Nyrstar Myra Falls

Nyrstar Myra Falls – Application to Amend *Mine's Act* Permit M-26: Requesting Surface Stockpile, Hauls, and Paste Backfill – Revision 1

Submitted to the BC Ministry of Energy, Mines, and Petroleum Resources (EMPR)

October 10, 2017

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1.0 Introduction

1.1 **Overview Nyrstar Myra Falls Ltd.**

Myra Falls is a historic 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 produced zinc, copper and lead concentrates with silver and gold credits. Ore concentrate was trucked to a port terminal in Campbell River where it was shipped to refining smelters around the world. The mine has been operating since 1966 with peak production in excess of 1.3M tonnes/year.

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. Nyrstar 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.

The operating company is registered as ***822638-5, Nyrstar Myra Falls Ltd.*** (NMF). The company contacts for the location are:

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NMF maintains an office at the Campbell River Load-out Facility located in Campbell River and has a separate mailing address as listed below.

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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 Tables 1 and 2 next page); the site offices are located within L1344 Being Bear Paw Mineral Claim, Clayoquot District.

Table 1: Mining Leases and Crown Grants

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 2: Mineral Claims

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

Other key contact information for Nyrstar Myra Falls follows.

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1.2 Current Application

Nyrstar had suspended active milling and mining at the Myra Falls Mine in June of 2015 due to high operating costs related to failing infrastructure and mine practices. Remedial work was initiated at this time to carry out required rehabilitation work on infrastructure onsite. Market conditions continued to decline during this time causing Nyrstar to suspend all work and to place the site under care & maintenance in October 2015.

During the temporary suspension, site staff worked with the consulting firm McKinsey & Company to optimize the mine plan for a restart. The Nyrstar Board of Directors conditionally approved the restart plan on May 04, 2017 and released 5M€ to begin critical path and seasonal work in preparation for a full restart. On August 1, 2017, the Nyrstar Board of Directors were satisfied that conditions for a full restart approval were in place and approved the restart of the mine. The restart schedule for the mine is progressive based on infrastructure repair/installation, with major milestones being; first production ore from surface in February 2018, Mill restart in March 2018, and production volumes increasing from 232,000 tonnes/year in 2018 increasing to 783,612 tonnes/year full capacity in 2021. At full capacity, Nyrstar Myra Falls will directly employ 377.

The initial works will be initiated commence under the current Mine's Act permit M-26 and will focus primarily on rehabilitation of existing works (where required), infrastructure improvements (including new ore and waste passes, development, and repairs needed in the existing mill and on the surface infrastructure.

This application will cover the changes to NMF's current *Mine's Act* permit M-26 required to fully implement the restart plan as developed. Key changes to the existing mining methods required for the restart plan include:

- Updated 5 year Mine Plan
- Surface haulage of ore and waste from the Price Mine
- Surface haulage of ore and waste from the Lynx Mine
- Surface stockpile of ore
- Backfill - switch from Hydraulic-fill using Coarse Sand to Paste-fill using full-fraction tailings
- Updated 5 Year Closure Schedule.

Additional permitting requirements in support of the restart plan include updates to the Effluent Permit PE- 06858, updates to the Air Permit PA-02408, and a letter of authorization from BC Parks to expand and replace surface infrastructure impacted by the restart projects.

Earlier in 2017 approvals were received from Vancouver Island Health Authority and BC Parks to temporarily expand the site camp facility, replacing the kitchen and adding 2 new sets of bunkhouses. The old kitchen and the older bunkhouses will be removed following the completion of the restart construction projects 24 months after of the commencement of the restart project, effectively replacing the camp facility with a newer facility.

1.3 Project Location, Access and Land-use

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, Mines and Petroleum Resources (EMPR) as listed above.

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.

Figure 1 on the following page provides an overview of the site with the various claim and lease boundaries.

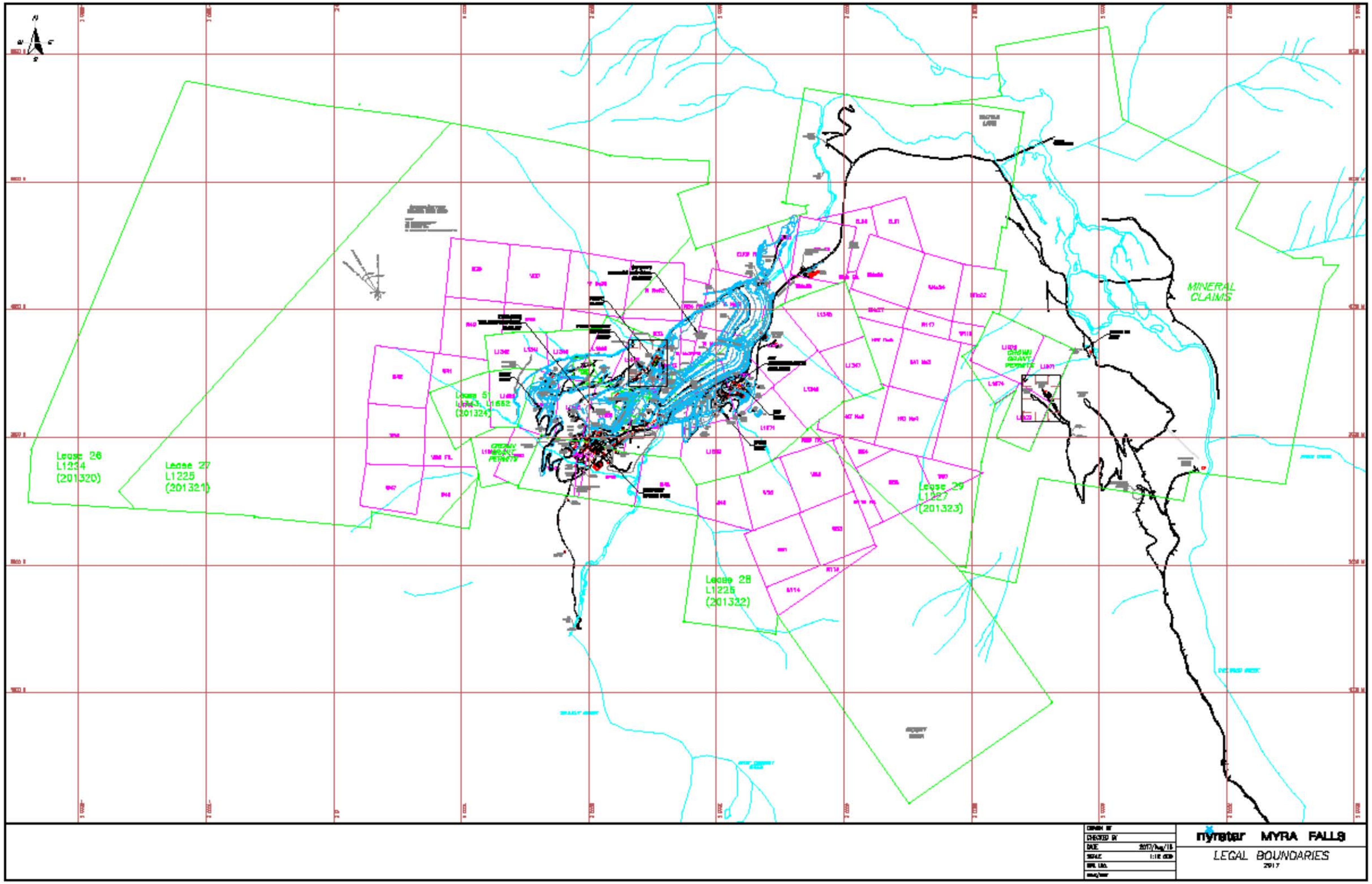

Figure 1: Site Overview including the Legal Boundaries

2.0 Infrastructure and Site Components

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 the HW mine complex, the Phillips Reach ramp, the 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 "Old TDF" and the "Lynx TDF"), a lime addition water treatment system, a potable water treatment system, paste plant, backfill plant and associated facilities.

2.1 **Mining**

Historic open pit mines are visible as the Upper Lynx Open Pit, and the Myra Open Pit, however these are no longer active. The Lower Lynx Open Pit was converted into a Tailings Disposal Facility.

Active mining at NMF is currently limited to underground as described below. All of the mines are still considered to have exploration potential, and planned exploration activities could continue to identify new resources. The HW, Lynx and Myra underground mines are located within the Myra Valley, and the Price Mine is located within the Thelwood Valley.

Information describing the geological environment, mining layouts, stope design, and ground support requirements including monitoring protocols and information storage is included in Appendix 1: Nyrstar Rock mechanics Program. There is a small sinkhole under the Lynx Tailings Facility related to the direct contact with previous underground workings; Myra Falls expects no subsidence in other areas of the site. Updated ventilation plans and backfill containment structures are under development and will be submitted to the EMPR for review 8 weeks prior to restart.

Figure 2: Myra Falls Ore Bodies below depicts the different ore bodies discussed in the following sections to identify the vertical and planar alignment relative to the surface structures such as the HW Shaft and the Phillips Reach Surface Ramp. Cross Sections and Plans have been provided in digital format for review for each location; these are collectively referred to as Appendices 2a – 2i.

2.1.1 HW Mine

The HW Mine opened in 1985 following the discovery of the HW deposit, a large sulphide deposit of 20 million tonnes. This discovery marked a period of expansion for the operation when production rates increased to 3600 tonnes per day during the late 1980's through to the early 2000's. Mining of the HW deposit has subsequently declined and will continue to be mined at a rate of 300 tonnes per day as the orebody nears depletion. Today the principal mining areas are located to the west – the Battle and Gap orebodies – and to the east - the 43 Block and the South Flank orebodies. However, all underground production areas still rely heavily on the infrastructure of the HW Mine

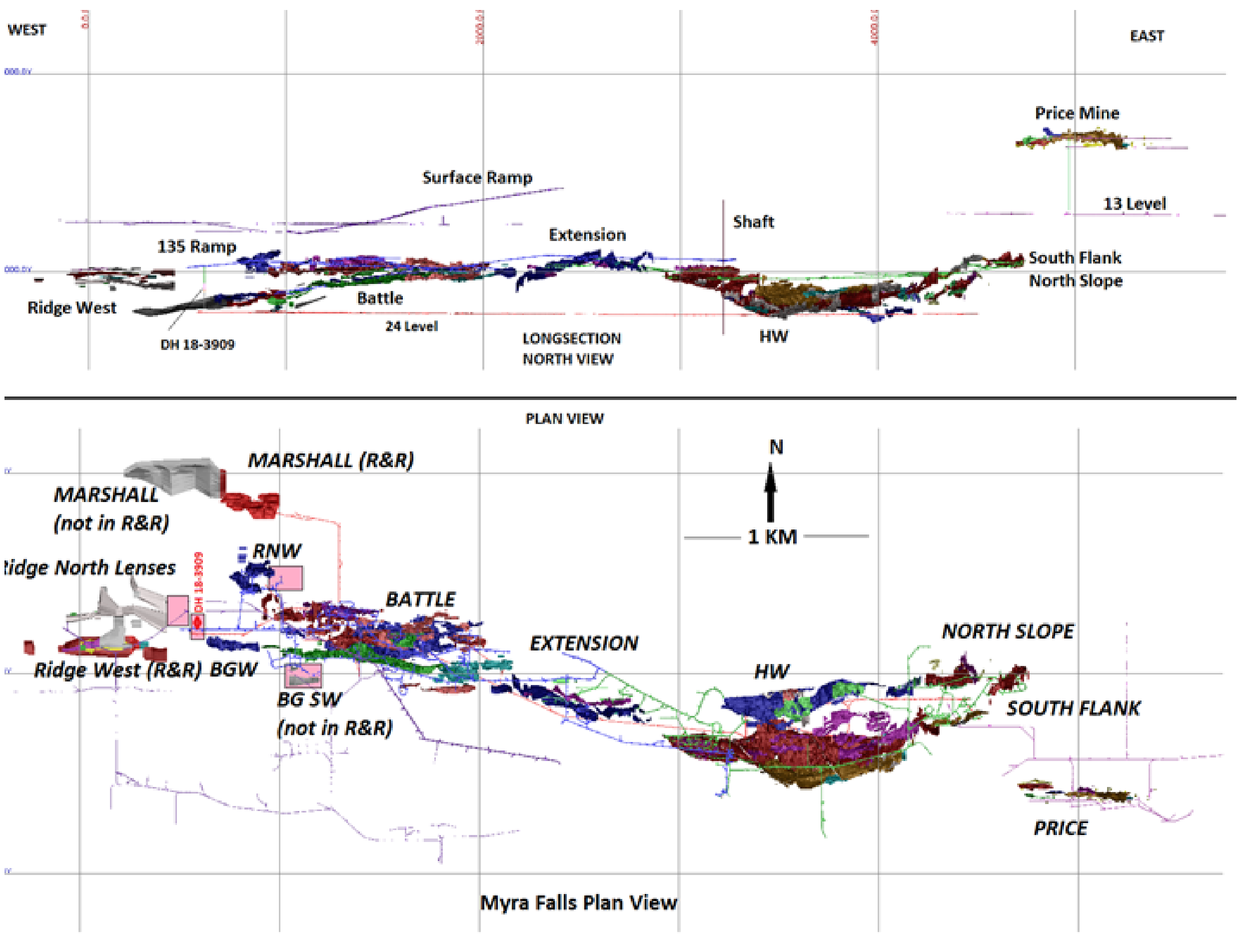

Figure 2: Myra Falls Ore Bodies

to provide access and ventilation. As such, the HW Mine remains an integral part of future mine planning.

