Nyrstar Myra Falls

Annual Environmental and Reclamation Report

2014

This report addresses the annual reporting requirements for Effluent Permit PE-06858, submitted to the Ministry of Environment and the Annual Reclamation Report submitted to the Ministry of Energy and Mines for Mine's Act permit M-26.

Nyrstar Myra Falls Annual Environmental Report for 2014

Submitted on March 31, 2015 for the annual reporting requirements of:

- Effluent Permit PE-06858 for the Ministry of Environment; and
- *Mine's Act* Permit M-26 for the Ministry of Energy and Mines.

Contacts:

François Tremblay, General Manager

250-287-9271 (3279)

Francois.Tremblay@nyrstar.com

Nicole Pesonen, Environmental Manager

250-287-9271 (3316)

Nicole.Pesonen@nyrstar.com

EXECUTIVE SUMMARY

Myra Falls is a 525,000 tonne per year base metal mine located at the south end of Buttle Lake on Vancouver Island, 90 km southwest of the city of Campbell River. The mining and milling operation produces zinc, copper and lead concentrates with silver and gold credits. Myra falls is a wholly owned subsidiary of Nyrstar, a European-based company with corporate offices in Zurich, Switzerland.

This annual report details the environmental monitoring activities at Myra Falls for 2014, and fulfills the annual reporting requirements of the Ministry of Environment and the Ministry of Energy and Mines.

Water quality monitoring in 2014 showed higher than average concentrations of metals in both the water treatment system effluent and the receiving environment in the second half of the year. Very low creek volume and higher effluent loadings lead to the increase in substance concentrations in Myra Creek in the summer and fall. Infrastructure deterioration lead to higher concentrations than in previous years, updates and repairs and maintenance began in earnest in December 2014, and is ongoing.

Major environmental and construction projects in 2014 were focused on dam raise projects. The annual Lynx dam raise which has increased the height of the impoundment berm to allow for sufficient paste tailings storage capacity until April 2016, including adequate storm surge capacity plus freeboard requirements. Construction of the 2014 Lynx Dam raise focused on two aspects: 1) construction of a Spring Drain designed to convey water springing from exposed bedrock north of the TDF through the dam; 2) the placement of additional fill to raise the main dam 5.5 m to a minimum elevation of 3404.3 m. An estimated 64,470 m^3 of PAG mine waste was used during this construction phase. Spring Drain construction began in September and concluded in November. This involved encapsulating clean drainage and filter material in a geo-membrane, and surrounding these conveyance layers with J-material, a mixture of reclaim sand and mine waste. Approximately 2,510 m^3 of clean coarse filter material, 2,459 m^3 clean fine filter material, and 2,085 m^3 of clean drain rock were used in the construction of the Spring Drain. A 4:1 buttress along the Lynx TDF East Arm was also constructed in 2014.

Construction began in 2014 to raise the dam in Jim Mitchell Lake, providing increased water storage and hydro power capacity and thereby reducing the demand on diesel power generation.

Upgrades to the upper portion (0+000 to 0+225) of the Lower Lynx Diversion Ditch were completed in December. This involved excavating waste to subgrade material within the expanded footprint, placing a geo-membrane liner on top of subgrade, rip-rap to a minimum thickness of 1 m on the liner, and 6 inch-minus clean fill on top of the rip-rap for trafficability. Approximately 5,600 m^3 of NAG construction material was used to upgrade the Lower Lynx Diversion Ditch in 2014. The remainder of the diversion ditch will be upgraded in 2015, increasing the Inflow Design Flood (IDF) to a minimum of one third between a 1:1000 year flood event and the Probable Maximum Flood (PMF).

Additional geotechnical stability analyses based on the requirements that came from the Mount Polley tailings dam failure will inform upgrades to current mine infrastructure. Upgrades to the water management system are being permitted.

The interim closure plan for the Old TDF will be submitted to the Ministry of Energy and Mines By December 2016. A comprehensive site-wide closure plan will be submitted to the Ministry by December 2017.

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1.0 Introduction

1.1 Scope of Report

Myra Falls is a 525,000 tonne per year base metal mine located at the south end of Buttle Lake on Vancouver Island, 90 km southwest of the city of Campbell River. The mining and milling operation produces zinc, copper and lead concentrates with silver and gold credits. Myra falls is a wholly owned subsidiary of Nyrstar, a European-based company with corporate offices in Zurich, Switzerland.

The following report details the environmental monitoring activities at Myra Falls for 2014. The report was prepared to fulfill the annual reporting requirements of the Ministry of Environment and the Ministry of Energy and Mines. The report contains:

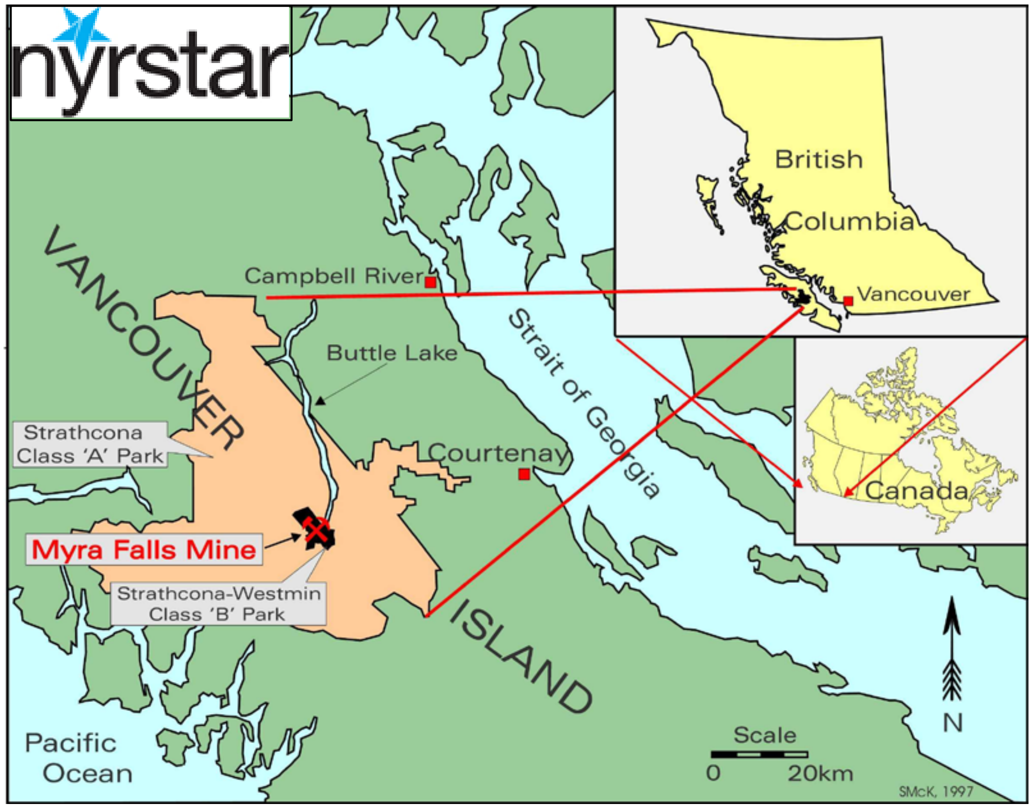
- An annual review and interpretive report required under Section 3.6 of effluent permit PE-06858 - issued under the provisions of the Environmental Protection Act and administered by the Ministry of Environment, plus ad-hoc reporting requirements;
- Monitoring results required under provisions of *Mine's Act* Permit M-26, administered by the Ministry of Energy and Mines; and,
- The Annual Reclamation Report required under the *Mine's Act* Permit M-26, administered under the Ministry of Energy and Mines.

This report includes, but is not limited to: a summary of all required effluent and receiving environment monitoring data and interpretation for permits PE-06858 and M-26; a summary of spills, floods and/or other unusual events occurring on site in 2014; a discussion on the changes in the environment resulting from mining activity; and a projection of significant activities planned for 2015.

1.2 Nyrstar Myra Falls Site Overview

Myra Falls is located at the south end of Buttle Lake on Vancouver Island within the Strathcona Provincial Park Class 'B' boundary (Figure 1-1). The mining and milling operation produces zinc, copper and lead concentrates with silver and gold credits. Ore concentrate is trucked to a port terminal in Campbell River where it is shipped to refining smelters around the world. The mine has been operating since 1966 and as of December 31st 2014, directly employs 364 people.

Figure 1-1 Nyrstar Myra Falls Location



Nyrstar is an integrated mining and metals business based in Europe with corporate offices in Zurich, Switzerland, with market leading positions in zinc and lead, and growing positions in other base and precious metals. The company has mining, smelting, and other operations located in Europe, the Americas, China and Australia. Nyrstar is listed on NYSE Euronext Brussels under the symbol NYR. Nyrstar Myra Falls (NMF) is a wholly-owned subsidiary of Nyrstar.

1.2.1 Land Tenure

The Myra Falls mining operation occupies a footprint of 198.7 ha within Strathcona-Westmin Provincial Park. The park was partitioned from the Strathcona 'Class A' Provincial Park in 1965 and designated as a ‘Class B’ provincial park due to industrial activity. Strathcona-Westmin ‘Class B’ Provincial Park covers the area permitted for the mine to carry out its mining operations. The land was given special designation due to its mineral values and the decision by the provincial government to allow exploration and mining in this area. Mining began in 1966 and will continue as long as reserves and commodity prices permit. The property extends over parts of Phillips Ridge, Myra Valley, Mount Myra, Thelwood Valley and Price Valley.

The 3,328 ha area of Strathcona-Westmin ‘Class B’ Provincial Park is held as crown grants, mining leases and claims, issued under the *Mine’s Act* by the Ministry of Energy and Mines (MEM).

The mine property is comprised of 5 Crown-granted mining leases, 23 Crown-granted mineral rights and 44 mining claims, all wholly owned by Nyrstar Myra Falls Ltd. – see Table 1-1 and Table 1-2.

Table 1-1 Grants & Mining Leases in Myra Valley and Phillips Ridge

Crown Grants	Mining Leases
L1671, L1670, L1669, L1668, L1667, L1666, L1665, L1664, L1663, L1661, L1660, L1659, L1340, L1341, L1342, L1344, L1345, L1346, L1347, L1971, L1972, L1973, L1974	Lease 26 (201320) Lease 27 (201321) Lease 28 (201322) Lease 29 (201323) Lease 51 (201324)

Table 1-2 Mineral Claims in Thelwood Valley

Mineral Claims
201366, 201367, 201368, 201369, 201370, 201371, 201372, 201373, 201374, 201375, 201376, 201377, 201378, 201379, 201380, 201381, 201403, 201404, 201405, 201406, 201407, 201408, 201409, 201410, 201411, 201412, 201413, 201414, 201415, 201459, 201460, 201461, 201462, 201463, 201464, 201465, 201486, 201487, 201488, 201491, 201492, 201493, 201494, 201495

Myra Falls also operates under Park Use Permits issued by BC Parks. These permits authorize the use of 'Class B' parklands for mining, power generation, power transmission and roads. The current land use in the Myra Valley is for mining and mining-related purposes.

1.2.2 Regional Environmental/Ecological Conditions

1.2.2.1 Location and Topography

The footprint of the Nyrstar Myra Falls mine site straddles the Myra Valley and the lower reaches of Myra Creek. Myra Creek flows from west to east through a steep-sided hanging valley and discharges over Myra Falls into Buttle Lake. Three main tributaries feed Myra Creek within the site boundaries: Tennent Creek and Webster Creek from the south side and Arnica Creek from the north side. Also draining from the north side is the Lynx Diversion Ditch, an engineered water channel which runs along the northern perimeter of the site, diverting clean water away from the waste rock piles and tailings impoundment facilities.

The slopes of Myra Valley climb steeply with an average gradient of 1.5H:1V. To the south, the slope rises to 1814 m at the summit of Mount Myra from the average valley bottom elevation of 307 meters above sea level (MASL). Topography in the area exerts a strong influence on air mass movement and wind directions. Winds blow predominantly along the axis of the Myra Valley. At night, air masses are drawn down the mountains, continue along the valley floor and out over Buttle Lake. During the day, winds up cast along the mountainsides with air masses typically moving up the valley. Wind velocities at Nyrstar Myra Falls are generally low, typical of sites in protected valleys.

1.2.2.2 Myra Creek Drainage System

Myra Creek has a total length of 16 km and drains an area of 72 km^2 into Buttle Lake. Myra Creek and its tributaries are characterized by steep, cascading mountain streams bounded by rock. The creek descends in elevation from 1,814 m to 221 m at Buttle Lake. Its three major tributaries are Tennent Creek, Arnica Creek and Webster Creek.

Myra Creek flow is monitored at the "Car Bridge" (see Figure 1 in Appendix 1) with a pressure transducer and data logger system. The system logs creek-stage measurements at 15 minute intervals. Stage measurements are converted to flow using a stage-discharge curve calculation. See Table 25 in Appendix II for calculated Myra Creek flows in 2014.

1.2.2.3 Climate

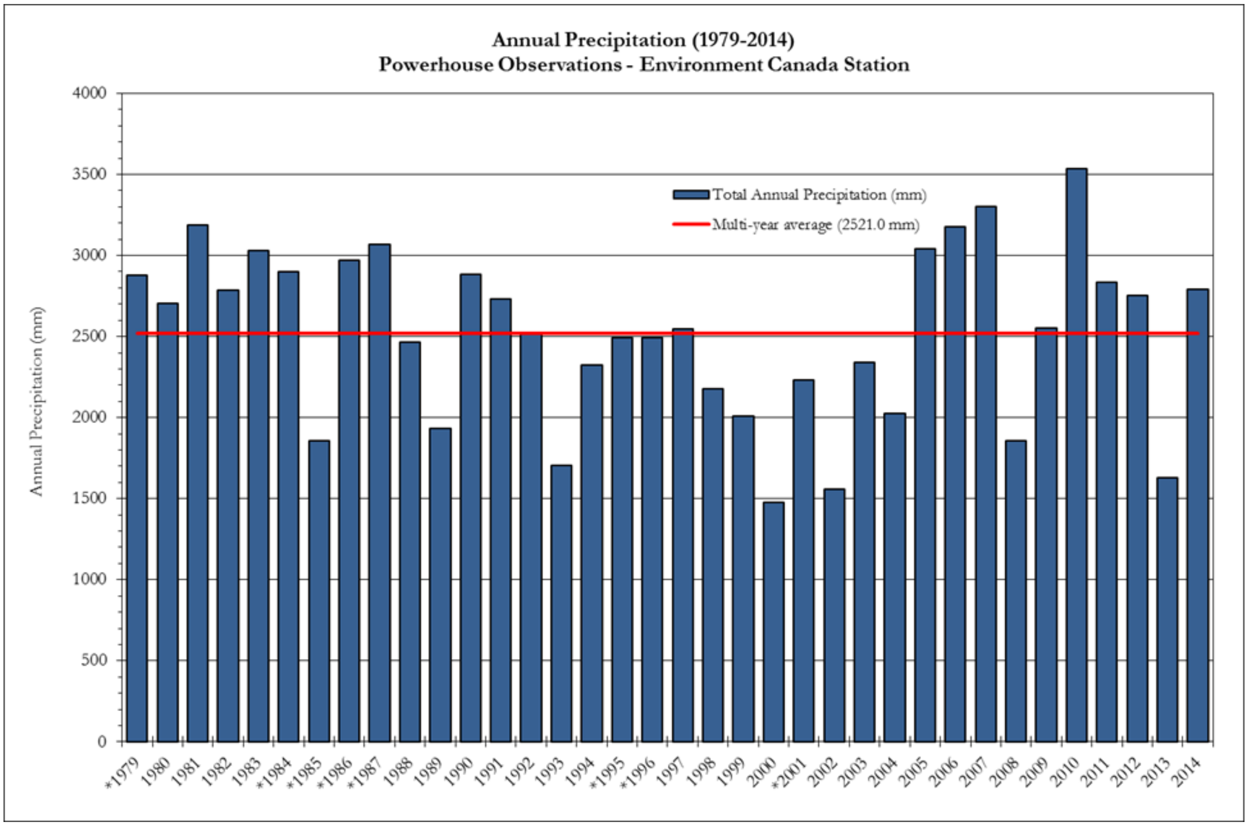
The climate in the Myra Valley and surrounding areas is classified as Marine West Coast as per the Köppen Climate Classification System. Weather patterns are typical of other coastal regions of British Columbia. Frequent fronts from the Pacific Ocean and Gulf of Alaska combine with orographic influences to produce abundant precipitation. Prevailing westerly winds and the moderating influence of the Pacific Ocean result in generally mild winters and warm summers, producing a relatively narrow annual temperature range. Freezing conditions can be expected to occur anytime from October through May. Records indicate that the site should average 160 frost-free days per year.

Myra Falls has been operating an Environment Canada weather station since 1979. The weather station is located outside the Powerhouse at approximately 360 MASL.

An automated weather station/data logger is used in conjunction with the Powerhouse weather station. This data is used for storm event logging, as the monitoring equipment records data with greater frequency and precision.

The total precipitation for 2014 was 2,790.6 mm as recorded at the Powerhouse. This is slightly higher than the annual average of 2,521 mm (based on 36 years of precipitation data). Refer to Figure 1-2 below.

Figure 1-2 Annual Precipitation (1979-2014) from Powerhouse Observations



1.2.2.4 Vegetation

The Myra Valley lies within a Coastal Western Hemlock (CWH) biogeoclimatic zone. Characteristic floristic features of zonal ecosystems in the CWH are: the prominence of western hemlock, the sparse herb layer, and the predominance of several moss species. The CWH zone is divided into 10 subzones which reflect the influence of the regional climate, based on variations in precipitation and continentality. The Ministry of Forests, Lands and Natural Resource Operations has classified the Myra Valley as *CWHmm1*, the submontane moist maritime subzone of the greater CWH biogeoclimatic zone. It is represented by the following species:

- Tree layer: Douglas fir (*Pseudotsuga menziesii*), western hemlock (*Tsuga heterophylla*), amabilis fir (*Abies amabilis*);

- Shrub layer: Alaskan blueberry (*Vaccinium alaskaense*), red huckleberry (*Vaccinium parvifolium*), salal (*Gaultheria shallon*);
- Herb layer: vanilla leaf (*Achlys triphylla*), bunchberry (*Cornus canadensis*), twinflower (*Linnaea borealis*);
- Moss layer: step moss (*Hylocomium spendens*), flat moss (*Plagiothecium undulatum*), lanky moss (*Rhytidiadelphus loreus*).

Reclamation and revegetation efforts will focus on restoring the ecosystem to reflect its native representative species. This will specifically involve planting pioneering woody and shrub species, and allowing for gradual natural ecosystem succession.

1.2.2.5 Wildlife

The Columbian black-tailed deer (*Odocoileus hemionus columbianus*) is the most common ungulate in the area. Deer use of Myra Valley is concentrated in south-facing areas with available forage. In general, exposed south-facing slopes have been recognized as valuable winter deer habitat on Vancouver Island. However, due to excessive snow accumulation, most of the Myra Valley does not support wintering deer.

Although not often seen in the Myra Valley, a stable herd of Roosevelt elk (*Cervus elaphus roosvelti*) is often observed in Thelwood Valley. Black bears (*Ursus americanus*), wolves (*Canis lupus crassodon*) and cougars (*Felis concolor vancouverensis*) are the other large mammals most likely to occupy the area. Small mammals observed in Myra Valley include American marten (*Martes americana caurina*), red squirrel (*Tamiascuirius hudsonicus*) and deer mice (*Peromyscus maniculatus*). Although presumed extirpated, the Vancouver Island wolverine (*Gulo gulo vancouverensis*) may also be present.

The Vancouver Island marmot (*Marmota vancouverensis*), a red-listed, critically imperiled species, has established colonies at Flower Ridge (8 kilometers southeast of the mine) and Marble Meadows (14 kilometers north of the mine).

Myra Creek is a low productivity, creek due to its cold water and steep gradient. The Lower Myra Falls also prevent the upstream migration of fish from Buttle Lake. As such, the cutthroat trout population is relatively low, and fish are found mainly upstream of the mine site in shady protected areas. The trout population in Myra Creek is vulnerable to extreme weather events, such as the flood in November 2006, when fish were flushed into Buttle Lake. However, subsequent fish population surveys have indicated that the population is gradually returning to pre-flood levels.

1.2.2.6 Geology and Geomorphology

Most of Vancouver Island is underlain by rocks of the Insular Belt of the Canadian Cordillera. The lower portion of this sequence has now been documented as having moved northwards under the influence of plate tectonics. At the base of this sequence is the Sicker Group, considered to be the oldest stratigraphic unit on Vancouver Island. It outcrops along the central spine of the island where it has been faulted upwards through younger rock sequences. It is within the Sicker Group, in a volcanic assemblage of rocks called the Myra Formation, that the ore deposits of Myra Falls are located.

These ore deposits occur in two stratigraphic horizons, termed the Lynx-Myra-Price horizon and the HW horizon (Figure 3-3). Both horizons are associated with volcanic rhyolite rocks and their derivatives. The ore deposits formed during a period of crustal rifting and volcanism and are genetically described as volcanogenic massive sulphide deposits. These deposits often exhibit complex metal zonation. Individual ore lenses vary significantly in metal content and zonation, lens shape and overall size. The principal sulphide minerals are: pyrite, sphalerite, chalcopyrite and galena, with minor amounts of tennantite and bornite. Secondary copper minerals may be locally significant.

Bedrock in the Myra Valley is overlain by a variety of glacial deposits laid down during and after the Fraser glaciation, which occurred from 29,000 to 13,000 B.P. At the height of this glaciation, a continuous ice sheet covered the area to a minimum elevation of 1300 m above sea level. Basal till, deposited in Myra Valley by the advancing glacier front, is uniform, and characterized as a massive, unsorted deposit composed of volcanic clasts within a silty sand to sand matrix. In the early stages of deglaciation, a lake formed on the valley floor, and glaciolacustrine clay, silt and fine sand were deposited over the basal till. These sediments have been intersected in drill holes - the thickest intersections at mid-valley - in the middle and downstream half of the tailings disposal facility (TDF). As melt water volumes increased, coarser glaciofluvial sand and gravel was deposited over the lake sediments. The thickest glaciofluvial deposits, up to 35 m thick, are found at the upstream end of the TDF.

The most recent post-glacial deposits have resulted from the weathering and/or mass wasting of glacial deposits and bedrock. A significant deposit, composed of silty sand and angular rock fragments, is found in the Lynx Mine area. This deposit may be the result of a landslide or may be a late glacial terminal moraine. Other recent mass wasting processes include rock slides, rock falls, debris flows and avalanches. These processes have produced numerous colluvial fans at the base of the valley slopes.

1.2.3 Regional Management Plan

The Master Plan for Strathcona Provincial Park was approved in 1993 and defines land use and development for areas adjacent to Strathcona-Westmin Provincial Park. Accordingly, the Strathcona-Westmin Master Plan (approved in 1995), must recognize the direction and constraints that the Strathcona Provincial Park Master Plan places on land use and ensure that the actions specified in this plan have a minimal effect on Strathcona Provincial Park. The goal of this Master Plan is to accommodate the mine and, at the same time, protect the natural resources and provide recreation opportunities within the Park.

Strathcona-Westmin is a unique situation as no other provincial park contains an operating mine, and it is expected that the mine will operate for the foreseeable future. Nyrstar Myra Falls is committed to continuing a cooperative working relationship with BC Parks in meeting the Park's conservation and recreation goals. As an active participant in management of the Park the mine operator acknowledges the special responsibilities of operating in a provincial park, and is committed to carrying out its general mining activities in a manner which is appropriate in a sensitive area. As portions of the Park are no longer needed for mining activities, they will be added progressively to Strathcona Provincial Park.

BC Parks has the overall responsibility for managing the lands within the Park, however several branches of government have authority to issue orders to Nyrstar Myra Falls. The administration of regulations affecting the mine and mining operations involves the cooperation of many agencies including the Ministry of Energy and Mines, Ministry of Environment, Department of Fisheries and Oceans, and Environment Canada. Through their enabling legislation, each of these agencies has jurisdiction over the mine site.

1.2.4 Infrastructure and Site Components

A general site plan is presented in Figure 1 in Appendix I. The present land use for the Myra Valley is for mining and mining-related activities. Some mining activities also occur in the Thelwood Valley. The Nyrstar Myra Falls operations consist of: an underground mine, the HW mine complex, the Phillips' Reach ramp, the inactive Myra, Price and Lynx underground mines, a concentrating mill, office buildings and laboratory, camp facilities, two hydro-electric generating systems, a diesel powerhouse, two tailings disposal facilities (the "TDF" and the "Lynx TDF"), a lime addition water treatment system, a potable water treatment system, paste plant, backfill plant and associated facilities.

1.2.4.1 Roads

Access to the mine site is via a 90 km paved road from the city of Campbell River. The 40 km section from the Gold River junction to the mine site ("Westmin Road") is jointly maintained by the mine and the Ministry of Transportation, and allows public access into the center of Strathcona Park. The mine also maintains the Jim Mitchell Road, a gravel road that provides access to the Thelwood Power Station, to the Jim Mitchell and Thelwood lakes, and to BC Parks' hiking trails.

1.2.4.2 Buildings

No buildings were added or removed in 2014.

1.2.4.3 Tennent and Thelwood Power Stations

A small dam was constructed on Tennent Lake in the 1960's to provide water storage for the 3.0 MW Tennent Power Station which is located near the confluence of Tennent and Myra creeks. The water is conveyed from Tennent Lake to the power station via a penstock.

The Thelwood Power Station is located in Thelwood Valley immediately southeast of Myra Valley. Water to the 8.2 MW Thelwood Power Station is fed via a penstock from Jim Mitchell Lake. The facility has been in operation since the early 1980's and was commissioned to meet power requirements following the discovery of the HW Mine.

Backup diesel generators are situated in the Powerhouse building located adjacent to the Mill. These generators are used to supplement hydro-electricity, particularly during those periods when reservoir levels are low in Jim Mitchell Lake and Tennent Lake.

1.2.4.4 Power Lines

A number of overhead and underground power lines distribute power across the property. The main power line runs overhead from the Thelwood hydro-power station through the Price 13 level adit to the HW mine site. A second line runs from the Tennent Power Station alongside the Tennent Road to the mill complex.

1.2.4.5 Tailings Disposal Facilities

From 1967-1984 tailings were deposited sub-aqueously into the south end of Buttle Lake. From 1984 the mine has utilized a surface tailings disposal facility (TDF) for its tailings impoundment. In 2008, a newly constructed Lynx TDF became the main depositional facility for tailings and waste rock, replacing the old TDF which is now at full capacity. Presently, the Lynx TDF has storage capacity for approximately 10 years of production at current rates. A flow sheet detailing the tailings disposal system can be found in Figure 2 in Appendix I.

1.2.4.6 Lime Addition Water Treatment System

The water treatment system at Myra Falls collects and treats contaminated groundwater, surface runoff, mill effluent, tailings decant water, mine water and sewage treatment plant effluent. Contaminated water is directed to the primary reaction pond, the Superpond, where the pH is increased to 10-10.5 through the addition of lime slurry ($Ca(OH)_2$). The elevated pH causes metals to become insoluble and precipitate out of solution primarily as metal hydroxide sludge. The Superpond effluent discharges into the Myra Polishing Pond system, consisting of a series of 6 settling ponds and a CO_2 pH adjustment system that allow any remaining suspended solids to precipitate out of solution. The treated water is then discharged to Myra Creek via a 30" Parshall flume equipped with an ultrasonic device that continuously monitors flow rates. A flow sheet detailing the water treatment system can be found in Figure 3 in Appendix I.

In 2014, an estimated 446,400 kg of lime was used in the water treatment system. Environmental lime use is estimated by assigning 30% of the total annual site (mill) lime consumption to the water treatment system. A CO_2 injection system installed upstream of the final discharge location automatically reduces pH, if necessary, prior to discharge. Final effluent pH is monitored continuously to maintain a pH of less than 9.5 as per the federal Metal Mining Effluent Regulations.

The operation continues to reclaim approximately 15% of the treated effluent for mill use. This amounted to 1.83 million m^3 during 2014.

1.3 Exploration, Mining & Milling Activities in 2014

1.3.1 Exploration Summary

Exploration at Myra Falls was increased in 2014 with the focus put on diamond drilling and drill platform development. Exploration diamond drilling totalled 21,000 meters which resulted in the extensions of lenses discovered and developed in 2013 at the west end of the deposit (the Battle-Gap and Ridge West zone, see Figures 1-3 and 1-4. An additional 18,000 meters of operational diamond drilling was carried which further assisted in resource addition. The surface ramp was extended to re-access the Lynx mine workings which provided additional drill platforms in the west. The Price mine, located at the east end of Myra Falls was brought into production in 2014. This ongoing development will also gain access to new drill platforms. In addition to diamond drilling, two research initiatives were established in 2014. The first is a gold occurrence investigation carried out by Simon Fraser University, and the second is a PhD project with CODES from University of

Tasmania at Hobart which will focus on the litho-structural setting of the recently discovered west lenses.

