MMRD
94815

Ferguson, Susan M MEM:EX

From: Minister, MEM MEM:EX
Sent: Tuesday, January 26, 2016 9:16 AM
To: MEM Correspondence MEM:EX
Subject: FW: Victor Wyprysky

Info/File

-----Original Message-----
From: Victor Wyprysky [mailto:vw@chieftainmetals.com]
Sent: Tuesday, January 26, 2016 9:08 AM
To: Minister, MEM MEM:EX
Cc: Petrie, Cynthia MEM:EX
Subject:

Dear Minister Bennett
I understand from my colleagues you gave good mention of the Tulsequah project in a description of advanced mines in BC at Roundup. Thank you for the mention and your Governments support for mining projects such as ours in BC. Such support at this time is critical to investment confidence in our advanced project financing discussions.

Best Regards
Victor

Victor Wyprysky
President and CEO
Chieftain Metals Corp.
D: 416-479-5411
M: 416-305-8313
E: vw@chieftainmetals.com

McKnight, Elaine L MEM:EX

From: McKnight, Elaine L MEM:EX
Sent: Wednesday, January 27, 2016 8:40 AM
To: Cochrane, Marlene MEM:EX
Subject: Re: Chieftan metals

Thank you very much

Elaine

Sent from my Blackberry

From: Cochrane, Marlene MEM:EX
Sent: Wednesday, January 27, 2016 8:37 AM
To: McKnight, Elaine L MEM:EX
Subject: Chieftan metals

This meeting has been moved to Thursday at 11:00, right after the meeting with Jessica and Gary. Thanks, Elaine.

Marlene Cochrane
Senior Executive Assistant | Deputy Minister's Office
Ministry of Energy and Mines
Victoria | British Columbia
Phone (250) 952-0120

From: McKnight, Elaine L MEM:EX
Sent: Tuesday, January 26, 2016 2:47 PM
To: Cochrane, Marlene MEM:EX
Subject: Chieftan metals

Marlene is there any way we could move the chieftan metals meeting to Thursday. Tomorrow is so full.

Elaine

Sent from my Blackberry

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February 8, 2016

Diane Howe, Deputy Chief Inspector - Permitting
Ministry of Energy and Mines
PO Box 9320, Stn. Prov Govt
Victoria, BC V8W 9N3

Re: Tulsequah Chief M-232 Mines Act Permit Amendment for care and maintenance monitoring and reporting activities.

Dear Ms. Howe:

Please be advised that the Tulsequah Chief Mine Project is currently on *care and maintenance*. Following direction from the combined MEM, MoE & EAO November 2015 inspection report of the Tulsequah Chief Mine, Chieftain Metals Inc. ("CMI") is submitting this letter application to amend its M-232 Mines Act Permit with a revised program as required by the HSRC Sec:10.6.2(2a) when a mine ceases operation for a period longer than one year. Information provided in the initial Mine Act and subsequent amendment applications is still relevant, and will assist as background for this request.

Care and maintenance activities will conform to existing requirements with no new site disturbances, this amendment seeks approval for periodic surveillance and monitoring scheduled only during the spring freshet and open water season, specifically: April, May, August and October, with annual reporting to MEM. The specifics of the these activities are detailed in a revised "Tulsequah Chief Mine Project Environmental Monitoring and Surveillance Plan for Care & Maintenance (2016+)" and includes all MoE requirements under an amended EMA permit #105719. The reduction in environmental monitoring and sampling frequency is supported by the long term consistency with the historical results and repeatable seasonal fluctuation, combined with zero site activities to initiate new changes. The included Tulsequah Chief EMA Quarterly Monitoring Report for Q4 2015 fully documents this information.

Additional information currently being prepared/reviewed will be submitted, as requested prior to March 31st, 2016.

- As built report for the Exfiltration pond.
- Operations, Maintenance and Surveillance manual for the exfiltration pond.
- Plan for decommissioning the emergency sludge pond located besides the IWTP (will be included within 2015 Annual Reclamation report).

Further information requested regarding the IWTP will be provided prior to resuming operations including: signed, final IWTP electrical diagrams; signed IWTP construction plans; and as built report and OMS manual for the emergency sludge pond besides the IWTP.

Concurrently, CMI is applying to MoE to amend EMA Permit 105719 during this period of care and maintenance under Sec:18(5)(a) of the EMA.

Additionally, CMI is re-stating its commitment to re-commencing operations at the IWTP to MEM and MoE by implementing engineered solutions to address the previously identified deficiencies immediately upon receiving project financing to develop the Tulsequah Chief Mine. The IWTP was initially commissioned in anticipation of project construction activities, to conform with the Mines Act condition to treat contaminated discharges from the new HPAG facility at Rogers Creek, with any excess capacity utilized to treat the existing underground acid mine drainage (subsequently modified by MEM in the July 7, 2011 amendment approval to include all portal discharges). As previously discussed, new mine development and operations is the only viable alternative for cleanup and remediation of the historic acid mine drainage and metal leaching at the mine site. Permit amendments for new mine activities will be follow once financing is in place.

We trust this amendment application meets your requirements at this time, and look forward to reviewing a draft amended permit with you. If you have any questions, please do not hesitate to contact us.

Yours Sincerely,

Chieftain Metals Corp.

Keith Boyle, P.Eng.
Chief Operating Officer

/attach

cc. Mark Love, MoE Smithers
Arash Janfada, EPO, MoE Surrey
Rob Marsland, Chieftain
Eric Telford, TRTFN
Mark Connor, TRTFN

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February 8, 2016

Diane Howe
Deputy Chief Inspector,
Ministry of Energy and Mines
British Columbia
diane.howe@gov.bc.ca

Candace Caunce
Director, Compliance
Ministry of Environment
British Columbia
candace.caunce@gov.bc.ca

Autumn Cousins
Manager, Compliance
Environmental Assessment Office
British Columbia
autumn.cousins@gov.bc.ca

Dear Ms. Howe, Ms. Caunce and Ms. Cousins;

We have enclosed the Compliance Plan to put Chieftain Metals Corp's Tulsequah Chief Mine into compliance as requested in your letter dated November 10, 2015.

The Compliance Plan includes two letter applications to amend the EMA Permit #105719 and Mines Act Permit # M-232 to reflect the project's care and maintenance status while project financing is assembled to continue mine construction and development for this world class project.

Chieftain is committed to this compliance plan and will continue to work with government authorities and the Taku River Tlingit First Nation to properly maintain the site. We request that the Ministries respond and acknowledge that Chieftain would be in compliance with its certificate and permits upon completion of this plan.

Sincerely,

Victor Wyprysky
President and CEO

Cc. Eric Telford, Land and Resource Officer, Taku River Tlingit First Nation

Encl. Compliance Plan

CHIEFTAIN METALS CORP.
TULSEQUAH CHIEF PROJECT
COMPLIANCE PLAN

FEBRUARY 2016

CONTENTS

LIST OF APPENDICES

1. INTRODUCTION

On November 10, 2015, Chieftain Metals Corp. ("Chieftain") received a letter and orders from the British Columbia Ministry of Environment (MoE), Ministry of Energy and Mines (MEM) and Environmental Assessment Office (EAO) directing Chieftain to correct certain items of non-compliance as a result of recent inspections and 'to submit, within 90 days of the letter, an overall plan to bring the Mine into compliance. The plan should reflect, and is in addition to, any specific enforcement actions issued by the agencies'. The plan is due on February 9, 2016. The above-mentioned letter and orders are attached as Appendix A.

Chieftain submits the plan described herein in order to to bring the Tulsequah Chief Mine into compliance.

2. TULSEQUAH CHIEF PROJECT HISTORY

CMI ("CMI"), a wholly owned subsidiary of Chieftain, acquired the Tulsequah Chief Mine project, located in north-western British Columbia, out of receivership in September 2010.

The Tulsequah Chief Mine project has an Environmental Assessment Certificate (M02- 01) under the BC Environmental Assessment Act and a CEAA Screening (2004, FEAI 36077) under the Canadian Environmental Assessment Act. On February 27, 2009, the Environmental Assessment Certificate was amended to provide for an alternative access to the site via air-cushioned barge along the Taku River. On October 22, 2012, the BC Environmental Assessment Office amended M02-01 as a result of re-routing the access road. Subsequently, Ministry of Forests, Lands and Natural Resource Operations approved an amended SUP and issued a new PUP for the road access route. On January 14, 2015, Environment Minister Mary Polak determined that the Tulsequah Chief Mine project has been "substantially started" pursuant to BC statutes. As a result, the Environmental Assessment Certificate will remain in effect for the life of the project and CMI can continue building the mine.

Redfern was issued Mines Act permit M-232 on February 28, 2008, which approved pre-construction site clean up of historic waste rock dumps in preparation for mine site construction. The specifics of this work included the relocation of historic waste rock dumps to a contained facility, the construction of the containment facility, the installation of an Interim Water Treatment Plant (IWTP) and the construction of required water management structures. This permit was subsequently amended on September 2, 2008 to allow for the development of the Paddy's Flats area for storage of materials and supplies required in construction and two borrow sources. A further amendment was issued on November 7, 2008 approving limited construction activities. These activities were mainly focused on preparatory work at the mill site and underground. Upon receipt of the Mines Act permit, Redfern initiated construction activities at the Tulsequah Chief Mine site and these activities continued throughout 2008.

In January 2010, an amendment requesting the transfer to CMI of Permit M-232 and reclamation liability was approved. Additionally, the amendment reconciled some site disturbances, originally authorized under Redfern's exploration Permit MX-1-355, with the M-232 permit. Disturbances created under MX-1-355 that were transferred to M-232 included the construction of 14.7 km of local access road that includes the north and south causeways, construction of a 1.2 km airstrip (of which 1.06 km has been completed to date) and geotechnical drilling in the area of the proposed tailings management facility. CMI sought an additional amendment to the Mines Act permit during 2011 to revise the location of the IWTP and to construct a temporary lime sludge pond alongside the airstrip. The amendment was approved on July 7, 2011.

3. INTERIM WATER TREATMENT PLANT HISTORY

CMI provided MoE with a detailed discussion of the factors leading up to the Company's decision to curtail operations at the Tulsequah Chief Interim Water Treatment Plant (IWTP) in February 2013. This section summarises the information contained in that February report.

The Tulsequah Chief Interim Water Treatment Plant (IWTP) was engineered by Sanitherm Inc. under the direction of Wardrop Engineering and Redfern Resources. The original Request for Quotes (Rev 0) issued in September 2007 had required:

> *2.1.3 Water treatment plant to be a complete, skid-mounted, Arctic-grade, turnkey system with instrumentation and alarms.*
>
> *2.1.7 Water treatment plant shall be able to operate without constant supervision. Plant shall be provided with sufficient instrumentation and alarms to do so.*

However, the final proposal from Sanitherm received in November 2007 and based on Rev 1.0 of the RFQ, committed to:

> *The IWTP does not include a centralized PLC. If this is required, it can be added at an additional cost, depending on the level of control required.*
>
> *The flow rates through the Plant shall be manually set and adjusted. Once the flow rate is set and dosing of chemicals adjusted accordingly (and based on the on site lab tests) the Plant shall operate automatically. The specifics of the AMD water treatment require semiautomatic operations rather than fully automatic.*

These changes to the operational plans were predicated on an expectation that the IWTP would be operated in conjunction with and adjacent to an operating mineral processing facility. This plant was then designed and built in 2008 and shipped to site in late 2008 for an anticipated 2009 construction program.

The plant was originally envisaged through an EA commitment [ARD Responses, January 15, 1998 – attached as Appendix B] to provide treatment for the incremental loading that might occur when the historic PAG (HPAG) waste rock was removed from the site to facilitate mill

construction. It was anticipated that the plant might need to run for a year or so while mill construction was underway, but at a rate of less than 10 m^3/h. Any additional capacity was to be used to treat AMD from the Mine.

> The criteria used to design the water treatment unit are discussed below. The treatment unit will be used to treat drainage from the material placed on the PAG waste rock dump. The treatment unit will be self-contained and sized to treat influent at a rate of 8.0 m^3/hr. This estimate is based on the expected average annual flow from the PAG dump based on its current configuration and precipitation load as well as the 5400 dump area drainage, exclusive of current minewater discharge. The company feels this estimate is conservative since the PAG dump area has been designed at a 2.5:1 dump configuration suitable for reclamation. Since it is not designated for reclamation, the actual size will be less using a more standard angle of repose configuration for the dump. This will reduce the area of precipitation capture and drainage flow.

Ref. pg 6 of "Responses to ARD/WQ issues raised at the sub-committee meeting of January 14, 1998" submitted by Redfern to EAO on January 15, 1998. See Appendix B for complete document.

The current facility was designed to treat acidic discharge from the historic Tulsequah Chief Mine in conjunction with a full mine project until the upper underground workings could be back-filled as part of the designed operating mine plan, treating both the drainage from the HPAG and also acidic drainage from the historic underground workings.

As part of the acquisition of the Tulsequah Chief property from Redfern's receivers in 2010, CMI acquired the IWTP and delivered it back to the Tulsequah Chief by barge in June 2011 to meet the obligations of the Environment Canada Inspector's Direction dated February 22, 2011. The IWTP was constructed and commissioned onsite between June 2011 and March 2012.

The BC Ministry of Environment issued EMA Permit #105719 on 1 April 2012 upon completion of commissioning activities. Despite meeting the prescribed discharge water quality criteria, design parameters were not being met and operating costs were significantly higher than anticipated. CMI curtailed plant operations on 22 June 2012 due to corporate financial constraints.

4. EXPECTATIONS AND UNANTICIPATED OUTCOMES

The IWTP was designed to treat an average of 40 m^3 of influent per hour, with plant throughput expected to be lower during winter months and higher during the Spring snowmelt. Had activities at the plant continued over the course of a year, the expected average flow would have been realised. In the time period from March 1, 2012 to May 31, 2012, sludge was being produced at an average rate of 1 m^3 sludge per 52.8 m^3 treated water, or 1,200% of design output. Sludge production rates were similar in the 90 days prior to shut down (March 25 to June 22, 2012, at 1 m^3 per 56.3 m^3 of water). CMI did not anticipate that such large sludge volumes

would be generated as a by-product of water treatment activities nor the additional pressures that such production rates would place on personnel and equipment at the site. A detailed discussion of these unanticipated outcomes was provided to the MoE on 24 July 2012.

On November 6 and 7, 2012, Sohan Basra, a water treatment design consultant who is a specialist in High Density Sludge (HDS) lime treatment systems, evaluated the IWTP. CMI, in response to a need to assess options to improve the water treatment plant performance at the Tulsequah Chief site, tasked Applied Water Treatment Inc. (AWT) to develop a feasibility level cost estimate to convert the existing Acidic Water Treatment Plant (ATP) to a more reliable High Density Sludge (HDS) process.

The feasibility design includes major equipment re-sizing, equipment modification and updated reagent consumption estimates based on the water chemistry and flowrate predictions conducted by CMI .

The HDS treatment process is expected to produce a sludge consisting mostly of metal hydroxide (expected to be ~15-20% solids) and effluent that will meet the discharge water quality target as previously demonstrated at site. Improvements are planned to convert the existing water treatment process to a more reliable HDS process. The peak HDS process design flow is 97 m^3/hr and is expected to produce 30 to 40 kg/h of solids that will be included in the paste backfill mix as part of the mining process. The HDS process reduces the unit rate of sludge production due to increased sludge density and improves sludge stability, both chemically and physically (Applied Water Treatment, 2014). The HDS treatment process will produce a sludge consisting mostly of metal hydroxide (expected to be ~15-20% solids) and effluent that should meet the discharge water quality target as demonstrated at numerous sites globally and during IWTP operations in 2012.

Applied Water Treatment ("AWT") summarizes the process as follows: Lime and recycled sludge are added to the lime-sludge mix tank at the head of the process and this becomes the main neutralization agent. This mixture is discharged to the rapid mix tank where it is mixed with influent, thereby achieving neutralization. This mixture is fed to the main lime reactor where a combination of aggressive aeration and high shear agitation ensures optimum process chemistry and clarifier performance. The discharge from the lime reactor is treated with flocculent in the flocculation tank. The clarifier separates the treated effluent from the sludge, a portion of which is recycled to the head of the process. Clarifier overflow will be pumped through the existing polishing filter to ensure total suspended solids meet discharge requirements.

The existing reactor tanks in the IWTP will be modified to improve flow characteristics and include air injection. A small lime-sludge mix tank will be installed on top of the existing tank. The discharge from the second reactor tank will be transferred to a new conventional clarifier located outside the existing building.

The capital cost estimate prepared by AWT in November 2014 indicates that the cost to make the recommended upgrades will be about $775,000. Significant savings in both labour and reagent costs are anticipated. Detailed design work will commence upon receipt of full project

financing and construction will follow-on immediately thereafter. The upgraded plant will be commissioned by the time water draining from the relocated PAG rock requires treatment.

5. AQUATIC ENVIRONMENTAL RISK ASSESSMENT

At the request of the British Columbia Ministry of the Environment in 2013, British Columbia based independent scientists from Palmer Environmental Consulting Group, Core6 Environmental Ltd. and Triton Environmental Consultants (December 2013, follow-up memo December 2014) evaluated the water quality at four sites on the Tulsequah River near the confluence of the Taku River where the mine is located. The group conducted an Aquatic Ecological Risk Assessment focused on Coho salmon, Sockeye salmon, Dolly Varden/Bull Trout, and Chinook salmon. Based on the seasonal trends of metal concentrations in the Tulsequah River, and the life cycles and habitat preferences of these species, the report concluded that the risk of impacts as a result of the mine discharge is considered low for migratory salmon. The report also determined that the zone of influence of any ecological risk does not extend to the Taku River.

A report published by Joseph P. Hitselberger of the Alaska Department of Fish and Game (2012) (Scannelreported that fish tissue from resident Dolly Varden, captured near the mine, showed low metal levels despite the more than 50 years of historic discharge. The levels of metals found in the fish are below those found in the fish samples collected from vicinity of the Greens Creek Mine in Alaska.

A separate report produced by Phyllis Weber Scannell for the Alaska Department of Fish and Game titled 'Taku - Tulsequah River Mining Activity, Background Environmental Monitoring and Potential Mining Effects' in January 2012 reviewed water quality studies from the Tulsequah and Taku River drainages. Based on the information reviewed, a comparison amongst sites showed that the sampling site that was upstream of mining on the Tulsequah River, had the highest maximum concentrations of Aluminum, Iron, and Nickel compared to downstream near the confluence with the Taku River, and on the Taku River itself. Maximum concentrations of both total and dissolved concentrations of Cadmium, Copper, and Zinc were highest in the Taku River (both upstream and downstream of the confluence with the Tulsequah River). No evidence exists of downstream or ecological effects from the 60 years of mine discharge despite the elevated concentrations of metals in the water immediately downstream of the mine (Scannell 2012). There is evidence that naturally high concentrations exist in the Tulsequah river, upstream of the mine and in the Taku river, upstream of the Taku/Tulsequah confluence.

6. RETURN TO COMPLIANCE

This compliance plan addresses the orders issued November 10, 2015 by the Environmental Assessment Office, Ministry of Environment and Ministry of Energy and Mines.

Non-compliance Issues Addressed- Environmental Assessment Certificate M02-01

1) Immediately implement spill prevention measures ensuring that hydrocarbons are not spilled or otherwise released into the environment from any equipment or hydrocarbon storage located on the Project site;

2) by November 30, 2015, develop a plan to:

- remove the hydrocarbons that have been spilled at the four-non compliant locations into the receiving environment; and
- prevent future spills or other releases of hydrocarbons into the receiving environment at the Project site; and

3) develop and implement the plan identified in clause 2 to the satisfaction of the Environmental Assessment Office.

The plan, as requested by the Environmental Assessment Office, is as follows.

To ensure that hydrocarbons are not spilled or otherwise released into the environment, CMI:

a. on October 16, 2015, moved the AMC Pure Vis, a non-hydrocarbon drilling polymer, from the yard where a pail of the grease had leaked on the ground (bears may have consumed it), to inside the shop for storage.

b. on October 17, 2015, covered the fuel storage area with tarps so that the secondary containment would no longer collect precipitation and overflow onto the ground. The secondary containment will require a modification to the design prior to future operation.

c. on October 16, 2015, inspected equipment on site for hydrocarbon leaks. Readily available fuel has been recovered to reduce any potential of accidental leaks.

d. on October 16, 2015, repaired the fuel line to the incinerator. The incinerator is not being used at this time and will be upgraded prior to resumption from the care and maintenance condition, with a properly designed secondary containment.

Please see the attached memo (Appendix C) for the before and after pictures of the completed corrections.

All soils contaminated by hydrocarbons at the four locations identified during this inspection will be picked up by hand shovel and, if necessary, excavator, and placed in empty drums and then stored temporarily in the secondary containment. The holes left by the removal of the hydrocarbons will be filled with clean rock and gravels from the area. Upon project development and construction of an approved land farm, the soils will be moved to the approved land farm area.

The soils will be picked up after the snow is melted and frost has left the ground. This is estimated to be late April or early May 2016.

All future spills will be prevented with the covers on the secondary containment areas and the storage of the drill grease in the shop. All equipment not in use will be inspected and have fluids removed where necessary to prevent accidental discharge of hydrocarbons. Drip trays will be placed under any undrained equipment. A site inspection is performed when personnel visit the site, to ensure compliance.

CMI corrected the two other non-compliance issues raised in the inspection report:

a. on October 16, 2015, removed the pipes that were directing the discharge from the 5200 level adit directly to the river. The water is now flowing to the Exfiltration Pond adjacent to the 5200 level waste dump.

b. on October 16, 2015, water above the 5200 level portal now flows in a ditch (following the Portal Creek diversion pipe that had been crushed by fallen rocks) down the hill. The clean water no longer mixes with the contaminated water from the 5200 level portal. The ditch will be maintained by hand until such time during project development when the fallen rocks can be cleared, the rock face can be properly secured, and the diversion pipe repaired.

Non-compliance Issues Addressed- EMA Permit #105719

The letter to Neil Bailey, P.Eng. dated November 23, 2015, attached, responded directly to the orders from the site visit. Please see the attached letter in Appendix D.

A follow up call on December 1, 2015 occurred with the EAO, MoE and MEM with respect to the action plan to be submitted by Chieftain within 90 days from the date of the orders. Given that the site is on care and maintenance and that the IWTP is not operational, the MoE stated that a permit amendment to EMA Permit #105719 would be consistent with the current state of the project and Mine Reclamation Code for projects under care and maintenance for more than one year.

The attached letter (Appendix E) to the MoE requests an amendment to the EMA #105719 until such time as Chieftain obtains project financing and construction has re-commenced. The supporting documentation requested by the MoE is attached to the request.

Non-compliance Issues Addressed- Health, Safety and Reclamation Code for British Columbia

The orders issued by the MEM were answered within the prescribed 15 days. See attached response (Appendix F).

The Tulsequah Chief site has been on care and maintenance since the shutting down of the IWTP on June 22, 2012. As such, CMI is attaching a request that the Mines Act Permit be amended to reflect the care and maintenance condition of the site (Appendix G). Pre-construction/early construction activities will resume at site upon Chieftain securing project financing.

As part of the application, CMI will provide an as-built drawing and an Operations, Maintenance and Surveillance manual for the Exfiltration Pond on or prior to March 31, 2016. These items will complete the orders issued by the MEM on November 10, 2015 with respect to the Exfiltration Pond.

Upon re-commencement of construction activities on site, the first works to be completed are the completion of the HPAG lined storage area, collection and moving of the HPAG waste to the lined storage and, once completely relocated, the waste will be covered to prevent precipitation from infiltrating through the waste. The IWTP will be retro-fitted with the new equipment outlined in the feasibility study and will then treat the acidic drainage from both the HPAG pile and the underground workings. The sludge from the IWTP will be hauled and stored in the temporary storage pit at the airstrip until such time as the sludge pit can be reclaimed and the sludge sent underground as part of the paste fill.

7. CONCLUSION

Chieftain remains committed to advancing the Tulsequah Chief Project through construction and into production, and maintains its commitment to re-commissioning the Tulsequah Chief Interim Water Treatment Plant at the earliest possible time upon completion of project financing and commencement of project construction.

As demonstrated in the attachments, the scope of the impact is well known, whereby approximately 80% of the acidic drainage is a result of the old underground workings and the remaining 20% is due to the waste piles on surface. The majority of the acid drainage from the waste pile occurs during the spring thaw. Therefore, any solution to deal with the drainage must address the water from the old underground workings.

Studies have concluded that the acid drainage is of low risk to the aquatic life in the Tulsequah with no impact in the Taku River over the near 60 years of drainage. Therefore, the only appropriate and viable solution to the historic drainage is to put the mine into production and fill the old workings.

CMI will continue to work with authorities and the Taku River Tlingit First Nation to properly monitor and survey the site according to the amendment applications enclosed and requests that the ministries acknowledge that Chieftain will be in compliance after amending the permits and following the amended monitoring and surveillance.

REFERENCES

Hitselberger, J.P., 2012. Tulsequah Chief Mine acid rock drainage: whole body metals concentrations in Dolly Varden char. Alaska Department of Fish and Game, Technical Report No. 11-09, Douglas, AK.

Palmer Environmental Consulting Group, Inc., Triton Environmental Consultants Ltd., and Core 6 Environmental Ltd., Aquatic Ecological Risk Assessment Tulsequah Chief Mine, report prepared for Chieftain Metals Inc., December 2013.

Palmer Environmental Consulting Group, Inc., Response to MoE Review of Tulsequah AERA, Memorandum prepared for Chieftain Metals, December 2014.

Scannell Scientific Inc. 2012. Taku – Tulsequah River Mining Activity Background Environmental Monitoring and Potential Mining Effects: Technical Report No. 12-01. Report prepared for the Alaska Department of Fish and Game, Division of Habitat.

LIST OF APPENDICES

A. Letter and Orders issued November 10, 2015
B. Responses to ARD/WQ issues raised at the sub-committee meeting of January 14, 1998
C. Memo with photos of corrective measures
D. Letter to Neil Bailey, MoE, dated November 23
E. Application to amend EMA Permit #105719
F. MEM Response Letter
G. Application to amend MA Permit M-232

APPENDIX A

Letter and Orders issued November 10, 2015

APPENDIX B

Responses to ARD/WQ issues raised at the sub-committee meeting of January 14, 1998

APPENDIX C

Memo with photos of corrective measures

APPENDIX D

Letter to Neil Bailey, MoE, dated November 23, 2015

APPENDIX E

Application to Amend EMA Permit #105719

APPENDIX F

MEM Response Letter

APPENDIX G

Application to Amend MA Permit M-232

APPENDICE

A. Letter and Orders issued November 10, 2015

BRITISH COLUMBIA

File: 30020-25 TULAC

Reference: 292869

November 10, 2015

SENT VIA EMAIL

Keith Boyle
Chief Operating Officer
Chieftain Metals Corp
Suite 2510, 2 Bloor Street West
Toronto ON M4W 3E2
keith.boyle@chieftainmetals.com

Dear Mr. Boyle:

We are writing to advise you of the results of recent inspections of the Tulsequah Mine by the Ministry of Energy and Mines, Ministry of Environment and the Environmental Assessment Office. The results of these inspections and associated enforcement for non-compliances identified during the inspections are attached. Any questions relating to any specific enforcement requirement should be directed to the agency that issued that enforcement action.

Recognizing their distinct authorities, the three agencies are coordinating regulatory oversight and will work with Chieftain Metals Corp to determine an appropriate path forward for resolving on going non-compliances for this Project. Within 90 days of this letter, please submit an overall plan to bring the Mine into compliance. This plan should reflect, and is in addition to, any specific enforcement actions issued by the agencies.

We are pleased to arrange a meeting to discuss this letter and next steps.

Yours truly,

Diane Howe
Deputy Chief Inspector,
Ministry of Energy and Mines

Cassandra Caunce
Director, Compliance
Ministry of Environment

Autumn Cousins
Manager, Compliance,
Environmental Assessment Office

...2

Attachments (5)

cc: Eric Telford, Land and Resource Officer, Taku River Tlingit First Nation

BRITISH COLUMBIA

November 5, 2015

File: 105719

VIA EMAIL (rob.marsland@chieftainmetals.com)

Rob Marsland
Senior Environmental Engineer
Chieftain Metals Inc.
Unit 118, 1515 Broadway St,
Port Coquitlam BC
V3C 6M2 Canada

Dear Mr. Marsland:

RE: Non-compliance Advisory Letter Resulting from Inspection of permit number 105719 for Chieftain Metals Inc.'s Tulsequah Chief mine under the *Environmental Management Act*

On Oct. 15, 2015 the Tulsequah Chief facility near Atlin, BC was inspected by staff from the Ministry of Environment and Ministry of Energy and Mines. Thank you for your time during the inspection.

Enclosed is an inspection record and photo log from that site inspection. Please review the attached inspection record for further details.

Below lists the section, the non-compliance of that section and the action required related to the Permit (105719).

- Section 1.1.5 The authorized works include, but are not limited to, a water collection and conveyance system, pumps, an acid water treatment plant which includes a neutralization chamber, rapid mix tank, flocculent tank, inclined plate-type separator/thickener, filters and holding tanks, a discharge line, outfall to the Tulsequah River, and related appurtenances approximately located as shown on Site Plan A.
  Section 2.1 – Bypasses
  Any bypass of the authorized works is prohibited unless the approval of the Director is obtained and confirmed in writing.

Non-compliance: Written Approval for the bypass of the water treatment plant was not obtained and the discharge does not meet the conditions specified in Section 3.6. As a result, Chieftain Metals Inc. is in violation of Section 2.1 Bypasses.

Ministry of Environment Northern Region
Environmental Protection Division
Mailing Address:
Bag 5000 - 3726 Alfred Avenue
Smithers BC V0J 2N0
Telephone: 250 847-7260
Facsimile: 250 847-7591
Website: www.gov.bc.ca/env

Action: Commission the IWTP immediately once site development occurs.

- Section 4. Discharge and Receiving Environment Monitoring.

Commencing July 1, 2014, Section 4.0 of permit 105719 is to read as follows:
-Sampling monthly from October through February increased to bi-weekly April through May and then returns to monthly in the period from June to September.
-The sites to be sampled remain W10, W46, SE2, W51 and W31
-The parameters to be sampled for remain total and dissolved metals, pH, conductivity, turbidity suspended solids, hardness and alkalinity.
Non-compliance: The Permittee did not meet the amended requirements for Discharge and Receiving Environment Monitoring on the following dates and locations:
-At site W51 for July 29, 2014 pH, conductivity and alkalinity were not monitored for.
-Monitoring of W46 is suspended in June 2015 as path of river no longer passes through this location.
Action: Ensure monitoring occurs in the locations, frequencies and parameters required in The June 12 2014 Amendment to Section 4.0 Discharge and Receiving Environment Monitoring. Contact Director regarding amending the W46 monitoring location.

Failure to comply with the terms and conditions set out in your authorizations is a violation under the *Environmental Management Act* (EMA). A person who fails to comply with a provision of EMA may be found guilty of an offence and could be liable, on summary conviction, to a penalty. For your reference, EMA and all related and pertinent British Columbia Laws can be found at http://www.bclaws.ca/.

This advisory, the alleged violation and the circumstances to which it refers will form part of the compliance history of Chieftain Metals Inc. and its responsible officials and will be taken into account in the event of future non-compliance. You are directed to do the following:

1. Implement the necessary changes or modifications **immediately** to address this situation and to bring it into compliance.
2. Notify this office by email or letter within 30 days of this letter, advising what corrective measures have been taken, and what else is being done, to bring this authorization into compliance.

Please note that this authorization is considered out of compliance until such a time as it can be confirmed to meet the authorization requirements. If you have any questions with regard to this advisory, please contact Neil Bailey at 250 847-7456 or email Neil.Bailey@gov.bc.ca.

Yours truly,

Neil Bailey

Neil Bailey, P.Eng.
Senior Environmental Protection Officer

Attachments: Inspection Record & Photo log

Cc Mark Love (by email), Section Head Mining Authorizations, Ministry of Environment, Mark.Love@gov.bc.ca
Cassandra Caunce (by email), Director Compliance & Integrated Pest Management Ministry of Environment, Cassandra.Caunce@gov.bc.ca
Diane Howe (by email), Deputy Inspector of Mines, Ministry of Energy and Mines, Diane.Howe@gov.bc.ca

BRITISH COLUMBIA Ministry of Energy and Mines

Province of British Columbia
MINISTRY OF ENERGY AND MINES
Report of Inspector of Mines
Reclamation
(Issued pursuant to Section 15 of the *Mines Act*)

Inspection No.:	**59777**
File:	**«FILE_NO»**
Mine No.:	**0100019**
Permit No.:	**M-232**
Emp/Cont:	**1**
Orders :	**2**
Stop Work:	

Mine Name:	Tulsequah Chief
Location:	Atlin MD / 58.737, -133.600
Owner, Manager:	Keith Boyle, Terry Zanger
Company:	Chieftain Metals Inc
Address:	Unit 118, 1515 Broadway Street Port Coquitlam BC V3C 6M2
# Workers Contacted:	1
Type of Mining:	METAL MINE UNDERGROUND
Date of Inspection:	2015/10/15
Accompanying Inspectors:	Mark Love (MOE), Neil Bailey (MOE)
Copies to	Al Hoffman, Doug Flynn, Heather Narynski, Mark Love (MOE), Chris Parks (EAO)

Written response is required from the Mine Manager within 15 days of receiving the report. In this document, Code means Health, Safety and Reclamation Code for Mines in British Columbia.

This inspection of Tulsequah Chief Mine, owned by Chieftain Metals Inc (CMI) was conducted on October 15, 2015 by Diane Howe (MEM Deputy Chief Inspector-Permitting), Neil Bailey (MOE Compliance), and Mark Love (MOE Director), accompanied by Terry Zanger (Chieftain Mine Manager) and Rob Marsland (environmental engineer, Chieftain Contactor). Access to the site was via helicopter from Atlin (45 mins). The weather at the site was cloudy/overcast in the morning changing to a drizzle with snow predicted later in the afternoon in Atlin. Access using the helicopter limited the inspection to 3.5 hours.

At the time of the inspection, 2 employees and 1 contractor were in camp, completing their monthly monitoring requirements and preparing the camp for winter. The mine has been on a care and maintenance status since June 2012.

The purpose of this inspection was visit the surface works at the mine and provide an opportunity to become familiar with the site and specifically:

- To assess if the mine is meeting the intent of their mine permit (M-232),the HSRCode and Mines Act,
- To assess if mine monitoring and management practices at the mine are consistent with generally acceptable practices at mines in BC that are on care and maintenance; and

Diane Howe
Deputy Chief Inspector
6th Floor , 1810 Blanshard St., Victoria
Address

DHowe
Signature – Inspector of Mines
Report Date: November 9, 2015

- To provide general comment on conditions at the mine.

The following areas were inspected during the mine visit:

- Lime Sludge Pit at Shaza airstrip
- 5400 portal area
- 5200 portal area
- Minesite exfiltration pond
- Mine Acid Water Treatment Plant (AWTP)
- Cleared areas around Rogers Creek (future location of HPAG, NAG waste rock dumps)

The following reports provided a general understanding of the current conditions of the site: the 2014 Annual Reclamation Report, 2014 Annual Environmental Monitoring report and the 2015 Closure Management Manual submitted to MEM, as well as the observations and discussion that occurred on-site and during the inspection. This report documents MEM's observations related to requirements of the M-232 permit, the *Health, Safety and Reclamation Code for Mines in BC*, and established best practices.

Note space has been provided after each Order/recommendation for the Mine managers response.

Background

The mine is a historical, small, underground base metal operation which saw production from 1951 to 1957; (pre reclamation legislation) at which time the mine closed due to low metal prices. There still remains today legacy metal leaching/acid mine drainage/ (ML/ARD) concerns with water moving through the underground workings picking up contamination and discharging through the lower portals, plus surface drainage from the historical PAG waste rock left on site. There are no tailings facilities on site. Total disturbance reported in the 2014 Annual Reclamation Report was 105.8 ha, with ~50% being road construction.

In 2007 the company (then Redfern Resources Ltd.) applied for and received a Mines Act permit for limited construction works. This application was to allow the company to start with the clean-up of historical waste rock and dumps and construct water management structures to support the water treatment plant (WTP). In 2008 the company applied for an amendment to their mine permit which would have led to a full production permit, however the company went into bankruptcy protection. A limited amount of construction works permitted have been completed to date, critical however was the purchase of the water treatment plant (WTP).

In early 2010 the mine acquired by Chieftain Metals Inc. (CMI), who have now responsible for all liability existing on site under the Mines Act. One of CMI's first actions was to construct and start operating the WTP. The WTP was commissioned in October 2011 but was suspended in June 2012 because the plant had been operating below design levels of efficiency resulting in higher than expected operating costs. The design flaw is in the sludge production not in the quality of effluent being produced. The plant remains idle pending an upgrade to the sludge settling efficiency. Of note is the long term plan for sludge management was to dispose underground, however with the underground not in operation the company had to find an alternative disposal location for high slurry sludge

The mine remains on care and maintenance and remains unattended with only bi-weekly surveillance and environmental sampling visits. Remote monitoring is provided by building alarms and security cameras with satellite communication connections. If alarms are triggered, personal based in Whitehorse or Atlin will attend the site.

Inspection Observations

Lime Sludge Pit at Shaza Strip

The temporary lime sludge storage pit, located just off the airstrip, contains approximate 35m^3 of sludge generated from the WTP and is lined with a filter fabric to prevent migration of the sludge to the subsurface gravel. No deposition has occurred since the WTP shut down in June 2012. CMI maintains monitoring from 3 groundwater wells. CMI has committed, should mine operations not resume, to relocating the sludge to a secure location to the Rogers Creek area, which will be capped and re-vegetated.

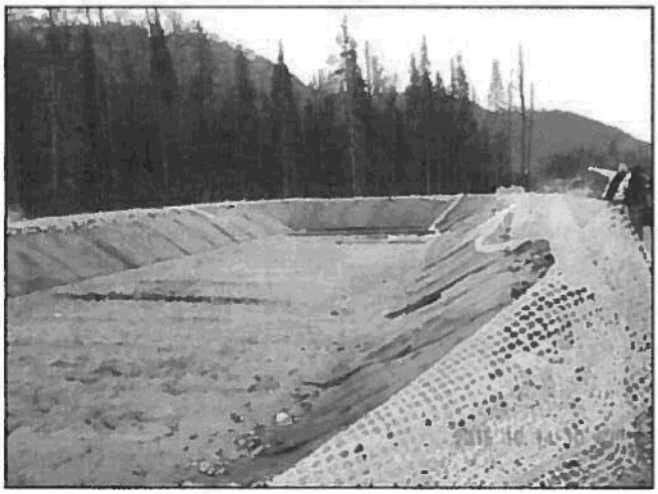


Photo 1: Lime Sludge Pit Shaza AirStrip.

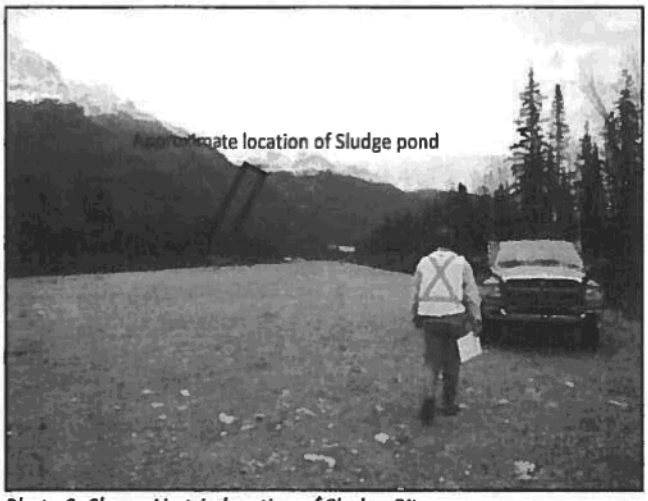


Photo 2: Shaza Airstrip location of Sludge Pit

5400 portal drainage

The 5400 portal, the upper most accessible portal, has been appropriately signed with "Danger No Entry" signage and is currently blocked by locked wooden doors. Limited work has been done at this portal site other than to remove the historic track from the underground and reconfigure the drainage exiting the portal. In 2011 CMI separated the acidic from non-acidic drainage inside the mine and today the non-acidic drainage (in black pipe Photo 3) is conveyed to Portal Creek where they are combined (photo 4) and directly discharged to the Tulsequah River via a buried (partial) 600mm HDPE pipeline.

The acidic drainage seen exiting the mine as an orange flow (approx. 1L/s)(Photo 3) is captured in a pipe near the portal and is directly conveyed by a buried pipeline to the exfiltration pond located near the Tulsequah River. All drainage from the 5400 portal has been directed away from the historical waste thus limiting contaminated flows. (Photos 5 and 6)

Photo 3:. The black pipe is diverting neutral drainage captured underground; The Fe stained drainage (acidic) is flowing freely from the portal and is captured in a pipe in the foreground.

Photo 4: The neutral drainage is combined with the Portal Creek drainage into a HDPE pipe and diverted away from historical waste rock to the Tulsequah River

Photo 5: The black pipe (arrow) is the acidic discharge from the 5400 portal. Portal Creek and the combined non-acidic drainage discharge to the left of the picture in an underground HDPE pipe.

Photo 6: showing the historical PAG rock left from early mining. The ~80,000 tonnes of material to be relocated once mining restarts to the PAG dump on Rogers Creek.

5200 Portal

The 5200 portal, the lower most accessible portal is appropriately signed with "Danger No Entry" signs but the wood door is open to allow the passage of the discharge pipe seen in photo (Photo 7). Within 300 meters inside the entrance however, is a 1.8 m high dam used as part of an inactive passive water treatment system and the tunnel beyond is partially flooded. Acidic flow from this portal; which also includes partial flow from the 5400 and 5900 levels, averages ~ 7L/s.

At the time of this inspection, the 5200 acidic discharge was being directly discharged to the Tulsequah River (Photo 8). MOE officials accompanying the author sampled at the end of pipe at this location. It is understood that the direct discharge to the Tulsequah River was also done last year during the high flow period in order to minimize sludge build up in the exfiltration pond thereby and reducing the hydraulic loading on the pond. (MEM understands this direct discharge has not approved by MOE and discussions are ongoing.)

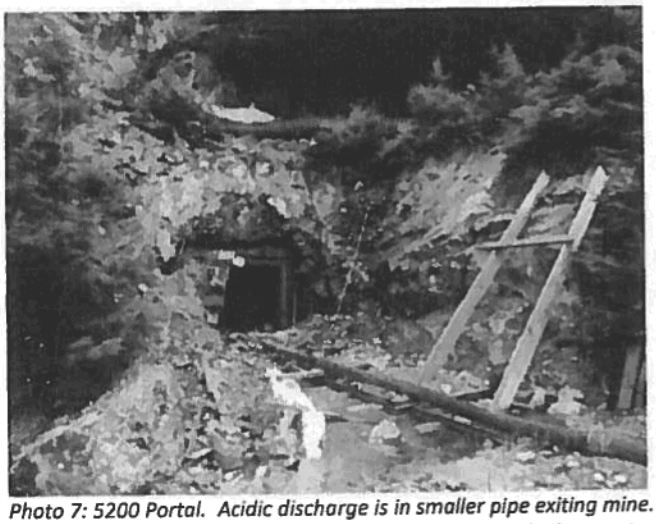


Photo 7: 5200 Portal. Acidic discharge is in smaller pipe exiting mine. 5400 non acidic and Portal creek water is contained in the larger pipe located above the portal.

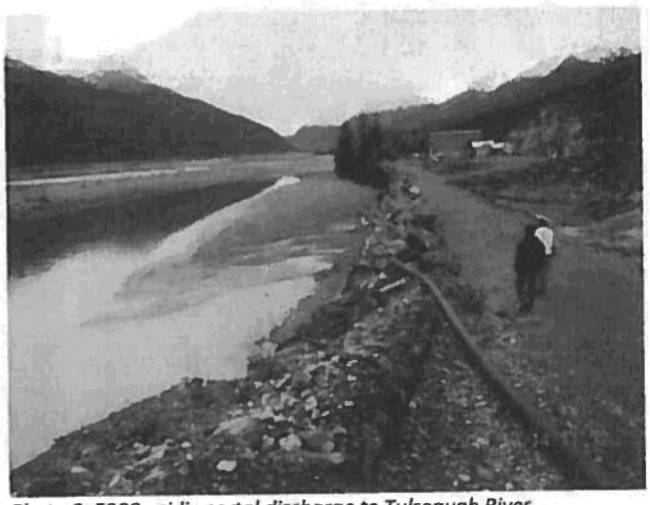


Photo 8: 5200 acidic portal discharge to Tulsequah River

Notable in Photo 7 is the 600mm HDPE pipe over top of the 5200 Portal entrance which is conveying the Portal Creek and 5400 non-acidic drainage to the Tulsequah River. The pipe requires ongoing monitoring and maintenance because of rock falling onto the pipe and at times crushing the pipe causing leakage. From the photo it can be seen the pipe is currently leaking with water spilling down to pond in front of the Portal. This pond drains into the ex-filtration pond via ditching and a culvert under the road.

Ex Filtration Pond

The observed ex-filtration pond was constructed in 2011 and was reportedly built to capture site drainage from the PAG waste dumps (Photos 9-11). Currently it is being used to capture all drainage, including the portal drainage, where the contaminated discharge is allowed to ex-filtrate through the road berm to the Tulsequah River (Photo 12). A filter fabric is used to prevent the migration of the Fe sludge into the dam rock void spaces would effectively block the diffuse flow. As noted in the 2014 ARR the sludge built up in 2013/14 nearly causing the pond to overflow requiring remediation to be taken by the company. (Note this incident was not reported to MEM)

A review of the applications submitted to MEM show the current ex filtration pond has not been built in accordance with the designs provided to the province. (Note MEM has not approved the design, construction or operation of this pond.)

A significant concern is the proper operation of the pond given there is no spillway observed and there is no continuous onsite presence.

Photo 9: Exfiltration pond receiving ditch water from the 5200 portal

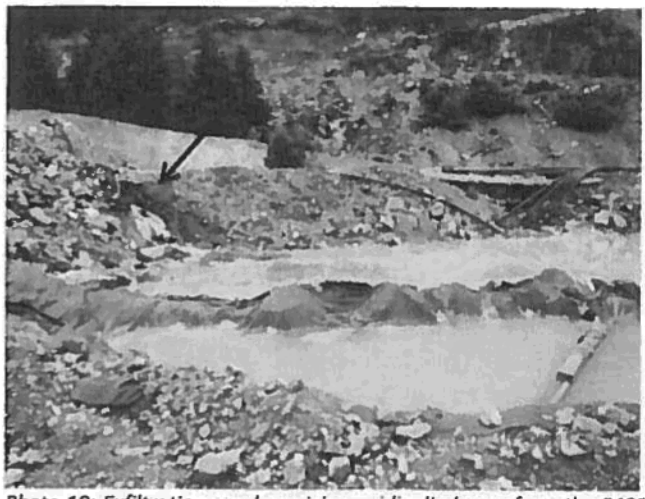


Photo 10: Exfiltration pond receiving acidic discharge from the 5400 portal

Photo 11 Exfiltration pond. Note high water level of sludge.

Photo 12: Diffuse discharge location through berm onto the Tulsequah river floodplain.

Acid Water Treatment Plant (WTP)

The WTP was constructed in its current location in 2011 after receiving approvals from the province to relocate and upgrade the previously proposed WTP (Photos 13, 14). The WTP is designed to treat acidic discharge on a temporary basis until the upper mine workings could be backfilled as per the mine design proposed in 2009. The plant ran from October 2011 till June 22, 2012 at which time operations were suspended due to operational issues. Since that time the company has sought guidance on process modification strategies to address the high operating costs. CMI has stated they are committed to re-commissioning the WTP at the earliest time upon completion of full project financing.

Noted during the inspection, beside the WTP, was another sludge pond which has not been approved by MEM (Photo 15)

Date of Inspection November 9, 2015 Initials DH (Inspector) Initials _____ (Manager)

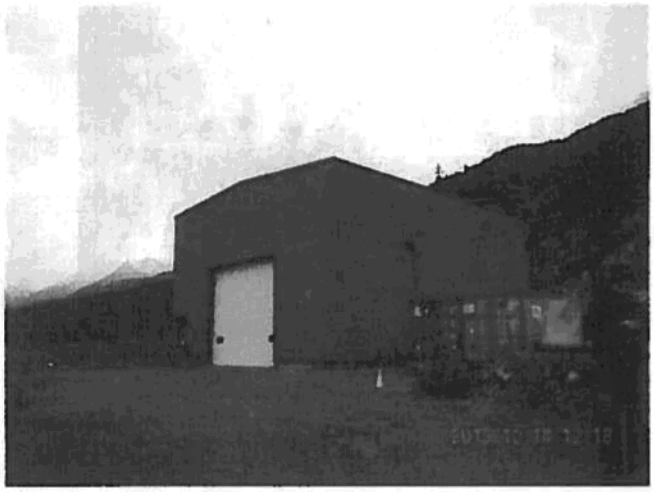


Photo 13: Acid Water Treatment Plant

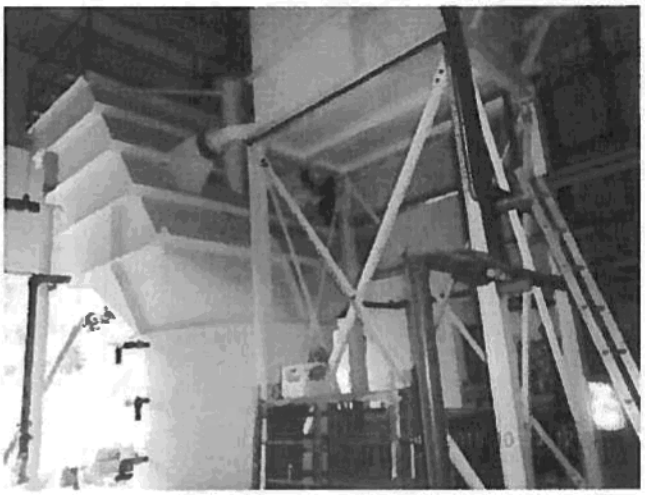


Photo 14: Inside the AWTP

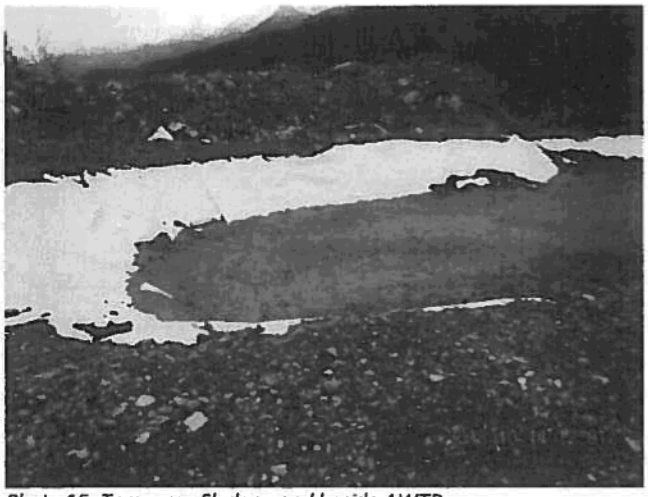


Photo 15:.Temporay Sludge pond beside AWTP

Photo 16: Site Collection Pond

Rogers Creek Area (HPAG and NAG areas)

Other than clearing, and some minor construction of berms the areas reserved for PAG and NAG waste rock storage has been minimal (Photo 18). Access to these areas from the main mine site is good; the causeway remains in good condition (Photo 17).

Photo 17; Causeway between mine and Rogers Creek area.

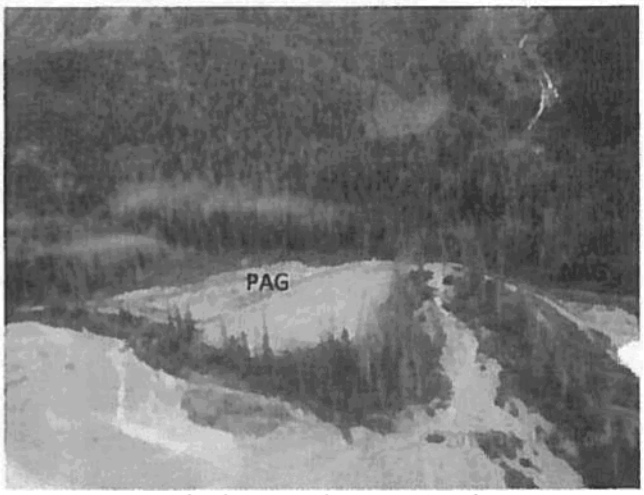


Photo 18: Clearing for the PAG and NAG waste rock areas.

Orders

The following orders are summarized based on observations and discussions that occurred on-site:

1. Pursuant to HSRC 10.5.1 and 10.5.2, the company shall provide to the Chief Inspector by March 31, 2016, or earlier, an as-built report for the exfiltration pond signed by a qualified professional engineer.

Managers response:

2. Pursuant to HSRC 10.5.2, the company shall provide to the Chief Inspector by March 31, 2016, or earlier an Operation, Maintenance and Surveillance manual for the exfiltration pond operations to include all other water management structures, including diversion structures.

Managers response:

Information Requirements

The following information requirements are summarized based on observations and discussions that occurred on-site

3. Prior to resuming operations of the sludge pond located beside the WTP, CMI shall provide to the Chief Inspector a final "as built" for the pond, and an operations, maintenance and surveillance manual. This may be combined with the OMS for the WTP once operations resume.

Managers response:

Date of Inspection November 9, 2015 Initials DH (Inspector) Initials _____ (Manager)

4. CMI shall provide in the next annual report or upon restart of operations, which ever comes sooner, a plan for the decommissioning of this pond

Managers response:

5. Prior to resuming operations of the WTP, CMI shall provide to the Chief Inspector final electrical line diagrams and building construction plans signed and sealed by a qualified professional.

Managers response:

Conclusion

The October 15th, 2015 inspection provided an excellent overview of the current mine site conditions and ongoing activities. Although the mine is on care and maintenance CMI continues to fulfill their obligations for monitoring and maintenance of the site. While the company does remain vigilant in this regard, this inspection has found that communication with the Province with respect to obtaining approvals and reporting issues need to be improved.

Date of Inspection November 9, 2015 Initials OH (Inspector) Initials _____ (Manager)

Ministry of Environment

Inspection Record

Environmental Protection Division

EP System: AMS	Inspection Status: *FINAL*
System Number: 105719	**Inspection No:** *23226*
EP System Status: *Active*	Inspection Date: 2015-10-15
Region: Skeena	Office: Smithers
Trigger: Planned	**Incidents of Non-Compliance Observed:** Yes
Non-Compliance Decision Matrix Level: Level 1	Non-Compliance Decision Matrix Category: Category B
Inspector Name(s): Neil Bailey	Risk Ranking: 0 to 1 = Low
Audit:	Total Non-Compliance(s): 2

Regulated Party:
CHIEFTAIN METALS INC.

Regulated Party Contact(s):
Rob Marsland
Senior Environmental Engineer

Mailing Address:
Chieftain Metals Inc. c/o Terry Chandler, Executive Vice President, Unit 118, 1515 Broadway St, Port Coquitlam BC V3C 6M2

Phone No: (604) 836 7559	Fax No:

Contact Email: rob.marsland@chieftainmetals.com

Location Description or Site Address:
Tulsequah Chief Mine Site mine located approximately 100 kilometers south of Atlin, BC and 64 kilometers northeast of Juneau, Alaska on the east bank of Tulsequah River in northwest British Columbia.

Latitude: 58.71666 N	Longitude: 133.5833 W

Receiving Environment(s): Surfacewater

Summary

MONITORING AND REPORTING REQUIREMENTS		
Inspection Period: **From:** 2014-07-01 **To:** 2015-10-15		
Requirement Source: Permit		
Activity: On Site	Waste Type: Effluent	
Inspection Summary: Site inspection was conducted on Oct. 15th by Neil Bailey (MOE), Mark Love (MOE) and Diane Howe (MEM). Site tour was provided by Rob Marsland, Senior Environmental Engineer. Terri Zanger and Rob Motley were also on site from Chieftain. Weather was overcast, 1 deg. C, periods of light rain. Site currently in care and maintenance, with the water treatment plant shut down until activities resume at the site (moving of waste rock). 2014 Q3 and Q4, 2015 Q1 and Q2 reports were reviewed for compliance with the permit. The following non-compliances were noted from the Oct. 15th site inspection and data review: 1) Written Approval for the bypass of the water treatment plant was not obtained and the discharge does not meet the conditions specified in Section 3.6. The permittee is in non-compliance with section 2.1 of the permit. 2) At site W51 for July 29, 2014 pH, conductivity and alkalinity were not monitored for. Monitoring of W46 is suspended in June 2015 as path of river no longer passes through this location.		**Response:** Advisory
ACTIONS REQUIRED BY REGULATED PARTY: 1)Commission the IWTP immediately once site development occurs. 2)Ensure monitoring occurs in the locations, frequencies and parameters required in The June 12 2014 Amendment to Section 4.0 Discharge and Receiving Environment Monitoring. Contact Director regarding amending the monitoring location of W46.		
ADDITIONAL COMMENTS: On June 6, 2012, Chieftain Metals Inc., sent a letter to Mr. Wade, Comin, Inspector, Environment Canada, with copy to Ian Sharpe, Regional Director, Environmental Protection, of the Ministry of Environment. The letter informed Mr. Comin, that the Company intended to cease operations of the mine water treatment plant at the Tulsequah Chief Mine site. Subsequently, Chieftain Metals notified the Ministry that they had ceased operating the water treatment plant as of June 22, 2012 and were bypassing the authorized works. Permit 105719 issued under the Environmental Management Act (EMA), on April 27, 2012 requires that water from the 5200, 5400, and 5900 portals and mine site runoff report be collected and treated through prescribed works specified in Section 1.1.5. Further, Section 2.1 prohibits the bypass of authorized works unless there is written approval from the Director,		

or that it meets the conditions specified in Section 3.6, which allows for the discharge of neutral mine water from the underground that meets the limits specified in Section 1.1.3 of the authorization.

Permit amendment issued on June 12, 2014 amending Discharge and Receiving Environment Monitoring. Commencing July 1, 2014, Section 4.0 of permit 105719 is to read as follows:
-Sample monthly from October through February increased to bi-weekly April through May and then returns to monthly in the period from June to September.
-The sites to be sampled remain W10, W46, SE2, W51 and W31
-The parameters to be sampled for remain total and dissolved metals, pH, conductivity, turbidity. suspended solids, hardness and alkalinity.

An Aquatic Ecological Risk Assessment was conducted in the Tulsquah River in 2013 by triton Environmental, Palmer Environmental and Core6.

Compliance History:

Advisory issued 2012-05-21 for accidental release of mine water.

Written Approval for the bypass of the water treatment plant was not obtained and the discharge did not meet the conditions specified in Section 3.6. As a result, Chieftain Metals Inc. was in violation of Section 2.1 ___Bypasses___ of Permit 105719. Warning issued 2012-07-24.

2012-12-06 Notice of non-compliance for sludge pond seep.

2013-01-16 Advisory issued requiring permittee to follow monitoring requirements laid out in the Discharge and Receiving Environment Authorization Amendment - specifically the weekly metals sampling required at W10 and W32.

Compliance Summary	In	Out	N/A	N/D
Discharge	1	0	0	0
Operations	0	1	0	0
Reporting	1	0	0	0
Monitoring	0	1	1	0

Inspection Details

Requirement Type: Monitoring

Requirement Description:

Section 1.1.3 Interim Acid Water Treatment Plant (IAWTP) discharge characteristics:
Maximum allowable concentration in any grab sample
0.5mg/L for Aluminum(dissolved),
0.05mg/L for Arsenic(dissolved), Copper(dissolved) and Lead(dissolved)
0.2 mg/L for Zinc(dissolved)
30mg/L for TSS, 6.0-9.5 pH units
50% Survival in 100% Concentration, Minimum - Rainbow Trout 96 hr Acute Lethality, Single Concentration
These limits apply to treated effluent discharge from the IAWTP and the Neutral pH Mine Water (NMW).

Details/Findings:

IAWTP being shut down since June22, 2012 there was no discharge of treated mine effluent form the plant to sample.

Compliance: Not Applicable

Requirement Type: Operations

Requirement Description:

1.1.5 The authorized works include, but are not limited to, a water collection and conveyance system, pumps, an acid water treatment plant which includes a neutralization chamber, rapid mix tank, flocculent tank, inclined plate-type separator/thickener, filters and holding tanks, a discharge line, outfall to the Tulsequah River, and related appurtenances approximately located as shown on Site Plan A.

Section 2.1 Bypasses
Any bypass of the authorized works is prohibited unless the approval of the Director is obtained and confirmed in writing.

Details/Findings:

Written Approval for the bypass of the water treatment plant was not obtained and the discharge does not meet the conditions specified in Section 3.6. As a result, Chieftain Metals Inc. is in violation of Section 2.1 _Bypasses_ of Permit 105719.

Compliance: Out

Requirement Type: Discharge

Requirement Description:

3.6.1 Uncontaminated groundwater from underground drill holes with characteristics better than or equal to that specified in section 1.1.3, may bypass the treatment plant and be diverted to Portal Creek.

Details/Findings:

Neutral pH water met the criteria for diversion for all data reviewed.

Compliance: In

Requirement Type: Monitoring

Requirement Description:

Section 4.0 Discharge and Receiving Environment Monitoring.
Commencing July 1, 2014, Section 4.0 of permit 105719 is to read as follows:
-Sample monthly from October through February increased to bi-weekly April through May and then returns to monthly in the period from June to September.
-The sites to be sampled remain W10, W46, SE2, W51 and W31
-The parameters to be sampled for remain total and dissolved metals, pH, conductivity, turbidity. suspended solids, hardness and alkalinity.

Details/Findings:

The Permittee did not meet the amended requirements for Discharge and Receiving Environment Monitoring on the following dates and locations:
-At site W51 for July 29, 2014 pH, conductivity and alkalinity were not monitored for.
-Monitoring of W46 is suspended in June 2015 as path of river no longer passes through this location.

Compliance: Out

Requirement Type: Reporting

Requirement Description:

5.7 Annual report
The Permittee shall submit an annual report by March 31st of each year, with the first report submitted on March 31, 2013.

Details/Findings:

2014 Annual Report submitted and on file.

Compliance: In

Were the following collected during inspection:

Samples? ☐ Photos? ☑	EMS No.
Other (please specify)	
Is the Inspection related to an EA Project? ☐	EA Project Certificate Number:

INSPECTION CONDUCTED BY:	
Signature Neil Bailey	*Date Signed* 2015-11-05
ENCLOSURE(S) TO REGULATED PARTY & DESCRIPTION:	
CVIS Archives	
REGULATORY CONSIDERATIONS:	

DISCLAIMER:

Please note that sections of the permit, regulation or code of practice referenced in this inspection record are for guidance and are not the official version. Please refer to the original permit, regulation or code of practice.
To see the most up to date version of regulations and codes of practices please visit:
http://www.bclaws.ca/

If you require a copy of the original permit, please contact the inspector noted on this inspection record or visit: http://www2.gov.bc.ca/gov/topic.page?id=DF89089126D042FD96DF5D8C1D8B1E41&title=Publicly%20Viewable%20Authorizations

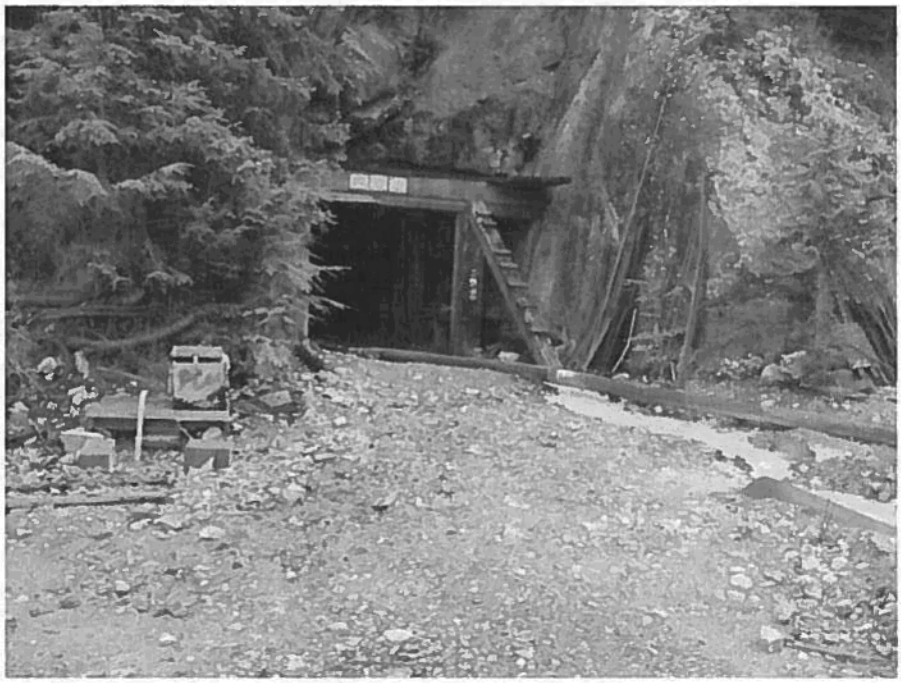
It is also important to note that this inspection record does not necessarily reflect each requirement or condition of the authorization therefore compliance is noted only for the requirements or conditions listed in the inspection record.

Ministry of Environment	Skeena Region Environmental Protection Division	Mailing Address: Bag 5000, 3726 Alfred St Smithers, BC V0J 2N0	Phone: (250) 847-7260 Fax: (250) 847-7591 Website: http://www.gov.bc.ca/env

Authorization: 105719	Client Name: Chieftain Metals Inc.
CVIS IR #: 23226	(Date) Site Inspection Photos; Oct. 15, 2015

Photo 1 Site from the air, viewed from the Northwest.	
Photo 2 Sludge pond adjacent runway.	

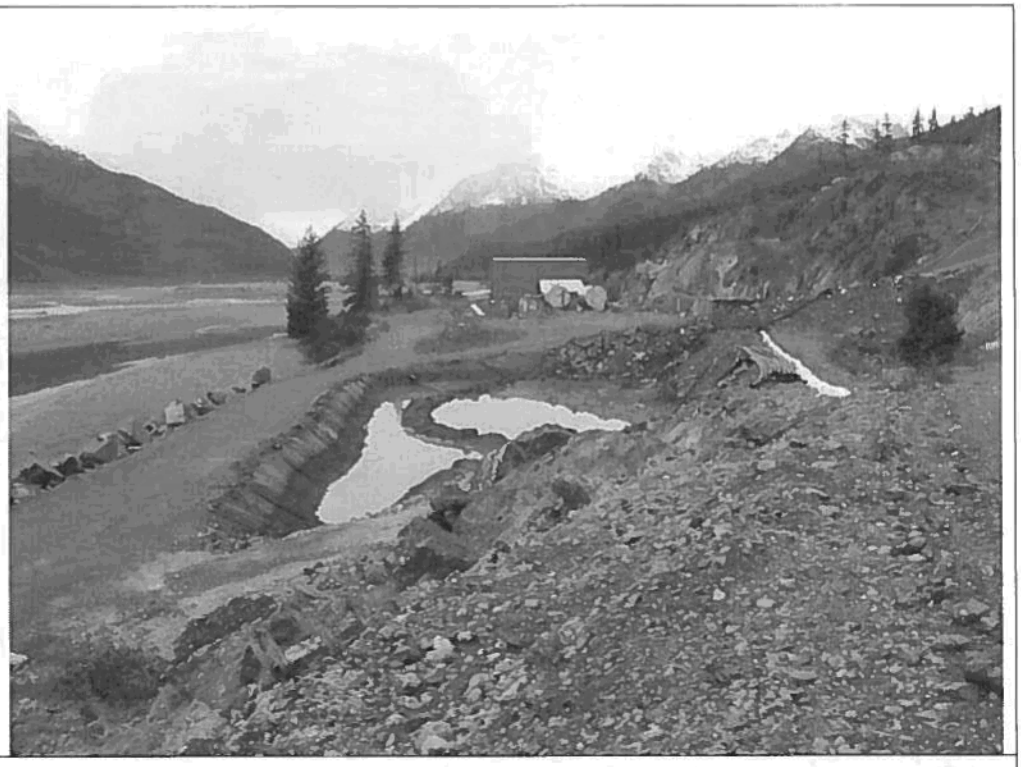
Authorization: 105719	Client Name: Chieftain Metals Inc.
CVIS IR #: 23226	(Date) Site Inspection Photos; Oct. 15, 2015

Photo 3 5400 portal.	
Photo 4 Neutral Mine Water discharge.	

Authorization: 105719	Client Name: Chieftain Metals Inc.
CVIS IR #: 23226	(Date) Site Inspection Photos; Oct. 15, 2015

Photo 5 View from 5400 to 5200 level.	
Photo 6 Waste rock, view from 5400 portal.	

Authorization: 105719	Client Name: Chieftain Metals Inc.
CVIS IR #: 23226	(Date) Site Inspection Photos; Oct. 15, 2015

Photo 7 Exfiltration Pond.	
Photo 8 5200 portal. Large rock on neutral mine water bypass pipe.	

Authorization: 105719	Client Name: Chieftain Metals Inc.
CVIS IR #: 23226	(Date) Site Inspection Photos; Oct. 15, 2015

Photo 9 5200 discharge location. Samples for TSS, total metal and dissolved metals taken at this location.	
Photo 10 View to IWTP discharge point.	

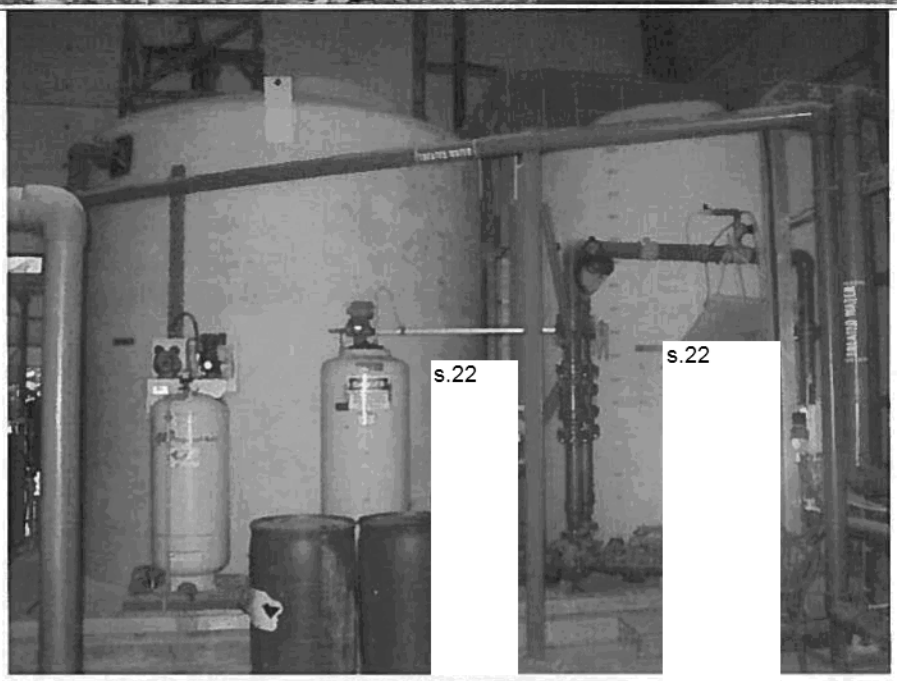
Authorization: 105719	Client Name: Chieftain Metals Inc.
CVIS IR #: 23226	(Date) Site Inspection Photos; Oct. 15, 2015

Photo 11

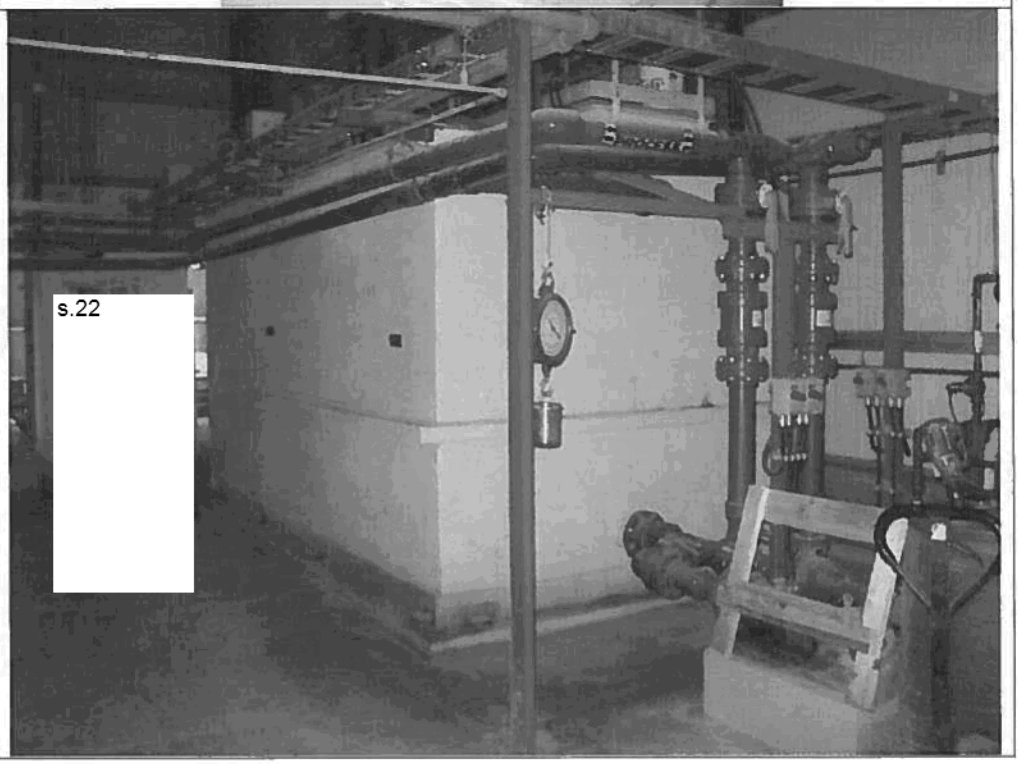
Sludge storage pond adjacent to IWTP.

