



# Closure Plan - Prefeasibility Study 2019 Update

Brunswick Smelter  
Belledune, New Brunswick

Glencore Canada Corporation





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## List of Acronyms

AACE	Association for the Advancement of Costing Engineering International
ACM	Asbestos Containing Materials
ASTs	Aboveground Storage Tanks
BHO	Bulk Handling Operation
BTEX	Benzene, Toluene, Ethylbenzene, and Xylenes
BTGS	Belledune Thermal Generating Station
CAD	Canadian Dollars
CCME	Canadian Council of Ministers of the Environment
CEAA	Canadian Environmental Assessment Act
CEPA	Canadian Environmental Protection Act
CN	Canadian National Railway
COPC	Contaminant of Potential Concern
CRA	Conestoga-Rovers & Associates
CRP	Cooling Recycle Pond
CW	Cooling Water
DAP	Di-Ammonium Phosphate Plant
DFO	Department of Fisheries and Oceans
DGA	Data Gap Assessment
EIA	Environmental Impact Assessment
EMP	Environmental Management Plan
EPCM	Engineering, Procurement, and Contract Management
EQS	Environmental Quality Standard
ERA	Ecological Risk Assessment
FIGQG	Federal Interim Groundwater Quality Guidelines
GAC	Granular Activated Carbon
GHD	GHD Limited
Glencore	Glencore Canada Corporation
Ha	Hectares
HGS	Hydrogeological Study
HHERA	Human Health and Ecological Risk Assessment
HHRA	Human Health Risk Assessment
HQ	Hazard Quotients
HSEC	Health, Safety, Environment and Communities



## List of Acronyms

IEM	Integrated Environmental Management
ISQG	Interim Sediment Quality Guidelines
kg	Kilograms
m	Metre
m <sup>2</sup>	Square Meter
m <sup>3</sup>	Cubic Meter
MAP	Monoammonium Phosphate
masl	Metres Above Sea Level
mg	Milligram
MHW Area	Material Handling West Area
mm	Millimeter
mTPH	Petroleum Hydrocarbons
MW	Monitoring Well
NB Power	New Brunswick Power
NBDELG	New Brunswick Department of Environment and Local Government
NBDNRE	New Brunswick Department of Natural Resources and Energy
NBDTI	New Brunswick Department of Transportation and Infrastructure
NBESAs	Environmentally Significant Areas
nm <sup>3</sup>	Normal Cubic Metre
NORM	Naturally Occurring Radioactive Materials
NSE	Nova Scotia Department of Environment
NSMDC	North Shore Micmac District Council
NTNBI	Nature Trust of New Brunswick Inc.
OPEX	Operational Expenditures
PAH	Polycyclic Aromatic Hydrocarbon
PAP	Phosphoric Acid Plant
PCB	Polychlorinated Biphenyls
PEL	Probable Effects Levels
PFS	Prefeasibility Study
PID	Property Identification
PILC	Paper-Insulated Lead-Covered
Port	Port of Belledune
ppmv	Parts Per Million by Volume
ppt	Parts per Thousand
RBCA	Risk Based Corrective Action





## List of Acronyms

RBSLs	Risk Based Screening Levels
RPD	Relative Percent Differences
RPW	Recycled Process Water
SeQG	Sediment Quality Guidelines
SNB	Service New Brunswick
SNC	SNC-Lavalin
SQGs	Soil Quality Guidelines
SRF	Short Rotary Furnace
Ssc	South Charlo Formation
SSTLs	Site Specific Target levels
SWPs	Safe Work Procedures
TKN	Total Kjeldahl Nitrogen
TPE	Total Potency Equivalent
USTs	Underground Storage Tanks
VOC	volatile organic carbon
WAWA	Watercourse and Wetland Alteration Permit
WESP	Wet Electrostatic Precipitator
WTP	Water Treatment Plant
WWTP	Wastewater Treatment Plant
µSv/hr	Microsieverts/hour



# 1. Executive Summary and Recommendations

The Brunswick Smelter is a primary lead/silver smelter located at 692 Main Street (Highway 134) in Belledune, NB and is owned by Glencore Canada Corporation (Glencore). The facility was originally commissioned in 1966 by East Coast Smelting. The Brunswick Smelter was originally designed as a lead-zinc smelter to produce metallic lead and zinc from concentrates produced locally at the Brunswick Mine Site located 35 kilometres south of Bathurst, New Brunswick.

In March 2013, the Brunswick Mine Site officially ceased operation, resulting in elimination of the main feedstock for the Brunswick Smelter. The facility remains operational by importing a variety of feedstocks for refining, and continues to operate as a primary lead smelter with a reported production capacity of 120,000 tonnes per year.

The Brunswick Smelter facility includes the Smelter Area, Material Handling West (MHW) Area and the former Fertilizer Plant (which ceased operation in 1995). Also associated with the Brunswick Smelter is a 35 hectare (Ha) slag pile as well as a freshwater pumphouse and associated infrastructure.

## 1.1 Summary Project Description

GHD Limited (GHD) was retained by Glencore to provide engineering and project management services in the review of the 2008/2009 Closure Plan Prefeasibility Study (PFS) and prepare an updated closure plan based on current conditions at the Brunswick Smelter (Closure Plan – PFS 2019 Update; herein referred to as the 2019 Closure Plan Update). The 2019 Closure Plan Update includes validation of the information presented in the 2008/2009 Closure Plan PFS as well as incorporating current conditions for the closure of the Brunswick Smelter.

The 2019 Closure Plan Update focuses mainly on infrastructure located on the Glencore owned properties directly north of Highway 134 (Smelter Area, MHW Area and Fertilizer Plant) but also includes the existing slag pile (also referred to as the New Slag Pile) located south of Highway 134 and the conveyors that extend from the MHW Area to the Port of Belledune. The Jacquet River Pumphouse (located off-Site approximately 14 km to the west) and associated reservoir and freshwater pipeline (all owned by Glencore), are also discussed as part of the 2019 Closure Plan Update.

### 1.1.1 Project Status

The 2019 Closure Plan Update was reviewed by Glencore in November/December 2019 and finalized by GHD following receipt of comments.

### 1.1.2 Project Description

GHD completed an existing conditions investigation (in conjunction with the historical document reviews) at the Site in July 2019 to understand Site infrastructure, identify changes that have occurred at the Site since 2008/2009 and identify any data gaps that required additional Site investigations.



As part of the 2019 Closure Plan Update, a Hydrogeological Study and Data Gap Assessment (HGS and DGA) of the Site was completed. The primary objective of the HGS and DGA was to evaluate hydrogeological conditions of the Smelter Area, specifically the Back 40 and Back 50 area, but also included the assessment of current soil and groundwater conditions in other areas of the Site.

Concurrent with the HGS and DGA, a Naturally Occurring Radioactive Materials (NORM) and Hazardous Materials (Hazmat) Survey for the Fertilizer Plant was also completed to determine the quantity of potential NORM impacted building materials, equipment, residual products and/or soil remaining in the Fertilizer Plant area that would require specific remediation or disposal as part of decommissioning activities.

### 1.1.3 Project Work Breakdown

A conceptual decommissioning schedule is presented in Section 14. The schedule shows decommissioning activities and pre-decommissioning engineering work. The duration and sequencing of each activity is based on GHD's professional experience, best management practices, and on current market conditions. The duration of each activity will ultimately be dependent on contractor availability and the selected contractor's resources (i.e., equipment and human resources) and proposed means and methods; and the sequencing will partially be dependent on the selected contractor's preference and the contractor's ability to execute multiple decommissioning activities in a safe manner.

## 1.2 Scope of Pre-Feasibility Study

The overall objective is to determine the necessary decommissioning activities to close the Brunswick Smelter in a manner that is environmentally and economically sound, in compliance with applicable provincial and federal regulations and standards, and maximizes the potential end use value of the Site.

It is understood that the Site will be fully demolished and restored to an open space condition with the majority of the Site held in perpetuity by Glencore as a vacant but fenced or partially fenced property with the potential for future industrial use.

One of the key assumptions of the 2019 Closure Plan Update (similar to the 2008/2009 Closure Plan PFS) is the utilization of the Brunswick Mine site (located approximately 70 km from the Smelter) for the disposal of various demolition debris at the existing open pit area. Future closure and/or operational requirements associated with the Brunswick Mine site are not included in the 2019 Closure Plan Update.

Additional key concepts of the 2019 Closure Plan Update include:

- Glencore personnel pre-decommissioning work generally limited to the planning and support for the removal of raw concentrate that is stockpiled in various areas of the Site.
- Building cleaning will be limited to a wash down of dust from building material surfaces prior to demolition, with washwaters being conveyed through existing infrastructure or via vacuum trucks for on-Site treatment. Washed building demolition debris such as concrete will be transported to the Brunswick Mine site for disposal (as noted above).



- Permitting, design and construction of a special waste landfill(s) for disposal of metal impacted demolition debris or NORM impacted materials is not considered required based on information provided by Glencore and results of the 2019 NORM Trade-off Study.
- Long-term water management at the Site will be provided by modifying the existing storm water management system (drainage ditches) and utilizing engineered wetlands (conceptual) to naturally attenuate metal impacted groundwater and surface water at the Site and to eliminate the long term use of the WWTP following Site closure. This includes modifications to an existing diversion ditch that will also serve as a groundwater interceptor trench for the Smelter Area.
- Apply approximately 0.6 m thick soil cover over areas of the Site determined to have metal impacts in surface soil (exceeding human health risk based screening levels) utilizing locally sourced borrow materials (thickness to be determined as part of detailed design). This includes covering terrestrial areas of Belledune Point but assumes no further remediation of the existing Salt Water Lagoon on Belledune Point is required. Portions of the on-Site borrow pit to be re-established as engineered wetland areas. Application of soil cover has been assumed for the purposes of the 2019 Closure Plan Update and consistent with the 2008/2009 Closure Plan PFS. However, a trade-off study is recommended as part of the additional pre-decommissioning engineering studies to evaluate potential future environmental liabilities associated with covering the metal impacted soil compared to excavation and off-Site disposal.
- The Jacquet River Pumphouse and associated infrastructure will remain in place and under the care and maintenance of Glencore for the foreseeable future.

A number of additional assumptions and key concepts for the closure of the Facility were made in consultation with Glencore. A summary of the assumptions are provided in Section 2 of this report.

### 1.3 Risk Analysis

GHD and Glencore reviewed and updated the project Risk Register (initially developed as part of the 2008/2009 Closure Plan PFS). Risks were identified and listed for each area covered by the scope of the PFS. Projects risks are ranked as: very low level risks “green” (42 occurrences), low level risks “yellow” (16 occurrences), medium level risks “orange” (3 occurrences) and high level risks “red” (0 occurrences). The risk categories (including Planning Assumptions, Health and Safety, Engineering Design, Environmental, First Nations and Heritage, and Facility Demolition) are presented in the comprehensive Risk Register presented in Section 16.