Figure 1-3 Distribution of known ore lenses at Myra Falls

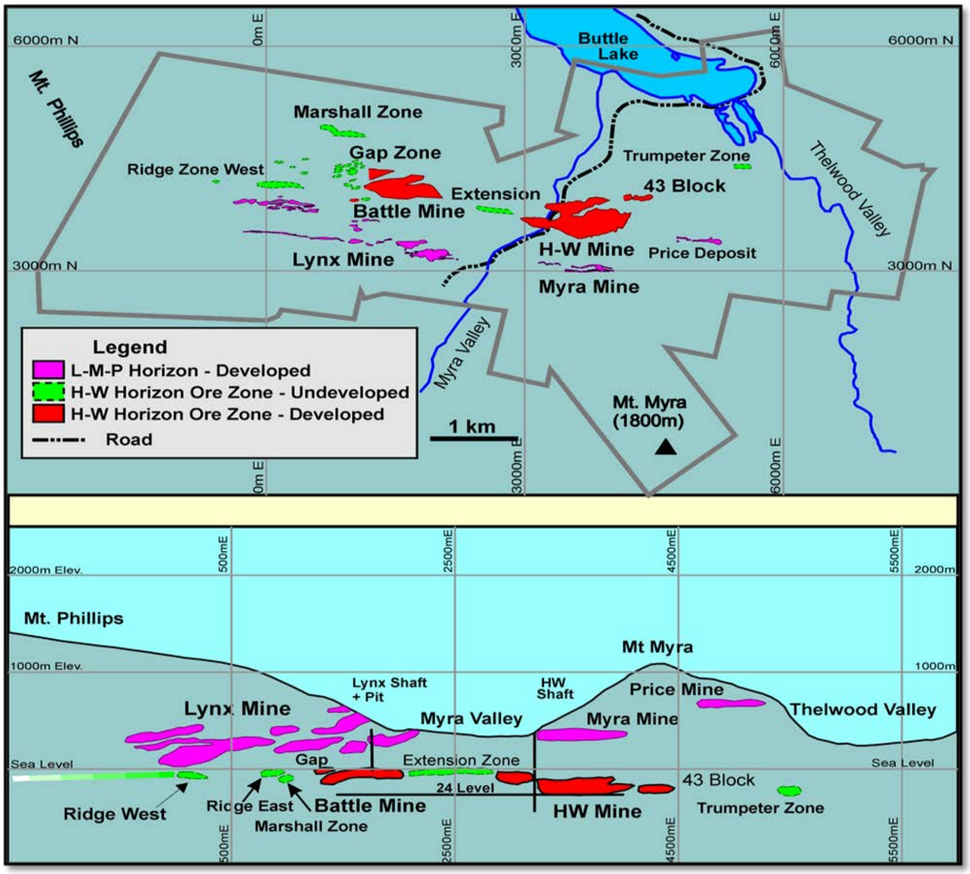
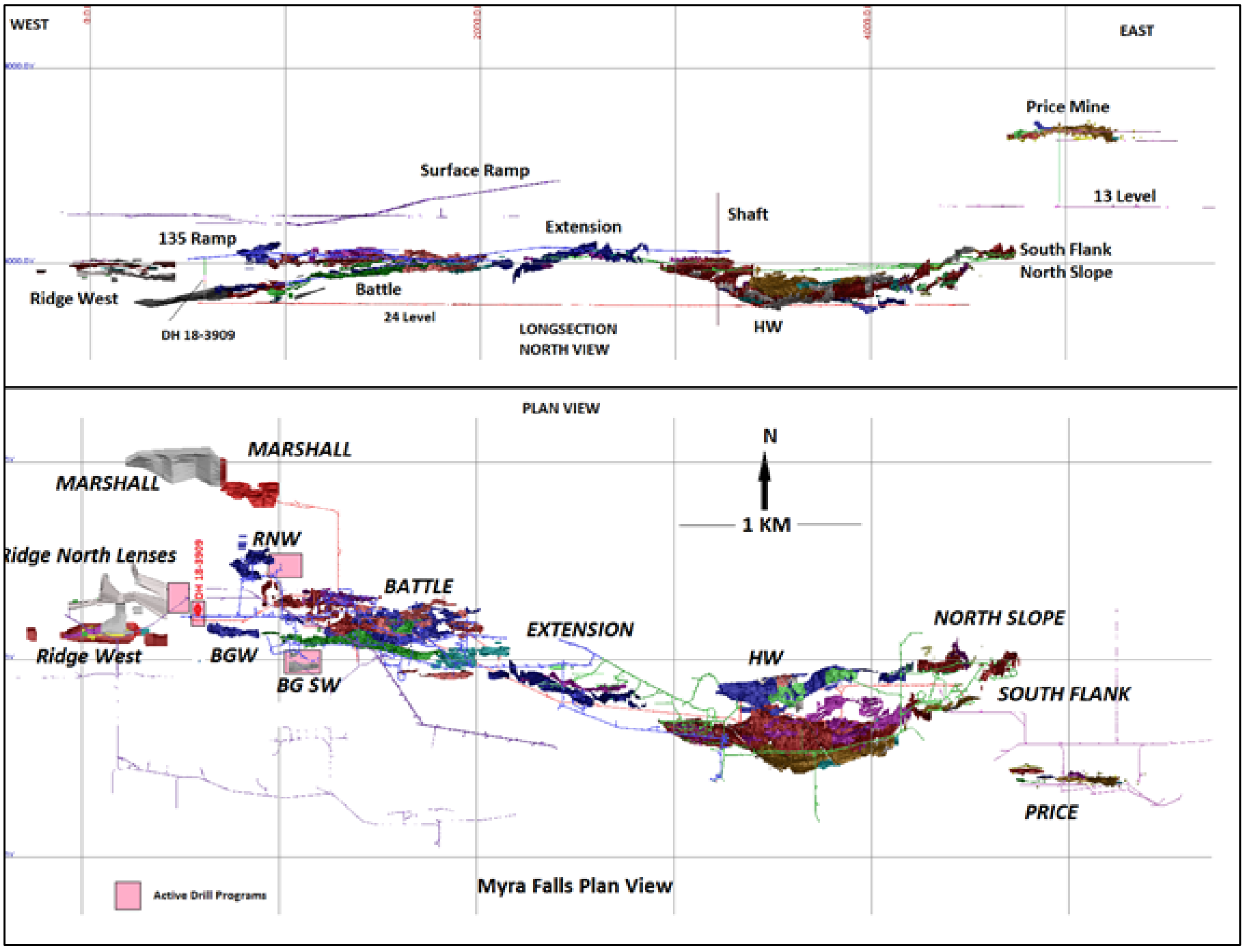


Figure 1-4 Updated Model Depicting Known Ore Bodies at Myra Falls



1.3.2 Mining Summary

In 2014, 463,766 tonnes of ore were run through the mill concentrator. The Battle mine produced 65 % of the material while the HW and Extension zone contributed 33 %. The price mine was brought into operation in 2014, representing 2% of the mill feed. Waste hoisted to surface amounted to 110,000 tonnes.

Production for 2015 is targeting 525,000 tonnes with major development planned in two new areas, Ridge West, and West Block.

1.3.3 Milling Summary

Ore is processed through a milling facility that separates and concentrates the ore into four metal products: a zinc concentrate, a copper concentrate, a lead concentrate and a free gold product. In 2014, the mill processed 465,680 tonnes of ore with average grades of 6.45% zinc, 0.71% copper, 0.69% lead, 2.05 g/t gold and 94.33 g/t silver.

The mill produced zinc concentrate averaging 52.24% zinc, copper concentrate averaging 22.23% copper, and lead concentrate averaging 32.45% lead. Both the copper and lead concentrate contained significant gold and silver credits. Total concentrate production was 51,123 tonnes of zinc concentrate, 10,434 tonnes of copper concentrate and 4,578 tonnes of lead concentrate. Mill recoveries for zinc, copper and lead were 88.91%, 70.56% and 46.50% respectively. Table 1-3 provides a summary of mill production including cumulative production statistics since start-up (cumulative lead statistics are not available).

Table 1-3 Mill Production Summary

	2014	2013	2012	Mine Life Total
Ore Milled (tonnes)	465,680	523,122	521,824	30,823,751
Number of operating days	240	302	308	15,590
Average tonnes / per operating day	1,669	1,732	1,694	1,977
Grade of Ore:				
Gold (g/t)	2.05	1. 54	1.22	1.54
Silver (g/t)	94.33	57.89	43.44	47.67
Copper (%)	0.71	0.88	0.96	1.62
Zinc (%)	6.45	5.91	6.88	5.42
Lead Concentrate				
Tonnes	4,578	2,881	3,288	NA
Lead Grade (%)	32.45	32.96	34.91	NA
Lead Recovery (%)	46.50	33.82	41.38	NA
Copper Concentrate:				
Tonnes	10,434	14,132	16,024	1,688,897
Copper Grade (%)	22.23	23. 00	23.47	25.24
Copper Recovery (%)	70.56	70.73	75.08	85.59
Zinc Concentrate:				
Tonnes	51,132	51,247	58,735	2,776,525
Zinc Grade (%)	52.24	53.46	54.42	53.21
Zinc recovery (%)	88.91	88.65	89.04	88.47

2.0 Water Quality Monitoring

The water quality monitoring program at Myra Falls fulfills the monitoring requirements of several different regulatory agencies. The monitoring programs of the Ministry of Environment and the Ministry of Energy and Mines are described in the following section[1]. Maps of the water quality monitoring sites can be found in Figures 4, 5 and 6 in Appendix I.

2.1 Water Quality Monitoring for Effluent Permit PE-06858

The water quality monitoring program for effluent permit PE-06858 (issued by the Ministry of Environment) includes effluent sampling, receiving environment sampling (including Buttle Lake), as well as reference and untreated mine flow sampling. Depending on sampling requirements, water samples are taken at frequencies from daily to quarterly. Sampling results discussed in this section are organized and based on the effluent permit monitoring requirements only. Refer to effluent permit PE-06858 for details.

The Ministry of Environment has requested that receiving environment sample results be compared to the BC Water Quality Guidelines for Freshwater Aquatic Life (WQGs) for the following parameters: total zinc, total copper, dissolved aluminum, total and dissolved iron, total cadmium, dissolved sulfate and nutrients. In instances where a receiving environment sample result has exceeded the applicable guideline in Myra Creek or Buttle Lake, 10-year charts were prepared to show the changes in parameter concentration over time for monitoring locations downstream of the exceeded parameter.

Most of the water quality samples have been taken at a frequency of less than 5 times in 30 days, and therefore a comparison to the 30-day average (chronic) water quality guideline is not directly applicable. However, the chronic guideline has been included in the charts for reference.

[1] All chemical parameter results are reported in mg/L (unless otherwise noted).

Parameters that exceed permit limits and/or the BC Water Quality Guidelines (in the receiving environment) are highlighted in bold within the data tables.

2.1.1 Reference Site Monitoring – Myra Creek (MC-M1)

Background water quality, upstream of all mining and mining-related activity, is established through samples taken at the reference sample site "M1". M1 is sampled quarterly and results are presented in Table 2-1 below. The Environmental Management System ID (EMS-ID) for this site is 0124784.

The calculated WQGs for this station and all other downstream receiving environment stations (at the request of the Ministry of Environment) are based on the average annual hardness of 14.1 mg/L (N=4).

Table 2-1 Myra Creek, M-1 Water Quality Monitoring Summary for 2014

	pH	T-Zn	D-Zn	T-Al	D-Al	T-Cu	D-Cu	T-Fe	D-Fe	T-Pb	D-Pb
Max WQG	**6.5-9.0**	**0.033**	**n/a**	**n/a**	**0.1**	**0.003325**	**n/a**	**1**	**0.35**	**0.006744**	**n/a**
2/12/14	7.8	0.00020	0.00012	0.0329	0.0328	0.000143	0.000131	0.0049	0.0035	0.000009	<0.0000050
5/27/14	7.4	0.00013	<0.00010	0.0408	0.0395	0.000100	0.000126	0.0088	0.0067	0.000007	<0.0000050
8/19/14	6.9	0.00114	0.00029	0.0195	0.0270	0.000646	0.000166	0.0049	0.0011	0.000075	0.0000110
11/12/14	6.6	0.00086	0.00054	0.0349	0.0283	0.000727	0.000343	0.0061	0.0025	0.000251	0.0000223

All parameters monitored under permit PE-06858 were below the applicable WQGs for 2014.

2.1.2 Myra Ponds Effluent Monitoring

Treated effluent is discharged from a point source location ("MP-EFF") and is monitored for a number of parameters at various frequencies. Some analyses, such as daily total zinc and copper, are handled in-house, while the majority of the samples are sent to Maxxam Analytics Ltd for chemical analyses and to Nautilus Environmental for LC_{50} bioassays.

Effluent pH and flow are continuously monitored through an automated system, with quality control checks performed by operational personnel every 6 hours. Daily average and maximum effluent pHs and effluent flow volumes are shown in Table 1 in Appendix II. No effluent pHs exceeded the limits set out in PE-06858 in 2014. The maximum daily authorized effluent discharge rate (110,000 m^3/day) was exceeded on December 9 and 10 due to heavy precipitation events.

Effluent is sampled daily with a Sigma SD900 composite auto-sampler, which takes samples every 3 hours (8 sub-samples per day). Weekly, monthly and quarterly water quality samples are taken as grab samples (with the exception of weekly composite copper samples). The samples are sent off-site for analyses of total suspended solids (TSS), total and dissolved metals by ICP-MS, sulfate, nitrogen, phosphorus and acute toxicity (96-hr rainbow trout LC_{50}).

Certain effluent parameters are subject to discharge limits under PE-06858, including: TSS, pH, total and dissolved metals (copper, zinc, cadmium and lead) and toxicity. The effluent discharge limits can be found in the effluent quality tables below and in Section 1.1.2 of effluent permit PE-06858.

The Myra Ponds effluent discharge EMS-ID is E100666.

2.1.2.1 Effluent Quality

In April 2008, the lime addition system of the water treatment system was changed from manual to automatic. The “auto-lime” addition system allows the lime slurry volume to be continuously adjusted based on the inflow pH.

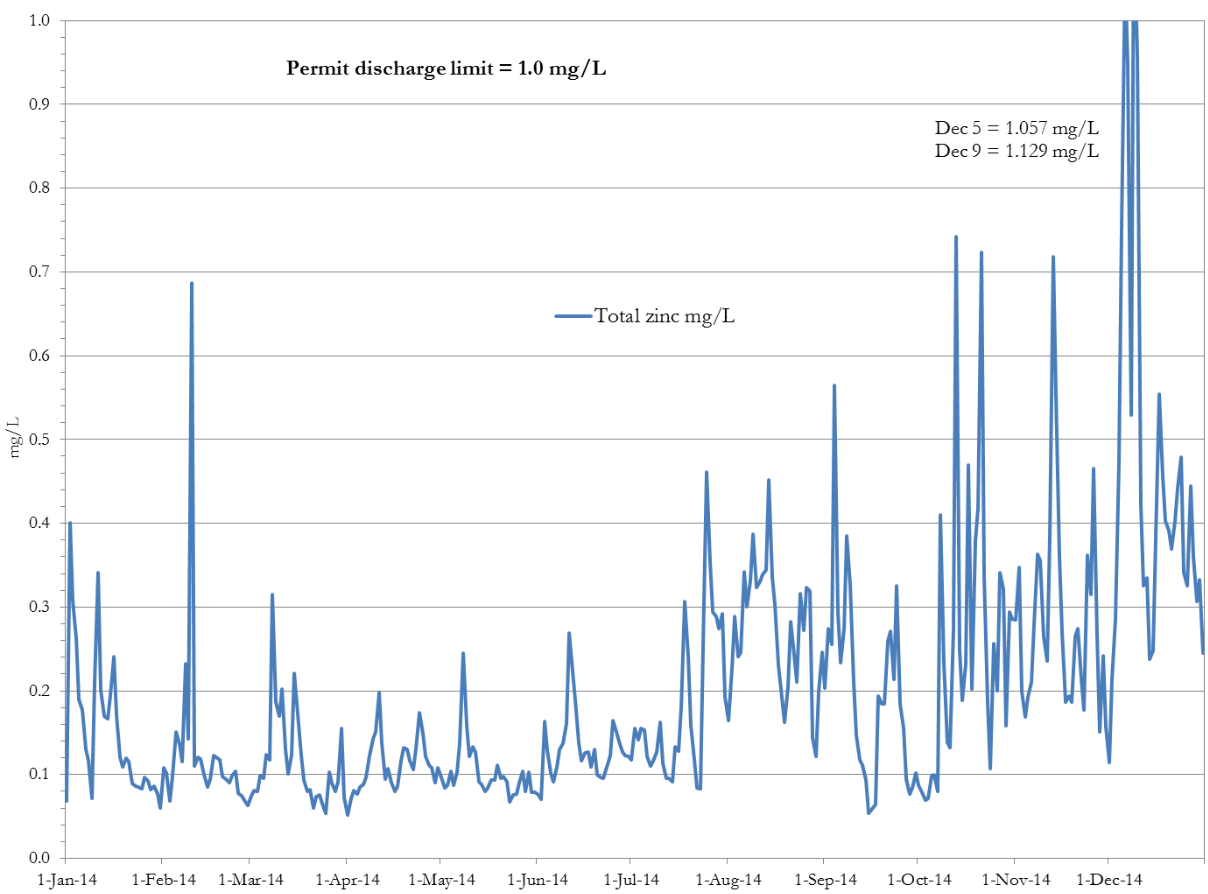
Water quality monitoring in 2014 showed higher than average concentrations of metals in both the water treatment system effluent and the receiving environment in the second half of the year. Very low creek volume and higher effluent loadings lead to the increase in substance concentrations in Myra Creek in the summer and fall. Infrastructure deterioration lead to higher concentrations than in previous years, updates and repairs and maintenance began in earnest in December 2014, and is ongoing.

There were two non-compliance events in which the permitted effluent discharge limits were exceeded in 2014. Refer to Section 2.3 for information on non-compliance events and reportable spills. All other effluent parameters were within the permitted discharge limits, and no samples were missed.

2.1.2.2 Daily Composite Effluent Sampling

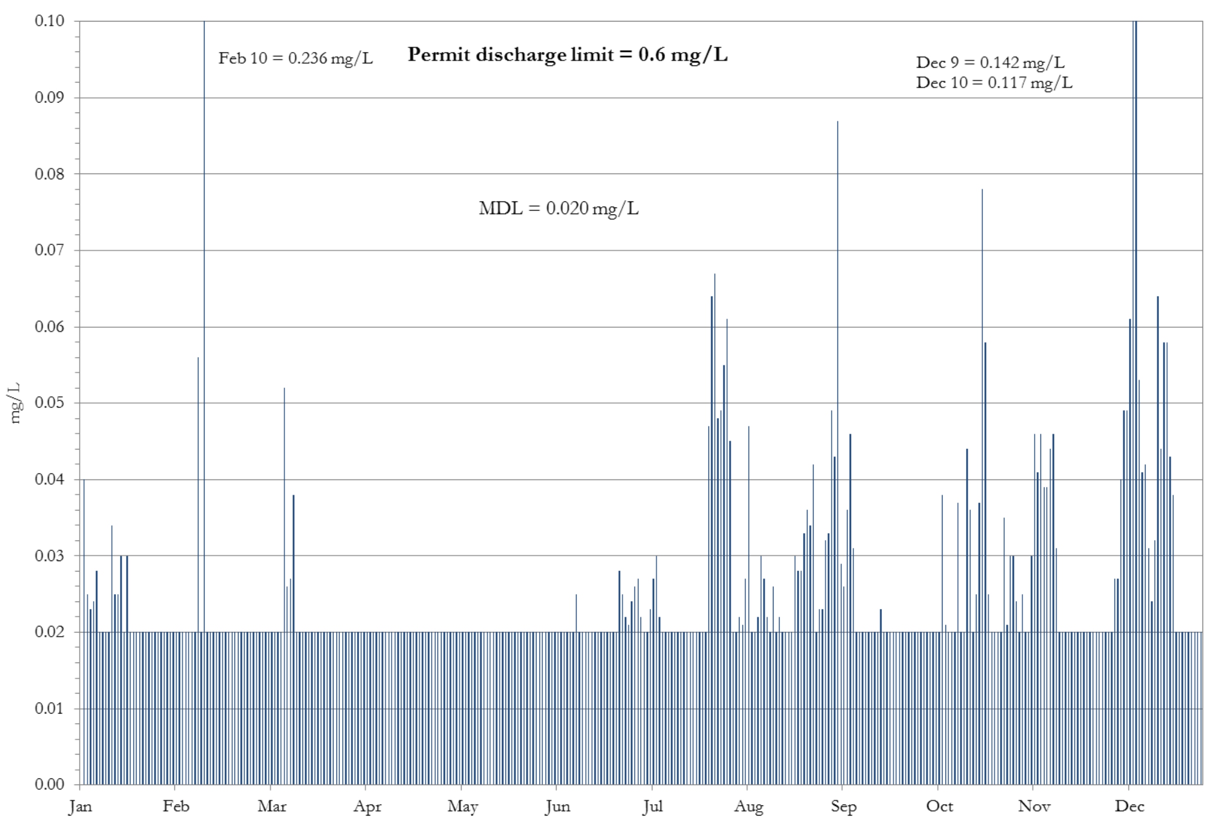
Daily composite sampling of total zinc and total copper are analyzed in-house with an atomic absorption (AA) spectrophotometer. Results are presented in Table 1 in Appendix II. All results were well below the permitted discharge limit of 1.0 mg/L for total zinc and 0.6 mg/L for total copper with the exception of the December 6 and 9 daily zinc results (see Section 2-3). Daily zinc results are presented in Figure 2-1. The figure shows zinc levels increasing slightly during the fall due to increased precipitation. In general, additional flow in the water treatment system results in less retention time and lower overall performance. High sludge volumes in the ponds, numerous intermittent power issues and lime addition problems contributed to higher metal concentrations in the effluent in the latter part of the year.

Figure 2-1 Myra Ponds Effluent Daily Composite Samples – Total Zinc



Due to the AA's relatively high method detection limit for copper (MDL = 0.020 mg/L), and the relatively low concentration of copper in most daily samples, most results were reported as less-than-detect, or <0.020 mg/L. Starting January 2, 2013, at the request of the Ministry of Environment, total and dissolved copper are collected as weekly composites using subsamples from the daily composite samples. Results are presented in Table 2-2. In-house analysis of daily composites for total copper was retained and results are presented in Figure 2-2. While the same increasing concentration pattern is apparent in the copper composites as in the daily zinc concentrations over time in 2014, all daily total copper levels remain below the permitted discharge limit of 0.6 mg/L.

Figure 2-2 Myra Ponds Effluent Daily Composite Samples – Total Copper



2.1.2.3 Weekly, Monthly and Quarterly Effluent Samples

The treated effluent is sampled on a weekly basis for total and dissolved copper and total lead. Copper is collected as described above, as a weekly composite, while lead is collected as a weekly grab sample. The weekly composite samples include daily samples collected Wednesday through the following Tuesday of each week. Total and dissolved copper are subject to a discharge limit of 0.6 mg/L and 0.2 mg/L respectively under PE-06858. No weekly composite copper samples exceeded either discharge limit in 2014. The total lead samples have remained as weekly grab samples. There is no discharge limit for total lead under PE-06858 (see Table 2-2 – the dates reflect the day the composite samples were collected and sent to Maxxam Analytics, and is the day of the weekly grab sample for lead).

The average annual total copper value was 0.017 mg/L and the dissolved value was 0.005 mg/L, well below the copper discharge limits (0.600 mg/L and 0.200 mg/L for total and dissolved respectively).

Table 2-2 Weekly Effluent Grab Sample Results, 2014

	T-Cu Comp.	D-Cu Comp.	T-Pb Grab		T-Cu Comp.	D-Cu Comp.	T-Pb Grab
Permit Limit (mg/L)	**0.60**	**0.20**	**n/a**		**0.60**	**0.20**	**n/a**
1/02/14	0.0081	0.0025	0.0032	7/02/14	0.0139	0.0074	0.0042
1/08/14	0.0156	0.0110	0.0095	7/08/14	0.0199	0.0094	0.0020
1/15/14	0.0138	0.0037	0.0035	7/17/14	0.0115	0.0063	0.0029
1/23/14	0.0080	0.0042	0.0041	7/24/14	0.0093	0.0044	0.0018
1/30/14	0.0076	0.0046	0.0078	7/31/14	0.0286	0.0248	0.0014
2/05/14	0.0112	0.0039	0.0015	8/06/14	0.0149	0.0102	0.0015
2/12/14	0.0609	0.0036	0.0037	8/14/14	0.0233	0.0137	0.0138
2/19/14	0.0071	0.0028	0.0030	8/20/14	0.0124	0.0058	0.0038
2/26/14	0.0064	0.0027	0.0034	8/28/14	0.0212	0.0154	0.0020
3/05/14	0.0068	0.0032	0.0017	9/04/14	0.0245	0.0145	0.0028
3/12/14	0.0195	0.0035	0.0016	9/11/14	0.0291	0.0127	0.0020
3/19/14	0.0108	0.0040	0.0051	9/18/14	0.0095	0.0057	0.0037
3/26/14	0.0069	0.0015	0.0021	9/25/14	0.0144	0.0067	0.0082
4/02/14	0.0099	0.0027	0.0010	10/02/14	0.0138	0.0044	0.0014
4/09/14	0.0094	0.0040	0.0019	10/08/14	0.0058	0.0026	0.0158
4/15/14	0.0120	0.0039	0.0007	10/15/14	0.0141	0.0055	0.0021
4/23/14	0.0089	0.0025	0.0004	10/23/14	0.0392	0.0029	0.0101
4/30/14	0.0073	0.0039	0.0018	10/30/14	0.0169	0.0029	0.0187
5/07/14	0.0061	0.0025	0.0017	11/06/14	0.0218	0.0045	0.0223
5/14/14	0.0058	0.0022	0.0035	11/13/14	0.0387	0.0037	0.0080
5/22/14	0.0060	0.0019	0.0190	11/20/14	0.0223	0.0030	0.0052
5/28/14	0.0078	0.0028	0.0023	11/26/14	0.0273	0.0032	0.0059
6/03/14	0.0059	0.0027	0.0013	12/03/14	0.0390	0.0023	0.0099
6/11/14	0.0095	0.0027	0.0019	12/10/14	0.0568	0.0034	0.0357
6/18/14	0.0112	0.0046	0.0011	12/17/14	0.0356	0.0017	0.0062
6/25/14	0.0086	0.0029	0.0020	12/23/14	0.0348	0.0025	0.0065
				12/30/14	0.0232	0.0038	0.0023

The effluent is sampled monthly for total suspended solids, dissolved zinc and dissolved lead. No monthly grab sample taken in 2014 exceeded permit discharge limits (see Table 2-3); however a weekly grab sample taken under the Metal Mining Effluent Regulations (MMER) exceeded the TSS limit set out in PE-06858 on February 5. See Table 2-18 in Section 2.3 for details.

Table 2-3 Monthly Effluent Grab Sample Results, 2014

	TSS	D-Zn	D-Pb
Permit Limit (mg/L)	**25**	**0.5**	**0.05**
1/30/14	<4.0	0.0485	0.0000420
2/12/14	<4.0	0.0544	0.0000330
3/19/14	<4.0	0.0362	0.0000350
4/30/14	4.2	0.0925	0.0000360
5/27/14	<4.0	0.1200	0.0000200
6/18/14	<4.0	0.0758	0.0000160
7/09/14	<4.0	0.0365	0.0000130
8/19/14	<4.0	0.1580	0.0000610
9/16/14	<4.0	0.0215	0.0001970
10/08/14	<4.0	0.1350	0.0003480
11/12/14	5.5	0.0563	0.0000367
12/16/14	10.0	0.2150	0.0000188

The effluent is sampled on a quarterly basis for total and dissolved cadmium, acute lethality (toxicity), dissolved sulfate, total nitrogen and total phosphorus. Dissolved cadmium and toxicity are subject to limits under PE-06858, however no sample exceeded these limits in 2014 (Table 2-4). All rainbow trout 96-hour LC_{50} test results were >100% vol/vol.

Table 2-4 Quarterly Effluent Grab Sample Results

	T-Cd mg/L	D-Cd mg/L	Toxicity (96-hr RBT LC_{50}) % vol/vol	D-SO4 mg/L	T-N mg/L	T-Phos mg/L
Permit Limit	**n/a**	**0.005**	**100%**	**n/a**	**n/a**	**n/a**
2/12/14	0.000488	0.000269	>100	259	2.9	0.005
5/12/14	0.000306	0.000234	>100	369	4.7	0.004
8/19/14	0.000849	0.000681	>100	276	1.4	0.003
11/12/14	0.000727	0.000443	>100	306	1.7	0.004

2.1.2.4 Effluent Flow Monitoring

Effluent flow is monitored continuously by a 30" Parshall flume with an ultrasonic flow measuring device. The total volume discharged is recorded every 24 hours from a flow totalizer (from 6:30 am to 6:30 am). Flow through the water treatment system is generally associated with precipitation and therefore shows seasonal variability. Table 2-5 shows the average, minimum and maximum flows recorded each month. The maximum permitted discharge rate for effluent is 110,000 m^3/day. This rate was exceeded on December 9 and 10, 2014 due to a heavy rainfall event (see Table 1 in Appendix II for daily effluent volumes). This was communicated with the Ministry and authorization was granted. There were other occasions where the instantaneous discharge rate was seen to approach 110,000 m^3/day, but not was not actually exceeded. These events were also communicated to the Ministry. See Table 2-18 in section 2-3 for additional details.

Table 2-5 Monthly Effluent Volumes Summary, 2014

Flow (m3/day)	Monthly Average	Monthly Min	Monthly Max	Monthly Total
Jan	30,633	22,420	58,901	949,610
Feb	27,691	18,864	39,833	775,338
Mar	35,607	25,001	55,468	1,103,821
Apr	31,619	26,430	42,396	948,574
May	29,604	27,122	32,441	917,709
Jun	28,955	23,902	33,694	868,639
Jul	26,389	19,256	29,553	818,055
Aug	24,764	22,450	29,071	767,682
Sep	24,078	18,982	38,510	722,343
Oct	45,475	22,613	91,270	1,409,739
Nov	42,547	21,240	102,511	1,276,408
Dec	53,335	25,651	132,115	1,653,399
Annual	33,456	18,864	132,115	12,211,317

The authorized rate of discharge is an annual average of 48,000 m^3/day. The 2014 annual average effluent flow rate was 33,456 m^3/day. In 2014, the total annual effluent flow volume was 12.2 million m^3, lower than the 2012 total (13.0 million m^3), but higher than the 2013 total (11.3 million m^3).