Photo 12

Water treatment plant holding tanks.



Authorization: 105719	Client Name: Chieftain Metals Inc.
CVIS IR #: 23226	(Date) Site Inspection Photos; Oct. 15, 2015

Photo 13 Neutralization chamber.	
Photo 14 Rapid mixing tank.	

Environmental Assessment Office

Inspection Record

Project Name: Tulsequah Chief Mine Project	Inspection Status:
Certificate #: M02-01	Inspection No:
Certificate Status: *Certified*	Inspection Date: 2015-07-14
Region: Skeena	Office: Victoria
Trigger: Planned	**Incidents of Non-Compliance Observed: Yes**
Non-Compliance Decision Matrix Level: Level 3 - Moderate temporary impact likely	Non-Compliance Decision Matrix Category: Many NCs, little/not aware/not capable to comply
Inspector Name(s): Compliance Officer Drew Milne and Senior Compliance Officer Chris Parks	
Audit Record(s):	Total Non-Compliance(s):
Proponents Name: Chieftain Metals Corporation	
Proponents Contact(s): Chief Operating Officer Keith Boyle	
Mailing Address: Chieftain Metals Corporation Suite 2510 2 Bloor Street West Toronto, Ontario M4W 3E2	
Phone No: 416.479.5417	Fax No: 416.479.5420
Contact Email: keith.boyle@chieftainmetals.com	
Location Description: The Tulsequah Mine Project (Project) is located in northwestern British Columbia on the Tulsequah River near its junction with the Taku River, approximately 100 kilometres south of the town of Atlin, British Columbia and 65 kilometres northeast of Juneau, Alaska. Access to the mine site is via boat (from Juneau, Alaska)or by air from Atlin.	
Lat: 58° 44'12.03 N	Long: 133° 36'02.60" W
Sector: Mines	

Summary

MONITORING AND REPORTING REQUIREMENTS

Inspection Period:
From: 2015-07-14 **To:** 2015-07-14

Certificate or Act:
Certificate under the Environmental Assessment Act

Activity: On Site

Inspection Summary:

This record details the results of an inspection against conditions attached to Environmental Assessment Certificate M02-01 (EAC), currently held by Chieftain Metals Corporation, that occurred on 2015-07-14. The inspection was conducted by Drew Milne, Compliance Officer, EAO, and Chris Parks, Senior Compliance Officer, EAO. The purpose of the inspection was to determine compliance with specific conditions of EAC# M02-01.

Chieftain Metals Corporation Mine Manager Terry Zanger and staff Rob Motley accompanied C&E Milne and C&E Parks during the site inspection. Upon completion of the field component of the inspection, officers conducted an onsite inspection debrief with Mine Manager T. Zanger and R. Motley and noted that they required further information to inform their inspection report.

The mine site inspection and site documentation review was conducted over the course of one field day and several office days reviewing data sets, reviewing requested information, and joint agency information sharing.

After review of observations and information obtained during the inspection and provided subsequent to the inspection by Chieftain Metals Corporation, the following compliance determinations have been made:

1. Chieftain Metals Corporation is out of compliance with Conditions 1.4.1 and 1.4.2 of the Table of Conditions (Schedule B of the EAC), with respect to the drainage and collection of contaminated water;

2. Chieftain Metals Corporation is out of compliance with Condition 1 of the EAC, specific to requirements of the Construction and Operations Wildlife Management Plan listed in Annex 1 of the EAC amendment # 3 M02-01 (2009).

3. Chieftain Metals Corporation is out of compliance with Condition 1 of the Certificate which requires the Certificate Holder to cause the Project to be designed, located, constructed, operated and/or abandoned in accordance with the documents and correspondence listed in Schedule A to the Certificate. Schedule A of the Certificate, as amended, includes "Tulsequah Chief Project Report – Volume IV Environmental Management, Redfern Resources Ltd., July 1997", which includes a commitment concerning a Spill Contingency Plan for the Project

EAO COMPLIANCE AND ENFORCEMENT HAS CONFIRMED THAT CHIEFTAIN METALS IS IN NON COMPIANCE WITH CONDITIONS 1, 1.4.1, AND 1.4.2 OF EAC#M02-01, ISSUED FOR THE TULSEQUAH CHIEF MINE PROJECT. PLEASE

Response:

REFER TO THE "ACTIONS REQUIRED BY PROPONENT" SECTION OF THIS INSPECTION RECORD FOR DETAILS OF ENFORCEMENT MEASURES.	

Compliance Summary	In	Out	N/A	N/D
Automatically populated upon upload				

Inspection Details

Types of Compliance: **Construction**

Requirement Description:

SCHEDULE B Commitment 1.4.1
Ensure the underground drainage system transports all contaminated water to the collection location for effluent treatment plant.

Findings:

EAO C&E Officers observed that not all effluent water is being directed to "the collection location for the effluent treatment plant" as required by Commitment 1.4.1. Some of the effluent water observed is being directed to the Tulsequah River (See Attached Photo: IMG_0346, IMG_0394, IMG_0395, IMG_0396).

EAO C&E Officers noted that an Effluent Treatment Plant has been constructed, but is not operational. Mine Manager T. Zanger stated to EAO C&E Officers that the "Waste Water Treatment Plant had not been operation for approximately two years." MOE EPD has requirements for water treatment during construction. EAO C&E has referred this matter to MOE EPD.

Chieftain Metals has been previously warned by Environment Canada that discharge of effluent to the Tulsequah River is contrary to the Federal Fisheries Act. (See attached Appendix A).

Compliance: Out

Types of Compliance: **Construction**

Requirement Description:

SCHEDULE B Commitment 1.4.2
To reduce treatment costs, wherever feasible divert clean water away from areas of potential contamination and, if possible, discharge separately.

Findings:

EAO C&E Officers observed neutral mine water from the 5400 Portal flowing, due to a system of bypass failures, into the 5200 Portal and mixing with contaminated mine contact water.
The neutral mine water pipe was observed to be damaged in at least five locations allowing for the discharge of the neutral mine water into the mine at the 5200 Portal level (See attached overview Photo IMG_0346).
Neutral mine water flow velocity can be compared at the intake with the outflow in photos: Neutral water Intake: IMG_0402; Neutral water outflow: IMG_0387. Neutral mine water was observed by officers discharging from the bypass pipe and flowing into the 5200 Portal (See Attached pipe damage Photo IMG_0388, IMG_0389, IMG_0390, IMG_0391, IMG_0392 and IMG_0393).

Compliance: Out

Types of Compliance: **Construction**

Requirement Description:

Condition 1 of the Certificate requires the Certificate Holder to cause the Project to be designed, located, constructed, operated and/or abandoned in accordance with the documents and correspondence listed Annex 1 of the EAC amendment # 3 M02-01 (2009). Annex 1 amendment # 3 M02-01 (2009) includes the Wildlife Management Plan.

Section 2.1.2.4 "Waste Handling and Disposal" of this plan requires that any grease, oils, fuels or antifreeze stored on-site must be stored in bear-proof areas or containers.

Findings:

EAO C&E Officers observed that at Shazzah Camp Site, maintenance/fuel storage area, contrary to the Construction and Operations Wildlife Management Plan:

Two wooden pallets, stacked one on top of the other, full of 20L grease containers (AMC PURE-VIS). These 20L grease containers were not secured in a bear proof-container;
Conflict wildlife (assumed to be a bear) had punctured at least two of the 20L plastic containers and consumed some of the grease (See photos IMG_0420 IMG_0421 and IMG_0422).

Compliance: Out

Types of Compliance: **Construction**

Requirement Description:

Condition 1 of the Certificate requires the Certificate Holder to cause the Project to be designed, located, constructed, operated and/or abandoned in accordance with the documents and correspondence listed in Schedule A to the Certificate. Schedule A of the Certificate, as amended, includes "Tulsequah Chief Project Report – Volume IV Environmental Management, Redfern Resources Ltd., July 1997", which includes a commitment concerning a Spill Contingency Plan for the Project (Appendix C).

Findings:

EAO C&E Officers observed the following at Shazzah Camp Site maintenance and fuel storage area, contrary to the Spill Prevention and Response Plan:

1. Two pallets full of 20L grease containers (AMC PURE-VIS) were not stored in a secondary containment unit and were leaking onto/into the unprotected ground (See photos IMG_0420, IMG-0421 and IMG_0422).

2. A secondary containment unit is in place, however the unit is not covered with a roof. It is collecting precipitation which is causing the precipitation and hydrocarbons to overflow at the at a low point in the containment unit (See photos IMG_0412, IMG-0413, IMG_0414 and IMG_0415).

3. A dump truck, a white transport truck, and the garbage incinerator fuel tank were observed to be leaking hydrocarbons to ground (See photos: Dump truck IMG_0416, IMG_0417 and IMG_0418; Transport Truck IMG_0423 and IMG_0424 and incineration fuel tank IMG_0425).

4. The vehicles (white transport truck and dump truck), the secondary containment unit, and potentially the 20L grease container leak have been leaking for some time (months - years) and have not been inspected monthly as required by the Spill Prevention and Response Plan.

Compliance: Out

ACTIONS REQUIRED BY PROPONENT(S) & ADDITIONAL COMMENTS:

CHIEFTAIN METALS IS HEREBY WARNED THAT THE PROJECT IS NOT COMPLIANT WITH CONDITIONS 1.4.1 AND 1.4.2 OF EAC#M02-01. AS REFERENCED IN THE JOINT MOE/MEM/EAO NOVEMBER 10, 2015 LETTER, CHIEFTAIN IS REQUESTED WITHIN 90 DAYS TO PROVIDE A PLAN FOR HOW CHIEFTAIN WILL ADDRESS REGULATORY REQUIREMENTS, INCLUDING ENFORCEMENT ISSUED BY THE AGENCIES.

CHIEFTAIN METALS IS IN NON-COMPLIANCE WITH CONDITION 1 OF EAC#M02-01. IN RESPONSE TO THIS NON COMPLIANCE, EAO C&E HAS ISSUED AN ORDER TO REMEDY UNDER SECTION 34 OF THE ENVIRONMENTAL ASSESSMENT ACT (SEE ATTACHED).

EAO C&E MAY CONDUCT A FOLLOW UP INSPECTION TO DETERMINE IF THE TULSEQUAH CHIEF PROJECT HAS BEEN BROUGHT BACK INTO COMPLIANCE WITH THESE REQUIREMENTS. CONTINUED NON COMPLIANCE WITH THESE REQUIREMENTS MAY RESULT IN ADDITIONAL ENFORCEMENT UNDER THE ENVIRONMENTAL ASSESSMENT ACT.

INSPECTION CONDUCTED BY:

Signature *Date Signed :*

Compliance Officer Drew Milne	2015-11-10

ENCLOSURE(S) TO PROPONENT(S) & DESCRIPTION:

Inspection Photographs
Appendix A: Warning by Environment Canada 2012
Appendix B: Construction and Operations Wildlife Management Plan (2008)
Appendix C: Tulsequah Chief Project Report Volume IV Environmental Management

REGULATORY CONSIDERATIONS:

The Ministry of Energy and Mines and Ministry of Environment, Environmental Protection Division conducted an inspection on October 15, 2015. The three agencies are coordinating enforcement for non-compliances identified by each agency. On November 10, 2105, the three agencies issued a joint letter, including the results of the agencies' inspections and resulting enforcement.

Environmental Assessment Office	Mailing Address: 1st Floor 836 Yates St PO Box 9426 Stn Prov Govt Victoria BC V8W 9V1	General Inquiries: (250) 356-7479 Fax: (250) 356-7440 E-mail: eaoinfo@gov.bc.ca Website: http://www.eao.gov.bc.ca

IN THE MATTER OF THE ENVIRONMENTAL ASSESSMENT ACT S.B.C. 2002, c.43
(ACT)
AND
NON-COMPLIANCES
WITH ENVIRONMENTAL ASSESSMENT CERTIFICATE M02-01
ORDER UNDER SECTION 34(1)

WHEREAS:

A. On December 12, 2002, Environmental Assessment (EA) Certificate M02-01(Certificate) was issued to Chieftain Metals (Certificate Holder) for the Tulsequah Chief Mine Project (Project). Condition 1 of the Certificate requires the Certificate Holder to cause the Project to be designed, located, constructed, operated and/or abandoned in accordance with the documents and correspondence listed in Schedule A to the Certificate. Schedule A of the Certificate, as amended, includes "Tulsequah Chief Project Report – Volume IV Environmental Management, Redfern Resources Ltd., July 1997", which includes a commitment concerning a Spill Contingency Plan for the Project (Spill Plan).

B. On July 14, 2015, in his role as EA Compliance Officer, the undersigned conducted an inspection of the Project. Based on observations during the inspection and review of information following the inspection, the undersigned has determined that the Certificate Holder is not compliant with Condition 1 of the Certificate due to a failure to construct and operate the Project in accordance with the Spill Plan and that non-compliance with this condition has resulted in hydrocarbons spilling into the environment.

C. On July 14, 2015, the undersigned verbally advised the Mine Manager representing the Certificate Holder of the alleged non-compliances so that the Certificate Holder could begin to remedy the hydrocarbon spillage while the occurrence of non-compliances was being confirmed by the undersigned.

D. The undersigned has received written delegation of the Minister's powers under Section 34 of the Act.

DEFINITIONS:

In this Order,

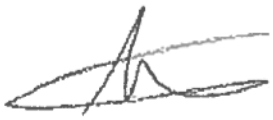
(a) "four non-compliant locations" means the four locations at or near the Tulsequah Chief Shazzah Camp maintenance yard identified in the undersigned's report for the July 14, 2015 inspection as being non-compliant with the Spill Plan required by the Certificate; and

(b) "to the satisfaction" means, in relation to a provision of this Order that requires the Certificate Holder develop a plan to the satisfaction of the Environmental Assessment Office (EAO). After submitting a draft of the plan to EAO, the Certificate Holder will not need to make further revisions to, or obtain further approval of, such plan unless EAO communicates to the Certificate Holder that further revisions to such plan are required. However, any such required changes or approval must be pursued by the Certificate Holder in accordance with the timelines and in a manner that are acceptable to EAO.

NOW THEREFORE:

Pursuant to Section 34(1) of the Act, I order that the Certificate Holder:

1) immediately implement spill prevention measures that are adequate to ensure that hydrocarbons are not spilled or otherwise release into the environment from any equipment or hydrocarbon storage located on the Project site;
2) by November 30, 2015, develop a plan to:
    - remove the hydrocarbons that have been spilled at the four-non compliant locations into the receiving environment; and
    - prevent future spills or other releases of hydrocarbons into the receiving environment at the Project site; and
3) develop and implement the plan identified in clause 2 to the satisfaction of the Environmental Assessment Office.



Drew Milne,
EA Compliance Officer
Environmental Assessment Office

Dated November 10, 2015

APPENDICE

B. Responses to ARD/WQ issues raised at the sub-committee meeting of January 14, 1998

Responses to ARD/WQ issues raised at the sub-committee meeting of January 14, 1998

January 15, 1998

Redfern Resources Ltd.

Historic Workings

Water treatment scenarios post-closure and proposed schedule of mitigation during development prior to operation.

See attachment A.

Temporary PAG waste rock dump.

Expected flow and maximum acidity levels.

Redfern's principal ARD consultant, Dr. K. Morin, indicates that peak instantaneous PAG acidity levels could be as high as 2000 mg/l but that the expected max range is likely to be between 500 and 1000 mg/l. Due to the anticipated reduction in size of the area of the PAG dump to reflect a higher dump slope for non-reclaim design, the area of precipitation catchment will be reduced. Average annual flow rates will be approximately 4 m^3/hr. This will be merged with the other influent sources from Mine water and tailings supernatant for the water treatment plant at the expected treatment rate of 211 m^3/hr. Because of the low relative amount of PAG drainage compared to the other influent sources the effect of higher acidity levels can be readily accommodated within the design capacity.

Commitment for impervious liner system for drainage collection and cost capability.

The PAG storage site can be designed with a double liner for additional security. An estimate by Bruce Geotechnical Consultants, including reduced areal extent to allow for a steeper angle dump suitable for temporary storage, indicates that costs will be similar to the original single liner but larger area design. Redfern will provide final design for this facility at permit stage to meet the security objectives once geotechnical studies are completed.

New Underground Workings

PAG waste rock

Questions concerning the potential for accumulated acidity in the PAG material prior to flooding, calculation of maximum neutralization requirements and cost considerations.

This is provided in Attachment B. A period of 12 years was utilized for the accumulation period assuming 2 years for the mine to completely flood. This was calculated from the estimated new mine void space on closure (workings less backfill volume) at approximately 700,000 m^3 and the in-mine estimated flow rate of approximately 47 m^3/hr. This yielded a time for flooding of 620 days or two years to be conservative.

Pyrite Concentrate in Whole tailings backfill

1. Weathering potential of backfill and potential for oxidation of sulphides in backfill.
2. Cement required to maintain encapsulation of sulphide material in consolidated, impermeable backfill.

The company recognizes that a large amount of pyrite will be contained in the backfilled tailings to be emplaced in the new underground workings. This represents a significant source of potential acidity if not adequately protected from oxidation.

Experience to date, based on drainage chemistry at Myra Falls, BC, and Louvicourt mine, PQ, (personal communication with mine personnel) indicates that paste backfill technology effectively prevents oxidation, even when backfill occurs in zones of high sulphide rock.

Conditions at Louvicourt closely parallel the Tulsequah chief proposal: high sulphide (30-60%) whole tailings paste backfill, 60m stopes and backfill emplacement in zones of high sulphide content. This has been the mine waste disposal strategy since 1994 and research on backfill with similar average cement content to that proposed at Tulsequah indicates only peripheral oxidation.

However, due to the potential importance of this source and the relative new nature of this technique, Redfern commits to conducting additional research through further case studies to determine if use of lower levels of cement could reduce the effectiveness of the backfill strategy. If such is indicated then additional cement levels will be employed, or suitable alternative methodology, to ensure that little or no pyrite oxidation will occur in the backfill prior to flooding.

Attachment A

Water Treatment Pre and Post Operation

Pre and Post-Operation Water Treatment

Tulsequah Chief Project

The following discusses the conceptual water treatment during the two year pre-production period and contingency plans for post-operational water treatment should the Company's proposed ARD mitigation plans be incompletely effective in eliminating contaminated seepage from the historic mine workings.

In the pre-development phase, treatment of the full volume of mine water discharge from the historic mine workings is not considered possible for several reasons. The principal reason is the lack of a suitable site for secure disposal of the volume of treatment sludge which would be produced, which is considered to be approximately 7 times the volumes (either low-density or filter-reduced) considered in the more limited treatment scenarios presented below. In addition, installation of a water treatment plant suitable for handling all of the current mine water discharge would entail essentially the full-size plant envisaged for operations. This requires more extensive engineering, site preparation, power requirements, and reagent supply and storage considerations during a period when the project development crews will be relying on air and limited seasonal barge transportation for support. The full plant requires installation at a site after full geotechnical evaluation and operational permitting by the Mines Branch. Allowing for arrival of suitable equipment and surveying this cannot be completed in the summer of 1998 (pre-operation year 1). Detailed engineering and supply orders for the necessary equipment would have to be in place by Mar 01/98 at the latest which means that it would have to commence immediately (pre-Certificate). At present, detailed geotechnical evaluation, and surveys are contemplated in 1998 with full site preparation and construction commencing in summer 1999. Site excavation will entail some degree of rock blasting and it is not practical to complete this only for the water treatment plant in advance of the rest of site preparation if only because the presence of an operating plant would preclude effective completion of further blasting requirements. For these reasons, the Company considers that handling <u>all</u> current and development discharge volumes will not be practical until near commencement of operations.

Nevertheless there will be opportunity for site mitigation efforts to attempt to reduce the volume of minewater emanating from the workings through locating and sealing sources of inflow, to the full extent possible. The Company will also endeavour to optimize the proposed smaller treatment plant to handle as much as possible of the current discharge and bring expanded treatment capacity on-line as soon as practical and sludge storage sites are available. This proposed schedule is appended.

During development the Company recognizes that PAG waste rock will be encountered and is contemplated to be stored on surface for an extended period before removal to permanent in-mine storage sites. The Company also proposes to move a portion of the existing PAG waste from the waste piles near the 5200 portal (60m Level) and site road area to the new PAG temporary storage site. During the development stage the Company expects to collect drainage from the new PAG temporary waste storage site and also from the residual historic waste piles below the 5400 Level portal. This latter site would be segregated from current minewater discharge emanating from the 5400 portal and only precipitation infiltration and run-off discharge would be collected and treated initially. Two scenarios are presented which consider contaminated drainage from the PAG waste dump and the 5400L waste dump. The first scenario uses a small scale lime treatment unit similar to a EIMCO model #1 HRB reactor-clarifier, the second scenario incorporates a Shriver filter press in addition to the lime treatment unit. Eskay Creek Mine is reportedly using such a filter press to reduce sludge volumes at their operation.

The criteria used to design the water treatment unit are discussed below. The treatment unit will be used to treat drainage from the material placed on the PAG waste rock dump. The treatment unit will be self-contained and sized to treat influent at a rate of 8.0 m^3/hr. This estimate is based on the expected average annual flow from the PAG dump based on its current configuration and precipitation load as well as the 5400 dump area drainage, exclusive of current minewater discharge. The company feels this estimate is conservative since the PAG dump area has been designed at a 2.5:1 dump configuration suitable for reclamation. Since it is not designated for reclamation, the actual size will be less using a more standard angle of repose configuration for the dump. This will reduce the area of precipitation capture and drainage flow.

Any additional capacity can be utilized for treating current minewater discharge. The influent water is conservatively estimated to have the capacity to create 0.45 g of solids / litre of influent. In Scenario 1, the unit will produce sludge containing 3% solids. In Scenario 2, using the filter press, the unit would produce sludge containing 50% solids.

The solids in the influent has been calculated by prorating the bench scale test results (60/40 tailings supernatant/mine water) to a scenario of 100% mine water by conservatively assuming that all of the solids produced from the bench scale testing were derived from the mine water. Following this logic, if 40% mine water creates 0.18 g of solids / litre of influent then 100% mine water could create as much as 0.45 g/L solids. Therefore thickened sludge at 3% solids can be removed from the treatment unit at an approximate rate of 0.1 m^3/hour producing approximately 1,000 m^3 of sludge in one year. This sludge could be piped back to the mine site and stored in an unused heading on the 5400 L that has a storage volume of 3,000 m^3. The sludge would be pumped to the backfill plant during Year 1 production. At that time, the total volume of 2,000 m^3 of stored sludge could be removed from the heading in 8 days by adding this material to the final mixer pan in the backfill plant at a rate of 10.34 m^3/hour. This backfill material would be placed in the new mine workings below present water table in Phase 1 stope voids between the -120m level and the 0 m level. Removing the stored sludge early in the production period will subsequently allow the heading to be used for mine water storage.

Scenario 2, which would incorporate the use of the filter press, would reduce the sludge volume by increasing the solids content in the sludge from 3% to 50%. The rate of sludge volume production would correspondingly be reduced to 0.0048 m^3/hour or 42 m^3 in a year. This amount of sludge could be transferred to storage drums (~210/yr) and ultimately be placed in a stope that will be filled with PAG waste rock. In similar fashion, the existing precipitate sludges which have accumulated in various areas in the historic workings can be collected, run through the filter press, if necessary, and stored in drums for ultimate storage. Temporary storage areas could include some of the abandoned headings on the 5200 and 5400 levels which are not required for new mine development.

The capital and operating costs associated with each of these scenarios is presented in Table 1

and 2. The operating cost assumptions are based on incremental cost to the overall site support, labour, power and supply costs associated with the development work program.

Due to the extensive efforts which are proposed to mitigate by backfilling and sealing from oxidation all existing sources of ARD in the historic working areas, it is anticipated that any residual drainage from the mine site on closure will meet receiving water quality standards. However, it is recognized that there are few examples at this time of similar scale mitigation of old mine sites. To allow for the low probability situation of incomplete mitigation, the Company has also prepared a cost estimate for contingency water treatment plant post mine closure in the event that the historic workings produced low flow leakage of unacceptable water quality. In this case it is assumed that the required volume will be small as the surface PAG waste dumps (new and old) will be gone, the old workings will be mostly occupied and bulkheaded by solid cemented paste backfill and extensive neutralizing capacity will be present for any groundwater which passes through the mine area..

For the cost estimate it is assumed that the development phase water treatment plant will be suitable for the influent volume at $8m^3/hr$ or less. No additional capital costs are forecast as the components will be available at the mine. Although the influent water quality is very likely to be substantially better than used for the development phase scenario, the volumes of reagents and resulting treatment sludge are conservatively assumed to be the same as for the earlier described scenarios. For conservative operational cost considerations it is also assumed that the access road is de-activated and site access is only gained through continued use of the project airstrip and airstrip access road with appropriate allowance for maintenance. The cost estimate for this contingency treatment scenario is given in Table 2. Disposal of sludge volume is potentially problematic unless a filter press is used to reduce the volume. It is suggested that the disused limestone quarry could be considered for a treatment sludge disposal site, in drums or other media. At closure the limestone quarry is estimated to have a volume of 40,000 m^3 which is more than ample for projected sludge volume. It should be noted that sludge volumes would actually be significantly less given that the influent water quality would be unlikely to have the acidity or metal loadings used in the development phase treatment scenarios. An alternative

suggestion, which may be more acceptable from a land-use perspective is to return the sludge to the flooded new workings via a gravity feed pipe.

In order to meet worst-case scenario concerns, the Company has also examined the cost of conducting full-scale contingent water treatment post-closure of the full volume of mine water flows currently discharging from the site. This is presented at the end of the attached tables. It contemplates keeping the operational treatment plant in place post-closure and treating $47m^3/hr$ of influent. To further evaluate conservative cost implications, the operating costs also envisage only air access to site. A Shriver filter press would probably be required to keep sludge volumes as low as possible. In this case the operating cost is approximately $485,000 annually. Again, in worst-case mode, if water quality was similar to current mine-water discharge then anticipated volumes of sludge at 50% solids, would be $247m^3/year$. This scenario is considered to have an extremely low probability. As indicated above the probable best disposal site will be the flooded underground workings.

One approach which could be applicable for all of the scenarios discussed is the potential use of a bioreactor that would produce negligible sludge volumes but would require sulphate addition (cost item) during operation. However, detailed information on cost and performance for this alternative could not be obtained because key staff members who are developing the technology through a research program at the Britannia mine have been away on holiday.

In summary, Redfern believes that an operational program is outlined which can allow commencement of mitigation of existing ARD discharge at the Tulsequah Mine site during development, with commencement of full water treatment and mitigation as soon as possible when plant site infrastructure, access and suitable sludge storage locations permit. Contingency plans for post-closure collect and treat are also available in the unlikely event that this is required.

Proposed Schedule of Water Quality Mitigation Procedures

1998:

April Commence geotechnical investigations at plant-sites and waste storage areas.

June	Commence evaluation of upper workings for rehabilitative requirements and identification of water inflow sources and reduction strategies.
July	Barge to site equipment, reagents and supplies for pre-development activities and water treatment plant. Commence in-mine flow mitigation work and isolation of existing iron precipitates, where required. Commence rough grading of plant and infrastructure sites.
July - Sept	Commence construction of waste rock pads and access. Camp and power re-furbishment. Construct and commission assay/ABA site lab.
Sept-Oct	Complete construction of temporary water treatment plant, drainage collection systems for PAG and 5400 level dumps.
Nov	Move 5200 level dump material to PAG waste pad, commence water treatment of PAG dump, 5400 dump drainage and as much as possible of minewater.
December-	Commence underground development program. Waste rock deposition on pads.

1999:

July-Oct	Prepare full effluent treatment plant site, commence construction and commissioning.
November	Treatment plant commisioned. If suitable temporary storage site for treatment sludge is identified, treatment of mine-waters in advance of full operation may proceed.

2000

December	Backfill plant in operation. Commence backfill/sludge disposal.

This schedule is predicated on financing and timely receipt of construction permitting authorizations. In the event that delays in any of these components are encountered then the proposed schedule would need to be revised accordingly. Some of the operational in-mine mitigation efforts could still proceed.

If a longer-term delay is anticipated then the Company and the requisite agencies would need to establish a suitable alternate mitigation/site remediation plan.

Table 1. Capital Cost Estimates

Scenario 1 - Pre-production Treatment Plant - No Filter Press for Treatment Sludge

ITEM	DESCRIPTION	POWER (Kw)	COST ($CAN)
1	Reactor Clarifier - 10 ft. diam., skid mounted w. control panel	3.700	$100,000
2	Clarifier underflow pumps x 2 - Flow = 2m³/hr	0.375	$2,000
3	Underflow stock tank - 3m x 3m		$3,500
4	Equipment installation - 2 persons x 12 hr/day x 5 days x $50/hr		$6,000
5	Building - pre-engineered - 9m x 9m insulated, installed HVAC		$50,000
	Subtotal	4.075	$161,500
	Contingency @ 20%		$32,300
	TOTAL		**$193,800**

Scenario 2 - Pre-production Treatment Plant - Plus Filter Press for Treatment Sludge

	Subtotal Capital items from Scenario 1		$161,500
6	Filter feed pump x 1 - batch operation, flow=5m³/hr - filter pressure = 420 kpa	1.500	$1,500
7	Filter press - Eimco Model 1000 FB, 25 ft³		$70,000
	Subtotal		$233,000
	Contingency @ 20%		$46,600
	TOTAL		$279,600

Table 2. Annual Operating Costs

Scenarios 1 and 2 Pre-Operation

ITEM	DESCRIPTION	POWER (Kw)	COST ($CAN)
1	Reagents - scaled from Full-size plant - 10t lime, 4.7t Ferric sulphate, .098t floc, 1.3t Sulphuric acid		$6,205
2	Power - est. 39070 kwh/yr @ $0.107		$4,180
3	Personnel - 3 hr/day using site development crew		$31,317
	Subtotal		$41,702
	Contingency @ 10%		$4,170
	TOTAL		**$45,872**

Annual Operating Cost for Contingent Post-Closure Small-scale Treatment Plant to treat 8m³/hr.

1	Manpower, 2 people 14 days in/ 14 days out rotation, 12 hr./day, 2190 hr/yr. $20/hr base rate, Benefits 43%	$125,268
2	Rotation and service flights Cessna 207 x 26 flights @ $350	$9,100
3	Road and airstrip maintenance	$16,000
4	Food/lodging/camp maintenance	$40,000
5	Reagents	$6,205
6	Reagent air transport 16t @ 2t/trip Shorts Skyvan @ $900 ea.	$7,200
7	Camp power and vehicle fuel cost 250 bbl @ $140/bbl	$35,000
8	Fuel transport	$22,500
	Subtotal	$261,273
	Contingency @ 10%	$26,127

	TOTAL	**$287,400**

* All resources to be provided by air transport * Assumes acidity of 300mg/l

Annual Operating Cost for Contingent Post-Closure Full-scale Treatment Plant Operation Unlikely Worst-Case Scenario of Treating 47m³/hr.

DESCRIPTION		COST ($CAN)
Manpower, 2 people - 14 days in/ 14 days out rotation, 12 hr./day, 2190 hr/yr. - $20/hr base rate, Benefits 43%		$125,268
Rotation and service flights - (Covered by Reagent/fuel supply flights below)		
Road and airstrip maintenance		$16,000
Food/lodging/camp maintenance		$40,000
Reagents - scaled from Full-size plant - 59t lime, 27.5t Ferric sulphate, 15.21t floc, 7.6t Sulphuric acid		$36,300
Reagent air transport - 109t @ 2t/trip Shorts Skyvan @ $900 ea.		$49,500
Camp power and vehicle fuel cost - 750 bbl @ $140/bbl		$105,000
Fuel transport		$67,500
	Subtotal	$439,568
Contingency @ 10%		$43,957
	Total	**$483,525**

* Unlikely scenario for historic workings in which current drainage flow of 47 m^3/hr and acidity of 300 mg/l is maintained, on average.

* All resources to be maintained by air transport, allowing road to be de-commissioned.

* Sludge to be disposed of in flooded underground workings using gravity feed

Attachment B

Responses prepared by the Minesite Drainage Assessment Group

MINESITE DRAINAGE ASSESSMENT GROUP
(A Division of Morwijk Enterprises Ltd.)

SUITE 2401, 289 DRAKE STREET,
VANCOUVER, BRITISH COLUMBIA V6B 5Z5
CANADA

BY FAX AND MAIL

January 13, 1998
FILE: 2015-1

Mr. Terry Chandler
Redfern Resources Ltd.
Box 40, Suite 900,
999 West Hastings Street
Vancouver, British Columbia V6C 2W2

RE: Tulsequah Chief - Additional Responses to MEI Questions

As you requested, I have calculated (1) the equivalent waste-rock tonnage represented by the reactive wall area for the new workings and (2) the total amount of acidity that would be produced by 200,000 t of net-acid-generating waste rock over 12 years. These calculations answer questions raised by Dr. Bill Price of MEI.

Equivalent Waste-Rock Tonnage for Reactive Surface Area of New Workings

Bill asked that we calculate a waste-rock tonnage that would be equivalent to the reactive surface area of the new workings. I was hesitant to do this, because waste-rock tonnage and reactive wall area are two different and distinct concepts, and they really are not comparable. This has been recognized in research for over 30 years, and was the reason for MEND developing the Minewall technique. Nevertheless, at the risk that this information will be taken out of context, I have made the calculations.

As you indicated, the average cross-section of the new workings is 4 m by 4 m. Since the void volume of the new workings has been estimated at 2.4×10^6 m^3, then the total length of equivalent workings is 150,000 m. When converted to exposed surface area, there is 2.4×10^6 m^2 of exposed rock. An additional factor for fractures extending into the wall is assumed to be 100, so the total reactive surface area of the new workings is estimated at 2.4×10^8 m^2.

This reactive area of 2.4×10^8 m^2 can be equated to particle-surface areas of waste rock (conceptually incorrect). For example, Bill asked that we assume the equivalent waste rock has the grain diameter of coarse to very coarse sand (1 mm). Based on the assumptions of a diameter of 1 mm, a cubic particle shape, and a specific gravity of 2.7, then 2.4×10^8 m^2 is equivalent to 220,000 t of sandy waste rock. If the grain diameter is assumed to be medium sand (0.35 mm), then the equivalent tonnage is 75,000 t. If the grain diameter is assumed to be gravel to pebbles (4 mm), then the equivalent tonnage is 860,000 t.

Total Amount of Acidity Produced by 200,000 t of Net-Acid-Generating Waste Rock

Bill also asked that we calculated the total amount of acidity generated by 200,000 t of net-acid-generating waste rock over 12 years. This is suggestive of the total production of the "PAG" rock in the "PAG" dump including (1) after it is moved under underground and (2) before it is flooded.

As indicated in the Application Report, the average rate from the three acidic humidity cells containing waste rock was 575 mg SO_4/kg/wk, or 600 mg $CaCO_3$/kg/wk. Therefore, 200,000 t (or $2x10^8$ kg) would generate a total acidity of 75,000 t $CaCO_3$ over 12 years. Please note that this is *total* acid generation. The cells showed that roughly half of this acidity is neutralized as it is generated by nearby minerals. Therefore, a better estimate of actual net acid generation is 38,000 t. Additionally, this total assumes that all the rock in the "PAG" dump generates net acidity and at this rate for 12 years, both of which may be incorrect. Furthermore, a significant portion of this acidity production would be released from the rock and not retained, accounting for the proposed treatment of water from this dump. Finally, based on ABA results to date, all of the sulphide in Unit 2a would be oxidized before seven years at this rate, and 90% of sulphide in Unit 1 c,d before 12 years. Therefore, actual retained acidity would likely be much less than 38,000 t.

Sincerely,

Kevin A. Morin, Ph.D., P.Geo.
President

Redfern

Redfern Resources Ltd.
Box 40, Suite 900
999 West Hastings St.
Vancouver, B.C. V6C 2W2
Phone: (604) 669-4775
Fax: (604) 669-5330

FAX COVER SHEET

FAX NUMBER TRANSMITTED TO: see below
TOTAL NUMBER OF PAGES: 2

To: ARD/Water Quality Subcommittee
Of: Tulsequah Chief Project Committee
From: Janice Loukras
Subject:
Date: January 20, 1998

COMMENTS:
Original will NOT follow.

Attached is a correction to the Jan 15,1998 ARD Response from Redfern regarding an error in the proposed interim treatment schedule.

Mr. Garry Alexander, MELP
FAX: 250-356-7183

Mr. Stephen Sheehan, EC
FAX: 604-666-6858

Mr. Norm Ringstad, EAO
FAX: 250-387-2208

Mr Ian Sharpe, MELP
FAX: 250-847-7591

Mr. Herb Klassen, DFO
FAX: 604-666-7907

Ms. Glenda Ferris
Phone/fax: 250-845-3177

Mr. Craig Stewart, MELP
FAX: 250-847-7591

Ms. Kerry Howard, Alaska
FAX: 907-465-3075

Mrs. Rosemary Fox
Ph: 250-847-5150

Mr. Bill Price, MEI
FAX: 250-847-7603

Ms. Susan Carlick, TRTFN
FAX: 250-651-7714

Mr. Tony Pearse, TRTFN
FAX: 250-539-3025

IF YOU DO NOT RECEIVE ALL PAGES, PLEASE TELEPHONE US IMMEDIATELY AT (604) 669-4775.

Contingency plans for post-closure collect and treat are also available in the unlikely event that this is required.

Proposed Schedule of Water Quality Mitigation Procedures

1998:

April	Commence geotechnical investigations at plant-sites and waste storage areas.
June	Commence evaluation of upper workings for rehabilitative requirements and identification of water inflow sources and reduction strategies.
July	Barge to site equipment, reagents and supplies for pre-development activities and water treatment plant. Commence in-mine flow mitigation work and isolation of existing iron precipitates, where required. Commence rough grading of plant and infrastructure sites.
July - Sept	Commence construction of waste rock pads and access. Camp and power re-furbishment. Construct and commission assay/ABA site lab.
Sept-Oct	Complete construction of temporary water treatment plant, drainage collection systems for PAG and 5400 level dumps.
Nov	Move 5200 level dump material to PAG waste pad, commence water treatment of PAG dump, 5400 dump drainage and as much as possible of minewater.
December-	Commence underground development program. Waste rock deposition on pads.

1999:

July-Oct	Prepare full effluent treatment plant site, commence construction and commissioning.
November	Treatment plant commisioned. If suitable temporary storage site for treatment sludge is identified, treatment of mine-waters in advance of full operation may proceed.

2000

December	Backfill plant in operation. Commence backfill/sludge disposal.

APPENDICE

C. Memo with photos of corrective measures

MEMO

FROM : TERRY ZANGER
TO : KEITH BOYLE
CC: ROB MARSLAND
SUBJECT: EAO COMPLIANCE VISIT

DATE : NOVEMBER 3, 2015

Keith,

Please find the attached corrective measures completed as a result of the EAO Compliance visit of July 14, 2015.

Should you have any questions please don't hesitate to call me.

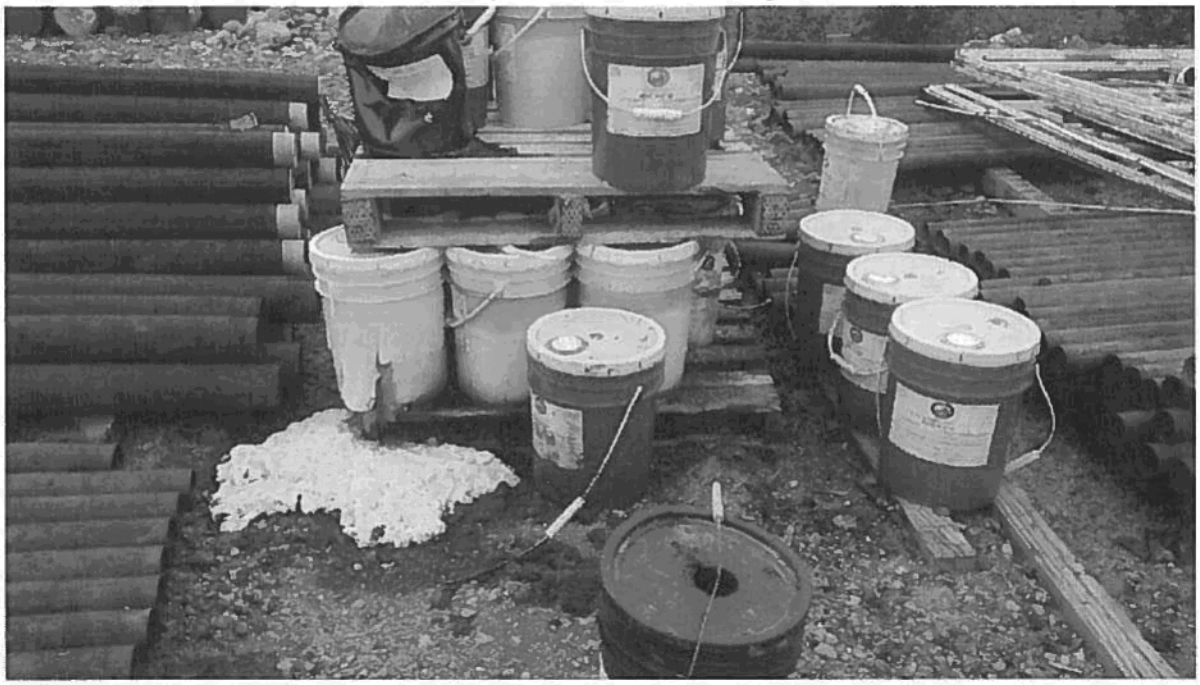
Cheers,

Terry

1.4.1 Summer (High Flow) exfiltration pond bypass pipes removed Oct 16, 2015.

1.4.2 Ditching used to improve neutral water flow past 5200 Portal. Requires on-going maintenance until pipe repair is possible. See before and after photos below.

Condition 1 of the EAC-Construction and Operations Wildlife Management Plan

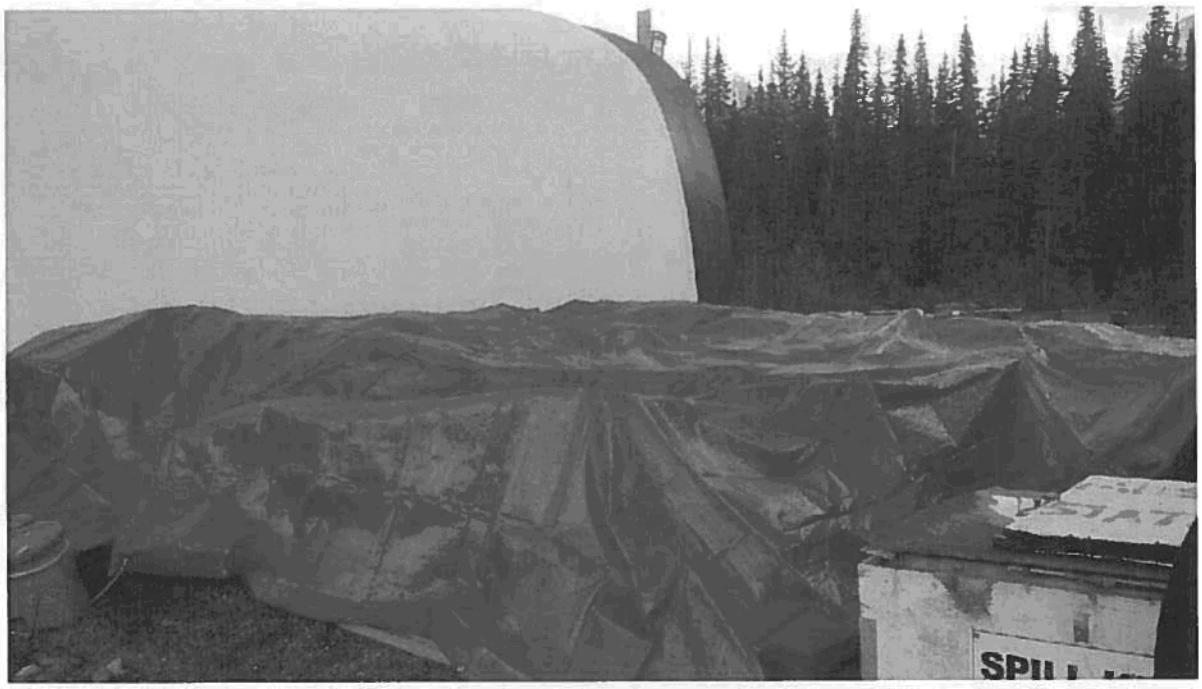


There were 22 pails of unused drilling products, including 2 partial (20 litre) pails of rod grease. The leaking white bucket contained AMC Pure Vis, a non-hydrocarbon drilling polymer. Bucket likely burst due to freezing conditions. Wildlife may have disturbed grease buckets but un-likely to have consumed any. Green buckets contain AMC K-Ion. Initial clean-up completed July 14. Pallets moved in to storage Oct 16, 2015 (photo below).

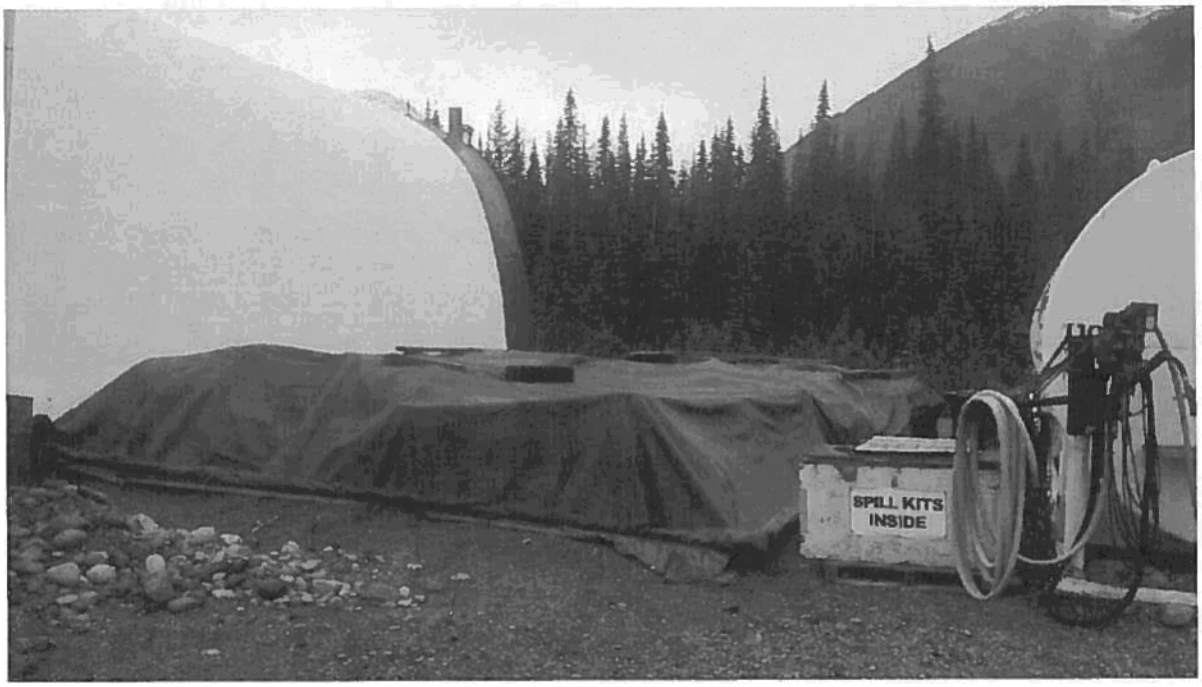
2-Secondary containment storage pad. Most of these drums are empty and have been on pad since Redfern operated site in 2008.

On Oct 17, some of the full 20 litre used oil pails were removed and flown out to Atlin.

On Oct 17, a temporary cover was placed over the empty drums and secondary containment.



The tarps were anchored with heavy filter fabric.



On October 17th, the Glycol storage was covered with landfill liner material.

3-Moxi Dump Truck - site re-treated with oil sponge. White dump truck appears to have leaked diesel from underbody fuel filter due to ice. Fuel tank now empty – but readily available fuel had been previously scavenged from unused vehicles and tanks for camp heat, so only a relatively small volume remained in the lines and bottom of tank. Incinerator return fuel line was repaired Oct 16. The incinerator has not been used since last winter due to fire bans and camp being idled.

4-Monthly inspections for hydrocarbon spills have been implemented. All previously identified problems have been responded to at time of discovery. Spill kits are widely distributed over the site and staff have been trained to use them. All reportable fuel spills have response documents on file.

APPENDICE

D. Letter to Neil Bailey, MoE, dated November 23

CHIEFTAIN METALS CORP.

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November 23, 2015

Neil Bailey, P.Eng.
Senior Environmental Protection Officer
Ministry of Environment - Northern Region
Environmental Protection Division
Bag 5000, 3726 Alfred Avenue
Smithers BC V0J 2N0

Dear Sir,

RE: Non-compliance Advisory Letter Resulting from Inspection of permit number 105719 for Chieftain Metals Inc.'s Tulsequah Chief mine under the Environmental Management Act

Please find below, CMI's responses to the orders of November 10, 2015.

For ease of responding, the orders have been copied here and responded to in sequence.

> "Below lists the section, the non-compliance of that section and the action required related to the Permit (105719).
>
> Section 1.1.5 The authorized works include, but are not limited to, a water collection and conveyance system, pumps, an acid water treatment plant which includes a neutralization chamber, rapid mix tank, flocculent tank, inclined plate-type separator/thickener, filters and holding tanks, a discharge line, outfall to the Tulsequah River, and related appurtenances approximately located as shown on Site Plan A.
>
> Section 2.1 – Bypasses
>
> Any bypass of the authorized works is prohibited unless the approval of the Director is obtained and confirmed in writing.
>
> Non-compliance: Written Approval for the bypass of the water treatment plant was not obtained and the discharge does not meet the conditions specified in Section 3.6. As a result, Chieftain Metals Inc. is in violation of Section 2.1 Bypasses.
>
> Action: Commission the IWTP immediately once site development occurs.

RESPONSE: Acknowledged. Chieftain Metals will commission the IWTP immediately once site development occurs.

Section 4. Discharge and Receiving Environment Monitoring.

Commencing July 1, 2014, Section 4.0 of permit 105719 is to read as follows:

-Sampling monthly from October through February increased to bi-weekly April through May and then returns to monthly in the period from June to September.
-The sites to be sampled remain W10, W46, SE2, W51 and W31
-The parameters to be sampled for remain total and dissolved metals, pH, conductivity, turbidity suspended solids, hardness and alkalinity.

Non-compliance: The Permittee did not meet the amended requirements for Discharge and
Receiving Environment Monitoring on the following dates and locations:

-At site W51 for July 29, 2014 pH, conductivity and alkalinity were not monitored for.
-Monitoring of W46 is suspended in June 2015 as path of river no longer passes through this location.

Action: Ensure monitoring occurs in the locations, frequencies and parameters required in the June 12 2014 Amendment to Section 4.0 Discharge and Receiving Environment Monitoring. Contact Director regarding amending the W46 monitoring location.

RESPONSE: The required monthly sample at W51 in July 2014 was collected on July 27, 2014. All required analyses were performed on that sample. Supplemental samples were collected on July 25, 26, 28 and 29 and analysed for select parameters.

A letter under separate cover will be sent to the Director regarding amending the W46 monitoring.

This advisory, the alleged violation and the circumstances to which it refers will form part of the compliance history of Chieftain Metals Inc. and its responsible officials and will be taken into account in the event of future non-compliance. You are directed to do the following:

1. Implement the necessary changes or modifications immediately to address this situation and to bring it into compliance.
2. Notify this office by email or letter within 30 days of this letter, advising what corrective measures have been taken, and what else is being done, to bring this authorization into compliance.

CHIEFTAIN METALS CORP

Please be advised that the inspection report quotes incorrect contact information. Please note change of contact information:

Keith Boyle, P.Eng.
Chief Operating Officer
Chieftain Metals Inc.
2 Bloor W, Suite 2510
Toronto, ON M5W 3E2

Sincerely,

Keith Boyle, P.Eng.
Chief Operation Officer

cc. Mark Love (by email), Section Head Mining Authorizations, Ministry of Environment, Mark.Love@gov.bc.ca
Cassandra Caunce (by email), Director Compliance & Integrated Pest Management Ministry of Environment, Cassandra.Caunce@gov.bc.ca
Diane Howe (by email), Deputy Inspector of Mines, Ministry of Energy and Mines, Diane.Howe@gov.bc.ca
Eric Telford, Lands and Resources, TRTFN

CHIEFTAIN METALS CORP

23 November 2015

Andrea Doll
Environmental Protection Officer
BC Ministry of Environment,
Environmental Protection Division
Bag 5000, 3726 Alfred Ave
Smithers, BC V0J 2N0

Dear Ms. Doll:

Re: **EMA Discharge Approval 105719 – Amendment to temporarily remove W46**

The Tulsequah River water quality monitoring station W46 was established to monitor the near-field dilution of the discharge from the IWTP. Since operation of the treatment plant will remain suspended until site development occurs, Chieftain Metals hereby requests that the requirement to collect samples at W46 also be suspended until plant operations resume.

Sampling at the W46 location became problematic this summer when the river mainstem moved away from the Tulsequah minesite in the vicinity of the W46 sample location and there was no river water to sample (only tributary inflow which has a different characteristic, since it is not glacial meltwater). The attached photos illustrate the condition of the river bed in the vicinity of the W46 sample site in October 2015.

If you have any questions regarding this requested change in monitoring, please do not hesitate to contact us.

Yours Sincerely,

Chieftain Metals Corp.

Keith Boyle, P.Eng.
Chief Operating Officer

/attach

cc. Neil Bailey, Compliance Officer, MoE Smithers
Mark Love, Mining Operations - Section Head, MoE Smithers
Rob Marsland, Chieftain
Eric Telford, TRTFN

Site Photos – October 14, 2015

Looking downstream on river floodplain in vicinity of W46 sample location

APPENDICE

E. Application to amend EMA Permit #105719

CHIEFTAIN METALS CORP.

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February 08, 2016

Mark P. Love, P. Ag.
Mining Operations - North West and Vancouver Island Regions
Ministry of Environment,
Bag 5000, 3726 Alfred Ave
Smithers, BC V0J 2N0

Re: Tulsequah Chief EMA Permit 105719 – Amendment for current care and maintenance conditions

Dear Mr. Love:

Please be advised that the Tulsequah Chief Mine Project is currently on *care and maintenance*. Chieftain Metals Inc. ("CMI") is requesting amendment of EMA Permit 105719 related to the effluent discharge and operations of the interim acid water treatment plant ("IWTP"), to reflect the current conditions, until such a time when the IWTP is re-started, under Sec:18(5)(a) of the EMA.

To assist your determination for this activity, the following supporting documents addressing the MoE information request (December 8, 2015), and a revised Environmental Monitoring and Surveillance Plan including amended monitoring, sampling frequency and analysis requirements, are attached:

- Tulsequah Chief Mine ARD/ML Mitigation Assessment 2015 Update.
- EMA Permit #105719 Quarterly Monitoring Report for Q4 2015.

In the Tulsequah Chief Mine Project Environmental Monitoring and Surveillance (EM&S) Plan: Care & Maintenance (2016+), a reduction in sampling frequency to April, May, August and October is supported by the consistency with the historical results and the predictable recurring seasonal fluctuations, combined with zero site activities to initiate new changes. The included Tulsequah Chief EMA Q4 2015 Report fully documents this information.

Concurrently Chieftain is applying to MEM to amend Mine Act Permit M-232 during this period of care and maintenance as directed by Sec:10.6.2(2a) of the HSRC.

CMI is committed to re-commencing operations at the IWTP and implementing engineered solutions to address the previously identified operational deficiencies immediately upon receiving project financing to develop the Tulsequah Chief Mine. The IWTP was initially commissioned in anticipation of project construction activities, to conform with the Mines Act condition to treat contaminated discharges from the new HPAG facility at Rogers Creek and with any excess capacity utilized to treat the existing underground acid mine drainage (subsequently modified by MEM in the July 7, 2011 amendment

approval to include all portal discharges). As previously discussed, new mine development and operations is the only viable alternative for cleanup and remediation of the historic acid mine drainage and metal leaching at the mine site. Permit amendments for new mine activities will follow once financing is in place.

We trust this amendment application meets your requirements at this time, and look forward to reviewing a draft amended permit with you. If you have any questions, please do not hesitate to contact us.

Yours Sincerely,

Chieftain Metals Corp.

Keith Boyle, P.Eng.
Chief Operating Officer

/attach

cc. Neil Bailey, Compliance Officer, MoE Smithers
Arash Janfada, EPO, MoE Surrey
Diane Howe, MEM Victoria
Rob Marsland, Chieftain
Eric Telford, TRTFN
Mark Connor, TRTFN

Tulsequah Chief Mine Acid Rock Drainage / Metal Leaching Mitigation Assessment 2015 Update.

At the request of MoE, a review of the history of past Acid Mine Drainage / Metal Leaching ("ARD/ML") mitigation measures undertaken and recommended at the Tulsequah Chief Mine is presented. The contributions of several key consultants quantifying the sources and identifying possible solutions to mitigate the ARD/ML at the Tulsequah Chief mine site is reviewed.

Geochemical source assessment of ARD loadings

There are two sources for the ARD/ML from the Tulsequah Chief Mine:

1. Portal discharges from the 5200, 5400 and 5900 levels.
2. Surface waste rock seepage from the 6400, 5900, 5400 and 5200 portals dumps.

Both have remained unchanged for the last 20+ years, with consistent metal loading recorded in water quality analysis from the receiving environment monitoring (Chieftain 2016).

The Steffen, Robertson and Kirsten (SRK) 1992 study evaluated and compared the relative contributions of metal loading from the portal discharge and the waste dumps. They determined that for the contaminant metals of concern entering the receiving environment, 83-87% were contributed from the portal discharge, which it designated the primary rehabilitation objective. The current untreated portal discharge water quality is recorded at the SE-2 sampling location with approximate flow rate 10 L/s and characterized by low pH, high acidity, low alkalinity and elevated concentrations of metals and sulphides. The water quality results from the aquatic environmental risk assessment are still representative (Palmer, Core6 & Triton 2013 Table 2) and updated in the 2015 Q4 water quality report (Chieftain 2016 Table 2). Redfern 2008 measured the 5900 portal discharge flow of near neutral pH water at the rate of 6 L/s the 5400 level about 1 L/s and the 5200 portal discharging 7 L/s of water.

The waste dumps have been sampled in the initial source assessment conducted by Hallam Knight Piesold (HKP) in 1991, SRK in 1992, Rescan 1997 and GLL in 2008 for static and kinetic testing. The majority of the results have a NPR <1 indicating acid generating potential (PAG). The few not acid generating (NAG) sample results were located towards the bottom of the dump piles showing that the dumps are underlain by a NAG layer. HKP 1991 considered mechanically separating the NAG and PAG layers impracticable. All reports acknowledge the seasonal flushing of metals with increased loading to the receiving environment due to extra infiltration during the Spring thaw and also in the Fall with rainfall. The majority of the waste rock is located at the 5400 (56%) and 5200 (19%) portal locations, with much smaller dumps at the 5900 (16%) and 6400 (9%) portal locations (Rescan 1997 Table 4.2-4). Subsequent to the initial work the waste dump at the 5400 portal has cover layer of NAG waste rock from exploration drift development in 1992, 1993 and 2004.

Rescan 1997 quantified the 5400 waste dump seepage water quality from station 60 with a flow rate of 0.96L/s, also characterized as low pH, high acidity, low alkalinity and elevated concentrations of metals and sulphides (Rescan 1997, Appendix C.4-1 and re-stated average in GLL 2008b Table 2-4).

Tulsequah Chief acid rock drainage mitigation work completed

The Acid Mine Drainage / Metal Leaching (ARD/ML) mitigation work completed at the Tulsequah Chief Mine began with numerous consulting studies commissioned by Redfern Resources since it acquired the property in 1992 and continued by Chieftain Metals Inc. ("Chieftain") since 2011. Apart from the reduction of mine inflows, the remainder of mitigation measures implemented to date have struggled to perform as designed. The common issue is excessive precipitation of iron oxyhydroxides plugging and changing the designed water flow regime, reducing the effectiveness of the mitigation measure. The subsequent maintenance required to remove the iron oxyhydroxides to allow mine waters to return to design flow rates have proven to be labour and support intensive, and in some cases ineffective with unsustainable costs. The mitigation work completed to date follows below.

Gartner Lee Limited designed a mine water tile bed and it was constructed by Redfern Resources in May 2000 (GLL 2000). The mine waters from the 5200 and 5400 levels were directed to a sump connected to the tile field / shallow infiltration gallery (28m x18m x2m) adjacent to Tulsequah River. The water was allowed to infiltrate into the ground water and alluvial gravels at the discharge rate of 14 L/s, and upwell into the Tulsequah River. Neutral mine water from the North drift was directed to the Tulsequah River from the 5400 portal over the mine dump and into a small channel. This removed the point source for the mine discharge, but the tile field subsequently failed with mineral precipitates clogging the tile perforations and probable biofouling with iron and manganese bacteria (Klohn 2003b). Redfern's mitigation efforts and consultant report expenditures from 1992-2000 totaled $406,238.

An underground water source management study conducted by Klohn Crippen and implemented during Fall 2003 changed flows and reduced the amount of water requiring treatment by approximately 50% (Klohn 2003b): at the 6200 Level low pH water was diverted down shaft to the 5400 Level; at the 6100 Level all water was diverted down ore pass to 5900 Level; at the 5900 Level all water from level and received from ore pass diverted to the portal and directed to Camp Creek; at the 5400 level all water diverted down 5245 manway raise to the 5200 level. Diamond drill holes were plugged on the 5900, 5400 and 5200 levels to reduce water inflows.

Klohn Crippen also evaluated water treatment options and recommended a passive sulfide reducing bacteria (SRB) treatment as the most practicable option for Tulsequah Chief mine. Passive options were pursued as it was understood regulators considered the initial 1992 SRK adit sealing plan high risk, due to the potential for plug failure with resultant large volume release incident and probable significant fish mortality (Redfern 2005 December periodic report). A bioreactor development laboratory bench column test with synthetic acid mine water showed that decomposing wood chips removing oxygen and local limestone can neutralize acidic mine water on a short retention time and provide an anoxic neutral pH environment necessary for SRB development (MT 2003). Redfern's expenditures for mitigation option assessment and water diversion efforts in 2003 totaled $119,350.

Klohn Crippen designed and supervised construction of a pilot passive underground water treatment system with a settling reservoir and bioreactor constructed during July-August 2004 and commissioned 9th, September, 2004. The pilot plant located in the old locomotive charging station 5200 Level (300m from

portal) was constructed as 4 cells: 2m long x 4.8m wide x 1.8m high. Each bioreactor cell has three layers: 0.45m bottom drain of river rock and gravel; followed by 1m organic wood chips and limestone layer with inoculant, bonemeal, sulphur prills and biodegradable plastic; followed by with 0.2m cap layer of organic wood chips and sulphur prills; and topped with filter cloth. Settled feed water was distributed above each cell with perforated pipe at the bottom of each cell collecting the effluent. The reservoir diluted the acid water and retained aluminum and iron precipitates and the bioreactor neutralized acid water and removing metals. Iron precipitates formed on the surface of the filter fabric either by filtering or new precipitation with the increase in pH. The surface mulch layer removes dissolved oxygen for the anoxic environment required by the SRB to from insoluble sulphides. The November 2004 results (MT 2005) show the pilot plant is effective in removing acidity governed mainly by limestone dissolution kinetics and retention time, rather than any biological process, with the increase in pH the main driver for the reduction in metal concentrations from the feed water, removal rates: Aluminum 85%; Iron 88%; Cadmium 65%; Copper 85%; Lead 93%; and Zinc 13%. Modifications were made in November 2004 to improve SRB performance by increasing surface mulch by 6" and adding an ethylene glycol drip system above cells 3 and 4, to react and remove dissolved oxygen, with any excess utilized as a feed source by the SRB to benefit the sulphate reduction reaction. Redfern expenditures for passive water pilot plant design and construction and further underground water assessment and diversion in 2004 totaled $292,790.

The Klohn March 2005 evaluation showed the pilot plant consistently neutralized the mine waters from 3.1-3.5pH to discharges of 6.0-6.7pH with metal removal efficiency improved from November with copper 85% and zinc 20-35% removal (Klohn 2005). Hydrogen sulphide gas was detected February 2005 suggests SRB were active and forming insoluble copper sulphides. Zinc removal is poor relative to the other metals and Klohn states that "even with an increase in SRB activity Zinc removal is expected to reach 40% at best". The iron precipitates were restricted to the top few centimeters of the mulch and could be easily cleaned off by scraping the filter fabric and flushing the top layer once or twice a year. A 60 litre sample of treated effluent from the pilot plant collected on Feb 5th 2005 for 96hour LC_{50} rainbow trout bioassay test was still toxic with a dilution factor of 6 times required to render the sample non-toxic.

A vent raise concrete plug was poured at 6550 level July 4-6th, 2005, to prevent inflow of snow melt through the mine to the 5900 level. The success of the plug was noted in winter 2005/6 with the 5900 level flows lower than previously recorded.

Construction of the full scale passive water treatment plant commenced in May 2005 with four pervious sludge-retaining limestone berms 1.3-1.8m high and between 50 and 100m apart on the 5200 level, followed by three anoxic limestone cells (No. 1-3) 20m long, 1.9m high. The limestone cells are lined with 0.2m gravel underdrain material, 1.3m limestone and wood chip mulch(20%) mixture, and topped with 0.05-0.2m inoculated mulch layer seeded by mixing in old mulch from the pilot plant and covered with burlap, the cells are connected in a vertical flow pond arrangement with underdrains in the base feeding the top of the next sequential cell. The SRB cell (No. 4) is 28m long with similar construction to the anoxic limestone cells except the 1.3m limestone and wood chips mulch(33%) layer also contains sulphur prills and bonemeal. Glycol drips were also set up at cells 1 and 4 to react and remove dissolved oxygen. The SRB cell was started on July 19th with only a small flow to encourage SRB development.

After about 40 days the plant started malfunctioning with inconsistent flows noted on August 29th 2005 with 13-50mm iron sludge blocking the burlap and stopping water percolating through the cells and causing overtopping to the next cell. The burlap was replaced with geotextile panels and the 5400 north drift neutral mine water was re-directed to the 5200 level to increase the pH to encourage Fe to precipitate before the cells. Maintenance was again conducted in November 2005 with replacement of the geotextile and installation of Sodium Hydroxide drip(72 L/day) on the 5400 level to increase the pH further and promote Fe to precipitate before the cells (Fe precipitates at pH 3.5, Al precipitates at pH 4.5 and Zn precipitates at pH 8.5). Redfern expenditures for the completion of the pilot plant study and full scale passive water plant design and construction, monitoring, and modifications in 2005 totaled $771,420.51.

Throughout 2006 the passive water treatment plant continued to operate and required periodic maintenance with washing of the top layer of mulch and replacement of the geotextile due to excessive sludge buildup in: February; April; and October. The April maintenance determined that the deep iron penetration into cell 1 limestone layer could not be cleaned up and permeability restored, so this cell was abandoned after 8 months of operations. The February 2005 results show that the 4-5 L/s flow through treatment cells 1-3 removed: 80% Fe, 84% Al, 87% Cu and 52% Zn; and the 0.3 L/s through the SRB cell removed 88% Cd, 93% Cu, and 63% Zn.

Additional mechanical technical problems occurred throughout 2006 with both the Glycol and NaOH distribution dosing systems, with solutions progressively implemented at the remote mine site. The periodically effective glycol drip combined with the draining of the cells for maintenance impeded the establishment of anoxic conditions needed for SRB development, but the smell of sulphides was noted in September 2006. Inconsistent dosing of the NaOH and subsequent determination that the NaOH was reacting with drill cuttings in the 5400 drift and precipitating calcium carbonate above 8.3 pH reduced the effectiveness of the NaOH in raising the pH and precipitating iron hydroxides, this was corrected in December by redirecting the NaOH with the piped neutral mine water direct to the 5245 raise.

In the May 2007 cell number 2 was abandoned with iron penetrating the limestone layer with ineffective percolation, the mulch was washed and geotextile replaced in cells 3 and 4. With the reduction in the number of functioning cells the flow rate was reduced.

The challenges encountered in the operation and maintenance of the passive water treatment plant are documented in the quarterly confidential reports provided to Environment Canada and BC MOE from May 2005 to October 2007. No further maintenance or monitoring was completed on the passive water treatment plant from October 2007 when Redfern prepared the remaining NaOH in anticipation it would last until the mechanical interim acid water treatment plant would be operational by the end of 2008.

Redfern updated the portal discharge flows in 2008 with the diversion and drill holes plugged in 2003/2005 modified to open the drillhole margo plugs and direct the water to the neutral mine water efforts. This controlled the discharge release point, rather than allowing the excess seepage under high pore pressure to escape through remote fractures, etc. This continues to contribute to reducing the water volume requiring treatment by 50%, conforming to the EA commitments 1.3.1 and 1.4.3.

Chieftain acquired the Tulsequah Chief Project in September 2010 and in preparation for mine construction re-commenced plans to build and operate the same water treatment plant that had been designed by Sanitherm Inc. for Redfern. The IWTP was designed to conform to the initial Mine Act conditions and treat the contaminated discharges from the Rodgers Creek new HPAG facility, with any excess capacity utilized to treat the existing underground acid mine drainage. Chieftain received approval to amended the Mine Act permit on July 7, 2011 and move the location of the IWTP from Rodgers Creek to the permeant location at the mine site, MEM also included the condition that all discharges from the 5200, 5400, and 5900 portals be treated. The interim acid water treatment plant was designed to treat 40 m^3/h (11.1 L/s) with peak flow rate of up to 100 m^3/h (27.8 L/s), neutralizing the acid mine waste water and removing dissolved heavy metals, precipitated and suspended solids and turbidity, designed to produce an effluent of: Al <= 1.0 mg/l; As <= 0.1 mg/l; Cu <= 0.05 mg/l; Fe <=0.3 mg/l; Zn <= 0.2 mg/L; pH 8.5-9.5; and Turbidity <=0.3 NTU (Sanitherm 2008).

The basic acid mine drainage(AMD) treatment process consisted of neutralization of the AMD by lime slurry and applying sludge recycle followed by pH adjustment and heavy metal co-precipitation, then flocculation and coagulation(enhanced using ferric chloride and Percol 2640 polymer as pH adjustment / flocculent aid), clarification/thickening was to be done using Sanitherm design inclined plate type clarifier/thickener(IPS-T) where suspended solids are removed under gravity force and laminar conditions with concentrated sludge and clear effluent produced. The sludge is removed and the clear effluent filtered through Zeolite filters("polishing") where traces of heavy metals and turbidity are removed, a final pH adjustment is applied if needed and treated effluent disposed of in the Tulsequah river

The Plant was barged to the mine site in May/June 2011 and construction was complete in October 2011 with commissioning in November 2011 to February 2012. The plant was fully operation by early February 2012 with issuance of EMA discharge permit 105719 on April 4th, 2012. Chieftain operated the plant pursuant to its water quality discharge permit conditions until June 22nd, 2012 when operations were curtailed. Chieftain then entered into a period of non-compliance with permit 105719.