Ore is transferred via a system of ore passes to 24 level, a common haulage level. From 24 level, the ore is fed to an underground crusher and crushed to -6" size before being hoisted to surface and conveyed via an enclosed overland conveyor to the Mill. Mining voids were backfilled with hydraulic sand fill and/or waste rock. The hydraulic sand fill contains variable cement content, depending on the stress load characteristic requirements of the area being filled. The backfill was delivered from the surface Backfill Plant, which utilized the coarser sand fraction of the tailings delivered from the Mill. In August 2018, NMF will be transitioning to a paste backfill utilizing full size fraction of the tailings stream. This change in procedure is discussed in Section 4.7.11 and is one of the primary changes to the mining techniques applied for in this application.

2.1.2 Lynx Mine

In 1966, the Lynx Mine became the first producing area at Myra Falls. Initially, all ore was produced from the open pit at a rate of 850 tonnes per day. With the development of the Lynx underground mine, production was maintained from both open pit and underground sources until 1973, when the ore reserves in the open pit were considered to be mined out. Underground mining continued until 1993, when mining was suspended for economic reasons. Remnant pockets of ore were occasionally mined during 2000-2008, the most significant of which was the removal of the crown pillar in 2007-2008. The Lynx Mine remains an integral component of the mining infrastructure, providing the intake ventilation for the western production areas of the operation, as well as providing a second emergency egress from underground. Significant ore reserves and potential remain in and adjacent to the Lynx Mine.

Mining in Lynx 5 and 6 levels will be undertaken in 2018 and is expected to be mined to completion by early 2019 if significant additional resources are not identified in this area during the exploration scheduled in 2018. Mining will be conducted by a contract mining company (Dumas Contracting Ltd.) at an expected mining rate of up to 15,000 tonnes / month. The ore will be hauled via surface road that is further discussed in section 4.5.1.

2.1.3 Myra Mine

The Myra Mine operated from 1970 until known resources were depleted in 1985. The Myra Mine is connected to the HW Mine on 13 level and provides a main emergency escape way out of the HW Mine. Myra 13 level access also provides ventilation flow to the shaft area of the HW Mine. The main hydropower transmission line is routed through Myra 13 level from the Thelwood Valley, exiting the Myra 11 level portal in the Myra Valley.

2.1.4 43BLK-NS

The 43 Block and North Slope mine areas are accessed from 23 and 20 levels. They are an eastward extension of the HW North Upper zone. The area was progressively explored for and developed beginning in the early nineties. The production will be moved through 430 ore-pass at an anticipated rate of 240 tonnes per day. It is being actively explored.

2.1.5 Extension

The Extension zone is located between The HW and Battle deposits. It is a faulted offset of the HW deposit northwest across the Shaft Fault and is generally similar in mineralogy, that is a semi massive sulphide lens, primarily sphalerite and chalcopyrite. Production from the Extension zone begins in 2018 at a planned rate of 100 tonnes per day. In the current mine plan, it will be moved through 325 ore-pass.

2.1.6 Battle Gap BG, BG-SW

The Battle and Gap zone runs from about 2000 east to 800 east and is a composite of thin , stacked semi massive, polymetallic, primarily zinc rich sulphides. It was delineated in 1992-95 and first production in 1995. It is in the mine plan at a rate of 360 tonnes per day and will be moved to the central crusher via several ore-passes.

2.1.7 BGW

BGW is a faulted displacement of the Battle Main and Gopher lenses to the west. It was discovered in 2013. It sits at the base of the Myra stratigraphy and is a semi-massive polymetallic lens that currently is in the plan at 350 tonnes per day but first production is several years out.

2.1.8 Ridge West

The Ridge West is an undeveloped multi lens deposit that is on strike and analogous to the Battle Upper lenses. The connection to the Battle deposit has not been drilled off to date but is part of ongoing exploration and definition drill programs. Once accessed and developed, this deposit will play a major part in production in later years at a rate of 500 tonnes per day.

2.1.9 Ridge NW

The Ridge North West was discovered in 2012 and has been further delineated and extended year over year. It lies north of the Ridge – Battle trend and is offset down dip to the north by a major fault. It is a very high grade polymetallic lens that has been folded and locally faulted. It is in the production plan at 225 tonnes per day.

2.1.10 Marshall

The Marshall zone is comprised of two major lenses and represents the largest undeveloped deposit in the Myra complex of lenses. It lies north and west of the Ridge West- Battle trend and is a zinc rich mineralized zone associated with rhyolitic intrusions. It is in the later years of the plan at 450 tonnes per day.

2.1.11 Price Mine

The Price Mine orebody was accessed in the early 1980's with development on 4 level, 5 level and 9 level. However, with the discovery of the HW deposit, all mining interest switched back to the Myra Valley. As such, the Price Mine has yet to realize significant production. The Price orebody still has significant associated exploration potential. Also, the Price 13 level portal is critical in the transmission of hydropower from Thelwood Valley into Myra Valley.

2.2 The Mill

The mill has a 2700 tonne per day capacity and produces three concentrates zinc, copper and lead. All concentrates are trucked to a ship-loading facility in Campbell River.

The milling process involves four stages; crushing, grinding, flotation and dewatering. The mill receives underground ore via a 1.4 km long enclosed conveyor system which discharges into a 3,600 tonne Coarse Ore Bin (COB). Ore can also be received via the conveyor from the old Lynx Crusher Building to the COB providing some flexibility for the operation. The crushing plant consists of a secondary Symons standard cone crusher and a tertiary Symons short head cone crusher which provide a nominal capacity of 270 tonnes per hour. Product from the tertiary screen undersize reports to two 3,500 tonne fine ore bins.

The grinding plant consists of two parallel grinding and regrinding circuits, each with a Dominion rod mill and a Dominion ball mill. Product size from the grinding circuit is 75-80% minus 200 mesh.

The ground ore is fed to a copper-lead-zinc sequential flotation circuit. The copper and zinc sides are essentially identical with a conditioner, roughers, scavengers, a Dominion regrind mill, regrind cyclones and cleaner banks. From the cleaners, the concentrates are thickened in their respective thickeners to 70% solids and then transferred to 3,000 cft. stock tanks prior to filtration.

All concentrates are filtered using Larox pressure filters which discharge to storage bins, ready for transport to Campbell River. To reduce dust potential, the filters produce a concentrate with a moisture content that is set above 7%.

2.3 Tailings Disposal Facilities

From 1967-1984 tailings were deposited subaqueously 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.

2.3.1 Old Tailings Disposal Facility

The Old TDF has not been in active use since 2008, and has been recently upgraded to meet current standards for water management and seismic stability. The facility closure plan has been submitted to the BC Ministry Of Energy, Mines and Petroleum Resources (EMPR) for review; a permit decision is expected in early 2018. Additional closure works of this facility will be implemented following the approval of the closure plan.

2.3.2 Lynx Tailings Disposal Facility

The Lynx TDF is a paste tailings deposition area on the north side of the valley within the previous open-pit mine, retained by a centerline-raised earthfill dam with a final proposed design height of approximately 57 m. Following completion of mining, Lynx Pit was infilled with up to 40 m of various waste materials, including blast rock, creek bed materials, potentially acid generating (PAG) rock, tailings, sludges from the Lynx and Price Ponds, and other random fills. (Amec Foster Wheeler, March 2015)

The facility has been designed to store the 1:200 Annual Exceedance Probability (AEP) event Environmental Design Flood (EDF) of 300,000 m^3, with flood waters in excess of that volume directed out of the facility through the Emergency Spillway to Myra Creek. The spillway is permitted for construction and will be in place by the end of construction season 2017.

At final elevation the facility will provide storage for approximately 1.5 Mt of pasted tailings, or approximately 12 years of surface deposition requirements.

2.4 Waste Rock Dumps

Between 1966 and 1975, over 4.6 million m^3 of waste rock was generated from mining the Lynx Open Pit. The rock was removed to three dump sites: Dump #1, #2 and #3-4 subsequently, the waste rock dumps have had additional material added from all underground operations. From 2000 through 2008, the remnant ore lenses and the crown pillar were mined in the Lynx Open Pit, and deposited in Dump 6. Waste Rock Dumps 2, 3 and 6 will be used as source material in construction of the Lynx TDF and will be stabilized for Final Closure in the process.

2.4.1 Waste Rock Dump 1

Dump 1 is located east of Lynx TDF, the dump is founded on the valley floor near about 3360 m elevation and abuts the north valley side slope. The dump is a sidehill fill about 900 m long, with a broad flat top with a width of up to 150 m. The southeast facing side of the dump is buried by Dumps 6A and 6B and is inundated by the Old TDF. Approximately 80 m of the west end of the dump is covered by Dump 2. The west end of the dump has an estimated volume of 900,000 m^3. (Amec Foster Wheeler, March 2016) This is the current active waste rock dump on site.

2.4.2 Waste Rock Dump 2

Dump 2 is located on the north valley side slope above Lynx TDF. The top of the dump is at elevation 3630 m, located near 5 Level Portal, and the bottom of the dump is at elevation 3420 m at the southeast corner, 80 m of which extends onto the west end of Dump 1. The dump is crossed by several active and abandoned access roads and has periodically been used as a source of borrow. The access roads and borrow areas have created irregular benches along the dump surface. The benches are generally between 5 and 20 m wide and partially cut into natural soil or are adjacent to bedrock. Cut slopes from the access roads and borrow areas are commonly over steepened and are marginally stable. Slopes between the benches are up to 70 m high and generally stand at between 38° and 40°. The dump has an estimated volume of approximately 1,000,000 m3. (Amec Foster Wheeler, March 2016)

2.4.3 Waste Rock Dump 3

Dump 3 is located within the Lower Pit Lynx Pit. The waste dump is divided into an upper and lower area separated by an intermediate bench, the upper and lower areas are labeled 3A and 3B respectively. The face of Dump 3A is about 100 m high and between elevations 3440 and 3540 m. It was dumped directly from the bedrock rim between the Upper and Lower Pits and lacks a flat top surface. The face of the dump was undercut by past borrow operations and has a slope angle of between 38° and 40° with some short scarps and overhangs up to about 5 m high. Exposures in the scarps and overhangs indicate the waste rock consists of interlayered unaltered medium strong rock and sericite altered weak rock. The sericite altered layers appear to be weakly cemented. The waste rock generally consists of well graded gravel and cobble size fragments and has isolated boulders generally less than 1 m in diameter. (Amec Foster Wheeler, March 2016)

2.4.4 Waste Rock Dump 4

Dump 4 is located west of Lynx pit on a moderately steep gradient spur that extends south from the steeper valley slope. The spur generally slopes south, away from Lynx TDF. The top of the dump is at 3580 m elevation and located near 6 Level portal, and the bottom of the dump is located at elevation 3470 m, about half way between 8 Level and 10 Level-East portals. Waste rock appears to have been dumped over the pit edge near 8 Level portal and currently makes up part of Dump 3A. (Amec Foster Wheeler, March 2016)

2.4.5 Waste Rock Dump 5

Dump 5 contained the relocated tailings from the former Lynx Emergency Tailings Pond. This dump was completely mined out as construction materials for use in the Lynx TDF construction.

2.4.6 Waste Rock Dump 6

Dump 6 is located on top of Waste Rock Dump 1 above the Old TDF and is comprised of waste rock mined during the extraction of the Lynx crown pillar and has been slated for closure in conjunction with the Old TDF. Waste materials in excess of the required volumes for the Closure Design as submitted will be utilized for construction of the Lynx TDF. Remaining volumes are to be utilized in the land-forming work in the Old TDF closure project and will be fully covered when the project is complete.

