moisture (%)	80.7	83.9	84.9	93.9	94.4
Metals	Mercury (Hg)-Total (mg/kg wwt)	0.101	0.037	0.021	0.0058	0.0049
Speciated Metals	Methylmercury (as MeHg) (mg/kg wwt)	0.0062	0.0028	0.0020	0.0028	0.0027

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1981162-9				
	Description	SURFACE WATE				
	Sampled Date	14-AUG-17				
	Sampled Time	08:15				
	Client ID	WTS-23				
Grouping	**Analyte**					
WATER						
Total Metals	Mercury (Hg)-Total (ug/L)	0.00050				
Dissolved Metals	Dissolved MeHg Filtration Location	FIELD				
	Dissolved Mercury Filtration Location	FIELD				
	Mercury (Hg)-Dissolved (ug/L)	<0.00050				
Speciated Metals	Methylmercury (as MeHg)-Dissolved (ug/L)	<0.000050				
	Methylmercury (as MeHg)-Total (ug/L)	<0.000050				

Reference Information

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
HG-200.2-CVAF-VA	Soil	Mercury in Soil by CVAFS	EPA 200.2/1631E (mod)
Soil samples are digested with nitric and hydrochloric acids, followed by analysis by CVAFS.			
HG-D-U-CVAF-VA	Water	Diss. Mercury in Water by CVAFS (Ultra)	APHA 3030 B / EPA 1631 REV. E
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 Method 1631 Rev. E. by the United States Environmental Protection Agency (EPA). The procedure may involve preliminary sample treatment by filtration (APHA 3030B) and involves a cold-oxidation of the acidified sample using bromine monochloride prior to a purge and trap concentration step and final reduction of the sample with stannous chloride. Instrumental analysis is by cold vapour atomic fluorescence spectrophotometry.			
HG-T-U-CVAF-VA	Water	Total Mercury in Water by CVAFS (Ultra)	EPA 1631 REV. E
This analysis is carried out using procedures adapted from Method 1631 Rev. E. by the United States Environmental Protection Agency (EPA). The procedure involves a cold-oxidation of the acidified sample using bromine monochloride prior to a purge and trap concentration step and final reduction of the sample with stannous chloride. Instrumental analysis is by cold vapour atomic fluorescence spectrophotometry.			
HG-WET-CVAFS-N-VA	Tissue	Mercury in Tissue by CVAFS (WET)	EPA 200.3, EPA 245.7
This method is conducted following British Columbia Lab Manual method "Metals in Animal Tissue and Vegetation (Biota) - Prescriptive". Tissue samples are homogenized and sub-sampled prior to hotblock digestion with nitric and hydrochloric acids, in combination with addition of hydrogen peroxide. Analysis is by atomic fluorescence spectrophotometry or atomic absorption spectrophotometry, adapted from US EPA Method 245.7.			
HG-WET-MICR-CVAF-VA	Tissue	Mercury in Tissue by CVAFS Micro (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.			
MEHG-D-GCAF-VA	Water	Diss. Methylmercury in Water by GCAFS	EPA 1630
This method follows Method 1630 of the US EPA. Samples are distilled under an inert gas flow to isolate methylmercury and minimize matrix interferences. The distillate is analyzed by aqueous phase ethylation, purge and trap, desorption and GC separation. The separated species are then pyrolized to elemental Hg and quantified by cold vapour atomic flourescence spectroscopy. Results are reported "as MeHg".			
MEHG-GCAF-VA	Soil	Methylmercury in Soil by GCAFS	DeWild et al. (2004)
This method follows procedures published by DeWild, Olund, Olsen and Tate (2004) for the US Geological Survey (Techniques and Methods 5A-7). Samples are leached with an acidic copper sulphate solution to solubilize methylmercury for inorganic complexes. The methylmercury is then extracted into dichloromethane and then an aliquot is back extracted into ultra-pure water. The extract is analyzed by aqueous phase ethylation, purge and trap, desorption and GC separation. The separated species are then pyrolized to elemental Hg and quantified by cold vapour atomic flourescence spectroscopy. Results are reported "as MeHg".			
MEHG-T-GCAF-VA	Water	Total Methylmercury in Water by GCAFS	EPA 1630
This method follows Method 1630 of the US EPA. Samples are distilled under an inert gas flow to isolate methylmercury and minimize matrix interferences. The distillate is analyzed by aqueous phase ethylation, purge and trap, desorption and GC separation. THe separated species are then pyrolized to elemental Hg and quantified by cold vapour atomic flourescence spectroscopy. Results are reported "as MeHg".			
MEHG-WET-GCAF-VA	Tissue	Methylmercury in Tissue by GCAFS (Wet)	Liang et al. (1994)
This method follows the procedures published by Liang, Bloom and Horvat in Clinical Chemistry (Vol 40, No 4, 1994). Samples are homogenized and then digested in a methanolic potassium hydroxide solution. An aliquot of the digestate is analyzed by aqueous phase ethylation, purge and trap, desorption and GC separation. The separated species are then pyrolized to elemental Hg and quantified by cold vapour atomic fluorescence spectroscopy. Results are reported "as MeHg".			
MOISTURE-BIOPSY-VA	Tissue	Moisture Content (low weight) in tissue	Puget Sound WQ Authority, Apr 1997
This analysis is carried out gravimetrically by drying the sample at <60 deg. C for a minimum of three days.			
MOISTURE-TISS-VA	Tissue	% Moisture in Tissues	Puget Sound WQ Authority, Apr 1997
This analysis is carried out gravimetrically by drying the sample at 105 C for a minimum of six hours.			
MOISTURE-VA	Soil	Moisture content	CWS for PHC in Soil - Tier 1
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:

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.

