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Annual Report Overview

Report: Coal Mountain Operations Permit 4750 Annual Report 2015 – March 31 2016

Overview: This report summarizes Teck Coal Limited Coal Mountain Operations (CMO) 2015 permitted effluent monitoring program and satisfies the annual reporting requirements for *Environmental Management Act* (*EMA*) Permit 4750 (last amended June 2015).

This report was prepared by Teck.

If you have questions regarding this report, please:

- Phone toll-free to 1.855.806.6854
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Teck

March 31, 2016

Douglas J. Hill, P. Eng
Regional Operations Director - Mining
Ministry of Environment
640 Borland St
Williams Lake, BC V2G 4T1

RE: Coal Mountain Operations Annual Report Submission for Permit PE-4750

Attention: Lorna Green, Sr. Environmental Protection Officer

Dear Ms. Green,

Please find enclosed the 2015 Annual Water Monitoring Report for Teck Resources Limited (Teck) - Coal Mountain Operations (CMO) as required under Section 5.3 of *Environmental Management Act* Permit 4750.

Please contact me at 250.425.7367 or at rick.magliocco@teck.com should you have any questions or concerns regarding this submission.

Sincerely,

Rick Magliocco, B.Sc., PMP
Senior Environmental Coordinator

Cc: Ed Morash, CMO General Manager

Laura Bevan-Griffin, Teck Environment Superintendent

Encl.

Permit 4750 – Coal Mountain Operations Annual Report

March 31, 2016

Teck

Prepared by

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Reviewed by

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Table of Contents

List of Tables

List of Figures

List of Maps

List of Appendices

Executive Summary

This report summarizes Teck Resources Limited – Coal Mountain Operations (CMO) 2015 permitted effluent monitoring program and satisfies the annual reporting requirements for *Environmental Management Act* (*EMA*) Permit 4750 (last amended June 2015). Requirements for *EMA* Permit 107517 (issued on November 19, 2014) will be detailed in a separate annual report.

Total suspended solids (TSS) concentrations exceeded the permit limit of 50 mg/L in 6% (2 of 34) of monitoring samples from the Main Interceptor Sedimentation Ponds decant E102488 (CM_SPD). Other pond discharge locations sampling results were below permit limits for TSS.

An unauthorized discharge was reported on June 3 from the Loadout Infiltration Ponds (E258015) into Michel Creek, due to a heavy rain event.

TSS and BOD_5 concentrations for E206439 (CM_SEW) and EPH concentrations for E206437 (CM_WBE) were below permit limits. Daily flows for both locations were below discharge limits.

Flocculant mix solution usage was approximately 240 L of Cationic (20%) and 2,360 L Anionic (1%) in 2015.

During 2015, CMO reported ten Provincial Emergency Program (PEP) reportable spills related to hydrocarbons and one related to antifreeze. Where possible corrective and/or preventative actions were implemented to address spills and to prevent a re-occurrence.

Water management improvements included upgrade of flow measurement structures at E102488 (CM_SPD) and at the North Ditch. A new automated flocculant station was installed on the North Ditch and a Revised Flocculant Management Plan was accepted by MOE in October.

TSS concentrations and turbidity values were most elevated during the end of May/beginning of June, coinciding with freshet flow.

1 Description of Mine Operation and Discharges

1.1 Introduction

Teck Resources Limited (Teck) – Coal Mountain Operation (CMO) operates a metallurgical coal mine and processing plant in the southeast corner of British Columbia (BC), approximately 25 kilometres southeast of the town of Sparwood (Map 1). The CMO property is on 520 hectares (ha) of privately owned land, 260 ha of coal lease land and 2,275 ha of coal license land.

Mining activity at Coal Mountain began in 1908 with small, underground mines and continued intermittently as open pit operations with various owners. The existing CMO mining area consists of two private land parcels (numbered 6997 and 6999) and Coal Lease 13, which is held to the south of lot 6997. The surrounding area is held in Coal Licences.

In 2015, CMO produced 2.5 million tonnes of clean coal and mined approximately 10 million bank cubic metres of waste rock.

1.2 Overview of Operations

In 2015 CMO operated under Environmental Management Permit 4750 (last amended June 25, 2015) and Teck's Environmental Management Permit PE 107517 (received on November 19, 2014), both issued by the BC Ministry of Environment (MOE). All sampling required under both permits was completed in 2015. However, only annual reporting requirements under Permit 4750 will be addressed in this report, while Permit 107517 requirements will be addressed in a separate regional report submitted concurrently to the Director on March 31, 2016. Required Permit 4750 sampling was conducted at the locations listed in Table 1 and shown in Map 1.

Table 1. Summary of Permit 4750 sampling sites

EMS ID	Site ID	UTM NAD 83 Zone 11		Type	Description
		Easting	Northing		
E102488	CM_SPD	668866.7	5487415.6	Discharge	Decant Discharge from Main Interceptor Sedimentation Ponds to Corbin Creek
E206438	CM_CCPD	670006.7	5486381.8	Discharge	Decant Discharge from Corbin Sedimentation Pond to Corbin Creek
E298733	CM_PC2	670330.5	5486350.0	Discharge	Pengelly Channel to Corbin Creek
E206437	CM_WBE	668520.4	5487363.6	Discharge	Discharge to Maintenance Infiltration ponds
E206439	CM_SEW	668520.4	5487363.6	Discharge	Treated Domestic Effluent
E258015	CM_LOIP	668210.5	5487654.4	Discharge	Loadout Infiltration Ponds
E258175	CM_MC1	668171.0	5482892.6	Receiving	Michel Creek upstream of Operations
E258937	CM_MC2	667185.8	5488210.7	Receiving	Michel Creek downstream of Operations near Andy Good Creek Junction
200209	CM_CC1	668520.4	5487363.6	Receiving	Corbin Creek near confluence with Michel Creek

1.3 Maintenance of Works

In 2015, CMO submitted a document to MOE titled "2015 Routine Water Infrastructure Maintenance Requiring MOE Notification" (Appendix A). The intent of this document is to replace individual Process Modification Notifications (PMN), as required under Section 2.4 in Permit 4750, by detailing all routine maintenance conducted on CMO's authorized works, including mitigation and water quality monitoring, to ensure permit levels are maintained. This document is updated annually and submitted to MOE prior to the start of freshet.

1.4 Water Management

1.4.1 Water Management Infrastructure

Existing water management infrastructure for the drainage control, storage, treatment and discharge of water at CMO is outlined below. An overview of the water management system for the site is presented in Map 2.

1.4.1.1 Ditches

Water collection structures at CMO are used to collect and convey mine influenced water. There is one clean water diversion (Scrubby Creek) and two main contact water collection ditches: West Ditch and North Ditch.

West Ditch captures surface and shallow groundwater flows from the west side of the mine below the west haul road, including water from the dormant West Spoils.

North Ditch collects water from the base of the East and West haul roads, Middle Mountain Refuse Spoil (Middle Mountain), 14 Pit Horizontal Drain, and from the processing plant, maintenance shop, and administration building areas. Mine water intercepted from these areas flows into the North Ditch via the 'Horseshoe' and 'Step' ponds.

Water conveyed by the West and North ditches reports to the Main Ponds (E102488 – CM_SPD - Main Ponds).

The 7 Pit Settling Ponds (SPSP), located southwest of the active mining areas, collects water from Kovack, Peach, Kuta and Niven creeks to settle out solids prior to discharging to Michel Creek. The SPSP system was historically used to settle out TSS from 7 Pit dewatering activities that no longer occur. In 2014, CMO received approval from MOE to remove the SPSP permitted sampling location from Permit 4750.

1.4.1.2 Rock Drains

CMO has two rock drains on site in Pengelly and Corbin creeks (Map 2). Pengelly Creek is an ephemeral watercourse that typically only flows during spring freshet or during other significant rain events. A section of Pengelly Creek was historically spoiled over creating the Pengelly Rock Drain. Water discharging from the Pengelly Rock Drain flows through a short channel prior to discharging into Corbin Creek (E298733-CM_PC2).

Corbin Creek flows through the Corbin Creek Rock Drain (CCRD) which was constructed from spoil material. The CCRD discharges into Corbin Pond which decants via a spillway (E206438 – CM_CCPD) into Corbin Creek.

1.4.1.3 Ponds

CMO has two main sedimentation pond facilities for settling out TSS: Corbin Sedimentation Pond and the Main Ponds. Corbin Pond receives flow from the CCRD (including upper Corbin Creek catchment area and infiltration through the overlying East Spoils), and runoff from the East Access Road and 6 Pit. Corbin Pond is impounded by an earth fill dam (Corbin Creek Dam) that is approximately 18 metres (m) high.

The Main Ponds (a series of two ponds) are located in the northwest corner of CMO. The West and North interceptor ditches discharge into these ponds. The majority of sediment received by this system is transported from the North Ditch; therefore, a series of sumps and small ponds have been constructed along the North Ditch system to assist with settling out solids. In addition, CMO operates an automated flocculant station on the North Ditch, located just upstream of the Main Ponds, that is activated when sediment loads are high. CMO submitted a revised Flocculant Management Plan to MOE in September 2015 that included increased dosage rates (Section 6.1 and Appendix B). Decant discharge from the Main Ponds (E102488 – CM_SEW) flows through a short constructed channel before it converges with Corbin Creek.

1.4.1.4 Infiltration ponds

There are two infiltration pond systems authorized under Permit 4750: the Maintenance Infiltration Ponds (E206437-CM_WBE) and the Loadout Infiltration Ponds (E258015).

The Maintenance Infiltration Ponds receive effluent from the maintenance shop oil-water separator.

The Loadout Infiltration Pond (E258015) receives surface water runoff from the coal loadout area.

1.4.1.5 Sumps

Various sumps on site collect surface water runoff and encourage infiltration. These include the Hotel Sumps that collect water runoff from the south side of the main access road and the Sowchuck Sump that collects runoff from Middle Mountain at the north end of the site.

1.4.1.6 Pits

Pit dewatering at CMO is directed to backfilled/dormant pits or to established/permitted mine contact water collection systems. CMO has two active pits, 6 Pit and 37 Pit, and two completed pits, 34 Pit and 14 Pit, that form the in-pit water management system. Pit dewatering from 6 Pit is directed through Corbin Pond during freshet. Pit dewatering from 37 Pit is directed to 34 Pit which is in the process of being backfilled. The water/load balance (SRK, 2015) assumes that water from 34 Pit will flow subsurface into 14 Pit (downslope of 34 Pit) as the geology suggested. However, further investigation conducted in late 2015 suggests that water from 34 Pit would also flow west out of 34 Pit, underneath the west haul road, and discharge into the West Ditch. Water balance assumptions and water quality predictions will be revised as required.

Pit 14 has been backfilled. Water accumulating within the backfilled pit is discharged to the Horseshoe Ponds through a horizontal drain pipe.

1.4.1.7 Wastewater infrastructure

The Sewage Treatment Plant (STP) services the majority of the central shops and offices on site. Effluent discharged from the STP to a tile field is authorized under Permit 4750 (E206439-CM_SEW).

A separate tile field, servicing the plant, is located north of CMO's breaker (north septic system). This system is regulated under Ministry of Health guidelines and procedures.

All other septic systems are portable and managed by transporting waste off site.

All wastewater infrastructures are inspected and maintained regularly to ensure proper functioning.

1.4.2 Changes to Water Management in 2015

CMO's Field Analysis Method to Determine Total Suspended Solids (Appendix C) was approved by MOE in August 2015. This method is more reliable and accurate than previously utilized methods (e.g., turbidity wedge) and can be used to make quick, reliable management decisions related to water quality discharges into the receiving environment. Updated correlation curves for each surface discharge location are provided in Section 6.3.

An updated Flocculant Management Plan (FMP) was submitted to MOE, as per Section 3.1 in Permit 4750, in September 2015 (Appendix B). Further details on the revised FMP can be found in Section 6.1.

CMO improved flow measuring capabilities on the Main Ponds system by installing a new compound weir at E102488 (CM_SPD) and a new Parshall flume upstream of the flocculant station. These projects will facilitate more reliable and accurate flow measurements on the system.

1.4.3 Water Related Studies and Other Works

Studies completed at CMO related to water are briefly described below.

- A site-wide Load Balance Model (SRK, 2015) and a Metal Leaching and Acid Rock Drainage Management Plan, prepared by CMO, were submitted to the Ministry of Energy and Mines on June 30, 2015 (MOE was copied on the submission). Please refer to Section 6.2 for further details.
- Teck's 2015 Calcite Pilot Plant, authorized under Appendix 3 of Permit 4750 (June 25, 2015 amendment), ran at CMO from August 10th to September 26th, 2015. The objectives of the 2015 program were to test for the prevention and removal of calcite precipitation using antiscalants, evaluate changes in phosphorus and cadmium concentrations as a result of antiscalant addition and/or calcite precipitation, and confirm that no acute toxicity occurred. All three objectives were achieved for the three antiscalants tested. Further details can be found in the final Performance Evaluation Report for the Calcite Pilot Program that was submitted to MOE on March 1, 2016 (Appendix D).
- Phase 1 of the Groundwater Monitoring Program (SRK 2015b) was implemented in 2015. From August 10–21, 2015, ten nested groundwater wells were installed in five locations. Monitoring results and interpretation, along with recommended changes to Phase 2 (2016 program), will be submitted to MOE under separate cover by the March 31 deadline (as per Section 9.2.2.5 in Permit 107517).

1.5 Effluent Permit Overview

Currently, there are two environmental management permits that are applicable to management and discharge of water from CMO: CMO's site-specific permit (Permit 4750) and Teck's Elk Valley permit (Permit 107517). This section will focus on monitoring locations, authorized works, and discharge requirements specified by Permit 4750. The required frequency of monitoring at each sampling location is discussed in Section 4.1. CMO compliance related to Permit 107517 will be discussed under separate cover in Teck's 2015 Permit 107517 Annual Report.

1.5.1 CMO Permit 4750

Permit 4750 (Appendix E) was last amended on June 25, 2015 under provisions of the *Environmental Management Act* (*EMA*). Permit 4750 authorizes discharge of effluent to the land and water and supersedes and amends all previous versions issued under Part 2, Section 14 of the *EMA*. It defines the allowable quantity and quality of discharge and dictates monitoring and reporting requirements.

Permit 4750 lists six discharge sample locations and three receiving environment sample locations. A complete list of authorized works can be found in Section 1 of the permit (Appendix E) under each discharge site.

Monitoring and reporting requirements are specified in Sections 4 and 5 of Permit 4750. There are no permit limits for receiving environment sites in Permit 4750; however, monitoring results must be compared to approved and working BC Water Quality Guidelines for the Protection of Freshwater Aquatic Life (BC WQG FAL) when applicable.

Permit 4750 specifies limits on TSS, turbidity, flow, 5-day biochemical oxygen demand (BOD_5), and extractable petroleum hydrocarbons (EPH). Monitoring requirements including field parameters, conventional parameters, major ions, nutrients, total and dissolved metals scan, and toxicity are required under Permit 107517 and will be discussed in the Permit 107517 Annual Report.

1.5.2 Timeline of Permit 4750 Amendments

Permit 4750 was last amended on June 25, 2015 to authorize the discharge of the Calcite Treatment Pilot Project. A list of Permit 4750 versions and amendments is provided in Table 2.

Table 2. Permit 4750 amendment summary (since 2005)

<table>
<tr><th>Issuing Agency</th><th>Permit Number</th><th>Date of Issuance</th><th>Content</th><th colspan="3">Period Applicable</th></tr>
<tr><td>BC MWLAP[1]</td><td rowspan="5">PE 4750</td><td>26-May-05</td><td>Amended permit</td><td>26-May-05</td><td>to</td><td rowspan="2">25-Sep-14</td></tr>
<tr><td rowspan="4">BC MOE</td><td>24-Oct-08</td><td>Selenium program amendment</td><td>24-Oct-08</td><td>to</td></tr>
<tr><td>25-Sep-14</td><td>Amended permit</td><td>25-Sep-14</td><td>to</td><td>16-Dec-14</td></tr>
<tr><td>16-Dec-14</td><td>Amended permit</td><td>16-Dec-14</td><td>to</td><td>25-June-15</td></tr>
<tr><td>25-Jun-15</td><td>Amended permit</td><td>25-Jun-15</td><td>To current</td><td></td></tr>
</table>

[1] Ministry of Water, Land and Air Protection (now Ministry of Environment)

2 Incidents and Compliance Summary

2.1 Incidents

2.1.1 Incidents Related to Water Quality

There was one unauthorized discharge event at CMO in 2015 and two Provincial Emergency Program (PEP) reportable spills related to water. Water quality incidents and unauthorized discharges associated with Permit 4750 are summarized briefly in Table 3. All incidents were reported to MOE and detailed descriptions were included in quarterly reports. Permit non-compliances are discussed in Section 2.3.1.

Table 3. Summary of 2015 incidents related to water quality

<table>
<tr><th>#</th><th>Date</th><th>Type</th><th>Substance</th><th>Estimated Quantity</th><th>Units</th><th>Location</th><th>PEP #</th></tr>
<tr><td>1</td><td>03/15/2015</td><td>Unauthorized discharge</td><td>Sediment</td><td>107</td><td>kg</td><td>Discharge to Michel Creek from the Loadout Infiltration Ponds (E258015)</td><td>Quantity did not trigger PEP reporting</td></tr>
<tr><td colspan="8">Incident Summary
Approximately 60 mm of rain in a 30 hour period, combined with partially frozen ground (hindering infiltration), caused effluent from the Loadout Infiltration Ponds (E258015) to discharge directly into Michel Creek via a culvert under the Corbin Highway. It was estimated that the unauthorized discharge lasted approximately 24 hours resulting in total calculated sediment loading of 107 kg.</td></tr>
<tr><td colspan="8">Corrective Action[2]
Water quality sampling was initiated upon discovery. CMO Operations Department set up a pump and pipeline system to direct water from the ponds to the north side of the rail loop ditch (where there is sufficient area for the effluent to infiltrate) to stop the unauthorized discharge.
CMO has implemented a management plan for this area that includes monitoring of the ditch and pumping to an infiltration area within the rail loop if required. CMO also installed a manual flow control gate on the upstream side of the Corbin Highway culvert to prevent any further unauthorized surface discharges.</td></tr>
<tr><th>#</th><th>Date</th><th>Type</th><th>Substance</th><th>Estimated Quantity</th><th>Units</th><th>Location</th><th>PEP #</th></tr>
<tr><td>2</td><td>02/10/2015</td><td>Oil/Petroleum</td><td>Diesel Fuel/Used Oil</td><td>20</td><td>L</td><td>Diesel Fuel Island</td><td>143403</td></tr>
<tr><td colspan="8">Incident Summary
Approximately 20 L of diesel and hydraulic oil were spilled to ground from where it was improperly stored in some pails. It was estimated that less than 10 L of the diesel ended up flowing into CMO's dirty water ditch system where it was captured in the step ponds at a t-style culvert.</td></tr>
<tr><td colspan="8">Corrective Actions
This incident was reviewed as a PowerPoint presentation with all CMO employees during safety meetings. Key lessons learned were shared including employees responsibility to speak up immediately if they see improperly stored hazardous materials.</td></tr>
</table>

[2] CMO submitted a written response (RE: Response to CVIS Record 15201 – Unauthorized discharge from E258015) to the Ministry on May 27, 2015 that summarized the incident and detailed corrective actions implemented.

#	Date	Type	Substance	Estimated Quantity	Units	Location	PEP #
3	03/12/2015	Oil/Petroleum	Diesel Fuel	10	L	Diesel Fuel island	143721

Incident Summary
It is estimated that less than 10 L of diesel from a previous spill entered CMO's dirty water ditch system from the diesel island where it was captured in the step ponds at a t-style culvert. The source is believed to be from a separate fuel spill that occurred in December 2014 from a parked scraper (non-PEP reportable spill). It is believed that some diesel from the original spill remained under the snow and ice after the cleanup and was re-mobilized once temperatures rose.

Corrective Actions
CMO implemented the following corrective actions to prevent a re-occurrence of this type of spill:

- proper cleanup techniques were communicated to operations and maintenance foremen;
- existing CMO policies were revised to include guidelines for heavy equipment parking around watercourses; and
- existing CMO policies were revised to include more specific guidance on proper spill cleanup.

Additional Comments

Spills of hydrocarbon liquids that entered the Main Ponds ditch system from the Diesel Fuel Island were captured in the Step Ponds at a t-style culvert. CMO utilized a third-party vacuum truck to skim all hydrocarbons off of the pond surface and conducted confirmatory sampling to ensure that all hydrocarbon liquids were recovered. Precautionary sampling for total extractable hydrocarbons was also conducted at the discharge location E102488 (CM_SPD).

With the exception of the incidents above, there were no other reportable incidents related to water quality at CMO in 2015.

2.1.2 All Other Reportable Spills and Incidents

Spills and incidents at CMO are entered into an incident tracking system which helps to determine root causes and corrective or preventative actions to help prevent re-occurrences. When applicable, spills and incidents are reported to the MOE directly and/or via PEP. CMO reported ten PEP spills related to hydrocarbon substances and one related to antifreeze in 2015. All reportable spills to ground that occurred at CMO in 2015 are provided briefly in Table 4 (all previously reported in detail to the MOE in quarterly reports).

CMO attempts to capture as much of the spill as possible before it hits the ground by using spill trays where possible. Liquids are then removed from the trays utilizing CMO's sucker trailer. CMO utilizes a third-party vacuum truck to recover large spill volumes when required. All spilled product and other contaminated material recovered (e.g., soaker pads, soil) is taken off site for disposal utilizing a third-party contractor.

Table 4. Summary of all other PEP reportable spills for 2015

#	Date	Substance	Qty.	Unit	Location	PEP #	Incident Summary	Corrective Actions
1	1/24/2015	Hydraulic Oil	900	L	6 Pit	143205	A bolt broke in the flange of a hydraulic line on one of CMO's shovels causing a spill to the ground.	This incident was reviewed with mechanics and it was reinforced that new bolts must always be used when replacing high pressure lines.

#	Date	Substance	Qty.	Unit	Location	PEP #	Incident Summary	Corrective Actions
2	3/12/2015	Hydraulic Oil	150	L	6 Pit	143727	Two hoses rubbing together caused a small leak that led to a hydraulic line failure on one of CMO's shovels. The failure caused approximately 150 L of hydraulic oil to spill to ground.	The incident was reviewed with mechanics to ensure that hydraulic lines are properly routed when installed.
3	3/14/2015	Sewage, Raw	100	L	Sewage Plant Mem-brane tank	Re-ported to MOE	The sewage spill occurred when the pump float that controls the transfer pump got hung up on a metal lip near the top of the membrane tank. This then caused the tank to overfill and spill over.	A guard was installed to prevent the float from catching on the lip.
4	4/17/2015	Diesel	200	L	Diesel Fuel Island	150156	While filling a fuel/lube truck, approximately 200 L of diesel overflowed from the top of the truck's tank and spilled onto the ground. The spill was caused by driver inattentiveness while fueling and because the truck did not have a pressureless fueling system.	A new pressureless system was installed on the fuel/lube truck to eliminate the risk of overfilling. Employees responsible for the fuel/lube truck were reminded that the equipment is not to be left unattended for any period of time while fueling.
5	5/27/2015	Diesel	450	L	Diesel Fuel Island	150579	The operator of the fuel/lube truck noticed a small leak coming from the diesel island's main nozzle while preparing to fill the truck. The employee started inspecting the nozzle to determine the cause of the leak which caused the nozzle to suddenly come apart right at the swivel resulting in a diesel spill of approximately 450 L to ground before the flow was shut off.	The preventative maintenance program for the diesel fuel arm was reviewed and the frequency of inspections was increased to prevent a re-occurrence.
6	5/30/2015	Ethylene Glycol and water	200	L	6 Pit Spoil	150611	A coolant leak was discovered on a haul truck. Coolant was being drained into a spill pool to facilitate repairs but it was later noticed that the spill pool itself was leaking.	It was determined that the spill pools are not robust enough to remain intact through multiple usages and therefore must be disposed of after each use to prevent a re-occurrence.

#	Date	Substance	Qty.	Unit	Location	PEP #	Incident Summary	Corrective Actions
7	6/27/2015	Hydraulic Oil	250	L	6 Pit	150882	CMO's heavy duty tow hauler was travelling in the pits when the hydraulic connector hose (for connecting to the hydraulics system of haul trucks being towed) that hangs down at the back got caught in a tire chain which pulled it loose. This caused a spill of approximately 250 L of hydraulic oil to ground. There was also found to be a problem with the main control valve for the buddy dump system which caused oil to pump out of the system instead of just draining what oil was in the hose.	The connector hose was secured further back towards the reels and a secondary means of securing the hoses on the reels was also installed. The control valve was repaired.
8	7/12/2015	Hydraulic Oil	208	L	37 Pit	151072	While drilling in 37 Pit, approximately 250 L of hydraulic oil spilled from a cracked steel hydraulic line on the drill's right track.	CMO is currently considering the possibility of phasing out all steel hydraulic lines and replacing them with hoses which provide better visibility related to wear and tear.
9	8/22/2015	Hydraulic Oil	150	L	6 Pit	151494	Approximately 150 L of hydraulic oil spilled to ground when a drain plug for the shovel's travel motor worked its way loose.	This incident was reviewed with the mechanic responsible to re-iterate the importance of using a torque wrench where required.
10	9/30/2015	Hydraulic Oil	600	L	37 Pit	151864	An improperly installed main steel hydraulic line leading to the shovel's swing motor came loose resulting in a spill of approximately 600 L of hydraulic oil onto the ground.	CMO continues to discuss these types of spills with employees and contractors to reinforce that parts and equipment must always be properly installed to prevent spills.

Additional Comments

CMO has an established Fluid & Lube Management System which has a primary goal of minimizing the number and severity of hydraulic oil spills. CMO takes a proactive approach through early identification of drips and leaks and scheduling repairs before hoses or connections have a chance to fail or rupture. Below is a brief outline of some of the other aspects of the program:

- Automatic scheduling of hose exchanges for high pressure and safety critical hoses on the shovels.
- There is a dedicated shovel mechanic who is on the equipment during the majority of breaks to look for issues, including leaks.
- CMO has a daily walk-around and inspection checklist for heavy mining equipment. Any leaks or cracked hoses noted during this inspection are immediately reported to the Maintenance Department

who then issues a work order to have the problem looked at. The equipment is checked in more detail during monthly preventative maintenance inspections.

- Includes a hydraulic training program for heavy-duty mechanics: This program includes a) hose manufacturing, b) hydraulic safety, c) proper hose routing, d) inspection criteria, and e) installation criteria including use of new flange bolts. CMO currently requires this training to be updated annually.
- Use of the best available parts including high quality O-rings.
- A Fluid and Lube Management Committee manages the program at CMO. This includes holding a bi-monthly meeting where fluid-lube statistics are reviewed, improvement projects are discussed, and issues or concerns with the program are problem-solved. The attendees of these meetings typically include the site General Manager, Maintenance and Operations Superintendent, Maintenance and Operations General Foreman, Senior Environmental Coordinator, as well as representation from maintenance engineering, heavy-duty mechanics, servicemen, and operators.

In addition to this program, CMO sets targets for annual spill reduction through our Environmental Management System and Teck's Sustainability Program. CMO also has an internal reporting and tracking system for spills. Spills entered into this system are reviewed by senior management and the Environmental Department and corrective actions are assigned as required. All of these measures help CMO to work towards continual improvement of spill management practices.

2.2 Compliance Summary

A summary of Permit 4750 authorized discharge limits is provided in Table 5.

Table 5. Summary of site permit limits

EMS ID	Site ID	Parameter	Permit 4750 Limit
E102488	Main Interceptor Sedimentation Ponds (CM_SPD)	Flow	1.5 m^3/s
		TSS	50 mg/L
E206437	Maintenance Infiltration Ponds (CM_WBE)	Flow	1.5 m^3/min to maximum 120 m^3/d
		EPH	15 mg/L
E206438	Corbin Sedimentation Pond (CM_CCPD)	Flow	50 mg/L
		TSS	5.4 m^3/s
E206439	Sewage Treatment Plant (CM_SEW)	Flow	56.8 m^3/day,
		BOD	5 mg/L
		TSS	30 mg/L
E298733	Pengelly Channel (CM_PC2)	Flow	2.11 m^3/s
		TSS	50 mg/L

Notes: TSS = total suspended solids; EPH = extractable petroleum hydrocarbons

2.3 Non-Compliances

2.3.1 Permit Exceedances

CMO had two non-compliances (2 of 34 sampling events) under Permit 4750 in 2015 (Table 6).

Table 6. Permit 4750 non-compliance summary

Date	EMS ID	Lo-cation Code	Pa-rameter	Result	Unit	Criteria	Approved Guideline	Incident Summary
3/15/2015	E102488	CM_SPD	TSS	55.2	mg/L	50	PE 4750 Limit (Section 1.1.1)	An intense rain event (~ 82mm over 48 hours), combined with partially frozen ground, resulted in a TSS exceedance at discharge site E102488 (CM_SPD). The high precipitation and impairment of infiltration due to partially frozen ground resulted in levels of TSS which were too great for the sedimentation pond to sufficiently treat. CMO's flocculant station was not available at the time due to the winter shutdown.
6/2/2015	E102488	CM_SPD	TSS	51.6	mg/L	50	PE 4750 Limit (Section 1.1.1)	A brief but intense rain event (~ 30mm over 24 hours) resulted in a TSS exceedance at discharge site E102488 (CM_SPD). CMO's flocculant station was activated to assist with sediment load reduction.

Additional Comments

The following corrective and preventative long-term actions have been implemented to reduce sediment load discharging from the Main Ponds system:

- A revised FMP was accepted by MOE in 2015 which allows CMO to increase dosing rates and to install “flock blocks” on the Main Ponds system.
- An automated flocculant station was installed in Q4 2015. This new station will turn on automatically during non-frozen months when triggered by elevated inlet turbidity (as outlined in the approved FMP). This new station will also allow CMO to administer flocculant during frozen months when there are significant warming periods with rain and open water conditions.

In addition to these measures, CMO has a water system monitoring program that targets high priority locations on the Main Ponds system requiring maintenance (e.g., sump and ditch cleanouts). Sediment source control for the Main Ponds system is also conducted on CMO's Middle Mountain (where CMO's mixed coal refuse is spoiled) including progressive reclamation (seeding, fertilizing, planting) and proactive water management (e.g., directing surface water flow to ditches and sumps). CMO will also be investigating alternative sediment source control on Middle Mountain in 2016 (e.g., erosion control products).

CMO also utilizes the approved method for field analysis of TSS to make quick, reliable decisions related to water quality where it discharges to the receiving environment. This method utilizes the site-specific linear relationship between field-measured turbidity and lab TSS at CMO's three surface discharge locations:

E102488 (CM_SPD), E206438 (CM_CCPD) and E298733 (CM_PC2). With this tool, CMO is able to proactively implement management actions (e.g., halting maintenance of authorized works) prior to exceeding permit limits. Further detail on this method is provided in Section 6.3.

2.3.2 Receiving Environment Water Quality Results Exceeding Approved and Working Water Quality Guidelines

A summary of Approved and Working Water Quality Guidelines and Site Performance Objectives will be described (as per Permit 4750 Section 5.3 iv) in detail in the Permit 107517 Annual Report.

2.3.3 Missing and Unattainable Data

All monitoring is conducted in accordance with Permit 4750. When data is not obtained it is categorized as either missed data or unattainable data. Missed sample non-compliances are the result of operator error (e.g., miscommunication, sampling planning errors, equipment failures, and shipping delays). Data categorized as unattainable occurs when circumstances prevent the collection of water samples from authorized discharges and/or receiving environment sampling sites throughout the calendar year. Such circumstances are generally out of Teck's control and include, but are not necessarily limited to, unsafe sampling conditions for personnel, no flow due to freezing conditions, or cessation of discharge activities. There were three discrete flow measurements missed in 2015. A summary of CMO missing data for 2015 is provided in Table 7, and unattainable data is summarized in Table 8.

Table 7. Missed data summary

#	EMS ID	Site ID	Date	Parameters	Reason
1	E258175	CM_MC1	02/03/2015	Flow	Flow meter malfunction

Table 8. Unattainable data summary

#	EMS ID	Site ID	Date	Parameters	Reason
1	E258175	CM_MC1	04/29/2015	Flow	Unsafe to take a manual flow measurement due to high water conditions
2	E258175	CM_MC1	06/03/2015	Flow	Unsafe to take a manual flow measurement due to high water conditions

3 Data Quality Assurance and Quality Control (QA/QC)

3.1 QA/QC Program

3.1.1 Staff Training

CMO staff and contractors are trained using onsite Standard Practices & Procedures (SP&P), as well as other training sessions available throughout the year. CMO's Environmental SP&P documents include training for all environmental monitoring and reporting activities including sampling procedures, shipping methods, and equipment calibration procedures. These documents are reviewed annually by environmental staff and contractors.

3.1.2 Equipment Calibration

Equipment is calibrated as per manufacturer's specifications and calibration dates are tracked internally. In-house calibrations are conducted using certified calibration solutions and the calibration results are recorded on the appropriate calibration forms; these forms are filed in a calibration log sheet binder. Equipment requiring manufacturer calibration is either shipped off site to the appropriate location or a manufacturer representative performs the calibration onsite. Manufacturer calibration log sheets are filed in a calibration log sheet binder.

3.1.3 Record Keeping

Data quality is maintained by storing all sampling data in a controlled database. The current data management application at CMO is EQuIS (Environmental Quality Information System). User defined rules are applied to the uploading of data. Additionally, all data is subjected to comparison against standards such as: permit limits, Approved and Working Water Quality Guidelines, or other criteria as specified by the Director.

3.1.4 Sample Analysis

Third party sample analysis is conducted by:

ALS Laboratory Group:
8081 Loughheed HWY
Suite 100
Burnaby, BC

Analyses are carried out in accordance with procedures described in the most recent edition of the "BC Laboratory Methods Manual for the Analysis of Water, Wastewater, Sediment, Biological Materials and Discrete Ambient Air," or by suitable alternative procedures as authorized by the Director.

3.1.5 Lab QA/QC Data

A total of 41 lab QA/QC samples were conducted in 2015 including field duplicates and field blanks. Lab replicates, method blanks, and lab matrix spikes, are also conducted on all sample sets sent to the lab. Copies of the 2015 lab Certificate of Analysis including the QA/QC data are available upon request.

3.1.6 Field Duplicates

Field duplicate sample precision was evaluated using a relative percent difference (RPD), which is the difference between the duplicates as a function of their average. The following criteria were used to evaluate each set of duplicate samples:

- Pass: RPD is less than or equal to 20%
- Pass-1: RPD is greater than 20%, and the analysis results are less than 5 times the DL
- Pass-2: RPD is between 20% and 50%, and the analysis results are between 5 and 999 times the DL
- Fail: RPD is greater than 50%, and the analysis results are between 5 and 999 times the DL

Throughout 2015 a total of 22 duplicate samples were taken. Of the 22 duplicate samples evaluated, all of them passed according to the criteria explained above.

Table 9. 2015 RPD comparison with duplicates

EMS ID	Site ID	Date	TSS			Turbidity		
			Original (mg/L)	Duplicate (mg/L)	RPD (%)	Original	Duplicate (mg/L)	RPD (%)
0200209	CM_CC1	3/23/2015	1.8	1.9	5.4	2.01	2.5	20.5
		3/30/2015	3.6	3.8	5.4	4.32	4.6	6.3
		4/15/2015	<1	1.3	26.1	0.72	0.85	16.5
		5/13/2015	2.2	1.4	44.4	1.6	1.3	20.7
		5/20/2015	1.2	1.2	0.0	0.8	0.5	46.2
		5/27/2015	4.7	7.2	42.0	1.95	2.2	12.0
		6/17/2015	1.8	1.6	11.8	0.45	0.4	11.8
		6/24/2015	<1	< 1.0	0.0	0.42	0.5	17.4
		6/30/2015	1	< 2.0	66.7	0.35	0.4	13.3
		7/27/2015	1.9	2.8	38.3	0.3	0.3	0.0
		8/5/2015	1.1	< 1.0	9.5	0.38	0.4	10
		12/2/2015	<1	1.1	9.5	0.74	0.7	1.36
	CM_CCPD	6/3/2015	8.8	7.6	14.6	7	8.02	13.6
	CM_MC2	3/16/2015	29.7	29.4	1.0	18.9	20.6	8.6
		6/10/2015	13.4	16.3	19.5	4.12	6.03	37.6
		7/15/2015	1.9	1.9	0.0	0.55	0.57	3.6
		7/21/2015	1.2	<1.0	18.18	0.61	0.62	1.63
	CM_MC1	7/8/2015	<1	< 1.0	0.0	0.25	0.31	21.4
		10/7/2015	<1	< 1.0	0.0	0.13	0.17	26.7
	CM_PC2	4/22/2015	<1	< 1.0	0.0	0.24	0.31	25.5
		4/29/2015	<1	< 1.0	0.0	0.19	0.27	34.8
	CM_SPD	2/3/2015P	1.6	1.7	6.1	1.46	1.62	10.4
		5/6/2015P	18	18.5	2.7	16.9	14.5	15.3

3.1.7 Blanks/Replicate Samples

Control blanks (field blanks) and duplicate sampling were conducted throughout the year in accordance with procedures established in “BC Field Sampling Manual for Continuous Monitoring Plus the Collection of Air, Air-Emission, Water, Wastewater, Soil, Sediment, and Biological Samples,” or by suitable alternative procedures as authorized by the Director. All monitoring results are presented in Appendix F.

A total of 19 field blank samples were analysed in 2015 (Table 10) with the majority of sample results below detection limits. Two samples taken on March 30 and June 30 had results above detection limits for turbidity indicating a potential issue related to these sampling events. This triggered a review of sampling procedures to ensure sample collection is performed properly to avoid potential cross contamination.

Table 10. 2015 field blank summary

Analyte	Total Suspended Solids, Lab	Turbidity, Lab
Analytic Method	**SM2540D**	**E180.1**
Unit	**mg/L**	**NTU**
Date	**Result**	**Result**
2/3/2015	< 1.0	< 0.10
3/30/2015	< 1.0	**0.11**
4/15/2015	< 1.0	< 0.10
4/22/2015	< 1.0	< 0.10
4/29/2015	< 1.0	< 0.10
5/13/2015	< 1.0	< 0.10
5/20/2015	< 1.0	< 0.10
5/27/2015	< 3.0	< 0.10
6/10/2015	< 1.0	< 0.10
6/17/2015	< 1.0	< 0.10
6/24/2015	< 1.0	< 0.10
6/30/2015	< 1.0	**1.93**
7/8/2015	< 1.0	< 0.10
7/15/2015	< 1.0	< 0.10
7/27/2015	< 1.0	< 0.10
8/5/2015	< 1.0	< 0.10
9/2/2015	< 1.0	< 0.10
11/4/2015	< 1.0	< 0.10
12/2/2015	< 1.0	< 0.10

3.2 QA/QC Issues

QA/QC issues in 2015 related to sample collection are presented in Table 11.

Table 11. Summary of 2015 QA/QC issues

EMS ID	Site ID	Date	Issue	Reason
E206439 E206437	CM_SEW CM_WBE	01/06/2015	Temperature of samples >10°C (13°C)	Samples were shipped with insufficient number of ice packs
E206439	CM_SEW	02/05/2015	Temperature of samples >10°C (13.4°C)	
E102488, E206438, E298733, E258175, E258937, 0200209	CM_SPD, CM_CCPD, CM_PC2, CM_MC1, CM_MC2, CM_CC1	05/20/2015	Samples received with a temperature greater than 10°C (14°C)	
E206438 E298733	CM_CCPD CM_PC2	06/15/2015	Samples received with a temperature greater than 10°C (11°C)	
E102488, E206438, E298733, E258175, E258937, 0200209	CM_SPD, CM_CCPD, CM_PC2, CM_MC1, CM_MC2, CM_CC1	06/24/2015	Samples received with a temperature greater than 10°C (13°C)	
E102488, E206438, E298733, E258175, E258937, 0200209, E298734	All samples except for CM_SEW and CM_WBE	09/2/2015	Samples were received with a temperature greater than 10°C (16°C).	The time and temperature exceedances were related to transportation issues to the laboratory in Burnaby during the Labour Day long weekend.

CMO has implemented changes to ensure that packing and shipping of samples is conducted in a way to preserve optimal temperature conditions, especially during summer months.

4 Water Monitoring Program Description

4.1 Water Quality and Quantity Monitoring Requirements

Samples were collected from January 1, 2015 to December 31, 2015 in accordance with Permit 4750 (Table 12). All sample results can be viewed in Appendix F – Monitoring Data and QA/QC data.

Table 12. Monitoring requirements for Permit 4750

EMS ID	Site ID	Parameters				
		(mg/L)	(mg/L)	NTU	(mg/L)	(m^3/s)*
		Biochemical Oxygen Demand (BOD_5)	Total Suspended Solids (TSS)	Turbidity	Extractable Petroleum Hydrocarbons (EPH)	Flow
E102488	CM_SPD	-	W/M	W/M	-	W/M
E206437	CM_WBE	-	-	-	Q	Q
E206438	CM_CCPD	-	W/M	W/M	-	W/M
E206439	CM_SEW	M	M	M	-	M
E298733	CM_PC2	-	W/M	W/M	-	W/M
E258175	CM_MC1	-	W/M	W/M	-	W/M
E258937	CM_MC2	-	W/M	W/M	-	-
0200209	CM_CC1	-	W/M	W/M	-	-

Notes: M = monthly from August 1 - March 31; W = Weekly from April 1 - July 31; Q = Quarterly
** m^3/day for CM_SEW and CM_WBE*

4.2 Sampling Methodology

4.2.1 Hydrology

Flow velocity measurements in 2015 were taken using a Swoffer 2100 portable flow meter. Water levels at all routine surface water monitoring sites were monitored using staff gauges. Continuous flow and level loggers are installed at the upstream Michel Creek sampling site (CM_MC1 - E258175) and in Corbin Creek between CMO and the Michel Creek confluence (CM_CC1 - 0200209)[3].

A *Flow Monitoring Protocol* was developed for Teck in 2010 (Kerr Wood Leidal Associates [KWL] 2010). It was reviewed and accepted by provincial agencies in Spring 2011. The protocol outlines standard procedures for flow monitoring and provides information on equipment, measurement approaches, calculations, documentation, and quality control. CMO's hydrometric program in 2015 was consistent with the *Flow Monitoring Protocol* (KWL 2015). Stage-discharge relationships, to be used in conjunction with the staff gauges and level loggers, have been developed for most of the sampling locations.

4.2.2 Water Quality

Sampling was carried out in accordance with the BC Field Sampling Manual (MWLAP[4] 2003). Water samples were collected and sent to the ALS Laboratory in Burnaby, BC, for analysis. ALS is an accredited laboratory that conforms to standards found in the BC Environmental Laboratory Manual (MOE 2005). Certificates of Analysis for water quality results presented in this report can be provided upon request.

[3] Flow monitoring at CM_CC1 and CM_MC2 will be discussed in Permit 107517 Annual Report.
[4] Ministry of Water, Land and Air Protection (now Ministry of Environment).

Detection limits for TSS and turbidity, as well as analytical methods, are listed in Table 13.

Table 13. Site parameters, detection limits, and analytic methods

Parameter	Unit	Analytic Method	Detection Limit (DL)
TSS	mg/L	APHA 2540D	1.0
Turbidity	NTU	APHA 2130 Turbidity	0.1
BOD_5	mg/L	APHA 5210 B-Biochemical Oxygen Demand	2
EPH Total	mg/L	BC Lab Manual	0.5

4.2.3 Toxicity Testing

All acute and chronic toxicity results are discussed in the 2015 Permit 107517 Annual Report.

5 Monitoring Results

5.1 Water Quality Results

5.1.1 Introduction

In this section, water quality data are presented by parameter and compared to permit limits where applicable. Permit 4750, as described in Table 11, specifies monitoring requirements for discharge and receiving environment for parameters such as TSS, turbidity, BOD_5, EPH and flow.

All 2015 permitted monitoring parameters are discussed. 2015 raw data with statistical summaries are presented in Appendix F. Historical data are presented in Appendix G.

5.1.2 Total Suspended Solids (TSS) and Turbidity

5.1.2.1 Receiving Environment

2015 TSS and turbidity data for CMO's three receiving environment sampling sites are presented in Figure 1 and 2 respectively.

Twenty nine samples were collected at 0200209 (CM_CC1), 26 at E258175 (CM_MC1) and 41[5] at E258937 (CM_MC2).

Twenty eight percent of the samples (8 of 29) collected at 0200209 (CM_CC1), 50% of the samples (13 of 26) collected at E258175 (CM_MC1) and 15% of the samples (6 of 41) collected at E102488 (CM_MC2) were below the TSS detection limit (DL) of 1 mg/L.

TSS concentrations in the receiving environment were generally most elevated during the end of May / beginning of June (i.e., coinciding with freshet); although mid-March also had elevated concentrations of TSS most likely due to a rain event.

A maximum concentration of 33.2 mg/L TSS was recorded at 0200209 (CM_CC1) on March 15. At E258175 (CM_MC1) and E258937 (CM_MC2) maximum concentrations were recorded on June 3 (47.2 mg/L) and May 26 (111 mg/L) respectively.

[5] The higher number of samples collected at CM_MC2 is due to additional sample collection to pair with chronic toxicity sampling.

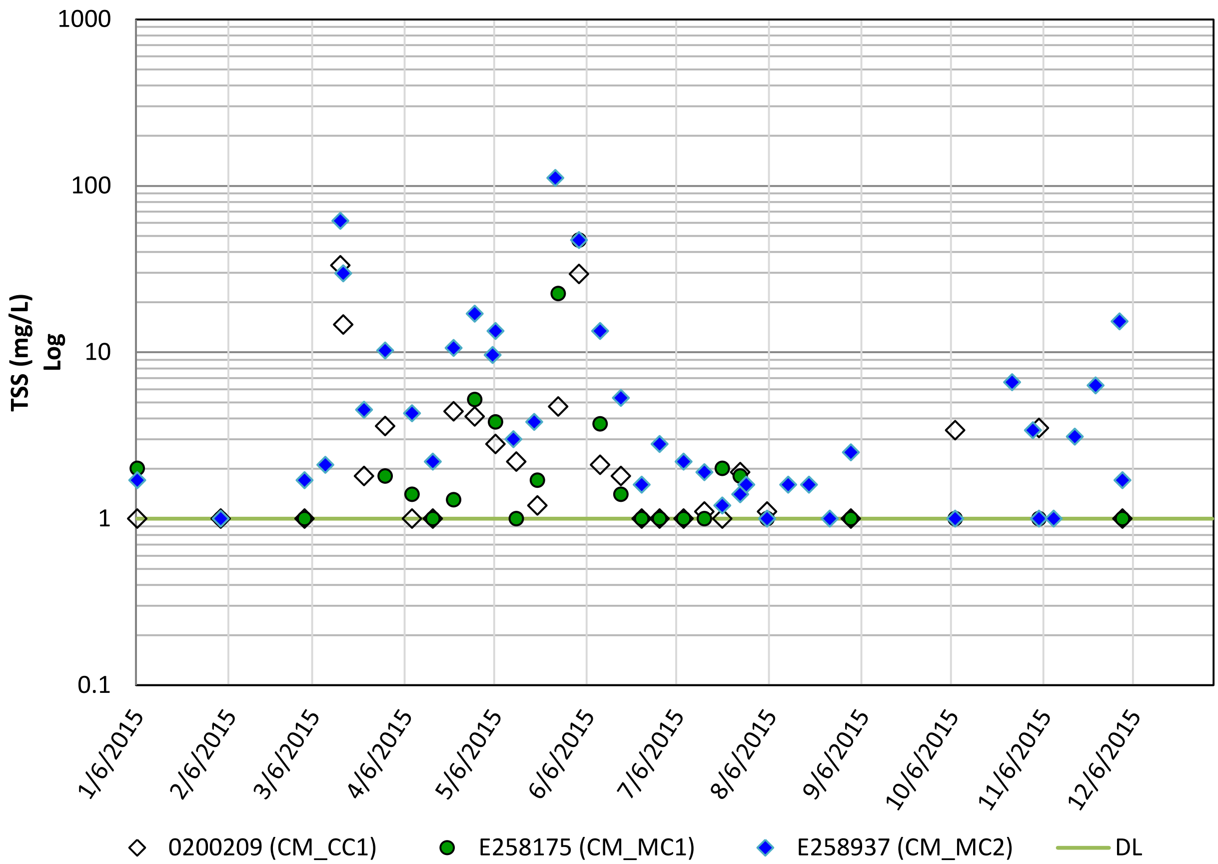


Figure 1. Total suspended solids - receiving environment

Turbidity values in the receiving environment were most elevated during the end of May / beginning of June (coinciding with freshet) and consistent with the TSS results.

A maximum turbidity value of 41 NTU was recorded at 0200209 (CM_CC1) on March 15, coinciding with the highest TSS concentration in that location. At E258175 (CM_MC1) and E258937 (CM_MC2) maximum turbidity values were recorded on June 3 (20.5 NTU) and May 26 (54 NTU) respectively (Figure 2).

All samples collected at the receiving environment locations reported values above the DL of 0.1 NTU.

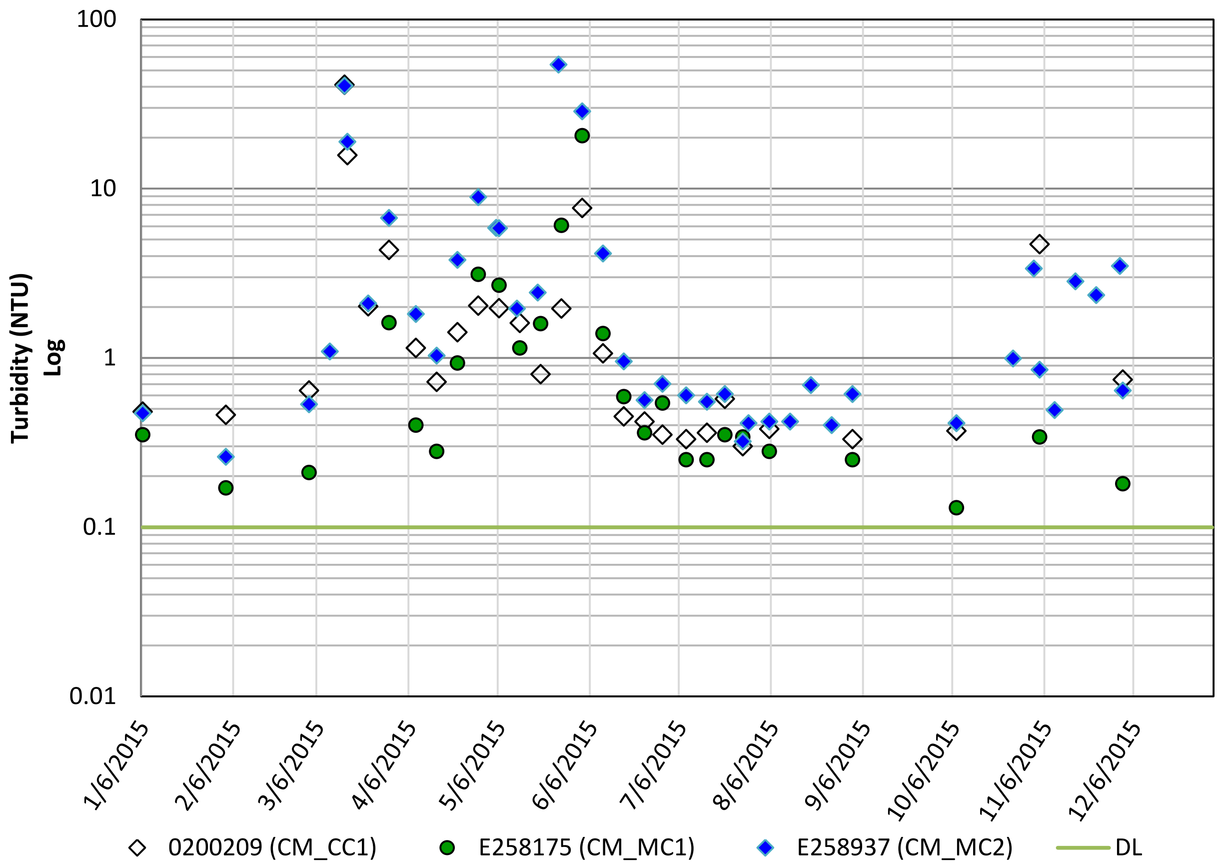


Figure 2. Turbidity – CMO receiving environment

5.1.2.2 Discharge Locations

TSS data for CMO's permitted discharge locations E102488 (CM_SPD), E206438 (CM_CCPD) and E298733 (CM_PC2) are presented in Figure 3.

Thirty samples were collected at E206438 (CM_CCPD), 18 at E298733 (CM_PC2) and 34 at E102488 (CM_SPD). There was zero flow at E298733 (CM_PC2) from January to March and from July to December.

Two samples (6% of total samples collected) from E102488 (CM_SPD) exceeded the 50 mg/L TSS limit. These two events occurred on March 15 (55.2 mg/L) and June 2 (51.6 mg/L) as described in Section 2.3.1. E206438 (CM_CCPD) and E298733 (CM_PC2) did not exceed TSS permit limits throughout the year.

Forty percent of the samples (12 of 30) collected at E206438 (CM_CCPD) and 78% of the samples (14 of 18) collected at E298733 (CM_PC2) were below the TSS DL of 1 mg/L. All samples collected at CM_SPD were above the detection limit.

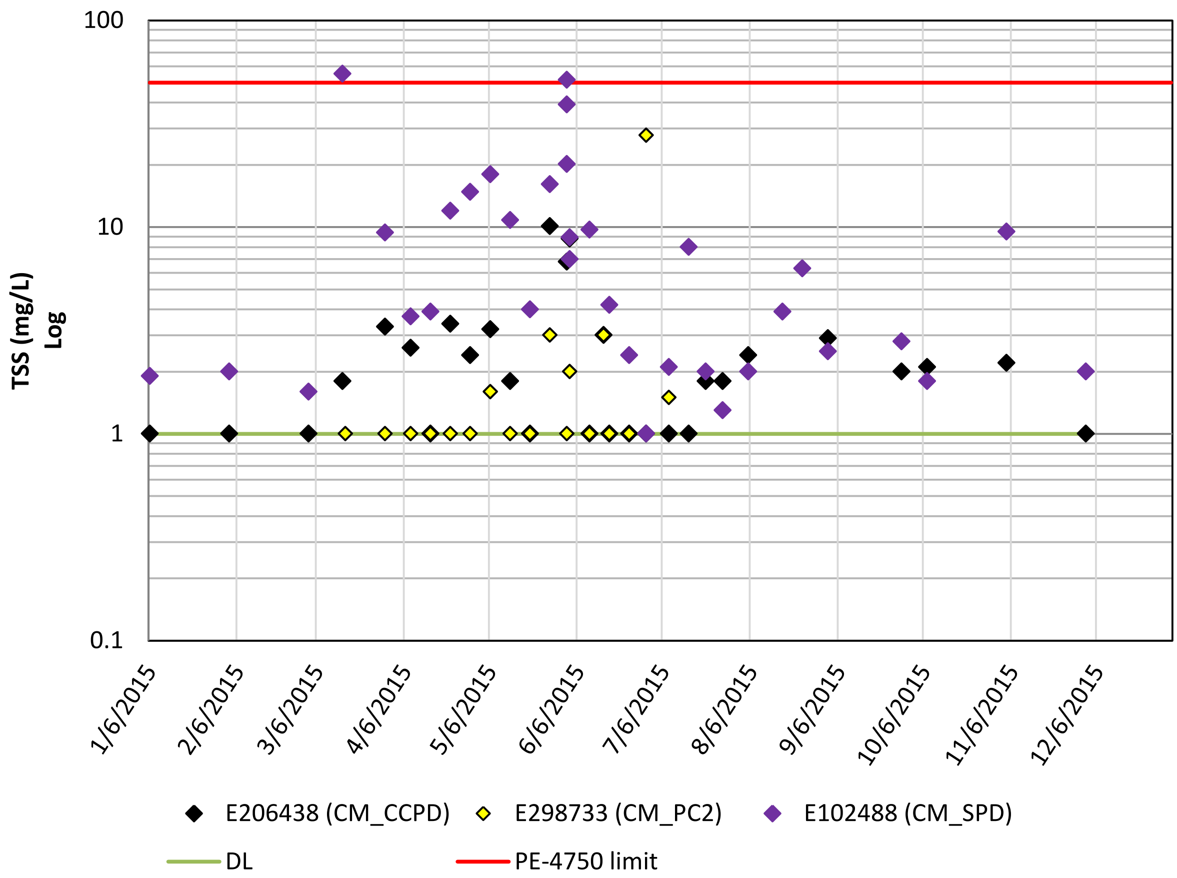


Figure 3. Total suspended solids – CMO discharge locations

Lab turbidity data for discharge locations E102488 (CM_SPD), E206438 (CM_CCPD) and E298733 (CM_PC2) are presented in Figure 4.

A maximum turbidity value of 74.1 NTU was recorded at E102488 (CM_SPD) on March 15, coinciding with the TSS exceedance at this location. At E206438 (CM_CCPD) and E298733 (CM_PC2) maximum turbidity values were recorded on June 3 (7 NTU) and May 20 (1.5 NTU) respectively.

All turbidity values recorded at the three discharge locations were above the DL of 0.1 NTU.

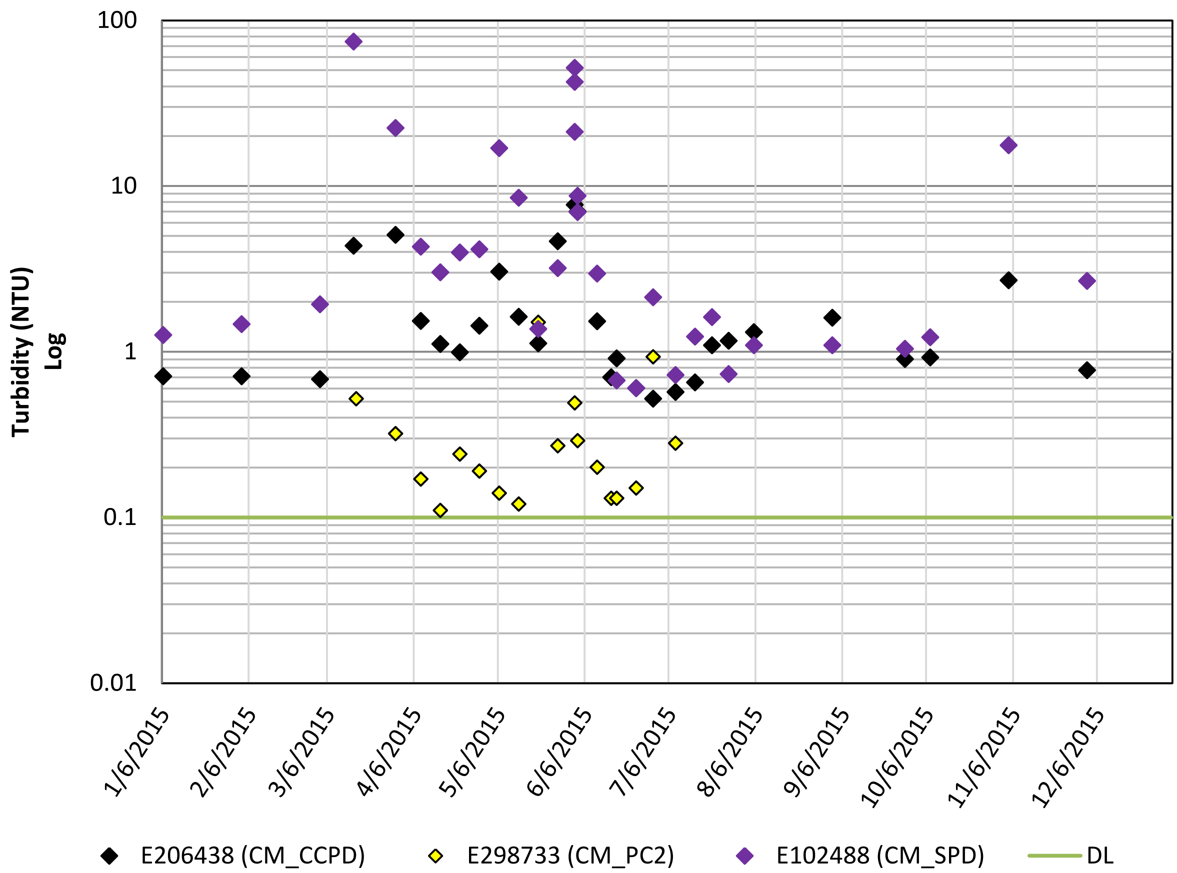


Figure 4. Lab turbidity – CMO discharge locations

5.1.2.3 Historical Data (Receiving/Discharge)

TSS historical data (2000 - 2015) for receiving environment stations are presented in Figure 5. Data suggests that TSS concentrations at E258175 (CM_MC1) have remained generally stable and a slight increasing trend in TSS concentrations is evident at 0200209 (CM_CC1) and E258937 (CM_MC2); however, signs of a reduction in TSS concentrations are evident since the beginning of 2014 and more so during 2015. The decrease of TSS concentrations over the past two years may be related, in part, to a decrease in TSS concentrations discharging from CMO's discharge locations. A similar pattern can be observed in Figure 6 especially at E102488 (CM_SPD), where TSS concentrations started to drop in 2014. In 2015, there were two TSS exceedances at E102488 (CM_SPD) compared to four events registered in 2014.

Reduction of TSS concentrations since 2014 at E102488 (CM_SPD) is mostly related to a major cleanout of sediment from the primary (upstream) pond in the Main Ponds system that was completed in 2014. In addition, CMO improved water management on Middle Mountain (minimizing sediment runoff) in 2014, improved management activities such as preventive maintenance of authorized works, and made improvements to flocculant use on site.

E206438 (CM_CCPD) has historically only reported three TSS exceedances. E298733 (CM_PC2) generally only flows from April to the end of June and has never reported a TSS exceedance.

As shown in the Figures, measured TSS and turbidity concentrations peaked during the 2013 Q_{200} event.

Lab turbidity values can be correlated to TSS concentrations; therefore, historical trends for both receiving environment and discharge locations are similar to what was described for TSS concentrations. Historical turbidity data are presented in Figures 15 and 16 for receiving environment and discharge locations, respectively.

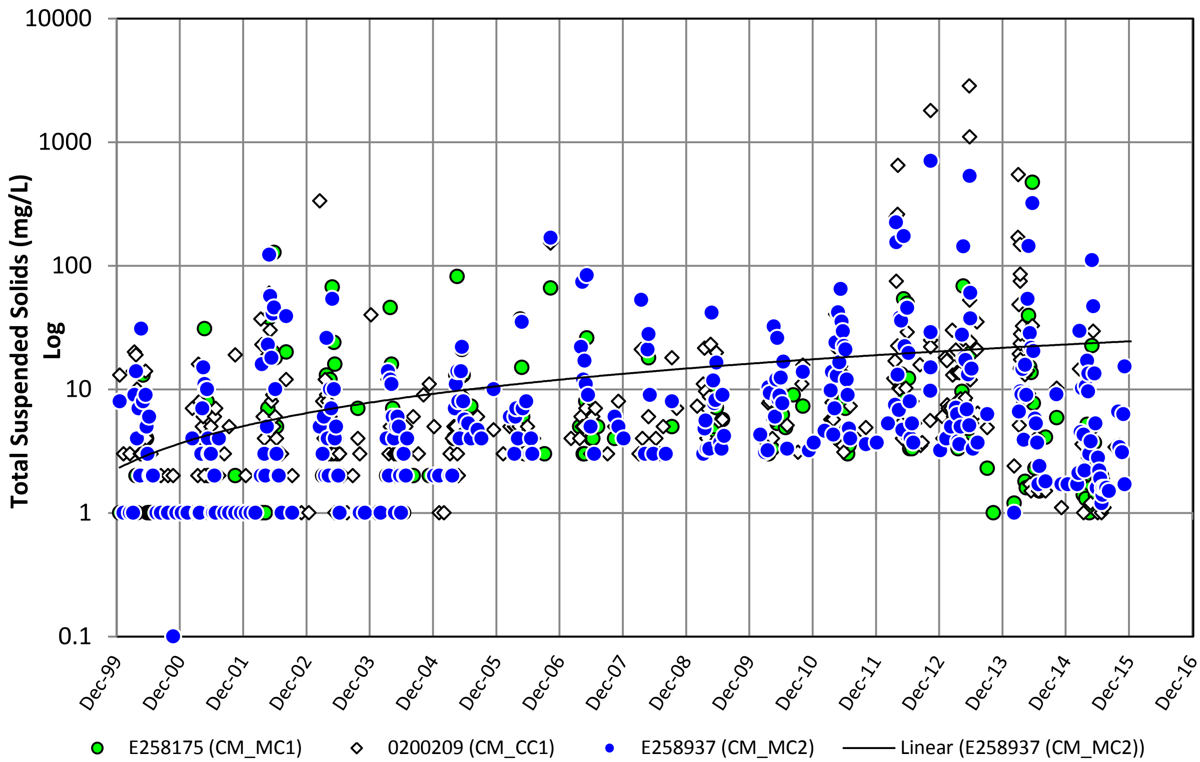


Figure 5. Historical TSS data – receiving environment stations

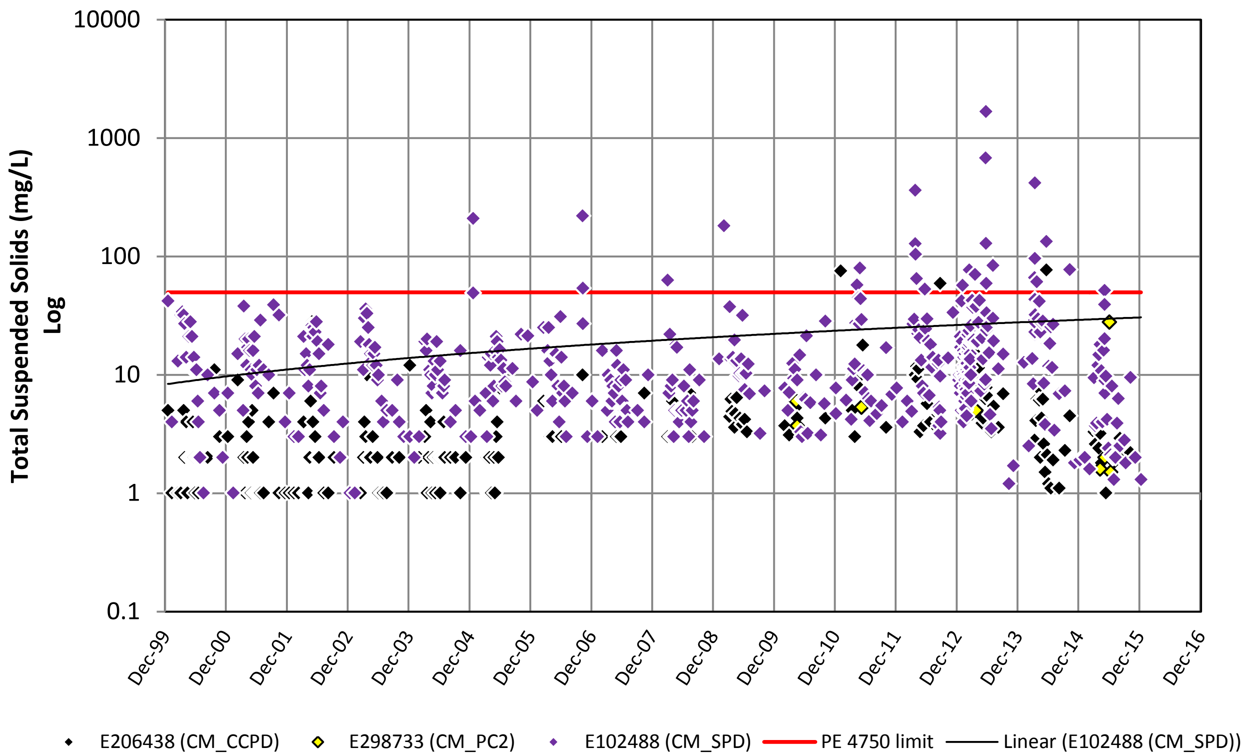


Figure 6. Historical TSS data – discharge locations

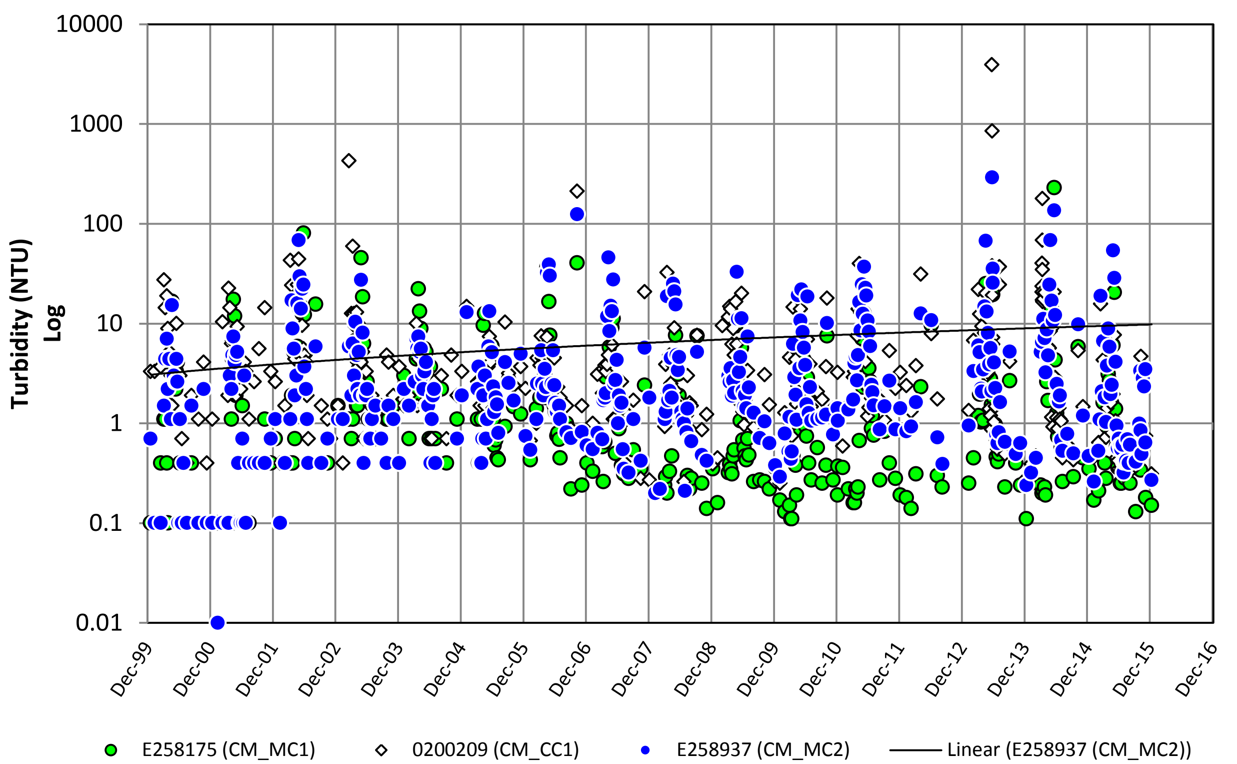


Figure 7. Historical lab turbidity data – receiving environment

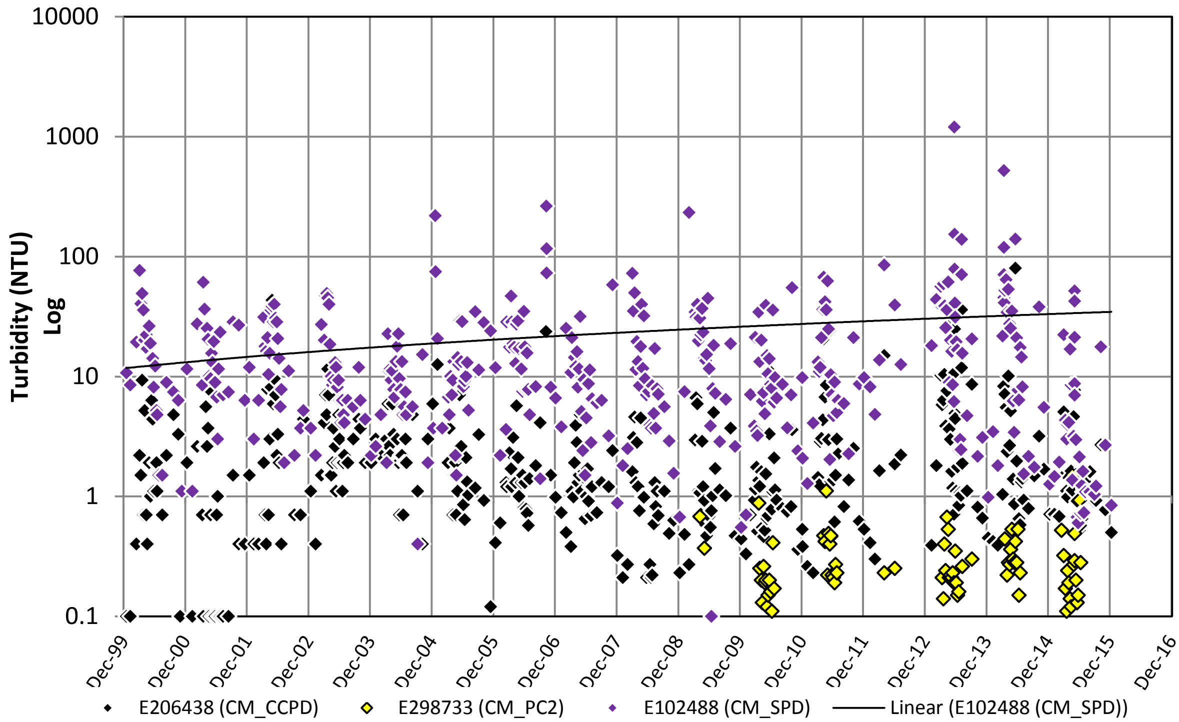


Figure 8. Historical lab turbidity data – discharge locations

5.1.2.4 Sewage Treatment Plant

Thirteen samples were collected at CM_SEW and none exceeded the TSS limit of 30 mg/L (Figure 9). Ninety two percent of the samples collected (12 of 13) were below the DL of 1 mg/L[6].

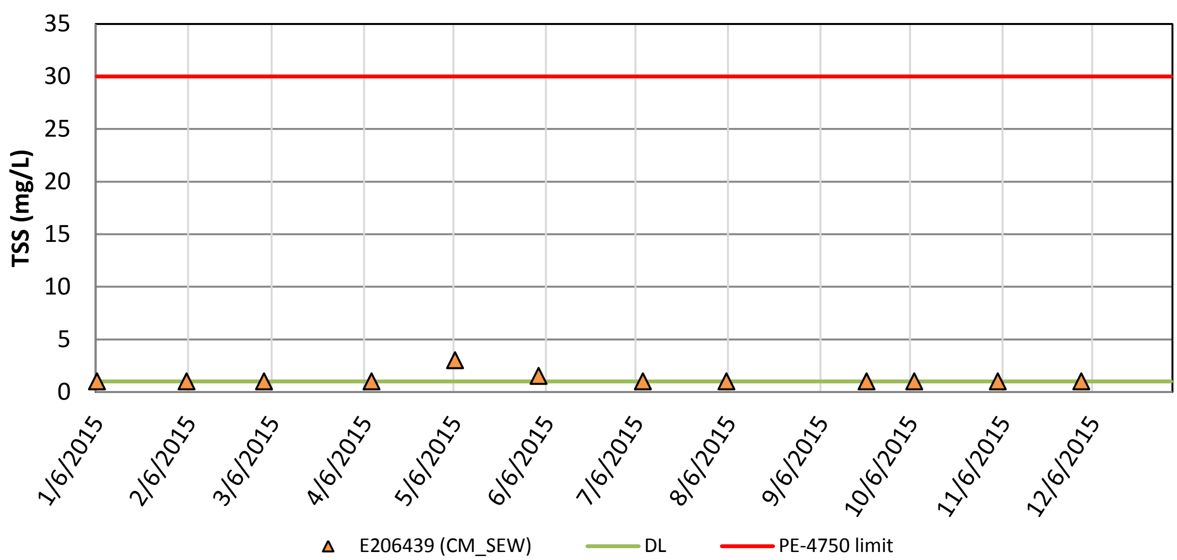


Figure 9. TSS – sewage treatment plant

[6] May 6 TSS DL was raised to 3 mg/L due to matrix interference. TSS concentrations for this date were still below the DL.

A maximum lab turbidity value of 1.26 NTU was recorded on January 6 for CM-SEW. All turbidity values recorded were above the 0.1 mg/L DL (Figure 10).

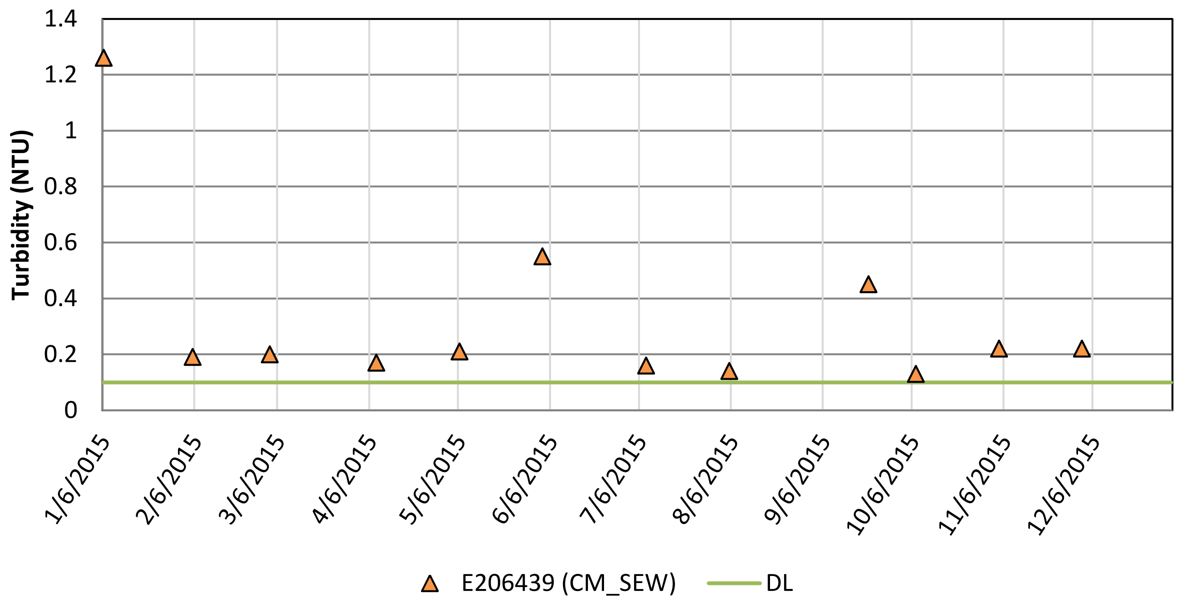


Figure 10. Lab turbidity – sewage treatment plant

All 2015 BOD_5 results for CM_SEW were below the 40 mg/L and 20 mg/L (12 month average) permit limits. Moreover, all BOD_5 results were below the 2 mg/L DL (Figure 11).

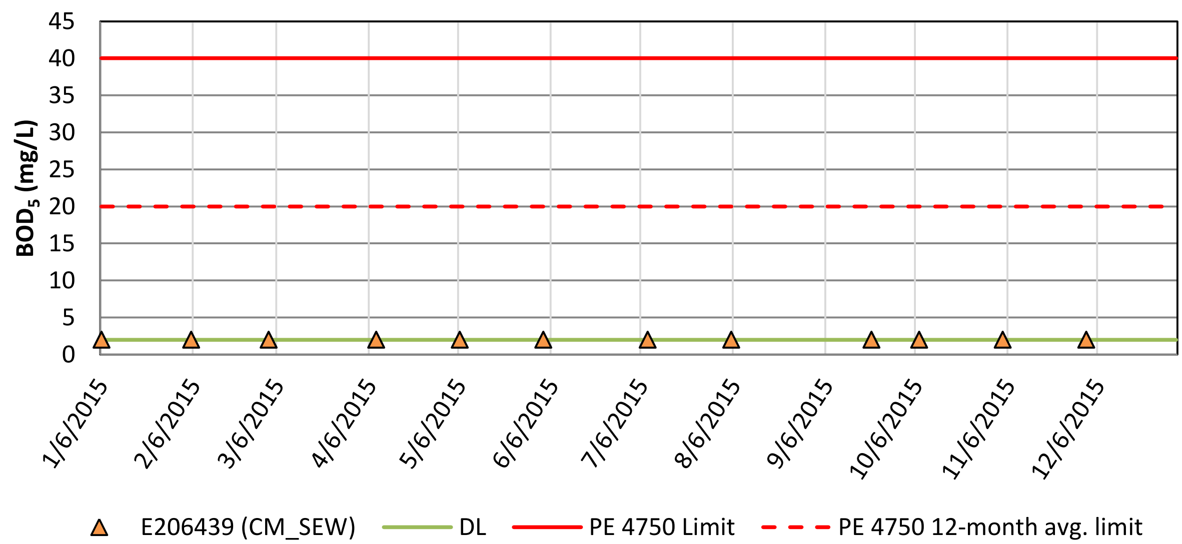


Figure 11. BOD_5 – sewage treatment plant

5.1.2.5 Maintenance Infiltration Ponds

A total of 12 samples were collected at the effluent discharge from CMO's maintenance facility oil-water separator E206437 (CM_WBE) (Figure 12). All results were below the 15 mg/L EPH limit. A maximum concentration of 8.72 mg/L EPH was recorded on May 6. Seventeen percent of the samples (2 of 12) were below the 0.5 mg/L DL.

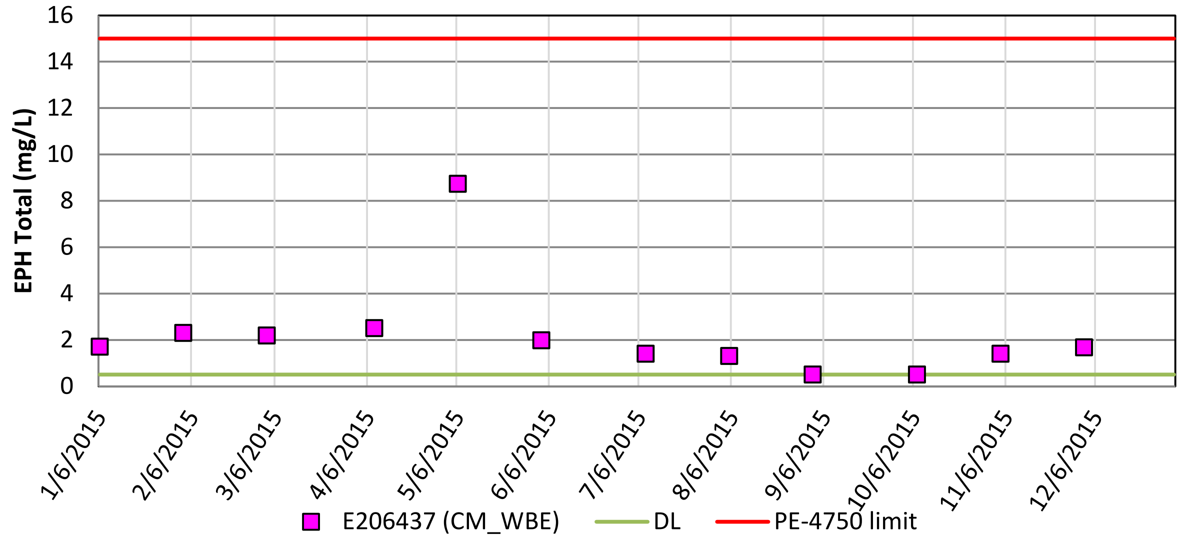


Figure 12. Extractable petroleum hydrocarbons – CM_WBE

5.1.2.6 Historical Data (CM_SEW and CM_WBE)

Historically, E206437 (CM_WBE) had a permit limit for total extractable hydrocarbons (TEH) of 30 mg/L. When Permit 4750 was amended in September 2014, the limit for TEH was lowered to 15 mg/L.

A new limit of 15 mg/L EPH was implemented for E206437 (CM_WBE) in the June 2015 amendment.

Reduction of TEH concentrations can be observed since 2008. Six exceedances were recorded since 2008-2010 and only one in 2014. In 2015, all EPH concentrations were below the 15 mg/L permit limit.