The risk register is to be reviewed and updated on a regular basis, as the Closure Project progresses.

### 1.4 Recommendations and Next Step Work Plan

Section 17 identifies recommendations and next step work plans (or studies) necessary to further develop the closure concept and to refine the Risk Register. The following are some of the key studies:

- Complete a topographic survey to verify existing grades and designing surface water management plans and soil cover requirements (among others);
- Complete a detailed hydrologic and hydraulic study to refine surface water management plans;



- Complete detailed design of the treatment wetlands for inclusion in hydraulic study;
- Complete a wetland treatability study to confirm the suitability and effectiveness of the proposed treatment options;
- Conduct a slope stability and physical property analysis of New Slag Pile material to ensure cover design provides adequate protection and limits failure potential;
- Determine Site-specific risk based screening levels for the primary contaminants of concern including metals and petroleum hydrocarbons in soil and groundwater;
- Facilitate consultation with local First Nation communities as part of future Facility closure planning;
- Evaluate possible re-use or re-processing options for stockpiled residue material as well as sulfuric acid that have the potential to significantly reduce closure costs;
- Complete a trade-off study to evaluate potential future environmental liabilities associated with covering the metal impacted soil compared to excavation and off-Site disposal; and
- Update the hazardous materials inventory for the Site.

## 2. Introduction

The Brunswick Smelter is a primary lead/silver smelter located at 692 Main Street in Belledune, NB (Figure 1) and is owned by Glencore Canada Corporation (Glencore). The facility was originally commissioned in 1966 by East Coast Smelting. The Brunswick Smelter was originally designed as a lead-zinc smelter to produce metallic lead and zinc from concentrates produced locally at the Brunswick Mine Site located 35 kilometres south of Bathurst. The facility also formerly included a fertilizer plant (which closed in 1995). The fertilizer plant initially produced a monoammonium phosphate product and later di-ammonium phosphate product, using by-products from the smelting process.

In March 2013, the Brunswick Mine Site officially ceased operation, resulting in elimination of the main feedstock for the Brunswick Smelter. The Facility remains operational by importing a variety of feedstocks for refining, and continues to operate as a primary lead smelter with a reported production capacity of 120,000 tonnes per year.

A 2008/2009 Closure Plan Prefeasibility Study (PFS) and Cost Estimating Report (also referred to as the “2008/2009 Closure Plan PFS”) was completed for the Brunswick Smelter facility in 2009 by SNC-Lavalin (SNC). The 2008/2009 Closure Plan PFS included closure cost forecasting, providing Glencore with an estimate of future liability associated with the closure and demolition of the Brunswick Smelter facility. GHD Limited (GHD) was retained by Glencore to provide engineering and project management services in the review of the 2008/2009 Closure Plan PFS and preparation of an updated closure plan based on current conditions at the Brunswick Smelter (Closure Plan – PFS 2019 Update; herein referred to as the 2019 Closure Plan Update). The 2019 Closure Plan Update includes validation of the information presented in the 2008/2009 Closure Plan PFS for comparison to existing conditions.



The Brunswick Smelter facility includes the Smelter Area, Material Handling West Area (MHW Area), and the Fertilizer Plant located north of Highway 134 in Belledune, NB (collectively referred to as the “Site” or “Facility”). A Site Location Map, Property Plan and Overall Site Plan are provided on Figures 1, 2 and 3, respectively. The location of various Site features are shown on Figure 4.

The Study Area included in the 2019 Closure Plan Update is identified in yellow, in relation to third party properties and crown-owned reclaimed land, on Figure 2. The 2019 Closure Plan Update focuses mainly on infrastructure located on the Glencore owned properties directly north of Highway 134 (Smelter Area, MHW Area and Fertilizer Plant) but also includes an existing slag pile (also referred to as the New Slag Pile) located south of Highway 134 and the conveyors that extend from the MHW Area to the Port (Figure 3). The Jacquet River Pumphouse (located off-Site approximately 14 km to the west) and associated reservoir and freshwater pipeline (owned by Glencore) are discussed in the Closure Plan. However, decommissioning of this infrastructure was not included in the 2019 Closure Plan Update as the Jacquet River Pumphouse supplies freshwater to other commercial/industrial operations in the area as well as several residential properties.

Adjacent and nearby third party industrial properties are owned by Irving Oil, NB Power, New Brunswick Department of Transportation, the Port of Belledune (Port), Caribou Mining and Canadian National Railway (CN) main line to the south. Two adjacent properties are also owned by the Roman Catholic Bishop of Bathurst (including the cemetery near the MHW area). The adjacent third party properties and crown owned reclaimed land are not included within the 2019 Closure Plan Update Study Area, excluding the cemetery property located between the Smelter Area and the MHW Area (Figure 3). Although this cemetery property area is owned by Roman Catholic Bishop of Bathurst, environmental conditions within the cemetery were reviewed as part of the 2019 Closure Plan Update.

In addition, there are four sub-stations located at the Site that are reportedly owned by NB Power. The removal of infrastructure associated with these substations such as transformers and associated electrical distribution lines is not included with 2019 Closure Plan Update.

## 2.1 General Site Description

The Site is located within an industrial area of Belledune with the active facilities primarily located north of Highway 134. Vacant wooded properties owned by Glencore as well as the New Slag Pile are located south of Highway 134. As noted above, the Site is serviced with freshwater supplied by the Jacquet River Pumphouse. The pumphouse and associated infrastructure also supplies freshwater to several industrial facilities in the Belledune area (such as the Port and Chaleur Sawmill) as well as residents on Chaleur Drive.

The Brunswick Smelter is an operational lead smelting facility and includes three areas including:

- 1) The Smelter Area (which is the largest portion of the Site including: the Back 50, Back 40 and Process Sludge areas, Belledune Point, the Acid Plant, the Smelter buildings (Sintering Plant, Blast Furnace, Refinery) and the New Slag Pile.
- 2) The Materials Handling West Area (formerly known as the Bulk Handling Operation [BHO]) which includes the Coke Fines Storage Area and the Concentrate Storage Domes. The MHW Area moves incoming imported concentrates through the Port, toward interim storage and delivery to the Smelter. The MHW Area also houses several ancillary operations, most notably



lead acid battery recycling/recovery, as well as temporary storage of raw materials/feedstocks for the Smelter and the recycling programs.

- 3) The Fertilizer Plant area (located within the MHW Area) which includes two inactive buildings, the Di-Ammonium Phosphate Plant and Phosphoric Acid Plant (DAP and PAP buildings), as well as a Scrap Yard area.

Site Plans specific to the Smelter Area, the MHW Area, the Fertilizer Plant and the Jacquet River water supply are shown on Figures 5A, 5B, 5C and 5D, respectively. Details of the buildings and systems associated with the Facility are discussed in Section 3.

## 2.2 Prefeasibility Study Objectives

GHD was retained by Glencore to review and update the 2008/2009 Closure Plan PFS for the Brunswick Smelter. The overall objective is to determine the necessary decommissioning activities to close the Brunswick Smelter in a manner that is environmentally and economically sound, in compliance with applicable provincial and federal regulations and standards, and maximizes the potential end use value of the Site. As previously indicated, the 2019 Closure Plan Update includes infrastructure associated with the Smelter Area including the New Slag Pile, MHW Area, and Fertilizer Plant. The Jacquet River Pumphouse and associated freshwater reservoir and pipeline are also included in the 2019 Closure Plan from a long-term operational perspective but decommissioning of this infrastructure was not included in the 2019 Closure Plan Update.

In preparation of the 2019 Closure Plan Update, it is GHD's understanding that the Site will be fully demolished and restored to an open space condition with the majority of the Site held in perpetuity by Glencore as a vacant but fenced or partially fenced property with the potential for future industrial use.

A key concept of the 2008/2009 Closure Plan PFS that is being carried forward in the 2019 Closure Plan Update is the utilization of the Brunswick Mine Site (located approximately 70 km from the Smelter) for the disposal of various demolition debris at the existing open pit area (Figure 6). Future closure and/or operational requirements associated with the Brunswick Mine Site are not included in the 2019 Closure Plan Update.

GHD has reviewed the 2008/2009 Closure Plan PFS to determine if the information presented is valid, timely and complete, and has provided recommendations to Glencore as to whether an update should be executed, where applicable. In conjunction with the document reviews, GHD completed an existing conditions investigation at the Site in July 2019 to understand Site infrastructure, identify changes that have occurred at the Site since 2008/2009 and identify any data gaps that require additional Site investigations. As part of the data gap review, Glencore requested GHD to prepare a separate technical memorandum for each section of the 2008/2009 Closure Plan PFS report detailing the report review findings. The memorandums outlining the findings of GHD's review of the 2008/2009 Closure Plan PFS are provided in Appendix A.

As part of the data gap assessment, Glencore personnel familiar with the Site provided information concerning the past and current use of the Site, accompanied GHD during the Site inspection activities, and/or provided additional building and infrastructure plans. The Glencore personnel involved as part of the existing conditions evaluation and data gap assessment included:



- Ms. Kelly Longval (Glencore Project Manager),
- Mr. Bob Butler (Glencore Project Sponsor), as well as
- Mr. Florian Reher, and
- Mr. Rick Schwenger.

GHD sub-consultants including personnel from Roy Consultants (Roy), Delsan AIM and SC&A were also involved with certain aspects of the data gap assessment work. The sub-consultants work has been integrated into the overall 2019 Closure Plan Update findings.

The purpose of conducting a detailed review of the available information and interviewing staff familiar with the Site was to develop a reasonable and approximate estimate of the types of materials associated with the Site infrastructure to be included in the 2019 Closure Plan Update as well as conceptual future land use requirements. Through development of the material inventory, an approximate estimation of the quantities associated with decontamination and industrial cleaning of the Site in advance of demolition, and the volume of voids that would require infilling following demolition were also determined.

As part of the 2019 Closure Plan Update, GHD also completed a Hydrogeological Study and Data Gap Assessment (HGS and DGA) of the Site (report dated January 2020). The primary objective of the HGS and DGA was to evaluate hydrogeological conditions of the Smelter Area, specifically the Back 40 and Back 50 area, but also included the assessment of current soil and groundwater conditions in other areas of the Site (November 2019).

Concurrent with the HGS and DGA, GHD also completed a Naturally Occurring Radioactive Materials (NORM) and Hazardous Materials (Hazmat) Survey for the Fertilizer Plant Area (report dated January 2020). The primary objective of the NORM and Hazmat survey was to determine the quantity of potential NORM impacted building materials, equipment, residual products and/or soil remaining in the Fertilizer Plant area, specifically the DAP and PAP buildings, that would require specific remediation or disposal as part of future Facility decommissioning activities.