L1981162-COFC

Chain of Custody / Analytical Request Form

Canada 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:	Azimuth Consulting Group	☐ Standard ☐ Other	◉ Regular (Standard Turnaround Times - Business Days)
Contact:	Eric Franz	☑ PDF ☑ Excel ☐ Digital ☐ Fax	○ Priority (2-4 Business Days) - 50% Surcharge - Contact ALS to Confirm TAT
Address:	218-2902 West Broadway	Email 1: efranz@azimuthgroup.ca	○ Emergency (1-2 Bus. Days) - 100% Surcharge - Contact ALS to Confirm TAT
	Vancouver, BC V6K2G8	Email 2: gmann@azimuthgroup.ca	○ Same Day or Weekend Emergency - Contact ALS to Confirm TAT
Phone:	604-730-1220 Fax:	Email 3:	
Invoice To	Same as Report ? ☑ Yes ☐ No	**Client / Project Information**	**Analysis Request**
Hardcopy of Invoice with Report?	☐ Yes ☑ No	Job #: WTP Mercury Baseline	Please indicate below Filtered, Preserved or both (F, P, F/P)
Company:		PO / AFE:	
Contact:		LSD:	
Address:			
Phone:	Fax:	Quote #: Q63005	
Lab Work Order # (lab use only)		**ALS Contact:** Brent Mack	**Sampler:** Eric Franz

Sample #	Sample Identification (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	Methyl Hg in Soil by GCAFS	HG in Soil by CVAFS	Moisture content	Hg in Tissue Micro (Wet)	Methyl Hg in Tissue (wet)	Moisture in Tissue	% Moisture in Tissues	Tissue/Veg Micro Prep	Ultra low Hg in water	Ultra low Hg in water (diss)	Methyl Hg in water	Methyl Hg in water (diss)	Number of Containers
													F	F	P	F/P	
	WTS-SC-1 (0-1)	15-Aug-17	9:25	Sediment	X	X	X										1
	WTS-SC-5 (0-1)	15-Aug-17	9:40	Sediment	X	X	X										1
	WTS-SC-9 (0-1)	15-Aug-17	10:30	Sediment	X	X	X										1
	WTS-BN-1	20-Aug-17	15:35	Tissue				X	X	X	X	X					1
	WTS-BN-5	20-Aug-17	17:45	Tissue				X	X	X	X	X					1
	WTS-BN-9	21-Aug-17	16:00	Tissue				X	X	X	X	X					1
	WTS-ZP-1	20-Aug-17	11:30	Tissue				X	X	X	X	X					1
	MAM-ZP-1	16-Aug-17	18:30	Tissue				X	X	X	X	X					1
	WTS-23	14-Aug-17	8:15	Surface Water									X	X	X	X	4
	MAM-23	16-Aug-17	17:00	Surface Water									X	X	X	X	4

Special Instructions / Regulations with water or land use (CCME-Freshwater Aquatic Life/BC CSR - Commercial/AB Tier 1 - Natural, etc) / Hazardous Details

Water samples for Ultra low Hg analysis (total and dissolved) were not preserved in the field.

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
Eric Franz	22 Aug 17	7:00	Logan	Aug 25	8:30	16.5 °C				

AZIMUTH CONSULTING GROUP INC.
ATTN: Eric Franz
218 - 2902 West Broadway
Vancouver BC V6K 2G8

Date Received: 01-SEP-17
Report Date: 25-SEP-17 17:04 (MT)
Version: FINAL

Client Phone: 604-730-1220

Certificate of Analysis

Lab Work Order #: L1985255

Project P.O. #: NOT SUBMITTED
Job Reference: WTP MERCURY BASELINE
C of C Numbers:
Legal Site Desc:

Brent Mack, B.Sc.
Account Manager

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1985255-1	L1985255-2	L1985255-3		
	Description	Surface Water	Surface Water	Surface Water		
	Sampled Date	28-AUG-17	28-AUG-17			
	Sampled Time	11:20	10:20			
	Client ID	WTS-23	MAM-23	WTP TRAV-1		
Grouping	**Analyte**					
WATER						
Total Metals	Mercury (Hg)-Total (ug/L)	0.00052	<0.00050	<0.00050		
Dissolved Metals	Dissolved MeHg Filtration Location	FIELD	FIELD			
	Dissolved Mercury Filtration Location	FIELD	FIELD			
	Mercury (Hg)-Dissolved (ug/L)	<0.00050	<0.00050			
Speciated Metals	Methylmercury (as MeHg)-Dissolved (ug/L)	<0.000050	<0.000050			
	Methylmercury (as MeHg)-Total (ug/L)	<0.000050	<0.000050	<0.000050		