2.5 Mine Contact Water Management & 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.

No change in the water management or flows from underground are expected to result from the changes listed in this application.

Non-contact water is directed around the site in diversion ditches. Arnica Creek Diversion Ditch directs waster away from the Lynx TDF and Waste Rock Dumps 2 and 4 to Arnica Creek. The Upper Lynx Diversion Ditch directs water away from the Lynx TDF and Waste Dump 2 to Cascade Creek. The Lower Lynx Diversion Ditch diverts Cascade Creek and clean water away from the Old TDF, Waste Dumps 1 and 6 to Myra Creek, just downstream of the daily Effluent Monitoring Site MC-TP4.

2.6 Stockpiles

2.6.1 Ore

Nyrstar Myra Fall does not currently have an ore stockpile on surface, however NMF has determined that a surface stockpile will be required for both restart and in support of the optimized mine plan. In this application Nyrstar is applying for a 15,000 tonne lined stockpile located adjacent to the mill to allow ore storage in preparation for the mill restart, tentatively scheduled for March 2018.

The design for this stockpile has been developed by Onsite Engineering, with a local mine water management plan developed by Amec Foster Wheeler (AFW). These designs are provided for permitting consideration in Appendix 3 A & B, respectively. This stockpile will contain materials mined from the Lynx Underground Mine, as well as materials mined from the Price Mine. The stockpile will be approximately 15,000 tonnes in capacity and will be fully lined to prevent seepage from the stored ore entering the groundwater table in the area. A geotechnical stability analysis is underway for this facility and will be provided upon completion.

This ore stockpile will be used between the start of mining (currently scheduled for January and February 2018 respectively) and the scheduled restart of the mill. Materials from the other mine areas will be brought to surface via the HW shaft. The HW shaft is not expected to be available for hoisting until May 2018 due to rehabilitation works in the shaft, ore handling systems, crusher and on the tramming level. This facility is a temporary one, and will not include a radial stacker or other similar equipment. Myra Falls will utilize a temporary mobile crusher with conveyor to introduce the material back to the current mill system at the current Lynx Crusher Building via the existing conveyance system. Detailed engineering for the crusher system is not yet completed however the specifications for the suggested equipment are included as Appendix 3 C.

A future permit application to expand this stockpile to a permanent facility will be submitted prior to the expected requirement for the larger facility in 2021.

2.6.2 Waste and Construction Stockpiles

NMF has several small operational stockpiles of sorted waste rock and clean rock for the construction of the Lynx TDF and the Old TDF Closure Cover. Clean materials are stockpiled in the Clean Rock quarry, while sorted waste materials are stockpiled outside the construction footprint, within the contact water drainage area. Stockpile specifications are provided in annual issued for construction designs provided by Amec Foster Wheeler.

2.6.3 Growth Medium Stockpile

There is a small growth medium stockpile located in the clean quarry. This material was salvaged from the Core Rack Area Borrow (CRAB) during the development of that facility in 2012. This material will be used to blend with till from the CRAB as final closure cover as well as in localized areas that will not be disturbed for the duration of the mine life where vegetation is desirable.

2.7 **Roads, Pipelines, Power lines and Buildings**

A paved public road runs through the mine property, ending at a BC Parks' parking lot. A number of unpaved restricted-access roads branch off the main road. Until closure is complete, maintenance of these roads is the responsibility of NMF.

Nyrstar is applying for surface haulage over the Lynx / Arnica Road and the Jim Mitchell Lake Road as discussed in section 4.5 Detailed Mine Plan; Appendices 4 and 5 detail the improvements to these roads that would be required should the surface hauls be approved. The current site Traffic Management Plan is included as Appendix 6; this will be updated upon restart to include the Jim Mitchell Lake Road if the surface haul from Price is approved and submitted to the EMPR for review 8 weeks prior to haulage starting in this location.

There are two pipeline corridors for hydropower generation: the Thelwood Penstock, a 48" inch pipe which runs from Jim Mitchell Lake to the Thelwood Power house; and the Tennent Penstock, a 24" line which runs from Tennent Lake to the Tennent Power house. The Thelwood Penstock follows a gravel road from Jim Mitchell Lake, while the Tennent Penstock follows a hiking trail from Tennent Lake.

The overhead power line from Thelwood Power house runs along the gravel access road into Price 13 level portal and daylights in Myra Valley. The power line from Tennent Power house is buried under the shoulder of the gravel access road and daylights in the Mill area. There are other overland and buried communications and power lines within the mine site that support mining activities. A 35 foot communications tower is located adjacent to the BC Parks Lower Myra Falls parking lot.

All roads, pipelines, powerlines and buildings not required for post-closure care and maintenance or public park access will be dismantled and removed, and the site reclaimed.

Backup diesel generators were 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. NMF has applied to BC Parks for approval to move this diesel facility to a new location adjacent to the warehouse

NMF excluded the Power facilities in the Closure Costing estimation in the first draft of the closure costing review. This was reconsidered in the updated version and NMF has instead opted to include costs to remove Thelwood and the related infrastructure, and retain Tennent for long term power needs for water treatment.

2.8 Explosive facilities

NMF holds two surface explosives permits, each with two magazines identified (one each for powder and cap storage). One is located on the Tennent Road, the other is located on the Price Road. These surface magazines provide short term storage for explosives prior to deployment for storage underground. Responsibility for maintaining and monitoring the surface facilities are designated to the Chief Engineer.

There are currently two magazines located underground in the Price Mine, with an additional four planned in the first year of mining. There are four magazines located in the Lynx Mine and in Phillips Reach, and eight located in the HW-BG mines. No additional magazines are currently planned for the HW/BG areas of the mine in support of the restart of Myra Falls Mine at this time.

Responsibility for maintaining and monitoring the underground facilities are designated to underground shift supervisors who report weekly inventories to the Mine Superintendent.

Nyrstar intends to build permanent doors and install locks on all underground cap & powder magazines as per Section 8.1.6 of the Health Safety and Reclamation Code stating that explosives magazines shall be locked at all times.

3.0 Regional Environmental/Ecological Conditions

3.1 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.

3.2 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" 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.

3.3 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 averages 160 frost-free days per year.

3.4 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, a 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.

3.5 **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, oligotrophic 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.

3.6 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. 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.

4.0 Mine Plan

4.1 Mine Plan Overview (Baldwin, 2017)

Myra Falls will operate four underground mines upon re-start: the HW mine which commenced production in 1985, the Battle-Gap (GP) mine which commenced significant production in 1997, the Price Mine which commenced production in 2014 and the Lynx 5/6 mine which has yet to produce ore. The main HW mine is accessed by a 715 meter deep, six-compartment vertical shaft serviced by a 49 meter high headframe. The shaft is linked to the production areas by many kilometers of ramps and lateral development. The Battle-Gap mine is linked to the HW shaft by a 1.8 kilometer long drift on the 18 level. The Price Mine is accessed by a portal in the Thelwood Valley and the Lynx 5/6 mine is accessed by a portal in the Myra Valley. The mine operates on two ten hour shifts per day. All workers and materials are transported to and from the HW/BG mines via the HW shaft, while the Price and Lynx mines are accessed via portals on surface.

Mining in the HW mine accounts for approximately 25% of the annual production. The mining methods currently used in the HW mine are sublevel stoping with longhole drilling. Stopes that have been mined out will be backfilled with cement-stabilized paste backfill.

Mining in the Battle-Gap also includes sublevel stoping with longhole drilling, but also includes drift-and-fill mining techniques, depending upon the ore geometry and ground conditions. Opened in 1997, this mine is the primary production source, accounting for over 50% of total mill feed. Cemented paste backfilling is applied here as well. Over 50% of tailings generated by the mill will be returned underground as fill in the HW and Battle-Gap zones.

Mining in the Lynx Mine only accounts for approximately 5% of the annual production. The planned mining method will be sublevel stoping with longhole drilling. Planned exploration drilling may upgrade some narrow ore zones that would be mined by drift-and-fill mining techniques, if they prove to be economic. Lynx 5 and 6 levels were assessed by a third party engineer and recommendations were made to improve access to the area. This report, as well as typical layouts, have been included as Appendix 7.

Mining in the Price Mine accounts for a little over 10% of the annual production. The mining methods include sublevel stoping with longhole drilling, but will also include drift-and-fill mining techniques where ore thicknesses do not warrant longhole mining. Rehabilitation work in the Price 4 and 5 Levels is similar to that expected in the Lynx Mine and the standards and layouts are expected to be very similar. Site specific designs are under development and will be provided if required.

Loaded by rubber-tired diesel scooptrams and hauled to ore- passes, blasted material falls by gravity to the main haulage level (24 Level). Mineralized material is transported by electric locomotives to the primary jaw crusher located underground on 25 Level in the HW mine. Trains are loaded and sent to the crusher according to specific tramming schedules designed, where possible, to blend grade variations. Mineralized material is crushed to less than 150 millimeters in a 1.2 meter by 1.1

meter jaw crusher and hoisted to the surface in two counterbalanced 10.5 tonne capacity skips to a 100 tonne storage bin in the headframe. From there the mineralized material is transported by a 1.4 kilometer long conveyor to a 3,600 tonne coarse storage bin at the concentrator.

Ground control is achieved by means of rebar rockbolts, welded wire mesh screen, shotcrete and tight filling of voids with cemented paste backfill.

The Phillips Reach surface ramp started in 2005 is complete to level 15 in the Lynx mine. The ramp provides emergency access to the lower levels of the Lynx mine as well as ventilation to the west end of the Battle-Gap mine. Figure 3 Development Relative to Surface Infrastructure depicts the layout of the development underground in the current conditions.

4.2 Acid Rock Drainage Prediction and Management

Myra Falls Mine produces both potentially acid generating (PAG) and non-PAG waste materials. Historically it has been difficult to segregate the PAG from non-PAG wastes brought to surface as all materials are conveyed through the same waste and ore pass circuit and cross contamination is not preventable operationally.

Restricting waste to surface to non-PAG materials only is not operationally viable due to the cross contamination in the conveyance system, however Nyrstar acknowledges the value in reducing the overall volume of PAG materials to surface where possible. A reduction in the proportion of PAG materials to surface will serve to reduce the source of the water contamination and reduce the long-term impacts of mining in the Myra Valley as a result.

To achieve the desired reduction in the ratio of PAG to non-PAG materials brought to surface, the NMF geology team will perform a preliminary screening of underground waste using Total Sulphur of 10 percent to determine where PAG materials are prevalent. These will be incorporated in the mine model, and areas of known PAG waste will be targeted for underground disposal wherever possible. The PAG waste would be preferentially used underground as co-disposal with paste backfill in closed mine-working or as underground road bedding if appropriate.

4.2.1 Non-PAG as a Clean-fill substitute

The Price and Lynx Mines will be mined via surface access, which may allow non-PAG materials to be segregated as clean-fill. If this is desired, NMF would perform a coarse screening on unbroken rock as described above, isolating potentially non-PAG zones. A full Acid Base Accounting (ABA) profile would then be performed on the broken rock post-blast. If the ABA profile indicates that the material has a Neutralization Potential Ratio (NPR) of 3 or more, NMF will stockpile the material separately on surface, and approach EMPR with a request to use the material as clean rock in construction.

As Total Sulphur concentration was not standard parameter prior to shut-down it is unknown if this will be a considerable source of non-PAG material during the mining access via surface in the Price and Lynx Mines.