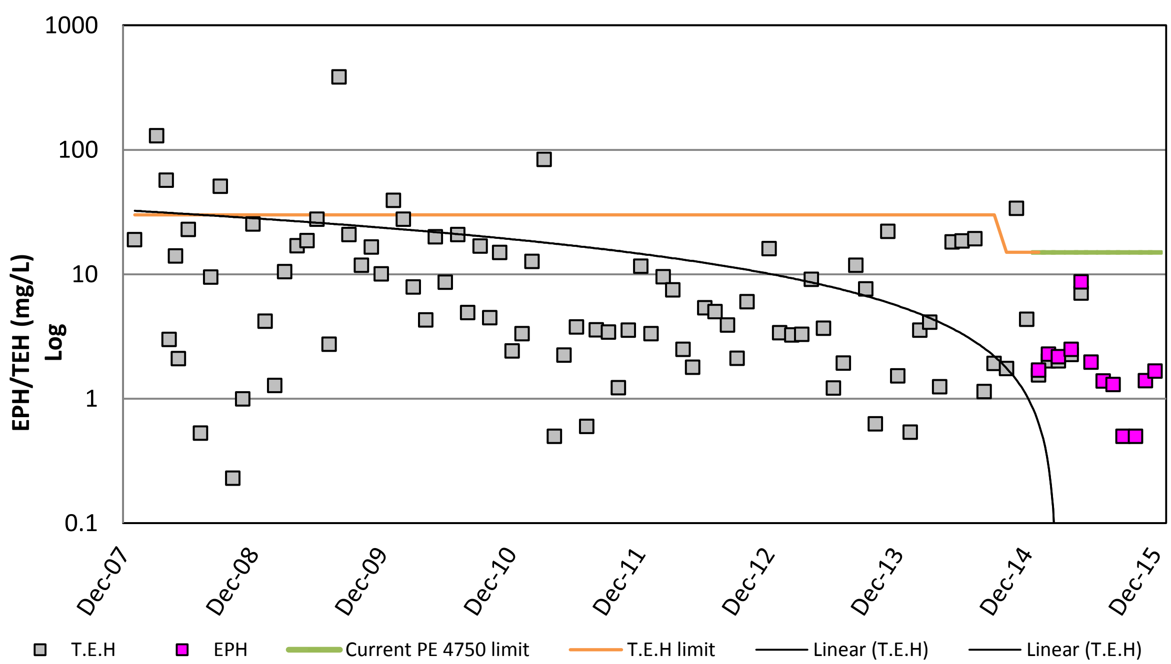


Figure 13. Historical TEH/EPH data - CM_WBE

Historical data for E206439 (CM_SEW) indicates a reduction in TSS concentrations (Figure 14). The reduction in TSS concentrations can mainly be attributed to improvement of maintenance practices and increased monitoring of the STP operation. The majority of TSS concentrations recorded since 2013 are below the 1 mg/L DL.

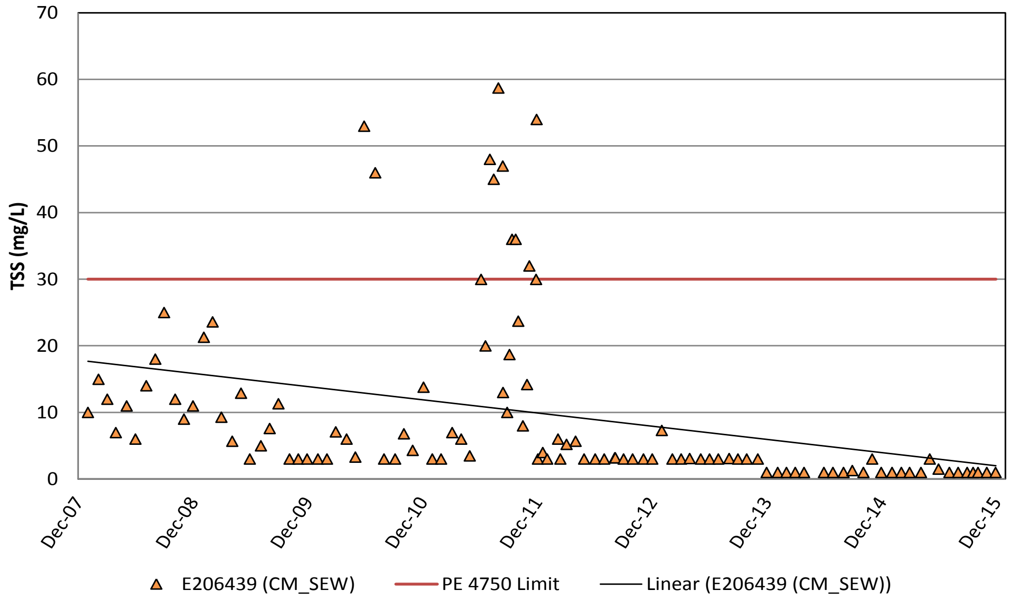


Figure 14. Historical TSS data – CM_SEW

Lab turbidity data has only been recorded since 2015[7] (Figure 10). Historically, the majority of BOD_5 concentrations for E206439 (CM_SEW) have been below the 2 mg/L[8] DL.

[7] In the quarterly report submission (Q4-2014) CMO reported that turbidity data was not included in the sampling plan. This requirement was included in the September 2014 Permit 4750 amendment.

[8] The DL was 5 mg/L from mid-2008 to the end of 2012. Since 2013 the DL has been 2 mg/L.

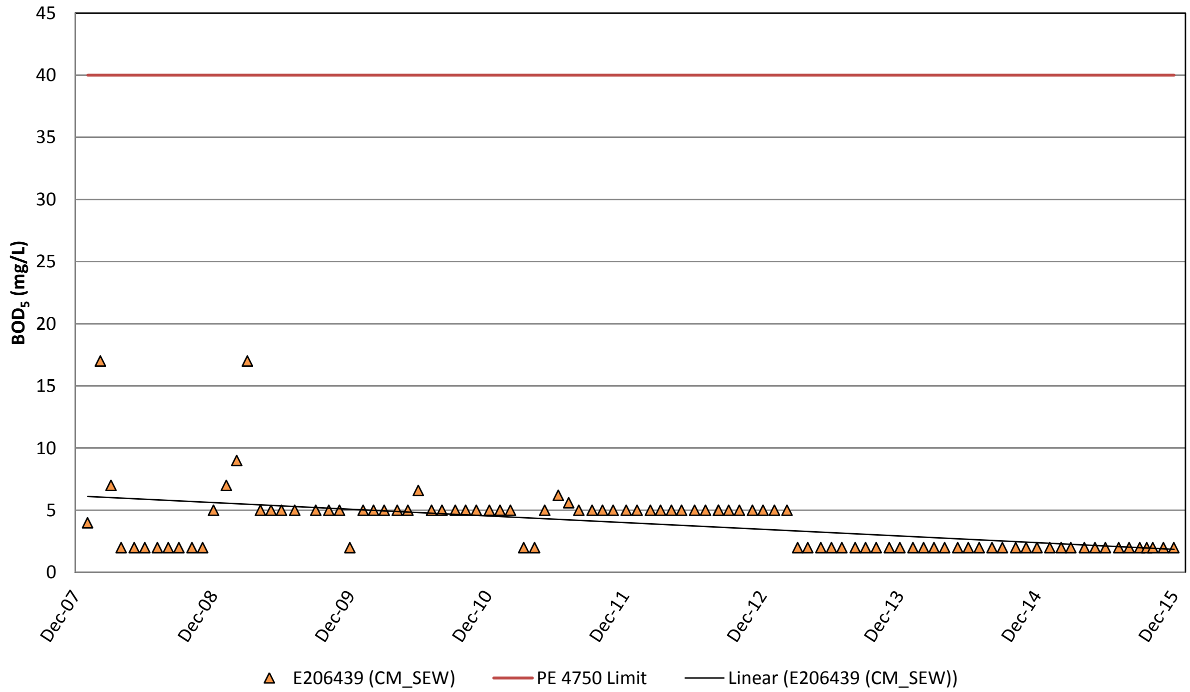


Figure 15. Historical BOD_5 data – CM_SEW

5.2 Water Quantity Results

In this section, flow monitoring data are presented and compared to permit limits where applicable. The 2015 data are presented in tabular form in Appendix F.

Permit 4750 requires flow measurements at all discharge locations (see Table 11).

5.2.1 Receiving Environment (CM_MC1)

In 2015, freshet generally commenced (i.e., flows started to increase) at CMO in mid to late April.

Measured peak flow at E258175 (CM_MC1) was 1.29 m^3/s on May 27. The lowest flow recorded occurred on September 2 with a measured value of 0.03 m^3/s (Figure 16).

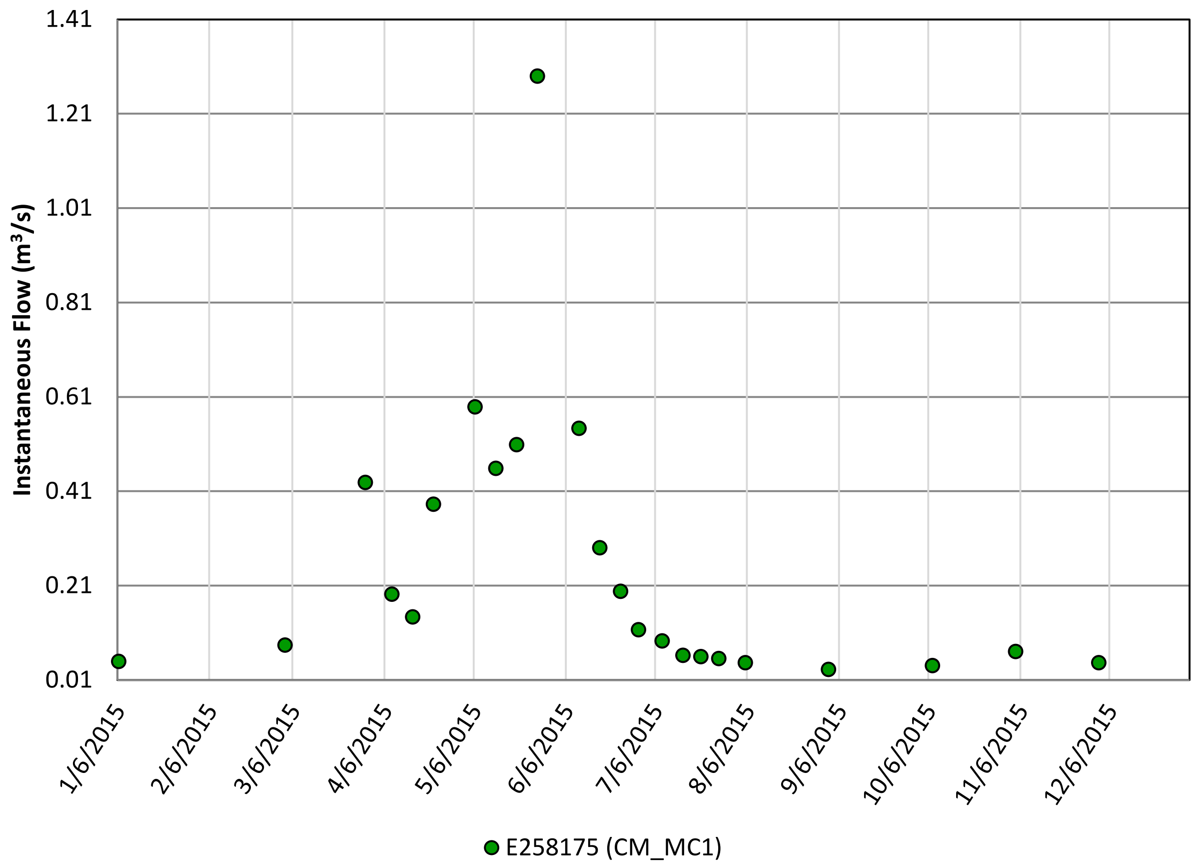


Figure 16. Instantaneous flow – Michel Creek upstream of operations

From August 15 to September 15, Michel creek and other streams around the Elk Valley were closed to fishing due to low flow and high temperature conditions. This is supported by the comparatively low flows observed at E258175 (CM_MC1) during the same period.

Historical flow data (collected since October 2008) is presented in Figure 17 and shows an overall decreasing trend. 2015 was a dryer year overall when compared to 2014.

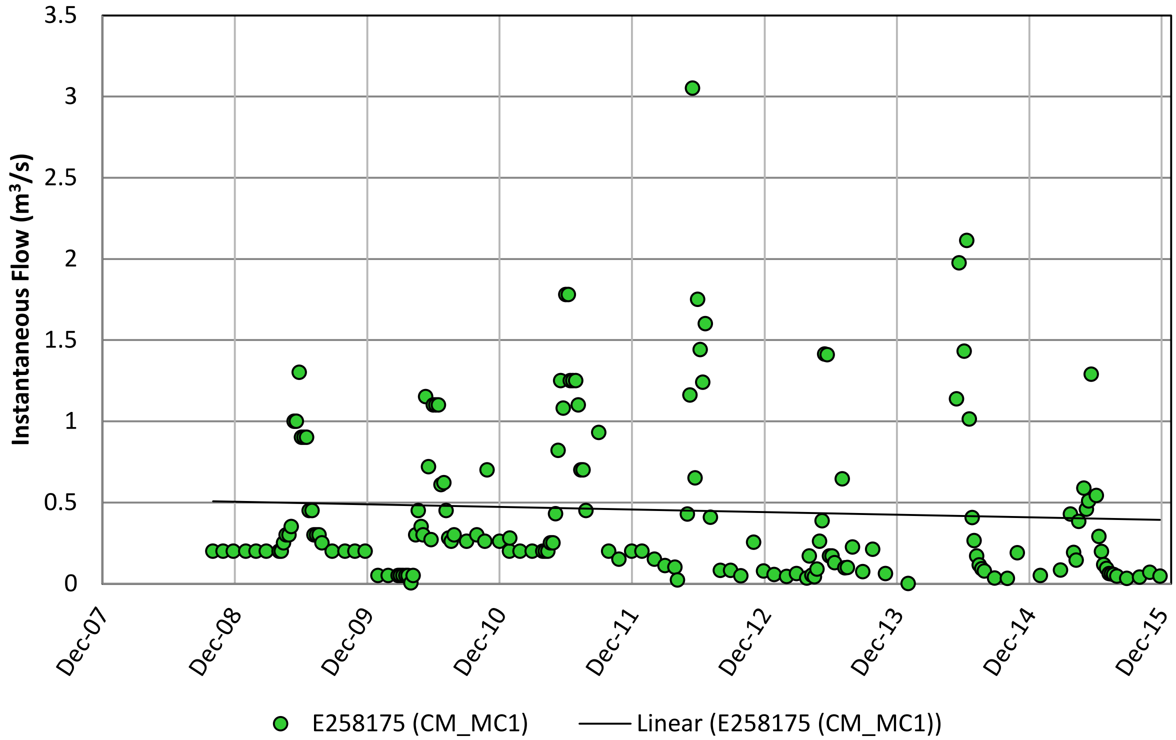


Figure 17. Historical flow data – CM_MC1

5.2.2 Discharge Locations

Flow data for CMO's three sedimentation pond decants are presented in Figure 18. E206438 (CM_CCPD) generally had the highest flows of the sedimentation pond decants, followed by E102488 (CM_SPD) and then E298733 (CM_PC2).

Measured peak flows for all three stations, recorded on June 3, were well below permitted Q_{10} discharge rates. Peak flow measurements were as follows: E206438 (CM_CCPD) was 0.923 m^3/s; E298733 (CM_PC2) was 0.609 m^3/s and; E102488 (CM_SPD) was 0.19 m^3/s.

Historical flow data for these discharge sites are presented in Figure 19 and shows an overall decreasing trend similar to the receiving environment locations. Overall, discharge rates were lower in 2015 when compared to 2014.

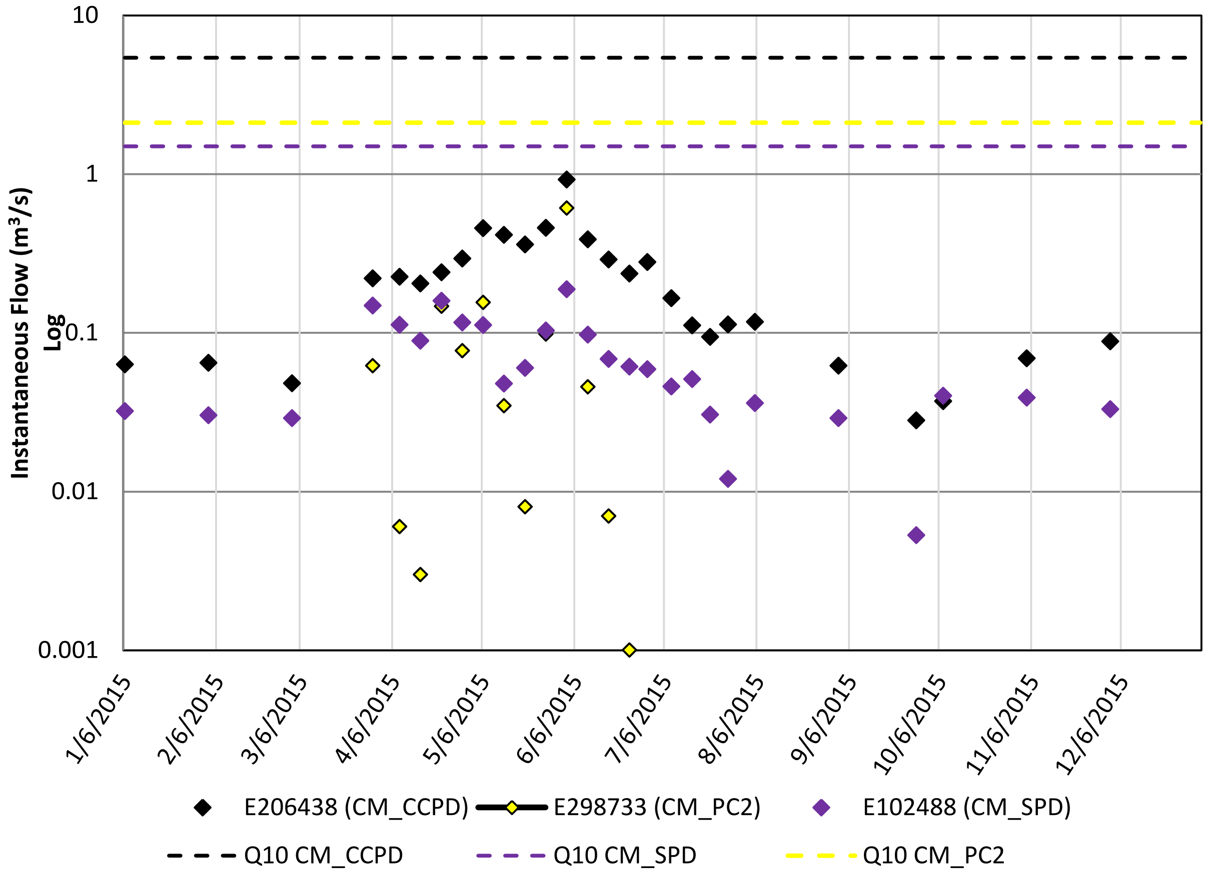


Figure 18. Discharge locations – instantaneous flows

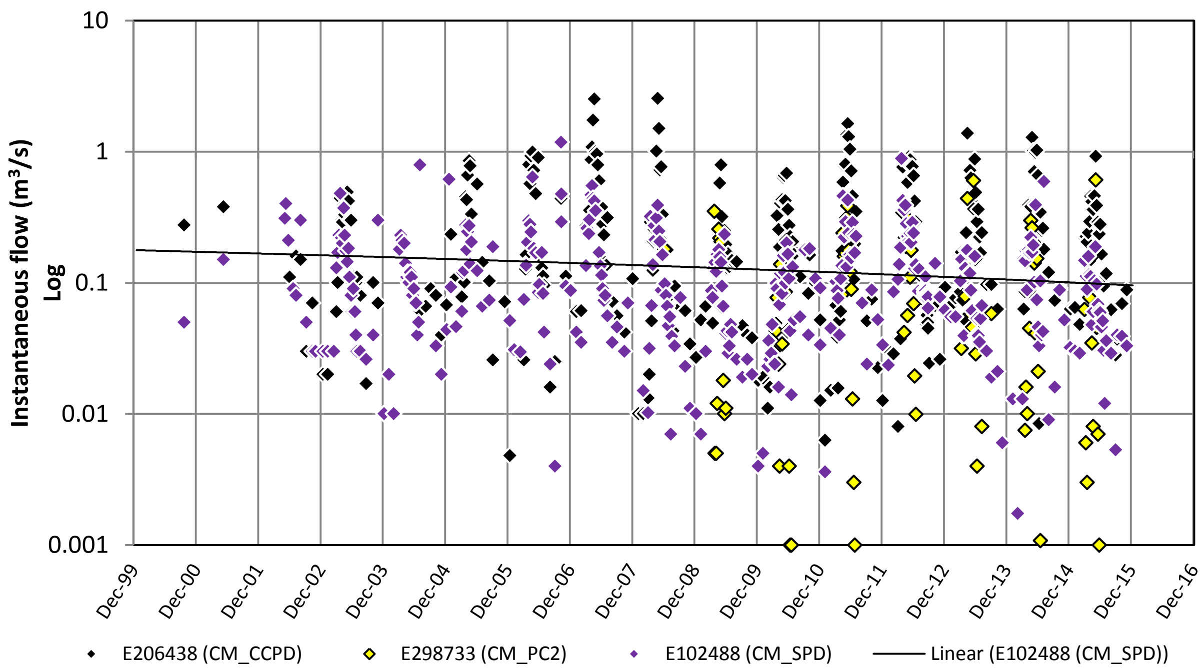


Figure 19. Historical flow data – discharge locations

5.2.3 Sewage Treatment Plant and Maintenance Infiltration Ponds Discharge

Flow data for E206439 (CM_SEW) and E206437 (CM_WBE) are presented in Figure 20.

In 2015, measured flow rates of treated domestic effluent (CM_SEW) ranged from 9.72 m^3/d on August 5 to 19.65 m^3/d on March 3. None of the daily flows measured exceeded the permit limit of 56.8 m^3/d.

Flow measurements for the Maintenance Infiltration Ponds influent (CM_WBE) ranged from 20.5 m^3/d on January 6 to 51.0 m^3/d on April 8. The permit limit of 120 m^3/d was not exceeded.

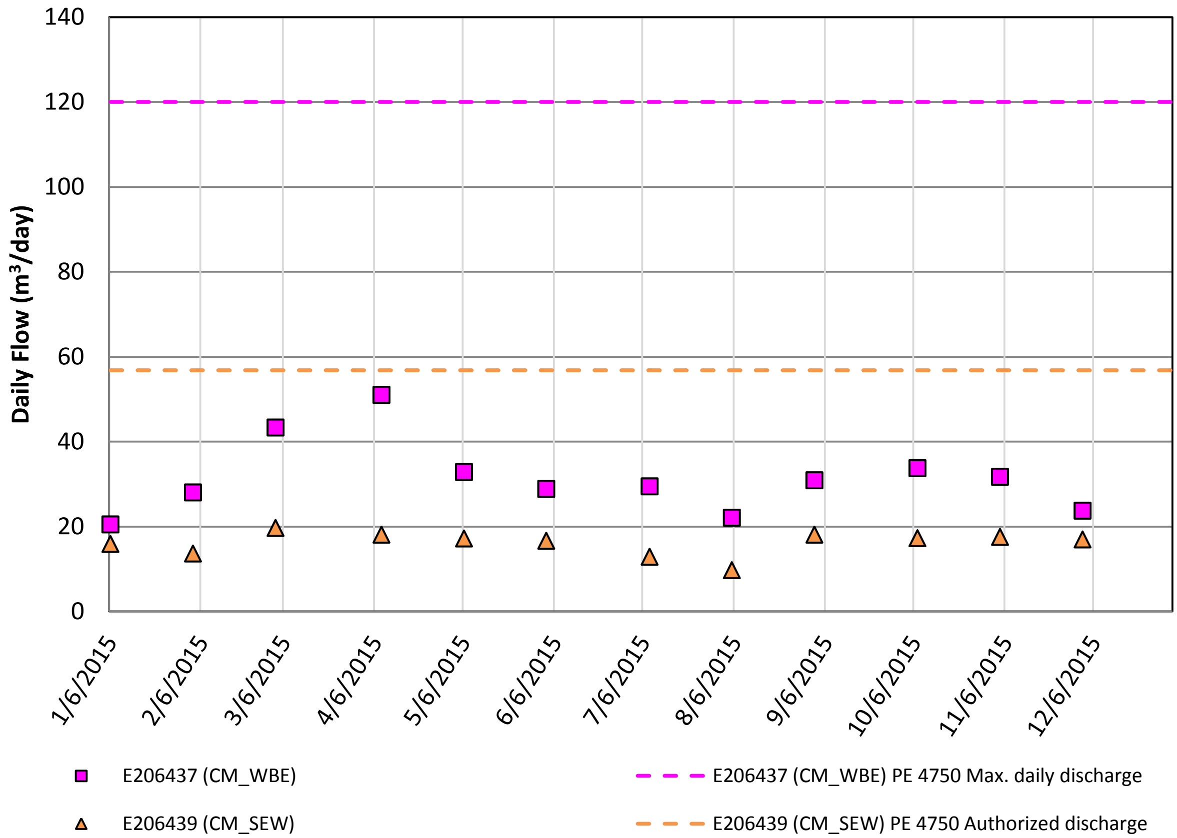


Figure 20. Daily flows – CM_SEW and CM_WBE

Historical flow data for these discharge sites are presented in Figure 21. Flow rates have remained fairly constant and have been below permit discharge limits.

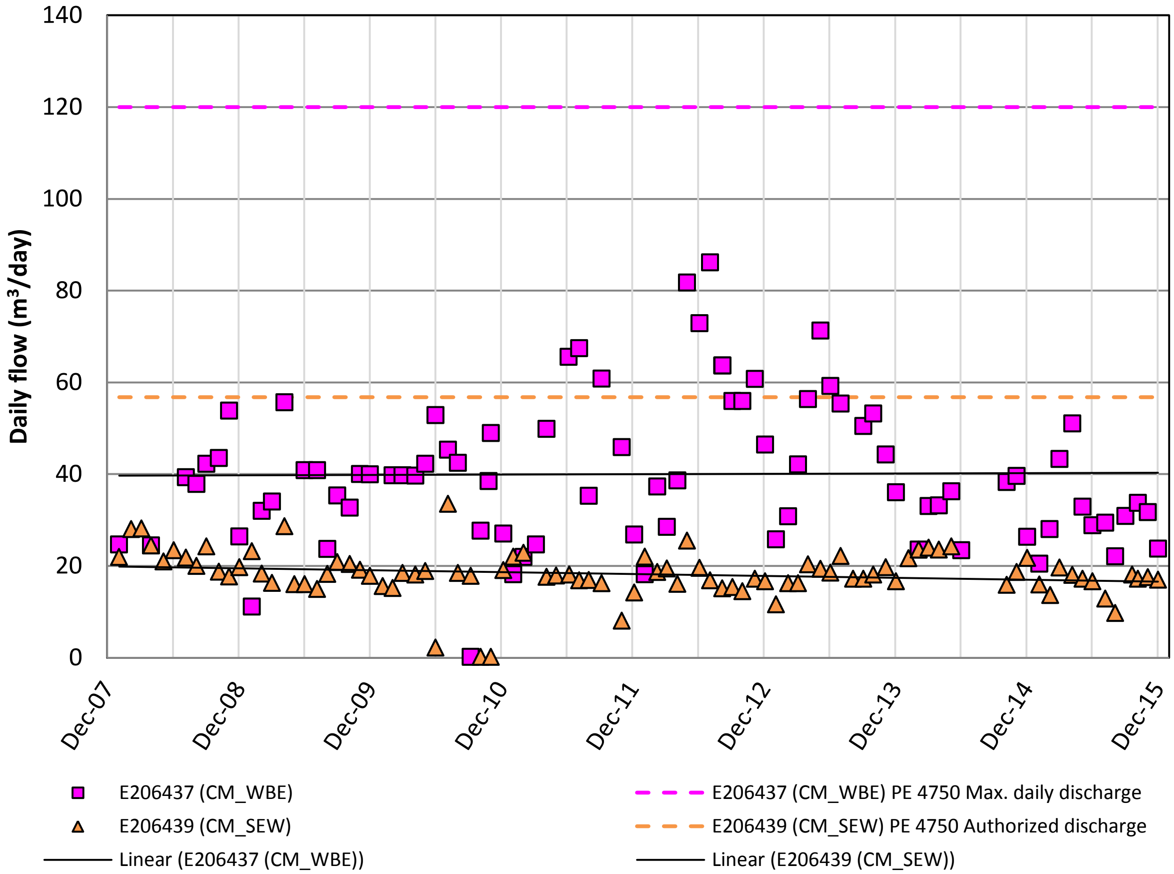


Figure 21. Historical flow data – CM_WBE and CM_SEW

6 Management Plan Summary

A summary of CMO specific management plans related to surface water is provided in the following sections. CMO's overall water management strategy, including monitoring and maintenance activities, is incorporated into an Integrated Water Management Plan (IWMP). The IWMP is reviewed periodically by key CMO employees and is updated annually to ensure that it stays up-to-date with current practices and permit requirements.

6.1 Flocculant Management Plan (FMP)

On September 21st, CMO submitted a revised FMP, prepared by Hemmera Envirochem Incorporated, to MOE as required under Section 3.1 of Permit 4750. The FMP is provided in Appendix B.

The revised FMP included an increase in flocculant dosage rates and methodology for utilizing flocculant "blocks" on CMO's Main Ponds system. The FMP was reviewed by MOE and accepted without further comment on October 28th.

CMO also installed a new automated flocculant station on the North Ditch (upstream of the Main Ponds) in 2015. This new station is a significant improvement over the previous version since it will be able to administer flocculant automatically when triggered by elevated inlet turbidity. This will give CMO the ability to administer flocculant after hours (i.e., evenings and weekends) and at certain times in the winter when there are significant warming periods with rain.

6.2 ML/ARD Management Plan

A site wide Load Balance Model (LBM) (SRK, 2015) and a Metal Leaching and Acid Rock Drainage (ML/ARD) Management Plan, prepared by CMO, were submitted to the Ministry of Energy and Mines on June 30, 2015 (MOE was copied on the submission).

The main objective of the LBM is to understand how mass loadings from CMO's pits, spoils and refuse affects water quality downstream of operations.

The LBM incorporated key findings from a comprehensive water quality data review and from the development of a water balance model and Geochemical Characterization Plan (SRK, 2015b). Water quality predictions made with the LBM concluded that end of mine life concentrations for sulphate, selenium, nitrate and cadmium at the Michel Creek Downstream of Operations (CM_MC2- E258937) would remain within permitted limits (specified in PE 107517). CMO will update the LBM and water quality predictions in 2016 using recent data and information gathered during Phase 1 of the Groundwater Monitoring Program.

The ML/ARD Management Plan was created to describe management of PAG waste rock in CMO's mine plan such that:

- Potential for ML/ARD in waste rock and pit walls is minimized to the extent practicable both during active operations and at closure;
- Operational flexibility is maintained by incorporating potentially acid rock generating (PAG) waste rock monitoring and management activities into normal mining operations;
- Requirement for management of the site following the end of operations is minimized; and
- By managing for ARD potential, the potential for pH depression and accelerated leaching of heavy elements (such as cadmium) will be controlled and therefore water quality conditions, maintained or improved.

Based on a review of options presented by SRK (2015), CMO determined that the majority of remaining PAG waste should be actively managed by blending with non-PAG waste rock in the spoils. This is analogous to historical practices except that blending will be deliberately implemented (CMO, 2015). The Management Plan has been fully implemented since February 2016.

6.3 Method for Field Analysis of TSS

CMO submitted a final TSS/turbidity relationship memo to MOE on August 19th as required under Section 2.3, Total Suspended Solids Sampling, of Permit 4750 (Appendix C). The memo outlined a conservative approach for determining TSS concentrations in the field based on real-time turbidity results. The method was approved by the Ministry on October 16, 2015. CMO has been utilizing this method to proactively manage water quality on site. Management actions to take based on field turbidity readings are summarized in Table 14.

Table 14. CMO field TSS determination matrix

Condition	Location (EMS#-CMO ID)	Action
Field turbidity between 30-50 NTU	E102488 CM_SPD E289733 CM_PC2 E206438 CM_CCPD	• Investigate possible sediment sources and implement management actions if required (e.g., administer flocculant where approved, suspend maintenance of works, etc.).
Field turbidity exceeds 50 NTU		• Immediately report a suspected TSS exceedance to the Ministry • Collect a TSS sample and send for rush analysis • Continue to monitor the discharge until turbidity values are back below reporting levels for potential TSS exceedances • Follow up with MOE once lab results are received

CMO has updated the TSS/turbidity correlation charts for each location (see Figure 22–24) with data obtained in the last two quarters of 2015. No changes to the approved methodology are being proposed based on the updated correlation charts.

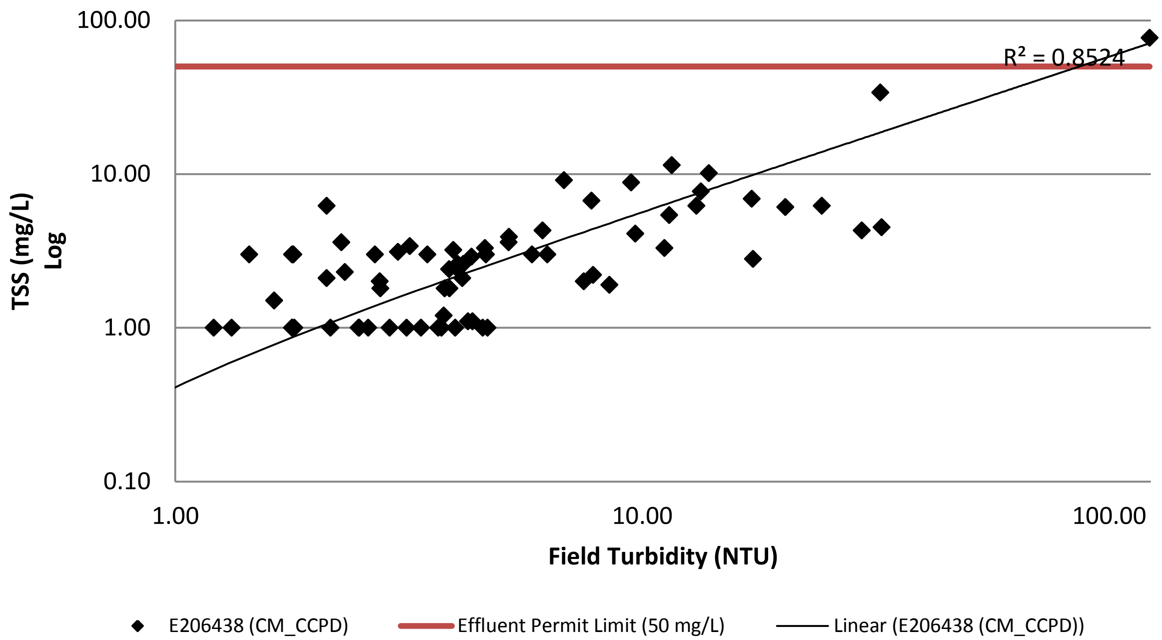


Figure 22. TSS vs turbidity values at E206438 (CM_CCPD)

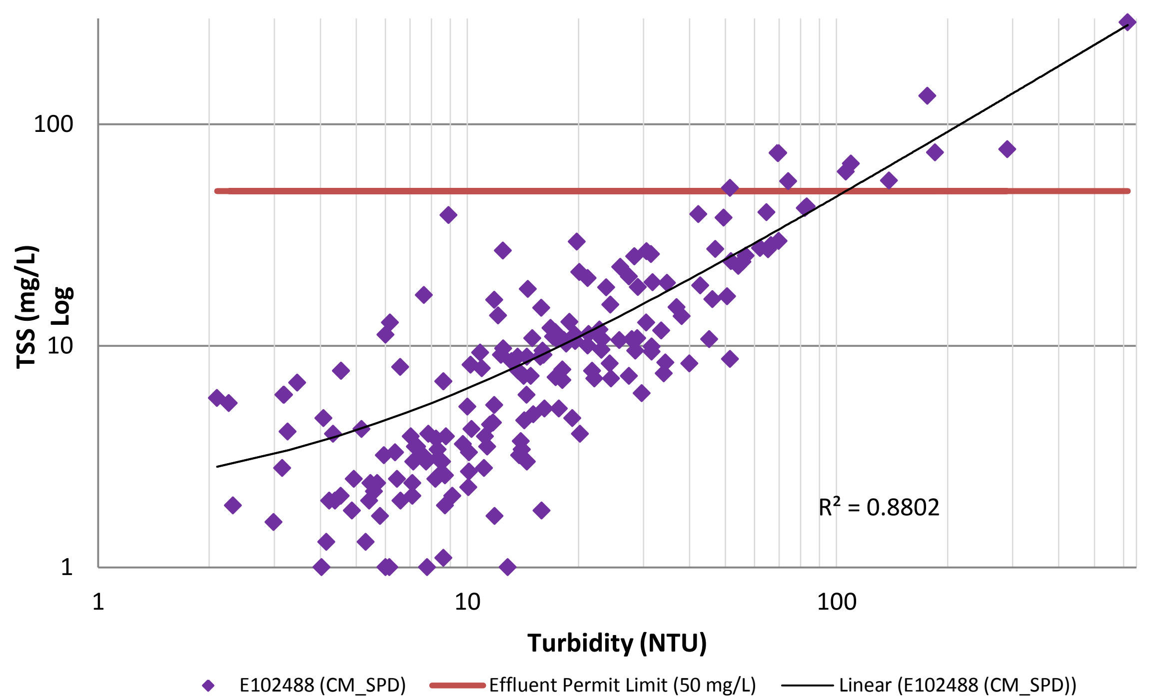


Figure 23. TSS vs turbidity values at E102488 (CM_SPD)

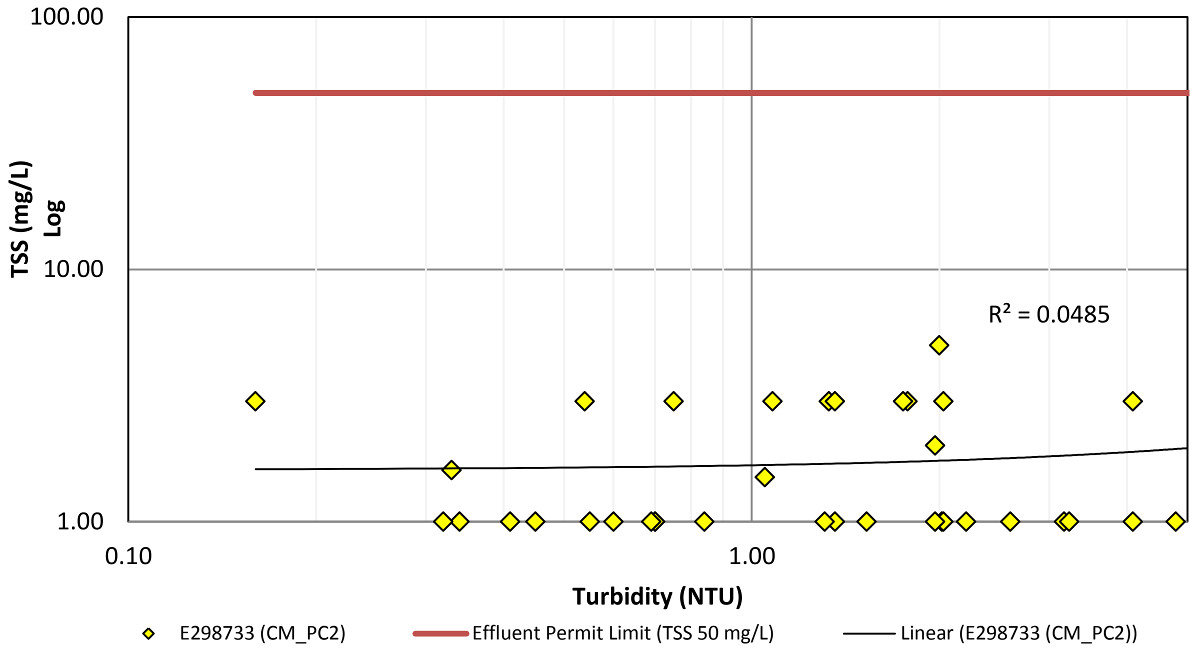


Figure 24. TSS vs turbidity values at E298733 (CM_PC2)

7 Summary and Conclusions

This report summarizes CMO's permitted effluent monitoring program and satisfies the annual reporting requirements for Permit 4750. Permit 4750 was most recently updated and amended in June 2015 and authorizes effluent discharge from CMO.

Flow, EPH and BOD_5 limits were not exceeded in 2015. TSS concentrations exceeded the permit limit of 50 mg/L in 6% (2 of 34) of collected samples from E102488 (CM_SPD). CMO achieved a 50% reduction on TSS non compliances compared to 2014 when four TSS exceedances were reported. Pond discharge from E206438 (CM_CCPD) and decant discharge from E298733 (CM_PC2) results were below permit limits.

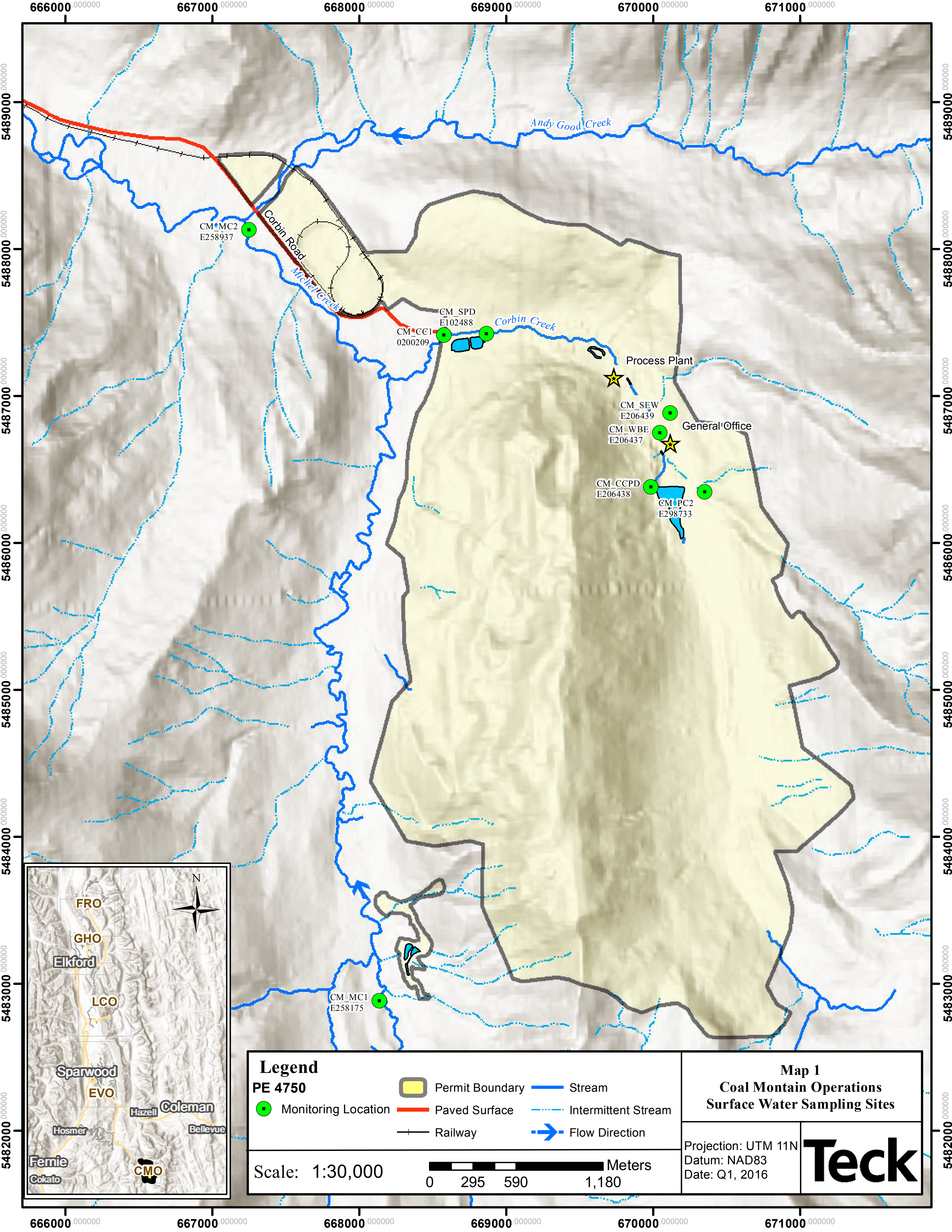
CMO continues to work on improving site water management. The updated FMP and new automated flocculant station are anticipated to help reduce TSS loading and the risk of exceeding TSS limits. Upgraded flow monitoring structures were installed on E102488 (CM_SPD) and the north ditch in order to improve flow measurement accuracy and reliability. The approved TSS/turbidity field analysis method will also contribute to improve water quality at the discharge locations by proactively identifying conditions that could trigger non-compliances.

8 References

SRK Consulting (Canada) Inc. 2015b. Groundwater Monitoring Program. Report prepared for Teck Coal – Coal Mountain Operations. May 2015.

SRK Consulting (Canada) Inc. 2015. Coal Mountain Operations Load Balance Model. Report prepared for Teck Coal – CMO. June 2015.

MAPS



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Andy Good Creek
Corbin Road
Michel Creek
Corbin Creek
CM_MC2
E258937
CM_SPD
E102488
CM_CC1
0200209
Process Plant
CM_SEW
E206439
CM_WBE
E206437
General Office
CM_CCPD
E206438
CM_PC2
E298733
CM_MC1
E258175
FRO
GHO
Elkford
LCO
Sparwood
EVO
Hazell
Coleman
Hosmer
Bellevue
Fernie
Cokato
CMO
N
Legend
PE 4750
Monitoring Location
Permit Boundary
Paved Surface
Railway
Stream
Intermittent Stream
Flow Direction
Scale: 1:30,000
0 295 590 1,180 Meters
Map 1
Coal Montain Operations
Surface Water Sampling Sites
Projection: UTM 11N
Datum: NAD83
Date: Q1, 2016
Teck

Legend

Water Management

- Settling Pond
- Stream
- Intermittent Stream
- Ditch
- Rock Drain
- FacilityLocations

CMO Water Management System

1:16,000

0 250 500 1,000 1,500 2,000 Meters

N W E S

Teck does not accept responsibility for errors, omossions, or the positional accuracy of this information. Information is for planning purposes only and is subject to change. It is the users responsibility to verify accuracy of information. Not to be duplicated or distributed without prior consent from Teck Coal Limited.

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Date: Q1, 2016
Author: CMO Environment

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Appendix A 2015 Routine Water Infrastructure Maintenance Requiring MOE Notification

2015 Routine Water Infrastructure Maintenance Requiring Ministry of Environment Notification

Coal Mountain Operations

May 28, 2015

Teck

Prepared by

Kennedy Allen

Environmental Co-op Student

Reviewed by

Rick Magliocco

Senior Environmental Officer

Table of Contents

1.0 Introduction

Teck Coal Limited (Teck Coal) – Coal Mountain Operations (CMO) is located in the southeastern Rocky Mountains of British Columbia (BC) approximately 25 kilometres (km) southeast from the town of Sparwood (Figure 1). The CMO property is on 520 hectares (ha) of privately owned land, 260 ha of coal lease land and 2,275 ha of coal license land.

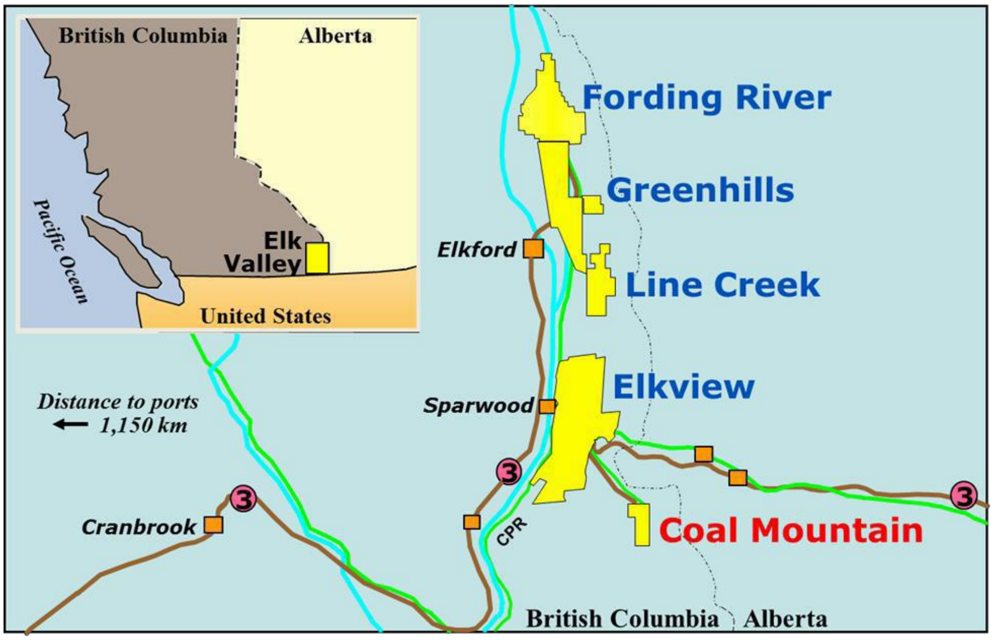

Figure 1: CMO Location Map

CMO is required to manage surface water runoff from the mine site. Permit PE -4750, issued under the *Environmental Management Act* and administered by the Ministry of Environment (MOE), limits the total suspended solids (TSS) concentration that can be discharged into the receiving environment to 50 mg/L.

Section 2.1 of PE-4750 states that the permittee must inspect authorized works regularly and maintain them in good working order. Section 2.2 states that prior approval from the MOE is required when planning to bypass authorized works. Finally, Section 2.4 states that the MOE must be notified prior to implementing changes to any process that may adversely affect the quality and/or quantity of the discharge.

This document provides notification to the MOE, as per Section 2.4, regarding CMO's plans to maintain authorized works in good working order in 2015. All work identified in this document can be considered routine maintenance (i.e., that is typically conducted each year) that does not require bypassing of authorized works. CMO's Operations Department conducts all cleanouts and must get approval from the Environmental Department prior to commencing any work. The Environmental Department will check on conditions prior to starting to ensure that there are no water quality concerns.

Measures to protect the environment are included with each description. Frequency of cleanouts is estimated based on past experience.

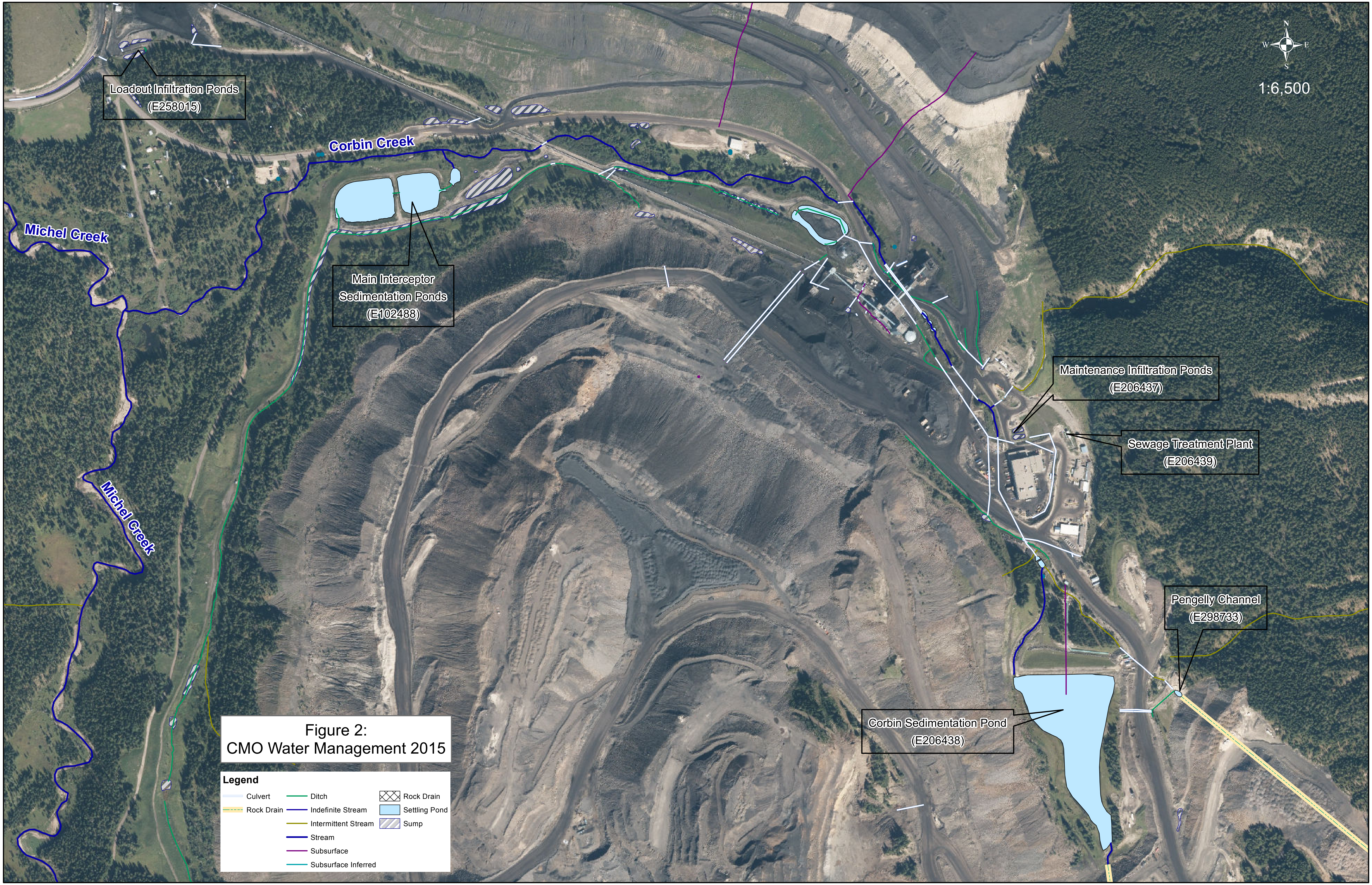

Figure 2:
CMO Water Management 2015

2.0 Dirty Water System

The Dirty Water System (DWS) is defined as all works (e.g., ditches, ponds) that collect surface water runoff from the mine site which eventually discharges at the Main Interceptor Sedimentation Ponds (Figure 2).

2.1 Area 1 – General Office (G.O) and Maintenance Shop

Area 1 includes the General Office (G.O) and the Maintenance Shop (Figure 3). Measures to ensure water quality conditions are met during the Shop Sump and Maintenance Shop Ditch cleanouts include the following:

- No other work to occur on the DWS during cleanouts unless previously approved by the Environmental Department.
- Turbidity monitoring at the Main Interceptor Sedimentation Ponds decant (E102488) will not be conducted for these cleanouts as the infrastructure is small and there is sufficient settling capacity downstream of these works. However, monitoring of water quality will be initiated if the cleanout occurs during adverse weather conditions (e.g., heavy rainfall).
- The North Ditch floc station will be activated as per approved CMO Floc Management Plan, if required (e.g., if cleanout occurs during adverse weather conditions).
- Sediment will be disposed of on CMO's Middle Mountain where mixed refuse is spoiled.

Cleanout of the Maintenance Infiltration Ponds is not planned for 2015. When required, notification for the cleanout of these ponds will be submitted to the MOE separately since there are specific requirements that need to be met for the disposal of sediment.

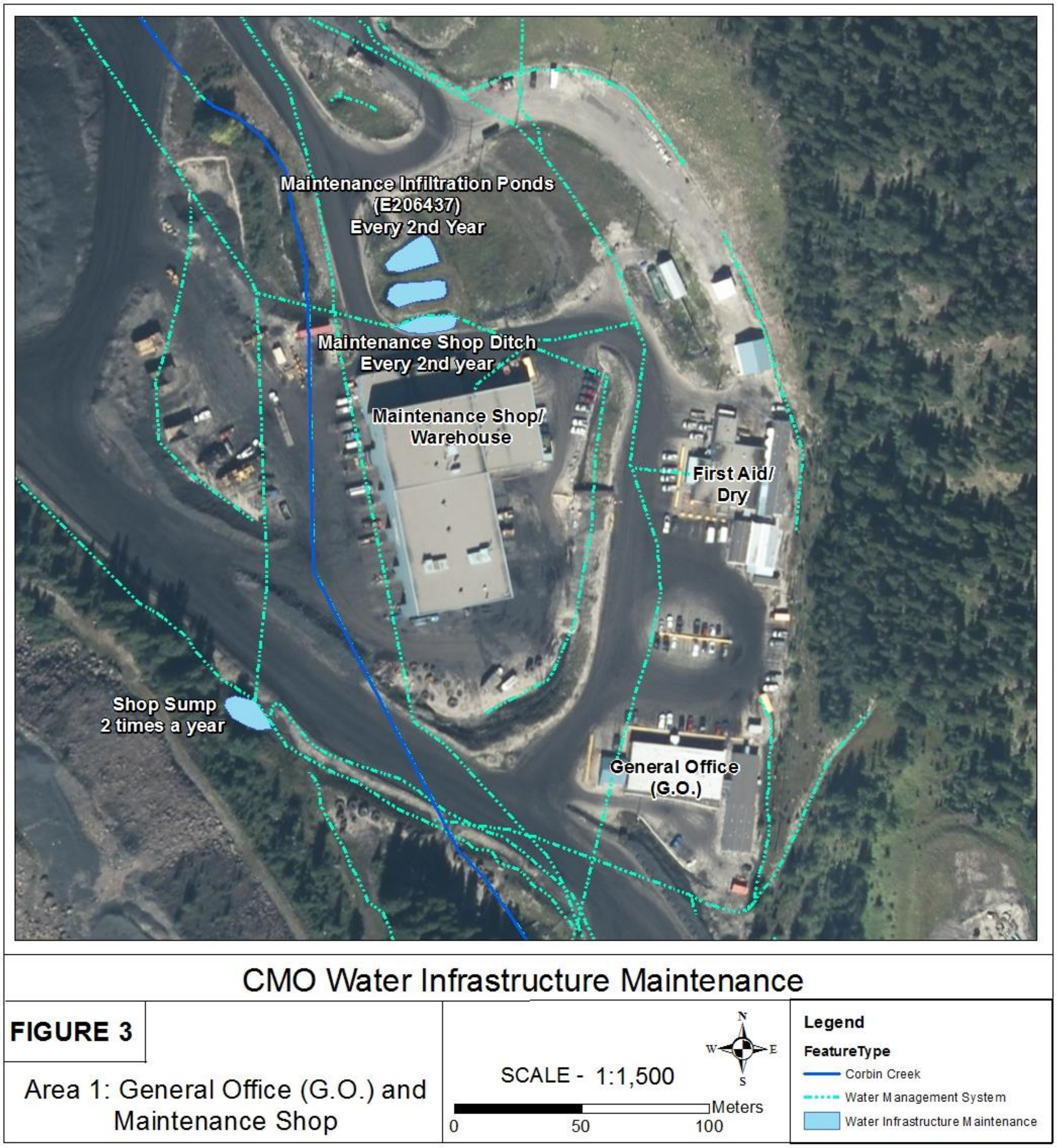

Figure 3: General Office (G.O.) and Maintenance Shop

2.2 Area 2 – Processing Plant

Area 2 includes the Processing Plant and surrounding area (Figure 4). Measures to ensure water quality conditions are met during the Lockblock Sump, the Plant Offices Sumps, the Refuse Sump and the Middle Mountain Ditch cleanouts include the following:

- No other work to occur on the DWS during cleanouts unless previously approved by the Environmental Department.
- Turbidity monitoring at the Main Interceptor Sedimentation Ponds decant (E102488) will not be conducted for these cleanouts as the infrastructure is small and there is sufficient settling capacity downstream of these works. However, monitoring of water quality will be initiated if the cleanout occurs during adverse weather conditions (e.g., heavy rainfall).
- The North Ditch floc station will be activated as per approved CMO Floc Management Plan, if required (e.g., if cleanout occurs during adverse weather conditions).
- Sediment will be disposed of on CMO's Middle Mountain where mixed refuse is spoiled.

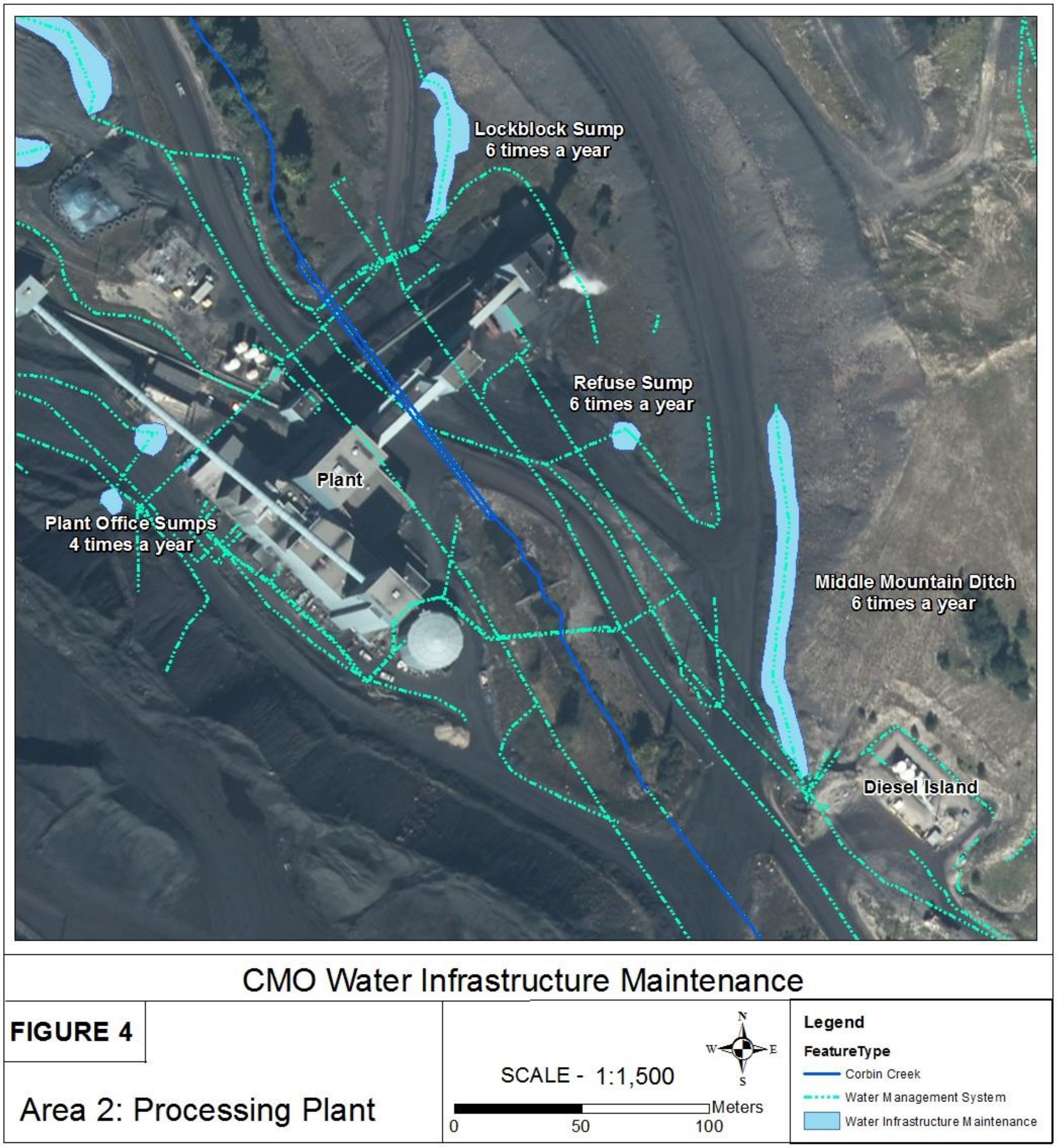

Figure 4: Processing Plant

2.3 Area 3 – Step Ponds and Horseshoe Ponds

Area 3 includes the Step Ponds and the Horseshoe Ponds (Figure 5). Measures to ensure water quality conditions are met during the Step Ponds and Horseshoe Ponds cleanouts include the following:

- No other work to occur on the DWS during cleanouts.
- Turbidity monitoring will be conducted at the Main Interceptor Sedimentation Ponds decant (E102488) and at Corbin Creek (E200209) while the work is occurring. This will occur at a frequency of three times per shift at a minimum.
- A TSS sample will be collected if turbidity exceeds 50 NTU at E102488 (which correlates to approximately 40 mg/L TSS according to CMO's draft TSS/Turbidity relationship for this discharge). Notification of a possible exceedance will be sent to MOE if this occurs and will be followed up with analytical results.
- The North Ditch floc station will be activated as per approved CMO Floc Management Plan, if required (e.g., if cleanout occurs during adverse weather conditions).
- Sediment will be disposed of on CMO's Middle Mountain where mixed refuse is spoiled.

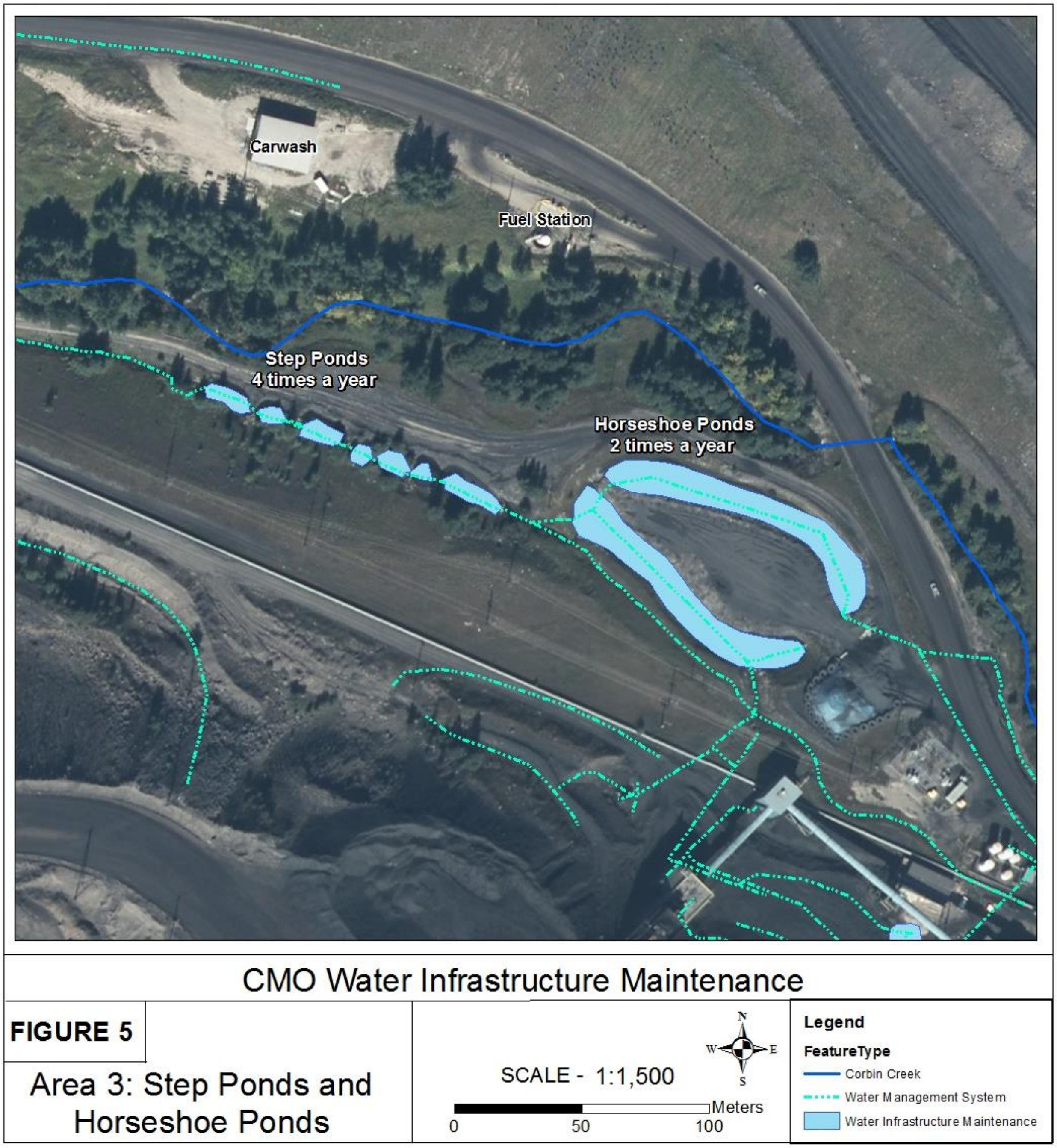

Figure 5: Step Ponds and Horseshoe Ponds

2.4 Area 4 – Conveyor Sump and North Ditch

Area 4 includes the Conveyor Sump and a section of the North Ditch upstream of the floc shack (Figure 6). Measures to ensure water quality conditions are met during the Conveyor Sump and the North Ditch cleanouts include the following:

- No other work to occur on the DWS during cleanouts.
- Turbidity monitoring will be conducted at the Main Interceptor Sedimentation Ponds decant (E102488) and at Corbin Creek (E200209) while the work is occurring. This will occur at a frequency of three times per shift at a minimum.
- A TSS sample will be collected if turbidity exceeds 50 NTU at E102488 (which correlates to approximately 40 mg/L TSS according to CMO's draft TSS/Turbidity relationship for this discharge). Notification of a possible exceedance will be sent to MOE if this occurs and will be followed up with analytical results.
- The North Ditch floc station will be activated as per approved CMO Floc Management Plan, if required (e.g., if cleanout occurs during adverse weather conditions).
- Sediment will be disposed of on CMO's Middle Mountain where mixed refuse is spoiled.

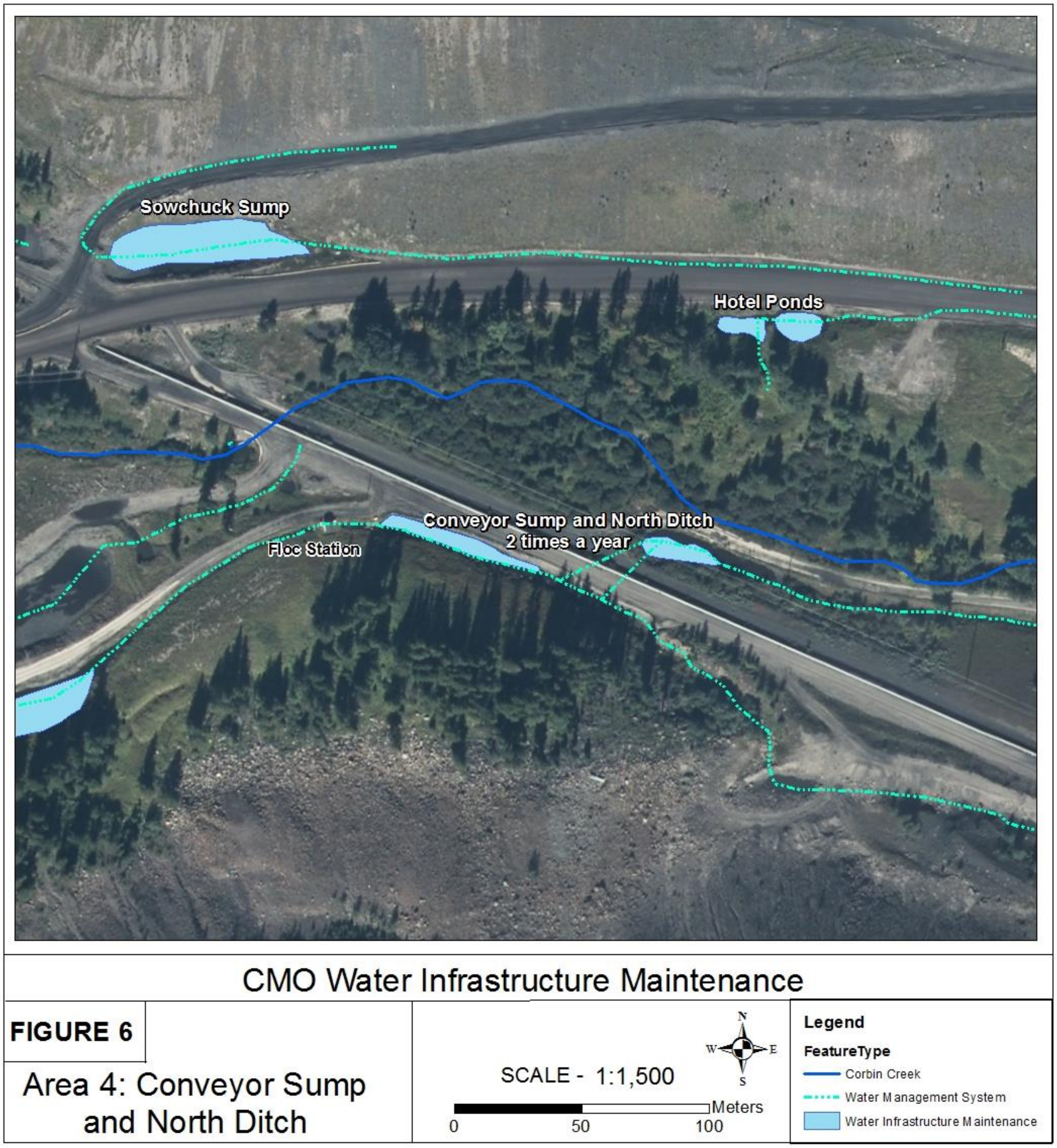

Figure 6: Conveyor Sump and North Ditch

2.5 Area 5 – Main Interceptor Sedimentation Ponds and the North and West Ditches

Area 5 includes the North and West ditches upstream of the Main Interceptor Sedimentation Ponds (Figure 7). Measures to ensure water quality conditions are met during the North and West ditch cleanouts include the following:

- No other work to occur on the DWS during cleanouts.
- Turbidity monitoring will be conducted at the Main Interceptor Sedimentation Ponds decant (E102488) and at Corbin Creek (E200209) while the work is occurring. This will occur at a frequency of three times per shift at a minimum.
- A TSS sample will be collected if turbidity exceeds 50 NTU at E102488 (which correlates to approximately 40 mg/L TSS according to CMO's draft TSS/Turbidity relationship for this discharge). Notification of a possible exceedance will be sent to MOE if this occurs and will be followed up with analytical results.
- The North Ditch floc station will be activated as per approved CMO Floc Management Plan, if required (e.g., if cleanout occurs during adverse weather conditions).
- Sediment will be disposed of on CMO's Middle Mountain where mixed refuse is spoiled.

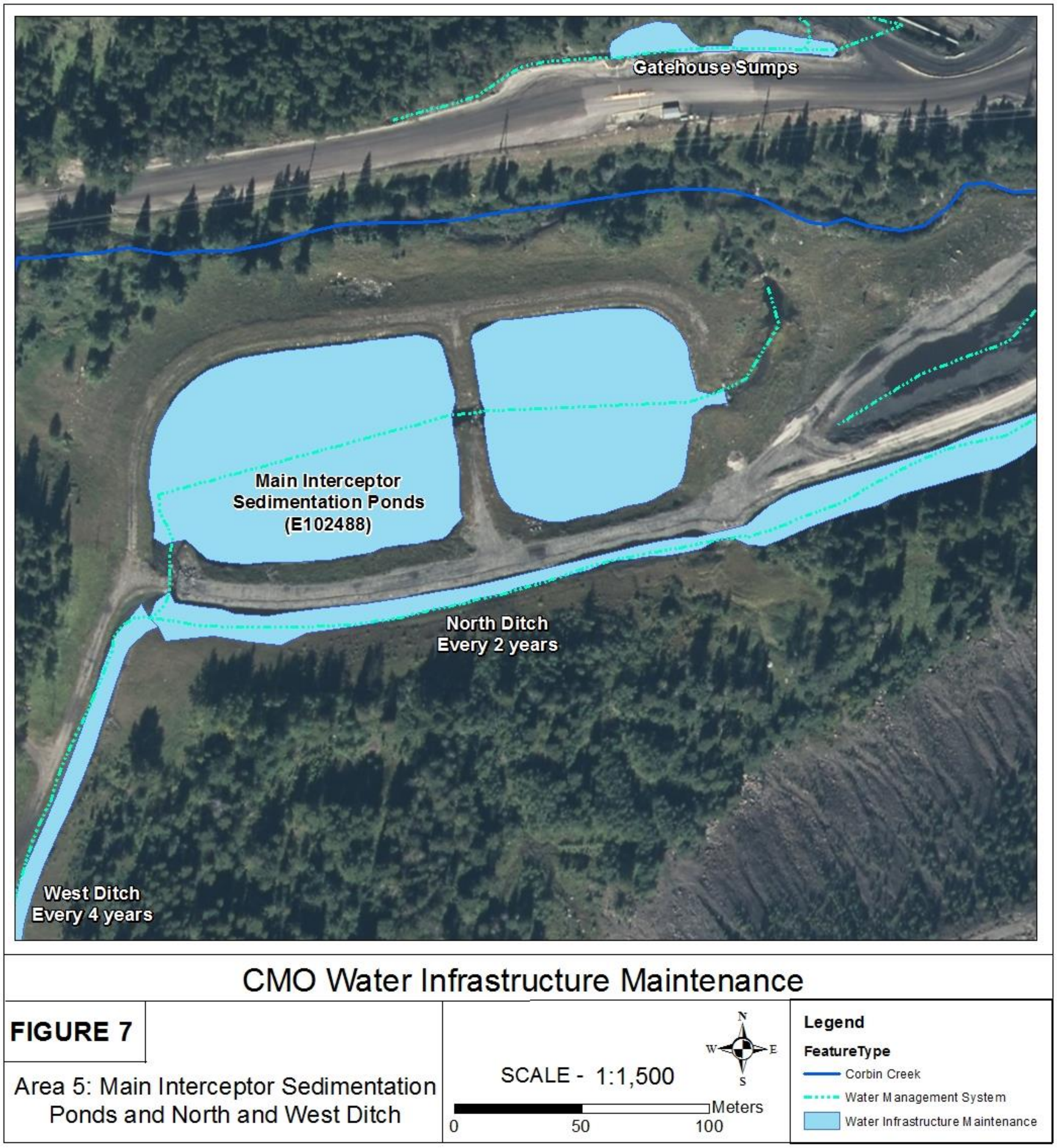

Figure 7: Main Interceptor Sedimentation Ponds

3.0 Loadout Infiltration Pond, Sump and Ditches

Measures to ensure water quality conditions are met during the Loadout Infiltration Ponds and Loadout Sump (Figure 8) cleanouts include the following:

- Ponds and sump cleanout will only occur when there is no risk of the pond discharging to the receiving environment (i.e., Michel Creek).
- Sediment from the ponds will be disposed of on CMO's Middle Mountain where mixed refuse is spoiled.

Measures to ensure water quality conditions are met during the Loadout Infiltration Pond Ditch (Figure 8) cleanout include the following:

- Ditch cleanout will only occur during low flow periods when there is no discharge from the pond and the ditch is not flowing.
- Sediment from the ditches will be disposed of on CMO's Middle Mountain where mixed refuse is spoiled.

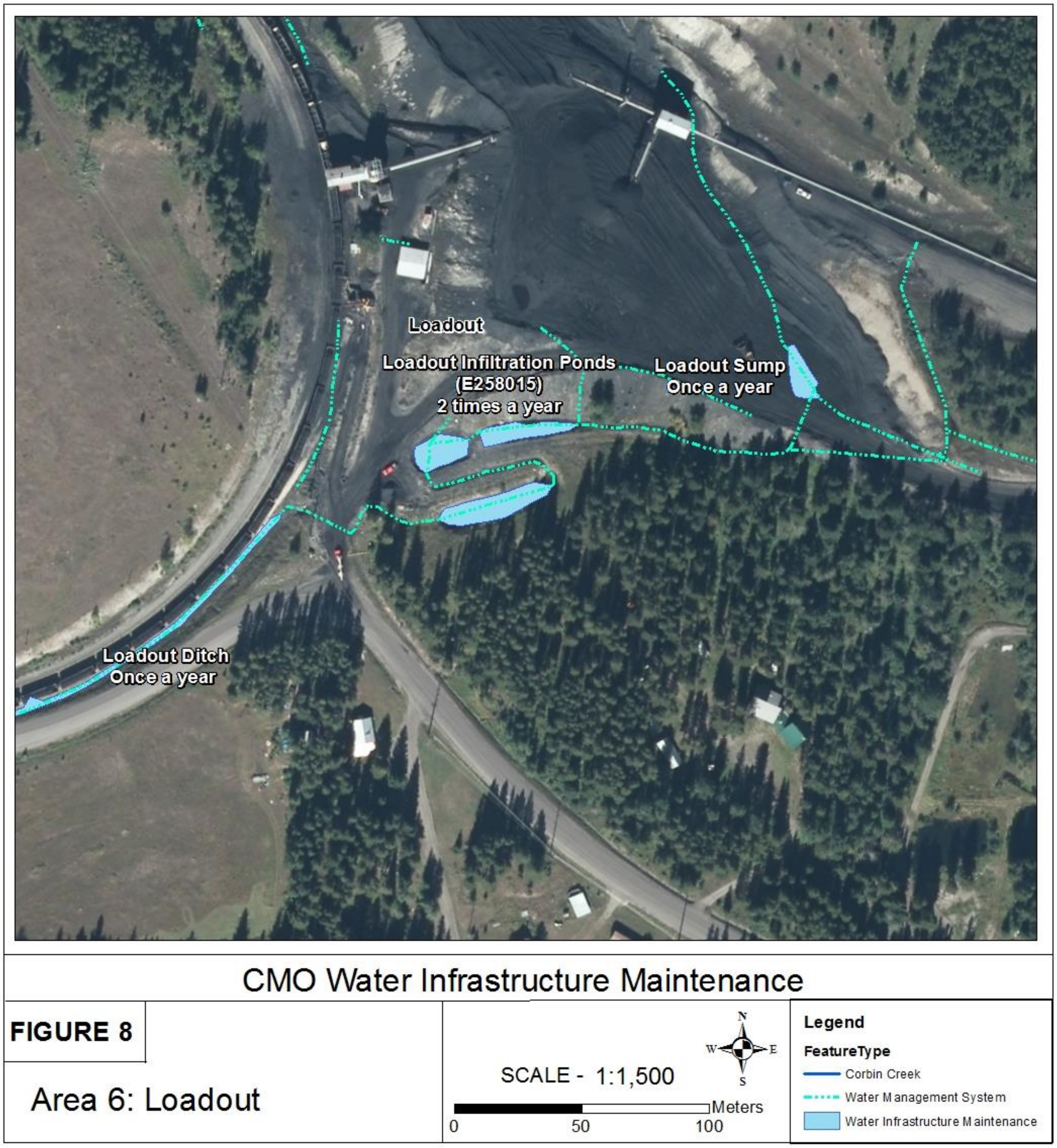

Figure 8: Loadout

4.0 Closing

The purpose of this document is to provide notification to the MOE, under Section 2.4 of PE-4750, regarding routine work that is conducted to maintain CMO's surface water management infrastructure. CMO plans to submit similar notification to the MOE each year prior to the start of the first planned maintenance activities.

All measures will be followed to ensure that maintenance work on the surface water infrastructure system is monitored and causes minimal disturbance. When an emergency situation arises additional notification will be supplied to the MOE and the appropriate turbidity and TSS samples will be collected.

Appendix B Flocculant Management Plan

Coal Mountain Operations
Revised Flocculant Management Plan
(September 2015)

Prepared for:
Teck Coal Limited – Coal Mountain Operations
Warehouse 01, 2261 Corbin Road
Sparwood, BC V0B 2G0

Prepared by:
Hemmera Envirochem Inc.
18th Floor, 4730 Kingsway
Burnaby, BC V5H 0C6

File: 577-021.01
September 2015

HEMMERA

Hemmera Envirochem Inc.
18th Floor, 4730 Kingsway
Burnaby, BC V5H 0C6
T: 604.669.0424
F: 604.669.0430
hemmera.com

September 18, 2015
File: 577-021.01

Teck Coal Limited – Coal Mountain Operations
Warehouse 01, 2261 Corbin Road
Sparwood, BC V0B 2G0

Attn: Rick Magliocco, Senior Environmental Officer, CMO (rick.magliocco@teck.com)

Dear Rick,

Re: Revised Coal Mountain Operations Flocculant Management Plan

Hemmera is pleased to provide you with an electronic copy of this Flocculant Management Plan (FMP).

We have appreciated the opportunity to work with you on this project and trust that this FMP meets your requirements. Please feel free to contact the undersigned by phone or email regarding any questions or further information that you may require.

Regards,
Hemmera Envirochem Inc.

Doug Bright, PhD, R.P.Bio.
Practice Lead, Environmental Risk Assessment
604.669.0424 (606)
dbright@hemmera.com

Michael Choi, B.Sc.
Business Leader, Physical Sciences
604.669.0424 (115)
mchoi@hemmera.com

EXECUTIVE SUMMARY

Teck Coal Limited – Coal Mountain Operations (CMO) is authorized by effluent permit PE-4750, issued under the provisions of the *Environmental Management Act,* to use flocculant in accordance with an approved Flocculant Management Plan (FMP). Pursuant to Section 3.1 of permit PE-4750, flocculant will be used at CMO in accordance with the practices and procedures described in this plan.

CMO is currently permitted to administer flocculant within the north and west interceptor ditches. Currently, only one operational flocculant station is permanently maintained on the North Ditch. A mobile station is available for use as necessary. Flocculant is used in conjunction with sumps and settling ponds to improve effluent discharge quality by reducing total suspended solids (TSS) levels to below permitted levels (50 mg/L TSS).