Reference Information

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
HG-D-U-CVAF-VA	Water	Diss. Mercury in Water by CVAFS (Ultra)	APHA 3030 B / EPA 1631 REV. E

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 Method 1631 Rev. E. by the United States Environmental Protection Agency (EPA). The procedure may involve preliminary sample treatment by filtration (APHA 3030B) and involves a cold-oxidation of the acidified sample using bromine monochloride prior to a purge and trap concentration step and final reduction of the sample with stannous chloride. Instrumental analysis is by cold vapour atomic fluorescence spectrophotometry.

HG-T-U-CVAF-VA	Water	Total Mercury in Water by CVAFS (Ultra)	EPA 1631 REV. E

This analysis is carried out using procedures adapted from Method 1631 Rev. E. by the United States Environmental Protection Agency (EPA). The procedure involves a cold-oxidation of the acidified sample using bromine monochloride prior to a purge and trap concentration step and final reduction of the sample with stannous chloride. Instrumental analysis is by cold vapour atomic fluorescence spectrophotometry.

MEHG-D-GCAF-VA	Water	Diss. Methylmercury in Water by GCAFS	EPA 1630

This method follows Method 1630 of the US EPA. Samples are distilled under an inert gas flow to isolate methylmercury and minimize matrix interferences. The distillate is analyzed by aqueous phase ethylation, purge and trap, desorption and GC separation. The separated species are then pyrolized to elemental Hg and quantified by cold vapour atomic flourescence spectroscopy. Results are reported "as MeHg".

MEHG-T-GCAF-VA	Water	Total Methylmercury in Water by GCAFS	EPA 1630

This method follows Method 1630 of the US EPA. Samples are distilled under an inert gas flow to isolate methylmercury and minimize matrix interferences. The distillate is analyzed by aqueous phase ethylation, purge and trap, desorption and GC separation. THe separated species are then pyrolized to elemental Hg and quantified by cold vapour atomic flourescence spectroscopy. Results are reported "as MeHg".

** 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:

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 # _____

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Report To		**Report Format / Distribution**	**Service Requested** (Rush for routine analysis subject to availability)
Company:	Azimuth Consulting Group	☐ Standard ☐ Other	◉ Regular (Standard Turnaround Times - Business Days)
Contact:	Eric Franz	☑ PDF ☑ Excel ☐ Digital ☐ Fax	○ Priority (2-4 Business Days) - 50% Surcharge - Contact ALS to Confirm TAT
Address:	218-2902 West Broadway	Email 1: efranz@azimuthgroup.ca	○ Emergency (1-2 Bus. Days) - 100% Surcharge - Contact ALS to Confirm TAT
	Vancouver, BC V6K2G8	Email 2: gmann@azimuthgroup.ca	○ Same Day or Weekend Emergency - Contact ALS to Confirm TAT
Phone:	604-730-1220 Fax:	Email 3:	
Invoice To	Same as Report ? ☑ Yes ☐ No	**Client / Project Information**	**Analysis Request**
Hardcopy of Invoice with Report?	☐ Yes ☑ No	Job #: WTP Mercury Baseline	Please indicate below Filtered, Preserved or both (F, P, F/P)
Company:		PO / AFE:	
Contact:		LSD:	
Address:			
Phone:	Fax:	Quote #: Q63005	
Lab Work Order # (lab use only)		**ALS Contact:** Brent Mack	**Sampler:** Eric Franz

Sample #	Sample Identification (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	Methyl Hg in Soil by GCAFS	HG in Soil by CVAFS	Moisture content	Hg in Tissue Micro (Wet)	Methyl Hg in Tissue (wet)	Moisture in Tissue	% Moisture in Tissues	Tissue/Veg Micro Prep	Ultra low Hg in water	Ultra low Hg in water (diss)	Methyl Hg in water	Methyl Hg in water (diss)	Number of Containers
														F	P	F/P	
	WTS-23	28-Aug-17	11:20	Surface Water									X	X	X	X	4
	MAM-23	28-Aug-17	10:20	Surface Water									X	X	X	X	4
	WTP TRAV-1	-	-	Surface Water									X		X		2

L1985255-COFC

Special Instructions / Regulations with water or land use (CCME-Freshwater Aquatic Life/BC CSR - Commercial/AB Tier 1 - Natural, etc) / Hazardous Details

Water samples for Ultra low Hg analysis (total and dissolved) were not preserved in the field. Methyl Hg samples were preserved in the field. All samples submitted in 120 mL amber according to instructions from Brent Mack.

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
Eric Franz	29-Aug-17	6:20	Cade	Sept 1	1340	14.7 14.2 °C				