The data collected as part of the HGS and DGA together with the NORM and Hazmat survey were used to develop the remedial action plans and environmental mitigation measures that are included in the 2019 Closure Plan Update to meet current environmental standards and best practices. The HGS and DGA report is provided in Appendix B. The NORM and Hazardous Materials Survey report is included in Appendix C.

### 2.3 List of Assumptions

As indicated in the preceding Section, it is GHD's understanding that the Site will be fully demolished and restored to an open space condition with the majority of the Site held in perpetuity by Glencore as a vacant but fenced or partially fenced property. Although there is the potential that some areas of the Site and associated buildings such as the MHW Area and the rail spur line bordering the west portion of the Site may be sold or transferred to adjacent land owners or businesses as part of the Facility closure process, for conservatism and as per instructions from Glencore, it has been assumed that all infrastructure associated with the Brunswick Smelter will be decommissioned and demolished. The Freshwater Supply infrastructure (including the Jacquet River Pumphouse, Reservoir, and Freshwater Supply Line) also has the potential to be sold or transferred to third





parties as part of the Facility closure process. However, for the purposes of the 2019 Closure Plan Update, it has been assumed that this infrastructure will remain in place and operational for the foreseeable future.

The following is a list of the project assumptions.

- Health and safety is paramount.
- Decommissioning must comply with all local, provincial, and federal regulations.
- Decommissioning project will be completed over a period of approximately eight years.
- Glencore will provide project management and contract administration duties with support from an engineering consultant during the decommissioning and demolition period. A third party qualified consultant will provide technical support for contract administration and oversight during the closure works.
- All Glencore infrastructure to be sold/decommissioned/demolished.
- Although opportunities may exist to sell infrastructure at the MHW Area, for conservative purposes it has been assumed that all infrastructure will require decommissioning and demolition.
- Although opportunities may exist to transfer ownership of the Freshwater Supply infrastructure (including the Jacquet River Pumphouse, Reservoir, and Freshwater Supply Line) to third parties, it has been assumed that all infrastructure will remain in place and under the care and maintenance of Glencore for the foreseeable future.
- Although opportunities may exist to transfer ownership of a portion of the rail spur line to third parties, for conservative purposes it has been assumed that the removal of the on-Site spur line, including the rails and rail ties will be Glencore's responsibility. The portion of the rail spur line from the CN main line to Shannon Drive is assumed to remain. It is noted that there is also a short rail line extending off of the Glencore rail spur line property into the NB Power property that is assumed to remain.
- Pricing data for salvageable materials was based on pricing averages over the last five years obtained during other demolition projects.
- Facility infrastructure is to be removed to match existing grade. Slabs-on-grade and below-grade foundations to remain and above-grade concrete foundations will be removed to match existing grade, with the exception of the old concrete foundation present to the west of the Saltwater Lagoon. This foundation location would require construction of an access road resulting in potential destruction of ecological habitat would be required to demolish the foundation. The documents indicated that there has previously been rare plants identified in the area, therefore the old concrete foundation will be abandoned in place.
- Sub-surface floors, including trenches and pits, are to be broken up to allow for drainage.
- Below-grade tunnels will be exposed and crushed, and then the tunnel backfilled.
- New perimeter fencing and access roads will be constructed as part of final Site grading.
- Buried utilities under 0.5 m diameter shall be abandoned in place and cut and capped at buildings and manholes.



- Existing earthen dam and associated retention pond at the New Slag Pile will be retained as part of the Facility closure works and serve as a component of surface water management for the area.
- Water management after closure will be limited to surface water drainage systems. Existing stormwater piping will be abandoned in place, and manholes/catch basins will be backfilled to match existing grade.
- Conceptually, passive engineered wetland systems will be constructed for post-closure treatment of surface water run-off generated at the Site. One engineered wetland would be constructed at the current location of the Smelter Cooling Recycle Pond (CRP) pond and will discharge to the Bay. One engineered wetland would be constructed in the current location of the Bulk Acid Tanks in the MHW Area and will discharge to the adjacent Port cell. A third conceptual engineered wetland would be constructed north of the New Slag Pile, in the Borrow Pit area and will discharge to the Bay through an open ditch and culvert system. Conceptual designs are included in the 2019 Closure Plan Update. However, future detailed designs would be required to determine grading and elevation requirements, potential construction materials and filter media, and discharge locations and limits.
- The existing Smelter Wastewater Treatment Plant (WWTP) will remain operational throughout the decommissioning and demolition to treat wastewater generated from the closure activities. Glencore has indicated that at Facility shutdown, 70% of the WWTP operation capacity will be available for cleaning washwater. However, no cleaning will be able to be completed during the spring melt.
- Infrastructure cleaning consisting of building wash downs and on-Site washwater treatment through the WWTP will be utilized to limit off-Site disposal of bulk dust. In addition, it is assumed that water and power sources will be available to the decommissioning/demolition contractor(s) to complete the cleaning activities.
- The Smelter WWTP will operate for a period of approximately 2 to 4 years following completion of final Site grading and the construction of engineered wetlands.
- Site cover will be 0.6 m thick for purposes of the current closure study. However, actual cover thickness developed during future detailed design phases may vary depending on elevation requirements, concentrations of contaminants in soil and future land uses for specific areas of the Site. Application of soil cover has been assumed for the purposes of the 2019 Closure Plan Update and consistent with the 2008/2009 Closure Plan PFS. However, a trade-off study is recommended as part of the additional pre-decommissioning engineering studies to evaluate potential future environmental liabilities associated with covering the metal impacted soil compared to excavation and off-Site disposal.
- Metal-impacted soil remediation approach (i.e., soil cover) and future surface water run-off passive treatment technologies (i.e., engineered wetlands) will meet regulatory requirements.
- The area of the New Slag Pile that will require cover is estimated based on current conditions (December 2019).
- It has been assumed the slag present in the New Slag Pile is considered non-leachable and does not require an impermeable cap for closure.



- Quantities and characterization data for processed raw materials, imported ore and process sludge, as well as a process tank inventory and estimate of residual materials requiring handling and disposal were provided by Glencore for inclusion in the 2019 Closure Plan Update.
- No decommissioning activities such as chemical sweep; emptying and disposal of liquids from pipelines, reservoirs, process piping and process equipment; removal and disposal of various residues in buildings, such as sludge and dust accumulations; nor general cleaning will be completed by Facility personnel prior to mobilization of decommissioning/demolition contractor(s).
- After Facility closure is announced and prior to demolition contractor(s) mobilizing to Site, it is assumed that Glencore personnel will plan and provide support for the removal of all raw concentrate that is stacked on various areas of the Site, including re-distributing the concentrate to other Glencore facilities or returning the concentrate to the supplier.
- No known Paper-Insulated Lead-Covered (PILC) cables are present on Site, as indicated by Glencore personnel.
- Based on the previous rehabilitation works completed at Saltwater Lagoon (former Old Slag Pile), Glencore has indicated that it is reasonable to assume that additional rehabilitation works of Belledune Point will not be required as part of future Facility closure activities.
- Further evaluation or remediation of sediment in Chaleur Bay adjacent to the Site is not required, based on information provided by Glencore. As such, recommendations on additional evaluation or remediation of sediments in Chaleur Bay adjacent to the Site are not included in the 2019 Closure Plan Update.
- Material quantities in the 2008/2009 Closure Plan PFS are considered accurate and complete, and the 2008/2009 quantities were utilized in the current study update. Breakdowns of these quantities were not provided in the 2008/2009 Closure Plan PFS and only an overall summary of quantities was provided for the Smelter Area, MHW Area and the Fertilizer Plant, therefore a 10% verification could not be completed on the quantities. In addition, in the 2008/2009 Closure Plan PFS, it is not clear if the lengths of conveyors have been included in the steel take-offs for recycling. Glencore confirmed that GHD should assume that the quantities were included in the steel take-offs for recycling.
- All non-friable asbestos containing materials (ACM) will be disposed of with demolition debris at the open pit at the Brunswick Mine Site. All friable ACM will be disposed of off-Site at a licensed landfill (e.g., Red Pine Landfill).
- The friable ACM quantities presented in the existing 2016 Asbestos Management Program Inventory provided by Glencore (Glencore, 2016) are considered to be accurate but complete quantities of non-friable ACM were not provided in the 2016 report. As such, quantities of non-friable ACM (i.e., transite siding) listed in the 2008/2009 Closure Plan PFS are considered accurate for the purposes of the 2019 Closure Plan Update.
- Non-impacted and metal impacted demolition debris present at the Site can be disposed of at the existing demolition debris open pit area of the Brunswick Mine Site, which was created during the Brunswick Mine Site closure activities. Materials with flaking lead-based paint are considered suitable for disposal at the Brunswick Mine Open Pit, and no allowance for off-Site disposal of flaking lead-based paint is required. In addition, it is assumed that the Brunswick



Mine Site Water Treatment Plant (WTP) is able to treat metals that would be typically associated with demolition debris from the Smelter Site, and that the proposed disposal areas are within the watershed that flows to the Brunswick Mine Site WTP. No assessment of the Brunswick Mine Site WTP or watershed catchment area was conducted as part of the current closure plan update.

- Glencore is responsible for decommissioning and demolition of electrical substation buildings, building contents, substation yard fencing and equipment foundations. NB Power owns and is responsible for the decommissioning and removal of transformers and other equipment within the substations yards.
- For the purposes of the 2019 Closure Plan Update, it has been assumed that the oil remaining on-Site transformers contain PCB concentrations below 2 mg/kg and can be recycled or reused without special handling.
- For the purposes of the 2019 Closure Plan Update, it has been assumed that the hydrocarbon impacted soil and groundwater are likely present in certain areas on-Site and that assessment of these areas will only be possible after the Smelter is closed. However, it is assumed that the volume of impacted materials may have been reduced since 2009 given the reduction in use of petroleum hydrocarbons in the Smelter operations (i.e., conversion to a propane fuel source). Free product was not measured in existing monitor wells in 2019. To be conservative the volume estimates included in the 2008/2009 are carried forward in the 2019 Closure Plan Update.

## 3. Background

### 3.1 Site History

The facility was originally commissioned in 1966 by East Coast Smelting. The Brunswick Smelter was originally designed as a lead-zinc smelter to produce metallic lead and zinc from concentrates produced locally at the Brunswick Mine Site located 35 km south of the City of Bathurst. The facility also formerly included a fertilizer plant (which closed in 1995). In March 2013, the Brunswick Mine officially ceased operation, resulting in elimination of the main feedstock for the Brunswick Smelter. The Facility remained operational by importing a variety of feedstocks for refining, and continues to operate as a primary lead smelter with a reported production capacity of 120,000 tonnes per year.