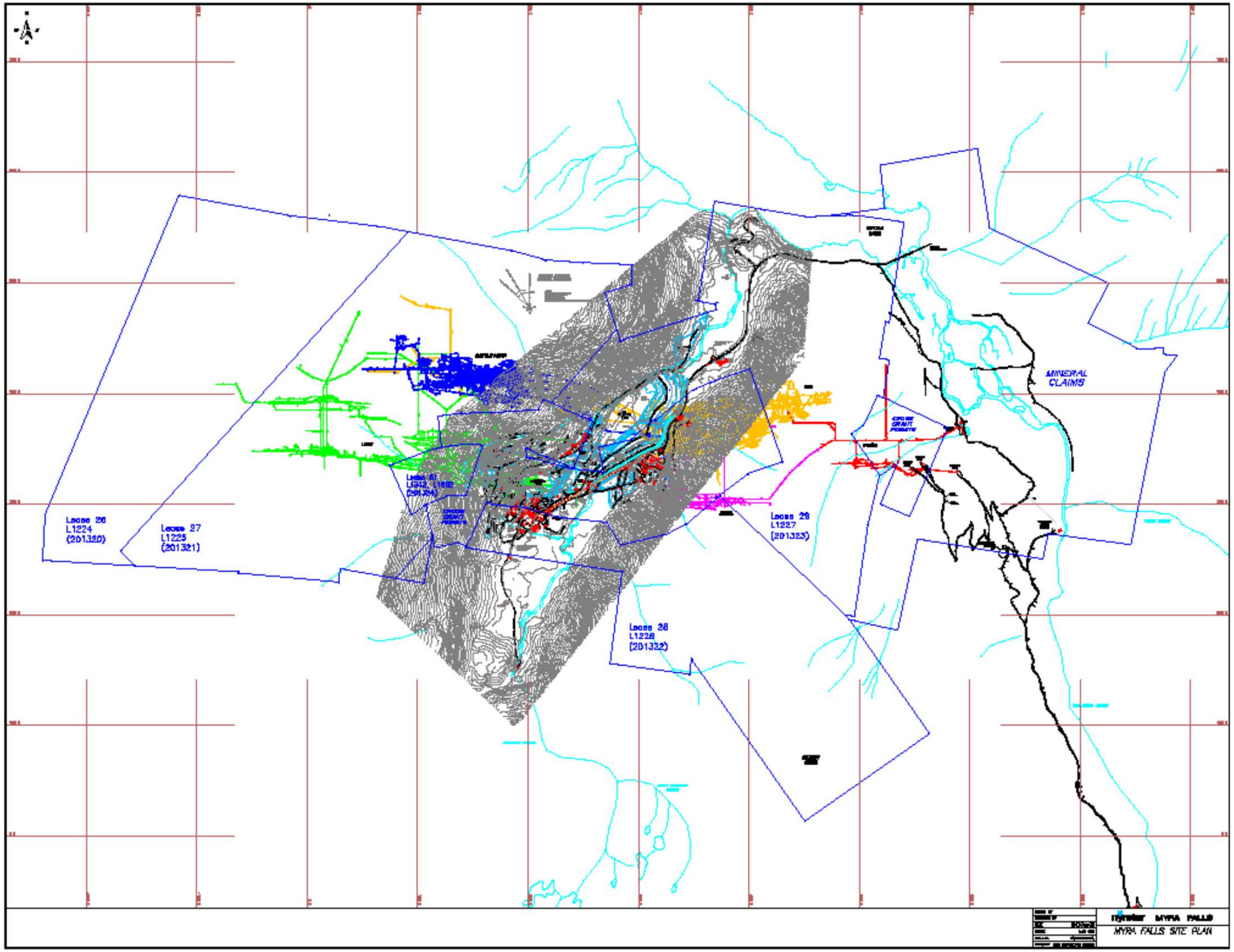

Figure 3 Development Relative to Surface Infrastructure

4.3 Development Sequence & Schedule (Baldwin, 2017)

Myra Falls will advance a total of 489 meters of capital development in 2017. This will consist mostly of slashing and bolting in both the Lynx and Price mines as listed in Table 3: 2017 Development below. The Lynx mining will be performed by a contractor (Dumas Contracting Ltd.), while the Price mining is currently planned to be completed by company personnel.

A small amount of capital drifting will also be completed, including an exploration drift in HW mine, to facilitate diamond drilling and resource expansion. This work will be performed by Myra Falls' personnel.

Table 3: 2017 Development

2017 Development		
Area	**m**	**Comments**
Lynx 5/6	98	Slashing & Bolting
Lynx 5/6	9	Development (DDCO)
Price 4L	317	Slashing & Bolting
Price 4L	15	Development
HW	50	Exploration Drift
Total	489	

As underground rehab is completed and access to various underground areas is re-established, capital development will accelerate. In 2018 Myra Falls will advance a total of 3,821 meters of capital development, as listed in Table 4: 2018 Development below.

The remainder of the Price mine slashing will be completed followed by 1,119 meters of lateral development on both 4 Level and 5 Level. In addition, a 52 meter orepass will be developed at Price to aid in ore handling. While the orepass will be completed by contractor (Dumas Contracting Ltd.), the lateral development is planned to be completed by company personnel.

The greatest advance will be in the BG mine, where 1,740 meters of lateral development will be completed. This will allow for additional mining in the Ridge North-West and the Upper Zones, while also advancing access toward the West Block, Ridge-Marshall Trend and Ridge West. This total also includes 400 meters of exploration drifting to facilitate diamond drilling for both resource expansion and increased resource definition. All of this work will be completed by Myra Falls' personnel.

There are 282 meters of vertical development budgeted to complete an orepass into the Ridge North-West area which will vastly increase the productivity of the area, as currently the closest orepass is in excess of 3.5 km away. This orepass will be completed by contractor (Dumas Contracting Ltd.)

Table 4: 2018 Development

2018 Development		
Area	**m**	**Comments**
Price 4L	363	Slashing & Bolting
Price 4L & 5L	1119	Development
24L	65	Development
BG	1740	Development
Extension	200	Development
Vertical Dev't		
Price	52	Short orepass 4L to 5L
24L	282	Ridge North West Orepass
Total	3821	

4.4 Existing Development

Nyrstar currently maintains approximately 12,000 m of underground development for both sustaining maintenance and production purposes. Standard future drift development is designed to 4.9m W x 5.2m H to facilitate the use of large mechanized equipment although development from past mining activities have been significantly smaller often resulting in operational constraints.

Myra Falls currently has six vertical ore passes through which material can be transported to the main haulage level on 24 Level.

4.5 Detailed Mine Plan

In support of the restart, Myra Falls is seeking approval for the surface haul from Lynx underground to the Temporary Surface Stockpile. The ore will be hauled from Lynx 6 portal down the existing Arnica / Lynx Access Road. Hauling would be completed with underground equipment at a maximum rate of 500 tonnes per day. Road upgrades will be required to bring the road back to haul road standards; the updated issued for construction design to address the area is included as Appendix 4. The road is not a public access road, and no new disturbance is expected. Dust suppression in the form of road watering and surfactant will be utilized to reduce fugitive dust on the surface haul during dry periods.

Myra Falls is also seeking approval of a temporary surface haul from the Price 13 Portal to the Surface stockpile adjacent to the mill. As the Jim Mitchell Lake Road is a 6 meter wide public road, upgrades will be required to bring it up to legal one-directional haul road standards. The design for this road upgrade was developed by Onsite Engineering and is included as Appendix 5. The underground work to rehabilitate the Price and Myra 13 levels, and the HW 20 level are slated to be completed by July 2018 at which time ore haulage will transition from a surface to underground haul for Price materials. Waste haulage from Price 13 Level will continue on surface until the end of 2018.

NMF has committed to using highway gravel trucks to execute the haul, on a schedule that avoids peak use times for the Park (Monday – Thursday evenings only as an example, details will be worked out collaboratively with BC Parks). Traffic management by way of flaggers and radio control will be utilized to minimize interactions between the haul trucks and the public road users. Trucks will utilize a cover to prevent losses of ore and waste along the route.

Dust suppression in the form of road watering and a non-toxic surfactant will be utilized to reduce environmental impacts to the Thelwood Valley as well as improve safety of the drivers using the road. Price mining has previously been conducted seasonally, closing when winter conditions make road maintenance of the Jim Mitchell Lake Road challenging. This will no longer be the case, with the Jim Mitchell Lake Road upgraded to an all season road Price will operate through the winter, maintaining the Jim Mitchell Lake Road open to the cut off to the Price 4 Portal access road.

As materials hauled on surface can be segregated more effectively than those hauled through the underground system, waste will be pre-screened to isolate PAG materials, and non-PAG will be hauled to the clean rock quarry and stockpiled in this location. PAG or unclassified materials will be hauled to the Lynx TDF construction stockpile for use in construction of the next Lynx TDF lift. Confirmation sampling will be conducted on the non-PAG materials under the guidance of Robertson GeoConsultants prior to its use as clean construction materials

The five year mine plan has been summarized in Table 5: Summarized 5-Year Mine Plan below. All values are reported as metric tonnes, and the waste to surface volumes assume that all waste produced underground comes to surface in the first 2 years of production.

Table 5: Summarized 5-Year Mine Plan

5 Year Production Plan						
Year	Total Ore Mined (Tonnes)	Mill Feed (Tonnes)	Tails Production (Tonnes)	Paste U/G (m^3)	Paste TDF (m^3)	Waste Surface (Tonnes)
2018	304,682	304,682	259,530	94,032	68,175	188,650
2019	440,377	440,377	367,258	126,245	103,291	299,336
2020	606,348	599,174	499,314	171,639	140,432	230,018
2021	738,009	714,119	594,819	204,469	167,293	272,366
2022	783,612	782,000	654,013	224,817	183,941	275,928

4.5.1 2018

Year one of the conceptual schedule is illustrated as calendar year 2018 in Table 6: 2018 Production and Waste Schedule. Ore will be hauled to the surface stockpile adjacent to the mill from the Lynx and Price underground mines. Materials will be crushed and introduced into the coarse ore bin using a temporary mobile jaw crusher and the existing conveyor system from the Lynx Crusher Building to the COB. This has been identified as a fugitive dust source in the Air Permit Amendment Application, and will utilize Best Management Practices (BMP) for dust suppression when in use. Ore from other underground areas will be brought to surface via the HW shaft, scheduled to start in May 2018.

Table 6: 2018 Production and Waste Schedule

Production Plan						
Month	Total Ore Mined	Mill Feed (Tonnes)	Tails Production (Tonnes)	Paste U/G (m^3)	Paste TDF (m^3)	Waste Surface (Tonnes)
Jan	**4,455**	0	0	0	0	12,425
Feb	**22,741**	27,196	24,299	0	15,187	12,425
Mar	**24,308**	24,308	20,858	0	13,036	11,332
Apr	**27,157**	27,157	23,299	0	14,562	17,971
May	**29,928**	29,928	25,673	0	16,046	18,636
Jun	**31,931**	31,931	27,390	17,118	0	18,417
Jul	**32,927**	32,927	28,243	17,652	0	18,811
Aug	**32,337**	32,337	26,985	16,865	0	17,834
Sep	**34,085**	34,085	28,481	17,801	0	17,399
Oct	**32,299**	32,299	27,034	13,517	3,379	17,275
Nov	**32,515**	32,515	27,271	11,079	5,965	13,701
Dec	**4,455**	0	0	0	0	12,425

Table 7: 2018 Production Plan by Mining Area (tonnes)

Ore Production Schedule							
Month	**Price**	**43BLK-NS**	**HW**	**BG**	**Ridge NW**	**Lynx**	**Total Mine**
Jan							**0**
Feb						4,455	
Mar	1,413	4,959	1,370			15,000	1,413
Apr	1,698	5,963	1,647			15,000	1,698
May	2,218	7,788	2,151			15,000	2,218
Jun	2,724	9,563	2,641			15,000	2,724
Jul	3,868	10,236	2,827			15,000	3,868
Aug	3,868	11,016	3,043			15,000	3,868
Sep	3,868	8,097	3,688	9,038	7,647		3,868
Oct	3,868	8,097	5,436	9,038	7,647		3,868
Nov	3,868	8,097	3,650	9,038	7,647		3,868
Dec	3,868	8,097	3,865	9,038	7,647		3,868

2018 production is starting in the Lynx Mine using mining contractors (Dumas Contracting Ltd.) over a 6 to 8 month timeframe. Lynx will be mined to the extent of the currently identified resources followed by some condemnation drilling by the exploration group. Assuming the drilling confirms that the resource has been exhausted the Lynx 5 and 6 levels will be slated for back-fill and reclamation.

Mining from Price Mine will commence in 2018, with waste and ore scheduled to be hauled over surface. The Jim Mitchell Road will be the main access way to Price 13 Portal, where the material will be brought to surface and hauled in highway gravel trucks.

Mining in other areas underground will focus on stopes that were developed prior to the shut-down and remain easily accessible. As development and rehabilitation work progresses, mining from these locations will occur in increments as access is provided and will ramp up progressively toward full production rates.

4.5.2 2019

Year two of the mine schedule is illustrated as calendar year 2019 in Table 8: 2019 Production and Waste Schedule. Ore may be hauled to the surface stockpile adjacent to the mill from the Price underground mine. Materials stockpiled on surface will be crushed and introduced into the COB using a temporary mobile jaw crusher and the existing conveyor system from the Lynx Crusher Building to the COB. All other ore will be brought to surface via the HW shaft. All waste is assumed to come to surface for disposal in 2019.