The FMP (approved by the Director, *Environmental Management Act*) replaces any permits, specifications or approvals previously granted by the Ministry of Environment for discharge of flocculant on the property. The FMP is intended to be an adaptive plan: Given observations over time, improved practices and procedures, and as new products are available and new regulations are enacted, the procedures within the plan may change. It is the intent of this document to be able to respond quickly and effectively to improved TSS management methods. Modifications to the FMP must be developed by a Qualified Professional (as defined in Section 2.9 of PE-4750) and submitted to the Director within 30 days of adoption as per Section 3.1 of PE-4750.

TABLE OF CONTENTS

List of Tables

List of Figures

1.0 CONTEXT

Teck Coal Limited's Coal Mountain Operations (CMO) has permanent and seasonal watercourses situated within the current and historical mining area. The mine site is located along the watershed divide between Michel Creek and Corbin Creek which are both receiving waters for CMO surface water discharges (**Figure 1** and **Figure 2**, as provided by Teck Coal). There are two main contact water collection ditches, West Ditch and North Ditch, both of which drain to Corbin Creek via CMO's Main Interceptor Sedimentation Ponds (**Figure 2**). Corbin Creek discharges to Michel Creek and the discharge is regulated under BC Ministry of Environment (MoE) Permit PE-4750. Under this permit, the use of flocculants to assist in reducing total suspended solids (TSS) is authorized for use within the north and west ditches.

Currently, only one operational flocculant station is permanently maintained on the North Ditch. The flocculant station on the West Ditch was decommissioned since reclamation on the west side of CMO has resulted in improved water quality in the West Ditch. A mobile station is also available for use when required at approved locations. CMO will operate the flocculant station during the winter as required and only when there are open flow conditions in the ditch.

The use of flocculants in the context of water quality and discharges to surface waters that support aquatic life requires a balance between adding sufficient flocculant to effectively achieve TSS objectives and the toxicity of residual un-complexed flocculant or its by-products. The network of settling ponds at CMO is effective at settling out TSS under normal operating and average flow conditions. Flocculant may be required under abnormal conditions such as heavy precipitation events, spring freshet, maintenance activities or erosion events. The efficacy of flocculants depends on the application concentration as well as the realized contact time under conditions conducive to particulate aggregation and settling. The toxicity of discharged water, where flocculant is applied, depends on the degree to which either un-complexed flocculants or flocculant breakdown by-products remain in solution and enter the receiving environment or are retained with the complexed, settled solids that remain in the settling pond system.

Teck Coal Limited Coal Mountain Operations Flocculant Management Plan

Coal Mountain Operations Overview

Legend

Notes

1. This map is not intended to be a "stand-alone" document, but a visual aid of the information contained within the referenced Report. It is intended to be used in conjunction with the scope of services and limitations described therein.
2. This drawing is not to scale.

Sources

Page Size: 11" x 17"

577-021.01	Production Date: Sep 15, 2015	Figure 1

HEMMERA Teck

Figure 1 Coal Mountain Operations Overview

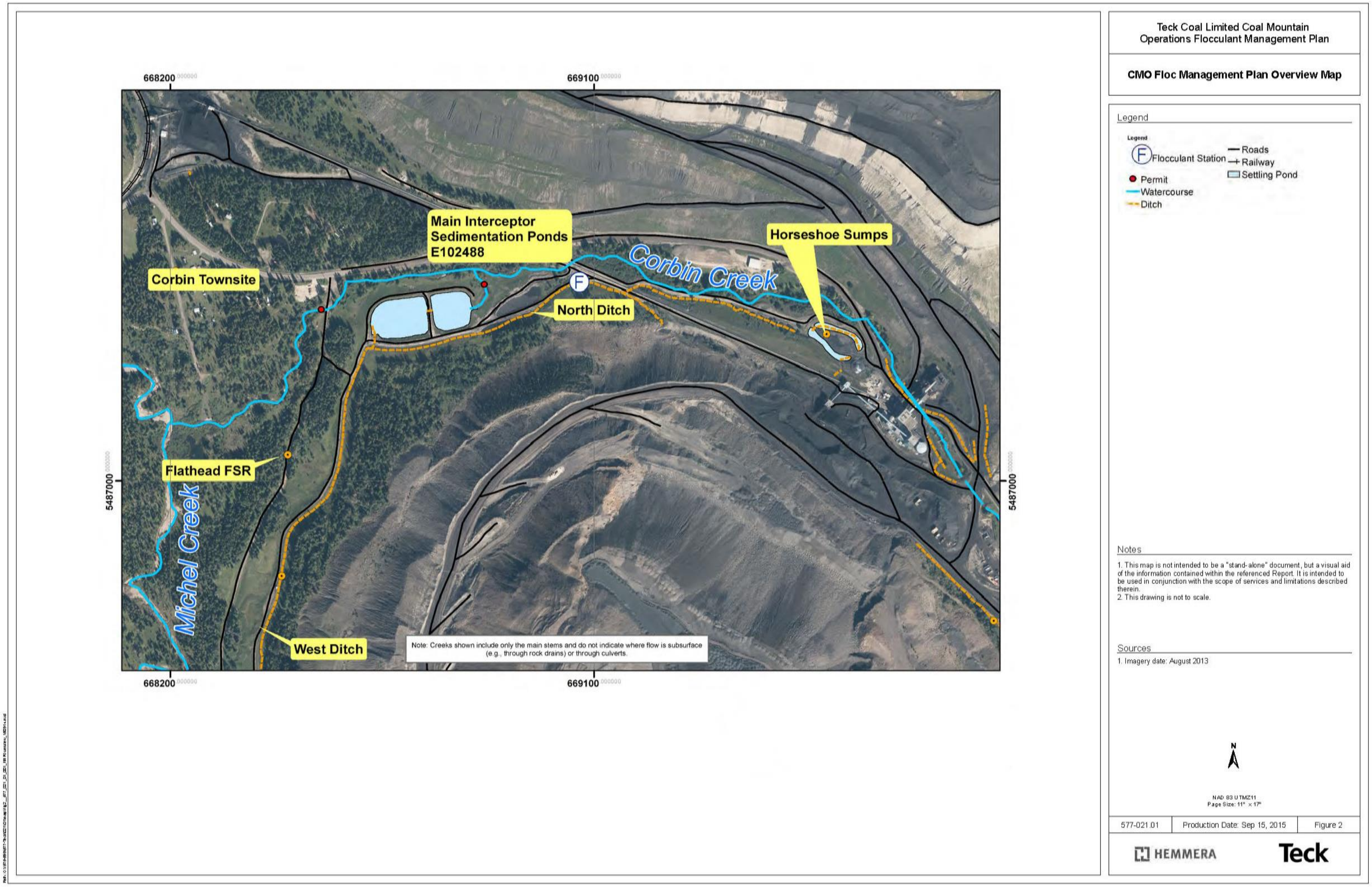

Figure 2 CMO Flocculant Management Plan Overview Map

2.0 REGULATORY / MANAGEMENT CONTEXT

The use of flocculant at CMO is guided by specifications listed in this Flocculant Management Plan (FMP). The approved FMP forms the basis for CMO's Standard Practices and Procedures (SP&P) (Teck Coal 2014a) document for flocculant use that contains detailed operational information. Pursuant to Section 3.1 of Permit PE-4750, flocculants may be used on the property only in conjunction with this plan. The FMP, as approved by the MoE Director, replaces any approvals previously granted for discharge of flocculant on the property.

The approved FMP must be adhered to at all times. Any release of flocculant contrary to the conditions of the plan is prohibited. The FMP is also intended to be a living document that will undergo periodic review and updates as required. Modifications to the FMP must be developed by a Qualified Professional (as defined in Section 2.9 of PE-4750) and submitted to the MoE Director within 30 days of adoption as per Section 3.1 of PE-4750.

3.0 CONDITIONS OF PRODUCT USE

All flocculant products must be subjected to laboratory bioassay toxicity tests to determine acceptable utilization rates. To ensure compliance in this area, CMO will:

- Maintain on file an updated copy of rainbow trout LC_{50} bioassay (in clean lab water) from the supplier for reference;
- Annually request written confirmation from the flocculant supplier verifying there has been no chemical change in the products and that the supplier itself has not changed. Copies of these written verifications will be stored on file for reference.

All personnel must follow the FMP and SP&P when administering flocculant.

4.0 FLOCCULANT TOXICITY

The flocculant products presently used for water treatment at Coal Mountain Operations include a cationic flocculant CYFLOC™ C-591 and an anionic flocculant CYFLOC A-1849RS. Both flocculants are manufactured by Cytec Industries Inc. CMO currently uses CYFLOC C-591 and CYFLOC A-1849RS flocculants in combination as recommended by the manufacturer.

In April and May 2014, Teck Coal's Elkview Operations (EVO) conducted toxicity testing with both juvenile rainbow trout (*Oncorhynchus mykiss*) and water flea (*Daphnia magna*) to determine the LC_{50} (96h) and estimated No Observed Effects Concentration (NOEC) of the flocculants both individually and in combination (Nautilus Environmental, 2014). Results of toxicity testing in clean lab water for the individual flocculants and flocculants used in combination indicate the following:

- Cationic flocculant CYFLOC C-591 alone has an LC_{50} of 0.85 mg/L and an NOEC of 0.6 mg/L.
- Anionic flocculant CYFLOC A-1849S alone has an LC_{50} of >3 mg/L and an NOEC of 3 mg/L.
- Cationic flocculant CYFLOC C-591 and anionic flocculant CYFLOC A-1849S in combination, (10:3 ratio), using multiple concentrations, has an LC_{50} of 0.74 mg/L and an NOEC of 0.6 mg/L.
- Cationic flocculant CYFLOC C-591 and anionic flocculant CYFLOC A-1849S in combination (10:3 ratio), using multiple cationic concentrations and a constant anionic concentration (3 mg/L), has an LC_{50} of 0.85 mg/L and an NOEC of 0.6 mg/L.

Suspended solids in water can mitigate the toxicity of flocculant by binding with it and forming settleable solids, effectively removing the flocculant from solution and reducing bioavailability. As such, toxicity testing conducted using clean laboratory water is not representative of actual environmental conditions. In order to test the effects of flocculant under representative field conditions including a variety of TSS concentrations, toxicity tests were completed in undiluted and dilutions of water from Goddard Creek, a watercourse in EVO's mining area where TSS is managed using flocculants. Reduced toxicity was observed when using site waters with suspended solids as compared to lab water.

The results generated using EVO test waters are considered applicable to CMO, given the similarities of the catchments of interest with regard to suspended solids entrained in surface runoff, and the best available toxicity information for CYFLOC C-591 and CYFLOC A-1849S where tests were conducted using waters with elevated TSS. The updated EVO FMP and associated toxicity data and dosing rates (below) have been accepted by MoE.

CMO surface discharges are expected to be similar to EVO sites with elevated TSS driven by issues specific to mining operations in geographically similar regions. CMO also manages elevated TSS levels using the same flocculant products as EVO in combination with settling ponds. This rationale is supported by flow and water quality data for both CMO and EVO locations, which show similar TSS levels and data trends.

In addition to the products above, Water Lynx 494 portable flocculation blocks (Clearflow 2013) have been identified for use at CMO. Water Lynx is designed, manufactured, and supplied by Clearflow Enviro Systems Group Inc. (Clearflow). The product is an anionic-based polymerizing treating agent used in water treatment that requires minimal maintenance after initial implementation.

Water Lynx is an anionic flocculant dispersing agent in the form of a semi-soft block wrapped in plastic netting. The flocculant product is dormant until it comes in contact with sediment laden water. On contact with sediment, the block slowly releases the copolymer, which binds to the sediment, increasing its mass and weight, thus aiding in aggregation of solids and expediting settling. As such, dosing is based on sediment suspended levels and increases with TSS concentrations.

The Water Lynx 494 flocculant product has already been used in field trials at EVO in 2014 and has subsequently been approved by MoE for use at that operation. This product is further recommended by the Alberta government and approved for use at Teck Coal's Greenhills Operations (GHO), Quintette Operations (QCO), and Cardinal River Operations (CRO).

Product toxicity studies were completed for Water Lynx at Maxxam Analytics in January 2013. Site specific toxicity information is available for EVO waters as part of trial use testing at Integrated Resource Consultants Inc. in May 2014. Results of toxicity testing indicate:

- Water Lynx 494 exhibited an NOEC of 125 mg/L and EC_{50} of 418.4 mg/L for *D. magna* (48 hours) bioassay (Teck Coal 2014b).
- Water Lynx 494 exhibited NOEC and LC_{50} concentrations of 65 mg/L and 210.2 mg/L respectively for juvenile rainbow trout (Teck Coal 2014b).
- Toxicity tests of EVO site waters (Six-Mile Creek final decant) collected 24 hours before and 48 hours after introduction of flocculant blocks indicated 0% mortality for *D. magna* (48 hours) and juvenile rainbow trout (96 hour) bioassay (IRC 2014a, IRC 2014b, Teck Coal 2014c).

The following are instructions for use of Clearflow Water Lynx flocculant products at CMO:

- Water Lynx blocks will be administered as per the manufacturer's recommended rates based on the following equation:

  Estimated flow (peak LPM) / block capacity (LPM) = # of blocks.

- To maximize block surface-to-flow dispersion block setup will depend on stream characteristics:
  - In shallow, high velocity streambed areas blocks will be immobilized in high-flow depressions using a rebar cross section.
  - In deeper areas with higher banks blocks will be fully suspended using nylon rope.

Site water quality will be monitored to assess water quality objectives for TSS are achieved.

CMO plans to administer Water Lynx products at locations throughout the operation where there is no permanent flocculant station and where there is sufficient capacity downstream to settle out the product and associated solids. Therefore, Water Lynx products will only be used on CMO's dirty water system (i.e., the water collection system that discharges to the Main Ponds) in the West Ditch or at locations upstream from the Horseshoe Ponds (**Figure 2**).

5.0 MAXIMUM AND EFFECTIVE DOSAGE RATES FOR CYFLOC PRODUCTS

As turbidity increases in the inflow of the CMO settling ponds, risk of flocculant toxicity to aquatic organisms from the outflow is decreased due to the mitigation of toxicity by the suspended solids (Nautilus Environmental 2014, Hemmera 2014). For this reason a tiered approach to flocculant dosing guidelines, such that higher TSS levels allow for a higher concentration of flocculant delivery, is applied for both the effective removal of suspended solids and to minimize potential effects of the flocculants on aquatic organisms. The following tiered dosing rates have been developed (**Table 5-1**):

- Flocculant will not be dispensed into watercourses with recorded turbidity values upstream of the station below 82 NTU.
- For low range turbidity conditions of 82 to 740 NTU:
    - Cationic flocculant will be administered at a maximum rate of 4 mg/L and anionic flocculant at 1.2 mg/L (10:3 ratio) when used in combination.
- For mid range turbidity conditions of 740 to 3,400 NTU:
    - Cationic flocculant will be administered at a maximum rate of 8 mg/L and anionic flocculant at 2.4 mg/L (10:3 ratio) when used in combination.
- For high range turbidity conditions of greater than 3,400 NTU:
    - Cationic flocculant will be administered at a maximum rate of 10 mg/L and anionic flocculant at 3 mg/L (10:3 ratio) when used in combination.

The maximum dosage rate for cationic CYFLOC C-591 at CMO locations is 10 mg/L. The maximum dosage of CYFLOC A-1849RS is 3 mg/L. Based on updated toxicity testing, these also apply as the maximum dosages of CYFLOC C-591 and CYFLOC A-1849RS when used in combination. These rates were updated based on the toxicity and flocculant settling tests conducted in April to May 2014 for the updated EVO FMP (see **Section 4.0**). These rates may need to be adjusted depending on dosage rate effectiveness observed over time as well as results from future bioassay tests (and as part of continuous improvement of the FMP).

Table 5-1 Cationic and Anionic Flocculant Application Limits

Dosing Level	Turbidity Range (NTU)*	CYFLOC C-591 Max. Cationic Dosage Rate (mg/L)	CYFLOC A-1849S Max. Anionic Dosage Rate (mg/L)
No Dose	<82	No Flocculant	No Flocculant
Low	82 to 740 NTU	4	1.2
Mid	740 NTU to 3,400 NTU	8	2.4
High	>3,400 NTU	10	3

* Recorded upstream from the flocculant station

6.0 OPERATION OF FLOCCULANT STATIONS

6.1 PROCEDURES

Procedures for operating flocculant stations have been developed to ensure water treatment is carried out in a safe, effective, consistent and environmentally responsible manner. Procedures stress the safe use of flocculants with regard to mixing, handling and effective dosage rates. Specific procedures have been developed for the permanent North Interceptor Ditch flocculant station and the mobile station. The following are general procedures that govern the administration of flocculant at CMO:

1. Record name, date, time and tank level on the flocculant Log Sheet.
2. If tank levels are low, mix solutions to desired dilution in appropriate containers.
3. Measure the turbidity of the water in the channel using a turbidity probe. Turbidity will determine dosing rate.

Note: No flocculant will be administered if turbidity is less than 82 NTU.

4. Record or measure flow in the channel that flocculant will be added to.
5. Determine the appropriate anionic and cationic flocculant dose rates (**Table 5-1**, above). Set the flocculant dosage rate to low according to the channel flow. Flow rate from the flocculant discharge lines will be routinely validated using a graduated cylinder and stop watch.
6. When safe to do so, check to ensure that the flocculant is working correctly by completing the 5 minute cylinder settling test. The intent of the settling test is to provide long term correlation between flocculant efficiency and turbidity/TSS permit requirements and should be performed on a monthly basis.
7. Record all pertinent information on the flocculant Log Sheet.
8. Periodically check the flocculant station to ensure:
   - 8.1. Flocculant dose rates remain effective for given turbidity and flow rates
   - 8.2. General systems are functioning normally
   - 8.3. An adequate supply of both anionic and cationic flocculant remains.
9. Stop flocculant treatment when the turbidity of the untreated water (i.e., upstream of flocculant addition) drops below 82 NTU.

6.2 TRAINING

Training of flocculant station operators is required to ensure compliance with this FMP. Training may include, but not be limited to, the following areas:

- Familiarization with location and layout of the flocculant stations and associated water treatment areas;
- Recording or measuring flow;

- Operation and basic maintenance of flocculant equipment;
- Theory of how flocculants work on charged suspended particles in watercourses (Moss and Dymond, 1978);
- Use of field turbidity meters;
- Use of the flocculant equipment (pumps, water tanks, heat tracing etc.);
- Use of the flocculant products (mixing and preparing flocculant solution, effectiveness testing by cylinder tests, and spill response);
- Familiarization of the MSDS information for each flocculant product used (Cytec 2011, Cytec 2013, and Water Lynx 494);
- Health and Safety protocols and procedures for the flocculant program and general safe working practices and procedures around the treatment equipment, ditches and ponds;
- Determining effective dosage; and
- Proper use of log sheets.

6.3 MAINTENANCE

Flocculant station maintenance is part of the routine activities in administering this FMP. General station maintenance is the responsibility of the CMO Environment Team. General station maintenance tasks are included in CMO's SP&P. This procedure is to be followed as required during active operation to ensure safety and proper environmental management of the flocculant stations.

As quality control measures, CMO Environmental staff will regularly conduct detailed monthly inspections on the permanent North Interceptor Ditch flocculant station. Emphasis is placed on safety, station readiness, log book orderliness, and cleanliness. Larger maintenance problems requiring millwrights (e.g. pump repairs) are handled through CMO's work request system.

7.0 SAFETY AND SECURITY

Safety and security measures to prevent accidents or unauthorized discharges of flocculant include but are not limited to the following:

- All flocculant stations are inaccessible to the public with access restricted by controlled security.
- All stations are equipped with a spill response kit such that any spills can be cleaned up safely and quickly.
- All stations are constructed so as to reduce the risk of a dispensing tank or pail being knocked over.
- The permanent flocculant station is ventilated to ensure a hazardous atmosphere situation cannot arise.
- Stations may be shut down and flocculant removed when not in use (e.g., during prolonged cold periods).

8.0 FLOCCULANT INVENTORY

To ensure that flocculant is always available for use, CYFLOC C-591 and CYFLOC A-1849RS are ordered in February of each year. Delivery time for flocculant from ordering to arrival is typically less than a week. Volume of flocculants on hand is monitored throughout the active season. An estimated supply of at least one month's worth of product required during normal operations is kept on site.

CYFLOC C-591 Cationic flocculant and CYFLOC A-1849RS Anionic flocculant each have a maximum shelf life of two years when stored in a temperature controlled environment (pers. comm. Eammon Guitard, Cytec Canada Inc, May 1 2014). Flocculant that has passed its expiry date is disposed of off-site and not used.

9.0 CLOSING

We sincerely appreciate the opportunity to have assisted you with this project and if there are any questions, please do not hesitate to contact the undersigned by phone at 604.669.0424.

Report prepared by:
Hemmera Envirochem Inc.

Jennifer Steele, B.Sc., MMM, P.Chem.
Environmental Scientist

Report peer reviewed by:
Hemmera Envirochem Inc.

Doug Bright, PhD, R.P.Bio.
Practice Lead, Environmental Risk Assessment

10.0 REFERENCES

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Teck Coal. 2014c. Elkview Operations – Water Lynx Block Trial: Six Mile Creek. Sparwood, BC.

Integrated Resource Consultants (IRC). 2014a. 48 Hours Daphnia Magna Bioassay Result. Report to ALS Environmental, May 6, 2014. Richmond, BC. As provided in Elkview Operations – Water Lynx Block Trial: Six Mile Creek, Teck Coal 2014.

Integrated Resource Consultants (IRC). 2014b. Rainbow Trout Bioassay Result. Report to ALS Environmental, May 6, 2014. Richmond, BC. As provided in Elkview Operations – Water Lynx Block Trial: Six Mile Creek, Teck Coal 2014.

11.0 STATEMENT OF LIMITATIONS

This report was prepared by Hemmera Envirochem Inc. ("Hemmera"), based on work conducted by Teck Coal and Hemmera, for the sole benefit and exclusive use of Teck Coal CMO. The material in it reflects Hemmera's best judgment in light of the information available to it at the time of preparing this Report. Any use that a third party makes of this Report, or any reliance on or decision made based on it, is the responsibility of such third parties. Hemmera accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions taken based on this Report.

Hemmera has performed the work as described above and made the findings and conclusions set out in this Report in a manner consistent with the level of care and skill normally exercised by members of the environmental science profession practicing under similar conditions at the time the work was performed.

This Report represents a reasonable review of the information available to Hemmera within the established Scope, work schedule and budgetary constraints. It is possible that the levels of contamination or hazardous materials may vary across the Site, and hence currently unrecognised contamination or potentially hazardous materials may exist at the Site. No warranty, expressed or implied, is given concerning the presence or level of contamination on the Site, except as specifically noted in this Report. The conclusions and recommendations contained in this Report are based upon applicable legislation existing at the time the Report was drafted. Any changes in the legislation may alter the conclusions and/or recommendations contained in the Report. Regulatory implications discussed in this Report were based on the applicable legislation existing at the time this Report was written.

In preparing this Report, Hemmera has relied in good faith on information provided by others as noted in this Report, and has assumed that the information provided by those individuals is both factual and accurate. Hemmera accepts no responsibility for any deficiency, misstatement or inaccuracy in this Report resulting from the information provided by those individuals.

The liability of Hemmera to Teck Coal CMO shall be limited to injury or loss caused by the negligent acts of Hemmera. The total aggregate liability of Hemmera related to this agreement shall not exceed the lesser of the actual damages incurred, or the total fee of Hemmera for services rendered on this project.

Appendix C Field Analysis Method to Determine Total Suspended Solids

BRITISH
COLUMBIA

File: 4750

October 16, 2015

Rick Magliocco
Senior Environmental Officer
Coal Mountain Operations – Teck Coal Limited
Box 3000
Sparwood, BC V0B 2G0

Dear Rick Magliocco,

Re: Proposed Field Analysis Method to Determine Total Suspended Solids

The Proposed Field Analysis Method to Determine Total Suspended Solids letter dated August 19, 2015 has been received and reviewed by ministry staff. The review indicates that the method meets the requirements of Section 2.3 of Permit PE-4750. As indicated in the letter, Teck must continue updating and refining the correlation curves to determine TSS values based on field NTU readings to assist in managing the control of suspended solids.

Pursuant to Section 2.3 of Permit PE-4750, I hereby approve the Coal Mountain Operations *Proposed Field Analysis Method to Determine Total Suspended Solids* dated August 19, 2015.

Yours truly,

Douglas Hill, P.Eng.
for Director, *Environmental Management Act*
Mining Operations

Carla Romero
Environmental Engineer
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July 15, 2015

Lorna Green
Environmental Protection Officer
Ministry of Environment
205 Industrial Road G
Cranbrook, BC V1C 7G5

Re: Proposed Field Analysis Method to Determine Total Suspended Solids

Dear Ms. Green,

Introduction

Teck Coal Limited - Coal Mountain Operations (CMO) is submitting this letter to the Ministry of Environment (MoE or the Ministry) requesting approval from the Director for CMO's proposed field analysis method to determine total suspended solids (TSS). Approval of this method is required under Section 2.3 of CMO's effluent permit, PE- 4750 (last amended June 25, 2015), which states the following:

> *"The Permittee must develop a tool for field analysis of total suspended solids (TSS) value and procedures for additional TSS sampling for discharges referenced in Section 1 of this permit and any effluent discharge to surface water from the mine property. The TSS determination method must be approved by the Director. This requirement does not replace TSS analysis by a certified lab that may be required in Section 3 of this permit."*

The proposed method involves estimating TSS in the field using established TSS-turbidity linear relationships that are unique to each discharge. This method is much more accurate than previously utilized methods (e.g., turbidity wedge) and can be used to make quick, reliable management decisions related to water quality where it discharges to the receiving environment. The method is described below and is currently being used by CMO to estimate TSS from field turbidity measurements.

Methodology and Results

CMO has three permitted surface discharge sample locations that require established TSS-turbidity relationships (Figure 1). Permitted discharge sample locations that are authorized to infiltrate were not included in this analysis. Field turbidity values and corresponding TSS laboratory results from past monitoring events have been analyzed to identify correlations between them. Available datasets for each discharge location are summarized in Table 1.

Table 1: Summary of Data

Location	Environmental Monitoring Site Number	Sample Period*	# of Samples	R^2 Value
Main Interceptor Sedimentation Ponds decant (CM_SPD)	E102488	2011-2015	175	0.8865
Corbin Sedimentation Pond decant (CM_CCPD)	E206438	2011-2015	64	0.8518
Pengelly Channel discharge (CM_PC2)	E298733	2011-2015	38	0.0475

(*) Until June 2015

Analysis of Main Interceptor Sedimentation Ponds decant data indicates that turbidity values up to 83 nephelometric turbidity units (NTU) correlate to TSS values below 50 mg/L. The majority of permit exceedances (i.e., TSS > 50 mg/L) were related to NTU values greater than 100. The one exception is an NTU value of 69 as shown in Figure 2. The linear correlation exhibited for this discharge appears to be strong, with a Coefficient of Determination (R^2) of 0.8865.

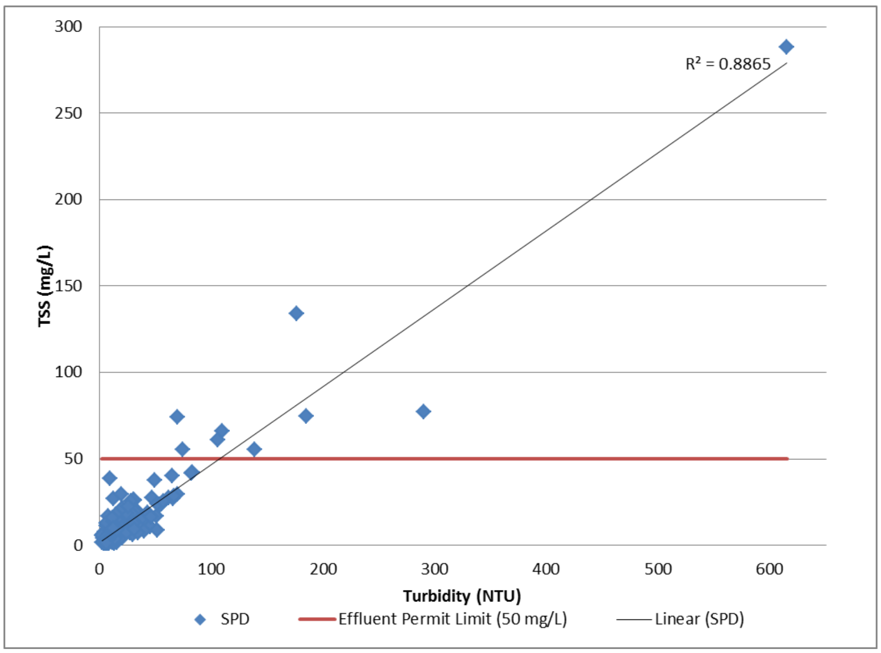

Figure 2: Field Turbidity vs TSS at CMO's Main Interceptor Sedimentation Ponds Decant (E102488)

Analysis of Corbin Sedimentation Pond decant data indicates that turbidity values up to 32 NTU correlate to TSS values well below 40 mg/L. Only one permit exceedance was identified from the data analyzed, with a TSS value of 77 mg/L and turbidity of 122 NTU as shown in Figure 3. No data has been recorded around the 50 mg/L TSS limit. The linear correlation exhibited for this discharge also appears to be strong, with a Coefficient of Determination (R^2) of 0.8518.

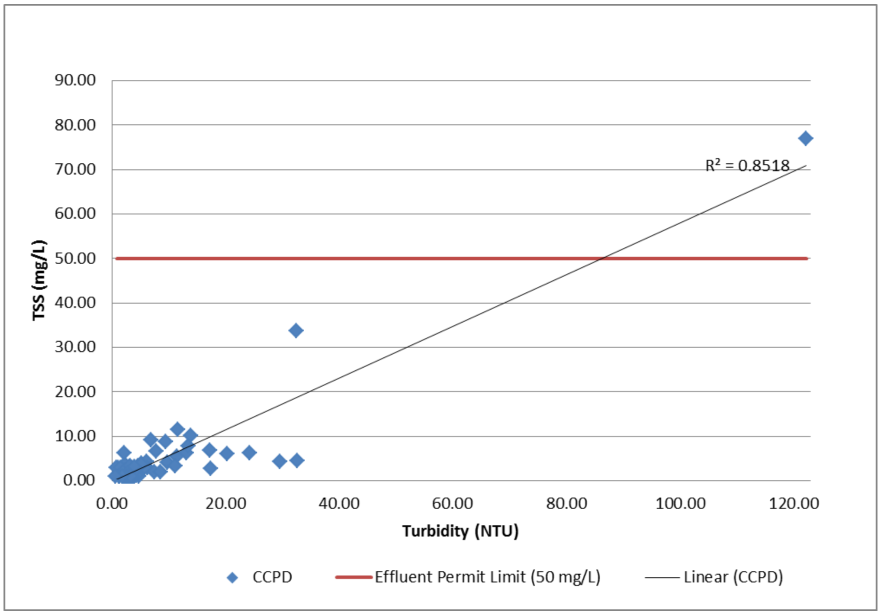

Figure 3. TSS vs turbidity values at CMO's Corbin Sedimentation Pond Discharge (E206438)

Pengelly Channel discharge data analyzed did not have a sufficient range of TSS and NTU values to develop a reliable correlation (i.e., R^2 = 0.0475) as shown in Figure 4. Pengelly creek only flows intermittently (typically April – August) and is dry the remainder of the year (except during heavy rain events). The Pengelly Channel discharge is typically very low in TSS as can be seen in the data (zero exceedances were identified from the data analyzed); therefore, it may be difficult to establish a reliable TSS-turbidity correlation for this discharge.

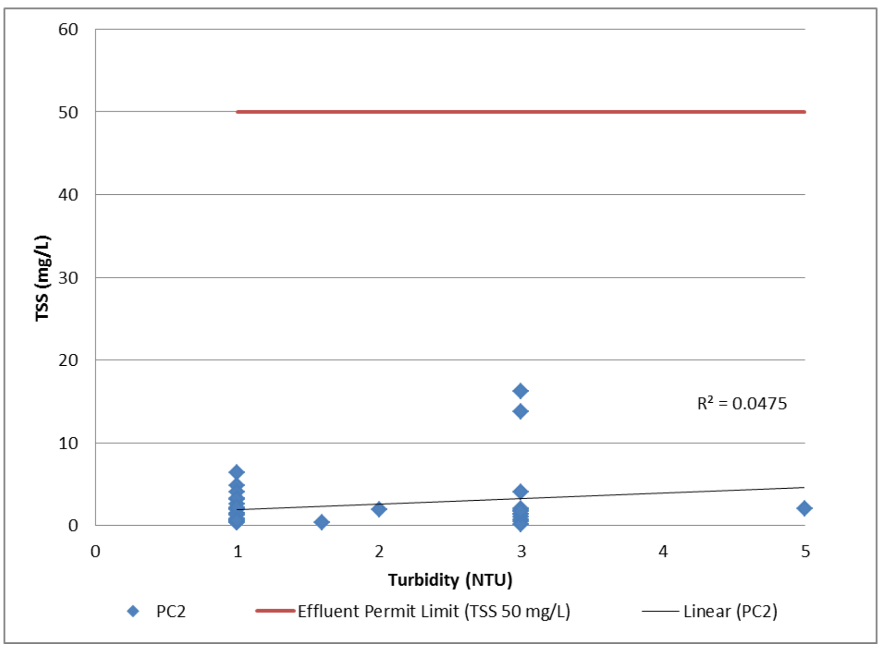

Figure 4. TSS vs turbidity values at CMO's Pengelly Channel Discharge (E298733)

Reporting Potential TSS Exceedances

Based on the above results, CMO is proposing a conservative approach for proactively managing water quality and reporting potential TSS exceedances at these permitted discharge locations. When turbidity is between 30-50 NTU, CMO will investigate possible sediment sources and may implement management actions if required (e.g., administer flocculant where approved, suspend maintenance work, etc.).

CMO will immediately report suspected TSS exceedances to the MoE, via phone or email as per Section 5.1 of PE- 4750, should turbidity values exceed 50 NTU. A TSS sample will then be taken at the discharge site and will be sent to ALS Environmental laboratory in Calgary for rush analysis.

When turbidity is above 50 NTU, CMO will continue to monitor the discharge until turbidity values are back below reporting levels for potential TSS exceedances, as described above. A follow up email will be sent to the Ministry once laboratory analysis is obtained indicating whether or not the permit exceedance occurred. CMO has been utilizing this practice recently to report and detect potential non-compliances with good results.

All TSS exceedances will be summarized in CMO's quarterly and annual reports and will include root cause and corrective actions.

Continual Improvement

TSS-turbidity relationships will be calibrated annually with up-to-date results (i.e., permitted and event sampling) from each of the surface discharge locations. Updated correlation charts will be provided in CMO's Annual Water Report. Any proposed changes to the program described herein will be submitted to the Ministry in writing for approval prior to implementing.

Closing

CMO trusts that the proposed procedure as described meets the intent of Section 2.3 of PE- 4750 and will be acceptable to the director as a field indicator of TSS. This procedure will be implemented at the following authorized discharges: Main Interceptor Sedimentation Ponds (E102488), Corbin Sedimentation Pond (E206438) and Pengelly Channel (E298733). This practice will not replace TSS analysis by a certified laboratory.

Please contact me at carla.romero@teck.com or at 250-425-7350 should you have any questions or require any further information.

Sincerely,

Carla Romero
Environmental Engineer, M.Eng.

Cc. Garett Turnbull, CMO Engineering Superintendent
Rick Magliocco, CMO Sr. Environmental Officer

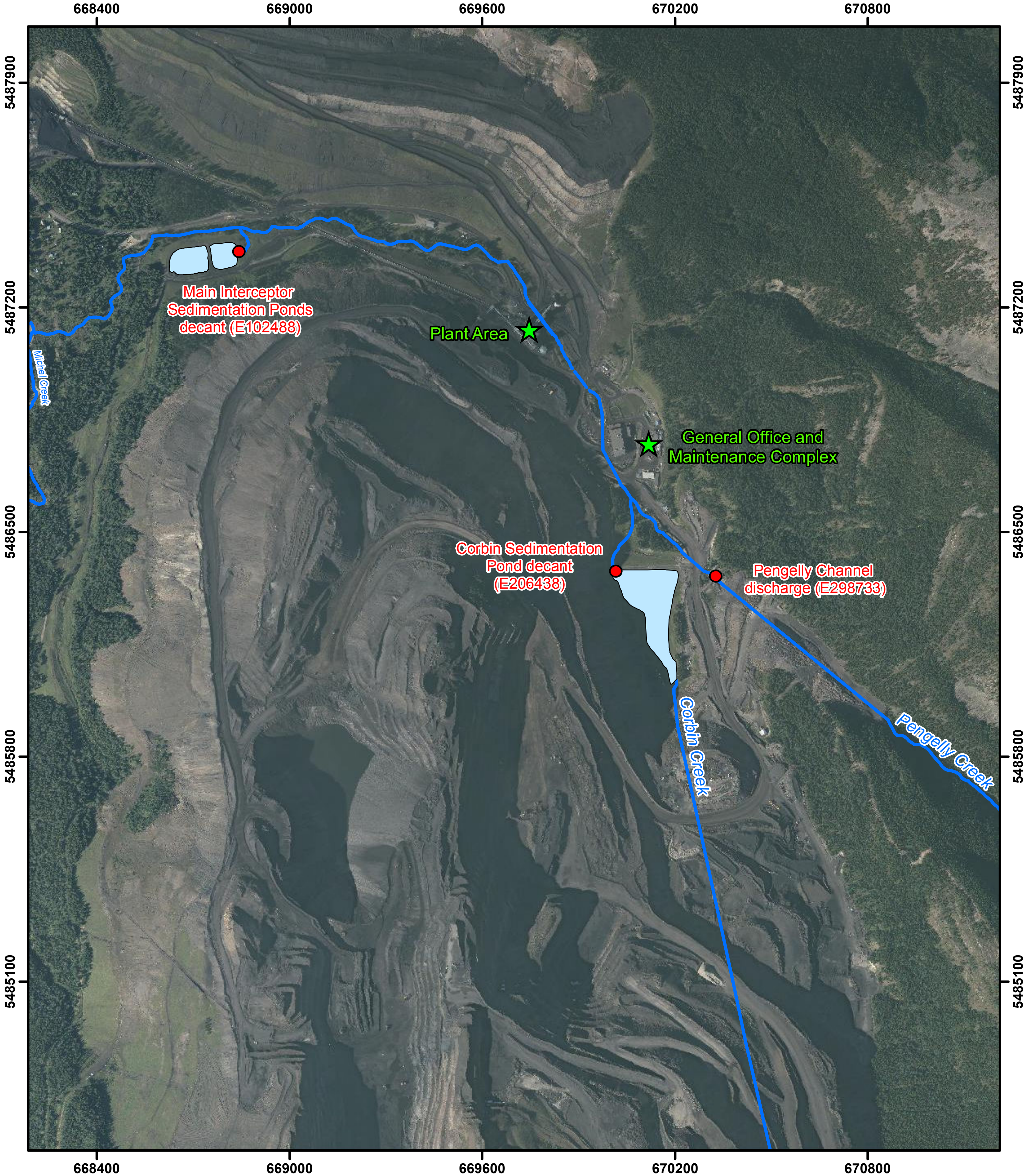

Figure 1: CMO Surface Discharge Monitoring Locations

1:15,000

0 187.5 375 750 Meters

Legend

Settling Pond

Watercourse

Projection: UTM11N NAD83
Date: Q3, 2015
Author: Enviroment CMO

N W E S

Teck

Appendix D Performance Evaluation Report for the Calcite Pilot Program

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March 1, 2016

Douglas Hill, P.Eng.
Regional Operations Director - Mining
Environmental Protection
Ministry of Environment
Williams Lake, BC

Dear Mr. Hill

Reference: Qualified Professional Endorsement of Teck's 2015 Calcite Pilot Plant Performance Evaluation Report

Teck Coal Limited (Teck) has prepared the enclosed Performance Evaluation Report for the 2015 Calcite Pilot Plant authorized under Appendix 3 of Coal Mountain Operations (CMO) *Environmental Management Act* permit PE-4750 (June 25, 2015 amendment).

Teck can confirm that the enclosed report was prepared by qualified staff and reviewed by a Qualified Professional as defined in Section 2.9 of PE-4750. Please accept signature and stamp outlined below as proof of this review.

Please contact the undersigned if you have any questions or comments.

Sincerely,

PROFESSIONAL ENGINEER
PROVINCE OF BRITISH COLUMBIA
Dr. J. C. MIRANDA TREVINO
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Mar 1st, 2016

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Applied Research and Technology Report

2015RR27

Calcite Pilot Plant: Calcite Precipitation Prevention using Antiscalants

BA Benson, JC Miranda

January 13, 2016

Teck

Distribution

This report is confidential and is to be used for internal purposes only.

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Thank you to Eric McIntyre for the groundwork that he developed in 2014 to help set this project up for success and for his continuous support during operations.

We would also like to thank Kevin Atherton and Stephane Brienne for their assistance and direction during the writing of this report.

Finally, we would like to recognize the outstanding work done by Trevor Houlden during the operation of this pilot.

SIGNED:

BA Benson
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RL Stephens
Director, Applied Research & Technology

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Table of Contents

1 Executive Summary

Teck Applied Research and Technology (ART) and external consultants have been investigating conditions and methods to either promote or inhibit calcite deposition. Using this information, Teck is working towards implementation of calcite treatment technologies that will either prevent the precipitation of calcite, or alternatively promote precipitation under controlled conditions that do not affect the receiving environment. Water chemistry and site characteristics vary from site to site, hence the importance of developing different technologies in order to develop a calcite treatment toolbox.

The 2015 Calcite Pilot Project objectives were to test for the prevention and removal of calcite precipitation using antiscalants, evaluate changes in phosphorus and cadmium concentration as a result of antiscalant addition and/or calcite precipitation, and confirm that no acute toxicity occurred. All three objectives were achieved for the three antiscalants tested (Nalco, GE, and Kroff).

Cadmium concentration in the untreated water decreased over the course of the control stream as a result of co-precipitation with calcite. The change in cadmium concentration found at the end of the stream is up to 18% lower than at the beginning of the stream.

In the treated water streams for the prevention studies, phosphorus concentrations increased by an average of 0.13 mg/L for Nalco, 0.25 mg/L for Kroff and 0.005 mg/L for GE.

The data from the calcite removal tests show little evidence of calcite dissolution. Visual inspection of the stream showed flakes shed from the walls of the pilot streams during the removal tests. This observation suggests that the antiscalants do not dissolve all the calcite precipitated on the rocks but break down some crystals, allowing the flakes to separate from the rock and travel down the streams as solids. This mechanism would also have little change in the water chemistry in the stream as the calcite would remain as a solid.

Based on the selection criteria set up for the project and the results from the pilot plant, the ranking of antiscalants for further use as a means to control calcite deposition is GE > Kroff > Nalco.

2 Introduction

2.1 Background

Teck Applied Research and Technology (ART) and external consultants have been investigating conditions and methods to either promote or inhibit calcite deposition. Using this information, Teck is working towards implementation of calcite treatment technologies that will either prevent the precipitation of calcite or, alternatively, promote precipitation under controlled conditions that do not affect the receiving environment. Water chemistry and site characteristics vary from site to site. Hence, it is important to develop different technologies in order to develop a calcite treatment technology toolbox.

In 2013, ART conducted a pilot plant program at Coal Mountain Operations (CMO) to test alkalinity reduction in Corbin Creek [McIntyre *et al.*, 2013]. However, alkalinity reduction introduces several challenges such as an increase in chloride or total organic carbon concentration. The use of antiscalants to prevent and/or remove calcite precipitation has been identified as an alternative to alkalinity reduction. Bench-scale test work in 2014 identified multiple antiscalants and tested their environmental effects. The effect on toxicity and water chemistry was assessed at pilot-scale. The two treatment conceptual models are described as follows:

1. Alkalinity Reduction

   $$H^+ + HCO_3^- \leftrightarrow CO_2 + H_2O$$

   a. Shifts reaction to the right converting alkalinity (bicarbonate) to carbon dioxide.
2. Antiscalant
   a. Crystal growth inhibitor (phosphonate, anionic co-polymer) that prevents calcite formation.
   b. Dispersing agent (anionic co-polymer) that dissolves calcite.

2.2 Objectives

The 2015 Calcite Pilot Program tested the applicability of antiscalants to control calcite in the Elk Valley watershed in terms of:

- Confirming vendor recommended dosage for the stream,
- Evaluating water chemistry changes (specifically phosphorus and cadmium) and potential toxicological effects,
- Evaluating treatment efficacy, cost and operational usability, and
- Comparing antiscalants to each other and to reagents used for alkalinity reduction.

The pilot test examined the use of antiscalants for the purpose of both calcite prevention and calcite removal.

Three antiscalants were used in the pilot program:

- Kroff KR-DP0168 (Kroff)
- Nalco 8357 (Nalco)
- GE Depositrol PY5206 (GE).

Kroff reagent is used at closed coal mine sites in West Virginia for in-stream calcite treatment. Nalco reagent is used in mineral processing plants for calcite treatment. GE reagent is currently used in cooling systems for calcite prevention. Each vendor recommended dosages for preventing and removing calcite buildup. These dosages are shown in Table **2.1.**

Table 2.1 2015 CMO Calcite Pilot Plant antiscalant dosages

Antiscalant	Prevent Dosage (mg reagent/L water)	Removal Dosage (mg/reagent/L water)
Kroff KR-DP0168	3	6
Nalco 8357	5	10
GE Depositrol PY5206	4	8

3 Pilot Plant Planning Stage

The 2013 alkalinity reduction calcite pilot program was used as the basis for planning the 2015 calcite pilot program. The equipment was installed at the same location at Coal Mountain Operations. The same contractors (West Kootenay Mechanical and Chinook Scaffold) were used for 2015 construction, maintenance, and demobilization.

3.1 Environment, Health and Safety

Environment, Health, Safety, and Community Work Plans (EHSC) and Environmental Protection Work Plans (EPWP) were developed for the project. These documents reviewed the operational tasks that were performed and the reagents that were used at the pilot plant. Separate EHSC and EPWP documents were required for the construction, operation, and demobilization stages of the pilot program. Each EHSC triggered additional safe work plans that were required for specific tasks including working alone and accessing Corbin Pond.

During the planning stage of the calcite pilot project a Failure Mode and Effects Analysis (FMEA) was completed that reviewed potential failures of the pilot project in terms of environmental impact, what the consequence of the failures were, and what controls were in place or needed to be developed and implemented to eliminate or minimize the risk. Acute toxicity testing using rainbow trout and Daphnia Magna was performed on mine affected water containing elevated concentrations (to simulate an upset condition) of Kroff, Nalco, and GE antiscalants with all tests passing. The results are shown in **Appendix A**.

As part of the safety program, a Construction Safety Officer (CSO) was onsite for the construction of the plant to chair toolbox talks and assist with crew risk assessments. For the operational portion of the calcite pilot project, a detailed safety training matrix was developed and followed. Training included all plant technical personnel receiving certification as a Mine Safety Supervisor from College of the Rockies.

Daily safety activities included toolbox talks to review tasks and completing Take 5 assessments to identify high-potential risks. Routine safety meetings, housekeeping tours, and critical parts inspections were held weekly.

3.2 Technical Program

The Data Quality Objectives (DQO) for the calcite pilot project can be found in **Appendix B**. The three antiscalants used for the calcite pilot plant were Kroff KR-DP0168 (Kroff), Nalco 8357 (Nalco), and GE Depositrol PY5206 (GE) and were tested for the purpose of both calcite prevention and calcite removal. Antiscalants were tested two at a time in conjunction with a control stream and the tests lasted approximately 17 days each. The overall objectives of the calcite prevention and removal tests are listed in section 2.2.

3.2.1 Method

The pilot project plant created conditions where the precipitation of calcite in the test stream was similar to that of the natural stream system. This was achieved by pumping the influent water through a process consisting of a mixer, a cascade, and a simulated stream. The mixer promoted a homogenous solution while the cascade and pilot stream promoted carbon dioxide off-gassing. The antiscalant was added prior to the mixer at the dosages recommended by vendors to prevent or remove calcite precipitation in the streams **(Table 2.1).** The DQO in **Appendix B** shows a process flow diagram of the system.

3.2.2 Test Plan

The calcite pilot project was designed to test the objectives that were described in the DQO**,** specifically antiscalant type and dosage. The antiscalant dosage was kept constant for each test. Calcite precipitation in the control streams was monitored and compared to the treated streams and deposition plates were used to quantify observations. Sampling was conducted twice a week to test for chemistry changes in the water, specifically cadmium and phosphorus. Cadmium is a constituent of interest in the Elk Valley Water Quality Plan and previous test work demonstrated that it co-precipitates with calcite. Phosphorus concentrations were of concern as the water is nutrient-limited, and increasing phosphorus can potentially cause eutrophication. The project followed the proposed test plan **(Table 3.1)** in terms of dates and dosages.

Table 3.1 Test Plan for 2015 Calcite Pilot

	Stream 1	**Stream 2**	**Stream 3**
Test 1 Dates	August 12 – August 27		
Test 1 Antiscalant/Objective	GE Prevent	Kroff Prevent	Control
Test 1 Dosage (mg/L)	5.0	3.0	n/a
Test 2 Dates	August 28 – September 12		
Test 2 Antiscalant/Objective	Control	Nalco Prevent	Kroff Removal
Test 2 Dosage (mg/L)	n/a	4.0	6.0
Test 3 Dates	September 13 – September 26		
Test 3 Antiscalant/Objective	GE Removal	Control	Nalco Removal
Test 3 Dosage (mg/L)	10.0	n/a	15.0

One major change in the test plan was increasing the concentration of the Nalco antiscalant for the calcite removal test. The Nalco representatives recommended increasing the dosage of Nalco antiscalant for the removal test from 10 mg/L to 25 mg/L. After completing a Management of Change (MOC) analysis, it was decided to increase the antiscalant dosage from 10 mg/L to 15 mg/L. Keeping the dosage at 15 mg/L kept the dosage in a comparable range to the other antiscalants used for the removal tests. Additionally, the co-precipitation of cadmium with calcite was being studied and increasing the dosage of antiscalant risked reducing the cadmium concentration removed in the discharge water. **Table 3.1** shows the final test schedule for the 2015 calcite pilot program. The objective for the test, either prevention or removal, is listed after the antiscalant name (example: Nalco Prevent identifies the test where Nalco antiscalant was used to prevent calcite precipitation).

3.3 Schedule

Table 3.2 shows the calcite pilot project schedule that was followed during the planning phase.

Table 3.2 The 2015 CMO Calcite Pilot Project Planning Schedule

Date	Milestone
March 1 – April 1	Preparation of appropriation requisition (AR) and necessary permits
April 1st	Site Tour conducted at CMO to meet with site contacts and review the pilot site
April 14th	AR submitted for project funding
May 13th	The pilot plant was approved by Ministry of Energy and Mines (MEM)
May 27th	Appropriation Requisition (AR) approved
May 28th	Construction contracts awarded to West Kootenay Mechanical and Chinook Scaffold.
June 17th	Site tour conducted at Coal Mountain Operations with construction and scaffold contractors.
June 25th	Approval granted from Ministry of Environment (MOE) to discharge pilot plant effluent to surface water at CMO
June 1st – July 1st	Development of the technical test plan and safety training matrix
July 1 – July 31st	Preparation of engineered drawings of pilot plant by AMEC

3.4 Site Preparation

The 2015 calcite pilot plant was constructed in the same general area as the 2013 pilot on the CMO property just north of Corbin Pond. The key activities for the site setup included levelling the site and moving two shipping containers, constructing the scaffold, and setting up the Corbin Pond pump. The equipment within the shipping container was reused from the 2013 pilot project. The acid make-up area and associated tanks were converted for potable water and antiscalant use. **Figure 3.1** shows the location of the pilot with regards to the CMO main offices and **Figure 3.2** shows the general layout of the pilot plant. The site was 0.5 km from the mine office and was accessed by driving up the East Access road.

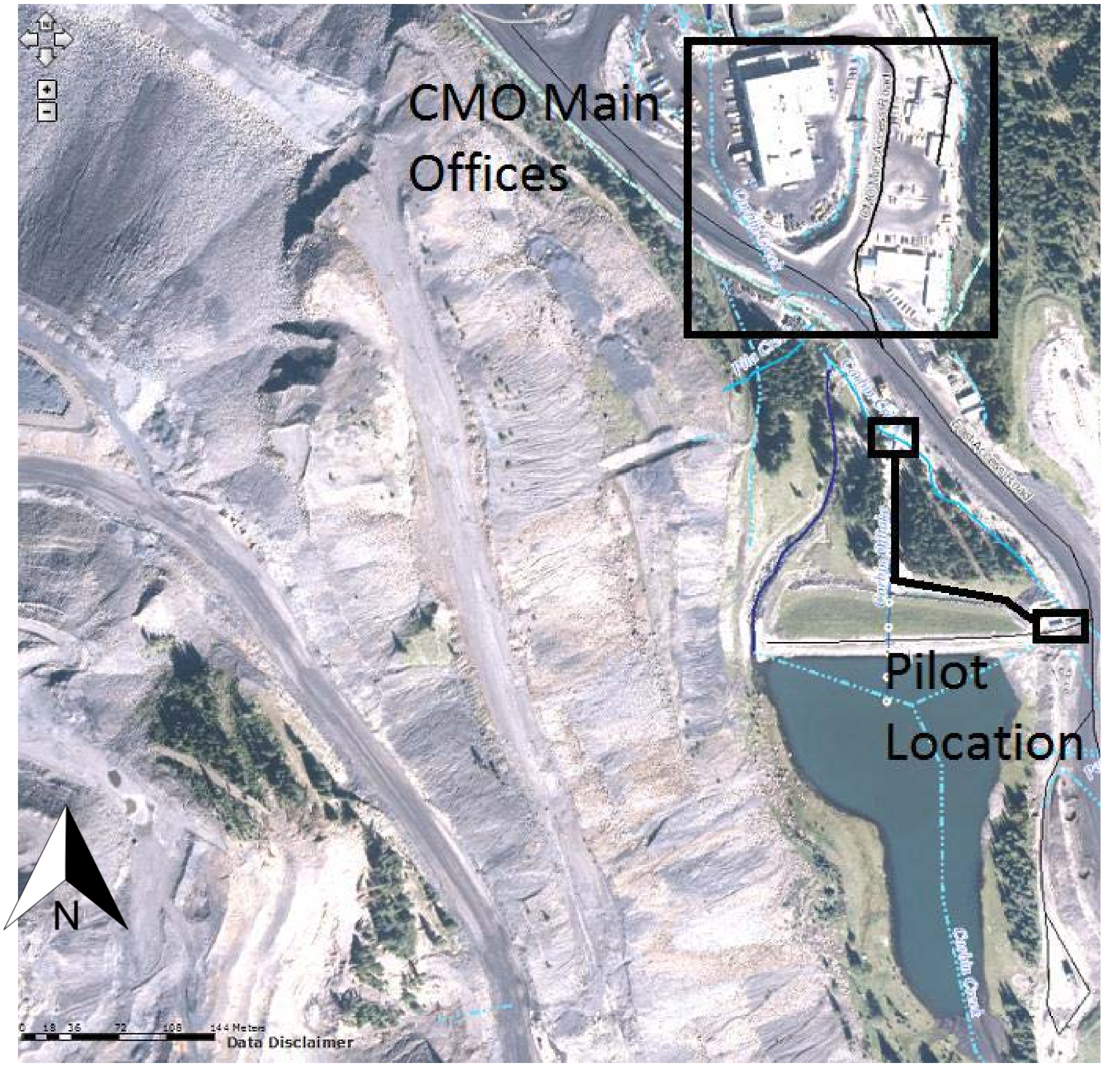


Figure 3.1 Calcite pilot location at CMO

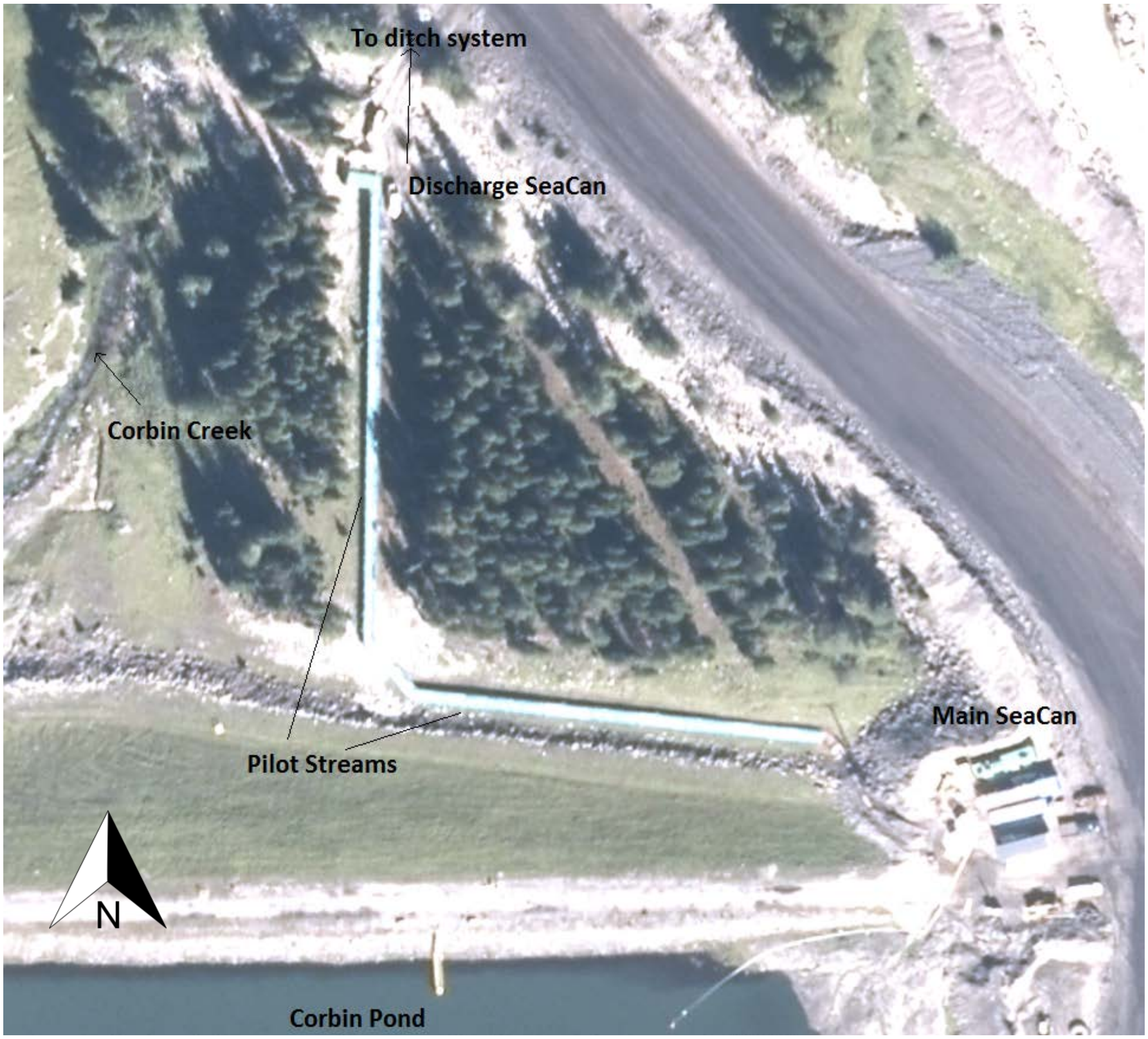


Figure 3.2 General layout of the calcite pilot plant. This photo depicts the 2013 pilot.

4 Operation

Construction of the 2015 calcite pilot plant was from July 6th to July 15th. The plant was commissioned on July 15th and July 16th. The plant was vacated for two weeks as CMO underwent a site shutdown. Operations began at the pilot plant on August 10th and ran until September 26th. The plant was then decommissioned and demobilized. There were no First Aid treatments during any phase of the project, nor were there any reportable spills to ground.

4.1 Pilot Plant Description

The equipment used for the program had been in storage at the Pengelly Laydown area of CMO and was lifted into place at the pilot site where it was inspected, cleaned, and assembled. Approximately 300 m^3 of Corbin Pond water was ran through the pilot plant daily. The effluent water was collected in discharge tanks before being directed by two pumps to the CMO main interceptor sedimentation pond system (PE-4750 site reference #E102488). The composition of the effluent changed throughout the course of the pilot plant based on which tests were being conducted. **Figure 4.1** shows a process flow diagram of the system, using stream #1. The process flow diagram of the entire system is in the DQO **(Appendix B)**.

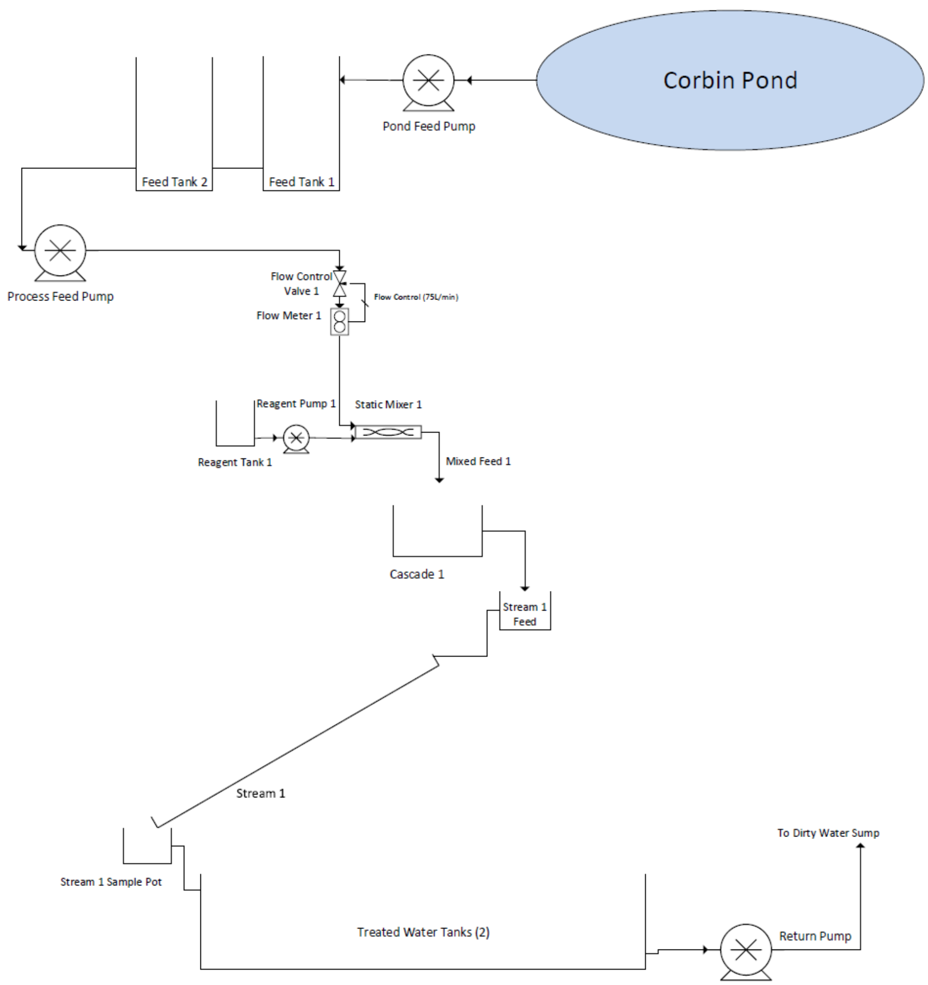


Figure 4.1 Process Flow Diagram of one stream

4.1.1 Pilot Feed

The calcite pilot plant was fed from Corbin Pond. A submersible pump located in Corbin Pond and two centrifugal pumps located in the process seacan pumped water through a 3” PVC pipe from the pond into two feed tanks situated west of the process seacan (**Figure 4.2**). Level sensors located in the feed tanks controlled the feed and booster pumps. The level set points were entered into the process seacan programmable logic controller (PLC) so that the pumps would turn on when the water level dropped to 20% of tank capacity and off when the water level reached 80% of tank capacity.

Figure 4.2 Corbin Pond and feed tanks outside of the process seacan

4.1.2 Process Seacan

The pond water was pumped from the feed tanks to the process seacan (**Figure 4.3**) through a 2” PVC pipe using two magnetically-coupled centrifugal pumps. The feed pipe then split the water into three streams, each of which was equipped with a flow control valve and meter. The target flow was set to 75 L/min for each stream. After the flow meter, the water passed through an inline mixer where antiscalant solution could be introduced. The control train did not receive an addition of antiscalant. **Figure 4.4** shows the stream 2 process control valve and inline mixer.

Figure 4.3 The interior of the process seacan

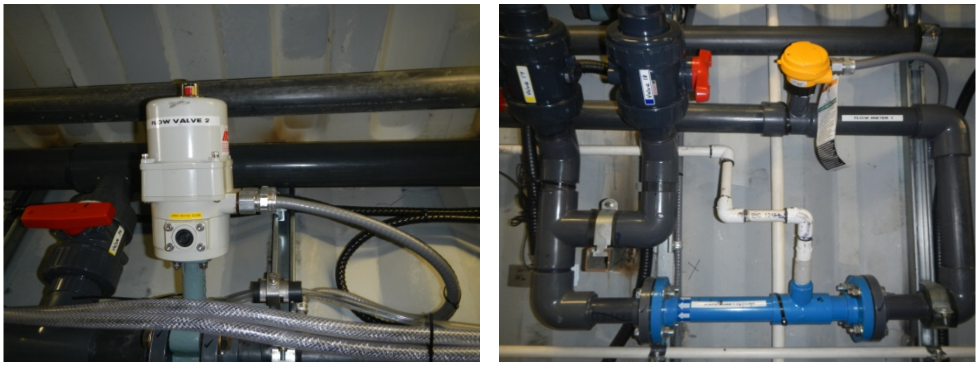


Figure 4.4 Process flow control valve (left); process flow meter and inline mixer (right)

From the inline mixer, the water flowed through a PVC pipe to a cascade. The PVC pipe was 6” in diameter and slowed the flow of water before it entered the cascade. Each cascade contained a V-notch weir to promote off-gassing of carbon dioxide [*Bayler et al, 2001*]. Water flowed out of the cascade and collected into cascade tanks that gravity fed the pilot streams (**Figure 4.5**).

Figure 4.5 Cascades located in the process seacan

4.1.3 Pilot Streams

Water was gravity fed into the pilot streams from the process seacan through 2” hoses. The 175 meter long pilot streams were made from 12” PVC pipe cut lengthwise **(Figures 4.6** and **4.7**). Rocks were placed throughout the pilot streams to provide stream-like conditions and encourage calcite precipitation. Weirs were installed between sections of pipe in areas where the scaffold slope was steep to increase the retention time of the water and to further promote off-gassing of CO_2. Water testing was performed to ensure that all leaks were repaired prior to turning on any reagents

Figure 4.6 Top sections of pilot streams (left) and final legs of pilot streams (right)

Figure 4.7 Full view of pilot streams

Unglazed ceramic tiles were used as deposition tiles. These tiles **(Figure 4.8)** were placed in various sections of each pilot stream as a method of quantifying calcite deposition or removal for each test. The deposition tiles were dried and weighed at the end of each test. Deposition tiles that gained mass in the control streams were moved to the removal test streams to verify whether the antiscalant was able to the remove the precipitate.

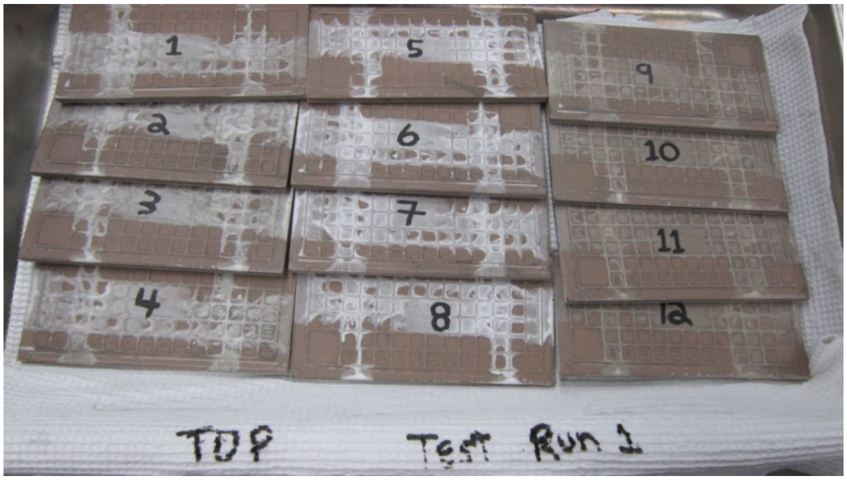


Figure 4.8 Deposition tiles after being exposed to the stream

4.1.4 Discharge Seacan

At the end of each pilot stream water flowed into sampling tanks that overflowed into two discharge tanks. To limit the extent of a spill in the case of a process failure, a flow switch was located between the sampling and discharge tanks and would stop the process if no flow was detected for 10 minutes. The discharge tanks were sized to contain all three stream volumes in case there was an emergency shutdown. The discharge pumps were controlled by level sensors in the discharge pumps. A monitoring pH probe was located between the discharge tanks and the discharge pumps and would stop the process if the pH of the discharge exceeded 9.0, which was the discharge permit limit for the pilot plant. Low pH alarm was not considered as the products were alkaline in nature.

4.1.5 Nalco Remote Deposition Monitor

Nalco's Remote Deposition Monitor (RDM) was installed in the discharge seacan. Water was pumped directly from a Nalco-treated or control stream to the RDM through a 1" hose. Water flowed through the RDM and was returned to the appropriate sampling tank. The required flow of water to the RDM was 5 gallons/minute which was supplied by a dedicated pump. A representative from Nalco came to site every Wednesday to download the information from the instrument for analysis.

4.1.6 Antiscalant Solution

Each vendor provided a recommended dosage to treat the influent water for the prevention and removal of calcite deposition. Due to the low flow that would be required if the antiscalants were used as received, each antiscalant was diluted in the process seacan reagent tanks (**Figure 4.9**). This allowed the reagent pumps to run at a higher (and more accurate) rate to treat the influent water. Potable water was delivered to site and stored in tanks. This water was pumped into the reagent tanks to make up the antiscalant solutions. **Table 4.1** shows the dilution factors of the antiscalant solutions used and the addition rate of the solution to Corbin Pond water.

Table 4.1 – Reagent flow rates and dilution factors used to treat Corbin Pond Water						
	Kroff		Nalco		GE	
	Prevent	Remove	Prevent	Remove	Prevent	Remove
Specific Gravity (g/mL)	1.32		1.17		1.22	
Recommended dose (mg/L)	3.00	6.00	4.00	15.00	5.00	10.0
(mL/L)	0.00227	0.00455	0.00342	0.0128	0.00410	0.00820
Corbin Pond Feed Flow Rate (L/min)	75	75	75	75	75	75
Flow rate of Antiscalant (mL/min)	0.170	0.341	0.256	0.962	0.307	0.615
Dilution Factor	100	75	75	25	50	40
Flow rate of Diluted Antiscalant (mL/min)	17.0	25.6	19.2	24.0	15.4	24.6

Figure 4.9 Antiscalant reagent tank and reagent pump

The flow rates of the reagent pumps were set in the PLC and tested prior to each test. The volume of reagent in the tanks was measured each morning to verify that the proper volume of reagent was consumed and the pumps were calibrated as needed.

4.2 Schedule

Table 4.2 details the calcite pilot project's Execution phase.

Table 4.2 The 2015 CMO Calcite Pilot Project Execution Timeline

Date	Task
July 6th – 15th	Construction of the Calcite Pilot Plant
July 15-17th	Commissioning of the Calcite Pilot Plant
July 21st – August 3rd	CMO Shutdown
August 4th	Submersible pump installed in Corbin Pond as a supplement to the feed pumps
August 10th	Pilot equipment water-tested after sitting idle during CMO shutdown; first test reagents mixed; Nalco's RDM installed in the discharge seacan.
August 12th	Deposition tiles placed throughout pilot streams. Kroff Prevention and GE Prevention tests commence (Test 1).
August 13th	Biweekly sampling campaign commences
August 14th	Electrical storm caused 2 hour power outage at pilot plant. Plant down for two hours.
August 15th	Electrical storm overnight caused power outage at pilot plant. Plant down overnight.
August 19th	First evidence of calcite precipitation on walls of control stream.
August 20th	CMO required power outage in order to complete an electrical tie-in at Corbin Dam. Power outage lasted approximately 8 hours. The lack of water in the pilot streams led to a large volume of coal dust collecting in the streams.
August 23rd	Calcite flakes appeared in the control stream.
August 26th	Nalco representatives visit site and recommend increasing the dosage for Nalco Removal.
August 27th	Deposition tiles removed from streams. End of Test 1. Plant shutdown for reagent change. Reagent tanks cleaned and second set of reagents mixed.
August 28th	WKM onsite to repair stream leaks and to install spare discharge pump.
August 29th	Deposition tiles returned to the pilot streams; Nalco Prevention and Kroff Removal tests commence (Test 2).
September 6th	First visual evidence of calcite flaking off from the walls of the Kroff dissolve stream
September 9th	Management of Change prepared to increase Nalco Removal test dosage from 10 mg/L to 15 mg/L and submitted to ART.
September 11th	MOC approved to increase Nalco Dissolve test dosage from 10 mg/L to 15 mg/L.
September 12th	Deposition tiles removed from streams.
September 13th	End of Test 2. Plant shutdown for reagent change. Reagent tanks cleaned and third set of reagents mixed. GE Removal and Nalco Removal test commence (Test 3).
September 17th	First evidence of algae growth in pilot stream 3 (Nalco Removal test)
September 20th	Booster pump failure – plant down
September 21st	Apex Electrical adjusted overload on booster pump relay; plant restarted
September 23rd	Second booster pump failure. Plant down for 6 hours. CMO electrician replaced relay for booster pump.
September 26th	Third booster pump failure, feed pump damaged. End of Test 3.
September 28th	Deposition tiles removed from streams; Biweekly sampling campaign concludes.
September 29th - October 4th	Plant decommissioned and tanks drained
October 5-12th	Plant demobilized

4.3 Operating and Sampling Procedures

The calcite pilot plant ran continuously, 24 hours/day (except as noted above), with operators on-site for a ten-hour shift each day. Each test lasted approximately 17 days and the dosage of antiscalant remained constant throughout each test. The shift consisted mainly of one operator per shift, with one crossover shift per week. The daily tasks at the calcite pilot plant included:

- Completing a toolbox talk and Take 5 risk assessment,
- Maintaining a safe work environment through housekeeping activities and safety tours,
- Maintaining plant controls based on the test plan,
- Monitoring process equipment,
- Troubleshooting any maintenance issues and either fixing or coordinating the fix for the issue,
- Sampling of one test train daily and conducting field measurements,
- Submitting and shipping samples to external laboratories,
- Making up antiscalant solutions as required,
- Collecting deposition tile data as required, and
- Completing a daily report with updates on safety, observations, data summary, and test plan progress.

One test train was sampled each day for field measurements. Field measurements were:

- Temperature
- pH – using an Oakton pH11 Series Meter
- Conductivity – using an Oakton Conductivity Meter
- $O_{2\ dis}$ – using an Extech DO meter
- $CO_{2\ dis}$, alkalinity, hardness – using HACH digital titrator kits
- Nitrate – using a HACH colourimeter kit

A small field laboratory was set up in the process seacan for these analyses (**Figure 4.10**). A tote of deionized water was shipped from ART to be used for the analyses. The majority of waste generated from the field laboratory was collected in a separate tote and removed by Terrapure at the completion of the project. Waste from the hardness and nitrate analyses were collected in separate containers due to the presence of EDTA and trace cadmium in their respective HACH kits.

Figure 4.10 Field laboratory in process seacan

Each pilot stream was sampled twice per week for external analyses, which included anions and nutrients, dissolved metals, total organic carbon, and other constituents. Toxicity samples were collected three times per test from the bottom of each pilot stream in addition to samples taken for MOE requirements (see section 4.4). All external samples were sent to ALS Environmental in Burnaby with quality control duplicates sent to AGAT Laboratories in Calgary and toxicity duplicates sent to HydroQual Laboratories in Calgary. The sampling plan can be found in **Appendix C**.

4.4 MOE Reporting

The MOE discharge authorization PE4750 for the calcite pilot plant is attached in **Appendix D**. Samples were collected weekly or biweekly for the parameters outlined in the permit. Acute toxicity testing was conducted monthly on the pilot plant effluent samples using single concentration toxicity tests for rainbow trout (96 h) and *Daphnia Magna* (48 h). All data received from MOE samples was provided to CMO to upload into the EQUIS database. The three sample locations for MOE reporting are given in **Table 4.2.**

Table 4.2 MOE monitoring locations and descriptions

Environmental Monitoring Site Number	Site Description and Location
E295092	Corbin Pond Influent via pipeline to Coal Mountain Pilot Calcite Treatment Plant
E295089	Coal Mountain Pilot Calcite Treatment Plant Effluent, discharge to Coal Mountain plant run-off water system via Main Sedimentation Pond to Corbin Creek
E102488	Main Sedimentation Pond Decant

4.5 Commissioning

Commissioning of the 2015 calcite pilot plant occurred directly after construction on July 16-17th. During commissioning, it was determined that the feed pumps were unable to provide the pilot plant with the volume of Corbin Pond water that was required to run the project. To continue with commissioning, West Kootenay Mechanical (WKM) personnel set up a portable water pump to fill the feed tanks and the plant was run manually. The plant sat idle for two weeks during CMO's summer shutdown, during which time a submersible booster pump was installed in Corbin Pond on August 4th.

ART personnel returned to CMO on August 10th to start the calcite pilot plant. WKM personnel also returned to repair leaks on the streams that occurred due to thermal expansion of the pipe sealant during the three weeks of sitting idle. The plant was water tested on automatic settings for two days prior to turning on the reagent pumps. Other activities that occurred during commissioning included:

- Utilizing the pre-startup checklist (**Appendix E**) to review construction for any deficiencies (guarding and electrical safeguards),
- Completing a full cleanout of all tanks in the process seacan using Corbin Pond water,
- Leak testing all pipes and process tanks with Corbin Pond water,
- Leak testing of pilot streams with Corbin Pond water,
- Testing all process pumps to ensure correct rotation of motors,
- Testing PLC control system in both auto and manual modes and entering the control system logic,
- Calibrating flow meters in process pipes and level sensors in feed/discharge tanks,
- Calibrating reagent pumps,
- Installing and testing the submersible booster pump in Corbin Pond to supplement the feed pumps, and
- Running the plant overnight with water and no personnel on-site.

4.6 Operational Challenges

As noted earlier, the major issue that was identified prior to startup was that the feed pump could not provide the plant with sufficient water to feed the pilot without a supplementary pump. Other operational challenges that occurred included:

- The flow sensors in the discharge seacan were not included on the PLC drawing and were not initially connected,
- The flow sensor switch at the bottom of pilot stream 1 would stick, prompting the system to shut down as it detected no flow,
- The pilot streams were close to the tree line allowing pine needles to drop into the pilot streams that affected the performance of the discharge pumps,
- The location of the pilot streams created steep slopes in some areas, leading to slipping hazards on cold days,
- The submersible booster pump installed in Corbin Pond, rated at 2 HP, was installed with a relay rated for 1 HP, causing the pump to fail, and
- The booster pump failed causing the feed pump to run dry and eventually fail, which ended the final test three days earlier than scheduled.

4.6.1 Flow Sensors

Three flow sensors were located in the discharge seacan between the sample pot and the discharge tanks. If no flow was detected after 10 minutes, the PLC would shut the process down. These flow sensors were not added to the drawings for the PLC and consequently were not connected during installation. Apex electricians diagnosed the issue on August 11th and completed the connection. Once connected, flow sensor #1 would cause the system to shut down unnecessarily. It was determined that the switch inside the sensor was sticking in the closed position. The unit was swapped with a new sensor on August 20th and spare sensors were purchased in case the fault occurred again.

4.6.2 Discharge Pump

The 2015 calcite pilot streams were installed closer to the tree line than in 2013. This provided more vehicular access to Corbin Dam for CMO personnel and also more access for crews erecting and demobilizing the pilot streams. This move created problems with the operation of the pilot because pine needles fell from the trees into the pilot streams and eventually reached the discharge pump. The discharge pump was replaced with the spare pump on August 28th as it had not been performing as expected, delivering low flow and having erratic operation. After removal, the pump was dismantled and pine needles were found to be blocking the impeller. The replacement pump was taken apart on September 6th as it started exhibiting erratic operation. Pine needles were again found to be causing a blockage **(Figure 4.11)**.

To prevent further blockages of the discharge pump, two sets of strainers were installed at the bottom of each pilot stream that were periodically cleaned by operators **(Figure 4.12)**.

Figure 4.11 Blockages of the discharge pump impeller on August 28 (left) and September 6 (right)

Figure 4.12 Strainers at the bottom of each stream

4.6.3 Pilot Stream Walkway

Installing the scaffold closer to the tree line proved to be beneficial for vehicular access but posed a safety issue that was not considered. The slope of the scaffold was steep in one area which created a slipping hazard on cold and wet mornings. Wherever possible, metal scaffold pieces were used in place of wood to provide better grip, but there was not enough of these pieces for the entire walkway. Anti-slip tape and metal mesh were stapled to the walkway in steep areas, providing some protection against slips. All visitors were made aware of this hazard during their calcite pilot plant site induction and were directed to use the handrail while on the walkway.

4.6.4 Pilot Feed Pumps

The submersible pump, installed to help the feed pumps provide the volume of water required to run the test work, performed adequately throughout the project. Towards the end of the project, the reliability of the booster pump started to decline and ultimately led to the test work finishing three days earlier than scheduled. On September 20th, the booster pump was found to be delivering no flow. Apex determined that the relay was tripped and it was reset. The overload threshold was found to be set too low and was adjusted to a more appropriate level. The pump failed again on August 23rd as the relay installed to run the two horsepower booster pump was undersized at one horsepower; the relay was replaced.

On August 26th the plant was down as the booster pump had tripped the relay. The relay was reset and the plant was turned on in manual mode to diagnose any issues. The booster pump turned on but the main feed pump had been damaged and water leaked onto the floor of the process seacan. The water collected in the safety shower containment area and was pumped out to the waste water tote.

The final tests (Nalco Dissolve and GE Dissolve) were terminated three days early based on the following considerations:

- The DQO set a decision rule that, if there were project delays or mechanical failures, the timeline would be evaluated and the priority would be placed on the preventive tests over the dissolution tests – the final test was a dissolution test,
- If the pump was replaced, there would only have been one additional day of test work based on the available resources, and
- The sampling campaign was complete for the final test.

4.7 Demobilization

The decommissioning and demobilization of the calcite pilot plant occurred from October 1-9th. A small gas-powered pump from ART was used to fill the feed tanks with Corbin Pond water and this water was used to clean the process tanks and run water through the system. All tanks were drained before WKM arrived on-site to dismantle the pilot.

No environmental or safety incidents occurred during the decommissioning and demobilization of the calcite pilot plant. The seacans, tanks, and piping were moved to a remote location at CMO for potential future use.

5 Results

The following section shows the most relevant results obtained in the pilot program. For the complete database of the information collected, refer to **Appendix F**.

5.1 General Comments

5.1.1 Safety

No environmental or safety incidents occurred during the construction, operation, or demobilization of the calcite pilot plant. The total number of man hours at the pilot site for the three stages of the project was 2300.

5.1.2 General Antiscalant Performance

All of the antiscalants tested during the pilot program were successful at preventing calcite deposition as shown in section 5.2 and forward. The sources of data were:

- Deposition tiles located inside the streams,
- Visual observations, and
- Water chemistry in three sample points (SP) as shown in **Figure 5.1**.

Figure 5.1 Sampling points locations in the pilot plant

The pH and CO_2 trends were consistent with 2013 pilot results, where the pH would increase along the pilot stream due to the carbon dioxide off-gassing (**Figure 5.2**). However, the control stream was the only stream that showed calcite deposition. This could be an indication that the antiscalant mechanism is as a crystal growth inhibitor that prevents calcite formation in the streams. The re-dissolution of calcite using a higher concentration of antiscalant yielded inconclusive results for all three types. However, flakes of calcite were observed in the streams indicating some type of effect in removing calcite.