2.1.3 Receiving Environment - Myra Creek below Pump House #4 (MC-TP4)

The sampling site "TP4" in Myra Creek is monitored daily for total zinc and copper and monthly for a number of other parameters. The TP4 sample site reflects water quality in Myra Creek immediately downstream of most mining and mining-related activity. Metal concentrations at TP4 are primarily affected by groundwater flow beneath the TDF and changes in creek volume due to rainfall and/or freshet.

The TDF new outer drain system and pump house were commissioned in February 2008. The new outer drain system was designed to intercept seeps flowing from the base of the TDF that were not adequately captured by the old Inner and Outer drains. Drain water is conveyed to the pump house by gravity where it is then pumped to the water treatment system.

The new outer drain system consists of three independent lines of different lengths, referred to as the Long, Medium and Short drains. These lines can be opened separately or in combination, and the degree to which each line is open can also be controlled. Since 2008, there has been a marked improvement in water quality at TP4 demonstrating that the new drainage collection system has been effective at capturing contaminated groundwater emanating from the TDF. The relationship between pumping rates, gate valve positions and water quality continues to be evaluated for optimal performance under a range of creek and weather conditions.

The EMS-ID for TP4 is E206805. No samples were missed in 2014.

2.1.3.1 Daily Composite Samples at TP4

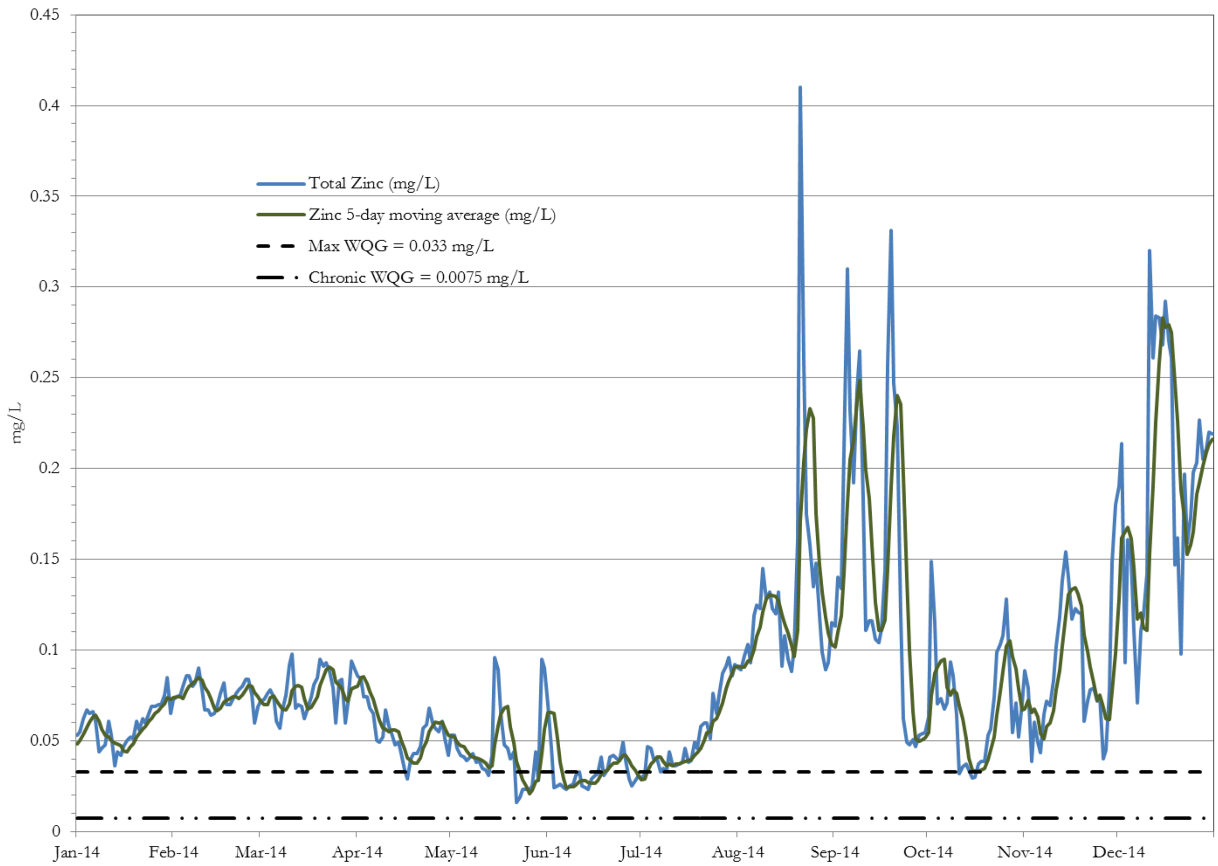
Daily composite samples at TP4 are collected using a Sigma 900 autosampler, with one sample taken every 3 hours. Each daily sample is a composite of 8 daily sub-samples. The samples are analyzed in-house for total zinc with an atomic absorption spectrophotometer (AA). Results are presented in Table 2 in Appendix II. No daily composite samples were missed during 2014, however after the heavy rainfall event of December 9/10, the autosampler stopped functioning, and the December 10-31 samples were taken as grab samples.

At the request of the Ministry of Environment, analytical results for the receiving environment that exceed the BC Water Quality Guidelines for Freshwater Aquatic Life (WQGs) are to be noted and presented separately in a chart. These parameters are to be presented in an additional chart that displays 10 years of data for year over year comparison. Where possible, both the maximum (acute) and 30-day average (chronic) guidelines are shown as dashed lines on the charts. This is for reference only, as not all samples were taken at the appropriate frequency for direct comparison with the chronic guideline (requires a minimum of 5 samples to be taken within 30 days). For the TP4 sampling site, only the daily samples have sufficient data for comparison, all other sample results will be compared to the maximum guideline, as the majority of the samples are taken on a monthly basis.

Some WQGs are calculated using hardness. In previous years, average ambient hardness was site specific, providing unique water quality guideline values at each sampling location. For the 2012, 2013 and 2014 annual reports, the average background (M1) hardness was used for all locations. This relatively low hardness value has created WQGs that are more conservative than in previous years, and therefore concentrations exceeding water quality guidelines do not necessarily indicate a site specific acute toxic effect or chronic impact over time.

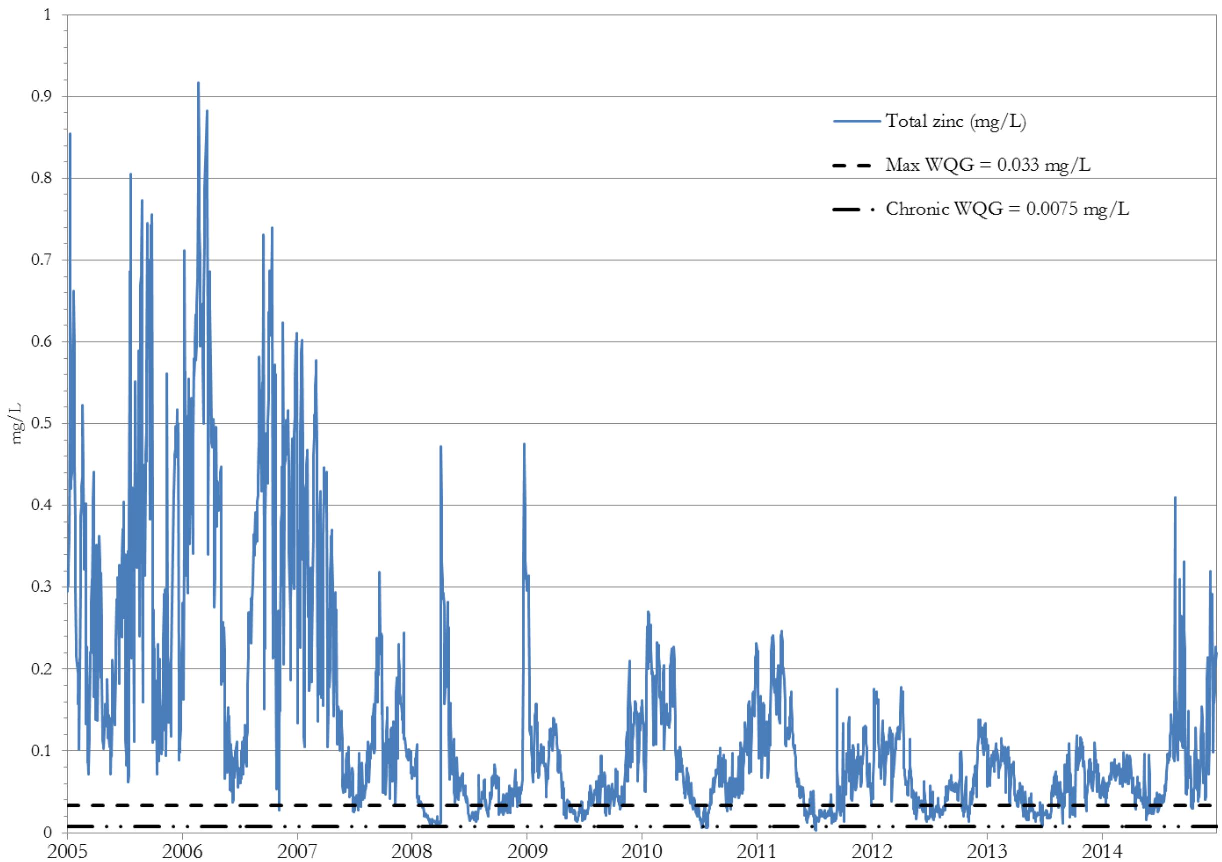
Figure 2-4 presents daily zinc results for 2014 with a 5-day moving average that can be compared to the 30-day chronic guideline for zinc (0.0075 mg/L). The maximum guideline of 0.033 mg/L is provided for reference.

Figure 2-3 Daily Composite Results for Zinc at TP4 with 5-Day Moving Average



The 5-day moving average for zinc consistently exceeds the 30-day average guideline, and 90.4% of the values also exceed the maximum guideline. A 10-year chart was prepared for multi-year comparison (Figure 2-4).

Figure 2-4 Total Zinc at TP4 2005-2014, Daily Composite Samples



The 10 year chart for TP4 daily zinc values shows improvement in downstream water quality since 2008. This is due to the installation of the new outer drain system and commissioning of the new pump house which have been successful at capturing seeps from the TDF that were not previously captured by the old drain system. Despite the improvements to water quality in recent years, zinc concentrations in Myra Creek frequently exceed both the acute and chronic WGQs.

The increase in zinc concentration seen in Myra Creek in the latter half of 2014 is a result of increased metal concentrations in the effluent (discharged upstream of TP4), and of numerous intermittent power outages throughout the year, especially in the summer months. Large-scale power outages shut down the pumps in the Pumphouse #4, and therefore the TDF under drains need to be shut in order to prevent flooding of the pumphouse. TDF groundwater is not able to be captured during under drain closures, and seeps into Myra Creek, resulting in higher metal concentrations.

2.1.3.2 Weekly Composite Samples at TP4

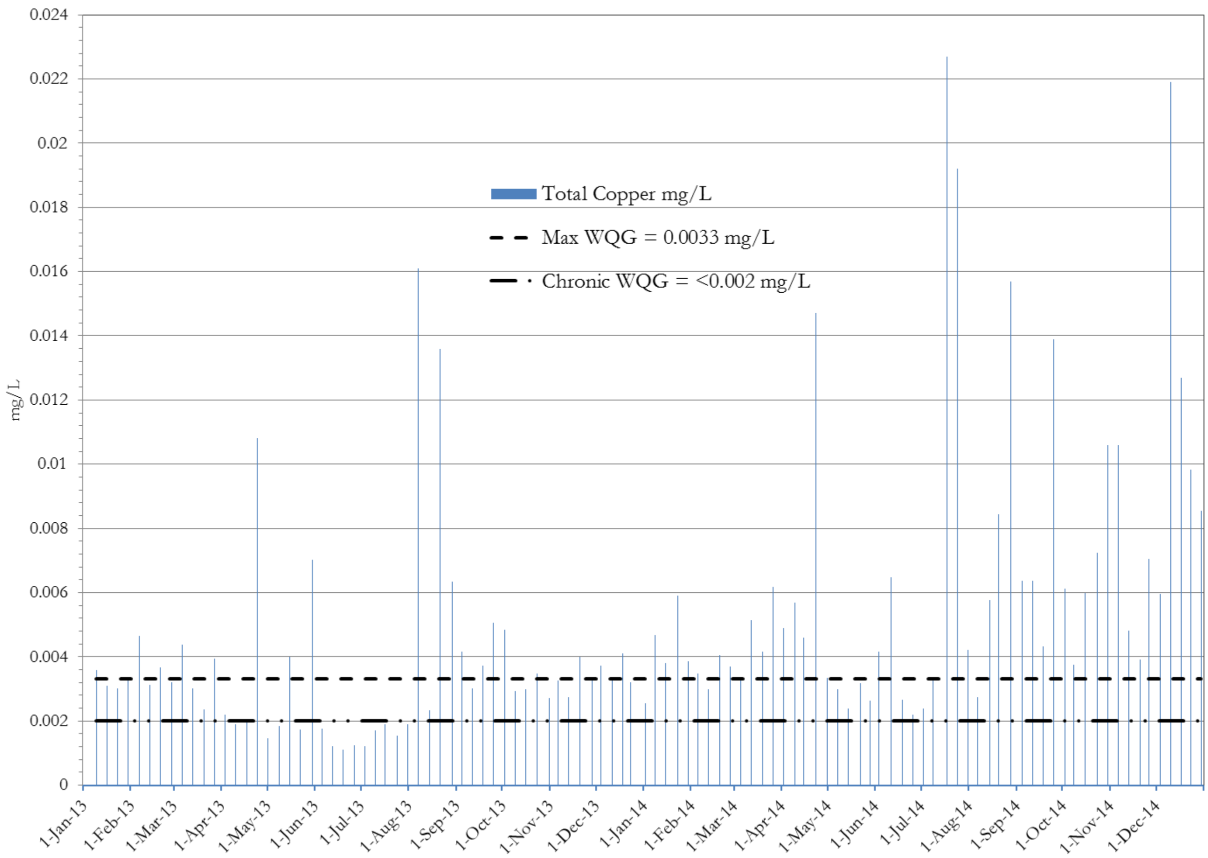
Since January 2013, weekly composite copper samples have been taken in lieu of daily copper samples at TP4. The detection limits on the AA are too high for environmental copper, resulting in daily copper values of <0.020 for the entire year. The new weekly composite copper samples (comprised of 7 daily composite samples) are sent to the outside lab for analysis on the ICP-MS. Results are shown in Table 2-6 and Figure 2-5. Water quality exceeded the acute WQG of 0.003325 mg/L in 83% of the samples, and exceeded the chronic WQG of <0.002 mg/L in 100% of the samples.

Table 2-6 TP4 Weekly Composite Samples for Total and Dissolved Copper

	T-Cu Comp.	D-Cu Comp.		T-Cu Comp.	D-Cu Comp.
WQG (mg/L)	**0.0033/<0.002**	**n/a**		**0.0033/<0.002**	**n/a**
1/02/14	**0.0026**	0.0024	7/02/14	**0.0024**	0.0020
1/08/14	**0.0047**	0.0044	7/08/14	**0.0033**	0.0026
1/15/14	**0.0038**	0.0034	7/17/14	**0.0227**	0.0115
1/23/14	**0.0059**	0.0037	7/24/14	**0.0192**	0.0090
1/30/14	**0.0039**	0.0034	7/31/14	**0.0042**	0.0029
2/05/14	**0.0035**	0.0025	8/06/14	**0.0027**	0.0024
2/12/14	**0.0030**	0.0022	8/14/14	**0.0058**	0.0038
2/19/14	**0.0040**	0.0030	8/20/14	**0.0085**	0.0046
2/26/14	**0.0037**	0.0024	8/28/14	**0.0157**	0.0081
3/05/14	**0.0034**	0.0028	9/04/14	**0.0064**	0.0034
3/12/14	**0.0051**	0.0040	9/11/14	**0.0064**	0.0034
3/19/14	**0.0042**	0.0036	9/18/14	**0.0043**	0.0025
3/26/14	**0.0062**	0.0036	9/25/14	**0.0139**	0.0064
4/02/14	**0.0049**	0.0037	10/02/14	**0.0061**	0.0033
4/09/14	**0.0057**	0.0054	10/08/14	**0.0037**	0.0027
4/15/14	**0.0046**	0.0031	10/15/14	**0.0060**	0.0048
4/23/14	**0.0147**	0.0072	10/23/14	**0.0072**	0.0051
4/30/14	**0.0033**	0.0028	10/30/14	**0.0106**	0.0077
5/07/14	**0.0030**	0.0027	11/06/14	**0.0106**	0.0067
5/14/14	**0.0024**	0.0022	11/13/14	**0.0048**	0.0033
5/22/14	**0.0032**	0.0028	11/20/14	**0.0039**	0.0030
5/28/14	**0.0026**	0.0021	11/26/14	**0.0071**	0.0050
6/03/14	**0.0042**	0.0031	12/03/14	**0.0060**	0.0047
6/11/14	**0.0065**	0.0037	12/10/14	**0.0219**	0.0028
6/18/14	**0.0027**	0.0042	12/17/14	**0.0127**	0.0089
6/25/14	**0.0022**	0.0018	12/23/14	**0.0098**	0.0065
			12/30/14	**0.0085**	0.0056

Bold	exceeds chronic guideline (0.002 mg/L)
Bold (shaded)	exceeds acute guideline (0.003 mg/L)

Figure 2-5 Weekly Composite Sample Results for Total Copper at TP4, 2014



Collection of the weekly composite copper sample commenced in January 2013, and therefore only two years of data are available. Because of this, a 10-year chart could not be developed.

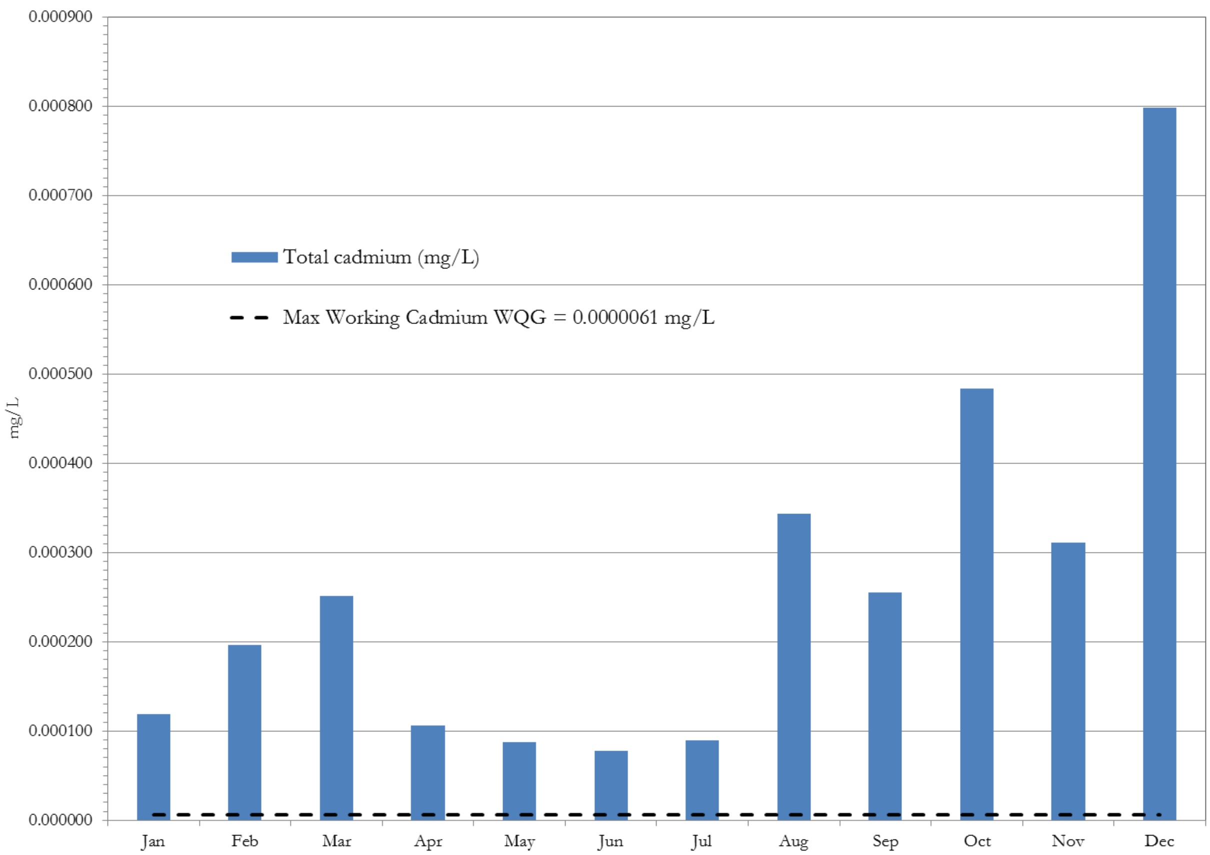
2.1.3.3 Monthly Grab Samples at TP4

Results for the monthly grab samples at TP4 are shown in Table 2-7 below. All of the tabled values are below the maximum water quality guidelines with the exception of cadmium (working guideline). As such, cadmium will be looked at in more detail. Figure 2-7 and Figure 2-8 present cadmium results for 2014 and 2005-2014, respectively. As there was no average (chronic) 30-day guideline for cadmium in 2014, it could not be included for comparison on the charts. WQGs were calculated using the average annual background hardness of 14.1 mg/L.

Table 2-7 Monthly Grab Sample Results for TP4, 2014

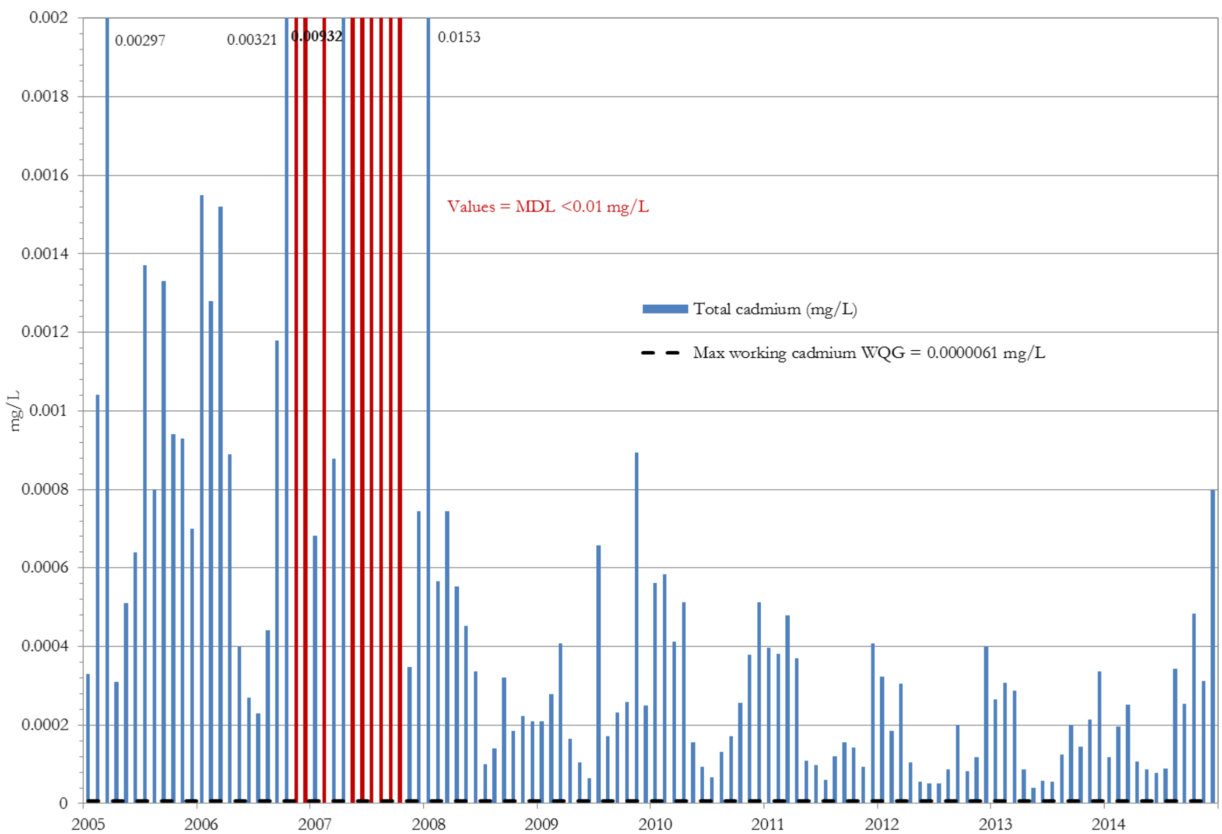
	D-Zn	T-Al	D-Al	T-Cd	D-Cd	D-Cu	T-Fe	D-Fe	T-Pb	D-Pb
Max WQG	*n/a*	*n/a*	*0.1*	*0.0000061*	*n/a*	*n/a*	*1.0*	*0.35*	*0.00674*	*n/a*
1/30/14	0.042	0.0417	0.0360	**0.000119**	0.000118	0.0024	0.009	0.004	0.00067	0.00020
2/12/14	0.057	0.0991	0.0607	**0.000196**	0.000182	0.0033	0.035	0.004	0.00090	0.00013
3/19/14	0.083	0.0446	0.0384	**0.000251**	0.000239	0.0027	0.009	0.002	0.00020	0.00007
4/30/14	0.038	0.0478	0.0552	**0.000106**	0.000101	0.0019	0.005	0.005	0.00002	0.00005
5/27/14	0.027	0.0462	0.0392	**0.000088**	0.000087	0.0015	0.010	0.004	0.00008	0.00005
6/18/14	0.030	0.0380	0.0396	**0.000078**	0.000079	0.0023	0.006	0.007	0.00006	0.00007
7/09/14	0.028	0.0485	0.0374	**0.000090**	0.000087	0.0018	0.008	0.003	0.00008	0.00003
8/19/14	0.092	0.0441	0.0468	**0.000344**	0.000327	0.0022	0.016	0.002	0.00100	0.00015
9/16/14	0.082	0.0909	0.0822	**0.000255**	0.000256	0.0033	0.009	0.001	0.00102	0.00038
10/08/14	0.106	0.0435	0.0383	**0.000484**	0.000472	0.0028	0.011	0.002	0.00118	0.00048
11/12/14	0.114	0.0506	0.0402	**0.000311**	0.000321	0.0033	0.019	0.002	0.00055	0.00007
12/16/14	0.251	0.0582	0.0366	**0.000798**	0.000784	0.0065	0.041	0.004	0.00065	0.00007

Figure 2-6 Monthly Grab Sample Results for Total Cadmium at TP4, 2014



The maximum working WQG for cadmium (0.0000061 mg/L) was exceeded in each sample throughout 2014.

Figure 2-7 Total Cadmium at TP4 2005-2014, Monthly Grab Sample



Monthly cadmium results at TP4 consistently exceed the WQG. However there is a marked improvement since 2008 when the new outer drains and pump house were commissioned.

2.1.4 Receiving Environment – Myra Creek downstream of mine site (M2)

The monitoring site "M2" is located approximately 1 km downstream from the east end of the TDF and TP4. Results for this station generally reflect the results seen at TP4, including the seasonal variation of metal concentrations. M2 is sampled on a monthly basis; therefore a chronic water quality guideline cannot be directly applied, however the maximum water quality guideline can. The EMS-ID for M2 is 0124785.

Table 2-8 shows the monthly sampling results for M2. The applicable maximum water quality guidelines were calculated using an annual average background hardness of 14.1 mg/L as the hardness does not vary much throughout the year in the upstream environment. Results exceeding the WQG are in bold.