A brief history of the Site in bullet form is provided below:

- 1967 - Plant starts production processing lead-zinc concentrate.
- 1968 - The sulfuric acid plant enters service as well as the PAP and DAP Fertilizer Plant.
- 1972 - Smelter converted to operate primarily as a lead smelter.
- 1980 – Transportation and storage of slag in the northern portion of the Smelter Area (Belledune Point) ceases and slag is now transported to new engineered impoundment south of the Smelter Area. The CRP with an 8 million gallon capacity is built as well as the WWTP.
- 1988 - Installation of groundwater monitoring wells in the vicinity of the Smelter Area.
- 1989 - Short rotary furnaces are installed at the Facility.



- 1995/1996 - Fertilizer Plant closes and buildings/area converted into a battery recycling plant and a storage facility for lead concentrates.
- 1996 - Seven storage domes are added to MHW Area (formerly BHO) area. The sinter domes are built. The battery breaker and the new facility for concentrate handling and storage are commissioned. A former groundwater barrier and pumping system was reportedly installed in 1996 to locally pump some groundwater north of the CRP (in the area of former monitoring wells GW-40 and GW-41 and send it to the CRP (CRA, 2007).
- 2008 - Closure activities began at Brunswick Mine. Slope cover began on the South tailings Basin in 2008 and continued to 2015.
- 2011 - New slag pile area increased from 15 hectares (Ha) to 35 Ha. The Silver Refinery expansion was completed. A septic system was built at the MHW Area.
- 2012 - The slag from the Old Slag Pile on Belledune Point was transported to the New Slag Pile area. The Old Slag Pile area is now referred to as a Saltwater Lagoon. The New Silver Refinery was constructed.
- 2013 - A rock wave barrier was built at the polishing pond adjacent to the Old Slag Pile. Two new propane tank farms were installed in the Smelter Area. Brunswick Mine officially ceased operations and eliminated the main feedstock to be processed at the Smelter Facility. The Brunswick Mine Site waste disposal area was reshaped, covered and revegetated.
- 2014 - The 2,000,000 litre bulk fuel storage tank at the Smelter was removed and replaced with a smaller 80,000 litre tank.
- 2015 – The Back 40 of the Smelter Area excavated with stored process residue and soils recovered for processing at the Facility. The Back 40 continues to be used for storage of in-process materials.
- 2016 - 187 Ha of the Brunswick Mine Site was regraded and vegetated. The legacy plastic and rubber pile at the Smelter Site were removed and disposed of at the Brunswick Mine open pit.
- 2017 - The area between the Smelter Area and MHW Area is used for storage of lime and explosives. The Brunswick Mine Site closure activities are completed. The final tailings basin regrading and cover was completed with exception of a small pond area.
- 2018 - A new Wet Electrostatic Precipitator (WESP) and associated electrical building were constructed. Ground settlement occurred at the Brunswick Mine Site in the area of the open pit access road, rendering the pit access road inaccessible.
- 2018/2019 - A new water management system (referred to as the Storm Water Storage Pond) was established at the MHW Area, with water being collected by gravity fed to a holding pond and pumping system. Collected water is then pumped to the CRP at the Smelter Area via an open air drainage ditch for subsequent treatment at the WWTP system.
- 2019 - The completion of the HGS and DGA and the NORM and Hazmat Survey in support of this 2019 Closure Plan Update.



## 3.2 Overview of Current Facilities

A summary of the Brunswick Smelter infrastructure is presented below. The infrastructure inventory has been divided into the following areas:

- Smelter Area (Including New Slag Pile);
- MHW Area;
- Fertilizer Plant;
- Petroleum Storage Tanks;
- Chemical Use and Storage; and
- Utility Services.

Table 1 lists the identified buildings and infrastructure considered in the Closure Plan. The Site Plan and the location of various Site features are shown on Figures 3 and 4. Site Plans specific to the Smelter Area, the MHW Area, and the Fertilizer Plant are also included as Figures 5A, 5B and 5C, respectively.

### 3.2.1 Smelter Area

- **Short Rotary Furnace (SRF) Building** – The SRF Building is located in the southeast portion of the Smelter Area, adjacent to the Furnace Building and Metal Storage. The building measures approximately 1394 m<sup>2</sup> (71.5 m by 19.5 m in plan view), is 22 m high, and is constructed of structural steel framing with a combination of precast concrete panel siding, metal siding, and ACM transite panel siding. Two short rotary furnaces are located inside the SRF Building which are used to process various lead byproducts including scrap battery plates, antimony slag, and a variety of other smelter or refinery co-products.
- **Lead Refinery** – The Lead Refinery is located in the southeast portion of the Smelter Area, adjacent to the Dross Building and Metal Storage. The building measures approximately 1788 m<sup>2</sup> (79.5 m by 22.5 m in plan view), is 22 m high and is constructed of structural steel framing with ACM transite panel siding. In the Lead Refinery, lead bullion is refined by removing residual copper with sulphur, softening the lead by oxidizing residual antimony, tin and arsenic with caustic soda, removing silver by precipitations with zinc, removing zinc with caustic soda, removing bismuth with magnesium and calcium and finally removing any residual impurities with caustic soda. Zinc-silver crust is oxidized to produce Doré metal, an impure silver that is processed or sold. Refined lead may be alloyed with calcium, tin or antimony prior to casting into a variety of shapes for shipment to customers.
- **Furnace Building** – The Furnace Building is located west of the SRF Building and measures approximately 1650 m<sup>2</sup> (33 m by 50 m in plan view), is 22 m high and is constructed of structural steel framing with a combination of precast concrete panel siding and ACM transite panel siding. This building houses a blast furnace, which processes sinter at <2% sulphur using metallurgical coke both as a fuel and as a reductant to reduce lead to the metallic state. The blast furnace is fed from the Charge Preparation Building. Blast air is enriched with oxygen to reduce energy consumption and the off-gases from the blast furnace are cleaned by the Furnace Baghouse to remove particulate matter prior to release.



- **Metal Storage Building** – The Metal Storage Building is located in the southeast portion of the Smelter Area, adjacent the Lead Refinery and SRF Building, the Metal Storage Building measures approximately 2210 m<sup>2</sup> (34 m by 65 m in plan view), is 10.5 m tall, and is constructed of structural steel framing, a combination of metal siding and ACM transite panel siding, with a reinforced concrete slab on grade. This building is used for storage and rail car loading of refined metal products that are ready for shipment to customers.
- **Dross Building** – The Dross Building is a steel frame structure with metal clad roofing and ACM transite panel siding. The Dross Building is located in the southeast portion of the Smelter Area, adjacent to the Lead Refinery and Furnace Building. The Dross Building was constructed before 1983 and measures approximately 1118 m<sup>2</sup> (26 m by 43 m in plan view). Lead bullion is processed in batches by the Dross Plant to produce >99.9% lead. Copper dross is first removed and processed in a reverberatory furnace to recover entrained lead and other valued metals by separating four distinct phases: 1) an oxide slag containing iron and zinc, 2) intermetallic speiss containing copper arsenide, antimonide and stannide (enriched in silver and gold), 3) copper-lead sulphide matte enriched in silver, and 4) metallic lead bullion enriched in silver and gold. Matte and speiss are sold for processing by other copper smelters.
- **Sinter Plant** – The Sinter Plant is located in the southwest portion of the Smelter Area, to the east of the Acid Plant. The Sinter Plant was constructed in 1973 and measures approximately 1012 m<sup>2</sup> (72 m by 26 m in plan view) and 25 m high. The Sinter Plant is constructed of structural steel framing with a combination of precast concrete panel siding and ACM transite panel siding. Feedstock from the Proportioning Plant is conveyed into the sinter machine to oxidize sulphide sulphur to sulphur dioxide. Moisture is added to the sinter plant return fines and fresh feed to produce a porous and reactive basic lead-iron silicate sinter with suitable mechanical properties. All Sinter Plant off-gases are cleaned to remove particulate matter prior to further processing or release. Strong gases are treated by a venturi scrubber and wet electrostatic precipitator, cooled and directed to the Acid Plant. Weak gases are treated by the Sinter Baghouse prior to discharge. Moist gases from the sinter machine and sinter recycle cooling containing submicron fines are treated by wet scrubbers. All emission control dusts from the sinter plant and gas cleaning are returned to the sinter machine as a dust or slurry.
- **Silver Refinery** – The Silver Refinery is located in the southeast portion of the Smelter Area, and is attached to the SRF Building. The building measures approximately 252 m<sup>2</sup> (18 m by 14 m in plan view) and is constructed of structural steel framing and metal siding exterior. The Silver Refinery expansion was completed in 2011 and the building houses a vacuum induction retort furnace.
- **Crusher Building** – The Crusher Building is located in the southwest portion of the Smelter Area, adjacent to the Sinter Plant. The building measures approximately 680 m<sup>2</sup> (17 m by 40 m in plan view), is 27 m tall and is constructed of structural steel framing and a combination of ACM transite panel siding, metal siding and precast concrete panel siding. The building houses screening and crushing equipment to crush the sinter from the Sinter Plant prior to forwarding to the Blast Furnace. Approximately two thirds of the sinter is recycled back to the sinter machine for further sulphur reduction.
- **Charge Preparation Building** – The Charge Preparation Building is located in the southwest portion of the Smelter Area, adjacent to the Crusher Building and Furnace Building. The building



measures approximately 655 m<sup>2</sup> (21 m by 21 m in plan view), is 24 m tall, and is constructed of structural steel framing and ACM transite panel siding. The Charge Preparation Building prepares the feed for the blast furnace. The building houses two bins, one for sinter and one for coke, and charges the blast furnace every few minutes with approximately 3 tonnes of sinter and 300 kg of coke.