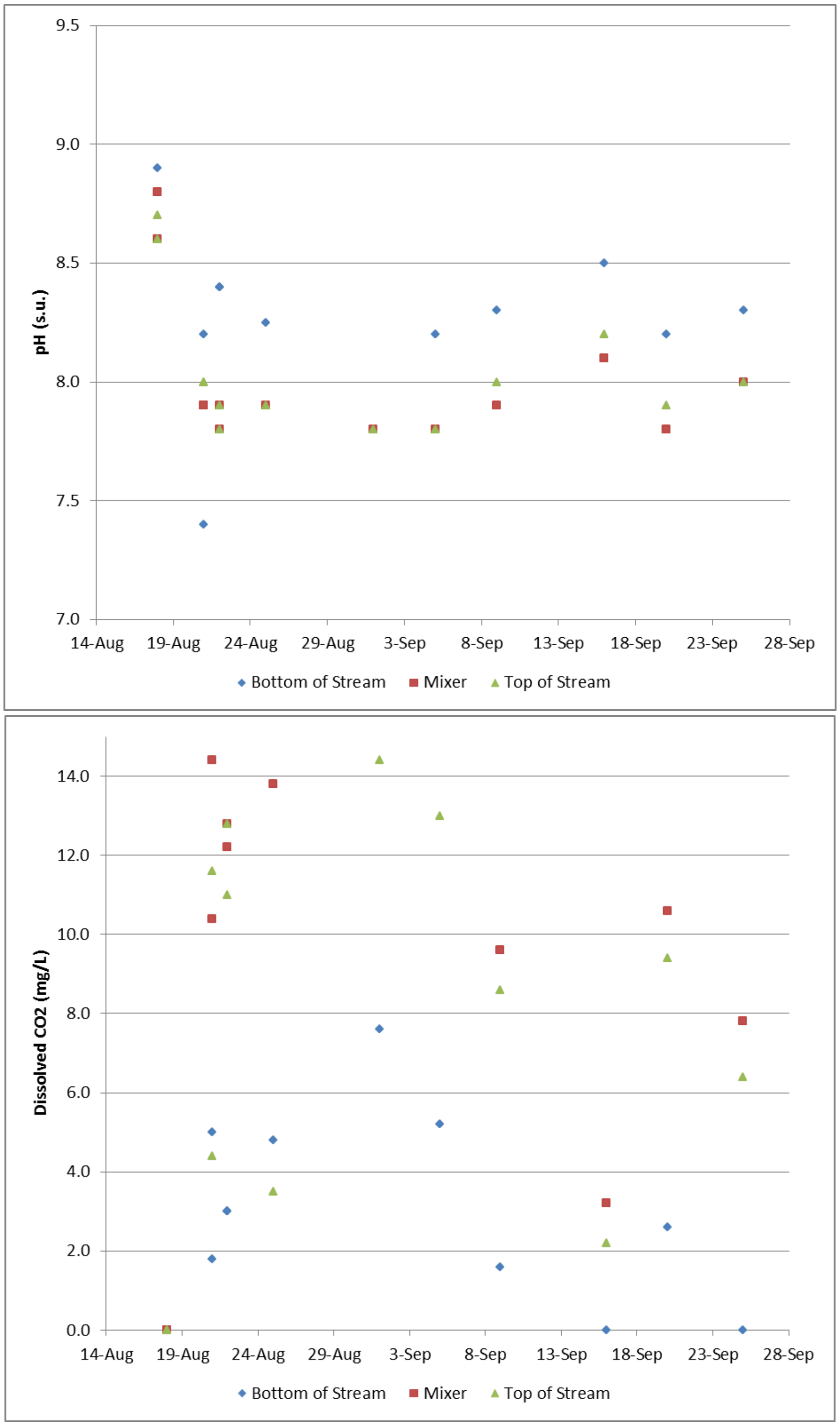


Figure 5.2 Dissolved CO_2 and pH trends in the control stream and different antiscalant tests

Total alkalinity did not vary significantly in the tested streams. Alkalinity reduction in the control stream occurred as expected. **Table 5.1** shows the alkalinity results during the pilot program.

Table 5.1 Calcite pilot project Alkalinity Results

Location	Test	8/13/2015	8/17/2015	8/20/2015	8/24/2015
Pilot Feed		344	351	341	342
Stream 1 Mixer	GE Prevent	356	353	364	367
Top of Stream 1		358	355	363	355
Bottom of Stream 1		362	356	368	356
Stream 2 Mixer	Kroff Prevent	356	353	362	359
Top of Stream 2		356	352	358	351
Bottom of Stream 2		360	357	365	355
Stream 3 Mixer	Control	353	351	352	357
Top of Stream 3		350	352	346	358
Bottom of Stream 3		323	325	320	325
Location	Test	8/31/2015	9/3/2015	9/7/2015	9/10/2015
Pilot Feed		356	341	360	345
Stream 1 Mixer	Control	357	341	366	359
Top of Stream 1		355	332	364	356
Bottom of Stream 1		333	319	335	315
Stream 2 Mixer	Nalco Prevent	367	371	364	372
Top of Stream 2		363	365	363	367
Bottom of Stream 2		362	368	363	370
Stream 3 Mixer	Kroff Removal	361	369	359	365
Top of Stream 3		361	368	359	371
Bottom of Stream 3		361	365	360	368
Location	Test	9/14/2015	9/17/2015	9/21/2015	9/24/2015
Pilot Feed		359	350	354	346
Stream 1 Mixer	GE Removal	364	374	378	376
Top of Stream 1		362	373	381	372
Bottom of Stream 1		370	371	377	376
Stream 2 Mixer	Control	367	360	344	348
Top of Stream 2		358	348	337	354
Bottom of Stream 2		339	330	314	335
Stream 3 Mixer	Nalco Removal	369	367	383	372
Top of Stream 3		369	372	382	372
Bottom of Stream 3		367	372	375	375

5.1.3 Toxicity

Toxicity samples were collected three times per test from the bottom of each pilot stream. Samples were sent to ALS and Nautilus laboratories where 96 hour single concentration toxicity tests for rainbow trout (*Oncorhynchus mykiss)* were conducted. All bottom of stream samples passed the toxicity tests with 0% mortality. Additional samples sent to Hydroqual confirmed the results obtained in the pilot. Additionally, samples from the pilot discharge (MOE sample point E295089) were collected and analyzed once a month during the highest dosage of operation. Toxicity for these samples was based on the 96 hour single concentration toxicity acute test for rainbow trout and the 48 hour single concentration acute toxicity test for *Daphnia Magna.* All pilot effluent samples passed the toxicity tests with 0% mortality for both species. **Table 5.2** details the results for both sets of toxicity samples.

Table 5.2 Calcite pilot project Toxicity Results

Date	Test	*Oncorhynchus mykiss* Survival (%)	*Daphnia Magna* Survival (%)
August 13	E295089 – Effluent	100	100
	GE Prevent	100	
	Kroff Prevent	100	
	Control	100	
August 20	GE Prevent	100	
	Kroff Prevent	100	
	Control	100	
August 24	GE Prevent	100	
	Kroff Prevent	100	
	Control	100	
September 3	E295089 – Effluent	100	100
	Nalco Prevent	100	
	Kroff Dissolve	100	
	Control	100	
September 7	Nalco Prevent	100	
	Kroff Dissolve	100	
	Control	100	
September 10	Nalco Prevent	100	
	Kroff Dissolve	100	
	Control	100	
September 17	Nalco Dissolve	100	
	GE Dissolve	100	
	Control	100	
September 21	Nalco Dissolve	100	
	GE Dissolve	100	
	Control	100	
September 24	Nalco Dissolve	100	
	GE Dissolve	100	
	Control	100	

5.1.4 External Factors affecting Calcite Precipitation

On August 20th, the power to the calcite pilot plant was shut off for 8.5 hours for Coal Mountain personnel to make an electrical tie-in at Corbin Dam. The power outage coincided with an active haul day down the East Access road. There was evidence of coal dust in the air that settled throughout the pilot streams. On August 23rd, large calcite flakes were found in the control stream. The coal dust may have acted as a seeding location for calcite crystallization. Another potential cause is that, during the power outage, the water in the control stream sat idle releasing CO_2 and raising the pH and saturation levels. The flakes were located close to the area that calcite was first observed precipitated on the pilot stream wall.

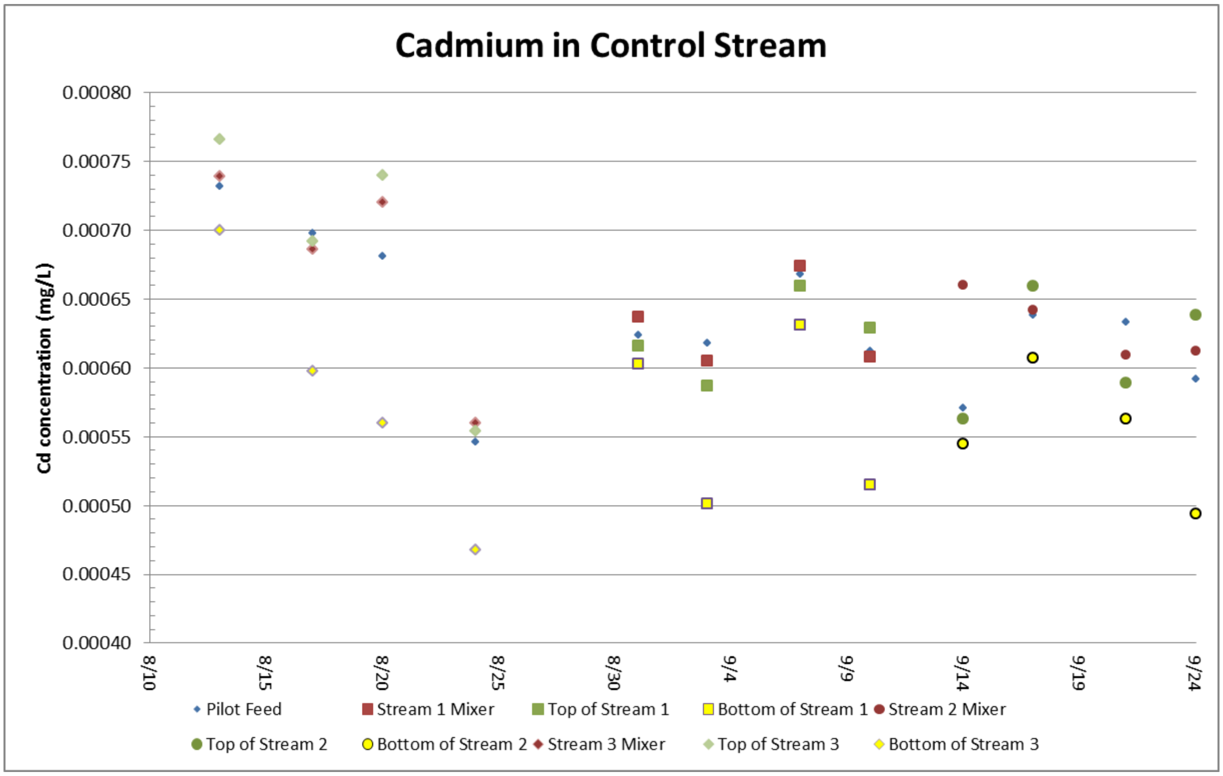
Figure 5.3 Calcite flakes seen on August 23, 2015 seeding on top of coal dust in Stream 3 (control stream)

On September 6th, the automated shutdown interlock was activated due to low flow and the plant was not operating upon operator arrival due to a low flow in stream #2. This could have been caused by a blockage or water freezing as the air temperature had dropped below freezing. Once the plant was running, large calcite flakes were observed to be detaching from the wall of the Kroff Dissolve test pilot stream walls. It is unknown if the flaking was due to the antiscalant or the probable freezing when the plant was not in operation. Calcite on the walls of the GE dissolve test stream also detached from the walls as witnessed on September 24th. The weather was warmer that week and had not dipped below freezing, which suggests that the antiscalant was breaking down the crystals.

5.2 Control Stream

The analysis and performance of the control stream was used to confirm and compare results obtained in the study. Calcite was observed on the walls of the control stream after nine days of the pilot plant start up. Days later, flakes were seen precipitated in the control stream on top of coal dust that had settled.

Figure 5.4 shows the changes in cadmium and phosphorus on the control stream over time. At the conclusion of each test, the control stream was changed (i.e. a test stream became a control stream). Hence, the potential of some cross contamination is possible, especially during the first days of the tests. Cadmium concentrations in Corbin Pond, the source water, ranged from 0.55 µg/L to 0.75 µg/L. The differences in concentrations between the mixer and top of the stream sampling points are within analytical error (see Appendix G for standard error calculation). While the difference in concentrations between Corbin Pond and bottom of the stream was as high as 0.1 µg/L. The change in concentration showed that up to 18% of the dissolved cadmium co-precipitated with calcite and an average of 11% removal. A key technical concern was the addition of phosphorus to the stream as phosphorus is a constituent of interest for MoE that has a discharge limit in active water treatment plants of 0.1 mg/l. Phosphorus concentrations in the control stream did not follow any particular trend. This could be in part because the concentrations very close to the detection limit of 0.002 mg/l. The rest of the water chemistry did not vary significantly in the control stream over time. The results and analysis from the deposition tiles are described in Section 5.6.



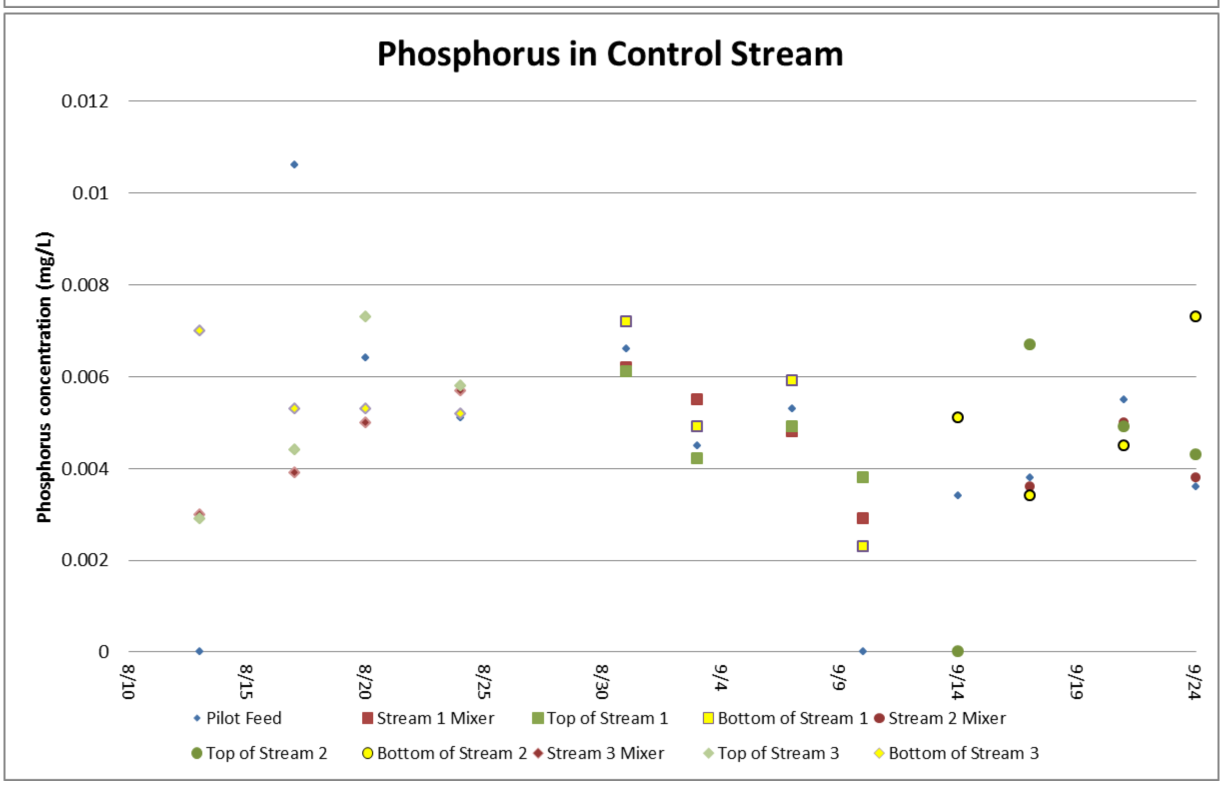


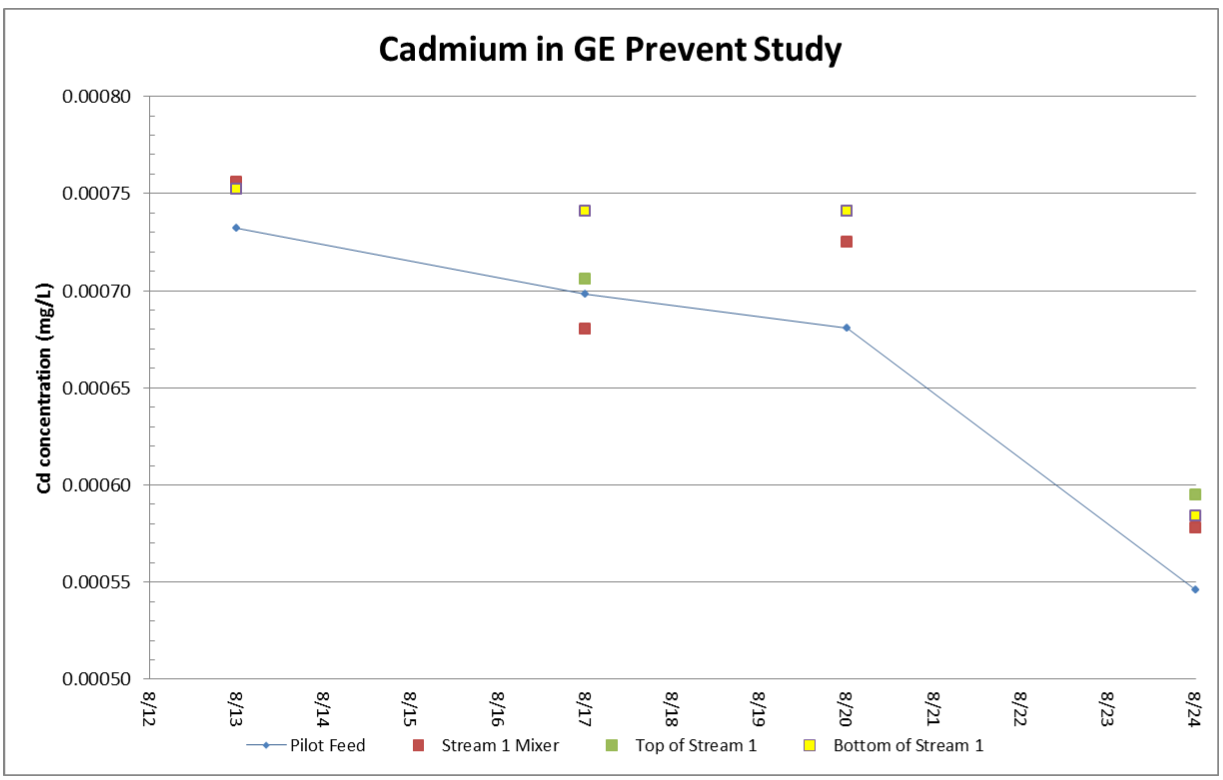
Figure 5.4 Control stream results for cadmium and phosphorus

5.3 GE Antiscalant

5.3.1 Prevention

GE Depositrol PY5206 yielded positive results in terms of calcite prevention and in the changes in water chemistry as shown in **Figure 5.5**. There was no change in cadmium concentration and calcite did not precipitate in the stream during GE Prevent test. Cadmium precipitation and calcite was present in the control stream during the same period of time. This difference was confirmed with the deposition tiles which are discussed later in the report. Similar to the control stream, the two elements of interest in the analysis were cadmium and phosphorus. There is not a clear pattern in the concentration of either element with respect to the feed concentration. During the duration of the test, phosphorus concentrations did not exceed 0.008 mg/l at the bottom of the stream.

There is minimal difference in the cadmium concentration between the bottom of the stream and the feed. Changes along the stream could be attributed to impurities in the rocks used to precipitate calcite or dust in the environment.



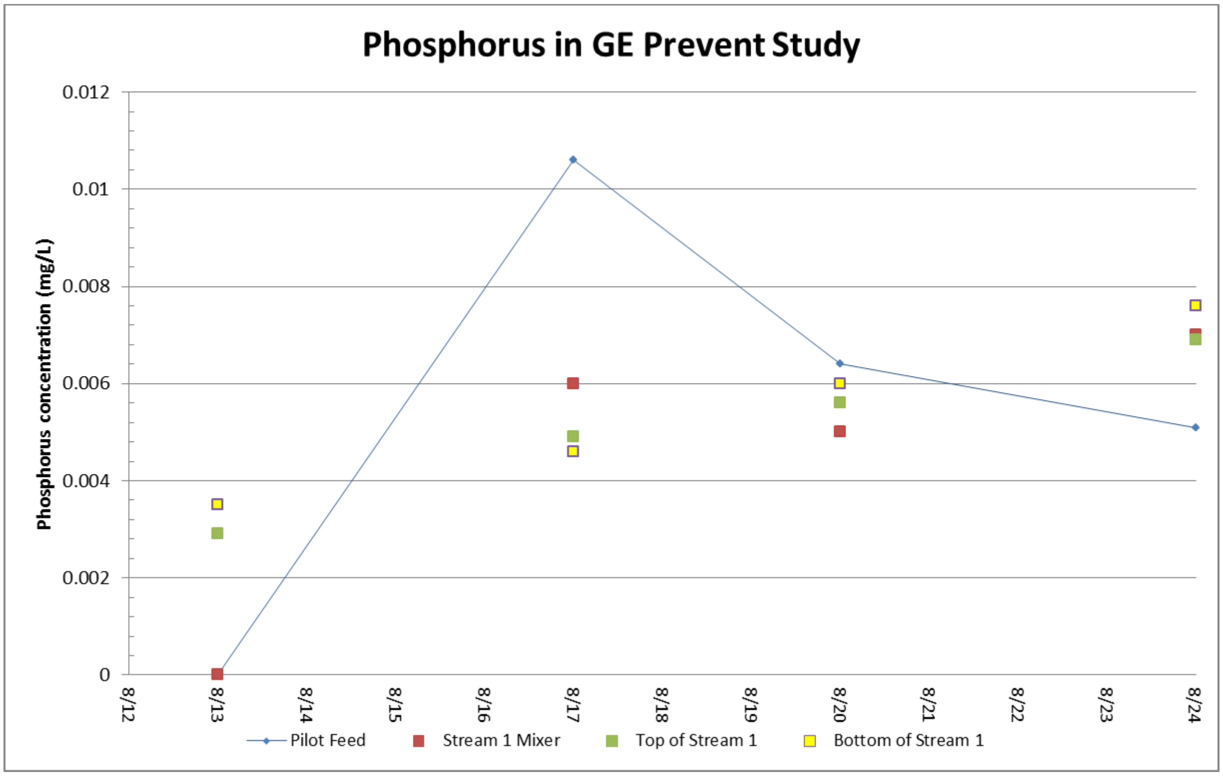


Figure 5.5 GE antiscalant results for prevention studies

5.3.2 Removal

The removal test was to determine if the antiscalant was capable of removing calcite already precipitated on the rocks and deposition tiles and to examine how the water chemistry changed. A higher concentration of antiscalant was used as explained in Section 4.3. Based on **Table 5.2**, where the data of deposition tiles is shown, the data do not support the hypothesis that the antiscalant at the dosages used in this test was effective in removing calcite from the tiles. The results of deposition tiles are discussed in more detail in Section 5.6. Phosphorus concentrations were higher at the beginning of the test possibly due to carry over from the previous test as phosphorus concentration did not increase during the last week of the experiment (before GE removal test, the chemical used was Kroff which contained a significant amount of phosphorus). The maximum phosphorus concentration was 0.008 mg/L, which was below the water quality guideline concentration of 0.1 mg/L as shown on **Figure 5.6**

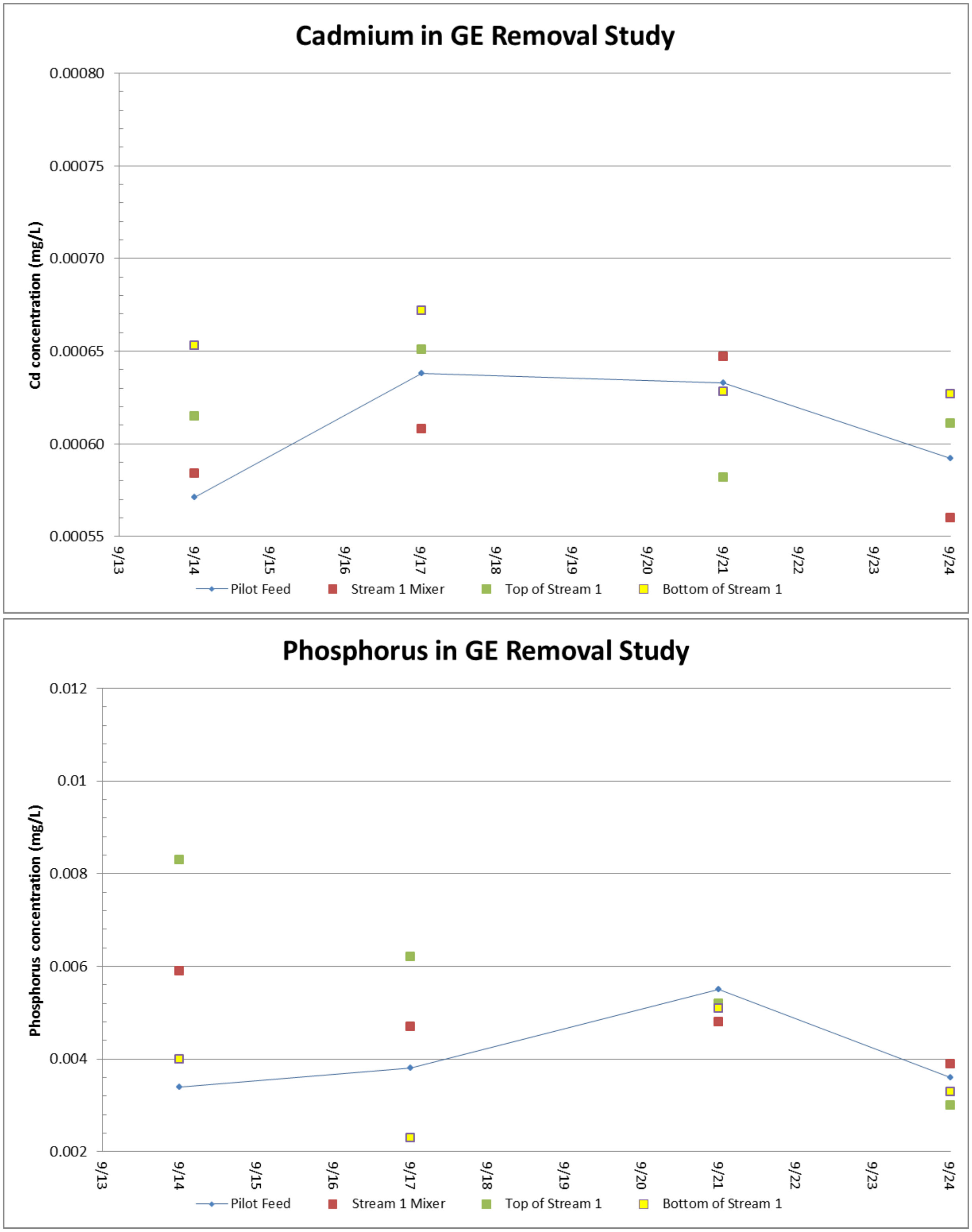


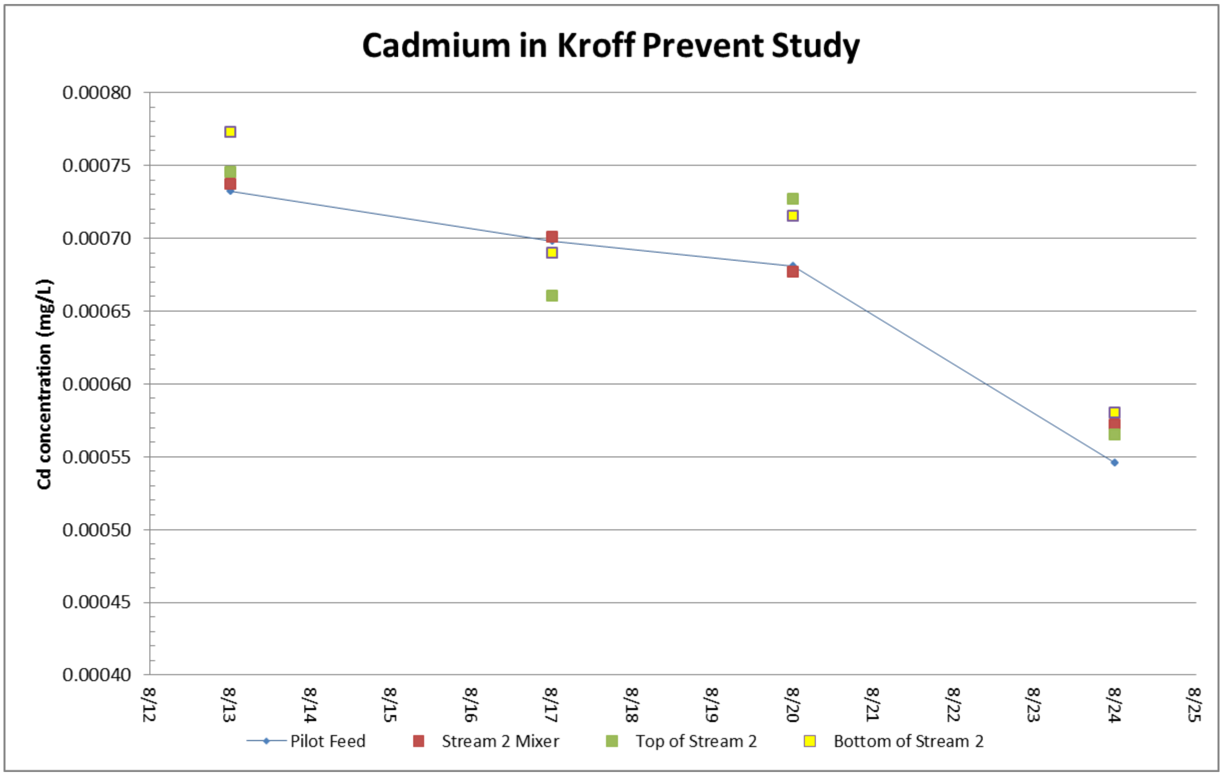
Figure 5.6 GE antiscalant results for removal studies

5.4 Kroff Antiscalant

5.4.1 Prevention

Based on the visual inspection of the pilot stream and data from deposition tiles, the use of Kroff KR-DP0168 antiscalant was successful in preventing calcite deposition. The control stream during the same period of the prevent study gained 0.9 g, most of which was expected to be calcite. Based on the results shown in **Appendix F**, Kroff antiscalant in the Prevent test added around 0.25 mg/L of total phosphorus.

Cadmium concentrations between feed and various sample points vary within 10% of each other, suggesting that cadmium was not being precipitated from the system. The results for both cadmium and phosphorus are shown in **Figure 5.7**



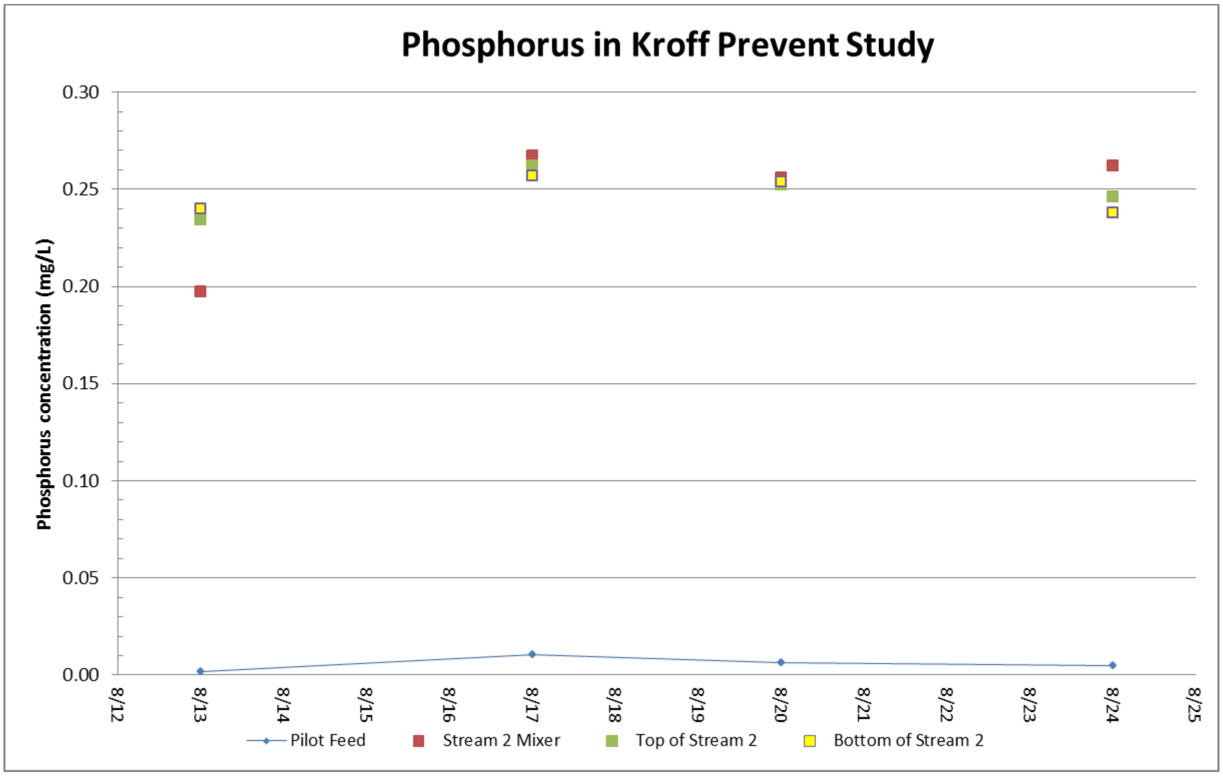
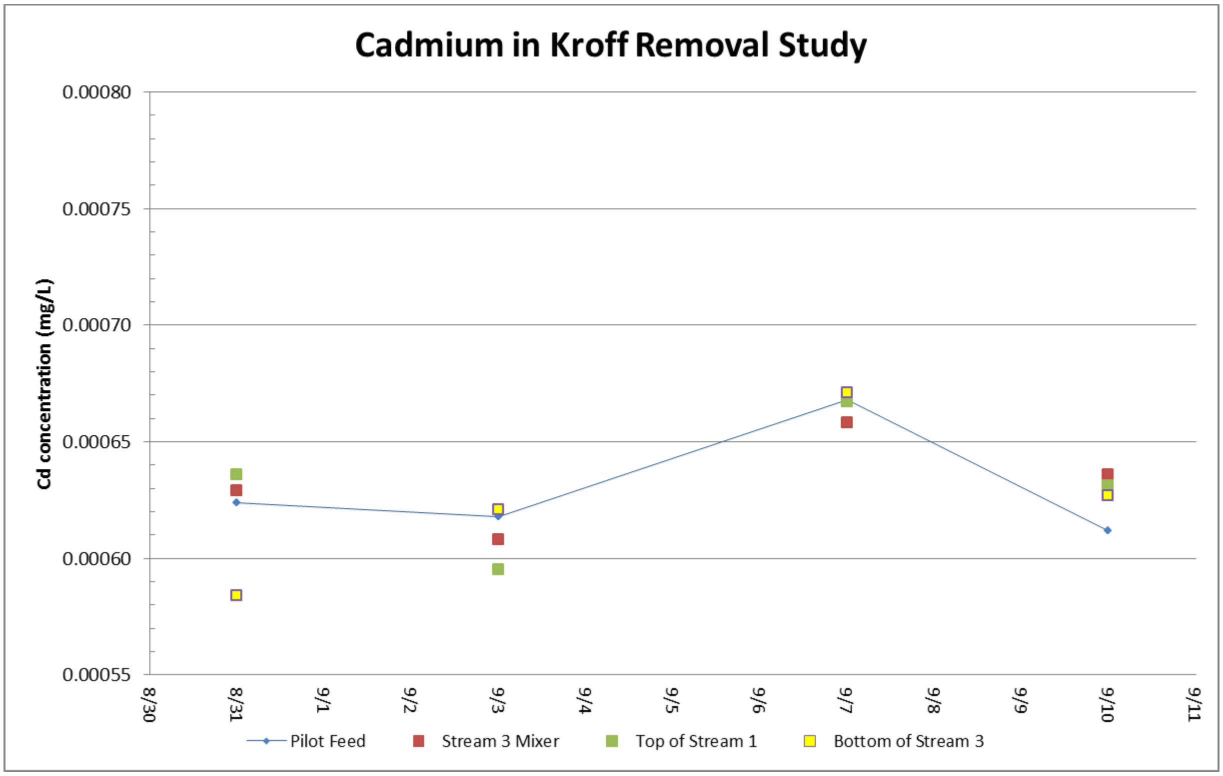


Figure 5.7 Kroff antiscalant results for prevention studies

5.4.2 Removal

The removal studies showed little evidence in water chemistry that suggests calcite dissolution. Visual inspections detected flakes breaking from the pilot stream rocks and walls that were identified as calcite. However, the presence of those flakes did not increase the concentration of cadmium in solution beyond measurement error, yielding only a maximum increment of 4 µg/L. The incremental increase in phosphorus concentration was on average 0.3 mg/L. **Figure 5.8** shows the results obtained during this study.



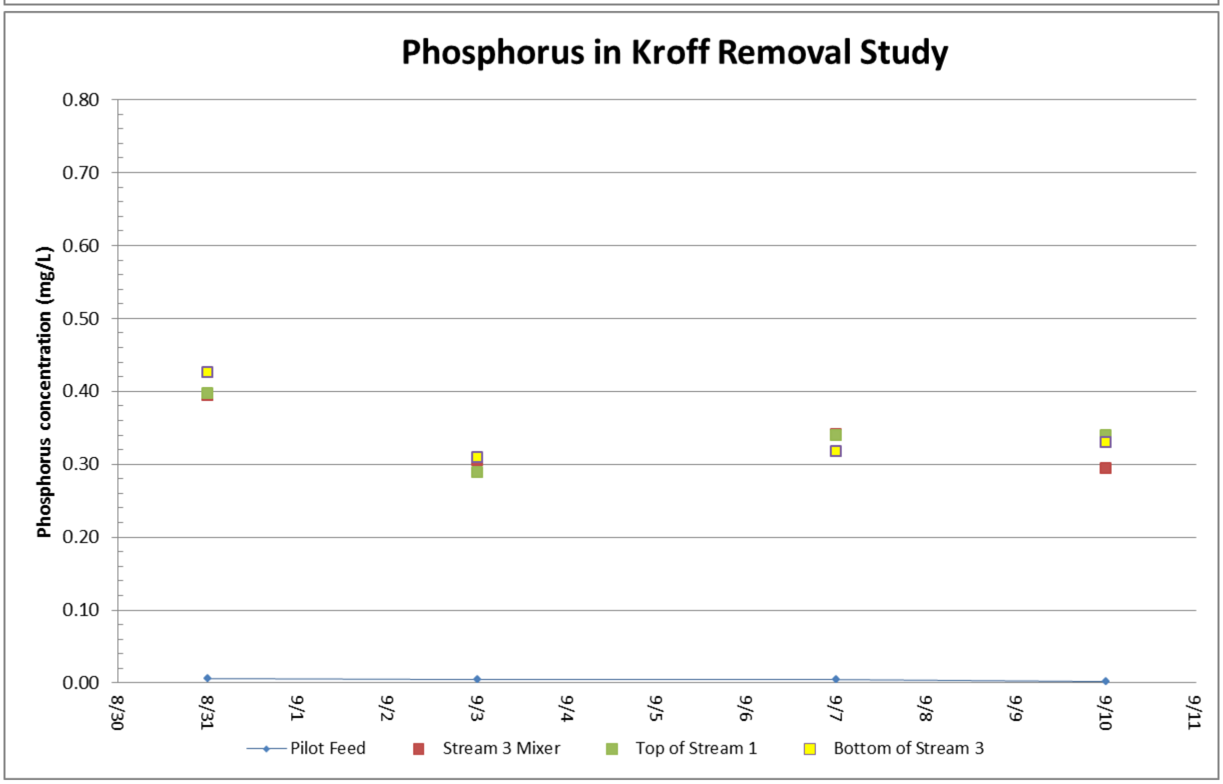
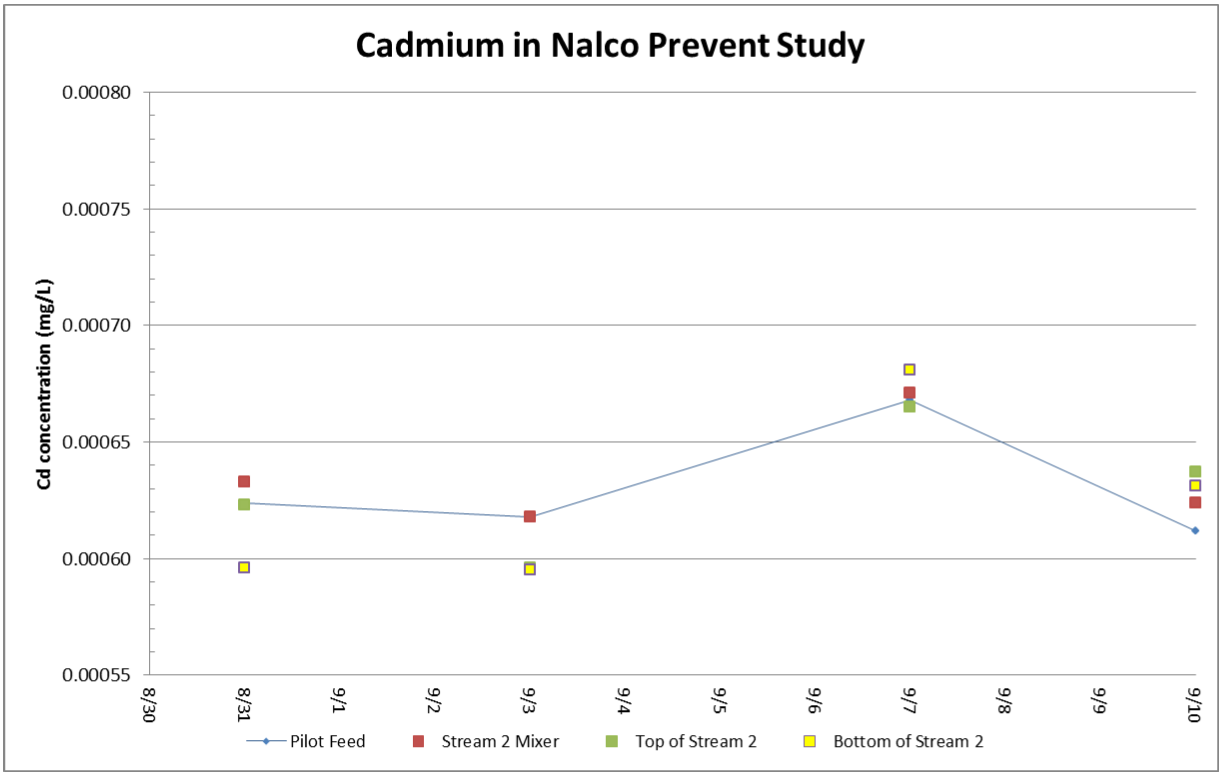


Figure 5.8 Kroff antiscalant results for removal studies

5.5 Nalco Antiscalant

5.5.1 Prevention

The results for the Nalco product were similar to the other two antiscalants. Calcite deposition was observed to be prevented in the pilot stream and the observation was confirmed by data from deposition tiles and water chemistry. **Figure 5.9** shows that the concentration of cadmium along the pilot stream was equivalent to the concentration at the feed. The amount of phosphorus added to the treated water was, on average, above 0.1 mg/L.



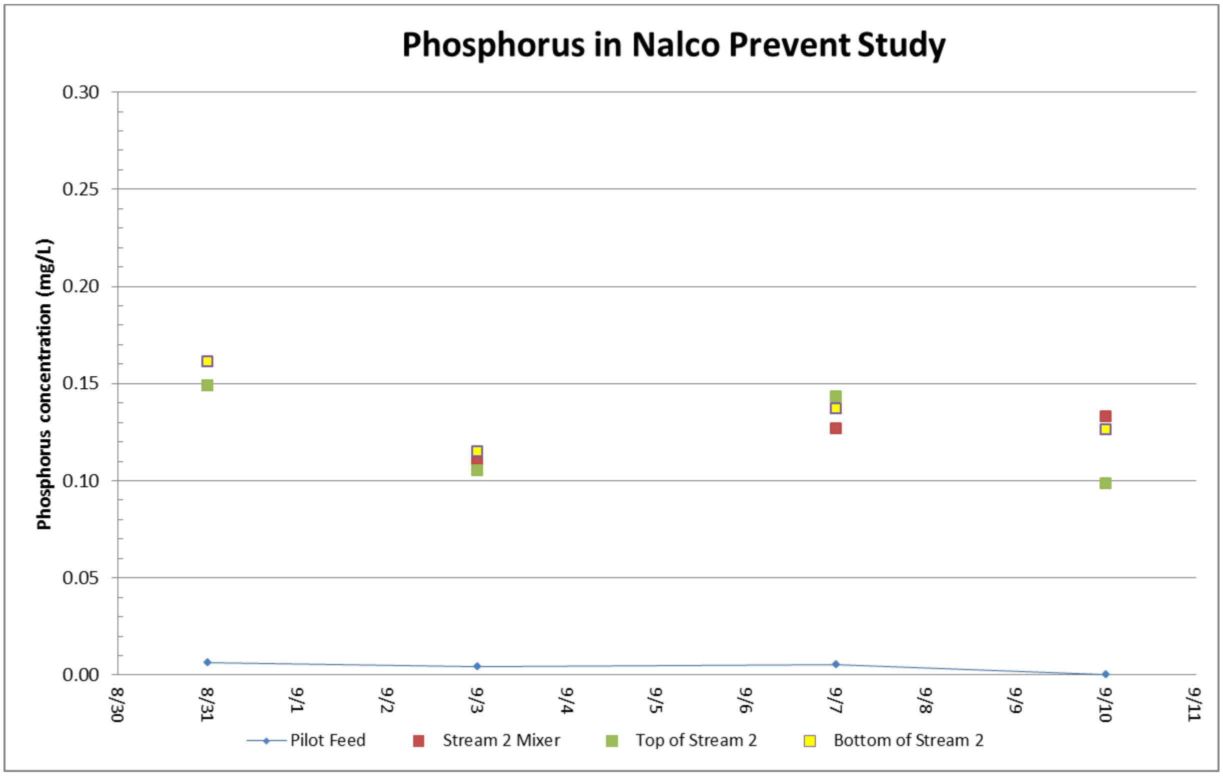
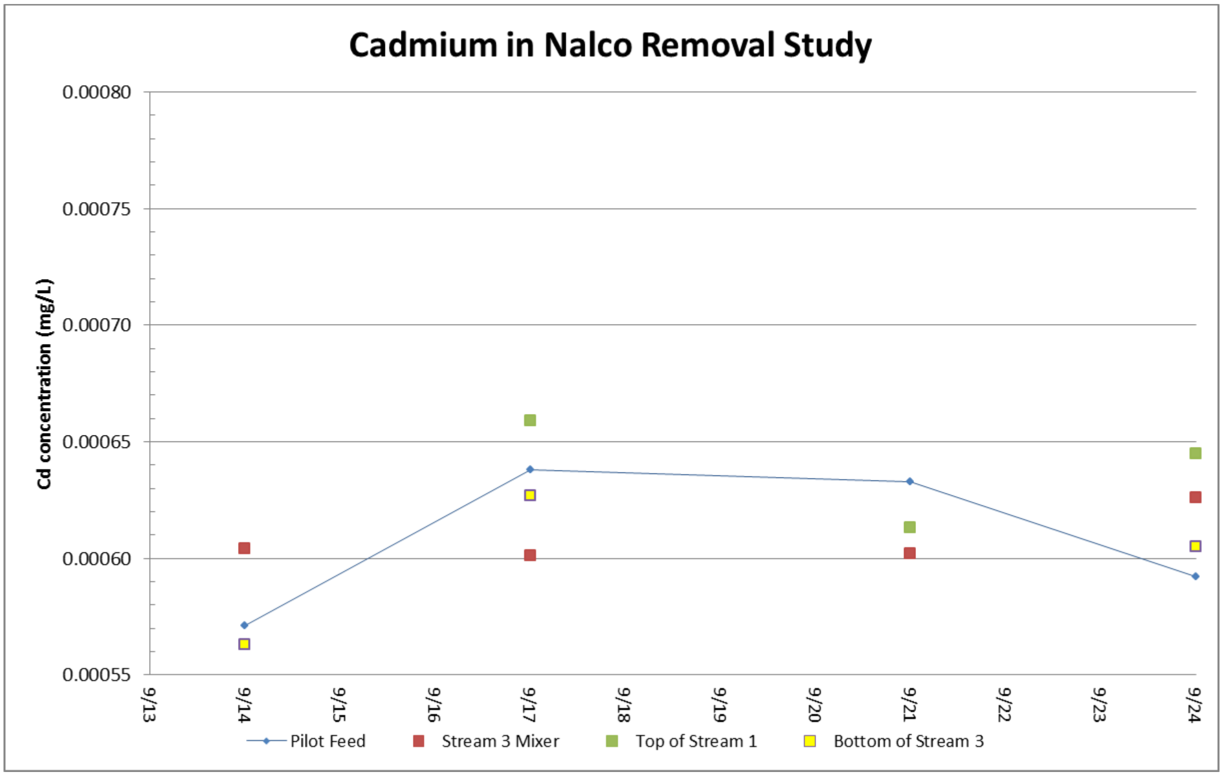


Figure 5.9 Nalco antiscalant results for prevention studies

5.5.2 Removal

The key result from the removal studies for the Nalco product was the inconclusive evidence for calcite removal from the stream. In addition, the amount of phosphorus added to the stream was, on average, above 0.6 mg/L as shown in **Figure 5.10**. This amount was twice the amount of phosphorus added in any other test by the other antiscalants hence eutrophication potential needs to be considered. Similar to the other products, there was little evidence of the effectiveness of the removal concentration; the only confirmation was the presence of some flakes in the pilot stream but neither deposition tiles nor water chemistry showed significant differences.



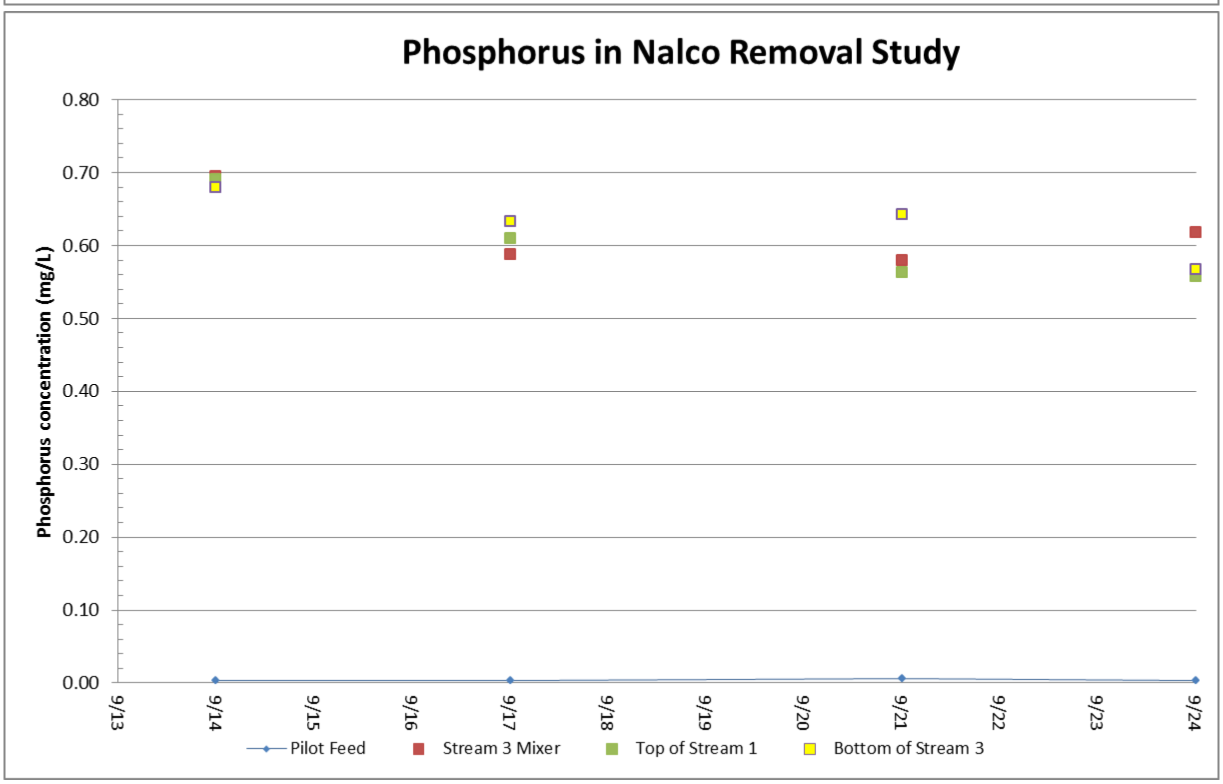


Figure 5.10 Nalco antiscalant results for Removal studies

5.5.3 Nalco Remote Deposition Monitor

Nalco's Remote Deposition Monitor (RDM) was installed in the discharge seacan and collected data from the bottom of the Nalco-treated streams or from the control stream. The RDM value shown on the instrument is a relative measure of scale present and the precipitation rate. The instrument is capable of providing real time measurements and can send alerts when the unit is alarming due to an increase in scale build up or a loss of flow. It was not possible to set the RDM up for real-time reporting as no cellular service was available at the site. Data were collected on a weekly basis and the report provided by Nalco is attached in **Appendix H**. The test report is consistent with physical observations made by plant operators. The period of no flow on the report is consistent with times that the pilot plant was not running.

During Test #1, the RDM was measuring the effluent from the control stream and the sensor was nearly blinded around August 26th. This is consistent with the amount of precipitation that occurred in the pilot stream after the power outage. The RDM values in the Nalco report increased with a steep slope during this period, indicating significant and rapid scale growth. The sensor and filter required cleaning as they were coated with scale.

During Tests #2 and 3, the RDM was monitoring streams being treated with Nalco's antiscalant product. The zero slope of the RDM values indicate that there was no scale growth and that the antiscalant was performing as expected. The zero slope also suggests that the antiscalant dosage could be optimized and possibly reduced.

5.6 Deposition Tiles

Unglazed ceramic tiles were inserted in the pilot streams and used to measure deposition. The tiles were left in the streams for the duration of each test. They were removed on the final day of the test, dried overnight, and then cooled and weighed. Tiles that previously gained mass in the control stream were moved into the removal test stream for subsequent tests. **Figure 5.11** shows the layout of the deposition tiles in the pilot streams. The observations of the control stream were consistent with those from the 2013 pilot, with the greatest amount of calcite precipitation occurring after the water travelled approximately 100 m down the pilot stream.

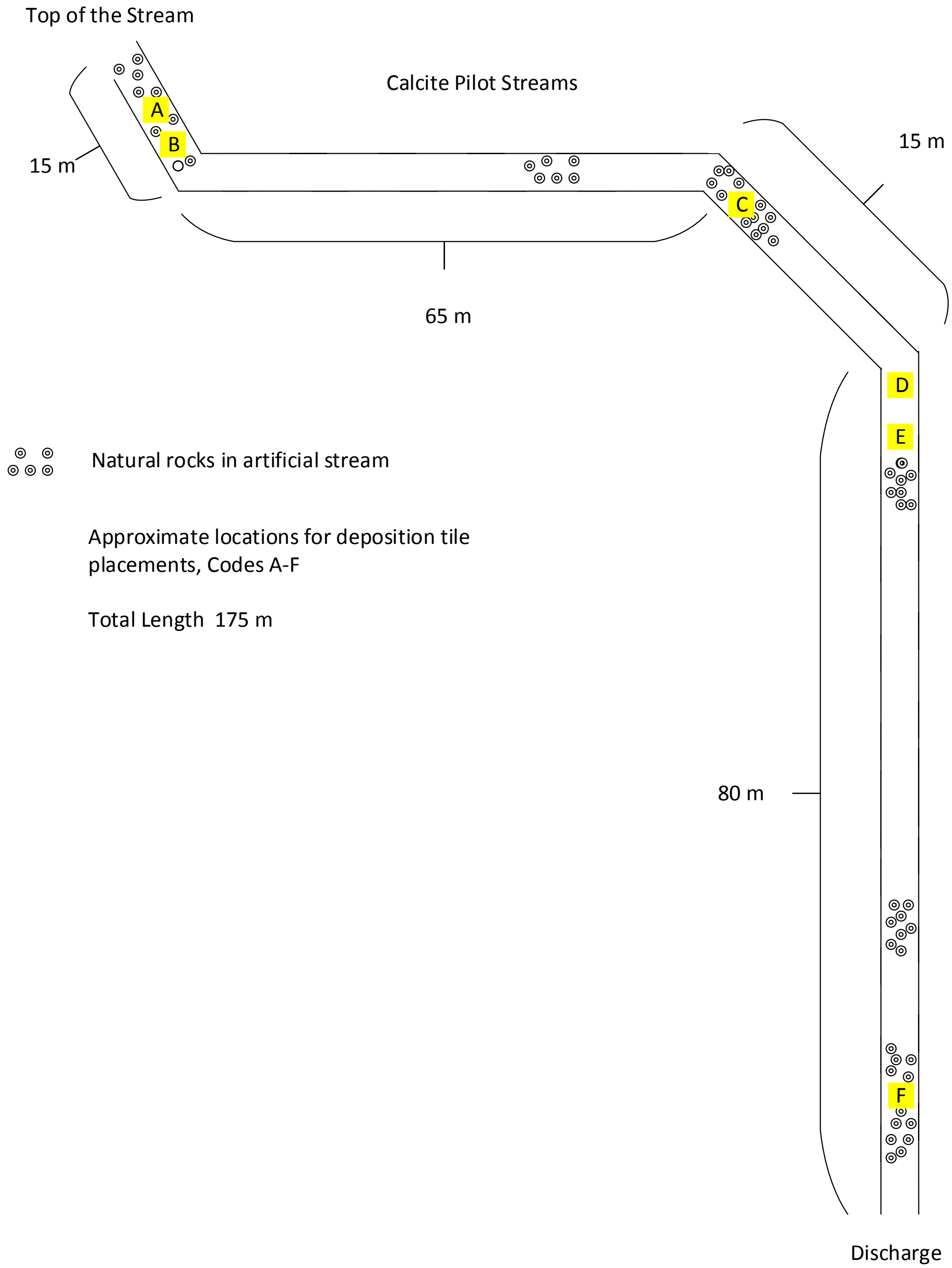


Figure 5.11 Deposition Tile Map

Test #1 showed the highest deposition growth on the tiles in the control stream, especially near the bottom of the stream as shown in **Table 5.3.** The deposition tile data for Test #1 is consistent with physical observations of calcite on the walls of the pilot streams and on the rocks placed in the control pilot stream. Calcite was first observed on the walls of the pilot streams just past tile location C.

Table 5.3 Deposition tiles results – August 12th to 27th

Tile Location	Stream #1 GE Prevent	Stream #2 Kroff Prevent	Stream #3 Control Stream	Comments
A	7.6	4.1	18.2	Exposure duration = 17 days
B	n/a	n/a	29.4	
C	5.3	3.5	44.7	
D	n/a	n/a	n/a	
E	n/a	n/a	85	Tile Location E exposed only for 8 days
F	8.2	2.4	131.8	
Average weight change per day (mg)	7.1	3.5	52.9	GE Prevent and Kroff Prevent results not significantly different from zero

The control results from Test #2 **(Table 5.4)** were consistent with Test #1, with the control stream tiles gaining an average of 27 mg/day, compared to 0.6 mg/day in the Nalco Prevent stream and 6.4 mg/day in the Kroff Removal stream. Some of the tiles locations are n/a because tiles were not installed in those positions during those tests. The Nalco Prevent and Kroff Removal results are within the analytical error of the balance used to weigh the tiles.

Table 5.4 Deposition tiles results – August 29th to September 11th

Tile Location	Stream #1 Control	Stream #2 Nalco Prevent	Stream #3 Kroff Dissolved	Comments
A	1.8	1.2	0.00	Exposure duration = 17 days
B	n/a	n/a	n/a	
C	4.7	-2.9	7.6	
D	33.5	n/a	14.1	
E	48.2	n/a	n/a	
F	47.6	2.4	4.7	
Average weight change per day (mg)	27	0.6	6.4	Nalco Prevent and Kroff Dissolved results not significantly different from zero

The tiles were exposed for a shorter period of time during Test #3 due to the plant shutting down early. The same pattern of calcite growth in the control stream continued during this period. The GE data show an average of 0.03 g being lost. This value is within the analytical error range of the balance, hence, it cannot be confirmed that dissolution is taking place.

Table 5.5 Deposition tiles results – September 13th to 26th

Tile Location	Stream #1 GE Dissolve	Stream #2 Control	Stream #3 Nalco Dissolve	Comments
A	-7.5	-5.8	-4.2	Exposure duration = 12 days
B	n/a	n/a	n/a	
C	0	25	5	
D	-3.3	88.3	14.1	
E	n/a	n/a	n/a	
F	-1.7	59.1	7.5	
Average weight change per day (mg)	-2.5	40.8	8.3	Dissolved results within analytical error

6 Discussion

The 2015 Calcite Pilot Program achieved the objectives defined in section 3.2. Calcite precipitation was prevented by the use of each of the three antiscalants tested; hence, the antiscalants provide a treatment option. The technical program identified changes in phosphorus and cadmium concentration as a result of antiscalant addition and/or calcite precipitation as an objective for understanding the potential effects on the streams. Another objective for the program was to test for acute toxicity of the antiscalants in the concentrations used. These objectives were accomplished as shown on the results presented in section 5.

The use of antiscalants provided some advantages compared to alkalinity reduction through acid addition. The amount of reagent added to the stream and changes in water chemistry are reduced using antiscalants. For acid addition, total organic carbon and chloride concentrations increased to close to water quality limits. On the other hand, antiscalants increased phosphorus concentration, and not with all products tested. Both technologies pass acute toxicity tests without any mortality in rainbow trout and daphnia magna.

6.1 Control Stream

Calcite precipitated in the control stream as expected within the first nine days of the pilot plant operation. The initial precipitation was observed on the pilot stream wall. Flakes appeared in the stream after an increase of suspended solids settled in the water due to external sources (see section 5.1.4). Precipitation on the rocks was observed a few days later.

Calcite precipitated in the control stream during the duration of the project, even when the control stream was changed every 17 days on average. However, the amount of precipitation varied with time as shown in the deposition tiles study. Precipitation was almost double on the first third of the project (early to mid-August) in comparison to the later stages (late August to September). This confirms the seasonal nature of calcite deposition and the need to incorporate seasonality into the treatment plant design. Part of this seasonal variation can be explained in the temperature of the feed water; the variation in the feed water temperature was 4^{o}C (from 12^{o}C on mid-August to 8^{o}C in late September), which is significant enough to affect the solubility of calcite.

In addition to temporal variations of calcite precipitation, there are also spatial variations. Limited calcite precipitation was observed in the first 75 meters, with maximum precipitation observed at around 100 meters. The amount of precipitation would then decrease and stabilize for the final 80 meters of the stream. These observations match the conceptual model for calcite formation, as excess carbon dioxide is off-gassed before calcite precipitates; this is supported by the alkalinity values that dropped on average 20 mg/L from the mid-section of the stream to the end part of the stream while alkalinity did not vary in the first section of the stream.

Similar to the 2013 campaign, the cadmium concentration decreased over the control stream as a result of co-precipitation with calcite, but the concentration trend along the length of the stream was different from the calcite precipitation trends. For cadmium, the major change in concentration was found at the end of the stream. A reason for this behavior could be that the off-gassing CO_2 slightly increased the pH of the water promoting the precipitation of the metal. On average, 11% of the cadmium was being removed by co-precipitation.

High phosphorus concentrations increase the potential for eutrophication. The data gathered in the pilot program showed that there is no significant difference between the phosphorus concentrations along the control stream. However, there could be an increase in phosphorous concentration as a result of adding two of the antiscalant (Nalco and Kroff).

6.2 Calcite Prevention

The performance evaluation of the antiscalants involves three components: presence of calcite in the stream, water chemistry changes, and toxicity effects at the working concentrations. Similar to the control stream, the tests lasted 17 days on average. As part of the evaluation, visual observations played an important role in the study. Each antiscalant prevented calcite precipitation as confirmed by the deposition tiles and by water chemistry. Additionally, none of the samples showed any toxicity effects on the species studied at the concentrations used.

The main differentiator between the three antiscalants was the phosphorus concentration. Phosphorus concentrations increased on average 0.13 mg/L for Nalco, 0.25 mg/L for Kroff, and 0.005 mg/L for GE. Other metals may have slightly increased in concentration (for example lead was in the range between 0.05 and 0.1 µg/L), but the changes are insignificant in comparison to water quality guidelines. Algae growth was observed during the transition period between Kroff Dissolve and Nalco Dissolve tests (September 17th). Both of these reagents have a high concentration of phosphorus and algae growth could be a consequence of one or both reagents and the test timeline.

Based on the change in alkalinity and dissolved carbon dioxide concentration, the calcite prevention mechanism is likely crystal inhibition as carbon dioxide concentrations decreased over the course of the stream but alkalinity remained constant. This shows that the bicarbonate ion remained in solution and it does not induce calcite precipitation, despite the shift in the reaction equilibrium. Antiscalants were even successful in preventing precipitation when extreme external factors such as increase in nucleation sites due to suspended solids occurred during the operation of the pilot plant. Such solids resulted in flakes developing in the control stream. These flakes were later confirmed as calcite via XRD.

Other than phosphorus, no other constituents of interest, such as total organic carbon and chloride, were modified by the addition of antiscalant. Cadmium did not show concentration changes outside of the analytical error of the method, indicating that the metal was not being precipitated in the test stream when compared to the control stream.

Table 6.1 shows a qualitative comparison of the antiscalants based on a pair by pair comparison of the products with the following criteria (when the boxes have the same color, there are no significant differences between the antiscalants):

1. Green: Best performance out of the three antiscalant s,

2. Yellow: Performance below green based on pair by pair comparison, and
3. Red: Performance below yellow based on pair by pair comparison.

Table 6.1 Antiscalants Comparison – Prevention Tests

Antiscalant	Prevents Calcite Precipitation?	No Phosphorus increase?
GE		
Kroff		
Nalco		

6.3 Calcite Removal

The performance evaluation of the antiscalants during the removal tests involved similar objectives as the prevention tests: removal of calcite on the stream, water chemistry changes, and toxicity effects at the working concentrations. Only one removal test lasted 17 days (Kroff) and the rest lasted 12 days due to challenges with the pilot plant operation. None of the samples showed any toxicity effects on the species studies at the concentrations used at the pilot plant.

The data from the calcite removal tests show very little change in mass of the deposition tiles (within analytical error of the balance) hence, the removal weight data is inconclusive. However, visual inspection of the stream identified flake material during the removal tests. This observation could indicate that the products do not dissolve the calcite precipitated on the rocks but breakdown crystals that allows the flakes to separate from the rock. These crystals carry on down the pilot streams as solids. This mechanism would also have very little change in the water chemistry as the calcite remains as a solid. The main difference in water chemistry is the phosphorus added by the different products, which was 0.3 and 0.6 mg/L for Kroff and Nalco respectively while the GE reagent did not add phosphorus

The only antiscalant that showed an increase in cadmium concentration is the GE product. However this change is only at the beginning of the stream and the concentration decreases along it. This could indicate that cadmium co-precipitates again in the stream. Another explanation is that the cadmium can be attached to the suspended solids (flakes) that are deposited on the stream. The same trend was found for the low concentration of phosphorus in the stream.

Overall, the results for the removal tests are a good starting point to understand the remediation efficiency of the products and confirm the expected removal mechanisms. Additional information such as flake composition and stability would be helpful in determining the pathway of the suspended solids created and potential effects on the environment. Since calcite removal was not measurable on the deposition tiles but was observed on the rocks, it will be important to determine if the shape, surface area or energy at impact has an effect on the removal.

Table 6.2 shows a qualitative comparison of the antiscalant based on the criteria explained in section 6.2.

Table 6.2 Antiscalant Comparison – Removal Tests

Antiscalant	Result in Calcite Removal?	No Phosphorus increase?
GE		
Kroff		
Nalco		

6.4 Additional Observations

During the course of the pilot, there were visual and practical observations that are difficult to quantify and/or evaluate. Inspecting the deposition tiles showed that the GE product provided a smoother and cleaner final surface than the other two antiscalants. Additionally, the Nalco product presented a characteristic odor during the dilution of the product. The field assessment indicated that the smell was not of concern; however, it was unpleasant for a brief period of time and could result in concerns from by operators.

Based on the selection criteria set up for the project and the results from the pilot plant, the ranking of antiscalants for further use as a means to control calcite deposition is GE > Kroff > Nalco.

7 Recommendations

The recommendations for the calcite pilot project are divided in two groups: Technical and Operational. A complete lessons learned document can be found in **Appendix I.**

7.1 Technical

- The recommended antiscalant to advance for pre-feasibility study is GE Depositrol PY5206. Further optimization work can be developed during a future study or following implementation.
- RDM equipment is useful in identifying calcite precipitation. An on-stream test for a year could document the seasonality of the precipitation and optimize treatment. Currently, the vendor (Nalco) is only interested in supplying their equipment in conjunction with supply of their product.
- Evaluation of TSS control is recommended for future removal testing.
- Chronic toxicity tests should be performed on the selected antiscalant with source water and expected concentrations

7.2 Operational

- Several modifications and improvements for the equipment were identified and documented on **Appendix I**. These recommendations will be useful for any future pilot work and full-scale implementation

8 References

Baylar, A.; Bagatur, T.; Tuna, A., 2001. “Aeration Performance of Triangular Notch Weirs at Recirculating Systems”, Water Quality Resource Journal, *Volume 36*, Issue 1, 121-132

McIntyre, E.; Franklin, I.; Jenkin, J.; Main, K.; Miranda-Trevino, JC. 2014. “Calcite Pilot Plant: Treatment of Corbin Creek at Coal Mountain Operations”, ART Report
2013RR34, Issued February 21, 2014.

9 Appendices

Appendix A

Daphnia Magna 48 hr LC50 @ 60mg/L Kroff antiscalant:

Maxxam

RESULTS OF *DAPHNIA MAGNA* 48 HR LC50 W/DILUTION

Success Through Science®

Client : 5323 Teck Metals Ltd., TRAIL

Client Project Name & Number:

Job Number: B439247

Sample Number: JP8796-01

Test Result:

48 hrs LC50 % vol/vol (95% CL): >100% (N/A) Statistical Method: Visual

Sample Name : EVO KRT

Description:	clear			**Sample Prior to Analysis:**	
Sample Collected:	May 13, 2014	Sampling Method :	N/A	pH:	7.6
Sample Collected By:	N/A	Site Collection:	N/A	Temperature :	20.0 °C
Sample Received:	May 15, 2014 09:00 AM	Volume Received:	1 x 1LP	Dissolved Oxygen:	9.9 mg/L
Analysis Start :	May 16, 2014 03:10 PM	Temp.Upon Arrival:	12 °C	Sample Conductance:	1293 µS/cm^2
End :	May 18, 2014 02:28 PM	Storage:	1-7 °C	Hardness:	780 mg $CaCO_3$/L

Concentration	Temperature (°C)	Temperature (°C)	Dissolved Oxygen (mg/L)	Dissolved Oxygen (mg/L)	pH	pH	Conductivity uS/cm^2	Mortality (#)	Mortality (%)	Immobility (#)
% vol/vol	Initial	48 hrs	Initial	48 hrs	Initial	48 hrs	Initial	48 hrs	48 hrs	48 hrs
0	20.8	19.8	8.5	8.9	8.0	8.3	342	0	0	0
6.25	20.6	19.8	9.0	8.9	8.0	8.2	397	0	0	0
12.5	20.6	19.9	9.0	9.0	8.0	8.2	444	0	0	0
25	20.5	20.0	9.0	8.9	8.0	8.2	553	0	0	0
50	20.5	20.0	9.0	8.9	7.9	8.3	783	0	0	0
100	20.3	20.1	9.0	8.9	7.9	8.4	1283	0	0	0

Comments : All neonates appeared and behaved normally.

Culture/Control/Dilution Water: Reconstituted Water-Moderately Hard

Hardness (EDTA Method): 104 mg/L $CaCO_3$ Other parameters available on request.

Test Conditions Test concentration : 0,6.25,12.5,25,50,100 (% vol/vol)

Organisms per Vessel :	10	Pre-aeration Time :	10 min	Rate of Pre-aeration :	25-50 mL/min/L
Total # of Organisms Used :	60	Test Temperature :	20 ± 2 °C	Test Hardness Adjusted :	No
Test Volume :	185 mL	Vessel Volume :	200 mL	Test pH Adjusted:	No
Loading Density :	18.5 mL/Daphnia	Photoperiod :	16:8 (light: dark)		

Test Organism :	*Daphnia magna*	Source :	Aquatic Biosystems
Age at Test Initiation :	<24 hrs	Average Brood Size :	28.0
Culture Photoperiod :	16:8 (light: dark)	% Mortality within 7 days :	4.9
Culture Temperature :	20 ± 2 °C	Time To First Brood :	9 Days
Culture Diet	2.5ml algae + 2.5 ml YCT; Sun. 1.25 ml algae + 1.25ml YCT.		

Reference chemical:	Zinc	Test Date:	May 06, 2014
Test Endpoint 48 hrs LC50 (95% confidence interval) :	0.43 (0.23, 0.68) mg/L	Statistical Method :	Probit
Historical Mean LC50 (warning limits) :	0.60 (0.25, 1.44) mg/L	Concentration :	0,0.05,0.1,0.5,1,5,10 mg/L

Test Method Maxxam's BBY2SOP-00007 based on Environment Canada's EPS/RM/14, 2nd Ed., 2000.

Method Deviations: None.

Note: The results contained in this report refer only to the testing of the sample submitted. This report may not be reproduced, except in its entirety, without the written aprroval of the laboratory.

Analyst : Michael Armstrong

Verified By : Pam Howes, Study Director

Date: May 21, 2014 01:41 PM

Rainbow Trout 96 hr LC50 @ 60 mg/L Kroff antiscalant:

Maxxam

RESULTS OF RAINBOW TROUT 96 HR LC50 @ 100%

Success Through Science®

Client : 5323 Teck Metals Ltd., TRAIL — Job Number: B439247

Client Project Name & Number: EVO LAB TESTS

Test Result:

96 hrs LC50 % vol/vol (95% CL): >100 (N/A) Statistical Method: Visual

Sample Name : EVO KRT

Description:	clear, colourless			Sample Number:	JP8796-01
Sample Collected:	May 13, 2014	Sampling Method :	N/A	Site Collection:	N/A
Sample Collected By:	N/A	Volume Received:	1 x 1LP	Temp.Upon Arrival:	12 °C Storage: 1-7 °C
Sample Received:	May 15, 2014 09:00 AM	pH:	7.6	Dissolved Oxygen:	10.2 mg/L
Analysis Start :	May 18, 2014 12:55 PM	Temperature :	14.0 °C	Sample Conductance:	1050 µS/cm [2]

Concentration	Temperature (°C)	Temperature (°C)	Dissolved Oxygen (mg/L)	Dissolved Oxygen (mg/L)	pH	pH	Conductivity uS/cm²	Mortality (#)	Mortality (%)	Atypical Behaviour (#)
% vol/vol	Initial	96 hrs	Initial	96 hrs	Initial	96 hrs	Initial	96 hrs	96 hrs	96 hrs
0	14.7	15.3	10.0	9.6	7.7	7.5	39	0	0	0
100	14.1	15.2	10.3	9.6	7.7	8.4	1052	0	0	0

Comments : All fish appeared and behaved normally during the test.

Culture/Control/Dilution Water Burnaby Municipal Dechlorinated Water

Hardness (EDTA Method): 23 mg/L $CaCO_3$ Other parameters available on request.

Test Conditions Test concentration : 0,100 (% vol/vol)

Organisms per Vessel :	10	Test Temperature :	15 ± 1 °C	Solution Depth :	>15 cm
Total # of Organisms Used :	20	Pre-aeration Time :	30 min.	Rate of Pre-aeration :	6.5±1 mL/min/L
Test Volume :	18 L	Vessel Volume :	20L	Test pH Adjusted:	No
Loading Density :	0.44 g/L	Photoperiod :	16:8 (light: dark)		

Test Organism : Rainbow Trout *(Oncorhynchus mykiss)* Source : Miracle Springs Inc.

Culture Temperature :	15 ± 2 °C	Weight (Mean) +- SD :	0.80 ± 0.17 g	Length (Mean) +- SD :	4.61 ± 0.29 cm
Culture Water Renewal :	≥ 1L/min/kg fish	Weight (Range) :	0.53 – 1.25 g	Length (Range) :	4.10 – 5.30 cm
Culture Photoperiod :	16:8 (light: dark)			% Mortality within 7 days :	0%

Feeding rate and frequency : daily: 1-5% biomass of trout.

Reference chemical: Zinc — Test Date: May 13, 2014

Test Endpoint 96 hrs LC50 (95% confidence interval) : 0.07 (0.06, 0.09) mg/L — Statistical Method : Untrimmed Spearman-Kärber

Historical Mean LC50 (warning limits) : 0.11 (0.05, 0.23) mg/L — Concentration : 0,0.04,0.08,0.16,0.32,0.64 mg/L

Test Method Maxxam's BBY2SOP-00004. This method also follows EPS 1/RM/13 as a primary reference.

Method Deviations : None.

Note: The results contained in this report refer only to the testing of the sample submitted. This report may not be reproduced, except in its entirety, without the written aprroval of the laboratory.

Analyst : Michael Brassil

Verified By : Pam Howes, Study Director — Date: May 26, 2014 10:11 AM

Daphnia Magna 48 hr LC50 @ 60 mg/L Nalco antiscalant:

RESULTS OF *DAPHNIA MAGNA* 48 HR LC50 W/DILUTION

Maxxam — Success Through Science®

Client : 5323 Teck Metals Ltd., TRAIL

Job Number: B439247

Client Project Name & Number:

Sample Number: JP8797-01

Test Result:

48 hrs LC50 % vol/vol (95% CL): >100% (N/A) Statistical Method: Visual

Sample Name : EVO NAT

Description:	clear			**Sample Prior to Analysis:**	
Sample Collected:	May 13, 2014	Sampling Method :	N/A	pH:	7.9
Sample Collected By:	N/A	Site Collection:	N/A	Temperature :	20.0 °C
Sample Received:	May 15, 2014 09:00 AM	Volume Received:	1 x 1LP	Dissolved Oxygen:	10.0 mg/L
Analysis Start :	May 16, 2014 03:20 PM	Temp.Upon Arrival:	12 °C	Sample Conductance:	1298 µS/cm ^{2}
End :	May 18, 2014 02:29 PM	Storage:	1-7 °C	Hardness:	800 mg $CaCO_3$/L

Concentration	Temperature (°C)	Temperature (°C)	Dissolved Oxygen (mg/L)	Dissolved Oxygen (mg/L)	pH	pH	Conductivity uS/cm²	Mortality (#)	Mortality (%)	Immobility (#)
% vol/vol	Initial	48 hrs	Initial	48 hrs	Initial	48 hrs	Initial	48 hrs	48 hrs	48 hrs
0	20.8	20.0	8.5	8.9	8.0	8.5	342	0	0	0
6.25	20.8	20.0	9.0	8.9	8.1	8.3	407	0	0	0
12.5	20.8	20.2	9.0	8.9	8.0	8.3	446	0	0	0
25	20.7	20.3	9.0	8.9	8.1	8.3	567	0	0	0
50	20.7	20.3	9.0	8.9	8.2	8.3	770	0	0	0
100	20.2	20.3	9.0	8.9	8.1	8.5	1299	0	0	0

Comments : All neonates appeared and behaved normally.

Culture/Control/Dilution Water: Reconstituted Water-Moderately Hard

Hardness (EDTA Method): 104 mg/L $CaCO_3$ Other parameters available on request.

Test Conditions Test concentration : 0,6.25,12.5,25,50,100 (% vol/vol)

Organisms per Vessel :	10	Pre-aeration Time :	10 min	Rate of Pre-aeration :	25-50 mL/min/L
Total # of Organisms Used :	60	Test Temperature :	20 ± 2 °C	Test Hardness Adjusted :	No
Test Volume :	185 mL	Vessel Volume :	200 mL	Test pH Adjusted:	No
Loading Density :	18.5 mL/Daphnia	Photoperiod :	16:8 (light: dark)		

Test Organism : *Daphnia magna* Source : Aquatic Biosystems

Age at Test Initiation :	<24 hrs	Average Brood Size :	28.0
Culture Photoperiod :	16:8 (light: dark)	% Mortality within 7 days :	4.9
Culture Temperature :	20 ± 2 °C	Time To First Brood :	9 Days
Culture Diet	2.5ml algae + 2.5 ml YCT; Sun. 1.25 ml algae + 1.25ml YCT.		

Reference chemical: Zinc Test Date: May 06, 2014

Test Endpoint 48 hrs LC50 (95% confidence interval) : 0.43 (0.23, 0.68) mg/L Statistical Method : Probit

Historical Mean LC50 (warning limits) : 0.60 (0.25, 1.44) mg/L Concentration : 0,0.05,0.1,0.5,1,5,10 mg/L

Test Method Maxxam's BBY2SOP-00007 based on Environment Canada's EPS/RM/14, 2nd Ed., 2000.

Method Deviations: None.

Note: The results contained in this report refer only to the testing of the sample submitted. This report may not be reproduced, except in its entirety, without the written aprroval of the laboratory.

Analyst : Michael Armstrong

Verified By : Pam Howes, Study Director

Date: May 21, 2014 01:43 PM

Rainbow Trout 96 hr LC50 @60 mg/L Nalco antiscalant:

Maxxam

RESULTS OF RAINBOW TROUT 96 HR LC50 @ 100%

Success Through Science®

Client : 5323 Teck Metals Ltd., TRAIL | Job Number: B439247

Client Project Name & Number: EVO LAB TESTS

Test Result:

96 hrs LC50 % vol/vol (95% CL): >100 (N/A) Statistical Method: Visual

Sample Name : EVO NAT

Description:	clear, colourless			Sample Number:	JP8797-01
Sample Collected:	May 13, 2014	Sampling Method :	N/A	Site Collection:	N/A
Sample Collected By:	N/A	Volume Received:	1 x 1LP	Temp.Upon Arrival:	12 °C Storage: 1-7 °C
Sample Received:	May 15, 2014 09:00 AM	pH:	7.9	Dissolved Oxygen:	10.3 mg/L
Analysis Start :	May 18, 2014 12:55 PM	Temperature :	14.1 °C	Sample Conductance:	1057 µS/cm [2]

Concentration	Temperature (°C)	Temperature (°C)	Dissolved Oxygen (mg/L)	Dissolved Oxygen (mg/L)	pH	pH	Conductivity uS/cm²	Mortality (#)	Mortality (%)	Atypical Behaviour (#)
% vol/vol	Initial	96 hrs	Initial	96 hrs	Initial	96 hrs	Initial	96 hrs	96 hrs	96 hrs
0	14.7	15.3	10.0	9.6	7.7	7.5	39	0	0	0
100	14.1	15.3	10.3	9.3	7.9	8.3	1058	0	0	0

Comments : All fish appeared and behaved normally during the test.

Culture/Control/Dilution Water Burnaby Municipal Dechlorinated Water

Hardness (EDTA Method): 23 mg/L $CaCO_3$ Other parameters available on request.

Test Conditions Test concentration : 0,100 (% vol/vol)

Organisms per Vessel :	10	Test Temperature :	15 ± 1 °C	Solution Depth :	>15 cm
Total # of Organisms Used :	20	Pre-aeration Time :	30 min.	Rate of Pre-aeration :	6.5±1 mL/min/L
Test Volume :	18 L	Vessel Volume :	20L	Test pH Adjusted:	No
Loading Density :	0.44 g/L	Photoperiod :	16:8 (light: dark)		

Test Organism : Rainbow Trout *(Oncorhynchus mykiss)* Source : Miracle Springs Inc.

Culture Temperature :	15 ± 2 °C	Weight (Mean) +- SD :	0.80 ± 0.17 g	Length (Mean) +- SD :	4.61 ± 0.29 cm
Culture Water Renewal :	≥ 1L/min/kg fish	Weight (Range) :	0.53 – 1.25 g	Length (Range) :	4.10 – 5.30 cm
Culture Photoperiod :	16:8 (light: dark)			% Mortality within 7 days :	0%

Feeding rate and frequency : daily: 1-5% biomass of trout.

Reference chemical: Zinc | Test Date: May 13, 2014

Test Endpoint 96 hrs LC50 (95% confidence interval) : 0.07 (0.06, 0.09) mg/L | Statistical Method : Untrimmed Spearman-Kärber

Historical Mean LC50 (warning limits) : 0.11 (0.05, 0.23) mg/L | Concentration : 0,0.04,0.08,0.16,0.32,0.64 mg/L

Test Method Maxxam's BBY2SOP-00004. This method also follows EPS 1/RM/13 as a primary reference.

Method Deviations : None.

Note: The results contained in this report refer only to the testing of the sample submitted. This report may not be reproduced, except in its entirety, without the written aprroval of the laboratory.

Analyst : Michael Brassil

Verified By : Pam Howes, Study Director | Date: May 26, 2014 10:15 AM

Daphnia Magna 48 hr LC50 @ 100 mg/L GE antiscalant:

HydroQual Laboratories Ltd.