Table 2-8 Monthly Grab Sample Results for M2, 2014

	pH	Temp	T-Zn	D-Zn	T-Al	D-Al	T-Cd	D-Cd	T-Cu	D-Cu
WQG (max)	*6.5-9.5*	*n/a*	*0.033*	*n/a*	*n/a*	*0.1*	*0.0000006*	*n/a*	*0.0033*	*n/a*
1/30/14	7.2	2.3	**0.052**	0.045	0.041	0.035	**0.000119**	0.000125	0.0026	0.0022
2/12/14	7.2	2.3	**0.071**	0.062	0.062	0.049	**0.000182**	0.000176	**0.0036**	0.0030
3/19/14	7.5	4.6	**0.081**	0.080	0.050	0.036	**0.000251**	0.000249	**0.0034**	0.0029
4/30/14	7.4	6.3	**0.039**	0.039	0.054	0.049	**0.000104**	0.000106	0.0022	0.0026
5/27/14	7.7	7.5	0.029	0.026	0.044	0.040	**0.000079**	0.000081	0.0020	0.0017
6/18/14	7.8	6.9	0.028	0.028	0.037	0.031	**0.000075**	0.000076	0.0021	0.0018
7/09/14	7.1	12.2	**0.033**	0.030	0.042	0.034	**0.000095**	0.000094	0.0020	0.0017
8/19/14	7.5	16.7	**0.101**	0.088	0.039	0.042	**0.000340**	0.000317	**0.0038**	0.0020
9/16/14	7.3	12.7	**0.093**	0.094	0.069	0.058	**0.000300**	0.000288	**0.0038**	0.0031
10/08/14	7.6	12.5	**0.102**	0.093	0.040	0.036	**0.000406**	0.000405	0.0029	0.0022
11/12/14	7.8	4.4	**0.102**	0.091	0.043	0.035	**0.000280**	0.000262	**0.0044**	0.0031
12/16/14	7.6	4.2	**0.237**	0.220	0.047	0.028	**0.000702**	0.000668	**0.0082**	0.0058

	T-Fe	D-Fe	T-Pb	D-Pb	T-Phos	D-Phos	NH_3	Nitrate	Nitrite	D-SO_4
WQG (max)	*1*	*0.35*	*0.006744*	*n/a*	*0.01*	*n/a*	*11.6*	*32.8*	*0.06*	*128*
1/30/14	0.009	0.003	0.000189	0.000098	<0.0020	<0.0020	0.056	0.153	0.0084	42.7
2/12/14	0.020	0.005	0.000436	0.000106	0.0029	<0.0020	0.202	0.466	0.0156	71.0
3/19/14	0.015	0.003	0.000292	0.000094	<0.0020	<0.0020	0.054	0.119	0.0057	48.1
4/30/14	0.009	0.004	0.000079	0.000051	<0.0020	<0.0020	0.057	0.120	0.0041	29.5
5/27/14	0.009	0.003	0.000075	0.000032	<0.0020	0.0023	0.025	0.059	0.0037	19.6
6/18/14	0.009	0.001	0.000092	0.000038	<0.0020	<0.0020	0.033	0.115	0.0062	33.2
7/09/14	0.006	0.004	0.000062	0.000032	<0.0020	<0.0020	0.055	0.129	0.0053	36.8
8/19/14	0.014	0.002	0.000758	0.000148	<0.0020	<0.0020	0.096	0.248	0.0159	73.4
9/16/14	0.009	0.002	0.000871	0.000302	<0.0020	<0.0020	0.180	0.594	0.0289	**193.0**
10/08/14	0.008	0.002	0.000984	0.000434	<0.0020	<0.0020	0.084	0.266	0.0169	80.2
11/12/14	0.011	0.002	0.000293	0.000063	0.0040	<0.0020	0.032	0.122	0.0030	40.2
12/16/14	0.028	0.004	0.000404	0.000071	0.0024	<0.0020	0.030	0.104	0.0023	54.2

Zinc, copper, cadmium and dissolved sulphate were found to exceed the maximum water quality guidelines in 2014 (in bold). As such, charts for those parameters were prepared for 2014 and 2005-2014 (Figures 2-8 to 2-15). All results presented in these charts should be compared to the maximum guideline due to the sampling frequency. The 30-day chronic guideline has been included for reference. Seasonal effects are evident in all water quality parameters measured in 2014, with high concentrations of many parameters during low flow periods in Myra Creek in dissolved fractions and flushing related increases during high flow events in parameters associated with solid fractions. These increasing concentrations of the dissolved parameters relate to a higher proportion of flow in Myra Creek from mine impacted flows from both the treated mine effluent and any groundwater that may not be captured in the seepage collection system. The same seasonal fluctuations are seen in the back-ground chemistry, however the concentrations are much lower and the range between maximum and minimum concentration is narrower. The mine water influence is more pronounced in times of lower flow due to the increased proportion of the overall flow in the Myra Creek system during these times. This seasonal effect is seen throughout the following parameter specific discussion.

Figure 2-8 Monthly Grab Sample Results for Zinc at M2, 2014

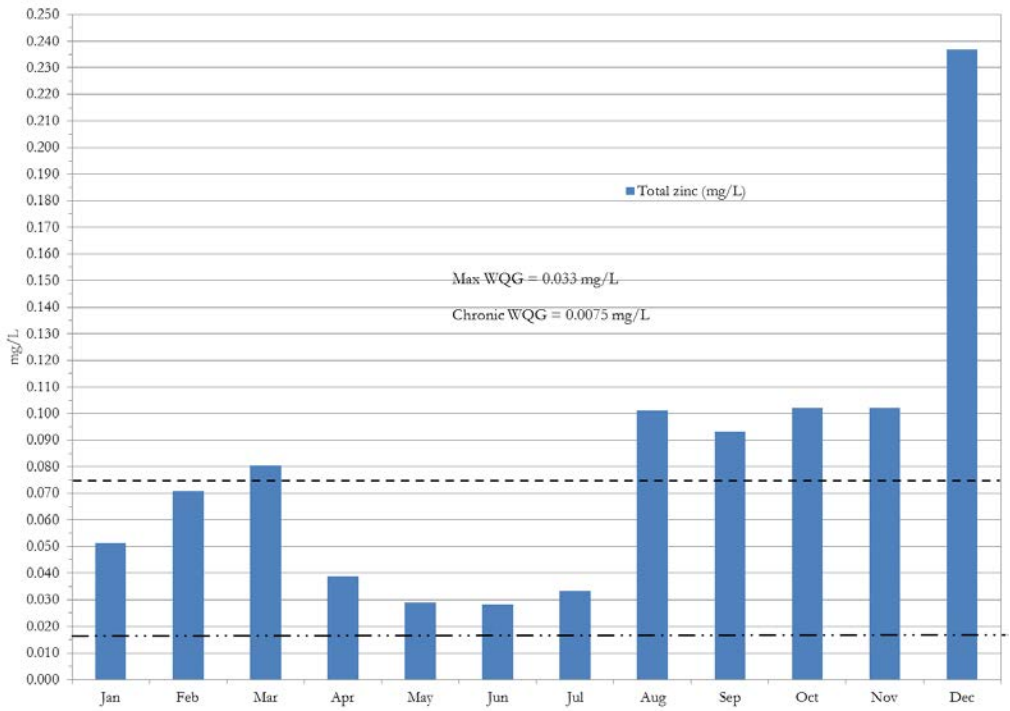
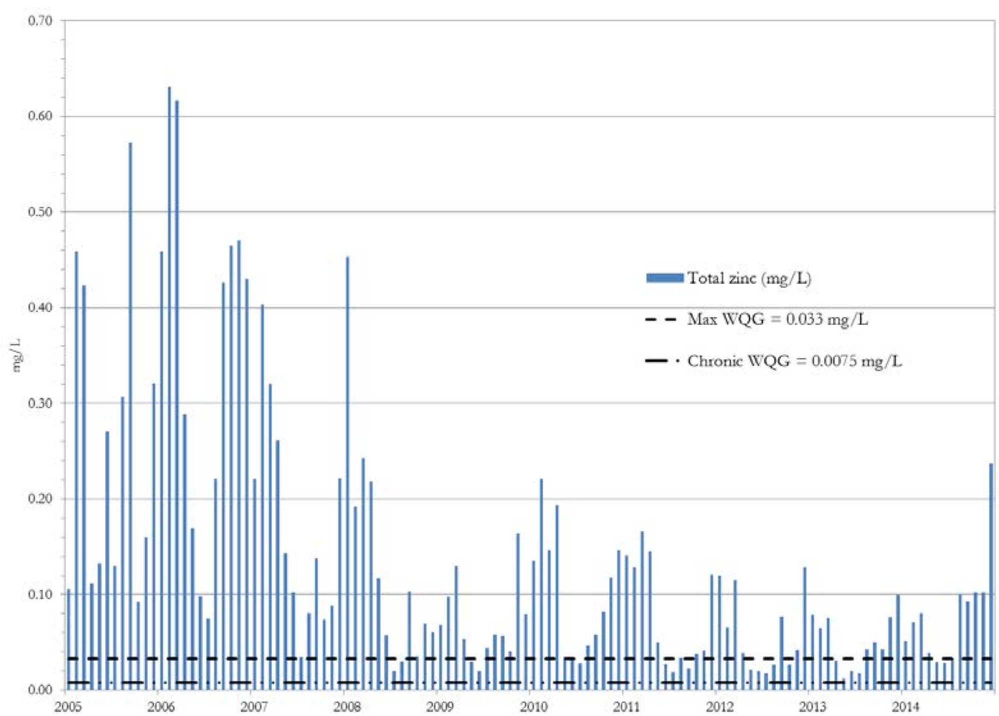


Figure 2-9 Total Zinc at M2 2005-2014, Monthly Grab Sample



Results over the last ten years show a marked improvement since 2008, however, zinc values continue to exceed the maximum water quality guideline of 0.033 mg/L most months of the year, and although they cannot be compared to the 30 day average guideline, it can be assumed that the weekly data would follow a similar pattern.

Figure 2-10 Monthly Grab Sample Results for Copper at M2, 2014

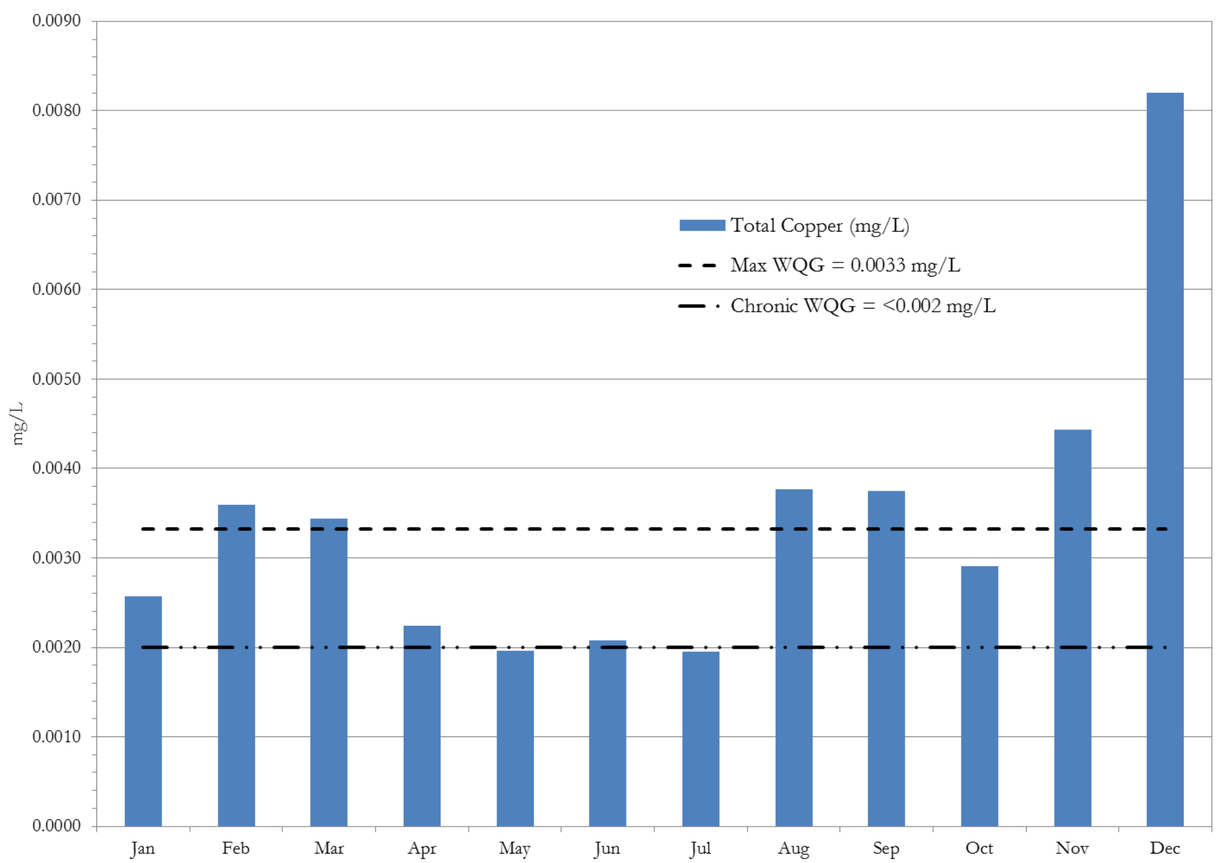
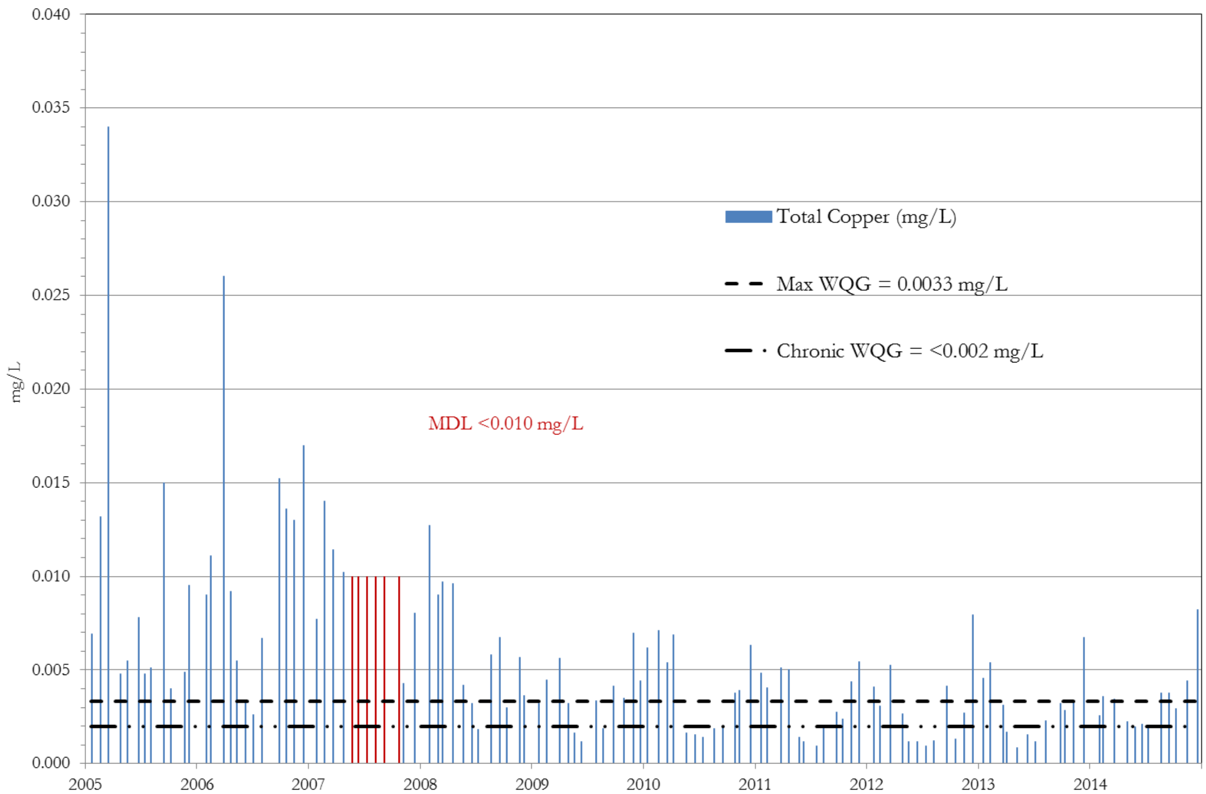


Figure 2-11 Total Copper at M2 2005-2014, Monthly Grab Sample



Six of the 12 samples from 2014 exceeded the maximum WQG (0.003 mg/L), and ten of the samples exceeded the chronic guideline (0.002 mg/L). 10 year chart reveals continuing improvement since 2008 due to the new outer drains and pumphouse.

Figure 2-12 Monthly Grab Sample Results for Cadmium at M2, 2014

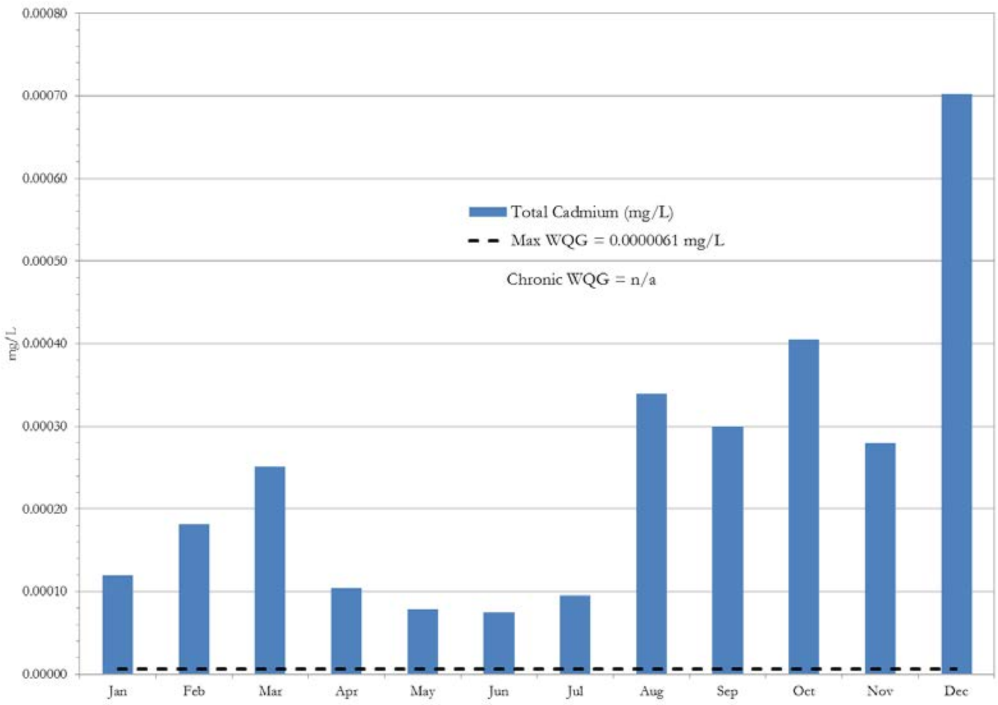
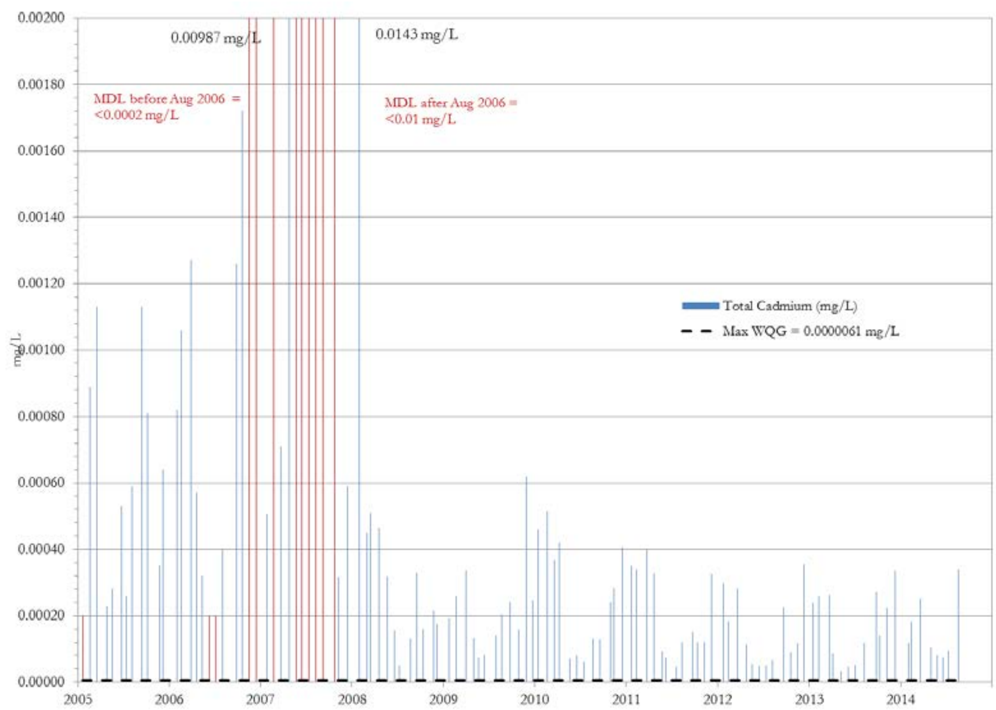


Figure 2-13 Total Cadmium at M2 2005-2014, Monthly Grab Sample



Results over the last ten years show an improvement since 2008, however, all cadmium values at M2 exceed the maximum water quality guideline of 0.0000061 mg/L. In 2014, dissolved sulphate exceeded the chronic water quality guideline of 128 mg/L (based on an annual average background hardness of 14.1 mg/L) in September. The results, taken on a monthly basis, cannot be directly compared to the chronic guideline, however, there is no maximum guideline.

Figure 2-14 Monthly Grab Sample Results for Dissolved Sulphate at M2, 2014

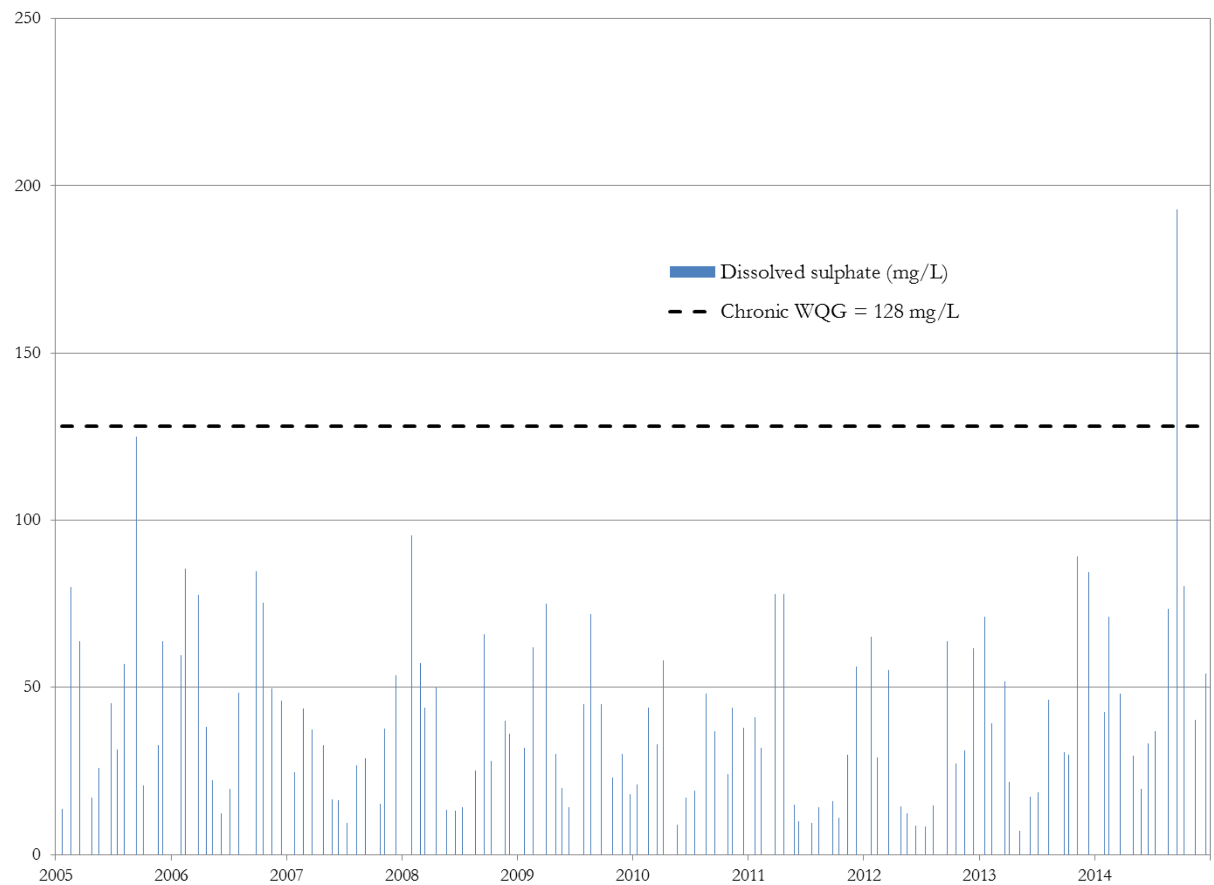
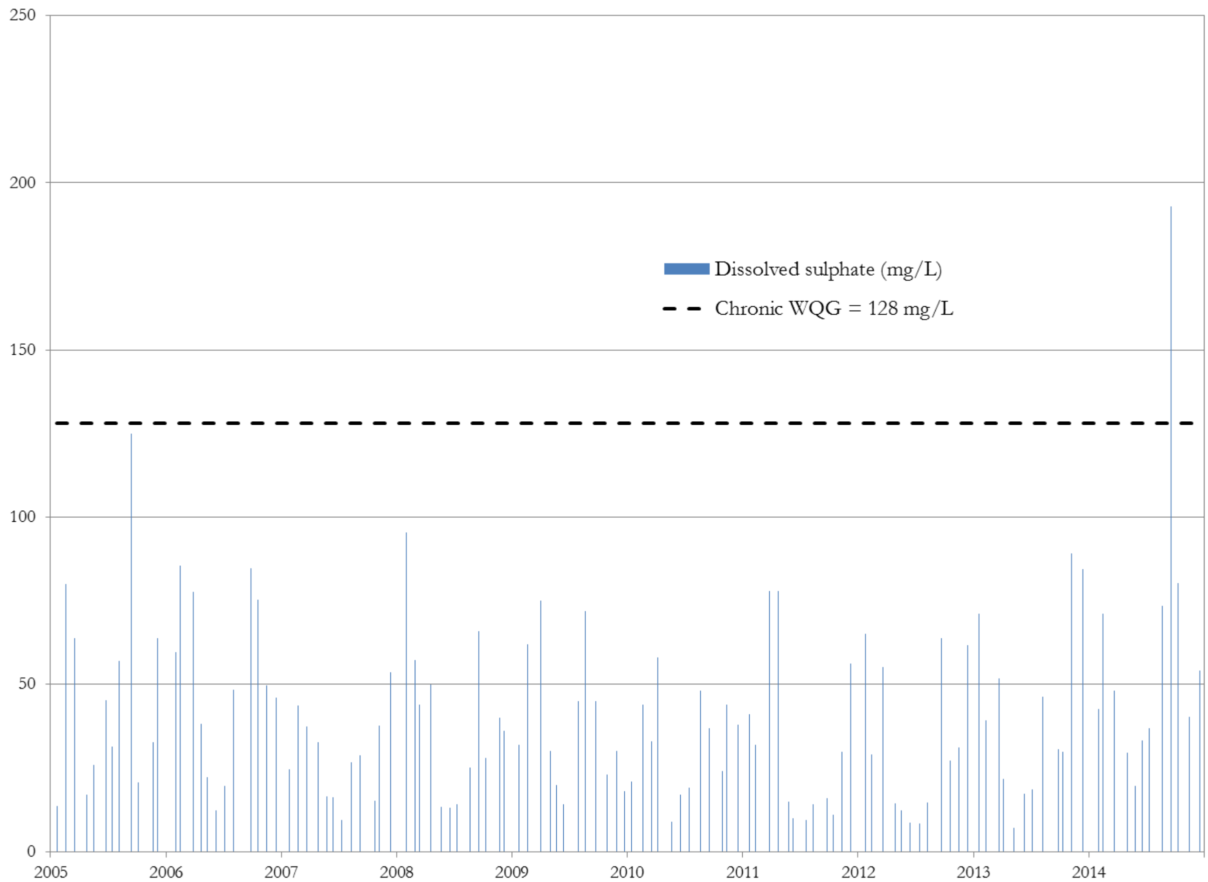


Figure 2-15 Dissolved Sulphate at M2 2005-2014, Monthly Grab Sample



2.1.5 Receiving Environment – Buttle Lake

Two locations in Buttle Lake are sampled six times per year in February, April, June, August, October and December. The two stations, Karst Creek and Henshaw Creek, are sampled for a variety of chemical, physical and biological parameters at various depths throughout the water column (0-100 m). A station map of the Buttle Lake and Gold River stations can be found in Figure 6 in Appendix I.

Comprehensive results for Buttle Lake are presented in Appendix II with the physical parameter results in Tables 3 and 4, and the chemical parameter results in Tables 5 and 6. Zooplankton data for both Henshaw and Karst Creeks are presented in Tables 7 to 12. Phytoplankton data for

Henshaw Creek sampling station are found in Tables 13 to 18. Phytoplankton data for Karst Creek sampling station are found in Tables 19 to 24.

The EMS-ID for the Henshaw sampling station, located mid-lake off Henshaw Creek is 0130082. This station is closest to the historic sub-aqueous tailings disposal area in Buttle Lake, in use from 1967-1984. The EMS-ID for the Karst sampling station, located mid-lake off Karst Creek boat ramp, is 0130090.

Buttle Lake water quality is comparable to previous years. The deep water samples at the Henshaw Creek sampling site (Hen-60) continue to show the highest metal concentrations. This could be related to the close proximity of this sampling location to the historic tailings deposition area in Buttle Lake, the nearby influence of Myra Creek, natural lake processes, lake water levels, or a combination of factors.

Due to upstream (Myra Creek) exceedances of zinc, copper and cadmium, charts have been prepared for these metals for the downstream portions of the watershed. All calculated WQGs will use the average hardness from reference site M1. Water quality charts are provided for zinc in Figures 2-16 to 2-18, charts for copper are found in Figures 2-19 to 2-21, and cadmium charts are found in Figure 2-22 to 2-24. Results for the charts will be categorized by metal and presented in order of distance from the Myra Creek discharge into Buttle Lake, from nearest to farthest (from Henshaw to Karst to Gold River) to track water quality trends through the watershed.

The Van Dorn sampler was lost during sampling in February 2014 before all stations were sampled for water chemistry. Data is missing for February for Hen-10, Hen-20, Hen-40 and Hen-60, as well as for Kars-60 and Kar-100.