It became apparent in Q2 2012 that the operating cost based on actual experience at the IWTP was now estimated to be $4.4M per annum and not the budgeted $1M (for a correctly functioning plant). This new operating cost was evaluated with the emerging delays in completing the new feasibility study and subsequent financing timeline. The IWTP was built as integral part of the mine development complex to treat the contaminated discharge from the new Rogers Creek HPAG facility, plus mine discharge to capacity, and not as a standalone facility. The determination was made that mine development was not guaranteed to commence in 2012 and without a firm start date for mine construction continued operation of the IWTP, and in particular with its current inefficient process was not a sustainable option for a junior mining company with zero revenue. A major factor in the cost overrun was the additional handling and transport of thirteen times the designed volume of sludge, which outstripped capacity and necessitated substantial additional support costs. After the operations of the IWTP were curtailed the inefficiencies were investigated during 2012 with consultant reviews concluding inadequate test work prior to plant construction lead to several components being undersized requiring higher reagent consumption and the installed IPS-T clarifier (producing fluffy low density low percentage solids sludge) inappropriate for the application, process improvement were suggested. The total construction cost and operating cost

expended by Chieftain until June 2012 was approximately $9M. The above is discussed in detail in Chieftain 2012.

No further site ARD/ML mitigation measures have taken place since the curtailing of the IWTP operations in 2012. The additional studies on restarting the IWTP are discussed in the optimization section below.

Evaluation of possible ARD mitigation strategies

The preliminary and conceptual approach to control ARD/ML was recommended by Hallam Knight Piesold (HKP) 1991 and was improved by the Steffen, Robertson and Kirsten (SRK) 1992 report with walk away solutions using best available technology to the ARD/ML problem, with the objective to significantly reduce the contaminant release from the waste dumps and underground mine. The Rescan 1997 Environmental Assessment Project description considered remediation in conjunction with mine operations with mechanical water treatment and disposal and flooding of the waste rock in new underground stopes. This remediation in conjunction with new mine operations has since been refined by Redfern and Chieftain. All cost for the proposed activities are order of magnitude estimates only in the $ at the time, and useful as a historic reference only.

Remediation plans for the Underground Mine

HKP 1991 suggested segregating the contaminated and clean underground mine water to the maximum amount possible, by first mapping flows in the mine and identifying flows that are of acceptable quality and piping to the surface for direct release. All other underground flows would be collected in sumps to be piped to a water treatment plant. Long term suppression of the ARD would require flooding the mine with plugs as close to the adits as possible, as controlling infiltration of precipitation is not an option. HKP also warned that a few isolated defects around the plugs could results in major water losses under the expected head pressures. The plugs would be constructed by radial curtain grouting and excavation of a keyway, and pressure grouting after the concrete has completed shrinking. After flooding of the mine, springs could occur in the existing waste dumps causing further problems, also uncontrolled surface discharge could occur through unsealed historic diamond drillholes. HKP 1991 estimated costs of $241K for the underground bulk heads.

SRK's 1992 short term solution involved plugging the 5200 level only and water diversions to the prevent inflow into the mine, including water flushing through the 5600 A zone stope (estimated to reduce loadings by 26%). SRK's 1992 long term plan for ARD/ML involved flooding the mine to prevent oxidation and acid generation with variations on flooding the mine to either the 5900 or 6200 levels. Water is expected to escape via short groundwater pathways in the vicinity of the 6200 level, with small incremental benefit compared to not plugging the 5900 level. SRK also noted that the water quality in the flooded mine will be worse than the existing discharge as oxidation products in unflushed parts of the mine would go into solution. Once flooded the underground mine discharge would be either a flow-through or over flow

system with either: direct pipe point discharge; diffuser discharge; or deep point discharge in the alluvial gravels. The flow-through system through would be best suited to high pressure discharge in a diffuser, but with the higher initial metal concentration from the remnant oxidation products. The SRK cost for 3 UG plugs and diffuser was $625.6K.

Redfern also evaluated the immediate construction of an underground plug at the 5900 level in 1994 that was not dependent on the construction of a diffuser system or flooding of the lower levels, and "while the plug would not actually impound water, it's construction would provide partial completion of the mine closure plan" (Klohn 1994). An order of magnitude cost estimate for this 5900 level plug was $210K.

Remediation plans for the Waste dumps

Four remediation options have been proposed for the waste dumps:

- Cover in place;
- Move and flood in bed rock;
- Move and bury and flood in river or;
- Move and dispose underground below the 5200 level in new voids and flood.

HKP 1991 proposed three options: covering the waste dumps with either a low permeability mixture of local fine alluvial sand and bentonite or high density polyethylene (HDPE) liner. HKP noted it would be difficult to cover the 5900 and 6400 dumps due to their steep terrain and difficult access and recommended re-locating them to the 5400 level with an underlay of HDPE liner and sand bedding. Cost of covering and sealing waste dumps was estimated as $650K in 1991 $. A bed rock flooding alternative would be to encapsulate the 5200 and 5400 waste underwater in a new bedrock excavation 12m x 120m x 50m below the 5400 level, excavation and moving cost $615K. HKP also proposed disposal of the waste rock in the Tulsequah river alluvial flood plain with a 6m deep trench covering 20,000m^2 and piling the waste rock 3m high and covering with 3m of gravel, but noted numerous concerns, cost $1.225M. SRK 1992 also suggested that the waste could be buried below the low water level in the Tulsequah River, but this option was also not preferred.

SRK 1992 proposed to consolidate and cover the 5400 and 5200 waste dumps by moving the 5200 waste to the north end of the 5400 dump and cover with HDPE geomembrane, cost $528.6K. SRK also acknowledged that the 6400 and 5900 waste dumps are causing small ARD loads, but it would not be cost effective to reduce further and recommended leaving them in place. SRK also concluded that the because the majority of the discharge ARD/ML source is from the underground workings the incremental benefit achieved by placing a cover on the waste rock at the 5400 level could only be justified if the mine is first flooded to the 5900 level, significantly reducing the relative portion of ARD/ML loading from the underground discharge.

Remediation plans for Surface Runoff

HKP 1991 proposed diversion water control ditches could be constructed above the waste dumps to divert precipitation runoff and discharged to natural drainages. Snow removal from the dumps would also reduce large quantities of water from infiltrating the dumps during Spring thaw, but would likely be cost prohibitive. The runoff from the mine dumps could also be collected in sumps and directed for treatment.

Remediation Treatment of Effluent Mine water

HKP 1991 proposed a conventional lime addition water treatment system and settling pond. The costs quoted as an order of magnitude: $109K for site piping and $227 for the water treatment plant. SRK 1992 did not consider chemical treatment as a viable option due to the remoteness of the mine location. Rescan 1997 proposed an effluent treatment plant as part of new mine development. GLL constructed a passive water treatment system as an intervening measure in 2005, and Redfern considered building new cells at the passive water treatment plan to extends its life with: 2 new cells in each of 2007 ($325K), 2010 ($345K), and 2013 ($366K). Operating costs for maintaining the passive water treatment plant were estimated as $150-180K per year. New cells were not added to the passive water treatment plant, as plans were in place to construct the interim acid water treatment plant during 2008.

Chieftain constructed and commissioned the interim acid water treatment plant in late 2011/Q1 2012.

Remediation in Conjunction with New Mine Development

As part of the 1997 Rescan Environmental Assessment the mitigation and remediation of the existing ARD/ML was considered for the first time in conjunction with new mine development and operations. The drainage from the old mine was to be directed to a effluent treatment plant and the long term management enacted by filling the old Cominco stopes with acid consuming paste backfill (96% desulphurized tailings and 4% cement) to restrict water movement through he mine workings and provide sufficient neutralizing potential to prevent acid forming conditions (Rescan 1997 Vol IV). The historic broken ore would be removed and placed in new empty stopes below the 5200 level, before filling with paste backfill. Rescan proposed backfilling the upper mine with desulphurized tailings as it was uncertain at the time if the higher elevation upper workings would be sealed and flooded upon closure.

Interim acid Water Treatment Plant Optimization Study

The interim acid water treatment plant constructed by Chieftain was audited by Sohan Basra on November 5-8th, 2012 (AWT 2012). A feasibility design estimate based on this work was completed by Applied Water Treatment Inc. November 3, 2014 (AWT 2014). Several recommendations were made to improve the operation, efficiency and availability of the plant. By modifying the process, the idealized 5% solids (actual experience <1%) produced in the lime precipitation system can be improved to 30% solids in the proposed

High Density Sludge (HDS) system, reducing the volume of sludge by over 95%, and additionally producing a higher quality effluent with lower reagent neutralization costs. Specific recommendation were:

- Increase lime slurry concentration from 3% to 15% solids to extend retention time to at least 2 to 4 minutes in new installed lime/sludge mix tank, this tank, not included in the current plant, is a key component of the HDS process for enhancing precipitation with lime coating recycled sludge particles to create enucleated sites for new material to precipitate.
- Increase reactor tank capacity and conduct test work to design upcomer separating reactor 1 from reactor 2, and minimizing the potential for short circuiting. Approximately 20% of the sludge produced in the HDS process is recycled to the reactor tanks where it requires a designed retention time of 60 minutes to achieve lime utilization of 90%. The current reactor tanks are undersized for this purpose with a retention size of only 10 minutes at high flows and estimated lime utilization of 60% (no test work was undertaken to design the upcomers by Sanitherm). The velocity through the upcomer needs to be sufficiently high to carry the grit particles through to the clarifier, otherwise the grit will accumulate in the first reactor tank necessitating removal, and correctly understanding this parameter will be a product of the new test work.
- Discontinue use of expensive ferric chloride for use as pH adjustment in lime reactor tank, if pH adjustment needed consider using cheaper ferric sulfate.
- Replace current pump feed IPS-T clarifier with standard gravity fed thickener/ clarifier, simplifying the piping system and using proven technology in common usage for this application.

Three options were presented by AWT to change the operation from a lime precipitation system to a high density sludge (HDS) process with increasing scale of scope and cost:

1. Minor upgrades of the existing plant to optimize, enhancing the treatment as much as possible. But not improving operating or chemical reagent costs significantly. This is not considered viable by Chieftain, with the high operating costs not justifiable.
2. Modification / retrofit of the plant to incorporate higher flows(97-120m^3/hr) with installation of new lime/sludge contact tank, replacement of reactor tank to two correctly sized tanks and replacement of clarifier. This will reduce reagent consumption and address the sludge densification problem with subsequent reduction in handling and support costs. This cost was calculated by AWT 2014 as option 1, totaling $733K. This is the preferred option by Chieftain, modifying the existing plant to be able to function as initially specified with a moderate capital expenditure.
3. Design a new effluent treatment plant to incorporate surface and mill water with capacity of 230m^3/hr. This cost was calculated by AWT 2014 as option 2, totaling $1.729M. This will ultimately be built to as part of the mine complex development to treat the production effluent from the mill processes, but this large capital expenditure is premature at this stage.

For options 2 and 3 a three to four week pilot plant study was recommended to gather engineering data required for the planed design and following conceptual engineering design and budget.

Estimated costs for the ARD/ML mitigation options

- Plugging the 5200, 5400, and 5900 portals with an overflow drain discharge directed to exfiltrate into the Tulsequah river is estimated to cost at least $1M, based on previous estimates with Bank of Canada inflation adjustments. Chieftain is discounting this option and not providing an accurate cost and engineering assessment because of previous understandings that regulators considered this an undesirable high risk option, with potential for resultant large volume release incident and probable significant fish mortality.
- Re-locating both the 5200 and 5400 HPAG to the temporary lined HPAG facility and covering at Rogers creek is estimated to cost $1.2M, based on the 2014 JDS feasibility and is included as part of the mine plan and scheduled as one of the first activities. Chieftain is not considering the SRK recommendation of relocating the 5200 portal HPAG waste dump to combine with the 5400 HPAG and covering with HDPE liner with estimated cost of $500K. This SRK recommendation will only reduce to the ARD/ML loadings by 15-20% and is not considered cost effective, with additionally, the highest impact on the receiving environment receptors from this HPAG contaminant loading only occurring during the freshet when salmon species are not migrating and eggs are not incubating and hatching (Palmer, Core6 & Triton 2013).
- IWTP design fixes to modify the existing lime precipitation system to the recommended high density sludge system is estimated to cost $733K (AWT 2014), which is Chieftain's preferred option.

Preferred ARD mitigation strategy and recommendations / commitments

Chieftain is in complete agreement with the 1992 SRK report that the underground discharge is the priority in remediation and mitigation of the ARD/ML at the Tulsequah Chief mine site and maintains its preference to implement the design fixes and restart the interim acid water treatment plant in conjunction with new mine development and relocation of the HPAG to Rogers Creek and ultimately flooded underground below the 5200 level. Chieftain is not in a position to and cannot present a business case to operate the IWTP and treat water as a standalone operation without mine development. The only permanent solution to the ARD/ML is new mine operations: removing the broken ore and filling the old stopes with cemented desulphurized paste, ultimately moving the broken ore and existing HPAG material to new voids below the 5200 level where it can be flooded. This will stop the oxidation reactions in the broken ore and HPAG, and significantly reduce the exposed rock surface area in the upper mine available to react with water flowing through the mine. Chieftain is fully committed to this option and is actively pursuing mine financing opportunities. Once funding for mine construction is in place Chieftain will immediately re-commencing operations at the IWTP, and implement engineered solutions to address the previously identified deficiencies. As discussed, this is the only viable long term alternative for cleanup and remediation of the historic acid mine drainage and metal leaching at the mine site.

In the immediate term Chieftain will continue to monitor the water quality in the Tulsequah River with sampling during the open water season and compare with the historic data. The 2013 aquatic ecological risk assessment (AERA) shows that the fish resource downstream from the Tulsequah Chief mine site is at a healthy level and the 60 years of historic discharge posed low risk to fish. Additionally studies on resident Dolly Varden/Bull trout tissues show they are not affected by the mine discharges (ADF&G 2012).

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Tulsequah Chief Mine Project

Environmental Monitoring and Surveillance Plan: Care & Maintenance (2016+)

Chieftain Metals Inc

February 2016

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1. Introduction

The Environmental Monitoring and Surveillance (EM&S) Plan: Care and Maintenance (2016+) is a supporting document to Chieftain Metals Inc.'s (Chieftain) EMA Permit #105719 amendment application for the Tulsequah Chief mine site. All monitoring requirements for the Tulsequah site for have been consolidated in this document. This document has been created as a stand-alone document so that it can easily be modified or updated to address monitoring concerns or issues that may arise at a later date.

The plan is designed to ensure that potential environmental impacts are identified and mitigated before they occur. It is recognized that it may be necessary to change this plan in response to changing site conditions.

Contingency measures are not dealt with in this plan. Contingency measures were provided in the Acid Water Treatment Plant Technical Assessment Report (Chieftain, 2011).

This document covers the current site care and maintenance activities where the interim acid water treatment plant (IWTP) is non operational. Monitoring and surveillance activities will be occurring approximately quarterly during the open water season, with focused EM&S during the spring freshet/thaw. The specific months where the EM&S activities are scheduled to occur are: April, May, August, and October. The reduction in sampling frequency in the EM&S plan is supported by the consistency with the historical results and repeatable seasonal fluctuation, combined with zero site activities to initiate new changes. The recently submitted Tulsequah Chief Mine EMA Permit Q4 2015 Monitoring Report fully documents this information.

The plan will be updated at the end of the care and maintenance and the commencement of new construction to reflect those new activities. Some on-going baseline monitoring is included in this plan.

2. Monitoring and Surveillance

2.1 General Description

For the purposes of this plan, "monitoring" and "surveillance" consists of two distinct activities. "Surveillance" refers to visual inspections of structures such as surface water pond levels, drains, sumps, ditches, etc. A consolidated table of the surveillance activities is provided in Table 1. "Monitoring" refers to the collection of samples for analysis or field testing.

Surveillance Location	Location Description	Frequency of Surveillance Activities	Maintenance Activities
SE-2	Exfiltration Pond	Four times per year – observe water levels, sedimentation build up, riprap displacement, berm settlement	Clean out sediment build up, ensure pond and spillway are clear of debris and in working order
ATP Feed/ SE-3	Site Collection Pond	Nil, not in use	Pump down pond as required
Airstrip snow	Dispersed sites	Daily data logger: snow fall and snow accumulation; Snow Survey in early April	Maintain glycol precip gauge and HOBO weather station as required
Chasm and Shazah Creek	Bridge crossings	Four times per year – check for build up of logs/branches under bridges and at staff gauges	Remove accumulated debris to ensure free passage of water
Portal Creek diversion	Intake for Portal Creek	Four times per year – Sedimentation build up on intake, check intake screen regularly	Cleanout sediment build up, check intake and repair as necessary
Temporary Sludge Pond	Adjacent to ATP	Four times per year – check for water accumulation	Pump to ATP Feed pond if necessary
Lime Sludge Storage Pit	Adjacent to Airstrip	Four times per year – check for slumping or water ponding; check for erosion from surface water within 30 m of pit	
NAG site soil stockpile	Soil Stockpile Silt Fences	Four times per year – ensure stockpiles are re-vegetated	Apply seed if bare patches are showing signs of erosion.
Shazah Camp	All mobile equipment, genset and incinerator	Four times per year – check drip trays, secondary containment	Remove water, collect spilled product, replace oil sponges as required.

Table 2 provides a consolidated summary of the monitoring activities. Table 3 provides the UTM coordinates for the monitoring locations.

Table 1. Summary of Surveillance and Maintenance Activities

Surveillance Location	Location Description	Frequency of Surveillance Activities	Maintenance Activities
SE-2	Exfiltration Pond	Four times per year – observe water levels, sedimentation build up, riprap displacement, berm settlement	Clean out sediment build up, ensure pond and spillway are clear of debris and in working order
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Portal Creek diversion	Intake for Portal Creek	Four times per year – Sedimentation build up on intake, check intake screen regularly	Cleanout sediment build up, check intake and repair as necessary
Temporary Sludge Pond	Adjacent to ATP	Four times per year – check for water accumulation	Pump to ATP Feed pond if necessary
Lime Sludge Storage Pit	Adjacent to Airstrip	Four times per year – check for slumping or water ponding; check for erosion from surface water within 30 m of pit	
NAG site soil stockpile	Soil Stockpile Silt Fences	Four times per year – ensure stockpiles are re-vegetated	Apply seed if bare patches are showing signs of erosion.
Shazah Camp	All mobile equipment, genset and incinerator	Four times per year – check drip trays, secondary containment	Remove water, collect spilled product, replace oil sponges as required.

Table 2. Summary of Water Quality Monitoring

Sampling Location	Location Description/Rationale	Frequency of Field Parameters* and Lab Analysis
Shazah Camp	Climate Data – HOBO weather station and glycol precipitation gauge	April, August and October - download dataloggers; replenish glycol
Chasm Creek and Shazah Creek	Hydrometric stations	April or May, August and October – download dataloggers (including barologger), record staff gauge reading; take manual flow measurements

Sampling Location	Location Description/Rationale	Frequency of Field Parameters* and Lab Analysis
ATP Feed Sump/SE-3	Site Collection Pond - intake sump to ATP	Nil, not in use
ATP Discharge **E272507**	Acid Water Treatment Plant Discharge to Tulsequah River	Nil, not in use
NMW Discharge **E277509**	Neutral pH Mine Water Discharge from 5400 adit to Portal Creek	April/May/August/October: Field parameters, flow, general chemistry, total and dissolved metals
SE-2	Exfiltration pond spillway	April/May/August/October: total and dissolved metals, general chemistry
P-07-03, MW11-3 and MW11-5 to MW11-7	Near proposed PAG Facility	Download datalogger and record water levels at least once per year
MW11-9 to -10	Near proposed NAG Dump	Record water levels at least once per year
SP11-01 to -03 E287309 E287310 E287311	Near Lime Sludge Pit at airstrip	April/May/August/October - water levels; April and October: groundwater field parameters, dissolved metals, general chemistry
W10 **E272544**	Tulsequah River main stem upstream of Project	April/May/August/October: field parameters , total and dissolved metals, general chemistry
W46 **E272548**	Downstream of ATP discharge	Nil, not in use
W32 **E272546**	Tulsequah River mainstream downstream of Mine Site	April/May/August/October: field parameters, total and dissolved metals, general chemistry
W51 **E272547**	Downstream of ATP discharge	April/May/August/October: field parameters, total and dissolved metals, general chemistry
Borrow Pit	Near culvert	April, measure Dissolved Oxygen if ice cover present

* Field parameters and general chemistry are defined in Table 4.

Table 3 UTM Coordinates for Monitoring Locations

Sampling Location	UTM Coordinates Easting	UTM Coordinates Northing
SE-3/ATP Feed	580856	6511455
ATP Discharge	580790	6511500
NMW	581053	6511529
SE2	580920	6511355
P-07-03	581429	6510715
MW11-3	581635	6510593
MW11-5	581459	6510453
MW11-6	581442	6510530
MW11-7	581446	6510603
MW11-9	581519	6510226
SP11-01	579114	6513779
SP11-02	579196	6513375
SP11-03	579173	6513714
W10	578140	6514880
W51	581005	6511177
W32	581140	6507600
W46	580040	6511870
Borrow Pit	579660	6513410
Chasm Creek Bridge	579963	6513883
Shazah Creek Bridge	579556	6513334

Surveillance and monitoring activities near the Mill Site area are provided in Figure 1.

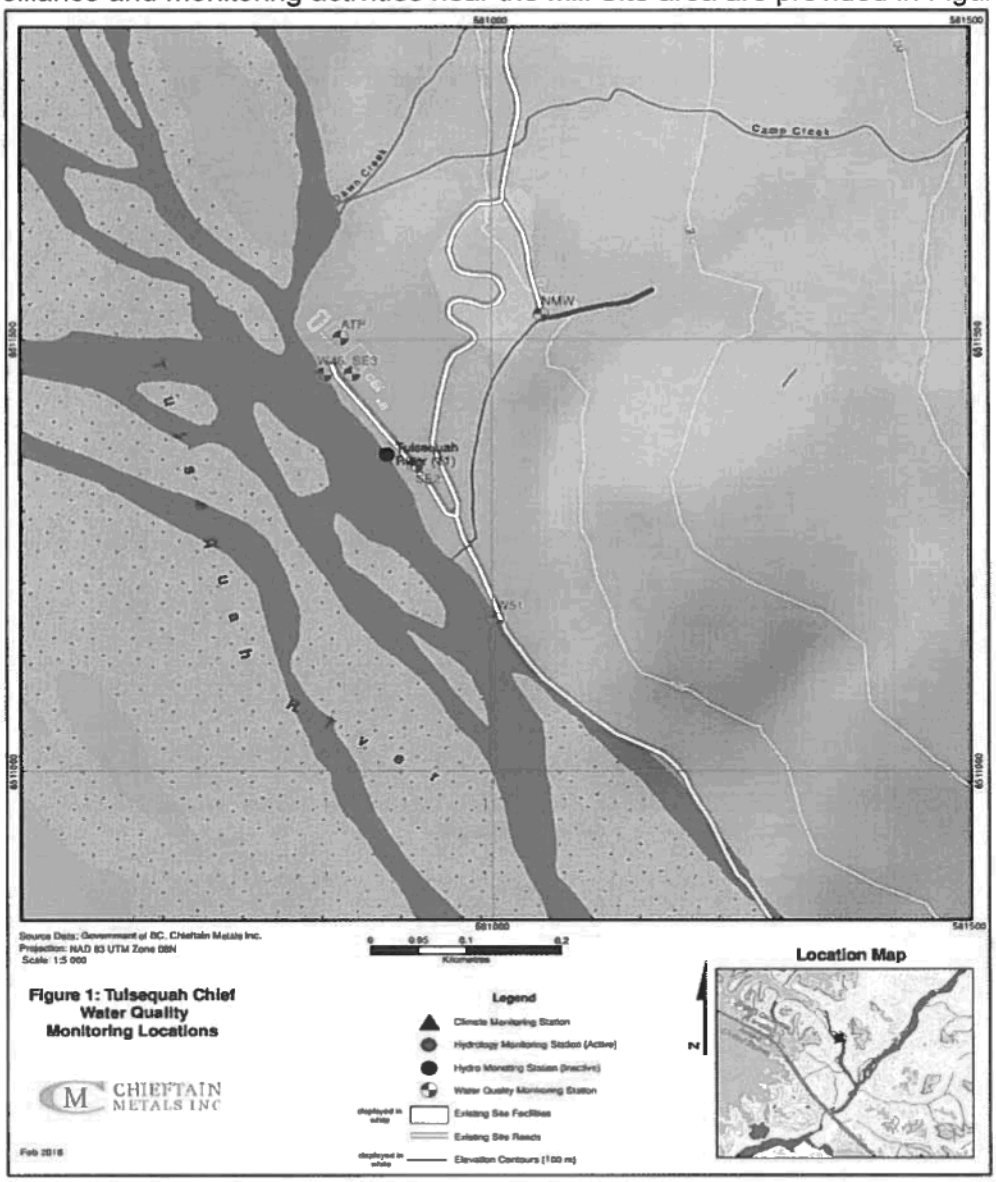


Figure 2 illustrates the lime pit area near the airstrip.

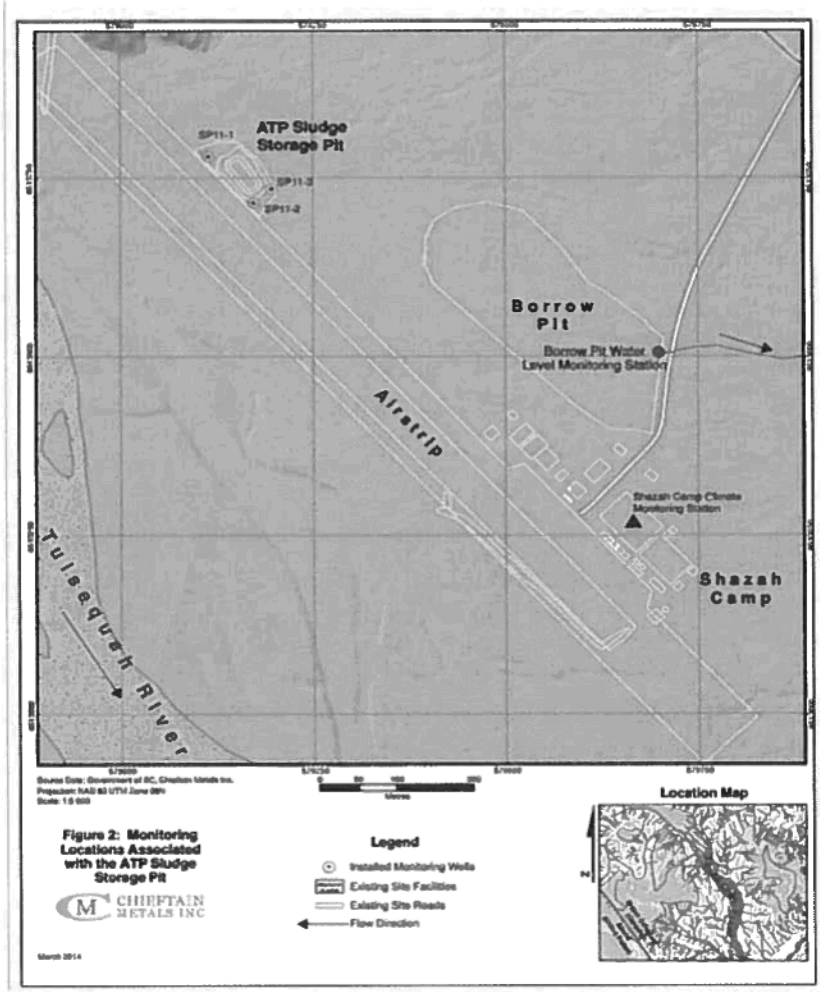


Figure 3 illustrates the PAG/NAG monitoring locations (for baseline purposes only).

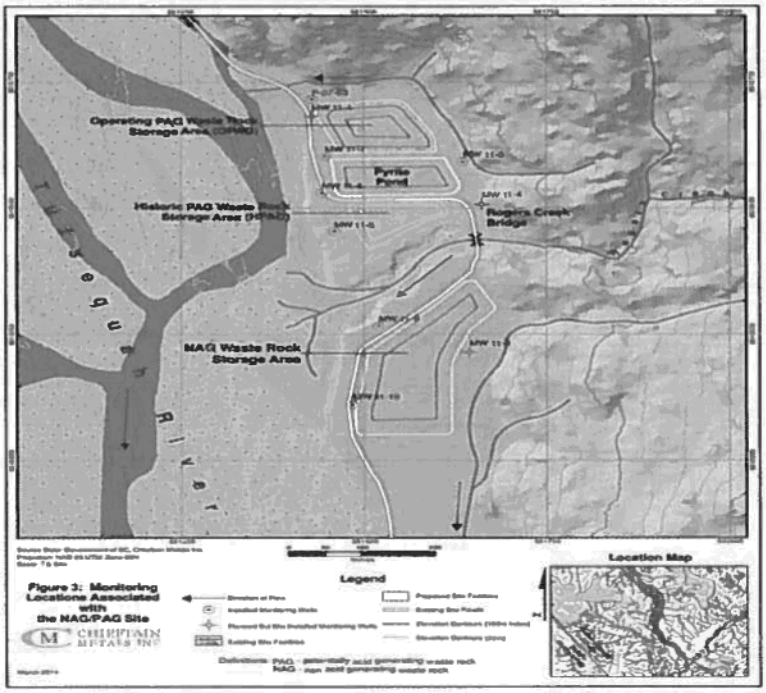


Figure 4 illustrates the receiving environment monitoring locations.

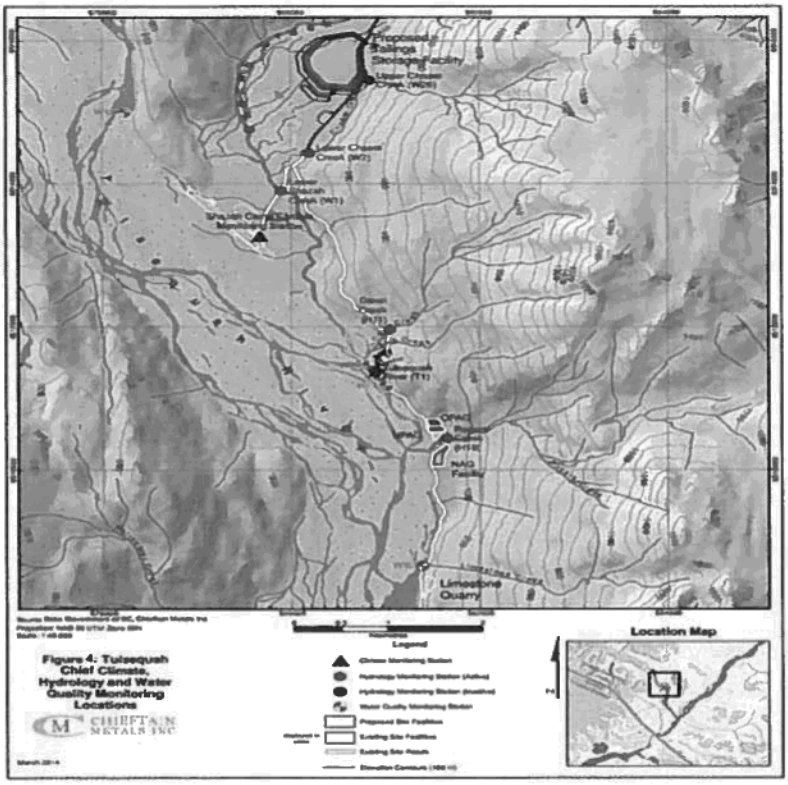


Table 4. Analytical Parameter List

Analysis Group	Parameter List
Field Parameters	pH
	Temperature (°C)
	Conductivity (µS/cm)
General Chemistry	Alkalinity, Total as $CaCO_3$
	Acidity as $CaCO_3$
	Hardness as $CaCO_3$
	Total Suspended Solids
	Sulphate (SO_4)
	Chloride

Analysis Group	Parameter List
Total & Dissolved Metals	Aluminum
	Antimony
	Arsenic
	Barium
	Cadmium
	Calcium
	Chromium
	Cobalt
	Copper
	Iron
	Lead
	Lithium
	Magnesium
	Manganese
	Molybdenum
	Nickel
	Potassium
	Selenium
	Silver
	Sodium
	Thallium
	Tin
	Titanium
	Uranium
	Vanadium
	Zinc

Table Notes:

1. Each heading represents a list of parameters that can be analyzed using a single bottle with appropriate preservative and/or sample preparation.
2. Detection Limits to meet the requirement of BC Aquatic Life Guidelines

Figure 1. Monitoring Locations Associated with the Mill Site

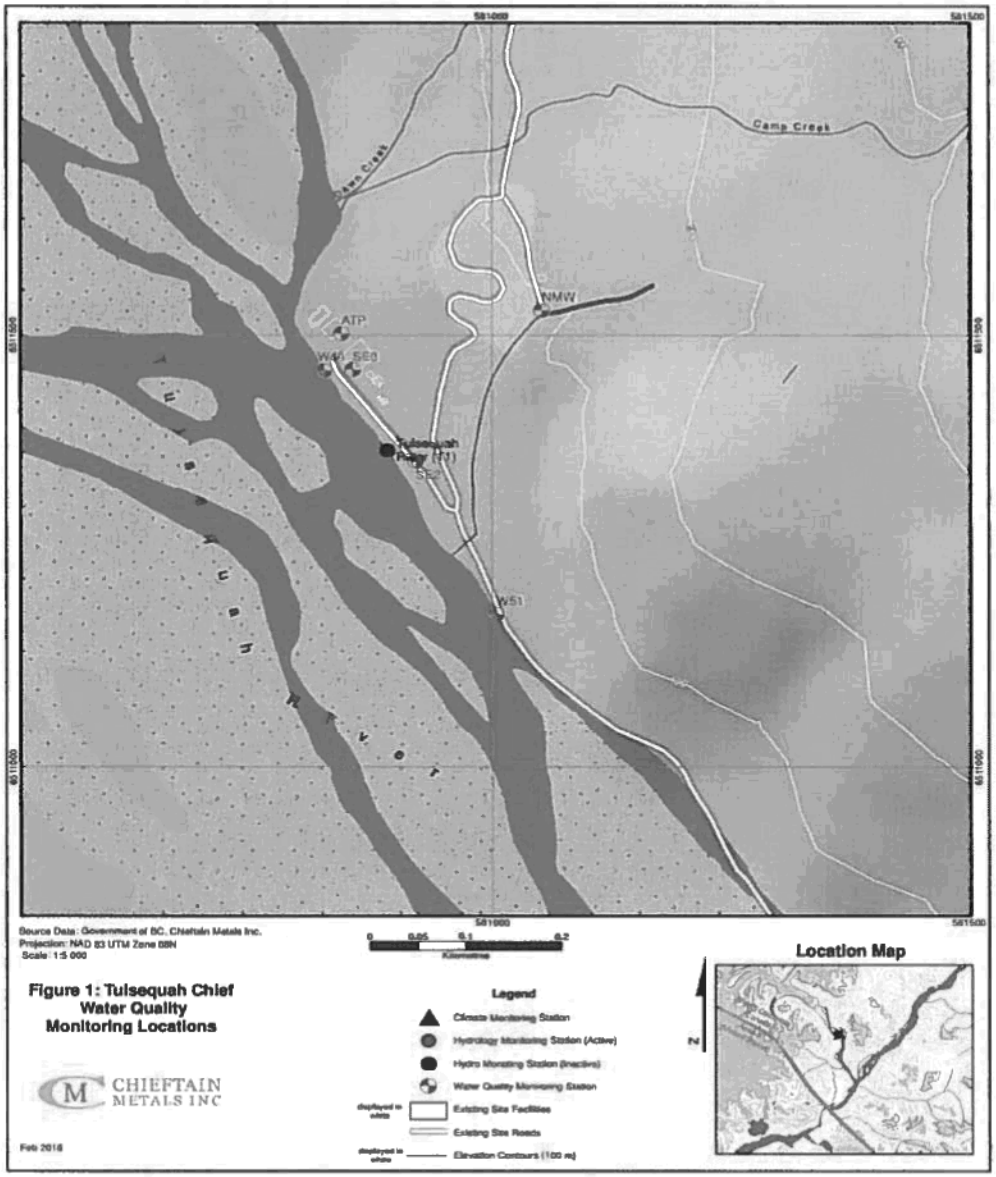


Figure 2. Monitoring Locations Associated with the Lime Sludge Pits

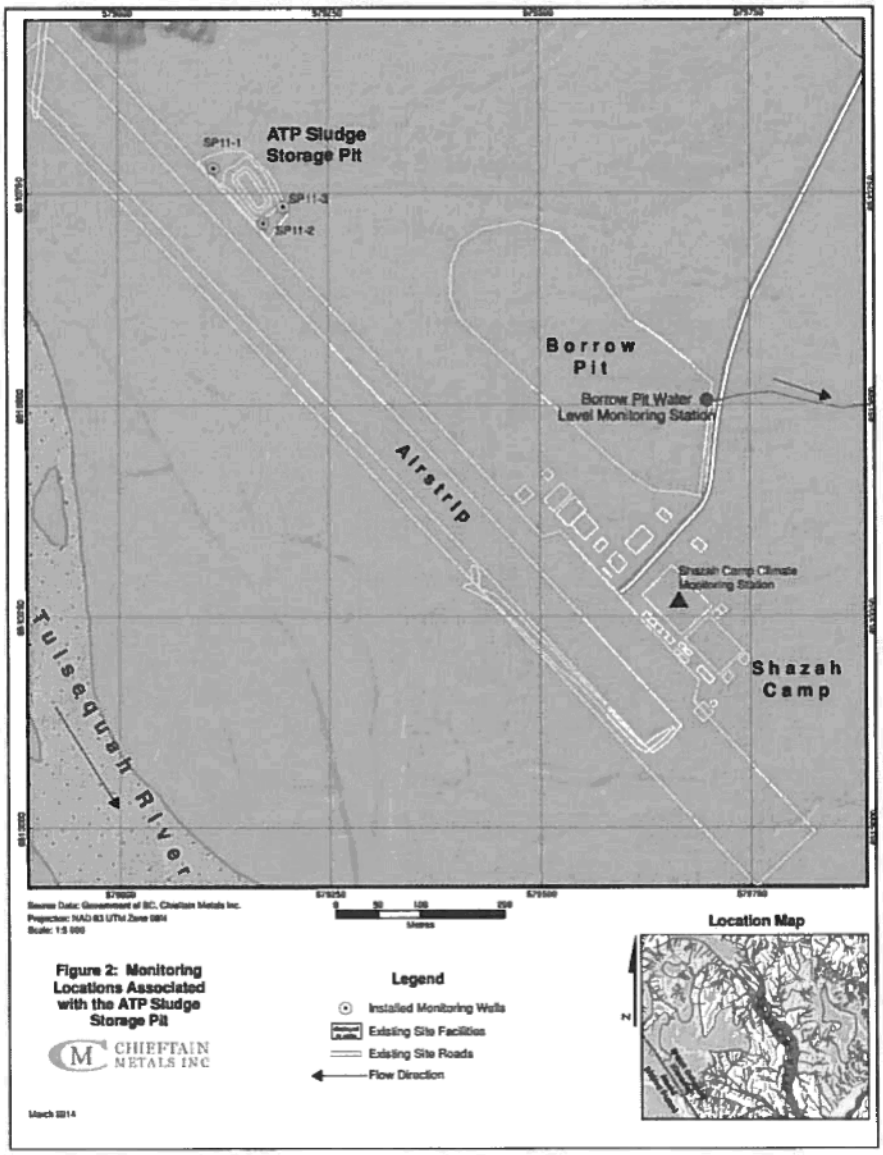


Figure 3. Monitoring Locations Associated with the NAG/PAG Site

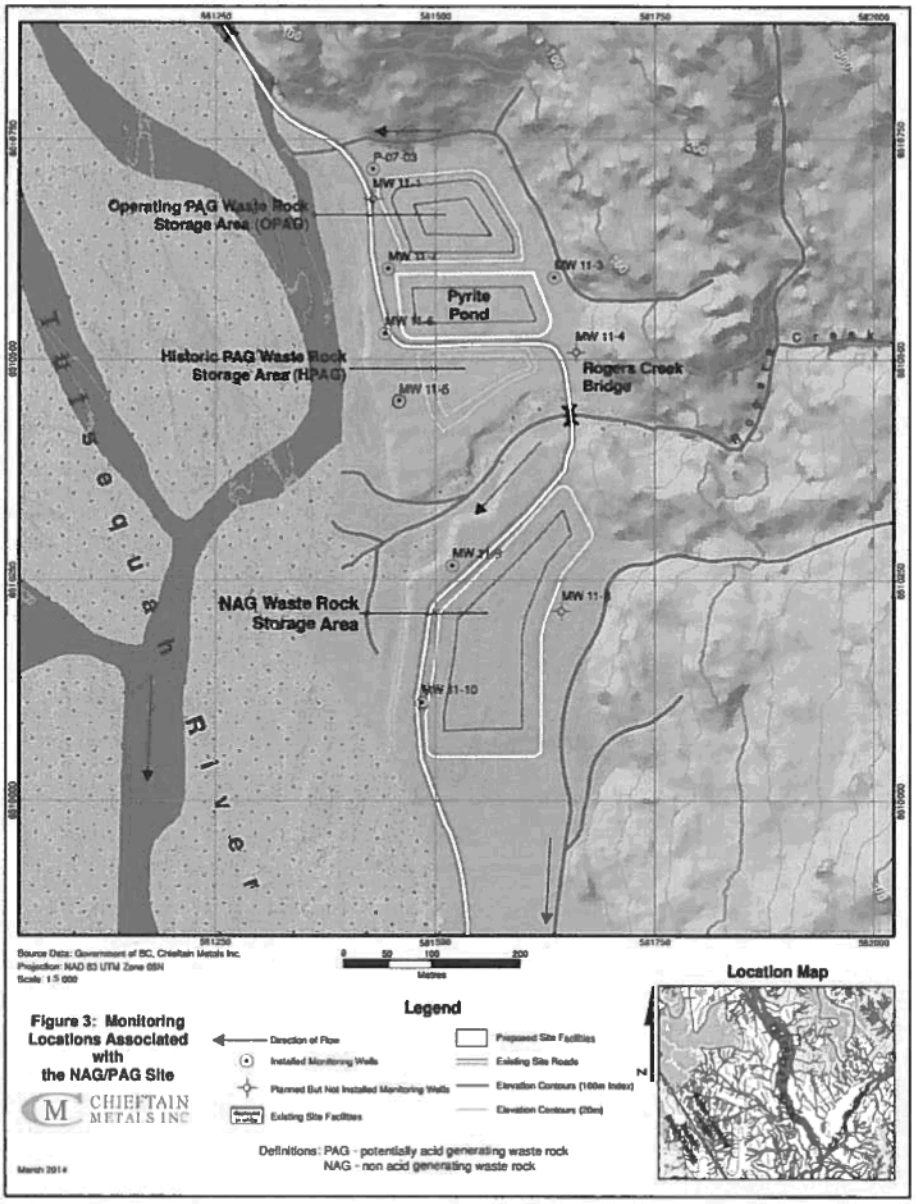
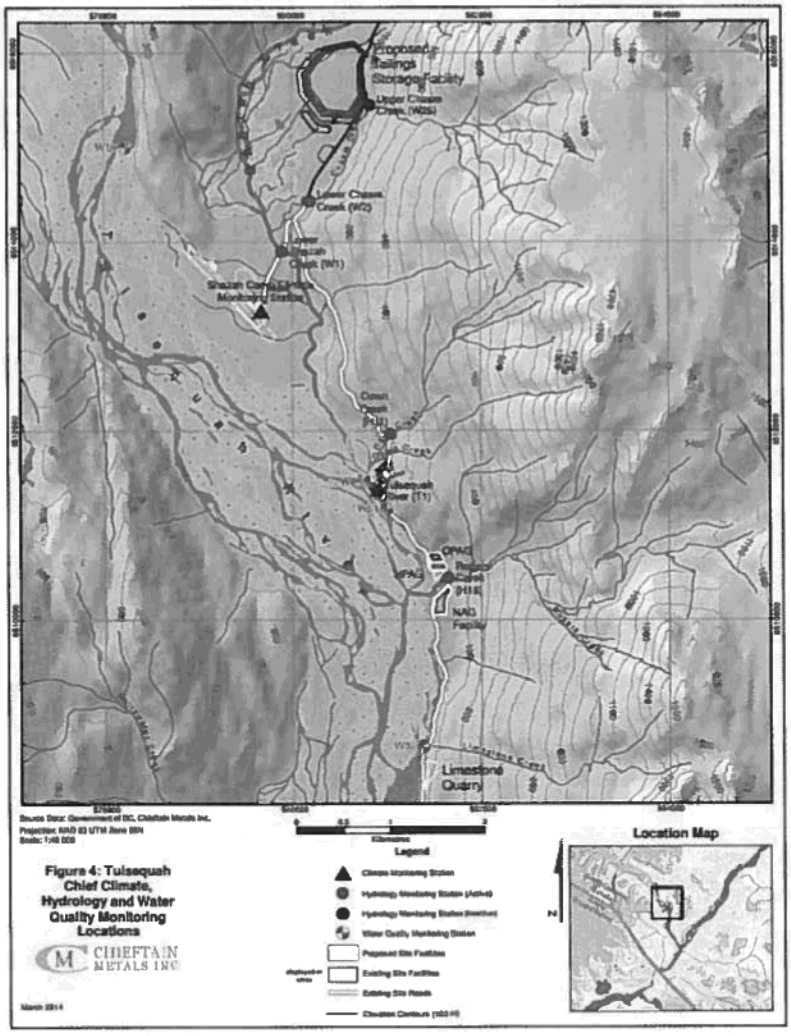


Figure 4. Site Plan and Discharge Locations



2.2 Surveillance Records

A logbook will be maintained to record all surveillance activities. April/May/August/October trip reports will be prepared by the Environmental Supervision team, summarizing all observations and measurements. The logbook will be available onsite for inspection at all times. Follow-up or corrective measures will be taken as needed, and recorded.

2.3 Analytical Parameters

A summary of the analytical parameters that will be tested during each monitoring event is summarized in Table 4. Each heading in Table 4 represents a list of parameters that can be analyzed using a single bottle with appropriate preservative and/or sample preparation. It should be noted that detection limits used for each parameter must meet requirements of BC Aquatic Life Guidelines. Additionally, field meters used to collect in-situ measurements will be calibrated regularly to ensure proper function and data quality.

Field notes will be kept using a standardized field form for each site. Field notes will be kept on file at site and be available for review at all times. April/May/August/October field reports will be prepared by the Environmental Supervision team summarizing field measurements and sample collection details.

2.4 Rationale for Determining Receiving Environment Sampling Locations

For the purposes of this monitoring plan, the "receiving environment" has been defined as the Tulsequah River. Sample sites located along the Tulsequah River are shown in Figure 1 and Figure 4. To provide context for pre-disturbance data, one monitoring location will be utilized upstream from the Mill Site (W10). W51 is situated to assess the water quality after the initial dilution zone for seepage from the Exfiltration Pond and replaces historic site W11. One additional monitoring location (W32) is positioned downstream of the mine site and of the planned facilities. This monitoring location will be compared to the upstream monitoring location (W10).

Due to the natural variability of the watercourse position within the Tulsequah River floodplain, the identified sample sites may be relocated in order to ensure the sites remain within the flow path of the pre-determined monitoring locations. This may involve site monitoring relocation and or the establishment of additional monitoring locations if river conditions significantly change during the construction period.

3. Reporting

As mentioned in Section 2, field data and samples will be collected in April/May/August/October. Laboratory monitoring results will be submitted by email to MoE within 30 days of receipt of the analytical results. Any non-compliances will be reported immediately (within 24 hours) and a summary of non-compliances and corrective action, taken will be submitted the Regional Manager of the Ministry of Environment within 30 days of the month end when the non-compliance was observed. An annual compilation report providing all available data will be submitted by March 31 of the following year. The report for 2016 is therefore due to be submitted no later than March 31st, 2017. The report will present the data in tabular and/or graphical format and will include interpretation comments.

4. References

Chieftain, 2011. Application and Technical Assessment Report for the Acid Water Treatment Plant at the Tulsequah Chief Site. August 2011.

Chieftain, 2016. EMA Permit 105716 – Quarterly Report for Q4 2015, submitted February 2016.

Ministry of Environment, EMA Discharge Permit 105719, issued April 3, 2012.

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31 January 2016

Arash Janfada
Environmental Protection Officer
BC Ministry of Environment, Environmental Protection Division
Bag 5000, 3726 Alfred Ave
Smithers, BC V0J 2N0

Dear Mr. Janfada:

Re: **EMA Discharge Authorization #105719 – Quarterly Monitoring Report for Q4 2015**

Chieftain Metals Inc. (Chieftain) is pleased to submit this quarterly monitoring report in accordance with the revised conditions of Permit 105719 under the provisions of the Environmental Management Act (EMA) for the October-December 2015 monitoring period. No samples were obtained in December. There were too many administrative and logistical hurdles to overcome with Christmas holidays, weather, availability of suitable aircraft and pilot, as well as the exceedingly limited amount of daylight at this time of year. In January 2016, we have brought in a helicopter from Whitehorse and successfully obtained the requisite samples.

Monitoring at the Tulsequah Chief Mine Site is conducted in accordance with EMA Permit 105719, which outlines surface and groundwater quality monitoring locations. While EMA Permit 105719 also details monitoring required for acid treatment plant effluent, and treatment plant sludge, treatment of mine effluent has been suspended and mine-influenced water (5200 and 5400 portals, waste rock runoff and local runoff) are combined in the Exfiltration Pond. Therefore, monitoring of acidic water treatment plant effluent is no longer relevant to the current conditions at the Tulsequah Chief mine site, and hence is not discussed in this report. While temporarily excluded from late 2012 until mid-2014, the neutral pH mine water has been re-added to the reporting schedule because this flow is once again being discharged directly to the environment via the Portal Creek diversion pipe, rather than via the Exfiltration Pond.

Monitoring results for neutral pH mine water, the 5200 portal, the exfiltration pond, receiving environment surface water monitoring stations and groundwater monitoring wells at the Tulsequah Chief Mine site are presented below. Surface water quality sampling is conducted monthly, and groundwater quality and level monitoring is conducted quarterly. Mercury sampling was discontinued in Q4 of 2013, as all samples taken in the 2012 – 2013 monitoring period resulted in values less than the reportable detection limits. The updated complete set of laboratory analytical results is presented in Appendix A.

1 EFFLUENT DISCHARGE MONITORING

As mentioned above, the interim acidic-water treatment plant (IWTP) was shut down in 2012 and is planned to be re-started upon securing full project financing. In addition, the results of an aquatic

ecological risk assessment conducted in late 2013 indicate that the risk to fish is low, whether the treatment plant is operating or not. From September 2012 to July 2014 all effluent from the historical underground workings was directed to the site exfiltration pond. Therefore, sampling of the treatment plant effluent and neutral pH mine water sites had been discontinued.

Earlier in 2014, it was recognized that the water level in the Site Exfiltration Pond was gradually rising, as sludge build-up on the filter fabric was increasing the resistance to flow. In July 2014, it was decided to remove the filter fabric, with the accumulated sludge, from the outer portion of the pond and to replace the filter fabric. To this end, most of the flows to the Exfiltration Pond were redirected around the pond, with the neutral pH mine water (station NMW) introduced to the Portal Creek diversion and the 5200 and 5400 portal discharges piped to the river. The local runoff and seepage from the 5400 waste dump continued to drain to the Exfiltration Pond (station SE-2) – although there was little flow at that time of year. Once the fabric was replaced, the 5400 portal was once again sent to the pond as well. The 5200 portal continued to be piped directly to river, until late October, while there was no activity underground and plenty of flow in the river adjacent to the mine. This is essentially the condition that had previously existed for over 50 years, until late 2011. During the 2015 freshet, the water level in the pond was again observed to be increasing, so in early June – once the Tulsequah River was into summer flow conditions – the 5200 portal discharge was re-directed straight to the river, consistent with historical practices.

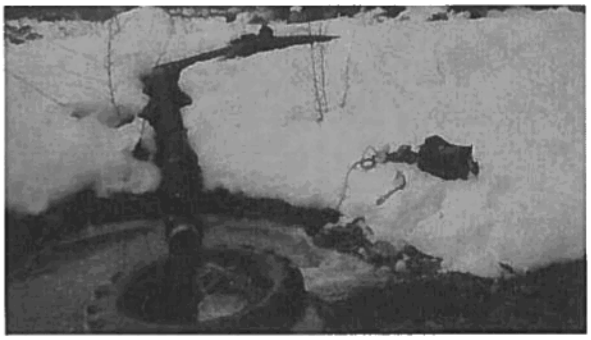
The Neutral pH Mine Water (NMW) (Picture 1 and Picture 2) and the Site Exfiltration pond (SE-2) (Picture 3 and Picture 4) were sampled in October and November. Station NMW is the clean, neutral pH water diverted from underground and discharged to the Portal Creek diversion, and so is monitored separately. During this Q4 monitoring period, the site Exfiltration Pond (station SE-2) represents the combined flow from the 5200 and 5400 portals, along with the local runoff (including from the waste rock dumps), as shown in Figure 1. During the summer and early fall, the 5200 portal flow bypassed the Exfiltration Pond and discharged by pipe directly to the river over the riprap as discussed in the previous report. The 5200 Portal flow had been redirected back to the Exfiltration Pond prior to collection of the October sample from the Exfiltration Pond.

Samples from SE-2 and the NMW were analyzed for total and dissolved metals (by ICP/ICPMS) and physical parameters including pH, conductivity, hardness and alkalinity/acidity. Laboratory and field parameter results are provided in Table 1 for key parameters.

Station SE-2 continues to be characterized by high dissolved metal concentrations, and low pH (pH 3.0-3.5), primarily driven by the loading from the 5200 portal discharge. Sample results for sulphate, total and dissolved zinc and cadmium concentrations for the monitoring period are shown in Figure 2, Figure 3 and Figure 4, respectively. Trends at station SE-2 are generally scattered, reflecting the variety of inputs; however, metal concentrations in Q4 2015 are generally comparable to previous concentrations. It should be noted that the highest values for sulphate, Cd and Zn (Aug 2014 and June 2015) both coincided with the times when the 5200 portal flow has been directed to the river rather than through the Exfiltration Pond and thus the reported results are more representative of the small amount of 5400 Portal flow rather than the larger 5200 Portal flow. The complete set of analytical results for station SE-2 is provided in the water quality database in Appendix A. Appendix B provides a number of plots comparing the 5200 and 5400 portal discharge analyses with the more recent SE-2 values, further demonstrating that biogeochemical conditions remain consistent with the past.

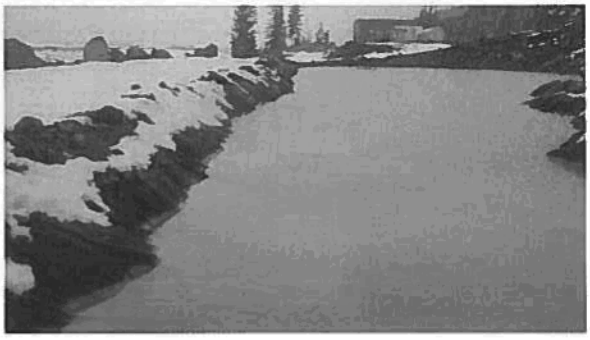
The Neutral pH Mine Water (NMW) is characterized by neutral pH with low metal concentrations (Table 1) and low suspended solids concentrations. Metal concentrations are more comparable to receiving environment values (Section 2 below), than to Exfiltration pond (SE-2) concentrations, and are will below the permit limits. Acidity (to pH 8.3) was not analyzed for in the laboratory suite, because of the neutral pH. It is interesting to note that the arsenic values in the NMW are higher than the portal discharges or SE-2, likely because of the absence of iron in the neutral pH water, but still well below the permit limit for the treated water. The complete set of analytical results for station NMW is provided in the water quality database in Appendix A.

Picture 1 – NMW Discharge (Oct 17, 2015)



Picture 2 – NMW Discharge in to Portal Creek Diversion (November 22, 2015)

Picture 3 – Exfiltration pond (Oct 17, 2015)



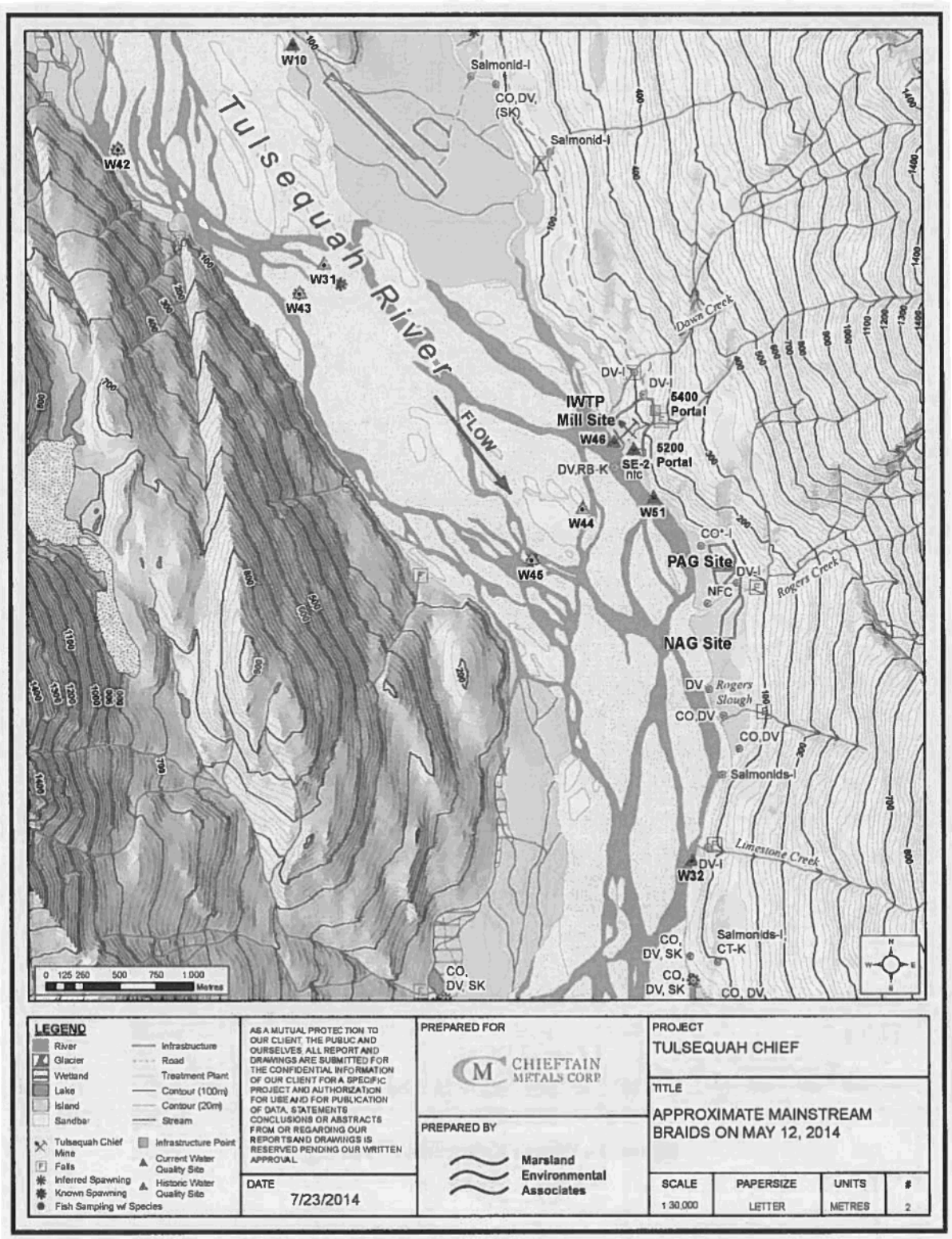
Picture 4 – Exfiltration pond (Nov 22, 2015)

Table 1 – SE-2 and NMW Water Quality for Key Parameters for Q4 2015

Parameter	Unit	SE2		NMW	
		17-Oct	22-Nov	17-Oct	22-Nov
Temperature – Field	°C	6.3	4	8.4	8.0
pH –Field	pH units	3.14	3.24	7.19	7.38
pH - Lab	pH units	3.33	3.26	7.94	4.94
Conductivity - Field	µS/cm	487	464.6	226.3	221.6
Conductivity - Lab	µS/cm	846	883	368	374
TSS	mg/L	24.3	22.5	2	2
D - Hardness	mg/L $CaCO_3$	210	207	145	145
Acidity (pH 8.3)	mg/L $CaCO_3$	183	199		
Sulphate	mg/L SO_4	310	334	77.3	71.8
Dissolved Metals					
Aluminum	µg/L	10000	13600	10	26.8
Arsenic	µg/L	1.49	1.83	27.7	27.2
Copper	µg/L	9980	8880	0.1	0.1
Lead	µg/L	143	118	0.45	0.1
Zinc	µg/L	45300	40500	13.1	14.1

Red indicates a value reported as less than the reportable detection limit, and presented as ½ the detection limit in the table above.

Figure 1 – Monitoring Locations Associated with the Receiving Environment



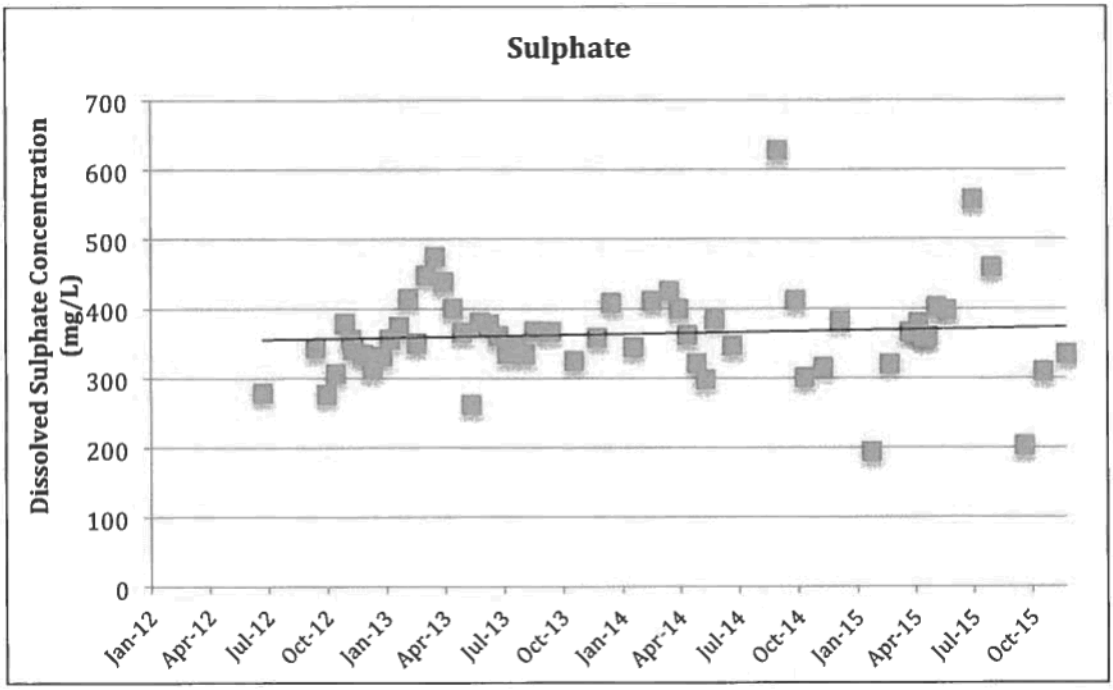


Figure 2 - Sulphate in Exfiltration Pond (SE-2)

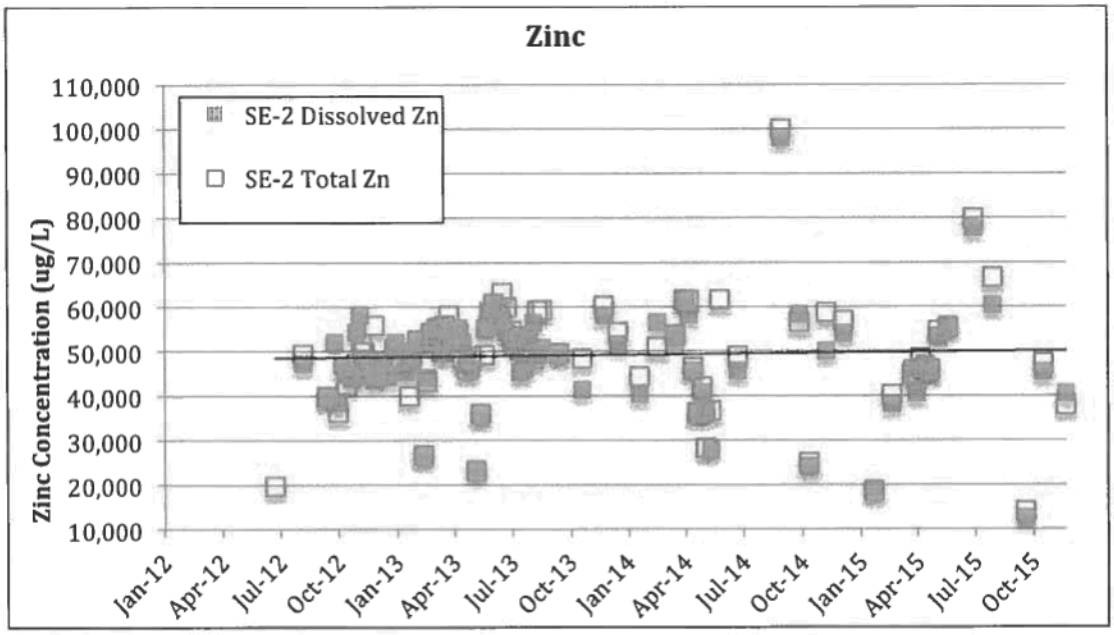


Figure 3 - Zinc in Exfiltration Pond (SE-2)

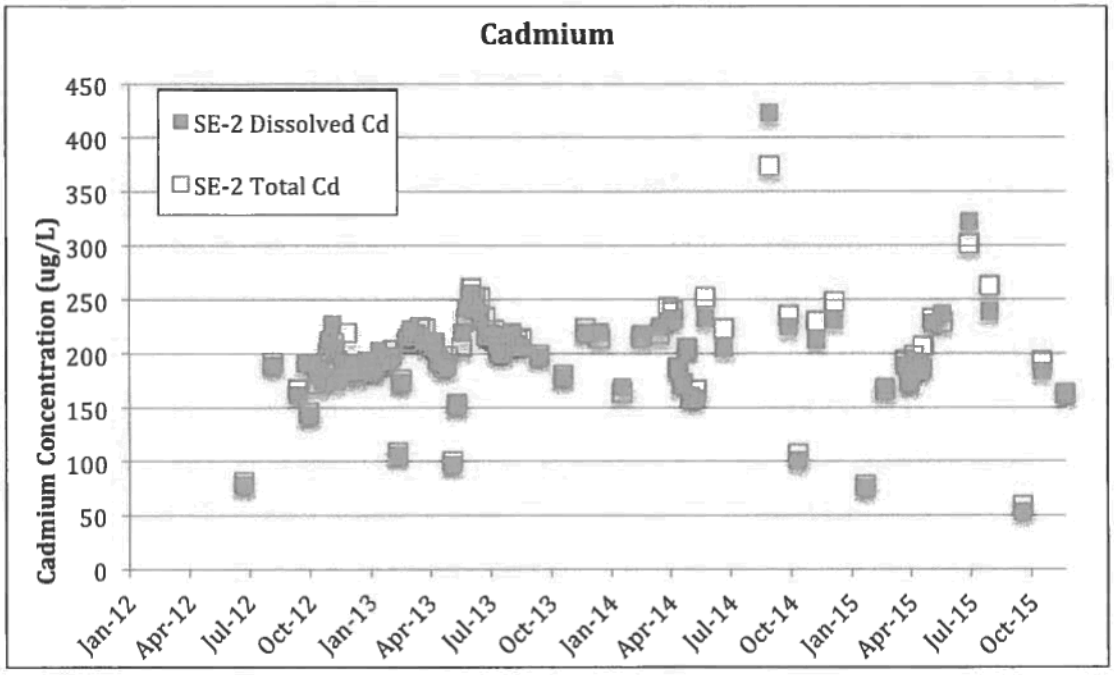


Figure 4 - Cadmium in Exfiltration Pond (SE-2)

2 RECEIVING ENVIRONMENT MONITORING

The latest jokulhaup occurred between June 30th and July 4th, 2015. It was a relatively small flood this year resulting in a peak discharge at Canyon Island on the Taku River of 69,000 cfs on July 2nd. Of that peak daily discharge, just over 40,000 cfs (~1,200 m^3/s) would have been the flow from the Tulsequah River.

On-going water quality monitoring in the receiving environment includes four sites along the Tulsequah River (Figure 1).

- W10 (4.5 km upstream from the site) - to provide background water quality.
- W46 (directly downstream of the IWTP discharge point) - to monitor water quality prior to complete dilution. Also serves as a background station while the IWTP is not operating. This station was discontinued in July 2015, when the river moved away from the bank at this location.
- W51 (~325 m downstream from the SE-2 discharge zone) – to monitor water quality after the initial dilution zone (IDZ).
- Station W32 (2.7 km downstream from the SE-2 discharge zone) – to monitor fully mixed water quality downstream of the mine site.

Water quality sampling is conducted monthly, with more frequent sampling during spring melt. Laboratory analysis includes total and dissolved metals (by ICP/ICPMS) and physical parameters including pH, conductivity, turbidity, total suspended solids, hardness and alkalinity. Full water quality results are provided in Appendix A, and the results from Q4 2015 for key parameters of concern are

provided in Table 2, compared to receiving environment water quality guidelines. The water quality guidelines for aluminum, copper, and zinc were taken from the site specific water quality objectives developed by AECOM, based on background water quality at W10, and presented in the report titled, "Tulsequah Chief Mine: Site Specific Water Quality Objectives" dated December 2008. These values were revisited in Table 3 of the Q3 2014 monitoring report, which suggests these (or very similar) values are still applicable, other than for D-Al. The D-Al number has been affected by a change in sampling technique, and could be revised downwards to 433 ug/L based on the P95 value for data up to November, 2015. For the same dataset, the P95 values for total copper and total zinc are virtually unchanged, at 13.3 ug/L and 30.2 ug/L, respectively, as would be expected. Water quality guidelines for arsenic and lead were sourced from the BC Water Quality Guidelines for the Protection of Aquatic Life. The lead guideline is hardness dependent and increases with increasing hardness levels. A hardness value between 20 mg/L and 40 mg/L was assumed, based on measured values at W10 in that range. Water quality results for each monitoring site are discussed further below.

Table 2 – Receiving Environment Water Quality Monitoring Results – Q4 2015

Parameters	Unit	Water Quality Objective	W10		W51		W32	
			17-Oct	22-Nov	17-Oct	22-Nov	17-Oct	22-Nov
Temperature – Field	°C		0.7	0.1	2.6	1	7.3	1.1
pH –Field	pH units		7.88	6.93	7.89	7.18	7.95	7.67
pH - Lab	pH units		7.59	7.56	7.71	7.73	7.86	7.91
Conductivity - Field	µS/cm		29.9	32.4	45.3	53.9	53.6	66.8
Conductivity - Lab	µS/cm		63.2	68.8	89.1	111	101	136
TSS	mg/L		75.3	48.5	40.3	11.3	13	4
Total Alkalinity	mg/L $CaCO_3$		20.8	21.9	28.2	35.3	42.8	53.6
Total Hardness	mg/L $CaCO_3$		26.8	29.7	57.7	73.6	47.1	61.2
Sulphate	mg/L SO_4		9.56	10.9	13.4	16.9	7.73	9.89
Metals								
Dissolved Aluminum	µg/L	611*	74.9	64.6	48.1	75.1	32.6	45.5
Total Arsenic	µg/L	5	3.01	2.51	3.11	1.77	1.91	0.98
Total Copper	µg/L	13	10.2	8.55	12	20.4	2.88	2.46
Total Lead	µg/L	6	3.06	2.38	2.22	1.33	0.45	0.2
Total Zinc	µg/L	31.9	22.2	17.6	42.9	99	8.7	7.1

Red indicates a value reported as less than the reportable detection limit, and presented as ½ the detection limit in the table above.
Note: Shaded cells indicate values in exceedance of the Water Quality Objective. *D-Al value based on data from 1994 to 2008.