Daphnia (48-h LC50/EC50) Test Report

Client: ALS106
Reference: 14-1070-01-DAD

Result Summary

Contents

Client: ALS Laboratory Group; operation Calgary

Sample: L1495274-1

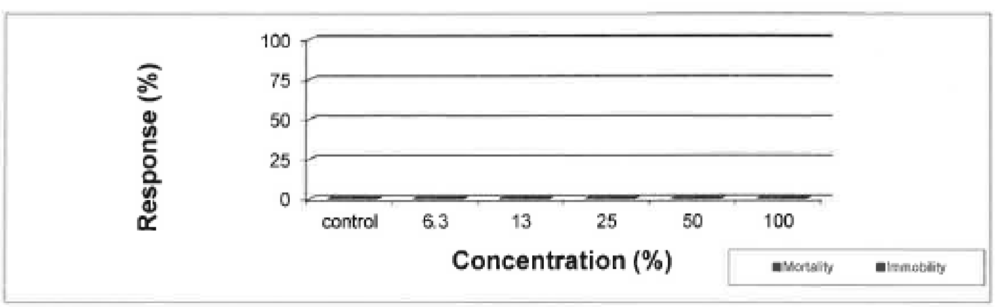
Collection: collected on 2014/07/29 at not given by not given
Receipt: received on 2014/07/31 at 1115 by A. Hoover
Containers: received 2 x 20 L carboys and 1 x 500 mL bottle at 19 °C, in good condition with no seals and no initials
Description: type: water, collection method: not given

Test: started on 2014/08/02 ; ended on 2014/08/04

Result:

	Endpoint (48-hour)	Value (%)	Confidence Limits (95%) lower	Confidence Limits (95%) upper	Method Calculated
Acute: (mortality)	LC50	>100			could not be calculated
	LC25	>100			could not be calculated
Acute: (immobility)	EC50	>100			could not be calculated
	EC25	>100			could not be calculated

Notes: LC25 & LC50, concentrations lethal to 25% and 50% of the test population



The test data and results are authorized and verified correct.

Technical Lead

Rainbow Trout 96 hr LC50 @ 100 mg/L GE antiscalant

HydroQual Laboratories Ltd.

Trout (96-h LC50) Test Report

Client: ALS106
Reference: 14-1070-01-TRD

Result Summary

Contents

Client: ALS Laboratory Group; operation Calgary

Sample: L1495274-1

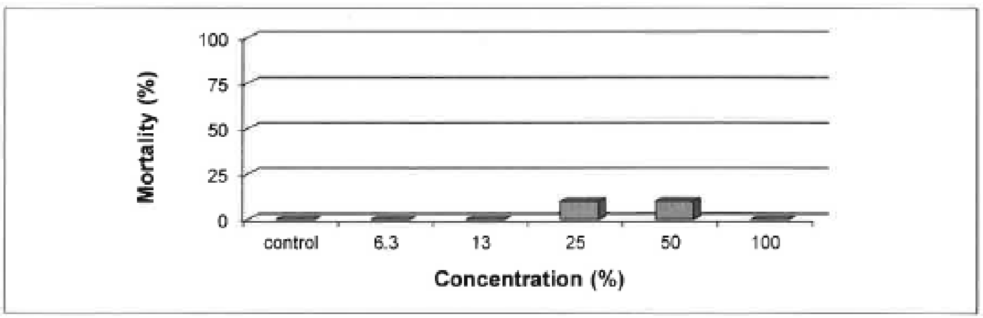
Collection: collected on 2014/07/29 at not given by not given
Receipt: received on 2014/07/31 at 1115 by A. Hoover
Containers: received 2 x 20 L carboys and 1 x 500 mL bottle at 19 °C, in good condition with no seals and no initials
Description: type: water, collection method: not given

Test: started on 2014/08/01 ; ended on 2014/08/05

Result:

	Endpoint (96-hour)	Value (%)	Confidence Limits (95%) lower	upper	Method Calculated
Acute: (mortality)	LC50	>100			could not be calculated
	LC25	>100			could not be calculated

Notes: LC25 & LC50, concentrations lethal to 25% and 50% of the test population



The test data and results are authorized and verified correct.

Technical Lead

Appendix B

Calcite Pilot Program 2015 – Data Quality Objectives

Problem Statement

Teck Coal's mining activities are, individually and cumulatively, resulting in chemical and physical changes to the aquatic ecosystem that have the potential to cause effects to water quality, aquatic biota, and aquatic-dependent biota. Formation of calcite in streams receiving drainage from some of Teck Coal's mines is a concern because of its potentially adverse effects on aquatic habitat.

Teck Coal has developed a strategy to test passive treatments to prevent or control calcite precipitation in the streams using acid addition. However, the use of acid addition presents several challenges such as increase in chloride or total organic carbon concentration and increase in cost. The use of antiscalant to prevent and/or dissolved calcite precipitation has been identified as an alternative to acid addition nevertheless, the effect on toxicity and water chemistry need to be assessed to determine its effectiveness.

Conceptual Model

Two treatment conceptual models are described as follows:

1. Acid addition

   $$H^+ + HCO_3^- \leftrightarrow CO_2 + H_2O$$

   a. Shifts reaction to the right converting alkalinity (bicarbonate) to carbon dioxide.
2. Antiscalant
   a. Crystal growth inhibitor (phosphonate, anionic co-polymer) that prevents $CaCO_3$ formation.
   b. Dispersing agent (anionic co-polymer) that dissolves $CaCO_3$ formation.

Risks and Opportunities

Risks

1. Increase in phosphorus concentration in the pilot plant effluent
2. Lack of cadmium co-precipitation with calcite (maintain cadmium concentration in the stream)
3. Water chemistry may change due to environmental effects (i.e. weather)

Opportunities

1. Test calcite deposition plates from NALCO

Program Objectives

1. Confirm calcite deposition prevention with vendor's suggested dosage
2. Determine water chemistry changes after antiscalant dosage
3. Evaluate toxicity (acute and chronic) of treated water
4. Gather required information for engineering design

5. Antiscalant calcite precipitation inhibition performance comparison
6. Economical Comparison of antiscalant and acid addition treatment

Key Questions

1. Does the reagent prevent calcite precipitation?
2. Does the reagent dissolve calcite?
3. Does prevention/dissolution a function of distance?
4. Do the recommended dosages prevent and dissolve calcite?
5. How does the reagent effect the receiving environment?
6. Is the reagent better than acid addition environmentally and economically?
7. Is the Remote Deposition Monitor (RDM) effective in measure calcite deposition?

Possible Outcomes

1. Evaluation of strength and weakness of each antiscalant used
2. Evaluation of potential effect on the environment by each antiscalant
3. Engineering package for pre-feasibility study
4. RDM Evaluation

Key Input to decision

1. Does the reagent prevent calcite precipitation?
   - Calcite deposition rate (plates and RDM for Nalco stream)
   - Water chemistry
   - Visual inspections
2. Does the reagent dissolve calcite?
   - Water chemistry
   - Visual inspection
   - Calcite deposition rate (plates and rocks)
3. Is prevention/dissolution a function of distance?
   - Calcite deposition over plates/rocks over different positions in the pilot stream
4. Do the suggested dosages prevent and dissolve calcite?
   - Antiscalant dosage
   - Calcite deposition rate (plates and RDM for Nalco stream)
   - Water chemistry
5. How does the reagent effect the receiving environment?
   - Acute toxicity
   - Chronic toxicity
   - Phosphorus concentration
   - Cd concentration
   - pH
   - TOC
6. Is the reagent better than acid addition environmentally and economically?
   - Cost per cubic meter treated
   - Chloride concentration
   - pH
   - TOC concentration
   - Acute toxicity
   - Chronic toxicity
7. Is the Remote Deposition Monitor (RDM) effective in measure calcite deposition?
   - Water chemistry
   - Deposition rates (plates and rocks)

Study Boundaries

The study will be performed from July to September on Corbin Creek located at Coal Mountain Operations. There will be three antiscalants to be tested:

- Kroff KR-DP0168
- Nalco 8357
- GE Scaletrol PDC 9317

Decision Rules

1. If the effluent discharge exceeds permitting limits for water quality and toxicity, then either shut down the test or reduce dosages (time permitting).
2. If the prevent dosage does not prevent precipitation, increase the dosage and evaluate timeline and dissolved dosage.
3. If the dissolve dosage does not dissolve precipitation, review effect on MOE permit to increase dosage, evaluate timeline.
4. If there are project delays or mechanical failures, evaluate timeline - the priority will be on the preventive tests over the dissolution tests.
5. If calcite is still precipitating after the antiscalant addition and steps 2 and 3 are followed, finish the test work.

Performance Criteria

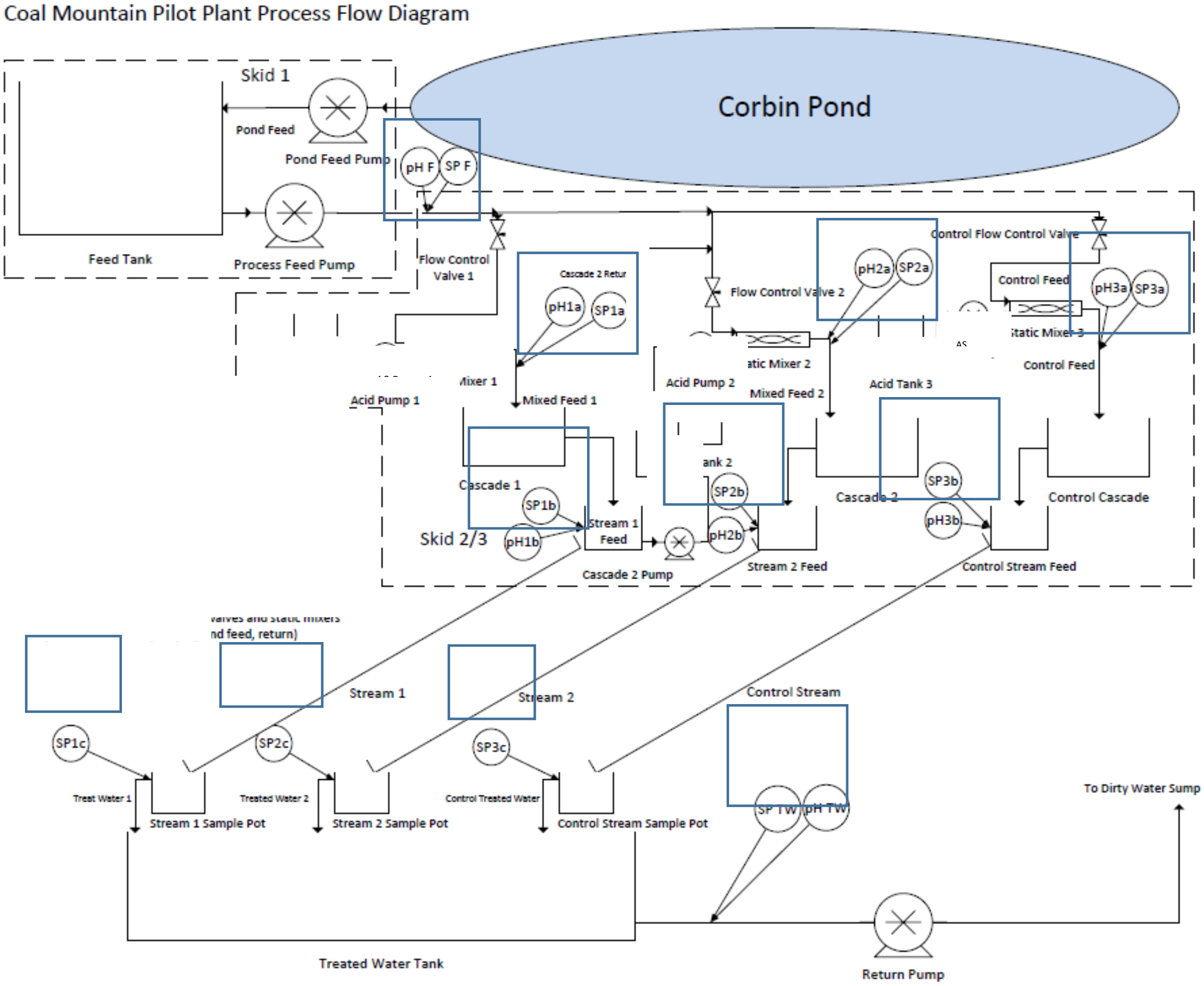
1. How to do we evaluate each antiscalant?
    a. Musts
        i. Acute and chronic toxicity tests with antiscalant must be within +/- 10% of the control
        ii. Permit guidelines must be met
        iii. Visually, calcite will not be present and confirmed by deposition plates
    b. Wants
        i. Cost of antiscalant per cubic meter
        ii. Water quality changes in constituents of interest (phosphorous, cadmium, sulphate, molybdenum)
        iii. Operability – ease of mixing, hygiene, availability of product

Test/Sampling Plan

- Schedule:
    - Sampling to occur two times per week
    - Sampling points to include:
        - Pilot feed
        - Pilot stream mixers (3)
        - Top of pilot streams (3)
        - Bottom of pilot streams (3)

- Treated return water
- Duplicate sample for QA/QC

Coal Mountain Pilot Plant Process Flow Diagram



- Toxicity – 3 samples per antiscalant test for acute toxicity, LC_{50} 96 hr rainbow trout
- Water chemistry – alkalinity, anions, BOD, TSS, COD, TOC, total metals

- Internal Analyses:
  - Alkalinity, pH, temperature, calcium, hardness, CO_2
  - Deposition plates

Appendix C

Coal Mountain Calcite - Sampling Calendar

Sunday July 19	Monday July 20	Tuesday July 21	Wed. July 22	Thursday July 23	Friday July 24	Saturday Jul 25
		CMO Shutdown				
Sunday July 26	Monday July 27	Tuesday July 28	Wednes. July 29	Thursday July 30	Friday July 31	Saturday August 1
CMO Shutdown						
Sunday August 2	Monday August 3	Tuesday August 4	Wed. August 5	Thursday August 6	Friday August 7	Saturday August 8
CMO Shutdown						
Sunday August 9	Monday Aug.10	Tuesday Aug. 11	Wed. Aug. 12	Thursday Aug. 13	Friday Aug. 14	Saturday Aug. 15
	Start-up	Run #1 / Test # 1,2,3				
				Survey #1		
travel to	Wet Test			MoE		
Sparwood	Nalco/RDM			Effl. & BIO.		
	WKM onsite			Bio to ALS		
	Bev & TJH	Bev & TJH	Bev & TJH/5	Bev & TJH	Trevor	Trevor/ 5hrs
Sunday Aug. 16	Monday Aug.17	Tuesday Aug. 18	Wed. Aug. 19	Thursday Aug. 20	Friday Aug. 21	Saturday Aug. 22
Run #1 / Test # 1,2,3						
	Survey #2			Survey #3		
	MoE			MoE		
	Inf/Eff/Sed.			Effluent		
	DI to ALS			Bio to ALS		
	Dup.4 X to Agate			Bio to HydroQual		
Trevor/ 5hrs	Trevor	Trevor	Trevor	Bev & TJH	Bev	Bev
Sunday Aug. 23	Monday Aug. 24	Tuesday Aug. 25	Wed. Aug. 26	Thursday Aug. 27	Friday Aug. 28	Saturday Aug. 29
Run #1 / Test # 1,2,3				Run #2 / Test # 4,5,6		
	Survey #4		Survey Reserve	switch		
	MoE			MoE		Calcite
	Inf/Eff/Sed.			Effl & Dupl.		
	Bio to ALS			switch		
Bev	Bev	Bev	Bev	Bev & TJH	Trevor	Trevor
Sunday Aug. 30	Monday Aug. 31	Tuesday Sept. 1	Wed. Sept. 2	Thursday Sept. 3	Friday Sept. 4	Saturday Sept. 5
Run #2 / Test # 4,5,6						
	Survey#5			Survey#6		
	MoE			MoE		
	Inf/Eff/Sed.			Effl. & BIO.		
	DI to ALS			Bio to ALS		
	Dup.4 X to Agate			Bio to HydroQual		
Trevor	Trevor	Trevor	Trevor	Bev & TJH	Bev	Bev

Coal Mountain Calcite - Sampling Calendar

Sunday Sept. 6	Monday Sept. 7	Tuesday Sept. 8	Wed. Sept. 9	Thursday Sept. 10	Friday Sept. 11	Saturday Sept. 12
Run #2 / Test # 4,5,6						
	Survey#7			Survey#8		
	MoE			MoE		
	Inf/Eff/Sed.			Effl & Dupl.		Survey Reserve
	Bio to ALS			Bio to ALS		
Bev	Bev	Bev	Bev	Bev & TJH	Trevor	Trevor
Sunday Sept. 13	**Monday Sept. 14**	**Tuesday Sept. 15**	**Wed. Sept. 16**	**Thursday Sept. 17**	**Friday Sept. 18**	**Saturday Sept. 19**
Run #3 / Test # 7,8,9						
switch	Survey#9			Survey#10		
	MoE			MoE		
	Inf/Eff/Sed.			Effluent		
				Bio to ALS		
	Dup.4 X to Agate			Bio to HydroQual		
Trevor	Trevor	Trevor	Trevor	Bev & TJH	Bev	Bev
Sunday Sept. 20	**Monday Sept. 21**	**Tuesday Sept. 22**	**Wed. Sept. 23**	**Thursday Sept. 24**	**Friday Sept. 25**	**Saturday Sept. 26**
Run #3 / Test # 7,8,9						
	Survey#11			Survey#12		
	MoE			MoE		
	Inf/Eff/Sed.			Effl & Dupl.		
	Bio to ALS			Bio to ALS		
	DI to ALS					
Bev	Bev	Bev	Bev	Bev & TJH	Trevor	Trevor
Sunday Sept. 27	**Monday Sept. 28**	**Tuesday Sept. 29**	**Wed. Sept. 30**	**Thursday October 1**	**Friday October 2**	**Saturday October 3**
Run #3 / Test # 7,8,9			**DEMOBILIZATION**		All tanks drained, water off	**DEMOB.**
	Survey Reserve		**Shutdown**			
	MoE					
	Inf/Eff/Sed.					
Trevor	Trevor	Trevor	Trevor	Bev & TJH	Bev	Bev
Sunday October 4	**Monday October 5**	**Tuesday October 6**	**Wed. October 7**	**Thursday October 8**	**Friday October 9**	**Saturday Oct. 10**
DEMOBILIZATION						
Bev	Bev	Bev	Bev	Bev & TJH	Trevor	Trevor

Appendix D

APPENDIX 3: COAL MOUNTAIN OPERATIONS CALCITE TREATMENT PILOT PROJECT

Under the Provisions of the Environmental Management Act

Teck Coal Limited
Coal Mountain Operation
PO Box 3000
Sparwood, BC V0B 2G0

is authorized to discharge effluent to surface water from Coal Mountain Operations located near Sparwood, British Columbia, subject to the terms and conditions listed below. Contravention of any of these conditions is a violation of the *Environmental Management Act* and may lead to prosecution.

This discharge is authorized to occur from June 29, 2015 to October 2, 2015.

A1. <u>AUTHORIZED DISCHARGES</u>

A1.1 <u>Authorized source</u>

This section applies to the discharge of effluent from the Coal Mountain Pilot Calcite Treatment Plant, for the following treatment technologies; antiscalant addition and cascade precipitation into the Coal Mountain plant area surface water run-off system via the Main Sedimentation Pond to Corbin Creek. The site reference number for this discharge is E295089.

A1.1.1 The maximum authorized rate of discharge is 400 L/min.
The average daily authorized rate of discharge is 225 L/min.

A1.1.2 The characteristics of the discharge exiting the treatment system (E295089) shall be equivalent to or better than:

Date issued: September 30, 1977
Date amended: June 25, 2015
(most recent)

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for Director, *Environmental Management Act*
Southern Interior

PARAMETER	LIMIT/UNITS
96 hr Rainbow Trout Single Concentration toxicity test	50% Survival in 100% Concentration, Minimum
48 hr *Daphnia magna* Single Concentration toxicity test	50% Survival in 100% Concentration, Minimum
pH	6.0 – 9.0
Total Phosphorus	Increase over background of not more than 0.30 mg/L
Orthophosphate	Increase over background of not more than 10 µg/L
Total Organic Carbon	Increase over background of not more than 10 mg/L

A1.1.3 The authorized works are a submersible pump intake, piping, influent equalization tank, antiscalant containment and injection stations, mixing modules, cascade feed tanks and platforms, residual/effluent equalization tank, associated transfer pumps, pH probes, discharge to plant run-off system, and related appurtenances.

A1.1.4 The location of the facilities from which the discharge originates and the point of discharge is District Lot 6999, Kootenay Land District.

A2. OPERATIONAL REQUIREMENTS

A2.2 Effluent Non-Toxicity

The discharges to surface water referenced in Section 1of this approval must not be acutely toxic to aquatic organisms at the point which it enters the receiving environment. The undiluted effluent must not cause greater than 50% mortality in 96 hr Rainbow Trout (*Oncorhynchus mykiss)* single concentration toxicity tests (EPS 1/RM/13 2nd edition, December 2000) and greater than 50% mortality in 48 hr *Daphnia magna* single concentration toxicity tests (EPS 1/RM/14 2nd edition, December 2000).

Date issued: September 30, 1977
Date amended: June 25, 2015
(most recent)

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A3. MONITORING REQUIREMENTS

A3.1 Monitoring Locations

DISCHARGE SAMPLE LOCATIONS	
ENVIROMENTAL MONITORING SITE NUMBERS	**SITE DESCRIPTION AND LOCATION**
E295092	Corbin Pond Influent via pipeline to Coal Mountain Pilot Calcite Treatment Plant
E295089	Coal Mountain Pilot Calcite Treatment Plant Effluent, discharge to Coal Mountain plant run-off water system via Main Sedimentation Pond to Corbin Creek.
E102488	Main Sedimentation Pond Decant

A3.2 Sampling Frequency and Parameters

PARAMETER	E295092 (INFLUENT)	E295089 (EFFLUENT)	E102488 (MAIN POND)
pH (field)	W[1]	2W	W
Temperature (field)	W	2W	W
Specific conductivity (field)	W	2W	W
Flow	W	2W	W
Alkalinity	W	2W	W
Major Ions and Nutrients[2]	W	2W	W
Total dissolved solids	W	2W	W
Total suspended solids	W	2W	W
Biological oxygen demand	W	2W	W
Chemical oxygen demand	W	2W	W
Total organic carbon	W	2W	W
Dissolved organic carbon	W	2W	W
Total metals[3]	W	2W	W
Total dissolved metals[4]	W	2W	W
Dissolved CO2	W	2W	
Hardness	W	2W	W
96 hr Rainbow Trout Single Concentration toxicity test[5]		M	
48 hr *Daphnia magna* Single Concentration toxicity test		M	

[1] – Sample frequencies are twice weekly (2W), weekly (W) or monthly (M).
[2] – **Major Ions and Nutrients** include bromide, fluoride, calcium, chloride, magnesium, potassium, sodium, sulphate, ammonia, nitrate, nitrite, total phosphorus, orthophosphate

Date issued: September 30, 1977
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(most recent)

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[3]- **Total Metals Scan** must be an ICPMS total metals scan and include aluminum, antimony, arsenic, barium, beryllium, bismuth, boron, cadmium, chromium, cobalt, copper, iron, lead, lithium, manganese, mercury, molybdenum, nickel, selenium, silver, strontium, thallium, tin, titanium, uranium, vanadium, and zinc.
[4] - **Dissolved Metals Scan** must be an ICPMS dissolved metals scan and include aluminum, antimony, arsenic, barium, beryllium, bismuth, boron, cadmium, chromium, cobalt, copper, iron, lead, lithium, manganese, mercury, molybdenum, nickel, selenium, silver, strontium, thallium, tin, titanium, uranium, vanadium, and zinc.
[5] –**Toxicity testing** should be during the highest dosage operating conditions of pilot operation

A3.4 **Minimum Detection Limit**

Minimum analytical detection limits for each parameter listed in section 3.2 must be suitable for comparison with the applicable standards listed in the most recent Approved and Working Water Quality Guidelines prepared by Ministry of Environment.

A3.5 **Quality Assurance**

All analytical data required by the approval to be submitted shall be conducted by a laboratory acceptable to the Director. At the request of the Director, the Permittee Holder shall provide the laboratory quality assurance data, associated field blanks and duplicate analysis results along with the submission of data required under Section 3.2 of the permit.

A4. **REPORTING REQUIREMENTS**

A4.1 **Reporting**

Maintain analytical data, maintain records of type and dose of reagent added to treat the effluent discharge and submit the data, suitably tabulated, for the approval period to the Director. The report shall be submitted within 60 days of the end of the pilot period.

A4.2 **Performance Evaluation Reporting**

A final report, at the end of the pilot period, shall be submitted to the Director, evaluating the performance of the pilot treatment technologies. This must include analytical results of the effluent and toxicity results. The report must be submitted by March 1, 2016.

A4.3 **Non-compliance Reporting**

The Permittee shall immediately contact the Director or an Officer designated by the Director by e-mail and/or telephone of any non-compliance with the requirements of this permit and take appropriate remedial action. Written confirmation of all non-compliance events is required by e-mail within 24 hours of the original notification unless otherwise directed by the Director. Applicable lab results must be submitted to the Director immediately upon receipt.

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Date amended: June 25, 2015
(most recent)

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Southern Interior

Appendix E

1. General Safety

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Item #	Category / Item to Assess	Status
1.	Have all appropriate personnel (Operations, Technical, Supervision) received adequate and appropriate training on the equipment and operating procedures	
2.	Has adequate and appropriate PPE been specified in the SOP? Has the PPE been provided and the operator trained? Is the training documented?	
3.	Have measures been taken to adequately guard all dangerous parts of the equipment	
4.	Has sufficient provision been made for the electrical and/or mechanical isolation of the equipment?	
5.	Are points of isolation clearly marked/labeled and readily accessible?	
6.	Have bump/trip hazards been properly identified and adequately marked? Have all sharp edges been removed?	
7.	Has proper guarding, handrails/barriers, been provided to prevent falls?	
8.	Have all hot/cold surfaces been adequately guarded to prevent burns? Are all cold surfaces adequately insulated to prevent condensation drips?	
9.	Are safety showers and eye wash facilities provided and adequately marked? Are the safety showers and eye wash facilities on a routine inspection program? Are safety showers and eye wash facilities visible and accessible and comply with applicable legislation?	
10.	Has sufficient lighting been provided so operations can be carried out safely?	
11.	Are notices, dials, screens for providing operational instructions, safety warnings and emergency information provided, if required, and positioned so that they are clearly visible and easily read?	
12.	Have all overhead fixtures been properly secured?	
13.	Are all of the applicable work permit procedures in place? Have the operating, maintenance and supervisory personnel been properly trained on the work permit procedures?	
14.	Has fire protection systems been inspected? Has acceptance testing been completed and documented? Is there an agreed on test and inspection program for the fire protection systems?	

Taken from AIChe 2007 Guidelines for Performing Effective Presafety start up reviews.

2. Machinery/Equipment Safety

Item #	Category / Item to Assess	Status
1.	Has the machinery/equipment been installed so that it will be stable and secure during operation?	
2.	Has all access to dangerous moving parts, or danger zones created by the equipment been prevented by the provision of the correct guards, interlocks and/or barriers	
3.	Have the correct safety measures been taken to prevent any risk from hot/cold surfaces, ejection of material, failure of parts and their ejection, overheating/fire?	
4.	Has safe access been provided to the equipment that requires operator and calibration and maintenance personnel access for normal operations, adjustments, service, calibration, maintenance or repair? Have slip, trip, trap, crush, entanglement, fall, bump and cut hazards been minimized?	
5.	Is the equipment provided with the properly identified STARTS/STOP and EMERGENCY controls that are positioned for safe operation without hesitation or loss of time and without ambiguity?	
6.	Is the equipment provided with a clearly identified means to securely isolate it from all energy sources?	

3. Ergonomics

Item #	Category / Item to Assess	Status
1.	Have the workstations, workplace or equipment been constructed so that need for stooping, bending, stretching, over-reaching and working over-head during operation has been eliminated or minimized?	
2.	Has the need to lift, carry, push or pull heavy loads or parts been eliminated to the extent possible?	
3.	Are all display screens, dials and START/STOP/EMERGENCY buttons positioned so that they are readily visible and accessible by the operating personnel?	
4.	Have visual display screens been positioned so that interference from glare is reduced to the minimum?	
5.	Have workstations been designed and equipped so that the operator can adopt a comfortable position?	
6.	Does the operation increases the risk of upper limb disorder? (i.e. repetitive tasks, prolonged operation)	

Taken from AIChe 2007 Guidelines for Performing Effective Presafety start up reviews.

4. Occupational Health

Item #	Category / Item to Assess	Status
1.	Have all health risks arising from the gases, liquids, dusts, mists, biological hazards or vapors used by, contained in or emitted by this equipment been assessed? Have the health risks been eliminated or are adequate engineering controls utilized to minimize the risk?	
2.	Has adequate respiratory protective equipment been specified in the operating procedures?	
3.	Has the need for an occupational health monitoring program been assessed? Has a monitoring program been scheduled?	
4.	Have the operating procedures been reviewed to take into account any additional health hazards which may arise from operation or maintenance of the equipment?	
5.	Has adequate local exhaust ventilation been installed, tested, balanced and entered on an inspection schedule?	
6.	Have adequate inspection/cleaning ports been provided on ductwork?	
7.	Are relief facilities directed to a safe place away from the workplace?	
8.	Has a noise survey been considered and a noise compliance plan prepared if required?	
9.	Has all insulation been identified?	
10.	Has all pipe work, tanks and equipment containing hazardous materials been adequately labeled?	

5. Process Technology

Item #	Category / Item to Assess	Status
1.	Are up to date MSDS available?	
2.	Have the hazardous effects of inadvertent mixing of different materials been considered?	
3.	Has the process design basis been documented/updated? Has the control philosophy and sequence of operation been documented?	
4.	Has the equipment design basis been documented/updated (i.e. BFD, P&IDs)?	
5.	Have the recommendations from PHA, HAZOPS been implemented?	
6.	Are all relief devices shown on the P&IDs? Are standard marking used on the relief devices? Are the relief/rupture pressures included on the P&IDs?	
7.	Have the pressure relief device calculations been provided? Does the sizing of pressure relief devices agreed with the calculated sizes? Do the calculations take into the downstream piping?	
8.	Do the relief devices vent to safe locations? Is containment provided for liquids and solids released from pressure relief devices?	
9.	Are there isolation valves that, if closed, will inhibit the operation of pressure relief devices?	
10.	Are all pressure relief devices included in the preventive maintenance program?	

6. Management of Change/Process Hazard Analysis

Item #	Category / Item to Assess	Status
1.	Has a management of change process documented?	
2.	Has a test authorization been approved?	
3.	Are all actions items necessary for startup completed?	
4.	Have all changes made during construction been recorded and authorized? Have hazard evaluations been done on all the changes made during construction?	
5.	Have project PHA been approved and a final project safety report been prepared?	
6.	Are all action items, deemed necessary by the PHA team for startup, complete?	
7.	Has the project been approved as “Safe to proceed with” by the PHA team?	

7. Quality Assurance

Taken from AIChe 2007 Guidelines for Performing Effective Presafety start up reviews.

Item #	Category / Item to Assess	Status
1.	Have checks and inspections been made to ensure that critical equipment is installed properly and is consistent with design specifications and vendor's recommendations test, equipment alignment and service to process inter-connections?	
2.	Have quality assurance inspection reports, covering fabrication, assembly and installation, been completed in accordance with the project's quality assurance plan and reports filed with the equipment and design basis documentation?	
3.	Ensure that: • Construction meets the design specifications • Construction matches the drawings	
4.	Have the following documents been provided and approved: • Instrument indexes and instrument loop diagrams • Tabulation, including settings of interlocks, trips, process alarms and permissive descriptions • As built drawings covering P&IDs, electrical, piping and mechanical • Data sheets for pressure equipment built to ASME or equivalent codes • Welder certification • Non destructive test certifications • Electrical certification for classified areas	

Taken from AIChe 2007 Guidelines for Performing Effective Presafety start up reviews.

8. Mechanical Integrity

Item #	Category / Item to Assess	Status
1.	Have maintenance procedures been approved?	
2.	Have maintenance personnel been trained?	
3.	Have spare parts listed been developed? Are there adequate inventories of spare parts, operating supplies and maintenance materials?	
4.	Have quality control procedures been approved for maintenance materials and spare parts?	
5.	Have inspections and tests for the following equipment been included in a maintenance schedule: • Pressure vessels and storage tanks • Pressure relief systems, vent systems and devices • Emergency devices • Fire protection equipment • Piping systems in critical services • Key process to service tie-ins • Electrical earthering, grounding, bonding • MCC starters • Emergency alarm and communication system • Monitoring devices and sensors • Pumps • Lifting equipment	
6.	Has a reliability engineering analysis been considered/completed for PSM critical equipment?	
7.	Is the equipment inspected by any outside body of certificates on file	
8.	Have all commissioning tests or inspections been identified?	

9. Operating Procedures and Safe work practices

Taken from AIChe 2007 Guidelines for Performing Effective Presafety start up reviews.

Item #	Category / Item to Assess	Status
1.	Have SOP been prepared/updated and approved? Do SOP cover: • Initial start up • Normal start up • Normal operations • Normal shutdowns • Emergency operations including emergency shutdown • Start up after emergency shutdown • Start up following turnarounds/prolonged shutdowns • Equipment clean-outs and preparation for maintenance • Change control procedures	

10. Training

Item #	Category / Item to Assess	Status
1.	Has specific process training been given to personnel?	
2.	Have training records been updated?	

11. Contractor Safety

Item #	Category / Item to Assess	Status
1.	Have all contract personnel been adequately trained in appropriate chemical awareness, maintenance and operating activities and evacuation procedures?	

12. Interlocks and alarms

Item #	Category / Item to Assess	Status
1.	Has the alarm/interlock been classified and designed by the project team?	
2.	Did the loop testing confirm that the alarm/interlock action proved, under all conceivable failure conditions, to be fail-safe?	
3.	Prior to this PSSR, has an interlock/critical alarm SOP for testing been prepared/reviewed/authorized by a competent person for each new or upgraded control system?	
4.	For alarms/interlocks with more than one software or hardware circuit, have all possible interlock routes tested?	
5.	Does the control system documentation specify: • Major components and their model and serial numbers? • All communication cables layout and configuration? • Any configurable or custom settings and set up?	
6.	Has all appropriate process technology been updated?	
7.	Has consideration been given to suitable fire detection and prevention systems for the equipment?	
8.	Do you have an appropriate procedure to ensure that your software is protected?	
9.	Has software been properly documented and filed?	
10.	Has all software been properly validated and tested?	
11.	Is there verification that the equipment does not re-start either on the re-setting of a protective device or the re-establishment of power after an outage	

13. Environment

Item #	Category / Item to Assess	Status
1.	Are all secondary containment facilities adequate?	
2.	Are all material storage facilities adequate and appropriately labeled?	
3.	Have adequate arrangements been made, prior to start-up for the identification, classification and safe disposal of all waste material?	
4.	Have all materials used in the system and authorized?	
5.	Are updated area spill procedures available?	
6.	Are material unloading facilities adequate and constructed in accordance to standard?	
7.	Have corporate guidelines followed during design of the project?	
8.	Have all waste streams been identified, quantified, analyzed and minimized?	
9.	Are all applicable permits up to date and approved?	

14. Fire Protection

Taken from AIChe 2007 Guidelines for Performing Effective Presafety start up reviews.

15. Electrical Safety

Item #	Category / Item to Assess	Status
1.	Have all necessary precautions been taken to ensure that the equipment is not a source of ignition to any flammable materials, irrespective of their source?	
2.	Are fire protection facilities adequate?	
3.	Are emergency escape routes, including ladders, adequate and properly signed?	
4.	Is emergency lighting adequate?	
5.	Is sufficient respiratory protective equipment, such as escape sets or self-contained breathing apparatus (SCBA) available?	
6.	Have emergency procedures been prepared and relevant personnel trained?	

Item #	Category / Item to Assess	Status
1.	Has the acceptance of electrical installations been completed by a competent personnel?	
2.	Has the equipment been properly installed and constructed to corporate guidelines and local legislation and does it meet any special installation requirements from the manufacturer?	
3.	Has equipment been designed and purchased for the conditions which it will operate?	
4.	Are all live parts adequately enclosed to prevent access?	
5.	Does grounding and bonding comply with corporate and local standards/legislation?	
6.	Have fuses or circuit breakers been provided which will automatically disconnect the supply?	
7.	Are first aid stations, single line drawings and PPE requirements available in motor control centers, electrical control rooms as appropriate?	
8.	Have all relevant documentation and drawings been updated to reflect current installation?	
9.	Have all new sub stations breakers, MCC isolators, starters or other appropriate equipment been registered on the site inspection schedule?	
10.	Have any electrical circuits, made redundant by this installation been properly D&R'd?	

16. Field Verification

Item #	Category / Item to Assess	Status
1.	Is the normal lighting adequate for normal and maintenance operations?	
2.	Is emergency lighting sufficient?	
3.	Are all hot and cold surfaces in the proximity of personnel insulated?	
4.	Are all instruments, equipment and piping adequately labeled?	
5.	Is there are any rusted and/or damaged equipment?	
6.	Are swing gates or chains installed at the top of ladders and/or access platforms?	
7.	Are there any gaps between platforms and equipment that could create foot hazard?	
8.	Is equipment and platform access adequate?	
9.	Do safety showers/eye wash stations create a hazard to personnel, potential for contamination of product or ingress to electrical equipment?	
10.	Are safety showers and eye wash stations adequately marked and readily visible? Is the access to the safety showers and eye wash stations uninhibited?	
11.	Are all pipelines labeled?	
12.	Are all electrical switches, disconnects, MCCs, control panels, cables labeled?	
13.	Is all the equipment clearly labeled? Where required, are the materials and hazards included in the labeling?	
14.	Are wall penetrations adequately sealed?	
15.	Are electrical conduits sealed in accordance with code requirements?	
16.	Are evacuation routes clearly marked?	
17.	Are fire extinguisher installed properly?	
18.	Has the required signage been posted?	
19.	Are emergency stops provided where there is a potential for entrapment or exposure?	
20.	Has all scaffolding and construction equipment no longer needed removed? Is housekeeping acceptable?	
21.	Is all required equipment guarding installed	
22.	Does all the applicable equipment have the required CE marking displayed? Does all the applicable equipment have the required UL listing/labelling?	
23.	Have noise-monitoring evaluations been completed? Have signs been posted where noise levels excess 85 dB? Are ear-plugs available near areas excedding 85 dB?	

Taken from AIChe 2007 Guidelines for Performing Effective Presafety start up reviews.

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Pre-startup safety review checklist	
Inspection Date:	
Area:	
Project Number:	
Title:	

Signatures below indicate acceptance that the equipment/process or project is safe and satisfactory to start-up with the exceptions noted	
Engineering Manager	Date
EHS Support SPO	Date
Operations/Technical Manager	Date
Operational Lead	Date
Technical Lead	Date
Project Manager	Date
Site Rep	Date

Taken from AIChe 2007 Guidelines for Performing Effective Presafety start up reviews.

Appendix F

				Stream 1 Test Conditions											
Date:	Feed pH	Feed Temp	Feed CO2	Test #	Type Antiscalant	Obj	Stream 1 pH	Stream 1 Temp	Stream 1 Mixer CO2	Top of Stream 1 pH	Top of Stream 1 Temp	Top of Stream 1 CO2	Bottom of Stream 1 pH	Bottom of Stream 1 Temperature	Bottom of Stream 1 CO2
9/25/2015	7.90	8.30	5.80												
9/23/2015	7.9	7.9	9.8	3	GE	Dissolve	7.9	7.9	9.6	7.9	7.9	8.2	8.2	6.7	2.4
9/22/2015	7.9	7.7	9.6												
9/20/2015	7.8	7.9	10.4												
9/19/2015	7.7	7.5	14.4	3	GE	Dissolve	7.8	7.5	14.4	7.9	7.5	12.4	8.2	7.2	5.6
9/18/2015	7.8	7.6	15.2												
9/16/2015	8.1	9.3	2.4												
9/15/2015	7.98	8.90	4.40	3	GE	Dissolve	8.08	8.9	3.6	8.13	8.9	3.6	8.49	7.8	
9/11/2015	8.15	16.80	3.20												
9/9/2015	8.00	7.90	7.00												
9/6/2015	7.90	7.50	11.80												
9/5/2015	7.80	8.30	11.60												
9/8/2015	8.00	7.50	9.00	2	Control		7.9	7.5	10	8	7.5	8.4	8.3	7.1	2.2
9/4/2015	7.90	8.70	9.80	2	Control		7.9	8.7	11.8	8	8.7	10.8	8.3	7.9	4.4
9/2/2015	7.90	9.80	13.80												
9/1/2015	7.80	9.30	14.40												
8/30/2015	7.60	10.50	12.80	2	Control		7.6	10.5	19.6	7.7	10.5	19.8	8.1	10.2	7
8/25/2015	7.98	11.90	9.60	1	GE	Prevent	7.9	11.9	13.8	7.91	11.7	14.6	8.25	11.9	4.8
8/22/2015	7.90	8.80	5.80												
8/22/2015	8.24	11.30	4.60												
8/21/2015	8.00	14.00	13.00	1	GE	Prevent	7.9	14	14.4	8	14	10.6	7.4	14	1.8
8/21/2015	7.90	13.00	9.60												
8/19/2015	8.90	11.00	n/a												
8/18/2015	8.70	12.00	n.a	1	GE	Prevent	8.6	12	n/a	8.6	12	n/a	8.9	11	n/a

				Stream 2 Test Conditions											
Date:	Feed pH	Feed Temp	Feed CO2	Test #	Type Antiscalant	Obj	Stream 2 Mixer pH	Stream 2 Mixer Temp	Stream 2 Mixer CO2 PPT		Top of Stream 2 CO2	Top of Stream 2 CO2	Bottom of Stream 2 pH	Bottom of Stream 2 Temperature	Bottom of Stream 2 CO2
9/25/2015	7.90	8.30	5.80	3	Control		8	8.3	7.8		6.4	6.4	8.3	7.6	
9/23/2015	7.9	7.9	9.8												
9/22/2015	7.9	7.7	9.6												
9/20/2015	7.8	7.9	10.4	3	Control		7.8	7.9	10.6		9.4	9.4	8.2	8.1	2.6
9/19/2015	7.7	7.5	14.4												
9/18/2015	7.8	7.6	15.2												
9/16/2015	8.1	9.3	2.4	3	Control		8.1	9	3.2		2.2	2.2	8.5	8.5	
9/15/2015	7.98	8.90	4.40												
9/11/2015	8.15	16.80	3.20												
9/9/2015	8.00	7.90	7.00	2	Nalco	Prevent	7.9	7.9	9.6		8.6	8.6	8.3	7.5	1.6
9/6/2015	7.90	7.50	11.80												
9/5/2015	7.80	8.30	11.60	2	Nalco	Prevent	7.8	8.3	15.2		13	13	8.2	7.2	5.2
9/8/2015	8.00	7.50	9.00												
9/4/2015	7.90	8.70	9.80												
9/2/2015	7.90	9.80	13.80												
9/1/2015	7.80	9.30	14.40	2	Nalco	Prevent	7.8	9.3	16.8		14.4	14.4	7.8	9.1	7.6
8/30/2015	7.60	10.50	12.80												
8/25/2015	7.98	11.90	9.60												
8/22/2015	7.90	8.80	5.80	1	Kroff	Prevent	7.8	8.5	12.8		12.8	12.8	8.4	7.8	3
8/22/2015	8.24	11.30	4.60												
8/21/2015	8.00	14.00	13.00												
8/21/2015	7.90	13.00	9.60												
8/19/2015	8.90	11.00	n/a	1	Kroff	Prevent	8.8	11	n/a		n/a	n/a	8.8	11	n/a
8/18/2015	8.70	12.00	n.a												

				Stream 3 Test Conditions											
Date:	Feed pH	Feed Temp	Feed CO2	Test #	Type Antiscalant	Obj	Stream 3 Mixer pH	Stream 3 Mixer Temp	Stream 3 Mixer CO2	Top of Stream 3 pH	Top of Stream 3 Temp	Top of Stream 3 CO2	Bottom of Stream 3 pH	Bottom of Stream 3 Temperature	Bottom of Stream 3 CO2
9/25/2015	7.90	8.30	5.80												
9/23/2015	7.9	7.9	9.8												
9/22/2015	7.9	7.7	9.6	3	Nalco	Dissolve	7.8	7.7	10.4	7.9	7.7	8.8	8.2	6.7	2.6
9/20/2015	7.8	7.9	10.4												
9/19/2015	7.7	7.5	14.4												
9/18/2015	7.8	7.6	15.2	3	Nalco	Dissolve	7.8	7.5	14.4	7.9	7.5	12.4	8.2	7.2	5.6
9/16/2015	8.1	9.3	2.4												
9/15/2015	7.98	8.90	4.40												
9/11/2015	8.15	16.80	3.20	2	Kroff	Dissolve	8.13	16.7	2.2	8.14	16.9	2.4	8.47	16.8	
9/9/2015	8.00	7.90	7.00												
9/6/2015	7.90	7.50	11.80	2	Kroff	Dissolve	7.8	7.5	13.4	7.9	7.5	12.2	8.2	7.1	4.2
9/5/2015	7.80	8.30	11.60												
9/8/2015	8.00	7.50	9.00												
9/4/2015	7.90	8.70	9.80												
9/2/2015	7.90	9.80	13.80	2	Kroff	Dissolve	7.9	9.8	13.8	7.9	9.8	13.4	8.38	13.1	12
9/1/2015	7.80	9.30	14.40												
8/30/2015	7.60	10.50	12.80												
8/25/2015	7.98	11.90	9.60												
8/22/2015	7.90	8.80	5.80												
8/22/2015	8.24	11.30	4.60	1	Control	Control	7.88	11.6	12.2	7.93	11.5	11	8.38	13.1	3
8/21/2015	8.00	14.00	13.00												
8/21/2015	7.90	13.00	9.60	1	Control	Control	7.9	13	10.4	8	13	11.6	8.2	13	5
8/19/2015	8.90	11.00	n/a												
8/18/2015	8.70	12.00	n.a												

Description	Date:	Test #	Hardness	TSS	Alk T	mmon	BR	Cl dis	F	Nitrate	Nitrite	P	SO4	TOC
Stream 1 Mixer	13-Aug	GE Prevent	1170	4.9	356		<0.25	<2.5	0.14	6.70	0.0206	<0.0020	782	1.50
Top of Stream 1	13-Aug	GE Prevent	1200	5.8	358		<0.25	<2.5	0.14	6.66	0.0210	0.0029	774	1.37
Bottom of Stream 1	13-Aug	GE Prevent	1170	12.9	362		<0.25	<2.5	0.14	6.68	0.0216	0.0035	780	1.64
Stream 2 Mixer	13-Aug	Kroff Prevent	1200	7.0	356		<0.25	<2.5	0.14	6.59	0.0217	0.197	770	1.50
Top of Stream 2	13-Aug	Kroff Prevent	1180	17.1	356		<0.25	<2.5	0.14	6.62	0.0212	0.234	776	1.40
Bottom of Stream 2	13-Aug	Kroff Prevent	1220	14.6	360		<0.25	<2.5	0.14	6.62	0.0212	0.24	773	2.32
Stream 3 Mixer	13-Aug	Control	1190	4.9	353		<0.25	<2.5	0.14	6.59	0.021	0.0030	770	1.14
Top of Stream 3	13-Aug	Control	1190	4.1	350		<0.25	<2.5	0.14	6.77	0.0226	0.0029	789	1.26
Bottom of Stream 3	13-Aug	Control	1210	15	323		<0.25	<2.5	0	6	0	0	756	2
Pilot Feed	13-Aug	Influent	1160	5.0	344		<0.25	<2.5	0.13	6.62	0.0212	<0.0020	770	1.25
Stream 1 Mixer	17-Aug	GE Prevent	1130	4.9	353		<0.50	<5.0	<0.20	6.76	0.018	0.0060	793	2.09
Stream 1 Mixer	17-Aug	GE Prevent	1150	2.0										
Top of Stream 1	17-Aug	GE Prevent	1170	5.5	355		<0.50	<5.0	<0.20	6.84	0.017	0.0049	802	1.76
Bottom of Stream 1	17-Aug	GE Prevent	1180	6.5	356		<0.50	<5.0	<0.20	6.85	0.017	0.0046	802	1.82
Stream 2 Mixer	17-Aug	Kroff Prevent	1170	5.2	353		<0.50	<5.0	<0.20	6.77	0.020	0.2670	793	2.13
Stream 2 Mixer	17-Aug	Kroff Prevent	1150	2.0										
Top of Stream 2	17-Aug	Kroff Prevent	1140	6.5	352		<0.50	<5.0	<0.20	6.77	0.018	0.2620	792	1.90
Bottom of Stream 2	17-Aug	Kroff Prevent	1170	7.6	357		<0.50	<5.0	<0.20	6.76	0.019	0.2570	791	2.21
Stream 3 Mixer	17-Aug	Control	1170	6.1	351		<0.50	<5.0	<0.20	6.82	0.0170	0.0039	800	1.92
Stream 3 Mixer	17-Aug	Control	1160	2										
Top of Stream 3	17-Aug	Control	1170	6.7	352		<0.50	<5.0	<0.20	6.64	0.018	0.0044	778	1.76
Bottom of Stream 3	17-Aug	Control	1180	20	325		<0.50	<5.0	<0.20	7	0	0	815	2
Pilot Feed	17-Aug	Influent	1150	4.1	351		<0.50	<5.0	<0.20	6.72	0.018	0.0106	790	1.79
Pilot Feed	17-Aug	Influent	1150	2										
Stream 1 Mixer	20-Aug	GE Prevent	1190	<3.0	364		<0.50	<5.0	<0.20	6.87	0.020	0.0050	803	1.93
Top of Stream 1	20-Aug	GE Prevent	1220	5.0	363		<0.50	<5.0	<0.20	6.79	0.021	0.0056	800	2.22
Bottom of Stream 1	20-Aug	GE Prevent	1210	<3.0	368		<0.50	<5.0	<0.20	6.86	0.020	0.0060	805	2.30
Stream 2 Mixer	20-Aug	Kroff Prevent	1180	3.9	362		<0.50	<5.0	<0.20	6.71	0.018	0.2560	786	2.15
Top of Stream 2	20-Aug	Kroff Prevent	1200	4.7	358		<0.50	<5.0	<0.20	6.87	0.019	0.2520	806	2.07
Bottom of Stream 2	20-Aug	Kroff Prevent	1210	5.3	365		<0.50	<5.0	<0.20	6.87	0.021	0.2540	802	2.23
Stream 3 Mixer	20-Aug	Control	1190	3.7	352		<0.50	<5.0	<0.20	6.86	0.020	0.0050	804	1.61
Top of Stream 3	20-Aug	Control	1220	7.6	346		<0.50	<5.0	<0.20	6.94	0.019	0.0073	811	2.59
Bottom of Stream 3	20-Aug	Control	1210	18	320		<0.50	<5.0	<0.20	7	0	0	804	2
Pilot Feed	20-Aug	Influent	1140	4.2	341		<0.50	<5.0	<0.20	6.61	0.018	0.0064	773	1.68
Stream 1 Mixer	24-Aug	GE Prevent	1170	4.2	367		<0.50	<5.0	<0.20	6.84	0.026	0.0070	799	2.11
Top of Stream 1	24-Aug	GE Prevent	1230	5.2	355		<0.50	<5.0	<0.20	6.83	0.024	0.0069	802	2.17
Bottom of Stream 1	24-Aug	GE Prevent	1180	9.1	356		<0.50	<5.0	<0.20	6.89	0.024	0.0076	808	1.94
Stream 2 Mixer	24-Aug	Kroff Prevent	1210	4.4	359		<0.50	<5.0	<0.20	6.90	0.023	0.2620	810	1.95
Top of Stream 2	24-Aug	Kroff Prevent	1200	3.6	351		<0.50	<5.0	<0.20	6.83	0.025	0.2460	801	1.99
Bottom of Stream 2	24-Aug	Kroff Prevent	1180	8.7	355		<0.50	<5.0	<0.20	6.92	0.026	0.2380	811	2.10
Stream 3 Mixer	24-Aug	Control	1190	4.0	357		<0.50	<5.0	<0.20	6.88	0.024	0.0057	807	1.89
Top of Stream 3	24-Aug	Control	1180	3.8	358		<0.50	<5.0	<0.20	6.92	0.022	0.0058	806	1.51
Bottom of Stream 3	24-Aug	Control	1190	9	325		<0.50	<5.0	<0.20	7	0	0	798	2
Pilot Feed	24-Aug	Influent	1170	5.5	342		<0.50	<5.0	<0.20	6.91	0.026	0.0051	808	1.74
Stream 1 Mixer	31-Aug	Control	1190	5.1	357		<0.50	<5.0	<0.20	7.03	0.019	0.0062	823	1.59
Top of Stream 1	31-Aug	Control	1170	3.7	355		<0.50	<5.0	<0.20	7.03	0.019	0.0061	824	1.53
Bottom of Stream 1	31-Aug	Control	1140	3.6	333		<0.50	<5.0	<0.20	6.68	0.018	0.0072	785	1.63

Description	Date:	Test #	Hardness	TSS	Alk T	mmon	BR	Cl dis	F	Nitrate	Nitrite	P	SO4	TOC
Stream 2 Mixer	31-Aug	Nalco Prevent	1210	3.2	367		<0.50	<5.0	<0.20	7.08	0.019	0.149	834	1.71
Top of Stream 2	31-Aug	Nalco Prevent	1180	3.2	363		<0.50	<5.0	<0.20	7.00	0.017	0.149	824	1.91
Bottom of Stream 2	31-Aug	Nalco Prevent	1140	10.3	362		<0.50	<5.0	<0.20	6.89	0.017	0.161	809	1.79
Stream 3 Mixer	8/31/2015	Kroff Dissolve	1190.00	3.90	361.00		<0.50	<5.0	<0.20	7.03	0.02	0.39	825.00	2.17
Top of Stream 3	42247.00	Kroff Dissolve	1200.00	<3.0	361.00		<0.50	<5.0	<0.20	6.89	0.02	0.40	809.00	2.27
Bottom of Stream 3	31-Aug	Kroff Dissolve	1130.00	3.40	361.00		<0.50	<5.0	<0.20	7.08	0.02	0.43	832.00	2.03
Pilot Feed	31-Aug	Influent	1200	3.9	356		<0.50	<5.0	<0.20	7.14	0.016	0.0066	840	1.24
Stream 1 Mixer	3-Sep	Control	1220	<3.0	341		<0.50	<5.0	<0.20	7.05	0.022	0.0055	841	1.41
Top of Stream 1	3-Sep	Control	1240	3.7	332		<0.50	<5.0	<0.20	6.99	0.017	0.0042	838	1.40
Bottom of Stream 1	3-Sep	Control	1220	6.2	319		<0.50	<5.0	<0.20	7.03	0.020	0.0049	842	1.56
Stream 2 Mixer	3-Sep	Nalco Prevent	1220	<3.0	371		<0.50	<5.0	<0.20	6.95	0.020	0.111	832	1.57
Top of Stream 2	3-Sep	Nalco Prevent	1230	3.1	365		<0.50	<5.0	<0.20	7.03	0.022	0.105	842	1.47
Bottom of Stream 2	3-Sep	Nalco Prevent	1220	3.9	368		<0.50	<5.0	<0.20	7.18	0.024	0.115	857	1.42
Stream 3 Mixer	9/3/2015	Kroff Dissolve	1230.00	<3.0	369.00		<0.50	<5.0	<0.20	6.91	0.02	0.31	826.00	1.88
Top of Stream 3	42250.00	Kroff Dissolve	1210.00	3.70	368.00		<0.50	<5.0	<0.20	7.00	0.02	0.29	839.00	1.78
Bottom of Stream 3	3-Sep	Kroff Dissolve	1220.00	9.20	365.00		<0.50	<5.0	<0.20	7.00	0.02	0.31	839.00	1.85
Pilot Feed	3-Sep	Influent	1210	<3.0	341		<0.50	<5.0	<0.20	7.01	0.023	0.0045	839	1.55
Stream 1 Mixer	7-Sep	Control	1210	6.3	366		<0.50	<5.0	<0.20	6.93	0.019	0.0048	821	1.33
Top of Stream 1	7-Sep	Control	1180	3.5	364		<0.50	<5.0	<0.20	7.22	0.020	0.0049	854	1.47
Bottom of Stream 1	7-Sep	Control	1200	6.3	335		<0.50	<5.0	<0.20	7.08	0.019	0.0059	838	1.57
Stream 2 Mixer	7-Sep	Nalco Prevent	1190	3.4	364		<0.50	<5.0	<0.20	6.90	0.019	0.127	815	1.42
Top of Stream 2	7-Sep	Nalco Prevent	1200	7.1	363		<0.50	<5.0	<0.20	7.14	0.023	0.143	842	1.58
Bottom of Stream 2	7-Sep	Nalco Prevent	1220	4.7	363		<0.50	<5.0	<0.20	7.20	0.019	0.137	850	1.82
Stream 3 Mixer	9/7/2015	Kroff Dissolve	1190.00	3.90	359.00		<0.50	<5.0	<0.20	7.10	0.02	0.34	842.00	1.91
Top of Stream 3	42254.00	Kroff Dissolve	1200.00	5.10	359.00		<0.50	<5.0	<0.20	7.18	0.02	0.34	850.00	1.92
Bottom of Stream 3	7-Sep	Kroff Dissolve	1190.00	9.40	360.00		<0.50	<5.0	<0.20	7.13	0.02	0.32	843.00	2.15
Pilot Feed	7-Sep	Influent	1180	5.3	360		<0.50	<5.0	<0.20	7.01	0.021	0.0053	828	1.45
Stream 1 Mixer	10-Sep	Control	1180	5.3	359		<0.50	<5.0	<0.20	6.88	0.019	0.0029	821	1.32
Top of Stream 1	10-Sep	Control	1220	6.3	356		<0.50	<5.0	<0.20	6.94	0.018	0.0038	827	1.03
Bottom of Stream 1	10-Sep	Control	1210	3.5	315		<0.50	<5.0	<0.20	7.06	0.020	0.0023	838	1.10
Stream 2 Mixer	10-Sep	Nalco Prevent	1240	3.8	372		<0.50	<5.0	<0.20	7.14	0.018	0.133	848	1.59
Top of Stream 2	10-Sep	Nalco Prevent	1230	4.9	367		<0.50	<5.0	<0.20	7.08	0.016	0.0984	845	1.85
Bottom of Stream 2	10-Sep	Nalco Prevent	1210	<3.0	370		<0.50	<5.0	<0.20	6.41	0.018	0.126	767	1.52
Stream 3 Mixer	10-Sep	Kroff Dissolve	1230	<3.0	365		<0.50	<5.0	<0.20	7.29	0.019	0.294	870	2.03
Top of Stream 3	10-Sep	Kroff Dissolve	1210	3.5	371		<0.50	<5.0	<0.20	6.79	0.021	0.340	810	1.80
Bottom of Stream 3	10-Sep	Kroff Dissolve	1200	<3.0	368		<0.50	<5.0	<0.20	7.53	0.024	0.330	897	1.71
Pilot Feed	10-Sep	Influent	1190	<3.0	345		<0.50	<5.0	<0.20	7.03	0.019	<0.0020	835	1.48
Stream 1 Mixer	14-Sep	GE Dissolve		3.5	364		<0.50	<5.0	<0.20	7.26	0.022	0.0059	859	1.38
Top of Stream 1	14-Sep	GE Dissolve		4.5	362		<1.0	<10	<0.40	7.24	0.025	0.0083	854	1.83
Bottom of Stream 1	14-Sep	GE Dissolve		3.3	370		<1.0	<10	<0.40	7.2	0.027	0.004	846	1.52
Stream 2 Mixer	14-Sep	Control		3.7	367		<0.50	<5.0	<0.20	7.13	0.022	<0.0020	841	1.27
Top of Stream 2	14-Sep	Control		4.9	358		<0.50	<5.0	<0.20	7.08	0.023	<0.0020	831	1.25
Bottom of Stream 2	14-Sep	Control		4.0	339		<0.50	<5.0	<0.20	7.19	0.023	0.0051	849	1.17
Stream 3 Mixer	14-Sep	Nalco Dissolve		3.7	369		<1.0	<10	<0.40	7.45	0.021	0.695	875	1.93
Top of Stream 3	42261	Nalco Dissolve		3.6	369		<0.50	<5.0	<0.20	7.18	0.022	0.691	846	2.13
Bottom of Stream 3	14-Sep	Nalco Dissolve		4.1	367		<1.0	<10	<0.40	7.27	0.025	0.679	856	2.06
Pilot Feed	14-Sep	Influent		4.1	359		<0.50	<5.0	<0.20	6.84	0.020	0.0034	800	0.96
Stream 1 Mixer	17-Sep	GE Dissolve	1210	6.6	374		<0.50	<5.0	<0.20	7.35	0.016	0.0047	872	1.80
Top of Stream 1	17-Sep	GE Dissolve	1230	4.9	373		<0.50	<5.0	<0.20	7.35	0.022	0.0062	867	1.91

Description	Date:	Test #	Hardness	TSS	Alk T	mmon	BR	Cl dis	F	Nitrate	Nitrite	P	SO4	TOC
Bottom of Stream 1	17-Sep	GE Dissolve	1250	<3.0	371		<0.50	<5.0	<0.20	7.41	0.016	0.0023	882	1.89
Stream 2 Mixer	17-Sep	Control	1270	<3.0	360		<0.50	<5.0	<0.20	7.46	0.016	0.0036	880	1.14
Top of Stream 2	17-Sep	Control	1260	<3.0	348		<0.50	<5.0	<0.20	7.27	0.014	0.0067	860	1.44
Bottom of Stream 2	17-Sep	Control	1250	4.1	330		<0.50	<5.0	<0.20	7.41	0.014	0.0034	879	1.17
Bottom of Stream 2 Dup	14-Sep	Control		3.3	339		<0.50	<5.0	<0.20	7.13	0.024	0.0031	841	1.07
Stream 3 Mixer	17-Sep	Nalco Dissolve	1230	<3.0	367		<0.50	<5.0	<0.20	7.36	0.014	0.588	867	1.87
Top of Stream 3	17-Sep	Nalco Dissolve	1250	6.5	372		<0.50	<5.0	<0.20	7.37	0.017	0.609	876	2.02
Bottom of Stream 3	17-Sep	Nalco Dissolve	1230	<3.0	372		<0.50	<5.0	<0.20	7.34	0.014	0.633	876	2.11
Pilot Feed	17-Sep	Influent	1210	3.4	350		<0.50	<5.0	<0.20	7.33	0.016	0.0038	867	1.16
Stream 1 Mixer	21-Sep	GE Dissolve	1250	<3.0	378		<0.50	<5.0	<0.20	7.25	0.014	0.0048	848	1.95
Top of Stream 1	21-Sep	GE Dissolve	1250	4.5	381		<0.50	<5.0	<0.20	7.22	0.016	0.0052	845	1.98
Bottom of Stream 1	21-Sep	GE Dissolve	1260	3.8	377		<0.50	<5.0	<0.20	7.06	0.013	0.0051	827	2.22
Bottom of Stream 1	21-Sep	GE Dissolve	1290	4	367	<0.02	<0.05	1.3	0.14	31.5	<0.01		837	
Stream 2 Mixer	21-Sep	Control	1220	4.3	344		<0.50	<5.0	<0.20	7.42	0.015	0.0050	872	1.26
Top of Stream 2	21-Sep	Control	1210	4.7	337		<0.50	<5.0	<0.20	7.23	0.014	0.0049	846	1.11
Bottom of Stream 2	21-Sep	Control	1280	8.9	314		<0.50	<5.0	<0.20	7.31	0.024	0.0045	848	1.21
Bottom of Stream 2	21-Sep	Control	1180	8	329	<0.02	<0.05	1.4	0.13	31.4	0.04		826	
Stream 3 Mixer	21-Sep	Nalco Dissolve	1250	3.9	383		<0.50	<5.0	<0.20	7.30	0.014	0.579	856	2.12
Top of Stream 3	21-Sep	Nalco Dissolve	1240	3.7	382		<0.50	<5.0	<0.20	7.44	0.015	0.563	871	2.25
Bottom of Stream 3	21-Sep	Nalco Dissolve	1300	5.7	375		<0.50	<5.0	<0.20	7.32	0.018	0.643	858	2.47
Bottom of Stream 3	21-Sep	Nalco Dissolve	1200	4	372	0.02	<0.05	1.9	0.14	31.3	<0.01		836	
Pilot Feed	21-Sep	Influent	1230	4.1	354		<0.50	<5.0	<0.20	5.76	0.012	0.0055	672	1.44
Stream 1 Mixer	24-Sep	GE Dissolve	1240	3.2	376		<1.0	<10	<0.40	7.44	<0.020	0.0039	871	1.61
Top of Stream 1	24-Sep	GE Dissolve	1220	4.6	372		<1.0	<10	<0.40	7.35	0.021	0.0030	860	1.79
Bottom of Stream 1	24-Sep	GE Dissolve	1210	4.5	376		<1.0	<10	<0.40	7.38	0.022	0.0033	865	1.76
Stream 2 Mixer	24-Sep	Control	1230	4.4	348		<0.50	<5.0	<0.20	7.37	0.020	0.0038	867	1.11
Top of Stream 2	24-Sep	Control	1230	4.3	354		<0.50	<5.0	<0.20	7.33	0.021	0.0043	857	1.06
Bottom of Stream 2	24-Sep	Control	1200	<3.0	335		<1.0	<10	<0.40	7.38	<0.020	0.0073	865	1.14
Treated Water Return	24-Sep	Effluent	1240	3.1	375		<1.0	<10	<0.40	7.48	<0.020	0.191	885	1.68
Treated Water Return	21-Sep	Effluent	1260	5.7	375		<0.50	<5.0	<0.20	7.11	0.016	0.175	835	2.15
Treated Water Return	21-Sep	Effluent	1270	3	365	0.02	<0.05	1.5	0.14	31	<0.01		822	
Treated Water Return	17-Sep	Effluent	1240	3.1	370		<0.50	<5.0	<0.20	7.39	0.013	0.211	875	1.86
Treated Water Return	14-Sep	Effluent		<3.0	371		<0.50	<5.0	<0.20	5.95	0.024	0.225	690	2.31
Treated Water Return	10-Sep	Effluent	1210	<3.0	369		<0.50	<5.0	<0.20	7.73	0.023	0.153	920	1.76
Treated Water Return	7-Sep	Effluent	1210	<3.0	367		<0.50	<5.0	<0.20	7.31	0.024	0.164	863	1.69
Treated Water Return	3-Sep	Effluent	1190	3.0	370		<0.50	<5.0	<0.20	7.00	0.023	0.136	838	1.60
Treated Water Return	31-Aug	Effluent	1170	4.0	366		<0.50	<5.0	<0.20	7.30	0.020	0.1850	859	1.87
Stream 3 Mixer	24-Sep	Nalco Dissolve	1250	3.1	372		<1.0	<10	<0.40	7.45	0.025	0.618	865	1.96
Top of Stream 3	24-Sep	Nalco Dissolve	1180	10.5	372		<1.0	<10	<0.40	7.55	<0.020	0.558	883	2.14
Bottom of Stream 3	24-Sep	Nalco Dissolve	1240	3.3	375		<1.0	<10	<0.40	7.43	<0.020	0.567	865	2.03
Top of Stream 3 Dup	7-Sep	Krof Dissolve	1270	3.7	362		<0.50	<5.0	<0.20	7.04	0.023	0.352	833	1.94
Top of Stream 2Dup	3-Sep	Nalco Prevent	1210	3.6	367		<0.50	<5.0	<0.20	6.94	0.020	0.117	832	1.34
Pilot Feed Duplicate	13-Aug	Influent	1190	6.7	341		<0.25	<2.5	0.14	6.77	0.022	0.0021	792	1.28

Description	Date:	Test #	Al Tot	Sb Tot	As Tot	Ba Tot	Be Tot	B Tot	Cd Tot	Ca Tot	Cr Tot	Co Tot
Stream 1 Mixer	13-Aug	GE Prevent	0.0227	0.000425	0.00027	0.0378	<0.000050	0.0356	0.000756	250	0.00021	0.000452
Top of Stream 1	13-Aug	GE Prevent	0.0205	0.000440	0.00028	0.0381	<0.000050	0.0408	0.000824	253	0.00016	0.000494
Bottom of Stream 1	13-Aug	GE Prevent	0.0379	0.000434	0.00029	0.0366	<0.000050	0.0377	0.000752	246	0.00018	0.000449
Stream 2 Mixer	13-Aug	Kroff Prevent	0.0249	0.000438	0.00031	0.0377	<0.000050	0.0417	0.000737	252	0.00015	0.000462
Top of Stream 2	13-Aug	Kroff Prevent	0.0209	0.000453	0.00031	0.0369	<0.000050	0.0378	0.000745	248	0.00016	0.000456
Bottom of Stream 2	13-Aug	Kroff Prevent	0.0817	0.000631	0.00049	0.0384	<0.000050	0.0405	0.000773	256	0.00034	0.000520
Stream 3 Mixer	13-Aug	Control	0.0196	0.000431	0.00027	0.0370	<0.000050	0.0405	0.000739	254	0.00013	0.000460
Top of Stream 3	13-Aug	Control	0.0186	0.000451	0.00028	0.0371	<0.000050	0.0395	0.000766	252	0.00012	0.000440
Bottom of Stream 3	13-Aug	Control	0	0	0	0	<0.000050	0	0	254	0	0
Pilot Feed	13-Aug	Influent	0.0203	0.000405	0.00024	0.0374	<0.000050	0.0353	0.000732	247	0.00012	0.000446
Stream 1 Mixer	17-Aug	GE Prevent	0.0914	0.000388	0.00030	0.0357	<0.000050	0.0297	0.000680	240	0.00021	0.000479
Stream 1 Mixer	17-Aug	GE Prevent	0.0680	0.000500	0.00070	0.0390	<0.0001	0.0400	0.000815	245	<0.0001	0.000500
Top of Stream 1	17-Aug	GE Prevent	0.0970	0.000420	0.00035	0.0360	<0.000050	0.0301	0.000706	249	0.00024	0.000520
Bottom of Stream 1	17-Aug	GE Prevent	0.0933	0.000401	0.00034	0.0370	<0.000050	0.0307	0.000741	249	0.00022	0.000513
Stream 2 Mixer	17-Aug	Kroff Prevent	0.0914	0.000394	0.00035	0.0364	<0.000050	0.0303	0.000701	246	0.00022	0.000482
Stream 2 Mixer	17-Aug	Kroff Prevent	0.0770	0.000400	0.00080	0.0384	<0.0001	0.0400	0.000735	253	0.00020	0.000500
Top of Stream 2	17-Aug	Kroff Prevent	0.0933	0.000383	0.00035	0.0339	<0.000050	0.0295	0.000660	240	0.00023	0.000467
Bottom of Stream 2	17-Aug	Kroff Prevent	0.0946	0.000383	0.00038	0.0353	<0.000050	0.0303	0.000690	248	0.00023	0.000489
Stream 3 Mixer	17-Aug	Control	0.0895	0.000401	0.00032	0.0358	<0.000050	0.0306	0.000686	248	0.00022	0.000496
Stream 3 Mixer	17-Aug	Control	0.092	0.0004	0.0009	0.0394	<0.0001	0.04	0.000733	244	0.0002	0.0005
Top of Stream 3	17-Aug	Control	0.0863	0.000397	0.00030	0.0352	<0.000050	0.0304	0.000692	244	0.00022	0.000492
Bottom of Stream 3	17-Aug	Control	0	0	0	0	<0.000050	0	0	248	0	0
Pilot Feed	17-Aug	Influent	0.0902	0.000384	0.00032	0.0366	<0.000050	0.0297	0.000698	242	0.00021	0.000489
Pilot Feed	17-Aug	Influent	0.063	0.0004	0.0006	0.0388	<0.0001	0.04	0.000808	250	0.0002	0.0006
Stream 1 Mixer	20-Aug	GE Prevent	0.0747	0.000427	0.00030	0.0381	<0.000050	0.0355	0.000725	249	0.00024	0.000567
Top of Stream 1	20-Aug	GE Prevent	0.0759	0.000433	0.00030	0.0395	<0.000050	0.0360	0.000741	255	0.00025	0.000572
Bottom of Stream 1	20-Aug	GE Prevent	0.0571	0.000459	0.00029	0.0386	<0.000050	0.0355	0.000741	254	0.00027	0.000605
Stream 2 Mixer	20-Aug	Kroff Prevent	0.0834	0.000409	0.00033	0.0383	<0.000050	0.0343	0.000677	246	0.00022	0.000539
Top of Stream 2	20-Aug	Kroff Prevent	0.0687	0.000427	0.00035	0.0385	<0.000050	0.0356	0.000727	250	0.00023	0.000553
Bottom of Stream 2	20-Aug	Kroff Prevent	0.0741	0.000445	0.00031	0.0383	<0.000050	0.0349	0.000715	255	0.00023	0.000555
Stream 3 Mixer	20-Aug	Control	0.0365	0.000429	0.00031	0.0386	<0.000050	0.0347	0.000720	251	0.00019	0.000567
Top of Stream 3	20-Aug	Control	0.0644	0.000433	0.00032	0.0389	<0.000050	0.0358	0.000740	256	0.00023	0.000598
Bottom of Stream 3	20-Aug	Control	0	0	0	0	<0.000050	0	0	254	0	0
Pilot Feed	20-Aug	Influent	0.0537	0.000402	0.00032	0.0370	<0.000050	0.0332	0.000681	238	0.00020	0.000530
Stream 1 Mixer	24-Aug	GE Prevent	0.0645	0.000475	0.00032	0.0367	<0.000050	0.0367	0.000578	242	0.00025	0.000700
Top of Stream 1	24-Aug	GE Prevent	0.0557	0.000458	0.00032	0.0389	<0.000050	0.0394	0.000595	252	0.00053	0.000755
Bottom of Stream 1	24-Aug	GE Prevent	0.1060	0.000486	0.00041	0.0404	<0.000050	0.0408	0.000584	248	0.00043	0.000785
Stream 2 Mixer	24-Aug	Kroff Prevent	0.0768	0.000473	0.00037	0.0380	<0.000050	0.0387	0.000572	248	0.00030	0.000734
Top of Stream 2	24-Aug	Kroff Prevent	0.0872	0.000428	0.00034	0.0383	<0.000050	0.0390	0.000565	245	0.00037	0.000707
Bottom of Stream 2	24-Aug	Kroff Prevent	0.1290	0.000440	0.00039	0.0399	<0.000050	0.0396	0.000580	243	0.00038	0.000774
Stream 3 Mixer	24-Aug	Control	0.0613	0.000506	0.00031	0.0382	<0.000050	0.0383	0.000560	245	0.00030	0.000737
Top of Stream 3	24-Aug	Control	0.0804	0.000473	0.00031	0.0400	<0.000050	0.0402	0.000554	241	0.00029	0.000793
Bottom of Stream 3	24-Aug	Control	0	0	0	0	<0.000050	0	0	245	0	0
Pilot Feed	24-Aug	Influent	0.0546	0.000560	0.00031	0.0362	<0.000050	0.0371	0.000546	241	0.00025	0.000711
Stream 1 Mixer	31-Aug	Control	0.0724	0.000378	0.00028	0.0390	<0.000050	0.0340	0.000637	250	0.00017	0.000747
Top of Stream 1	31-Aug	Control	0.0607	0.000362	0.00029	0.0395	<0.000050	0.0329	0.000616	250	0.00024	0.000707
Bottom of Stream 1	31-Aug	Control	0.0579	0.000354	0.00027	0.0392	<0.000050	0.0326	0.000603	237	0.00018	0.000686

Description	Date:	Test #	Al Tot	Sb Tot	As Tot	Ba Tot	Be Tot	B Tot	Cd Tot	Ca Tot	Cr Tot	Co Tot
Stream 2 Mixer	31-Aug	Nalco Prevent	0.0796	0.000396	0.00028	0.0399	<0.000050	0.0338	0.000633	250	0.00020	0.000715
Top of Stream 2	31-Aug	Nalco Prevent	0.0520	0.000376	0.00028	0.0408	<0.000050	0.0330	0.000623	245	0.00014	0.000708
Bottom of Stream 2	31-Aug	Nalco Prevent	0.0856	0.000378	0.00032	0.0385	<0.000050	0.0335	0.000596	234	0.00022	0.000715
Stream 3 Mixer	8/31/2015	Kroff Dissolve	0.08	0.00	0.00	0.04	<0.000050	0.03	0.00	248.00	0.00	0.00
Top of Stream 3	42247.00	Kroff Dissolve	0.07	0.00	0.00	0.04	<0.000050	0.03	0.00	250.00	0.00	0.00
Bottom of Stream 3	31-Aug	Kroff Dissolve	0.06	0.00	0.00	0.04	<0.000050	0.03	0.00	236.00	0.00	0.00
Pilot Feed	31-Aug	Influent	0.0842	0.000415	0.00029	0.0401	<0.000050	0.0340	0.000624	248	0.00021	0.000716
Stream 1 Mixer	3-Sep	Control	0.0349	0.000387	0.00026	0.0397	<0.000050	0.0342	0.000605	259	0.00020	0.000655
Top of Stream 1	3-Sep	Control	0.0378	0.000384	0.00031	0.0398	<0.000050	0.0346	0.000587	261	0.00014	0.000680
Bottom of Stream 1	3-Sep	Control	0.0421	0.000381	0.00031	0.0408	<0.000050	0.0341	0.000501	260	0.00016	0.000661
Stream 2 Mixer	3-Sep	Nalco Prevent	0.0390	0.000388	0.00031	0.0397	<0.000050	0.0350	0.000618	260	0.00023	0.000660
Top of Stream 2	3-Sep	Nalco Prevent	0.0364	0.000393	0.00030	0.0402	<0.000050	0.0342	0.000596	263	0.00018	0.000651
Bottom of Stream 2	3-Sep	Nalco Prevent	0.0489	0.000384	0.00031	0.0403	<0.000050	0.0349	0.000595	258	0.00016	0.000641
Stream 3 Mixer	9/3/2015	Kroff Dissolve	0.04	0.00	0.00	0.04	<0.000050	0.03	0.00	262.00	0.00	0.00
Top of Stream 3	42250.00	Kroff Dissolve	0.05	0.00	0.00	0.04	<0.000050	0.03	0.00	259.00	0.00	0.00
Bottom of Stream 3	3-Sep	Kroff Dissolve	0.05	0.00	0.00	0.04	<0.000050	0.03	0.00	259.00	0.00	0.00
Pilot Feed	3-Sep	Influent	0.0384	0.000382	0.00027	0.0396	<0.000050	0.0345	0.000618	257	0.00017	0.000651
Stream 1 Mixer	7-Sep	Control	0.0544	0.000376	0.00029	0.0404	<0.000050	0.0381	0.000674	251	0.00018	0.000683
Top of Stream 1	7-Sep	Control	0.0746	0.000371	0.00028	0.0403	<0.000050	0.0360	0.000659	247	0.00022	0.000655
Bottom of Stream 1	7-Sep	Control	0.0603	0.000439	0.00040	0.0402	<0.000050	0.0395	0.000631	249	0.00020	0.000647
Stream 2 Mixer	7-Sep	Nalco Prevent	0.0676	0.000379	0.00028	0.0400	<0.000050	0.0369	0.000671	248	0.00018	0.000664
Top of Stream 2	7-Sep	Nalco Prevent	0.0800	0.000440	0.00038	0.0402	<0.000050	0.0387	0.000665	247	0.00022	0.000666
Bottom of Stream 2	7-Sep	Nalco Prevent	0.0613	0.000424	0.00041	0.0405	<0.000050	0.0383	0.000681	254	0.00019	0.000642
Stream 3 Mixer	9/7/2015	Kroff Dissolve	0.09	0.00	0.00	0.04	<0.000050	0.04	0.00	248.00	0.00	0.00
Top of Stream 3	42254.00	Kroff Dissolve	0.08	0.00	0.00	0.04	<0.000050	0.04	0.00	244.00	0.00	0.00
Bottom of Stream 3	7-Sep	Kroff Dissolve	0.11	0.00	0.00	0.04	<0.000050	0.04	0.00	248.00	0.00	0.00
Pilot Feed	7-Sep	Influent	0.0600	0.000375	0.00028	0.0396	<0.000050	0.0362	0.000668	245	0.00019	0.000636
Stream 1 Mixer	10-Sep	Control	0.0337	0.000336	0.00037	0.0387	<0.000050	0.0384	0.000608	248	0.00036	0.000609
Top of Stream 1	10-Sep	Control	0.0473	0.000366	0.00037	0.0406	<0.000050	0.0401	0.000629	253	0.00019	0.000634
Bottom of Stream 1	10-Sep	Control	0.0348	0.000361	0.00033	0.0403	<0.000050	0.0397	0.000515	253	0.00017	0.000591
Stream 2 Mixer	10-Sep	Nalco Prevent	0.0578	0.000371	0.00040	0.0406	<0.000050	0.0402	0.000624	258	0.00020	0.000667
Top of Stream 2	10-Sep	Nalco Prevent	0.0551	0.000348	0.00039	0.0401	<0.000050	0.0394	0.000637	258	0.00023	0.000623
Bottom of Stream 2	10-Sep	Nalco Prevent	0.0341	0.000367	0.00036	0.0401	<0.000050	0.0397	0.000631	256	0.00019	0.000594
Stream 3 Mixer	10-Sep	Kroff Dissolve	0.0501	0.000351	0.00066	0.0405	<0.000050	0.0389	0.000636	255	0.00019	0.000626
Top of Stream 3	10-Sep	Kroff Dissolve	0.0312	0.000353	0.00043	0.0400	<0.000050	0.0390	0.000631	254	0.00021	0.000586
Bottom of Stream 3	10-Sep	Kroff Dissolve	0.0365	0.000349	0.00041	0.0397	<0.000050	0.0395	0.000627	252	0.00015	0.000584
Pilot Feed	10-Sep	Influent	0.0470	0.000344	0.00039	0.0402	<0.000050	0.0389	0.000612	252	0.00017	0.000596
Stream 1 Mixer	14-Sep	GE Dissolve	0.0436	0.000405	0.00027	0.0411	<0.000050	0.0408	0.000584	270	0.00024	0.000606
Top of Stream 1	14-Sep	GE Dissolve	0.0348	0.000384	0.00026	0.0397	<0.000050	0.0376	0.000615	260	0.0002	0.000575
Bottom of Stream 1	14-Sep	GE Dissolve	0.0306	0.000383	0.00031	0.0404	<0.000050	0.0381	0.000653	266	0.00018	0.000531
Stream 2 Mixer	14-Sep	Control	0.0343	0.000421	0.00026	0.0391	<0.000050	0.0398	0.000660	252	0.00096	0.000565
Top of Stream 2	14-Sep	Control	0.0241	0.000394	0.00027	0.0403	<0.000050	0.0383	0.000563	262	0.00024	0.000511
Bottom of Stream 2	14-Sep	Control	0.0233	0.000385	0.00034	0.0396	<0.000050	0.0367	0.000545	260	0.00056	0.000522
Stream 3 Mixer	14-Sep	Nalco Dissolve	0.0402	0.000392	0.00027	0.0407	<0.000050	0.0392	0.000604	264	0.00022	0.000561
Top of Stream 3	42261	Nalco Dissolve	0.0453	0.000402	0.00031	0.0414	<0.000050	0.0392	0.000896	269	0.00023	0.000575
Bottom of Stream 3	14-Sep	Nalco Dissolve	0.0344	0.000429	0.00028	0.0395	<0.000050	0.0391	0.000563	260	0.00021	0.000535
Pilot Feed	14-Sep	Influent	0.0187	0.000410	0.00025	0.0395	<0.000050	0.0394	0.000571	263	0.00016	0.000518
Stream 1 Mixer	17-Sep	GE Dissolve	0.0290	0.000431	0.00028	0.0405	<0.000050	0.0432	0.000608	255	0.00016	0.000574
Top of Stream 1	17-Sep	GE Dissolve	0.0315	0.000362	0.00024	0.0379	<0.000050	0.0379	0.000651	260	0.00019	0.000560