- **Acid Plant** – The Acid Plant is located in the southwest portion of the Smelter Area, adjacent to the Sinter Plant. The building measures approximately 3790 m<sup>2</sup> (92 m by 27 m, 32 m by 14 m and 17.5 m by 49 m in plan view). The roof elevation ranges from 7.5 m in the contact section of the building to 22 m. The Acid Plant was built in 1968 and is constructed of structural steel framing with a combination of precast concrete panel siding and ACM transite panel siding. The main component of the acid plant, the converter with internal heat exchangers, was replaced in 1997. In 2018, new WESP equipment was constructed, phasing out the usage of the old Acid Plant mist precipitators (still in place and of lead plate construction). The Acid Plant converts sulphur dioxide concentrations in the Sinter Plant exhaust gases to sulfuric acid. The acid is then pumped to the MHW Area via a 1500 m long aboveground pipeline (0.6 m diameter), where it is stored in two Bulk Acid Storage Tanks prior to shipment. The Acid Plant utilizes salt water pumped from the Salt Water Pumphouse to provide cooling of the weak acid stream to facilitate effective absorption of the sulphur dioxide gas stream.
- **Acid Stack** – The Acid Stack is located north of the Acid Plant, measuring 61 m tall and approximately 7 m in diameter. The stack is constructed of a concrete windshell with a carbon steel liner and a stainless steel thimble.
- **Sinter Baghouse and Stack** – The Sinter Baghouse and Stack is Located in the southwest portion of the Smelter Area, adjacent to the Furnace Baghouse and Oxygen Plant. The Sinter Baghouse measures approximately 530 m<sup>2</sup> (45 m by 10 m in plan view), is 14 m high, and is constructed of structural steel framing and metal siding. The Sinter Baghouse Stack is approximately 3 m in diameter and 32 m tall and is constructed of carbon steel. Dry gases, containing insufficient sulphur dioxide to be used in the manufacture of sulfuric acid, are treated in the Sinter Baghouse for particulate removal and then released to the atmosphere through the Sinter Baghouse Stack.
- **Furnace Baghouse and Stack** – The Furnace Baghouse is located in the south portion of the Smelter Area, adjacent to the Sinter Baghouse and Oxygen Plant. The building measures approximately 836 m<sup>2</sup> (38 m by 22 m in plan view), is 14 m high, and is constructed of structural steel framing, metal siding and metal roofing. The Furnace Baghouse Stack is approximately 3 m in diameter and 32 m tall and is constructed of carbon steel. The Furnace Baghouse cleans the off-gases from the blast furnace to remove to remove particulate matter prior to release. Furnace baghouse dust is returned to the sinter machine as a slurry.
- **Oxygen Plant** – The Oxygen Plant is located in the south portion of the Smelter Area, adjacent to the Furnace Baghouse and the Sinter Baghouse. The Oxygen Plant building measures approximately 150 m<sup>2</sup> (15 m by 10 m in plan view), and is approximately 4 m tall and is constructed of concrete block. Several carbon steel liquid oxygen tanks (approximately 2 m in diameter and between 4 m and 6 m tall) are located around the exterior of the Oxygen Plant Building.





- **SRF and Secondary Lead Storage Domes** – The SRF Storage Dome is located in the southeast portion of the Smelter Area, near the Furnace Baghouse and the Secondary Lead Storage Dome is located in the northeast portion, adjacent to the Car Unloading Building. The domes are 34 m diameter dome-roofed structures with a 3 m high concrete push wall and a concrete floor, and are 13 m tall. The roofs are constructed of wood framing with asphalt shingles.
- **Sinter Storage Dome** – The Sinter Storage Dome (also known as The Can) is located in the southwest portion of the Smelter Area, adjacent to the Sinter Plant. The Sinter Storage Dome has a diameter of approximately 25 m in plan view, is 16 m tall, and is constructed of structural steel framing with metal siding and metal roofing. Sinter produced in the Sinter Plant is forwarded to the Blast Furnace, however the Blast Furnace can only receive approximately 1,000 tonnes of sinter per day, while the Sinter Plant can produce up to 5,000 tonnes per day. Therefore, excess sinter from the Sinter Plant is stored in the Sinter Storage Dome until it is processed through the Blast Furnace.
- **Office Building** – The Office Building (also known as the Administration Building) is located in the southeast portion of the Smelter Area, east of the Laboratory Building. The building measures approximately 1036 m<sup>2</sup> (56 m by 18.5 m in plan view), is 3.6 m high and is covered with a combination of metal siding and architectural concrete siding. The building houses offices and meeting rooms.
- **Changehouse** – The Changehouse is located in the southeast portion of the Smelter Area, north of the Laboratory Building. The building measures approximately 1875 m<sup>2</sup> (46 m by 45 m in plan view), is 7 m tall, and is covered with a combination of metal siding and architectural concrete siding. The Changehouse houses security and medical personnel, locker and changes rooms, and a cafeteria.
- **Laboratory Building** – The Laboratory Building is located in the southeast portion of the Smelter Area, south of the Changehouse and Metal Storage Building. The building measures approximately 1350 m<sup>2</sup> (45 m by 30 m in plan view), is 4 m tall and is covered with a combination of metal siding and architectural concrete siding. The building houses the environmental personnel department, a laboratory, change rooms and locker rooms.
- **Maintenance Shop** – The Maintenance Shop is located in the northwest portion of the Smelter Area, adjacent to the Warehouse. The building measures approximately 2640 m<sup>2</sup> (55 m by 48 m in plan view), is 6 m tall, and is constructed of structural steel framing and precast concrete panel siding.
- **Garage** – The Garage (also known as the Mobile Equipment Garage) is located in the east portion of the Smelter Area, adjacent to the Sandblasting Building. The building measures approximately 900 m<sup>2</sup> (50 m by 18 m in plan view), is 6 m tall, and is constructed of structural steel framing and metal siding.
- **Sandblasting Building** – The Sandblasting Building (also known as the Plate Shop) is located in the east portion of the Smelter Area, south of the WWTP. The building measures approximately 630 m<sup>2</sup> (35 m by 18 m in plan view) and is approximately 6 m high, and is constructed of structural steel framing and metal siding.



- **Warehouse** – The Warehouse is located in the northeast portion of the Smelter Area, north of the Maintenance Shop. The building measures approximately 1250 m<sup>2</sup> (50 m by 25 m in plan view), is 5 m tall, and is constructed of structural steel framing and precast concrete panel siding.
- **Quonset Storage Dome** – The Quonset Storage Dome is located in the southeast portion of the Smelter area, adjacent to the SRF Dome. The building measures approximately 1560 m<sup>2</sup> (78 m by 20 m on plan view) and is an arched structure constructed of metal roofing and concrete floor. The building is used for general storage of various items including refined metal products ready for shipment and various reagents, hydraulic oils, and soda ash.
- **Raw Material Storage (RMS) Building** – The RMS Building (also known as Concentrate Storage or the Church) is located in the north portion of the Smelter Area, adjacent to the Warehouse. It is an A-Frame structural steel building with ACM transite panel roofing/walls. The building measures approximately 4025 m<sup>2</sup> (115 m by 35 m in plan view), is 25 m tall, and is used for storage of raw concentrates that are hauled by truck from the MHW Area. An enclosed conveyor transports the raw concentrates from the RMS Building to the Proportioning Plant.
- **Car Unloading Building** – The Car Unloading Building (also known as Car Dump or Rotary Concentrate Dumping Building) is located in the northeast portion of the Smelter Area, adjacent to the Dome. The building measures approximately 480 m<sup>2</sup> (30 m by 16 m in plan view), is 7.5 m high, and is constructed of structural steel framing and precast concrete panel siding. The building contains rotary equipment used to turn top-dumping rail cars over in order to dump into the large hopper beneath the building floor. The hopper pit is constructed of reinforced concrete walls and floor and is approximately 18 m deep. A conveyor system located at the bottom of the hopper transfers the dumped materials to the RMS Building. The Car Unloading Building is now primarily used for storage as concentrates are now largely delivered by truck from the MHW Area directly to the RMS Building.
- **Proportioning Plant** – Located north of the Sinter Plant. The building measures approximately 192 m<sup>2</sup> (32 m by 6 m in plan view), is 20 m tall, and is constructed of structural steel framing and a combination of ACM transite panel siding and precast concrete panel siding. Various raw concentrates conveyed from the RMS Building are distributed into several hoppers for proportioning with limestone and silica to form the Smelter feedstock, which is then conveyed to the Sinter Plant.
- **Main, West and Salt Water Substations** – Three substations located within the Smelter Area consisting of electrical transformers, structures and other electrical transmission equipment. The Main Substation is located in the northeast portion of the Smelter Area, adjacent to the Secondary Lead Storage Dome and has an associated building, which measures approximately 107 m<sup>2</sup> (16.5 m by 6.5 m in plan view). The West Substation is located at the western extent of the Smelter Area, located to the east of the Port access road and the cemetery. The Salt Water Substation is located adjacent to the Salt Water Pumphouse. Glencore is responsible for decommissioning and demolition of electrical substation buildings, building contents, substation yard fencing and equipment foundations. NB Power owns and is responsible for the decommissioning and removal of transformers, structures, and other equipment within the substation yards.



- **Steam Generating Plant** – The Steam Generating Plant is located in the southeast portion of the Smelter Area, adjacent to the Lead Refinery. The building measures approximately 563 m<sup>2</sup> (22.5 m by 25 m in plan view), is 4.5 m tall, and is constructed of structural steel framing and metal siding. The Steam Generating Plant is no longer in service.
- **Thaw Shed** – The Thaw Shed is located in the northwest portion of the Smelter Area, the building measures approximately 862 m<sup>2</sup> (75 m by 11.5 m in plan view), is 5 m tall, and is constructed with concrete block. According to the 2008/2009 PFS Report, there are ACM transite panels present in the interior of the Thaw Shed. The building was historically used to thaw rail cars containing ore concentrate from the Brunswick Mine Site in the winter prior to off-loading. The building is currently vacant.
- **Car Cover Removal Building** – The Car Cover Removal Building is located in the northwest portion of the Smelter Area, south of the Salt Water Pumphouse. The building measures approximately 450 m<sup>2</sup> (25 m by 18 m in plan view), is 6 m tall, and is constructed of structural steel with metal siding and metal roofing. The building was historically used to remove covers from the ore concentrate rail cars prior to off-loading. The building currently houses rented pilot test equipment for removal of mercury from the Smelter residues. A propane tank is located on the building exterior.
- **Salt Water Pumphouse** – Cooling water (CW) for the Acid Plant operations is obtained from Chaleur Bay via the Salt Water Pumphouse, which is located in the northwest portion of the Smelter Area, near the shoreline of Chaleur Bay. The building measures approximately 264 m<sup>2</sup> (22 m by 12 m in plan view), is 6 m high and is constructed of structural steel framing and precast concrete panel siding. The pumphouse structure intakes sea water and pumps the water from the concrete intake pit (approximately 6 m below the Pumphouse floor) to two underground CW lines (0.4 m and 0.9 m diameter) that service the Acid Plant. The sulfuric acid plant utilizes salt water to provide cooling of the weak acid stream to facilitate effective absorption of the sulphur dioxide gas stream. A 0.45 m salt water intake line also services the PAP building from the Salt Water Pumphouse. Salt water is taken in from Chaleur Bay at the Salt Water Pumphouse, and discharged through a 290 m long open ditch, which flows into two 1.8 m diameter underground pipes which then discharges to Chaleur Bay through an outlet structure located adjacent the Salt Water Pumphouse. The salt water supply and discharge do not come into contact with the metal processing facility.
- **Recycled Process Water (RPW) Building, Ponds, Clarifier and Pool** – The RPW system collects process water from the sinter and acid plants in order to minimize raw water use and metal discharges to the environment. Any surplus process water is directed to the CRP. The RPW is processed through an above-ground steel clarifier (25 m in diameter and 6 m high). An RPW Pool is used for storage of RPW and is located south of the RMS Building. The pool is an aboveground storage reservoir constructed of 1.2 m high steel walls lined with an impermeable liner, measuring approximately 1100 m<sup>2</sup> (46 m by 24 m in plan view). Other RPW ponds also include the North Pond, South Pond, and New Pond. The RPW Building is located directly west of the RPW Clarifier and houses pumping equipment for the RPW system. The RPW Building is approximately 120 m<sup>2</sup> (10 m by 12 m in plan view) and 5 m tall and is constructed of steel framing with precast concrete panel siding.