Figure 2-16 Total Zinc at Henshaw and Karst Creeks (all depths), 2014

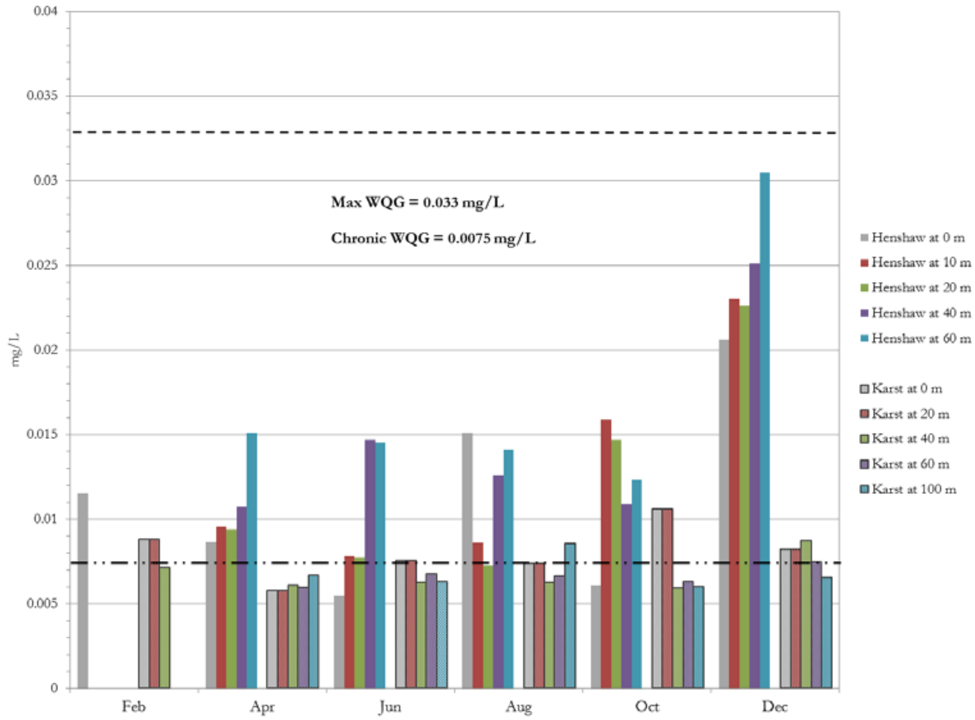


Figure 2-17 Total Zinc at Henshaw Creek (0-60m depth), 2005-2014

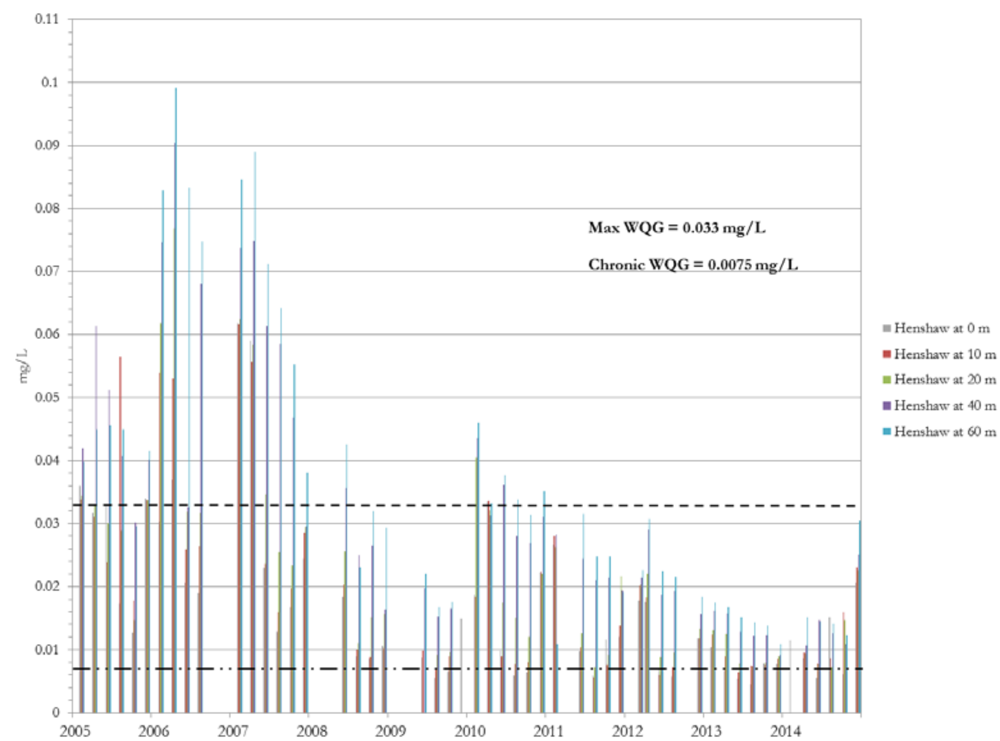
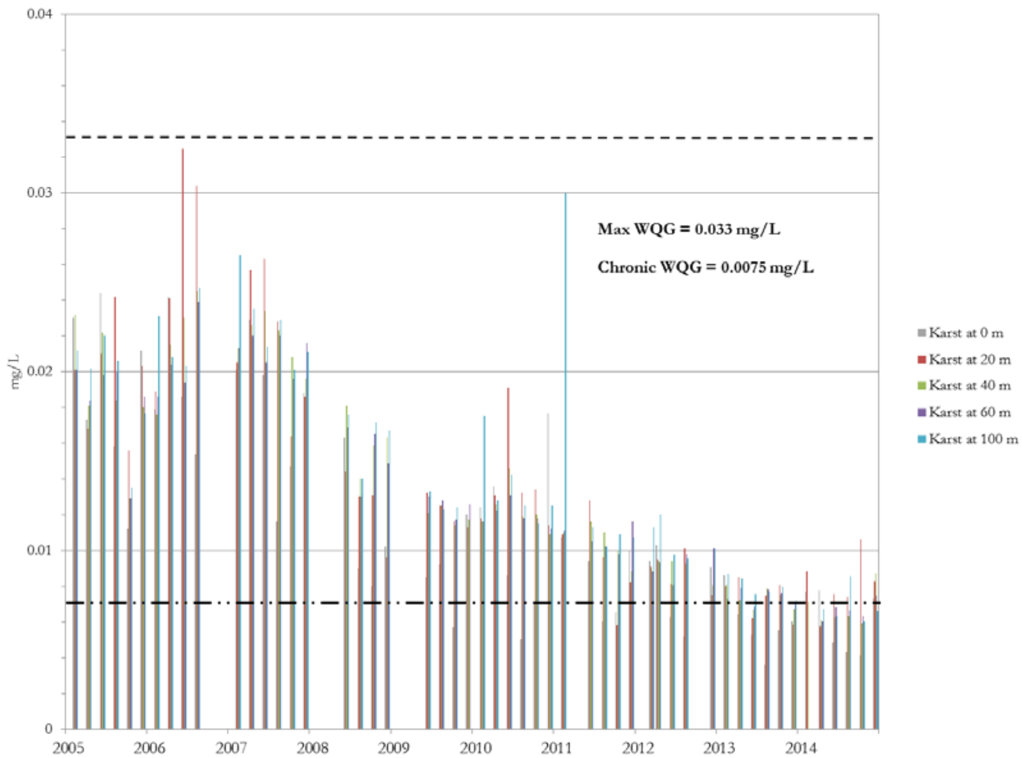


Figure 2-18 Total Zinc at Karst Creek (0-100m depth), 2005-2014



No zinc sample from Henshaw or Karst exceeded the maximum WQG in 2014. The chronic guideline was exceeded at times, and although the data cannot be compared to the 30 day average guideline, it can be assumed that weekly data would follow a similar pattern. The metal concentrations at Karst are less than the concentrations at Henshaw, decreasing with distance from Myra Creek and the mine site. The improved seepage capture from the new outer drains installed under the TDF in 2008 has shown overall improved water quality in Buttle Lake since 2008.

Figure 2-19 Total Copper at Henshaw and Karst Creeks (all depths), 2014

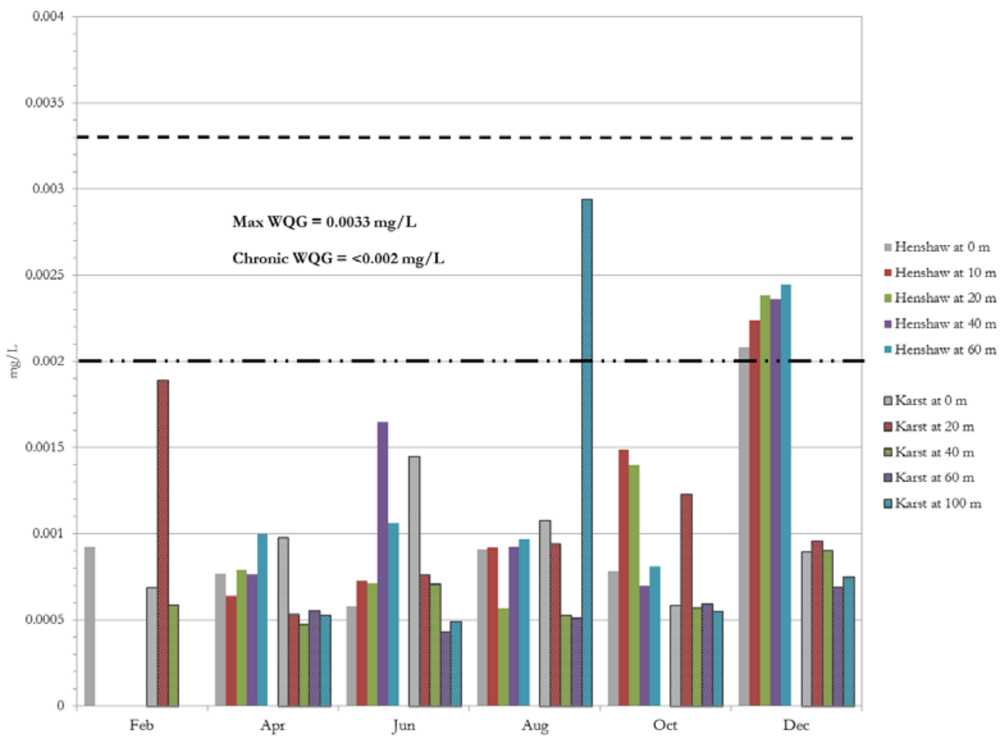


Figure 2-20 Total Copper at Henshaw Creek (0-60m depth), 2005-2014

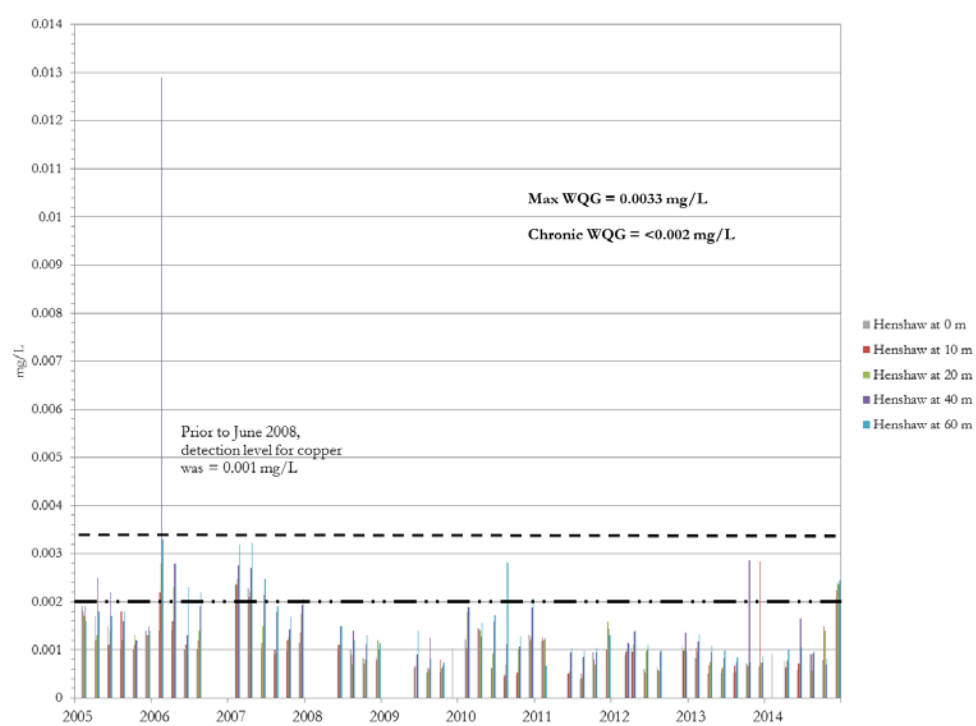
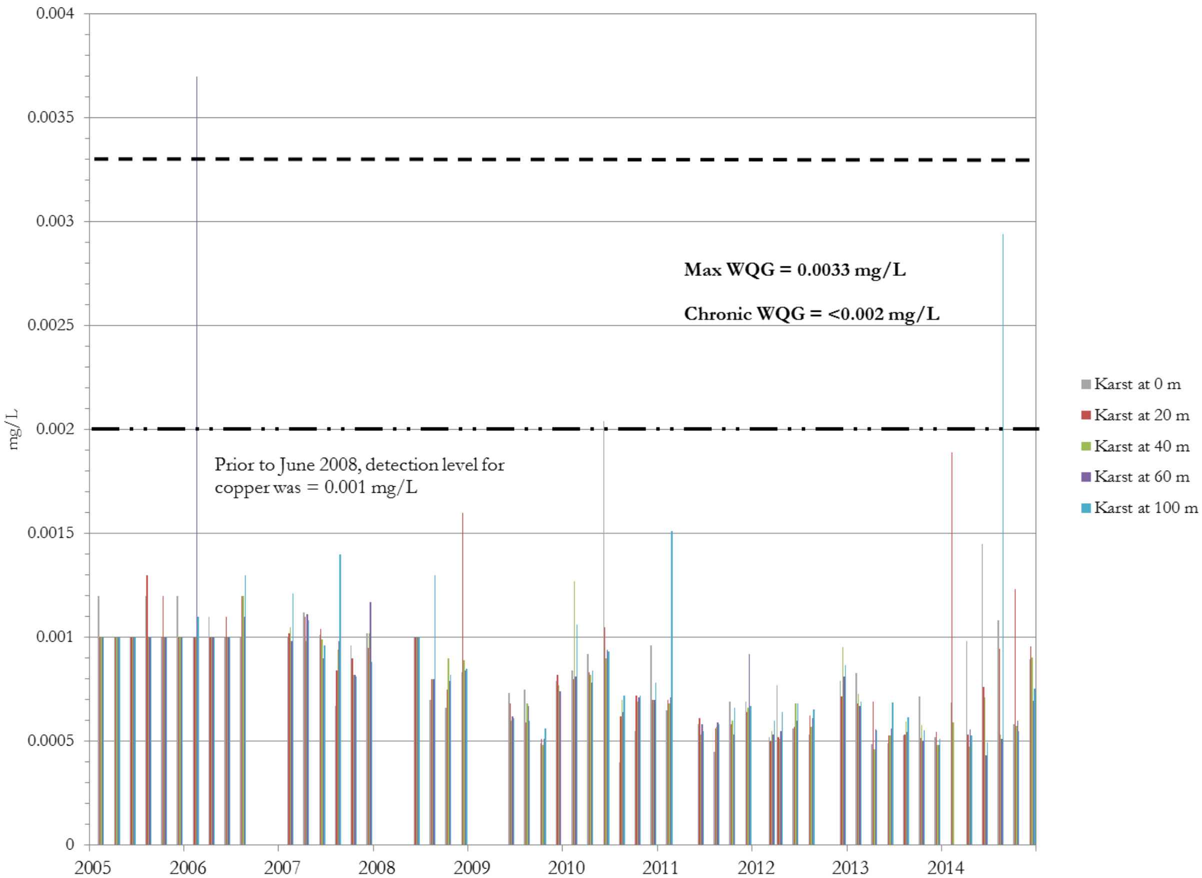


Figure 2-21 Total Copper at Karst Creek (0-100m depths), 2005-2014



None of the measured copper concentrations at Karst exceeded the maximum WQG in 2014. One deep water sample at Karst-100m exceeded the chronic guideline in August. All samples at Henshaw exceeded the chronic guideline in 2014. Although these exceedances are relatively minor, it is reflective of the same water quality issues seen upstream in the latter half of 2014.

Figure 2-22 Total Cadmium at Henshaw and Karst Creeks (all depths), 2014

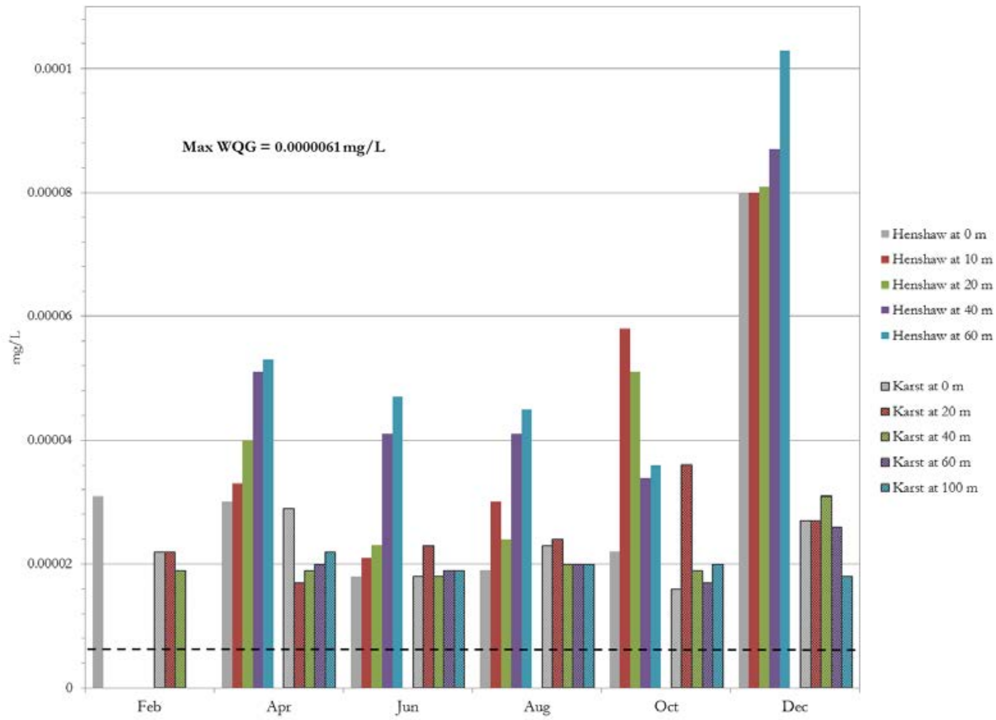


Figure 2-23 Total Cadmium at Henshaw Creek (0-60m depth), 2005-2014

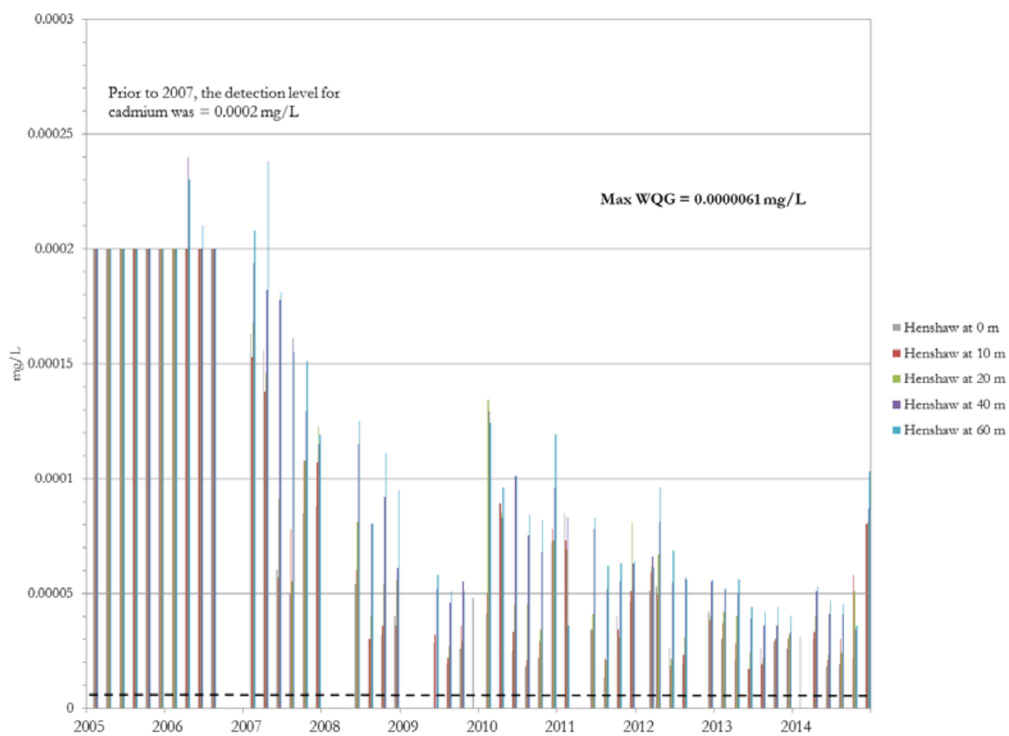
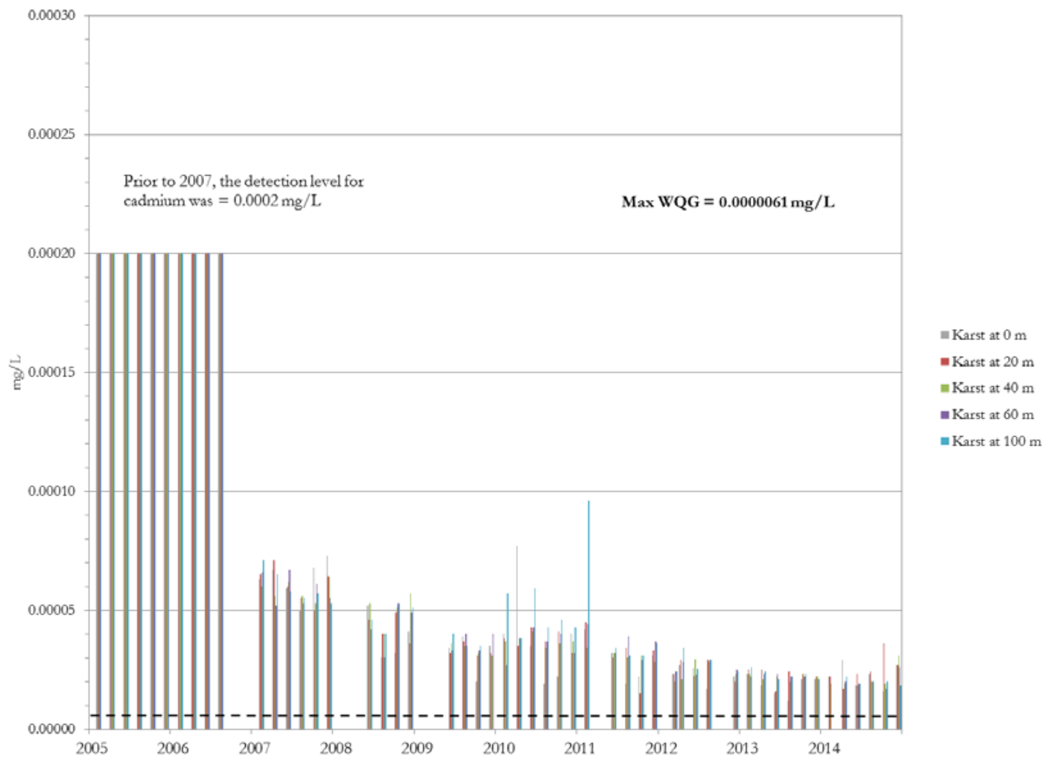


Figure 2-24 Total Cadmium at Karst Creek (0-100m depth), 2005-2014



Cadmium concentrations continue to exceed the maximum guideline in every sample from every station.

2.1.6 Receiving Environment – Gold River Bridge (Buttle Narrows)

Buttle Lake water quality at the Gold River Bridge (Buttle Narrows) is monitored on a monthly basis as a far-field receiving environment sampling station. The EMS-ID for this sampling location is 0130080.

Results for 2014 are presented in Table 2-9 below. Cadmium was the only metal to exceed the maximum BC WQGs in 2014.

Table 2-9 Monthly Grab Sample Results for Gold River Bridge

	ALK	T-Al	D-Al	T-Cd	D-Cd	T-Ca	D-Ca	T-Cu	D-Cu
WQG (max)	*n/a*	*n/a*	*0.1*	*0.0000061*	*n/a*	*n/a*	*n/a*	*0.00333*	*n/a*
1/15/14	25.5	0.010	0.007	**0.000019**	0.000020	9.89	9.47	0.00053	0.00048
2/05/14	25.4	0.013	0.007	**0.000016**	0.000017	9.88	9.82	0.00044	0.00047
3/12/14	26.9	0.010	0.006	**0.000019**	0.000018	9.72	9.82	0.00055	0.00044
4/30/14	26.1	0.003	0.006	**0.000023**	0.000022	10.80	10.30	0.00044	0.00068
5/29/14	25.5	0.011	0.009	**0.000018**	0.000017	10.50	9.82	0.00069	0.00039
6/11/14	23.8	0.012	0.009	**0.000015**	0.000015	9.88	9.71	0.00060	0.00048
7/09/14	25.4	0.019	0.011	**0.000013**	0.000013	9.94	9.10	0.00072	0.00060
8/20/14	24.7	0.015	0.012	**0.000009**	0.000006	9.04	9.00	0.00063	0.00044
9/17/14	26.9	0.011	0.008	**0.000015**	0.000013	11.00	10.80	0.00073	0.00054
10/14/14	27.3	0.012	0.007	**0.000014**	0.000013	10.60	10.50	0.00074	0.00044
11/19/14	24.8	0.020	0.013	**0.000014**	0.000014	11.00	9.64	0.00091	0.00063
12/17/14	25.8	0.022	0.013	**0.000017**	0.000016	9.31	8.90	0.00064	0.00058

	T-Fe	D-Fe	T-Pb	D-Pb	T-Mn	D-Mn	T-Zn	D-Zn	HARD
WQG (max)	*1*	*0.35*	*0.006744*	*n/a*	*n/a*	*n/a*	*0.033*	*n/a*	*n/a*
1/15/14	0.0053	0.0021	0.000091	0.000027	0.00142	0.00082	0.0057	0.0054	28.4
2/05/14	0.0054	0.0022	0.000079	0.000032	0.00153	0.00089	0.0056	0.0053	28.2
3/12/14	0.0100	0.0029	0.000024	<0.0000050	0.00233	0.00162	0.0062	0.0056	28.1
4/30/14	<0.0010	<0.0010	0.000019	0.000010	0.00007	<0.000050	0.0066	0.0060	30.4
5/29/14	0.0077	0.0015	0.000090	0.000006	0.00171	0.00077	0.0056	0.0045	30.1
6/11/14	0.0069	0.0055	0.000013	0.000011	0.00176	0.00148	0.0045	0.0044	28.2
7/09/14	0.0154	0.0060	0.000027	0.000017	0.00363	0.00161	0.0033	0.0030	28.5
8/20/14	0.0241	0.0048	0.000039	0.000005	0.00322	<0.000050	0.0032	0.0016	26.2
9/17/14	0.0073	0.0032	0.000106	0.000029	0.00147	0.00007	0.0039	0.0035	31.6
10/14/14	0.0063	0.0021	0.000025	0.000006	0.00118	0.00005	0.0036	0.0033	29.9
11/19/14	0.0141	0.0140	0.000054	0.000013	0.00099	0.00030	0.0040	0.0034	31.0
12/17/14	0.0134	0.0041	0.000017	<0.0000050	0.00107	0.00020	0.0040	0.0036	26.5

Charts for zinc, copper and cadmium have been prepared for Gold River Bridge samples, as well as 10 year charts for comparison.