Description	Date:	Test #	Al Tot	Sb Tot	As Tot	Ba Tot	Be Tot	B Tot	Cd Tot	Ca Tot	Cr Tot	Co Tot
Bottom of Stream 1	17-Sep	GE Dissolve	0.0294	0.000351	0.00024	0.0382	<0.000050	0.0388	0.000672	264	0.00019	0.000538
Stream 2 Mixer	17-Sep	Control	0.0261	0.000359	0.00024	0.0384	<0.000050	0.0380	0.000642	266	0.00017	0.000541
Top of Stream 2	17-Sep	Control	0.0489	0.000339	0.00027	0.0397	<0.000050	0.0390	0.000659	267	0.00024	0.000677
Bottom of Stream 2	17-Sep	Control	0.0200	0.000377	0.00026	0.0385	<0.000050	0.0401	0.000607	267	0.00020	0.000537
Bottom of Stream 2 Dup	14-Sep	Control	0.0350	0.000397	0.00027	0.0403	<0.000050	0.0357	0.000518	263	0.00018	0.000498
Stream 3 Mixer	17-Sep	Nalco Dissolve	0.0311	0.000345	0.00023	0.0379	<0.000050	0.0377	0.000601	259	0.00019	0.000530
Top of Stream 3	17-Sep	Nalco Dissolve	0.0637	0.000341	0.00028	0.0396	<0.000050	0.0383	0.000659	264	0.00024	0.000630
Bottom of Stream 3	17-Sep	Nalco Dissolve	0.0327	0.000345	0.00024	0.0382	<0.000050	0.0383	0.000627	262	0.00020	0.000523
Pilot Feed	17-Sep	Influent	0.0257	0.000421	0.00025	0.0408	<0.000050	0.0435	0.000638	258	0.00014	0.000540
Stream 1 Mixer	21-Sep	GE Dissolve	0.0483	0.000374	0.00027	0.0403	<0.000050	0.0394	0.000647	264	0.00018	0.000533
Top of Stream 1	21-Sep	GE Dissolve	0.0320	0.000356	0.00027	0.0404	<0.000050	0.0375	0.000582	262	0.00015	0.000544
Bottom of Stream 1	21-Sep	GE Dissolve	0.0388	0.000395	0.00026	0.0415	<0.000050	0.0351	0.000628	265	0.00017	0.000557
Bottom of Stream 1	21-Sep	GE Dissolve										
Stream 2 Mixer	21-Sep	Control	0.0416	0.000358	0.00026	0.0393	<0.000050	0.0377	0.000609	255	0.00015	0.000527
Top of Stream 2	21-Sep	Control	0.0360	0.000344	0.00027	0.0402	<0.000050	0.0373	0.000589	256	0.00016	0.000532
Bottom of Stream 2	21-Sep	Control	0.0361	0.000405	0.00028	0.0412	<0.000050	0.0364	0.000563	269	0.00016	0.000552
Bottom of Stream 2	21-Sep	Control	0.039	0.0004	0.0016	0.0437	<0.0001	0.03	0.000666	284	0.0005	0.0006
Stream 3 Mixer	21-Sep	Nalco Dissolve	0.0488	0.000368	0.00025	0.0408	<0.000050	0.0387	0.000602	263	0.00020	0.000554
Top of Stream 3	21-Sep	Nalco Dissolve	0.0526	0.000402	0.00027	0.0408	<0.000050	0.0352	0.000613	262	0.00018	0.000546
Bottom of Stream 3	21-Sep	Nalco Dissolve	0.0572	0.000369	0.00027	0.0419	<0.000050	0.0342	0.000662	272	0.00018	0.000563
Bottom of Stream 3	21-Sep	Nalco Dissolve	0.035	0.0004	0.0013	0.0428	<0.0001	0.03	0.000576	280	0.0005	0.0005
Pilot Feed	21-Sep	Influent	0.0571	0.000353	0.00026	0.0388	<0.000050	0.0409	0.000633	259	0.00019	0.000541
Stream 1 Mixer	24-Sep	GE Dissolve	0.0264	<0.00050	0.00037	0.0388	<0.000050	0.0427	0.000560	260	0.00019	0.000530
Top of Stream 1	24-Sep	GE Dissolve	0.0172	<0.00050	0.00036	0.0382	<0.000050	0.0422	0.000611	256	0.00019	0.000504
Bottom of Stream 1	24-Sep	GE Dissolve	0.0206	<0.00050	0.00034	0.0397	<0.000050	0.0419	0.000627	253	0.00017	0.000503
Stream 2 Mixer	24-Sep	Control	0.0237	<0.00050	0.00037	0.0386	<0.000050	0.0467	0.000612	257	0.00017	0.000514
Top of Stream 2	24-Sep	Control	0.0199	<0.00050	0.00035	0.0380	<0.000050	0.0446	0.000638	256	0.00017	0.000542
Bottom of Stream 2	24-Sep	Control	0.0227	<0.00050	0.00034	0.0395	<0.000050	0.0432	0.000494	250	0.00021	0.000485
Treated Water Return	24-Sep	Effluent	0.0258	<0.00050	0.00033	0.0397	<0.000050	0.0435	0.000597	257	0.00021	0.000497
Treated Water Return	21-Sep	Effluent	0.0430	0.000395	0.00028	0.0408	<0.000050	0.0353	0.000634	265	0.00017	0.000546
Treated Water Return	21-Sep	Effluent	0.042	0.0004	0.0014	0.0443	<0.0001	0.03	0.0007	285	0.0005	0.0005
Treated Water Return	17-Sep	Effluent	0.0286	0.000358	0.00023	0.0387	<0.000050	0.0394	0.000612	264	0.00019	0.000517
Treated Water Return	14-Sep	Effluent	0.0267	0.000390	0.00027	0.0399	<0.000050	0.0379	0.000583	261	0.00020	0.000524
Treated Water Return	10-Sep	Effluent	0.0430	0.000380	0.00036	0.0406	<0.000050	0.0400	0.000601	256	0.00025	0.000604
Treated Water Return	7-Sep	Effluent	0.0781	0.000415	0.00045	0.0399	<0.000050	0.0375	0.000606	251	0.00022	0.000649
Treated Water Return	3-Sep	Effluent	0.0473	0.000399	0.00031	0.0394	<0.000050	0.0355	0.000594	251	0.00017	0.000643
Treated Water Return	31-Aug	Effluent	0.0796	0.000417	0.00032	0.0386	<0.000050	0.0353	0.000615	243	0.00021	0.000726
Stream 3 Mixer	24-Sep	Nalco Dissolve	0.0372	<0.00050	0.00036	0.0406	<0.000050	0.0468	0.000626	260	0.00020	0.000524
Top of Stream 3	24-Sep	Nalco Dissolve	0.0502	<0.00050	0.00034	0.0388	<0.000050	0.0429	0.000645	248	0.00028	0.000599
Bottom of Stream 3	24-Sep	Nalco Dissolve	0.0280	<0.00050	0.00037	0.0402	<0.000050	0.0434	0.000605	258	0.00019	0.000525
Top of Stream 3 Dup	7-Sep	Krof Dissolve	0.0690	0.000435	0.00049	0.0408	<0.000050	0.0383	0.000704	261	0.00019	0.000669
Top of Stream 2Dup	3-Sep	Nalco Prevent	0.0423	0.000385	0.00029	0.0392	<0.000050	0.0351	0.000595	251	0.00016	0.000633
			0.0152	0.000424	0.00027	0.0371	<0.000050	0.0390	0.000783	250	0.00014	0.000447

Description	Date:	Test #	Cu Tot	Fe Tot	Pb Tot	Li Tot	Mg Tot	Mn Tot	Hg Tot	Mo Tot	Ni Tot	P Tot	K Tot	Se Tot	Si Tot
Stream 1 Mixer	13-Aug	GE Prevent	<0.00050	0.028	0.000134	0.0194	133	0.0129		0.011000	0.0633	<0.050	3.67	0.0289	1.47
Top of Stream 1	13-Aug	GE Prevent	<0.00050	0.029	0.000277	0.0213	137	0.0132		0.013700	0.0655	<0.050	3.73	0.0302	1.52
Bottom of Stream 1	13-Aug	GE Prevent	0.00326	0.051	0.000993	0.0201	134	0.0127		0.011900	0.0623	<0.050	3.48	0.0286	1.49
Stream 2 Mixer	13-Aug	Kroff Prevent	<0.00050	0.028	0.000102	0.0199	139	0.0131		0.000827	0.0639	0.173	3.70	0.0298	1.53
Top of Stream 2	13-Aug	Kroff Prevent	<0.00050	0.029	0.00144	0.0196	136	0.0127		0.000820	0.0631	0.199	3.59	0.0289	1.48
Bottom of Stream 2	13-Aug	Kroff Prevent	0.018	0.121	0.0046	0.0218	140	0.0145		0.000836	0.0652	0.2	3.61	0.0304	1.64
Stream 3 Mixer	13-Aug	Control	<0.00050	0.027	0.000186	0.0202	136	0.0129		0.000823	0.0629	<0.050	3.55	0.0293	1.54
Top of Stream 3	13-Aug	Control	<0.00050	0.029	0.000445	0.0202	137	0.0125		0.000828	0.0627	<0.050	3.51	0.0298	1.52
Bottom of Stream 3	13-Aug	Control	0	0	0	0	139	0		0	0	<0.050	4	0	2
Pilot Feed	13-Aug	Influent	<0.00050	0.022	<0.000030	0.0192	133	0.0127		0.000814	0.0627	<0.050	3.62	0.0295	1.43
Stream 1 Mixer	17-Aug	GE Prevent	<0.00050	0.059	0.000155	0.0193	130	0.0133		0.014100	0.0574	<0.050	3.27	0.0265	1.48
Stream 1 Mixer	17-Aug	GE Prevent	<0.0005	0.040	0.000080	0.0232	138	0.0160	<0.00001	0.014400	0.0571		3.60	0.0284	1.60
Top of Stream 1	17-Aug	GE Prevent	<0.00050	0.057	0.000158	0.0197	134	0.0138		0.015500	0.0586	<0.050	3.34	0.0275	1.52
Bottom of Stream 1	17-Aug	GE Prevent	0.0014	0.066	0.000394	0.0191	136	0.0138		0.014000	0.0585	<0.050	3.31	0.0288	1.55
Stream 2 Mixer	17-Aug	Kroff Prevent	<0.00050	0.061	0.000086	0.0195	136	0.0133		0.000835	0.0572	0.253	3.30	0.0277	1.52
Stream 2 Mixer	17-Aug	Kroff Prevent	<0.0005	0.050	0.00009	0.0227	139	0.0160	<0.00001	0.000840	0.0586		3.60	0.0262	1.60
Top of Stream 2	17-Aug	Kroff Prevent	<0.00050	0.055	0.000115	0.0193	132	0.0130		0.000822	0.0562	0.251	3.21	0.0265	1.49
Bottom of Stream 2	17-Aug	Kroff Prevent	0.00175	0.075	0.000427	0.0191	134	0.0136		0.000837	0.0570	0.255	3.24	0.0278	1.54
Stream 3 Mixer	17-Aug	Control	<0.00050	0.058	0.000077	0.0196	134	0.0131		0.000832	0.0576	<0.050	3.32	0.0270	1.53
Stream 3 Mixer	17-Aug	Control	<0.0005	0.05	<0.00005	0.023	133	0.015	<0.00001	0.00087	0.0559		3.5	0.0281	1.59
Top of Stream 3	17-Aug	Control	<0.00050	0.058	0.000264	0.0197	136	0.0133		0.000817	0.0571	<0.050	3.21	0.0276	1.50
Bottom of Stream 3	17-Aug	Control	0	0	0	0	136	0		0	0	<0.050	3	0	2
Pilot Feed	17-Aug	Influent	<0.00050	0.063	0.000090	0.0202	132	0.0135		0.000814	0.0575	<0.050	3.31	0.0268	1.48
Pilot Feed	17-Aug	Influent	<0.0005	0.05	0.00017	0.0228	138	0.017	<0.00001	0.00088	0.0619		3.5	0.029	1.6
Stream 1 Mixer	20-Aug	GE Prevent	<0.00050	0.063	0.000083	0.0216	137	0.0152		0.014500	0.0613	<0.050	3.60	0.0286	1.68
Top of Stream 1	20-Aug	GE Prevent	<0.00050	0.077	0.000171	0.0224	141	0.0158		0.014900	0.0621	<0.050	3.75	0.0293	1.69
Bottom of Stream 1	20-Aug	GE Prevent	<0.0025	0.070	0.000866	0.0218	140	0.0155		0.013300	0.0625	<0.050	3.69	0.0294	1.60
Stream 2 Mixer	20-Aug	Kroff Prevent	<0.00050	0.074	0.000088	0.0215	137	0.0153		0.000832	0.0601	0.212	3.56	0.0273	1.61
Top of Stream 2	20-Aug	Kroff Prevent	<0.00050	0.084	0.000238	0.0210	139	0.0153		0.000874	0.0603	0.215	3.61	0.0286	1.62
Bottom of Stream 2	20-Aug	Kroff Prevent	<0.0025	0.073	0.000500	0.0217	140	0.0154		0.000868	0.0616	0.224	3.66	0.0286	1.63
Stream 3 Mixer	20-Aug	Control	<0.00050	0.059	0.000078	0.0212	138	0.0156		0.000860	0.0612	<0.050	3.66	0.0289	1.56
Top of Stream 3	20-Aug	Control	<0.00050	0.101	0.000170	0.0217	142	0.0167		0.000910	0.0619	<0.050	3.66	0.0293	1.64
Bottom of Stream 3	20-Aug	Control	<0.0020	0	0	0	139	0		0	0	<0.050	4	0	2
Pilot Feed	20-Aug	Influent	<0.00050	0.064	0.000078	0.0210	132	0.0148		0.000832	0.0585	<0.050	3.44	0.0276	1.49
Stream 1 Mixer	24-Aug	GE Prevent	0.00076	0.072	0.000113	0.0201	139	0.0193	<0.0000050	0.014200	0.0608	<0.050	3.58	0.0266	1.74
Top of Stream 1	24-Aug	GE Prevent	<0.00050	0.089	0.000176	0.0216	146	0.0204	<0.0000050	0.015200	0.0625	<0.050	3.66	0.0271	1.73
Bottom of Stream 1	24-Aug	GE Prevent	0.00165	0.110	0.000523	0.0238	137	0.0215	<0.0000050	0.014400	0.0640	<0.050	3.81	0.0287	1.79
Stream 2 Mixer	24-Aug	Kroff Prevent	<0.00050	0.074	0.000099	0.0211	143	0.0194	<0.0000050	0.000886	0.0620	0.242	3.63	0.0270	1.82
Top of Stream 2	24-Aug	Kroff Prevent	<0.00050	0.071	0.000126	0.0213	142	0.0193	<0.0000050	0.000876	0.0610	0.23	3.61	0.0271	1.74
Bottom of Stream 2	24-Aug	Kroff Prevent	0.00166	0.107	0.000370	0.0220	139	0.0212	<0.0000050	0.000868	0.0625	0.225	3.74	0.0272	1.79
Stream 3 Mixer	24-Aug	Control	<0.00050	0.069	0.000107	0.0213	141	0.0198	<0.0000050	0.000881	0.0625	<0.050	3.63	0.0271	1.76
Top of Stream 3	24-Aug	Control	<0.00050	0.064	0.000116	0.0225	141	0.0203	<0.0000050	0.000884	0.0628	<0.050	3.79	0.0267	1.71
Bottom of Stream 3	24-Aug	Control	0	0	0	0	142	0	<0.0000050	0	0	<0.050	4	0	2
Pilot Feed	24-Aug	Influent	0.00059	0.063	0.000321	0.0204	137	0.0196	<0.0000050	0.000826	0.0617	<0.050	3.60	0.0272	1.69
Stream 1 Mixer	31-Aug	Control	<0.00050	0.066	0.000071	0.0214	138	0.0214		0.000833	0.0621	<0.050	3.65	0.0274	1.91
Top of Stream 1	31-Aug	Control	<0.00050	0.059	0.000094	0.0198	132	0.0205		0.000823	0.0603	<0.050	3.56	0.0268	1.77
Bottom of Stream 1	31-Aug	Control	0.00121	0.065	0.000239	0.0194	134	0.0204		0.000779	0.0587	<0.050	3.46	0.0265	1.73

Description	Date:	Test #	Cu Tot	Fe Tot	Pb Tot	Li Tot	Mg Tot	Mn Tot	Hg Tot	Mo Tot	Ni Tot	P Tot	K Tot	Se Tot	Si Tot
Stream 2 Mixer	31-Aug	Nalco Prevent	<0.00050	0.062	0.000078	0.0207	142	0.0213		0.000842	0.0609	0.148	3.56	0.0272	1.91
Top of Stream 2	31-Aug	Nalco Prevent	<0.00050	0.059	0.000117	0.0199	137	0.0209		0.000806	0.0611	0.149	3.59	0.0266	1.83
Bottom of Stream 2	31-Aug	Nalco Prevent	0.00267	0.114	0.000483	0.0197	135	0.0212		0.000813	0.0603	0.151	3.45	0.0258	1.75
Stream 3 Mixer	8/31/2015	Kroff Dissolve	<0.00050	0.07	0.00	0.02	139.00	0.02		0.00	0.06	0.37	3.61	0.03	1.92
Top of Stream 3	42247.00	Kroff Dissolve	<0.00050	0.07	0.00	0.02	139.00	0.02		0.00	0.06	0.41	3.73	0.03	1.88
Bottom of Stream 3	31-Aug	Kroff Dissolve	0.00	0.07	0.00	0.02	132.00	0.02		0.00	0.06	0.38	3.44	0.03	1.73
Pilot Feed	31-Aug	Influent	<0.00050	0.066	0.000168	0.0213	141	0.0208		0.000837	0.0608	<0.050	3.56	0.0272	1.88
Stream 1 Mixer	3-Sep	Control	<0.00050	0.040	0.000042	0.0215	140	0.0198	-	0.000860	0.0636	<0.050	3.58	0.0279	1.77
Top of Stream 1	3-Sep	Control	<0.00050	0.036	0.000051	0.0216	142	0.0197	-	0.000842	0.0647	<0.050	3.63	0.0275	1.80
Bottom of Stream 1	3-Sep	Control	0.00128	0.040	0.000144	0.0209	138	0.0191	-	0.000840	0.0640	<0.050	3.62	0.0277	1.77
Stream 2 Mixer	3-Sep	Nalco Prevent	0.00056	0.037	0.000068	0.0218	140	0.0193	-	0.000884	0.0630	0.153	3.57	0.0281	1.79
Top of Stream 2	3-Sep	Nalco Prevent	0.00062	0.036	0.000041	0.0212	140	0.0194	-	0.000875	0.0646	0.157	3.65	0.0283	1.79
Bottom of Stream 2	3-Sep	Nalco Prevent	0.00170	0.039	0.000249	0.0211	140	0.0197	-	0.000852	0.0645	0.151	3.66	0.0278	1.78
Stream 3 Mixer	9/3/2015	Kroff Dissolve	<0.00050	0.04	<0.000030	0.02	139.00	0.02	-	0.00	0.06	0.39	3.60	0.03	1.81
Top of Stream 3	42250.00	Kroff Dissolve	<0.00050	0.04	0.00	0.02	138.00	0.02	-	0.00	0.06	0.37	3.62	0.03	1.79
Bottom of Stream 3	3-Sep	Kroff Dissolve	0.00	0.04	0.00	0.02	140.00	0.02	-	0.00	0.06	0.37	3.62	0.03	1.76
Pilot Feed	3-Sep	Influent	<0.00050	0.035	0.000066	0.0221	138	0.0191	-	0.000871	0.0629	<0.050	3.55	0.0283	1.75
Stream 1 Mixer	7-Sep	Control	0.00397	0.043	0.000060	0.0210	142	0.0202	-	0.000895	0.0636	<0.050	3.73	0.0286	1.92
Top of Stream 1	7-Sep	Control	<0.00050	0.047	0.000071	0.0202	138	0.0198	-	0.000894	0.0630	<0.050	3.66	0.0287	1.91
Bottom of Stream 1	7-Sep	Control	0.00100	0.049	0.000199	0.0232	139	0.0198	-	0.000925	0.0610	<0.050	3.65	0.0290	1.92
Stream 2 Mixer	7-Sep	Nalco Prevent	<0.00050	0.040	0.000076	0.0206	138	0.0203	-	0.000896	0.0637	0.156	3.71	0.0281	1.92
Top of Stream 2	7-Sep	Nalco Prevent	<0.00050	0.045	0.000071	0.0227	142	0.0199	-	0.000903	0.0613	0.156	3.71	0.0283	1.93
Bottom of Stream 2	7-Sep	Nalco Prevent	0.00142	0.051	0.000218	0.0226	143	0.0197	-	0.000899	0.0598	0.167	3.64	0.0287	1.95
Stream 3 Mixer	9/7/2015	Kroff Dissolve	<0.00050	0.05	0.00	0.02	140.00	0.02	-	0.00	0.06	0.39	3.55	0.03	1.96
Top of Stream 3	42254.00	Kroff Dissolve	<0.00050	0.05	0.00	0.02	142.00	0.02	-	0.00	0.06	0.39	3.63	0.03	1.90
Bottom of Stream 3	7-Sep	Kroff Dissolve	0.00	0.08	0.00	0.02	138.00	0.02	-	0.00	0.06	0.39	3.70	0.03	1.95
Pilot Feed	7-Sep	Influent	<0.00050	0.047	0.000086	0.0198	138	0.0194	-	0.000863	0.0611	<0.050	3.51	0.0271	1.90
Stream 1 Mixer	10-Sep	Control	<0.00050	0.042	0.000066	0.0220	136	0.0179		0.000870	0.0608	<0.050	3.60	0.0266	1.72
Top of Stream 1	10-Sep	Control	<0.00050	0.052	0.000089	0.0228	143	0.0186		0.000890	0.0633	<0.050	3.79	0.0275	1.85
Bottom of Stream 1	10-Sep	Control	0.00083	0.033	0.000136	0.0226	140	0.0168		0.000900	0.0634	<0.050	3.73	0.0275	1.80
Stream 2 Mixer	10-Sep	Nalco Prevent	<0.00050	0.046	0.000057	0.0232	145	0.0192		0.000924	0.0653	0.147	3.83	0.0278	1.90
Top of Stream 2	10-Sep	Nalco Prevent	0.00068	0.045	0.000218	0.0224	143	0.0182		0.000900	0.0630	0.153	3.76	0.0274	1.90
Bottom of Stream 2	10-Sep	Nalco Prevent	0.00117	0.032	0.000187	0.0225	138	0.0169		0.000889	0.0636	0.134	3.75	0.0275	1.80
Stream 3 Mixer	10-Sep	Kroff Dissolve	<0.00050	0.046	0.000063	0.0230	144	0.0185		0.000871	0.0639	0.326	3.77	0.0276	1.84
Top of Stream 3	10-Sep	Kroff Dissolve	<0.00050	0.035	0.000076	0.0224	140	0.0173		0.000859	0.0626	0.344	3.68	0.0274	1.79
Bottom of Stream 3	10-Sep	Kroff Dissolve	0.00096	0.035	0.000108	0.0225	138	0.0171		0.000889	0.0628	0.336	3.70	0.0268	1.76
Pilot Feed	10-Sep	Influent	<0.00050	0.036	0.000209	0.0222	137	0.0177		0.000870	0.0637	<0.050	3.77	0.0278	1.78
Stream 1 Mixer	14-Sep	GE Dissolve	<0.00050	0.049	0.000051	0.0213	146	0.018	<0.0000050	0.0264	0.0651	<0.050	3.75	0.0301	1.84
Top of Stream 1	14-Sep	GE Dissolve	<0.00050	0.057	0.000125	0.0191	139	0.0175	<0.0000050	0.0252	0.0629	<0.050	3.62	0.0293	1.74
Bottom of Stream 1	14-Sep	GE Dissolve	0.00091	0.033	0.000149	0.0193	143	0.0159	<0.0000050	0.0261	0.0647	<0.050	3.79	0.0299	1.76
Stream 2 Mixer	14-Sep	Control	0.00139	0.162	0.000055	0.0204	139	0.0180	<0.0000050	0.00117	0.0641	<0.050	3.65	0.0291	1.76
Top of Stream 2	14-Sep	Control	<0.00050	0.031	0.000034	0.0193	142	0.0158	<0.0000050	0.000944	0.0641	<0.050	3.71	0.0293	1.73
Bottom of Stream 2	14-Sep	Control	0.00173	0.090	0.000232	0.0190	141	0.0158	<0.0000050	0.00129	0.0632	<0.050	3.68	0.0293	1.70
Stream 3 Mixer	14-Sep	Nalco Dissolve	<0.00050	0.035	0.000045	0.0201	142	0.0163	<0.0000050	0.000904	0.0637	0.665	3.68	0.0297	1.78
Top of Stream 3	42261	Nalco Dissolve	<0.00050	0.051	0.00006	0.0199	141	0.0172	<0.0000050	0.000928	0.0658	0.668	3.79	0.0303	1.82
Bottom of Stream 3	14-Sep	Nalco Dissolve	<0.0020	0.029	0.000234	0.0199	138	0.0153	<0.0000050	0.000897	0.0639	0.649	3.69	0.0287	1.72
Pilot Feed	14-Sep	Influent	<0.00050	0.025	0.000062	0.0213	141	0.0156	<0.0000050	0.000886	0.0630	<0.050	3.65	0.0292	1.72
Stream 1 Mixer	17-Sep	GE Dissolve	<0.00050	0.034	0.000065	0.0264	140	0.0175	<0.0000050	0.0267	0.0546	<0.050	3.65	0.0285	1.65
Top of Stream 1	17-Sep	GE Dissolve	<0.00050	0.046	0.000074	0.0214	142	0.0179	<0.0000050	0.0245	0.0612	<0.050	3.51	0.0274	1.62

Description	Date:	Test #	Cu Tot	Fe Tot	Pb Tot	Li Tot	Mg Tot	Mn Tot	Hg Tot	Mo Tot	Ni Tot	P Tot	K Tot	Se Tot	Si Tot
Bottom of Stream 1	17-Sep	GE Dissolve	0.00087	0.031	0.000133	0.0215	144	0.0171	<0.0000050	0.0241	0.0628	<0.050	3.64	0.0284	1.68
Stream 2 Mixer	17-Sep	Control	<0.00050	0.029	0.000044	0.0214	147	0.0169	<0.0000050	0.000861	0.0629	<0.050	3.58	0.0292	1.70
Top of Stream 2	17-Sep	Control	<0.00050	0.089	0.000120	0.0218	143	0.0215	<0.0000050	0.000875	0.0629	<0.050	3.64	0.0286	1.78
Bottom of Stream 2	17-Sep	Control	0.00215	0.031	0.000353	0.0222	142	0.0165	<0.0000050	0.000902	0.0629	<0.050	3.67	0.0285	1.68
ottom of Stream 2 D	14-Sep	Control	<0.0015	0.029	0.000164	0.0186	141	0.0148	<0.0000050	0.000866	0.0638	<0.050	3.68	0.0288	1.72
Stream 3 Mixer	17-Sep	Nalco Dissolve	<0.00050	0.028	0.000036	0.0213	142	0.0163	<0.0000050	0.000841	0.0604	0.595	3.49	0.0278	1.67
Top of Stream 3	17-Sep	Nalco Dissolve	<0.00050	0.079	0.000082	0.0214	143	0.0201	<0.0000050	0.000852	0.0620	0.633	3.56	0.0284	1.79
Bottom of Stream 3	17-Sep	Nalco Dissolve	0.00129	0.034	0.000252	0.0212	139	0.0167	<0.0000050	0.000848	0.0620	0.617	3.60	0.0274	1.65
Pilot Feed	17-Sep	Influent	<0.00050	0.029	0.000043	0.0269	138	0.0168	<0.0000050	0.000892	0.0542	<0.050	3.64	0.0290	1.69
Stream 1 Mixer	21-Sep	GE Dissolve	<0.00050	0.065	0.000054	0.0223	143	0.0169	<0.0000050	0.0228	0.0609	<0.050	3.61	0.0281	1.73
Top of Stream 1	21-Sep	GE Dissolve	<0.00050	0.063	0.000102	0.0208	144	0.0169	<0.0000050	0.0227	0.0606	<0.050	3.63	0.0279	1.66
Bottom of Stream 1	21-Sep	GE Dissolve	0.00084	0.061	0.000145	0.0218	145	0.0167	<0.0000050	0.0236	0.0609	<0.050	3.63	0.0290	1.72
Bottom of Stream 1	21-Sep	GE Dissolve													
Stream 2 Mixer	21-Sep	Control	0.00059	0.059	0.000057	0.0209	141	0.0164	<0.0000050	0.000848	0.0598	<0.050	3.54	0.0282	1.63
Top of Stream 2	21-Sep	Control	<0.00050	0.060	0.000054	0.0206	139	0.0162	<0.0000050	0.000840	0.0604	<0.050	3.60	0.0283	1.63
Bottom of Stream 2	21-Sep	Control	0.00138	0.064	0.000233	0.0234	147	0.0162	<0.0000050	0.000934	0.0617	<0.050	3.59	0.0282	1.74
Bottom of Stream 2	21-Sep	Control	0.0011	0.07	0.00021	0.0231	147	0.017	<0.00001	0.02302	0.0608		3.6	0.0241	1.74
Stream 3 Mixer	21-Sep	Nalco Dissolve	<0.00050	0.064	0.000061	0.0213	144	0.0171	<0.0000050	0.000876	0.0608	0.615	3.65	0.0284	1.71
Top of Stream 3	21-Sep	Nalco Dissolve	<0.00050	0.060	0.000072	0.0223	143	0.0168	<0.0000050	0.000864	0.0602	0.592	3.59	0.0276	1.69
Bottom of Stream 3	21-Sep	Nalco Dissolve	0.00216	0.069	0.000410	0.0218	150	0.0173	<0.0000050	0.000889	0.0616	0.646	3.59	0.0291	1.78
Bottom of Stream 3	21-Sep	Nalco Dissolve	0.0015	0.06	0.00025	0.0233	145	0.016	<0.00001	0.00083	0.0586		3.5	0.023	1.7
Pilot Feed	21-Sep	Influent	<0.00050	0.065	0.000073	0.0235	143	0.0168	<0.0000050	0.000827	0.0605	<0.050	3.62	0.0277	1.68
Stream 1 Mixer	24-Sep	GE Dissolve	<0.00050	0.039	0.000044	0.0212	144	0.0155		0.0258	0.0626	<0.050	3.61	0.0296	1.69
Top of Stream 1	24-Sep	GE Dissolve	<0.00050	0.033	0.000051	0.0206	142	0.0151		0.0242	0.0594	<0.050	3.49	0.0282	1.64
Bottom of Stream 1	24-Sep	GE Dissolve	0.00122	0.034	0.000226	0.0214	140	0.0145		0.0244	0.0603	<0.050	3.46	0.0287	1.62
Stream 2 Mixer	24-Sep	Control	<0.00050	0.038	0.000059	0.0218	142	0.0153		0.000922	0.0603	<0.050	3.51	0.0290	1.65
Top of Stream 2	24-Sep	Control	<0.00050	0.045	0.000080	0.0215	143	0.0160		0.000897	0.0609	<0.050	3.50	0.0291	1.65
Bottom of Stream 2	24-Sep	Control	0.00145	0.041	0.000190	0.0209	139	0.0139		0.000889	0.0568	<0.050	3.29	0.0285	1.61
reated Water Retur	24-Sep	Effluent	0.00103	0.037	0.000197	0.0214	144	0.0142		0.00892	0.0606	0.184	3.52	0.0288	1.65
reated Water Retur	21-Sep	Effluent	0.0229	0.064	0.000630	0.0228	145	0.0165	<0.0000050	0.00819	0.0609	0.220	3.47	0.0290	1.69
reated Water Retur	21-Sep	Effluent	0.0023	0.11	0.00046	0.0244	148	0.018	<0.00001	0.00087	0.058		3.6	0.0242	1.81
reated Water Retur	17-Sep	Effluent	0.00097	0.030	0.000201	0.0219	142	0.0165	<0.0000050	0.00875	0.0622	0.215	3.61	0.0280	1.67
reated Water Retur	14-Sep	Effluent	<0.0015	0.027	0.000265	0.0193	139	0.0151	<0.0000050	0.00910	0.0627	0.227	3.67	0.0291	1.70
reated Water Retur	10-Sep	Effluent	0.00116	0.033	0.000277	0.0221	140	0.0174		0.000907	0.0640	0.171	3.78	0.0279	1.84
reated Water Retur	7-Sep	Effluent	0.00125	0.046	0.000366	0.0225	142	0.0194	-	0.000888	0.0604	0.187	3.67	0.0288	1.95
reated Water Retur	3-Sep	Effluent	0.00144	0.036	0.000338	0.0217	137	0.0185	-	0.000868	0.0624	0.185	3.48	0.0266	1.74
reated Water Retur	31-Aug	Effluent	0.00149	0.062	0.000416	0.0203	137	0.0201		0.000858	0.0628	0.189	3.59	0.0275	1.89
Stream 3 Mixer	24-Sep	Nalco Dissolve	<0.00050	0.043	0.000039	0.0218	146	0.0157		0.000922	0.0614	0.633	3.58	0.0296	1.81
Top of Stream 3	24-Sep	Nalco Dissolve	<0.00050	0.092	0.000115	0.0207	137	0.0182		0.000888	0.0594	0.535	3.42	0.0286	1.65
Bottom of Stream 3	24-Sep	Nalco Dissolve	0.00146	0.040	0.000219	0.0214	144	0.0151		0.000903	0.0620	0.564	3.49	0.0297	1.64
Top of Stream 3 Du	7-Sep	Krof Dissolve	0.00060	0.052	0.000081	0.0235	149	0.0206	-	0.000915	0.0615	0.404	3.75	0.0295	2.02
Top of Stream 2Du	3-Sep	Nalco Prevent	<0.00050	0.038	0.000066	0.0212	140	0.0190	-	0.000873	0.0622	0.153	3.53	0.0277	1.82
			<0.00050	0.022	<0.000030	0.0204	137	0.0127		0.000817	0.0640	<0.050	3.69	0.0295	1.48

Description	Date:	Test #	Ag Tot	Na Tot	Sr Tot	Tl Tot	Sn Tot	Ti Tot	U Tot	V Tot	Zn Tot	BOD	COD
Stream 1 Mixer	13-Aug	GE Prevent	<0.000010	11.5	0.459	0.000060	<0.000050	<0.0010	0.00766	<0.00050	0.0701	<2.0	33
Top of Stream 1	13-Aug	GE Prevent	<0.000010	11.8	0.470	0.000061	<0.000050	<0.0010	0.00801	<0.00050	0.0736	<2.0	<20
Bottom of Stream 1	13-Aug	GE Prevent	<0.000010	11.1	0.447	0.000062	0.00008	0.001	0.00773	<0.00050	0.0782	<2.0	<20
Stream 2 Mixer	13-Aug	Kroff Prevent	<0.000010	11.3	0.474	0.000065	0.000056	<0.0010	0.00776	<0.00050	0.0713	<2.0	<20
Top of Stream 2	13-Aug	Kroff Prevent	<0.000010	11.1	0.452	0.000064	0.000094	<0.0010	0.00764	<0.00050	0.0698	<2.0	<20
Bottom of Stream 2	13-Aug	Kroff Prevent	0.000183	11.2	0.477	0.000066	0.00506	<0.0060	0.00812	<0.00050	0.0924	<2.0	<20
Stream 3 Mixer	13-Aug	Control	<0.000010	10.9	0.461	0.000062	0.000113	<0.0010	0.00776	<0.00050	0.0714	<2.0	<20
Top of Stream 3	13-Aug	Control	<0.000010	10.9	0.464	0.000063	0.000134	<0.0010	0.00786	<0.00050	0.0699	<2.0	<20
Bottom of Stream 3	13-Aug	Control	<0.000010	11	0	0	0	0	0	<0.00050	0	<2.0	<20
Pilot Feed	13-Aug	Influent	<0.000010	10.9	0.457	0.000058	<0.000050	<0.0010	0.00760	<0.00050	0.0689	<2.0	<20
Stream 1 Mixer	17-Aug	GE Prevent	0.000066	10.8	0.433	0.000053	<0.000050	0.0024	0.00757	<0.00050	0.0615	<2.0	<20
Stream 1 Mixer	17-Aug	GE Prevent	<0.00001	11.8	0.476	0.000060	<0.0001	<0.01	0.00851	<0.001	0.0870	<2	2
Top of Stream 1	17-Aug	GE Prevent	0.000041	11.2	0.449	0.000057	<0.000050	<0.0050	0.00774	0.00054	0.0634	<2.0	<20
Bottom of Stream 1	17-Aug	GE Prevent	0.000018	11.1	0.451	0.000054	<0.000050	<0.0030	0.00794	0.0005	0.0692	<2.0	<20
Stream 2 Mixer	17-Aug	Kroff Prevent	0.000059	10.6	0.445	0.000054	<0.000050	<0.0040	0.00773	0.0005	0.0615	<2.0	<20
Stream 2 Mixer	17-Aug	Kroff Prevent	<0.00001	11.7	0.484	0.000050	<0.0001	<0.01	0.00831	<0.001	0.0700	<2	1
Top of Stream 2	17-Aug	Kroff Prevent	0.000028	10.4	0.431	0.000054	<0.000050	0.0023	0.00754	<0.00050	0.0597	<2.0	<20
Bottom of Stream 2	17-Aug	Kroff Prevent	0.00002	10.6	0.448	0.000051	0.000096	<0.0040	0.00758	<0.00050	0.0673	<2.0	<20
Stream 3 Mixer	17-Aug	Control	0.000045	10.6	0.447	0.000055	<0.000050	<0.0030	0.00768	<0.00050	0.0618	<2.0	<20
Stream 3 Mixer	17-Aug	Control	0.00002	11.3	0.467	0.00006	<0.0001	<0.01	0.00815	<0.001	0.066	<2	2
Top of Stream 3	17-Aug	Control	0.000023	10.5	0.447	0.000056	<0.000050	<0.0030	0.00772	<0.00050	0.0611	<2.0	<20
Bottom of Stream 3	17-Aug	Control	0	11	0	0	<0.000050	<0.0050	0	<0.00050	0	<2.0	<20
Pilot Feed	17-Aug	Influent	<0.000010	10.6	0.434	0.000053	<0.000050	0.0024	0.00770	<0.00050	0.0623	2.6	<20
Pilot Feed	17-Aug	Influent	0.00002	11.4	0.498	0.00006	<0.0001	<0.01	0.00869	0.001	0.083	<2	1.00
Stream 1 Mixer	20-Aug	GE Prevent	<0.000010	11.9	0.459	0.000053	<0.000050	<0.0040	0.00764	0.00074	0.0648	<2.0	<20
Top of Stream 1	20-Aug	GE Prevent	<0.000010	12.3	0.480	0.000054	<0.000050	0.0025	0.00780	0.00084	0.0668	<2.0	<20
Bottom of Stream 1	20-Aug	GE Prevent	<0.000010	12.1	0.469	0.000055	0.000078	<0.0030	0.00777	0.00071	0.0846	<2.0	<20
Stream 2 Mixer	20-Aug	Kroff Prevent	<0.000010	11.3	0.457	0.000053	0.000087	<0.0030	0.00754	0.00068	0.0634	<2.0	<20
Top of Stream 2	20-Aug	Kroff Prevent	<0.000010	11.5	0.465	0.000055	<0.000050	<0.0030	0.00772	0.00078	0.0636	<2.0	<20
Bottom of Stream 2	20-Aug	Kroff Prevent	0.000021	11.6	0.464	0.000054	0.000448	<0.0030	0.00775	0.00084	0.0715	<2.0	<20
Stream 3 Mixer	20-Aug	Control	<0.000010	11.6	0.466	0.000052	<0.000050	<0.0020	0.00763	0.00065	0.0652	<2.0	<20
Top of Stream 3	20-Aug	Control	<0.000010	11.7	0.473	0.000053	<0.000050	<0.0030	0.00790	0.00078	0.0665	<2.0	<20
Bottom of Stream 3	20-Aug	Control	<0.000010	12	0	0	0	<0.0030	0	0	0	<2.0	<20
Pilot Feed	20-Aug	Influent	<0.000010	11.2	0.444	0.000049	<0.000050	<0.0020	0.00733	0.00062	0.0630	<2.0	<20
Stream 1 Mixer	24-Aug	GE Prevent	<0.000010	11.5	0.434	0.000047	<0.000050	<0.0020	0.00760	<0.00050	0.0613	<2.0	<20
Top of Stream 1	24-Aug	GE Prevent	<0.000010	11.5	0.458	0.000051	<0.000050	<0.0020	0.00792	<0.00050	0.0631	<2.0	<20
Bottom of Stream 1	24-Aug	GE Prevent	<0.000010	12.4	0.474	0.000052	0.00006	0.0033	0.00814	0.00092	0.0710	<2.0	<20
Stream 2 Mixer	24-Aug	Kroff Prevent	<0.000010	11.1	0.453	0.000047	<0.000050	0.0013	0.00763	<0.00050	0.0621	<2.0	<20
Top of Stream 2	24-Aug	Kroff Prevent	<0.000010	11.0	0.444	0.000050	<0.000050	0.0019	0.00785	<0.00050	0.0605	<2.0	<20
Bottom of Stream 2	24-Aug	Kroff Prevent	<0.000010	11.8	0.461	0.000050	0.000099	0.0048	0.00789	0.00099	0.0731	<2.0	<20
Stream 3 Mixer	24-Aug	Control	<0.000010	11.2	0.458	0.000054	<0.000050	<0.0020	0.00781	<0.00050	0.0622	<2.0	<20
Top of Stream 3	24-Aug	Control	<0.000010	11.6	0.473	0.000048	<0.000050	0.0037	0.00797	0.00077	0.0637	<2.0	<20
Bottom of Stream 3	24-Aug	Control	<0.000010	12	0	0	<0.000050	0	0	0	0	<2.0	<20
Pilot Feed	24-Aug	Influent	<0.000010	11.4	0.447	0.000050	<0.000050	<0.0020	0.00761	<0.00050	0.0637	<2.0	<20
Stream 1 Mixer	31-Aug	Control	<0.000010	11.7	0.436	0.000047	<0.000050	0.0022	0.00824	<0.00050	0.0651	<2.0	<20
Top of Stream 1	31-Aug	Control	<0.000010	11.2	0.433	0.000047	<0.000050	<0.0030	0.00807	<0.00050	0.0631	<2.0	<20
Bottom of Stream 1	31-Aug	Control	<0.000010	10.9	0.419	0.000044	<0.000050	<0.0030	0.00794	<0.00050	0.0660	<2.0	<20

Description	Date:	Test #	Ag Tot	Na Tot	Sr Tot	Tl Tot	Sn Tot	Ti Tot	U Tot	V Tot	Zn Tot	BOD	COD
Stream 2 Mixer	31-Aug	Nalco Prevent	<0.000010	11.6	0.440	0.000048	<0.000050	0.0021	0.00827	<0.00050	0.0638	<2.0	<20
Top of Stream 2	31-Aug	Nalco Prevent	<0.000010	11.6	0.429	0.000048	<0.000050	<0.0020	0.00816	<0.00050	0.0640	<2.0	<20
Bottom of Stream 2	31-Aug	Nalco Prevent	<0.000010	11.6	0.423	0.000047	0.000088	<0.0040	0.00808	<0.00050	0.0724	<2.0	<20
Stream 3 Mixer	8/31/2015	Kroff Dissolve	<0.000010	11.60	0.44	0.00	<0.000050	<0.0030	0.01	<0.00050	0.06	<2.0	<20
Top of Stream 3	42247.00	Kroff Dissolve	<0.000010	11.70	0.45	0.00	<0.000050	0.00	0.01	<0.00050	0.07	<2.0	<20
Bottom of Stream 3	31-Aug	Kroff Dissolve	<0.000010	11.30	0.42	0.00	0.00	0.00	0.01	<0.00050	0.07	<2.0	<20
Pilot Feed	31-Aug	Influent	<0.000010	11.4	0.432	0.000055	<0.000050	0.0026	0.00831	<0.00050	0.0652	<2.0	<20
Stream 1 Mixer	3-Sep	Control	<0.000010	11.9	0.473	0.000048	<0.000050	<0.0020	0.00797	<0.00050	0.0625	<2.0	<20
Top of Stream 1	3-Sep	Control	<0.000010	12.0	0.479	0.000051	<0.000050	<0.0020	0.00823	<0.00050	0.0624	<2.0	<20
Bottom of Stream 1	3-Sep	Control	<0.000010	12.0	0.470	0.000052	<0.000050	0.0012	0.00793	<0.00050	0.0621	<2.0	<20
Stream 2 Mixer	3-Sep	Nalco Prevent	<0.000010	12.1	0.480	0.000053	<0.000050	<0.0020	0.00828	<0.00050	0.0620	<2.0	<20
Top of Stream 2	3-Sep	Nalco Prevent	<0.000010	12.3	0.474	0.000052	<0.000050	0.0012	0.00826	<0.00050	0.0638	<2.0	<20
Bottom of Stream 2	3-Sep	Nalco Prevent	<0.000010	12.3	0.472	0.000051	<0.000050	0.0014	0.00809	<0.00050	0.0695	<2.0	<20
Stream 3 Mixer	9/3/2015	Kroff Dissolve	<0.000010	12.10	0.48	0.00	<0.000050	0.00	0.01	<0.00050	0.06	<2.0	<20
Top of Stream 3	42250.00	Kroff Dissolve	<0.000010	12.10	0.47	0.00	<0.000050	<0.0030	0.01	<0.00050	0.06	<2.0	<20
Bottom of Stream 3	3-Sep	Kroff Dissolve	<0.000010	12.00	0.48	0.00	<0.000050	<0.0020	0.01	<0.00050	0.07	<2.0	<20
Pilot Feed	3-Sep	Influent	<0.000010	11.9	0.474	0.000049	<0.000050	<0.0020	0.00806	<0.00050	0.0628	<2.0	<20
Stream 1 Mixer	7-Sep	Control	<0.000010	12.5	0.478	0.000048	0.000408	<0.0030	0.00777	<0.00050	0.0672	<2.0	<20
Top of Stream 1	7-Sep	Control	<0.000010	12.5	0.479	0.000051	<0.000050	0.0021	0.00789	0.00057	0.0668	<2.0	<20
Bottom of Stream 1	7-Sep	Control	<0.000010	12.2	0.500	0.000051	<0.000050	<0.0020	0.00813	<0.00050	0.0664	<2.0	<20
Stream 2 Mixer	7-Sep	Nalco Prevent	<0.000010	12.9	0.475	0.000050	<0.000050	<0.0030	0.00775	0.00052	0.0668	<2.0	<20
Top of Stream 2	7-Sep	Nalco Prevent	<0.000010	12.5	0.498	0.000051	<0.000050	0.0025	0.00805	<0.00050	0.0660	<2.0	<20
Bottom of Stream 2	7-Sep	Nalco Prevent	<0.000010	12.4	0.492	0.000050	<0.000050	0.0016	0.00784	<0.00050	0.0708	<2.0	<20
Stream 3 Mixer	9/7/2015	Kroff Dissolve	<0.000010	12.30	0.46	0.00	<0.000050	<0.0040	0.01	0.00	0.07	<2.0	<20
Top of Stream 3	42254.00	Kroff Dissolve	<0.000010	12.20	0.49	0.00	<0.000050	0.00	0.01	<0.00050	0.07	<2.0	<20
Bottom of Stream 3	7-Sep	Kroff Dissolve	<0.000010	12.20	0.49	0.00	0.00	0.00	0.01	0.00	0.07	<2.0	<20
Pilot Feed	7-Sep	Influent	<0.000010	11.9	0.463	0.000048	<0.000050	0.0023	0.00772	0.00050	0.0653	<2.0	<20
Stream 1 Mixer	10-Sep	Control	<0.000010	12.2	0.473	0.000047	<0.000050	<0.0010	0.00805	<0.00050	0.0619	<2.0	<20
Top of Stream 1	10-Sep	Control	<0.000010	12.4	0.491	0.000051	<0.000050	<0.0030	0.00822	<0.00050	0.0652	<2.0	<20
Bottom of Stream 1	10-Sep	Control	<0.000010	12.6	0.494	0.000049	<0.000050	<0.0020	0.00797	<0.00050	0.0580	<2.0	39
Stream 2 Mixer	10-Sep	Nalco Prevent	<0.000010	12.9	0.502	0.000054	<0.000050	0.0016	0.00826	<0.00050	0.0649	<2.0	<20
Top of Stream 2	10-Sep	Nalco Prevent	<0.000010	12.8	0.486	0.000050	<0.000050	<0.0020	0.00815	<0.00050	0.0641	<2.0	<20
Bottom of Stream 2	10-Sep	Nalco Prevent	<0.000010	12.7	0.493	0.000050	<0.000050	<0.0020	0.00830	<0.00050	0.0687	<2.0	<20
Stream 3 Mixer	10-Sep	Kroff Dissolve	<0.000010	12.6	0.494	0.000048	<0.000050	<0.0020	0.00809	<0.00050	0.0646	<2.0	<20
Top of Stream 3	10-Sep	Kroff Dissolve	<0.000010	12.2	0.485	0.000050	<0.000050	<0.0020	0.00819	<0.00050	0.0628	<2.0	<20
Bottom of Stream 3	10-Sep	Kroff Dissolve	<0.000010	12.7	0.497	0.000049	<0.000050	<0.0020	0.00821	<0.00050	0.0675	<2.0	<20
Pilot Feed	10-Sep	Influent	<0.000010	12.8	0.480	0.000051	<0.000050	<0.0020	0.00832	<0.00050	0.0640	<2.0	<20
Stream 1 Mixer	14-Sep	GE Dissolve	<0.000010	14.5	0.517	0.000053	<0.000050	0.0011	0.00773	<0.00050	0.061	<2.0	<20
Top of Stream 1	14-Sep	GE Dissolve	<0.000010	13.9	0.503	0.000049	<0.000050	<0.0010	0.00756	<0.00050	0.0595	<2.0	<20
Bottom of Stream 1	14-Sep	GE Dissolve	<0.000010	14.1	0.51	0.000051	<0.000050	<0.0010	0.00773	<0.00050	0.0649	<2.0	<20
Stream 2 Mixer	14-Sep	Control	<0.000010	13.6	0.505	0.000074	<0.000050	<0.0010	0.00777	<0.00050	0.0593	<2.0	<20
Top of Stream 2	14-Sep	Control	<0.000010	13.0	0.497	0.000051	<0.000050	<0.0010	0.00772	<0.00050	0.0593	<2.0	<20
Bottom of Stream 2	14-Sep	Control	<0.000010	13.1	0.506	0.000052	0.000121	0.0016	0.00774	<0.00050	0.0596	<2.0	<20
Stream 3 Mixer	14-Sep	Nalco Dissolve	<0.000010	14.1	0.507	0.000051	<0.000050	0.001	0.00774	<0.00050	0.0594	<2.0	<20
Top of Stream 3	42261	Nalco Dissolve	<0.000010	14.6	0.508	0.000053	<0.000050	<0.0010	0.00793	<0.00050	0.0615	<2.0	<20
Bottom of Stream 3	14-Sep	Nalco Dissolve	<0.000010	14.1	0.492	0.000059	<0.000050	0.0015	0.00804	<0.00050	0.0644	<2.0	<20
Pilot Feed	14-Sep	Influent	<0.000010	13.5	0.495	0.000071	<0.000050	<0.0010	0.00761	<0.00050	0.0593	<2.0	<20
Stream 1 Mixer	17-Sep	GE Dissolve	<0.000010	13.6	0.506	0.000061	<0.000050	<0.0010	0.00871	<0.00050	0.0609	<2.0	<20
Top of Stream 1	17-Sep	GE Dissolve	<0.000010	13.4	0.482	0.000055	<0.000050	0.0017	0.00823	<0.00050	0.0616	<2.0	<20

Description	Date:	Test #	Ag Tot	Na Tot	Sr Tot	Tl Tot	Sn Tot	Ti Tot	U Tot	V Tot	Zn Tot	BOD	COD
Bottom of Stream 1	17-Sep	GE Dissolve	<0.000010	13.8	0.496	0.000055	<0.000050	0.0011	0.00832	<0.00050	0.0656	<2.0	<20
Stream 2 Mixer	17-Sep	Control	<0.000010	12.9	0.490	0.000055	<0.000050	<0.0010	0.00821	<0.00050	0.0625	<2.0	<20
Top of Stream 2	17-Sep	Control	<0.000010	13.3	0.489	0.000058	<0.000050	0.0013	0.00857	<0.00050	0.0654	<2.0	<20
Bottom of Stream 2	17-Sep	Control	<0.000010	13.2	0.508	0.000057	0.000510	<0.0010	0.00861	<0.00050	0.0651	<2.0	<20
Bottom of Stream 2 Dup	14-Sep	Control	<0.000010	13.0	0.489	0.000052	<0.000050	<0.0010	0.00783	<0.00050	0.0587	<2.0	<20
Stream 3 Mixer	17-Sep	Nalco Dissolve	<0.000010	13.9	0.485	0.000054	<0.000050	<0.0010	0.00820	<0.00050	0.0613	<2.0	<20
Top of Stream 3	17-Sep	Nalco Dissolve	<0.000010	13.6	0.492	0.000057	<0.000050	0.0011	0.00823	<0.00050	0.0632	<2.0	<20
Bottom of Stream 3	17-Sep	Nalco Dissolve	<0.000010	13.4	0.486	0.000055	<0.000050	0.0013	0.00820	<0.00050	0.0658	<2.0	<20
Pilot Feed	17-Sep	Influent	<0.000010	12.8	0.509	0.000056	<0.000050	<0.0010	0.00892	<0.00050	0.0609	<2.0	<20
Stream 1 Mixer	21-Sep	GE Dissolve	<0.000010	12.9	0.500	0.000052	0.000066	<0.0010	0.00796	<0.00050	0.0624	<2.0	<20
Top of Stream 1	21-Sep	GE Dissolve	<0.000010	12.6	0.500	0.000053	<0.000050	<0.0010	0.00801	<0.00050	0.0625	<2.0	<20
Bottom of Stream 1	21-Sep	GE Dissolve	<0.000010	11.6	0.512	0.000058	<0.000050	0.0012	0.00834	<0.00050	0.0656	<2.0	<20
Bottom of Stream 1	21-Sep	GE Dissolve										<2	<1
Stream 2 Mixer	21-Sep	Control	<0.000010	12.1	0.490	0.000053	<0.000050	0.0011	0.00790	<0.00050	0.0606	<2.0	<20
Top of Stream 2	21-Sep	Control	<0.000010	12.0	0.494	0.000053	<0.000050	<0.0010	0.00770	<0.00050	0.0603	<2.0	<20
Bottom of Stream 2	21-Sep	Control	<0.000010	11.0	0.537	0.000062	<0.000050	<0.0010	0.00893	<0.00050	0.0632	<2.0	<20
Bottom of Stream 2	21-Sep	Control	0.00003	14.3	0.516	0.00008	0.0002	<0.01	0.00907	<0.001	0.066	<2	<1
Stream 3 Mixer	21-Sep	Nalco Dissolve	<0.000010	12.7	0.514	0.000053	<0.000050	0.0018	0.00781	<0.00050	0.0630	<2.0	<20
Top of Stream 3	21-Sep	Nalco Dissolve	<0.000010	10.9	0.508	0.000059	<0.000050	0.0017	0.00795	<0.00050	0.0618	<2.0	<20
Bottom of Stream 3	21-Sep	Nalco Dissolve	<0.000010	11.6	0.519	0.000056	<0.000050	0.0010	0.00831	<0.00050	0.0734	<2.0	<20
Bottom of Stream 3	21-Sep	Nalco Dissolve	0.00001	13.2	0.492	0.00006	<0.0001	<0.01	0.00884	<0.001	0.061	<2	6
Pilot Feed	21-Sep	Influent	<0.000010	12.3	0.499	0.000053	<0.000050	<0.0010	0.00785	<0.00050	0.0633	<2.0	<20
Stream 1 Mixer	24-Sep	GE Dissolve	<0.000010	13.7	0.520	0.000054	<0.000050	0.0020	0.00825	0.00058	0.0602	<2.0	<20
Top of Stream 1	24-Sep	GE Dissolve	<0.000010	13.2	0.509	0.000055	<0.000050	<0.0010	0.00812	0.00052	0.0576	<2.0	<20
Bottom of Stream 1	24-Sep	GE Dissolve	<0.000010	13.0	0.521	0.000053	<0.000050	<0.0010	0.00827	0.00051	0.0599	<2.0	<20
Stream 2 Mixer	24-Sep	Control	<0.000010	12.7	0.513	0.000053	<0.000050	<0.0010	0.00825	0.00050	0.0582	<2.0	<20
Top of Stream 2	24-Sep	Control	<0.000010	12.8	0.510	0.000055	<0.000050	<0.0020	0.00833	0.00051	0.0589	<2.0	<20
Bottom of Stream 2	24-Sep	Control	<0.000010	12.2	0.506	0.000053	0.000056	<0.0020	0.00820	<0.00050	0.0522	<2.0	<20
Treated Water Return	24-Sep	Effluent	<0.000010	13.0	0.517	0.000055	<0.000050	<0.0020	0.00829	<0.00050	0.0585	<2.0	<20
Treated Water Return	21-Sep	Effluent	<0.000010	11.1	0.505	0.000058	0.000080	<0.0010	0.00838	<0.00050	0.0685	<2.0	<20
Treated Water Return	21-Sep	Effluent	<0.00001	14.3	0.497	0.00006	0.0001	<0.01	0.00917	<0.001	0.071	<2	<1
Treated Water Return	17-Sep	Effluent	<0.000010	13.4	0.499	0.000055	<0.000050	0.0012	0.00838	<0.00050	0.0619	<2.0	<20
Treated Water Return	14-Sep	Effluent	<0.000010	13.4	0.491	0.000053	0.000051	<0.0010	0.00784	<0.00050	0.0619	<2.0	<20
Treated Water Return	10-Sep	Effluent	<0.000010	13.0	0.491	0.000050	<0.000050	<0.0020	0.00798	<0.00050	0.0668	<2.0	<20
Treated Water Return	7-Sep	Effluent	<0.000010	12.3	0.482	0.000053	<0.000050	<0.0030	0.00779	<0.00050	0.0685	<2.0	<20
Treated Water Return	3-Sep	Effluent	<0.000010	11.8	0.465	0.000053	<0.000050	<0.0020	0.00807	<0.00050	0.0651	<2.0	<20
Treated Water Return	31-Aug	Effluent	<0.000010	11.9	0.446	0.000049	<0.000050	<0.0030	0.00831	<0.00050	0.0691	<2.0	<20
Stream 3 Mixer	24-Sep	Nalco Dissolve	<0.000010	13.6	0.526	0.000057	<0.000050	<0.0030	0.00849	0.00056	0.0591	<2.0	<20
Top of Stream 3	24-Sep	Nalco Dissolve	<0.000010	13.0	0.498	0.000054	<0.000050	<0.0030	0.00808	0.00059	0.0596	<2.0	<20
Bottom of Stream 3	24-Sep	Nalco Dissolve	<0.000010	13.5	0.517	0.000055	<0.000050	<0.0020	0.00829	0.00052	0.0637	<2.0	<20
Top of Stream 3 Dup	7-Sep	Krof Dissolve	<0.000010	12.5	0.498	0.000051	<0.000050	0.0020	0.00805	<0.00050	0.0664	<2.0	<20
Top of Stream 2Dup	3-Sep	Nalco Prevent	<0.000010	11.9	0.464	0.000051	<0.000050	<0.0020	0.00785	<0.00050	0.0619	<2.0	<20
			<0.000010	11.4	0.461	0.000061	<0.000050	<0.0010	0.00777	<0.00050	0.0700	<2.0	<20

Appendix G

Standard Error Calculation

The standard error (S.E.) was calculated using the following formula:

$$S.E. = \frac{Standard\ Deviation - data\ set}{\sqrt{\#\ of\ data\ points}}$$

Table 1 shows the average of total phosphorus, cadmium and alkalinity and the standard error estimated.

Table 1 Statistical Analysis of Selected Data

ID	Total Phosphorus Avg (mg/L)	Total Phosphorus S.E. (mg/L)	Total Cadmium (mg/L)	Total Cadmium S.E. (mg/L)	Alkalinity (mg/L)	Alkaliity S.E. (mg/L)
Influent	0.006	0.0007	0.000634	1.54E-5	349	2.0
GE Prevent	0.005	0.0004	0.000702	2.25E-5	349	2.0
GE Dissolved	0.005	0.0006	0.000620	1.18E-5	371	1.6
Nalco Prevent	0.129	0.0056	0.000631	8.40E-6	372	1.1
Nalco Dissolved	0.467	0.0680	0.000626	7.90E-6	366	1.0
Kroff Prevent	0.247	0.0050	0.000679	2.00E-5	348	2.0
Kroff Dissolved	0.340	0.0130	0.000630	7.70E-6	357	1.2

Appendix H

TECHNICAL REPORT

Plant of:	**Teck Coal**	**Date:**	**September 11, 2015**
Address:		**Plant :**	**Coal Mountain**
City:	**Sparwood** **Prov:** **BC**	**Zip:**	
Attention:	**Beverly Benson**		
Copy to:	**Clemente Miranda**		
Nalco Copies:	**Craig Roach, Tom Barbour**		

Purpose: The purpose of this report is to share the data collected over the first month of the calcite inhibition trial on the Coal Mountain heap discharge water and communicate our findings.

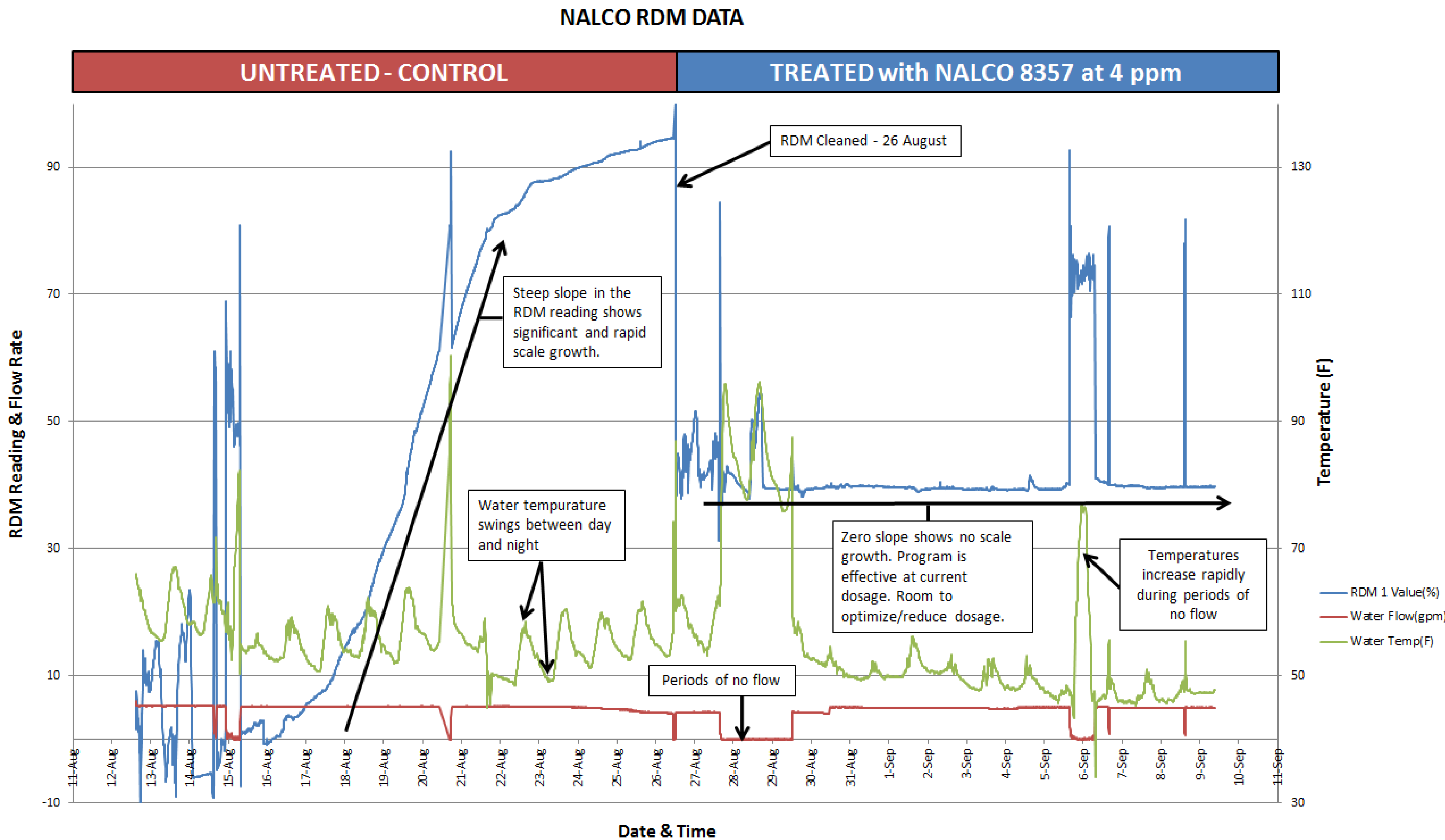
Background: A Nalco Remote Deposit Monitor (RDM) was installed on a control stream of the Teck Coal Mountain test flume on August 12. Data was collected and periodically downloaded. The data included on this report covers the measurements taken from August 12 through September 9.

Procedure: Water from the tail end of the outside flume (furthest from catwalk) was plumbed through a Nalco RDM. This RDM was configured to measure water flow rate, water temperature, and scale deposition. Measurements of flow and temperature are absolute while scale deposition is a relative figure from 0-100% of the sensor functionality. The measurements are continuous but were logged in 5 minute intervals. The recorded data was downloaded on Aug 26, Sep 2, and Sep 9.

Data: 3948 logged entries totaling 11,844 individual data points were consolidated and graphed in the chart found on the following page. Blue is the scale deposition reading and red is the flow rate in gallons per minute. Both are graphed using the left vertical axis. Temperature (°F) is green and graphed using the right vertical axis. Comments are in text boxes with black index arrows referencing the associated data.

Discussion: The left side of the graph shows the two week period monitoring the untreated control stream. The steep inclined blue line shows the scale growth is rapid and severe. The sensor was nearly blinded of by August 26 and was reading 95%. Both the screen filter on inlet and the sensor had to be cleaned as they were completely coated in scale. The red line shows flow and a small reduction in flow rate can be observed from about August 22 through the 26th. During the August 26 service, the RDM was cleaned including the filter screen and the sensor. The reading stabilized at approximately 40% after cleaning. Treatment started on the flume with the RDM using Nalco 8357 scale control at 4ppm on August 27. No sustained increase in the RDM reading was observed after treatment was initiated as can be seen by the horizontal trend of the RDM readings.

Conclusions: Nalco 8357 is effectively preventing calcite formation in the test apparatus and RDM at 4ppm under the current conditions. There may be room to reduce or optimize the antiscalant dosage however, further testing and monitoring with the RDM will yield the minimum needed dosage under a given set of conditions.



Please feel free to contact me with any questions or clarification. Dan Child: 626-523-6171, dechild@nalco.com

Appendix I

Record of Learning Log

Teck

Project Name: Calcite Pilot Project
Project Director: Kevin Atherton
Project Phase: Completion
Update Date: December 2, 2015

Learning No.:	Discipline	Learning Name	What was the Root Cause of the Issue / Achievement?	Corrective Area	Recommendation	Stage	Contributor
1	Operations Readiness	Datafile difficult to manage	Review it prior to operation to ensure applicability	Procedures (PPM)	**Include in checklist prior to field mobilization Ensure that MoE requirements are included in datafile**	**Planning**	
2	Contract Management	Arrange for maintenance was not ideal as the primary contractor was located in Trail	Lack of knowledge of the area / local resources	Procedures (PPM)	**List of Site contacts and expertise if going for outside contractor, arrange in advance maintenance strategy**	**Planning**	
3	Operations Readiness	Develop site induction prior to start up the plant	Oversight	Procedures (PPM)	**Include in checklist prior to field mobilization**	**Planning**	
4	Construction	Piping expanded when left empty	Materials used were affected by temperature Issue identified but no control were in place	Procedures (PPM)	**Outcome not significant Evaluate in future pilots potential S/D risk accordingly (What if analysis)**	**Planning**	
5	Project Management	Good Planning and reaction to CMO Shutdowns					
6	Environmental, Health, Safety and Community	Great Safety record, attention to detail and review of safety systems					
7	Environmental, Health, Safety and Community	Work team risk assessment done during operations		Risk	**Perform this analysis during the routine operation**	**Management & Execution**	
8	Contract Management	Right contractor for the job	Good internal communication				
9	Project Controls	Good project controls, no over reporting	Review reporting prior to start up	Procedures (PPM)	**Review type of reports before mobilization**	**Initiation and Set up**	
10	SERA	Permit requested with plenty of time					
11	Risk	Used of FMEA to identify risks					
12	Administration	Use of Teck Housing and vehicles out of Sparwood					
13	Environmental, Health, Safety and Community	Use of metal scaffolding to avoid slips	Material used	Procedures (PPM)	**What if analysis for changes in process/construction**	**Initiation and Set up**	
14	Environmental, Health, Safety and Community	Training matrix was a great tool to organize training					
15	Administration	Change Management documentation needs clarity	Training Internal specialized resource	Operations Engagement	**Set up refresh session for ART Provide feedback**	**Hand Over & Close Out**	
16	Pre-Operational Testing & Commissioning	Spend more time on commissioning to figure out PLC issues	Engineering Documentation not up to date	Requirements	**Include things to improve in the report as appendix in case the unit is used in the future Leave list in the trailer**	**Hand Over & Close Out**	
17	Risk	Use of DQO to set up the technical planning					
18	Administration	Sharepoint was very useful to keep information					
19	Administration	Good engagement with stakeholders					
20	SERA	Good understanding of SERA requirements before the project					
21	Contract Management	Changes in contractor personnel	unexpected departures	Contract Administration	**evaluate if needs to be in contract that key people do not change Transition strategy needs to be developed as needed**	**Planning**	

Appendix E Permit PE 4750

June 25, 2015

Tracking Number: 339791
Authorization Number: 4750

REGISTERED MAIL

Teck Coal Limited
Coal Mountain Operation
PO Box 3000
Sparwood, BC V0B 2G0

Dear Permittee:

Enclosed is Amended Permit 4750 issued under the provisions of the *Environmental Management Act*. Your attention is respectfully directed to the terms and conditions outlined in the permit. An annual fee will be determined according to the Permit Fees Regulation.

This permit does not authorize entry upon, crossing over, or use for any purpose of private or Crown lands or works, unless and except as authorized by the owner of such lands or works. The responsibility for obtaining such authority rests with the permittee. This permit is issued pursuant to the provisions of the *Environmental Management Act* to ensure compliance with Section 120(3) of that statute, which makes it an offence to discharge waste, from a prescribed industry or activity, without proper authorization. It is also the responsibility of the permittee to ensure that all activities conducted under this authorization are carried out with regard to the rights of third parties, and comply with other applicable legislation that may be in force.

This decision may be appealed to the Environmental Appeal Board in accordance with Part 8 of the *Environmental Management Act*. An appeal must be delivered within 30 days from the date that notice of this decision is given. For further information, please contact the Environmental Appeal Board at (250) 387-3464.

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Teck

March 1, 2016

Douglas Hill, P.Eng.
Regional Operations Director - Mining
Environmental Protection
Ministry of Environment
Williams Lake, BC

Dear Mr. Hill

Reference: Qualified Professional Endorsement of Teck's 2015 Calcite Pilot Plant Performance Evaluation Report

Teck Coal Limited (Teck) has prepared the enclosed Performance Evaluation Report for the 2015 Calcite Pilot Plant authorized under Appendix 3 of Coal Mountain Operations (CMO) *Environmental Management Act* permit PE-4750 (June 25, 2015 amendment).

Teck can confirm that the enclosed report was prepared by qualified staff and reviewed by a Qualified Professional as defined in Section 2.9 of PE-4750. Please accept signature and stamp outlined below as proof of this review.

Please contact the undersigned if you have any questions or comments.

Sincerely,

PROFESSIONAL
PROVINCE OF
Dr. J. C. MIRANDA TREVINO
43059
BRITISH COLUMBIA
ENGINEER

Mar 1st, 2016

Clemente Miranda, PhD, P.Eng.
Sr. Environmental Engineer
Teck Metals Ltd.
Clemente.Miranda@teck.com

BRITISH
COLUMBIA

File: 4750

October 16, 2015

Rick Magliocco
Senior Environmental Officer
Coal Mountain Operations – Teck Coal Limited
Box 3000
Sparwood, BC V0B 2G0

Dear Rick Magliocco,

Re: Proposed Field Analysis Method to Determine Total Suspended Solids

The Proposed Field Analysis Method to Determine Total Suspended Solids letter dated August 19, 2015 has been received and reviewed by ministry staff. The review indicates that the method meets the requirements of Section 2.3 of Permit PE-4750. As indicated in the letter, Teck must continue updating and refining the correlation curves to determine TSS values based on field NTU readings to assist in managing the control of suspended solids.

Pursuant to Section 2.3 of Permit PE-4750, I hereby approve the Coal Mountain Operations *Proposed Field Analysis Method to Determine Total Suspended Solids* dated August 19, 2015.

Yours truly,

Douglas Hill, P.Eng.
for Director, *Environmental Management Act*
Mining Operations

Ministry of Environment

Environmental Protection Division
Mining Operations

Mailing Address:
205 Industrial Road G
Cranbrook, BC V1C 7G5

Location:
205 Industrial Road G
Cranbrook, BC V1C 7G5
Telephone: 250-489-8450
Website: www.gov.bc.ca/env

Administration of this permit will be carried out by staff from Environmental Protection, Regional Operations Mining Team. Plans, data and reports pertinent to the permit are to be submitted to the Director, care of Ministry of Environment, Environmental Protection, 205 Industrial Road G, Cranbrook, BC, V1C 7G5.

Yours truly,

Douglas J. Hill, P.Eng.
for Director, *Environmental Management Act*
Mining Operations – Environmental Protection Division

Enclosure

cc: Ministry of Energy and Mines

MINISTRY OF
ENVIRONMENT

PERMIT

4750

Under the Provisions of the Environmental Management Act

Teck Coal Limited
Coal Mountain Operation
PO Box 3000
Sparwood, BC V0B 2G0

is authorized to discharge effluent to the land and water from a coal preparation plant and related facilities located approximately 30 kilometres south of Sparwood, British Columbia, subject to the terms and conditions listed below. Contravention of any of these conditions is a violation of the *Environmental Management Act* and may lead to Prosecution.

This Permit supersedes and amends all previous versions of Permit 4750 issued under Part 2, Section 14 of the *Environmental Management Act.*

1. AUTHORIZED DISCHARGES

1.1. This section applies to the discharge of effluent from surface water runoff from areas surrounding Coal Mountain into the MAIN INTERCEPTOR SEDIMENTATION PONDS, which discharges via a spillway into Corbin Creek. The site reference number for this discharge is E102488.

1.1.1. The characteristics of the discharge must not exceed:

Total Suspended Solids of 50 mg/L for discharge rates up to the Q10 flow (Section 2.9) of 1.5 m3/second.

1.1.2. The authorized works are sedimentation ponds, spillway, catch basins, interceptor ditches, diversion culverts, flocculant addition equipment and related appurtenances approximately located as shown on the attached site plan.

1.1.3. The location of the facilities from which the discharge originates and the point of discharge is Lot 6999, Kootenay Land District.

Date issued: September 30, 1977
Date amended: June 25, 2015
(most recent)

Douglas J. Hill, P.Eng.
for Director, *Environmental Management Act*
Southern Interior

1.2. This section applies to the discharge of wash water effluent from a Vehicle Maintenance Building to an oil/water separator thence to the MAINTENANCE INFILTRATION PONDS with no surface discharge or to the processing plant for make-up water. The site reference number for this discharge is E206437.

1.2.1. The maximum authorized rate of discharge is 0.38 cubic metres per minute to a maximum daily discharge of 120 cubic metres, as calculated from averaged total discharge volumes.

1.2.2. The characteristics of the discharge from the oil/water separator must not exceed:

Extractable Petroleum Hydrocarbons – 15 mg/L

1.2.3. The authorized works are an oil/water separator, two infiltration ponds, piping and related appurtenances, approximately located as shown on the attached site plan.

1.2.4. The location of the facilities from which the discharge originates and the point of discharge is Lot 6999, Kootenay Land District.

1.3. This section applies to the discharge of effluent from surface water runoff from the Corbin Creek drainage into the CORBIN SEDIMENTATION POND, thence overflow via a spillway into Corbin Creek. The site reference number for this discharge is E206438.

1.3.1. The characteristics of the discharge must not exceed:

Total Suspended Solids of 50 mg/L for discharge rates up to the Q10 flow (section 2.9) of 5.4 m3/second.

1.3.2. Periodic temporary bypass of the decant structure via the emergency drawdown piping at the north end of Corbin Sedimentation Pond is permitted for the purposes of testing emergency drawdown infrastructure.

Testing must occur no more than 12 times per year, for a maximum duration of 10 minutes each. Turbidity monitoring of the discharge must be conducted during drawdown testing to monitor that Total Suspended Solids concentrations limits in Section 1.3.1 are met; should there be suspicion of higher levels, TSS sampling must be completed.

1.3.3. The authorized works are a sedimentation pond, spillway, 50 metre pond inlet flocculant mixing zone, cut-off dike to collect the rock drain flow and elevate it to the inlet channel, emergency drawdown infrastructure, sediment catchment basin, and related appurtenances approximately located as shown on the attached site plan.

1.3.4. The location of the facilities from which the discharge originates and the point of discharge is Lot 6999, Kootenay Land District.

1.4. This section applies to the discharge of effluent from mine offices, warehouse and maintenance facility to a SEWAGE TREATMENT PLANT and thence to ground. The site reference number for this discharge is E206439.

1.4.1. The maximum authorized rate of discharge is 56.8 m3/day, as calculated from averaged total discharge volumes.

1.4.2. The characteristics of the discharge must not exceed:
Total Suspended Solids of 30 mg/L

5-Day Biochemical Oxygen Demand of 40 mg/L and a 12 month average of 20 mg/L.

1.4.3. The authorized works are grit chambers, equalization tank, extended aeration membrane filtration sewage treatment plant, tile field and related appurtenances approximately located as shown on the attached site plan.

1.4.4. The location of the facilities from which the discharge originates is Lot 6999, Parcel 74D, D520341 of Lot 4589, Plan N13 (East), Kootenay Land District.

1.4.5. The location of the point of discharge is Lot 6999, Kootenay Land District.

1.5. This section applies to the discharge of effluent from surface water runoff from the coal load out area into the LOADOUT INFILTRATION PONDS, thence decanting to the ground within the rail loop area. The site reference number for this discharge is E258015.

1.5.1. The characteristics of the discharge must not exceed:

Typical surface water runoff.

1.5.2. The authorized works are ditches, infiltration ponds, infiltration ditch, decant overflow and related appurtenances approximately located as shown on the attached site plan.

Date issued: September 30, 1977
Date amended: June 25, 2015
(most recent)

Douglas J. Hill, P.Eng.
for Director, *Environmental Management Act*
Southern Interior

1.5.3. The location of the facilities from which the discharge originates and the location of the point of discharge is Lot 7000, Kootenay Land District.

1.6. This section applies to the discharge of effluent from Pengelly Rock Drain and surface water runoff from Pengelly Spoil into the PENGELLY CHANNEL, thence to Corbin Creek. The site reference number for this discharge is E298733.

1.6.1. The characteristics of the discharge must not exceed:
Total Suspended Solids of 50 mg/L for discharge rates up to the Q10 flow (section 2.9) of 2.11 m3/second.

1.6.2. The authorized works are ditches, culverts, overflow channels and related appurtenances approximately located as shown in the attached site plan.

1.6.3. The location of the facilities from which the discharge originates and the location of the point of discharge is Lot 6999, Kootenay Land District.

1.7. This Section applies to the discharge of contaminants from MISCELLANEOUS OIL/WATER SEPARATORS at the Coal Mountain Operations site to ground. The characteristics of the discharge must be typical discharges originating from engineered industrial Oil/Water Separators.

These sources must be operated as per Part 2 Section 6 of the *Environmental Management Act* that prohibits the introduction of waste into the environment in such a manner or quantity as to cause pollution. The Director may require sampling or control measures at these sources at any time by specifying such requirements in writing to the Permittee.

2. GENERAL REQUIREMENTS

2.1. Maintenance of Works and Emergency Procedures

The Permittee must inspect the authorized works regularly and maintain them in good working order. In the event of a condition or emergency which prevents effective operation of the authorized works, leads to unauthorized discharge, or results in a permit exceedance, the Permittee must:

i. Comply with all applicable statutory requirements, including the Spill Reporting Regulation;

ii. Immediately contact the Director, Environmental Protection or an Officer designated by the Director by e-mail and/or telephone; and,

iii. Take appropriate remedial action for the prevention or mitigation of pollution.

The Director may reduce or suspend operations to protect the environment during a condition or emergency until the authorized works have been restored and/or corrective steps have been taken to prevent unauthorized discharges.

During and/or after the emergency event or condition, the Permittee must conduct appropriate sampling and analysis of discharges, which may be equivalent to or more stringent than the monitoring requirements of this permit and/or applicable statutory requirements. As the results of such sampling become available, the Permittee must provide the results to the Director or a designated Officer. The Director may require additional monitoring or reporting at any time by specifying such in writing to the Permittee.

The Permittee must prepare contingency plans outlining emergency procedures to be undertaken in the event of emergency incidents that may result in a significant release of contaminants to the environment.

2.2. **Controlled Bypasses**

Bypass of the authorized works, with the exception of 1.3.2, is prohibited unless the prior approval of the Director is obtained and confirmed in writing.

2.3. **Total Suspended Solids Sampling**

The Permittee must develop a tool for field analysis of total suspended solids (TSS) value and procedures for additional TSS sampling for discharges referenced in Section 1 of this permit and any effluent discharge to surface water from the mine property. The TSS determination method must be approved by the Director. This requirement does not replace TSS analysis by a certified lab that may be required in Section 3 of this permit.

2.4. **Process Modifications**

The Permittee must notify the Director in writing, prior to implementing changes to any process that may adversely affect the quality and/or quantity of the discharge. Notwithstanding notification under this Section, permitted levels must not be exceeded.

2.5. **Freeboard and Pond Maintenance**

The Permittee must maintain a minimum freeboard under normal operating conditions of 1.0 metre in the sedimentation ponds, and a spillway, overflow, or management plan must be in place to maintain a minimum of 0.5 metre during the maximum 24-hour storm event to which the pond is designed. Freeboard is defined as the difference in elevation between the top of a dike and the level of the liquid impounded by the dike.

Settled solids which have accumulated in all settling ponds must be removed as required to maintain their design performance. The Director must be notified prior to removing solids. The removed solids must be disposed of in a manner and at a location approved by the Director.

2.6. **Surface Water Runoff and Controls**

Surface water runoff from process areas and roads must be managed through a mine water management plan.

2.7. **Works**

Authorized works must be complete and in operation while discharging. The Permit authorizes the continued use of the existing treatment and disposal works.

Plans and specifications for new pollution abatement works and upgrades to existing works must be submitted to the Director before construction commences. Works must be constructed in accordance with approved plans.

Upgrading of the treatment works and disposal facilities may be required at any time at the direction of the Director, based on monitoring results, and/or any other pertinent information.

2.8. **Ten-Year Return Flood Flow**

The ten-year return flood flow or Q10 referenced in Section 1 is defined as the average calculated flood flow in cubic meters per second (m^3/s) over a 24-hour period that can be expected to occur once in a ten-year return period for a specified drainage basin.

If effluent flows for the relevant discharges in Section 1 exceed the Q10 flow, the Permittee must:

i. Immediately contact the Director, Environmental Protection, or an Officer designated by the Director by e-mail and/or telephone; and

ii. Take all reasonable actions to control suspended solids from entering into the environment.

2.9. **Qualified Professional**

All documents submitted to the Director must be signed by the author. Reports where an opinion or recommendation is expressed regarding data analysis, interpretation, assessment and/or design must also be sealed by an appropriately qualified professional, who in doing so takes professional responsibility for the content of the document. A qualified professional is defined as follows:

"Qualified Professional" means an applied scientist or technologist specializing in an applied science or technology applicable to the duty or function, including, if applicable and without limiting this, agrology, biology, chemistry, engineering, geology or hydrogeology and who

i. is registered with the appropriate professional organization, is acting under that organization's code of ethics and is subject to disciplinary action by that organization, and

ii. through suitable education, experience, accreditation and/or knowledge, may be reasonably relied on to provide advice within their area of expertise.

2.10. **Access Roads, Coal Hauling Roads and Sedimentation**

The Pemittee must ensure that the construction and the use of all new roads, existing roads, maintenance, or upgrading of any new or existing road, must be performed in such a manner that there is no adverse impact on receiving waters.

3. OPERATIONAL REQUIREMENTS

3.1. Use of Flocculants

The Permittee may use flocculants to maintain the level of total suspended solids equal to or less than permit limits in the discharges from sedimentation ponds. These flocculants must be used in accordance with the "Coal Mountain Operations Flocculant Management Plan" dated June 5, 2014, as updated from time to time. Any updates to this plan must be developed by a Qualified Professional, and submitted to the Director within 30 days of adoption. The Director may impose additional requirements for the use of flocculants for the protection of the environment.

3.2. Calcite Pilot Program

The Permittee may conduct a Calcite Pilot Program in 2015 as per Appendix 3. The Calcite Pilot Program is subject to applicable conditions of this permit.

4. MONITORING REQUIREMENTS

4.1. Discharge and Receiving Environment Monitoring Programs

The discharge and receiving environment water sampling sites are located approximately as shown in Appendix 1. Sampling sites, frequencies and parameters are defined in Appendix 2A, Tables 2 and 3. Definitions and explanatory notes are provided in Appendix 2A, Tables 4 and 5.

4.1.1. Sampling Sites

Discharge and receiving environment sample collection locations are described and numerically identified in Table 1:

Table 1: Discharge and Receiving Environment Sampling Locations

ENVIRONMENTAL MONITORING SITE (EMS) NUMBERS	***SITE DESCRIPTION AND LOCATION***
DISCHARGE SAMPLE LOCATIONS (APPENDIX 1C)	
E102488	Decant Discharge from Main Interceptor Sedimentation Ponds to Corbin Creek
E206437	Discharge to Maintenance Infiltration Ponds
E206438	Decant Discharge from Corbin Sedimentation Pond to Corbin Creek
E206439	Treated Domestic Effluent
E298733	Pengelly Channel to Corbin Creek
E258015	Loadout infiltration Ponds
RECEIVING ENVIRONMENT SAMPLE LOCATIONS (APPENDIX 1D)	
E258175	Michel Creek Upstream of Operations
E258937	Michel Creek Downstream of Operations near Andy Goode Creek Junction
E200209	Corbin Creek near Confluence with Michel Creek

4.1.2. Sampling Schedule

The Permittee is required to conduct the monitoring program identified in Appendix 2A, Tables 2 and 3. Details of sampling schedule are included in Appendix 2A.