Table 8: 2019 Production and Waste Schedule

Production Plan						
Month	**Total Ore Mined (Tonnes)**	**Mill Feed (Tonnes)**	**Tails Production (Tonnes)**	**Paste U/G (m^3)**	**Paste TDF (m^3)**	**Waste Surface (Tonnes)**
Jan	**30,666**	30,666	25,599	8,800	7,200	17,198
Feb	**29,841**	29,841	24,873	8,550	6,996	19,726
Mar	**29,608**	29,608	24,668	8,480	6,938	21,185
Apr	**22,841**	16,500	13,760	4,730	3,870	14,623
May	**29,462**	30,000	25,212	8,667	7,091	28,325
Jun	**34,248**	40,000	33,263	11,434	9,355	28,326
Jul	**37,009**	37,060	30,715	10,558	8,638	28,326
Aug	**24,586**	24,586	20,697	7,115	5,821	28,326
Sep	**50,529**	50,529	42,118	14,478	11,846	28,326
Oct	**50,529**	50,529	42,118	14,478	11,846	28,326
Nov	**50,529**	50,529	42,118	14,478	11,846	28,326
Dec	**50,529**	50,529	42,118	14,478	11,846	28,326

In 2019 mining will continue in the Price area with a surface haul from the Price 13 Portal. All other ore and waste will be brought to surface via the HW Shaft.

HW development and rehabilitation work will be completed to a sufficient degree to allow mining to continue at the optimal sustainable rate for HW, 43BLK-NS , Battle Gap, and Ridge North West in the third quarter. Mining will commence in Extension and Battle Gap West in early August, replacing the Lynx Mine in the production profile.

Table 9: 2019 Production by Mining Area (tonnes)

Ore Production Schedule								
Month	**Price**	**43BLK-NS**	**HW**	**Extension**	**BG**	**BG W**	**Ridge NW**	**Total Mine**
Jan	3,868	8,097	2,016		9,038		7,647	**30,666**
Feb	3,868	8,097	1,192		9,038		7,647	**29,841**
Mar	3,868	8,097	959		9,038		7,647	**29,608**
Apr	4,371	2,252	1,112		8,182		6,923	**22,841**
May	4,371	9,606	4,745		5,817		4,922	**29,462**
Jun	4,371	4,592	2,268		12,467		10,549	**34,248**
Jul	4,371	3,265	1,613		15,037		12,723	**37,009**
Aug	4,371	6,997	3,456		5,288		4,474	**24,586**
Sep	5,725	6,997	7,000	3,000	9,171	10,876	7,760	**50,529**
Oct	5,725	6,997	7,000	3,000	9,171	10,876	7,760	**50,529**
Nov	5,725	6,997	7,000	3,000	9,171	10,876	7,760	**50,529**
Dec	5,725	6,997	7,000	3,000	9,171	10,876	7,760	**50,529**

4.5.3 2020

Year three of the mine schedule is illustrated as calendar year 2020 in Table 10: 2020 Production and Waste Schedule. Ore will be brought to surface via the HW shaft. One third of the waste developed underground will be retained underground; potentially acid generating (PAG) waste will be identified in advance of mining based on exploration and infill drilling results and used to selectively sort PAG waste for preferential use in back-fill co-disposal of waste in ore stopes. The assumption that mine waste is PAG will continue for all waste coming to surface through the underground system. Nyrstar's intention is not to prevent PAG materials to surface entirely, but to reduce the volume of PAG on surface. All materials thought to be clean when brought to surface through the HW shaft will be tested to confirm prior to any geochemical based sorting on surface.

Table 10: 2020 Production and Waste Schedule

Production Plan						
Month	**Total Ore Mined (Tonnes)**	**Mill Feed (Tonnes)**	**Tails Production (Tonnes)**	**Paste U/G (m^3)**	**Paste TDF (m^3)**	**Waste Surface (Tonnes)**
Q1	151,587	151,587	126,353	43,434	35,537	56,651
Q2	151,587	151,587	126,353	43,434	35,537	56,651
Q3	151,587	135,500	112,944	38,824	31,765	55,028
Q4	151,587	151,587	126,353	43,434	35,537	56,651

Table 11: 2020 Production by Mining Area (tonnes)

Ore Production Schedule								
Month	Price	43BLK-NS	HW	Extension	BG	BG W	Ridge NW	Total (Mine)
Q1	17,175	20,991	21,000	9,000	27,513	32,628	23,280	151,587
Q2	17,175	20,991	21,000	9,000	27,513	32,628	23,280	151,587
Q3	17,175	20,991	21,000	9,000	27,513	32,628	23,280	151,587
Q4	17,175	20,991	21,000	9,000	27,513	32,628	23,280	151,587

In 2020 all mining planned will be brought to the mill via the HW Shaft and surface hauls will cease. Production is expected to continue at the optimal sustainable rate for Price, HW, 43BLK-NS, Battle Gap, Ridge North West, Extension and Battle Gap West with a steady state production profile.

4.5.4 2021

Year four of the mine schedule is illustrated as calendar year 2021 and summarized in Table 12: 2021 Production and Waste Schedule. Ore will be brought to surface via the HW shaft. One third of the waste developed underground will be retained underground; potentially acid generating (PAG) waste will be identified in advance of mining based on exploration and infill drilling results and used to selectively sort PAG waste for preferential use in back-fill co-disposal of waste in ore stopes. Mill feed is expected to reach full potential capacity in 2021.

Table 12: 2021 Production and Waste Schedule

Production Plan						
Month	Total Ore Mined (Tonnes)	Mill Feed (Tonnes)	Tails Production (Tonnes)	Paste U/G (m^3)	Paste TDF (m^3)	Waste Surface (Tonnes)
Q1	162,945	170,119	141,174	48,529	39,705	66,310
Q2	188,316	159,000	132,279	45,471	37,204	68,092
Q3	190,845	213,000	177,516	61,021	49,926	68,982
Q4	195,903	168,000	140,504	48,298	39,517	68,982

Table 13: 2021 Production by Mining Area (tonnes)

Ore Production Schedule										
	Price	43BLK-NS	HW	Extension	BG	BG W	Ridge West	Ridge NW	Marshall	Total (Mine)
Q1	17,175	13,109	24,000	9,000	27,513	32,628	15,000	24,520	0	162,945
Q2	17,175	0	30,000	9,000	27,513	32,628	45,000	27,000	0	188,316
Q3	17,175	0	27,000	9,000	25,342	32,628	41,000	25,000	13,700	190,845
Q4	17,175	0	21,000	9,000	21,000	32,628	33,000	21,000	41,100	195,903

Mining activity in 2021 will deplete the known resources in the 43 Block-NS in early 2021. Marshall is expected to come online in the third quarter of production, replacing the feed from the 43 Block-NS and augmenting feed from the HW, Battle Gap and Ridge North West, which are decreasing in the production volumes to a lower steady state production rate.

4.5.5 2022

Year five of the mine schedule is illustrated as calendar year 2022 in Table 14: 2022 Production and Waste Schedule. Ore will be brought to surface via the HW shaft. One third of the waste developed underground will be retained underground; potentially acid generating (PAG) waste will be identified in advance of mining based on exploration and infill drilling results and used to selectively sort PAG waste for preferential use in back-fill co-disposal of waste in ore stopes.

Table 14: 2022 Production and Waste Schedule

Production Plan						
Month	Total Ore Mined (Tonnes)	Mill Feed (Tonnes)	Tails Production (Tonnes)	Paste U/G (m^3)	Paste TDF (m^3)	Waste Surface (Tonnes)
Q1	195,903	227,000	189,848	65,260	53,395	68,982
Q2	195,903	167,000	139,668	48,011	39,282	68,982
Q3	195,903	216,000	180,648	62,098	50,807	68,982
Q4	195,903	172,000	143,849	49,448	40,458	68,982

Table 15: 2022 Production by Mining Area (Tonnes)

Ore Production Schedule									
	Price	HW	Extension	BG	BG W	Ridge West	Ridge NW	Marshall	Total (Mine)
Q1	17,175	21,000	9,000	21,000	32,628	33,000	21,000	41,100	195,903
Q2	17,175	21,000	9,000	21,000	32,628	33,000	21,000	41,100	195,903
Q3	17,175	21,000	9,000	21,000	32,628	33,000	21,000	41,100	195,903
Q4	17,175	21,000	9,000	21,000	32,628	33,000	21,000	41,100	195,903

In 2022 production is expected to continue at the optimal sustainable rate for Price, HW, Marshall, Battle Gap, Ridge North West, Extension and Battle Gap West with a steady state production profile.

4.6 Conceptual Life of Mine Plan

As of December 31 2016, the Myra Falls resource estimate (measured and indicated), was 7.7 million metric tonnes. At anticipated mining and depletion rates of approximately 650,000 metric tonnes per annum, a mine life of at least ten years is indicated. This estimate would be entirely dependent on forecasted and prevailing metal prices, currency exchange rates, as well as fluctuating costs of mining and processing.

Figure 3 Development Relative to Surface Infrastructure

4.7 **Processing Plant & Associated Facilities (Bussieres, 2017)**

The original Myra Falls concentrator, constructed in 1966, was replaced in 1984 by the existing Zn-Cu-Pb polymetallic concentrator, which has a nameplate capacity of 2700 tpd @ 88% utilization (≈ 1.0 Mtpa). It utilizes a conventional mineral processing process to separate copper, lead and zinc sulphide minerals into separate concentrates, which are then transported off-site for smelting and refining into pure copper, lead and zinc. At Full Potential production rates (calendar year 2021+), the mill production is expected to be 0.78 Mtpa; improvements to the mill will focus on increasing recovery as capacity is not a limiting factor for the updated mine plan.

4.7.1 Ore Handling

Ore extracted from ore bodies that are not accessible from surface portals is crushed underground to between 5 to 7in minus (adjustable) by a jaw crusher before being brought to surface through the mine's shaft. It is then discharged on conveyor No1, which discharges to conveyor No2 which in turn discharges into the coarse ore bin. The COB has a nominal live storage capacity of 3600 tonnes.

Ore extracted from the ore bodies that are accessible from surface portals is crushed on surface to between 5 to 7 in minus (adjustable) by a jaw crusher and discharged on conveyor No3 which also discharges into the COB.

Ore is then extracted from the Coarse ore bin by a variable speed "Hydrastroke" reciprocating feeder and discharged on conveyor No4, which feeds the crushing plant. A magnet installed at the discharge end of conveyor No4 collects any steel scrap present in the ore feed. Steel scrap recovered is either sent to recycling (when clean) or disposed of onsite in Waste Rock Dump 1.

A dust collection system with pick-up points at the points of material transfer in installed in the COB area. Particulate dust is removed from the air stream using fresh water sprays by a dust scrubbing system before it is discharged to the atmosphere. The sludge generated in the process is collected and pumped to the mill's tailings box.

4.7.2 Crushing

Ore from conveyor No4 discharges on the crushing circuit's primary screen, which is a double-deck 5 by 12 screen equipped with 19 mm by 50 mm slotted panels on the bottom deck. Primary screen undersize falls through a chute onto conveyor No8 and is sent to the two fine ore bins. The fine ore bins (FOBs) each have a nominal storage capacity of 3500 tonnes. Primary screen oversize is fed to a Symons 5.5ft, 250 hp (187 kW) standard head secondary cone crusher nominally adjusted to a 5/8" CSS. Crushed product from the secondary crusher falls through a chute to conveyor No5 and is recirculated through conveyors No6 and conveyors No7 to the tertiary crushing circuit which consists of a Symons 5.5 ft, 250 hp (187 kW) short head tertiary cone crusher configured in a reverse-closed circuit arrangement with a single deck 8 by 16 screen equipped with 18 mm by 60 mm zig zag slotted panels. Secondary screen undersize falls through a chute onto conveyor No8 while secondary screen oversize is recirculated back to the tertiary cone crusher.

Dust collection systems with pick-up points at the points of material transfer are installed in the crushing building, the conveyor 6 to conveyor 7 transfer building and in the FOBs area. Particulate dust is removed from the air stream using fresh water sprays by dust scrubbing system for 6/7 transfer area, the crusher building area, and the FOB area before it is discharged to the atmosphere. The sludge generated in the process is collected and pumped to the grinding circuit's pump boxes.

4.7.3 Grinding

Ore from the FOB extracted using belt feeders (11A/B/C/D) and discharged on conveyors 12A/B which each feed a separate grinding line consisting of an open-circuit primary 8 by 12, 350 hp rod mill followed by a secondary 11.5 by 15, 1000 hp ball mill in reverse-closed circuit with 20 in hydrocyclones for classification.