- **Cooling Recycle Pond (CRP)** – The CRP is located east of the WWTP and measures approximately 15,375 m<sup>2</sup> (205 m by 75 m in plan view). Surface water from the Facility flows by gravity to the CRP, including stormwater, roadway washings, process water overflows, slag granulation water, etc. This design was built into the water balance to ensure that any potentially contaminated water could be controlled by re-utilization as process slag granulation water. The pond, which was built in 1980, has a capacity of approximately 36,000 m<sup>3</sup> and is designed to contain peak storm conditions. The CRP is clay-lined, however, the current condition of the liner is unknown. A concrete settling basin and dewatering pad are located adjacent to the CRP for dewatering of slag. The dewatered slag is transported to the New Slag Pile via truck for disposal. All excess water, due to the net gain in water from precipitation, is treated through the WWTP and associated polishing pond, prior to discharge to the Chaleur Bay.
- **Settling Basin Pumphouse** – The Settling Basin Pumphouse (also known as CRP Pumphouse) is located adjacent to the CRP, the building measures approximately 63 m<sup>2</sup> (7 m by 9 m in plan view) and is 5 m tall. The building houses equipment for pumping of CRP water.
- **WWTP** – The WWTP is located in the northeast portion of the Smelter Area, west of the CRP. The building measures approximately 98 m<sup>2</sup> (14 m by 7 m in plan view), is 5 m tall, and is constructed of structural steel framing. The WWTP treats all excess water from the RPW system and CRP (prior to discharge) for removal of arsenic, cadmium, lead, copper, zinc and other metals by lime neutralization and air oxidation of iron and arsenic to precipitate metal hydroxides and gypsum. Water treatment sludge is reprocessed by the smelter. The treated water from the WWTP is directed to a polishing pond prior to discharging to the Chaleur Bay. The WWTP is included in the Approval to Operate #I-9101 (see Appendix F).
- **Dry Dock** – The Dry Dock is located on Belledune Point, northeast of the Salt Water Pumphouse. The Dry Dock measures approximately 800 m<sup>2</sup> (40 m by 20 m in plan view), and is constructed of steel sheet piling. The Dry Dock is no longer utilized and is currently filled with infiltrated groundwater.
- **Smelter Conveyor System and Transfer Houses** – The system consists of a series of conveyors with a total length of approximately 595 m, with two Transfer Houses for changes in elevations/direction in order to move concentrate from one conveyor or building to the next. The Conveyor Systems are steel framed structures and are enclosed with ACM transite panel siding. The Transfer Houses are steel structures with ACM transite panel siding and are generally 14.5 m in height.
- **Back 40/50 Areas** – The Back 40 and 50 Areas are used for material staging and are located northwest of the Acid Plant. These areas have been (and are currently) used for staging of secondary materials such as slag, bricks, scrap steel, speiss and matte, etc. This area was reportedly excavated to bedrock in 2015 and the excavated material was reprocessed through the smelter. Some screening and crushing is performed in these areas in preparation for reprocessing.
- **North Dross Storage** – Also known as North of the Acid Plant (or “NAP”), is a materials staging area used for staging of secondary materials such as residues and dross. Some screening and crushing are performed in these areas in preparation for reprocessing. A concrete foundation, known as the “Million Dollar Foundation” is located in the north portion of this staging area.



- **Jacquet River Pumphouse, Freshwater Reservoir, and Freshwater Supply Line** - Located approximately 14 km southwest of the Facility on the shoreline of the Jacquet River, the Jacquet River Pumphouse provides a supply of freshwater to the Brunswick Smelter and associated operations. The Jacquet River Pumphouse is approximately 150 m<sup>2</sup> (15 m by 10 m in plan view) and 5 m tall. The building is constructed of structural steel framing with concrete block walls and vinyl siding. The pumphouse structure intakes freshwater from the Jacquet River, passing through traveling screens, and then pumps water from the concrete intake sump (approximately 6 m below the Pumphouse floor) to the Freshwater Supply Line that services the Smelter Facility. The Freshwater Supply Line is a 0.76 m diameter pipeline that runs underground to the Facility, with the exception of an aerial section of pipeline that crosses Belledune River. A Freshwater Reservoir tank is located approximately 5 km southwest of the Facility for storage of freshwater pumped from the Jacquet River Pumphouse. The reservoir is approximately 20 m in diameter, 6 m tall, and is constructed of wood. In addition to supplying the Brunswick Smelter with freshwater, the Jacquet River Pumphouse, Freshwater Reservoir and Freshwater Supply Line also supply several third-parties, including a nearby mill, approximately 30 residences located on Chaleur Drive, and the Port. The locations of the Jacquet River Pumphouse, Freshwater Reservoir and Freshwater Supply Line are shown on Figure 5D.
- **New Slag Pile** – The New Slag Pile (also referred to as the New Slag Management Area) was constructed in 1980 is located approximately one kilometer to the south of the Smelter site. All run-off from the new slag pile is contained in a pond that is sampled prior to discharge. There is the provision to direct the water to the CRP and WWTP if the water does not meet specified discharge limits in the Certificate of Approval, however, this has never been a requirement. The current approved operational limit for the New Slag Pile is 35 Ha. Slag is generated at the blast furnace and is a stable crystalline material due to its rapid quenching; slag has been stored on-Site since commencement of smelter operations.
- **Belledune Point / Saltwater Lagoon (former Old Slag Pile)** - Between 1967 and the early 1980s, slag was hydraulically conveyed and stockpiled on Belledune Point. It was estimated that one million tonnes of slag were stored on Belledune point. In 1980 due to the limited storage capacity at Belledune Point, the New Slag Pile south of the Smelter was developed. The former slag pile was covered with approximately 150 mm of clean soil and riprap was added along the shoreline during the mid-1980s. In 2011 and 2012 a total of 526,000 m<sup>3</sup> of slag was moved from the Old Slag Pile to the New Slag Pile area.
- **Various Waste Disposal** – An area of active wood waste disposal is present on a portion of the Belledune Point (north of the rail lines). The wood waste is stockpiled and periodically chipped and leveled by Glencore. The aerial extent and depth of the wood waste disposal area has not been confirmed.
- There is also information regarding the buried zinc refinery building materials in a general area located east of the east-southeast of the CRP (Area 21 - Figure 4). The remnants of the zinc refinery including bricks from the furnace were dispose on-Site. Rubble from the zinc refinery was also encountered during the construction of the CRP (CRA, 2007). This area was being used for temporarily stockpiling dredge materials recovered from the CRP in July 2019. Details regarding the buried zinc refinery is not well documented in the literature (and based on long term Smelter employee recollections).



- In addition, the former aboveground Gypsum Line that once extended from the Fertilizer Plant to the Port of Belledune was decommissioned and the abandoned line is now being stored on Belledune Point. There is approximately 25 – 10 m long pieces of this line (consisting of 0.6 m diameter plastic pipe with outer wood sheathing. Gypsum contained between the plastic and wood was identified to require disposal as NORM.

### 3.2.2 Material Handling West Area

The MHW Area handles up to 750,000 tonnes of bulk products including lead and zinc concentrates, coke, sulfuric acid and recycled batteries, which are received by road, rail or sea, primarily in bulk. At times, material is also received in smaller packages such as in the case of spent lead-acid batteries. Lead-bearing raw materials are handled and stored inside buildings and storage domes/silos. The concentrates are processed through the concentrate storage and handling facilities and lead-acid batteries are handled in the Battery Recycling Plant and Battery Storage Building. The location of the MHW Area infrastructure are discussed below and shown on Figure 5B.

The MHW Area includes the following:

- **MHW Administration Building** – The MHW Administration Building is located in the southeast portion of the MHW Area, adjacent to the Security/Changehouse and Services Building. The building measures approximately 774 m<sup>2</sup> (43 m by 18 m in plan view).
- **Security/Changehouse** – The Security/Changehouse is located in the southwest portion of the MHW Area, adjacent to the Administration Building and the Battery Recycling Plant Building. The building measures approximately 777 m<sup>2</sup> (18.5 m x 42 m in plan view).
- **Services Building** – The Services Building is located in the southeast portion of the MHW Area, adjacent to the Battery Recycling Plant Building and the MHW Administration Building. The building measures approximately 577 m<sup>2</sup> (18.5 m by 31.2 m in plan view), is 6 m tall, and is covered in ACM transite panel siding.
- **Battery Recycling Plant** – The Battery Recycling Plant is located in the southwest portion of the MHW Area, adjacent to the Security/Changehouse. The building measures approximately 1325 m<sup>2</sup> (53 m by 25 m in plan view), is approximately 7 m tall, and is constructed of structural steel framing and ACM transite panel siding. The Battery Recycling Plant processes lead-acid batteries by passing the batteries through a crusher, followed by gravity separation and flotation. The resulting streams consisting of battery casings, battery plates, battery paste and spent acid are automatically sorted and temporarily stored before being transported to the Smelter Area for processing. The plastics are sold for recycling and acidic washwater is collected and used for pH control at the Smelter WWTP.
- **Battery Storage Building** – The Battery Storage Building is located in the southwest portion of the MHW Area, east of the DAP Building. The building measures approximately 7475 m<sup>2</sup> (65 m by 115 m in plan view), is approximately 27 m tall, and is an A-Frame structure constructed of structural steel framing and ACM transite panel roofing/siding. Imported automotive batteries as well as concentrates are stored in the building.
- **DAP Storage Building** – Located in the northwest portion of the MHW Area, directly north of the DAP Building. The building measures approximately 2942 m<sup>2</sup> (79.5 m by 37 m in plan view), is 16 m tall, and is an A-Frame constructed of structural steel framing and ACM transite panel



roofing/siding. The building was historically used for storage of DAP product and is currently used for storage of concentrates.