Figure 2-25 Total Zinc at Gold River Bridge, 2014

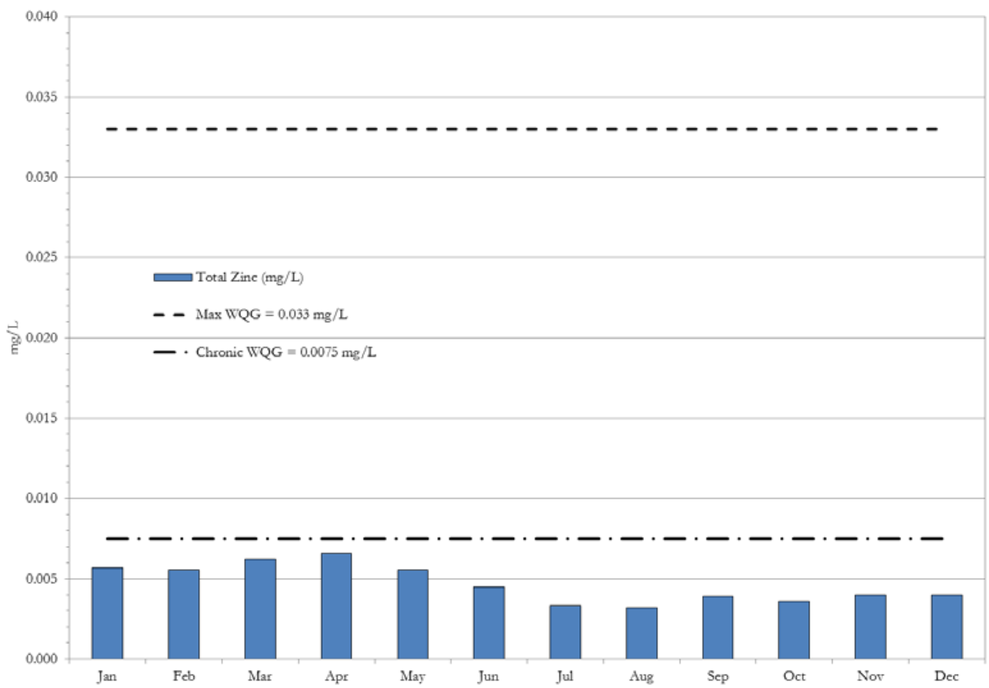


Figure 2-26 Total Zinc at Gold River Bridge, 2005-2014

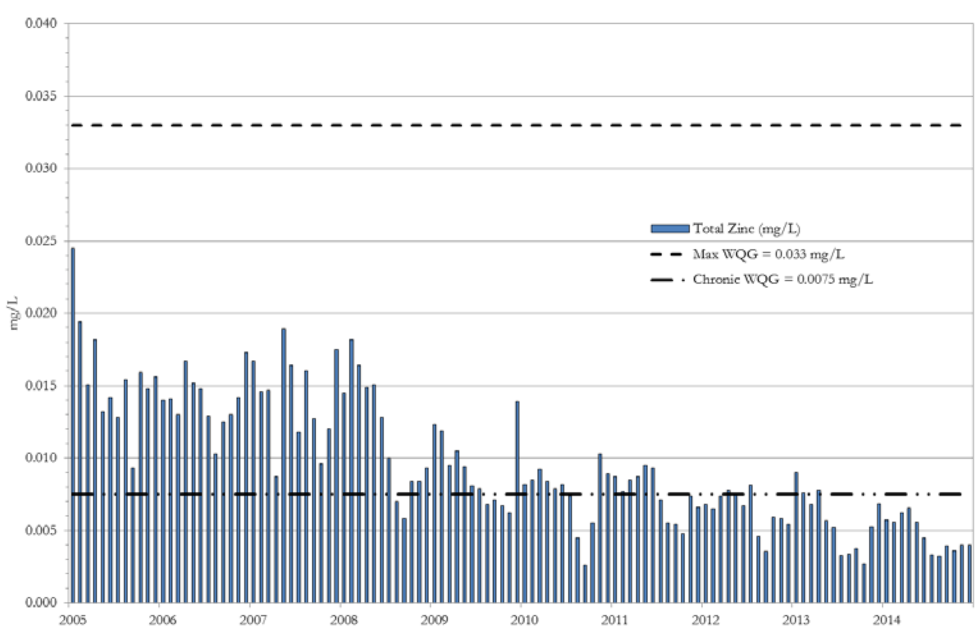


Figure 2-27 Total Copper at Gold River Bridge, 2014

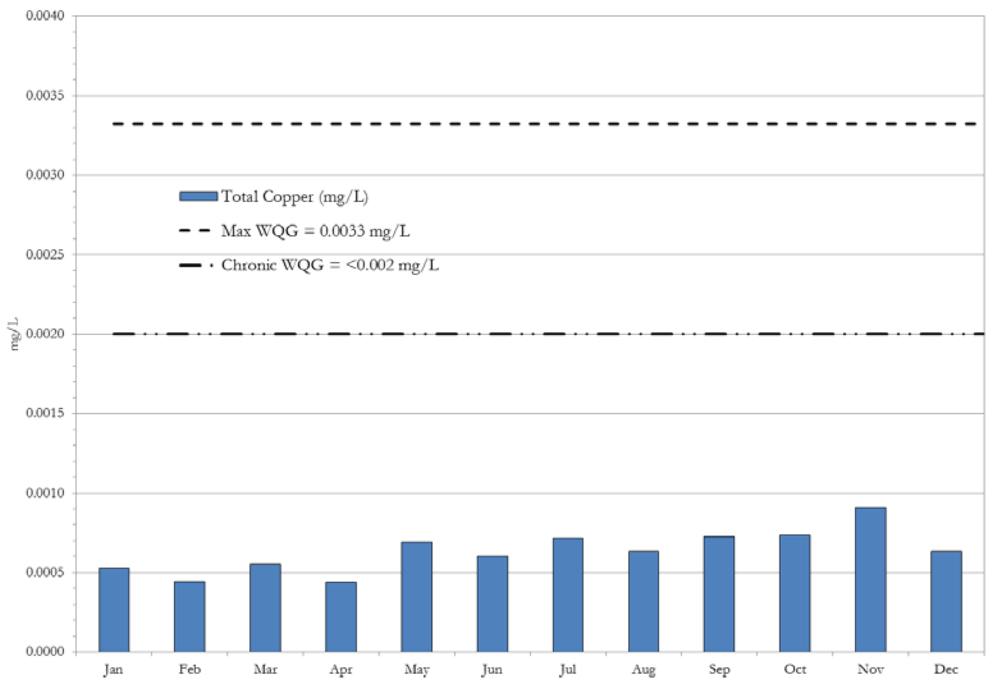


Figure 2-28 Total Copper at Gold River Bridge, 2005-2014

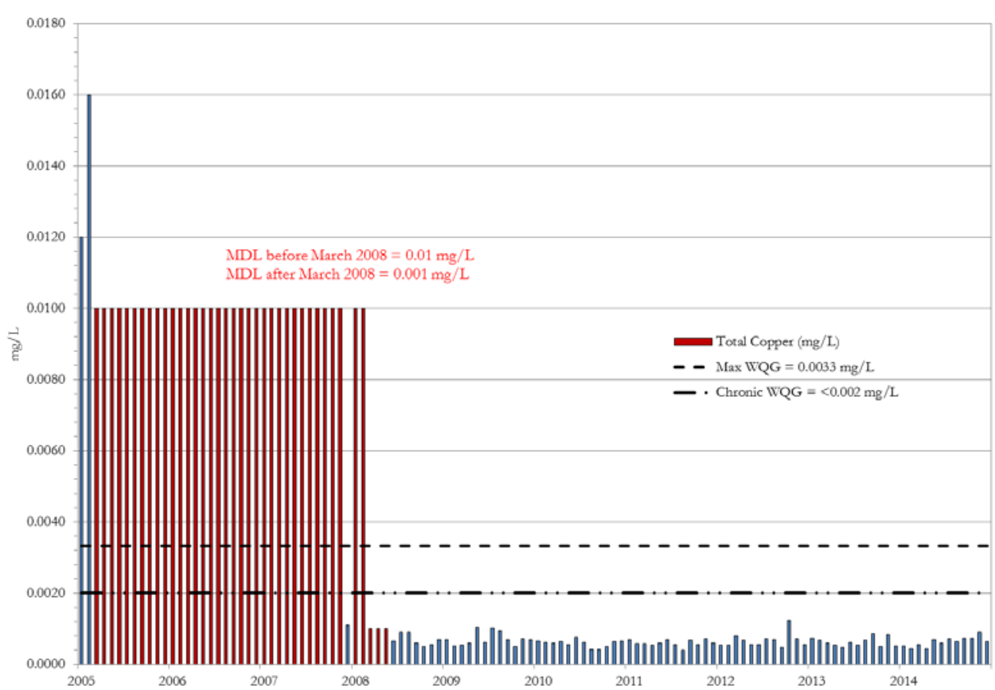


Figure 2-29 Total Cadmium at Gold River Bridge, 2014

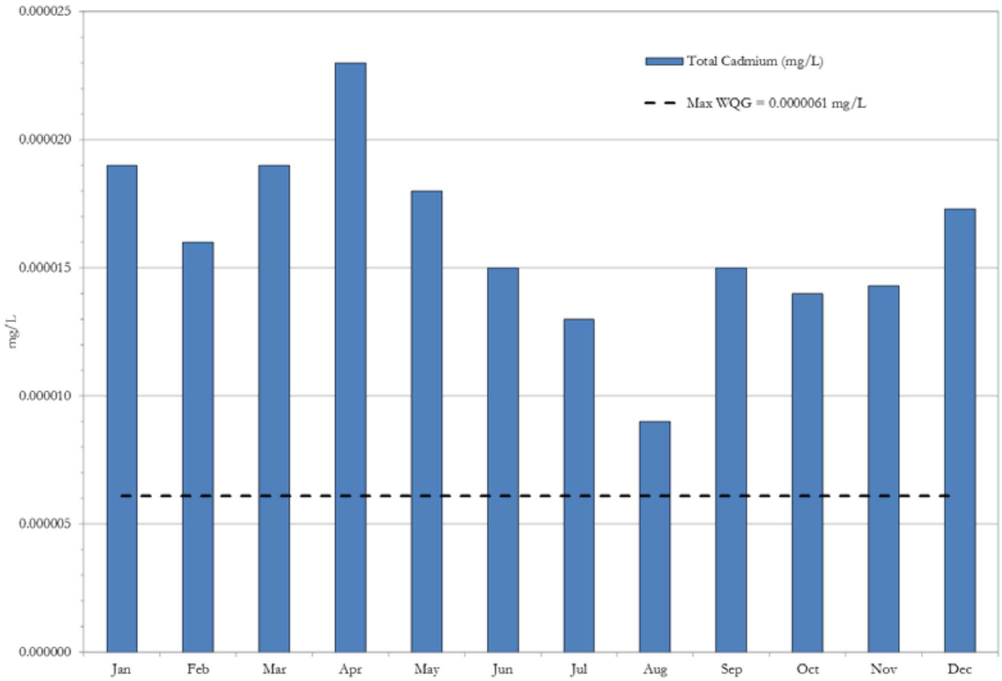
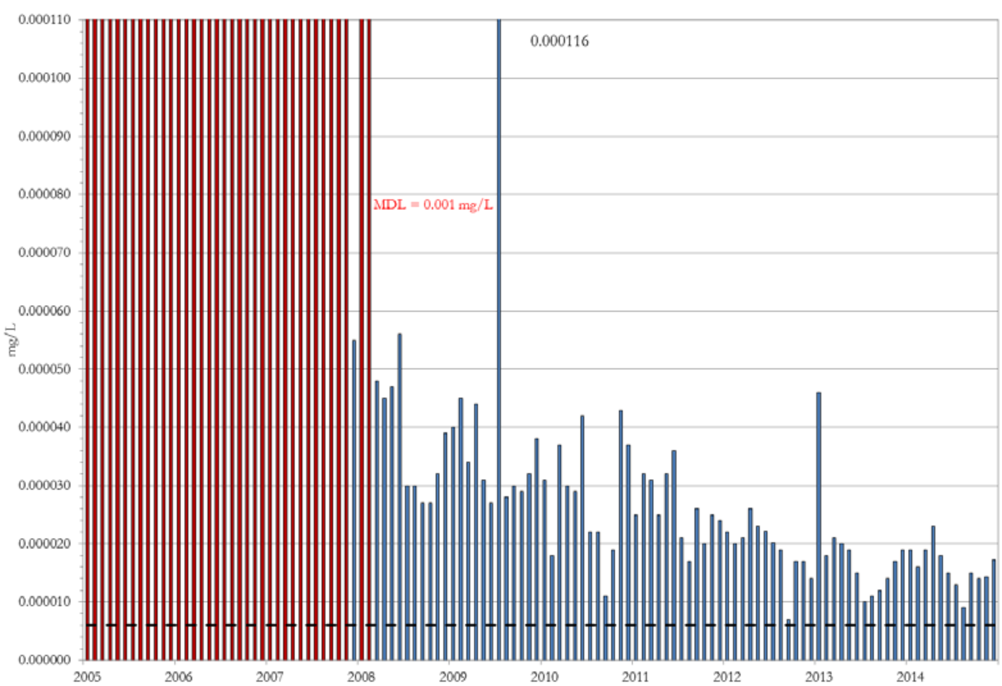


Figure 2-30 Total Cadmium at Gold River Bridge, 2005-2014



In 2014, neither the maximum or chronic guideline for zinc was exceeded at Gold River Bridge (Buttle Narrows). There have been no measured concentrations that exceeded the maximum guideline at this sampling location in more than 10 years. Total copper concentrations are well below both maximum and chronic WQG for every sample. High detection limits for copper before 2008 make it more difficult to detect trends, however all metals follow the general decrease in concentrations since 2008. Total cadmium exceeded the guideline in every sample.

2.1.7 Additional Water Quality Monitoring for PE-06858

2.1.7.1 Tailings Impoundment Area Supernatant (TMA-Decant)

Surface water from the TDF is contained and drains to the Superpond via decant towers for treatment. The permit limits for this location apply only if decant water is to be discharged to Myra Creek, however this practice is not used and Nyrstar Myra Falls will apply to have this section removed from the permit. The supernatant is conveyed to the water treatment system for treatment before release to the receiving environment. The EMS-ID for the TMA-Decant is E207740.

The TDF was filled to capacity in September 2011. Reclamation of the TDF is scheduled for completion by December 2017.

The paste tailings impoundment area supernatant is sampled quarterly. Water chemistry results are found in Table 2-10 below.

Table 2-10 Quarterly Grab Sample Results for TMA-Decant, 2014

	LAB pH	TSS	TOTAL ZINC	DISS. ZINC	TOTAL COPPER	DISS. COPPER	TOTAL CADMIUM	DISS. CADMIUM	TOTAL LEAD	DISS. LEAD	DISS. SULFATE	TOTAL NITROGEN	TOTAL PHOS.
*Permit Limit**	*n/a*	*20*	*0.5*	*0.25*	*0.3*	*0.1*	*n/a*	*0.003*	*n/a*	*0.03*	*n/a*	*n/a*	*n/a*
2/12/14	4.48	18.8	**10.3**	**8.78**	**1.760**	**1.680**	0.06700	**0.06100**	0.393	**0.332**	208.0	0.116	0.0516
11/12/14	7.05	122.0	**0.5**	**0.35**	**0.087**	**0.006**	0.00259	**0.00216**	0.226	**0.002**	210.0	0.893	0.0415

No samples were taken in May or August due to a lack of flow at this location. As the TDF is now at capacity, very little supernatant is available for sampling. This flow goes to the water treatment system, and is not released to the receiving environment.

2.1.7.2 Price Pond #1 (PR-13L)

Price Pond #1, although specified in PE-06858, no longer exists. The discharge pipe from the Price Mine 13 level (PR-13L) adit now reports to an infiltration pond known as Price Pond #2. The northwest side of Price Pond #2 was approved was an alternate sampling location. The EMS-ID for the east side of Price Pond #1 is E100662, and this EMS-ID was officially transferred to the Price Pond #2 location in the February 6, 2015 PE-06858 permit amendment.

PR-13L is sampled monthly, and results can be found in Table 2-10. The monitoring requirements for Price Mine discharge are for total zinc, total copper and pH. Additional parameters have been provided for comparison to the Price discharge limits.

Table 2-11 Monthly Grab Sample Results for PR-13L

	SUSPENDED SOLIDS	pH	TOTAL COPPER	DISSOLVED COPPER	TOTAL ZINC	DISSOLVED ZINC	DISSOLVED CADMIUM	DISSOLVED LEAD
Permit Limit	*25*	*6.5-8.5*	*0.6*	*0.2*	*1*	*0.5*	*0.005*	*0.05*
1/30/14	23	7.9	0.0212	0.0040	0.195	0.068	0.00053	0.00692
2/12/14	<4.0	8.1	0.0040	0.0024	0.084	0.074	0.00045	0.00541
3/19/14	4.0	8.2	0.0081	0.0064	0.078	0.057	0.00041	0.00730
4/30/14	<4.0	8.3	0.0068	0.0063	0.082	0.069	0.00048	0.00230
5/27/14	<4.0	8.1	0.0031	0.0027	0.070	0.064	0.00047	0.00200
6/18/14	<4.0	7.8	0.0033	0.0029	0.076	0.069	0.00044	0.00115
7/09/14	<4.0	7.7	0.0031	0.0024	0.083	0.077	0.00045	0.00145
8/19/14	<4.0	8.0	0.0036	0.0033	0.059	0.051	0.00027	0.00036
9/16/14	<4.0	8.0	0.0028	0.0025	0.044	0.043	0.00021	0.00050
10/08/14	<4.0	7.9	0.0029	0.0022	0.053	0.044	0.00023	0.00045
11/12/14	<4.0	8.0	0.0015	0.0013	0.049	0.046	0.00028	0.00077
12/16/14	<4.0	7.9	0.0028	0.0019	0.059	0.053	0.00035	0.00145

2.1.7.3 Sewage Treatment Plants

Myra Falls operates two sewage treatment plants (STP) to treat sewage and grey water. The HW STP is located adjacent to the warehouse and operates using a Klargester Roto Pack system. The Myra STP is located near the cookhouse and was replaced with a new dual-tank Segflow biological treatment system in July 2013. Effluent from the sewage treatment plants is pumped to the water treatment system for further treatment before discharge to the receiving environment. The plants are sampled quarterly for total suspended solids (TSS) and biological oxygen demand (BOD). Myra Ponds effluent is concurrently sampled to determine TSS and BOD levels before final discharge to Myra Creek. Results for all three locations are included in Table 2-12 below.

Table 2-12 Quarterly Grab Sample Results for Sewage Treatment Plants

	HW STP		Myra STP		Myra Ponds	
	BOD	TSS	BOD	TSS	BOD	TSS
Permit Limit	*45*	*60*	*45*	*60*	*45*	*60*
3/19/14	<6.0	<4.0	42.1	12.3	<6.0	5.0
6/18/14	<6.0	7.1	16.9	8.8	14.1	<4.0
9/23/14	<6.0	10.8	13.3	10.3	14.2	4.0
12/30/14	21.1	12.0	<6.0	4.3	7.6	4.8

No discharge limits were exceeded in 2014.

2.2 Water Quality Monitoring for Mining Permit M-26

2.2.1 TDF Under Drain Water Quality Monitoring

A quarterly TDF under drain monitoring program was established in 2010 to assess drain performance, track trends in water quality and detect significant changes in contaminant loadings from tailings and waste rock sources over time. The individual drain lines are sampled quarterly for dissolved metals, dissolved sulfate and acidity. Table 2-13 presents a summary of the results of TDF under drain monitoring for 2014. Drain water samples are taken at the drain risers just outside of

Pump House #4. A full set of parameters (including trace metals) for drain testing can be found in Table 26 in Appendix II.

Table 2-13 TDF Under Drain Monitoring Summary

		FIELD pH	COND. (uS/cm)	D-SO4	ACID. (to 8.3)	ALK.	D-Al	D-As	D-Cu	D-Cd	D-Ca	D-Fe	D-Pb	D-Zn
Inner Drain	3/07/14	4.7	1586.000	1010	227	<0.50	19.300	0.00065	3.100	0.0993	202.0	23.700	0.002900	30.90
Inner Drain	6/19/14	4.7	1654.000	1040	215	<0.50	20.000	0.00063	3.390	0.1010	222.0	21.000	0.002770	33.30
Inner Drain	8/07/14	4.8	1550.000	885	177	<0.50	14.800	0.00051	2.640	0.0849	197.0	12.900	0.002390	29.40
Inner Drain	11/24/14	4.4	1815.000	1080	310	<0.50	26.400	0.00089	4.820	0.1160	194.0	37.300	0.004040	39.00
Outer Drain	3/07/14	5.8	616.000	249	22.3	21.2	0.070	0.00008	0.351	0.0097	80.4	0.465	0.000005	4.43
Outer Drain	6/19/14	5.9	587.000	262	18.7	13.1	0.099	0.00006	0.413	0.0115	77.5	0.445	0.000006	4.77
Outer Drain	8/07/14	5.9	631.000	280	18.8	11.8	0.017	0.00008	0.348	0.0112	82.6	0.074	<0.0000050	4.47
Outer Drain	11/24/14	6.0	613.000	207	21.4	30.8	0.018	0.00002	0.186	0.0069	83.5	0.101	<0.0000050	3.91
Long Drain	3/07/14	6.5	368.000	141	7.62	35.6	0.013	0.00003	0.081	0.0029	51.2	<0.0010	0.000026	1.37
Long Drain	6/19/14	6.3	357.000	142	7.38	26.4	0.016	0.00003	0.107	0.0037	46.6	<0.0010	0.000029	1.82
Long Drain	8/07/14	6.3	386.000	156	7.67	22.5	0.014	0.00005	0.091	0.0035	50.0	<0.0010	0.000047	1.56
Long Drain	11/24/14	6.4	394.000	157	12.4	47.7	0.011	0.00003	0.053	0.0032	59.7	0.001	0.000026	1.35
Medium Drain	3/07/14	5.6	525.000	248	22.6	2.12	0.744	0.00007	0.412	0.0115	75.2	0.457	0.000052	5.66
Medium Drain	6/19/14	5.4	530.000	242	22.7	1.24	1.020	0.00007	0.422	0.0118	67.7	0.476	0.000074	5.80
Medium Drain	8/07/14	5.4	586.000	269	24	1.13	0.779	0.00008	0.354	0.0105	72.8	0.657	0.000110	4.84
Medium Drain	11/24/14	5.6	714.000	291	28.9	5.1	0.512	0.00008	0.519	0.0152	96.4	1.670	0.000109	7.48
Short Drain	3/07/14	6.4	409.000	169	10.7	38.6	0.004	0.00003	0.013	0.0011	62.0	0.009	0.000007	1.16
Short Drain	6/19/14	6.3	355.000	140	9.06	29.6	0.004	<0.000020	0.017	0.0014	51.2	0.014	0.000017	1.38
Short Drain	8/07/14	6.4	376.000	138	7.43	28.5	0.005	0.00004	0.014	0.0012	51.5	0.004	0.000031	0.92
Short Drain	11/24/14	6.2	653.000	238	19.7	57	0.014	0.00003	0.045	0.0040	98.3	0.022	0.000031	2.87

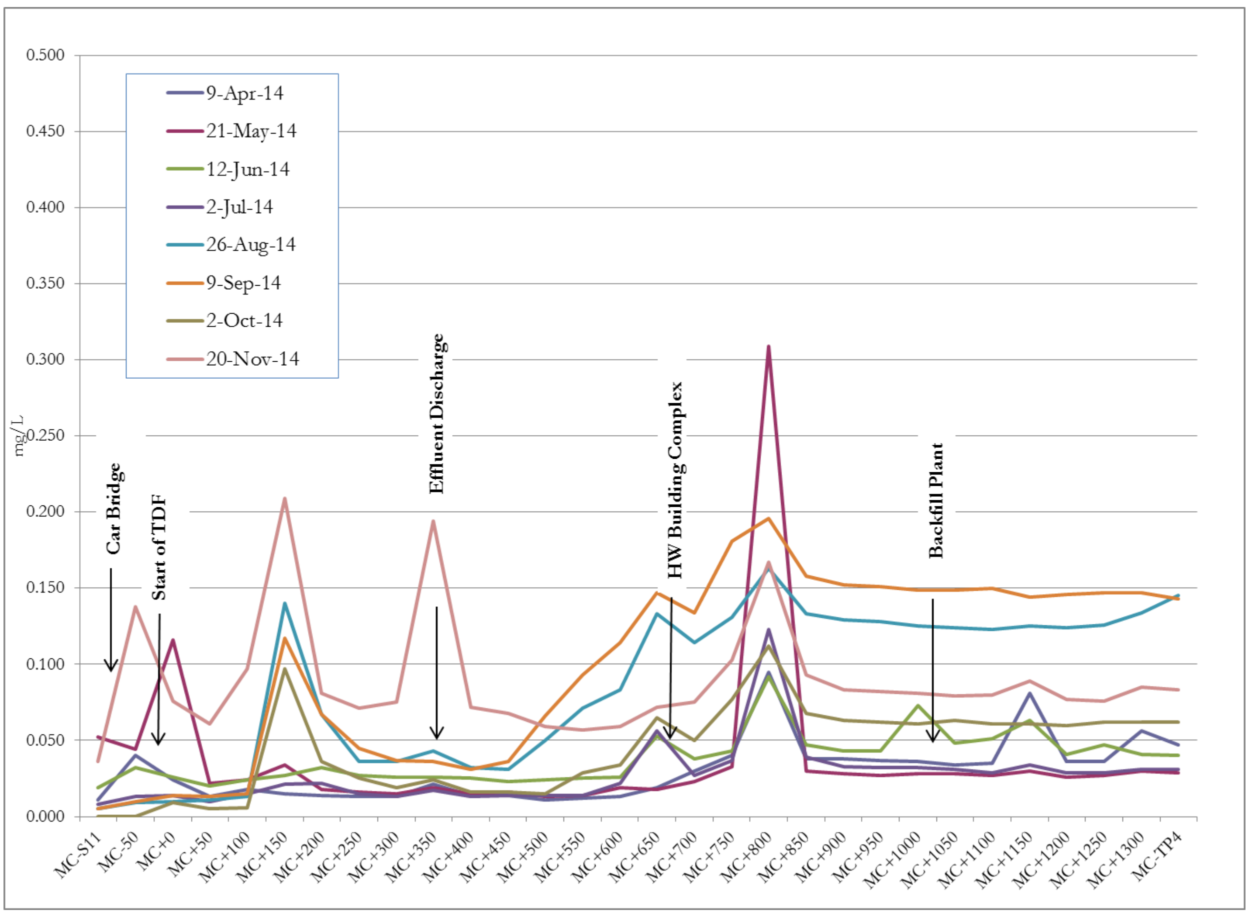
The Inner Drain continues to show the highest metal and sulfate levels and the lowest pH. This is expected, as the Inner Drain primarily drains the large waste rock dump (WRD#1) that is situated beneath the TDF. Unlike the outer drain lines, the Inner Drain is not diluted with creek water. Due to the relatively high concentrations of metals, it is important to keep all five drain lines open at all times.

No regular flow monitoring was performed on the individual drain flows in 2014, although the total flow from Pump House #4 (with all 5 drain lines operating) was recorded every 15 minutes, giving an annual average of 3145 gpm (or ~17,000 m^3/day). All drain lines can be opened or closed to varying degrees to regulate flows when necessary. It is operational practice to ensure the 'Inner Drain' and the 'Old Outer Drain' lines are kept 100% open at all times (except for emergencies or maintenance).

The New Outer Drain lines were installed in order to capture seeps emanating from the TDF that were not adequately captured by the Old Outer Drain. The three drain lines are situated below creek elevation to allow water from the creek to enter the drain, forming a hydraulic barrier. This system, while generally effective, may also cause the operation to treat an unnecessarily large volume of creek water. Operational experience suggests that the optimal settings for the New Outer Drain system (Long, Medium and Short drain lines) were found to be 10%, 10% and 1% respectively. These settings ensure that the maximum amount of seepage from the TDF is collected, while treating the minimum amount of water from Myra Creek.

TDF Under Drain performance is monitored by sampling Myra Creek every 50 m along the toe of the old TDF - from 50 m upstream of the car bridge to station TP4, 50 m downstream of the TDF. This profile is completed monthly if the creek banks are free of snow and ice. Conductivity readings are taken *in-situ* and samples are analyzed in-house for total zinc. Creek profile results for zinc in 2014 are presented in Figure 2-31.

Figure 2-31 Myra Creek Profile Zinc Results, 2014



Very little seepage was noted in the area of historic seepage from MC+1000 to MC-TP4, indicating that the New Outer Drain system is working effectively. The historic seepage in this area was in the 1-2 ppm zinc range before the installation of the new drain system. Note that fluctuating zinc concentrations in the creek over the course of a year are heavily influenced by creek volume. The increase in zinc at MC+600 is due to effluent mixing. Effluent is discharged on the right bank of Myra Creek and mixes at a bend in the creek around MC+600. The mixing location changes with creek flow.

The spike in zinc at station MC+800 correlates with a visible seep daylights slightly above creek level. This seep occurs directly upstream of a large bedrock outcrop that extends approximately from MC+800 to MC+900. This area is covered by the Old Outer Drain line only, with the connected portion of the New Outer Drain (Long Drain line) starting at MC+875. Interestingly, this seep daylights about 1 m above the average creek elevation, probably a result of the bedrock interface. The origin of this seep is unknown.

There are also two zones of rusty staining indicative of seepage on the outer 2:1 slope of the seismic berm. One is located at mid-berm height at MC+800 at the spillway/berm interface. The origin of this seep cannot be confirmed. It is thought that it may be due to preferential flow within the coarser rock of the spillway. The flow may originate from the Strip Area of the TDF. Measures are being taken to try to mitigate flow from the Strip Area.

The other zone of rusty staining is at MC+1230. This seep is relatively new, and may have resulted from the construction sequencing (outer clean fill shell was placed two years after the PAG core). A difference in material properties and hydraulic conductivities may have also resulted in a preferential flow path (coarser rock placed above less coarse rock).

The seeps causing the rusty staining could not be sampled independently due to lack of flow. The completion of the seismic upgrade berm and TDF closure cover may help to mitigate these seeps.

2.2.2 Groundwater Wells between the Outer Drain and Myra Creek

There are seven groundwater wells located between the outer drain(s) and Myra Creek. These wells were sampled quarterly in 2014. A map of groundwater well locations can be found in Figure 5 in Appendix I.