Grinding is conducted in a wet environment and water is added to the ore in the rod mill's feed chute to achieve a target pulp density of 75 to 80% solids at the rod mill's discharge. The rod mills use 3.5in steel rods as the grinding media. A mixture of DEX/MSP is also added to the rod mills' feed chute for galena depression. The rod mills discharge to common pumpboxes with the secondary ball mills through trommel screens, which protect the pumpbox's pumps by capturing and steel ball fragments or oversize particles. The recovered material collected by the trommel screens is disposed of onsite in Waste Rock Dump 1.

Process water is added to the common pumpboxes in order to dilute the pulp to an appropriate density before pumping to the hydrocyclones for particle size classification. The particles finer than the hydrocyclone's cut size exit through the overflow stream and proceed to copper flotation conditioner (92-010). The underflow stream, which contains the particles coarser than the cut size, is discharged onto a static screen, from which the coarse particles are intermittently fed to 30in Knelson gravity concentrators, with the rest of the underflow stream being recirculated back to the ball mills. A mixture of 1.5 in and 2.0 in steel balls is used in the ball mills as the grinding media. Process water can be added is needed to the ball mill's feed chute, as necessary, to maintain the target pulp density for optimum grinding efficiency. The ball mills also discharge through to common pumpboxes with the secondary ball mills through trommel screens to protect the pumpbox's pumps. As is the case for the rod mills, the material collected is disposed of onsite in Waste Rock Dump 1.

4.7.4 Gravity Gold Circuit

Coarse gold particles, along with some galena, pyrite and other impurities, are collected in the primary gold concentrate produced by the gravity concentrators. The primary gold concentrate is accumulated into storage tanks and is then pumped to the gold cleaning circuit, where is manually cleaned using water on a Deister No6 shaking table to produce a final gold concentrate. The final gold concentrate, as well as in intermediate gold-rich lead concentrate, are sent offsite for further processing. The gold cleaning circuit's tailings are combined with the final lead concentrate.

4.7.5 Copper Circuit

Ground pulp from the grinding circuit's hydrocyclone overflow is fed to the copper conditioning tank. MBS is added to the copper conditioning tank for pH adjustment and for galena, pyrite and sphalerite depression while Cytec 5100 collector is added for collection of copper-rich sulphide minerals. MIBC is finally added to the conditioner tank's discharge as the frother. The pulp from the copper conditioner is fed by gravity to the copper roughing flotation cell bank, which consists of a series of 10 mechanical flotation cells. In the flotation cells, air is injected and broken down to very small bubbles by the flotation cell's rotor. Copper-rich sulfide minerals are recovered by the air bubbles in the froth phase into a copper-rich rougher concentrate.

Copper rougher concentrate is combined with copper scavenging concentrate (the origin of which will be explained later) and pumped to the copper regrinding circuit. Copper rougher tails are combined with copper scavenging tails (the origin of which will be explained later) and pumped to the lead conditioner tank.

The copper regrinding circuit consists of a 7' by 12' ball mill arranged in a reverse closed circuit configuration with a battery of six 10 in hydrocyclones for classification. The regrind mill use 1in steel balls as the grinding media. The particles finer than the cut size exit through the overflow stream and proceed to the copper 1st cleaning conditioner, where they are combined with recirculated copper 2nd cleaning tails (the origin of which will be explained later). The underflow stream, which contains the particles coarser than the cut size, is recycled back to the regrind mill. As is the case for the rod and ball mills, the copper regrind mill is equipped with a trommel screen which captures steel ball fragments. The material collected is disposed of onsite in Waste Rock Dump 1.

At the copper 1st cleaning conditioner, MBS and Cytec 5100 collector are added. MIBC is finally added to the conditioner tank's discharge. The pulp from the copper 1st cleaning conditioner is fed by gravity to the copper 1st cleaning flotation cell bank, which consists of 2 mechanical flotation cells (92-033 & 92-034). Again, air is injected in the agitated pulp and an upgraded copper-rich 1st cleaner concentrate is recovered in the froth phase.

Copper 1st cleaning concentrate is pumped to the copper 2nd cleaning flotation cell bank for further upgrading. Copper 1st cleaning tails are fed by gravity to the copper scavenging flotation cell bank. The copper scavenger flotation cells bank consists of 4 mechanical flotation cells. MBS is added, Cytec 5100 collector is added and MIBC is finally added. Air is injected and any remaining recoverable copper is floated to a copper scavenger. This copper scavenger concentrate is combined with the copper rougher concentrate and pumped to the copper regrinding circuit. Copper scavenging tails are combined with the copper roughing and pumped to the lead conditioner tank.

The copper 2nd cleaning flotation cells bank consists of 3 mechanical flotation. MBS is added, Cytec 5100 collector is added and MIBC is finally added. Again, air is injected and an upgraded copper-rich 2st cleaner concentrate, which is the final copper concentrate, is recovered in the froth phase.

Copper 2nd cleaning tails are recirculated back to the copper 1st cleaning conditioner. The final concentrate is pumped to the copper thickener for dewatering.

4.7.6 Lead Circuit

Tailings from the copper circuit are pumped to the lead conditioning tank. Cytec 3418A collector is added for collection of lead-rich sulphide minerals. The pulp from the lead conditioner is fed by gravity to the lead roughing flotation cell bank, which consists of a series of 3 mechanical flotation cells. MIBC is finally added to the conditioner tank's discharge as the frother. Lead-rich sulfide minerals are recovered by the air bubbles in the froth phase into a lead-rich rougher concentrate. Lead rougher tails are combined with lead 1st cleaning tails (the origin of which will be explained later) and pumped to the zinc conditioner tank.

Lead rougher concentrate is pumped to the lead 1st cleaning flotation cell bank, which consists of 3 mechanical flotation cells. Cytec 3418A collector and MIBC are added, air is injected in the agitated pulp and an upgraded lead-rich 1st cleaner concentrate is recovered in the froth phase. Lead 1st cleaning concentrate is pumped to the lead 2nd cleaning flotation cell bank for further upgrading. Lead 1st cleaning tails are combined with lead roughing tails and pumped to the zinc conditioner tank.

The lead 2nd cleaning flotation cells bank consists of 3 mechanical flotation. Cytec 3418A collector and MIBC are added air is injected in the agitated pulp and an upgraded lead-rich 2nd cleaner concentrate, which is the final lead concentrate, is recovered in the froth phase. Lead 2nd cleaning tails are recirculated back to the lead 1st cleaning flotation cells. The final concentrate is pumped to the lead thickener for dewatering.

4.7.7 Zinc Circuit

Tailings from the lead circuit are pumped to the zinc conditioning tank. Lime is added for pH adjustment, followed by copper sulphate for activation of the zinc-rich sulphide minerals. Collector is subsequently added, followed by MIBC. The pulp is fed by gravity to the zinc roughing flotation cell bank, which consists of a series of 11 mechanical flotation cells. In the flotation cells, air is injected and broken down to very small bubbles by the flotation cell's rotor. Zinc-rich sulfide minerals are recovered by the air bubbles in the froth phase into a zinc-rich rougher concentrate.

Zinc rougher concentrate is combined with zinc scavenging concentrate and zinc 2nd cleaning tails (the origin of which will be explained later) and pumped to the zinc regrinding circuit. Copper sulphate is added to the zinc regrinding circuit's feed. Zinc rougher tails are combined with zinc scavenging tails (the origin of which will be explained later) and pumped to the final tailings pumpbox.

The zinc regrinding circuit consists of a 7' by 12' ball mill arranged in a reverse closed circuit configuration with a battery of six 10 in hydrocyclones for classification. The regrind mill use 1in steel balls as the grinding media. The particles finer than the cut size exit through the overflow stream and proceed to the zinc 1st cleaning conditioner. The underflow stream, which contains the particles coarser than the cut size, is recycled back to the regrind mill. As is the case for all other grinding mills, the zinc regrind mill is equipped with a trommel screen which captures steel ball fragments. The material collected is disposed of onsite in Waste Rock Dump 1.

At the zinc 1st cleaning conditioner, lime is added, followed by collector and MIBC. Pulp from the zinc 1st cleaning conditioner is fed by gravity to the zinc 1st cleaning flotation cell bank, which consists of 3 mechanical flotation cells. Again, air is injected in the agitated pulp and an upgraded zinc-rich 1st cleaner concentrate is recovered in the froth phase.

Zinc 1st cleaning concentrate pumped to the copper 2nd cleaning flotation cell bank for further upgrading. Zinc 1st cleaning tails are fed by gravity to the zinc scavenging flotation cell bank. The zinc scavenger flotation cells bank consists of 3 mechanical flotation cells. Collector and MIBC are added, air is injected and any remaining recoverable zinc containing minerals are floated to a zinc scavenger concentrate. This zinc scavenger concentrate is combined with the zinc rougher concentrate and zinc 2nd cleaning tails and pumped to the zinc regrinding circuit. Zinc scavenging tails are combined with the zinc roughing and pumped to the final tailings pumpbox.

The zinc 2nd cleaning flotation cells bank consists of 4 mechanical flotation cells. Collector and MIBC are added, air is injected and an upgraded zinc-rich 2st cleaner concentrate, which is the final zinc concentrate, is recovered in the froth phase. Zinc 2nd cleaning tails are combined with the zinc rougher and zinc scavenger concentrates and pumped to the zinc regrinding circuit. The final concentrate is pumped to the inside zinc thickener for dewatering.

4.7.8 Concentrate Dewatering

Primary concentrate dewatering is conducted in conventional thickeners. There is one dedicated concentrate thickener for each type of concentrate. An anionic polymer flocculant is added to the thickeners' feed stream to accelerate the concentrates' settling characteristics. The concentrates solid particles settle by gravity to the bottom of the thickeners' tanks and are mechanically directed to the thickeners' cone by the thickeners' rake systems. They are pumped from the thickeners' underflow to their respective stock tanks – there is one stock tank for each type of concentrate as is the case for the thickeners. Water recovered from the thickeners' overflow is pumped to a clarifier. An anionic polymer flocculant can be added to the thickeners' feed to accelerate the concentrates' settling characteristics.

Any remaining solids contained in the thickeners' overflow streams are given an additional opportunity to settle in the clarifier. An anionic polymer flocculant can be added to the clarifier's feed to accelerate settling characteristics. Overflow from the clarifier is sent to the final tailings pumpbox. Solids recovered from the clarifier can be pumped to the zinc, copper, or lead stock tanks.

Thickened concentrate slurry from the stock tanks is pumped to Larox pressure filters for final dewatering. A total of 5 pressure filters are installed, 2 of which are dedicated to copper concentrate dewatering, 2 of which are dedicated to zinc concentrate dewatering and 1 of which can be used for either lead or zinc concentrate dewatering. Each filter consists of a series of recessed plates, vertically stacked with a continuous filter cloth running between them, forming a series of parallel horizontal chambers. The cloth runs over the top surface of each plate, which forms the lower half of the chamber. An inflatable diaphragm in installed on the bottom surface of each plate, which forms the upper half of the chamber.

Thickened concentrate slurry is pumped from the stock tank into all chambers simultaneously. The solids are retained in the chamber by the filter cloth. As the solids build, the pumping pressure increases, and the filtrate is forced through the filter cloth and escapes through textured channels engraved on the top surface of each plate, until the required solids thickness is achieved.

High-pressure air then inflates the diaphragm, reducing the chamber volume and squeezing the solids to remove more filtrate. Compressed air is then blown through the solids for final dewatering. The moisture content is minimized and can be controlled precisely by adjusting the pressure and duration of the air blow.

The plate stack is opened and the dewatered solids are conveyed out of each chamber on the moving filter cloth and fall through a chute to the filtered concentrate stockpiles located in the concentrate loadout below. Filtrate water flows back to the clarifier.

4.7.9 Concentrate Trucking

The filtered copper and zinc concentrates are loaded into bulk 38 tonne tractor-trailer trucks using a front-end loader and trucked 90 kilometres to a concentrate storage facility in Campbell River for storage and subsequent loading onto bulk carrier ships. The filtered lead concentrate is bagged on site and then trucked a storage facility located in Vancouver. Concentrate trucks pass through a truck-wash station before leaving the concentrate loadout facility.

4.7.10 Mill Tailings

Mill tailings from the final tailings pumpbox are pumped to the paste plant.

4.7.11 Paste Backfill (Baldwin, Myra Falls Paste Backfill, 2017)

Areas that will be backfilled utilizing paste will include: Stopes, Drifts no longer needed for mining and exploration, and any openings not required for ventilation going forward. The backfill is currently limited to stopes and mining areas below the permanent water table, as the tailings are potentially acid generating (PAG). Work is underway to assess the geochemical behaviour of the backfill to determine a geochemically safe method to utilize backfill in the areas above the water table. This will be included in the next *Mine's Act* permit amendment submission scheduled for early 2018.