- **Storage Shed** – Located in the eastern portion of the MHW Area, adjacent to the Carpenter Shop/Pumphouse and the PCB Storage Building. The building measures approximately 30 m<sup>2</sup> (5 m by 6 m in plan view) and is used for general storage.
- **Carpenter Shop/Pumphouse** – The Carpenter Shop/Pumphouse is located in the east portion of the MHW Area, adjacent to the PCB Storage Building. The building measures approximately 84 m<sup>2</sup> (16.8 m by 5 m on plan view).
- **PCB Storage Building** – The former PCB Storage Building (a metal shipping container) is located in the east portion of the MHW Area, adjacent to the Carpenter Shop/Pumphouse and Storage. The building is no longer licensed as a PCB storage area and is currently empty.
- **Acid Pumphouse** – The Acid Pumphouse is located in the northeast portion of the MHW Area, adjacent to the Bulk Acid Storage Tanks. The building measures approximately 45 m<sup>2</sup> (9 m by 5 m in plan view) and houses equipment used for pumping of acid.
- **Acid Building and Emergency Shower** – The Acid Building and Emergency Shower is located in the northeast portion of the MHW Area, adjacent to the Acid Tanks and the Acid Pumphouse. The building measures approximately 25 m<sup>2</sup> (10 m by 2.5 m in plan view).
- **Process Acid Tanks (x 3)** – Three Process Acid Tanks for storage of various concentrations of acid (ranging from 30 to 100% acid) are adjacent to the PAP Building. The 30% acid tank is no longer in use and a fourth process acid tank was previously removed from the area. The tanks range in diameter from approximately 9 m to 14 m in plan view, are approximately 10 m tall, and are constructed of carbon steel.
- **Concentrate Storage Silos (x 2)** – Two Concentrate Storage Silos are located south of the Bulk Acid Tanks. The silos have a diameter of approximately 48 m and 41 m in plan view and are constructed of approximately 15 m high concrete walls, steel framed roof covered with metal siding.
- **Bulk Acid Tanks (#1 and #3)** – Two Bulk Acid Tanks located in the northeast portion of the MHW Area in an unlined soil containment berm. The tanks are constructed of carbon steel and have a diameter of approximately 37 m in plan view. The tanks store sulfuric acid produced in the Acid Plant at the Smelter Area, which is pumped to the tanks via an aboveground acid pipeline. A third Bulk Acid Tank (#2) was previously removed and is no longer present at the Site.
- **Railcar and Truck Unloading Building** – The Railcar and Truck Unloading Building is located in the northwest portion of the MHW Area, between the Coke Fines Storage Area and the Concentrate Storage Domes. The building measures approximately 303 m<sup>2</sup> (27.5 m by 11 m in plan view), is four stories high, and is constructed of structural steel framing, metal siding and metal roofing. Hoppers in the floor of the building are used to transfer unloaded concentrates to the Concentrate Storage Domes via conveyors.
- **Concentrate Storage Domes (x 7)** – Seven Concentrate Storage Domes are located in the northwest portion of the MHW Area, southeast of the Railcar and Truck Unloading Building. Four of the domes have a diameter of approximately 28 m in plan view, and three of the domes have



a diameter of approximately 49 m in plan view. The domes have concrete floors, 4 m high concrete push walls, and wood-framed domed roofs cover with asphalt shingles. A mobile stacker conveyor is used to distribute concentrates to the various domes.

- **Control Room** – The Control Room is located in the centre of the Concentrate Storage Domes area, the Control Room houses the operating controls for the mobile stack conveyor used to distribute concentrates to the various domes. The building measures approximately 49 m<sup>2</sup> (6.5 m by 7.5 m in plan view).
- **Truck Scale** – The Truck Scale is located in the northwest portion of the MHW Area, adjacent to the Battery Storage Building.
- **MHW Substation** – An electrical substation located in the eastern portion of the MHW Area, near the PCB Storage Building, consisting of transformers, transmission structures and other electrical equipment. Glencore is responsible for decommissioning and demolition of the substation yard fencing and equipment foundations. NB Power owns and is responsible for the decommissioning and removal of transformers, structures, and other equipment within the substations yard.
- **Stormwater Storage Pond** – The Stormwater Storage Pond is located west of the Bulk Acid Tanks, this pond was constructed in 2018/2019 to collect stormwater run-off from the MHW Area and discharges through a forcemain to the Smelter WWTP.
- **Concentrate Storage Containment Pond** – The Concentrate Storage Containment Pond is located northeast of the Concentrate Storage Domes, this ponds collects stormwater run-off from the area around the Concentrate Storage Domes and can be manually transferred through piping to the Stormwater Storage Pond, and then discharged to the Smelter WWTP for treatment.
- **Coke Fines Storage Area** – The Coke Fines Storage Area is located west of the Concentrate Storage Domes, coke fines are stored on the ground surface in this area.
- **MHW Conveyor System and Transfer Houses** – The system consists of a series of conveyors with a total length of approximately 1,500 m in 19 sections, with a Transfer House at each direction or elevation change in order to move concentrate from one conveyor to the next. A series of aboveground conveyors with a length of approximately 750 m extend onto the Port wharf to Terminal 1 where a gantry is used to off-load ships for importing raw concentrates. An aboveground acid line used to export sulfuric acid from the Bulk Storage Acid Tanks is also located on the conveyor system extending to the Port Terminal 1. A 100 m length of conveyor (half of which is located in a below ground tunnel) transfers raw concentrates that are dumped into the below grade hopper in the Railcar and Truck Unloading Building to the Concentrate Storage Domes. The remainder of the conveyor systems within the MHW Area are used to transfer raw concentrates between the various concentrate storage domes and silos. The Conveyor Systems are open steel frame structures. Several of the conveyor sections have had the conveyor belt removed, or are no longer operational, however live electrical wires are present on the conveyor structures. The Transfer Houses are steel structures with ACM transite panel siding and are generally 14.5 m in height.





### 3.2.3 Fertilizer Plant

The DAP & PAP buildings house the former Di-Ammonium Phosphate Plant and the former Phosphoric Acid Plant. The facility was constructed in 1967 and operated until 1995. It originally produced monoammonium (MAP) fertilizer, but later its production was switched to DAP fertilizer. An overview of the DAP & PAP infrastructure is provided below:

- **DAP Building** – The DAP Building is located north of the Battery Recycling Plant in the MHW Area. The building measures approximately 578 m<sup>2</sup> (27.5 m by 21 m in plan view) and ranges from approximately 14 m to 27 m in height. The DAP Building is constructed of structural steel framing, ACM transite panel siding, and concrete slab-on-grade. The DAP Building houses rotary kilns, bucket conveyors, silos, scrubber tanks, a Bunker C tank. A small electrical building associated with the DAP Building is also located on the northeast corner of the building. The equipment within the DAP Building has not been decommissioned or cleaned since the Fertilizer Plant ceased operation, and residual product remains in the equipment, including in piping and tanks. The current use of the building is limited to general storage on the ground floor.
- **PAP Building** – The PAP Building is located east of the DAP Building. The building measures approximately 1440 m<sup>2</sup> (30 m by 48 m in plan view) and ranges in height from approximately 17 m to 29 m. The PAP Building is constructed of structural steel framing, ACM transite panel siding, and concrete slab-on-grade. A portion of the Siporex panel roof in the building has collapsed and several areas of the steel grating appear to have reduced structural integrity. The PAP Building houses a large concrete attack tank, pan filters, bag house, ball mill, and various tanks and piping. A carbon steel rock silo (7.5 m diameter and 20 m tall) and a small electrical building are located on the northeast corner of the building. The equipment within the PAP Building has not been decommissioned or cleaned since the Fertilizer Plant ceased operation, and residual product remains in the equipment, including in piping and tanks. The current use of the building is limited to general storage on the ground floor.
- **Scrap Yard** – The Scrap Yard is a fenced in area (approximately 460 m<sup>2</sup>) located southeast of the PAP Building, where NORM-impacted equipment that was previously removed from the PAP Building is stored.
- **Lay Down Area** – Bulk product associated with the Fertilizer Plant operation was reportedly historically stored immediately east of the PAP building and referred to as the Lay Down Area. This area is still reportedly used for the storage of bulk product as part of the MHW Area operations.

### 3.2.4 Petroleum Storage Tanks

Petroleum hydrocarbons are in use at the Site including No. 2 fuel oil, gasoline, and waste oil contained in steel, aboveground storage tanks (ASTs) ranging in size from 900L to 80,000L. In addition, the Glencore underground services plan (8002-10-5026) shows a 1.5 inch diameter (4 cm) No. 2 fuel oil line extending from the west side of the Acid Plant to the Lead Refinery. It is noted, that the fuel storage and handling at the Site has been reduced by Glencore since the 2008/2009 Closure Plan PFS with the introduction of propane.



A list of the 18 current aboveground storage tanks (ASTs) containing petroleum hydrocarbons are presented in Table 2. These tanks will require decommissioning in accordance with the New Brunswick Petroleum Storage and Handling Regulations as part of the 2019 Closure Plan Update.

### 3.2.5 Chemical Use and Storage

Chemicals historically and presently used and stored at the Site include: lubricants, paint and solvents (degreasers), sulfuric acid, soda ash, hydrogen peroxide, liquid propane, catalyst, lime, carbon dioxide, liquid oxygen, liquid nitrogen, as well as various acids, reagents, and alcohols.

Various other small amounts of chemicals and universal wastes (rust inhibitors, degreasing agents, cleaners, etc.) were noted to be stored in the Maintenance Shop, Garage and Quonset Storage Dome.

A list of 61 current chemical and process water ASTs and RPW ponds (ranging in size from 135L to >2,000,000L) are presented in Table 3. These tanks (and ponds) will require decommissioning as part of the 2019 Closure Plan Update.

In addition to the tanks listed above, there are several other clean water and air tanks located in the Furnace Building, Lead Refinery and Silver Plant and a Salt Water Tank is located in the Acid Plant.

### 3.2.6 Utility Services

There are a number of utility services associated with the Site including freshwater, process water, fire suppression hydrants, sanitary and storm sewers, CW piping and overhead/underground electrical cabling. Select buried utilities associated with the Brunswick Smelter are presented on Figures 7A and 7B.

As noted in Section 2.1, the Site is serviced by freshwater from the Glencore Jacquet River Pumphouse which is located approximately 14 km southwest of the Site via a 0.76 m diameter concrete-lined steel pipeline. The Freshwater Supply Line runs underground to the Facility, with the exception of an aerial section of pipeline that crosses Belledune River. A Freshwater Reservoir tank is located approximately 5 km southwest of the Facility for storage of freshwater pumped from the Jacquet River Pumphouse. In addition to supplying the Brunswick Smelter with freshwater, the Jacquet River Pumphouse, Freshwater Reservoir and Freshwater Supply Line also supply several third parties, including Chaleur Sawmill, approximately 30 residences located on Chaleur Drive and as a back-up supply for the NB Power Belledune Thermal Generating Station (BTGS) and the Port. This freshwater is also utilized as process water and services fire suppression hydrants on Site. Potable water wells or process water wells are not known to be located at the Site.

Cooling water for the Facility operations is obtained from Chaleur Bay via the Salt Water Pumphouse, which is located in the northwest portion of the Smelter Area, near the shoreline of Chaleur Bay. The pumphouse structure intakes sea water and pumps the water through two underground lines (0.4 m and 0.9 m diameter) to the Acid Plant. A 0.45 m salt water intake line also services the PAP building from the Salt Water Pumphouse.