2.1 Tulsequah River upstream of Mine Site (W10)

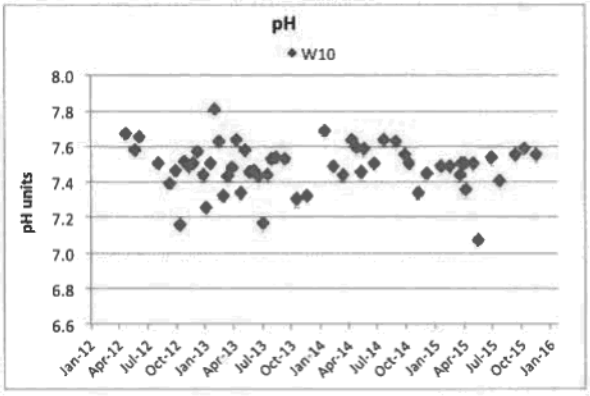
The conditions at the station W10 in Q3 are shown in Picture 7 and Picture 8. The jokulhaup has brought the main flow of the river right in to the riprap protecting the northern end of the airstrip and has caused some undercutting there. Concentrations for key parameters are presented in Figure 5 compared to the water quality objectives, for the 2012 - 2015 monitoring period. Generally the water quality at station

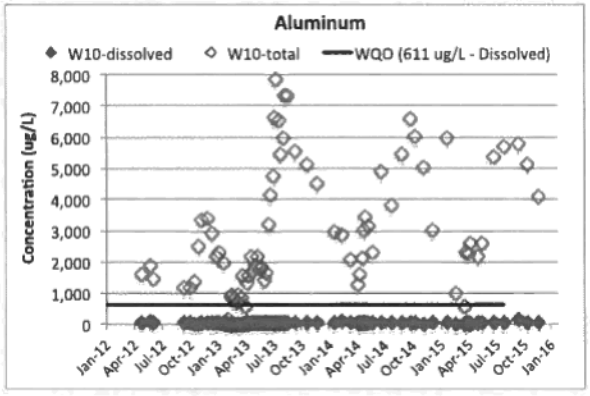
W10 is below the water quality objectives, although total aluminum concentrations are often greater than the dissolved aluminum objective (Figure 5). The copper concentration in the September 2015 sample is at the P95 level for the background dataset, and just slightly above the P90-based value determined in 2008. Dissolved fraction metal concentrations (zinc, aluminum, lead) are mostly less than the detection limit. The pH values at station W10 are circumneutral (average pH 7.5). The Q3 2015 sample results are comparable to the 2012-2014 sample concentrations.

Total metal concentrations exhibit seasonal trends where concentrations are slightly elevated at a certain time of the year, then decrease over the winter. In 2013 the metal concentrations peaked in July, whereas in 2014 the peak concentrations were exhibited in September and October. Total metals levels appear to be highest during the time of year when glacial melt water containing elevated levels of TSS (August – October) is a major contributor to the total Tulsequah River streamflow.

Picture 7 – Station W10 (Oct 17, 2015)

Picture 8 – Station W10 (Nov 22, 2015)





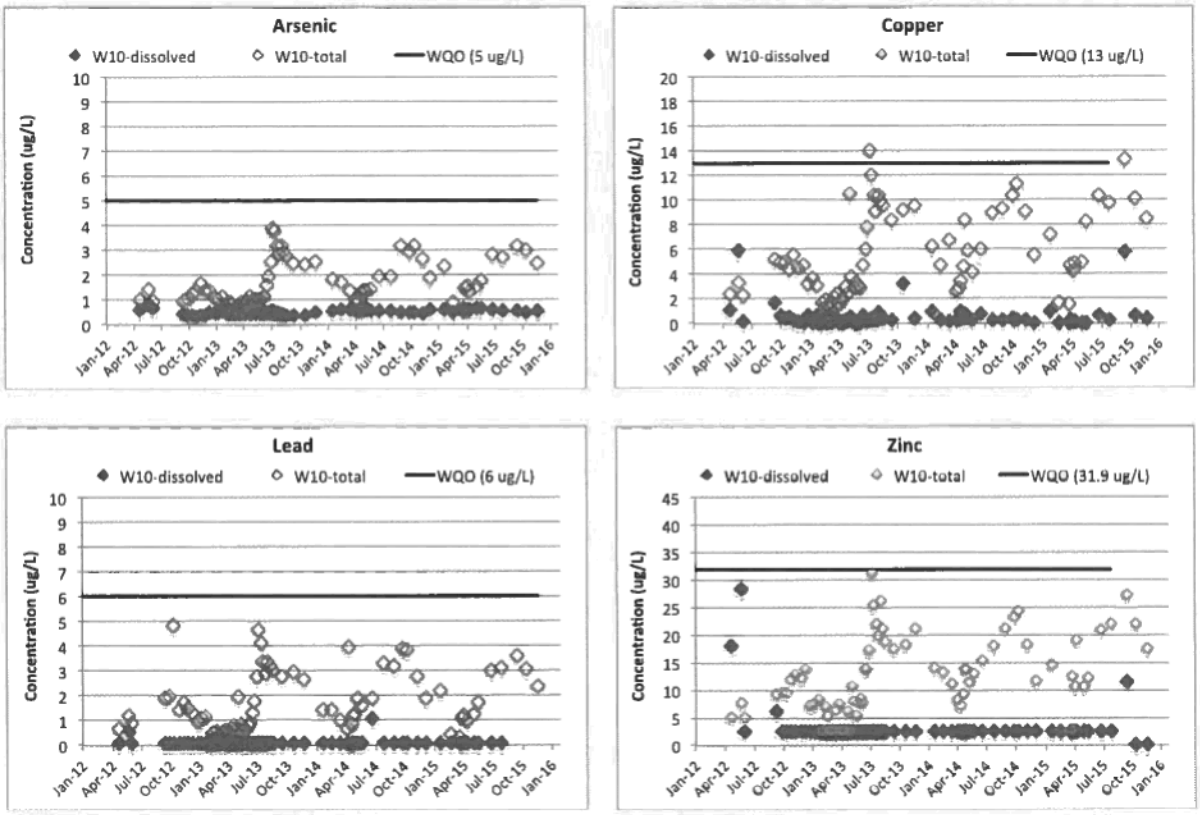


Figure 5 – Key Parameter Water Quality Results at Station W10, January 2012 – December 2015

2.2 Tulsequah River IDZ (W46)

As the acid treatment plant is not operating, station W46 also serves as a background water quality station. The Tulsequah River water quality at W46 is normally partly influenced by the flow from Shazah Creek as well as the local area tributaries of Dawn Creek and Camp Creek. The jokulhaup this summer pushed the mainstem of the river away from the bank at the ATP location, so the only water present near the normal W46 sampling location is from Camp and Dawn Creek. Since this creek water is not comparable to Tulsequah River water at W10 or W51, sampling at this station will be suspended until the river location changes again. Picture 9 and Picture 10 show the stream reach where the ATP would discharge and where the W46 would normally be sampled.

Picture 9 – ATP Discharge location – upstream of W46 (October 14, 2015)

Picture 10 – Looking downstream towards Station W46 (October 14, 2015)

2.3 Tulsequah River Near Field Downstream (W51)

The location of station W51 is shown on Figure 1. Conditions in Q4 are shown in Picture 11 and Picture 12.

Water quality results for station W51 are presented in Figure 6 for the 2012 - 2015 monitoring periods and are compared to the water quality objectives or Toxicity Reference Values (TRV) used in the Aquatic Ecological Risk Assessment. The metal concentrations at station W51 vary widely over the year, mostly in response to available dilution in the channel adjacent to the mine. Peaks in concentrations evident in Q3 decreased in Q4 2014, and continued to decrease in Q1 2015, similarly to trends in early 2014 Generally, water chemistry in 2015 is comparable to concentrations over the same period in 2014, until Q4 (Figure 6). Normally in Q4, the concentrations of Cd, Cu and Zn increase from the summertime values. However, this year the concentrations for these signature parameters remained in the same range.

In Q4 2015, water quality at monitoring station W51 was generally in exceedance of the water quality objectives for total copper and zinc (Table 2), similar to samples taken at station W51 in previous years. The pH values at station W51 are circumneutral (average value pH 7.55). Total suspended solids concentrations are low during April and May but increased in June as the glacier meltwater contribution increased. However, concentrations in Q4 are typically considerably higher than in Q3, as flows decrease with the onset of winter. This year, instead, concentrations only increased slightly, if at all. It is suspected that this is a result of seepage from the Exfiltration Pond entering the gravels of the river floodplain rather than mixing directly with the river water on surface. Photo 13 shows the ground conditions in mid-October. As water levels dropped further in November, even less of the seepage would have been able to mix directly with the river water. The zinc plot in Figure 7 best illustrates the usual trend of increasing concentration over the winter, peaking in April. Concentrations at station W51 increase in Q4 and Q1 as river flows decrease. The size of the peak has been smaller in years subsequent to 2012/13, but this year (winter 2015/16) there is only a barely discernable increase in concentration in October and November. A sneak preview of the January 2016 data, shows the zinc remains below the TRV at W51.

For the past three years, from late May until October, cadmium and zinc concentrations at W51 remain well below the TRV (and often below the WQO), during the time of year with greatest fish utilization of the mainstem.

Picture 11 – Station W51 (Oct 17, 2015)

Picture 12 – Station W51 (Nov 22, 2015)

Picture 13 – Seepage from Exfiltration Pond filtering in to floodplain adjacent to berm (Oct 14, 2015)

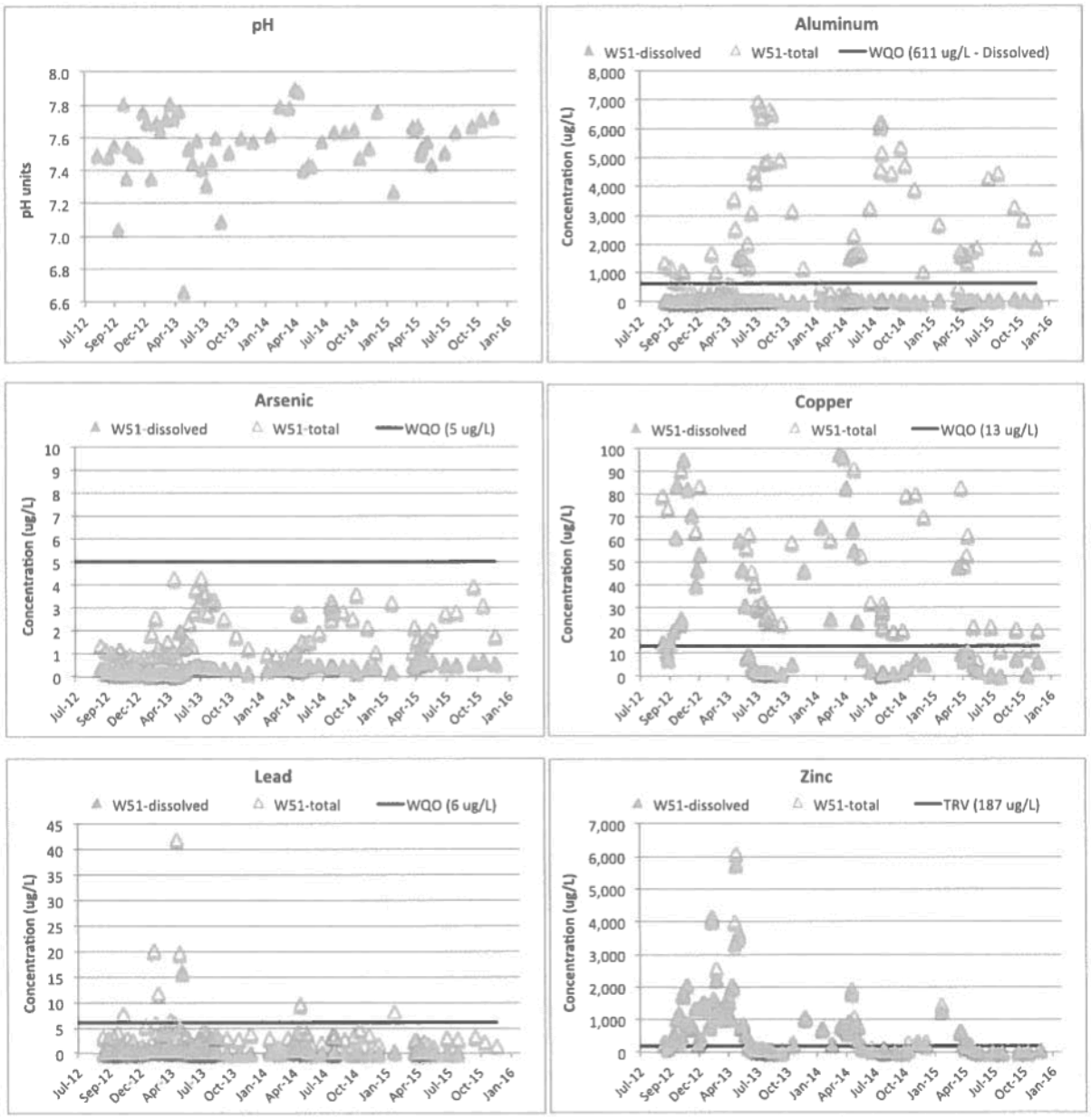


Figure 6 - Key Parameter Water Quality Results at Station W51, July 2012 to November 2015

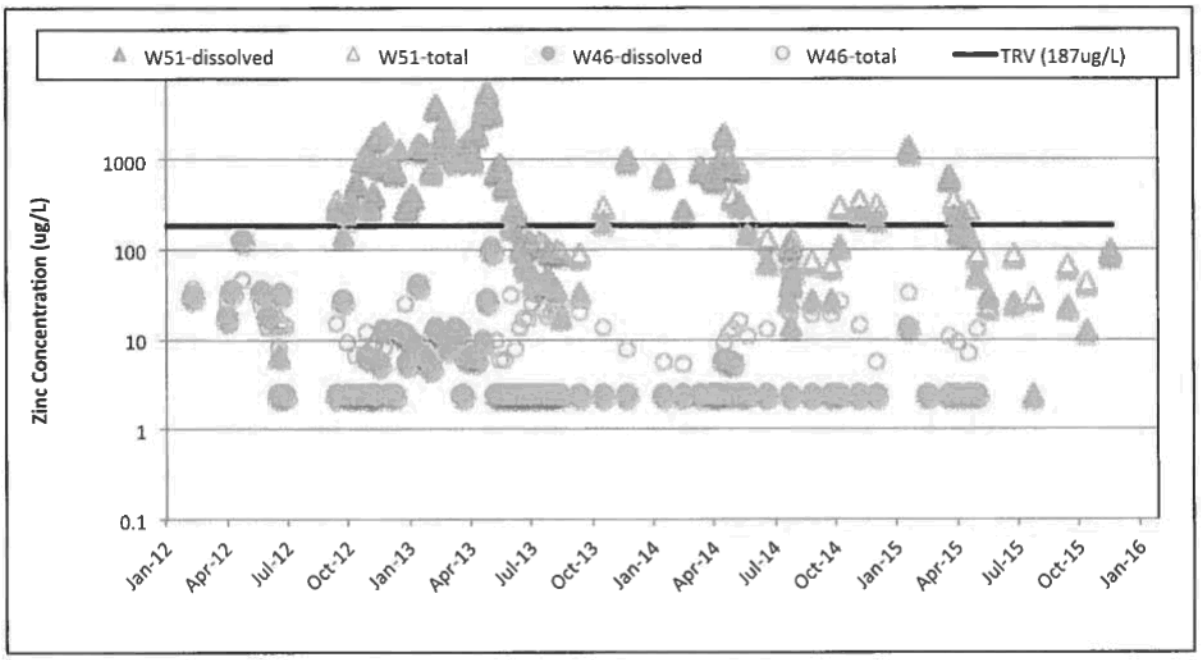


Figure 7 - Zinc Concentrations at Stations W46 and W51, January 2012 to December 2015

2.4 Tulsequah River Far Field Downstream (W32)

Water quality results for station W32 are presented in Figure 8 and are compared to the water quality objectives for the 2012 - 2015 monitoring periods. Station W32 in October and November is shown in Picture 13, and Picture 14, respectively. It is worth noting that the discharge of Limestone Creek entering the river can be seen – which was not typical in the past. Furthermore, the colour of the water at W32 is different than at W10 and W51. This is primarily because of lower turbidity (caused by lower TSS) in the water. Based on visual observations in October 2015, it appeared that most of the water at the W32 sample location is derived from Roger's Slough and Limestone Creek, with some contribution from Roger's Creek and a small braid of the Tulsequah river mainstem. Dissolved metal fractions at station W32 were generally low in Q3 and Q4 2015, and many were less than the reportable detection limit. Similarly, total metal fractions at station W32 were lower than at the other two (W10 or W51) river stations. Total metal concentrations of copper and zinc were also lower in Q3 and Q4 than in Q1 or Q2 2015. Based on the analytical results and observations of the river braiding in October, it appears that the sampling location used for W32 since late 2008 is no longer viable for assessing far-field impacts of the discharge from the mine site. For the November sampling campaign, the sample location was moved across the floodplain and slightly downstream to a river braid that is better exposed to the contaminant loading. Appendix C contains a series of photos to show the river braiding between the minesite and W32. It appears that most of the contaminant load from the mine is being directed away from the outlet of Limestone Creek, where W32 has been located since 2008. It does appear that most of the load should re-combine at about the location where the W32 sample was collected in November (and again in January 2016). However, closer inspection of the water quality data from November suggests that the new location may still have been just a little bit too far upstream to catch the full load from the mine. The February 2016 sample location will again be moved slightly further downstream such that the full mixing of the two braids can be sampled. It should also be noted that the Exfiltration Pond drainage is currently

discharge to the dry floodplain, as was discussed under W51 in Section 2.3. This appears to be reducing the overall loading to the Tulsequah at this time of year.

The paired correlations for sulphate, cadmium and zinc concentrations at stations W32 and W51 are shown in Figure 9, Figure 10 and Figure 11, respectively. The discrepancy in sulphate values in the latest sampling can be seen in the one value located well below the correlation line at the low end of the range of observed sample concentrations. There had initially been (prior to July 2013) reasonably good correlation between W32 and W51, reflecting the dilution occurring at about 30-fold for Cd and Zn. However, after the 2013 jokulhaup flood, which started on July 3rd, and started receding on July 6th, 2013, there seemed to be a change in the concentrations at W51 relative to the prior data. The Cd and Zn data displayed on Figure 12 and Figure 13 make this change particularly evident, by highlighting the year-to-year differences during the snow melt season (March to May). It is not as easy to see the change in the sulphate data since the incremental loading from the seepage is always readily diluted at W51. The 2014 flood occurred in mid July, and the data subsequent to July 2014 have been added to the graphs as a third group. It is clear that the dilution ratio has changed yet again, with even more dilution occurring quickly, between the Exfiltration Pond and W51, while the ultimate concentration at W32 remains unaffected. As mentioned, the 2015 flood occurred around July 2nd, but it now appears that a new correlation trend is not relevant for the sampling location used in Q3, since the flow is not representative of downstream conditions in the mainstem of the river.

The effect of dilution is also evident when comparing sulphate and metal concentrations between stations W32 and W10 (Figure 14, Figure 15, and Figure 16, note the logarithmic scale in the zinc graph). Sulphate and metal concentrations remain relatively stable at station W10 (upstream of the mine workings), however, the concentrations at station W32 (downstream of the mine workings) normally increase as flow diminishes over the winter, and then decrease again with the onset of freshet. During the ice-free periods, the concentrations of sulphate and total and dissolved metals are comparable upstream and downstream of the mine (even without treatment plant operation). The 2014 concentrations at both stations were comparable to historic values, confirming that the changes at W51 relate to river braiding, not to changes in total river flow. The 2015 values have been strongly affected by the changes in river braiding, as discussed above. Additional sampling at W32 over Q1 2016 should help evaluate the cause. Regardless of the cause, the concentrations in the river are lower this quarter than in past years.

Picture 16 – Looking upstream from Station W32 (Oct 17, 2015) – Limestone Creek can be seen entering from right

Picture 17 – New Station W32 looking towards Chief minesite (Nov 23, 2015)

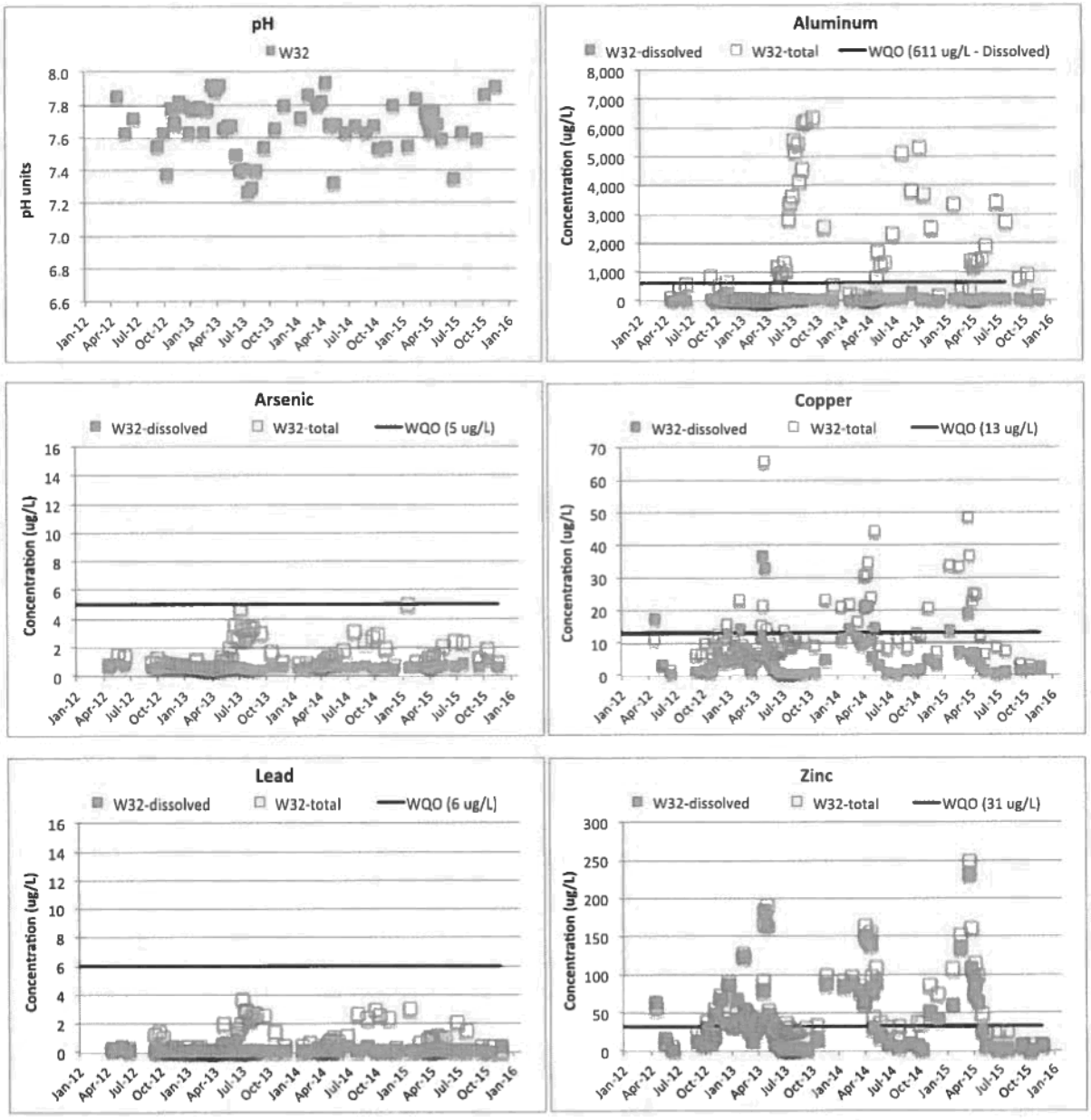


Figure 8 – Key Parameter Water Quality Results at Station W32, January 2012 – November 2015

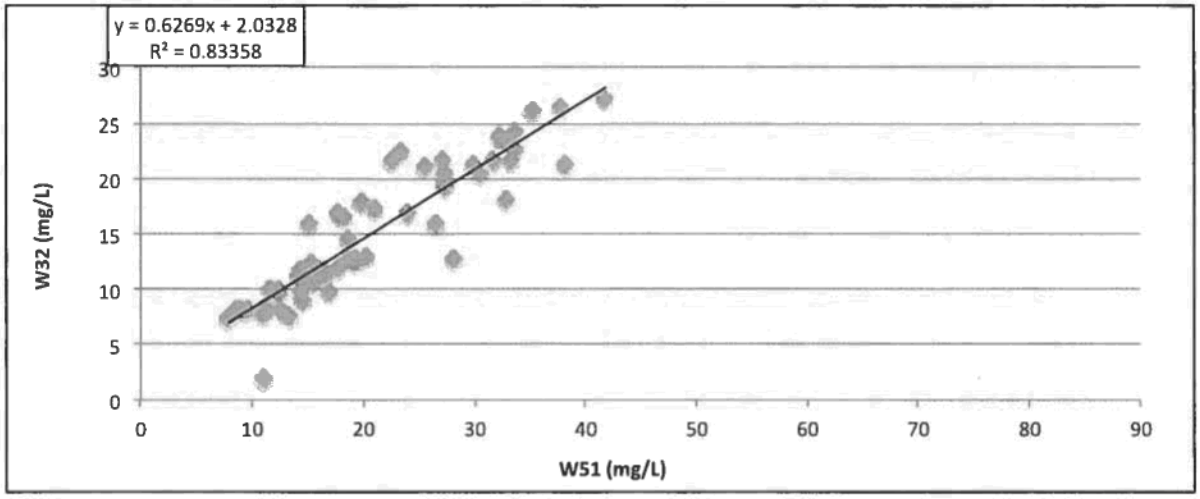


Figure 9 – Paired Correlation for Sulphate at W51 and W32

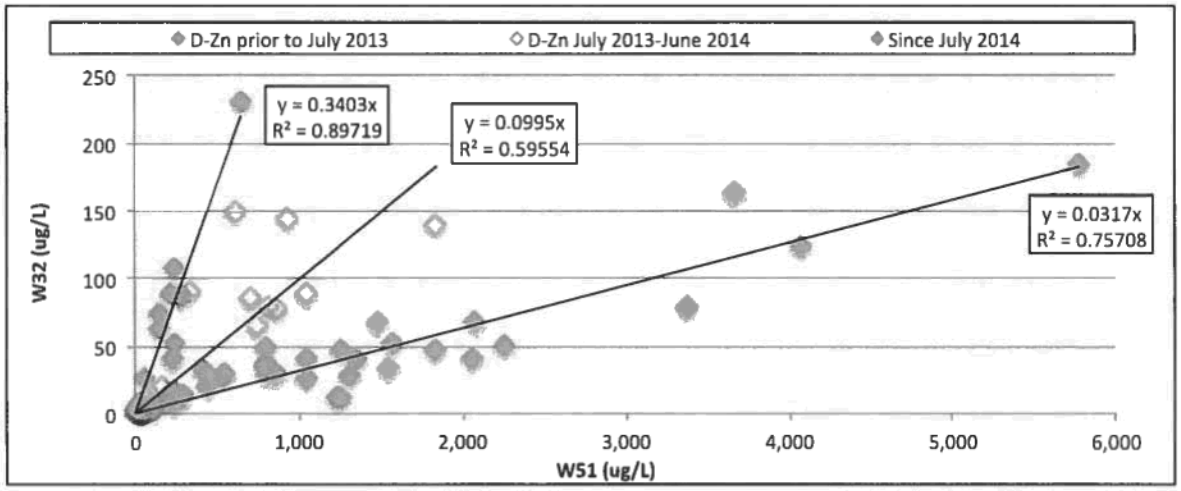


Figure 10 – Paired Correlation for Dissolved Zinc at W51 and W32

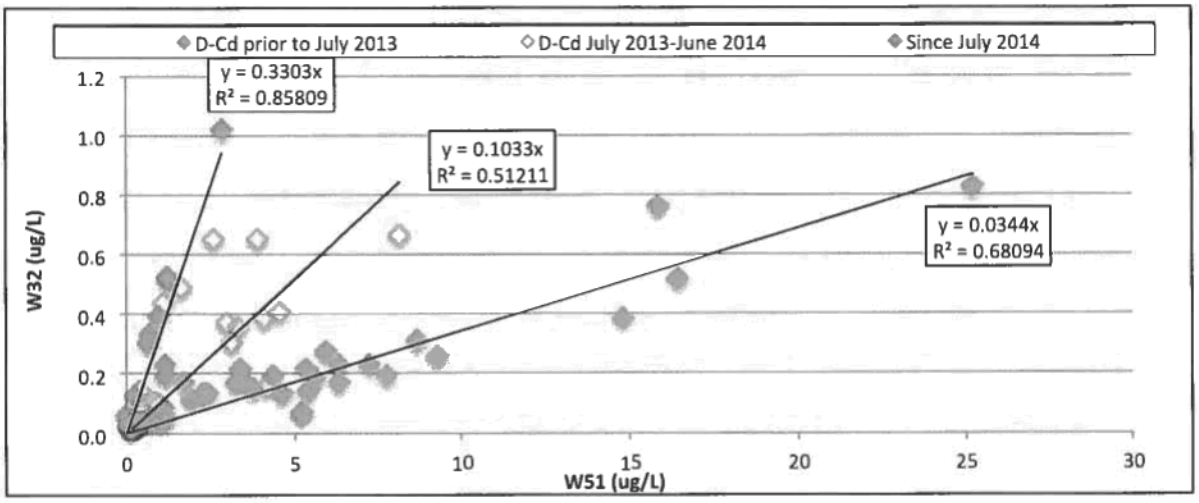


Figure 11 – Paired Correlation for Dissolved Cadmium at W51 and W32

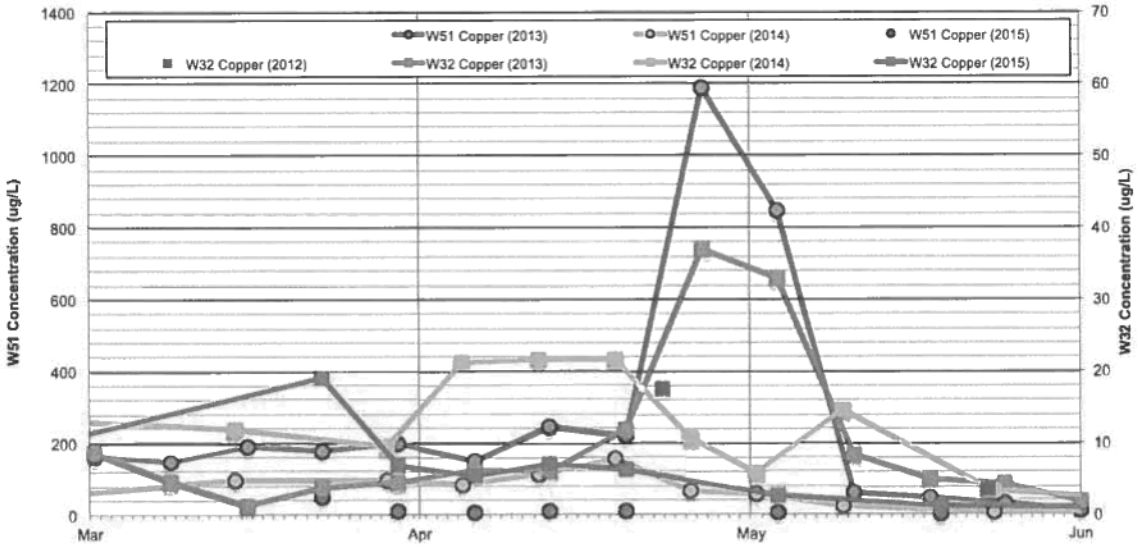


Figure 12 –Dissolved Copper at W51 and W32 during snow melt period from 2012 to 2015

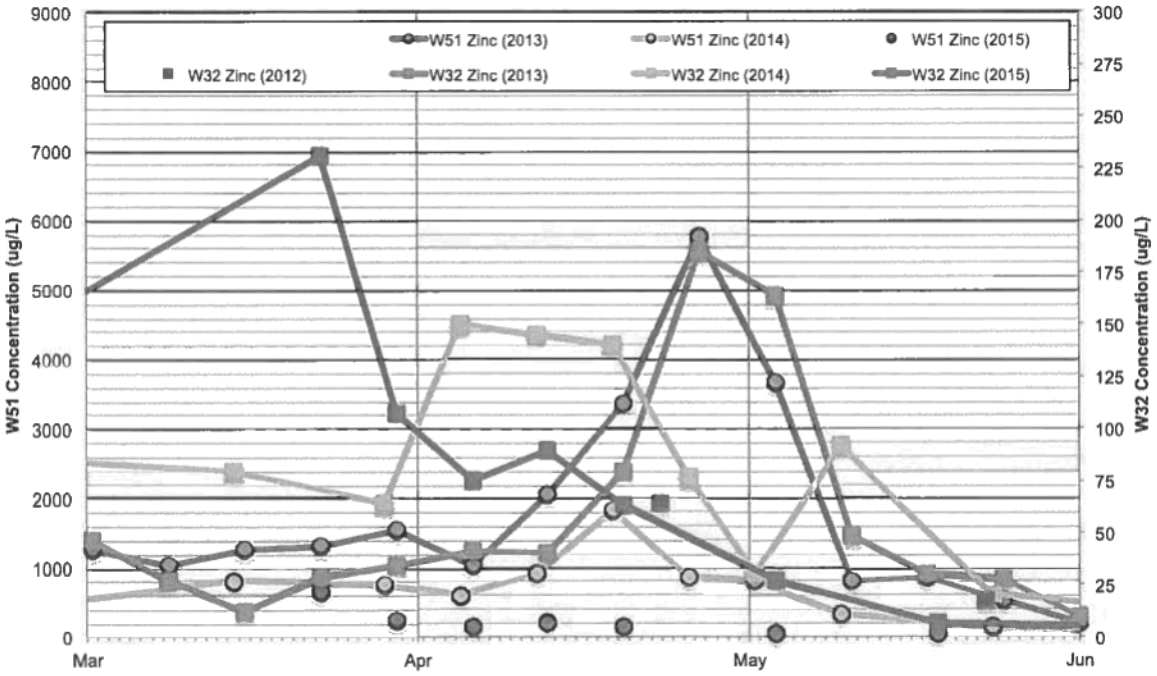


Figure 13 –Dissolved Zinc at W51 and W32 during snow melt period from 2012 to 2015

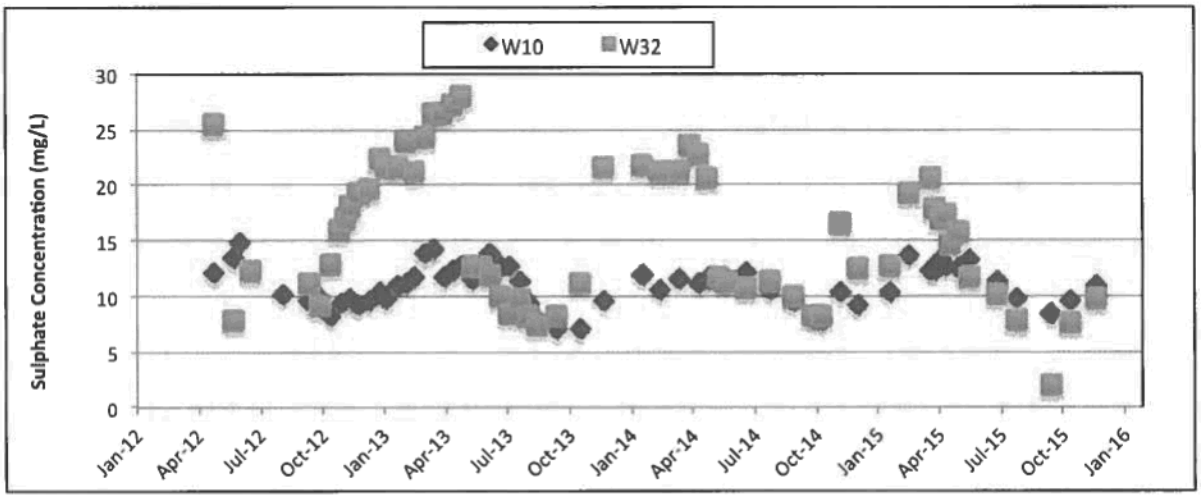


Figure 14 - Sulphate Concentrations at Stations W10 and W32

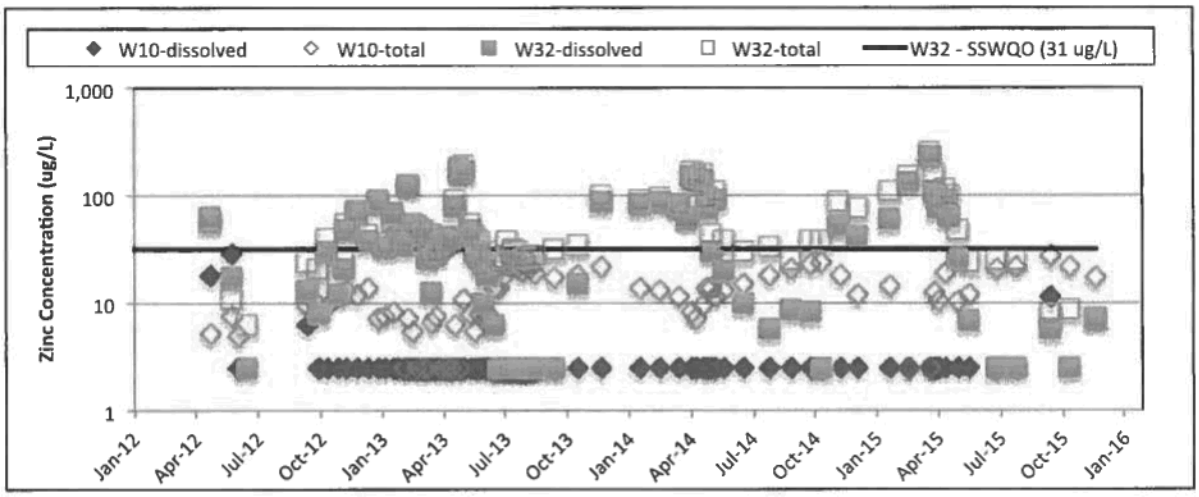


Figure 15 - Zinc Concentrations at Stations W10 and W32

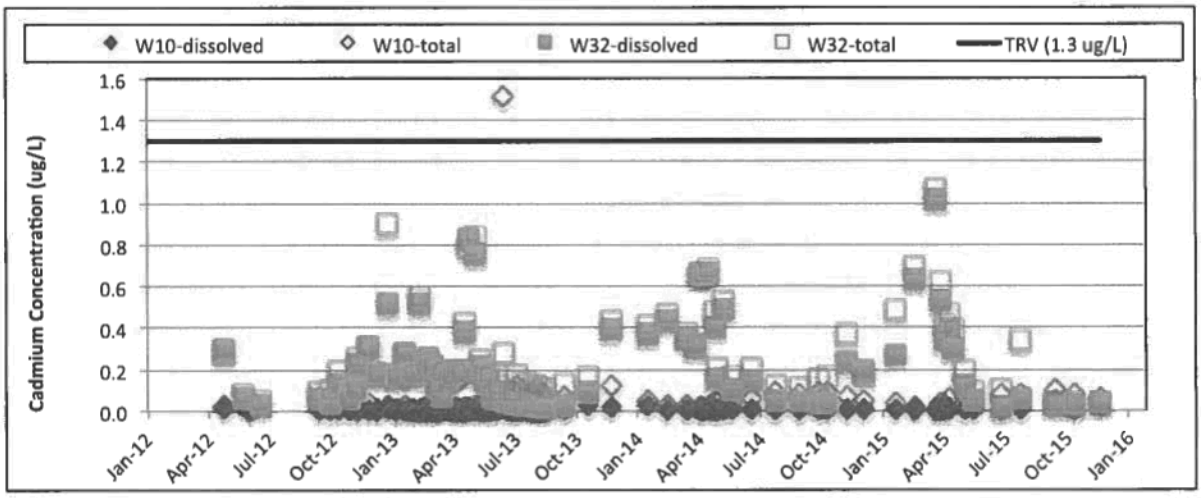


Figure 16 - Cadmium Concentrations at Stations W10 and W32

3 ATP SLUDGE MONITORING

No fresh sludge has been produced since the ATP was shut down. Sludge production (volume) was recorded and reported at the time that the totes were filled and transported away from the ATP, whether to the pond by the plant or the airstrip. No residual sludge has been transported from the sludge pond at the ATP to the sludge pit at the airstrip since the summer of 2012. Additional samples of the sludge were collected from the sludge pit by the airstrip in May 2014, and analytical results were presented in the Q2 2014 quarterly report.

4 MONITORING WELLS AT SLUDGE PIT

Water levels are measured in the groundwater monitoring wells, by measuring the depth of water from the top of the well. Figure 17 shows the locations of the wells relative to the sludge pit and airstrip. The elevation of the surface of the sludge was surveyed in May 2014, and was found to be up to El 58.0 m

near the north end and around El 57.7 m further towards the south end. The bottom of the sludge pit varies between El 57.3 m and El 57.8 m, so the sludge is generally only a 10 cm to 50 cm thick layer.

Groundwater well sampling occurred on September 18, 2015. Water quality results for select parameters of concern are presented in Table 4. The results are compared to the *Contaminated Sites Regulations Schedule 6 Generic Numerical Water Standards for Aquatic Life* (CSR Standards) where applicable, with the most conservative standard (i.e., lowest hardness value) presented. Most values are at least one order below the CSR Standards, with the exception of cadmium at well SP11-1 for which the concentrations fluctuate around the CSR Standard (calculated using baseline hardness). These results are generally comparable to results from samples taken in 2011 - 2014. Graphical representations of samples taken 2011 –2015 are presented in Figure 19, Figure 20 and Figure 21 for dissolved sulphate, zinc and cadmium, respectively.

Results for water levels are presented in Figure 18 and Table 5, as are the water levels from 2011 – 2015, for comparison. Water levels in Q1 and Q2 2015 were apparently affected by beaver activities in the Borrow pit pond. The usual seasonal drop off in water level did not occur over the winter because, with the camp being unoccupied since November 2014, some beaver activity had blocked the culvert draining from the pond and succeeded in storing extra water and runoff over the winter. This apparently increased the elevation of the water table as far away as the sludge pit, a distance of a few hundred metres. By June, the Borrow pit pond was beginning to encroach on the core racks to the east of the pond so the log jam was removed from the culvert and normal pond water levels were restored. However, beaver activity has continued throughout Q3 and the borrow pit pond level has consistently remained above the invert elevation of the outlet culvert. Unfortunately, the pressure transducer in the borrow pit has been lost because the beavers removed the shrub to which the transducer cable was attached, so no continuous record of pond level is available after April 2015. Efforts to remove the beavers from the pond continue.

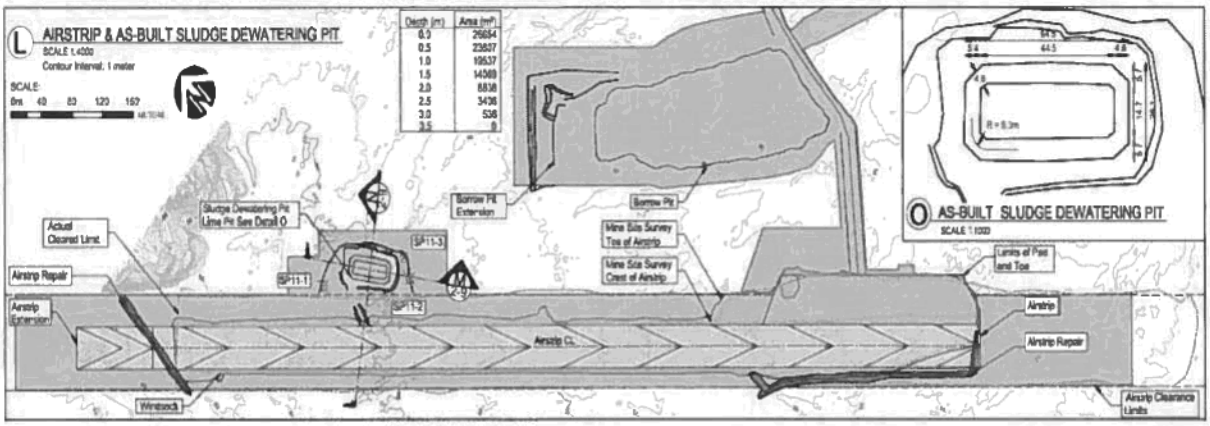


Figure 17 - Sludge Pit Monitoring Well Location

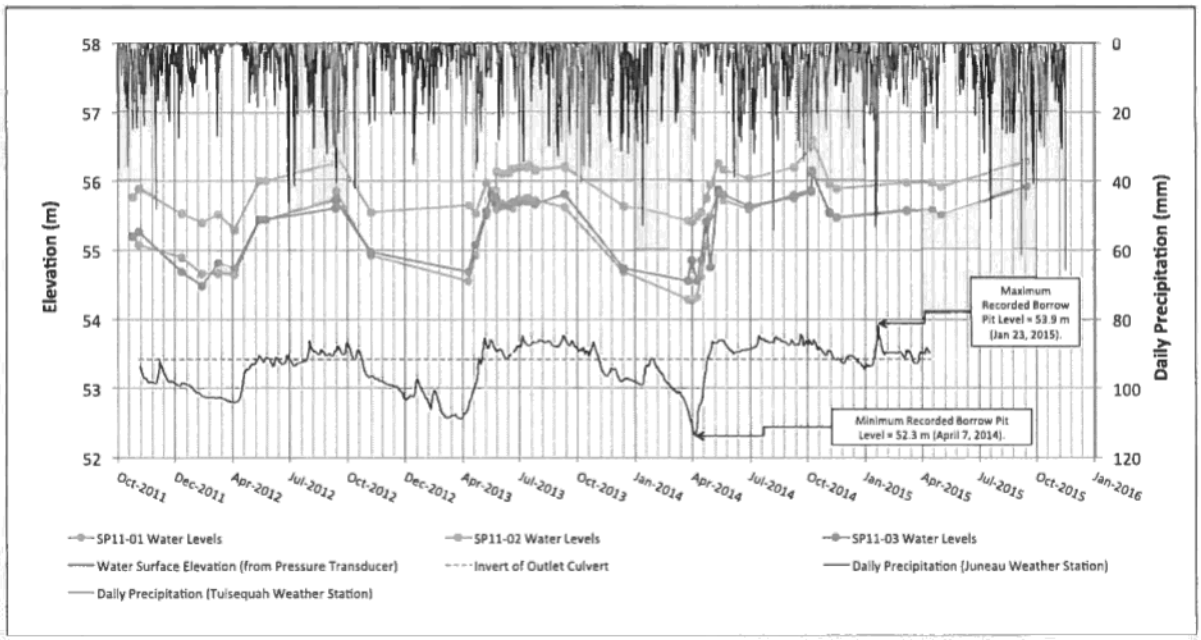


Figure 18 - Sludge Pit Water Levels

Table 4 – Sludge Pit Groundwater Monitoring Well Water Level Monitoring Results

Parameter	Unit	Contaminated Sites Regulations Schedule 6 Generic Numerical Water Standards for Aquatic Life*	Analytical Results		
			SP11-1 23-Nov	SP11-2 23-Nov	SP11-3 23-Nov
pH	pH units		7.38	7.47	7.56
Conductivity	uS/cm		185	124	109
TSS	mg/L		5.3	2	2
D - Hardness	mg/L $CaCO_3$		82	54.6	50.7
Sulphate	mg/L SO_4	1000	14.9	16.1	13.9
Chloride	mg/L	1500	1.2	0.51	0.6
Dissolved Metals					
Aluminum (Al)	ug/L		13.3	27.2	26.1
Antimony (Sb)	ug/L	200	0.25	0.25	0.25
Arsenic (Cs)	ug/L	50	0.94	0.13	0.05
Barium (Ba)	ug/L	10000	94.2	54.3	35.1
Beryllium (Be)	ug/L	53	0.05	0.05	0.05
Boron (B)	ug/L	50000	25	25	25
Cadmium (Cd)	ug/L	0.3	0.427	0.118	0.011
Cobalt (Co)	ug/L	40	8.09	0.25	0.25
Copper (Cu)	ug/L	20	2.16	1.9	0.63
Lead (Pb)	ug/L	40	0.25	0.1	0.1
Mercury (Hg)	ug/L	1			
Molybdenum (Mo)	ug/L	10000	0.5	0.5	0.5
Nickel (Ni)	ug/L	250	22.3	5.3	0.5
Selenium (Se)	ug/L	10	0.05	0.23	0.16
Silver (Ag)	ug/L	0.5	0.01	0.01	0.01
Thallium (Tl)	ug/L	3	0.025	0.025	0.025
Titanium (Ti)	ug/L	1000	2.5	2.5	2.5
Uranium (U)	ug/L	3000	0.13	0.05	0.05
Zinc (Zn)	ug/L	75	14.3	6.5	2.5

*Most conservative standard

Values in red were reported as less than the analysis method detection limit and shown here as 1/2 the method detection limit.

Highlighted values indicate exceedances of the CSR Standard

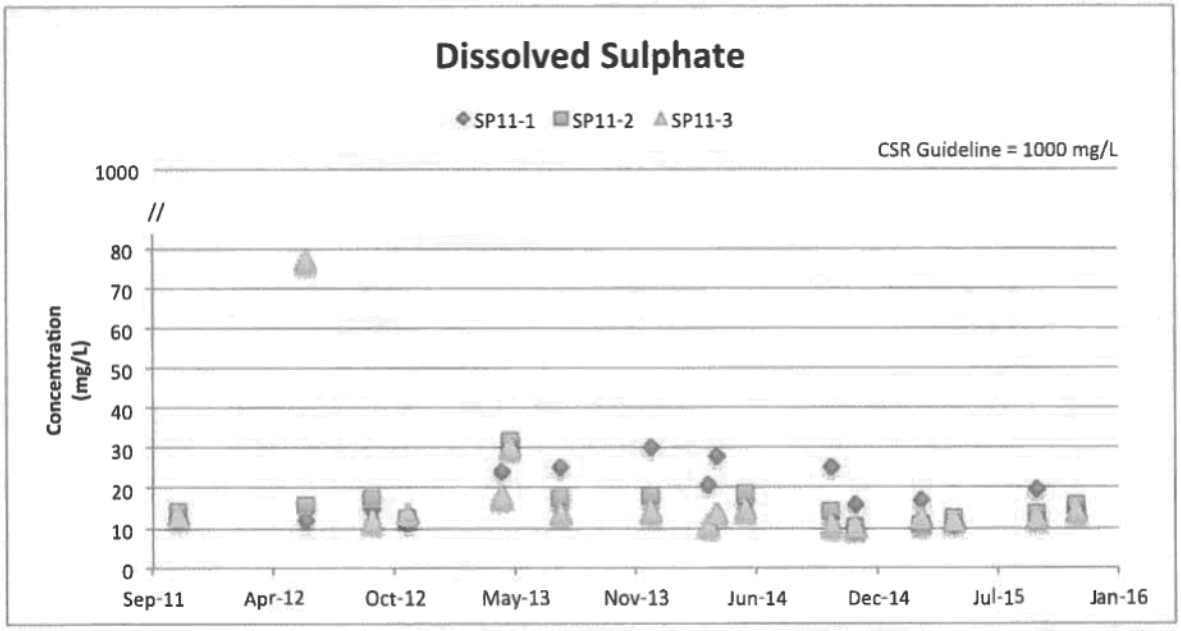


Figure 19 - Sulphate Concentrations at Sludge Pit Groundwater Monitoring Wells

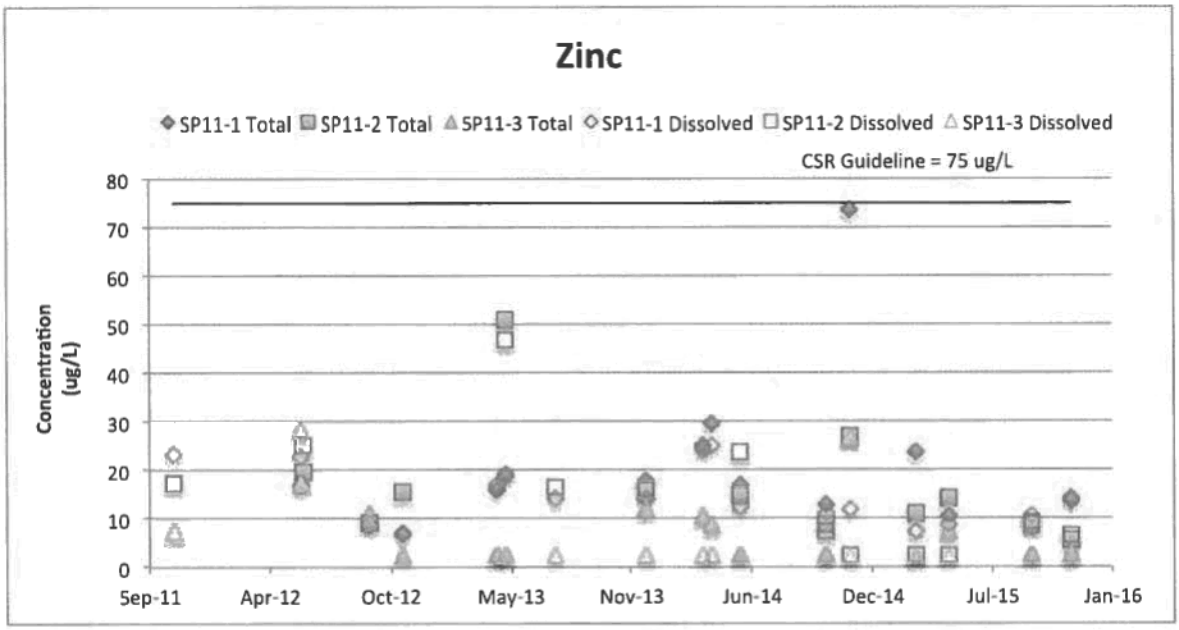


Figure 20 - Zinc Concentrations at Sludge Pit Groundwater Monitoring Wells

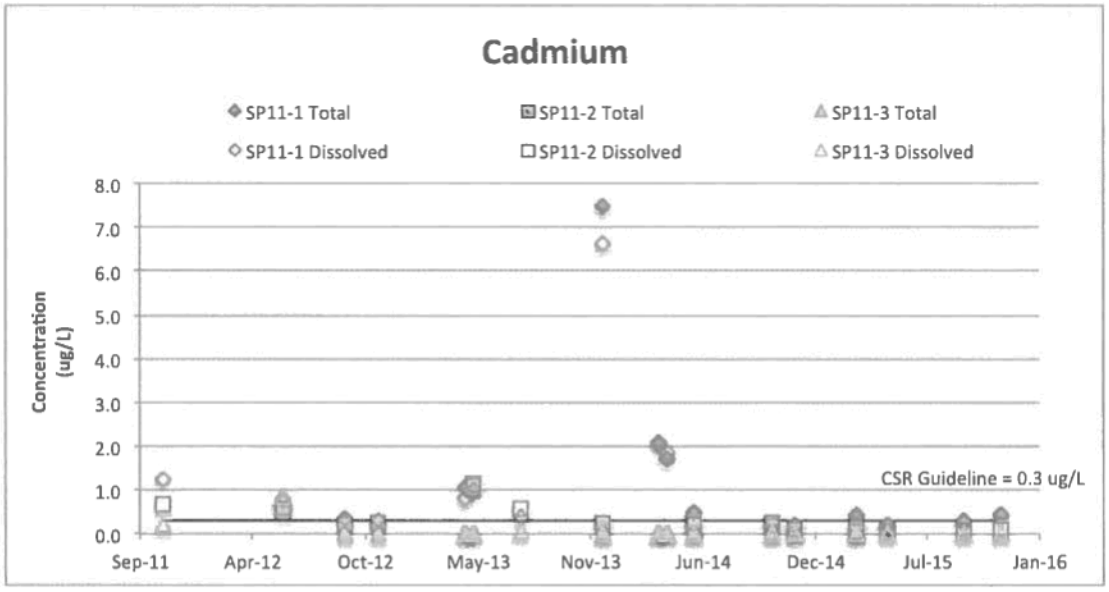


Figure 21 - Cadmium Concentrations at Sludge Pit Groundwater Monitoring Wells

Table 5 – Sludge Pit Groundwater Monitoring Well Water Level Monitoring Results

Well ID	SP11-1	SP11-2	SP11-3	Well ID	SP11-1	SP11-2	SP11-3
Date Measured	Water Level (masl)			Date Measured	Water Level (masl)		
25-Oct-11	55.77	55.22	55.19	13-Sep-13	56.20	55.63	55.81
04-Nov-11	55.88	55.08	55.26	15-Dec-13	55.64	54.69	54.74
11-Jan-12	55.54	54.90	54.69	27-Mar-14	55.42	-	54.55
12-Feb-12	55.40	54.66	54.84	03-Apr-14	55.41	-	54.86
10-Mar-12	55.51	54.66	54.81	11-Apr-14	55.49	54.33	54.56
04-Apr-12	55.30	54.65	54.73	18-Apr-14	55.54	54.62	54.85
15-May-12	56.01	55.44	55.44	25-Apr-14	55.75	55.06	55.41
24-May-12	56.01	55.44	55.44	02-May-14	55.94	55.49	54.75
11-Sep-12	56.24	55.73	55.60	15-May-14	56.25	55.81	55.87
14-Sep-12	56.37	55.84	55.72	23-May-14	56.17	55.73	55.80
06-Nov-12	55.54	54.93	54.97	03-Jul-14	56.04	55.60	55.63
12-Apr-13	55.65	54.56	54.69	12-Sep-14	56.20	55.80	55.76
23-Apr-13	55.53	54.93	55.07	11-Oct-14	55.82	55.46	55.41
10-May-13	55.98	55.51	55.56	07-Nov-14	55.96	55.54	55.55
18-May-13	55.85	55.81	55.80	19-Nov-14	55.89	55.46	55.47
25-May-13	55.85	55.69	55.68	10-Mar-15	55.97	55.56	55.58
26-May-13	56.13	55.59	55.75	19-Apr-15	55.98	55.58	55.58
04-Jun-13	56.11	55.68	55.64	04-May-15	55.91	55.50	55.50
15-Jun-13	56.12	55.67	55.63	18-Sep-15	56.27	55.92	55.90
22-Jun-13	56.18	55.61	55.69	23-Nov-16	55.87	55.41	55.47
02-Jul-13	56.20	55.74	55.70				
13-Jul-13	56.19	55.76	55.71	**Maximum**	**56.37**	**55.92**	**55.90**
18-Jul-13	56.21	55.75	55.71	**Minimum**	**55.30**	**54.33**	**54.55**
28-Jul-13	56.15	55.73	55.66	**Average**	**55.90**	**55.37**	**55.36**

5 CLOSURE

We trust this quarterly monitoring report meets your requirements at this time. If you have any questions, please do not hesitate to contact us.

Yours Sincerely,

Chieftain Metals Corp.

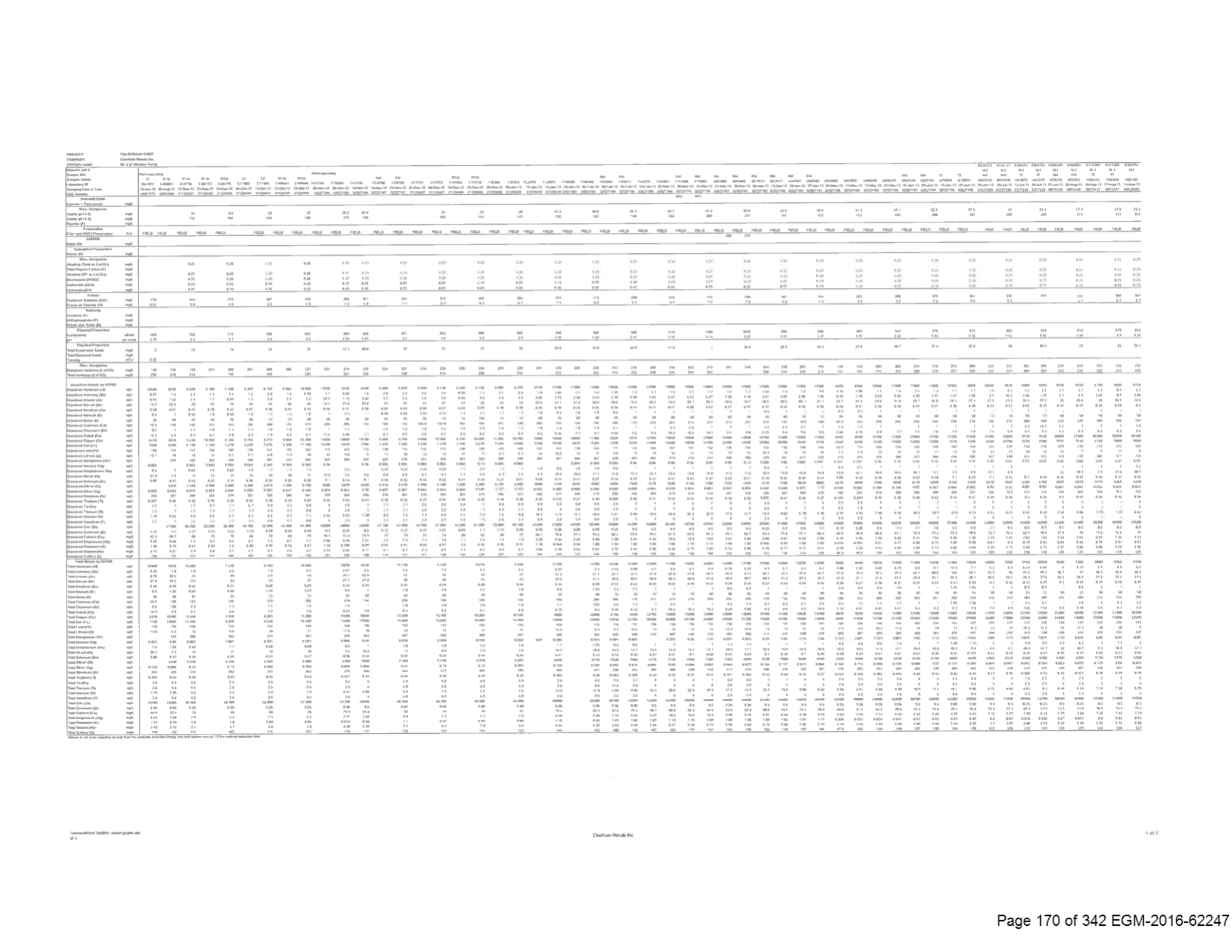
Keith Boyle, P.Eng.
Chief Operating Officer

/attach

cc. Neil Bailey, Compliance Officer, MoE Smithers
Rob Marsland, Chieftain
Victor Wypyrsky, Chieftain
Eric Telford, TRTFN
Mark Connor, TRTFN
Wade Comin, EC

APPENDIX A

Tulsequah Chief Water Quality Database



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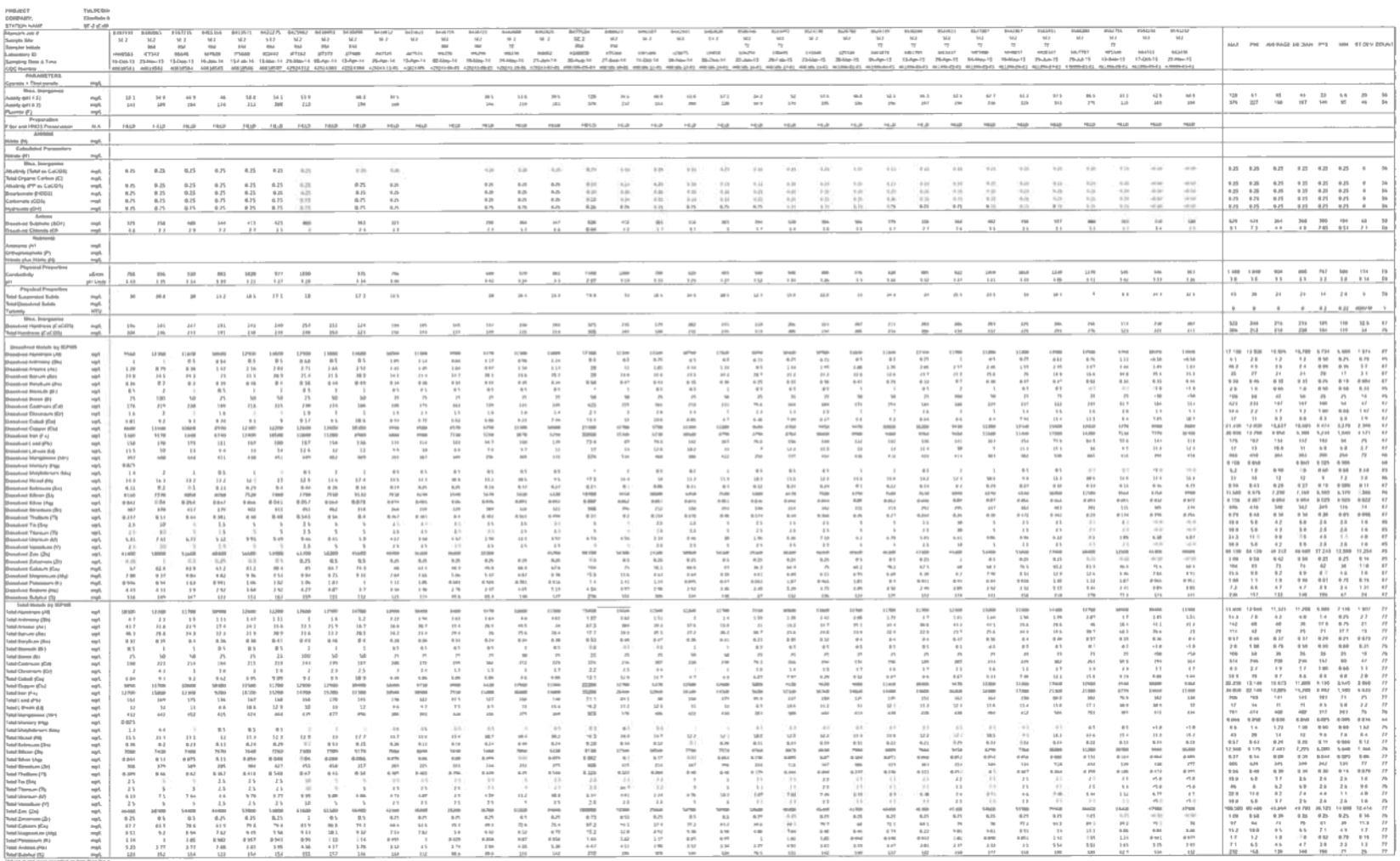