Table 2-14 Groundwater Wells between the Outer Drain and Myra Creek

		FIELD pH	COND. µS/cm	D-SO4 mg/L	ACID. (to 8.3) mg/L	D-Al mg/L	D-As mg/L	D-Cu mg/L	D-Cd mg/L	D-Ca mg/L	D-Fe mg/L	D-Pb mg/L	D-Zn mg/L
MW04-01	3/06/14	6.7	194	46	1.8	0.0012	0.00004	0.00032	0.000192	23.5	<0.0010	<0.0000050	0.452
MW04-01	6/19/14	6.6	177	33	4.5	0.0010	0.00003	0.00031	0.000173	21.4	<0.0010	<0.0000050	0.376
MW04-01	8/05/14	6.7	185	36	3.2	0.0015	0.00006	0.00026	0.000166	23.7	<0.0010	0.000018	0.344
MW04-01	11/25/14	6.8	194	48	3.5	0.0007	<0.000020	0.00042	0.000198	26.6	<0.0010	0.000007	0.430
MW-C	3/06/14	5.9	1112	559	23.2	0.1240	0.00011	0.50900	0.015200	151.0	0.3970	0.000013	6.190
MW-C	6/19/14	5.7	1067	547	31.5	0.2570	0.00013	0.73600	0.020400	169.0	1.0200	0.000032	9.270
MW-C	8/07/14	5.8	1173	587	28.0	0.1140	0.00013	0.48800	0.015600	168.0	0.0565	0.000006	5.770
MW-C	11/25/14	6.1	1061	514	28.8	0.0478	0.00008	0.34200	0.013300	143.0	0.9000	<0.0000050	6.060
MW-F	3/06/14	7.3	337	136	1.8	0.0095	0.00012	0.00742	0.001800	46.5	<0.0010	0.000013	1.020
MW-F	6/19/14	7.4	263	92	3.5	0.0161	0.00019	0.00876	0.002490	37.6	<0.0010	0.000016	1.480
MW-F	8/07/14					0.0112	0.00010	0.05820	0.009300	107.0	0.0089	0.000038	3.900
MW-F	11/25/14	7.0	222	72	3.1	0.0076	0.00009	0.00653	0.000734	29.7	<0.0010	0.000020	0.757
MW13-14S	3/05/14	5.06	813	384	50.8	3.5100	0.00016	0.84400	0.023700	97.3	0.0227	0.000061	11.400
MW13-14S	6/17/14	4.86	867	416	50.9	3.6700	0.00015	0.92900	0.025000	117.0	0.0619	0.000101	12.400
MW13-14S	8/05/14	5.52	574	269	19.3	0.0390	<0.000020	0.22800	0.012000	74.6	0.0016	<0.0000050	5.920
MW13-14S	11/24/14	4.66	987	456	71.7	5.0800	0.00034	1.17000	0.032000	125.0	3.2200	0.000105	15.400
MW13-14D	3/05/14	6.84	251	372	41.4	2.1000	0.00018	0.92100	0.023900	95.4	0.0079	0.000038	11.500
MW13-14D	6/17/14	5.27	830	387	43.4	2.6600	0.00016	0.98200	0.025300	111.0	0.0054	0.000111	12.200
MW13-14D	8/05/14	5.32	807	364	41.9	1.3900	<0.00010	0.88400	0.024400	106.0	0.0115	<0.000025	12.600
MW13-14D	11/24/14	5.05	962	456	59.9	4.1100	0.00034	1.20000	0.030100	115.0	0.0063	0.000050	14.900
MW13-15S	3/05/14	6.63	353	126	2.9	0.0015	0.00010	0.00066	0.000146	46.3	0.0011	0.000020	0.361
MW13-15S	6/17/14	6.5	412	164	3.5	0.0018	0.00005	0.00100	0.000275	54.8	<0.0010	0.000011	0.912
MW13-15S	8/05/14	6.58	274	97	2.8	<0.00050	<0.000020	0.00050	0.000036	32.8	<0.0010	0.000006	0.449
MW13-15S	11/24/14	6.38	605	190	9.0	0.0014	0.00006	0.00099	0.000310	83.4	<0.0010	0.000005	0.872
MW13-15D	3/05/14	6.97	540	232	2.1	0.0014	0.00015	0.00024	0.000030	84.2	<0.0010	<0.0000050	0.002
MW13-15D	6/17/14	6.94	573	212	2.2	0.0016	0.00010	0.00039	0.000028	93.3	0.0011	0.000008	0.002
MW13-15D	8/05/14	6.96	575	231	5.5	<0.00050	0.00008	0.00017	0.000005	91.8	<0.0010	<0.0000050	0.001
MW13-15D	11/24/14	6.89	534	194	4.9	0.0015	0.00007	0.00038	0.000024	81.7	<0.0010	0.000008	0.002

2.2.3 Groundwater Wells between the Lynx TDF and Myra Creek

There are 6 groundwater wells located between the Lynx TDF and Myra Creek. Eleven new wells (5 nested wells) were installed in 2014. Some of these wells are located between the Lynx TDF and Myra Creek. A routine sampling program for these new wells was established in late 2014, and monitoring results will be reported in the 2015 Annual Environmental Report. The dataset shows significant seasonal variability in some locations due to flushing and groundwater levels.

Table 2-15 Groundwater Wells between the Lynx TDF and Myra Creek

		FIELD pH	COND. µS/cm	D-SO4 mg/L	ACID. (to 8.3) mg/L	D-Al mg/L	D-As mg/L	D-Cu mg/L	D-Cd mg/L	D-Ca mg/L	D-Fe mg/L	D-Pb mg/L	D-Zn mg/L
MW11-01	3/06/14	5.8	596	240	30.8	0.0354	<0.00010	0.049	0.00519	82.5	<0.0050	0.00004	12.90
MW11-01	6/16/14	5.7	630	246	27.0	0.0140	<0.00010	0.045	0.00551	86.0	0.0234	0.00010	13.60
MW11-01	8/06/14	5.8	593	254	26.2	0.0142	0.00005	0.045	0.00439	79.9	0.0081	0.00032	10.20
MW11-01	11/26/14	5.7	874	353	43.2	0.0189	<0.00010	0.123	0.01490	128.0	<0.0050	0.00009	22.50
MW11-02	3/06/14	5.3	490	233	21.0	0.4480	0.00007	0.372	0.02410	65.8	0.0039	0.00159	7.55
MW11-02	6/19/14	5.2	374	150	20.7	0.7060	0.00005	0.361	0.01940	49.0	0.0018	0.00142	6.31
MW11-02	8/07/14	5.5	311	119	17.2	0.1190	0.00002	0.152	0.01100	36.4	0.0018	0.00074	3.91
MW11-02	11/25/14	4.9	902	393	93.9	8.0400	0.00019	1.660	0.06430	108.0	0.0187	0.00814	19.60
BK01-13D	3/04/14	6.2	259	98	15.0	0.0094	0.00003	0.023	0.00200	35.6	<0.0010	0.00004	1.12
BK01-13D	6/16/14	6.2	227	79	2.5	0.0068	<0.00002	0.017	0.00144	32.1	<0.0010	0.00006	0.82
BK01-13D	8/05/14	6.4	191	55	5.6	<0.0005	<0.00002	0.002	0.00015	25.9	<0.0010	<0.000005	0.31
BK01-13D	11/24/14	5.8	329	125	18.6	0.0726	0.00004	0.074	0.00471	43.0	0.0028	0.00008	2.31
BK01-13S	3/04/14	5.5	331	138	17.1	0.1880	0.00004	0.113	0.00712	42.9	<0.0010	0.00006	2.85
BK01-13S	6/16/14	5.4	359	147	13.3	0.0332	0.00004	0.123	0.00754	43.8	<0.0010	0.00003	3.14
BK01-13S	8/05/14	5.5	399	165	14.9	0.1030	0.00007	0.096	0.00671	51.3	<0.0010	0.00002	2.57
BK01-13S	11/24/14	5.4	355	153	15.1	0.2000	0.00005	0.116	0.00649	43.9	<0.0010	0.00005	2.70
MW11-04	3/05/14	5.5	543	228	18.7	0.2080	0.00009	0.231	0.00945	71.0	0.0055	0.00007	4.35
MW11-04	6/19/14	5.1	517	227	26.3	0.6560	0.00004	0.396	0.01390	64.0	<0.0010	0.00010	7.06
MW11-04	8/05/14	5.2	529	239	25.1	0.2390	0.00008	0.271	0.00978	61.8	0.0028	0.00025	4.94
MW11-04	11/24/14	5.1	848	359	39.5	1.0200	0.00015	0.636	0.02590	110.0	<0.0050	0.00024	11.40
MW-G	3/05/14	5.8	415	176	19.0	0.1460	0.00006	0.311	0.00888	51.1	0.0014	0.00008	3.27
MW-G	6/19/14	6.0	308	120	9.2	0.0295	<0.00002	0.029	0.00272	41.7	<0.0010	0.00002	1.47
MW-G	8/05/14	5.5	377	156	16.1	0.0833	0.00007	0.248	0.00782	44.9	0.0012	0.00005	2.92
MW-G	11/24/14	5.4	640	219	23.4	0.4250	0.00009	0.412	0.01250	80.9	0.0022	0.00025	4.61

2.2.4 Other Water Quality Monitoring for M-26

The "extended" water quality monitoring program established to monitor various mine and natural flows around the mine site that are not covered in other monitoring programs. Monitoring various mine flows - such as adit discharges - will build a database to assess loadings over time and will help determine post-closure lime requirements. All mine flows included in the Extended Monitoring Program report to the Water Treatment System. Results of mine flow monitoring are included in Table 2-16.

Table 2-16 Extended Monitoring Program Results for Mine Flows

		FIELD pH	COND. (mS/cm)	ACID. (to 8.3)	D-Al	D-As	D-Cu	D-Cd	D-Ca	D-Fe	D-Pb	D-Zn
LYNX LEVEL 10E	3/13/14	6.7	0.554	28.1	0.876	0.0354	2.550	0.1050	75.0	10.900	0.0256	24.00
LYNX LEVEL 10E	6/18/14	7.5	0.485	14.2	0.483	0.0089	1.390	0.0580	76.0	5.080	0.0089	14.20
LYNX LEVEL 10E	9/16/14	7.3	0.528	17.5	0.947	0.0072	2.320	0.0765	85.8	10.000	0.0114	21.20
LYNX LEVEL 10E	12/30/14	6.8	0.502	18.8	0.486	0.0130	1.360	0.0591	107.0	6.040	0.0187	14.60
3-RUNOFF (Lynx Road)	3/13/14	5.7	0.233	7.8	1.860	0.0010	0.699	0.0165	21.3	2.530	0.0011	4.05
3-RUNOFF (Lynx Road)	6/18/14	8.0	0.221	1.9	0.503	0.0002	0.199	0.0072	34.4	0.392	0.0003	1.90
3-RUNOFF (Lynx Road)	9/16/14	7.8	0.265	1.6	0.394	0.0002	0.160	0.0070	36.1	0.281	0.0002	1.73
3-RUNOFF (Lynx Road)	12/30/14	7.3	0.193	1.5	0.748	0.0002	0.238	0.0076	22.1	0.603	0.0007	1.90
HW PARKING LOT SUMP	3/13/14	7.6	0.29	0.9	0.036	0.0004	0.040	0.0047	37.3	0.059	0.0076	0.88
HW PARKING LOT SUMP	6/18/14	7.9	0.121	0.6	0.012	0.0004	0.005	0.0004	20.3	0.009	0.0034	0.06
HW PARKING LOT SUMP	9/16/14	7.8	0.167	0.6	0.354	0.0002	0.008	0.0014	24.1	0.103	0.0054	0.30
HW PARKING LOT SUMP	12/30/14	8.0	0.162	<0.50	0.009	0.0002	0.004	0.0003	25.4	0.005	0.0010	0.04
MYRA LEVEL 10	3/13/14	8.0	0.263	<0.50	0.102	0.0006	0.128	0.0044	42.3	0.841	0.0054	1.28
MYRA LEVEL 10	6/18/14	7.8	0.223	<0.50	0.041	0.0006	0.051	0.0013	39.1	0.372	0.0014	0.51
MYRA LEVEL 10	9/16/14	8.2	0.256	<0.50	0.042	0.0014	0.054	0.0014	48.6	0.395	0.0019	0.47
MYRA LEVEL 10	12/30/14	7.3	0.281	<0.50	0.082	0.0006	0.094	0.0035	46.8	1.210	0.0045	1.50
MYRA LEVEL 11	3/13/14	7.6	0.195	<0.50	0.062	0.0007	0.030	0.0021	31.2	1.070	0.0121	0.54
MYRA LEVEL 11	6/18/14	8.0	0.189	<0.50	0.029	0.0005	0.007	0.0011	34.4	0.696	0.0027	0.39
MYRA LEVEL 11	9/16/14	8.4	0.249	<0.50	0.014	0.0002	0.012	0.0010	45.3	0.038	0.0002	0.34
MYRA LEVEL 11	12/30/14	7.8	0.191	<0.50	0.015	0.0006	0.005	0.0008	34.3	0.336	0.0112	0.26
HW UNDERGROUND	3/13/14	7.7	1.169	4.4	0.802	0.0168	0.359	0.0330	125.0	3.730	0.3860	5.27
HW UNDERGROUND	6/18/14	9.1	1.496	1.3	0.470	0.0039	0.079	0.0024	179.0	0.868	0.0723	0.43
HW UNDERGROUND	9/16/14	8.8	1.468	2.1	0.226	0.0029	0.054	0.0045	196.0	0.528	0.0452	0.37
HW UNDERGROUND	12/30/14	6.8	1.194	18.3	0.225	0.0025	0.253	0.0496	137.0	1.800	0.0315	11.80
PHILLIP'S REACH	3/13/14	7.2	1.386	29.4	1.960	0.0016	0.487	0.0588	248.0	11.600	0.0145	18.10
PHILLIP'S REACH	6/18/14	6.9	1.383	14.4	0.677	0.0016	0.062	0.0252	214.0	1.600	0.0282	9.86
PHILLIP'S REACH	9/16/14	7.6	1.798	22.1	0.223	0.0001	0.037	0.0305	325.0	0.551	0.0018	12.60
PHILLIP'S REACH	12/30/14	6.0	1.731	78.9	2.210	0.0011	1.770	0.0983	269.0	17.200	0.1720	27.20

There are a number of flows in and around the mine site that are not mine-related discharges, such as the Diversion Ditch, Webster Creek, Arnica Creek, Thelwood Creek and Myra Creek at station S-11 (50 m upstream of the car bridge). Some of these flow paths, while naturally occurring, have been modified to allow for mining infrastructure. The Diversion Ditch collects runoff from the north valley slope and directs it down a shotcreted ditch around the Old TDF and into Myra Creek below Pump House 4. Webster and Arnica Creeks run through multiple culverts in areas of historic acid generating waste rock storage in the warehouse and mill/Lynx switchback areas before entering Myra Creek.

Monitoring these flows will help assess any potential impact from mine-related activities. The extended monitoring program was undertaken quarterly in 2014, and monitoring results for these stations are included in Table 2-17. Please note that the reported values are for dissolved metals and are compared to WQGs that are based on total metals.

Table 2-17 Extended Monitoring Program Results for Natural Flows

		FIELD pH	COND. (mS/cm)	ACID. (to 8.3)	D-Al	D-As	D-Cu	D-Cd	D-Ca	D-Fe	D-Pb	D-Zn
WQG (max)		**6.5-9.5**	**na**	**na**	**0.1**	***0.005**	***0.0030**	***0.0000061**	**na**	**0.35**	***0.006744**	***0.33**
DIVERSION DITCH	3/13/14	8.1	0.130	<0.50	0.0102	0.00004	0.00034	<0.0000050	19.8	0.003	0.00001	0.0006
DIVERSION DITCH	6/18/14	8.1	0.931	<0.50	0.0096	0.00003	0.00024	<0.0000050	15.4	0.012	0.00003	0.0005
DIVERSION DITCH	9/16/14	7.7	0.186	<0.50	0.0158	0.00010	0.00108	**0.000038**	33.4	0.015	0.00023	0.0045
DIVERSION DITCH	12/30/14	8.0	0.144	<0.50	0.0105	0.00004	0.00028	<0.0000050	21.4	0.005	0.00001	0.0008
ARNICA CREEK	3/13/14	7.3	0.211	<0.50	**0.2000**	0.00005	**0.04810**	**0.002140**	28.5	0.033	0.00011	**0.5620**
ARNICA CREEK	6/18/14	8.2	0.095	<0.50	0.0114	0.00002	0.00086	**0.000029**	15.9	0.006	0.00005	0.0067
ARNICA CREEK	9/16/14	7.1	0.152	<0.50	0.0252	0.00018	0.00242	**0.000223**	25.0	0.004	0.00126	**0.0425**
ARNICA CREEK	12/30/14	7.7	0.192	<0.50	0.0564	0.00003	**0.01060**	**0.000510**	27.6	0.004	0.00015	**0.1610**
WEBSTER CREEK	3/13/14	7.4	0.285	1.31	0.0476	0.00013	**0.04340**	**0.009520**	31.0	0.021	0.00100	**2.4400**
WEBSTER CREEK	6/18/14	7.9	0.071	<0.50	**0.3150**	0.00090	**0.02740**	**0.000445**	11.6	0.509	**0.02560**	**0.0980**
WEBSTER CREEK	9/16/14	8.1	0.068	<0.50	0.0313	0.00020	**0.00512**	**0.000210**	11.1	0.076	0.00076	**0.0363**
WEBSTER CREEK	12/30/14	7.9	0.160	<0.50	0.0421	0.00028	**0.02000**	**0.001450**	23.6	0.275	0.00378	**0.4430**
MYRA CREEK AT S11	3/13/14	7.3	0.055	<0.50	0.0278	0.00008	0.00148	**0.000085**	7.4	0.004	0.00004	**0.0332**
MYRA CREEK AT S11	6/18/14	7.2	0.029	<0.50	0.0203	0.00015	0.00037	**0.000014**	4.2	0.004	0.00002	0.0049
MYRA CREEK AT S11	9/16/14	7.8	0.033	<0.50	0.0173	0.00014	0.00038	**0.000014**	5.7	0.003	0.00006	0.0036
MYRA CREEK AT S11	12/30/14	7.7	0.064	<0.50	0.0340	0.00011	0.00261	**0.000183**	8.1	0.008	0.00003	**0.0592**
THELWOOD CREEK	3/13/14	7.8	0.063	<0.50	0.0323	0.00011	0.00020	0.000005	8.6	0.011	0.00001	0.0006
THELWOOD CREEK	6/18/14	7.9	0.058	<0.50	0.0209	0.00017	0.00017	<0.0000050	9.6	0.010	0.00001	0.0005
THELWOOD CREEK	9/16/14	8.3	0.088	<0.50	0.0057	0.00009	0.00023	<0.0000050	13.2	0.004	0.00001	0.0003
THELWOOD CREEK	12/30/14	7.9	0.063	<0.50	0.0313	0.00011	0.00023	**0.000007**	8.9	0.010	0.00002	0.0007

*WQGs are for total concentrations

The Diversion Ditch water quality exceeded the cadmium guideline in September. The water quality in Arnica and Webster Creeks exceed the WQGs for aluminum, copper, cadmium, lead and zinc at certain times of year. The Diversion Ditch, Arnica and Webster Creeks are not fish-bearing streams. Myra Creek at S-11 is located just upstream of the car bridge and represents Myra Creek water quality before the TDF reach. There were WQG exceedances for cadmium and zinc in 2014, showing that the creek is impacted by mining activities before entering the engineered portion of the creek that runs along the old TDF.

Thelwood Creek is the main stream located in the Thelwood Valley. Cadmium exceeded the WQG in December.

A map of water quality monitoring stations can be found in Figure 4 in Appendix I.

2.3 Spills, Excursions and Other Unusual Events

There were seven environmental events communicated to regulatory authorities in 2014. Table 2-18 provides a summary of events. Follow-up reports detailing the root cause and mitigation efforts were submitted to the Ministry of Environment and Environment Canada. Other agencies such as the Ministry of Energy and Mines, the Vancouver Island Health Authority and the city of Campbell River are also notified of these events.

Table 2-18 Summary of Reportable Spills, Excursions and Other Unusual Events

Incident Date	Incident Description	Permit or Regulation Limit Exceeded	Cause of Incident
Feb 5	Effluent grab sample taken for weekly MMER sampling – total suspended solids (TSS) result of 60.3 mg/L.	MMER – TSS grab sample limit 30.0 mg/L and Permit PE-06858 TSS limit of 25 mg/L.	After investigation, the cause of the high TSS sample was not determined. Water treatment pond "turn-over" suspected.
Sept 5	~16,000 L of acidic wash water (from Meyco SA 160 totes) entered Myra Creek	Spill of a deleterious substance – MMER and PE-06858.	Pump failure – wash water overflowed to Myra Creek after the Webster Creek pump failed to pump to the Water Treatment System.
Nov	Total zinc in effluent grab samples exceeded monthly average limit	MMER monthly average limit (0.50 mg/L)	Lime slurry line #1 plugged. Sludge build-up in Super Pond. Heavy rains flushing through compromised treatment system. Also, dredging during heavy rains likely resulted in agitating and stiring up settled metals that were subsequently flushed through system.

Dec 5, 6, 7 and 9	High total zinc in daily composite effluent samples for Dec 5 (0.75 mg/L), Dec 6 (1.057 mg/L), Dec 7 (0.948 mg/L) and Dec 9 (1.129 mg/L)	Effluent permit PE-06858 total zinc limit of 1.0 mg/L (for Dec 5 and 9), and MMER composite sample limit 0.75 mg/L (for Dec 5, 6, 7 and 9).	Result of high flows in the water treatment system (WTS) due to a multi-day heavy precipitation event. The WTS had been compromised by sediment and precipitate buildup, as well as lime line plugs and agitators malfunctioning.
Dec 20	Engine oil pumped to Water Treatment System	Possible release of deleterious substance into Myra Creek through effluent, although sampling revealed no detectable hydrocarbons.	Genset #22 (diesel power generator) failed resulting in release of approximately 1100 L of engine oil. Oil reported to containment but a manual pump was activated which pumped some of the oil to water treatment.

3.0 Environmental Activities in 2014

3.1 Power Generation and Consumption

Myra Falls utilizes hydro-generated power for the majority of its electrical needs. Additional power is provided by diesel generators as needed. Minimizing diesel generator use and maximizing hydro-based power continues to be a priority for the operation.

In 2014, just over 68.6% of the site's power was hydro-generated, and 31.4% was diesel-generated, a significant increase over previous years. The increase in diesel generated power is mainly due to poor snow pack in the upper mountains, resulting in less water available for hydro power generation. There were also a number of hydro power station issues that temporarily increased the reliance on diesel power throughout the year.

Myra Falls continues to implement a power use strategy to ensure that the main power consumption demands of milling, crushing, paste plant operation and skipping from underground are balanced over any 24 hour period. Decision making is centralized through the Mill Control room operator who continuously monitors both power generation and power consumption.

The breakdown of power generation for the period 2005-2014 is presented in Table 3-1.

Table 3-1 Myra Falls Total Electrical Power Produced by Source

	Total Annual MW hrs Produced	% from Hydro	% from Diesel Generation
2014	71,311	68.6	31.4
2013	73,705	81.7	18.3
2012	69,165	95.4	4.6
2011	68,449	97.2	2.8
2010	68,974	98.0	2.0
2009	62,579	91.2	8.8

2008	73,140	81.0	19.0
2007	85,151	89.4	10.6
2006	82,989	75.2	24.8
2005	91,226	73.0	27.0

3.2 Waste Management

3.2.1 Tailings Management

Coarse (sand-sized) tailings are used to backfill mined-out areas underground. In 2014, 67.1% of these coarser tailings were sent underground as backfill with 55,305 tonnes (32.9%) deposited on surface in either the Reclaim Sand Area or the Lynx TDF.

The fine tailings are thickened to a density of approximately ~65% in the Paste Plant, remixed with process water for pumping and then impounded into the Lynx TDF.

In 2014, the mill produced 400,009 tonnes of whole tailings. Of those:

- 231,903 tonnes were deposited into the Lynx TDF – at a conversion rate of 1.32 t/m^3 (AMEC, 2013) this equates to 175,684 m^3 or an average of 732.0 m^3 per operating day (permit PE-06858 authorizes a daily maximum of 8000 m^3/day and an annual average of 4,250 m^3/day as per provision 1.1.1);
- 112,801 tonnes of sand were piped underground as hydraulic backfill;
- 55,305 tonnes of sand were deposited to surface into either the Reclaim Sand Area or Lynx TDF.

During 2014, engineering studies were completed on feasibility regarding the placement of full tailings underground through underground paste production and delivery. Full tailings are anticipated to increase the current underground conversion rate of approximately 1.3 t/m^3 to greater than 1.7 t/m^3. Economic feasibility studies to determine if infrastructure investment will occur will be completed in early 2015, with potential detailed engineering and construction to follow. Meanwhile new "dump zones" in the old HW Mine are being investigated. Improvements in existing infrastructure to backfill the most easterly portion of 20 Level HW Mine South Flank and

North Slope areas, are complete and fully operational. Overall these combined changes should increase underground backfill placement from the current 28-32% of total mill tailings to better than 40%.

3.2.2 Sludge Management

Sludge is generated as a by-product of lime addition when lime is added to the water treatment system at the Lime Mix Tanks, located at the head of the Superpond. Myra Falls employs a floating "Flump Pump" in the Superpond to extract and pump sludge to the Paste Plant for deposition into Lynx TDF. In 2014, the Flump Pump ran for a total of 312 hours and removed an estimated 9,258.79 m^3 of sludge was removed at 4% solids. This equated to approximately 370 m^3 or 385 tonnes of solids reporting to the Lynx TDF.

When sludge buildup and consolidation exceeds the capacity of the Flump Pump a dredging program is implemented to remove sediments and solids from treatment ponds. In 2014, a dredging program was carried out by Mosier Construction from March to April, and again from August to December. All dredging in 2014 occurred in the Superpond. An estimated 43,828 m^3 of gravel, sand, silt and sludge was pumped at 10% solids via a dedicated pipeline into Lynx TDF or to the Paste Plant where it was incorporated with underflow for final deposition into Lynx TDF. In total, it is estimated that some 4,900 m^3 or 5797 tonnes of solids were removed from the Superpond during 2014. This equates to 32 m^3 or 37 tonnes of solids per operating day.

The annual survey to assess sludge accumulation in the six polishing ponds was completed in September. Sludge levels remained relatively constant with areas of Polishing Pond 1 showing signs of buildup. Sludge removal will continue from these polishing ponds during 2014. The long term operational plan for sludge management continues to be its incorporation into paste tailings.

3.2.3 Recycling

There are a number of long standing recycling programs at Myra Falls - office paper, corrugated cardboard, scrap metal, waste hydrocarbons and batteries. To this has been added an annual clean-up of stored waste products by Newalta and a more proactive approach to the recycling of electronics.

A summary of the major recycled items in 2014 is provided in Table 3-2.

Table 3-2 Materials Recycled in 2014

Waste Stream	Quantity	Unit
Paper/cardboard	3.54	tonnes
Wood	49.18	tonnes
Scrap metal	278.6	tonnes
Oil	87.28	tonnes
Other (bottles/cans/batteries/filters)	8.24	tonnes
Electronic materials	71	lbs
Drums/totes/bulk containers	218	each

Myra Falls is committed to continuing its efforts to re-use and recycle wherever possible, and to minimize the amount of materials disposed of on site. The operation continues to look for more opportunities to recycle.

3.2.4 Domestic Waste Management

In 2014, 180.3 tonnes of domestic-type refuse (mainly food garbage) was trucked off-site to the Campbell River Waste Management Centre.

3.3 Tree Removal

In 2014 a number of hazard trees considered to be safety concerns were identified and removed. This included two trees along Tennent Road, one near the Bunkhouse A and one 45 m tall fir near the Phillips Ridge/Upper Myra Falls parking lot that was removed at the request of BC Parks.

3.4 Major Construction Activities in 2014

3.4.1 Old Tailings Disposal Facility (Old TDF)

The TDF seismic upgrade project, initiated in 1999 to improve the dynamic stability of the TDF and provide additional tailings storage capacity, was completed July 31, 2013. This marked the completion of all planned operational construction activities on the Old TDF with future activities focusing on improved water management and the construction of a closure cover. In March 2014, a Detailed TDF Closure Cover Design (authored by O'Kane Consultants) was submitted to MEM. This report was not accepted due to water management concerns and changes to the Canadian Dam Safety guidelines which altered the acceptable factors of safety for dam height. Robertson GeoConsultants (RGC) is developing a new interim closure cover for the Old TDF. The interim design report will be submitted to MEM by October 31st, 2015, and the final report will be submitted by December 31st, 2016.

On October 23rd, 2014, during a monthly TDF inspection conducted by AMEC, a discrete seep was observed near the toe of the Old TDF paste berm along the east abutment. This area has previously been identified as a seepage zone. Whereas past seeps expressed as saturated ground, the newly observed seep was discrete in nature, discharging from a single hole approximately 8 cm across by 4 cm high. The flow rate was estimated to be approximately 10 L/min. and was discharging clear water at the time of inspection. However, a fan of tailings approximately 2 m wide by 3 m long was observed below the discharge point from previous high rain events. Precipitation on October 22nd, totalling 80 mm, caused a large pond to form above the observed seep in the east end of the Amalgamated Paste Area (APA). On October 23rd, the ponded water on the APA was immediately pumped to the Strip Area and on October 25th, an interim buttress was installed over the discrete seep. As a precaution, three additional buttresses were placed over areas along the east abutment that were previously mechanically disturbed. The buttresses consist of a medium weight geotextile filter fabric underneath a minimum of 300 mm of free draining filter rock.

From December 8th–10th, 2014, Myra Falls received 347.1 mm of precipitation resulting in uncommon expressions of groundwater and surface flows inundating the Reclaim Sand Area (RSA) and the Strip Area (a section of exposed conventional tailings located between the APA and outer embankment of the Old TDF). Due to a site-access road closure on December 9th, 2014, the full extent of the rain event was not realized until December 10th, 2014. AMEC was immediately called to site to assess the situation and determined that a controlled breach should be carried out to convey ponded water to treatment facilities and relieve the burden of water along The Strip. A 600 mm culvert was installed to convey water from the RSA to the Superpond on December 10th and a drainage ditch was installed to convey water from the Strip to the RSA on December 11th. The ditch was later enhanced with the installation of a 600 mm drainpipe. Because The Strip is effectively divided into two sections by the TDF spillway and culverts running through the spillway were not effectively conveying water, pumps were installed to pump water from Area I Strip (eastern portion) to Area II Strip (western portion). As a result, water levels were effectively reduced. Options to improve water management in this area are being assessed urgently with response measures and initial recommendations outlined by AMEC's memo *Emergency Response to High Water Levels in Old TDF 2014*.

Upgrades to the upper portion (0+000 to 0+225) of the Lower Lynx Diversion Ditch were completed on December 7th, 2014. This involved excavating waste to subgrade material within the expanded footprint, placing a geo-membrane liner on top of subgrade, rip-rap to a minimum thickness of 1 m on the liner, and 6 inch-minus clean fill on top of the rip-rap for trafficability. Approximately 5,600 m^3 of NAG construction material was used to upgrade the Lower Lynx Diversion Ditch in 2014. The remainder of the diversion ditch will be upgraded in 2015, increasing the Inflow Design Flood (IDF) to a minimum of one third between a 1:1000 year flood event and the Probable Maximum Flood (PMF).