There are no plans to mine below backfilled areas of any kind, however if this were to change in the future, Nyrstar will submit the proposed work plan and related safety procedures for review prior to implementation.

Before Myra Falls can resume operations, a method of backfilling stopes underground must be in place and working. Historically, Myra Falls has utilized a hydraulic backfill plant to fulfil this function. This type of plant takes the tailings stream and runs it through a cyclone to remove the fines fraction, typically around 70% of the tailings at Myra Falls in recent years, and sends this to the TDF. The coarse fraction, around 30% of the tailings stream, is mixed with water and normal Portland cement and sent by pipeline underground to fill open voids left from the mining process.
The hydraulic backfill plant has been one of the key bottlenecks at Myra Falls in recent years and has been the primary cause of low turnover rates of stopes, slowing the cycle time and reducing production. The switch from the current method to the pastefill method is currently scheduled for July, 2018. Prior to this date, materials will be stored in the Lynx TDF.

Myra Falls is seeking approval to switch to an alternate method of backfilling stopes underground would utilize a pastefill plant. This type of plant utilizes the entire mill tailings stream, thickens it to a paste like consistency by employing both a thickener and a disk filter. The paste is then mixed with a binder (usually some combination of cement, fly ash and blast furnace slag), and then the mixture is sent through a high pressure pipeline to underground openings. Acid Base Accounting Analysis will be performed on the recommended blends to ensure that there are no unanticipated geochemical impacts from the additives.

A properly functioning pastefill plant at Myra Falls will increase the rate of filling underground by approximately 200% by allowing the use of the full mill tailing stream. The elimination of excess water will negate the drain time required by the hydraulic backfill system, as well as the 'top-up' pours required to fill the voids. Additionally, backfill density will be able to be increased by at least 23% due to the dewatering capacity of the thickener and disk filter. The combination of increased density and reduced water load will decrease the set-up time for the backfill from approximately 28 days to roughly 7 days. The increased backfill density will have the added effect of decreasing the volume of the backfill, both in the underground stopes (allowing for more material to be utilized underground) and in the TDF, extending its projected life.

The path forward for Myra Falls will re-purpose the existing thickened tailings plant (paste plant) with a new internal configuration. This system will utilize the current building envelope, thickener, Schwing Bioset positive displacement pumps and disk filter. An additional disk filter will be added, as well as a new mixing tank and binder addition system. The cyclone pack previously utilized to produce coarse tailings for the hydraulic backfill plant will be removed and re-purposed in the mill. The only modification to the area outside the current structure will be for the cement silo on the north side of the building, as well as an access road to the silo. Detailed engineering of the improved paste plant infrastructure are currently under development by Patterson and Cooke (P&C) and will be provided to the EMPR prior to construction. Revised operational parameters will be developed prior to the commissioning of the plant and will be submitted to the EMPR 8 weeks before backfilling with paste is scheduled to begin.

Piping will utilize the current 5” induction hardened paste pipe that is currently on site, as well as new 6” paste pipe that is to be purchased. A third party engineering firm will provide Nyrstar with an engineered design for a pastefill bulkhead that will be implemented going forward. This design will be provided with the operational parameters 8 weeks prior to pastefill underground.

Planned paste plant operating parameters are 330 days per year, 90% utilization and 74 m^3/hr of paste production in order to meet Myra Falls Full Potential production plan. Additionally, there will be a dredging system included that will have the ability to remove material placed into the Lynx TDF, allowing for the production of pastefill when the mill is not operating (during either planned or unplanned downtime). Designs for the dredging system that will be utilized, along with operating procedures for that system, will be provided for EMPR review 8 weeks prior to commissioning the paste dredging system.

Part of the detailed engineering will include binder studies to determine the best backfill binder recipe to utilize at Myra Falls, and to evaluate any possible savings to be had while maintaining the required backfill properties of strength and flow-ability.

There are three key improvements expected with the construction and use of a fully functional pastefill plant at Myra Falls:

1. Improved Recovery – Recovery-to-reserve performance during the last few years of production at Myra Falls was poor. Sub 50% recoveries were typical. One of the primary reasons for this was the poor quality of backfill. This left two options for the mine – wait until backfill developed enough strength to mine adjacent to, which reduced stope cycle times, or leave ore pillars in order to speed up the mining cycle. Leaving pillars had become the standard option, which resulted in severely reduced ore recovery. A properly functioning pastefill system will produce higher quality, homogenous backfill with higher strengths and faster set-up times, negating the need to leave ore pillars, and hence, increasing recovery.

2. Reduced Dilution – This can be achieved by the following:
    a. Higher strength, denser pastefill will be less likely to fail when mining adjacent to it. This reduces the chances of fill failures mixing with the ore during the mucking of adjacent stopes.
    b. The elimination of excess water allows stopes to be tight-filled, providing support to the back. This reduces the chances of back failures of adjacent stopes by reducing the effective span of the back.

3. Improved Stope Cycle Times – These can be improved by the following:
    a. Paste backfill is a homogenous mixture, without the excess water that is contained in hydraulic backfill. This eliminates the bleeding of water from the backfill, greatly reducing the underground pumping requirements.

b. Impounded water in stopes requires weeks to drain and results in several "topping off" backfill pours, slowing cycle times.
c. The amount of coarse tailings suitable for hydraulic backfill is only approximately30% of total mill tailings, resulting in a shortage of backfill underground. For this reason, the backfill plant typically only runs on dayshift, and only runs a few hours per day. Pastefill utilizes total mill tailings and can be operated whenever the mill is running.

Additional benefits NMF can expect as a result of the pastefill include:

1. Reclaiming tailings previously deposited in the Lynx TDF via dredging into the pastefill plant, allowing filling of voids underground even when the mill is shut down.
2. Increased density of paste due to the inclusion of fines leads to decreased permeability, which is expected to reduce oxygen and water ingress through backfilled areas, thereby having the potential to reduce ARD seepage from the backfilled stopes.

5.0 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, as per 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." (R. J. Lampard, District Manager, 1995)

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.

5.1 **Old TDF Closure**

The Old TDF Closure Plan is currently under permitting review, with a decision expected in early 2018. Work that can be completed under the current permitting was initiated in 2017, and will continue until such time that NMF obtains a permit to construct the final cover. Nyrstar has changed the staging and implementation plan as submitted in December 2016 to account for the permitting schedule.

5.2 Lynx TDF Closure

The theoretic design for closure of the Lynx TDF was further developed in 2016 to allow for construction of the final closure cover on the berm face with each annual lift of the Lynx TDF berm. This design is still under permitting review, and the implementation plan has been edited to allow for the permitting schedule.

The theoretic cover design for the surface of the Lynx Paste has not been detailed for construction permitting efforts. The original design cover as submitted 2009 for the Lynx TDF permitting is assumed to be sufficient for closure cover requirements at this stage. This portion of the closure cover for the Lynx TDF will be detailed for construction permitting consideration six months or more prior to construction of that portion of the closure cover.

5.3 Waste Rock Dump Closure

Nyrstar has worked with AFW to establish a stabilization plan for the Waste Rock Dumps (WRD) above the Lynx TDF (WRD 2 and WRD 3) as well as WRD 6. A material balance was completed for these waste rock dumps and the majority of the material will be required for the construction of the Lynx TDF to final elevation. The remainder of the materials that were recommended to be removed will be relocated into the Upper Lynx Pit.

Table 16: Waste Rock Movement in Closure and Lynx TDF Construction (m^3)

	Waste to Lynx TDF				
Year	WRD 2	WRD 3	WRD 6	New waste	Total
2017	110,000	110,000	20,000	-	240,000
2018	-	237,500	-	27,500	265,000
2019	18,250	222,500	-	21,250	262,000
2020	69,500	-	73,000	27,500	170,000
2021	77,400	-	58,100	34,500	170,000
2022	135,500	-	-	34,500	170,000
2023	135,500	-	-	34,500	170,000
2024	7,850	-	-	120,150	128,000
Subtotal	**554,000**	**570,000**	**151,100**	**299,900**	**1,575,000**

Waste Rock Dump 4 (WRD 4) will be reclaimed when the Arnica / Lynx Access Road is no longer required as a haul road. Excess materials will be included in the Lynx TDF construction or as part of the paste cover landforming on the Lynx TDF when that facility is closed.

Waste Rock Dump 1 is still active, and a detailed closure design has not yet been developed. It has been suggested by both Roberston GeoConstultants (RGC) and AFW that the WRD 6 closure cover would be a suitable cover style for WRD 1.

Waste Rock Dump 6 will be closed in conjunction with the Old TDF closure cover. Waste Rock Dump 1 will be closed with the final closure cover of the paste berm surface.

5.4 Clean Fill Borrow Materials

The clean fill borrow studies were continued through 2016. A materials balance based on the current closure designs has been developed and potential sources were identified to be further developed for permitting applications in support of the closure needs. The original Environmental Impact Assessment and Archeological Potential Assessments were revised to expand to areas outside the current footprint for the two locations selected for further study and have been included in this application as Appendix 8 A. The Clean-rock quarry expansion design is included as Appendix 8 B.

Next steps to continue this work include a geophysics study to confirm depths and a engineered design for each borrow source. This work is ongoing and the results are expected to be included in a future application, scheduled for submission in March 2018. The expanded till fill locations are not expected to be required until 2020 at the earliest.

5.5 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.

5.6 Five Year Reclamation Plan

Much of the surface infrastructure as constructed is required for ongoing support of mining activities. The progressive reclamation plan for the next five years was developed to avoid impacting future and ongoing mining activities. Much of the closure work will be focused on the Lynx Waste Rock Dump Stabilization, which is currently underway as described in the following sections. Waste will be removed from Waste Rock Dumps (WRD) 2, 3 and 6 to the Lynx Tailings Disposal Facility (TDF), and from WRD 6 to WRD 2 for haul road construction.

5.6.1 2017

The project list as planned in 2017 is included as Table 17: 2017 Closure Projects. Waste rock dump stabilization is the major earthworks project in 2017. The area in Dump 2 is approximately 3.5 Ha and will be dug down to natural slope. Once the native materials are exposed, the material will be assessed for growth medium potential. If it is an appropriate growth medium, it will be stabilized using willow whips under the guidance of a qualified professional (Integral Ecology). Dump 3 will be left as a flat platform, consistent with the Waste Rock Dump 3 Stabilization Plan Option 1 (Amec Foster Wheeler, March 2017 b).

Table 17: 2017 Closure Projects

2017
APA berm stabilization
Clean-fill borrow & Design
Highwall stabilization plan & design
Lynx Closure Spillway detailed design for construction
Waste Dump 2 regrade year 1
Pitwall study
Waste Dump 6 grade cut year 1
Waste Dump 3 stabilization year 1
Seismic upgrade berm grading (including revegetation)
Buildings removal

Table 18: Volumetric Waste Movement 2017 (m^3)

Final Location		Source			
Total	Waste Dump	WRD 2	WRD 3	WRD 6	New Waste
240,000	Lynx TDF	110,000	110,000	20,000	-
14,000	WRD 2	-	-	14,000	-
254,000	**Total**	**110,000**	**110,000**	**34,000**	**-**

Figure 5 below indicates the borrow locations on the waste rock dumps that will be utilized in 2017. This will be completed in accordance with the detailed guidance provided by Amec Foster Wheeler to the construction team. WRD 2 areas are indicated in the yellow circle, WRD 3 is in orange.