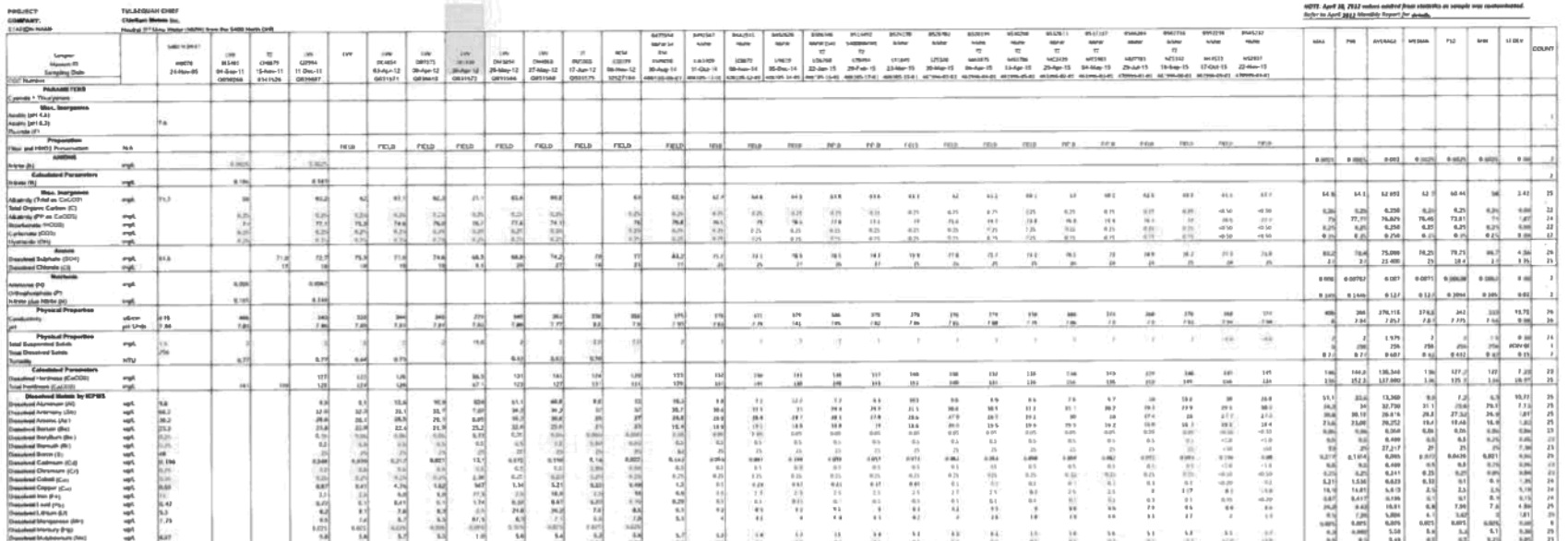

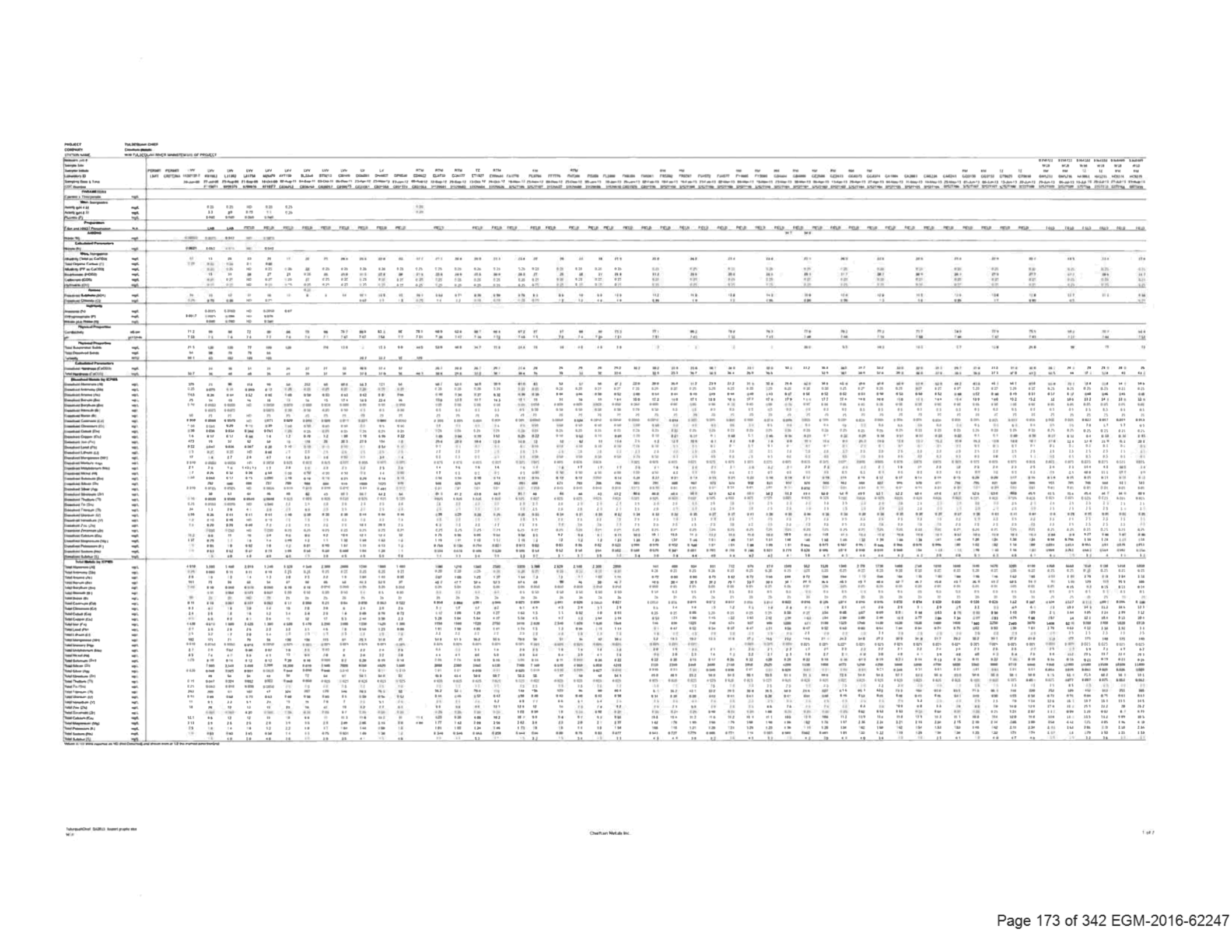

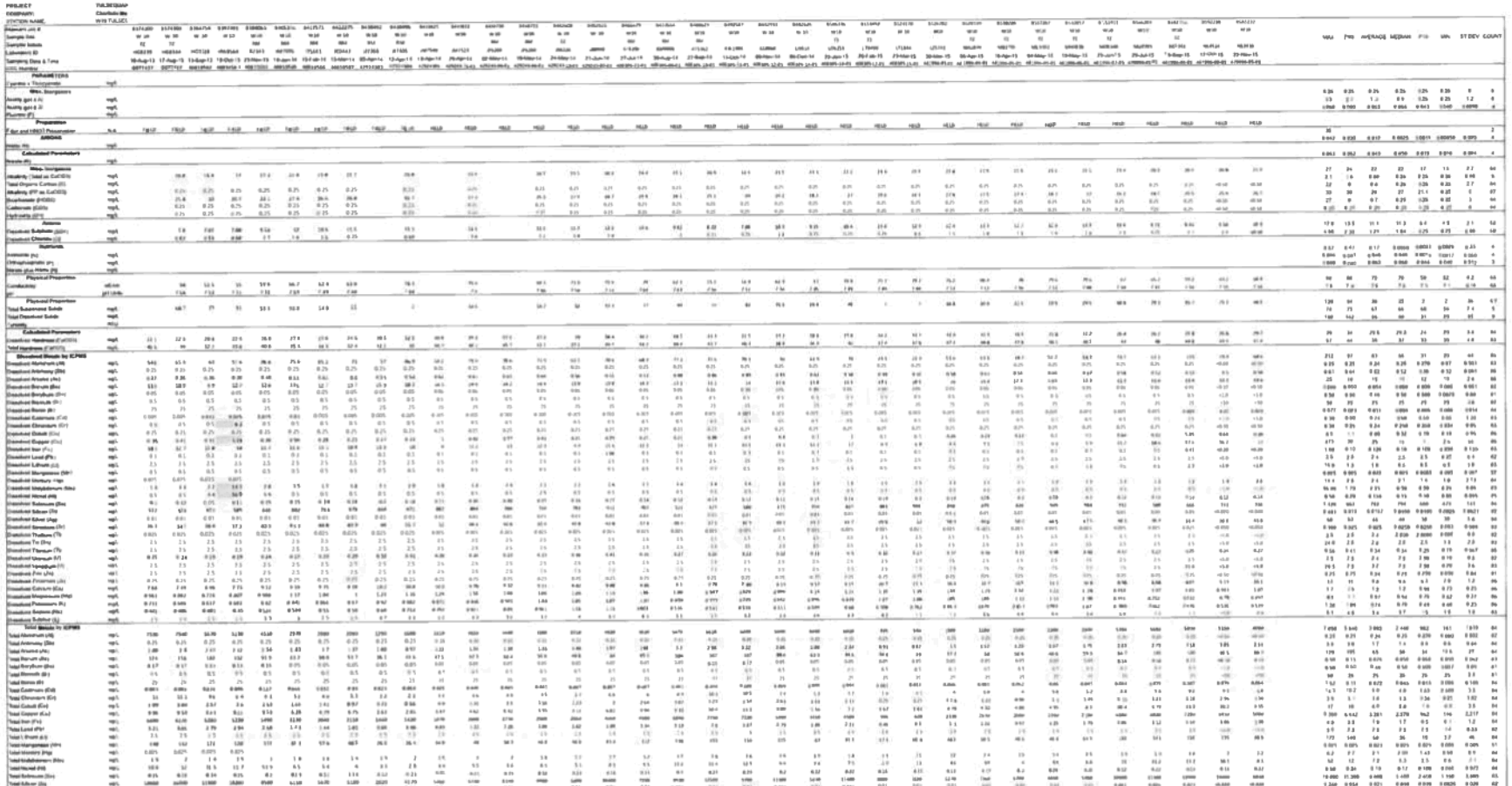

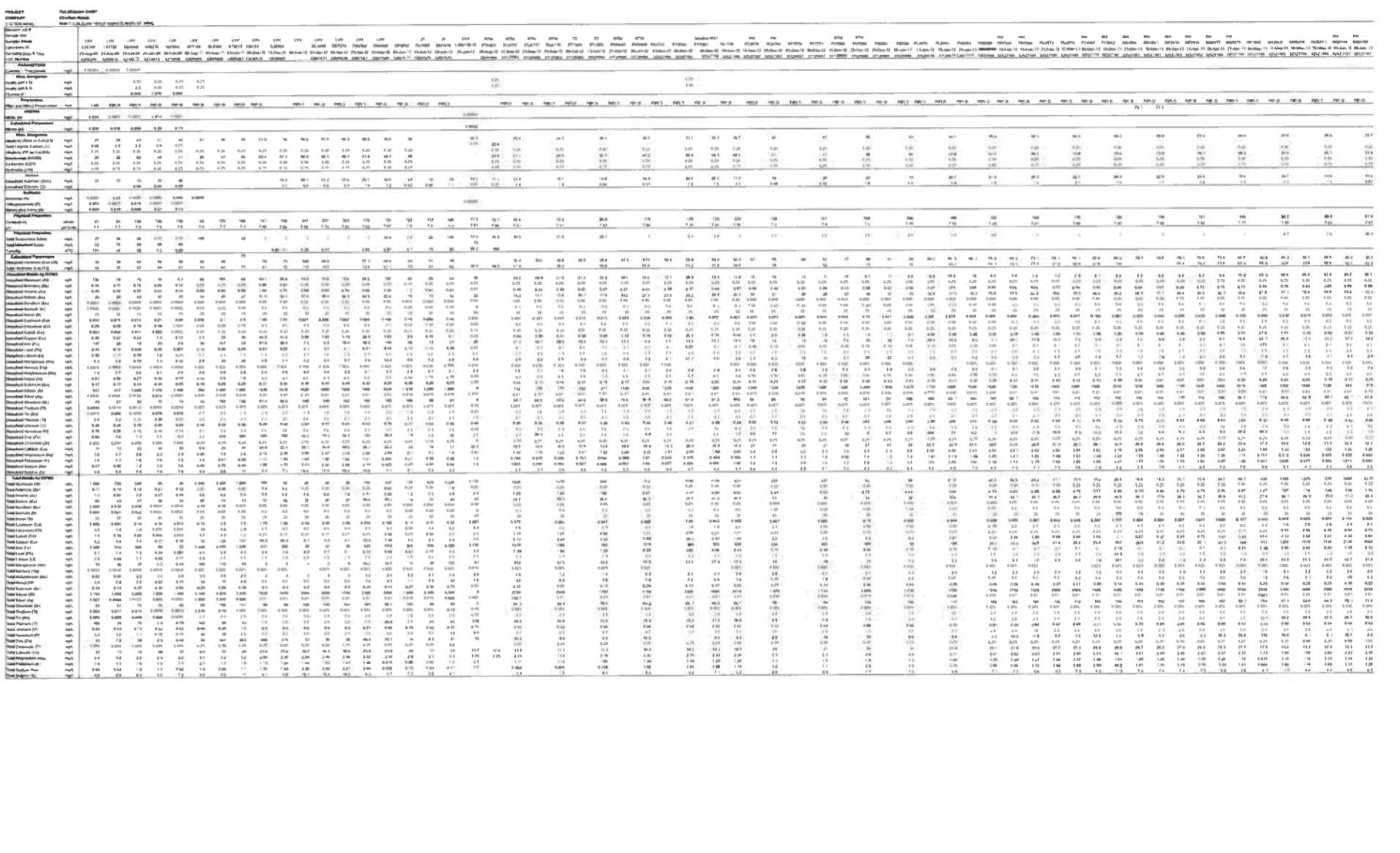

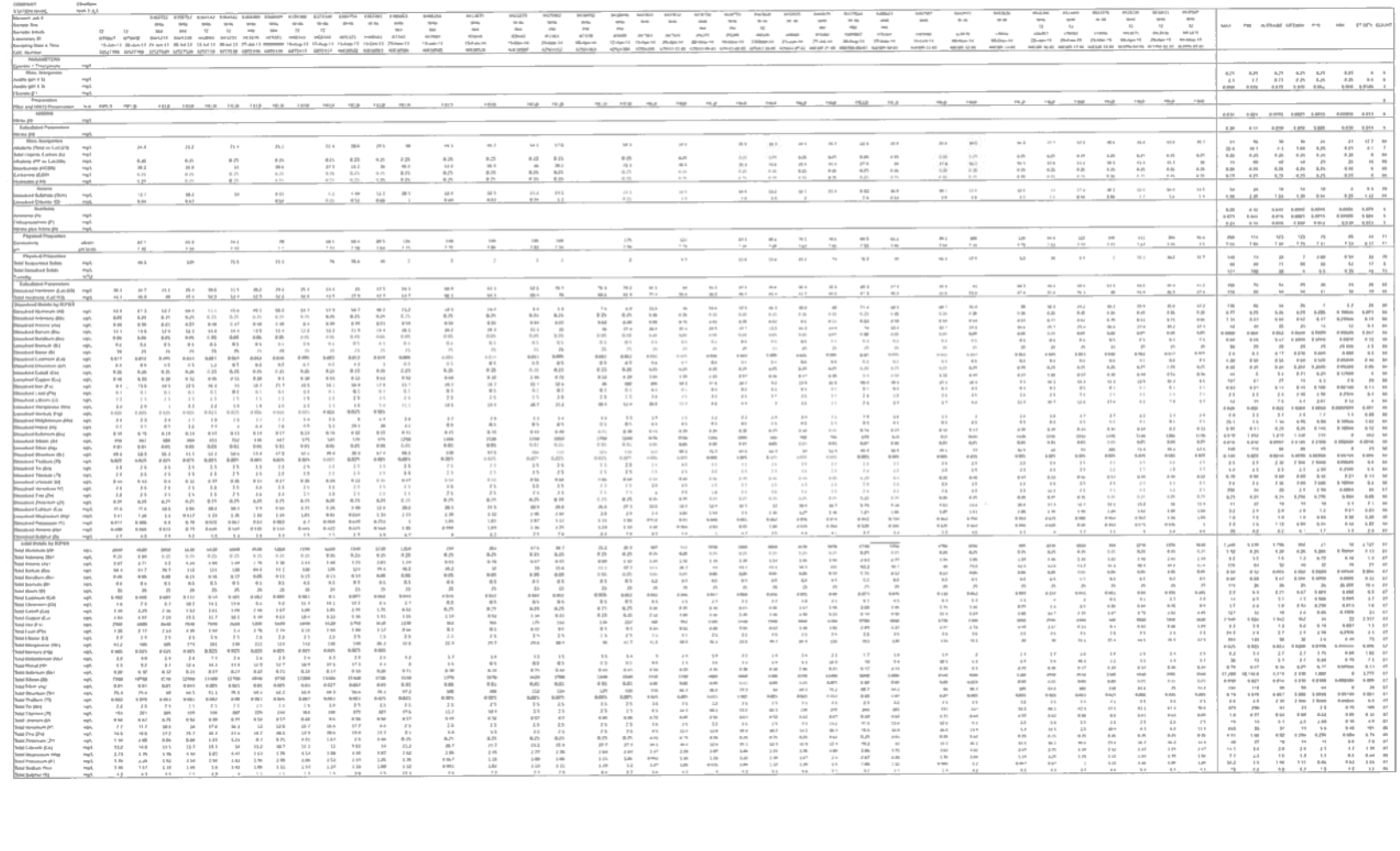

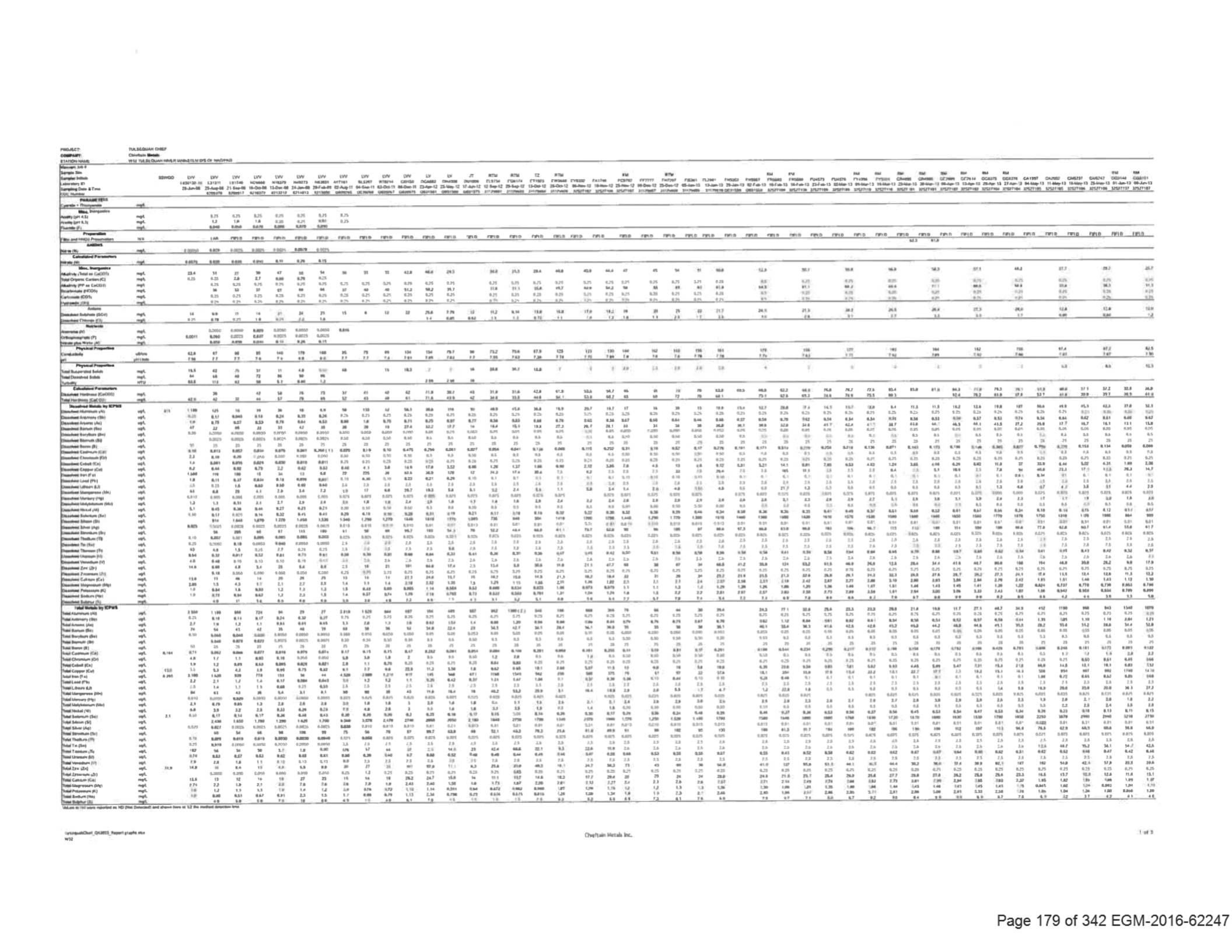

PROJECT: TULSEQUAH CHIEF
COMPANY: Chieftain Metals
STATION NAME: W12 TULSEQUAH RIVER MAINSTEM DS OF NADINA

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PROJECT: TULSEQUAH
COMPANY: Chieftain Me
STATION NAME: W32 TULSEC

Parameter	Unit																		
Maxxam Job #				8358722	8358722	8364182	8364182	8368485	8368489	8374300	8374300	8384754	8397491	8380065	8405254	8412571	8422275	8425982	8430452
Sample Site				W32	W32	W32	W32	W32	W32	W 32	W-32	W-32	W 32	W52	W52	W52	W 32	W52	W52
Sampler Initials		TZ	TZ	RM	RM	TZ	TZ	RM	RM	TZ	TZ			RM	RM	RM	RM	RM	RM
Laboratory ID		GT0876	GT0931	CW5232	CW5237	HA3082	HA1216	HC5975	HC9280	HG8340	HG8345	HD1119	HW8560	[illegible]7329	IM7606	I75657	JC0439	J7159	J27385
Sampling Date & Time		15-Jun-13	22-Jun-13	29-Jun-13	06-Jul-13	13-Jul-13	20-Jul-13	27-Jul-13	03-Aug-13	10-Aug-13	17-Aug-13	13-Sep-13	13-Oct-13	23-Nov-13	16-Jan-14	15-Feb-14	15-Mar-14	29-Mar-14	05-Apr-14
COC Number		37527108	37527108	32527109	32527109	3257110	3257110	G872438	G872438	G872437	G872437	40810502	40810501	40810503	40810505	40810506	40810507	47924352	47924383
PARAMETERS																			
Cyanide + Thiocyanate	mg/L																		
Misc. Inorganics																			
Acidity (pH 4.5)	mg/L																		
Acidity (pH 8.3)	mg/L																		
Fluoride (F)	mg/L																		
Preparation																			
Filter and HNO3 Preservation	N/A	FIELD	FIELD	FIELD	FIELD	FIELD	FIELD	FIELD	FIELD	FIELD	FIELD	FIELD	FIELD	FIELD	FIELD	FIELD	FIELD	FIELD	FIELD
ANIONS																			
Nitrite (N)	mg/L																		
Calculated Parameters																			
Nitrate (N)	mg/L																		
Misc. Inorganics																			
Alkalinity (Total as CaCO3)	mg/L		24.8		24.5		23.9		21		24.9	22.6	30.9	47.6	43.6	49.2	56.2	56.9	
Total Organic Carbon (C)	mg/L																		
Alkalinity (PP as CaCO3)	mg/L		0.25		0.25		0.25		0.25		0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	
Bicarbonate (HCO3)	mg/L		30.4		29.9		29.2		25.6		30.3	27.6	37.7	58	55.6	60.7	68.6	69.4	
Carbonate (CO3)	mg/L		0.25		0.25		0.25		0.25		0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	
Hydroxide (OH)	mg/L		0.25		0.25		0.25		0.25		0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	
Anions																			
Dissolved Sulphate (SO4)	mg/L		6.83		8.5		9.79		8.31		7.43	8.27	11.2	21.7	21.8	21.2	21.5	21.5	
Dissolved Chloride (Cl)	mg/L		0.77		0.75				0.57		0.25	0.25	0.62	1.5	1.1	1.5	1.4	2	
Nutrients																			
Ammonia (N)	mg/L																		
Orthophosphate (P)	mg/L																		
Nitrate plus Nitrite (N)	mg/L																		
Physical Properties																			
Conductivity	uS/cm		73.8		65.9		78.4		66.6		62.3	59.6	88.3	139	139	148	160	168	
pH	pH Units		7.40		7.41		7.33		7.29		7.4	7.54	7.66	7.8	7.72	7.86	7.8	7.67	
Physical Properties																			
Total Suspended Solids	mg/L		37.8		87.5		47		44.7		79	60	34.3	5	2	2	2	2	
Total Dissolved Solids	mg/L																		
Turbidity	NTU																		
Calculated Parameters																			
Dissolved Hardness (CaCO3)	mg/L	32.1	30.7	28.2	27.9	29.8	29.7	30.3	28.8	27	26	24.2	37.9	64.4	60.1	66	66.7	76.1	74.8
Total Hardness (CaCO3)	mg/L	43.8	42.2	41.6	46.5	47.9	54.3	41.1	41.9	44	44.2	39.4	47.4	63.6	61.3	66.3	71.6	73.1	78.2
Dissolved Metals by ICPMS																			
Dissolved Aluminum (Al)	ug/L	34.1	80.6	50.5	55.4	64.5	66.4	46.8	55	48.6	54	46.7	43.9	23.9	26.9	33.3	18.4	17.5	35.4
Dissolved Antimony (Sb)	ug/L	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Dissolved Arsenic (As)	ug/L	0.67	0.67	0.63	0.67	0.55	0.54	0.55	0.53	0.45	0.43	0.45	0.68	0.64	0.61	0.57	0.68	0.76	0.63
Dissolved Barium (Ba)	ug/L	13.1	13.6	12.9	13.5	14.6	14.3	15	13.6	12.5	12.7	11.9	18.5	29.1	27	30.3	35.8	37.2	38.2
Dissolved Beryllium (Be)	ug/L	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
Dissolved Bismuth (Bi)	ug/L	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Dissolved Boron (B)	ug/L	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25
Dissolved Cadmium (Cd)	ug/L	0.053	0.047	0.035	0.039	0.034	0.031	0.032	0.027	0.023	0.019	0.012	0.096	0.388	0.175	0.436	0.354	0.306	0.63
Dissolved Chromium (Cr)	ug/L	0.5	0.5	0.5	1.8	0.5	0.5	0.5	0.5	0.5	0.5	0.5	2.1	0.5	0.5	0.5	0.5	0.5	0.5
Dissolved Cobalt (Co)	ug/L	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.75	0.25	0.25	0.25
Dissolved Copper (Cu)	ug/L	1.00	1.04	0.51	0.66	0.51	0.46	0.55	0.45	0.52	0.66	0.53	1.2	5.1	11.1	14.3	11.8	9.45	21.2
Dissolved Iron (Fe)	ug/L	6.8	77.8	20.1	30.2	20	16.3	19.6	19.1	24.4	35	14.3	24.6	15.8	17.1	34.9	20.1	8.8	15.5
Dissolved Lead (Pb)	ug/L	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Dissolved Lithium (Li)	ug/L	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5
Dissolved Manganese (Mn)	ug/L	3.2	5.7	3.7	3.3	2.9	2.8	3.7	4.5	3.5	4.8	3	6.2	7.8	15.6	14.7	18.4	18.6	18.9
Dissolved Mercury (Hg)	ug/L	0.075	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025						
Dissolved Molybdenum (Mo)	ug/L	1.4	1.6	2.1	1.7	2.7	2.1	2	1.4	1.1	1.1	1.9	5.1	2.1	2.5	2.4	2.6	2.6	1.1
Dissolved Nickel (Ni)	ug/L	0.5	0.5	0.5	0.5	4.7	1.5	2.8	0.5	0.5	0.5	1.1	15.3	0.5	0.5	0.5	0.5	0.5	0.5
Dissolved Selenium (Se)	ug/L	0.14	0.06	0.15	0.14	0.16	0.13	0.11	0.11	0.12	0.11	0.05	0.17	0.29	0.1	0.25	0.39	0.46	0.41
Dissolved Silicon (Si)	ug/L	902	939	676	871	845	714	674	660	619	597	568	989	1290	1550	1550	1210	1660	1680
Dissolved Silver (Ag)	ug/L	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Dissolved Strontium (Sr)	ug/L	51.2	46.6	44.4	43.3	46	45.2	48.1	45.5	42.2	40.7	37.6	64.2	87.9	89.7	92.1	99.2	106	116
Dissolved Thallium (Tl)	ug/L	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025
Dissolved Tin (Sn)	ug/L	2.3	2.8	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5
Dissolved Titanium (Ti)	ug/L	2.3	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5
Dissolved Uranium (U)	ug/L	0.34	0.33	0.33	0.3	0.29	0.28	0.27	0.24	0.22	0.23	0.19	0.32	0.41	0.46	0.46	0.51	0.57	0.58
Dissolved Vanadium (V)	ug/L	2.5	2.6	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5
Dissolved Zinc (Zn)	ug/L	6.2	2.8	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	15.4	69.4	65.4	89.2	79.9	64.7	150
Dissolved Zirconium (Zr)	ug/L	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Dissolved Calcium (Ca)	mg/L	10.9	10.4	9.81	9.68	10.1	10	10.1	9.66	9.21	8.97	8.95	13.1	22.3	20.5	22.8	22.9	26.1	25.7
Dissolved Magnesium (Mg)	mg/L	1.22	1.13	0.907	0.909	1.1	1.14	1.21	1.13	0.962	0.875	0.773	1.27	2.11	2.17	2.2	2.34	2.67	2.6
Dissolved Potassium (K)	mg/L	0.700	0.709	0.661	0.704	0.733	0.73	0.731	0.718	0.642	0.604	0.556	0.648	1.09	0.919	1.24	1.02	1.14	1.15
Dissolved Sodium (Na)	mg/L	0.632	0.782	0.675	0.668	0.594	0.476	0.585	0.498	0.478	0.414	0.486	0.584	1.5	1.2	1.83	1.63	1.81	1.86
Dissolved Sulphur (S)	mg/L	3.9	3.2	1.5	1.5	4.4	4.1	3.3	3.3	1.5	1.5	1.5	3.7	7.2	6.7	7	5.9	7.9	8.4
Total Metals by ICPMS																			
Total Aluminum (Al)	ug/L	2850	3400	3650	5580	5300	5470	4130	4600	6170	6260	6370	2570	522	246	176	56	35.1	60
Total Antimony (Sb)	ug/L	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	1.1	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Total Arsenic (As)	ug/L	2.75	3.64	2.58	4.75	3.42	3.31	2.64	2.92	3.4	3.43	5.07	1.74	1.08	0.93	0.94	0.8	0.8	0.9
Total Barium (Ba)	ug/L	55.8	63.1	68.3	99.1	96.9	102	75.9	62.2	112	103	105	58.6	39.1	33.3	33.9	35.7	38.2	36.8
Total Beryllium (Be)	ug/L	0.05	0.05	0.05	0.13	0.1	0.13	0.05	0.05	0.14	0.14	0.11	0.05	0.05	0.05	0.05	0.05	0.05	0.05
Total Bismuth (Bi)	ug/L	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Total Boron (B)	ug/L	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25
Total Cadmium (Cd)	ug/L	0.275	0.091	0.097	0.19	0.133	0.135	0.139	0.118	0.117	0.587	0.129	0.109	0.434	0.409	0.461	0.376	0.357	0.66
Total Chromium (Cr)	ug/L	4.5	5.6	5.7	9.5	9.7	9.3	11	7.6	18.2	10	14	4	1.4	0.5	0.5	0.5	0.5	0.5
Total Cobalt (Co)	ug/L	1.31	1.79	1.87	3.33	2.78	2.71	2.25	2.43	2.86	2.83	2.78	1.28	0.25	0.25	0.25	0.25	0.25	0.25
Total Copper (Cu)	ug/L	8.29	7.73	8.83	15.9	11.6	11.2	9.15	9.37	33	10.8	18.8	9.6	21.5	21.3	23.9	16.7	11.4	30.6
Total Iron (Fe)	ug/L	2780	3570	3780	6740	6300	6350	4700	5130	6590	6260	5680	2530	527	297	188	90	45	181
Total Lead (Pb)	ug/L	1.36	1.64	2.03	3.74	2.83	2.92	2.27	2.48	2.78	2.64	2.62	1.49	0.55	0.52	0.67	0.29	0.1	0.48
Total Lithium (Li)	ug/L	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5
Total Manganese (Mn)	ug/L	56.7	79.7	86.7	155	129	132	182	111	139	140	129	63.2	18.7	19.7	17.9	19.9	18.3	19.9
Total Mercury (Hg)	ug/L	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025						
Total Molybdenum (Mo)	ug/L	2.2	2.2	2.2	2.6	4.1	2.7	8.3	1.6	1.6	2.1	6.3	2.3	1.4	2.3	2.5	2.7	2.8	2.7
Total Nickel (Ni)	ug/L	5.7	6.6	7	11.8	19.2	12.8	14.5	6.6	9.4	11.7	12.2	8.2	5.2	1.1	0.5	0.5	0.5	0.5
Total Selenium (Se)	ug/L	0.21	0.12	0.18	0.21	0.22	0.24	0.24	0.13	0.16	0.13	0.17	0.21	0.21	0.29	0.29	0.4	0.39	0.46
Total Silicon (Si)	ug/L	6930	8170	7800	10500	9420	11000	8360	9110	15500	12500	13200	5790	2320	1930	1280	1570	1540	1670
Total Silver (Ag)	ug/L	0.01	0.01	0.023	0.036	0.025	0.023	0.05	0.025	0.03	0.021	0.033	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Total Strontium (Sr)	ug/L	67.8	68.8	59.4	59.6	64.2	78.3	58.8	57.4	58.3	57.7	53.9	69.9	90	98.5	95.5	108	111	118
Total Thallium (Tl)	ug/L	0.075	0.058	0.05	0.066	0.065	0.074	0.025	0.054	0.076	0.07	0.068	0.025	0.025	0.025	0.025	0.025	0.025	0.025
Total Tin (Sn)	ug/L	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5
Total Titanium (Ti)	ug/L	120	107	193	333	258	367	166	236	333	365	310	125	20.6	9.8	7.2	2.5	2.5	2.5
Total Uranium (U)	ug/L	0.50	0.47	0.54	0.73	0.64	0.65	0.49	0.52	0.56	0.54	0.49	0.5	0.54	0.44	0.5	0.52	0.6	0.61
Total Vanadium (V)	ug/L	7.3	6.9	9.8	14.2	13.7	12.4	10.3	11	15.9	15.4	16.3	6.3	2.5	2.5	2.5	2.5	2.5	7.5
Total Zinc (Zn)	ug/L	26.7	23.8	24.1	38.6	31.5	30.1	25.8	26.2	27.8	27.6	31.2	54.8	99.2	92.2	97.7	85	64.7	169
Total Zirconium (Zr)	ug/L	0.86	2.24	0.63	4.05	0.74	2.57	0.59	0.79	1.63	1.18	1.83	0.25	0.25	0.75	0.25	0.25	0.25	0.25
Total Calcium (Ca)	mg/L	13.4	12.8	13.8	12	12.6	14.7	11	11.2	11.4	11.4	10.3	14.8	21.7	21.3	22.7	24.1	25.1	26.9
Total Magnesium (Mg)	mg/L	2.53	2.46	2.92	4.04	3.64	4.24	3.32	3.4	3.75	3.82	3.35	2.52	2.27	1.99	2.28	2.65	2.52	2.71
Total Potassium (K)	mg/L	1.57	1.72	1.74	2.13	2.16	2.4	1.69	1.79	2.4	2.35	2.55	1.35	1.23	0.892	1.29	1.04	1.08	1.13
Total Sodium (Na)	mg/L	1.29	1.25	1.33	1.37	1.36	1.21	0.947	1.02	1.4	1.15	1.52	0.869	1.33	1.32	1.89	1.68	1.94	1.68
Total Sulphur (S)	mg/L	4.3	3.9	1.6	1.5	4.1	4.4	3.2	1.5	1.5	1.5	3.1	4	10.8	5.7	8.2	6.4	6.6	6.8

Parameter	Unit																			
Maxxam Job #		8430456	8433821	8433812	8438710	8438721	8442688	8452621	8466679	8477854	8488623	8492587	8442991	8482626	8506166	8514493	8524178	8526782	8528139	8539288
Sample Site		W52	W52	W32	W32	W52	W 32	W 32	W52	W 32	W52	W52	W 32	W 32	W52	W52	W 32	W52	W52	W52
Sampler Initials		RM			RM	RM	TZ		RM	RM	RV				TZ	TZ			TZ	TZ
Laboratory ID		J27486	JM7598	JM7522	JP6275	JP6367	JR6327	[illegible]	[illegible]	[illegible]	K75963	KW1905	LC8869	LD5635	LD6254	L78491	L71845	L75376	M41878	M01785
Sampling Date & Time		12-Apr-14	13-Apr-14	26-Apr-14	02-May-14	10-May-14	24-May-14	21-Jun-14	27-Jul-14	30-Aug-14	27-Sep-14	11-Oct-14	08-Nov-14	05-Dec-14	22-Jan-15	28-Feb-15	23-Mar-15	30-Mar-15	06-Apr-15	13-Apr-15
COC Number		47924384	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
PARAMETERS																				
Cyanide + Thiocyanate	mg/L																			
Misc. Inorganics																				
Acidity (pH 4.5)	mg/L																			
Acidity (pH 8.3)	mg/L																			
Fluoride (F)	mg/L																			
Preparation																				
Filter and HNO3 Preservation	N/A	FIELD	FIELD	FIELD	FIELD	FIELD	FIELD	FIELD	FIELD	FIELD	FIELD	FIELD	FIELD	FIELD	FIELD	FIELD	FIELD	FIELD	FIELD	FIELD
ANIONS																				
Nitrite (N)	mg/L																			
Calculated Parameters																				
Nitrate (N)	mg/L																			
Misc. Inorganics																				
Alkalinity (Total as CaCO3)	mg/L	56.6		48.1		32.6	27.7	25.9	24.8	76	25	23.2	39.6	46.4	25	47.2	49	37	54.1	37.6
Total Organic Carbon (C)	mg/L																			
Alkalinity (PP as CaCO3)	mg/L	0.25		0.25		0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Bicarbonate (HCO3)	mg/L	69.3		58.9		27.6	33.8	31.6	30.2	31.7	30.4	28.3	48.1	56.6	34.2	57.6	59.8	45.2	41.9	46.1
Carbonate (CO3)	mg/L	0.25		0.25		0.25	0.25	0.25	0.25	0.75	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Hydroxide (OH)	mg/L	0.25		0.25		0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Anions																				
Dissolved Sulphate (SO4)	mg/L	22.8		29.6		12.8	11.4	10.7	11.1	9.80	8.20	8.2	16.5	12.6	12.8	19.4	20.6	19	16.9	17.4
Dissolved Chloride (Cl)	mg/L	2.2		1.2		1.5	1.5	1.6		2.1	0.61	0.25	4	0.81	1.6	0.8	1.1	1	1.5	1.2
Nutrients																				
Ammonia (N)	mg/L																			
Orthophosphate (P)	mg/L																			
Nitrate plus Nitrite (N)	mg/L																			
Physical Properties																				
Conductivity	uS/cm	175		132		82.9	86.2	77	77.5	79.4	68.6	66.7	106	114	94.6	139	149	122	119	114
pH	pH Units	7.94		7.68		7.35	7.68	7.63	7.67	7.63	7.67	7.53	7.54	7.8	7.55	7.84	7.76	7.73	7.67	7.63
Physical Properties																				
Total Suspended Solids	mg/L	2		4.3		12.3	5.5	21.6	55	38	12	17.6	9.3	2	49.3	2	2	7.8	10.5	6
Total Dissolved Solids	mg/L																			
Turbidity	NTU																			
Calculated Parameters																				
Dissolved Hardness (CaCO3)	mg/L	76.7	66.3	54.6	54.7	39.6	39.3	52.4	31.7	31.8	29.6	28.5	45.8	58.1	29.4	61.5	66.5	52	50.1	51.1
Total Hardness (CaCO3)	mg/L	79.5	66.5	58.2	68.6	41.3	39.8	38.5	41.6	38.7	49.4	37.9	53.6	49.7	51.4	66.7	71.4	56.8	54.5	56.9
Dissolved Metals by ICPMS																				
Dissolved Aluminum (Al)	ug/L	34.3	44	41	58.4	55.5	38.2	45.6	50.8	278	40.2	68	31.5	33.3	54.2	29.9	34.6	34.2	50.1	29.6
Dissolved Antimony (Sb)	ug/L	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Dissolved Arsenic (As)	ug/L	0.74	0.76	0.71	0.76	0.77	0.66	0.72	0.64	0.76	0.6	0.54	0.68	0.84	0.72	0.64	0.71	0.55	0.8	0.86
Dissolved Barium (Ba)	ug/L	17.5	98.1	24.6	16.8	19.9	15.2	14.2	17.7	29.8	14.5	13.5	19.8	20.1	17.2	31.1	31	16.1	23.7	14.1
Dissolved Beryllium (Be)	ug/L	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
Dissolved Bismuth (Bi)	ug/L	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Dissolved Boron (B)	ug/L	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25
Dissolved Cadmium (Cd)	ug/L	0.65	0.461	0.405	0.159	[illegible]	0.187	0.141	0.090	0.049	0.045	0.043	0.235	0.195	0.269	0.678	1.07	0.514	0.198	0.392
Dissolved Chromium (Cr)	ug/L	0.5	0.5	1.6	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Dissolved Cobalt (Co)	ug/L	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Dissolved Copper (Cu)	ug/L	21.6	21.6	18.7	5.76	14.8	2.32	1.96	0.75	1.79	1.27	2.05	5	1.54	11.9	7.59	19	4.64	5.14	7.2
Dissolved Iron (Fe)	ug/L	65	64.7	20.4	25.4	32.6	6.5	36.4	66.9	320	30.1	32.1	54.8	5.1	44.6	14.7	19.7	10.9	6.7	17
Dissolved Lead (Pb)	ug/L	0.23	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.4	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Dissolved Lithium (Li)	ug/L	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5
Dissolved Manganese (Mn)	ug/L	28.3	20.7	13.7	4.8	8.8	3.2	1.5	4	11.8	1.9	4.2	9.2	2.2	17	10.9	12.8	14.1	9.4	10.1
Dissolved Mercury (Hg)	ug/L																			
Dissolved Molybdenum (Mo)	ug/L	2.8	2.1	2.1	1.9	1.8	2	2	1.7	1.5	1.5	1.2	1.9	1.2	1.4	2.5	2.4	2.4	2.3	2.5
Dissolved Nickel (Ni)	ug/L	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.8	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Dissolved Selenium (Se)	ug/L	0.36	0.32	0.27	0.19	0.19	0.19	0.12	0.14	0.14	0.11	0.14	0.14	0.16	0.1	0.26	0.26	0.21	0.21	0.21
Dissolved Silicon (Si)	ug/L	1780	1740	1640	1630	1260	866	940	764	1050	667	904	1050	1680	1760	1450	1130	1700	1770	1300
Dissolved Silver (Ag)	ug/L	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Dissolved Strontium (Sr)	ug/L	118	102	86.1	59.6	45	56.9	52.2	47.7	58.3	50.6	45.3	71.7	62.5	65.6	91.4	99.1	52	71.9	77.6
Dissolved Thallium (Tl)	ug/L	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025
Dissolved Tin (Sn)	ug/L	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.8	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5
Dissolved Titanium (Ti)	ug/L	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	13.2	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5
Dissolved Uranium (U)	ug/L	0.58	0.5	0.51	0.4	0.41	0.36	0.37	0.52	0.3	0.29	0.75	0.6	0.28	0.47	0.44	0.47	0.42	0.44	0.44
Dissolved Vanadium (V)	ug/L	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5
Dissolved Zinc (Zn)	ug/L	145	149	77.4	30.6	51.4	29.1	38.1	5.7	8.8	8.2	2.5	52.1	41.4	60.7	134	251	100	75.4	89.6
Dissolved Zirconium (Zr)	ug/L	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Dissolved Calcium (Ca)	mg/L	26.3	22.8	18.8	11.7	13.5	11.2	10.9	10.5	10.4	10	9.79	15.5	17.6	11.4	21.2	21	17.7	17.3	17.5
Dissolved Magnesium (Mg)	mg/L	2.67	2.32	1.91	1.34	1.44	1.3	1.25	1.3	1.22	1.11	1.02	1.6	1.51	1.45	2.09	2.22	1.91	1.79	1.85
Dissolved Potassium (K)	mg/L	1.06	0.885	0.884	0.742	0.750	0.742	0.813	0.89	0.635	0.727	0.531	0.754	0.541	0.636	1.01	1.04	0.963	0.966	1.05
Dissolved Sodium (Na)	mg/L	1.51	1.10	1.06	0.771	0.805	0.924	0.932	0.761	0.880	0.606	0.537	0.760	0.936	0.786	1.24	1.17	1.3	1.03	1.09
Dissolved Sulphur (S)	mg/L	7.7	7.9	5.6	4.2	4.7	3.1	3.7	4	3.8	3.7	3.5	5.1	3.8	4.6	5.7	6	5.6	4.6	6.0
Total Metals by ICPMS																				
Total Aluminum (Al)	ug/L	75.9	174	424	1090	1330	1330	1330	5160	3410	5140	1680	2570	179	3160	491	121	1500	1210	1430
Total Antimony (Sb)	ug/L	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Total Arsenic (As)	ug/L	1.06	1.12	1.33	1.33	1.31	1.51	1.79	1.09	2.45	2.77	2.97	2.06	0.77	5.82	1.86	0.97	1.95	1.29	1.37
Total Barium (Ba)	ug/L	38.6	33.4	38.1	41	35.7	36.6	49.5	92.4	73.7	94.8	71.6	63.5	34.3	65.9	38.2	35	41.6	41	42.4
Total Beryllium (Be)	ug/L	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.13	0.05	0.12	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
Total Bismuth (Bi)	ug/L	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Total Boron (B)	ug/L	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25
Total Cadmium (Cd)	ug/L	0.659	0.601	0.479	0.204	0.527	0.162	0.306	0.121	0.112	0.150	0.165	0.372	0.179	0.486	0.699	1.07	0.622	0.419	0.466
Total Chromium (Cr)	ug/L	0.5	0.5	1.1	2.7	1.6	2.1	4	6.6	6.3	30.3	6	4.2	0.5	4.6	0.5	0.5	2.1	1.9	3.1
Total Cobalt (Co)	ug/L	0.25	0.25	0.25	0.65	0.87	0.72	1.29	2.09	2.1	2.68	2.15	1.28	0.25	1.71	0.25	0.25	0.6	0.68	0.57
Total Copper (Cu)	ug/L	31.2	34.9	24.1	11.8	44.7	9.21	8.24	11.5	8.87	15.1	17.3	20.6	7.64	34	33.7	48.8	56.7	33	25.7
Total Iron (Fe)	ug/L	159	273	653	1620	1890	1480	2480	5190	4640	5930	4680	2680	525	3450	661	578	1800	1170	1160
Total Lead (Pb)	ug/L	0.54	0.72	0.79	0.88	1.05	0.77	1.21	2.67	2.36	2.98	2.57	2.4	0.29	1.84	0.7	0.83	1.09	0.99	0.84
Total Lithium (Li)	ug/L	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.8	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5
Total Manganese (Mn)	ug/L	29.2	24.1	25.1	38.1	26.7	51.2	54.3	128	93.9	121	96.5	63.6	6.2	92.4	18.8	17	75.4	35.7	30
Total Mercury (Hg)	ug/L																			
Total Molybdenum (Mo)	ug/L	2.9	2.4	2.3	1.7	1.7	2	2	2	1.9	2	1.4	2	0.5	1.6	3.3	2.7	2.5	2.2	2.2
Total Nickel (Ni)	ug/L	0.5	0.5	1.9	3	2.7	2.9	5.1	10	6.1	9	7.9	5.2	1.5	6.9	2.6	3	2.5	3.1	2.2
Total Selenium (Se)	ug/L	0.41	0.31	0.29	0.2	0.29	0.18	0.11	0.22	0.15	0.24	0.23	0.24	0.21	0.28	0.29	0.22	0.3	0.29	0.24
Total Silicon (Si)	ug/L	1790	1920	3290	4480	3670	3580	5190	5290	6640	11500	6850	6190	1860	6400	2450	2150	3570	5290	4300
Total Silver (Ag)	ug/L	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.03	0.024	0.01	0.02	0.025	0.01	0.026	0.01	0.01	0.01	0.01	0.01
Total Strontium (Sr)	ug/L	119	98.7	88.2	60	66.7	59.5	68.2	87.6	60	67.3	54.8	64.6	65.8	75.7	98.5	100	82.9	79.6	79.7
Total Thallium (Tl)	ug/L	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.050	0.029	0.056	0.065	0.045	0.025	0.062	0.025	0.025	0.025	0.025	0.025
Total Tin (Sn)	ug/L	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.8	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5
Total Titanium (Ti)	ug/L	2.5	2.5	28.8	59.6	43.4	55	104	238	166	269	180	115	2.5	112	19	6.6	59.9	35	54.2
Total Uranium (U)	ug/L	0.62	0.59	0.6	0.47	0.49	0.44	0.49	0.61	0.5	0.59	0.5	0.57	0.29	0.76	0.58	0.56	0.58	0.56	0.54
Total Vanadium (V)	ug/L	7.5	2.5	2.5	2.5	7.9	3.9	6	12.8	9.3	14.2	9.9	5.9	2.5	7.5	2.5	2.5	2.5	2.5	2.5
Total Zinc (Zn)	ug/L	152	156	87.2	46.5	311	57.9	50.5	35	25.2	37.7	32.7	86.7	75	108	159	249	162	97.1	116
Total Zirconium (Zr)	ug/L	0.25	0.25	4.13	0.25	0.25	0.25	0.25	0.68	0.75	1.32	0.95	0.25	0.25	0.62	0.25	0.25	0.25	0.25	1.32
Total Calcium (Ca)	mg/L	27.3	23.7	20.4	12.1	14.3	12.8	11.6	12.1	10.3	11.5	10.1	16.7	17.4	15.7	22	24.8	18.8	17.3	18.8
Total Magnesium (Mg)	mg/L	2.74	2.6	2.24	1.48	1.85	1.89	2.3	2.76	3.38	3.77	2.98	2.91	1.54	2.96	2.28	2.32	2.42	2.38	2.42
Total Potassium (K)	mg/L	1.11	0.849	1.1	1.08	0.94	1.18	1.33	2.16	1.76	2.25	1.37	1.55	0.474	1.32	1.18	1.10	1.41	1.33	1.4
Total Sodium (Na)	mg/L	1.57	1.29	1.38	1.85	0.945	1.05	1.19	1.45	0.947	1.15	0.85	1.16	0.864	0.998	1.51	1.46	1.62	1.39	1.39
Total Sulphur (S)	mg/L	8.4	7.4	6.1	4.1	4.4	4.5	3.4	4	4.2	5.3	3.5	5.6	1.5	1.5	5.6	5.5	6.1	5.8	5.7

Values in red were reported as ND (Not Detected) i.e.

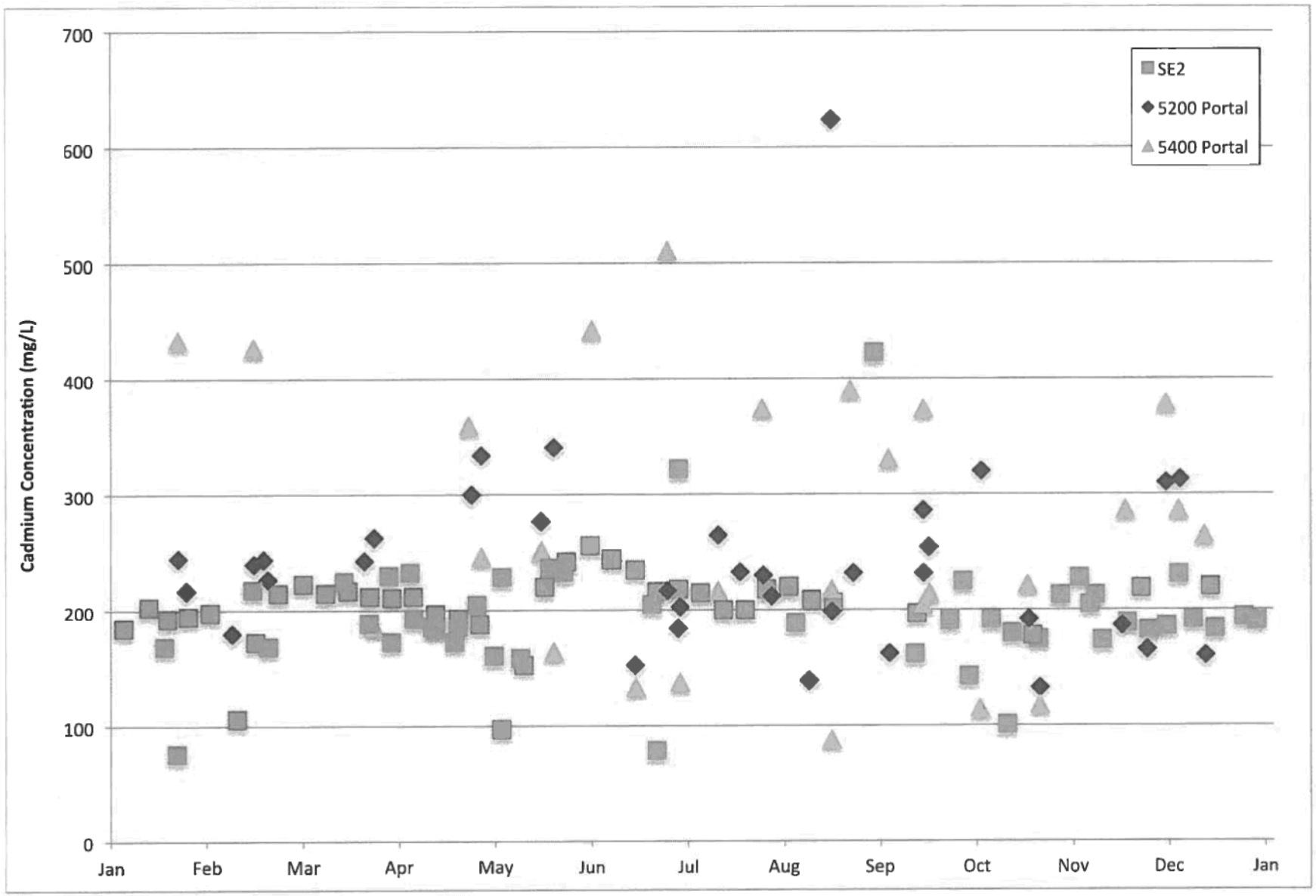
TulsequahChief_Q42015_Report graphs.xlsx
W32

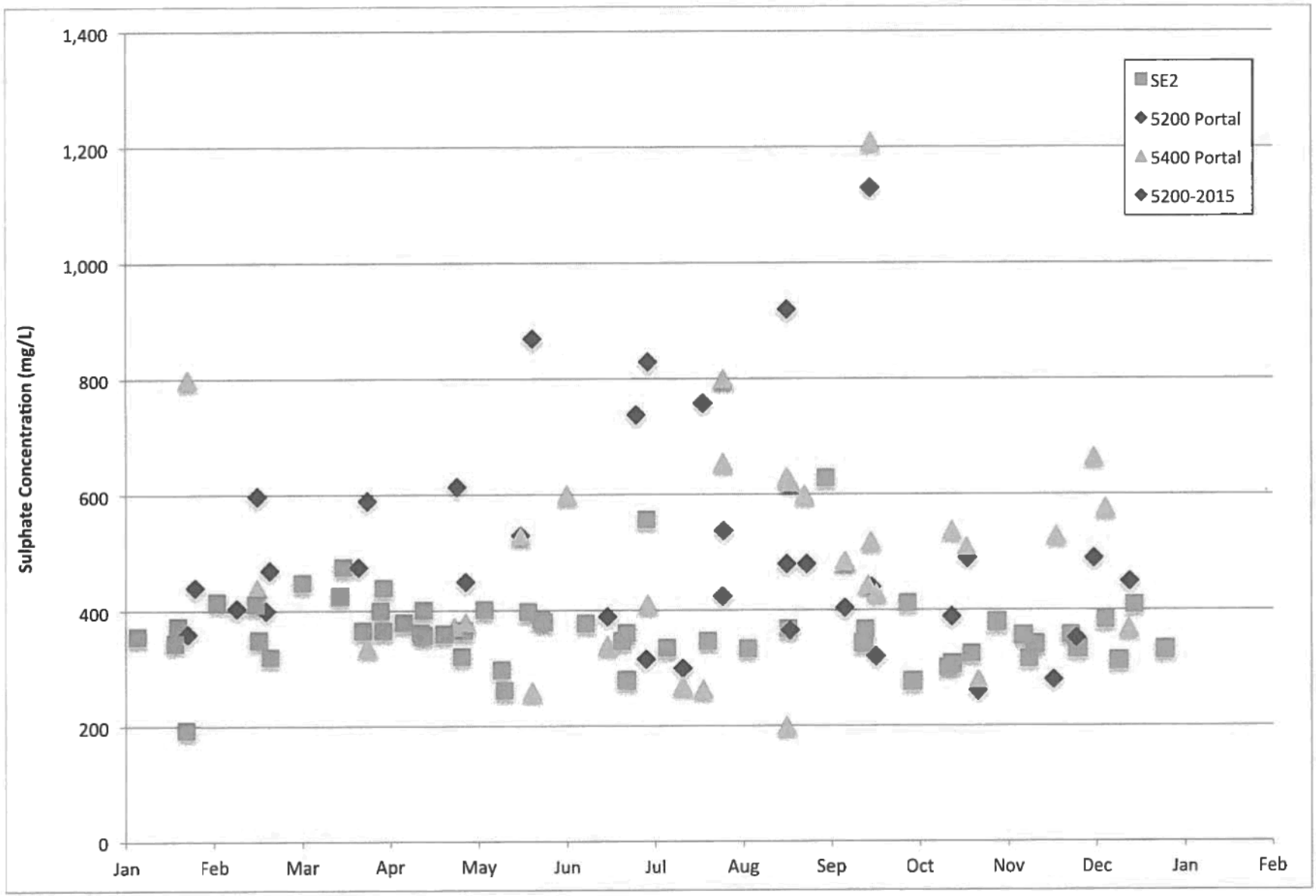
PROJECT:	TULSEQUAH															
COMPANY:	Chieftain Me															
STATION NAME:	WS2 TUL SLC															
Maxxam Job #		B536315	B537287	B542812	B544912	Rerun261	B547716	B552160	B543252							
Sample Site		WS2	WS2	WS2	WS2	WS2	T2	WS2	WS2							
Sampler Initials		T2	T2	T2	T2		T2	T2	T2							
Laboratory ID		WC1434	ME3679	MH8834	MH8844	MH7762	RK3227	RK4518	WS3648							
Sampling Date & Time		26-Apr-15	04-May-15	13-May-15	20-Jun-15	25-Jul-15	15-Sep-15	17-Oct-15	23-Nov-15							
KDC Number		15-TPN-02-ES	15-TPN-03-ES	15-TPN-05-ES	15-TPN-07-ES	15-TPN-09-ES	15-TPN-09-ES	15-TPN-09-ES	15-TPN-09-ES							
PARAMETERS																
Cyanide + Thiocyanate	mg/L															
Misc. Inorganics																
Acidity (pH 4.5)	mg/L									0.25	0.25	0.25	0.25	0.25	0	7
Acidity (pH 8.3)	mg/L									1.8	1.4	0.72	0.50	0.25	0.35	7
Fluoride (F)	mg/L									0.060	0.040	0.058	0.070	0.040	0.009	6
Preparation																
Filter and HNO3 Preservation	N/A	FIELD	FIELD	FIELD	FIELD	FIELD	FIELD	FIELD	FIELD							
Anions																
Nitrite (N)	mg/L									0.029	0.016	0.0066	0.0025	0.0017	0.0005	0.010	7
Calculated Parameters																
Nitrate (N)	mg/L									0.75	0.19	0.18	0.050	0.030	0.030	0.061	7
Misc. Inorganics																
Alkalinity (Total as CaCO3)	mg/L	95.9	29.9	26.8	20.6	26.3	23.7	42.9	53.6	58	35	38	36	24	21	12	71
Total Organic Carbon (C)	mg/L									2.8	2.7	1.1	0.75	0.25	0.25	1.1	7
Alkalinity (PP as CaCO3)	mg/L	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.50	0.25	0.25	0.25	0.25	0.25	0	79
Bicarbonate (HCO3)	mg/L	49.1	36.4	32.7	25.4	32.4	29	52.3	65.3	71	58	46	44	30	25	15	79
Carbonate (CO3)	mg/L	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.50	0.25	0.25	0.25	0.25	0.25	0	79
Hydroxide (OH)	mg/L	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.50	0.25	0.25	0.25	0.25	0.25	0	79
Anions																
Dissolved Sulphate (SO4)	mg/L	14.6	15.9	11.6	10.1	7.69	2.06	2.73	9.99	28	24	16	14	9	3.06	6.2	72
Dissolved Chloride (Cl)	mg/L	1.5	1.3	1	1.6	0.25	1	1.5	1.3	4.8	2.8	1.41	1.25	0.41	0.25	0.85	66
Nutrients																
Ammonia (N)	mg/L									0.070	0.018	0.0087	0.0050	0.0050	0.0050	0.0064	7
Orthophosphate (P)	mg/L									0.060	0.046	0.015	0.0025	0.0019	0.0011	0.021	7
Nitrate plus Nitrite (N)	mg/L									0.29	0.21	0.12	0.12	0.040	0.030	0.083	6
Physical Properties																
Conductivity	uS/cm	189	132	82	57.9	75	54.8	101	126	194	166	113	104	79	52.4	38	72
pH	pH Units	7.76	7.98	7.79	7.85	7.63	7.79	7.96	7.91	8.0	7.9	7.7	7.7	7.4	7.3	0.17	72
Physical Properties																
Total Suspended Solids	mg/L	6.4	9.8	16	41	41.2	25.5	10	3	68	56	18	9	2.0	0.50	22	71
Total Dissolved Solids	mg/L									96	92	74	72	54	40	19	7
Turbidity	NTU									113	86	34	12	1.2	0.60	41	10
Calculated Parameters																
Dissolved Hardness (CaCO3)	mg/L	62.7	42.6	34.9	28.9	29.6	32.3	47.3	63.2	93	79	51	49	29	23.6	16	66
Total Hardness (CaCO3)	mg/L	74.8	52.1	48.1	36.5	44.4	37.5	56.2	69.7	93	79	55	53	40	27.5	14	67
Dissolved Metals by ICPMS																
Dissolved Aluminum (Al)	ug/L	52	19.7	39.7	57.5	99.5	77.6	52.6	49.5	1,160	61	34	36	13.3	6.4	125	66
Dissolved Antimony (Sb)	ug/L	0.25	0.25	0.33	0.25	0.25	0.25	0.25	0.25	0.35	0.27	0.26	0.25	0.250	0.04	0.03	66
Dissolved Arsenic (As)	ug/L	0.58	0.65	0.73	0.67	0.84	0.66	1.13	0.72	1.5	0.76	0.56	0.64	0.34	0.43	0.17	66
Dissolved Barium (Ba)	ug/L	19.6	17.9	13.9	11.9	21.7	14.8	18.3	32.5	65	42	26	23	13	10.8	11	66
Dissolved Beryllium (Be)	ug/L	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.100	0.050	0.052	0.050	0.050	0.050	0.010	66
Dissolved Bismuth (Bi)	ug/L	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.50	0.50	0.47	0.500	0.500	0.0025	0.13	66
Dissolved Boron (B)	ug/L	25	25	25	25	25	25	25	25	50	25	25	25	25	25	2.8	66
Dissolved Cadmium (Cd)	ug/L	0.0513	0.0127	0.0067	0.0021	0.0057	0.0031	0.0070	0.0091	1.07	0.52	0.210	0.130	0.0511	0.0012	0.215	66
Dissolved Chromium (Cr)	ug/L	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	3.99	0.50	0.55	0.50	0.500	0.050	0.45	66
Dissolved Cobalt (Co)	ug/L	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	1.37	0.75	0.25	0.250	0.250	0.011	0.13	66
Dissolved Copper (Cu)	ug/L	0.96	0.91	1.24	0.44	1.1	1.97	2.09	2.91	37.8	14.3	6.9	3.86	0.55	0.40	8.9	66
Dissolved Iron (Fe)	ug/L	15.2	7.9	5	19.4	39.4	40.8	23.4	49.7	1,560	76	49	17	3	2.5	171	66
Dissolved Lead (Pb)	ug/L	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.09	1.76	0.24	0.15	0.10	0.100	0.051	0.19	66
Dissolved Lithium (Li)	ug/L	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.4	2.50	2.50	0.25	0.46	66
Dissolved Manganese (Mn)	ug/L	8.4	5	3.9	3	9.9	3.6	7.6	17.6	43	17	7.4	6.5	0.5	0.5	8.8	66
Dissolved Mercury (Hg)	ug/L									0.025	0.025	0.021	0.025	0.005	0.005	0.006	56
Dissolved Molybdenum (Mo)	ug/L	2.1	2.2	1.9	2	2.1	2.1	2.5	2.5	5.3	2.9	2.1	2.1	1.89	0.31	0.74	66
Dissolved Nickel (Ni)	ug/L	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	15.90	9.50	5.81	5.50	0.50	0.21	1.82	66
Dissolved Selenium (Se)	ug/L	0.05	0.05	0.07	0.1	0.12	0.05	0.05	0.05	0.51	0.46	0.25	0.23	0.110	0.02	0.14	66
Dissolved Silicon (Si)	ug/L	1260	1230	1040	871	808	1040	1040	1190	1,670	1,560	1,257	1,190	758	550	355	66
Dissolved Silver (Ag)	ug/L	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.025	0.010	0.0067	0.010	0.010	0.0025	0.0025	66
Dissolved Strontium (Sr)	ug/L	68.4	53.9	55.4	46	59	48	58.4	69.8	265	180	79	79	45	29	27	66
Dissolved Thallium (Tl)	ug/L	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.100	0.025	0.0244	0.0250	0.025	0.001	0.016	66
Dissolved Tin (Sn)	ug/L	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.21	2.50	2.50	0.050	0.7	66
Dissolved Titanium (Ti)	ug/L	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	53.8	2.5	3.1	2.5	2.50	0.25	0.8	66
Dissolved Uranium (U)	ug/L	0.41	0.38	0.38	0.3	0.39	0.42	0.51	0.52	0.75	0.64	0.43	0.42	0.27	0.017	0.15	66
Dissolved Vanadium (V)	ug/L	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	4.8	2.5	2.36	2.50	2.50	0.10	0.6	66
Dissolved Zinc (Zn)	ug/L	10.5	29.6	9.9	2.5	2.5	5.8	2.5	7.1	231	102	43.8	28.0	2.5	0.80	47.8	66
Dissolved Zirconium (Zr)	ug/L	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.24	0.250	0.250	0.050	0.010	66
Dissolved Calcium (Ca)	mg/L	18.9	14.5	13.9	9.91	12.1	10.3	15.7	21.7	46	29	16	17	10	6.45	7	66
Dissolved Magnesium (Mg)	mg/L	1.57	1.48	1.25	0.962	0.944	1.083	1.3	1.69	4.3	2.7	1.8	1.7	1.1	0.663	0.58	66
Dissolved Potassium (K)	mg/L	0.949	1.02	0.775	0.743	0.707	0.575	0.744	0.799	1.7	1.4	0.9	0.8	0.60	0.24	0.39	66
Dissolved Sodium (Na)	mg/L	1.93	1	0.869	0.787	0.929	0.748	0.719	1.16	3.8	2.5	1.3	1.01	0.51	0.459	0.79	66
Dissolved Sulphur (S)	mg/L	5	4.9	4.5	3.5	3.4	2.9	3.5	4.5	11	9.5	5.4	5.1	1.5	1.5	2.4	66
Total Metals by ICPMS																
Total Aluminum (Al)	ug/L	1320	1060	1580	1470	2720	740	894	141	6,370	4,271	1,458	796	27	12	1,775	66
Total Antimony (Sb)	ug/L	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	1.10	0.25	0.26	0.25	0.25	0.14	0.096	66
Total Arsenic (As)	ug/L	1.46	1.43	2.3	2.45	2.97	1.21	1.45	0.98	5.8	3.1	1.8	1.2	0.62	0.44	1.00	66
Total Barium (Ba)	ug/L	61.9	43	49.6	38.6	53.5	29.9	34.8	37.9	112	77	48	46	31	20	21	66
Total Beryllium (Be)	ug/L	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.500	0.050	0.060	0.050	0.050	0.050	0.053	66
Total Bismuth (Bi)	ug/L	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.50	0.50	0.47	0.500	0.500	0.0025	0.13	66
Total Boron (B)	ug/L	25	25	25	25	25	25	25	25	50	25	25	25	25	25	2.8	66
Total Cadmium (Cd)	ug/L	0.193	0.107	0.062	0.026	0.108	0.073	0.064	0.078	1.67	0.54	0.291	0.180	0.075	0.013	0.217	66
Total Chromium (Cr)	ug/L	2.5	2.5	3.4	5.9	5.2	3.3	3.9	0.5	13.8	7.8	3.6	1.3	0.500	0.050	3.1	66
Total Cobalt (Co)	ug/L	0.78	0.67	0.65	0.3	1.04	0.21	0.44	0.25	3.3	2.3	0.86	0.25	0.250	0.021	0.86	66
Total Copper (Cu)	ug/L	24.9	17.1	9.98	9.61	7.73	3.69	2.98	3.48	99.8	26.4	10.2	5.4	0.87	0.75	11.2	66
Total Iron (Fe)	ug/L	1,528	1,030	1,958	1,060	2,040	840	1,080	224	6,740	4,790	1,916	982	22	3	1,936	66
Total Lead (Pb)	ug/L	3.2	1.83	2.3	2.14	2.57	0.4	0.45	0.1	3.7	2.8	1.1	0.8	0.190	0.043	0.96	66
Total Lithium (Li)	ug/L	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.4	2.5	2.50	0.25	0.46	66
Total Manganese (Mn)	ug/L	17.3	11.2	49.2	19.6	73.2	29.7	59.1	33.4	153	104	41	27	1.4	0.5	40	66
Total Mercury (Hg)	ug/L									0.025	0.025	0.023	0.025	0.012	0.005	0.008	53
Total Molybdenum (Mo)	ug/L	2.3	2.4	2.9	2.3	1.7	0.5	0.5	2.5	6.3	2.9	2.3	2.3	1.29	0.68	1.0	66
Total Nickel (Ni)	ug/L	3.3	1.9	4.3	5.7	9	3.4	5.7	0.5	24.5	8.7	4.9	2.4	0.50	0.76	5.7	66
Total Selenium (Se)	ug/L	0.26	0.11	0.3	0.12	0.15	0.05	0.18	0.07	0.57	0.47	0.27	0.24	0.14	0.05	0.13	66
Total Silicon (Si)	ug/L	3030	2080	4210	2660	3800	2430	2420	2090	15,500	8,515	3,966	2,415	1,577	1,250	3,235	66
Total Silver (Ag)	ug/L	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.206	0.224	0.0123	0.010	0.010	0.0025	0.052	66
Total Strontium (Sr)	ug/L	76.7	74.5	58.6	51.8	53.7	52.6	67.2	77.5	119	107	79	77	56	33	20	66
Total Thallium (Tl)	ug/L	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.100	0.025	0.021	0.025	0.025	0.003	0.016	66
Total Tin (Sn)	ug/L	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.21	2.50	2.50	0.050	0.7	66
Total Titanium (Ti)	ug/L	63.1	42.7	93.2	178	154	64.6	98.2	5.7	365	196	69	30	2.5	0.80	81	66
Total Uranium (U)	ug/L	0.39	0.35	0.46	0.52	0.47	0.34	0.23	0.18	0.80	0.65	0.54	0.34	0.43	0.14	0.11	66
Total Vanadium (V)	ug/L	2.5	2.5	3.9	6.1	6.8	2.5	2.5	2.5	16.3	10.4	4.5	2.5	2.50	0.10	3.9	66
Total Zinc (Zn)	ug/L	99.2	48.6	23.5	24.9	24.9	8.1	8.7	9.3	248	118	56	36	11.2	4.8	45.5	66
Total Zirconium (Zr)	ug/L	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	4.2	1.21	0.44	0.250	0.250	0.050	0.61	66
Total Calcium (Ca)	mg/L	17.9	16.9	15.6	12	13.8	9.91	15.1	22.2	29	28	18	17	11	9	5.7	65
Total Magnesium (Mg)	mg/L	2.25	2.43	2.33	2.06	2.48	1.86	2.65	2.83	4.2	3.4	2.5	2.4	1.9	1.8	0.61	65
Total Potassium (K)	mg/L	1.17	1.46	1.25	1.3	1.37	0.489	0.679	1.01	2.8	1.8	1.3	1.2	0.80	0.41	0.43	66
Total Sodium (Na)	mg/L	1.39	1.33	1.21	1.14	0.826	0.581	0.913	2.48	3.8	2.8	1.8	1.26	0.60	0.50	0.72	66
Total Sulphur (S)	mg/L	5.3	3.5	3.5	4.2	3.5	3.5	4.5	7.4	11	9.5	5.7	5.3	1.5	1.5	2.5	66

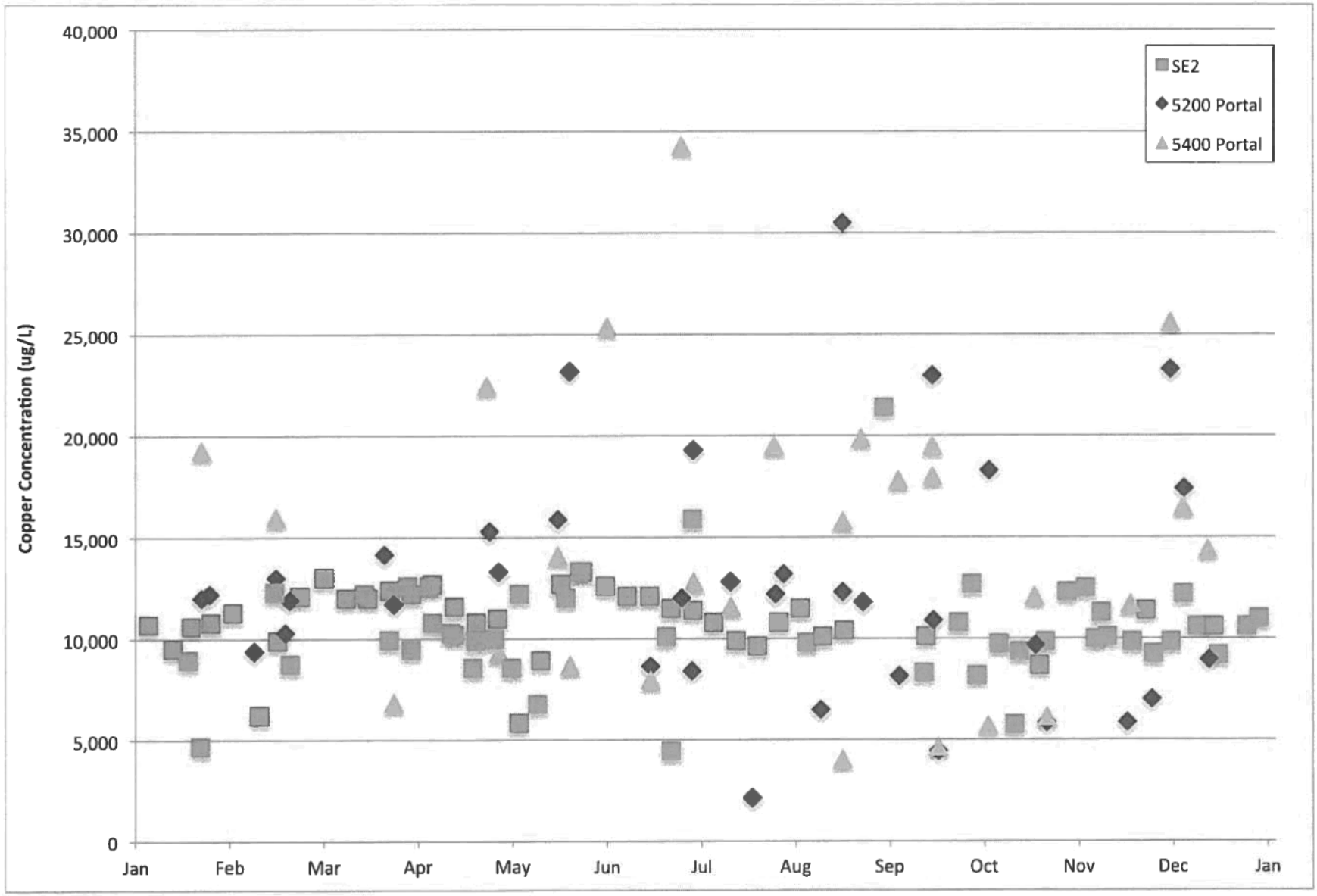
Values in red were reported as MD (Not Detected) w