4.1.3. Sampling and Analytical Procedures

4.1.3.1. Sampling Procedures & Lab Analyses

Sampling is to be carried out in accordance with the procedures described in the most recent edition of the "British Columbia Field Sampling Manual for Continuous Monitoring Plus the Collection of Air, Air-Emission, Water, Wastewater, Soil, Sediment, and Biological Samples," or by suitable alternative procedures as authorized by the Director.

Analyses are to be carried out in accordance with procedures described in the most recent edition of the "British Columbia Laboratory Methods Manual for the Analysis of Water, Wastewater, Sediment, Biological Materials and Discrete Ambient Air," or by suitable alternative procedures as authorized by the Director.

A copy of the above manual(s) may be purchased from the Queen's Printer Publications Centre, P. O. Box 9452, Stn. Prov. Gov't. Victoria, British Columbia, V8W 9V7 (1-800-663-6105 or (250) 387-6409). A copy of the manual is also available for inspection at all Environmental Protection offices.

Reports on methods, evaluations, recommendations and data must be made available to the Director on request.

4.1.3.2. Minimum Detection Limit

Minimum analytical detection limits for each parameter listed in Appendix 2A must be suitable for comparison with the applicable standards listed in the most recent Approved and Working Water Quality Guidelines prepared by Ministry of Environment.

4.1.3.3. Quality Assurance/Quality Control (QA/QC) Program

The Permittee must implement a Quality Assurance and Quality Control plan in accordance with the Environmental Data Quality Assurance Regulation and guidance provided in the "British Columbia Field Sampling Manual for Continuous Monitoring and the Collection of Air, Air-Emissions, Water, Wastewater, Soil, Sediment, and Biological Samples", and "British Columbia Laboratory Methods Manual for the Analysis of Water, Wastewater, Sediment, Biological Materials and Discrete Ambient Air."

4.1.3.4. Flow Measurements

Flow calculation methods for receiving streams or creeks must be based on a regional hydrological evaluation, and recommendations made by a qualified professional. Appropriate current and historical stream gauging data should be utilized. Methods must be updated at a frequency and in a manner recommended by a qualified professional.

Flow gauging stations required by Permit for discharge stations must be evaluated and documented to illustrate gauging method, consistency and relative accuracy. Reports on methods, evaluations and recommendations must be made available to the Director on request.

4.2. Local Aquatic Effects Monitoring Program

The Permittee may be required to develop and implement a Local Aquatic Effects Monitoring program to determine the effects of Coal Mountain Operations effluent discharge(s) on the receiving environment.

5. REPORTING REQUIREMENTS

5.1. Noncompliance Reporting

The Permittee must immediately contact the Director, Environmental Protection, or an Officer designated by the Director by e-mail or telephone of any non-compliance with the requirements of this permit and take appropriate remedial action. Written confirmation of all non-compliance events is required by e-mail within 24 hours of the original notification unless otherwise directed by the Director, Environmental Protection. Lab results must be submitted to the Director, Environmental Protection, immediately upon receipt.

5.2. Quarterly Reporting

The Permittee must submit the results of the discharge and receiving environment water sampling program (Section 3) directly into the Ministry of Environment's EMS database using the appropriate EMS site identification numbers within 30 days of the end of the quarter in which the samples were collected. The Permittee must submit a written quarterly report to the Director, Environmental Protection, or designate, identifying:

i. Receiving environment water quality results exceeding Approved and Working Water Quality Guidelines (or other criteria as specified by the Director),

ii. Effluent water quality results exceeding permit limits,

iii. Missing data or other QA/QC issues,

iv. Any reportable spills or other incidents related to water quality, occurring in the quarter, and

v. Measures being taken to reduce or eliminate non-compliances.

The Quarterly Report is due within 30 days of the end of the quarter in which the samples were taken.

5.3. **Annual Report**

The Permittee must prepare on an annual basis a report or series of reports summarizing activities, incidents, and discharge/receiving environment monitoring results. The report(s) must include but is not limited to:

i. A map of monitoring locations with EMS and Teck descriptors;

ii. A summary of non-compliances with the permit conditions for the previous calendar year. This must include interpretation of significance, and the status of corrective actions and/or ongoing investigations;

iii. A summary of environmental incidents reported during the previous calendar year, including corrective status;

iv. A summary of measured parameters, including appropriate graphs and comparison of results to permit limits, Approved and Working Water Quality Guidelines, Site Performance Objectives, or other criteria and benchmarks as specified by the director;

v. A summary of flocculants used at each pond location, in accordance with the approved Flocculant Management Plan, including types and trade names, concentrations and volumes of each type dosed, and frequency and duration of dosing;

vi. All acute and chronic toxicity test-specific reports from the laboratory and an interpreted summary and discussion of results, including recommendations and any subsequent actions where applicable;

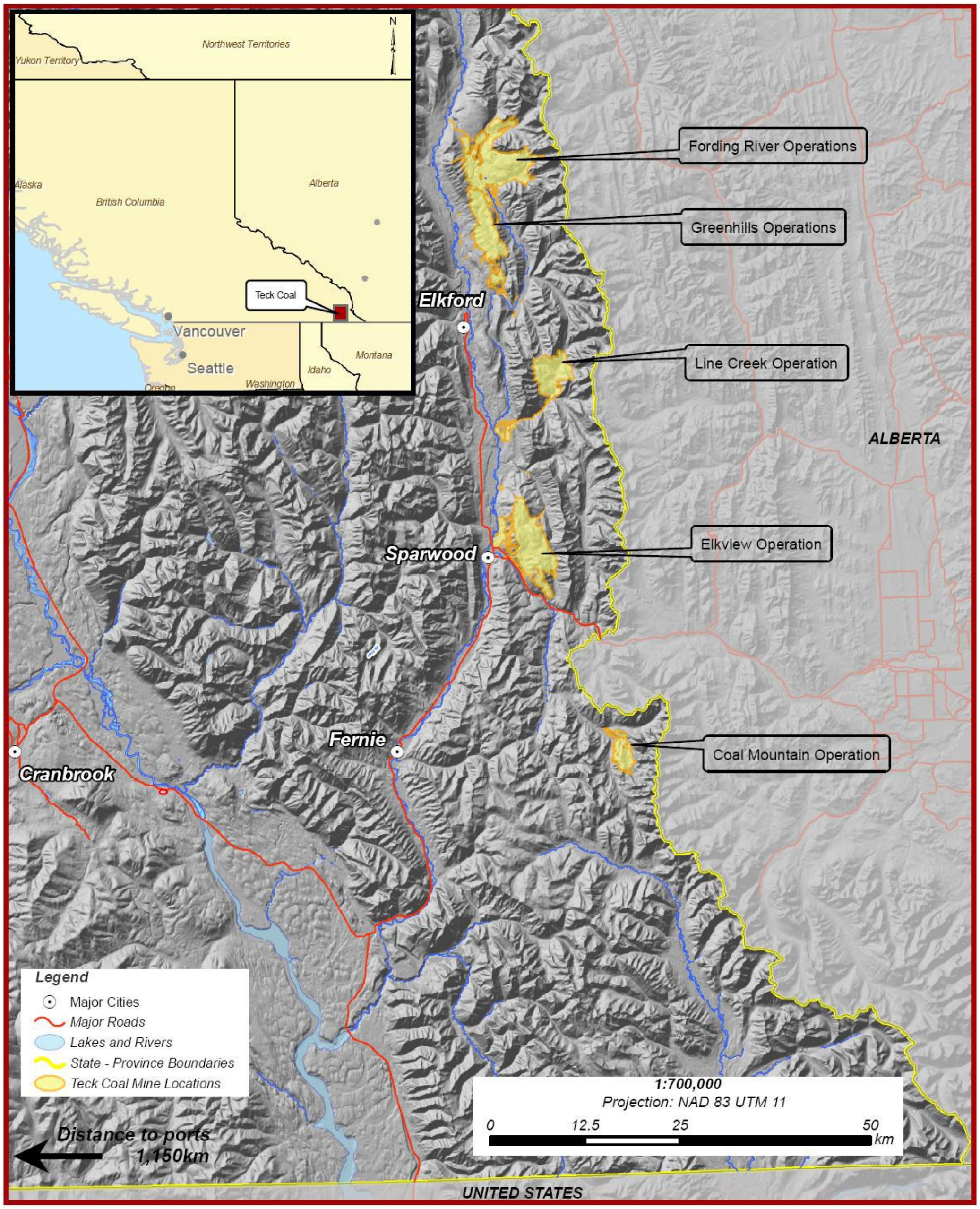
The Annual Report must be submitted to the Director on March 31st of each year following the data collection calendar year.

The Permittee must post the annual report on the company website by March 31 of each year. Copies must be made available for the Ministry of Energy and Mines and Ktunaxa First Nation. The Permittee may omit proprietary information from the publicly available annual report in accordance with the *Freedom of Information and Protection of Privacy Act*, as agreed to by the Director.

Date issued: September 30, 1977
Date amended: June 25, 2015
(most recent)

Douglas J. Hill, P.Eng.
for Director, *Environmental Management Act*
Southern Interior

APPENDIX 1A: TECK COAL LIMITED OPERATIONS LOCATION MAP



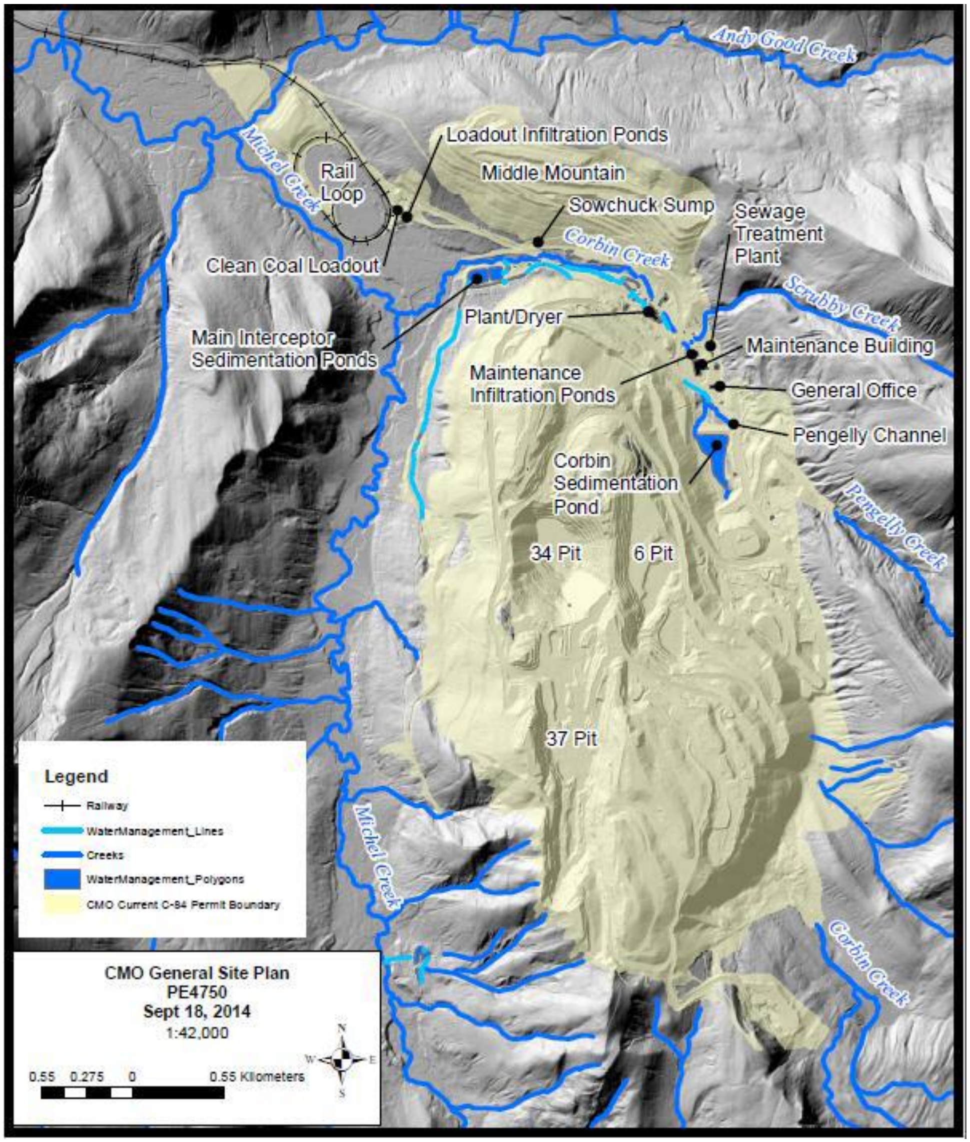
Date issued: September 30, 1977
Date amended: June 25, 2015
(most recent)

Douglas J. Hill, P.Eng.
for Director, *Environmental Management Act*
Southern Interior

Map 1 of 4

Permit Number: 4750

APPENDIX 1B: COAL MOUNTAIN OPERATIONS SITE PLAN



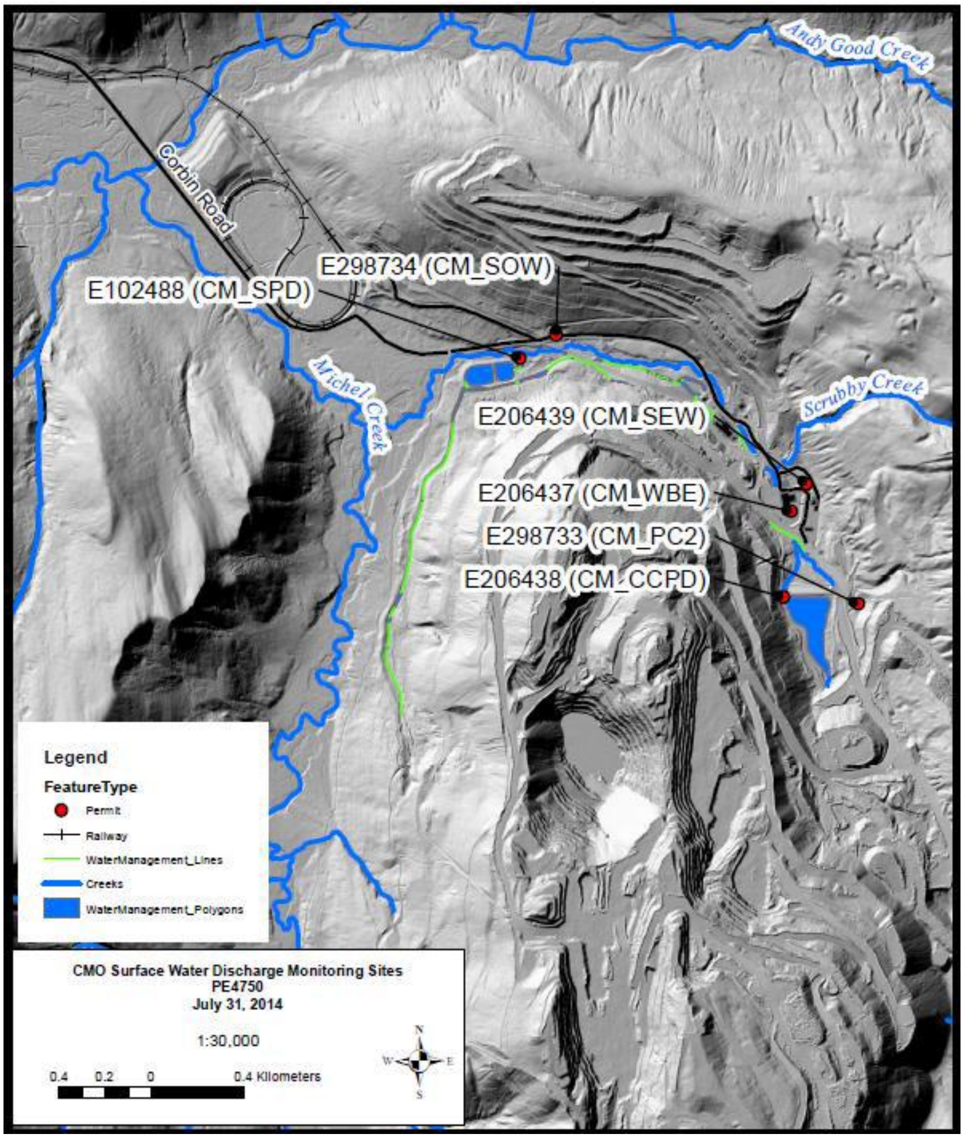
Date issued: September 30, 1977
Date amended: June 25, 2015
(most recent)

Douglas J. Hill, P.Eng.
for Director, *Environmental Management Act*
Southern Interior

Map 2 of 4

Permit Number: 4750

APPENDIX 1C: COAL MOUNTAIN OPERAITONS DISCHARGE MONITORING LOCATIONS MAP



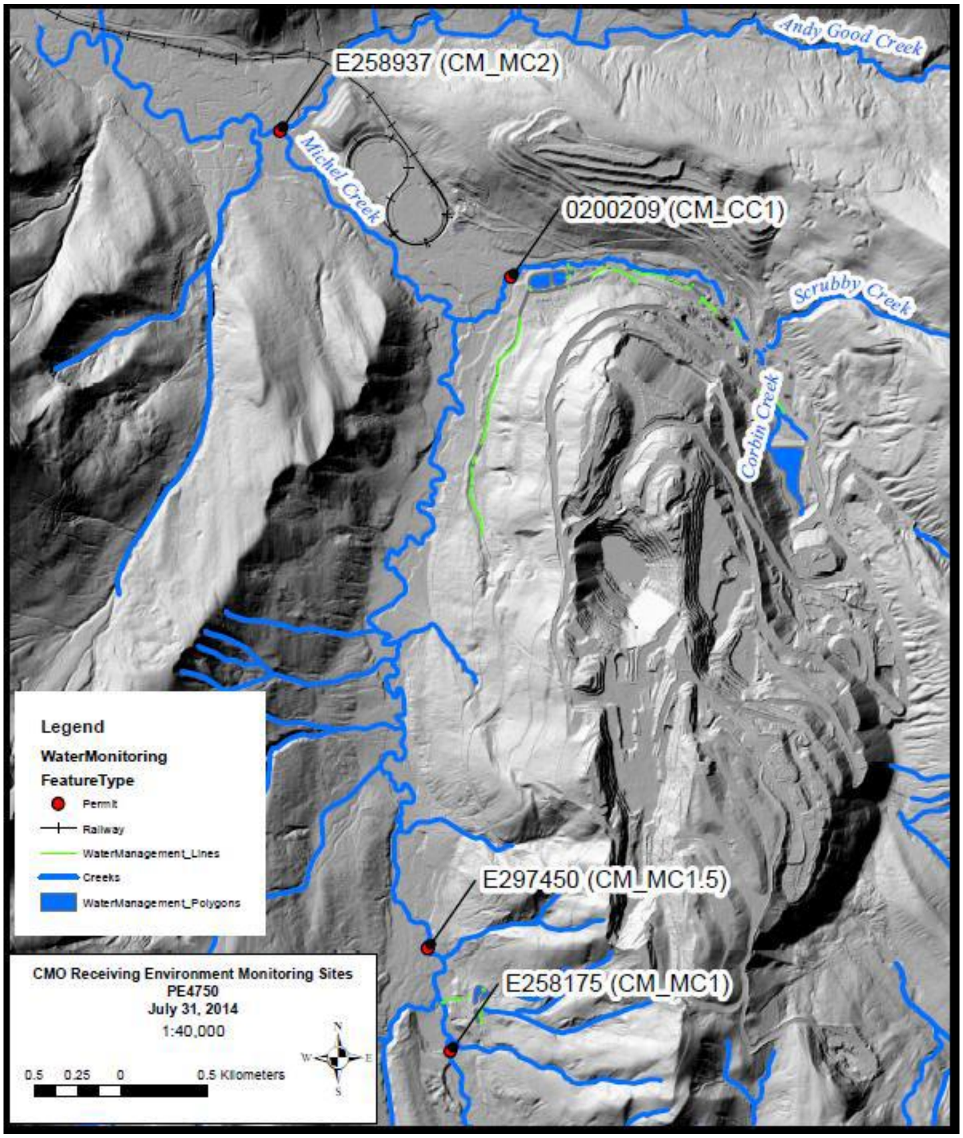
Date issued: September 30, 1977
Date amended: June 25, 2015
(most recent)

Douglas J. Hill, P.Eng.
for Director, *Environmental Management Act*
Southern Interior

Map 3 of 4

Permit Number: 4750

APPENDIX 1D: COAL MOUNTAIN OPERATIONS RECEIVING ENVIORNMENT MONITORING LOCATIONS MAP



Date issued: September 30, 1977
Date amended: June 25, 2015
(most recent)

Douglas J. Hill, P.Eng.
for Director, *Environmental Management Act*
Southern Interior

APPENDIX 2A: COAL MOUNTAIN OPERATIONS
SURFACE WATER DISCHARGE AND RECEIVING ENVIRONMENT MONITORING PROGRAM

TABLE 2: DISCHARGE MONITORING PROGRAM

	MINE SURFACE WATER DISCHARGE MONITORING SITES				
	DECANT DISCHARGE FROM MAIN INTERCEPTOR SEDIMENTATION PONDS (b)	**DISCHARGE TO MAINTENANCE INFILTRATION PONDS**	**DECANT DISCHARGE FROM CORBIN SEDIMENTATION POND (b)**	TREATED DOMESTIC EFFLUENT	**PENGELLY CHANNEL DECANT (b)**
EMS Number	***E102488***	***E206437***	***E206438***	***E206439***	***E298733***
PARAMETER	**MONITORING FREQUENCY**				
TSS & Turbidity	W/M		W/M	M	W/M
BOD				M	
EPH		Q			
Flow (a)	W/M	Q	W/M	M	W/M

1) Refer to Table 4, Appendix 2A, for abbreviation description
2) Refer to Table 5, Appendix 2A, for explanatory notes (a)-(b)

Date issued: September 30, 1977
Date amended: June 25, 2015
(most recent)

Douglas J. Hill, P.Eng.
for Director, *Environmental Management Act*
Southern Interior

APPENDIX 2A: COAL MOUNTAIN OPERATIONS
SURFACE WATER DISCHARGE AND RECEIVING ENVIRONMENT MONITORING PROGRAM

TABLE 3: RECEIVING ENVIRONMENT MONITORING PROGRAM

	RECEIVING ENVIRONMENT MONITORING SITES		
	MICHEL CREEK U/S OF OPERATIONS	**MICHEL CREEK D/S OF OPERATIONS NEAR ANY GOODE CREEK JUNCTION**	**CORBIN CREEK NEAR CONFLUENCE WITH MICHEL CREEK**
EMS Number	***E258175***	***E258937***	***0200209***
PARAMETER	**MONITORING FREQUENCY**		
TSS & Turbidity	W/M	W/M	W/M
Flow (a)	W/M	-	-

1) Refer to Table 4, Appendix 2A, for abbreviation description
2) Refer to Table 5, Appendix 2A, for explanatory notes (a)-(b)

Date issued: September 30, 1977
Date amended: June 25, 2015
(most recent)

Douglas J. Hill, P.Eng.
for Director, *Environmental Management Act*
Southern Interior

APPENDIX 2A: COAL MOUNTAIN OPERATIONS
MONITORING PROGRAM NOTES AND EXPLANATIONS

TABLE 4: ABBREVIATIONS FOR SURFACE WATER MONITORING PROGRAM
(Refer to Tables 2&3)

BOD	5-day Biochemical Oxygen Demand
C	Continuous Monitoring – rating curve or rated structure required, minimum of hourly data
EPH	Extractable Petroleum Hydrocarbons, a combination of HEPH (C19-32) & LEPH (C10-19)
M	Monthly frequency
Q	Quarterly frequency
TSS	Total Suspended Solids
W/M	Weekly frequency April 1 – July 31, monthly during the rest of the year.

TABLE 5: SURFACE WATER MONITORING PROGRAM: EXPLANATORY NOTES
(Refer to Tables 2&3)

a	**Flow measurements** must be taken in accordance with the BC Hydrometric RISC standards (2009) to the satisfaction of the Director, Environmental Protection
b	If the discharge point is not decanting to the receiving environment, water quality samples must be taken just inside the decant point for all parameters, with the exception of TSS and toxicity, as per the frequencies in Table 2.

Date issued: September 30, 1977
Date amended: June 25, 2015
(most recent)

Douglas J. Hill, P.Eng.
for Director, *Environmental Management Act*
Southern Interior

Permit Number: 4750

APPENDIX 3: COAL MOUNTAIN OPERATIONS CALCITE TREATMENT PILOT PROJECT

Under the Provisions of the Environmental Management Act

Teck Coal Limited
Coal Mountain Operation
PO Box 3000
Sparwood, BC V0B 2G0

is authorized to discharge effluent to surface water from Coal Mountain Operations located near Sparwood, British Columbia, subject to the terms and conditions listed below. Contravention of any of these conditions is a violation of the *Environmental Management Act* and may lead to prosecution.

This discharge is authorized to occur from June 29, 2015 to October 2, 2015.

A1. <u>AUTHORIZED DISCHARGES</u>

A1.1 <u>Authorized source</u>

This section applies to the discharge of effluent from the Coal Mountain Pilot Calcite Treatment Plant, for the following treatment technologies; antiscalant addition and cascade precipitation into the Coal Mountain plant area surface water run-off system via the Main Sedimentation Pond to Corbin Creek. The site reference number for this discharge is E295089.

A1.1.1 The maximum authorized rate of discharge is 400 L/min.
The average daily authorized rate of discharge is 225 L/min.

A1.1.2 The characteristics of the discharge exiting the treatment system (E295089) shall be equivalent to or better than:

Date issued: September 30, 1977
Date amended: June 25, 2015
(most recent)

Douglas J. Hill, P.Eng.
for Director, *Environmental Management Act*
Southern Interior

PARAMETER	LIMIT/UNITS
96 hr Rainbow Trout Single Concentration toxicity test	50% Survival in 100% Concentration, Minimum
48 hr *Daphnia magna* Single Concentration toxicity test	50% Survival in 100% Concentration, Minimum
pH	6.0 – 9.0
Total Phosphorus	Increase over background of not more than 0.30 mg/L
Orthophosphate	Increase over background of not more than 10 µg/L
Total Organic Carbon	Increase over background of not more than 10 mg/L

A1.1.3 The authorized works are a submersible pump intake, piping, influent equalization tank, antiscalant containment and injection stations, mixing modules, cascade feed tanks and platforms, residual/effluent equalization tank, associated transfer pumps, pH probes, discharge to plant run-off system, and related appurtenances.

A1.1.4 The location of the facilities from which the discharge originates and the point of discharge is District Lot 6999, Kootenay Land District.

A2. OPERATIONAL REQUIREMENTS

A2.2 Effluent Non-Toxicity

The discharges to surface water referenced in Section 1of this approval must not be acutely toxic to aquatic organisms at the point which it enters the receiving environment. The undiluted effluent must not cause greater than 50% mortality in 96 hr Rainbow Trout (*Oncorhynchus mykiss)* single concentration toxicity tests (EPS 1/RM/13 2nd edition, December 2000) and greater than 50% mortality in 48 hr *Daphnia magna* single concentration toxicity tests (EPS 1/RM/14 2nd edition, December 2000).

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Date amended: June 25, 2015
(most recent)

Douglas J. Hill, P.Eng.
for Director, *Environmental Management Act*
Southern Interior

A3. MONITORING REQUIREMENTS

A3.1 Monitoring Locations

DISCHARGE SAMPLE LOCATIONS	
ENVIROMENTAL MONITORING SITE NUMBERS	**SITE DESCRIPTION AND LOCATION**
E295092	Corbin Pond Influent via pipeline to Coal Mountain Pilot Calcite Treatment Plant
E295089	Coal Mountain Pilot Calcite Treatment Plant Effluent, discharge to Coal Mountain plant run-off water system via Main Sedimentation Pond to Corbin Creek.
E102488	Main Sedimentation Pond Decant

A3.2 Sampling Frequency and Parameters

PARAMETER	E295092 (INFLUENT)	E295089 (EFFLUENT)	E102488 (MAIN POND)
pH (field)	W[1]	2W	W
Temperature (field)	W	2W	W
Specific conductivity (field)	W	2W	W
Flow	W	2W	W
Alkalinity	W	2W	W
Major Ions and Nutrients[2]	W	2W	W
Total dissolved solids	W	2W	W
Total suspended solids	W	2W	W
Biological oxygen demand	W	2W	W
Chemical oxygen demand	W	2W	W
Total organic carbon	W	2W	W
Dissolved organic carbon	W	2W	W
Total metals[3]	W	2W	W
Total dissolved metals[4]	W	2W	W
Dissolved CO2	W	2W	
Hardness	W	2W	W
96 hr Rainbow Trout Single Concentration toxicity test[5]		M	
48 hr *Daphnia magna* Single Concentration toxicity test		M	

[1] – Sample frequencies are twice weekly (2W), weekly (W) or monthly (M).
[2] – **Major Ions and Nutrients** include bromide, fluoride, calcium, chloride, magnesium, potassium, sodium, sulphate, ammonia, nitrate, nitrite, total phosphorus, orthophosphate

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Douglas J. Hill, P.Eng.
for Director, *Environmental Management Act*
Southern Interior

[3]- **Total Metals Scan** must be an ICPMS total metals scan and include aluminum, antimony, arsenic, barium, beryllium, bismuth, boron, cadmium, chromium, cobalt, copper, iron, lead, lithium, manganese, mercury, molybdenum, nickel, selenium, silver, strontium, thallium, tin, titanium, uranium, vanadium, and zinc.
[4] - **Dissolved Metals Scan** must be an ICPMS dissolved metals scan and include aluminum, antimony, arsenic, barium, beryllium, bismuth, boron, cadmium, chromium, cobalt, copper, iron, lead, lithium, manganese, mercury, molybdenum, nickel, selenium, silver, strontium, thallium, tin, titanium, uranium, vanadium, and zinc.
[5] –**Toxicity testing** should be during the highest dosage operating conditions of pilot operation

A3.4 **Minimum Detection Limit**

Minimum analytical detection limits for each parameter listed in section 3.2 must be suitable for comparison with the applicable standards listed in the most recent Approved and Working Water Quality Guidelines prepared by Ministry of Environment.

A3.5 **Quality Assurance**

All analytical data required by the approval to be submitted shall be conducted by a laboratory acceptable to the Director. At the request of the Director, the Permittee Holder shall provide the laboratory quality assurance data, associated field blanks and duplicate analysis results along with the submission of data required under Section 3.2 of the permit.

A4. **REPORTING REQUIREMENTS**

A4.1 **Reporting**

Maintain analytical data, maintain records of type and dose of reagent added to treat the effluent discharge and submit the data, suitably tabulated, for the approval period to the Director. The report shall be submitted within 60 days of the end of the pilot period.

A4.2 **Performance Evaluation Reporting**

A final report, at the end of the pilot period, shall be submitted to the Director, evaluating the performance of the pilot treatment technologies. This must include analytical results of the effluent and toxicity results. The report must be submitted by March 1, 2016.

A4.3 **Non-compliance Reporting**

The Permittee shall immediately contact the Director or an Officer designated by the Director by e-mail and/or telephone of any non-compliance with the requirements of this permit and take appropriate remedial action. Written confirmation of all non-compliance events is required by e-mail within 24 hours of the original notification unless otherwise directed by the Director. Applicable lab results must be submitted to the Director immediately upon receipt.

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Southern Interior

Appendix F 2015 Monitoring Data, QA/QC data and Statistical Summaries

1. 2015 Flow data (m^3/s) – Discharge Locations

Site ID	CM_CCPD	CM_PC2	CM_SPD
EMS Code	E206438	E298733	E102488
Date			
1/6/2015			0.032
1/6/2015	0.063		
2/3/2015	0.0645		
2/3/2015			0.03016
3/3/2015			0.029
3/3/2015	0.048		
3/30/2015			0.148
3/30/2015		0.062	
3/30/2015	0.22		
4/8/2015		0.006	
4/8/2015	0.225		
4/8/2015			0.112
4/15/2015			0.089
4/15/2015		0.003	
4/15/2015	0.204		
4/22/2015			0.159
4/22/2015		0.147	
4/22/2015	0.24		
4/29/2015			0.116
4/29/2015		0.077	
4/29/2015	0.293		
5/6/2015		0.155	
5/6/2015	0.455504		
5/6/2015			0.111615
5/13/2015		0.034737	
5/13/2015	0.413677		
5/13/2015			0.04776
5/20/2015			0.06
5/20/2015		0.008	
5/20/2015	0.36		
5/27/2015			0.103246
5/27/2015		0.097930903	
5/27/2015	0.457716		
6/3/2015			0.188119
6/3/2015		0.609	
6/3/2015	0.923		
6/10/2015			0.097375
6/10/2015		0.04553	
6/10/2015	0.3878		
6/17/2015			0.068267
6/17/2015		0.007	
6/17/2015	0.289094		
6/24/2015		0.001	

Site ID	CM_CCPD	CM_PC2	CM_SPD
EMS Code	**E206438**	**E298733**	**E102488**
6/24/2015	0.235452		
6/24/2015			0.061085
6/30/2015		0	
6/30/2015	0.279		
6/30/2015			0.059
7/8/2015		0	
7/8/2015	0.165		
7/8/2015			0.0459
7/15/2015			0.051
7/15/2015	0.111		
7/21/2015			0.030495
7/21/2015		0	
7/21/2015	0.094		
7/27/2015	0.11262		0.012
8/5/2015	0.117		
8/5/2015			0.036
9/2/2015	0.062		
9/2/2015			0.029
9/28/2015	0.028		
9/28/2015			0.0053
10/7/2015		0	
10/7/2015	0.037		
10/7/2015			0.04
11/4/2015		0	
11/4/2015	0.069		
11/4/2015			0.039
12/2/2015		0	
12/2/2015	0.088		
12/2/2015			0.033
Minimum	**0.028**	**0.000**	**0.005**
Maximum	**0.923**	**0.609**	**0.188**
Mean	**0.224**	**0.066**	**0.068**
Median	**0.204**	**0.007**	**0.051**
Standard Deviation	**0.193**	**0.141**	**0.047**
Sample size	**27**	**19**	**27**

2. 2015 TSS & Turbidity Data – Discharge Locations

Parameter	TOTAL SUSPENDED SOLIDS (TSS)			TURBIDITY, LAB		
Unit	**mg/L**			**NTU**		
Site ID	**CM_CCPD**	**CM_PC2**	**CM_SPD**	**CM_CCPD**	**CM_PC2**	**CM_SPD**
EMS Code	**E206438**	**E298733**	**E102488**	**E206438**	**E298733**	**E102488**
Date						
1/6/2015			1.9			1.26
1/6/2015	< 1.0			0.71		
2/3/2015	< 1.0			0.71		
2/3/2015			2			1.46
3/3/2015			1.6			1.93
3/3/2015	< 1.0			0.68		
3/15/2015	1.8			4.35		
3/15/2015			55.2			74.1
3/16/2015		< 1.0			0.52	
3/30/2015			9.4			22.3
3/30/2015		< 1.0			0.32	
3/30/2015	3.3			5.06		
4/8/2015		< 1.0			0.17	
4/8/2015	2.6			1.53		
4/8/2015			3.7			4.3
4/15/2015			3.9			3.01
4/15/2015		< 1.0			0.11	
4/15/2015	< 1.0			1.11		
4/22/2015			12			3.96
4/22/2015		< 1.0			0.24	
4/22/2015	3.4			0.99		
4/29/2015			14.8			4.14
4/29/2015		< 1.0			0.19	
4/29/2015	2.4			1.43		
5/6/2015		1.6			0.14	
5/6/2015	3.2			3.04		
5/6/2015			18			16.9
5/13/2015		< 1.0			0.12	
5/13/2015	1.8			1.62		
5/13/2015			10.8			8.49
5/20/2015			4			1.37
5/20/2015		< 1.0			1.5	
5/20/2015	< 1.0			1.12		
5/27/2015			16.1			3.18
5/27/2015		< 3.0			0.27	
5/27/2015	10.1			4.62		
6/2/2015			51.6			51.5
6/2/2015		< 1.0			0.49	
6/2/2015	6.8			7.67		
6/2/2015			39.2			42.3
6/2/2015			20.2			21.2

Parameter	TOTAL SUSPENDED SOLIDS (TSS)			TURBIDITY, LAB		
Unit	mg/L			NTU		
Site ID	CM_CCPD	CM_PC2	CM_SPD	CM_CCPD	CM_PC2	CM_SPD
EMS Code	E206438	E298733	E102488	E206438	E298733	E102488
6/3/2015			7			8.69
6/3/2015			8.9			6.95
6/3/2015		2			0.29	
6/3/2015	8.8			7		
6/10/2015			9.7			2.96
6/10/2015		< 1.0			0.2	
6/10/2015	1			1.52		
6/15/2015	< 3.0	< 3.0		0.7	0.13	
6/17/2015			4.2			0.67
6/17/2015		< 1.0			0.13	
6/17/2015	< 1.0			0.91		
6/24/2015		< 1.0			0.15	
6/24/2015	< 1.0			0.6		
6/24/2015			2.4			0.6
6/30/2015		27.8			0.93	
6/30/2015	< 1.0			0.52		
6/30/2015			< 1.0			2.13
7/8/2015		1.5			0.28	
7/8/2015	< 1.0			0.57		
7/8/2015			2.1			0.72
7/15/2015			8			1.23
7/15/2015	< 1.0			0.65		
7/21/2015			2			1.61
7/21/2015	1.8			1.09		
7/27/2015	1.8		1.3	1.16		0.73
8/5/2015	2.4			1.31		
8/5/2015			2			1.09
8/17/2015			3.9			
8/24/2015			6.3			
9/2/2015	2.9			1.6		
9/2/2015			2.5			1.09
9/28/2015	2			0.9		
9/28/2015			2.8			1.04
10/7/2015	2.1			0.92		
10/7/2015			1.8			1.22
11/4/2015	2.2			2.69		
11/4/2015			9.5			17.6
12/2/2015	< 1.0			0.77		
12/2/2015			2			2.67
Minimum	1	1.5	1.3	0.52	0.11	0.60
Maximum	10.1	27.8	55.2	7.67	1.50	74.10
Mean	2.5	2.8	10.6	1.92	0.34	9.76
Median	1.8	1.0	5.3	1.12	0.22	2.82
Standard	2.3	6.3	13.7	1.91	0.35	16.78

Deviation						
Sample size	30	18	32	30	18	32
Non detects	8	13	6	0	0	0
% Non detects	26.7	72.2	18.8	0.0	0.0	0.0
DL	1.0	1.0	1.0	0.1	0.1	0.1

3. 2015 Flow data – CM_MC1

Site ID	**CM_MC1**
EMS Code	**E258175**
Date	
1/6/2015	0.049
3/3/2015	0.083
3/30/2015	0.428
4/8/2015	0.191
4/15/2015	0.143
4/22/2015	0.382
5/6/2015	0.588
5/13/2015	0.458
5/20/2015	0.508
5/27/2015	1.289
6/10/2015	0.543
6/17/2015	0.290
6/24/2015	0.198
6/30/2015	0.116
7/8/2015	0.092
7/15/2015	0.062
7/21/2015	0.059
7/27/2015	0.055
8/5/2015	0.046
9/2/2015	0.032
10/7/2015	0.040
11/4/2015	0.070
12/2/2015	0.046
Minimum	**0.032**
Maximum	**1.289**
Mean	**0.251**
Median	**0.116**
Standard Deviation	**0.293**
Sample size	**23**

4. 2015 TSS & Turbidity data – Receiving Environment

Parameter	TOTAL SUSPENDED SOLIDS			TURBIDITY, LAB		
Unit	mg/l			NTU		
Site ID	CM_CC1	CM_MC1	CM_MC2	CM_CC1	CM_MC1	CM_MC2
EMS code	0200209	E258175	E258937	0200209	E258175	E258937
Date						
1/6/2015			1.7			0.47
1/6/2015	< 1.0			0.48		
1/6/2015		< 2.0			0.35	
2/3/2015			< 1.0			0.26
2/3/2015	< 1.0			0.46		
2/3/2015		< 1.0			0.17	
3/3/2015			1.7			0.53
3/3/2015		< 1.0			0.21	
3/3/2015	< 1.0			0.64		
3/10/2015			2.1			1.09
3/15/2015	33.2			41		
3/15/2015			61.4			40.5
3/16/2015			29.7			18.9
3/16/2015	14.6			15.7		
3/23/2015			4.5			2.09
3/23/2015	1.8			2.01		
3/30/2015			10.2			6.69
3/30/2015		1.8			1.61	
3/30/2015	3.6			4.32		
4/8/2015		1.4			0.4	
4/8/2015	1			1.14		
4/8/2015			4.3			1.81
4/15/2015			2.2			1.03
4/15/2015		< 1.0			0.28	
4/15/2015	< 1.0			0.72		
4/22/2015		1.3			0.93	
4/22/2015			10.6			3.78
4/22/2015	4.4			1.41		
4/29/2015			17			8.88
4/29/2015		5.2			3.11	
4/29/2015	4.1			2.03		
5/5/2015			9.6			5.84
5/6/2015			13.4			5.83
5/6/2015		3.8			2.68	
5/6/2015	2.8			1.96		
5/12/2015			3			1.95
5/13/2015		1			1.14	
5/13/2015	2.2			1.6		
5/19/2015			3.8			2.42
5/20/2015		1.7			1.59	
5/20/2015	1.2			0.8		

Parameter	TOTAL SUSPENDED SOLIDS			TURBIDITY, LAB		
Unit	mg/l			NTU		
Site ID	CM_CC1	CM_MC1	CM_MC2	CM_CC1	CM_MC1	CM_MC2
EMS code	0200209	E258175	E258937	0200209	E258175	E258937
5/26/2015			111			54
5/27/2015		22.5			6.05	
5/27/2015	4.7			1.95		
6/3/2015			47.1			28.5
6/3/2015		47.2			20.5	
6/3/2015	29.5			7.67		
6/10/2015		3.7			1.39	
6/10/2015	2.1			1.06		
6/10/2015			13.4			4.12
6/17/2015			5.3			0.95
6/17/2015		1.4			0.59	
6/17/2015	1.8			0.45		
6/24/2015		< 1.0			0.36	
6/24/2015	< 1.0			0.42		
6/24/2015			1.6			0.56
6/30/2015	1			0.35		
6/30/2015		< 1.0			0.54	
6/30/2015			2.8			0.7
7/8/2015			2.2			0.6
7/8/2015		< 1.0			0.25	
7/8/2015	< 1.0			0.33		
7/15/2015			1.9			0.55
7/15/2015		< 1.0			0.25	
7/15/2015	1.1			0.36		
7/21/2015			1.2			0.61
7/21/2015		2			0.35	
7/21/2015	1			0.57		
7/27/2015			1.4			0.32
7/27/2015	1.9	1.8		0.3	0.34	
7/29/2015			1.6			0.41
8/5/2015		< 1.0			0.28	
8/5/2015			< 1.0			0.42
8/5/2015	1.1			0.38		
8/12/2015			1.6			0.42
8/19/2015			1.6			0.69
8/26/2015			< 1.0			0.4
9/2/2015			1.5			0.61
9/2/2015		< 1.0			0.25	
9/2/2015	< 1.0			0.33		
10/7/2015			< 1.0			0.41
10/7/2015		< 1.0			0.13	
10/7/2015	3.4			0.37		
10/26/2015			6.6			0.99
11/2/2015			3.4			3.36

Parameter	TOTAL SUSPENDED SOLIDS			TURBIDITY, LAB		
Unit	mg/l			NTU		
Site ID	CM_CC1	CM_MC1	CM_MC2	CM_CC1	CM_MC1	CM_MC2
EMS code	0200209	E258175	E258937	0200209	E258175	E258937
11/4/2015			< 1.0			0.85
11/4/2015		< 1.0			0.34	
11/4/2015	3.5			4.68		
11/9/2015			< 1.0			0.49
11/16/2015			3.1			2.82
11/23/2015			6.3			2.34
12/1/2015			15.3			3.48
12/2/2015			1.7			0.64
12/2/2015		< 1.0			0.18	
12/2/2015	< 1.0			0.74		
Minimum	1.0	1.0	1.2	0.30	0.13	0.26
Maximum	33.2	47.2	111.0	41.00	20.50	54.00
Mean	4.4	4.2	10.3	3.25	1.70	5.15
Median	1.8	1.2	2.9	0.74	0.36	0.99
Standard Deviation	7.9	9.7	20.5	7.90	4.05	11.09
Sample size	29	26	40	29	26	41
Non detects	8	13	6	0	0	0
% Non detects	28	50	15	0	0	0
DL	1.0	1.0, 2.0	1.0	0.10	0.10	0.10

5. 2015 E206437 (CM_WBE) Data

Parameter	Daily Flow	EPH Total
Unit	m3/day	mg/L
1/6/2015	20.48	1.7
2/3/2015	28	2.29
3/3/2015	43.3	2.18
4/8/2015	51	2.5
5/6/2015	32.86	8.72
6/3/2015	28.86	1.97
7/8/2015	29.41	1.39
8/5/2015	22.07	1.3
9/2/2015	30.86	0.5
10/7/2015	33.71	0.5
11/4/2015	31.71	1.4
12/2/2015	23.71	1.67
Minimum	20.5	0.5
Maximum	51.0	8.7
Mean	31.3	2.2
Median	30.1	1.7
Standard Deviation	8.6	2.2

Sample size	12.0	12.0
Non detects	n/a	2.0
% Non detects	n/a	16.7
DL	n/a	0.5

6. 2015 E206439 (CM_SEW) Data

Parameter	**Turbidity**	**TSS**	**BOD_5**	**Daily Flow**
Unit	**NTU**	**mg/L**	**mg/L**	**m^3/day**
1/6/2015	1.26	< 1.0	< 2.0	15.9
2/5/2015	0.19	< 1.0	< 2.0	13.59
3/3/2015	0.2	< 1.0	< 2.0	19.65
4/8/2015	0.17	< 1.0	< 2.0	18.04
5/6/2015	0.21	< 3.0	< 2.0	17.15
6/3/2015	0.55	1.5	< 2.0	16.62
7/8/2015	0.16	< 1.0	< 2.0	12.88
8/5/2015	0.14	< 1.0	< 2.0	9.72
9/21/2015	0.45	< 1.0	< 2.0	18.06
10/7/2015	0.13	< 1.0	< 2.0	17.206
11/4/2015	0.22	< 1.0	< 2.0	17.54
12/2/2015	0.22	< 1.0	< 2.0	16.94
Minimum	0.13	<1	< 2.0	9.72
Maximum	1.26	3	< 2.0	19.65
Mean	0.33	1.2	< 2.0	16.11
Median	0.21	<1	< 2.0	17.05
Standard Deviation	0.32	0.56	0.00	2.75
Sample size	12	12	12	12
Non detects	0	11	12	n/a
% Non detects	0	92	100	n/a
DL	0.1	1.0	2.0	n/a

7. 2015 QA/QD data collected

Location	Date	Sample Type	TSS (mg/L)	Turbidity, Lab (NTU)
E206438 (CM_CCPD)	4/22/2015	FB	< 1.0	< 0.10
	4/22/2015	N	3.4	0.99
	5/27/2015	N	10.1	4.62
	5/27/2015	FB	< 3.0	< 0.10
	6/3/2015	FD	7.6	8.02
	6/3/2015	N	8.8	7
E298733 (CM_PC2)	3/30/2015	FB	< 1.0	0.11
	4/22/2015	FD	< 1.0	0.31
	4/22/2015	N	< 1.0	0.24
	4/29/2015	N	< 1.0	0.19
	4/29/2015	FD	< 1.0	0.27
	5/20/2015	N	< 1.0	1.50
	5/20/2015	FB	< 1.0	< 0.10
	6/17/2015	FB	< 1.0	< 0.10
	6/17/2015	N	< 1.0	0.13
E102488 (CM_SPD)	2/3/2015	N	2.0	1.46
	2/3/2015	FD	1.7	1.62
	2/3/2015	FB	< 1.0	< 0.10
	5/6/2015	N	18.0	16.9
	5/6/2015	FD	18.5	14.5
	5/13/2015	N	10.8	8.49
	5/13/2015	FB	< 1.0	< 0.10
	8/5/2015	FB	< 1.0	< 0.10
	8/5/2015	N	2.0	1.09
0200209 (CM_CC1)	3/23/2015	FD	1.9	2.47
	3/23/2015	N	1.8	2.01
	3/30/2015	N	3.6	4.32
	3/30/2015	FD	3.8	4.55
	4/15/2015	N	< 1.0	0.72
	4/15/2015	FD	1.3	0.85
	5/13/2015	FD	1.4	1.3
	5/13/2015	N	2.2	1.6
	5/20/2015	N	1.2	0.8
	5/20/2015	FD	1.2	0.53
	5/27/2015	N	4.7	1.95
	5/27/2015	FD	7.2	2.18
	6/17/2015	FD	1.6	0.42
	6/17/2015	N	1.8	0.45
	6/24/2015	N	< 1.0	0.42
	6/24/2015	FD	< 1.0	0.49
	6/30/2015	FB	< 1.0	1.93
	6/30/2015	N	1	0.35
	6/30/2015	FD	< 2.0	0.41
	7/8/2015	N	< 1.0	0.33

Location	Date	Sample Type	TSS (mg/L)	Turbidity, Lab (NTU)
0200209 (CM_CC1)	7/8/2015	FB	< 1.0	< 0.10
	7/15/2015	N	1.1	0.36
	7/15/2015	FB	< 1.0	< 0.10
	7/27/2015	FB	< 1.0	< 0.10
	7/27/2015	FD	2.8	0.34
	7/27/2015	N	1.9	0.3
	8/5/2015	FD	< 1.0	0.42
	8/5/2015	N	1.1	0.38
	12/2/2015	FD	1.1	0.73
	12/2/2015	N	< 1.0	0.74
E258175 (CM_MC1)	4/15/2015	N	< 1.0	0.28
	4/15/2015	FB	< 1.0	< 0.10
	4/29/2015	FB	< 1.0	< 0.10
	4/29/2015	N	5.2	3.11
	7/8/2015	N	< 1.0	0.25
	7/8/2015	FD	< 1.0	0.31
	7/21/2015	N	2.0	0.35
	7/21/2015	FB	< 1.0	0.14
	9/2/2015	N	< 1.0	0.25
	9/2/2015	FB	< 1.0	< 0.10
	10/7/2015	FD	< 1.0	0.17
	10/7/2015	N	< 1.0	0.13
	11/4/2015	FB	< 1.0	< 0.10
	11/4/2015	N	< 1.0	0.34
	12/2/2015	N	< 1.0	0.18
	12/2/2015	FB	< 1.0	< 0.10
E258937 (CM_MC2)	3/16/2015	FD	29.4	20.6
	3/16/2015	N	29.7	18.9
	6/10/2015	FD	16.3	6.03
	6/10/2015	N	13.4	4.12
	6/10/2015	FB	< 1.0	< 0.10
	6/24/2015	FB	< 1.0	< 0.10
	6/24/2015	N	1.6	0.56
	7/15/2015	N	1.9	0.55
	7/15/2015	FD	1.9	0.57
	7/21/2015	N	1.2	0.61
	7/21/2015	FD	< 1.0	0.62

N: normal permitted sample; FD: Field Duplicate; FB: Field Blank

Appendix G Historical Monitoring Data

Appendix G - Historical Monitoring Data

E258175 - CM_MC1

sample_date	INSTANTANEOUS FLOW (m^3/s)	TOTAL SUSPENDED SOLIDS (mg/L)	TURBIDITY, LAB (NTU)
18-Jan-00		1	0.1
10-Feb-00		1	0.1
17-Mar-00		1	0.4
4-Apr-00		1	1.1
13-Apr-00		1	1.1
21-Apr-00		2	0.4
27-Apr-00		1	0.1
6-May-00		2	1.5
15-May-00			
21-May-00		31	16.7
1-Jun-00		13	3.7
12-Jun-00		3	2.2
16-Jun-00		4	3.3
22-Jun-00		4	4.1
27-Jun-00		1	0.1
7-Jul-00		1	0.4
14-Jul-00		1	0.1
18-Jul-00		1	0.1
28-Jul-00		1	0.4
17-Aug-00		1	0.1
12-Sep-00		1	0.4
23-Oct-00		1	0.1
21-Nov-00		1	2.2
11-Dec-00		1	0.1
11-Jan-01		1	0.1
12-Feb-01		1	0.1
12-Mar-01		1	0.1
12-Apr-01		1	0.1
17-Apr-01		1	0.1
24-Apr-01		1	0.1
3-May-01		1	1.1
9-May-01		8	4.4
15-May-01		15	17.4
22-May-01		31	11.9
30-May-01		4	1.9
5-Jun-01		8	4.8
11-Jun-01		2	0.1
19-Jun-01		1	0.1
27-Jun-01		1	0.1
5-Jul-01		1	1.5

sample_date	INSTANTANEOUS FLOW (m^3/s)	TOTAL SUSPENDED SOLIDS (mg/L)	TURBIDITY, LAB (NTU)
11-Jul-01		1	0.1
17-Jul-01		1	0.1
26-Jul-01		1	0.1
13-Aug-01		1	0.1
13-Sep-01		1	0.4
11-Oct-01		1	0.4
13-Nov-01			
14-Nov-01		2	1.1
19-Dec-01		1	0.4
14-Jan-02		1	0.7
11-Feb-02		1	0.1
11-Mar-02		1	0.4
11-Apr-02		1	0.4
18-Apr-02		2	1.9
25-Apr-02		1	0.4
2-May-02		2	5.2
8-May-02		1	0.7
23-May-02		7	5.9
30-May-02		38	22.6
5-Jun-02		21	14.1
19-Jun-02		20	12.6
26-Jun-02		128	80.4
3-Jul-02		18	12.2
11-Jul-02		5	5.2
18-Jul-02		2	1.1
24-Jul-02		3	0.4
9-Aug-02		< 1.0	< 0.1
5-Sep-02		20	15.6
6-Sep-02			
9-Oct-02		< 1.0	< 0.1
14-Nov-02		< 1.0	0.4
2-Dec-02		< 1.0	< 0.1
10-Dec-02			
14-Jan-03		< 1.0	1.5
30-Jan-03			
11-Feb-03		< 1.0	< 0.1
18-Mar-03		< 1.0	1.1
3-Apr-03		2	0.7
10-Apr-03		< 1.0	1.1
25-Apr-03		13	6.7
2-May-03		< 1.0	1.5
8-May-03		< 1.0	1.5
15-May-03		12	9.3

sample_date	INSTANTANEOUS FLOW (m^3/s)	TOTAL SUSPENDED SOLIDS (mg/L)	TURBIDITY, LAB (NTU)
22-May-03		3	4.1
29-May-03		67	45.6
6-Jun-03		24	18.5
12-Jun-03		16	6.3
19-Jun-03		4	2.6
27-Jun-03		3	2.2
3-Jul-03		2	2.6
10-Jul-03		< 1.0	1.1
21-Jul-03		< 1.0	1.1
25-Jul-03		< 1.0	0.7
31-Jul-03		< 1.0	1.1
21-Aug-03		< 1.0	0.7
23-Sep-03		< 1.0	< 0.1
24-Oct-03		7	1.1
4-Nov-03		< 1.0	1.1
2-Dec-03		< 1.0	1.5
16-Dec-03			
3-Jan-04			
6-Jan-04		< 1.0	0.4
3-Feb-04		< 1.0	3
3-Mar-04		< 1.0	0.7
6-Apr-04		2	1.9
14-Apr-04		4	4.4
20-Apr-04		< 1.0	2.6
27-Apr-04		46	22.2
4-May-04		16	13.3
11-May-04		7	8.9
18-May-04		6	4.8
25-May-04		4	4.1
1-Jun-04		5	5.6
9-Jun-04		4	5.2
15-Jun-04		4	3
22-Jun-04		3	1.9
29-Jun-04		< 1.0	0.7
6-Jul-04		< 1.0	3.7
13-Jul-04		1	0.7
20-Jul-04		< 1.0	1.9
27-Jul-04		2	1.9
3-Aug-04		< 1.0	0.7
7-Sep-04		2	2.2
5-Oct-04			
7-Oct-04		< 1.0	0.4
4-Nov-04			

sample_date	INSTANTANEOUS FLOW (m^3/s)	TOTAL SUSPENDED SOLIDS (mg/L)	TURBIDITY, LAB (NTU)
5-Nov-04		< 1.0	< 0.1
8-Dec-04		2	1.1
2-Feb-05		< 1.0	13.3
2-Mar-05			
2-Mar-05		< 1.0	< 0.1
6-Apr-05		2	1.1
12-Apr-05		< 1.0	0.4
20-Apr-05		2	0.4
28-Apr-05		4	1.1
4-May-05		2	1.9
10-May-05		13	9.6
17-May-05		82	12.6
24-May-05		13	3
31-May-05		5	2.6
13-Jun-05		21	13
21-Jun-05		13	5.9
28-Jun-05		6.3	5.98
5-Jul-05		< 4.0	1.1
12-Jul-05		< 4.0	0.6
20-Jul-05		< 4.0	0.68
28-Jul-05		< 4.0	0.45
2-Aug-05			
4-Aug-05		7.3	0.43
13-Sep-05		< 4.0	0.93
4-Oct-05		< 4.0	2.74
1-Nov-05			
3-Nov-05		< 4.0	1.47
13-Dec-05		< 4.0	1.24
7-Feb-06		< 3.0	0.43
15-Mar-06		< 3.0	1.4
4-Apr-06		< 3.0	1.8
3-May-06		< 3.0	3.1
11-May-06		< 3.0	1.8
16-May-06		37	36.8
26-May-06		15	16.6
1-Jun-06		6	7.6
13-Jun-06		3	2.3
21-Jun-06		< 3.0	2.4
28-Jun-06		< 3.0	1.5
4-Jul-06		< 3.0	1.3
12-Jul-06		< 3.0	0.75
18-Jul-06		< 3.0	0.8
25-Jul-06		< 3.0	0.69

sample_date	INSTANTANEOUS FLOW (m^3/s)	TOTAL SUSPENDED SOLIDS (mg/L)	TURBIDITY, LAB (NTU)
1-Aug-06		< 3.0	0.45
6-Sep-06		< 3.0	1
3-Oct-06		3	0.22
7-Nov-06		66	40.6
5-Dec-06		< 3.0	0.24
3-Jan-07		< 3.0	0.4
6-Feb-07		< 3.0	0.33
6-Mar-07		< 3.0	< 0.2
3-Apr-07		< 3.0	0.58
9-Apr-07		< 3.0	0.26
19-Apr-07		< 3.0	0.65
24-Apr-07		5	2.9
15-May-07		3	5.8
22-May-07		3	9.3
29-May-07		8	9.1
5-Jun-07		26	11.2
12-Jun-07		5	< 0.2
19-Jun-07		< 3.0	0.5
26-Jun-07		< 3.0	< 0.2
3-Jul-07		4	1.1
10-Jul-07		4	0.88
17-Jul-07		< 3.0	1.5
24-Jul-07		< 3.0	0.38
1-Aug-07		< 3.0	< 0.2
7-Aug-07		5	0.31
4-Sep-07		< 3.0	0.28
2-Oct-07		< 3.0	0.54
13-Nov-07		4	0.35
5-Dec-07		< 3.0	2.4
2-Jan-08		< 3.0	< 0.2
5-Feb-08		< 3.0	0.2
4-Mar-08		< 3.0	< 0.2
1-Apr-08		< 3.0	0.24
7-Apr-08		< 3.0	0.29
14-Apr-08		< 3.0	0.2
21-Apr-08		< 3.0	< 0.2
28-Apr-08		3	0.33
6-May-08		< 3.0	1.4
12-May-08		3	0.47
26-May-08		18	15.9
3-Jun-08		3	7.6
9-Jun-08		< 3.0	4.7

sample_date	INSTANTANEOUS FLOW (m^3/s)	TOTAL SUSPENDED SOLIDS (mg/L)	TURBIDITY, LAB (NTU)
16-Jun-08		< 3.0	3.1
23-Jun-08		< 3.0	1.9
7-Jul-08		< 3.0	< 0.2
14-Jul-08		< 3.0	< 0.2
21-Jul-08		< 3.0	< 0.2
28-Jul-08		< 3.0	0.21
5-Aug-08		< 3.0	0.22
11-Aug-08		3	0.3
18-Aug-08		< 3.0	0.22
25-Aug-08		< 3.0	0.22
2-Sep-08		< 3.0	0.28
7-Oct-08	0.2	5	7.5
4-Nov-08	0.2	< 3.0	0.25
2-Dec-08	0.2	< 3.0	0.14
6-Jan-09	0.2	< 3.0	0.35
3-Feb-09	0.2	< 3.0	0.16
3-Mar-09	0.2	< 3.0	< 0.10
7-Apr-09	0.2	< 3.0	0.32
14-Apr-09	0.2	< 3.0	0.39
20-Apr-09	0.25	< 3.0	0.35
27-Apr-09	0.3	< 3.0	0.31
5-May-09	0.3	< 3.0	0.47
11-May-09	0.35	< 3.0	0.54
19-May-09	1	9.7	9.46
25-May-09	1	5	3.06
2-Jun-09	1.3	4.4	5.06
8-Jun-09	0.9	5	2
15-Jun-09	0.9	< 3.0	1.06
22-Jun-09	0.9	7.1	5.71
29-Jun-09	0.45	< 3.0	0.68
7-Jul-09	0.45	< 3.0	0.56
13-Jul-09	0.3	< 3.0	0.47
20-Jul-09	0.3	< 3.0	0.43
27-Jul-09	0.3	5.7	0.7
4-Aug-09	0.25	< 3.0	0.48
1-Sep-09	0.2	< 3.0	0.26
6-Oct-09	0.2	< 3.0	0.27
3-Nov-09	0.2	< 3.0	0.26
1-Dec-09	0.2	< 3.0	0.22
5-Jan-10	0.05		0.36
2-Feb-10	0.05		0.17
2-Mar-10	0.05	< 3.0	0.13
8-Mar-10	0.05	< 3.0	
15-Mar-10	0.05		

sample_date	INSTANTANEOUS FLOW (m^3/s)	TOTAL SUSPENDED SOLIDS (mg/L)	TURBIDITY, LAB (NTU)
23-Mar-10	0.05	< 3.0	< 0.1
29-Mar-10	0.05	< 3.0	0.15
6-Apr-10	0.005	< 3.0	0.11
12-Apr-10	0.05	< 3.0	0.11
19-Apr-10	0.3	3	0.48
26-Apr-10	0.45	< 3.0	0.85
4-May-10	0.35	< 3.0	0.38
10-May-10	0.3	3.3	0.19
17-May-10	1.15	< 3.0	4.59
25-May-10	0.72	< 3.0	1.12
1-Jun-10	0.27	6.5	4.63
7-Jun-10	1.1	5.3	6.7
14-Jun-10	1.1	< 3.0	2.87
21-Jun-10	1.1	6.2	4.35
28-Jun-10	0.61	< 3.0	0.95
6-Jul-10	0.62	6.2	0.74
12-Jul-10	0.45	< 3.0	2.88
19-Jul-10	0.28	< 3.0	0.4
26-Jul-10	0.26	4.9	2.04
3-Aug-10	0.3	< 3.0	0.27
7-Sep-10	0.26	9	0.57
5-Oct-10	0.3	< 3.0	0.25
27-Oct-10	0.26	< 3.0	0.38
2-Nov-10	0.7	7.3	7.51
7-Dec-10	0.26	< 3.0	0.27
3-Jan-11	0.2	< 3.0	0.19
4-Jan-11	0.28	< 3.0	0.37
1-Feb-11	0.2	< 3.0	0.36
7-Mar-11	0.2	< 3.0	0.22
5-Apr-11	0.2	< 3.0	0.16
12-Apr-11	0.2	< 3.0	0.16
19-Apr-11	0.2	< 3.0	0.22
26-Apr-11	0.25	< 3.0	0.2
3-May-11	0.25	< 3.0	0.23
10-May-11	0.43	< 3.0	0.67
17-May-11	0.82	< 3.0	2.51
24-May-11	1.25	10.3	7.09
31-May-11	1.08	3.9	2.3
7-Jun-11	1.78	22.7	12.7
14-Jun-11	1.78	12.5	8.17
20-Jun-11	1.25	12.8	8.15
27-Jun-11	1.25	8.4	2.39
5-Jul-11	1.25	7	3.56
12-Jul-11	1.1	4.7	2.62

sample_date	INSTANTANEOUS FLOW (m^3/s)	TOTAL SUSPENDED SOLIDS (mg/L)	TURBIDITY, LAB (NTU)
19-Jul-11	0.7	3	0.89
25-Jul-11	0.7	3.5	1.19
2-Aug-11	0.45	< 3.0	0.76
6-Sep-11	0.93	< 3.0	0.27
4-Oct-11	0.2	< 3.0	0.83
1-Nov-11	0.15	< 3.0	0.4
6-Dec-11	0.2	< 3.0	0.28
3-Jan-12	0.2	< 3.0	0.19
7-Feb-12	0.15	< 3.0	0.18
7-Mar-12	0.11	< 3.0	0.14
3-Apr-12	0.1	< 3.0	0.31
10-Apr-12	0.022	< 3.0	
17-Apr-12		< 3.0	
1-May-12		< 3.0	2.31
8-May-12	0.427	< 3.0	
15-May-12	1.16	12	
22-May-12	3.05	13.3	
29-May-12	0.65	< 3.0	
5-Jun-12	1.75	54	
12-Jun-12	1.44	8.3	
19-Jun-12	1.24	22.2	
26-Jun-12	1.6	49.6	
3-Jul-12		12.3	9.66
10-Jul-12	0.408	3.3	
17-Jul-12		< 3.0	
24-Jul-12		3.3	
31-Jul-12		< 3.0	
7-Aug-12	0.08	< 3.0	0.3
4-Sep-12	0.08	< 3.0	0.23
2-Oct-12	0.0466	< 3.0	
6-Nov-12	0.255	< 3.0	
4-Dec-12	0.077	< 3.0	
2-Jan-13	0.0558	< 3.0	
5-Feb-13	0.0444	< 3.0	0.25
5-Mar-13	0.0614	< 3.0	0.45
2-Apr-13	0.0329	7	1.19
9-Apr-13	0.169	6.3	1.95
16-Apr-13	0.0521	3.3	1.03
23-Apr-13	0.0408	3.6	1.05
30-Apr-13	0.0879	< 3.0	1.07
7-May-13	0.261	9.6	5.8
14-May-13	0.386	68.5	25.1
21-May-13	1.414	8	5.24
28-May-13	1.41	18.5	4.61

4-Jun-13	0.169	4.3	2.69
11-Jun-13	0.169	4.8	2.79
18-Jun-13	0.129		1.53
25-Jun-13		19.6	19.5
2-Jul-13		< 3.0	1.75
9-Jul-13	0.645	< 3.0	0.97
16-Jul-13	0.0973	< 3.0	0.46
23-Jul-13	0.099	< 3.0	0.41
30-Jul-13		< 3.0	0.49
6-Aug-13	0.224	< 3.0	0.75
3-Sep-13	0.0726	< 3.0	0.23
1-Oct-13	0.21	2.3	2.66
5-Nov-13	0.062	1	0.4
3-Dec-13		< 1.0	0.24
7-Jan-14	0	< 1.0	0.11
4-Feb-14		< 1.0	0.25
4-Mar-14		1.2	0.46
1-Apr-14		< 1.0	0.24
8-Apr-14		< 1.0	0.2
15-Apr-14		< 3.0	0.21
22-Apr-14		< 1.0	0.23
29-Apr-14		< 1.0	0.19
6-May-14		1.8	2.61
13-May-14		1.6	1.69
20-May-14	1.137	31.7	12.1
27-May-14	1.975	39.5	21.8
3-Jun-14		15.1	14.1
10-Jun-14	1.431	13.7	9.76
17-Jun-14	2.112	473	230
24-Jun-14	1.013	7.7	4.32
2-Jul-14	0.406	2.3	1.26
8-Jul-14	0.264	< 1.0	0.73
15-Jul-14	0.17	1.8	1.06
22-Jul-14	0.115	< 1.0	0.69
29-Jul-14	0.0912	1.5	0.57
5-Aug-14	0.0763	< 1.0	0.26
2-Sep-14	0.034362	4.1	0.77
7-Oct-14	0.032	< 1.0	0.29
4-Nov-14	0.189	5.9	5.82
3-Dec-14		< 1.0	0.45
6-Jan-15	0.049	< 2.0	0.35
3-Feb-15		< 1.0	0.17
3-Mar-15	0.0834	< 1.0	0.21
30-Mar-15	0.428	1.8	1.61
8-Apr-15	0.191	1.4	0.4
15-Apr-15	0.143	< 1.0	0.28

sample_date	INSTANTANEOUS FLOW (m^3/s)	TOTAL SUSPENDED SOLIDS (mg/L)	TURBIDITY, LAB (NTU)
22-Apr-15	0.382	1.3	0.93
29-Apr-15		5.2	3.11
6-May-15	0.5881832	3.8	2.68
13-May-15	0.4581135	1	1.14
20-May-15	0.508	1.7	1.59
27-May-15	1.28935	22.5	6.05
3-Jun-15		47.2	20.5
10-Jun-15	0.542871	3.7	1.39
17-Jun-15	0.29	1.4	0.59
24-Jun-15	0.19754	< 1.0	0.36
30-Jun-15	0.116	< 1.0	0.54
8-Jul-15	0.092	< 1.0	0.25
15-Jul-15	0.0615	< 1.0	0.25
21-Jul-15	0.059	2	0.35
27-Jul-15	0.05526	1.8	0.34
5-Aug-15	0.046	< 1.0	0.28
2-Sep-15	0.032	< 1.0	0.25
2-Sep-15		< 1.0	< 0.10
7-Oct-15	0.04	< 1.0	0.13
4-Nov-15	0.07	< 1.0	0.34
2-Dec-15	0.046	< 1.0	0.18
6-Jan-16		< 1.0	0.15

E206438 - CM_CCPD

sample_date	INSTANTANEOUS FLOW (m^3/s)	TOTAL SUSPENDED SOLIDS (mg/L)	TURBIDITY, LAB (NTU)
18-Jan-00		5	0.1
10-Feb-00		1	0.1
17-Mar-00		1	0.4
4-Apr-00		1	2.2
13-Apr-00		2	1.5
21-Apr-00		5	9.3
27-Apr-00		2	0.7
6-May-00		4	5.2
15-May-00		1	0.7
21-May-00		2	0.4
1-Jun-00		2	1.9
9-Jun-00		2	1
16-Jun-00		4	6.3
22-Jun-00		2	4.4
27-Jun-00		1	1.1
7-Jul-00		2	1.9
14-Jul-00		2	1.9
18-Jul-00		1	1.1
28-Jul-00		2	1.5
17-Aug-00		1	0.7
12-Sep-00		2	2.2
23-Oct-00	0.276	11	4.8
21-Nov-00		3	3.3
1-Dec-00		2	0.1
11-Jan-01		3	1.9
12-Feb-01		1	0.1
12-Mar-01		9	2.6
12-Apr-01		1	0.7
17-Apr-01		2	0.1
24-Apr-01		1	2.6
3-May-01		3	5.6
9-May-01		2	2.6
15-May-01		4	3.7
22-May-01		1	0.1
30-May-01		1	0.7
5-Jun-01		5	7.4
11-Jun-01	0.38	2	0.1
19-Jun-01		1	0.1
27-Jun-01		1	0.1

sample_date	INSTANTANEOUS FLOW (m^3/s)	TOTAL SUSPENDED SOLIDS (mg/L)	TURBIDITY, LAB (NTU)
5-Jul-01		1	0.7
11-Jul-01		1	1
17-Jul-01		1	0.1
26-Jul-01		1	0.1
13-Aug-01		1	0.1
13-Sep-01		4	0.1
11-Oct-01		7	1.5
14-Nov-01		1	0.4
19-Dec-01		1	0.4
14-Jan-02		1	1.5
11-Feb-02		1	0.4
11-Mar-02		1	0.4
11-Apr-02		4	1.9
18-Apr-02		1	0.7
25-Apr-02		1	0.4
2-May-02		1	7.8
8-May-02		1	0.7
17-May-02		2	3
23-May-02		6	8.1
30-May-02		28	43.3
5-Jun-02		4	5.9
11-Jun-02		3	9.6
19-Jun-02		3	7
26-Jun-02		2	2.2
3-Jul-02	0.11	2	3.3
11-Jul-02		2	1.9
18-Jul-02		1	0.4
24-Jul-02		1	0.4
9-Aug-02	0.16	1	< 0.1
5-Sep-02	0.15	1	< 0.1
9-Oct-02	0.03	2	0.7
14-Nov-02	0.07	2	0.7
2-Dec-02	0.03	< 1.0	4.4
14-Jan-03	0.02	< 1.0	1.1
11-Feb-03	0.02	< 1.0	0.4
18-Mar-03	0.03	1	1.5
3-Apr-03	0.06	2	4.1
10-Apr-03	0.1	4	7
18-Apr-03	0.17	3	4.8
25-Apr-03	0.44	10	11.5
2-May-03	0.3	2	7

sample_date	INSTANTANEOUS FLOW (m^3/s)	TOTAL SUSPENDED SOLIDS (mg/L)	TURBIDITY, LAB (NTU)
8-May-03	0.29	< 1.0	1.5
15-May-03	0.39	2	1.5
22-May-03	0.33	< 1.0	1.9
29-May-03		3	3.7
6-Jun-03	0.492	< 1.0	2.6
12-Jun-03	0.42	< 1.0	1.1
19-Jun-03	0.3	1	1.9
27-Jun-03	0.3	2	4.8
3-Jul-03	0.09	1	3
10-Jul-03	0.11	< 1.0	1.9
21-Jul-03	0.1	1	1.1
25-Jul-03	0.1	1	1.9
31-Jul-03	0.11	1	2.2
21-Aug-03	0.08	1	1.9
23-Sep-03	0.017	2	3
24-Oct-03		4	4.4
4-Nov-03	0.1	2	3.7
2-Dec-03	0.07	< 1.0	1.9
6-Jan-04	0.01	12	1.9
3-Feb-04	0.02	< 1.0	3
3-Mar-04	0.01	2	2.2
6-Apr-04	0.18	3	3
14-Apr-04	0.23	5	5.9
20-Apr-04	0.21	1	2.6
27-Apr-04		2	2.2
4-May-04	0.198	4	7.8
11-May-04	0.142	4	5.9
18-May-04	0.105	1	3.3
25-May-04	0.124	2	1.9
1-Jun-04	0.099	< 1.0	1.9
9-Jun-04	0.115	1	3
15-Jun-04	0.107	2	1.9
22-Jun-04	0.0822	2	0.7
29-Jun-04	0.0881	2	2.2
6-Jul-04	0.073	1	2.2
14-Jul-04	0.0722	2	0.7
20-Jul-04	0.0383	2	1.9
27-Jul-04	0.0502	4	3
3-Aug-04	0.0608	2	1.9
7-Sep-04	0.066	2	4.8
7-Oct-04	0.09	2	1.1

sample_date	INSTANTANEOUS FLOW (m^3/s)	TOTAL SUSPENDED SOLIDS (mg/L)	TURBIDITY, LAB (NTU)
5-Nov-04	0.08	1	0.4
8-Dec-04	0.04	2	3
5-Jan-05	0.0675	< 1.0	5.9
1-Feb-05	0.234	< 1.0	12.6
2-Mar-05	0.109	< 1.0	< 0.1
6-Apr-05	0.078	3	1.9
12-Apr-05	0.124	2	3.7
20-Apr-05	0.101	1	0.7
28-Apr-05	0.45	2	0.7
4-May-05	0.429	1	0.7
10-May-05	0.661	1	1.5
19-May-05	0.852	< 1.0	1.9
24-May-05	0.778	2	0.7
31-May-05	0.334	1	1.1
7-Jun-05		3	2.2
13-Jun-05		4	7
21-Jun-05		2	2.6
28-Jun-05		7.7	
5-Jul-05	0.565	< 4.0	0.85
12-Jul-05		< 4.0	0.64
20-Jul-05		< 4.0	2.1
28-Jul-05		< 4.0	1.32
4-Aug-05	0.143	< 4.0	1.03
13-Sep-05	0.103	< 4.0	1.17
4-Oct-05	0.0257	< 4.0	3.28
3-Nov-05		< 4.0	0.92
13-Dec-05	0.0716	< 4.0	0.12
11-Jan-06	0.0048	< 4.0	0.41
7-Feb-06	0.0309	< 3.0	0.6
15-Mar-06	0.028	< 3.0	1.3
18-Mar-06		6	1.2
4-Apr-06	0.0257	< 3.0	2.3
13-Apr-06	0.127	< 3.0	1.7
18-Apr-06	0.163	6	1.2
25-Apr-06	0.294	3	3.1
3-May-06	0.794	6	16.8
11-May-06	0.567	3	1.3
16-May-06	0.928	6	5.7
26-May-06	0.99	< 3.0	2.1
1-Jun-06	0.721	< 3.0	1
13-Jun-06	0.476	< 3.0	1.3

sample_date	INSTANTANEOUS FLOW (m^3/s)	TOTAL SUSPENDED SOLIDS (mg/L)	TURBIDITY, LAB (NTU)
21-Jun-06		< 3.0	1.5
28-Jun-06	0.9	3	0.8
4-Jul-06	0.157	3	1.3
12-Jul-06		< 3.0	0.78
18-Jul-06	0.13	< 3.0	0.72
25-Jul-06	0.112	< 3.0	0.57
1-Aug-06	0.095	3	1.4
6-Sep-06	0.016	< 3.0	1.8
3-Oct-06	0.025	< 3.0	4.1
7-Nov-06	0.438	10	23.7
5-Dec-06	0.112	< 3.0	1.5
2-Jan-07	0.09	< 3.0	0.98
6-Feb-07	0.06	< 3.0	0.73
6-Mar-07	0.061	3	0.5
3-Apr-07	0.271	< 3.0	0.38
9-Apr-07	0.24	< 3.0	1.1
19-Apr-07	0.365	5	0.99
24-Apr-07	0.357	6	1.9
2-May-07	0.864	6	3.9
9-May-07	1.081	< 3.0	2.8
15-May-07	1.737	< 3.0	1.3
22-May-07	2.509	< 3.0	1.5
29-May-07	0.997	3	4.8
5-Jun-07	0.959	< 3.0	1.1
12-Jun-07	0.79	< 3.0	< 0.2
19-Jun-07	0.596	3	1.6
26-Jun-07	0.376	3	0.65
3-Jul-07	0.376	5	1
10-Jul-07	0.28	< 3.0	1.7
17-Jul-07	0.231	< 3.0	0.91
24-Jul-07	0.143	< 3.0	1.2
1-Aug-07	0.136	4	0.69
7-Aug-07	0.313	4	1.2
4-Sep-07	0.072	< 3.0	0.73
2-Oct-07	0.056	< 3.0	1.3
13-Nov-07	0.042	7	1.2
5-Dec-07	0.07	< 3.0	2.4
2-Jan-08	0.107	< 3.0	0.32
5-Feb-08	0.01	< 3.0	0.21
4-Mar-08	0.01	< 3.0	0.27
1-Apr-08	0.0132	3	1.6

sample_date	INSTANTANEOUS FLOW (m^3/s)	TOTAL SUSPENDED SOLIDS (mg/L)	TURBIDITY, LAB (NTU)
7-Apr-08	0.02	< 3.0	3.1
14-Apr-08	0.29	< 3.0	4.6
21-Apr-08	0.051	3	1.3
28-Apr-08	0.124	6	2.8
6-May-08	0.254	< 3.0	1.2
12-May-08	0.292	5	0.76
20-May-08	1.01	< 3.0	4.5
26-May-08	2.55	4	8.4
3-Jun-08	1.497	< 3.0	1
9-Jun-08	0.724	< 3.0	0.98
16-Jun-08	0.766	< 3.0	< 0.2
23-Jun-08	0.332	< 3.0	0.21
7-Jul-08	0.18	< 3.0	< 0.2
14-Jul-08	0.178	< 3.0	0.27
21-Jul-08	0.178	< 3.0	0.21
28-Jul-08	0.095	< 3.0	0.22
5-Aug-08	0.079	< 3.0	0.59
11-Aug-08	0.044	7	1.3
18-Aug-08	0.09	5	0.82
25-Aug-08	0.043	3	1.1
2-Sep-08	0.094	5	0.69
7-Oct-08	0.065	< 3.0	1.1
4-Nov-08	0.061	3	0.49
2-Dec-08	0.034	< 3.0	0.63
6-Jan-09	0.027	< 3.0	0.23
3-Feb-09	0.052	< 3.0	0.48
3-Mar-09	0.066	< 3.0	0.27
7-Apr-09		4.4	2.94
14-Apr-09	0.049	6.2	6.65
20-Apr-09	0.075	4.9	5.9
27-Apr-09	0.119	< 3.0	1.1
5-May-09	0.136	3.6	1.07
11-May-09	0.133	4.7	0.71
19-May-09	0.334	6.4	2.87
25-May-09	0.573	< 3.0	1.2
2-Jun-09	0.79	< 3.0	0.92
8-Jun-09	0.318	4.3	0.58
15-Jun-09	0.215	< 3.0	0.47
22-Jun-09	0.25	3.8	0.67
29-Jun-09	0.196	< 3.0	0.68
7-Jul-09	0.13	4.2	0.55

sample_date	INSTANTANEOUS FLOW (m^3/s)	TOTAL SUSPENDED SOLIDS (mg/L)	TURBIDITY, LAB (NTU)
13-Jul-09	0.166	< 3.0	0.76
20-Jul-09	0.133	3.3	1.01
27-Jul-09	0.143	< 3.0	4.99
4-Aug-09	0.148	< 3.0	1.71
1-Sep-09	0.144	< 3.0	1.13
6-Oct-09	0.047	< 3.0	1.01
3-Nov-09	0.04	< 3.0	3.7
1-Dec-09	0.038	< 3.0	0.47
5-Jan-10	0.018		0.44
2-Feb-10	0.019	< 3.0	0.33
2-Mar-10	0.011	3.7	0.7
8-Mar-10	0.017		
15-Mar-10	0.016		
23-Mar-10	0.0243	< 3.0	0.93
29-Mar-10	0.037	3.1	1.15
6-Apr-10	0.033	< 3.0	1.75
12-Apr-10	0.03	< 3.0	0.51
19-Apr-10	0.049	< 3.0	1.36
26-Apr-10	0.324	< 3.0	1.21
4-May-10	0.255	< 3.0	1.6
10-May-10	0.187	5.3	0.55
17-May-10	0.403	4.3	0.46
25-May-10	0.43	< 3.0	0.52
1-Jun-10	0.633	< 3.0	1.54
7-Jun-10	0.658	< 3.0	0.65
14-Jun-10	0.422	< 3.0	0.69
21-Jun-10	0.682	< 3.0	3.32
28-Jun-10	0.362	< 3.0	10.9
6-Jul-10	0.274	6.2	0.78
12-Jul-10	0.225	< 3.0	1.09
19-Jul-10	0.184	< 3.0	2.09
26-Jul-10	0.206	< 3.0	1.13
3-Aug-10	0.164	< 3.0	0.93
7-Sep-10	0.111	< 5.0	0.79
5-Oct-10	0.169	< 3.0	0.75
27-Oct-10	0.0827	< 3.0	0.82
2-Nov-10	0.162	4.3	3.58
7-Dec-10	0.099	< 3.0	0.36
3-Jan-11	0.0126	< 3.0	0.53
4-Jan-11	0.052	< 3.0	0.38
1-Feb-11	0.0063	75.4	0.26

sample_date	INSTANTANEOUS FLOW (m^3/s)	TOTAL SUSPENDED SOLIDS (mg/L)	TURBIDITY, LAB (NTU)
7-Mar-11	0.0151	< 3.0	0.23
5-Apr-11	0.0672	< 3.0	1.44
12-Apr-11	0.0384	5	1.25
19-Apr-11	0.0157	9.8	2.86
26-Apr-11	0.052	3	3.04
3-May-11	0.0605	< 3.0	4.35
10-May-11	0.175	9.2	20.6
17-May-11	0.583	< 3.0	6.73
24-May-11	0.777	7.8	8.46
31-May-11	0.801	11.2	10.8
7-Jun-11	1.344	< 3.0	2.96
14-Jun-11	1.63	17.8	24.1
20-Jun-11	1.3	< 3.0	1.33
27-Jun-11	1.04	< 3.0	0.46
5-Jul-11	0.711	< 3.0	1.37
12-Jul-11	0.458	< 3.0	0.61
19-Jul-11	0.106	< 3.0	1.5
25-Jul-11	0.198	< 3.0	3
2-Aug-11	0.348	< 3.0	2.25
6-Sep-11		< 3.0	0.82
4-Oct-11	0.0512	< 3.0	1.37
1-Nov-11	0.0749	3.6	2.51
6-Dec-11	0.0225	< 3.0	0.62
3-Jan-12	0.0126	< 3.0	0.53
7-Feb-12	0.0304	< 3.0	0.41
7-Mar-12	0.0287	< 3.0	0.3
3-Apr-12	0.008	< 3.0	1.63
10-Apr-12		< 3.0	
17-Apr-12	0.0373	< 3.0	
24-Apr-12	0.343	10	
1-May-12	0.759	11.7	14.9
8-May-12	0.386	9.2	
15-May-12	0.862	11.3	
22-May-12	0.898	3.3	
29-May-12	0.58	< 3.0	
5-Jun-12	0.91	< 3.0	
12-Jun-12	0.865	3.7	
19-Jun-12	0.768	< 3.0	
26-Jun-12	0.77	< 3.0	
3-Jul-12	0.653	5.7	1.86
10-Jul-12	0.42	< 3.0	

sample_date	INSTANTANEOUS FLOW (m^3/s)	TOTAL SUSPENDED SOLIDS (mg/L)	TURBIDITY, LAB (NTU)
17-Jul-12	0.291	< 3.0	
24-Jul-12		4	
31-Jul-12		< 3.0	
7-Aug-12	0.114	< 3.0	2.21
4-Sep-12	0.115	3.5	
6-Sep-12	0.0924	4.6	
7-Sep-12	0.0669	< 3.0	
10-Sep-12	0.0867	< 3.0	
12-Sep-12	0.0669	< 3.0	
14-Sep-12	0.0482	4	
17-Sep-12	0.0688	< 3.0	
19-Sep-12	0.0547	< 3.0	
20-Sep-12	0.0564	59	
24-Sep-12	0.0498	3.3	
26-Sep-12	0.045	< 3.0	
2-Oct-12	0.0244		
6-Nov-12	0.067	< 3.0	
4-Dec-12	0.026	< 3.0	
2-Jan-13	0.0923	< 3.0	
5-Feb-13	0.067	< 3.0	0.39
5-Mar-13	0.0765	4.3	1.8
2-Apr-13	0.0851	9.4	10.2
9-Apr-13	0.171	15.7	5.79
16-Apr-13	0.0735	11.5	6.37
23-Apr-13	0.0528	9.1	10.4
30-Apr-13	0.124	< 3.0	3.87
7-May-13	0.24	11.4	7.57
14-May-13	1.376	33.8	26
21-May-13	0.719	< 3.0	3.64
28-May-13	0.719	3.9	2.99
4-Jun-13	0.628	4.3	1.61
11-Jun-13	0.414	< 3.0	1.17
18-Jun-13	0.365	6.2	0.71
21-Jun-13		27.8	24.8
22-Jun-13		7.8	10.7
24-Jun-13		9.1	4.92
25-Jun-13	0.875	6.7	4.46
2-Jul-13	0.489	< 3.0	1.1
9-Jul-13	0.292	< 3.0	1.76
16-Jul-13	0.362	< 3.0	0.84
23-Jul-13	0.222	3.3	1.07

sample_date	INSTANTANEOUS FLOW (m^3/s)	TOTAL SUSPENDED SOLIDS (mg/L)	TURBIDITY, LAB (NTU)
30-Jul-13	0.169	< 3.0	1.02
2-Aug-13		20	36
2-Aug-13		< 4.0	11.8
6-Aug-13	0.24	5.4	1.88
3-Sep-13	0.097	3.6	1.11
1-Oct-13	0.097	6.9	8.58
5-Nov-13	0.063	< 1.0	0.81
3-Dec-13		< 1.0	0.66
7-Jan-14	0	< 1.0	0.45
4-Feb-14		< 1.0	0.42
4-Mar-14		< 1.0	0.39
1-Apr-14		< 1.0	1.04
8-Apr-14	0.063	2.8	8.29
15-Apr-14	0.085	4.1	7.08
22-Apr-14	0.142	6.2	5.5
29-Apr-14	0.153	7.7	2.36
6-May-14	0.39	6.1	10.1
13-May-14	0.297	2	2.65
20-May-14	0.379	4.3	5.17
27-May-14	1.283	6.2	6.21
3-Jun-14	1.012	2.6	1.39
10-Jun-14	0.702	1.5	0.86
17-Jun-14	0.987	77	79.9
24-Jun-14	1.024	2.1	1.96
2-Jul-14	0.658	1.2	0.54
8-Jul-14	0.0084	< 1.0	0.65
15-Jul-14	0.344	1.1	0.58
22-Jul-14	0.25	< 1.0	1.32
29-Jul-14	0.26	1.9	1.41
5-Aug-14	0.18	< 1.0	0.93
2-Sep-14	0.12	1.1	0.79
7-Oct-14	0.073	2.3	1.48
4-Nov-14	0.091	4.5	3.17
3-Dec-14		< 1.0	1.68
6-Jan-15	0.063	< 1.0	0.71
3-Feb-15	0.0645	< 1.0	0.71
3-Mar-15	0.048	< 1.0	0.68
30-Mar-15	0.22	3.3	5.06
8-Apr-15	0.225	2.6	1.53
15-Apr-15	0.204	< 1.0	1.11
22-Apr-15	0.24	3.4	0.99

sample_date	INSTANTANEOUS FLOW (m^3/s)	TOTAL SUSPENDED SOLIDS (mg/L)	TURBIDITY, LAB (NTU)
29-Apr-15	0.293	2.4	1.43
6-May-15	0.455504	3.2	3.04
13-May-15	0.413677	1.8	1.62
20-May-15	0.36	< 1.0	1.12
27-May-15	0.457716	10.1	4.62
2-Jun-15		6.8	7.67
3-Jun-15			
3-Jun-15	0.923	8.8	7
10-Jun-15	0.3878	1	1.52
15-Jun-15		< 3.0	0.7
17-Jun-15	0.289094	< 1.0	0.91
24-Jun-15	0.235452	< 1.0	0.6
30-Jun-15	0.279	< 1.0	0.52
8-Jul-15	0.165	< 1.0	0.57
15-Jul-15	0.111	< 1.0	0.65
21-Jul-15	0.094	1.8	1.09
27-Jul-15	0.11262	1.8	1.16
5-Aug-15	0.117	2.4	1.31
2-Sep-15	0.062	2.9	1.6
28-Sep-15	0.028	2	0.9
7-Oct-15	0.037	2.1	0.92
4-Nov-15	0.069	2.2	2.69
5-Nov-15			
2-Dec-15	0.088	< 1.0	0.77
6-Jan-16		< 1.0	0.5