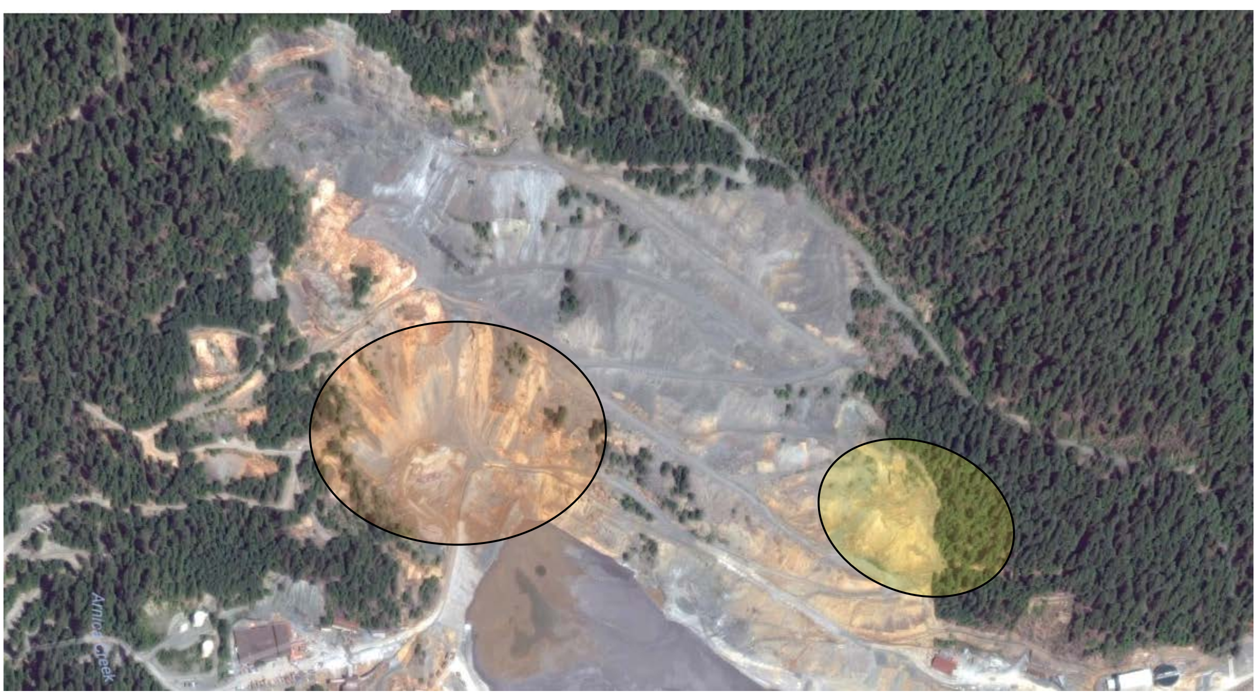

Figure 4: 2017 Areas of Waste Stabilization Activities

5.6.2 2018

The projects scheduled for 2018 are included as

Table 19: 2018 Closure Projects.

Table 19: 2018 Closure Projects

2018
Lynx Spillway
Myra & Arnica Creeks ~30 meter riparian restoration
Revegetation
Waste Dump 2 regrade year 2
East Strip Ditch & drains (Old TDF)
Waste Dump 6 grade cut Year 2
Waste Dump 3 stabilization Year 2
Buildings removal
Lynx TDF - outer berm year 1

Table 20: Volumetric Waste Movement 2018 (m^3)

Final Location		Source			
Total	Waste Dump	WRD 2	WRD 3	WRD 6	New Waste
265,000	Lynx TDF	-	237,500	-	27,500
66,825	WRD 1	-	-	-	66,825
200,000	Upper Lynx Pit	200,000	-	-	
531,825	**Total**	**200,000**	**237,500**	**-**	**94,325**

Waste Rock from WRD 2 (yellow oval on Figure 5will be directed to the Upper Lynx Pit (purple oval on Figure 5). This material will be sloped to 2:1 and offset from the pit edges as recommended by Amec Foster Wheeler in the upcoming Pit Rim Stability Analysis. Materials placed in this location will be tested for acid rock drainage and metal leaching potential (ARD/ML) to ensure closure seepage chemistry can be accurately predicted. Natural ground will be exposed in WRD 2, which will be stabilized using willow whips and hydro seeding as appropriate. The new waste storage location will be covered in 30 cm of topsoil and planted with plugs. Drainage from the new dump will be directed to treatment and monitored for quality.

Waste Dump 3 (orange circle) will be used for Lynx TDF construction be left as a flat bench following the work in 2018.

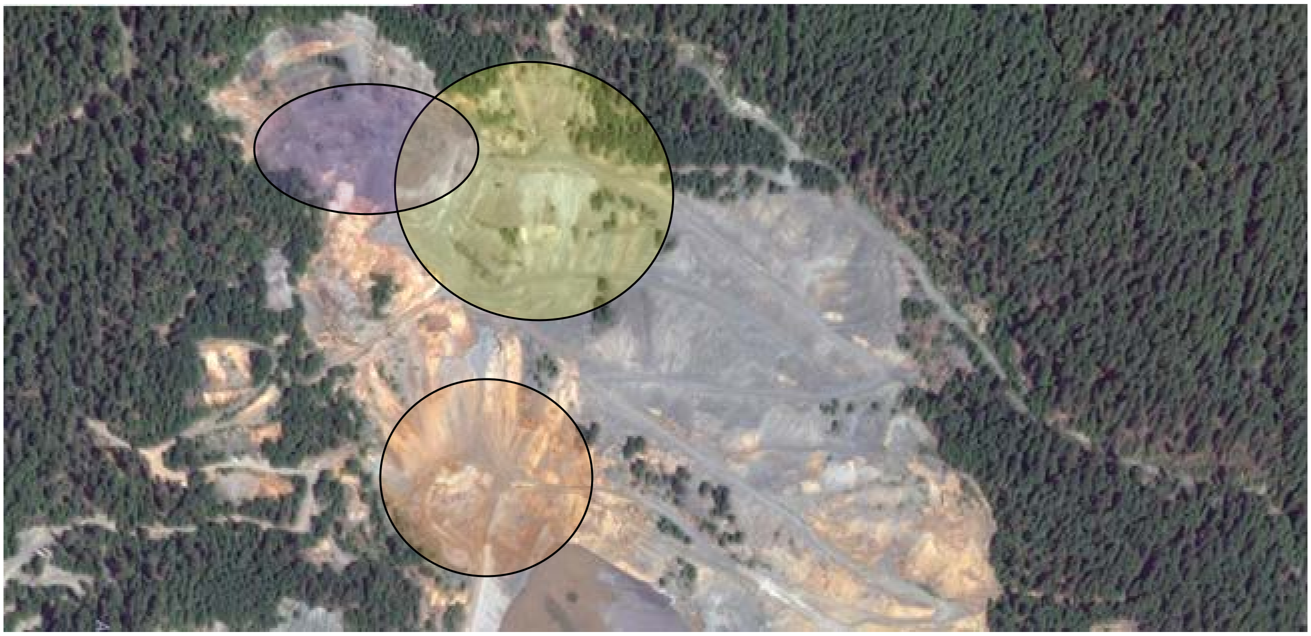

Figure 5: Areas of Waste Stabilization Activities 2018

5.6.3 2019

Progressive reclamation work in 2019 is included in Table 21: 2019 Closure Projects below.

Table 21: 2019 Closure Projects

2019
Lynx TDF - outer berm year 2
ETA/Cookhouse Area
Myra Creek ~30 meter riparian restoration
Waste Dump 2 regrade
Revegetation
APA Grading & land forming
Channel 1
Channel 3
strip cover & land forming

In 2019 the majority of Lynx Construction material will be sourced from WRD 3, completing the stabilization plan for the facility. The remaining materials will be sourced from WRD 2, preparing for the 2020 work by removing the hazard location for the larger WRD removal activities. Natural ground will be exposed in WRD2, which will be stabilized using willow whips and hydro seeding as appropriate.

Table 22: Volumetric Waste Movement 2019 (m^3)

Final Location		Source			
Total	Waste Dump	WRD 2	WRD 3	WRD 6	New Waste
262,000	Lynx TDF	18,250	222,500	-	21,250
128,418	WRD 1	-	-	-	128,418
390,418	**Total**	**18,250**	**222,500**	**-**	**149,668**

Nyrstar will cease reducing the elevation of Waste Dump 3 at the paste level at the time of construction; if a shortfall were to occur due to higher than anticipated paste elevation, additional waste rock would be sourced from Waste Dump 2, in the area depicted in Figure 6 in the following section as a yellow oval.

Figure 6: Areas of Waste Stabilization Activities 2019

5.6.4 2020

Progressive reclamation projects planned for 2020 are listed in Table 23 below.

In 2020 waste rock removal from WRD 2 and WRD 6 will provide the bulk of the Lynx TDF construction materials. WRD 2 will be stabilized in two stages, with the yellow oval in Figure 7 as Stage 1 followed by the blue oval as stage 2.

Table 23: 2020 Closure Projects

2020
Project
Lynx TDF - outer berm year 3
APA cover (Old TDF)
Waste Dump 6 Cover & Cascade Debris Basin
Channel 2a (Old TDF)
Channel 2 (Old TDF)
Re-Vegetation

Waste rock will be removed from each bench bounded by the switchback roads to prevent undercutting the bank above which is required for road access. Natural ground will be exposed in each area, which will be stabilized using willow whips and hydro seeding as appropriate.

Table 24: Volumetric Waste Movement 2020 (m^3)

Final Location		Source			
Total	Waste Dump	WRD 2	WRD 3	WRD 6	New Waste
170,000	Lynx TDF	69,500	-	73,000	27,500
87,509	WRD 1	-	-	-	87,509
257,509	**Total**	**69,500**	**-**	**73,000**	**115,009**

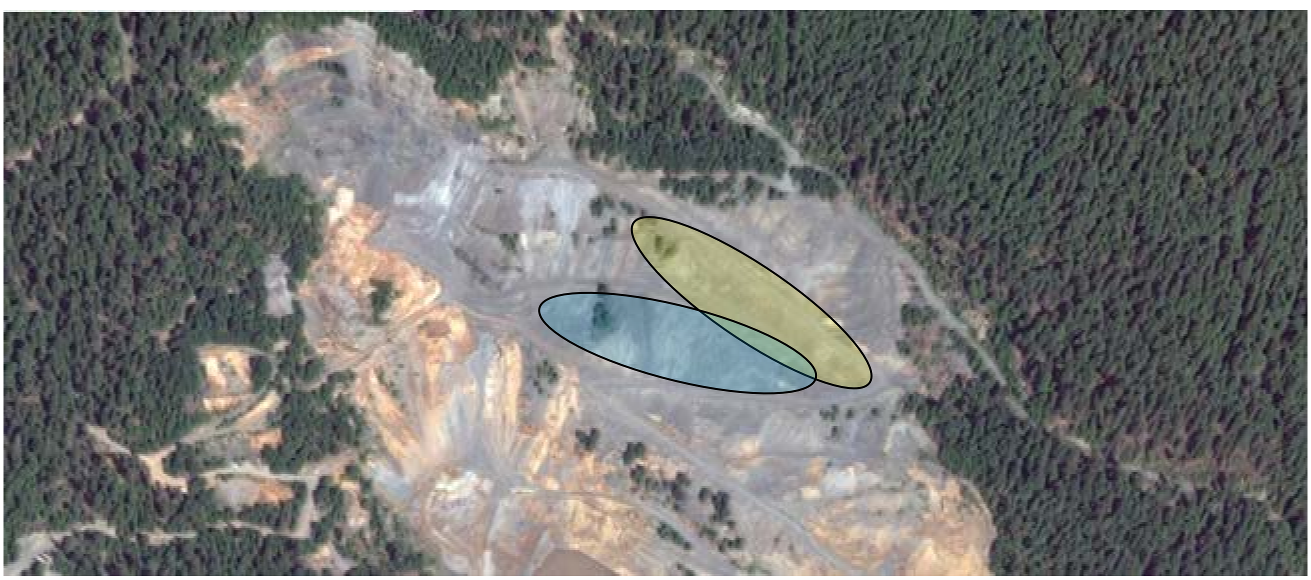

Figure 7: Waste Rock Stabilization Areas 2020

5.6.5 2021

In 2021 progressive closure plans are listed below in Table 25: 2021 Closure Projects.

Table 25: 2021 Closure Projects

2021
Project
APA cover
Re-Vegetation
Water treatment plant design
Lynx TDF - outer berm year 4

Waste Rock stabilization in WRD 2 and WRD 6 continue in 2021, with similar volumes from each location. This work completes the removal of excess waste in WRD 6 to allow completion of the closure cover as designed for that facility. Waste rock from the area in WRD 2 will be utilized in Lynx TDF construction, removing the remaining switchback from the existing access road to the natural ground. The native materials will be stabilized using willow whips and hydro seeding as appropriate.

Table 26: Volumetric Waste Movement 2021 (m^3)

Final Location		**Source**			
Total	Waste Dump	WRD 2	WRD 3	WRD 6	New Waste
170,000	Lynx TDF	77,400	-	58,100	34,500
101,683	WRD 1	-	-	-	101,683
271,683	**Total**	**77,400**	**-**	**58,100**	**136,183**

Figure 8: Waste Rock Stabilization Activities 2021

6.0 Closure Costing

The closure costing model has been updated and will be submitted as a separate confidential report.

7.0 References

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