A full review of the construction activity is provided in the *Myra Falls Tailings Storage Facilities, 2014 Construction Report* authored by AMEC Foster Wheeler.

3.4.2 Lynx Tailings Disposal Facility (Lynx TDF)

The Lynx TDF has been a functional tailings disposal facility since February 2008. This facility was developed within the footprint of the mined out Lynx open pit. After the bottom of the open pit was sealed in 2006, a water trap was constructed at the base of the original starter berm. This water trap, which collects water percolating from and through the tailings, is connected to an under drain system built within the paste tailings pile. The water trap is in turn connected to an outer "T-drain" that conveys all leachate to the site's water treatment system.

In 2014 construction occurred during the months of January, February and March to build a 4:1 buttress along the Lynx East Arm. Construction of the 2014 Lynx Dam raise focused on two aspects: 1) construction of a Spring Drain designed to convey water springing from exposed bedrock north of the TDF through the dam; 2) the placement of additional fill to raise the main dam 5.5 m to a minimum elevation of 3404.3 m. An estimated 64,470 m^3 of PAG mine waste was used during this construction phase. As well, approximately 16,065 m^3 stored in the J-zone Construction Pile, (formerly Waste Rock Dump #5) and approximately 22,050 m^3 of sand from the Reclaim Sand Area were used to complete the raise. The primary construction period for the Lynx Dam raise occurred from May to September 2014, at which point efforts shifted to construction of the Spring Drain, a French Drain constructed to convey seepage water through the east arm of the Lynx TDF.

Spring Drain construction began in September and concluded in November. This involved encapsulating clean drainage and filter material in a geo-membrane, and surrounding these conveyance layers with J-material, a mixture of reclaim sand and mine waste. Approximately 2,510 m^3 of clean coarse filter material, 2,459 m^3 clean fine filter material, and 2,085 m^3 of clean drain rock were used in the construction of the Spring Drain. As well, 7,156 m^3 of J-material was used during construction. All NAG construction material was sourced from the Quarry or CRAB. The last phase of Spring Drain construction occurred concurrently with the final construction of the Lynx Dam, as the completion of the dam's east arm was dependent upon the completion of the Spring Drain. Both projects were completed on November 20, 2014.

These additional lifts have provided sufficient paste tailings storage capacity until April 2016, including adequate storm surge capacity plus freeboard requirements. A full review of the construction activity is provided in the *Myra Falls Tailings Storage Facilities 2014 Construction Report* authored by AMEC.

3.4.3 Jim Mitchell Dam

Construction began in 2014 to raise the dam in Jim Mitchell Lake, providing increased water storage and hydro power capacity and thereby reducing the demand on diesel power generation. Uplands Contracting Ltd. was contracted to carry out the dam raise and Klohn Crippen Berger was contracted as Environmental Monitors (EM). All construction material was sourced from the Thelwood clean fill borrow. In total, approximately 1,500 m^3 of clean fill was placed during 2014 construction of Jim Mitchell Dam. Although all construction material was sieve tested to ensure proper gradation, due to contractor error (screening and placing material without the EM on site), a large amount of material placed did not meet specifications as it contained too many fines. This material will be mixed with the required grade to meet specifications during 2015 construction. All material placed in 2015 to complete the 2 m dam raise will be inspected and screened by Klohn Crippen Berger to ensure specifications are met.

On October 22nd, 2014 the culmination of heavy rainfall during October caused erosion of construction material placed near the Jim Mitchell Dam for ramping/access purposes. The resulting erosion gully carried the construction material towards Thelwood Creek. The majority of material settled well back of creek flow. However, continuing precipitation and increased surface runoff resulted in high creek levels forming a back eddy towards the toe of the dam on October 28th, 2014, at which point it is suspected fine sediment entered the creek. After creek levels subsided, three silt fences, a row of weighed down hay bales and a small rock berm constructed by hand were installed to filter fines from surface flows and mitigate possible agitation from future back eddies. MEM, MoE and BC Parks were notified regarding the incident and response.

3.5 Summary of Major Environmental Activities Planned for 2015

The following activities are planned for 2015:

- Complete upgrade of Lynx Lower Diversion Ditch to meet CDA minimum IDF requirement of 1/3 between 1:1000 and PMF rain event.
- Conduct drill program for geotechnical and groundwater investigation of APA seepage zone to inform future upgrades to water management and closure of Old TDF.
- Design Old TDF interim cover and submit to the ministry of Energy and Mines by October 31, 2015.
- Conduct geotechnical feasibility study of rock fill embankment site-wide closure scenario.
- Continue sludge removal from the Superpond and polishing ponds.
- Assess the stability and performance of the waste rock dumps above the Lynx TDF prior to 2015 dam raise.
- Foundation prep of 2015 Lynx Dam footprint including the removal of all buildings and infrastructure.
- Relocate and upgrade the diesel powerhouse.
- Continue to reduce diesel consumption by raising Jim Mitchell dam to increase water storage potential in Jim Mitchell Lake.
- Raise the Lynx TDF berm to ensure sufficient capacity for paste tailings storage and freeboard until 2017.
- Complete construction of the Lynx Spring Drain.
- Re-grade main bench of Old TDF Seismic Upgrade Berm to provide positive drainage.
- Conduct high flow 5-in-30 water quality sampling and complete monthly sampling requirements to assist in development of Site Specific Water Quality Objectives with the Ministry of Environment.
- Perform high flow Disconnected Drain Test to assess potential value of connecting the Medium New Outer Drain (0+400 - 0+800) section to treatment (low flow test completed in 2013).
- Pipe surface flow from Lynx 10E portal to treatment or to the Mill for process water.
- Pipe Phillips Reach surface flow to Mill to be incorporated into process water.

- Continue to re-vegetate areas of the mine site as they become available.
- Continue working with Ministry of Environment to update effluent permit PE-06858, air emission permit PA-2408, and refuse permit PR-2561 to reflect operational changes and to improve monitoring.
- Assess the requirements and availability of clean fill for Old TDF reclamation and begin determination of the next clean-fill borough location.

4.0 Reclamation Activities at Myra Falls

A primary objective of closure of Nyrstar Myra Falls is to create a safe and stable post-closure site where minimal long term maintenance is required, and where water quality will meet standards of environmental protection in perpetuity. Mining-impacted areas will be reclaimed to reflect the surrounding parkland.

The approved end land use of the Myra Falls site, according to the *Strathcona-Westmin Park Master Plan,* is to: "return this area to Strathcona Provincial Park, reclaimed and rehabilitated as much as practically possible, so that it will become part of the larger Strathcona Provincial Park. The mine's role in this endeavour will be to conduct its operations, including restoration of disturbed areas, in a manner that recognizes the Park's wilderness and recreational qualities and to work with BC Parks in protecting these resources for the enjoyment of present and future generations."

In conjunction with the overall objectives of final reclamation, progressive reclamation is adopted wherever practical. However, given that much of the infrastructure is required for long-term operations, the majority of reclamation work will be implemented after the mine and its associated metallurgical facilities have closed.

4.1 Mining Program

4.1.1 Surface Development to Date

The general site plan, depicting the surface development to date, is provided in Figure 1 in Appendix I. The majority of the footprint of the mining operations is in Myra Valley, with additional mining infrastructure located in Thelwood Valley. The direct disturbance footprint totals 198.7 ha (hydro generating stations included, hydro dam infrastructure excluded). A summary of the areas disturbed and reclaimed is presented in Table 4-1.

Table 4-1 Summary of Areas Disturbed and Reclaimed (ha)

Disturbance	MINING		RECLAMATION							
	Area Disturbed (ha)		Area Recontoured (ha)		Area Seeded/ Planted (ha)		Area Fertilized (ha)		Area Revegetated Revegetated (ha)	
	2014	*Total*	*2014*	*Total*	*2014*	*Total*	*2014*	*Total*	*2014*	*Total*
Waste Dumps	0	16.4	0	0	0	0	0	0	0	0
Tailings Facilities	0	55.3	0	0	0	3.8	0	3	0	1
Plant Site (Lynx and Mill)	0	19.3	0	0	0	0	0	0	0	0
Roads (including Jim Mitchell Lake road)	0	21	0	17.3	0	21.3	0	21.3	0	14.3
Administration (HW-Myra and Backfill Plant)	0	14.9	0	0	0	0	0	0	0	0
Pit (Lynx Pit and Quarry)	0	23.9	0	0	0	0	0	0	0	0
Stockpiles	0	0	0	0	0	0	0	0	0	0
Clean Fill Borrow Sites	0	6	0	0	0	0	0	0	0	0
Linear (Myra Creek)	0	1.6	0	1.6	0	0	0	0	0	0
Other (Price, Phillip's Reach, Water Treatment Ponds, old camp site, cookhouse area)	0	40.3	0	11.3	0	7.1	0	7	0	7
Total	**0**	**198.7**	**0**	**30.2**	**0**	**32.2**	**0**	**31.3**	**0**	**22.3**

The old Tailings Disposal Facility (TDF) is now available for reclamation. The TDF occupies an approximate footprint of 45 ha, which accounts for approximately 25% of the operational footprint, and is the first significant opportunity for progressive reclamation on the mine site.

4.1.2 Current Life of Mine Plan

As of December 31 2014, the Myra Falls resource estimate (measured and indicated), was 7.4 million metric tonnes. The current mine plan and depletion rate at 550,000 metric tonnes per annum would indicate a mine life of at least ten years. This estimate would be entirely dependent on forecasted and prevailing metal prices, currency exchange rates, as well as fluctuating costs of mining and processing.

4.1.3 Surface Development in the Past Year

There was no surface development that resulted in new areas of disturbance in 2014. Construction efforts focussed on areas within the existing mine footprint.

4.1.4 Surface Development Projected Over the Next Five Years

Mining at Myra Falls is confined to underground operations. Surface development is limited to waste management, such as tailings facility construction and infrastructure upgrades, and the development of clean fill borrow sites.

Within the property there are a number of clean fill sources. However, not all of these sources are available until after closure. The operation is assessing the readily available clean fill in Myra Valley for its pre-closure needs and at this time recognizes that it must outline the next most logical clean fill resource which will require permitting before the clean fill materials of the current clean fill borrow site (the Core-Rack Area Borrow, or "CRAB") have been exhausted. A significant clean fill resource of over 9 million m^3 has also been indicated in Thelwood Valley and this resource may be required for future reclamation purposes. A clean-fill availability assessment will be included in the 2015 permit applications to the Ministry of Energy and Mines for the work to be completed in 2015, and a comprehensive clean fill assessment will be submitted with the site-wide mine closure plan to be submitted in 2017.

Annual berm raises of the Lynx TDF will continue over the next 5 years. Annual raises of the berm will increase its height and advance the toe of the berm, requiring the removal of the 80 ft. thickener building and the relocation of the diesel powerhouse and lime silos. This work is all within the existing operational footprint.

5.0 Environmental Protection Program

5.1 ML/ARD Characterization and Management

Clean-fill is classified in a laboratory by either sulfur analysis and/or acid-base accounting. Currently Myra Falls sources its clean-fill materials – predominantly a dense native till - from the Core Rack Area Borrow (the "CRAB"), a borrow site located on the eastern-most end of the property next to the core sample storage area. Native till material is considered "clean" if the total sulfur content is <0.1% (as per the M-26 permit amendment from July 2005).

As construction in 2014 focused on construction of the Lynx TDF, which utilizes waste rock, no clean fill testing or confirmatory analyses were performed.

Table 5-1 documents the volumes and classification of waste rock, tailings and other mine waste that is stored on surface as of December 31, 2014.

Table 5-1 Waste Rock, Tailings and Other Mine Waste

	Acid Generating Waste (tonnes)		Potentially Acid Generating Waste (tonnes)		Non-Acid Generating Waste (tonnes)	
Waste Rock Dumps	**2014**	**Total**	**2014**	**Total**	**2014**	**Total**
WRD #1 (by Paste Plant)	0	0	6,375	5,588,375	0	0
WRD #2 (Upper East Borrow)	0	0	0	1,786,000	0	0
WRD #3 and #4 (Upper East Borro	0	0	0	520,000	0	0
J-zone Construction Pile	0	0	19,155	114,365	0	0
WRD #6 (west end of TDF)	0	0	0	598,000	0	0
WRD #7 (back of Lynx Pit)	0	0	0	9,564	0	0
WRD @ east end of Lynx berm	0	0	42,300	87,380	0	0
Total	0	0	67,830	8,635,854	0	0
Tailings Facilities						
TDF	0	0	0	11,593,347	0	0
Lynx TDF	0	0	231,903	1,712,638	0	6,000
Total	0	0	231,903	13,305,985	0	6,000
Low Grade Ore/Coarse Reject/Other Mine Waste						
None	0	0	0	0	0	0
Total	0	0	0	0	0	0

There are eight seven active waste rock dumps (WRD) currently at Myra Falls. WRD #1 includes the old refuse landfill site and is located near the Paste Plant. To the northeast, it is overlain by WRD #6. WRDs #3 and #4 are located around the Lynx TDF/old Lynx Pit area. The volume and configuration of these dumps will change with ongoing clean fill extraction and the construction of the Lynx TDF. WRD #7 is located within the mid-level of the Lynx open pit, above the final elevation of the Lynx TDF. It is a seldom used storage area for HW underground waste rock. Two other areas are used for the storage of waste rock materials; 1) an active J-zone construction pile that stores HW waste rock and reclaim sand to be used in the ongoing construction of the Lynx berm and which is located in the old WRD #5/Superpile location and 2) the area between the east arm of the Lynx berm and WRD #1 which became an active storage area for HW waste rock in 2013.

Significant volumes of waste rock (approximately 1.3 million m^3) will be required to complete construction of the Lynx TDF berm. These volumes will be sourced primarily from development waste rock brought from underground and from the existing waste rock storage dumps. The reduction/elimination of the waste rock storage dumps will reduce both the environmental liabilities on surface and the volume of clean fill required in the final reclamation of the site.

A detailed inventory of the materials stored within the Lynx TDF is given in Table 5-2. This inventory does not include any materials that have been used in the construction of the Lynx berm.

Table 5-2 Inventory of Materials Contained in the Lynx TDF

Inventory of Materials Contained in the Lynx TDF (tonnes)								
	Paste tailings	**Reclaim sand**	**Rock berms**	**Refuse**	**Waste dumps**	**Surface PAG**	**Price Mine**	**Total tonnes**
2014	231,903	22,050	0	750	0	0	0	254,703
2013	190,962	32,180	0	1,000	0	10,600	0	234,742
2012	194,518	2,205	0	1,000	0	5,500	0	203,223
2011	124,890	3,800	1,980	1,000	303,761	4,500	0	439,931
2010	119,637	3,000	0	1,000	177,980	250	1,346	303,213
2009	100,023	400	12,000	1,000	0	0	0	113,423
2008	207,209	18,190	0	1,000	0	0	0	226,399
Total	**1,169,142**	**81,825**	**13,980**	**6,750**	**481,741**	**20,850**	**1,346**	**1,775,634**

A summary of the development rock produced by the operation for the period 2005 until 2013 is provided in Table 5-3.

Table 5-3 Waste Rock Produced 2005-2013

	Waste Rock Produced Underground (tonnes)	Lynx 5 Level Waste Rock to Surface (tonnes)	Phillips Reach Waste Rock to Surface (tonnes)	HW Waste Rock to Surface (tonnes)	HW Waste Rock kept Underground (tonnes)
2013	271,602	0	4,883	143,197	123,522
2012	160,000	0	0	117,400	42,600
2011	167,450	0	0	82,380	85,070
2010	104,465	0	0	21,064	83,401
2009	89,280	0	0	17,266	72,014
2008	110,000	0	0	46,200	63,800
2007	249,020	60,000	51,794	118,179	17,048
2006	227,170	0	88,165	90,379	48,626
2005	242,232	0	34,284	39,485	168,463

Table 5-3 shows an increase in the waste development rock placed on surface from 2011 (this table could not be updated for 2014 before the date of publishing). This reflects current mine plans which require an increase in development meters towards new production areas. It also reflects a trend in the increase in development meters required per tonne of ore produced. This is the result of developing smaller ore lenses as the larger ore lenses become mined out.

5.2 Surface Water Quality and Quantity

Surface water quality and quantity is discussed in detail in Section 2.0, and a map depicting monitoring locations can be found in Figure 4 in Appendix I.

5.3 Groundwater Quality and Quantity

Groundwater monitoring is discussed in Section 2.0.

5.4 Water Management

Effective water management is paramount at Myra Falls. Although the volume of Mill process water remains relatively constant, groundwater and surface runoff volumes are subject to abrupt changes in response to precipitation events. Precipitation at the site can vary drastically, ranging from approximately 1500 to 3500 mm annually. Variable precipitation levels and extreme rainfall/melting events can create site water management challenges.

The design requirement for the water treatment system is to manage a 1:200 year return period precipitation event. In July 2012, AMEC evaluated and revised the design storm values to include precipitation data from 2008-2011. These new design storm values (with the previous values in brackets) are as follows:

- 1 in 200 year return period, 24 hour rainfall event = 220 mm (229 mm)
- 1 in 1,000 year return period, 24 hour rainfall event = 236 mm (252 mm)
- 24 hour snow melt event = 17 mm (17 mm)
- 24-hour duration Probable Maximum Precipitation (PMP) = 635 mm (550 mm)

The intensity and duration of rain events play a major role in the ability of the water treatment system to adequately manage the initial surge of runoff. Furthermore, anticipation of heavy rain events and the implementation of protocols to mitigate adverse effects is an important component of water management. There have been a number of events in recent years that have tested the site's ability to manage high water volumes and have forced the operation to assess its overall water management strategy. Upgrading the capacity of surface water infrastructure, preventing contact water and diverting clean water from treatment facilities, mitigating surface erosion and solids reporting to treatment ponds, and improving and/or installing decants and spillways for more effective water drainage are aspects Myra Falls has been assessed in 2014 and will continue to be investigated as a site priority.

5.5 Erosion and Sediment Control

In October of 2014, measures were implemented at Jim Mitchell Dam to mitigate the erosion and potential deposition of construction material into Thelwood Creek. These measures were carried out in response to heavy rain events creating erosion gullies in material placed for ramping and access purposes for the construction of the Jim Mitchell Dam raise. This included the installation of three silt fences, a row of weighed down hay bales, and a hand constructed rock berm to mitigate the erosion of fines and buffer back eddies from Thelwood Creek during high flows.

An erosion and sediment control management plan will be created in 2015 to identify vulnerable areas in Myra Valley and appropriate mitigation measures. Further efforts will focus on the installation of infrastructures and appurtenances to enhance landform stability and prevent deposition of sediments in both treatment facilities and water courses. The management plan will be informed by a 2015 LiDAR survey.

5.6 Vegetation Management

Details of invasive plant species management can be found in the *Myra Falls Invasive Plant Management Plan* (Integral Ecology), submitted to the Ministry of Energy and Mines on March 31, 2014. The plan is based on the following actions:

1. Control and eradication of identified priority species from the mine site;

2. Ongoing monitoring of invasive plants;

3. Implementing measures to assist in preventing the distribution of propagules by limiting import onto the site; and

4. Implementing measures that contribute to the management of off-site invasive species populations to limit or prevent their advancement onto mine property and their role as an ongoing local source of invasive species. This action will require collaboration with other management agencies.

Early identification of problem plants is key to limiting the spread of invasive plants at Myra Falls. Though the surrounding Park areas are largely pristine and free of invasive plants, introduced species are often found in easily-accessed areas due to car, boat, human, and animal traffic. Ongoing monitoring combined with control efforts as practicable will limit the spread of the current invasive plant populations and inhibit the establishment of new populations and new species occurrences.

5.7 Wildlife Protection

Wildlife and habitat assessments, including songbird nest surveys, are carried out before any new surface development occurs. There was no new surface development done in 2014 and no new development in planned for 2015.

5.8 Archaeological Resources

It is not known if the Myra Valley was an area of archaeological significance before Myra Falls began operations in 1966. A recent archaeological overview assessment was completed in July 2012 in advance of the CRAB development. The report stated that the CRAB area is an area of low potential for the presence of an archaeological site, and no further archaeological work was recommended.

6.0 Reclamation Program

6.1 Long Term Stability

The long term stability of the two tailings disposal facilities are reviewed annually by AMEC, the Engineer-of-Record for Nyrstar Myra Falls. Robertson GeoConsultants Inc. (RGC) and BCG Engineering Inc. (BCG) were both retained to produce third-party reviews of AMEC's Dam Safety

Inspection Reports in 2013 and 2014. Details of the long term stability of the tailings impoundments can be found in the following reports:

- AMEC Environment and Infrastructure, *Myra Falls Tailings Storage Facilities 2013 Annual Dam Status Report* submitted to MEM in March 2014.
- RGC produced two formal Dam Safety Reviews (DSRs) for the Old TDF and the Lynx TDF in accordance with the CDA Dam Safety Guidelines. The reports, titled *Myra Falls Lynx Tailings Disposal Facility 2013 Dam Safety Review* and *Myra Falls Old Tailings Disposal Facility 2013 Dam Safety Review* were submitted to MEM in February 2014.
- AMEC submitted a *2014-Q3 Dam Safety Inspection Report* in November 2014 in response to the Chief Inspector's Orders dated August 18, 2014.
- Also in response to the Chief Inspector's Orders dated August 18, 2014, an independent third-party review/audit was conducted on AMEC's *2014-Q3 Dam Safety Inspection Report* by BCG Engineering Inc. in December 2014. This report was submitted to MEM in January 2015.

Nyrstar has provided MEM with an aggressive work plan to address any deficiencies and/or recommendations noted in the reports to ensure that the outstanding geotechnical and geochemical concerns are addressed to protect current and future dam integrity.

6.2 Revegetation

The goal of the Myra Falls revegetation program is to create a sustainable vegetation cover that is reflective of the surrounding coastal western hemlock ecosystem. In order to achieve this, the site has adopted a natural ecosystem succession approach to revegetation, in which pioneering species such as red alder are planted to begin the natural successional process. Once established, the alders modify and improve the planting site by changing the soil and microclimatic conditions though atmospheric nitrogen fixation, providing leaf litter and shade, enhancing soil stability, and encouraging biodiversity by providing habitat and forage for animal life. Secondary species, such as Douglas-fir, whose optimal growing conditions are suited to growing beneath the protective canopy of alder, should begin to voluntarily establish themselves under these conditions. This process continues until a climax condition is reached.

The principle area of the site that is undergoing this successional revegetation trial is the upper 2:1 slope of the TDF seismic berm. This steep area of compacted rock is a challenging area in which to establish vegetation. The lack of soil and nutrients, as well as 2-3 months of dry weather conditions will reduce the success of all but the hardiest of vegetation types. Despite these challenges, the red alder plantings have been successful. The alder has grown rapidly and is performing as expected, especially in the east end of the TDF, where the first seedlings were planted in late 2008. Numerous volunteer vegetation species have been noted on the berm, which are documented in detail in the attached Integral Ecology report *Nyrstar Myra Falls Revegetation Monitoring 2012 - 2014*.

Future reclamation efforts will focus on in-fill planting of red alder, which has seen the greatest success since planting began. Secondary species such as Douglas-fir will be planted once the alders have become more established. Initial planting of Douglas-fir as a pioneering species had minimal success, except in areas of heavy alder growth. The berm will continue to be monitored for revegetation success and principles learned here will be applied to the rest of the site.

As the planting density of the TDF seismic berm slope has been deemed adequate, no new or infill planting was done in 2014.

6.3 Growth Medium

The availability of growth medium material at Myra Falls is limited to local native till. Due to the location in a Provincial Park, no supplemental materials (such as municipal compost, biosolids, fish/forest compost, etc.) are permitted due to concerns regarding the introduction or preferential development of invasive species. The native till material has previously been sourced from borrow areas within the mine lease boundary. In general, the local till material is relatively well-graded; it has sufficient fines to provide adequate moisture retention for growing native plant species, plus sufficient gravel and cobble size particles to provide adequate resistance to soil erosion. The material, if placed in a 1.0 m thick (or greater) reclamation cover layer over mining-impacted areas will also provide some storage capacity for precipitation and subsequent release via evapotranspiration, thereby reducing net percolation volumes through mine waste during the summer months.

As the growth medium till is sourced from a naturally mineralized area, testing of placed clean fill material on the TDF seismic berm has shown elevated metal concentrations, particularly for zinc, but also for cadmium, copper and lead. Till materials will continue to be tested for suitability as a growth medium for future reclamation projects.

6.4 Additional Closure Details

The site-wide closure plan is currently being prepared by Robertson GeoConsultants, and will be submitted to MEM by December 31st, 2017. The closure plan will include details on:

- post-closure landforms;
- the removal of equipment, scrap and /recyclables, and the treatment of foundations;
- progressive and final reclamation of waste dump, watercourses and open pits and roads;
- infrastructure decommissioning/reclamation;
- activities conducted to secure potentially dangerous surface areas and underground openings;
- and programs for chemical management and disposal.

The reclamation of the old TDF will be described in a detailed closure plan that is currently being prepared by Robertson GeoConsultants and will be submitted to the Ministry of Energy and Mines by July 31st, 2015. The workplan for this report will be submitted by April 30th, 2015.

6.5 Reclamation Research

Reclamation research efforts undertaken during 2014 were primarily in support of site-wide closure planning, with the next update to the site-wide closure plan due for submission to the Ministry of Energy and Mines by December 31, 2017. Myra Falls has contracted Roberston GeoConultants Inc. (RGC) to provide the lead in producing this plan. To better understand groundwater flow patterns an additional 41 monitoring wells were established in Myra Valley during August 2013, with another 11 wells (5 nested wells) installed in 2014. These wells have been routinely sampled through the year and RGC is developing a clearer understanding of groundwater flow regimes from this new data. Meanwhile, the 3D groundwater contaminant load model that was developed for the TDF closure plan in 2012 has now been expanded to include the entire site-wide footprint within Myra Valley.

6.6 Five Year Reclamation Plan

Reclamation over the next five years at Myra Falls will include the continued upgrades of infrastructure to Canadian Dam Association guidelines for final closure layout of the Old TDF, APA area and the Lower Lynx Diversion Ditch. The permitting and earthworks for the immediate upgrade requirements will be performed in 2015. The earthworks will continue in 2016 and 2017 to completion.

Concurrently with the stabilization and upgrades to the current infrastructure, Myra falls is working on research into two parallel final site wide closure plans, and will develop a permit application for the option that is the best fit for an application to be submitted by December 31, 2017.

7.0 Documents Submitted to Government in 2014

Table 7-1 lists documents and reports distributed to the Ministry of Energy and Mines and/or the Ministry of Environment in 2014.

Table 7-1 Reports Submitted to BC Government in 2014

Document/Report	Author	Date Produced	Reason
Myra Falls Old Tailings Facility 2013 Dam Safety Review	Robertson GeoConsultants Ltd.	Feb-14	CDA Guidelines
Myra Falls Lynx Tailings Facility 2013 Dam Safety Review	Robertson GeoConsultants Ltd.	Feb-14	CDA Guidelines
Nyrstar Myra Falls Closure Scenarios Risk Assessment	Robertson GeoConsultants	Feb-14	Assess potential closure scenarios for viability
Annual Environmental Report for 2013	Nyrstar Myra Falls	31-Mar-14	Annual requirement
Nyrstar Myra Falls Tailings Disposal Facility – Closure Detailed Design and Construction Plan	O'Kane Consultants Inc.	Mar-14	2013 Permit Amendment Requirement
RGC Response to MEM Review of Dam Safety Review Reports – Tailings Disposal Facilities	Robertson GeoConsultants	31-Mar-14	Response to questions and comments as required

Invasive Species Management Plan	Integral Ecology Ltd.	31-Mar-14	2013 Permit Amendment Requirement
Myra Falls Tailings Storage Facilities 2013 Annual Dam Status Report	AMEC Environment and Infrastructure	Apr-14	Annual requirement
Myra Falls Tailings Storage Facilities 2013 Construction Report	AMEC Environment and Infrastructure	Apr-14	Annual requirement
Emergency Management document	Nyrstar Myra Falls	Jun-13	Updated version of the document
Closure Cost Estimate	Robertson GeoConsultants Ltd.	31-Jul-14	Requirement as part of the Interim Site-Wide Closure and Reclamation Plan
2014-Q3 Dam Safety Inspection Report	AMEC Environmental and Infrastructure	19-Nov-14	Chief Inspector's Orders from August 18, 2014
Mine Manager's Letter to Chief Inspector Summarizing Recommendations of the DSI Third Party Review	Acting Mine Manager John Knapp	02-Dec-14	Chief Inspector's Orders from August 18, 2014
2014 Independent Audit/Review of Tailings Dam Safety Inspection and Consequence Classification:	BCG Engineering Inc.	01-Dec-14	Chief Inspector's Orders from August 18, 2014

Myra Falls Mine, BC			
2014 Independent Audit/Review of Tailings Dam Consequence Classification: Myra Falls Mine, BC	BCG Engineering Inc.	Dec-14	Chief Inspector's Orders from August 18, 2014
Emergency Preparedness and Response Plan (Emergency Management Program)	Nyrstar Myra Falls Ltd.	Jan-15	Chief Inspector's Orders from August 18, 2014
Myra Falls Dam Breach Inundation Study	AMEC Environmental and Infrastructure	Jan-15	Chief Inspector's Orders from August 18, 2014

8.0 Reclamation Liability Cost Estimate

On October 3, 2011 the Ministry of Energy, Mines and Natural Gas amended the M-26 mining permit. In doing so the reclamation security bond was increased from $30.8, through a schedule of annual increases, to $70.6 million by August 30, 2015.

Currently the reclamation security bond is funded to a level of $66.8 million.

A detailed closure cost estimate was prepared in 2014 by Robertson GeoConsultants and can be found in Appendix III.

APPENDIX I:

MAPS AND DRAWINGS