E298733 - CM_PC2

sample_date	INSTANTANEOUS FLOW (m^3/s)	TOTAL SUSPENDED SOLIDS (mg/L)	TURBIDITY, LAB (NTU)
6-May-08	0.209		
3-Jun-08	0.215		
7-Jul-08	0.18		
23-Apr-09	0.351		
27-Apr-09	0.005		
5-May-09	0.005	< 3.0	0.68
11-May-09	0.012		
19-May-09	0.256		
25-May-09	0.219		
2-Jun-09	0.206	< 3.0	0.37
8-Jun-09	0.066		
15-Jun-09	0.018		
22-Jun-09	0.01		
29-Jun-09	0.011		
15-Mar-10			
19-Apr-10	0.043	< 3.0	0.88
26-Apr-10	0.077	< 3.0	0.25
4-May-10	0.024	< 3.0	0.2
10-May-10	0.004	6	0.13
17-May-10	0.138	3.7	0.26
25-May-10	0.034	< 3.0	0.19
1-Jun-10	0.105	< 3.0	0.2
7-Jun-10	0.105	< 3.0	0.12
14-Jun-10	0.085	< 3.0	0.15
21-Jun-10	0.209	< 3.0	0.2
28-Jun-10	0.043	3.1	0.16
6-Jul-10	0.004	< 3.0	0.11
12-Jul-10	0.001	< 3.0	0.41
19-Jul-10	0.001	< 3.0	0.17
10-May-11	0.081	< 3.0	0.47
17-May-11	0.239	< 3.0	0.42
24-May-11	0.159	< 3.0	1.11
31-May-11	0.168	< 3.0	0.22
7-Jun-11	0.312	5.3	0.49
14-Jun-11	0.386	< 3.0	0.4
20-Jun-11	0.177	< 3.0	0.47
27-Jun-11	0.121	< 3.0	0.22
5-Jul-11	0.089	< 3.0	0.21
12-Jul-11	0.013	< 3.0	0.19

sample_date	INSTANTANEOUS FLOW (m^3/s)	TOTAL SUSPENDED SOLIDS (mg/L)	TURBIDITY, LAB (NTU)
19-Jul-11	0.003	< 3.0	0.27
25-Jul-11	0.001	< 3.0	0.23
24-Apr-12		< 3.0	
1-May-12		< 3.0	0.23
8-May-12	0.0417	< 3.0	
15-May-12	0.221	< 3.0	
22-May-12	0.188	< 3.0	
29-May-12	0.0561	< 3.0	
5-Jun-12	0.301	< 3.0	
12-Jun-12	0.11	< 3.0	
19-Jun-12	0.177	< 3.0	
26-Jun-12	0.249	< 3.0	
3-Jul-12	0.069	< 3.0	0.25
10-Jul-12	0.0194	< 3.0	
17-Jul-12	0.00993	< 3.0	
24-Jul-12		< 3.0	
9-Apr-13	0.0316	< 3.0	0.21
16-Apr-13		< 3.0	0.14
23-Apr-13		5	0.4
30-Apr-13	0.0786	< 3.0	0.24
7-May-13	0.146	< 3.0	0.67
14-May-13	0.439	< 3.0	0.53
21-May-13			
21-May-13		< 3.0	0.21
28-May-13		< 3.0	0.22
28-May-13	0.165		
4-Jun-13	0.0576	< 3.0	0.21
11-Jun-13	0.0455		
11-Jun-13		< 3.0	0.23
18-Jun-13	0.6003	< 3.0	0.19
25-Jun-13	0.153	< 3.0	0.35
2-Jul-13	0.0286	< 3.0	0.19
9-Jul-13	0.004	< 3.0	0.15
16-Jul-13		< 3.0	0.16
16-Jul-13			
6-Aug-13	0.008	< 3.0	0.26
1-Oct-13	0.058	< 1.0	0.3
15-Apr-14	0.0075	< 3.0	0.44
22-Apr-14	0.016		
29-Apr-14	0.01	< 1.0	0.22
6-May-14	0.087	< 1.0	0.28

sample_date	INSTANTANEOUS FLOW (m^3/s)	TOTAL SUSPENDED SOLIDS (mg/L)	TURBIDITY, LAB (NTU)
13-May-14	0.045	< 1.0	0.27
20-May-14	0.298	< 1.0	0.36
27-May-14	0.262	< 1.0	0.53
3-Jun-14	0.202	< 1.0	0.3
10-Jun-14	0.141	< 1.0	0.28
17-Jun-14	0.0411	< 1.0	0.42
24-Jun-14	0.153	< 1.0	0.28
2-Jul-14	0.021	< 1.0	0.53
8-Jul-14		< 1.0	0.15
15-Jul-14	0.00108	< 1.0	0.23
16-Mar-15		< 1.0	0.52
30-Mar-15	0.062569	< 1.0	0.32
8-Apr-15	0.006	< 1.0	0.17
15-Apr-15	0.003	< 1.0	0.11
22-Apr-15	0.147	< 1.0	0.24
29-Apr-15	0.077	< 1.0	0.19
6-May-15	0.155	1.6	0.14
13-May-15	0.034737	< 1.0	0.12
20-May-15	0.008	< 1.0	1.5
27-May-15	0.097930903	< 3.0	0.27
2-Jun-15		< 1.0	0.49
3-Jun-15			

E102488 - CM_SPD

sample_date	INSTANTANEOUS FLOW (m^3/s)	TOTAL SUSPENDED SOLIDS (mg/L)	TURBIDITY, LAB (NTU)
18-Jan-00		42	10.7
10-Feb-00		4	8.5
17-Mar-00		13	19.3
4-Apr-00		32	76.7
13-Apr-00		34	40.4
21-Apr-00		32	49.3
27-Apr-00		27	35.6
6-May-00		14	20
15-May-00		21	22.2
21-May-00		21	17
1-Jun-00		28	26.3
9-Jun-00		21	18.9
16-Jun-00		11	14.4
22-Jun-00		14	14.1
27-Jun-00		11	8.1
7-Jul-00		11	12.2
14-Jul-00		6	5.2
18-Jul-00		4	4.8
28-Jul-00		2	1.5
17-Aug-00		1	1.5
12-Sep-00		10	8.9
23-Oct-00	0.05	7	7.4
21-Nov-00		5	6.3
11-Dec-00		2	1.1
11-Jan-01		7	11.5
12-Feb-01		1	1.1
12-Mar-01		15	27.4
12-Apr-01		5	8.5
17-Apr-01		38	61.1
24-Apr-01		20	36.3
3-May-01		12	20.4
9-May-01		17	25.2
15-May-01		20	20.4
22-May-01		16	10
30-May-01		11	9.6
5-Jun-01		10	15.6
11-Jun-01	0.15	16	13
19-Jun-01		21	19.6
27-Jun-01		8	8.9

sample_date	INSTANTANEOUS FLOW (m^3/s)	TOTAL SUSPENDED SOLIDS (mg/L)	TURBIDITY, LAB (NTU)
5-Jul-01		11	6.7
11-Jul-01		7	3
17-Jul-01		12	11.5
26-Jul-01		29	23.3
13-Aug-01		11	7
13-Sep-01		10	7.4
11-Oct-01		39	28.5
14-Nov-01		32	26.7
19-Dec-01		4	6.3
14-Jan-02		7	11.9
11-Feb-02		3	3
11-Mar-02		3	6.3
11-Apr-02		21	31.1
18-Apr-02		11	17.8
25-Apr-02		15	16.3
2-May-02		12	21.1
8-May-02		8	10.4
17-May-02		11	15.6
23-May-02		26	35.6
30-May-02		26	38.5
5-Jun-02	0.31	21	28.5
11-Jun-02	0.4	25	40
19-Jun-02		23	30.7
26-Jun-02	0.21	28	28.5
3-Jul-02		19	20.7
11-Jul-02		15	14.1
18-Jul-02		7	5.6
24-Jul-02	0.09	8	7.8
9-Aug-02	0.08	5	1.9
5-Sep-02	0.3	18	11.1
9-Oct-02	0.05	3	2.2
14-Nov-02	0.03	2	3.7
2-Dec-02	0.03	4	5.2
14-Jan-03	0.03	1	3.7
11-Feb-03	0.03	1	2.2
18-Mar-03	0.03	19	27
3-Apr-03	0.13	11	20
10-Apr-03	0.17	30	47
18-Apr-03	0.23	36	49.3
25-Apr-03	0.48	33	45.2
2-May-03	0.22	25	40

sample_date	INSTANTANEOUS FLOW (m^3/s)	TOTAL SUSPENDED SOLIDS (mg/L)	TURBIDITY, LAB (NTU)
8-May-03	0.2	18	18.5
15-May-03	0.37	15	10
22-May-03	0.23	13	8.5
29-May-03	0.175	12	9.3
6-Jun-03	0.144	15	13
12-Jun-03	0.183	17	11.9
19-Jun-03	0.11	12	8.1
27-Jun-03	0.08	9	9.3
3-Jul-03	0.06	10	6.3
10-Jul-03	0.09	6	4.1
21-Jul-03	0.06	6	6.3
25-Jul-03	0.04	4	4.8
31-Jul-03	0.03	4	4.1
21-Aug-03	0.03	5	6.3
23-Sep-03	0.026	5	5.6
24-Oct-03		9	11.9
4-Nov-03	0.04	4	6.3
2-Dec-03	0.3	3	4.4
6-Jan-04	0.01	3	2.2
3-Feb-04	0.02	2	2.6
3-Mar-04	0.01	3	4.8
6-Apr-04	0.18	19	1.9
14-Apr-04	0.23	16	22.6
20-Apr-04	0.21	20	11.1
27-Apr-04		11	11.5
4-May-04	0.2	11	9.3
11-May-04	0.14	10	11.1
18-May-04	0.11	7	7.8
25-May-04	0.12	8	6.7
1-Jun-04	0.1	13	13.3
9-Jun-04	0.12	10	17.8
15-Jun-04	0.11	19	22.6
22-Jun-04	0.08	11	9.6
29-Jun-04	0.09	7	7.8
6-Jul-04	0.07	13	13.3
13-Jul-04	0.07	7	4.8
20-Jul-04	0.04	7	5.6
27-Jul-04	0.05	8	7.4
3-Aug-04	0.79	9	4.8
7-Sep-04		4	5.6
7-Oct-04		5	0.4

sample_date	INSTANTANEOUS FLOW (m^3/s)	TOTAL SUSPENDED SOLIDS (mg/L)	TURBIDITY, LAB (NTU)
4-Nov-04	0.033		
5-Nov-04	0.033	16	15.2
8-Dec-04	0.02	3	1.9
7-Jan-05	0.044	3	3.7
19-Jan-05			
19-Jan-05			
19-Jan-05			
20-Jan-05	0.616	209	218.5
21-Jan-05		49	74.8
1-Feb-05	0.0924	6	20.7
2-Mar-05			
2-Mar-05	0.0462	5	3.7
6-Apr-05	0.0605	7	6.7
12-Apr-05	0.119	3	4.8
20-Apr-05	0.124	14	10
28-Apr-05	0.275	15	7
4-May-05	0.179	12	9.3
10-May-05	0.245	15	13.3
19-May-05	0.272	6	2.2
24-May-05	0.139	8	1.5
31-May-05	0.204	16	14.4
7-Jun-05		21	12.6
13-Jun-05		19	28.9
21-Jun-05		14	13.3
28-Jun-05		16.3	28.7
5-Jul-05	0.123	13.3	8.23
12-Jul-05		8	9.17
20-Jul-05		11.3	9.99
28-Jul-05		8.7	13
2-Aug-05			
4-Aug-05	0.066	8	5.23
13-Sep-05	0.0737	11.3	34.7
4-Oct-05	0.188	6	11.3
1-Nov-05			
3-Nov-05		22	28.1
13-Dec-05		21.3	23.9
11-Jan-06	0.0515	8.7	11.8
7-Feb-06	0.0308	5	2.2
15-Mar-06	0.0297	< 3.0	3.6
18-Mar-06		25	28.5
4-Apr-06	0.0746	< 3.0	17.5

sample_date	INSTANTANEOUS FLOW (m^3/s)	TOTAL SUSPENDED SOLIDS (mg/L)	TURBIDITY, LAB (NTU)
13-Apr-06	0.138	16	46.7
18-Apr-06	0.136	25	28.5
25-Apr-06	0.203	13	18.7
3-May-06	0.296	10	17.5
11-May-06	0.278	6	12.8
16-May-06	0.244	15	27.3
26-May-06	0.639	15	29.1
1-Jun-06	0.183	15	17.1
13-Jun-06	0.169	8	11.5
21-Jun-06		4	7.5
28-Jun-06	0.084	31	34.8
4-Jul-06	0.097	14	17.6
12-Jul-06		7	7.7
18-Jul-06	0.17	8	15.7
25-Jul-06	0.083	6	7.8
1-Aug-06	0.042	3	4.8
6-Sep-06	0.024	7	8.2
3-Oct-06	0.004	< 3.0	1.4
7-Nov-06	1.18	220	263
9-Nov-06	0.292	27	72.9
9-Nov-06	0.475	54	116
5-Dec-06	0.094	3	8.1
3-Jan-07	0.087	6	6.6
6-Feb-07	0.042	3	3.8
6-Mar-07	0.035	16	25.2
3-Apr-07	0.135	5	10.8
9-Apr-07	0.261	10	21
19-Apr-07	0.237	6	14.4
24-Apr-07	0.303	9	14.4
2-May-07	0.468	6	12
9-May-07	0.548	8	16.1
15-May-07	0.438	7	8.1
22-May-07	0.42	4	11.5
29-May-07	0.354	16	31.6
5-Jun-07	0.173	12	5.1
12-Jun-07	0.168	8	2.4
19-Jun-07	0.17	4	9.4
26-Jun-07	0.134	9	1.5
3-Jul-07	0.114	6	4.5
10-Jul-07	0.09	11	8.6
17-Jul-07	0.073	5	8.7

sample_date	INSTANTANEOUS FLOW (m^3/s)	TOTAL SUSPENDED SOLIDS (mg/L)	TURBIDITY, LAB (NTU)
24-Jul-07	0.08	9	11.3
1-Aug-07	0.057	5	2.8
7-Aug-07	0.056	4	6.5
4-Sep-07	0.035	< 3.0	6
2-Oct-07	0.046	5	6.3
13-Nov-07	0.03	4	3.2
5-Dec-07	0.07	10	57.9
2-Jan-08		< 3.0	0.88
5-Feb-08		< 3.0	1.8
4-Mar-08	0.015	< 3.0	2.5
1-Apr-08	0.0102	63	72.4
7-Apr-08	0.0315	7	35.1
14-Apr-08	0.32	22	49.8
21-Apr-08	0.0669	8	11.4
28-Apr-08	0.137	9	19.6
6-May-08	0.273	3	13.3
12-May-08	0.213	5	8.4
20-May-08	0.311	18	17.7
26-May-08	0.389	17	39.8
3-Jun-08	0.247	5	11.7
9-Jun-08	0.206	4	31.9
16-Jun-08	0.0877	5	9.5
23-Jun-08	0.163	5	7
7-Jul-08	0.098	8	7.5
14-Jul-08	0.08	< 3.0	3.9
21-Jul-08	0.066	5	3.7
28-Jul-08	0.047	6	8.4
5-Aug-08	0.055	3	4.9
11-Aug-08	0.007	11	17.1
18-Aug-08	0.039	4	3.7
25-Aug-08	0.033	5	7.9
2-Sep-08	0.033	6	7.1
26-Sep-08			
7-Oct-08	0.077	9	5.6
4-Nov-08	0.023	3	2.9
2-Dec-08	0.011	< 3.0	1.56
6-Jan-09	0.01	< 3.0	0.67
3-Feb-09	0.007	13.6	7.47
3-Mar-09	0.03	181	233
7-Apr-09	0.087	37.6	34.5
14-Apr-09	0.077	13.5	31.1

sample_date	INSTANTANEOUS FLOW (m^3/s)	TOTAL SUSPENDED SOLIDS (mg/L)	TURBIDITY, LAB (NTU)
20-Apr-09	0.13	19.6	39.8
27-Apr-09	0.143	14	19.8
5-May-09	0.122	19.6	30.7
11-May-09	0.164	12.7	22.3
19-May-09	0.179	13.1	36.8
25-May-09	0.157	9.7	23.4
2-Jun-09	0.143	9.8	14.1
8-Jun-09	0.094	10.3	13.5
15-Jun-09	0.066	13.6	15.2
22-Jun-09	0.234	31.7	44.7
29-Jun-09	0.041	10.2	11.6
7-Jul-09	0.043	7.5	3.86
13-Jul-09	0.029	10.3	0.1
20-Jul-09	0.033	< 3.0	7.91
27-Jul-09	0.048	12.3	18.2
4-Aug-09	0.042	6.9	7.24
1-Sep-09	0.026		2.85
6-Oct-09	0.019	3.2	6.42
3-Nov-09	0.026	7.3	18.7
1-Dec-09	0.02	< 3.0	2.61
5-Jan-10	0.004		0.55
2-Feb-10	0.005	< 3.0	0.7
2-Mar-10	0.023	7.7	7.03
8-Mar-10	0.036		
15-Mar-10	0.026		
23-Mar-10	0.029	5	3.85
29-Mar-10	0.048	7.1	21.2
6-Apr-10	0.024	< 3.0	3.5
12-Apr-10	0.024	< 3.0	3.22
19-Apr-10	0.099	12.5	34.5
26-Apr-10	0.09	9.3	13.3
4-May-10	0.016	11.1	20
10-May-10	0.068	< 3.0	6.2
17-May-10	0.117	9	7.31
25-May-10	0.083	< 3.0	4.87
1-Jun-10	0.161	14.7	39.2
7-Jun-10	0.12	3.3	14.9
14-Jun-10	0.099	3	10.5
21-Jun-10	0.201	6.2	14
28-Jun-10	0.165	6.4	8.58
6-Jul-10	0.108	6.2	7.95

sample_date	INSTANTANEOUS FLOW (m^3/s)	TOTAL SUSPENDED SOLIDS (mg/L)	TURBIDITY, LAB (NTU)
12-Jul-10	0.043	21.3	35.6
19-Jul-10	0.014	3.2	6.08
26-Jul-10	0.132	< 3.0	9.79
3-Aug-10	0.052	5.8	6.58
7-Sep-10	0.055	10	8.58
5-Oct-10	0.178	3.1	3.73
27-Oct-10	0.04	5.7	7.02
2-Nov-10	0.182	28.3	55
7-Dec-10	0.107	< 3.0	2.39
3-Jan-11	0.0336	7.7	9.76
4-Jan-11	0.0913	4.7	2.07
1-Feb-11	0.0036	< 3.0	1.28
7-Mar-11	0.045	6.1	4.09
5-Apr-11	0.102	4.2	13.2
12-Apr-11	0.0869	9	11
19-Apr-11	0.0759	11.2	11.9
26-Apr-11	0.04	12.3	21
3-May-11	0.107	27.3	36.1
10-May-11	0.135	57.4	67.3
17-May-11	0.458	44.6	42
24-May-11	0.223	26.9	36
27-May-11		80	
31-May-11	0.291	43.9	62.3
7-Jun-11	0.132	29.3	24.9
14-Jun-11	0.426	< 3.0	2.03
20-Jun-11	0.24	10.8	10.3
27-Jun-11	0.163	7.1	7.03
5-Jul-11	0.154	10.3	4.71
12-Jul-11	0.288	10	8.97
19-Jul-11	0.232	6.3	6.37
25-Jul-11	0.169	4.1	4.99
2-Aug-11	0.226	6	6.32
6-Sep-11	0.07	4.7	5.95
4-Oct-11	0.024	5.5	2.26
13-Oct-11			
1-Nov-11	0.0882	16.9	21
6-Dec-11	0.0523	6.8	8.66
3-Jan-12	0.0336	7.7	9.76
7-Feb-12	0.0235	4	8.17
7-Mar-12	0.0851	6	4.83
3-Apr-12	0.106	4.9	13.7

sample_date	INSTANTANEOUS FLOW (m^3/s)	TOTAL SUSPENDED SOLIDS (mg/L)	TURBIDITY, LAB (NTU)
10-Apr-12	0.138	26.9	
17-Apr-12	0.186	29.5	
23-Apr-12		362	
24-Apr-12	0.887	128	
25-Apr-12		104	
1-May-12	0.424	65.1	85
8-May-12	0.358	22.2	
15-May-12	0.391	24	
22-May-12	0.281	20.7	
29-May-12	0.226	13.3	
5-Jun-12	0.208	8	
12-Jun-12	0.238	7	
19-Jun-12	0.203	52.8	
26-Jun-12	0.288	24.4	
3-Jul-12	0.239	29.7	39.3
10-Jul-12	0.128	19.3	
17-Jul-12	0.137	6.7	
24-Jul-12		18	
31-Jul-12	0.086	11.6	
7-Aug-12	0.126	14	12.6
4-Sep-12	0.0794	< 3.0	
5-Sep-12	0.0891		
6-Sep-12	0.085	5	
7-Sep-12	0.0836	12.4	
10-Sep-12	0.111	13.3	
11-Sep-12	0.0867		
12-Sep-12	0.0806	3.7	
13-Sep-12	0.0794		
14-Sep-12	0.08	5.3	
17-Sep-12	0.0742	5	
18-Sep-12	0.0812		
19-Sep-12	0.0824	3.2	
20-Sep-12	0.0748	9.7	
24-Sep-12	0.081	4	
25-Sep-12	0.078		
26-Sep-12	0.064	< 3.0	
2-Oct-12			
6-Nov-12	0.14	13.9	
4-Dec-12	0.078	33.6	
2-Jan-13	0.0618	< 3.0	
8-Jan-13		< 4.0	

sample_date	INSTANTANEOUS FLOW (m^3/s)	TOTAL SUSPENDED SOLIDS (mg/L)	TURBIDITY, LAB (NTU)
9-Jan-13		9	
10-Jan-13		5	
11-Jan-13		< 4.0	
12-Jan-13		10	
13-Jan-13		< 4.0	
14-Jan-13		6	
15-Jan-13		6	
16-Jan-13		< 4.0	
17-Jan-13		7	
18-Jan-13		8	
19-Jan-13		21	
20-Jan-13		17	
21-Jan-13		< 4.0	
22-Jan-13		< 4.0	
23-Jan-13		6	
24-Jan-13		5	
25-Jan-13		15	
26-Jan-13		42	
28-Jan-13		< 4.0	
29-Jan-13		6	
30-Jan-13		19.2	
31-Jan-13		10	
1-Feb-13		57	
2-Feb-13		15	
3-Feb-13		14	
4-Feb-13		< 4.0	
5-Feb-13	0.0548	10.7	18
6-Feb-13		16	
7-Feb-13		4	
8-Feb-13		10	
9-Feb-13		14	
10-Feb-13		< 4.0	
11-Feb-13		12	
12-Feb-13		6	
13-Feb-13		6	
14-Feb-13		9.5	
15-Feb-13		11.5	
16-Feb-13		9	
16-Feb-13		5	
16-Feb-13		15	
17-Feb-13		8	

sample_date	INSTANTANEOUS FLOW (m^3/s)	TOTAL SUSPENDED SOLIDS (mg/L)	TURBIDITY, LAB (NTU)
17-Feb-13		11	
17-Feb-13		5.2	
21-Feb-13		7.5	
22-Feb-13		< 4.0	
23-Feb-13		< 4.0	
24-Feb-13		6.5	
25-Feb-13		4.5	
26-Feb-13		11	
27-Feb-13		11	
28-Feb-13		12.5	
1-Mar-13		8.5	
2-Mar-13		10	
3-Mar-13		7	
4-Mar-13		14	
5-Mar-13	0.0548	21.875	43.7
6-Mar-13		15.5	
7-Mar-13		10.5	
8-Mar-13		17	
9-Mar-13		9	
10-Mar-13		8.5	
11-Mar-13		23.5	
12-Mar-13		11.5	
13-Mar-13		77	
14-Mar-13		18	
15-Mar-13		26.5	
16-Mar-13		10	
16-Mar-13		11.5	
17-Mar-13		14	
18-Mar-13		15	
19-Mar-13		13.5	
20-Mar-13		26	
21-Mar-13		19	
22-Mar-13		10	
23-Mar-13		< 4.0	
24-Mar-13		6	
28-Mar-13		19.4	
31-Mar-13		42.6	
2-Apr-13	0.103	37	56.1
9-Apr-13	0.151	19.7	38
16-Apr-13	0.0394	70.3	59.2
23-Apr-13	0.0394	37.8	38.7

sample_date	INSTANTANEOUS FLOW (m^3/s)	TOTAL SUSPENDED SOLIDS (mg/L)	TURBIDITY, LAB (NTU)
30-Apr-13	0.129	19.2	25.4
7-May-13	0.177	27.6	35.9
14-May-13	0.177	42.5	61.5
21-May-13	0.118	7.3	8.89
28-May-13	0.118	20.5	20.1
28-May-13			
31-May-13			
4-Jun-13	0.0875	13.6	16.2
11-Jun-13	0.0613	8.3	8.52
12-Jun-13		9	
18-Jun-13	0.1561	9.1	6.16
19-Jun-13		677	< 0.10
20-Jun-13		1670	1200
21-Jun-13		129	153
22-Jun-13		59.2	78.6
24-Jun-13		33.3	40.8
25-Jun-13	0.159	23.9	31.1
2-Jul-13	0.0394	25.9	19.4
9-Jul-13	0.0535	15.3	16.7
16-Jul-13	0.0394	4.6	2.42
23-Jul-13	0.0353	3.5	2.98
30-Jul-13	0.053	< 3.0	2.45
2-Aug-13		84	139
2-Aug-13		30	70.8
6-Aug-13	0.067	19.3	15.6
6-Aug-13			
3-Sep-13	0.0302	11.2	4.69
3-Sep-13			
3-Sep-13			
1-Oct-13	0.019	14.9	20.6
5-Nov-13	0.021	1.2	2.16
3-Dec-13	0.006	1.7	3.1
7-Jan-14	0	< 1.0	0.98
7-Jan-14			
4-Feb-14	0.013	12.7	3.46
4-Mar-14	0.00174	2.5	1.8
4-Mar-14			
26-Mar-14		13.7	
1-Apr-14	0.013	8.4	21.7
8-Apr-14		29	69.7
8-Apr-14	0.152	66.3	68.5

sample_date	INSTANTANEOUS FLOW (m^3/s)	TOTAL SUSPENDED SOLIDS (mg/L)	TURBIDITY, LAB (NTU)
9-Apr-14		417	520
9-Apr-14		96	119
10-Apr-14		43.3	70.6
10-Apr-14		21.9	40.8
10-Apr-14		22.9	45.4
11-Apr-14		32.2	41.2
15-Apr-14	0.147	27.2	52.3
22-Apr-14	0.175	61.1	64
29-Apr-14	0.088	29.7	34.2
6-May-14	0.178	41.8	53.3
13-May-14	0.169	22.9	27.5
20-May-14	0.221	27.3	25.2
27-May-14	0.171	28.4	35
3-Jun-14	0.193	8.5	6.25
10-Jun-14	0.101	3.8	3.41
17-Jun-14	0.393	134	140
24-Jun-14	0.074	18.4	20.9
2-Jul-14	0.046	11.8	7.68
8-Jul-14	0.033	18.3	6.37
15-Jul-14	0.103	25.3	17.4
22-Jul-14	0.04	11.5	14.5
29-Jul-14			
29-Jul-14	0.0425	26.7	8.16
5-Aug-14	0.592	3.4	1.54
2-Sep-14	0.009	6.9	2.16
7-Oct-14	0.016	7.3	1.75
4-Nov-14	0.088	77.1	38
3-Dec-14	0.052	1.8	5.53
6-Jan-15	0.032	1.9	1.26
3-Feb-15	0.03016	2	1.46
3-Mar-15	0.029	1.6	1.93
30-Mar-15	0.148	9.4	22.3
8-Apr-15	0.112	3.7	4.3
15-Apr-15	0.089	3.9	3.01
22-Apr-15	0.159	12	3.96
29-Apr-15	0.116	14.8	4.14
6-May-15	0.111615	18	16.9
13-May-15	0.04776	10.8	8.49
20-May-15	0.06	4	1.37
27-May-15	0.103246	16.1	3.18
2-Jun-15		51.6	51.5

sample_date	INSTANTANEOUS FLOW (m^3/s)	TOTAL SUSPENDED SOLIDS (mg/L)	TURBIDITY, LAB (NTU)
2-Jun-15		39.2	42.3
2-Jun-15		20.2	21.2
3-Jun-15			
3-Jun-15		7	8.69
3-Jun-15	0.188119	8.9	6.95
10-Jun-15	0.097375	9.7	2.96
17-Jun-15	0.068267	4.2	0.67
24-Jun-15	0.061085	2.4	0.6
30-Jun-15	0.059	< 1.0	2.13
8-Jul-15	0.0459	2.1	0.72
15-Jul-15	0.051	8	1.23
21-Jul-15	0.030495	2	1.61
27-Jul-15	0.012	1.3	0.73
5-Aug-15	0.036	2	1.09
17-Aug-15		3.9	
24-Aug-15		6.3	
2-Sep-15	0.029	2.5	1.09
28-Sep-15	0.0053	2.8	1.04
7-Oct-15	0.04	1.8	1.22
4-Nov-15			
4-Nov-15	0.039	9.5	17.6
2-Dec-15	0.033	2	2.67
6-Jan-16		1.3	0.84

0200209 - CM_CC1

sample_date	TOTAL SUSPENDED SOLIDS (mg/L)	TURBIDITY, LAB (NTU)
18-Jan-00	13	3.3
10-Feb-00	3	3.3
17-Mar-00	3	3.7
4-Apr-00	14	27.4
13-Apr-00	20	14.4
21-Apr-00	19	18.9
27-Apr-00	10	8.9
6-May-00	4	5.2
15-May-00	3	3
21-May-00	3	1.5
1-Jun-00	4	4.1
9-Jun-00	4	3.3
16-Jun-00	14	10
22-Jun-00	4	4.1
27-Jun-00	3	1.1
7-Jul-00	3	3
14-Jul-00	3	1.1
18-Jul-00	3	0.7
28-Jul-00	2	0.4
17-Aug-00	1	0.4
12-Sep-00	2	1.9
23-Oct-00	2	1.1
21-Nov-00	2	4.1
11-Dec-00	1	0.4
11-Jan-01	1	1.1
12-Feb-01	1	0.1
12-Mar-01	7	10.4
12-Apr-01	2	1.9
17-Apr-01	16	22.6
24-Apr-01	8	14.4
3-May-01	4	6.3
9-May-01	5	6.7
15-May-01	6	3.3
22-May-01	2	0.1
30-May-01	3	1.9
5-Jun-01	7	9.3
11-Jun-01	3	0.4
19-Jun-01	3	0.4
27-Jun-01	5	2.2

sample_date	TOTAL SUSPENDED SOLIDS (mg/L)	TURBIDITY, LAB (NTU)
5-Jul-01	3	0.4
11-Jul-01	3	0.1
17-Jul-01	6	4.1
26-Jul-01	7	3.3
13-Aug-01	2	1.1
13-Sep-01	3	2.6
11-Oct-01	5	5.6
14-Nov-01	19	14.4
19-Dec-01	1	3.3
14-Jan-02	2	2.6
11-Feb-02	1	0.4
11-Mar-02	1	1.5
11-Apr-02	37	43
18-Apr-02	23	24.1
25-Apr-02	6	5.6
2-May-02	4	8.9
8-May-02	5	4.4
17-May-02	5	5.2
23-May-02	19	24.4
30-May-02	60	44.1
5-Jun-02	30	16.3
11-Jun-02	8	13
19-Jun-02	9	9.6
26-Jun-02	5	5.6
3-Jul-02	6	4.8
11-Jul-02	4	4.1
18-Jul-02	3	1.9
24-Jul-02	2	0.7
9-Aug-02	3	0.4
5-Sep-02	12	< 0.1
9-Oct-02	2	1.5
14-Nov-02	< 1.0	1.1
2-Dec-02	1	0.7
14-Jan-03	1	1.5
11-Feb-03	< 1.0	0.4
18-Mar-03	335	425.9
3-Apr-03	8	12.6
10-Apr-03	4	59.3
18-Apr-03	12	12.6
25-Apr-03	9	9.3

sample_date	TOTAL SUSPENDED SOLIDS (mg/L)	TURBIDITY, LAB (NTU)
2-May-03	8	13
8-May-03	3	4.1
15-May-03	6	3.7
22-May-03	2	2.6
29-May-03	7	4.1
6-Jun-03	3	5.2
12-Jun-03	1	0.7
19-Jun-03	2	2.2
27-Jun-03	2	3.3
3-Jul-03	2	2.2
10-Jul-03	3	1.9
21-Jul-03	2	1.5
25-Jul-03	2	1.5
31-Jul-03	2	1.9
21-Aug-03	1	1.5
23-Sep-03	2	1.5
24-Oct-03	4	4.8
4-Nov-03	3	4.1
2-Dec-03	< 1.0	1.9
6-Jan-04	40	3.7
3-Feb-04	1	1.5
3-Mar-04	< 1.0	1.9
6-Apr-04	4	2.6
14-Apr-04	12	10
20-Apr-04	3	1.5
27-Apr-04	5	4.4
4-May-04	11	5.2
11-May-04	6	5.2
18-May-04	3	2.6
25-May-04	2	1.5
1-Jun-04	3	2.6
9-Jun-04	3	3.3
15-Jun-04	2	3.3
22-Jun-04	3	1.9
29-Jun-04	2	1.9
6-Jul-04	2	0.7
14-Jul-04	3	0.7
20-Jul-04	4	2.2
27-Jul-04	5	2.6
3-Aug-04	3	1.9
7-Sep-04	6	3

sample_date	TOTAL SUSPENDED SOLIDS (mg/L)	TURBIDITY, LAB (NTU)
7-Oct-04	3	0.7
4-Nov-04		
5-Nov-04	9	4.8
8-Dec-04	11	1.9
5-Jan-05	5	3.3
2-Feb-05	1	14.8
2-Mar-05		
2-Mar-05	1	< 0.1
6-Apr-05	3	2.6
12-Apr-05	2	2.6
20-Apr-05	4	1.5
28-Apr-05	5	1.9
4-May-05	2	0.4
10-May-05	5	3
19-May-05	3	1.5
24-May-05	2	0.7
31-May-05	4	2.2
7-Jun-05	12	3.7
13-Jun-05	9	7.4
21-Jun-05	8	4.1
28-Jun-05	7.7	5.73
5-Jul-05	< 4.0	1.42
12-Jul-05	< 4.0	1.23
20-Jul-05	< 4.0	1.38
28-Jul-05	< 4.0	1.51
2-Aug-05		
4-Aug-05	< 4.0	0.76
13-Sep-05	6	10.3
4-Oct-05	< 4.0	3.16
1-Nov-05		
3-Nov-05	< 4.0	2.39
13-Dec-05	4.7	3.7
11-Jan-06	< 4.0	2.23
7-Feb-06	3	0.67
15-Mar-06	< 3.0	1
18-Mar-06	5	4.5
4-Apr-06	< 3.0	3.8
13-Apr-06	5	7.5
18-Apr-06	5	4.5
25-Apr-06	7	2.8
3-May-06	< 3.0	4.4

sample_date	TOTAL SUSPENDED SOLIDS (mg/L)	TURBIDITY, LAB (NTU)
11-May-06	5	1.9
16-May-06	4	7.3
26-May-06	4	4.6
1-Jun-06	< 3.0	1.9
13-Jun-06	< 3.0	2.1
21-Jun-06	< 3.0	1.6
28-Jun-06	5	4.5
4-Jul-06	4	1.7
12-Jul-06	< 3.0	1.9
18-Jul-06	< 3.0	2.3
25-Jul-06	< 3.0	1.4
1-Aug-06	4	1.8
6-Sep-06	< 3.0	1.5
3-Oct-06	< 3.0	0.88
7-Nov-06	152	212
5-Dec-06	< 3.0	1.5
2-Jan-07	< 3.0	0.73
6-Feb-07	< 3.0	1
6-Mar-07	4	3.1
3-Apr-07	< 3.0	2
9-Apr-07	< 3.0	3.5
19-Apr-07	< 3.0	3.8
24-Apr-07	4	3.3
2-May-07	6	3.9
9-May-07	5	4.8
15-May-07	5	1.9
22-May-07	< 3.0	2.4
29-May-07	7	6.1
5-Jun-07	< 3.0	1.1
12-Jun-07	< 3.0	1.1
19-Jun-07	< 3.0	2.7
26-Jun-07	3	< 0.2
3-Jul-07	3	1.9
10-Jul-07	6	2.5
17-Jul-07	< 3.0	1.9
24-Jul-07	7	2.6
1-Aug-07	< 3.0	1
7-Aug-07	< 3.0	0.41
4-Sep-07	< 3.0	1.2
2-Oct-07	3	1.7
13-Nov-07	5	0.28

sample_date	TOTAL SUSPENDED SOLIDS (mg/L)	TURBIDITY, LAB (NTU)
5-Dec-07	8	20.8
2-Jan-08	< 3.0	0.27
5-Feb-08	< 3.0	0.22
4-Mar-08	< 3.0	0.21
1-Apr-08	3	0.93
7-Apr-08	< 3.0	3.9
14-Apr-08	21	32.4
21-Apr-08	4	2
28-Apr-08	3	4.8
6-May-08	< 3.0	2.5
12-May-08	3	1.8
20-May-08	3	3.8
26-May-08	6	9
3-Jun-08	< 3.0	2.1
9-Jun-08	< 3.0	4
16-Jun-08	< 3.0	1.7
23-Jun-08	< 3.0	1.5
7-Jul-08	4	1.1
14-Jul-08	3	1.1
21-Jul-08	< 3.0	0.26
28-Jul-08	< 3.0	1.3
5-Aug-08	< 3.0	1.2
11-Aug-08	3	3
18-Aug-08	5	0.9
25-Aug-08	< 3.0	1.6
2-Sep-08	3	1.5
7-Oct-08	18	7.6
4-Nov-08	7	0.86
2-Dec-08	< 3.0	1.23
6-Jan-09	< 3.0	0.39
3-Feb-09	< 3.0	0.45
3-Mar-09	7.3	9.53
7-Apr-09	11	11.6
14-Apr-09	21.5	14.8
20-Apr-09	9.6	14
27-Apr-09	4	6.18
5-May-09	6.9	8.92
11-May-09	8.7	4.83
19-May-09	23.1	16.5
25-May-09	11.7	6.2
2-Jun-09	< 3.0	2.6

sample_date	TOTAL SUSPENDED SOLIDS (mg/L)	TURBIDITY, LAB (NTU)
8-Jun-09	3.7	1.63
15-Jun-09	< 3.0	2.56
22-Jun-09	19.8	20.1
29-Jun-09	< 3.0	1.3
7-Jul-09	5.5	0.96
13-Jul-09	< 3.0	1.71
20-Jul-09	< 3.0	2.13
27-Jul-09	5.7	3.37
4-Aug-09	< 3.0	1.43
1-Sep-09	< 3.0	0.91
6-Oct-09	< 3.0	1.1
3-Nov-09	< 3.0	3.07
1-Dec-09	< 3.0	1.53
5-Jan-10		0.26
2-Feb-10	< 3.0	0.25
2-Mar-10	< 3.0	1.27
8-Mar-10		
15-Mar-10		
23-Mar-10	< 3.0	0.88
29-Mar-10	3.8	4.59
6-Apr-10	< 3.0	0.99
12-Apr-10	< 3.0	0.74
19-Apr-10	7.7	14.6
26-Apr-10	8	2.7
4-May-10	< 3.0	4.35
10-May-10	4	1.56
17-May-10	5.7	2.36
25-May-10	< 3.0	1.32
1-Jun-10	8.5	14
7-Jun-10	< 3.0	2.61
14-Jun-10	< 3.0	1.96
21-Jun-10	< 3.0	3.64
28-Jun-10	< 3.0	2.02
6-Jul-10	< 3.0	1.94
12-Jul-10	8	6.93
19-Jul-10	< 3.0	1.75
26-Jul-10	< 3.0	3.91
3-Aug-10	5.1	1.47
7-Sep-10	< 3.0	2.07
5-Oct-10	3.1	1.72
27-Oct-10	11	3.68

sample_date	TOTAL SUSPENDED SOLIDS (mg/L)	TURBIDITY, LAB (NTU)
2-Nov-10	15.7	17.9
7-Dec-10	< 3.0	1.41
3-Jan-11	3.7	3.23
4-Jan-11	< 3.0	1.16
1-Feb-11	< 3.0	0.59
7-Mar-11	< 3.0	1.52
5-Apr-11	< 3.0	2.9
12-Apr-11	5.7	3.31
19-Apr-11	7.8	4.49
26-Apr-11	5.7	7.54
3-May-11	14.7	14
10-May-11	40.4	39.8
17-May-11	10.6	12.8
24-May-11	20.9	13.8
27-May-11	24	
31-May-11	10.5	18.2
7-Jun-11	15.3	5.51
14-Jun-11	3.8	4.14
20-Jun-11	3.5	2.37
27-Jun-11	3.1	1.17
5-Jul-11	< 3.0	1.43
12-Jul-11	4	2.09
19-Jul-11	< 3.0	1.77
25-Jul-11	< 3.0	2.25
2-Aug-11	7.3	2.14
6-Sep-11	4	1.73
4-Oct-11	< 3.0	1.07
1-Nov-11	4.9	5.34
6-Dec-11	< 3.0	2.24
3-Jan-12	3.7	3.23
7-Feb-12	< 3.0	2.38
7-Mar-12	< 3.0	1.31
3-Apr-12	< 3.0	3.77
10-Apr-12	12.2	
17-Apr-12	16.9	
23-Apr-12	248	
24-Apr-12	74.7	
1-May-12	22.4	31.2
2-May-12	260	
2-May-12	650	
8-May-12	10.2	

sample_date	TOTAL SUSPENDED SOLIDS (mg/L)	TURBIDITY, LAB (NTU)
15-May-12	10	
22-May-12	5.3	
29-May-12	4	
5-Jun-12	< 3.0	
12-Jun-12	4.3	
19-Jun-12	10.2	
26-Jun-12	28.9	
3-Jul-12	8.3	7.91
10-Jul-12	< 3.0	
17-Jul-12	4	
24-Jul-12	8	
31-Jul-12	< 3.0	
7-Aug-12	5.3	1.75
4-Sep-12	< 3.0	
5-Sep-12		
6-Sep-12	< 3.0	
7-Sep-12	15.8	
10-Sep-12	3.5	
11-Sep-12		
12-Sep-12	< 3.0	
13-Sep-12		
14-Sep-12	< 3.0	
17-Sep-12	< 3.0	
18-Sep-12		
19-Sep-12	< 3.0	
20-Sep-12	3.7	
24-Sep-12	< 3.0	
25-Sep-12		
26-Sep-12	< 3.0	
2-Oct-12		
6-Nov-12	5.6	
7-Nov-12	1800	
7-Nov-12	25	
7-Nov-12	22	
4-Dec-12	< 3.0	
2-Jan-13	< 3.0	
8-Jan-13	< 4.0	
9-Jan-13	< 4.0	
10-Jan-13	< 4.0	
11-Jan-13	< 4.0	
12-Jan-13	< 4.0	

sample_date	TOTAL SUSPENDED SOLIDS (mg/L)	TURBIDITY, LAB (NTU)
13-Jan-13	< 4.0	
14-Jan-13	6	
15-Jan-13	< 4.0	
16-Jan-13	< 4.0	
17-Jan-13	4	
18-Jan-13	< 4.0	
19-Jan-13	< 4.0	
20-Jan-13	< 4.0	
21-Jan-13	< 4.0	
22-Jan-13	< 4.0	
23-Jan-13	< 4.0	
24-Jan-13	< 4.0	
25-Jan-13	< 4.0	
26-Jan-13	< 4.0	
27-Jan-13	< 4.0	
28-Jan-13	< 4.0	
29-Jan-13	< 4.0	
30-Jan-13	< 4.0	
31-Jan-13	< 4.0	
1-Feb-13	18	
2-Feb-13	< 4.0	
3-Feb-13	< 4.0	
4-Feb-13	< 4.0	
5-Feb-13	< 3.0	1.34
6-Feb-13	4	
7-Feb-13	< 4.0	
8-Feb-13	< 4.0	
9-Feb-13	< 4.0	
10-Feb-13	17	
11-Feb-13	7.5	
12-Feb-13	< 4.0	
13-Feb-13	< 4.0	
14-Feb-13	< 4.0	
15-Feb-13	< 4.0	
16-Feb-13	< 4.0	
16-Feb-13	4	
16-Feb-13	< 4.0	
17-Feb-13	7	
17-Feb-13	< 4.0	
17-Feb-13	< 4.0	
21-Feb-13	< 4.0	

sample_date	TOTAL SUSPENDED SOLIDS (mg/L)	TURBIDITY, LAB (NTU)
22-Feb-13	< 4.0	
23-Feb-13	< 4.0	
24-Feb-13	< 4.0	
25-Feb-13	< 4.0	
26-Feb-13	< 4.0	
27-Feb-13	< 4.0	
28-Feb-13	< 4.0	
1-Mar-13	< 4.0	
2-Mar-13	< 4.0	
3-Mar-13	< 4.0	
4-Mar-13	< 4.0	
5-Mar-13	7	6.77
6-Mar-13	4	
7-Mar-13	< 4.0	
8-Mar-13	4.5	
9-Mar-13	< 4.0	
10-Mar-13	< 4.0	
11-Mar-13	< 4.0	
12-Mar-13	< 4.0	
13-Mar-13	30	
14-Mar-13	5	
15-Mar-13	13	
16-Mar-13	< 4.0	
16-Mar-13	< 4.0	
17-Mar-13	4.5	
18-Mar-13	< 4.0	
19-Mar-13	< 4.0	
20-Mar-13	6	
21-Mar-13	6	
22-Mar-13	< 4.0	
23-Mar-13	< 4.0	
24-Mar-13	< 4.0	
2-Apr-13	20.8	21.9
9-Apr-13	13.7	12.4
16-Apr-13	8.1	4.95
23-Apr-13	13.6	9.39
30-Apr-13	8.4	5.85
7-May-13	17.1	7.99
14-May-13	25.2	20.1
21-May-13	< 3.0	3.03
28-May-13		

sample_date	TOTAL SUSPENDED SOLIDS (mg/L)	TURBIDITY, LAB (NTU)
28-May-13	8.5	3.22
31-May-13		
4-Jun-13	3.6	1.39
11-Jun-13	< 3.0	1.19
18-Jun-13	< 3.0	0.87
19-Jun-13	2850	3910
20-Jun-13	1100	848
21-Jun-13	52.5	37.8
22-Jun-13	24.5	19.2
24-Jun-13	14.3	7.21
25-Jun-13	11.9	6.17
2-Jul-13	5.3	1.03
9-Jul-13	< 3.0	1.48
16-Jul-13	< 3.0	0.67
23-Jul-13	< 3.0	0.55
30-Jul-13	< 3.0	0.65
2-Aug-13	35	36.9
2-Aug-13	21	24.5
6-Aug-13	6.4	1.62
6-Aug-13		
3-Sep-13		0.49
3-Sep-13	< 3.0	
1-Oct-13	4.9	4.16
5-Nov-13	< 1.0	0.55
3-Dec-13	< 1.0	0.6
7-Jan-14	< 1.0	0.28
7-Jan-14		
4-Feb-14	< 1.0	0.39
4-Feb-14		
4-Mar-14	2.4	0.47
4-Mar-14		
26-Mar-14	169	
27-Mar-14	6.3	
27-Mar-14	< 4.0	
28-Mar-14	545	
1-Apr-14	6.6	6.62
1-Apr-14	48.5	
2-Apr-14	19.3	
3-Apr-14	5.1	
4-Apr-14	< 4.0	
7-Apr-14	< 4.0	6.11

sample_date	TOTAL SUSPENDED SOLIDS (mg/L)	TURBIDITY, LAB (NTU)
8-Apr-14	14.6	23.5
8-Apr-14	23.4	20.6
8-Apr-14	74.6	40.1
9-Apr-14	149	178
9-Apr-14	85.3	68.3
10-Apr-14	28	34.6
10-Apr-14	17.3	17.2
11-Apr-14	15	16.6
15-Apr-14	14.5	17.6
22-Apr-14	32.5	20.4
29-Apr-14	7.9	7.43
6-May-14	13.1	10.8
13-May-14	8.1	5.9
20-May-14	14.1	5.66
27-May-14	9.2	8.37
3-Jun-14	1.7	1.15
10-Jun-14	1.5	0.92
17-Jun-14	32.6	20.7
24-Jun-14	3.7	2.88
2-Jul-14	< 1.0	1.13
2-Jul-14		
8-Jul-14	2.4	0.88
15-Jul-14	4.1	1.42
22-Jul-14	1.5	1.1
29-Jul-14	2.2	1.05
5-Aug-14	< 1.0	0.45
2-Sep-14	1.5	0.61
7-Oct-14	< 1.0	0.43
4-Nov-14	10.2	5.33
4-Nov-14		
3-Dec-14	1.1	1.47
6-Jan-15	< 1.0	0.48
3-Feb-15	< 1.0	0.46
3-Mar-15	< 1.0	0.64
16-Mar-15	14.6	15.7
23-Mar-15	1.8	2.01
30-Mar-15	3.6	4.32
8-Apr-15	1	1.14
15-Apr-15	< 1.0	0.72
22-Apr-15	4.4	1.41
29-Apr-15	4.1	2.03

sample_date	TOTAL SUSPENDED SOLIDS (mg/L)	TURBIDITY, LAB (NTU)
6-May-15	2.8	1.96
13-May-15	2.2	1.6
20-May-15	1.2	0.8
27-May-15	4.7	1.95
3-Jun-15	29.5	7.67
10-Jun-15	2.1	1.06
17-Jun-15	1.8	0.45
24-Jun-15	< 1.0	0.42
30-Jun-15	1	0.35
8-Jul-15	< 1.0	0.33
15-Jul-15	1.1	0.36
21-Jul-15	1	0.57
27-Jul-15	1.9	0.3
5-Aug-15	1.1	0.38
2-Sep-15	< 1.0	0.33
7-Oct-15	3.4	0.37
4-Nov-15	3.5	4.68
2-Dec-15	< 1.0	0.74
6-Jan-16	< 1.0	0.31

E258937 - CM_MC2

sample_date	TOTAL SUSPENDED SOLIDS (mg/L)	TURBIDITY, LAB (NTU)
18-Jan-00	8	0.7
10-Feb-00	1	0.1
17-Mar-00	1	0.1
4-Apr-00	1	1.5
13-Apr-00	9	4.4
21-Apr-00	14	7
27-Apr-00	4	2.2
6-May-00	7	4.4
15-May-00	2	1.1
21-May-00	31	15.2
1-Jun-00	8	3
12-Jun-00	5	2.6
16-Jun-00	9	4.4
22-Jun-00	5	2.6
27-Jun-00	3	0.1
7-Jul-00	6	1.1
14-Jul-00	2	0.1
18-Jul-00	2	0.1
28-Jul-00	2	0.4
17-Aug-00	1	0.1
12-Sep-00	1	1.5
23-Oct-00	1	0.1
21-Nov-00	0.1	2.2
11-Dec-00	1	0.1
11-Jan-01	1	0.1
12-Feb-01	1	0.01
12-Mar-01	4	0.1
12-Apr-01	1	0.1
17-Apr-01	1	0.1
24-Apr-01	1	3
3-May-01	3	2.2
9-May-01	7	4.8
15-May-01	15	7.4
22-May-01	11	4.1
30-May-01	10	4.8
5-Jun-01	10	5.2
11-Jun-01	4	0.4
19-Jun-01	3	0.1
27-Jun-01	3	0.1

sample_date	TOTAL SUSPENDED SOLIDS (mg/L)	TURBIDITY, LAB (NTU)
5-Jul-01	1	0.7
11-Jul-01	1	0.1
17-Jul-01	2	3
26-Jul-01	1	0.1
13-Aug-01	4	0.4
13-Sep-01	1	0.4
11-Oct-01	1	0.4
14-Nov-01	1	0.4
19-Dec-01	1	0.7
14-Jan-02	1	1.1
11-Feb-02	1	0.1
11-Mar-02	1	0.4
11-Apr-02	2	1.1
18-Apr-02	16	17
25-Apr-02	3	8.9
2-May-02	3	5.6
8-May-02	2	1.9
17-May-02	5	3
23-May-02	23	15.9
30-May-02	123	68.5
5-Jun-02	57	29.6
11-Jun-02	18	14.1
19-Jun-02	41	22.2
26-Jun-02	46	24.4
3-Jul-02	10	3.7
11-Jul-02	3	2.2
18-Jul-02	2	1.1
24-Jul-02	2	0.4
9-Aug-02	1	< 0.1
5-Sep-02	39	5.9
9-Oct-02	1	0.4
14-Nov-02	< 1.0	0.7
2-Dec-02	< 1.0	< 0.1
14-Jan-03	< 1.0	1.1
11-Feb-03	< 1.0	1.1
18-Mar-03	5	5.9
3-Apr-03	3	1.9
10-Apr-03	6	6.3
18-Apr-03	2	3
25-Apr-03	26	10.4
2-May-03	4	4.8

sample_date	TOTAL SUSPENDED SOLIDS (mg/L)	TURBIDITY, LAB (NTU)
8-May-03	2	2.2
15-May-03	10	5.2
22-May-03	7	1.9
29-May-03	54	27.4
6-Jun-03	10	8.1
12-Jun-03	4	0.4
19-Jun-03	5	1.9
27-Jun-03	2	1.9
3-Jul-03	2	2.2
10-Jul-03	1	0.7
21-Jul-03	< 1.0	0.7
25-Jul-03	< 1.0	1.1
31-Jul-03	< 1.0	1.1
21-Aug-03	< 1.0	1.5
23-Sep-03	< 1.0	0.7
24-Oct-03	1	0.4
4-Nov-03	1	1.5
2-Dec-03	1	1.1
6-Jan-04	< 1.0	0.4
3-Feb-04	< 1.0	2.2
3-Mar-04	1	1.5
6-Apr-04	4	2.6
14-Apr-04	14	7
20-Apr-04	2	5.6
27-Apr-04	12	7.4
4-May-04	11	5.2
11-May-04	6	5.6
18-May-04	4	3
25-May-04	1	2.2
1-Jun-04	5	3.3
9-Jun-04	6	4.1
15-Jun-04	5	1.5
22-Jun-04	2	1.5
29-Jun-04	1	0.4
6-Jul-04	3	0.4
13-Jul-04	3	1.1
20-Jul-04	2	1.9
27-Jul-04	2	2.2
3-Aug-04	4	0.4
8-Dec-04	< 1.0	0.7
5-Jan-05	2	1.9

sample_date	TOTAL SUSPENDED SOLIDS (mg/L)	TURBIDITY, LAB (NTU)
2-Mar-05		
2-Mar-05	< 1.0	< 0.1
6-Apr-05	2	2.2
12-Apr-05	< 1.0	3.7
20-Apr-05	2	0.4
28-Apr-05	7	0.4
4-May-05	7	0.7
10-May-05	11	1.9
19-May-05	14	3
24-May-05	8	0.7
31-May-05	4	1.1
9-Jun-05	14	5.9
13-Jun-05	22	13.3
21-Jun-05	8	5.2
28-Jun-05	5.7	5.15
5-Jul-05	< 4.0	2.33
12-Jul-05	< 4.0	1.29
20-Jul-05	5.3	1.81
28-Jul-05	< 4.0	1.54
2-Aug-05		
4-Aug-05	4	0.8
13-Sep-05	4.7	4.09
4-Oct-05	4	2.53
1-Nov-05		
3-Nov-05	< 4.0	1.69
13-Dec-05	10	4.96
11-Jan-06	< 4.0	0.74
7-Feb-06	< 3.0	0.54
15-Mar-06	< 3.0	1.1
18-Mar-06	6	2.5
13-Apr-06	3	5.4
18-Apr-06	6	2.5
25-Apr-06	7	1.9
3-May-06	4	3.5
11-May-06	< 3.0	2.3
16-May-06	35	32.4
26-May-06	35	39.1
1-Jun-06	7	30.1
13-Jun-06	< 3.0	2.5
21-Jun-06	8	5.4
28-Jun-06	< 3.0	2.4

sample_date	TOTAL SUSPENDED SOLIDS (mg/L)	TURBIDITY, LAB (NTU)
4-Jul-06	< 3.0	1.6
12-Jul-06	3	1.3
18-Jul-06	4	1.5
25-Jul-06	3	1.5
1-Aug-06	< 3.0	1.1
6-Sep-06	< 3.0	0.81
3-Oct-06	< 3.0	0.71
7-Nov-06	168	124
5-Dec-06	< 3.0	0.82
2-Jan-07	< 3.0	0.6
6-Feb-07	< 3.0	0.55
6-Mar-07	< 3.0	0.8
3-Apr-07	< 3.0	0.69
9-Apr-07	< 3.0	1.7
19-Apr-07	< 3.0	1.8
24-Apr-07	< 3.0	2
2-May-07	22	11.8
9-May-07	74	45.7
15-May-07	12	8.4
22-May-07	17	15
29-May-07	11	13.3
5-Jun-07	84	27.5
12-Jun-07	9	2.5
19-Jun-07	< 3.0	2.7
26-Jun-07	5	4.3
3-Jul-07	< 3.0	1
10-Jul-07	< 3.0	1.9
17-Jul-07	3	1.5
24-Jul-07	< 3.0	1.6
1-Aug-07	< 3.0	0.55
7-Aug-07	< 3.0	0.35
4-Sep-07	< 3.0	0.32
2-Oct-07	< 3.0	1.1
13-Nov-07	6	0.42
5-Dec-07	5	5.7
2-Jan-08	4	1.8
5-Feb-08	< 3.0	0.2
4-Mar-08	< 3.0	0.22
1-Apr-08	< 3.0	1.1
7-Apr-08	< 3.0	1.3
14-Apr-08	53	18.8

sample_date	TOTAL SUSPENDED SOLIDS (mg/L)	TURBIDITY, LAB (NTU)
21-Apr-08	< 3.0	1.7
28-Apr-08	< 3.0	2.1
6-May-08	3	4.5
12-May-08	< 3.0	1.8
20-May-08	21	25.1
26-May-08	28	21
3-Jun-08	9	15.5
9-Jun-08	< 3.0	4.8
16-Jun-08	< 3.0	3.4
23-Jun-08	3	4.6
7-Jul-08	< 3.0	1.3
14-Jul-08	< 3.0	1.1
21-Jul-08	< 3.0	1
28-Jul-08	< 3.0	0.21
5-Aug-08	< 3.0	0.81
11-Aug-08	< 3.0	1.4
18-Aug-08	< 3.0	0.68
25-Aug-08	< 3.0	0.65
2-Sep-08	3	0.66
7-Oct-08	8	5.2
4-Nov-08	< 3.0	0.48
2-Dec-08	< 3.0	0.42
7-Apr-09	3	2.99
14-Apr-09	4.8	2.59
20-Apr-09	5.6	3.56
27-Apr-09	3.3	1.88
5-May-09	< 3.0	2.69
11-May-09	3.3	2.01
19-May-09	41.1	34
25-May-09	41.7	33
2-Jun-09	11.8	11.1
8-Jun-09	7.7	3.25
15-Jun-09	8.2	4.61
22-Jun-09	16.4	11.3
29-Jun-09	< 3.0	2.11
7-Jul-09	< 3.0	1.46
13-Jul-09	3.7	1.91
20-Jul-09	3.3	1.41
27-Jul-09	9	7.38
4-Aug-09	4.2	2.29
1-Sep-09	< 3.0	1.27

sample_date	TOTAL SUSPENDED SOLIDS (mg/L)	TURBIDITY, LAB (NTU)
6-Oct-09	< 3.0	0.71
3-Nov-09	< 3.0	1.04
1-Dec-09	< 3.0	0.63
5-Jan-10		0.38
2-Feb-10	< 3.0	0.29
2-Mar-10	4.3	0.79
8-Mar-10		
15-Mar-10		
23-Mar-10	< 3.0	0.52
29-Mar-10	3.1	1.16
6-Apr-10	< 3.0	0.44
12-Apr-10	3.2	0.52
19-Apr-10	10.4	6.24
26-Apr-10	9.3	2.9
4-May-10	< 3.0	1.92
10-May-10	< 3.0	1.08
17-May-10	32.3	19.2
25-May-10	6	3.56
1-Jun-10	12	10.7
7-Jun-10	26	21.9
14-Jun-10	8.3	8.17
21-Jun-10	8.9	5.72
28-Jun-10	12.4	3.84
6-Jul-10	7.7	1.54
12-Jul-10	16.7	18.6
19-Jul-10	< 3.0	1.26
26-Jul-10	< 3.0	2.3
3-Aug-10	3.3	1.06
7-Sep-10	< 3.0	1.11
5-Oct-10	< 3.0	1.14
27-Oct-10	< 3.0	1.22
2-Nov-10	13.8	10.1
7-Dec-10	3.2	0.77
3-Jan-11	3.7	1.41
4-Jan-11	< 3.0	1.06
7-Mar-11	4.6	1.37
5-Apr-11	< 3.0	1.73
12-Apr-11	9.8	4.01
19-Apr-11	13.8	4.65
26-Apr-11	4.3	2.68
3-May-11	7	4.81

sample_date	TOTAL SUSPENDED SOLIDS (mg/L)	TURBIDITY, LAB (NTU)
10-May-11	23.9	16.4
17-May-11	12.9	8.52
24-May-11	41.9	24.6
31-May-11	16.5	12.5
7-Jun-11	64.7	36.9
14-Jun-11	35.2	22.7
20-Jun-11	29.5	19.1
27-Jun-11	22.4	10.7
5-Jul-11	21	8.29
12-Jul-11	12	5.94
19-Jul-11	9	2.42
25-Jul-11	4.8	2.05
2-Aug-11	4	1.51
6-Sep-11	< 3.0	0.87
4-Oct-11	< 3.0	1.48
1-Nov-11	3.6	2.67
6-Dec-11	< 3.0	0.87
3-Jan-12	3.7	1.41
7-Feb-12	< 3.0	0.83
7-Mar-12	5.3	0.93
3-Apr-12	< 3.0	1.63
10-Apr-12	< 3.0	
17-Apr-12	7.5	
23-Apr-12	224	
24-Apr-12	155	
1-May-12	13.1	12.6
8-May-12	6.8	
15-May-12	38	
22-May-12	36	
29-May-12	4.7	
5-Jun-12	174	
12-Jun-12	22.3	
19-Jun-12	45.5	
26-Jun-12	45.6	
3-Jul-12	19.7	10.8
10-Jul-12	8	
17-Jul-12	4	
24-Jul-12	5.3	
31-Jul-12	3.7	
7-Aug-12	< 3.0	0.72
4-Sep-12	< 3.0	0.39

sample_date	TOTAL SUSPENDED SOLIDS (mg/L)	TURBIDITY, LAB (NTU)
2-Oct-12	< 3.0	
6-Nov-12	9.7	
7-Nov-12	705	
7-Nov-12	29	
7-Nov-12	15	
4-Dec-12	< 3.0	
2-Jan-13	3.2	
5-Feb-13	4	0.95
5-Mar-13	5	3.32
2-Apr-13	7.1	6.01
9-Apr-13	6.3	5.14
16-Apr-13	3.8	2.22
23-Apr-13	3.6	2.07
30-Apr-13	5	3.45
7-May-13	27.6	14.8
14-May-13	143	67.5
21-May-13	18	13.2
28-May-13	17.2	8.02
4-Jun-13	6.9	3.89
11-Jun-13	13.2	5.68
18-Jun-13	5.1	2.11
20-Jun-13	533	290
24-Jun-13	60.3	35.4
25-Jun-13	37.5	25.6
2-Jul-13	14.7	4.07
9-Jul-13	3.3	2.25
16-Jul-13	< 3.0	0.77
23-Jul-13	< 3.0	0.63
30-Jul-13	< 3.0	0.81
6-Aug-13	3.7	1.62
3-Sep-13	< 3.0	0.65
1-Oct-13	6.3	5.22
5-Nov-13	< 1.0	0.49
3-Dec-13	< 1.0	0.63
7-Jan-14	< 1.0	0.24
4-Feb-14	< 1.0	0.32
4-Mar-14	1	0.45
1-Apr-14	6.6	5.19
8-Apr-14	9.6	6.52
15-Apr-14	9.1	11.1
22-Apr-14	14.6	7.12

sample_date	TOTAL SUSPENDED SOLIDS (mg/L)	TURBIDITY, LAB (NTU)
29-Apr-14	3.9	3.24
6-May-14	15.8	8.72
13-May-14	9	4.78
20-May-14	53.9	24.5
27-May-14	144	68.5
3-Jun-14	28.4	16.9
10-Jun-14	21.6	10.6
17-Jun-14	320	136
24-Jun-14	20.4	12.1
2-Jul-14	5.8	2.48
8-Jul-14	5.3	1.75
15-Jul-14		
15-Jul-14	3.7	1.65
22-Jul-14	1.7	1.9
29-Jul-14	2.4	0.68
5-Aug-14	< 1.0	0.53
2-Sep-14	1.8	0.78
7-Oct-14	< 1.0	0.5
4-Nov-14	9.1	9.79
3-Dec-14	1.7	1.19
6-Jan-15	1.7	0.47
3-Feb-15	< 1.0	0.26
3-Mar-15	1.7	0.53
10-Mar-15	2.1	1.09
16-Mar-15	29.7	18.9
23-Mar-15	4.5	2.09
30-Mar-15	10.2	6.69
8-Apr-15	4.3	1.81
15-Apr-15	2.2	1.03
22-Apr-15	10.6	3.78
29-Apr-15	17	8.88
5-May-15	9.6	5.84
6-May-15	13.4	5.83
12-May-15		
12-May-15	3	1.95
19-May-15		
19-May-15	3.8	2.42
26-May-15		
26-May-15	111	54
3-Jun-15		
3-Jun-15	47.1	28.5

sample_date	TOTAL SUSPENDED SOLIDS (mg/L)	TURBIDITY, LAB (NTU)
10-Jun-15	13.4	4.12
17-Jun-15	5.3	0.95
24-Jun-15	1.6	0.56
30-Jun-15	2.8	0.7
8-Jul-15	2.2	0.6
15-Jul-15	1.9	0.55
21-Jul-15	1.2	0.61
27-Jul-15	1.4	0.32
29-Jul-15	1.6	0.41
5-Aug-15	< 1.0	0.42
12-Aug-15	1.6	0.42
12-Aug-15		
19-Aug-15	1.6	0.69
19-Aug-15		
26-Aug-15	< 1.0	0.4
2-Sep-15	1.5	0.61
7-Oct-15	< 1.0	0.41
26-Oct-15	6.6	0.99
2-Nov-15	3.4	3.36
2-Nov-15		
4-Nov-15	< 1.0	0.85
9-Nov-15		
9-Nov-15	< 1.0	0.49
16-Nov-15	3.1	2.82
23-Nov-15	6.3	2.34
23-Nov-15		
1-Dec-15	15.3	3.48
2-Dec-15	1.7	0.64
6-Jan-16	< 1.0	0.27

E206437 - CM_WBE: T.E.H and EPH

sample_date	T.E.H (mg/L)	EPH (mg/L)
1/3/2008	19	
3/5/2008	130	
4/1/2008	57	
4/10/2008	3	
4/28/2008	14	
5/6/2008	2.1	
6/3/2008	23	
7/7/2008	0.53	
8/5/2008	9.5	
9/2/2008	51	
10/7/2008	0.23	
11/4/2008	1	
12/3/2008	25.4	
1/6/2009	4.2	
2/3/2009	1.28	
3/3/2009	10.5	
4/7/2009	17	
5/5/2009	18.6	
6/2/2009	27.7	
7/7/2009	2.74	
8/4/2009	385	
9/1/2009	20.9	
10/6/2009	11.8	
11/3/2009	16.6	
12/1/2009	10.1	
1/5/2010	39.4	
2/2/2010	27.8	
3/2/2010	7.92	
4/6/2010	4.3	
5/4/2010	20	
6/1/2010	8.65	
7/6/2010	20.9	
8/3/2010	4.92	
9/7/2010	16.9	
10/5/2010	4.47	
11/2/2010	15	
12/7/2010	2.42	
1/4/2011	3.34	
2/1/2011	12.7	
3/8/2011	83.77	
4/6/2011	0.5	
5/3/2011	2.25	
6/7/2011	3.78	
7/6/2011	0.6	

sample_date	T.E.H (mg/L)	EPH (mg/L)
8/2/2011	3.58	
9/6/2011	3.43	
10/4/2011	1.23	
11/1/2011	3.56	
12/6/2011	11.6	
1/4/2012	3.34	
2/8/2012	9.56	
3/6/2012	7.5	
4/4/2012	2.5	
5/1/2012	1.79	
6/5/2012	5.39	
7/4/2012	5.03	
8/8/2012	3.92	
9/4/2012	2.12	
10/2/2012	6.04	
12/4/2012	16.1	
1/3/2013	3.39	
2/6/2013	3.26	
3/6/2013	3.29	
4/2/2013	9.09	
5/7/2013	3.68	
6/4/2013	1.22	
7/2/2013	1.94	
8/6/2013	11.8	
9/3/2013	7.63	
10/1/2013	0.63	
11/5/2013	22.2	
12/3/2013	1.53	
1/7/2014	0.54	
2/4/2014	3.55	
3/4/2014	4.12	
4/1/2014	1.25	
5/6/2014	18.2	
6/3/2014	18.5	
7/9/2014	19.3	
8/5/2014	1.14	
9/2/2014	1.92	
10/7/2014	1.75	
11/4/2014	34	
12/3/2014	4.35	
1/6/2015	1.55	1.7
2/3/2015	2.02	2.29
3/3/2015	2.02	2.18
4/8/2015	2.27	2.5
5/6/2015	7.067	8.72

sample_date	T.E.H (mg/L)	EPH (mg/L)
6/3/2015		1.97
7/8/2015		1.39
8/5/2015		1.3
9/2/2015		0.5
10/7/2015		0.5
11/4/2015		1.4
12/2/2015		1.67

E206439 - CM_SEW: TSS, Lab Turbidity and BOD_5

Sample_date	BOD_5 (mg/L)	TOTAL SUSPENDED SOLIDS (mg/L)	TURBIDITY, LAB (NTU)
1/3/2008	4	10	
2/6/2008	17	15	
3/5/2008	7	12	
4/1/2008	2	7	
5/6/2008	< 2	11	
6/3/2008	< 2	6	
7/7/2008	< 2	14	
8/5/2008	< 2	18	
9/2/2008	< 2	25	
10/7/2008	< 2	12	
11/4/2008	< 2	9	
12/3/2008	< 5	11	
1/6/2009	7	21.3	
2/3/2009	9	23.6	
3/3/2009	17	9.3	
4/7/2009	< 5.0	5.7	
5/5/2009	< 5.0	12.9	
6/2/2009	< 5.0	< 3.0	
7/7/2009	< 5.0	< 5.0	
8/4/2009	347	7.6	
9/1/2009	< 5.0	11.3	
10/6/2009	< 5.0	< 3.0	
11/3/2009	< 5.0	< 3.0	
12/1/2009	< 2.0	< 3.0	
1/5/2010	< 5	< 3	
2/2/2010	< 5	< 3	
3/2/2010	< 5	7.1	
4/6/2010	< 5	6	

Sample_date	BOD_5 (mg/L)	TOTAL SUSPENDED SOLIDS (mg/L)	TURBIDITY, LAB (NTU)
5/4/2010	< 5	3.3	
6/1/2010	6.6	53	
7/6/2010	< 5	46	
8/3/2010	< 5	< 3	
9/7/2010	< 5	< 3	
10/5/2010	< 5	6.8	
11/2/2010	< 5	4.3	4.53
12/7/2010	< 5	13.8	
1/4/2011	< 5.0	< 3.0	
2/1/2011	< 5.0	< 3.0	
3/8/2011	< 2	7	
4/6/2011	< 2	6	
5/3/2011	< 5.0	3.5	
6/8/2011	6.2	30	
6/22/2011		20	
7/6/2011	5.6	48	
7/18/2011		45	
8/2/2011	< 5	58.7	
8/16/2011		47	
8/17/2011		13	
8/30/2011		10	
9/6/2011	< 5	18.7	
9/15/2011		36	
9/26/2011		36	
10/4/2011	< 5	23.7	
10/19/2011		8	
11/1/2011	< 5.0	14.2	
11/9/2011		32	
11/30/2011		30	
12/2/2011		54	
12/6/2011	< 5.0	< 3.0	
12/21/2011		4	
1/4/2012	< 5.0	< 3.0	
2/8/2012	< 5.0	6	
2/15/2012		< 3.0	
3/6/2012	< 5.0	5.2	
4/4/2012	< 5.0	5.7	
5/1/2012	< 5.0	< 3.0	
6/5/2012	< 5.0	< 3.0	
7/4/2012	< 5.0	< 3.0	
8/7/2012	< 5.0	3.2	
8/8/2012	< 5.0	3.2	
9/4/2012	< 5.0	< 3.0	
10/2/2012	< 5.0	< 3.0	
11/6/2012	< 5.0	< 3.0	

Sample_date	BOD_5 (mg/L)	TOTAL SUSPENDED SOLIDS (mg/L)	TURBIDITY, LAB (NTU)
12/4/2012	< 5.0	< 3.0	
1/3/2013	< 5.0	7.3	
2/6/2013	< 5.0	< 3.0	
3/6/2013	< 2.0	< 3.0	
4/2/2013	< 2.0	3.1	
5/7/2013	< 2.0	< 3.0	
6/4/2013	< 2.0	< 3.0	
7/2/2013	< 2.0	< 3.0	
8/6/2013	< 2.0	3.1	
9/3/2013	< 2.0	< 3.0	
10/1/2013	< 2.0	< 3.0	
11/5/2013	< 2.0	< 3.0	
12/3/2013	< 2.0	< 1.0	
1/7/2014	< 2.0	< 1.0	
2/4/2014	< 2.0		
3/4/2014	< 2.0		
4/1/2014	< 2.0		
5/6/2014	< 2.0		
6/3/2014	< 2.0		
7/2/2014	< 2.0		
8/5/2014	< 2.0		
9/2/2014	< 2.0		
10/7/2014	< 2.0		
11/4/2014	< 2.0		
12/3/2014	< 2.0		
1/6/2015	< 2.0		1.26
2/5/2015	< 2.0		0.19
3/3/2015	< 2.0		0.20
4/8/2015	< 2.0		0.17
5/6/2015	< 2.0		0.21
6/3/2015	< 2.0		0.55
7/8/2015	< 2.0		0.16
8/5/2015	< 2.0		0.14
9/2/2015	< 2.0		
9/21/2015	< 2.0		0.45
10/7/2015	< 2.0		0.13
11/4/2015	< 2.0		0.22
12/2/2015	< 2.0		0.22

E206437 - CM_WBE and E206439 - CM_SEW: Daily Flows

Sample_date	CM_SEW Daily Flow (m^3/day)	CM_WBE Daily Flow (m3/day)
1/3/2008	21.93	24.64
2/6/2008	28	
3/5/2008	28.1	
4/1/2008	24.42	24.43
5/6/2008	20.956	
6/3/2008	23.37	
7/7/2008	21.81	39.3
8/5/2008	19.96	37.84
9/2/2008	24.26	42.23
10/7/2008	18.72	43.5
11/4/2008	17.69	53.83
12/3/2008	19.68	26.36
1/6/2009	23.21	11.14
2/3/2009	18.29	31.96
3/3/2009	16.24	34.01
4/7/2009	28.6	55.61
5/5/2009	16	
6/2/2009	16	40.8
7/7/2009	14.91	40.86
8/4/2009	18.22	23.67
9/1/2009	20.8	35.3
10/6/2009	20.4	32.69
11/3/2009	19.1	39.99
12/1/2009	17.805	39.95
1/5/2010	15.57	
2/2/2010	15.15	39.75
3/2/2010	18.435	39.75
4/6/2010	18.117	39.67
5/4/2010	18.85	42.25
6/1/2010	2.18	52.84
7/6/2010	33.5	45.29
8/3/2010	18.465	42.47
9/7/2010	17.83	0.13
10/5/2010	0.163	27.64
10/27/2010		38.47
11/2/2010	0.174	48.96
12/7/2010	19.032	27.03
1/4/2011	22.007	18.14
2/1/2011	22.85	21.9
3/8/2011		24.67
4/6/2011	17.59	49.87
5/3/2011	17.86	

Sample_date	CM_SEW Daily Flow (m^3/day)	CM_WBE Daily Flow (m3/day)
6/7/2011		65.54
6/8/2011	18.091	
7/6/2011	16.825	67.43
8/2/2011	16.867	35.22
9/6/2011	16.196	60.76
11/1/2011	8.03	45.89
12/6/2011	14.167	26.8
1/4/2012	22.007	18.14
2/8/2012	18.64	37.26
3/6/2012	19.41	28.48
4/4/2012	16.076	38.62
5/1/2012	25.45	81.75
6/5/2012	19.537	72.84
7/4/2012	16.85	86.09
8/7/2012	15.11	63.65
8/8/2012		63.65
9/4/2012		55.92
9/4/2012	15.35	
10/2/2012	14.439	
10/2/2012		55.92
11/6/2012		60.75
11/6/2012	17.166	
12/4/2012	16.59	
12/4/2012		46.43
1/3/2013	11.57	
1/3/2013		25.75
2/6/2013		30.78
2/6/2013	16.22	
3/6/2013	16.21	
3/6/2013		42.12
4/2/2013	20.30	
4/2/2013		56.32
5/7/2013		71.29
5/7/2013	19.33	
6/4/2013	18.53	
6/4/2013		59.16
7/2/2013	22.14	
7/2/2013		55.36
8/6/2013	17.2	
9/3/2013	17.2	
9/3/2013		50.44
10/1/2013	18.10	53.19
11/5/2013	19.66	

Sample_date	CM_SEW Daily Flow (m^3/day)	CM_WBE Daily Flow (m3/day)
11/5/2013		44.26
12/3/2013	16.59	
12/3/2013		35.99
1/7/2014	21.67	
2/4/2014		23.5
2/4/2014	23.51	
3/4/2014	23.94	
3/4/2014		33
4/1/2014	23.53	
4/1/2014		33.14
5/6/2014	24.24	
5/6/2014		36.22
6/3/2014		23.38
10/7/2014	15.83	
10/7/2014		38.25
11/4/2014	18.66	
11/4/2014		39.57
12/3/2014	21.7	
12/3/2014		26.3
1/6/2015	15.9	20.48
2/3/2015		28.0
2/5/2015	13.59	
3/3/2015	19.65	
3/3/2015		43.3
4/8/2015	18.04	
4/8/2015		51.0
5/6/2015		32.86
5/6/2015	17.15	
6/3/2015		28.86
6/3/2015	16.62	
7/8/2015	12.88	
7/8/2015		29.41
8/5/2015	9.72	
8/5/2015		22.07
9/2/2015		30.86
9/21/2015	18.06	
10/7/2015	17.206	
10/7/2015		33.71
11/4/2015		31.71
11/4/2015	17.54	
12/2/2015		23.71
12/2/2015	16.94	