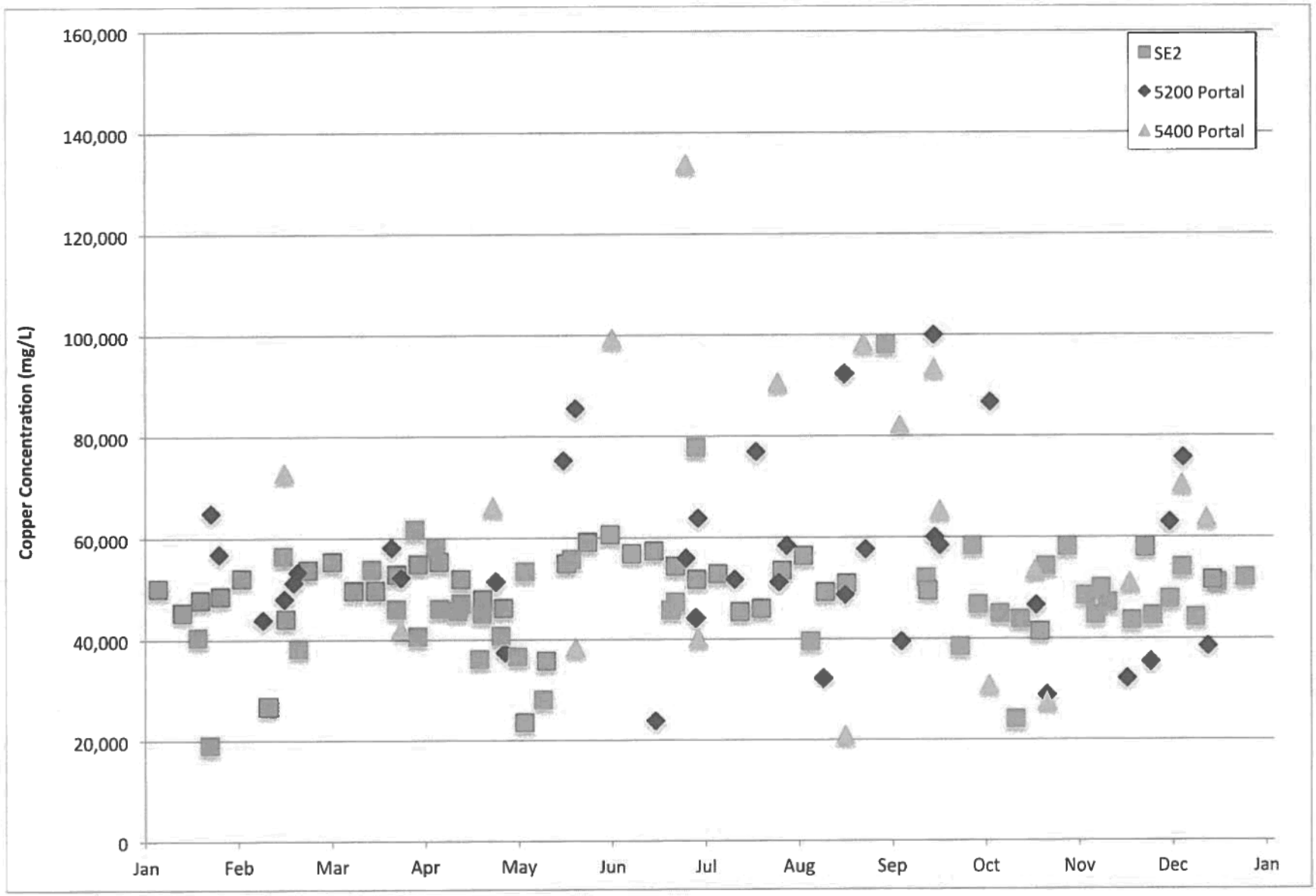
APPENDIX B

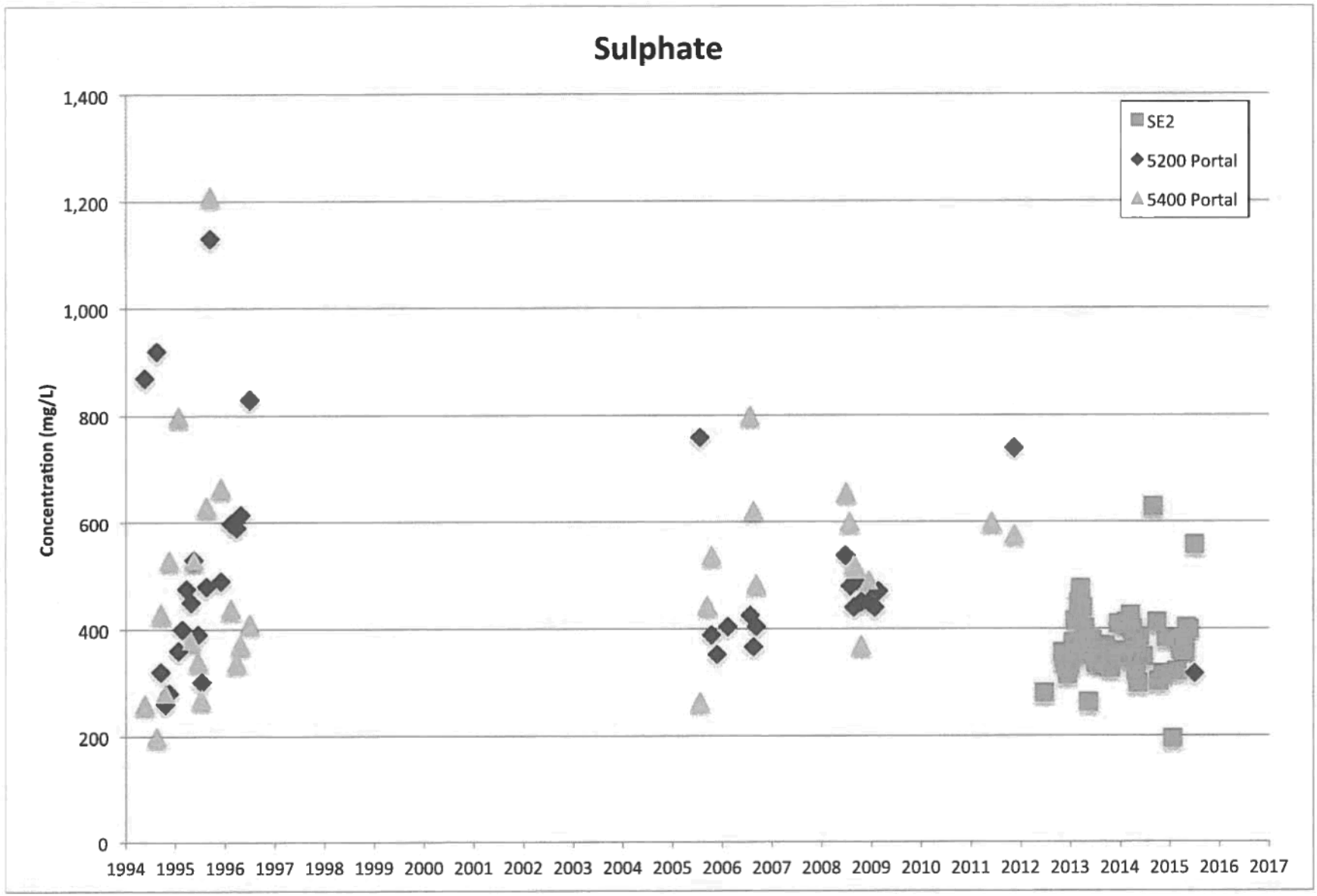
Tulsequah Chief Portal Discharge Quality

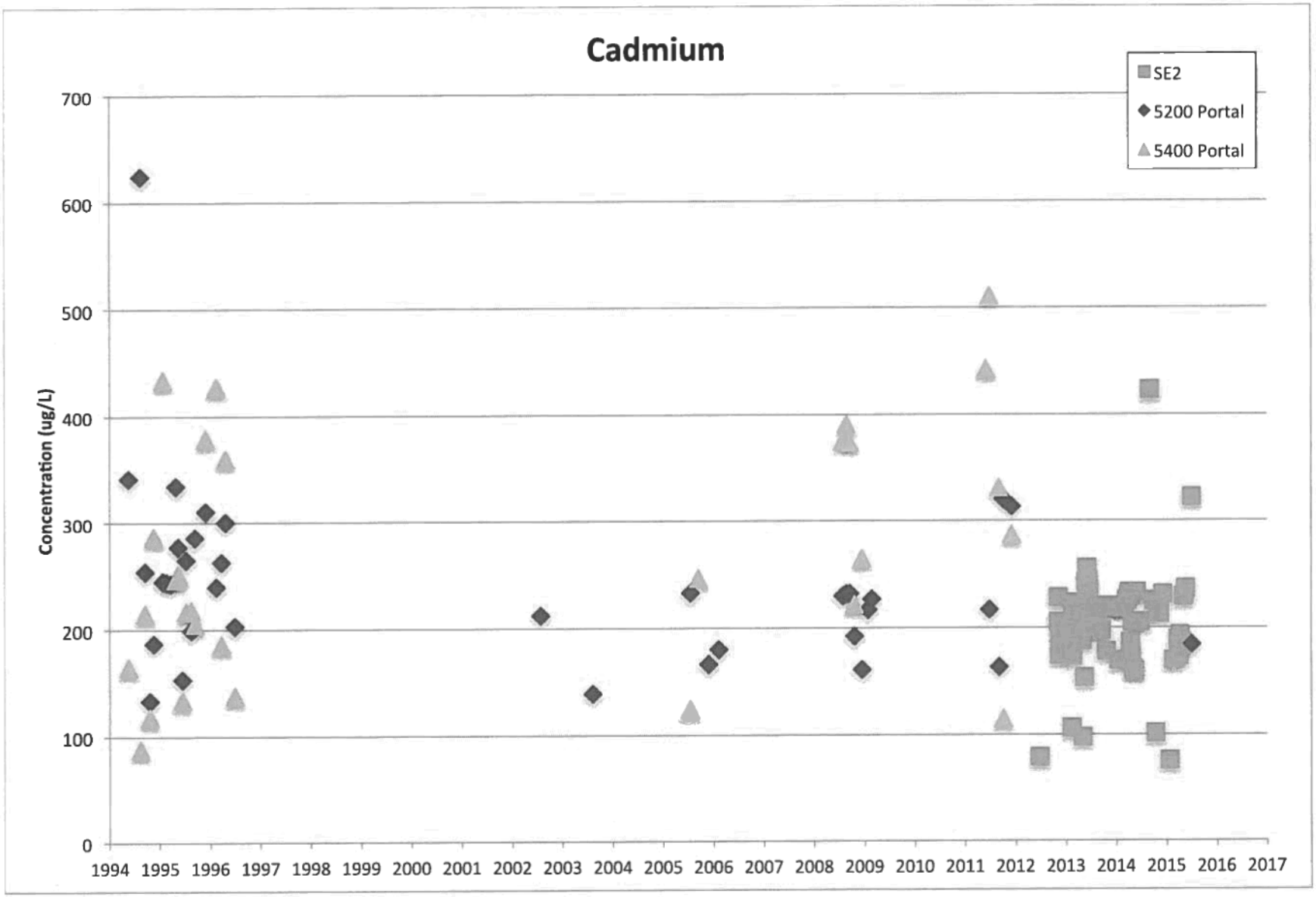

Cadmium Concentration (mg/L)
700
600
500
400
300
200
100
0
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Jan
SE2
5200 Portal
5400 Portal

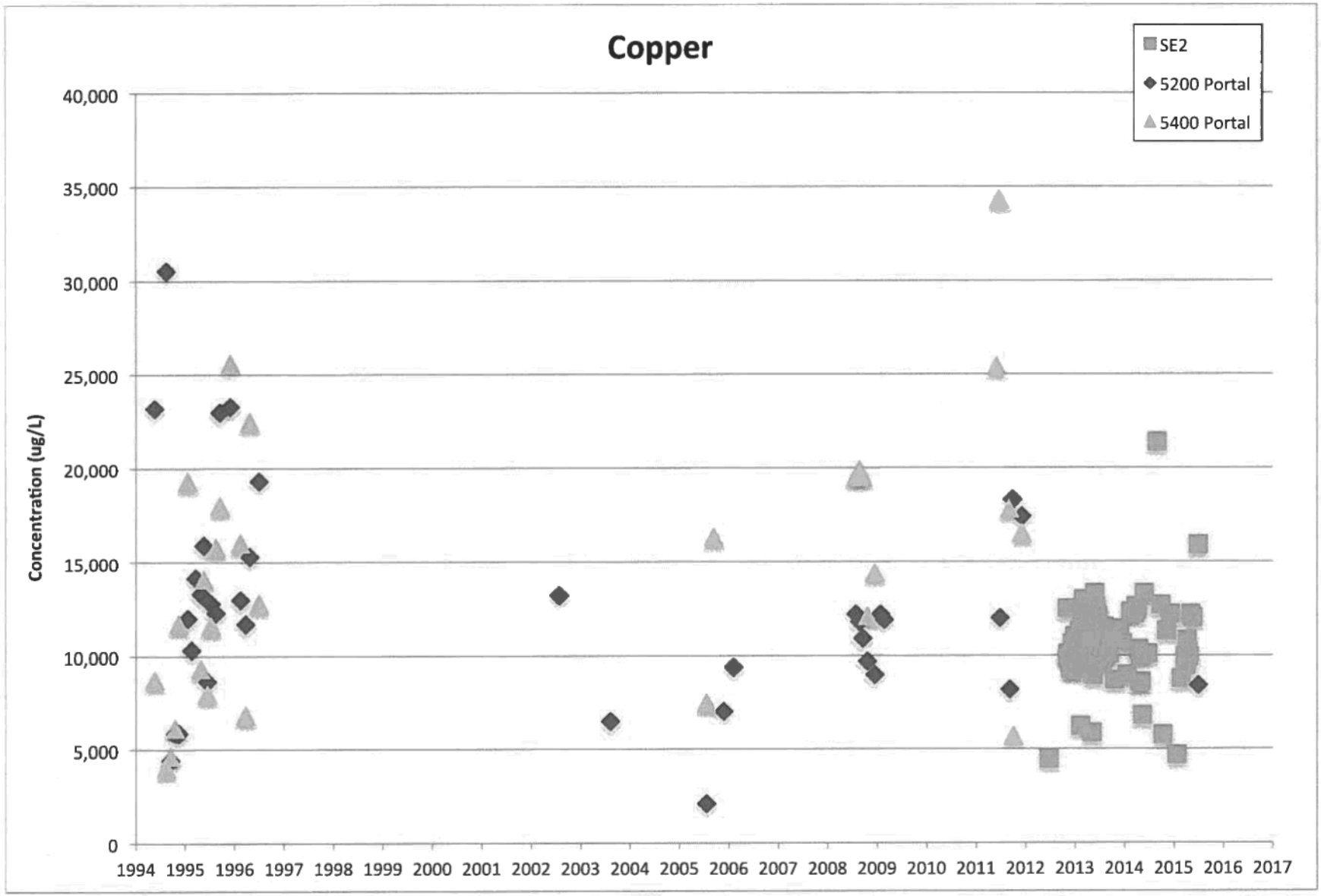

1,400
1,200
1,000
800
600
400
200
0
Sulphate Concentration (mg/L)
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Jan
Feb
SE2
5200 Portal
5400 Portal
5200-2015

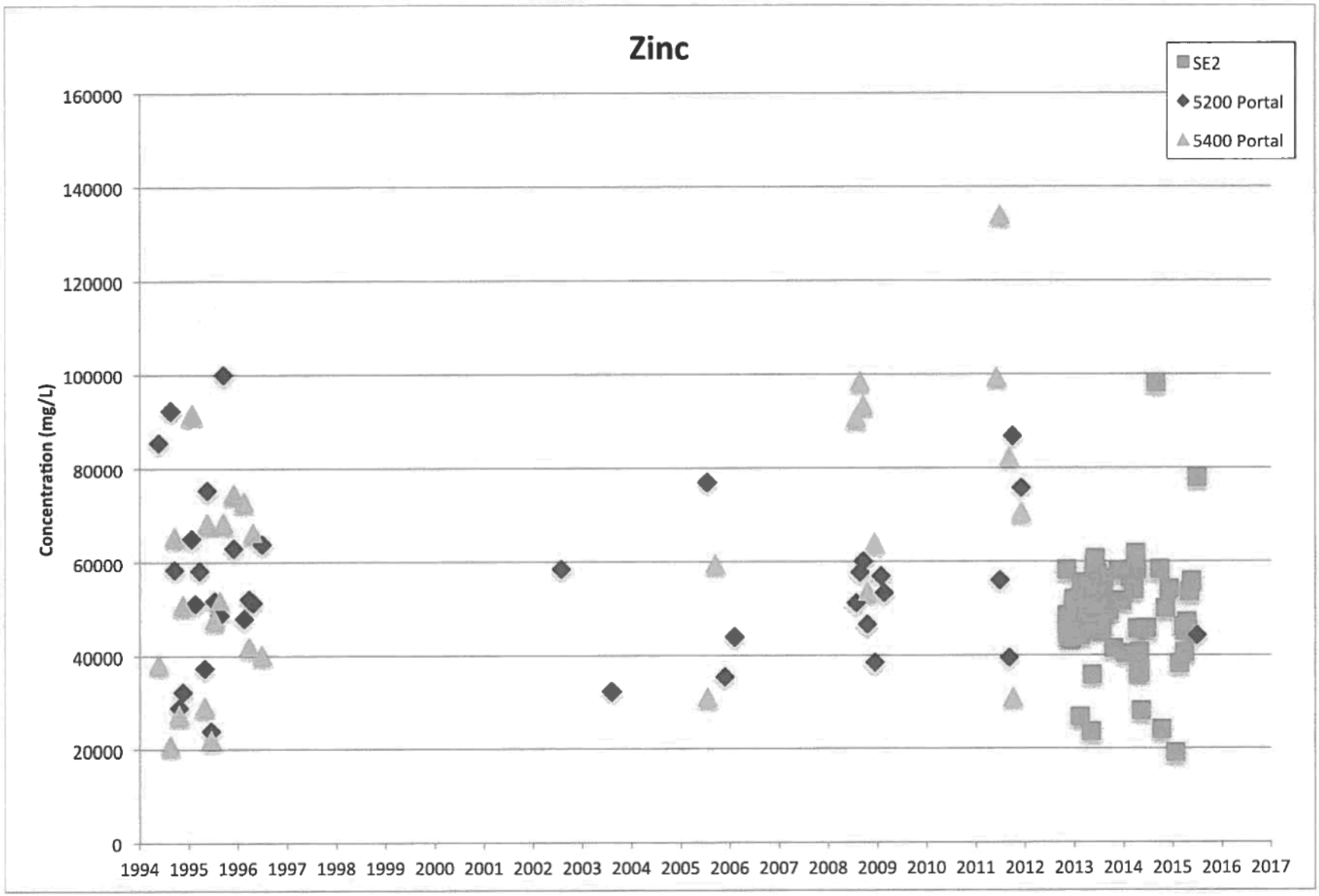

40,000
35,000
30,000
25,000
20,000
15,000
10,000
5,000
0
Copper Concentration (ug/L)
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Jan
SE2
5200 Portal
5400 Portal


160,000
140,000
120,000
100,000
80,000
60,000
40,000
20,000
0
Copper Concentration (mg/L)
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Jan
SE2
5200 Portal
5400 Portal


Sulphate
Concentration (mg/L)
1,400
1,200
1,000
800
600
400
200
0
1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017
SE2
5200 Portal
5400 Portal


Cadmium
SE2
5200 Portal
5400 Portal
Concentration (ug/L)
0
100
200
300
400
500
600
700
1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017


Copper
SE2
5200 Portal
5400 Portal
Concentration (ug/L)
40,000
35,000
30,000
25,000
20,000
15,000
10,000
5,000
0
1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017


Zinc
SE2
5200 Portal
5400 Portal
Concentration (mg/L)
160000
140000
120000
100000
80000
60000
40000
20000
0
1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017

PROJECT: TULSEQUAH CHIEF
COMPANY: REDFERN RESOURCES LIMITED
STATION NAME: 5400 PORTAL OUTFLOW
External Lab Analyses: Historical

Sampler Initials		PERMIT	PERMIT																			5400 PORTAL	5400	5400 Portal	5400 Portal	5400	5450 Portal
ALS/Maxxam ID		LIMIT	CRITERIA																			19-Jul-05	14-Sep-05	13-Oct-05	29-Jul-06	18-Aug-06	06-Sep-06
Sampling Date & Time				21-May-94	17-Aug-94	17-Sep-94	22-Oct-94	18-Nov-94	23-Jan-95	28-Apr-95	17-May-95	16-Jun-05	12-Jul-95	17-Aug-95	15-Sep-95	01-Dec-95	18-Feb-96	25-Mar-96	24-Apr-96	30-Jun-96		5	5	2	5	2	1
COC Number																											
PARAMETERS																											
Cyanide + Thiocyanate	mg/L																										
Misc. Inorganics																											
Acidity (pH 4.5)	mg/L																					73.5	217	282	479	354	239
Acidity (pH 8.3)	mg/L																						11.32				
Fluoride (F)	mg/L																										
Preparation																											
Filter and HNO3 Preservation	N/A																										
ANIONS																											
Nitrite (N)	mg/L																						0.0005				
Calculated Parameters																											
Nitrate (N)	mg/L																						0.182				
Misc. Inorganics																							1				
Alkalinity (Total as CaCO3)	mg/L																										
Total Organic Carbon (C)	mg/L																										
Alkalinity (PP as CaCO3)	mg/L																					0.5	46.1	1	1	1	1
Bicarbonate (HCO3)	mg/L																										
Carbonate (CO3)	mg/L																										
Hydroxide (OH)	mg/L																										
Anions																											
Dissolved Sulphate (SO4)	mg/L			250	200	430	280	530	630	380	530	340	270	630	1,210	685	439	338	372	411		264	444	538	800	621	484
Dissolved Chloride (Cl)	mg/L																						13.7				
Nutrients																											
Ammonia (N)	mg/L																										
Orthophosphate (P)	mg/L																										
Nitrate plus Nitrite (N)	mg/L																										
Physical Properties																											
Conductivity	uS/cm																					617	1010	1180	1660	1420	1060
pH	pH Units																					5.11	3.32	3.15	2.93	2.99	3.27
Physical Properties																											
Total Suspended Solids	mg/L																					28.2	75	81.3	106		70.2
Total Dissolved Solids	mg/L																					501	671	845	1250		805
Turbidity	NTU																										
Misc. Inorganics																											
Dissolved Hardness (CaCO3)	mg/L																					218		298		315	
Total Hardness (CaCO3)	mg/L																										
Dissolved Metals by ICPMS																											
Dissolved Aluminum (Al)	ug/L																					1530	8210				
Dissolved Antimony (Sb)	ug/L																					100	100				
Dissolved Arsenic (As)	ug/L																					100	100				
Dissolved Barium (Ba)	ug/L																					25	22				
Dissolved Beryllium (Be)	ug/L																					2.5	2.5				
Dissolved Bismuth (Bi)	ug/L																					100	100				
Dissolved Boron (B)	ug/L																					50	98				
Dissolved Cadmium (Cd)	ug/L			105	88.2	215	118	287	434	247	282	134	217	218	205	379	427.5	186	360	138		174	247				
Dissolved Chromium (Cr)	ug/L																					5	5				
Dissolved Cobalt (Co)	ug/L																					5	5				
Dissolved Copper (Cu)	ug/L			8720	4040	4670	6140	11700	19300	9329	14100	7990	11600	15800	18000	25600	16000	6850	22500	12800		7450	16300				
Dissolved Iron (Fe)	ug/L																					2280	3440				
Dissolved Lead (Pb)	ug/L																					1.4	23				
Dissolved Lithium (Li)	ug/L																					15	18				
Dissolved Manganese (Mn)	ug/L																					140	281				
Dissolved Mercury (Hg)	ug/L																										
Dissolved Molybdenum (Mo)	ug/L																					15	15				
Dissolved Nickel (Ni)	ug/L																					25	25				
Dissolved Selenium (Se)	ug/L																					100	100				
Dissolved Silicon (Si)	ug/L																					5360	6190				
Dissolved Silver (Ag)	ug/L																					5	5				
Dissolved Strontium (Sr)	ug/L																					135	430				
Dissolved Thallium (Tl)	ug/L																					100	100				
Dissolved Tin (Sn)	ug/L																					15	15				
Dissolved Titanium (Ti)	ug/L																					3	3				
Dissolved Uranium (U)	ug/L																										
Dissolved Vanadium (V)	ug/L																					15	15				
Dissolved Zinc (Zn)	ug/L			38,400	21,000	65,500	27,600	51,100	91,800	29,300	58,400	32,200	47,900	51,900	68,500	74,600	73,000	42,000	66,300	49,300		31000	59600				
Dissolved Zirconium (Zr)	ug/L																					77.1	80.5	-	-	-	-
Dissolved Calcium (Ca)	mg/L																					6.14	9.21	-	-	-	-
Dissolved Magnesium (Mg)	mg/L																					1	1	-	-	-	-
Dissolved Potassium (K)	mg/L																					19.5	12.6	-	-	-	-
Dissolved Sodium (Na)	mg/L																										
Dissolved Sulphur (S)	mg/L																										
Total Metals by ICPMS																											
Total Aluminum (Al)	ug/L																					3330	8290	11000	18700	13000	9960
Total Antimony (Sb)	ug/L																					100	100	100	12.6	12.6	7.1
Total Arsenic (As)	ug/L																					139	430	470	676	508	782
Total Barium (Ba)	ug/L																					29	22	26	24.3	22.2	29.8
Total Beryllium (Be)	ug/L																					2.5	2.5	2.5	5	5	5
Total Bismuth (Bi)	ug/L																					100	100	100	9	9	9
Total Boron (B)	ug/L																					50	50	50	100	100	100
Total Cadmium (Cd)	ug/L			171	102	222	125	280	351	268	300	158	224	228	185	408	440	294	403	138		129	250	323	505	386	276
Total Chromium (Cr)	ug/L																					5	5	5	5	5	5
Total Cobalt (Co)	ug/L																					5	5	5	14.7	10.5	8.1
Total Copper (Cu)	ug/L			9440	5580	5820	7210	15000	25600	10400	18600	8630	12700	24500	18700	29000	16600	8640	22500	21200		7900	18400	20700	32900	21100	15400
Total Iron (Fe)	ug/L																					25200	35400	46100	80400	54800	33400
Total Lead (Pb)	ug/L																					17	29	37.3	61.3	43.3	43.2
Total Lithium (Li)	ug/L																					15	37	15	90	99	50
Total Manganese (Mn)	ug/L																					138	263	334	544	445	357
Total Mercury (Hg)	ug/L																										
Total Molybdenum (Mo)	ug/L																					15	15	15	1.1	2.3	1.5
Total Nickel (Ni)	ug/L																					25	25	25	18	13	11
Total Selenium (Se)	ug/L																					100	100	100	10	10	10
Total Silicon (Si)	ug/L																					5730	8330	6850	7370	7510	6630
Total Silver (Ag)	ug/L																					5	5	5	0.29	0.26	0.1
Total Strontium (Sr)	ug/L																					332	435	498	677	566	558
Total Thallium (Tl)	ug/L																					100	100	100	1	1	1
Total Tin (Sn)	ug/L																					15	15	15	1	1	1
Total Titanium (Ti)	ug/L																					5	5	5	5	5	5
Total Uranium (U)	ug/L																								12.4	8.92	6.45
Total Vanadium (V)	ug/L																					15	15	15	10	10	10
Total Zinc (Zn)	ug/L			42500	24300	75500	30800	51700	122000	33400	83300	32400	49400	79600	73100	104000	76500	41900	66800	49600		31500	59600	82900	127000	87000	58300
Total Zirconium (Zr)	ug/L																					77.1	91.2	101	113	105	91.2
Total Calcium (Ca)	mg/L																					6.06	9.28	10.9	14.9	12.9	10.4
Total Magnesium (Mg)	mg/L																					1	1	1	1	1	1
Total Potassium (K)	mg/L																					19.2	12.7	4.2	4.6	5.9	4.5
Total Sodium (Na)	mg/L																										
Total Sulphur (S)	mg/L																										

Values in red were reported as ND (Not Detected) and shown here at 1/2 the method detection limit

Greater than Permit Limit

Greater than Permit Criteria

LVV	LVV	LVV	LVV	LVV	LVV	LVV	LVV	LVV	LVV	TZ	LVV		MAX	P90	AVERAGE	MEDIAN	P10	MIN	ST DEV
L650132-1	K91981	L31301	L70980	M26571	N18375	AR5568	AW9567	BL5400	BT0212	CH8878	CI0148								
27-Jun-08	28-Jul-08	23-Aug-08	15-Sep-08	18-Oct-08	13-Dec-08	02-Jun-11	28-Jun-11	04-Sep-11	03-Oct-11	15-Nov-11	05-Dec-11								
	F115071	8209378	F117984	8210371	8213212	EB215711	8334401	G039268	G039287	8341528	G039975								
	141	135	123	56	0.25	58			0.25		88.3		141	137	75	74	0.75	0.25	56
	385	379	359	198	267	317			52		271		385	381	279	294	154	52	112
	1.1	1.1	1.3	0.71	1.0								1.3	1.2	1.0	1.1	0.83	0.71	0.20
	LAB	LAB	FIELD	FIELD	FIELD	FIELD	FIELD	FIELD	FIELD		FIELD								
0.00050	0.0080	0.0025	ND	0.0080	0.0090			0.0025 (1)	0.015				0.015	0.012	0.0072	0.0080	0.0015	0.00050	0.0061
0.238	0.23	0.25	0.27	0.20	0.30			0.29	0.17		0		0.30	0.29	0.24	0.24	0.19	0.17	0.042
1.0	0.25	0.25	ND	ND	0.25	ND	0.25	0.25	0.25		0.25		1.00	0.48	0.34	0.25	0.25	0.25	0
-			0.60	0.50	1.6								1.6	1.4	0.90	0.60	0.52	0.50	0.61
	0.25	0.25	ND	ND	0.25	ND	0.25	0.25	0.25		0.25		0.25	0.25	0.25	0.25	0.25	0.25	0
	0.25	0.25	ND	ND	0.25	ND	0.25	0.25	0.25		0.25		0.25	0.25	0.25	0.25	0.25	0.25	0
	0.25	0.25	ND	ND	0.25	ND	0.25	0.25	0.25		0.25		0.25	0.25	0.25	0.25	0.25	0.25	0
	0.25	0.25	ND	ND	0.25	ND	0.25	0.25	0.25		0.25		0.25	0.25	0.25	0.25	0.25	0.25	0
655	600	520	510	370	490	600				577			655	617	540	549	454	370	88
0.95	1.4	1.1	2.5	ND	1.0					0.6			2.5	2.0	1.3	1.1	0.78	0.60	0.66
		0.0050	0.070	0.030	0.010			0.052 (2)	0.018				0.070	0.054	0.027	0.018	0.0070	0.0050	0.026
0.0048	0.058			0.010	0.0090								0.068	0.044	0.020	0.0085	0.0061	0.0048	0.025
	0.24	0.25	0.27	0.20	0.30		0.0025 (1)	0.298 (3)	0.18		0		0.30	0.28	0.24	0.24	0.19	0.18	0.041
1420	1,400	1,500	1,400	1,000	1,100	1,250	1,510	1,400	567		1170		1,510	1,500	1,247	1,400	1,000	567	280
3.02	[illegible]	3.0	[illegible]	[illegible]	3.2	3.3	3.2	[illegible]	4.8		3.07		4.8	3.3	3.3	3.1	3.0	3.0	0.53
62.7	53	53	ND	92	60	160			30		81		160	112	74	61	46	30	39
1070	990	960	820	690	670	980							1,070	1,022	940	870	828	690	119
209	187			378	295								378	353	267	252	194	187	87
	321	306	297	223	232		401	219	196		252		401	337	272	252	214	196	65
343	313	290	280	221	237	327	381	262	183	250	245		381	341	281	285	223	183	58
	13,400	13,600	12,300	7,290	8,750	20,600	26,500	11,900	1,660		12100		26,500	21,190	12,810	12,200	6,727	1,660	6,847
	0.40	0.30	3.6	1.5	2.4	21	2.0	2.5	1.0		0.65		21	5.3	3.5	1.8	0.39	0.30	8.2
	5.7	4.7	297	143	197	286	24	59	2.4		57.0		297	287	108	58	4.5	2.4	116
	22	23	33	41	30	6,810	53	18	25		31.5		6,810	729	709	31	22	18	2,144
	0.52	0.47	0.50	0.31	0.35	0.90	0.90	0.50	0.10		0.36		0.90	0.81	0.48	0.49	0.29	0.10	0.23
	0.015	0.015	ND	ND	0.015	ND	1.0	5.0	1.0		1.25		5.0	2.8	1.2	1.00	0.015	0.015	1.8
	150	150	ND	ND	150	ND	50	250	50		66		250	190	124	150	50	50	73
	375	381	374	222	265	443	511	331	115		287		511	450	331	353	211	115	114
	2.3	2.8	4.0	1.2	1.4	13	9.0	5.0	1.0		5.3		13	9.4	4.5	3.3	1.2	1.0	3.0
	11	10	8.3	5.9	6.6	15	29	8.0	3.0		8.0		29	16	11	9.2	5.6	3.0	7.2
	19,500	19,900	19,500	12,100	14,400	25,400	34,300	17,800	5,710		18500		34,300	26,290	18,511	18,660	11,461	5,710	7,653
	24,600	20,800	49,500	20,900	30,000	37,400	25,900	32,300	1,950		28000		49,500	38,810	27,135	26,950	18,915	1,950	12,304
	38	37	51	25	32	2,010	1,270	123	8.0		137		2,010	1,344	373	44	23	8.0	692
	15	14	13	8.0	10	20	21	25	11		6.5		25	21	14	14	7.9	6.5	6.0
	484	481	424	232	263	683	2,220	371	128		358		2,220	837	560	398	222	128	603
	0.025	0.025	ND	ND	0.025	0.010	0.050	0.25	0.050		0.065		0.25	0.12	0.063	0.038	0.021	0.010	0.078
	0.50	0.15	0.50	ND	0.30	ND	1.0	5.0	1.0		1.25		5.0	2.4	1.2	0.75	0.26	0.15	1.6
	14	15	16	11	11	28	43	11	4.0		12.8		43	30	16	13	9.9	4.0	11
	0.10	0.30	0.40	ND	0.30	0.60	0.10	0.50	0.50		0.31		0.60	0.52	0.35	0.31	0.10	0.10	0.17
	6,210	6,940	7,870	5,620	5,600	16,300	15,000	8,860	5,100		7310		16,300	15,130	8,200	6,535	5,559	5,190	4,023
	0.080	0.11	0.11	0.080	0.090	4.5	0.42	0.10	0.020		0.134		4.5	0.8	0.56	0.11	0.056	0.020	1.4
	632	608	580	388	447	738	649	399	328		434		738	658	520	514	382	328	137
	0.24	0.25	0.22	0.15	0.18	1.1	2.1 (2)	0.25	0.10		0.37		1.1	0.52	0.32	0.24	0.14	0.10	0.30
	0.025	0.025	0.20	ND	0.025	ND	5.0	25	5.0		6.5		25	12	5.2	2.60	0.025	0.025	8.4
	1.5	1.5	21	12	29	79	5.0	25	5.0		6.5		79	34	19	9	1.5	1.5	23
	8.8	8.3	7.8	4.8	5.5	15	14	6.0	1.5		6.86		15	14	7.8	7.3	4.5	1.5	4.0
	0.50	0.50	ND	ND	0.50	ND	5.0	25	5.0		6.5		25	14	6.1	5.0	0.50	0.50	8.7
	90,700	98,500	93,500	53,600	63,900	99,500	134,000	82,300	31,000		78600		134,000	102,950	81,760	86,500	51,340	31,000	28,587
	0.25	0.25	ND	ND	0.60	ND	0.50	2.5	0.50		0.65		2.5	1.4	0.75	0.50	0.25	0.25	0.79
	107	102	99	75	77	105	125	70	70		82.4		125	109	91	91	70	70	19
	13	12	12	8.5	9.4	18	22	11	5.2		10.6		22	18	12	11	8.2	5.2	4.4
	1.4	1.3	1.3	1.2	1.8	3.3	4.1	1.2	1.2		1.38		4.1	3.4	1.8	1.3	1.2	1.2	1.0
	4.9	4.8	4.8	3.1	4.9	4.4	5.6	3.9	13		3.30		13	6.3	5.3	4.8	3.3	3.1	2.5
	238	217	222 (2)	143	163	221	294	197	84		181		294	249	194	197	131	84	60
17,300	13,500	13,600	12,200	6,920	9,360		24,900	13,500	3,360		11100		24,900	14,730	12,074	12,250	8,564	3,360	5,595
5.0	5.9	12	9.9	6.5	7.0		8.0	9.0	14		9.5		14	12	8.7	8.5	5.8	5.0000	2.8
270	311	652	528	360	410		130	465	147		392		652	540	367	376	145	130	182
10	22	27	45	42	43		975	199	46		645		975	658	225	44	20	10.000	366
10	0.50	0.50	0.40	0.33	0.38		1.0	0.50	0.10		0.4		10.0	1.90	1.41	0.45	0.307	0.100	3.03
	0.040	0.075	ND	0.030	0.015		1.5	1.5	0.50		0.5		1.5	1.5	0.51	0.270	0.022	0.015	0.64
50	150	250	ND	ND	150		50	50	25		25		250	180	94	50	25	25.000	81
387	369	413	370	225	296		487	385	96		283		487	420	331	370	212	96	111
10	2.8	3.0	4.0	1.4	2.0		11	3.0	0.50		5		11	10.1	4.3	3.0	1.31	0.500	3.5
11	11	10	9.5	6.0	7.3		26	10	2.6		8.3		26	13	10	9.7	5.6	2.6	8.1
19,000	19,900	19,900	19,800	12,200	18,200		31,200	21,200	5,210		18700		31,200	22,200	18,131	19,400	11,501	5,210	8,649
52,800	48,500	84,100	65,400	40,200	51,800		38,200	83,300	12,900		51300		84,100	67,270	50,850	51,560	35,670	12,900	18,845
39	37	39	78	29	40		1,370	182	30		178		1,370	301	202	40	30	28	415
50	15	13	13	8.0	11		21	13	12		11		50	24	17	13	10.7	8.000	12.2
478	468	450	412	232	270		1,980	423	114		373		1,980	628	520	418	220	114	526
0.010	0.025	0.050	ND	ND	0.025		0.050	0.060	0.025		0.005		0.060	0.050	0.030	0.025	0.009	0.005000	0.018
10	1.4	1.5	1.1	0.90	1.6		1.5	1.5	3.0		0.5		10.0	3.7	2.3	1.5	0.86	0.500	2.78
10	14	15	17	11	10		36	13	4.0		13		38	18	14	13	9.4	4.000	8
10	0.30	0.50	0.50	0.40	0.40		0.50	0.60	0.50		0.4		10.00	1.54	1.41	0.50	0.39	0.300	3.02
	7,100	7,970	7,000	5,690	5,700		14,600	8,090	5,190		7700		14,600	9,382	7,671	7,100	5,590	5,190	2,507
0.20	0.14	0.17	0.18	0.11	0.18		1.8	0.58	0.090		0.64		1.8	0.76	0.41	0.18	0.108	0.09000	0.52
	612	580	557	392	477		653	474	313		448		653	620	502	477	378	313	111
2.0	0.23	0.17	0.27	0.14	0.20		1.0	0.20	0.090		0.25		2.0	1.10	0.46	0.22	0.135	0.0900	0.60
5.0	0.23	0.10	0.20	0.060	0.11		6.0	5.0	2.5		2.5		5.0	5.0	2.1	1.37	0.096	0.0600	2.2
5.0	6.0	33	24	39	30		29	17	2.5		19		39	34	20	22	4.8	2.5000	13
8.4	8.8	8.3	7.5	4.8	8.1		14	7.0	2.5		6.6		14	10	7.5	7.3	4.8	2.5	3.0
10	0.50	1.0	ND	ND	0.50		5.0	5.0	2.5		2.5		10.0	6.5	3.4	2.5	0.50	0.500	3.2
99,700	92,400	105,000	83,500	58,400	73,900		123,000	97,200	20,800		71200		123,000	106,800	83,310	92,950	52,840	20,800	28,984
	0.80	1.0	ND	0.70	1.0		0.50	0.50	0.25		0.7		1.0	1.0	0.66	0.70	0.43	0.25	0.26
115	104	96	93	74	80		119	83	65		79.7		119	115	91	88	73	65	18
13.3	13	12	11	8.5	9.3		21	13	5.1		11.1		21	14	12	12	8.2	5.1	4.0
1.0	1.3	1.2	1.3	1.2	1.2		3.7	1.3	1.1		1.38		3.7	1.6	1.5	1.3	1.1	1.0	0.79
5.2	4.9	4.5	4.6	3.2	3.6		5.4	3.7	12		2.96		12	6.0	5.0	4.6	3.1	3.0	2.5
	232	239	217	130	152		290	227	79		173		290	249	193	217	120	79	65

PROJECT: TULSEQUAH CHIEF
COMPANY: REDFERN RESOURCES LIMITED
STATION NAME: 5200 PORTAL OUTFLOW
External Lab Analysis: Historical

Parameter	Units	PERMIT LIMIT	PERMIT CRITERIA	21-May-94	17-Aug-94	17-Sep-94	22-Oct-94	17-Nov-94	25-Jan-95	19-Feb-95	22-Mar-95	25-Apr-95	17-May-95	15-Jun-95	12-Jul-95	17-Aug-95	15-Sep-95	01-Dec-95	15-Feb-96	25-Mar-96	25-Apr-96	30-Jun-96	06-Jun-01	25-Jul-02	18-Aug-03
Sampler Initials																									
ALS/Maxxam ID																									
COC Number																									
PARAMETERS																									
Cyanide + Thiocyanate	mg/L																								
Misc. Inorganics																									
Acidity (pH 4.5)	mg/L																								
Acidity (pH 8.3)	mg/L																								
Fluoride (F)	mg/L																								
Preparation																									
Filter and HNO3 Preservation	N/A																								
ANIONS																									
Nitrite (N)	mg/L																								
Calculated Parameters																									
Nitrate (N)	mg/L																								
Misc. Inorganics																									
Alkalinity (Total as CaCO3)	mg/L																								
Total Organic Carbon (C)	mg/L																								
Alkalinity (PP as CaCO3)	mg/L																								
Bicarbonate (HCO3)	mg/L																								
Carbonate (CO3)	mg/L																								
Hydroxide (OH)	mg/L																								
Anions																									
Dissolved Sulphate (SO4)	mg/L			670	620	520	290	290	580	480	475	450	530	560	300	480	1170	490	590	560	614	630			
Dissolved Chloride (Cl)	mg/L																								
Nutrients																									
Ammonia (N)	mg/L																								
Orthophosphate (P)	mg/L																								
Nitrate plus Nitrite (N)	mg/L																								
Physical Properties																									
Conductivity	uS/cm																								
pH	pH Units																								
Physical Properties																									
Total Suspended Solids	mg/L																								
Total Dissolved Solids	mg/L																								
Turbidity	NTU																								
Misc. Inorganics																									
Dissolved Hardness (CaCO3)	mg/L																								
Total Hardness (CaCO3)	mg/L																								
Dissolved Metals by ICPMS																									
Dissolved Aluminum (Al)	ug/L																								
Dissolved Antimony (Sb)	ug/L																								
Dissolved Arsenic (As)	ug/L																								
Dissolved Barium (Ba)	ug/L																								
Dissolved Beryllium (Be)	ug/L																								
Dissolved Bismuth (Bi)	ug/L																								
Dissolved Boron (B)	ug/L																								
Dissolved Cadmium (Cd)	ug/L			341	424	254	133	187	245	244	243	334	277	153	265	189	288	319	249	283	310	293		212	139
Dissolved Chromium (Cr)	ug/L																								
Dissolved Cobalt (Co)	ug/L																								
Dissolved Copper (Cu)	ug/L			21290.00	30500.00	4450.00	5600.00	5600.00	12000.00	16300.00	14150.00	13300.00	15900.00	4050.00	12050.00	12300.00	23000.00	21300.00	13000.00	11700.00	15300.00	15300.00		13200.00	6432.00
Dissolved Iron (Fe)	ug/L																								
Dissolved Lead (Pb)	ug/L																								
Dissolved Lithium (Li)	ug/L																								
Dissolved Manganese (Mn)	ug/L																								
Dissolved Mercury (Hg)	ug/L																								
Dissolved Molybdenum (Mo)	ug/L																								
Dissolved Nickel (Ni)	ug/L																								
Dissolved Selenium (Se)	ug/L																								
Dissolved Silicon (Si)	ug/L																								
Dissolved Silver (Ag)	ug/L																								
Dissolved Strontium (Sr)	ug/L																								
Dissolved Thallium (Tl)	ug/L																								
Dissolved Tin (Sn)	ug/L																								
Dissolved Titanium (Ti)	ug/L																								
Dissolved Uranium (U)	ug/L																								
Dissolved Vanadium (V)	ug/L																								
Dissolved Zinc (Zn)	ug/L			85900	92400	65400	29900	32200	64900	51200	52200	37400	75300	23900	51600	48700	108000	63900	48900	52200	51400	63900		58400	32280
Dissolved Zirconium (Zr)	ug/L																								
Dissolved Calcium (Ca)	mg/L																								
Dissolved Magnesium (Mg)	mg/L																								
Dissolved Potassium (K)	mg/L																								
Dissolved Sodium (Na)	mg/L																								
Dissolved Sulphur (S)	mg/L																								
Total Metals by ICPMS																									
Total Aluminum (Al)	ug/L																								
Total Antimony (Sb)	ug/L																								
Total Arsenic (As)	ug/L																								
Total Barium (Ba)	ug/L																								
Total Beryllium (Be)	ug/L																								
Total Bismuth (Bi)	ug/L																								
Total Boron (B)	ug/L																								
Total Cadmium (Cd)	ug/L			341	844	255	138	194	281	243	296	384	371	189	270	298	383	312	250	274	324	295		222	166.5
Total Chromium (Cr)	ug/L																								
Total Cobalt (Co)	ug/L																								
Total Copper (Cu)	ug/L			25700	30900	21700	7480	5920	17200	10400	18000	15900	20500	8800	13200	16400	23200	25000	14300	12900	18000	19900	13900	11750	6895
Total Iron (Fe)	ug/L																								
Total Lead (Pb)	ug/L																								
Total Lithium (Li)	ug/L																								
Total Manganese (Mn)	ug/L																								
Total Mercury (Hg)	ug/L																								
Total Molybdenum (Mo)	ug/L																								
Total Nickel (Ni)	ug/L																								
Total Selenium (Se)	ug/L																								
Total Silicon (Si)	ug/L																								
Total Silver (Ag)	ug/L																								
Total Strontium (Sr)	ug/L																								
Total Thallium (Tl)	ug/L																								
Total Tin (Sn)	ug/L																								
Total Titanium (Ti)	ug/L																								
Total Uranium (U)	ug/L																								
Total Vanadium (V)	ug/L																								
Total Zinc (Zn)	ug/L			82800	97200	60700	34700	32300	87900	51300	74100	41800	98400	25900	52800	53900	100000	74800	48000	57000	52300	61700	53500	60400	31580
Total Zirconium (Zr)	ug/L																								
Total Calcium (Ca)	mg/L																								
Total Magnesium (Mg)	mg/L																								
Total Potassium (K)	mg/L																								
Total Sodium (Na)	mg/L																								
Total Sulphur (S)	mg/L																								

Parameter	Units	19-Jul-05	13-Oct-05	25-Nov-05	09-Feb-06	26-Jul-06	18-Aug-06	06-Sep-06	08-06-27	08-07-26	08-08-21	08-09-15
Sampler Initials									LVV	LVV	LVV	LVV
ALS/Maxxam ID		5200 PORTAL	5200 Portal	5200 PORTAL	5200 Portal	5200 Portal	5200 PORTAL	5200 Portal	L650132-2	K81987	I 31294	I 78979
COC Number		6	4	4	1	4	3	2		F115071	B209178	F117984
PARAMETERS												
Cyanide + Thiocyanate	mg/L											
Misc. Inorganics												
Acidity (pH 4.5)	mg/L									58	50	46
Acidity (pH 8.3)	mg/L	111	72.8	85.5	176.8	115	102	122		228	212	217
Fluoride (F)	mg/L									1.1	1.1	1.2
Preparation												
Filter and HNO3 Preservation	N/A									LAB	LAB	FIELD
ANIONS												
Nitrite (N)	mg/L								0.00050	0.0040	0.0025	ND
Calculated Parameters												
Nitrate (N)	mg/L								0.22	0.22	0.050	0.20
Misc. Inorganics												
Alkalinity (Total as CaCO3)	mg/L								1.0	0.25	0.25	ND
Total Organic Carbon (C)	mg/L											ND
Alkalinity (PP as CaCO3)	mg/L	58.8	11.8	5.8	21.8	1	1	1		0.25	0.25	ND
Bicarbonate (HCO3)	mg/L									0.25	0.25	ND
Carbonate (CO3)	mg/L									0.25	0.25	ND
Hydroxide (OH)	mg/L									0.25	0.25	ND
Anions												
Dissolved Sulphate (SO4)	mg/L	758	589	552	464	425	564	404	537	490	440	480
Dissolved Chloride (Cl)	mg/L								17.9	18	19	18
Nutrients												
Ammonia (N)	mg/L										0.0060	0.040
Orthophosphate (P)	mg/L								0.00050	0.0050		
Nitrate plus Nitrite (N)	mg/L									0.23	0.050	0.20
Physical Properties												
Conductivity	uS/cm	1450	967	900	869	917	679	636	1220	1,200	1,180	1,180
pH	pH Units	6.88	6.38	5.43	4.92	4.71	4.51	4.32	3.23		3.3	3.4
Physical Properties												
Total Suspended Solids	mg/L	29.2	24.5	20.8	22.6	23.4		17.2	36.7	31	29	4.0
Total Dissolved Solids	mg/L	1300	858	613		783		676	847	690	810	850
Turbidity	NTU								123	13		
Misc. Inorganics												
Dissolved Hardness (CaCO3)	mg/L	785	780				583			342	331	317
Total Hardness (CaCO3)	mg/L								353	311	301	300
Dissolved Metals by ICPMS												
Dissolved Aluminum (Al)	ug/L	54		1540	8190					11,600	12,000	11,300
Dissolved Antimony (Sb)	ug/L	100		0.6	0.5					0.22	0.20	4.1 (1)
Dissolved Arsenic (As)	ug/L	100		0.6	0.5					0.97	0.90	11.8 (1)
Dissolved Barium (Ba)	ug/L	34		21.9	21.8					17	18	25
Dissolved Beryllium (Be)	ug/L	2.5		2.5	2.5					0.35	0.38	0.40
Dissolved Bismuth (Bi)	ug/L	100		2.5	2.5					0.0025	0.015	ND
Dissolved Boron (B)	ug/L	50		50	50					25	150	ND
Dissolved Cadmium (Cd)	ug/L	253		186	180					230	232	232
Dissolved Chromium (Cr)	ug/L	5		2.5	2.5					1.2	1.1	1.0
Dissolved Cobalt (Co)	ug/L	18		6.9	6.2					6.2	6.0	7.8
Dissolved Copper (Cu)	ug/L	2120		7020	6378					12,200	11,800	10,900
Dissolved Iron (Fe)	ug/L	99		15	138					1,960	2,600	17900 (1)
Dissolved Lead (Pb)	ug/L	11.5		50.8	96.1					166	169	177
Dissolved Lithium (Li)	ug/L	32		25	25					17	18	15
Dissolved Manganese (Mn)	ug/L	1990		292	337					317	319	312
Dissolved Mercury (Hg)	ug/L									0.0050	0.025	ND
Dissolved Molybdenum (Mo)	ug/L	15		0.25	0.25					0.24	0.15	ND
Dissolved Nickel (Ni)	ug/L	75		6.9	7.5					8.1	8.2	8.1
Dissolved Selenium (Se)	ug/L	100		5	5					0.39	0.40	0.50
Dissolved Silicon (Si)	ug/L	7480		5680	9820					5,410	5,830	7290 (1)
Dissolved Silver (Ag)	ug/L	5		0.05	0.05					0.043	0.060	0.079
Dissolved Strontium (Sr)	ug/L	989		595	553					518	542	524
Dissolved Thallium (Tl)	ug/L	150		0.5	0.5					0.74	0.74	0.70
Dissolved Tin (Sn)	ug/L	15		0.9	0.8					0.0050	0.075	0.10
Dissolved Titanium (Ti)	ug/L	5		5	5					0.29	1.5	13
Dissolved Uranium (U)	ug/L			5.61	5.42					11	10	10
Dissolved Vanadium (V)	ug/L	15		5	5					0.19	0.50	ND
Dissolved Zinc (Zn)	ug/L	76800		76400	47980					51,200	57,700	60,100
Dissolved Zirconium (Zr)	ug/L									0.050	0.25	ND
Dissolved Calcium (Ca)	mg/L	788		110	113					122	118	111
Dissolved Magnesium (Mg)	mg/L	17.1		8.69	7.69					9.2	9.2	9.1
Dissolved Potassium (K)	mg/L	5.1		1	1					1.1	1.1	1.2
Dissolved Sodium (Na)	mg/L	10.4		23.5	13.9					11	12	12
Dissolved Sulphur (S)	mg/L									105	161	101 (2)
Total Metals by ICPMS												
Total Aluminum (Al)	ug/L	610	2950	4840	5660	8780	7050	6080	13,700	11,500	11,800	11,300
Total Antimony (Sb)	ug/L	100	100	2.3	5.1	2.5	2.5	4.8	5.0	3.7	3.5	1.5
Total Arsenic (As)	ug/L	100	100	6	18.7	8.6	5.4	6.2	21	15	13	2.2
Total Barium (Ba)	ug/L	306	90	26.0	35.3	25.8	16.7	25.1	10	19	17	29
Total Beryllium (Be)	ug/L	2.5	2.5	2.5	2.5	2.5	5	2.5	10	0.35	0.30	0.30
Total Bismuth (Bi)	ug/L	100	100	2.5	2.5	2.5	5	2.5		0.015	0.025	ND
Total Boron (B)	ug/L	50	50	50	50	50	100	50	50	150	250	ND
Total Cadmium (Cd)	ug/L	229	165	178	186	195	151	158	264	223	229	234
Total Chromium (Cr)	ug/L	5	5	2.5	2.5	2.5	5	2.5	10	1.6	0.50	1.0
Total Cobalt (Co)	ug/L	16	5	7.1	8.2	6.6	6.4	7	10	8.4	7.5	7.9
Total Copper (Cu)	ug/L	3290	7100	7530	9330	9920	7710	7510	14,300	12,900	11,500	11,300
Total Iron (Fe)	ug/L	7250	4840	4145	19980	9980	7140	8190	24,600	19,419	17,700	13,600
Total Lead (Pb)	ug/L	23.6	39.8	83.4	119	93.4	98.8	87.7	195	171	183	173
Total Lithium (Li)	ug/L	36	27	25	25	25	50	25	50	18	16	16
Total Manganese (Mn)	ug/L	1830	326	301	342	362	278	299	367	309	299	310
Total Mercury (Hg)	ug/L								0.010	0.025	0.050	ND
Total Molybdenum (Mo)	ug/L	15	15	0.68	1.25	0.75	2.6	1.25	10	0.70	0.25	ND
Total Nickel (Ni)	ug/L	25	25	6.9	7.9	12.5	5	6.2	10	6.7	7.6	8.8
Total Selenium (Se)	ug/L	100	100	5	5	5	10	5	10	0.40	0.50	0.40
Total Silicon (Si)	ug/L	8050	6210	5640	6480	5800	5870	5910		7,580	7,090	5,700
Total Silver (Ag)	ug/L	5	5	0.05	0.05	0.05	0.1	0.05	0.20	0.090	0.050	ND
Total Strontium (Sr)	ug/L	516	613	524	570	578	478	494		499	510	518
Total Thallium (Tl)	ug/L	100	100	0.5	0.5	0.5	1	0.5	2.0	0.87	0.84	0.65
Total Tin (Sn)	ug/L	15	15	0.5	0.5	0.5	1	0.5	5.0	0.21	0.050	ND
Total Titanium (Ti)	ug/L	4	5	5	5	5	5	5	5.0	1.5	23	11
Total Uranium (U)	ug/L			5.7	9.42	9.82	7.15	6.75	10	12	10.8	8.9
Total Vanadium (V)	ug/L	15	15	5	5	5	10	5	10	0.50	1.0	ND
Total Zinc (Zn)	ug/L	78700	41900	58600	44800	47200	34500	35300	61,900	54,700	60,200	60,300
Total Zirconium (Zr)	ug/L									0.25	0.50	ND
Total Calcium (Ca)	mg/L	279	142	112	118	124	108	102	125	109	106	109
Total Magnesium (Mg)	mg/L	17.5	8.90	9.15	8.57	8.72	5.83	5.81	10.5	9.3	8.8	9.1
Total Potassium (K)	mg/L	5.2	1	1	1	1	1	1	1.0	1.8	0.99	1.2
Total Sodium (Na)	mg/L	10.7	13.2	23.9	15.3	29.4	31.8	33.3	12.8	12	11	12
Total Sulphur (S)	mg/L									174	170	173

Values in red were reported as ND (Not Detected) and shown here at 1/2 the method detection limit

Greater than Permit Limit

Greater than Permit Criteria

8/9/2011

5200

LVV	LVV	LVV	LVV	LVV	LVV	LVV	TZ	LVV	TZ		MAX	P90	AVERAGE	MEDIAN	P10	MIN	ST DEV
M2577	N1875	N4269	N8362	AP2568	R1399	RT211	CH9993	CB747	M2938								
08-18-18	08-12-13	09-01-25	05-02-26	11-06-26	11-09-04	13-10-03	11-11-15	11-12-05	15-06-25								
6216971	6213212	6216913	6213950	6334401	G270256	G270257	6341525	G270573	48/789-07-61								
49	9.25	35	48			79		185	38.9		196	81	80	48	39	9.25	39
187	186	186	178			236		329	174		526	247	212	200	174	156	47
0.96	1.2	1.1	1.1								1.2	1.2	1.1	1.1	1.0	0.96	0.076
FIELD	FIELD	FIELD	FIELD	FIELD	FIELD	FIELD		FIELD	FIELD								
0.0059	0.0025	0.0025	0.0051	0.0025	0.0025	0.012		0			0.2196	0.0120	0.0073	0.0025	0.0025	0.00059	0.0644
0.18	0.25	0.24	0.16		0.19	0.20		0			0.25	0.24	0.20	0.20	0.16	0.050	0.053
ND	0.25	0.25	0.25	0.25	0.25	0.25		0.25	0.25		1.0	0.25	0.12	0.25	0.25	0.25	0.23
2.2	1.4	1.4	0.25								2.2	2.0	1.3	1.4	0.10	0.25	0.80
ND	0.25	0.25	0.24	0.25	0.25	0.25		0.24	0.25		0.25	0.25	0.25	0.25	0.25	0.25	0
ND	0.25	0.25	0.25	0.25	0.25	0.25		0.25	0.25		0.25	0.25	0.25	0.25	0.25	0.25	0
ND	0.25	0.25	0.25	0.25	0.25	0.25		0.25	0.25		0.25	0.25	0.25	0.25	0.25	0.25	0
ND	0.25	0.25	0.25	0.25	0.25	0.25		0.25	0.25		0.25	0.25	0.25	0.25	0.25	0.25	0
458	458	440	479				736		518		736	557	481	460	429	316	106
15	17	18	18				15		5.8		19	18	18	17	14	8	3.9
0.018	0.0010	0.10	0.0060		0.017 (2)	0.025					0.10	0.064	0.027	0.0190	0.0060	0.0010	0.035
0.0060	0.0016	0.0058	0.0020								0.0060	0.0076	0.0053	0.0050	0.0024	0.00050	0.0023
0.18	0.25	0.24	0.18		0.18	0.21					0.25	0.24	0.19	0.20	0.15	0.050	0.053
1.000	1.000	1.000	1.100	1.120	1.000	1.200		1.440	847		1.440	1.360	1.117	1.100	1.000	847	195
3.7	3.4	3.5	3.7	3.3	3.4	3.1		3	3.41		3.5	3.4	3.3	3.3	3.1	3.0	0.140
34	27	27	25			73			23.8		73	43	32	27	24	4.8	18.8
758	816	780	779								870	846	800	805	757	730	38
169	167	66	72								121	118	81	99	62	13	69
271	241	301	325	331	253	371			218		373	342	301	317	243	218	49
281	259	259	261		279	281	382	332	212		382	378	306	301	279	212	47
								351									
12.180	9.200	9.450	10.800	12.680	6.760	16.800		29750	8620		29.760	19.280	12.976	11.950	8.730	6.529	3.891
1.5	1.1	1.2	1.3	1.1	2.5	1.8		1.5	8.8		2.5	1.5	1.15	1.1	0.22	0.20	0.61
2.6	2.7	2.6	3.5	2.7	6.10	12		24.5	9.5		24.5	12.4	4.9	2.7	0.60	0.10	7.1
22	21	20	17	19.7	19	26		28.2	27.7		31.7	29	23	21	17	17	39.2
0.33	0.28	0.30	0.32	0.30	0.10	0.60		0.50	0.25		0.50	0.30	0.28	0.24	0.20	0.24	0.103
ND	0.815	0.875	0.815	0.50	5.0	1.8		1.25	0.5		5.000	1.825	0.852	0.763	0.0139	0.0025	1.1325
ND	110	250	150	25	250	50		65	25		250	250	114	100	25	25	89
192	161	217	227	217	163	320		313	184		320	305	274	272	185	161	50
1.3	1.2	0.740	1.1	2.3	5.0	3.8		5.1	0.5		5.1	4.5	1.99	1.2	0.50	0.810	1.84
5.9	6.3	7.0	7.5	10	5.9	13		12.6	5.7		13.9	11.8	8.1	7.8	5.5	5.0	2.41
9.880	8.979	12.200	11.900	12.000	6.179	18.200		17400	6419		18.380	16.800	11.626	11.250	8.468	6.179	3.190
18.790	9.740	18.300	11.900	14.080	7.166	18.850		17700	6250		18.790	18.650	11.969	10.160	1.998	2.669	10.184
158	125	141	138	148	115	240		218	146		248	214	181	183	138	115	37
14	17	15	16	26	75	17		18	8.7		75	29	16	16	13	8	4.9
250	216	262	296	443	238	680		467	304		680	465	331	307	230	216	87
ND	0.825	0.960	0.825	0.875	0.25	0.200		0.765	0.110		0.765	0.110	0.667	0.525	0.819	0.1250	0.079
ND	0.15	0.21	0.15	0.10	5.0	1.0		1.25	0.5		1.00	1.05	0.57	0.38	0.15	0.15	1.481
12	9.6	11	10	12	5.0	14		15.3	7.1		15	14	10.9	9.7	7.2	5.0	3.8
0.20	0.68	0.20	0.60	0.30	0.10	0.60		0.50	0.24		0.50	0.50	0.37	0.40	0.20	0.20	0.11
4.430	3.189	5.680	5.710	7.750	5.940	6.360		9260	9303		9.300	8.240	6.615	6.630	5.418	3.189	1.974
0.840	0.649	0.760	0.815	0.940	0.10	0.75		0.750	0.851		0.760	0.115	0.667	0.672	0.632	0.615	0.068
461	499	771	506	581	415	735		618	368		836	666	596	521	499	368	86
0.84	0.67	0.55	0.52	0.73	0.69	1.0		0.67	0.787		1.00	0.74	0.69	0.68	0.51	0.47	0.14
ND	0.825	0.050	0.825	2.5	25	5.5		6.5	2.4		25.00	6.100	3.794	3.180	0.823	0.0750	7.352
8.9	8.9	9.8	5.0	7.3	25	5.5		6.5	2.5		25	13	7.2	5.8	1.8	0.25	6.7
9.5	9.5	10	11	12	7.9	16		19.7	7.81		20	13	11	10	7.3	7.9	3.91
ND	8.50	1.9	0.50	2.5	25	5.5		6.5	2.5		25.0	6.95	4.61	4.75	0.55	0.10	7.54
48.600	38.500	56.900	53.300	58.000	19.500	84.900		75700	44200		86.900	74.140	55.542	54.850	39.975	33.500	14.116
ND	0.29	0.95	0.75	0.25	2.5	0.95		0.65	0.25		2.50	0.91	0.55	0.25	0.23	0.055	0.71
97	89	186	115	113	88	125		113	76		125	122	105	112	88	76	15
8.1	7.1	8.7	9.5	12	9.2	16		12.9	6.61		14.1	12.6	9.7	9.2	7.2	6.6	2.21
1.8	2.8	1.5	1.1	4.2	1.5	1.3		1.33	0.779		4.2	2.8	1.8	1.1	1.0	0.8	1.09
3.8	11	11	9.4	12	10.0 (1)	4.7		6.31	3.77		12	12	9	11	6.2	3.8	3.9
152	133	155	179	199	146	251		261	152		263	251	178	161	133	132	44
9.950	10.500	9.250	10.200	14.160	10.100	19.900		18700	8770		19.900	17.780	12.252	11.300	9.350	8.770	3.462
4.4	3.9	4.8	4.3	4.9	2.9	3.9		6.3	2.4		6.3	5.8	3.9	3.5	2.5	0.7800	1.2
29	18	21	24	18	19	84		112	27.4		112	38	28	25	13.5	3.7	29.1
29	27	19	18	154	25	52		132	27.8		154	118	62	21	17	18.890	48.3
9.38	9.38	9.39	9.49	9.68	9.39	9.50		9.5	8.25		10.00	9.50	9.11	9.38	8.39	8.210	2.67
ND	0.815	0.705	0.705	4.5	9.10	9.50		9.5	9.5		9.500	0.000	0.361	0.263	0.815	0.815	0.4858
ND	150	250	250	50	25	25		25	25		250	250	114	100	25	25.000	89
200	199	229	230	234	192	259		256	183		259	254	232	230	183	183	34
1.4	1.2	0.99	0.93	1.5	1.8	3.8		5	1.3		10.9	4.8	2.20	1.30	0.50	0.500	2.85
7.1	7.1	5.8	7.4	10	6.7	15		12.8	6.89		12.7	11.7	8.6	7.5	6.7	5.1	2.19
18.190	11.180	12.740	12.080	12.080	9.629	17.598		16708	9998		17.580	16.226	12.321	11.508	9.618	9.958	2.115
19.900	21.430	17.200	17.900	25.580	16.078	44.979		45858	12858		45.880	40.700	29.754	19.480	16.080	12.678	10.567
159	193	157	161	158	135	281		235	152		281	227	172	169	139	137	38
15	14	13	15	20	15	19		19	10.8		50	20	18	15	13.2	10.890	9.9
253	252	295	295	439	277	494		456	318		494	474	335	309	256	252	76
ND	0.825	0.760	0.825	0.825	0.825	0.825		0.822			0.878	0.845	0.815	0.825	0.821	0.810000	0.015
9.50	8.3	8.2	9.90	11.5	9.10	9.40		9.6	8.5		10.9	9.7	8.5	9.80	8.50	8.210	3.5
8.2	7.5	13	9.3	13	5.9	14		10	7.5		15	14	10.9	9.6	7.7	7.500	2.6
9.50	9.50	9.20	9.40	9.50	9.40	9.50		9.5	9.24		10.00	9.50	9.14	9.40	9.25	9.200	2.84
8.710	8.540	7.480	8.950	8.950	6.120	8.520		8240	9560		8.628	8.174	6.951	6.915	5.614	5.560	924
8.889	8.878	8.879	8.790	8.260	8.950	8.29		8.51	8.041		8.918	8.251	8.133	8.875	8.850	8.84170	0.139
486	477	503	518	575	497	897		605	358		897	566	516	513	473	358	76
8.69	8.50	8.50	9.51	8.78	9.10	9.39		9.80	8.767		9.80	8.87	9.15	8.85	8.52	8.1800	0.29
ND	8.850	8.950	9.950	9.9	2.1	2.1		2.5	2.1		5.10	5.05	1.935	2.300	0.850	0.0500	1.525
25	21	24	6.8	9.9	2.5	2.5		2.5	2.5		25	24	10	5	2.5	1.1800	9
16.9	11	8.6	11	13	8.8	19		29.8	8.33		29	18	12	10.5	8.6	8.3	3.9
ND	9.50	1.0	1.0	0.5	7.5	2.5		7.5	2.5		10.0	9.0	7.64	7.90	0.50	0.100	2.79
50.900	46.000	51.100	50.200	56.300	46.400	79.400		70800	47100		79.900	66.700	57.200	56.900	47.480	46.400	7.958
ND	8.25	8.50	0.50	0.50	8.25	8.25		8.25	8.25		8.50	8.50	8.15	8.25	8.25	8.25	0.13
99	99	105	99	109	97	125		112	72.4		125	122	105	106	97	72	11.6
8.4	7.9	9.1	9.8	12	6.9	14		12.4	7.47		14.3	12.4	9.8	9.1	8.0	7.9	2.02
1.1	1.1	1.1	0.95	1.1	1.3	1.3		1.16	0.711		1.1	1.3	1.3	1.1	0.98	0.71	0.055
9.4	9.4	11	9.1	12	10	4.4		5.58	4.18		13	12	9	10	4.7	4.2	2.9
149	141	184	191 (1)	196	159	265		214	122		265	215	174	174	148	122	35

PROJECT: TULSEQUAH CHIEF
COMPANY: REDFERN RESOURCES LIMITED
STATION NAME: 5400 PORTAL OUTFLOW
External Lab Analysis: Historical

Sampler Initials		PERMIT	PERMIT																			5400 PORTAL	5400	5400 Portal	5400 Portal	5400	5400 Portal
ALS/Maxxam ID		LIMIT	CRITERIA																			19-Jul-05	14-Sep-05	13-Oct-05	26-Jul-06	18-Aug-06	06-Sep-06
Sampling Date & Time				21-May-84	17-Aug-84	17-Sep-84	22-Oct-84	18-Nov-84	23-Jan-85	28-Apr-85	17-May-95	16-Jun-95	12-Jul-95	17-Aug-95	15-Sep-95	01-Dec-95	18-Feb-96	25-Mar-96	24-Apr-96	30-Jun-96		5	5	2	5	2	1
COC Number																											
PARAMETERS																											
Cyanide + Thiocyanate	mg/L																										
Misc. Inorganics																											
Acidity (pH 4.5)	mg/L																					73.5	217	282	479	354	239
Acidity (pH 8.3)	mg/L																						1.32				
Fluoride (F)	mg/L																										
Preparation																											
Filter and HNO3 Preservation	N/A																										
ANIONS																											
Nitrite (N)	mg/L																						< 0.005				
Calculated Parameters																											
Nitrate (N)	mg/L																						0.182				
Misc. Inorganics																							< 1				
Alkalinity (total as CaCO3)	mg/L																										
Total Organic Carbon (C)	mg/L																					0.5	46.1	1	1	1	1
Alkalinity (PP as CaCO3)	mg/L																										
Bicarbonate (HCO3)	mg/L																										
Carbonate (CO3)	mg/L																										
Hydroxide (OH)	mg/L																										
Anions																											
Dissolved Sulphate (SO4)	mg/L			250	200	430	280	530	600	380	530	340	270	630	1,210	685	435	338	372	411		264	444	538	800	821	484
Dissolved Chloride (Cl)	mg/L																						13.7				
Nutrients																											
Ammonia (N)	mg/L																										
Orthophosphate (P)	mg/L																										
Nitrate plus Nitrite (N)	mg/L																										
Physical Properties																											
Conductivity	uS/cm																					617	1010	1180	1680	1420	1060
pH	pH Units																					5.11	3.32	3.15	2.93	2.99	3.27
Physical Properties																											
Total Suspended Solids	mg/L																					28.2	75	81.3	106		70.2
Total Dissolved Solids	mg/L																					501	671	845	1250		835
Turbidity	NTU																										
Misc. Inorganics																											
Dissolved Hardness (CaCO3)	mg/L																					218		256		315	
Total Hardness (CaCO3)	mg/L																										
Dissolved Metals by ICPMS																											
Dissolved Aluminum (Al)	ug/L																					15.30	8210				
Dissolved Antimony (Sb)	ug/L																					100	100				
Dissolved Arsenic (As)	ug/L																					100	100				
Dissolved Barium (Ba)	ug/L																					25	22				
Dissolved Beryllium (Be)	ug/L																					2.5	2.5				
Dissolved Bismuth (Bi)	ug/L																					100	100				
Dissolved Boron (B)	ug/L																					50	50				
Dissolved Cadmium (Cd)	ug/L			185	88.2	215	118	287	434	247	252	134	217	218	205	379	427.5	186	360	139		124	247				
Dissolved Chromium (Cr)	ug/L																					5	5				
Dissolved Cobalt (Co)	ug/L																					5	5				
Dissolved Copper (Cu)	ug/L			8720	4040	4879	6148	11700	19300	8320	14100	7990	11600	15800	18300	25600	16000	6850	22500	12800		7450	16300				
Dissolved Iron (Fe)	ug/L																					2380	3440				
Dissolved Lead (Pb)	ug/L																					1.4	23				
Dissolved Lithium (Li)	ug/L																					15	19				
Dissolved Manganese (Mn)	ug/L																					149	261				
Dissolved Mercury (Hg)	ug/L																										
Dissolved Molybdenum (Mo)	ug/L																					15	15				
Dissolved Nickel (Ni)	ug/L																					25	25				
Dissolved Selenium (Se)	ug/L																					100	100				
Dissolved Silicon (Si)	ug/L																					5360	8190				
Dissolved Silver (Ag)	ug/L																					5	5				
Dissolved Strontium (Sr)	ug/L																					335	430				
Dissolved Thallium (Tl)	ug/L																					100	100				
Dissolved Tin (Sn)	ug/L																					15	15				
Dissolved Titanium (Ti)	ug/L																					5	5				
Dissolved Uranium (U)	ug/L																					15	15				
Dissolved Vanadium (V)	ug/L																					15	15				
Dissolved Zinc (Zn)	ug/L			38,400	21,000	63,500	27,600	51,100	91,800	29,300	68,400	72,700	47,900	51,900	68,500	74,800	73,000	42,000	66,300	40,300		11000	19500				
Dissolved Zirconium (Zr)	ug/L																										
Dissolved Calcium (Ca)	mg/L																					77.1	83.5	-	-	-	-
Dissolved Magnesium (Mg)	mg/L																					6.14	9.21	-	-	-	-
Dissolved Potassium (K)	mg/L																					1	1	-	-	-	-
Dissolved Sodium (Na)	mg/L																					19.5	12.6	-	-	-	-
Dissolved Sulphur (S)	mg/L																										
Total Metals by ICPMS																											
Total Aluminum (Al)	ug/L																					3930	8290	11000	18700	13000	9860
Total Antimony (Sb)	ug/L																					100	100	100	12.6	12.6	7.1
Total Arsenic (As)	ug/L																					130	4.30	470	626	506	282
Total Barium (Ba)	ug/L																					29	22	26	24.3	22.2	29.9
Total Beryllium (Be)	ug/L																					2.5	2.5	2.5	5	5	5
Total Bismuth (Bi)	ug/L																					100	100	100	100	100	100
Total Boron (B)	ug/L																					50	50	50	100	100	100
Total Cadmium (Cd)	ug/L			171	192	222	125	280	351	268	300	158	224	228	185	408	440	294	483	138		125	250	323	505	386	276
Total Chromium (Cr)	ug/L																					5	5	5	5	5	5
Total Cobalt (Co)	ug/L																					5	5	5	14.2	10.5	8.1
Total Copper (Cu)	ug/L			9440	5580	5820	7210	1800	25500	10400	18600	8430	12700	24500	18700	29000	16600	8640	22500	21200		7900	18400	20700	32900	21100	15400
Total Iron (Fe)	ug/L																					25,200	35400	48100	80400	54600	39400
Total Lead (Pb)	ug/L																					17	28	37.3	51.3	43.3	43.2
Total Lithium (Li)	ug/L																					15	17	18	50	50	50
Total Manganese (Mn)	ug/L																					138	263	334	544	445	357
Total Mercury (Hg)	ug/L																										
Total Molybdenum (Mo)	ug/L																					15	15	1.5	1.1	2.3	0.5
Total Nickel (Ni)	ug/L																					25	25	25	18	13	11
Total Selenium (Se)	ug/L																					100	100	100	10	10	10
Total Silicon (Si)	ug/L																					5730	6330	6850	7370	7510	6630
Total Silver (Ag)	ug/L																					5	5	5	0.79	0.28	0.1
Total Strontium (Sr)	ug/L																					332	435	496	677	666	556
Total Thallium (Tl)	ug/L																					100	100	100	1	1	1
Total Tin (Sn)	ug/L																					15	15	15	1	1	1
Total Titanium (Ti)	ug/L																					5	5	5	3	5	5
Total Uranium (U)	ug/L																								12.4	8.92	6.45
Total Vanadium (V)	ug/L																					15	15	15	10	10	10
Total Zinc (Zn)	ug/L			42500	24500	75500	36900	51700	122000	33500	83300	32400	49400	79500	73100	104000	76500	41900	66800	40620		31500	59600	82900	127000	87000	59300
Total Zirconium (Zr)	ug/L																										
Total Calcium (Ca)	mg/L																					77.1	91.2	101	113	105	91.2
Total Magnesium (Mg)	mg/L																					6.96	9.28	10.9	14.9	12.9	10.4
Total Potassium (K)	mg/L																					1	1	1	1	1	1
Total Sodium (Na)	mg/L																					19.2	12.7	4.2	4.6	5.9	4.5
Total Sulphur (S)	mg/L																										

Values in red were reported as ND (Not Detected) and shown here at 1/2 the method detection limit

Greater than Permit Limit

Greater than Permit Criteria

LVV	LVV	LVV	LVV	LVV	LVV	LVV	LVV	LVV	LVV	TZ	LVV		MAX	P90	AVERAGE	MEDIAN	P10	MIN	ST DEV
L650132-1	K91981	L31301	L70980	M26571	N18375	AR5565	AW9567	BL5400	BT0212	CH8678	CX0148								
27-Jun-08	28-Jul-08	23-Aug-08	15-Sep-08	18-Oct-08	13-Dec-08	02-Jun-11	26-Jun-11	04-Sep-11	03-Oct-11	15-Nov-11	05-Dec-11								
	F115071	8209378	F117984	8210371	8213212	EB215711	8334401	G038268	G039267	6341526	G039975								
	141	135	123	56	0.25	59			0.25		88.3		141	137	75	74	0.25	0.25	58
	385	379	359	198	267	317			52		271		385	381	279	294	154	52	112
	1.1	1.1	1.3	0.71	1.0								1.3	1.2	1.0	1.1	0.83	0.71	0.20
	LAB	LAB	FIELD	FIELD	FIELD	FIELD	FIELD	FIELD	FIELD		FIELD								
0.00050	0.0080	0.0025	ND	0.0080	0.0090			0.0025 (1)	0.015				0.015	0.012	0.0072	0.0080	0.0015	0.00050	0.0061
0.238	0.23	0.25	0.27	0.20	0.30			0.29	0.17		0		0.30	0.29	0.24	0.24	0.19	0.17	0.042
1.0	0.75	0.75	ND	ND	0.25	ND	0.75	0.25	0.25		0.25		1.00	0.48	0.34	0.25	0.25	0.25	0
-			0.60	0.50	1.6								1.6	1.4	0.90	0.80	0.52	0.50	0.61
	0.25	0.25	ND	ND	0.25	ND	0.25	0.25	0.25		0.25		0.25	0.25	0.25	0.25	0.25	0.25	0
	0.25	0.25	ND	ND	0.25	ND	0.25	0.25	0.25		0.25		0.25	0.25	0.25	0.25	0.25	0.25	0
	0.25	0.25	ND	ND	0.25	ND	0.25	0.25	0.25		0.25		0.25	0.25	0.25	0.25	0.25	0.25	0
	0.25	0.25	ND	ND	0.25	ND	0.25	0.25	0.25		0.25		0.25	0.25	0.25	0.25	0.25	0.25	0
655	600	520	510	370	490	600				577			655	617	540	549	454	370	88
0.95	1.4	1.1	2.5	ND	1.0					0.6			2.5	2.0	1.3	1.1	0.78	0.60	0.66
		0.0050	0.070	0.030	0.010			0.062 (2)	0.018				0.070	0.054	0.027	0.018	0.0070	0.0050	0.028
0.0048	0.058			0.010	0.0090								0.068	0.044	0.020	0.0095	0.0061	0.0048	0.025
	0.24	0.25	0.27	0.20	0.30		0.0025 (1)	0.288 (3)	0.18		0		0.30	0.28	0.24	0.24	0.19	0.18	0.041
1420	1,400	1,500	1,400	1,000	1,100	1,250	1,510	1,400	567		1170		1,510	1,500	1,247	1,400	1,000	567	260
3.02	[illegible]	3.0	[illegible]	[illegible]	3.2	3.3	3.2	[illegible]	4.8		3.07		4.8	3.3	3.3	3.1	3.0	3.0	0.53
62.7	53	53	ND	82	60	160			30		81		160	112	74	61	46	30	39
1070	990	960	920	690	970	980							1,070	1,022	940	970	828	690	119
209	187			378	295								378	353	267	252	194	187	87
	321	306	297	223	232		401	219	198		252		401	337	272	252	214	198	65
343	313	290	280	221	237	327	381	262	183	290	245		381	341	281	285	223	183	58
	13,400	13,600	12,300	7,290	8,750	20,600	26,500	11,900	1,660		12100		26,500	21,190	12,810	12,200	6,727	1,660	6,847
	0.40	0.30	3.6	1.5	2.4	21	2.0	7.5	1.0		0.66		21	5.3	3.5	1.8	0.39	0.30	6.2
	5.7	4.7	297	143	197	286	24	59	2.4		57.0		297	287	108	58	4.5	2.4	116
	22	23	33	41	30	6,810	53	18	25		31.5		6,810	729	709	31	22	18	2,144
	0.52	0.47	0.50	0.31	0.35	0.60	0.90	0.50	0.10		0.36		0.90	0.81	0.48	0.45	0.29	0.10	0.23
	0.015	0.015	ND	ND	0.015	ND	1.0	5.0	1.0		1.25		5.0	2.8	1.2	1.00	0.015	0.015	1.8
	150	150	ND	ND	150	ND	50	250	50		60		250	190	124	150	50	50	73
	375	391	374	222	265	443	511	331	115		287		511	450	331	353	211	115	114
	2.3	2.8	4.0	1.2	1.4	13	9.8	5.0	1.0		5.3		13	9.4	4.5	3.3	1.2	1.0	3.9
	11	10	8.3	5.9	8.6	15	29	9.0	3.0		8.0		29	16	11	9.2	5.6	3.0	7.2
	19,500	18,900	19,500	12,100	14,400	25,400	34,300	17,800	5,710		16500		34,300	26,290	18,511	18,660	11,461	5,710	7,663
	24,600	20,800	49,500	20,900	30,000	37,400	25,900	32,300	1,950		28000		49,500	38,610	27,135	28,950	18,915	1,950	12,304
	36	37	51	25	32	2,010	1,270	123	8.0		137		2,010	1,344	373	44	23	8.0	692
	15	14	13	8.0	10	20	21	25	11		8.5		25	21	14	14	7.9	8.5	6.0
	464	461	424	232	263	683	2,220	371	128		358		2,220	837	560	398	222	128	603
	0.025	0.025	ND	ND	0.025	0.010	0.050	0.25	0.050		0.065		0.25	0.12	0.063	0.038	0.021	0.010	0.078
	0.50	0.15	0.50	ND	0.30	ND	1.0	5.0	1.0		1.25		5.0	2.4	1.2	0.75	0.28	0.15	1.6
	14	15	18	11	11	28	43	11	4.0		12.8		43	30	16	13	9.9	4.0	11
	0.10	0.30	0.40	ND	0.30	0.60	0.10	0.50	0.50		0.31		0.60	0.52	0.35	0.31	0.10	0.10	0.17
	6,210	6,840	7,870	5,820	5,600	16,300	15,000	6,860	5,190		7318		16,300	15,130	8,200	6,535	5,559	5,100	4,023
	0.080	0.11	0.11	0.080	0.090	4.5	0.42	0.10	0.020		0.134		4.5	0.8	0.56	0.11	0.056	0.020	1.4
	632	608	580	388	447	738	649	299	328		434		738	658	520	514	382	328	137
	0.24	0.25	0.22	0.15	0.18	1.1	2.1 (2)	0.25	0.10		0.37		1.1	0.52	0.32	0.24	0.14	0.10	0.30
	0.025	0.025	0.20	ND	0.025	ND	5.0	25	5.0		6.5		25	17	5.2	2.60	0.025	0.025	8.4
	1.5	1.5	21	12	29	79	5.0	25	5.0		6.5		79	34	19	9	1.5	1.5	23
	8.8	8.3	7.8	4.8	5.5	15	14	6.0	1.5		6.86		15	14	7.8	7.3	4.5	1.5	4.0
	0.50	0.50	ND	ND	0.50	ND	5.0	25	5.0		8.5		25	14	6.1	5.0	0.50	0.50	8.7
	90,700	98,500	93,500	53,600	63,900	99,500	134,000	82,300	31,000		70600		134,000	102,950	81,760	86,500	51,340	31,000	28,587
	0.25	0.25	ND	ND	0.60	ND	0.50	2.5	0.50		0.65		2.5	1.4	0.75	0.50	0.25	0.25	0.79
	107	102	99	75	77	105	125	70	70		83.4		125	109	91	91	70	70	19
	13	12	12	8.5	9.4	18	22	11	5.2		10.6		22	18	12	11	8.2	5.2	4.4
	1.4	1.3	1.3	1.2	1.8	3.3	4.1	1.2	1.2		1.38		4.1	3.4	1.8	1.3	1.2	1.2	1.0
	4.9	4.8	4.8	3.1	4.9	4.4	5.6	3.9	13		3.30		13	6.3	5.3	4.8	3.3	3.1	2.8
	238	217	222 (2)	143	163	221	294	197	84		181		294	249	194	197	131	84	60
12,300	13,500	13,600	12,200	6,920	9,350		24,900	13,500	3,360		11100		24,900	14,730	12,074	12,250	6,564	3,360	5,595
5.0	5.9	12	9.9	6.5	7.0		8.0	9.0	14		9.5		14	12	8.7	8.5	5.8	5.0000	2.8
270	311	652	528	360	410		130	465	147		392		652	540	367	376	145	130	162
10	22	27	45	42	43		975	199	48		845		975	858	225	44	20	10.000	366
10	0.50	0.50	0.40	0.33	0.38		1.0	0.50	0.10		0.4		10.0	1.90	1.41	0.45	0.307	0.100	3.03
	0.040	0.025	ND	0.030	0.015		1.5	1.5	0.50		0.5		1.5	1.5	0.51	0.270	0.022	0.015	0.64
50	150	250	ND	ND	150		50	50	25		25		250	180	94	50	25	25.000	81
387	369	413	370	225	296		487	385	96		283		487	420	331	370	212	96	111
10	2.8	3.0	4.0	1.4	2.0		11	3.0	0.50		5		11	10.1	4.3	3.0	1.31	0.500	3.5
11	11	10	9.5	6.0	7.3		26	10	2.6		8.3		26	13	10	9.7	5.6	2.6	6.1
19,000	19,900	19,900	19,800	12,200	18,200		31,200	21,200	5,210		18700		31,200	22,200	18,131	19,400	11,501	5,210	8,649
52,800	48,500	84,100	65,400	40,200	51,800		38,200	63,300	12,900		51300		84,100	67,270	50,850	51,560	35,670	12,900	18,845
33	37	39	78	28	40		1,370	182	30		178		1,370	301	202	40	30	28	415
50	15	13	13	8.0	11		21	13	12		11		50	24	17	13	10.7	8.000	12.2
478	468	450	412	232	270		1,980	423	114		373		1,980	628	520	418	220	114	526
0.010	0.025	0.060	ND	ND	0.025		0.050	0.050	0.025		0.005		0.050	0.050	0.030	0.025	0.009	0.005000	0.018
10	1.4	1.5	1.1	0.90	1.8		1.5	1.5	3.0		0.5		10.0	3.7	2.3	1.5	0.88	0.500	2.78
10	14	15	17	11	10		38	13	4.0		13		38	18	14	13	9.4	4.000	8
10	0.30	0.50	0.50	0.40	0.40		0.50	0.60	0.50		0.4		10.00	1.54	1.41	0.50	0.39	0.300	3.02
	7,100	7,970	7,000	5,690	5,700		14,600	8,090	5,190		7700		14,600	9,382	7,671	7,100	5,500	5,190	2,507
0.79	0.14	0.17	0.18	0.11	0.18		1.8	0.58	0.090		0.64		1.8	0.76	0.41	0.18	0.108	0.09000	0.52
	612	580	567	392	477		653	474	313		448		653	620	502	477	378	313	111
2.0	0.23	0.17	0.27	0.14	0.20		1.0	0.29	0.090		0.25		2.0	1.10	0.45	0.22	0.135	0.0900	0.60
5.0	0.23	0.10	0.20	0.060	0.11		5.0	5.0	2.5		2.5		5.0	5.0	2.1	1.37	0.096	0.0600	2.2
5.0	6.0	33	24	39	30		29	17	2.5		19		39	34	20	22	4.8	2.5000	13
8.4	8.8	8.3	7.5	4.8	6.1		14	7.0	2.5		6.6		14	10	7.5	7.3	4.8	2.5	3.0
10	0.50	1.0	ND	ND	0.50		5.0	5.0	2.5		2.5		10.0	6.5	3.4	2.5	0.50	0.500	3.2
99,700	92,400	105,000	93,500	56,400	73,900		123,000	97,200	20,800		71200		123,000	106,800	83,310	92,950	52,840	20,800	28,984
	0.80	1.0	ND	0.70	1.0		0.50	0.50	0.25		0.7		1.0	1.0	0.68	0.70	0.43	0.25	0.26
115	104	96	93	74	80		119	83	65		79.7		119	115	91	88	73	65	18
13.3	13	12	11	8.5	9.3		21	13	5.1		11.1		21	14	12	12	8.2	5.1	4.0
1.0	1.3	1.2	1.3	1.2	1.2		3.7	1.3	1.1		1.38		3.7	1.6	1.5	1.3	1.1	1.0	0.79
5.2	4.9	4.5	4.6	3.2	3.8		5.4	3.7	12		2.96		12	6.0	5.0	4.6	3.1	3.0	2.5
	232	239	217	130	152		290	227	79		173		290	249	193	217	120	79	65

APPENDIX C

Tulsequah River Floodplain Braid Photos

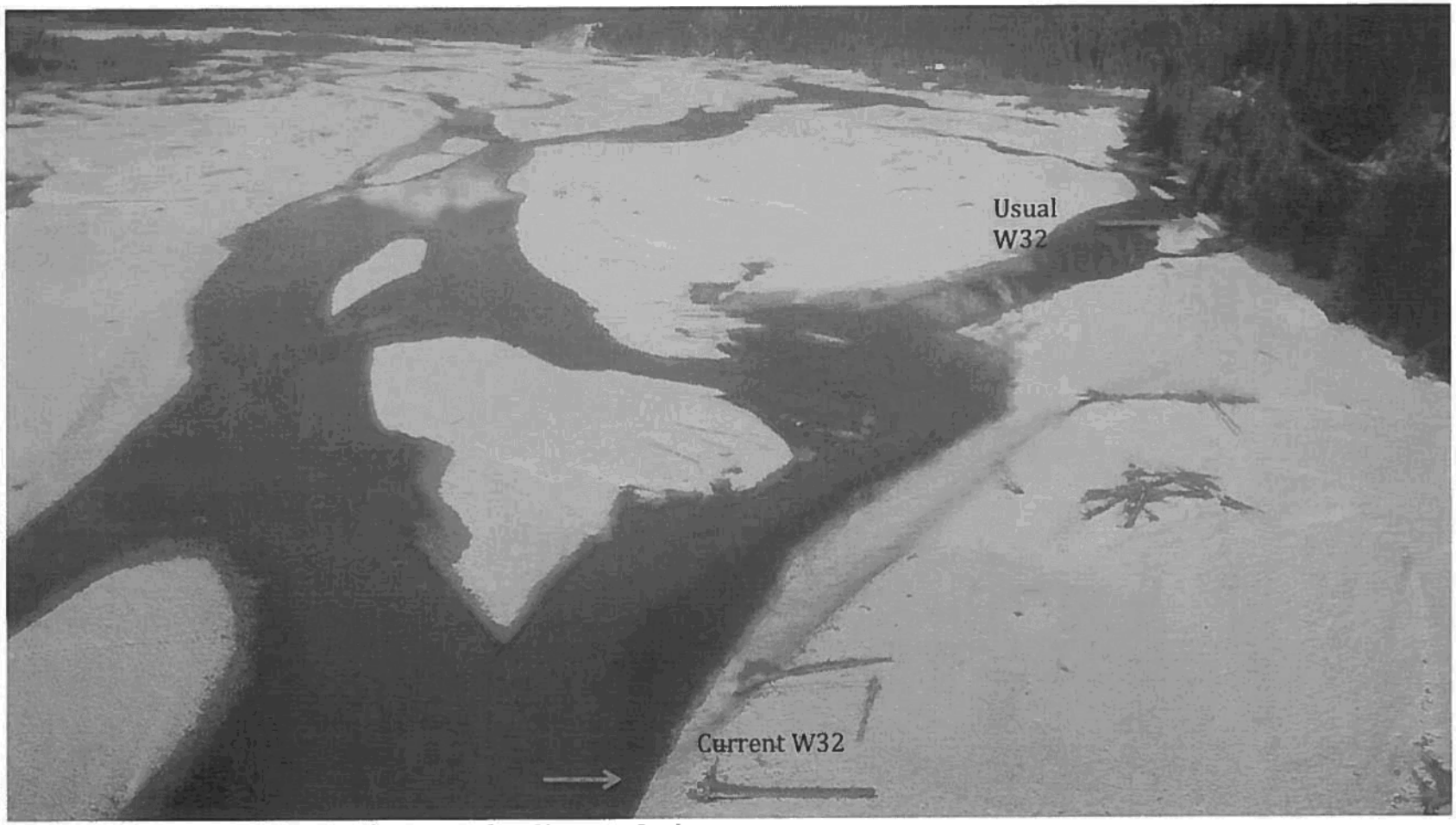
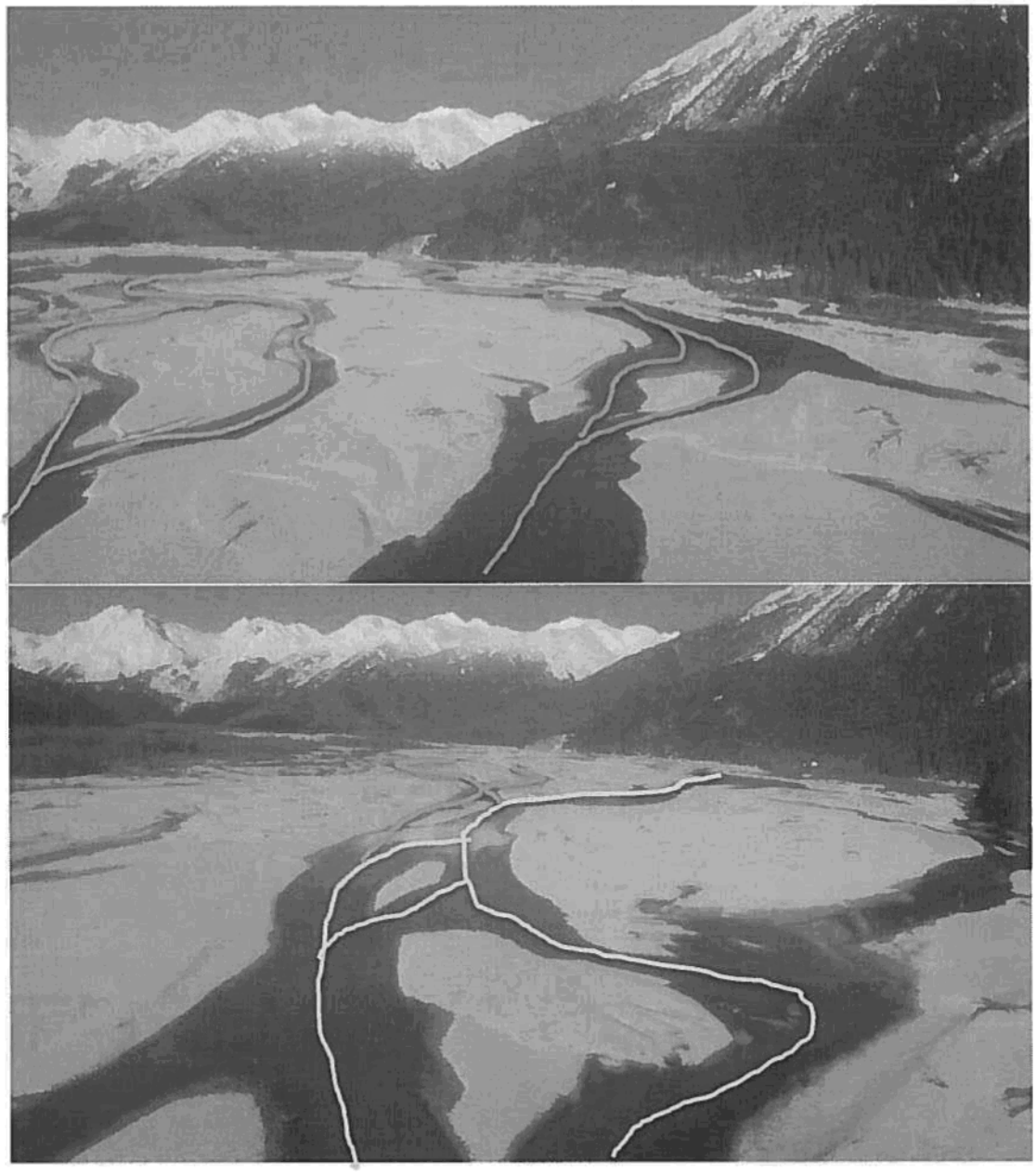
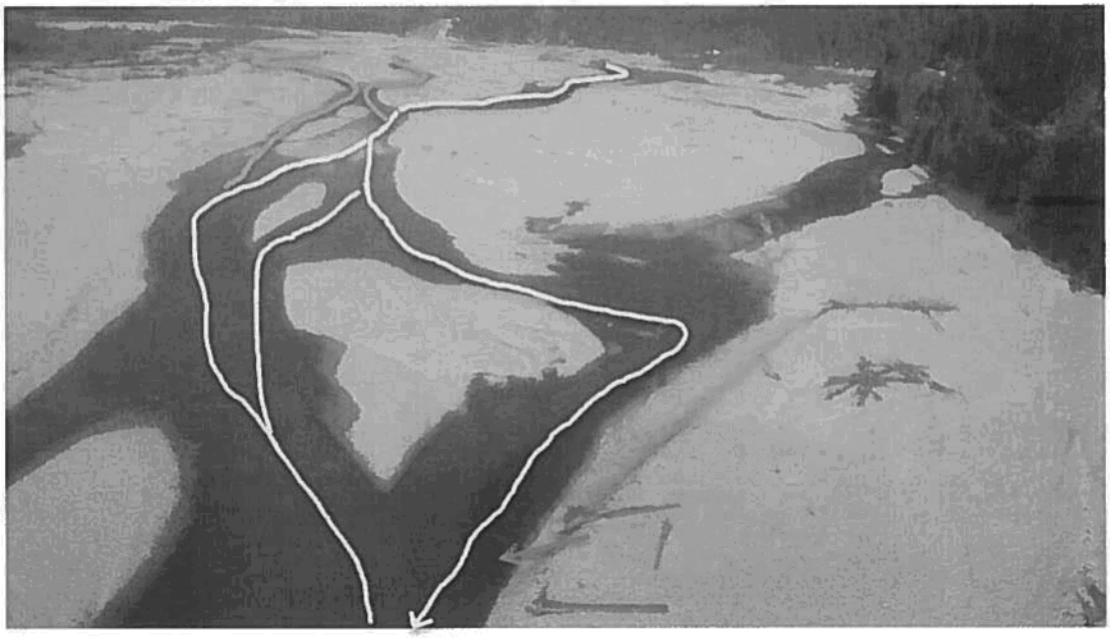


Figure 1 - Revised W32 sample location, downstream from Limestone Creek

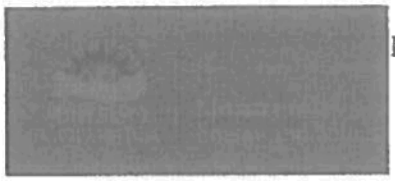




The location used to collect the W32 sample in November and January is just upstream of the confluence of two braids. The February sample will be collected downstream of the confluence instead. The recent measured concentrations have been lower than historical values for this station. This may be a result of the braids having differing concentrations. However, it may also be a result of the Exfiltration Pond now discharging to the dry flood plain rather than in to the river water.

APPENDICE

F. MEM Response Letter



Province of British Columbia
MINISTRY OF ENERGY AND MINES
Report of Inspector of Mines
Reclamation
(Issued pursuant to Section 15 of the *Mines Act*)

Inspection No.:	59777
File:	«FILE_NO»
Mine No.:	0100019
Permit No.:	M-232
Emp/Cont:	1
Orders :	2
Stop Work:	

Mine Name:	Tulsequah Chief
Location:	Atlin MD / 58.737, -133.600
Owner, Manager:	Keith Boyle, Terry Zanger
Company:	Chieftain Metals Inc
Address:	Unit 118, 1515 Broadway Street Port Coquitlam BC V3C 6M2
# Workers Contacted:	1
Type of Mining:	METAL MINE UNDERGROUND
Date of Inspection:	2015/10/15
Accompanying Inspectors:	Mark Love (MOE), Neil Bailey (MOE)
Copies to	Al Hoffman, Doug Flynn, Heather Narynski, Mark Love (MOE), Chris Parks (EAO)

Written response is required from the Mine Manager within 15 days of receiving the report. In this document, Code means Health, Safety and Reclamation Code for Mines in British Columbia.

This inspection of Tulsequah Chief Mine, owned by Chieftain Metals Inc (CMI) was conducted on October 15, 2015 by Diane Howe (MEM Deputy Chief Inspector-Permitting), Neil Bailey (MOE Compliance), and Mark Love (MOE Director), accompanied by Terry Zanger (Chieftain Mine Manager) and Rob Marsland (environmental engineer, Chieftain Contactor). Access to the site was via helicopter from Atlin (45 mins). The weather at the site was cloudy/overcast in the morning changing to a drizzle with snow predicted later in the afternoon in Atlin. Access using the helicopter limited the inspection to 3.5 hours.

At the time of the inspection, 2 employees and 1 contractor were in camp, completing their monthly monitoring requirements and preparing the camp for winter. The mine has been on a care and maintenance status since June 2012.

The purpose of this inspection was visit the surface works at the mine and provide an opportunity to become familiar with the site and specifically:

- To assess if the mine is meeting the intent of their mine permit (M-232),the HSRCode and Mines Act,
- To assess if mine monitoring and management practices at the mine are consistent with generally acceptable practices at mines in BC that are on care and maintenance; and

Diane Howe

Deputy Chief Inspector

6th Floor , 1810 Blanshard St., Victoria

Address

Signature – Inspector of Mines

Report Date: November 9, 2015

- To provide general comment on conditions at the mine.

The following areas were inspected during the mine visit:

- Lime Sludge Pit at Shaza airstrip
- 5400 portal area
- 5200 portal area
- Minesite exfiltration pond
- Mine Acid Water Treatment Plant (AWTP)
- Cleared areas around Rogers Creek (future location of HPAG, NAG waste rock dumps)

The following reports provided a general understanding of the current conditions of the site: the 2014 Annual Reclamation Report, 2014 Annual Environmental Monitoring report and the 2015 Closure Management Manual submitted to MEM, as well as the observations and discussion that occurred on-site and during the inspection. This report documents MEM's observations related to requirements of the M-232 permit, the *Health, Safety and Reclamation Code for Mines in BC*, and established best practices.

Note space has been provided after each Order/recommendation for the Mine managers response.

Background

The mine is a historical, small, underground base metal operation which saw production from 1951 to 1957; (pre reclamation legislation) at which time the mine closed due to low metal prices. There still remains today legacy metal leaching/acid mine drainage/ (ML/ARD) concerns with water moving through the underground workings picking up contamination and discharging through the lower portals, plus surface drainage from the historical PAG waste rock left on site. There are no tailings facilities on site. Total disturbance reported in the 2014 Annual Reclamation Report was 105.8 ha, with ~50% being road construction.

In 2007 the company (then Redfern Resources Ltd.) applied for and received a Mines Act permit for limited construction works. This application was to allow the company to start with the clean-up of historical waste rock and dumps and construct water management structures to support the water treatment plant (WTP). In 2008 the company applied for an amendment to their mine permit which would have led to a full production permit, however the company went into bankruptcy protection. A limited amount of construction works permitted have been completed to date, critical however was the purchase of the water treatment plant (WTP).

In early 2010 the mine acquired by Chieftain Metals Inc. (CMI), who have now responsible for all liability existing on site under the Mines Act. One of CMI's first actions was to construct and start operating the WTP. The WTP was commissioned in October 2011 but was suspended in June 2012 because the plant had been operating below design levels of efficiency resulting in higher than expected operating costs. The design flaw is in the sludge production not in the quality of effluent being produced. The plant remains idle pending an upgrade to the sludge settling efficiency. Of note is the long term plan for sludge management was to dispose underground, however with the underground not in operation the company had to find an alternative disposal location for high slurry sludge

The mine remains on care and maintenance and remains unattended with only bi-weekly surveillance and environmental sampling visits. Remote monitoring is provided by building alarms and security cameras with satellite communication connections. If alarms are triggered, personal based in Whitehorse or Atlin will attend the site.

Inspection Observations

Lime Sludge Pit at Shaza Strip

The temporary lime sludge storage pit, located just off the airstrip, contains approximate 35m^3 of sludge generated from the WTP and is lined with a filter fabric to prevent migration of the sludge to the subsurface gravel. No deposition has occurred since the WTP shut down in June 2012. CMI maintains monitoring from 3 groundwater wells. CMI has committed, should mine operations not resume, to relocating the sludge to a secure location to the Rogers Creek area, which will be capped and re-vegetated.

Photo 1: Lime Sludge Pit Shaza AirStrip.

Photo 2: Shaza Airstrip location of Sludge Pit

5400 portal drainage

The 5400 portal, the upper most accessible portal, has been appropriately signed with "Danger No Entry" signage and is currently blocked by locked wooden doors. Limited work has been done at this portal site other than to remove the historic track from the underground and reconfigure the drainage exiting the portal. In 2011 CMI separated the acidic from non-acidic drainage inside the mine and today the non-acidic drainage (in black pipe Photo 3) is conveyed to Portal Creek where they are combined (photo 4) and directly discharged to the Tulsequah River via a buried (partial) 600mm HDPE pipeline.

The acidic drainage seen exiting the mine as an orange flow (approx. 1L/s)(Photo 3) is captured in a pipe near the portal and is directly conveyed by a buried pipeline to the exfiltration pond located near the Tulsequah River. All drainage from the 5400 portal has been directed away from the historical waste thus limiting contaminated flows. (Photos 5 and 6)

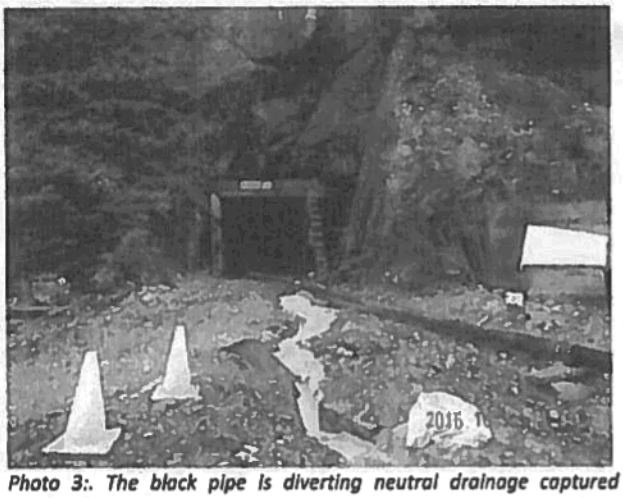


Photo 3:. The black pipe is diverting neutral drainage captured underground; The Fe stained drainage (acidic) is flowing freely from the portal and is captured in a pipe in the foreground.

Photo 4: The neutral drainage is combined with the Portal Creek drainage into a HDPE pipe and diverted away from historical waste rock to the Tulsequah River

Photo 5: The black pipe (arrow) is the acidic discharge from the 5400 portal. Portal Creek and the combined non-acidic drainage discharge to the left of the picture in an underground HDPE pipe.

Photo 6: showing the historical PAG rock left from early mining. The ~80,000 tonnes of material to be relocated once mining restarts to the PAG dump on Rogers Creek.

5200 Portal

The 5200 portal, the lower most accessible portal is appropriately signed with "Danger No Entry" signs but the wood door is open to allow the passage of the discharge pipe seen in photo (Photo 7). Within 300 meters inside the entrance however, is a 1.8 m high dam used as part of an inactive passive water treatment system and the tunnel beyond is partially flooded. Acidic flow from this portal; which also includes partial flow from the 5400 and 5900 levels, averages ~ 7L/s.

At the time of this inspection, the 5200 acidic discharge was being directly discharged to the Tulsequah River (Photo 8). MOE officials accompanying the author sampled at the end of pipe at this location. It is understood that the direct discharge to the Tulsequah River was also done last year during the high flow period in order to minimize sludge build up in the exfiltration pond thereby and reducing the hydraulic loading on the pond. (MEM understands this direct discharge has not approved by MOE and discussions are ongoing.)

Date of Inspection November 9, 2015 Initials _____ (Inspector) Initials _____ (Manager)

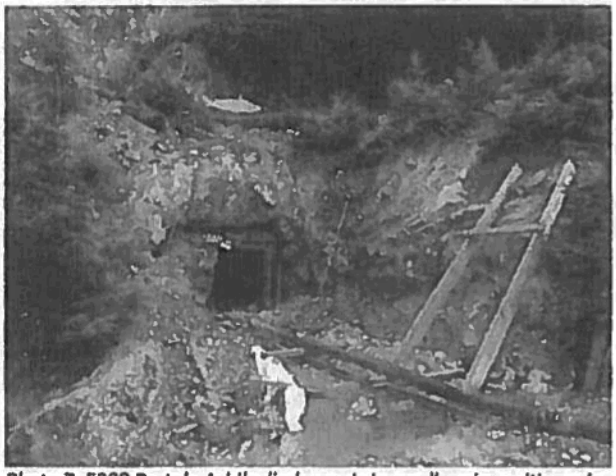


Photo 7: 5200 Portal. Acidic discharge is in smaller pipe exiting mine. 5400 non acidic and Portal creek water is contained in the larger pipe located above the portal.

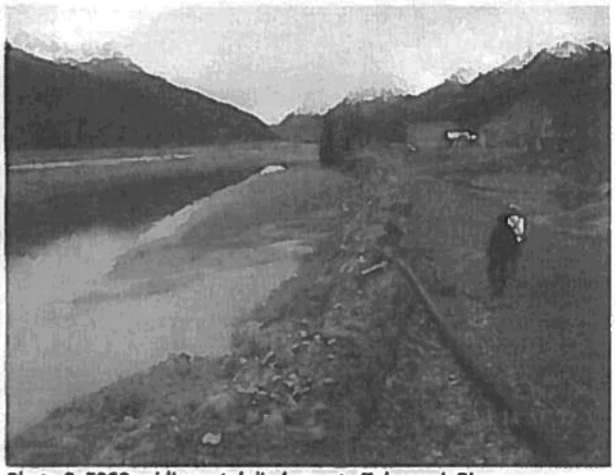


Photo 8: 5200 acidic portal discharge to Tulsequah River

Notable in Photo 7 is the 600mm HDPE pipe over top of the 5200 Portal entrance which is conveying the Portal Creek and 5400 non-acidic drainage to the Tulsequah River. The pipe requires ongoing monitoring and maintenance because of rock falling onto the pipe and at times crushing the pipe causing leakage. From the photo it can be seen the pipe is currently leaking with water spilling down to pond in front of the Portal. This pond drains into the ex-filtration pond via ditching and a culvert under the road.

Ex Filtration Pond

The observed ex-filtration pond was constructed in 2011 and was reportedly built to capture site drainage from the PAG waste dumps (Photos 9-11). Currently it is being used to capture all drainage, including the portal drainage, where the contaminated discharge is allowed to ex-filtrate through the road berm to the Tulsequah River (Photo 12). A filter fabric is used to prevent the migration of the Fe sludge into the dam rock void spaces would effectively block the diffuse flow. As noted in the 2014 ARR the sludge built up in 2013/14 nearly causing the pond to overflow requiring remediation to be taken by the company. (Note this incident was not reported to MEM)

A review of the applications submitted to MEM show the current ex filtration pond has not been built in accordance with the designs provided to the province. (Note MEM has not approved the design, construction or operation of this pond.)

A significant concern is the proper operation of the pond given there is no spillway observed and there is no continuous onsite presence.

Photo 9: Exfiltration pond receiving ditch water from the 5200 portal

Photo 10: Exfiltration pond receiving acidic discharge from the 5400 portal

Photo 11 Exfiltration pond. Note high water level of sludge.

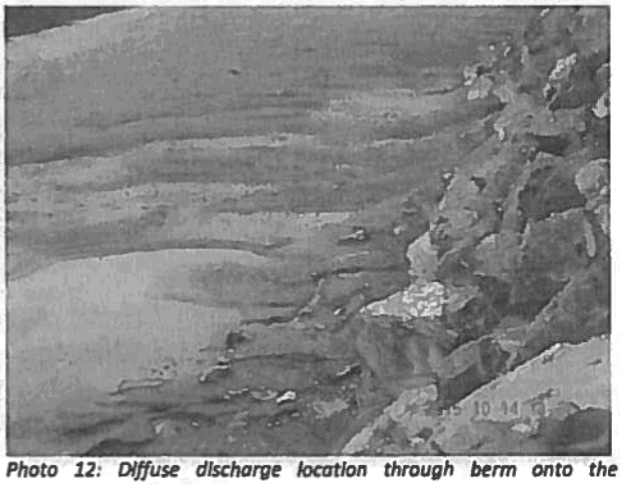


Photo 12: Diffuse discharge location through berm onto the Tulsequah river floodplain.

Acid Water Treatment Plant (WTP)

The WTP was constructed in its current location in 2011 after receiving approvals from the province to relocate and upgrade the previously proposed WTP (Photos 13, 14). The WTP is designed to treat acidic discharge on a temporary basis until the upper mine workings could be backfilled as per the mine design proposed in 2009. The plant ran from October 2011 till June 22, 2012 at which time operations were suspended due to operational issues. Since that time the company has sought guidance on process modification strategies to address the high operating costs. CMI has stated they are committed to re-commissioning the WTP at the earliest time upon completion of full project financing.

Noted during the inspection, beside the WTP, was another sludge pond which has not been approved by MEM (Photo 15)

Date of Inspection November 9, 2015 Initials _____ (Inspector) Initials _____ (Manager)

Photo 13: Acid Water Treatment Plant

Photo 14: Inside the AWTP

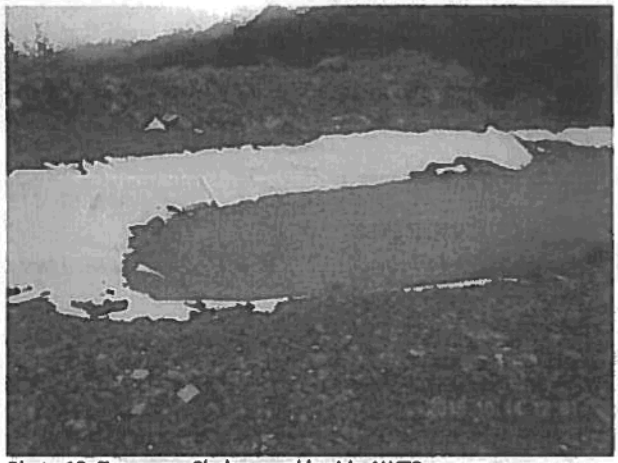


Photo 15:.Temporay Sludge pond beside AWTP

Photo 16: Site Collection Pond

Rogers Creek Area (HPAG and NAG areas)

Other than clearing, and some minor construction of berms the areas reserved for PAG and NAG waste rock storage has been minimal (Photo 18). Access to these areas from the main mine site is good; the causeway remains in good condition (Photo 17).

Date of Inspection November 9, 2015 Initials _____ (Inspector) Initials _____ (Manager)

Photo 17; Causeway between mine and Rogers Creek area.

Photo 18: Clearing for the PAG and NAG waste rock areas.

Orders

The following orders are summarized based on observations and discussions that occurred on-site:

1. Pursuant to HSRC 10.5.1 and 10.5.2, the company shall provide to the Chief Inspector by March 31, 2016, or earlier, an as-built report for the exfiltration pond signed by a qualified professional engineer.

Managers response:

Acknowledged. Chieftain will provide an as-built report for the exfiltration pond signed by a qualified professional engineer by March 31, 2016.

2. Pursuant to HSRC 10.5.2, the company shall provide to the Chief Inspector by March 31, 2016, or earlier an Operation, Maintenance and Surveillance manual for the exfiltration pond operations to include all other water management structures, including diversion structures.

Managers response:

Acknowledged. Chieftain will provide an Operation, Maintenance and Surveillance manual for the exfiltration pond operations which will include all other water management structures, including diversion structures by March 31, 2016.

Information Requirements

The following information requirements are summarized based on observations and discussions that occurred on-site

3. Prior to resuming operations of the sludge pond located beside the WTP, CMI shall provide to the Chief Inspector a final "as built" for the pond, and an operations, maintenance and surveillance manual. This may be combined with the OMS for the WTP once operations resume.

Date of Inspection November 9, 2015 Initials _____ (Inspector) Initials _____ (Manager)

Managers response:

Acknowledged.

4. CMI shall provide in the next annual report or upon restart of operations, which ever comes sooner, a plan for the decommissioning of this pond

Managers response:

Acknowledged. Chieftain will provide a plan for the decommissioning of the sludge pond located beside the WTP in the next annual report or upon restart of operations, which ever comes sooner.

5. Prior to resuming operations of the WTP, CMI shall provide to the Chief Inspector final electrical line diagrams and building construction plans signed and sealed by a qualified professional.

Managers response:

Acknowledged. Chieftain will provide final electrical line diagrams and building construction plans for the WTP signed and sealed by a qualified professional prior to resuming operations of the WTP.

Conclusion

The October 15th, 2015 inspection provided an excellent overview of the current mine site conditions and ongoing activities. Although the mine is on care and maintenance CMI continues to fulfill their obligations for monitoring and maintenance of the site. While the company does remain vigilant in this regard, this inspection has found that communication with the Province with respect to obtaining approvals and reporting issues need to be improved.

Date of Inspection November 9, 2015 Initials _____ (Inspector) Initials _____ (Manager)

APPENDICE

G. Application to amend MA Permit M-232

Page 217 to/à Page 218

Withheld pursuant to/removed as

DUPLICATE

Metcalfe, Megan MEM:EX

From: Keith Boyle <keith.boyle@chieftainmetals.com>
Sent: Monday, February 22, 2016 8:03 AM
To: Janfada, Arash ENV:EX
Cc: Love, Mark P ENV:EX; Howe, Diane J MEM:EX; Leta McCulloch; Rob Marsland
Subject: Application form for EMA Permit Amendment
Attachments: 001.pdf; ATT00001.txt

Categories: d Filing

Arash,

Please find attached the permit application form for the EMA permit amendment.

Should you have any further questions, please feel free to contact me.

Cheers,

Keith

BRITISH COLUMBIA
The Best Place on Earth

Ministry of Environment

Environmental Management Branch
Business Services Section
PO Box 9377 Stn Prov Govt
Victoria, BC V8W 9M1
Fax: (250) 356-0299

Courier delivery address: Ministry of Environment,
Environmental Management Branch, Business Services Section
3rd Floor, 2975 Jutland Rd., Victoria BC V8T 5J9

Pre-Authorization#
Tracking#

Application for an Authorization to Discharge Waste under the *Environmental Management Act*

This Application Form can be submitted to the Ministry of Environment by mail or courier. If paying by CREDIT CARD, the signed Payment Form and Application Form can be faxed.

INSTRUCTIONS:

1. If you are completing this form by hand, please PRINT clearly. All fields marked with an asterisk* must be completed. Please visit http://www.env.gov.bc.ca/epd/waste_discharge_auth/index.htm to review the information and Guidance Documents that will assist you in understanding the application process and any other documents that may be required.

2. If a **New Permit, New Approval or New Operational Certificate** is required, ***please use this application form***.
A **Permit** is an Authorization to discharge waste to the environment.
An **Approval** is an Authorization to discharge waste to the environment for a maximum of 15 months.
An **Operational Certificate** is a set of conditions issued by the Ministry of Environment for facilities included in a solid or liquid Waste Management Plan.

A new application is a multi-step process that requires submission of a preliminary application, followed by meetings with Ministry staff, followed by submission of a final application together with the application fee and Payment Form ($200 for a Permit; $100 plus variable fee for an Approval).

Preliminary Application: All fields on Pages 1 to 3 marked with an asterisk * must be completed for the submission of a preliminary application.

Final Application: Sign and date your final application at the bottom of Page 3. Include your Pre-Authorization# and Tracking# in the fields on Page 1. Pages 1 - 4 and 6 must be completed for the submission of a final application. Page 5 is only required if your regional representative advised that a Technical Assessment Report is not required.

3. Your regional representative will advise you of any additional documents (such as Environmental Protection Notice, Site Plan(s), Location Map, Consultation Report, Technical Assessment Report) that are required for your application.

*Purpose of Application [e.g., to discharge air emissions from a sawmill]

The Tulsequah Chief Mine Project is currently on care and maintenance. Chieftain Metals Inc. ("CMI") is requesting amendment of EMA Permit 105719 related to the effluent discharge and operations of the interim acid water treatment plant ("IWTP"), to reflect the current conditions, until such a time when the IWTP is re-started. A revised Environmental Monitoring and Surveillance Plan including amended monitoring, sampling frequency and analysis requirements is requested as outlined and included in the application with attached" "Tulsequah Chief Mine Project, Environmental Monitoring and Surveillance Plan: Care & Maintenance (2016+)"

Is this Authorization required for remediation of a contaminated site? ☒ Yes ☐ No

*Authorization Type: ☒ Permit ☐ Approval ☐ Operational Certificate

Authorized Agent Information

*(*Complete only if you are an Authorized Agent for the Applicant)*

Agent's Company Name **OR** First and Last Name			
Agent Numbers [e.g., (999) 999-9999]	Phone:	Cell:	Fax:
E-mail Address			

Applicant's Authorization for Agent

I / we *(applicant)* hereby authorize _____ *(Agent)*

to deal with the Ministry directly on all aspects of this application.

Applicant's Name

_____ Date (month.dd.yyyy)

Signature of Applicant *(not Agent or Representative)*

(You will need to sign this only if you are authorizing an agent or representative to act on your behalf.)

Applicant Information

*(Must be the name of the company or person seeking authorization, **NOT** the Agent)*

*Company Legal Name *(as registered with the BC Registrar of Companies)* **OR** Individual's Full Legal Name	CHIEFTAIN METALS INC.		
Doing Business As *(if applicable)*			
*Applicant Numbers [e.g., (999) 999-9999]	Phone:	Cell:	Fax:
	(416) 479-5410		(416) 479-5420
E-mail Address			
*Legal Address *(as registered with BC Registrar of Companies)*	2 Bloor Street West Suite 2000 Toronto, ON M4E 3E2		
*Mailing Address *(if different from above)*	2 Bloor Street West Suite 2510 Toronto, ON M4E 3E2		
*Billing Address *(if different from above)*			
*Nearest Municipality to Facility/Site	none - Stikine Region is unincorporated; closest town is Atlin (unincorporated)		

Contact Information for this Application

*(Name of person the Ministry can contact for this Application, **NOT** the Agent)*

*Contact First and Last Name	Keith Boyle		
*Contact Numbers [e.g., (999) 999-9999]	Phone: (416) 479-5414	Cell: (416) 627-0659	Fax: (416) 479-5420
E-mail Address	keith.boyle@chieftainmetals.com		

Facility Location and Information

*Facility Type and Description *(describe the primary activity of the facility)*: Interim acid water treatment plant that is currently inactive in care and maintenance producing zero effluent and zero byproduct sludge. When in operation the plant receives acid mine drainage water and uses lime and flocculants to precipitate metals to produce treated effluent and iron oxyhydroxide sludge byproduct.

NAICS Code: | Regional District: Stikine Region (unincorporated)

*Facility Location:

Source of Data: ☐ GPS ☒ Survey

*Latitude: 58.73607865 N

*Longitude: 133.6036194 W

(Must be in decimal degrees format)

Other *(Please list)*:

*Either Legal Land Description or PID/PIN/Crown File Number is required.

Legal Land Description *(Lot/Block/Plan)*: Mineral Claim Title ID: 590422; Owner: 248384 CHIEFTAIN METALS INC. 100.0% - Mines Act Permit M-232

OR

PID/PIN/Crown File No.: (If necessary, attach a separate page.)

*Facility Address *(civic address)* [e.g., 1234 Main Street, Vancouver, BC, V8W 9M1 **OR** if no civic address, describe location e.g., 3 km North of Sechelt, BC on Highway 101]: No Street Address

*Is Applicant Legal Land Owner? ☐ Yes ☒ No *(*If No, please provide details below)*

Legal Land Owner Name	Crown, Province of British Columbia		
Legal Land Owner Numbers [e.g., (999) 999-9999]	Phone:	Cell:	Fax:
E-mail Address			

*Facility Operator/Site Contact First and Last Name	Terry Zanger		
*Facility Operator/Site Contact Numbers [e.g., (999) 999-9999]	Phone: (867) 667-7499	Cell:	Fax:
E-mail Address	terry.zanger@chieftainmetals.com		

Feb 12, 2016

Date (month.dd.yyyy)

Signature of Applicant *(or Agent, if applicable)*

Discharge Source and Associated Details
(Please provide one page for each Discharge)

*Description of Discharge Source: Untreated acid mine drainage water effluent

*Discharge Type: *(select all that apply)* ☐ Air ☒ Effluent ☐ Refuse

Proposed Treatment and Disposal *(effluent disposal method must be identified, i.e., subsurface or irrigation)*: infiltration of effluent to Tulsequah River through exfiltration pond

*Discharge Location *(if different from facility location)*:

*Source of Data: ☒ GPS ☐ Survey

*Latitude: 58.73602524 N

*Longitude: 133.6043930 W

(Must be in decimal degrees format)

Other *(Please list)*:

*Either Legal Land Description or PID/PIN/Crown File Number is required.

Legal Land Description *(Lot/Block/Plan)*: Mineral Claim Title ID: 590422; Owner: 248384 CHIEFTAIN METALS INC. 100.0% - Mines Act Permit M-232

OR

PID/PIN/Crown File No.: (If necessary, attach a separate page.)

Rate of Discharge (Flow)

Minimum Discharge Rate	Average Discharge Rate	Maximum Discharge Rate	Units	Duration	Duration Units [e.g., hrs/day]	Frequency	Frequency Units [e.g., days/week]

Contaminants or Parameters in the Discharge

Parameter or Contaminant Name	Minimum	Average	Maximum	Units

Add another page | Remove page

Receiving Environment

Complete all pertinent fields.

CHARACTERISTICS OF RECEIVING ENVIRONMENT

Distance to nearest surface water (metres)	
Low water dilution ratio	
Name of water body	
Flushing rate (years)	
Precipitation (mm/y)	
Distance to highest water table (metres)	
Soil Type and profile (to 3 metres depth)	
Other	

DISTANCE TO SPECIFIED FEATURES

Water Well (metres)	
Reservoir (metres)	
Dwelling (metres)	
Serviced Lot (metres)	
Recreational Area (metres)	
Residential or Health Care Facility (metres)	
Other Distance (metres)	

LAND USE/AMBIENT GUIDELINES

Background water/air Quality	
Plume/Dispersion modeling results	
Other Discharges near your location	

Payment Form

Amount of Payment Submitted $200

Form of Payment

The Ministry of Environment accepts AMERICAN EXPRESS, MASTERCARD or VISA as well as cheque or money order. Please indicate how you will be paying:

☐ Cheque ☐ Money Order ☒ Credit Card

(Please provide your credit card information in the area below)

Cheque or Money Order Payment Option

For payment by Cheque or money order please make payable to **Minister of Finance** and mail to the appropriate address below.

Name as it appears on cheque or money order:

Credit Card Payment Option

Do not complete this section if you are paying by cheque or money order.

Please bill my: ☐ AMERICAN EXPRESS

☐ MASTERCARD

☒ VISA

Name as it appears on Credit Card	Keith Boyle, Chieftain Metals Inc
Name of applicant if different than name on Card	
Contact telephone number for Cardholder	416 479-5414
Credit Card Number	s.21
Credit Card Expiry Date	s.21
Signature	

Credit card information provided on this form will not be retained. Upon authorization of payment request, this page will be destroyed.

Mailing and Contact Information

You can **MAIL** your completed application form with a cheque, money order or this credit card payment form to:

Environmental Management Branch
Ministry Of Environment
PO Box 9377 Stn Prov Govt
Victoria, BC V8W 9M1

Or **DELIVER** by courier to:

3rd Floor, 2975 Jutland Road, Victoria, BC V8T 5J9

You can **FAX** your completed application form and this credit card payment form to: **(250) 356-0299**

Print Form Reset Form

Metcalfe, Megan MEM:EX

From: Keith Boyle <keith.boyle@chieftainmetals.com>
Sent: Tuesday, March 29, 2016 11:53 AM
To: Howe, Diane J MEM:EX; candace.caunce@gov.bc.ca; Cousins, Autumn EAO:EX
Cc: Telford Eric; Love, Mark P ENV:EX; Rob Marsland
Subject: Chieftain Metals Corp's Compliance Plan - Tulsequah Chief Mine
Attachments: 20160329 Letter Exfiltration Pond OMS.pdf; 20160329 Exfiltration_Pond_OMS_Asbuilt_Checklist.pdf

Dear Ms. Howe, Ms. Caunce and Ms. Cousins;

Please accept our submission as per the compliance plan submitted on February 8, 2016.

Regards,

Keith Boyle
COO
Chieftain Metals Corp.

CHIEFTAIN METALS INC.
TULSEQUAH CHIEF PROJECT
EXFILTRATION POND OMS MANUAL

MARCH 2016

TABLE OF CONTENTS

LIST OF TABLES

LIST OF APPENDICES

1 INTRODUCTION

This document is provided to fulfill the following requirement issued by MEM on November 9, 2015:

> *Pursuant to HSRC 10.5.2, the company shall provide to the Chief Inspector, by March 31, 2016 or earlier, an Operation, Maintenance and Surveillance Manual for the Exfiltration Pond operations, to include all other water management structures, including diversion structures.*

The Tulsequah Chief Mine Exfiltration Pond was built initially to provide sediment control during site construction activities. The original structures were put in place in the summer of 2008. An internal berm was created to trap most of the sediment and then the road base, constructed of rockfill overlain by filter fabric, was used to serve as a "polishing" pond. This limited facility remained in place until the summer of 2011.

That summer, as construction of the Interim Water Treatment Plant began, the road was raised to its current elevation of roughly El 47.0 m. In addition, a layer of coarse riprap was placed along the downstream face to provide additional stabilization against the force of jokulhaup derived flooding in the Tulsequah River. The 'As-built' condition of the Exfiltration Pond is described in SNT (2016) and is included in Appendix A.

At the same time, Portal Creek was directed into a 900 mm diameter HDPE pipe and diverted across the mine site to discharge to the river without contacting PAG waste rock. Furthermore, the 5400 adit discharge was separated underground and brought to surface as separate acidic and neutral pH mine water flows. The neutral mine water (NMW) is combined with the Portal Creek flow and routed directly to the river. The acidic discharge is conveyed across the 5400 waste dump in an HDPE pipe and currently discharges to the Exfiltration Pond, along with seepage water from the 5400 dump and other site runoff.

The 5200 portal discharge can be collected in an HDPE pipe, but most of the time simply flows in a shallow trench across the 5200 waste dump until discharging in to the Exfiltration Pond.

2 DESIGN BASIS

2.1 Design Criteria

There were no specific criteria for the Exfiltration Pond. In 2011, it was conceived to detain excess runoff that exceeded the pumping capacity to the ATP Feed Pond. The rockfill construction, wide (4.0 m) dam crest, low dam height (max 4.5 m) and stable slopes (1.75:1 upstream, 1.1:1 downstream) ensure a geotechnically and hydraulically stable structure. The

planned spillway is oversized and will be able to handle any predictable flows. By having a spillway, if the increasing hydraulic resistance resulting from a gradual buildup of sludge causes the pond level to rise, the excess water will simply flow through the designated channel, rather than over the lowest point in the road. Again, the pervious rockfill ensures stability.

2.2 Consequence of Failure

SNT Engineering estimated the maximum storage volume of the pond to be 1760 m^3. Guidance for dam failure consequence classifications are provided by the BC FLNRO (2011). The exfiltration pond could be considered to have a "low" consequence of failure for the following reasons:

- There is no possibility of loss of life other than through unforeseeable misadventure.
- Minimal short-term loss or deterioration and no long-term loss or deterioration of (a) fisheries habitat or wildlife habitat, (b) rare or endangered species, or (c) unique landscapes or sites of cultural significance.
- Minimal economic losses mostly limited to the dam owner's property, with virtually no pre-existing potential for development within the dam inundation zone.

3 OPERATION

There are no operating procedures, per se. Redirecting the 5200 Portal discharge to the Tulsequah River seasonally, to bypass the Exfiltration Pond, helps reduce the rate of sludge building on the filter fabric which in turn reduces likelihood of spillway discharge and the need to replace the filter fabric.

4 SURVEILLANCE

A checklist for surveillance is provided in Appendix B. The key items to monitor for are:

- dam stability
- diversion works integrity
- conveyance capacity of the filter cloth

4.1 Surveillance Frequency and Trigger Levels

The Exfiltration Pond and associated water diversion appurtenances are inspected daily/weekly when personnel are based at site or whenever site visits are scheduled, if less often.

4.2 Dam Stability Monitoring

Dam Crest

- Evidence of settlement of the dam crests must be checked for regularly, and confirmed by survey as required.

Dam Toe

- Evidence of abundant seepage must be checked for regularly. Unusual amount of seepage at a single location, may be evidence of pending dam stability issues and must be brought to the attention of SNT or another qualified civil/geotechnical engineer.

Dam Face

- Evidence of cracking or slumping on any of the dam faces may be an indication of a dam stability issue and must be brought to the attention of a geotechnical engineer.
- Check for erosion of berm by jokulhaups – scour/undercutting, displacement of riprap or rockfill.

4.3 Monitoring of Diversion Works

Portal Creek Diversion

- Ensure inlet remains clear – especially in autumn (late August/September when leaves drop from trees and the build-up of organic matter and coarse sediment washing down creek can obscure the inlet screen).
- Ensure flow remains in diversion pipe/channel at least until flow has passed beyond the 5200 portal area so that the hydraulic loading to the Exfiltration Pond is minimized (especially during snow melt period).
- Look for increased damage to the pipe due to rock-fall.

Neutral Mine Water (NMW)

- Ensure NMW discharge is directed to the inlet of the Portal Creek diversion.

5200 Portal Discharge

- Re-route 5200 portal flow away from pond and into the Tulsequah River by an alternate route during summer months, when river flows are higher and TSS in river is naturally elevated (June to October) to reduce rate of sediment build-up on filter fabric,

5400 Portal Discharge

- Ensure acidic flow can enter the collection pipe, rather than flowing over the waste rock,

- Ensure pipe integrity is maintained when freezing conditions decrease portal discharge flow and potentially cause ice blockage in pipeline,

4.4 Conveyance Capacity of the Filter Cloth

- Check for blinding of filter cloth leading to overtopping (prior to spillway construction) or discharge through the spillway (once spillway is installed in May 2016)
- Ensure no iron staining in spillway (evidence of surface discharge). If pond level enters spillway, it is time to make arrangements to replace the filter fabric on the upstream face.
- Ensure diffuse discharge to river bed during snow melt in March/April and in to May when pond flows are highest but river flow is still relatively low. If all seepage flow is at a single location, that suggests damage to the filter cloth resulting in a preferential flowpath, and it is time to make arrangements to replace the filter fabric on the upstream face.

4.5 Documentation and Reporting

Documentation is to be prepared by the Site Inspector as part of the Annual Inspection report, incorporating all surveillance and maintenance data and results of all water sampling. The Site Inspector is to submit completed Inspection Forms with the Annual Inspection report.

5 MAINTENANCE

The maintenance objective is to ensure that all facilities remain in good condition and are capable of functioning as designed under severe conditions, up to and including their design events.

5.1 Routine and Preventative Maintenance

Routine maintenance at Tulsequah is predicated on response to items noted during routine surveillance and environmental monitoring of the facilities. There is no need for any regularly scheduled maintenance, per se.

5.2 Event-Driven Maintenance

There are four primary event driven maintenance activities:

- Repairs to the berm following a jokulhaup.
- Replacement of the filter fabric on the berm face if water levels rise to the point of surface discharge through the spillway.
- Clean-out of the Portal Creek diversion inlet if there is an excessive accumulation of gravel and organic detritus.
- Repairs to Portal Creek diversion when additional rock falls further damage the pipe.

5.3 Documentation and Reporting

Documentation and reporting is the responsibility of the Site Inspector:

- For routine maintenance note any maintenance activities undertaken for inclusion with annual inspection report; and
- For event-driven surveillance and associated maintenance, prepare incident report appropriate to the severity of impact.

6 EMERGENCY PREPAREDNESS AND RESPONSE

Information provided in this section is extracted from Chieftain's Emergency Response Plan (ERP), dated June 2015. These procedures are intended for use when an incident occurs that seriously affects the environment, property, and infrastructure or endangers lives.

An Environmental Emergency is defined as a release of contaminants to the environment without authorization. This could be a loss of iron sludge as a result of berm failure. It also would include the loss of sludge-containing water over the spillway during a major storm event,

or anything that may have an adverse effect on the receiving environment.

In addition to potential environmental emergencies, where a release of solids has occurred, there are also "structural emergencies" where evidence of potential physical instability is observed but no release has yet occurred. These include major blockages in the spillways or diversion channels, slumping or cracking on the berm, major seeps or boils. Such items need to be brought to the attention of the Mine Manager immediately and may necessitate implementation of remedial action. The Emergency Response Protocol is summarized in Table 6-1.

Table 6-1 Emergency Response Protocol

Person Responsible	Action Required	Urgency	Comments
Person finding the problem.	1. Take appropriate action. 2. Notify Mine Manager	Immediate Immediate	Take steps to contain and minimize the impact on the environment. Provide information: 1. Type of emergency. 2. Product involved. 3. Location of emergency. 4. Measures being taken
Mine Manager	1. Decide on action necessary to mitigate 2. Notify appropriate Regulatory Agencies 3. Notify other MEM staff. 4. Notify geotechnical engineer (e.g., SNT) if deemed necessary	Immediate As soon as practical	The agency notified will be as per legal requirements for the type of emergency involved.
MEM	Decide on action necessary to mitigate impacts.	As soon as possible	

Provide information as follows:

a) the reporting person's name and telephone number;

b) the location and time of the discharge or failure;

c) the type and quantity of the substance released;

d) the cause of the discharge;

e) action taken to stop, contain and minimize the effects of the discharge;

f) time discharge was contained and stopped;

g) a description of the discharge location and of the area surrounding the discharge, i.e., location relative to watercourses;

h) the names of the agencies on the scene; and

i) the names of the other persons or agencies advised concerning the discharge.

For all incidents:

- Keep a record of information reported to PEP, MoE, and MEM;
- Collect samples that parallel those taken by the Environmental Protection Officer/Conservation Officer; and,
- Prepare and submit a report describing the discharge to the Environmental Protection Officer, MoE, and to the Manager, Reclamation and Permitting.

6.1 Regulatory Contacts

Table 6-2 Contact Information for Regulators

Agency	Contact
Ministry of the Solicitor General Provincial Emergency Program	1-800-663-3456 (250) 354-6395
Ministry of Environment	Mark Love Section Head, Smithers (250) 847-7416 (office) (250) 877-9237 (mobile)
Ministry of Energy and Mines	Diane Howe Deputy Chief Inspector of Mines (250) 952-0183 (office) Doug Flynn Senior Inspector of Mines (250) 847-7386 (office) (250)-877-9747 (mobile)
Environment Canada	(604) 664-9100 (phone) (604) 713-9517 (fax) enviroinfo@ec.gc.ca
Department of Fisheries and Oceans	(604) 666-0384 (phone) (604) 666-1847 (fax)

6.2 Mine Support Contacts

The personnel responsible for the management and operation of the Tulsequah Chief Mine during the care and maintenance period and responsible for security and integrity are:

- Chief Operating Officer
- Mine Manager
- Environmental Engineer
- Environmental Technician

The responsibilities are listed in Table 6-3.

Table 6-3 Roles and Responsibilities of Tulsequah Chief Mine Personnel

Position	Responsibilities
Chief Operating Officer	Responsible for overall project management and site performance. The COO has the ultimate responsibility for ensuring that all aspects of project operation are in compliance with Chieftain Metals' environmental policies and the site is operated within the provisions of all applicable environmental regulations and guidelines.
Mine Manager	Responsible from implementing Chieftain Metals environmental policies and the Tulsequah Chief mine Closure Management Manual; and ensures site activities are carried out in compliance with the BC Mines Act and Health, Safety and Reclamation Code.
Environmental Engineer	Responsible for developing and implementing Chieftain Metals environmental policies with integration of all permit requirements. Evaluating mitigation activities, communicating effectiveness to the mine manager and modifying where appropriate. Overseeing periodic reporting obligations and notifications in instances of non-compliance. The environmental engineer also has the authority to shut-down the site in the event of any potentially hazardous event that involves undue risk to the safety of people or the environment.
Environmental Technician (Environmental Monitor)	Responsible for site monitoring and sampling activities and inspecting facilities as defined in the closure maintenance manual and site operating practices. The Environmental Technician is responsible for reporting events of non-compliance to the Mine Manager and Environmental Engineer and assisting in mitigation activities where appropriate. The monitor will have the authority to stop any activity that is deemed to pose a risk to the environment; work can only proceed when the identified risk has been addressed and concerns rectified.

Source: Chieftain 2015

Reclamation activities are not anticipated for 2016, but if undertaken will be carried out by a contractor, who will follow Chieftain's Closure Maintenance Manual to minimize any disturbances. The Environmental Technician (monitor) who will be either an employee of Chieftain Metals Inc. or independent contractor will observe these activities and compliance.

Table 6-4 Contact Information for Mine Support

Mine Personnel	
Chief Operating Officer	Keith Boyle keith.boyle@chieftainmetals.com (416) 479-5414 (office) (416) 627-0659 (mobile)
Mine Manger	Terry Zanger terry.zanger@chieftainmetals.com (403) 648-3721 (mine site) (867) 336-3293 (mobile) s.22
Environmental Engineer	Rob Marsland rob.marsland@chieftainmetals.com (604) 836-7559 (mobile)
Civil/Geotechnical Engineer	Les Thiessen SNT Engineering, Nelson les@snteng.ca (250) 551-0654 (mobile)
Hydrotechnical Engineer	Rob Griffith MEA, Pemberton rgriffith@meabc.ca (778) 926-2022 (mobile)
Construction Contractors – supply of equipment and materials for repairs	
Arctic Construction (excavator, dump truck)	Whitehorse (867) 393-2980
Swede Martensson	Whitehorse (867) 333-0192 (mobile)
Air Charter	
Helicopter	Discovery Helicopters Whitehorse 250-651-7569
Fixed Wing	Atlin Air Charters 250-651-0025

6.3 Directions to Site

Table 6-5 Marshalling Locations with Helicopter Landing Zones

Site	Coordinates (NAD83 UTM Zone 8V)	
Shazah Camp	579,600 E	6,513,200 N
Tulsequah Chief Mine	581,000 E	6,511,600 N
Big Bull Mine	584,400 E	6,503,900 N
Barge Camp	584,900 E	6,501,400 N
Site	**Coordinates (NAD83 Lat/Long)**	
Shazah Camp	133.62° W	58.75° N
Tulsequah Chief Mine	133.60° W	58.74° N
Big Bull Mine	133.54° W	58.67° N
Barge Camp	133.54° W	58.64° N

6.4 Site Radio Frequencies

Radio Repeater: 159.540 Rx, 154.540 TX tone 97.4,

Simplex: 159.540 tone 97.4

REFERENCES

Chieftain (2015). Emergency Response Plan, June 2015.

MFLNRO (2011). Dam Failure Consequence Classification Conversion Guideline for Dams in British Columbia (BC Reg. 163/2011, November 30, 2011).

SNT (2016). Tulsequah Exfiltration Pond Berm Stability. Prepared for Chieftain Metals. Prepared by SNT Engineering. March 6, 2016.

APPENDIX A

EXFILTRATION POND AS-BUILT DESCRIPTION AND SPILLWAY DESIGN

SNT Engineering Ltd.

Suite 3- 385 Baker St.
Nelson, BC, V1L 4H6
250 354 7683

Email: info@snteng.ca
www.snteng.ca

March 3, 2016

Keith Boyle, P.Eng.
Chief Operating Officer
Chieftain Metals Inc.
Toronto, ON

By email: keith.boyle@cheiftainmetals.com

Dear Mr. Boyle:

Re: Tulsequah Exfiltration Pond Berm Stability

SNT Engineering is pleased to provide our opinion regarding the stability of the road/berm that forms the detention structure for the acidic water draining from the Tulsequah Chief Mine site. The berm was raised to its current configuration in the summer of 2011 and has performed successfully for 4 years, with water levels fluctuating widely throughout the year on both sides of the road. Our assessment concludes that, as long as water levels inside and out remain within the historic range, and the rip rap and other granular construction materials remain in place, the berm is likely to continue to function as expected.

Our understanding is that this roadway was designed and constructed in two stages. The initial stage was in 2008, and the second stage was in 2011. The road base was initially installed in 2008 to detain the drainage of water from the mine site to the river and allow the solids in the runoff to settle out. The road was originally going to be a retaining wall, in the 2008 design, and construction of the road base and the initial lift was completed in the summer of 2008. The original design from 2008 is shown in Appendix A. Appendix B provides a series of photos (1 through 10) taken during 2008 showing the pond and berm.

After the current design was drafted by SNT in early 2011 (Appendix C - Figure 1-2), there was a change in respect to the exfiltration pond location, as the open water river channel ran through the design footprint at the time construction was scheduled to begin. While the as-constructed facility does not have the same water detention capacity as the proposed pond, it is what the site allows for at present. While the road has been in place since 2008, it was to be incorporated into the 2011 detention pond design. However, the river had encroached on the proposed berm location so the existing road was raised instead in summer 2011. Earthwork preparation for the installation of a pipe running from the 5200 Portal to the site collection pond also began at this time. Appendix B photos (11 through 17) show the construction of raising the berm elevation. The 2011 AS-BUILT drawings are included as Appendix C – sheets CMI-16-01-101 and 102.

Between September 2012 and July 2014 all effluent from the historical underground workings was directed to the site exfiltration pond. Since that time water level has risen and dropped seasonally and the filter fabric was replaced in 2014 and accumulated sludge removed from the berm face.
Based on empirical evidence the berm can retain water to at least a level within 30-40 cm of the lowest point on the road crest. (Appendix B – Photos 18 through 23).

We recommend regrading the top of the berm to establish a controlled spill point over the existing rip rap apron. This will direct surface discharge from the pond to keep the road from overtopping, in case of exceptional high water level in the pond. The 2011 design had envisaged a spillway with a 5 m base width, 2H:1V side slopes and a depth of 0.5 m. The D3 dozer on site should be capable of scraping down the existing road surface to provide this drainage channel. Filter fabric will need to be place over the entire excavated footprint, extending down both the upstream and downstream faces of the berm. The channel should be directed in to the coarsest riprap on the downstream face of the road prism. See Appendix C – Sheet CMI-16-01-103 for the new spillway design layout.

The water in the Exfiltration Pond is monitored in accordance with EMA Permit Authorization #105719 as site SE-2. Any discharge through this spillway would be monitored as the SE-3 monitoring location.

We trust the information included in this report meets your requirements at this time. Please do not hesitate to contact the undersigned should you have any questions.

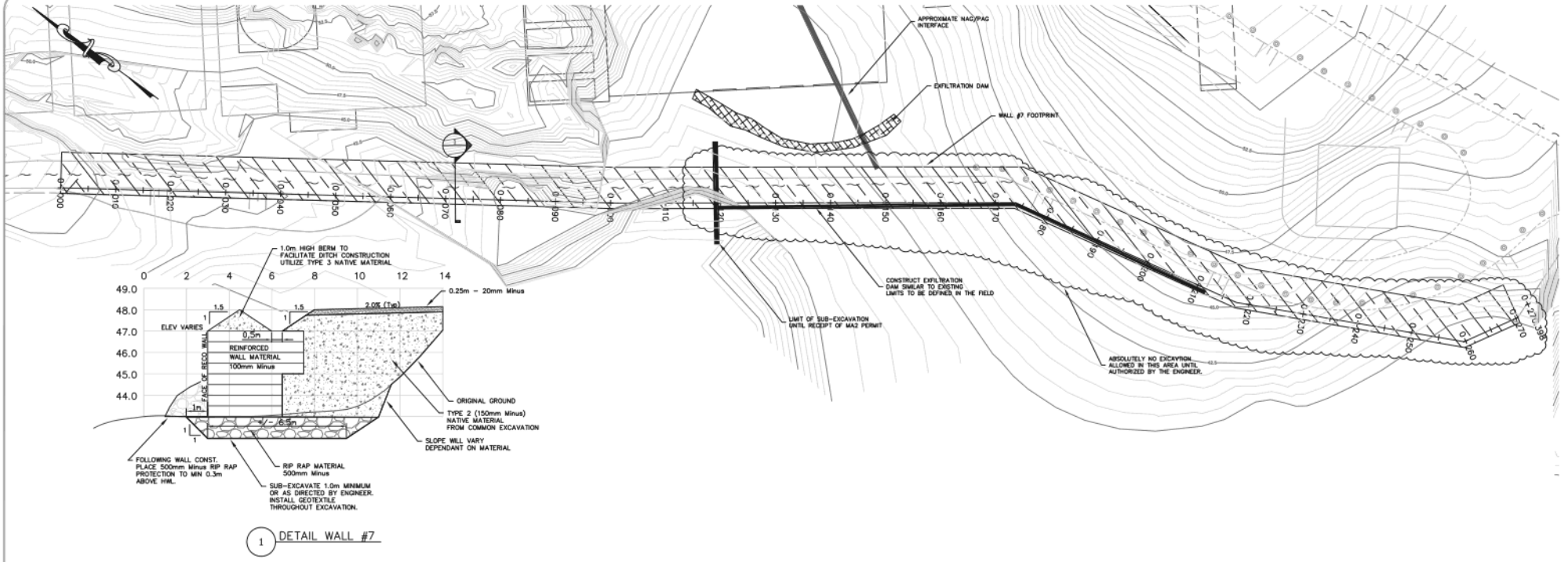
Yours truly,
SNT Engineering Ltd.

Les Thiessen, P.Eng.
Civil Engineering Division

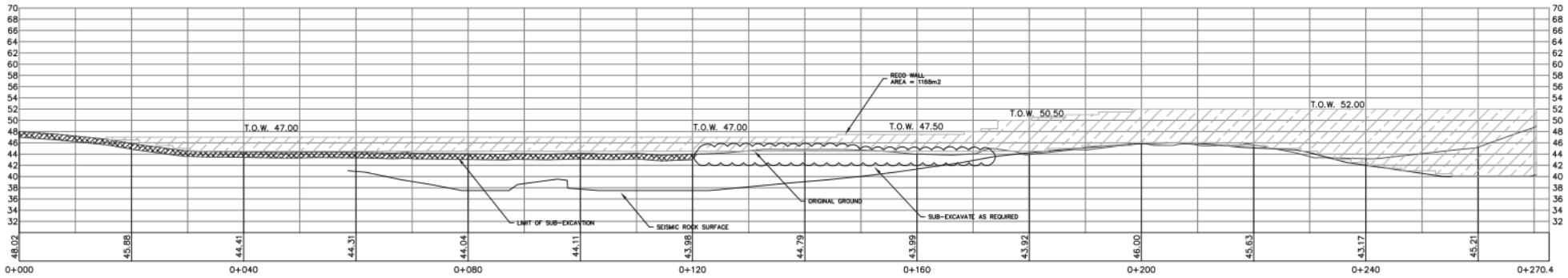
Attachment:
Appendix A – 2008 Wall #7 Design by Sandwell
Appendix B – Photo sheets – Construction and Pond Performance
Appendix C – 2011 As-built Road , 2016 Spillway Design and Photo Sketch

Appendix A

2008 Wall #7 Design by Sandwell



1 DETAIL WALL #7



speed and precision worldwide
Sandwell

WALL #7
October, 2008
SCALE NTS

REDFERN

A05 - 20 - 802 R1

Appendix B

Photo Sheets – Construction and Pond Performance

1 - June 28, 2008

Site cleared but no earthworks started.

2 - August 27, 2008

Interior Filtration Berm and small pond/sump excavation.

3 - Sep 22, 2008

Pond area filled with water, internal Filtration Berm unchanged.

4 - September 27, 2008

5 - September 28, 2008

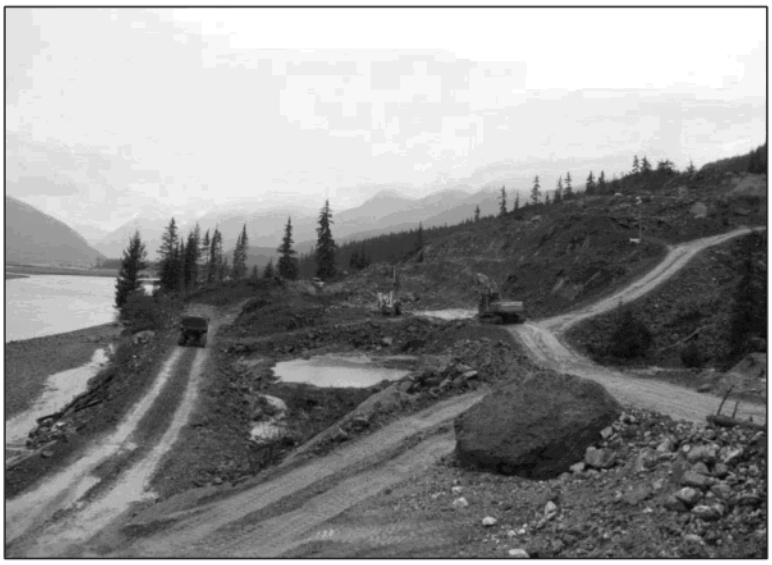
View looking down river. Note site drainage isolated from river.

6 - September 30, 2008

Construction of road/berm has commenced

7 - October 3, 2008

Sedimentation Pond berm in service as road.



8 - October 3, 2008:

Berm in use as road to access water treatment plant area.

9 - October 5th, 2008

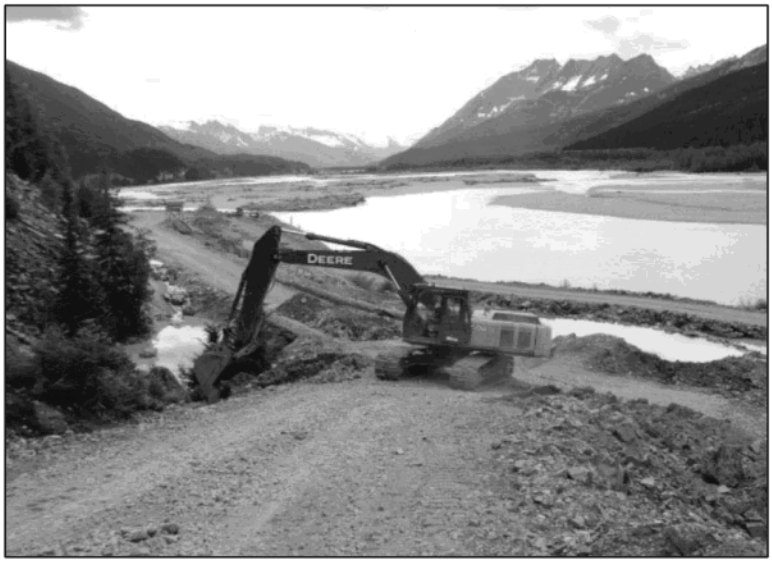
Looking south along Chief site at the new lower bench access berm constructed to control both sediment and water flow.

10 - October 17, 2008
Note large area of floodplain between road and river.

11 - July 13, 2011

Prior to 2011 construction. Sedimentation/Exfiltration Pond has been receiving site drainage for 3 years by this point.

12 - July 20, 2011



13 - July 27, 2011

14 - August 8, 2011

Earthwork Activities along the 5200 Portal level. Note that the river is now adjacent to the berm and toe of 5200 waste rock (compare with Oct 2008 photos). Berm construction completed and riprap placed.

15 - September 12, 2012

View north along road towards treatment plant.

16 - May 2014

Aerial view north along Tulsequah River

17 - July 29, 2014

View south along road towards 5200 waste dump

18 - July 2014

Upstream face. Sludge dug out and filter cloth replaced.

19 - July 2014

Upstream face. Sludge dug out and filtration cloth replaced

20 - July 2014

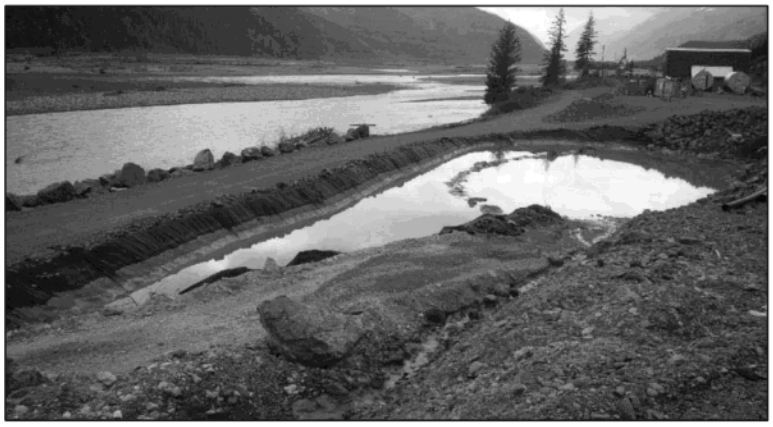
Upstream face. Sludge dug out and filter cloth replaced.

21 - May 19, 2015

View downstream of full pond.

22 - June 2, 2015

Pond full.

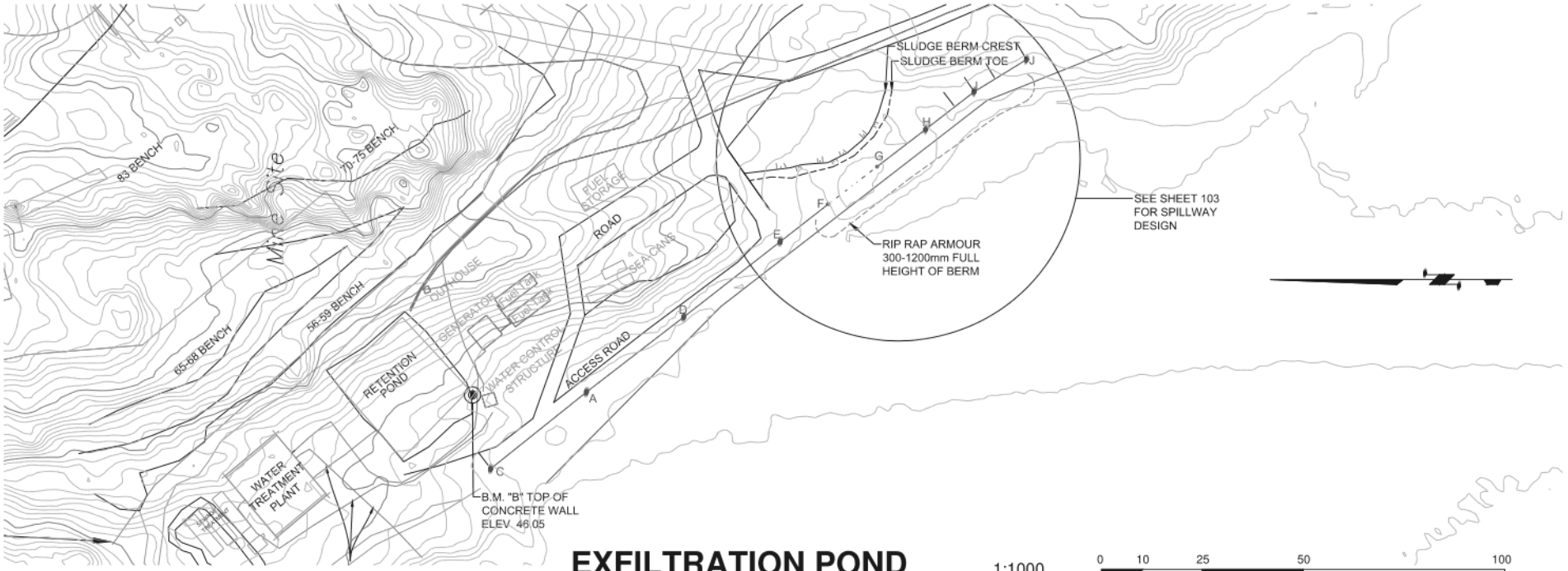


23 - June 2, 2015:

Pond after 16 hours
without 5200 Portal flow.

Appendix C

2011 As-Built Road, 2016 Spillway Design and Photo Sketch

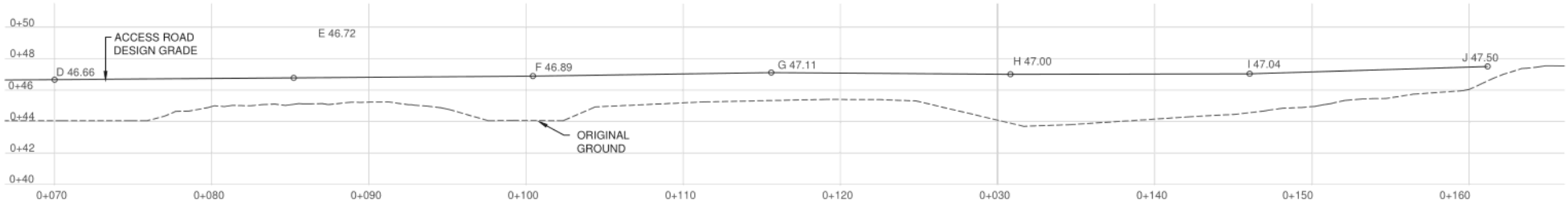


EXFILTRATION POND

1:1000

GENERAL ARRANGEMENT

0 10 25 50 100 METERS



ACCESS ROAD / BERM

1:250

PROFILE

SNT Engineering Ltd.
• Civil
• Structural
• Geotechnical
SUITE 3 - 385 BAKER STREET
NELSON, BC, V1L 4H6
Tel (250) 354-7683
info@snteng.ca www.snteng.ca

CHIEFTAIN METALS CORP.

MARSLAND ENVIRONMENTAL ASSOCIATES

SCALE: AS SHOWN

Designed: LES THIESSEN Date: 2014/12/02
Drawn: A. McINTYRE Date: 2016/02/02

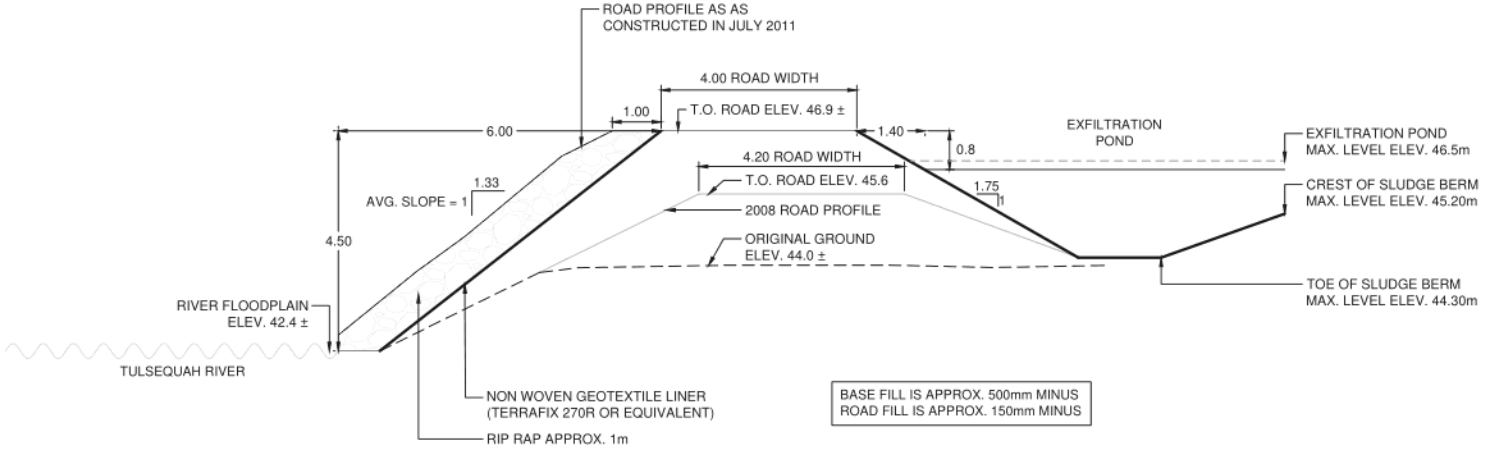
Rev	Date	DESCRIPTION	Init
0	2015/03/02	ISSUED FOR AS-BUILTS	AM

REVISIONS

SITE: TULSEQUAH CHIEF MINE

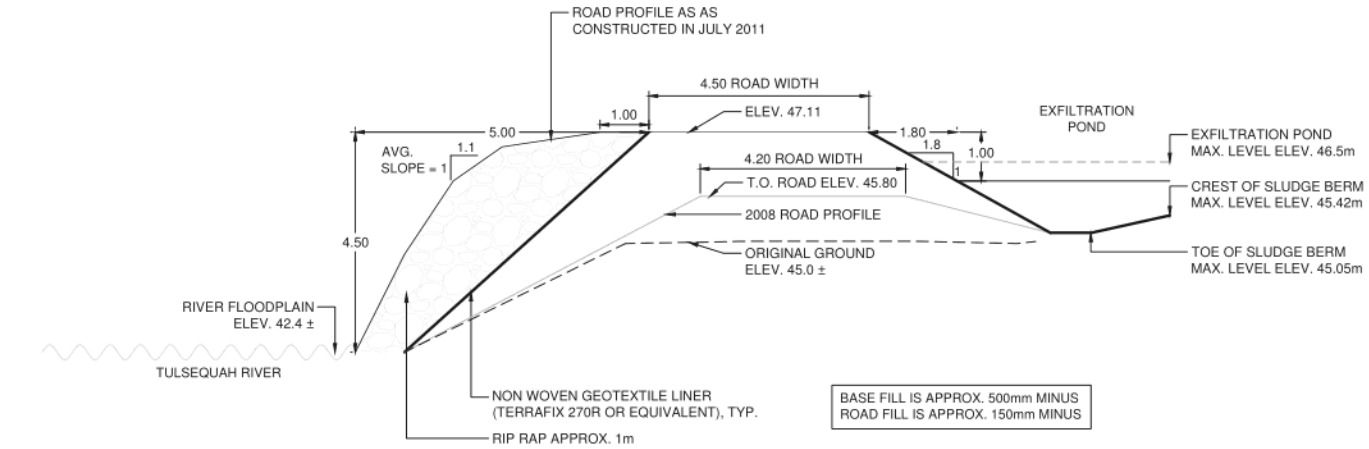
DRAWING TITLE: EXFILTRATION POND BERM AS-BUILT

ORIGINAL SIGNED and SEALED BY: LES THIESSEN
APPROVED BY:
DESIGN ENGINEER: LES THIESSEN
SNT PROJECT No: CMI-16-01
DRAWING No: CMI-16-01-101 | 0



SCALE:
METRES
0m 1 2 3 4

A ROAD SECTION AT POINT F
SCALE1:100



SCALE:
METRES
0m 1 2 3 4

B ROAD SECTION AT POINT G
SCALE1:100

SNT Engineering Ltd.
• Civil
• Structural
• Geotechnical
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Tel (250) 354-7683
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CHIEFTAIN METALS CORP.

MARSLAND ENVIRONMENTAL ASSOCIATES

SCALE AS SHOWN
Designed LES THIESSEN Date 2014/12/02
Drawn K.L. Date 2016/02/02

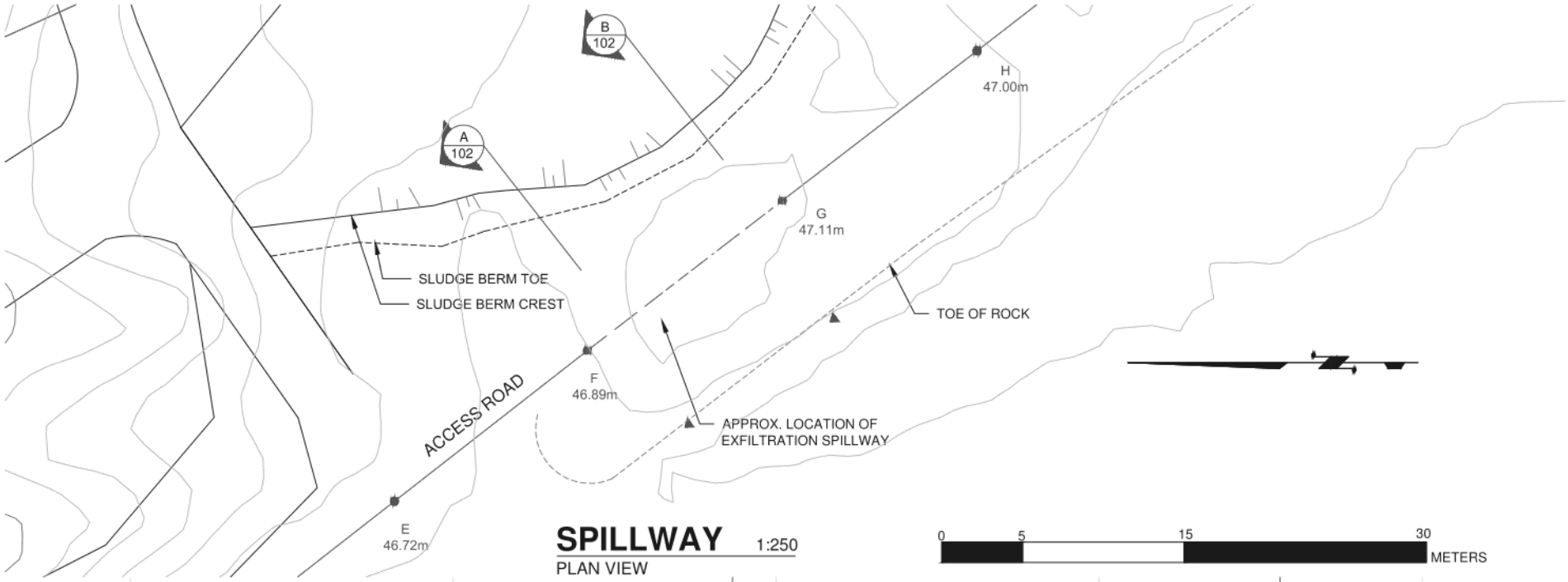
Rev	Date	DESCRIPTION	Init
0	2015/03/02	ISSUED FOR AS-BUILTS	AM

REVISIONS

SITE: TULSEQUAH CHIEF MINE

DRAWING TITLE: EXFILTRATION POND BERM AS-BUILT SECTIONS

ORIGINAL SIGNED and SEALED BY: LES THIESSEN
APPROVED BY:
DESIGN ENGINEER LES THIESSEN
SNT PROJECT No. CMI-16-01
DRAWING No. CMI-16-01-102 | 0



SPILLWAY 1:250
PLAN VIEW

0 5 15 30 METERS

SPILLWAY 1:125
PROFILE

SNT Engineering Ltd.
• Civil
• Structural
• Geotechnical
SUITE 3 - 385 BAKER STREET
NELSON, BC, V1L 4H6
Tel (250) 354-7683
info@snteng.ca www.snteng.ca

CHIEFTAIN METALS CORP.

MARSLAND ENVIRONMENTAL ASSOCIATES

SCALE: AS SHOWN
Designed: LES THIESSEN Date: 2014/12/02
Drawn: A. McINTYRE Date: 2016/02/02

Rev	Date	DESCRIPTION	Init.
0	2015/03/02	ISSUED FOR AS-BUILTS	AM

REVISIONS

SITE: TULSEQUAH CHIEF MINE

DRAWING TITLE: SPILLWAY PLAN AND PROFILE

ORIGINAL SIGNED and SEALED BY: LES THIESSEN
APPROVED BY:
DESIGN ENGINEER: LES THIESSEN
PROJECT NO.: CMI-16-01
DRAWING NO.: CMI-16-01-103 | 0

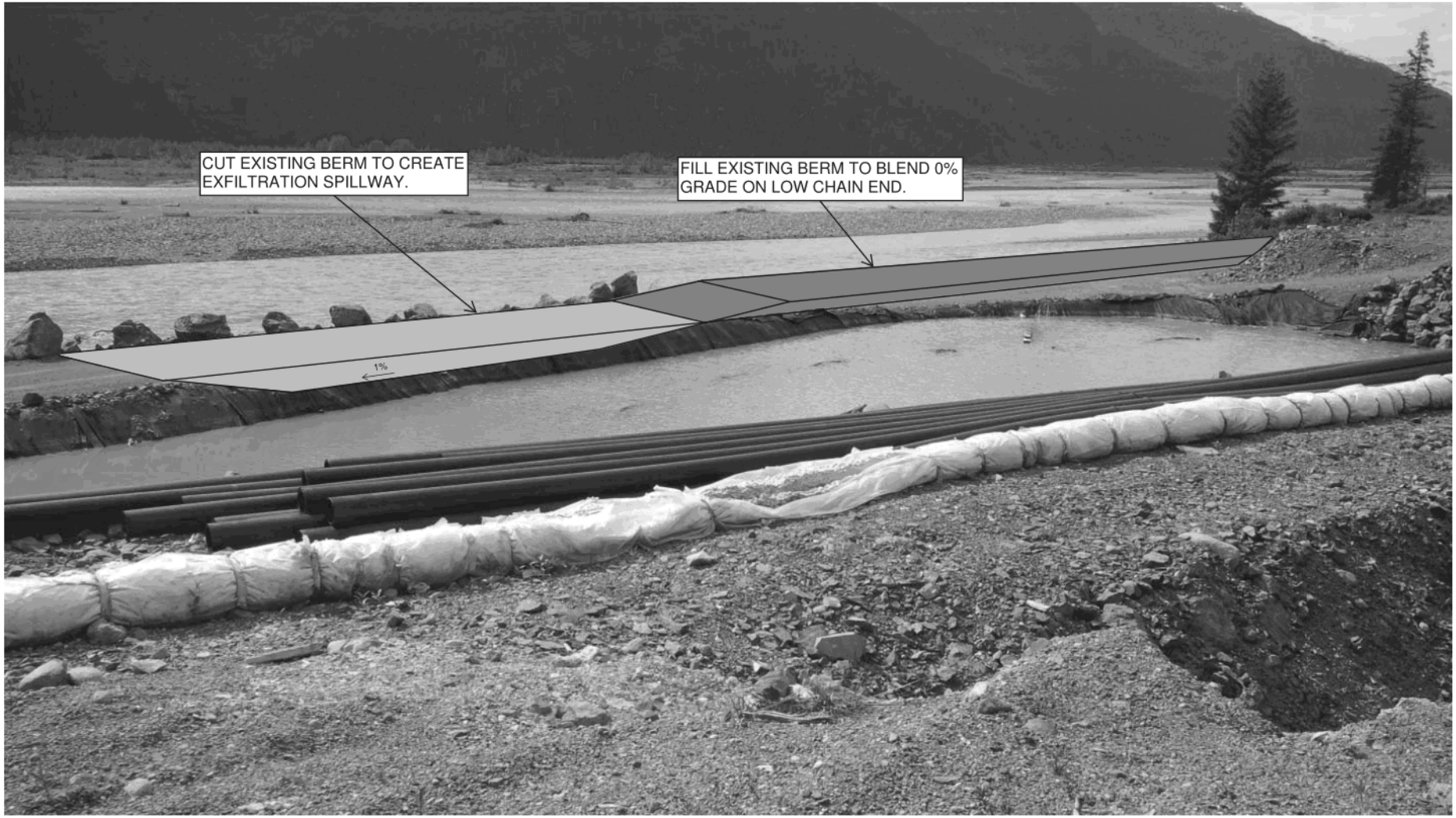


FIGURE: VISUAL REPRESENTATION OF EXFILTRATION SPILLWAY

APPENDIX B

EXFILTRATION POND SITE SURVEILLANCE CHECKLIST

BRITISH COLUMBIA
The Best Place on Earth

SITE SURVEILLANCE
(For Dams with Earth or Rock Embankments)

Dam Name: Tulsequah Chief Exfiltration Pond Berm Dam File #: _____
Inspection Date: _____ Frequency of Inspections: Quarterly
Your Name: _____ Other Participants: _____

Was the spillway flowing? If yes, what was the water depth over the spillway sill? _____
Y N (circle one) If no, how far was the water below the spillway sill level? _____

Are the following components of your dam in *SATISFACTORY CONDITION*? Yes or No?

Check box if applicable - Please refer to the Inspection and Maintenance of Dams manual for dam inspection information

EMBANKMENT	Y	N	***OUTLET***	Y	N	***SPILLWAY***	Y	N	***DIVERSIONS***	Y	N
1. U/S Slope	☐	☐	1. Seepage at toe	☐	☐	1. Entrance	☐	☐	1. Inlet Apron	☐	☐
2. Crest	☐	☐	2.	☐	☐	2. Sill	☐	☐	2. Inlet screen	☐	☐
3. D/S Slope	☐	☐	3.	☐	☐	3. Apron	☐	☐	3. Pipe integrity	☐	☐
4. D/S Toe	☐	☐	4.	☐	☐	4. Channel	☐	☐	4. Water losses	☐	☐
5. Filter fabric	☐	☐	5.	☐	☐	5. Channel Slopes	☐	☐		☐	☐
6. Rip rap	☐	☐	6.	☐	☐		☐	☐		☐	☐

Were any of the following *POTENTIAL PROBLEM INDICATORS* found?

INDICATOR	***EMBANKMENT***		***OUTLET***		***SPILLWAY***	
	YES	NO	YES	NO	YES	NO
a) Seepage (other than along toe)	☐	☐	☐	☐	☐	☐
b) External Erosion	☐	☐	☐	☐	☐	☐
c) Cracks	☐	☐	☐	☐	☐	☐
d) Settlement	☐	☐	☐	☐	☐	☐
e) Sloughing / Slides	☐	☐	☐	☐	☐	☐
f) Animal Activity	☐	☐	☐	☐	☐	☐
g) Excessive Growth	☐	☐	☐	☐	☐	☐
h) Excessive Debris	☐	☐	☐	☐	☐	☐

Comment on any problems, concerns or deficiencies found:

_____
_____
_____
_____
_____

- ***Complete and file this report form as required in your OMS manual.***
- ***This form may be used for quarterly inspections for low failure consequence dams (see Schedule 2 of the Dam Safety Regulation).***
- ***Documentation of your site surveillance may be requested by a Provincial Dam Safety Officer.***

Updated: September 2014

SITE SURVEILLANCE
(For Dams with Earth or Rock Embankments)

Sketch

CHIEFTAIN METALS CORP.

TSXV: CFB

March 29, 2016

Diane Howe
Deputy Chief Inspector,
BC Ministry of Energy and Mines
British Columbia
diane.howe@gov.bc.ca

Candace Caunce
Director, Compliance
Ministry of Environment
British Columbia
candace.caunce@gov.bc.ca

Autumn Cousins
Manager, Compliance
Environmental Assessment Office
British Columbia
autumn.cousins@gov.bc.ca

Dear Ms. Howe, Ms. Caunce and Ms. Cousins;

Chieftain Metals hereby submits the "Tulsequah Chief Project, Exfiltration Pond OMS Manual" which includes the as-built report for the Exfiltration Pond, fulfilling Orders 1. and 2. from the November 9, 2015 Ministry of Energy and Mines Report of Inspector of Mines.

This document is also included in the 2015 Annual Reclamation Report (ARR). The ARR includes the plan for decommissioning the emergency sludge pond located beside the IWTP and forms part of the Mines Act Permit amendment application putting the mine on care and maintenance that was submitted as Appendix G of the February 8, 2016 "Compliance Plan."

When site conditions allow, likely in May, Chieftain will complete the works outlined in the "Compliance Plan" that address the deficiencies identified during the site visits last year and subsequent orders issued by the various departments.

Sincerely,

Keith Boyle, P.Eng.
Chief Operating Officer

Cc. Eric Telford, Land and Resource Officer, Taku River Tlingit First Nation
Mark Love, MoE Smithers
Rob Marsland, MEA

Encl. Exfiltration Pond OMS Manual

Metcalfe, Megan MEM:EX

From: Keith Boyle <keith.boyle@chieftainmetals.com>
Sent: Tuesday, March 29, 2016 12:33 PM
To: Howe, Diane J MEM:EX
Cc: Flynn, Doug MEM:EX; Terry Zanger; Marsland Rob
Subject: Report of Inspector of Mines
Attachments: 20160329 Exfiltration_Pond_OMS_Asbuilt_Checklist.pdf; ATT00001.txt; 001.pdf; ATT00002.txt

Diane,

Please find attached the Report of Inspector of Mines issued Nov 9, 2015 with notes (hand written) stating that Orders 1, 2 and 4 have been fulfilled.

The attached document contains the as-built drawing/report of the exfiltration pond and OMS manual for the exfiltration pond. The Annual Reclamation Report, to be forwarded shortly, includes the plan for the decommissioning of the pond next to the IWTP.

Terry will post the Inspection report on his next site visit.

Regards,

Keith

Page 267 to/à Page 313

Withheld pursuant to/removed as

DUPLICATE

Metcalfe, Megan MEM:EX

From: Love, Mark P ENV:EX
Sent: Monday, April 4, 2016 11:04 AM
To: Howe, Diane J MEM:EX
Cc: Hill, Douglas J ENV:EX; Janfada, Arash ENV:EX; McConnachie, Jennifer MEM:EX
Subject: Tulsequah Chief - Next Steps

Hi Diane,

Your favorite topic: Tulsequah Chief. Are you and Jennifer able to find some time to get together and discuss the status of MOE and MEM's regulatory next steps?

Regards,

Mark P. Love P. Ag.
Mining Operations - North West and Vancouver Island Regions
Ministry of Environment, Smithers
Phone# 250-847-7416
Cell # 250-877-9237
mark.love@gov.bc.ca

Metcalfe, Megan MEM:EX

From: Love, Mark P ENV:EX
Sent: Monday, April 18, 2016 10:03 AM
To: Howe, Diane J MEM:EX
Cc: McConnachie, Jennifer MEM:EX
Subject: FW: Conf. Call with Lt. Gov. Mallott Friday, April 22nd at 2:10pm (PST)

Hi Diane,

FYI – your minister is likely to discuss Tulsequah Chief with Lt. Governor Byron Mallott Friday, April 22nd .

I have been asked to prepare a few bullet by tomorrow morning. Perhaps this is a crazy idea but our position should be co-ordinated with yours. Peter seems to think we had plans for an enforcement order which is not accurate. In fact I thought that MEM was going to issue "requirements" to update their interim closure plan that would (we hoped) addressing some of MoE issues.

Do you have a few minutes to discuss ?

Regards,

Mark P. Love P. Ag.
Mining Operations - North West and Vancouver Island Regions
Ministry of Environment, Smithers
Phone# 250-847-7416
Cell # 250-877-9237
mark.love@gov.bc.ca

From: Hill, Douglas J ENV:EX
Sent: Monday, April 18, 2016 9:34 AM
To: Love, Mark P ENV:EX
Cc: Graham, Mark ENV:EX
Subject: FW: Conf. Call with Lt. Gov. Mallott Friday, April 22nd at 2:10pm (PST)

Mark L, could you assist Mark G on putting some bullets together. I am thinking by tomorrow morning would be good.

djh

From: Zacharias, Mark ENV:EX
Sent: Monday, April 18, 2016 9:26 AM
To: Graham, Mark ENV:EX; Hill, Douglas J ENV:EX
Cc: McGuire, Jennifer ENV:EX; Gooderham, Coleen E ENV:EX
Subject: FW: Conf. Call with Lt. Gov. Mallott Friday, April 22nd at 2:10pm (PST)

Doug/Mark:

Can I get a quick couple of bullets on where we are wrt Tulsequah?

Regards, MZ

From: Robb, Peter L. MEM:EX
Sent: Monday, April 18, 2016 9:01 AM
To: Zacharias, Mark ENV:EX
Subject: FW: Conf. Call with Lt. Gov. Mallott Friday, April 22nd at 2:10pm (PST)

Mark,

We should probably have a quick call on this ahead of MBB call with LT Mallott. Where is MOE at with respect to the enforcement orders at Tulsequah as that will be a question I am sure he will be asked.

Cheers,

From: Rioux, Luke MEM:EX
Sent: Thursday, April 14, 2016 12:46 PM
To: Bennett, Bill MEM:EX
Cc: Wallace-Deering, Eric MEM:EX; Denniston, Tristan M MEM:EX; Lewis, Ted MEM:EX; Costa, Sarina MEM:EX; McKnight, Elaine L MEM:EX; Robb, Peter L. MEM:EX; Cochrane, Marlene MEM:EX
Subject: Conf. Call with Lt. Gov. Mallott Friday, April 22nd at 2:10pm (PST)

Hi Minister,

A conference call has been scheduled next Friday, April 22nd at 2:10pm (PST) for your meeting with Lt. Governor Byron Mallott, regarding the letter the Lt. Gov. sent to Mr. Chris Sandrolini of the U.S. State Department Office of Canadian Affairs (attached).

The letter was forwarded to us by Mr. Peter Chodos, Executive VP for Corporate Development at Chieftain Metals Corp., who wants to speak with you about this letter as it "appears to deviate from the recently signed Alaska/BC MOU" (incoming email also attached).

I have updated your calendar with the details for this conference call as well.

Please let me know if you need anything further.

Thank you,

Luke Rioux
Administrative Assistant to the Hon. Bill Bennett | Ministry of Energy and Mines
Room 301, Parliament Buildings | Victoria, BC | V8W 9E2 | 250-387-5896

Metcalfe, Megan MEM:EX

From: Love, Mark P ENV:EX
Sent: Monday, April 18, 2016 10:54 AM
To: Howe, Diane J MEM:EX
Cc: McConnachie, Jennifer MEM:EX; Graham, Mark ENV:EX; Janfada, Arash ENV:EX
Subject: RE: Conf. Call with Lt. Gov. Mallott Friday, April 22nd at 2:10pm (PST)

I'll set up the meeting.

I recall MEM was working on drafting a letter that would require CM to update their Closure Plan and perhaps implement closure should the project continue to look like it won't go forward. Is that correct?

Is MEM going to send in an update / bullets to Peter Rob?

Regards,

Mark P. Love P. Ag.
Mining Operations - North West and Vancouver Island Regions
Ministry of Environment, Smithers
Phone# 250-847-7416
Cell # 250-877-9237
mark.love@gov.bc.ca

From: Howe, Diane J MEM:EX
Sent: Monday, April 18, 2016 10:48 AM
To: Love, Mark P ENV:EX
Cc: McConnachie, Jennifer MEM:EX
Subject: Re: Conf. Call with Lt. Gov. Mallott Friday, April 22nd at 2:10pm (PST)

Hi Mark,

I am travelling today and tomorrow, however the company has submitted (asked by government) a permit amendment for the care and maintenance period. I believe MOE got a similar request at the same time.

We are reviewing the as builds for the exfiltration pond now. (MEM orders)

Can you set up a meeting request for this Thursday or Friday so we can discuss.

Regards, Diane

On Apr 18, 2016, at 10:02, Love, Mark P ENV:EX <Mark.Love@gov.bc.ca> wrote:

> Hi Diane,
>
> FYI – your minister is likely to discuss Tulsequah Chief with Lt. Governor Byron Mallott Friday, April 22nd .
>
> I have been asked to prepare a few bullet by tomorrow morning. Perhaps this is a crazy idea but our position should be co-ordinated with yours. Peter seems to think we had plans for an

enforcement order which is not accurate. In fact I thought that MEM was going to issue "requirements" to update their interim closure plan that would (we hoped) addressing some of MoE issues.

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Mark P. Love P. Ag.
Mining Operations - North West and Vancouver Island Regions
Ministry of Environment, Smithers
Phone# 250-847-7416
Cell # 250-877-9237
mark.love@gov.bc.ca

From: Hill, Douglas J ENV:EX
Sent: Monday, April 18, 2016 9:34 AM
To: Love, Mark P ENV:EX
Cc: Graham, Mark ENV:EX
Subject: FW: Conf. Call with Lt. Gov. Mallott Friday, April 22nd at 2:10pm (PST)

Mark L, could you assist Mark G on putting some bullets together. I am thinking by tomorrow morning would be good.

djh

From: Zacharias, Mark ENV:EX
Sent: Monday, April 18, 2016 9:26 AM
To: Graham, Mark ENV:EX; Hill, Douglas J ENV:EX
Cc: McGuire, Jennifer ENV:EX; Gooderham, Coleen E ENV:EX
Subject: FW: Conf. Call with Lt. Gov. Mallott Friday, April 22nd at 2:10pm (PST)

Doug/Mark:

Can I get a quick couple of bullets on where we are wrt Tulsequah?

Regards, MZ

From: Robb, Peter L. MEM:EX
Sent: Monday, April 18, 2016 9:01 AM
To: Zacharias, Mark ENV:EX
Subject: FW: Conf. Call with Lt. Gov. Mallott Friday, April 22nd at 2:10pm (PST)

Mark,

We should probably have a quick call on this ahead of MBB call with LT Mallott. Where is MOE at with respect to the enforcement orders at Tulsequah as that will be a question I am sure he will be asked.

Cheers,

From: Rioux, Luke MEM:EX
Sent: Thursday, April 14, 2016 12:46 PM
To: Bennett, Bill MEM:EX

Cc: Wallace-Deering, Eric MEM:EX; Denniston, Tristan M MEM:EX; Lewis, Ted MEM:EX; Costa, Sarina MEM:EX; McKnight, Elaine L MEM:EX; Robb, Peter L. MEM:EX; Cochrane, Marlene MEM:EX
Subject: Conf. Call with Lt. Gov. Mallott Friday, April 22nd at 2:10pm (PST)

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The letter was forwarded to us by Mr. Peter Chodos, Executive VP for Corporate Development at Chieftain Metals Corp., who wants to speak with you about this letter as it "appears to deviate from the recently signed Alaska/BC MOU" (incoming email also attached).

I have updated your calendar with the details for this conference call as well.

Please let me know if you need anything further.

Thank you,

Luke Rioux
Administrative Assistant to the Hon. Bill Bennett | Ministry of Energy and Mines
Room 301, Parliament Buildings | Victoria, BC | V8W 9E2 | 250-387-5896

Metcalfe, Megan MEM:EX

From: Love, Mark P ENV:EX
Sent: Wednesday, April 20, 2016 8:58 AM
To: Howe, Diane J MEM:EX
Subject: FW: Conf. Call with Lt. Gov. Mallott Friday, April 22nd at 2:10pm (PST)

FYI – Our bullets set to Peter Rob

Mark P. Love P. Ag.
Mining Operations - North West and Vancouver Island Regions
Ministry of Environment, Smithers
Phone# 250-847-7416
Cell # 250-877-9237
mark.love@gov.bc.ca

From: Zacharias, Mark ENV:EX
Sent: Tuesday, April 19, 2016 11:59 AM
To: Hill, Douglas J ENV:EX; Robb, Peter L. MEM:EX
Cc: Love, Mark P ENV:EX; Graham, Mark ENV:EX; Gooderham, Coleen E ENV:EX
Subject: RE: Conf. Call with Lt. Gov. Mallott Friday, April 22nd at 2:10pm (PST)

Thx Doug: Over to you Peter.

Regards, MZ

From: Hill, Douglas J ENV:EX
Sent: Tuesday, April 19, 2016 11:41 AM
To: Zacharias, Mark ENV:EX
Cc: Love, Mark P ENV:EX; Graham, Mark ENV:EX; Gooderham, Coleen E ENV:EX
Subject: FW: Conf. Call with Lt. Gov. Mallott Friday, April 22nd at 2:10pm (PST)

Mark, here are the bullets put together by Mark Love and Mark Graham:

KEY MESSAGES:

- An aquatic Ecological Risk Assessment report from 2013 concluded that acid rock drainage at this site is considered a low overall risk to the receiving environment. To date, the impact to fish resources from this site are minimal;
- Cleanup of historic ARD drainage could be addressed by 1) commencing mining production or 2) implementing an appropriate closure plan that includes water treatment and capping of historic waste rock;
- Re-commissioning mining production is contingent on Chieftain receiving adequate financing.

CURRENT STATUS:

- MoE continues to work with MEM to take a co-ordinated approach to the review of the Compliance Plan, the review of Chieftain Metals application for amendment to their EMA and MA permits, and the determination of next steps in respect to compliance.

UPDATE:

- Chieftain Metals submitted a Closure Management Manual in June 2015 that summarizes closure activities planned for the site, including options for addressing /mitigating impacts from unabated Acid rock drainage. MEM has yet to undertake a co-ordinated review of the document.
- On November 10, 2015, MoE, EAO and MEM sent Chieftain Metals a joint letter that detailed the non-compliances with the EMA, MA and EAC. The letter required that they submit a compliance plan within 90 days.
- Chieftain Metals submitted a Compliance Plan (Plan) in February of 2016. The Plan proposed that the non-compliances be addressed in part through permit amendments to both the EMA and MA permits to reflect the fact that the site never became operational and is in a state of extended care and maintenance.
- The Plan included a request to amend the EMA permit to remove the requirement to operate the interim water treatment plant until such time as financing is acquired and the project moves into construction.
- The rational for the amendment is that:

    - The initial requirements for interim water treatment were intended only to address impacted water associated with construction of the project. Since the project never got underway, those requirements need not apply.

    - Impacts to the fishery resources from the current discharge of untreated ARD are minimal, the influence of untreated discharges on water quality is relatively small, and no impacts are expected in the Taku River. This is supported by an Aquatic Ecological Risk Assessment conducted in 2013

    - The feasibility of operating the treatment plant is contingent on the project receiving financing and proceeding to production.

- Chieftan was advised by MOE that submission of a permit amendment application is expected to include:
    - A feasibility assessment of mitigation measures that could be implemented to reduce metal loadings to the Tulsequah River during this extended interim care and maintenance phase. This should include at a minimum the following:
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    - An accounting of all ARD mitigation work completed to date
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- Chieftain argues it has limited financing to effectively operate the water treatment plant or cap waste rock without the project moving forward, and that Chieftan should not be responsible for operating a treatment system unless the project proceeds into construction;

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Sent: Monday, April 18, 2016 9:26 AM
To: Graham, Mark ENV:EX; Hill, Douglas J ENV:EX

Cc: McGuire, Jennifer ENV:EX; Gooderham, Coleen E ENV:EX
Subject: FW: Conf. Call with Lt. Gov. Mallott Friday, April 22nd at 2:10pm (PST)

Doug/Mark:

Can I get a quick couple of bullets on where we are wrt Tulsequah?

Regards, MZ

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Sent: Monday, April 18, 2016 9:01 AM
To: Zacharias, Mark ENV:EX
Subject: FW: Conf. Call with Lt. Gov. Mallott Friday, April 22nd at 2:10pm (PST)

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We should probably have a quick call on this ahead of MBB call with LT Mallott. Where is MOE at with respect to the enforcement orders at Tulsequah as that will be a question I am sure he will be asked.

Cheers,

From: Rioux, Luke MEM:EX
Sent: Thursday, April 14, 2016 12:46 PM
To: Bennett, Bill MEM:EX
Cc: Wallace-Deering, Eric MEM:EX; Denniston, Tristan M MEM:EX; Lewis, Ted MEM:EX; Costa, Sarina MEM:EX; McKnight, Elaine L MEM:EX; Robb, Peter L. MEM:EX; Cochrane, Marlene MEM:EX
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Hi Minister,

A conference call has been scheduled next Friday, April 22nd at 2:10pm (PST) for your meeting with Lt. Governor Byron Mallott, regarding the letter the Lt. Gov. sent to Mr. Chris Sandrolini of the U.S. State Department Office of Canadian Affairs (attached).

The letter was forwarded to us by Mr. Peter Chodos, Executive VP for Corporate Development at Chieftain Metals Corp., who wants to speak with you about this letter as it "appears to deviate from the recently signed Alaska/BC MOU" (incoming email also attached).

I have updated your calendar with the details for this conference call as well.

Please let me know if you need anything further.

Thank you,

Luke Rioux
Administrative Assistant to the Hon. Bill Bennett | Ministry of Energy and Mines
Room 301, Parliament Buildings | Victoria, BC | V8W 9E2 | 250-387-5896

Metcalfe, Megan MEM:EX

From: Graham, Mark ENV:EX
Sent: Thursday, April 21, 2016 11:14 AM
To: Zacharias, Mark ENV:EX; Robb, Peter L. MEM:EX
Cc: Love, Mark P ENV:EX; Gooderham, Coleen E ENV:EX; Hill, Douglas J ENV:EX; Howe, Diane J MEM:EX
Subject: RE: Conf. Call with Lt. Gov. Mallott Friday, April 22nd at 2:10pm (PST) (CLARIFCATION)

Hi Mark Z. and Peter,

I just want to clarify one point about the bullets below for the call on Friday. Based on our discussions with MEM today, water treatment and capping of waste rock is **not a** realistic option for Chieftain's closure plan due to lack of financing. The only realistic option for full treatment is for production to commence. I've made changes the bullets to reflect that below:

Regards

Mark G

From: Hill, Douglas J ENV:EX
Sent: Tuesday, April 19, 2016 11:41 AM
To: Zacharias, Mark ENV:EX
Cc: Love, Mark P ENV:EX; Graham, Mark ENV:EX; Gooderham, Coleen E ENV:EX
Subject: FW: Conf. Call with Lt. Gov. Mallott Friday, April 22nd at 2:10pm (PST)

Mark, here are the bullets put together by Mark Love and Mark Graham:

KEY MESSAGES:

- An aquatic Ecological Risk Assessment report from 2013 concluded that acid rock drainage at this site is considered a low overall risk to the receiving environment. To date, the impact to fish resources from this site are minimal;
- Cleanup of historic ARD drainage can only realistically be addressed by commencing mining production. Chieftain does not have adequate financing to manage water treatment and capping of historic waste rock as part of a closure plan;
- Re-commissioning mining production is contingent on Chieftain receiving adequate financing.

CURRENT STATUS:

- MoE continues to work with MEM to take a co-ordinated approach to the review of the Compliance Plan, the review of Chieftain Metals application for amendment to their EMA and MA permits, and the determination of next steps in respect to compliance.

UPDATE:

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Thank you,

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Administrative Assistant to the Hon. Bill Bennett | Ministry of Energy and Mines
Room 301, Parliament Buildings | Victoria, BC | V8W 9E2 | 250-387-5896

Metcalfe, Megan MEM:EX

From: Hill, Douglas J ENV:EX
Sent: Wednesday, April 27, 2016 4:45 PM
To: Karn, David GCPE:EX
Cc: Smith, Curtis ENV:EX; Cotton, Brian GCPE:EX; McGuire, Jennifer ENV:EX; Hoffman, Al MEM:EX; Howe, Diane J MEM:EX
Subject: RE: media request - Juneau Empire - Tulsequah Chief Mine clean up

David, the email attached has the latest MOE bullets for this file. Some specific answers from MOE perspective in red to the questions posed:

Back in Nov. BC officials told Chieftain Metals to clean up the Tulsequah Chief Mine (http://www.cbc.ca/news/canada/north/tulsequah-chief-mine-inspection-1.3323686). The company was given 90 days to submit a plan. Did the company ever submit one?
A plan was submitted to address non-compliance with the EA Certificate, MEM permit and EMA permit.

If so, what is the plan and where is Chieftain at in regards to the clean up?
In regards to the EMA permit, Chieftain has submitted further assessment work to MOE and MEM this year:

- An updated geochemical source assessment of ARD loadings.
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It not, what is your office doing about it?
How is your office enforcing the clean up order? Are there fines, penalties?
MOE has been working with MEM to consider further orders by the Chief Inspector. MOE is considering the submitted monitoring plan update and may impose additional monitoring for 2016 above what is indicated in the plan. The requirement for the treatment plant authorised in the permit was based on the company moving forward with development of the property, and the plant was intended to treat effluent generated as a result of that development. Options for ordering site clean-up may be considered in future if there is no indication that the project is going to proceed.

Who ultimately is responsible for cleaning up the BC mine?
Chieftain recently defaulted on a $4 million payment towards a loan (http://www.chieftainmetals.com/2016/04/06/chieftain-metals-corp-provides-update-on-corporate-debt/). With its financial issues, it doesn't appear that cleaning up is a top priority. Will the BC gov take responsibility for cleaning it up?
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I have not had a chance to check in with MEM on these responses so am copying Al and Diane.

djh

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Sent: Wednesday, April 27, 2016 2:16 PM
To: Hill, Douglas J ENV:EX
Cc: Smith, Curtis ENV:EX; Cotton, Brian GCPE:EX
Subject: media request - Juneau Empire - Tulsequah Chief Mine clean up

Doug,

Our Mines ADM Peter Robb said this should be sent to MOE for response and that you would have the latest on it.

Also, see the attached email.

<< Message: FW: Conf. Call with Lt. Gov. Mallott Friday, April 22nd at 2:10pm (PST) >>

reporter: Lisa Phu, Juneau Empire lisa.phu@juneauempire.com 907-523-2246

deadline: 5pm

request: Questions re: Chieftain Metals

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Metcalfe, Megan MEM:EX

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To: Dalal, Suntanu GCPE:EX
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To: Hill, Douglas J ENV:EX
Cc: Smith, Curtis ENV:EX; Cotton, Brian GCPE:EX; McGuire, Jennifer ENV:EX; Hoffman, Al MEM:EX; Howe, Diane J MEM:EX
Subject: Re: media request - Juneau Empire - Tulsequah Chief Mine clean up

Doug, I will share with MEM as they requested. Thank you.

Sent from my BlackBerry 10 smartphone on the TELUS network.

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Sent: Wednesday, April 27, 2016 4:44 PM
To: Karn, David GCPE:EX
Cc: Smith, Curtis ENV:EX; Cotton, Brian GCPE:EX; McGuire, Jennifer ENV:EX; Hoffman, Al MEM:EX; Howe, Diane J MEM:EX
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Metcalfe, Megan MEM:EX

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To: Karn, David GCPE:EX
Cc: Smith, Curtis ENV:EX; Cotton, Brian GCPE:EX; McGuire, Jennifer ENV:EX; Howe, Diane J MEM:EX; Graham, Mark ENV:EX
Subject: RE: media request - Juneau Empire - Tulsequah Chief Mine clean up

David, attached is the first letter from last fall that we received in response to the inspections. The February submission that we have would have to be requested via FOI since it includes information, including costing information, that is likely protected under the FOI provision preventing disclosure harmful to business interests of a third party, and so would have to go through the harms assessment process.

Douglas Hill, P.Eng.
Regional Operations Director - Mining
Environmental Protection
Ph: 250-398-4542

From: Karn, David GCPE:EX
Sent: Thursday, April 28, 2016 12:33 PM
To: Hill, Douglas J ENV:EX
Cc: Smith, Curtis ENV:EX; Cotton, Brian GCPE:EX; McGuire, Jennifer ENV:EX; Howe, Diane J MEM:EX
Subject: RE: media request - Juneau Empire - Tulsequah Chief Mine clean up

Doug, the reporter has asked for a copy of the compliance plan submitted by the company. Was that sent to MoE or MEM?

From: Hill, Douglas J ENV:EX
Sent: Wednesday, April 27, 2016 4:45 PM
To: Karn, David GCPE:EX
Cc: Smith, Curtis ENV:EX; Cotton, Brian GCPE:EX; McGuire, Jennifer ENV:EX; Hoffman, Al MEM:EX; Howe, Diane J MEM:EX
Subject: RE: media request - Juneau Empire - Tulsequah Chief Mine clean up

<< Message: FW: Conf. Call with Lt. Gov. Mallott Friday, April 22nd at 2:10pm (PST) >>

David, the email attached has the latest MOE bullets for this file. Some specific answers from MOE perspective in red to the questions posed:

Back in Nov. BC officials told Chieftain Metals to clean up the Tulsequah Chief Mine (http://www.cbc.ca/news/canada/north/tulsequah-chief-mine-inspection-1.3323686). The company was given 90 days to submit a plan. Did the company ever submit one?
A plan was submitted to address non-compliance with the EA Certificate, MEM permit and EMA permit.

If so, what is the plan and where is Chieftain at in regards to the clean up?
In regards to the EMA permit, Chieftain has submitted further assessment work to MOE and MEM this year:

- An updated geochemical source assessment of ARD loadings.
- A review of ARD mitigation work completed to date and evaluation of possible ARD mitigation strategies for future implementation
- A summary of the water treatment plant optimization study undertaken
- A review of estimated costs for ARD mitigation strategies presented.
- An updated monitoring plan, and summary of latest water quality data

It not, what is your office doing about it?
How is your office enforcing the clean up order? Are there fines, penalties?
MOE has been working with MEM to consider further orders by the Chief Inspector. MOE is considering the submitted monitoring plan update and may impose additional monitoring for 2016 above what is indicated in the plan. The requirement for the treatment plant authorised in the permit was based on the company moving forward with development of the property, and the plant was intended to treat effluent generated as a result of that development. Options for ordering site clean-up may be considered in future if there is no indication that the project is going to proceed.

Who ultimately is responsible for cleaning up the BC mine?
Chieftain recently defaulted on a $4 million payment towards a loan (http://www.chieftainmetals.com/2016/04/06/chieftain-metals-corp-provides-update-on-corporate-debt/). With its financial issues, it doesn't appear that cleaning up is a top priority. Will the BC gov take responsibility for cleaning it up?
The Ministry of Energy and Mines holds the bond for reclamation of the site, for activities undertaken by Chieftain. MEM works with MOE and FLNR in managing historic mine sites. The first step in cleanup of a historic mine site is identifying persons having known responsibility to clean up a site. Sites identified as truly orphaned and may require government funding or partnership programs to facilitate cleanup.

I have not had a chance to check in with MEM on these responses so am copying Al and Diane.

djh

From: Karn, David GCPE:EX
Sent: Wednesday, April 27, 2016 2:16 PM
To: Hill, Douglas J ENV:EX
Cc: Smith, Curtis ENV:EX; Cotton, Brian GCPE:EX
Subject: media request - Juneau Empire - Tulsequah Chief Mine clean up

Doug,

Our Mines ADM Peter Robb said this should be sent to MOE for response and that you would have the latest on it.

Also, see the attached email.

<< Message: FW: Conf. Call with Lt. Gov. Mallott Friday, April 22nd at 2:10pm (PST) >>

reporter: Lisa Phu, Juneau Empire lisa.phu@juneauempire.com 907-523-2246

deadline: 5pm

request: Questions re: Chieftain Metals

Back in Nov. BC officials told Chieftain Metals to clean up the Tulsequah Chief Mine (http://www.cbc.ca/news/canada/north/tulsequah-chief-mine-inspection-1.3323686). The company was given 90 days to submit a plan. Did the company ever submit one?

If so, what is the plan and where is Chieftain at in regards to the clean up?

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CHIEFTAIN METALS CORP.

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Atlin, BC V0W 1A0
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November 23, 2015

Neil Bailey, P.Eng.
Senior Environmental Protection Officer
Ministry of Environment - Northern Region
Environmental Protection Division
Bag 5000, 3726 Alfred Avenue
Smithers BC V0J 2N0

Dear Sir,

RE: Non-compliance Advisory Letter Resulting from Inspection of permit number 105719 for Chieftain Metals Inc.'s Tulsequah Chief mine under the Environmental Management Act

Please find below, CMI's responses to the orders of November 10, 2015.

For ease of responding, the orders have been copied here and responded to in sequence.

> "Below lists the section, the non-compliance of that section and the action required related to the Permit (105719).
>
> Section 1.1.5 The authorized works include, but are not limited to, a water collection and conveyance system, pumps, an acid water treatment plant which includes a neutralization chamber, rapid mix tank, flocculent tank, inclined plate-type separator/thickener, filters and holding tanks, a discharge line, outfall to the Tulsequah River, and related appurtenances approximately located as shown on Site Plan A.
>
> Section 2.1 – Bypasses
>
> Any bypass of the authorized works is prohibited unless the approval of the Director is obtained and confirmed in writing.
>
> Non-compliance: Written Approval for the bypass of the water treatment plant was not obtained and the discharge does not meet the conditions specified in Section 3.6. As a result, Chieftain Metals Inc. is in violation of Section 2.1 Bypasses.
>
> Action: Commission the IWTP immediately once site development occurs.

RESPONSE: Acknowledged. Chieftain Metals will commission the IWTP immediately once site development occurs.

Section 4. Discharge and Receiving Environment Monitoring.

Commencing July 1, 2014, Section 4.0 of permit 105719 is to read as follows:

-Sampling monthly from October through February increased to bi-weekly April through May and then returns to monthly in the period from June to September.
-The sites to be sampled remain W10, W46, SE2, W51 and W31
-The parameters to be sampled for remain total and dissolved metals, pH, conductivity, turbidity suspended solids, hardness and alkalinity.

Non-compliance: The Permittee did not meet the amended requirements for Discharge and
Receiving Environment Monitoring on the following dates and locations:

-At site W51 for July 29, 2014 pH, conductivity and alkalinity were not monitored for.
-Monitoring of W46 is suspended in June 2015 as path of river no longer passes through this location.

Action: Ensure monitoring occurs in the locations, frequencies and parameters required in the June 12 2014 Amendment to Section 4.0 Discharge and Receiving Environment Monitoring. Contact Director regarding amending the W46 monitoring location.

RESPONSE: The required monthly sample at W51 in July 2014 was collected on July 27, 2014. All required analyses were performed on that sample. Supplemental samples were collected on July 25, 26, 28 and 29 and analysed for select parameters.

A letter under separate cover will be sent to the Director regarding amending the W46 monitoring.

This advisory, the alleged violation and the circumstances to which it refers will form part of the compliance history of Chieftain Metals Inc. and its responsible officials and will be taken into account in the event of future non-compliance. You are directed to do the following:

1. Implement the necessary changes or modifications immediately to address this situation and to bring it into compliance.
2. Notify this office by email or letter within 30 days of this letter, advising what corrective measures have been taken, and what else is being done, to bring this authorization into compliance.

CHIEFTAIN METALS CORP.

Please be advised that the inspection report quotes incorrect contact information. Please note change of contact information:

Keith Boyle, P.Eng.
Chief Operating Officer
Chieftain Metals Inc.
2 Bloor W, Suite 2510
Toronto, ON M5W 3E2

Sincerely,

Keith Boyle, P.Eng.
Chief Operation Officer

cc. Mark Love (by email), Section Head Mining Authorizations, Ministry of Environment, Mark.Love@gov.bc.ca
Cassandra Caunce (by email), Director Compliance & Integrated Pest Management Ministry of Environment, Cassandra.Caunce@gov.bc.ca
Diane Howe (by email), Deputy Inspector of Mines, Ministry of Energy and Mines, Diane.Howe@gov.bc.ca
Eric Telford, Lands and Resources, TRTFN

Metcalfe, Megan MEM:EX

From: Marques, Victor MEM:EX
Sent: Thursday, May 12, 2016 11:09 AM
To: Howe, Diane J MEM:EX
Cc: Constable, Lowell MEM:EX
Subject: RE: REVIEW: Tulsequah Chief OMS

Categories: a Priority

Hi Diane, you can forward my comments on the OMS:

Project Description

1. Location map is needed showing mine location. They have only provided coordinates to a helipad location.
2. A site plan is needed showing the pond, access roads, water diversion structures related to the pond (inflow, outflow, diversions, etc)
3. Need a description of how to access the pond.
4. The following design details are missing:
    a. Does the embankment meet CDA guidelines? What is the design earthquake and design flood event?
    b. A statement regarding the objective / purpose of the facility. What are closure requirements? It is understood it is a leaky structure and is only to contain the sludge.
    c. Crest width, height, and slopes are provided but the length of the embankment is not provided nor is it obvious looking at the drawings.
    d. What is the embankment constructed of? What are the foundations?
    e. What is the watershed area that reports to the pond, normal operating water level, freeboard requirements, inflow design flood, design seismic event, etc.
    f. Downstream rip rap design requirements i.e. what is the minimum rip rap sizing required for a design flood event of the Tulsequah River?
5. What are the downstream consequences / significance of a failure?

Operations

6. Org Chart of Mine personnel responsible for the Exfiltration pond including any consultants and contractors plus phone numbers and emails.
7. Details on operation is lacking. i.e. It states that portal discharge is to bypass the pond seasonally – more detail is needed on this for the OMS. How and where is this done? Is this permitted?
8. Is there a contingency location to divert water and sludge in case the pond is full or requires repair?

Maintenance

9. When is sludge cleanout and/or filter replacement needed?

Surveillance

10. Downstream toe erosion along the river should be included in the monitoring section i.e. needs more emphasis - outside of the dam stability section.
11. What frequency are inspections to be conducted? This should be specific – weekly, monthly, annually, etc. and what about after freshet, flood or earthquake?
12. What time of year should formal annual inspections be conducted?
13. Who is called when the inspector sees something outside of normal? Is it the mine manager or is it the engineer? Provide names and phone numbers and make sure they are up to date.

Appendix: As-Built

1. How was the berm built? What equipment? What foundation preparation was done? What are the foundations?
2. Two construction materials are noted in the drawings: Base Fill (500mm minus) and Road Fill (150mm minus). How thick were the material zones? How many lifts were they constructed? Were there any compaction requirements?
3. Need more details on the materials used. Where did the granular fill come from? Has piping been considered? Was there any QA/QC on the construction and if so where are the records?
4. A statement in the as-built is needed indicating the berm was "built in general conformance with the design".

Additional notes / concerns

5. Spillways are typically not aligned over a dam crest unless erosion of the dam crest and downstream face is addressed and a safer alternative alignment is not practical. If water is flowing over the spillway what measures are in place to prevent erosion of the embankment?
6. The OMS is to be updated, as well as an as-built, after the spillway is constructed.

Feel free to contact me with any questions,

Victor Marques, P.Eng.
Sr. Geotechnical Inspector
Ministry of Energy and Mines
O: 250.952.0843 C: 250.889.1593
www.gov.bc.ca/minepermitting

-----Original Message-----
From: Howe, Diane J MEM:EX
Sent: Thursday, April 7, 2016 7:58 AM
To: Marques, Victor MEM:EX
Subject: RE: REVIEW: Tulsequah Chief OMS

Thanks Victor,

Happy to spend some time with you going over the file just so you are not having to start from scratch!
Diane
-----Original Message-----
From: Constable, Lowell MEM:EX
Sent: Wednesday, April 6, 2016 4:40 PM
To: Howe, Diane J MEM:EX
Subject: Re: REVIEW: Tulsequah Chief OMS

Hi Diane,

Victor is going to review this.

Thanks,
Lowell

Sent from my iPhone

> On Apr 6, 2016, at 11:20 AM, Howe, Diane J MEM:EX <Diane.Howe@gov.bc.ca> wrote:
>
> Hi Lowell,
>
> I know its a crazy week for you, but I wanted to put this on your radar to assign someone to review.
>
> Tulsequah Chief, a small, historical underground mine located south of Atlin, is on care and maintenance and last year myself, MOE and EAO paid a visit to the site to check on reports of non-compliance. A few things came up on the environment side, however on our end, the company constructed an exfiltration pond on the side of the hill adjacent to the River to collect the discharge from the old underground workings. The flow is minimal most of the year, but has a distinct red colour to it that makes everyone nervous. Anyway the pond observed was not the pond they had originally applied to construct (which was not approved anyway) so in my inspection report I had asked the company to provide an as-built and OMS as the pond looked like it could potentially overflow and I did not observe a spillway.
>
> Attached is the OMS and as-built reports. Who ever this gets assigned to I'm happy to share the history of the site as I recall it. My ultimate goal is to amend the MEM permit approving their care and maintenance program, so critical to this is approving the OMS and or making sure the OMS is up to standard.
>
> My inspection report is in MMS (also the project files).
>
> Thanks Lowell,
>
> Regards, Diane
>
> <2016 03 29 Exfiltration Pond OMS Manual.pdf>

Metcalfe, Megan MEM:EX

From: Love, Mark P ENV:EX
Sent: Wednesday, May 18, 2016 12:39 PM
To: 'Keith Boyle'
Cc: Rob Marsland; Howe, Diane J MEM:EX; Janfada, Arash ENV:EX; Bailey, Neil ENV:EX
Subject: RE: Permit amendment applications

Hello Keith,

The MOE is only now beginning the screening review of your application. You should expect to have screening level review comments back by the end of May. At that time we will arrange a conference call to discuss our comments and next steps.

Regards,

Mark P. Love P. Ag.
Mining Operations - North West and Vancouver Island Regions Ministry of Environment, Smithers Phone# 250-847-7416
Cell # 250-877-9237 mark.love@gov.bc.ca

-----Original Message-----
From: Keith Boyle [mailto:keith.boyle@chieftainmetals.com]
Sent: Tuesday, May 10, 2016 6:52 AM
To: Love, Mark P ENV:EX; Howe, Diane J MEM:EX
Cc: Rob Marsland
Subject: Permit amendment applications

Mark and Diane,

It has been a couple of months since Chieftain submitted its applications for the Mines Act and EMA permit amendment to reflect care and maintenance.

Who should we speak with on its status.

To let you know, Chieftain representatives will be on site this week to clean up the hydrocarbon stained ground identified by the EAO. This activity completes the action plan except cutting of the proposed spillway in the exfiltration pond which requires the amended permit.

Thanks for your attention to this matter.

Regards,

Keith