Industrial wastewater is generated at the Smelter Area and at the MHW Area as part of the Facility operations. Recycled process water generated in the Smelter buildings is directed to the RPW system, passing through the RPW clarifier and the RPW ponds/pool. RPW is then directed to the



CRP, which discharges to the WWTP for treatment prior to passing through a polishing pond and discharging to Chaleur Bay. All surface water from the Smelter Area flows by gravity to the CRP, including stormwater, roadway washings, process water overflows, slag granulation water, etc. Water from the CRP is re-used as process slag granulation water and for cooling the furnace top. All excess water in the CRP, due to the net gain in water from precipitation, is treated through the WWTP prior to discharge to Chaleur Bay. Effluent monitoring is completed by Glencore as part of the Approval to Operate I-9010 (see Appendix F).

Surface water run-off from the MHW Area is collected in a Storm Water Storage Pond and then pumped to the Smelter WWTP for treatment via a forcemain. Surface water run-off from around the Concentrate Storage Domes at the MHW is collected by the Concentrate Storage Containment Pond and is able to be manually transferred through piping to the Storm Water Storage Pond, and then discharged to the Smelter WWTP for treatment.

All Domestic Wastewater generated on-Site is treated through on-Site septic system (tank and drainage field) located east of the MHW Administration Building and a sewage treatment plant located north of the Smelter's Garage Building.

There are two main diversion ditches that are designed to direct surface water from adjacent lands around the Smelter directly to Chaleur Bay. A third diversion ditch is located east of the Coke Fines Storage Area. The objective is to limit the surface water that comes in close proximity to the Site operations to reduce the risk of metal contamination.

The Facility receives electricity from the NB Power provincial grid to service the on-Site buildings. Four electrical substations are located on the Site including: the MHW electrical substation, the West electrical substation, the Salt Water electrical substation, and the Main electrical substation.

## 4. Regional Settings

### 4.1 General

The Brunswick Smelter is located in northern New Brunswick approximately 34 km northwest of Bathurst, along the coastline of Chaleur Bay. Primary access to the Site is from Highway 134. The MHW Area is also accessible via Shannon Drive. The nearest water bodies relative to the Plant Site include:

- Chaleur Bay directly north of the Site;
- Saltwater Lagoon located north of the Smelter Area, on Belledune Point, which was re-created through the removal and rehabilitation of the Old Slag Pile; and
- A small pond and regulated wetland area located directly north of the New Slag Pile.

The area surrounding the Facility is a mixture of industrial and commercial development as well as vacant land.

The Port is located north of the MHW Area, and consists of four marine terminals, a liquid bulk storage compound, and freight station. Glencore currently leases Terminal 1 at the Port for import and export of mineral concentrates, sulfuric acid, and liquid petroleum cargoes. Other operations at



the Port include import and export of coal, petroleum coke, liquid petroleum, wood pellets, gypsum, aggregate, road salt, and silica sand. The Facility is intersected by the Port access road, which divides the MHW Area from the Smelter Area of the Site. The NB Power BTGS is a 450 Megawatt coal-fired power plant, is located west of the MHW Area. The nearest residential properties are located approximately one kilometre east of the Smelter Area.

The surface topography of the Site is relatively flat with a gentle slope to the north, towards Chaleur Bay. The New Slag Pile, south of the Smelter, forms a local topographical high.

The geology in the Belledune area (in the vicinity of the Site) consists of early to late Silurian age bedrock of the Chaleurs Group including coarse to medium grained terrestrial to nearshore marine, clastic and volcanoclastic rocks of the South Charlo Formation ( $S_{sc}$ ) as well as nearshore marine carbonate rocks and associated fine-grained, calcareous, siliclastic rocks of the La Vielle Formation ( $S_{LA}$ ) as shown below (Wilson, 2006). Bedrock is overlain by Late Wisconsinan and/or early Holocene in age marine sediments mapped a sand, silt, gravel and clay generally 0.5 to 3 metres thick (Rampton, 1984).

The Nature Trust of New Brunswick Inc. (NTNBI) list of Environmentally Significant Areas (NBESAs) identified three NBESAs within approximately 5 kilometres of the Site. Belledune Point (Site #066) was identified as an important area for plants, birds and geology and the Belledune Shoreline/Hendry Brook (Site #067) and Chapel Point Shoreline (Site #068) were identified as important areas for geology and fossils. Although the NTNBI database does not identify specific locations as supporting species at risk, the environmentally significant areas listed in the vicinity of the Site, as a whole, were identified as containing unique or distinctive plant and/or animal associations, and/or habitats, and/or landforms, which make them outstanding examples as a representative of its type. Of the three NBESAs listed as occurring within 5 kilometres of the Site, only Belledune Point is located within the Brunswick Smelter Site.

The rare plant *Stellaria longipipes* (Long Stalked Starwort or Goldie's Starwort) was identified within a small area of Belledune Point (north of the Salt Water Pumphouse) during a botany inspection in July 2006 (CRA, 2007). The botanist report also noted that two other rare plant species previously identified in the area in the late 1970s and early 1980s included *Zigadenus elegans* Pursh (White Camass) and *Draba arabisans* Mixhx. (Rock Whitlow-Grass); however, they were not observed in 2006.

## 4.2 Climate and Hydrology

The Site is located in an area referred to as the Northern Uplands Ecoregion which arcs across northernmost New Brunswick between the two separate portions of the Highlands Ecoregion (NBDNR, 2007). The northern edge of this eco-region, where the Site is located, borders the lower Restigouche River and Chaleur Bay.

Chaleur Bay receives an annual average of 730 m<sup>3</sup>/s of freshwater from its drainage basin: 3,000 m<sup>3</sup>/s when water levels are high (in May) and 220 m<sup>3</sup>/s when they are low (in February). Chaleur Bay is a saline environment (salinity greater than 17 parts per thousand [ppt]) except during the spring freshet. In summer, the salinity of the surface water of the bay (depth of 0–30 m) is on the order of 28 parts per thousand, and its temperature can exceed 18°C (Gagnon, 1997). The Site is in an Eco-District of the Northern Uplands Ecoregion referred to as the Nicolas Denys Eco-District.



This eco-district averages only 10 km wide and is the most subdued of all eco-districts in the Northern Uplands Ecoregion. Its rock formations are similar to those of other eco-districts, but are topographically much less dramatic than elsewhere in the ecoregion (NBDNR, 2007). The main tributaries that discharge into Chaleur Bay include the Restigouche, Cascapédia, Bonaventure, Petite Cascapédia, Nouvelle, Charlo, Nigadoo, Tetagouche and Nepisiguit rivers. Elevations in the area range from sea level or low coastal cliffs at Chaleur Bay up to a maximum height of about 150 m on the western boundary.

The area of Belledune receives a significant amount of rainfall during the year and receives the highest annual average precipitation amount in province at 970 mm. Precipitation amounts are lowest in February, with an average of 63 mm and the most precipitation falls in August, with an average of 96 mm. During the year, the average temperatures vary on average by 28.9°C. At an average temperature of 18.5°C, July is the hottest month of the year. January has the lowest average temperature of the year with an average of -10.4 °C.

The New Slag Pile is the highest land feature on the Glencore property. The elevation at the base of the New Slag Pile (near a Regulated Wetland) is approximately 25 metres above sea level (masl) and slopes northward to Highway 134 (with an elevation of 10 to 12 masl). The Smelter Area of the Site (between Highway 134 and the rail spur line) is relatively flat with a slight northward gradient that ranges in elevation from approximately 7.5 to 5 masl. North of the rail spur line, within the Belledune Point area, the surface elevation is 4 to 3 masl and then slopes to the beach of Chaleur Bay at sea level. Within Belledune point, there are two large, shallow surface water pond areas including the Saltwater Lagoon (which was created by the removal of the former slag pile in 2011/2012). The depth of the Saltwater Lagoon was approximately 1.2 m and residual slag can be visually observed at the base and shoreline of the lagoon.

South of Highway 134 the hydrology is controlled by overland flow and infiltration in the forest covered land. A retention pond is present directly northeast of the New Slag Pile that receives surface water run-off from the slag pile. The retention pond was created as part of the New Slag Pile design and has been subsequently designated by the New Brunswick Department of Environment and Local Government (NBDELG) as a regulated wetland. Drainage from the regulated wetland is primarily by a drainage ditch that directs water northward towards Highway 134 referred to as the West Drainage Ditch. This ditch flows through a culvert beneath Highway 134 and bisects the Smelter Area to the west side of the Back 50 and discharges to Chaleur Bay south west of the Salt Water Pumphouse. A secondary drainage ditch originates south of the New Slag Pile (this ditch does not receive run-off from the New Slag Pile), referred to as the East Drainage Ditch, which flows northeast and bisects the Smelter Site to the east of the CRP and discharges directly to Chaleur Bay.

Other ditches located within the Smelter Area include a process discharge water ditch through the Back 50 area that drains to Chaleur Bay. Surface water and stormwater within the Smelter area is also collected via the on-Site drainage network and directed to the CRP and the on-Site WWTP prior to discharge to Chaleur Bay. In particular a surface water/stormwater collection ditch parallels the spur line between the Smelter Area buildings and Belledune Point and discharges into the CRP.

Within the MHW Area, the elevation ranges from approximately 20 masl and slope north and northeast to the Port property that has an elevation of approximately 4 masl. A new stormwater collection pond was recently constructed in the MHW Area directly east of the bulk acid tanks. Water



accumulating in this pond is pumped to a drainage ditch in the Smelter Area that parallels the existing rail spur line and discharges into the CRP (as noted above).

The existing stormwater ditching layout is presented on Figure 8.

## 5. Legal

### 5.1 Water Rights

For the preparation of the Decommissioning Plan, GHD personnel reviewed existing leases or contractual agreements associated with the Site properties that may be affected by the Facility closure.

The Site obtains cooling water from the Salt Water Pump house located in the northwest portion of the Smelter Area, near the shoreline of Chaleur Bay. The pump house draws water from Waterlot A (PID #20441275) owned by the Government of Canada with the assessed owner being the Belledune Port Authority as identified by Service New Brunswick (SNB) (Figure 2). The Belledune Port Authority is also the listed owner for two additional Waterlots PID #20252649 and #20445979 (Lots B and C, respectively) located on either side of Waterlot A. Underwater infrastructure extending into Chaleur Bay associated with the Site is not known to exist excluding the intake sumps/pits in the Salt Water Pump house.

As part of the Approval to Operate I-9010 (Item 64), Glencore is required to inspect the phosphogypsum pile that was created in Waterlot A from the historical discharge of gypsum associated with the Fertilizer Plant. The phosphogypsum was reportedly directly discharged to Chaleur Bay north of the Port wharf. The Gypsum Line that historically extended from the Fertilizer Plant to the Port has been removed and the piping is currently stockpiled at the Smelter Area (south of the Saltwater Lagoon).

### 5.2 Land Ownership

The study area for the purpose of the 2019 Closure Plan Update consists of 36 parcels of Glencore owned land (identified by SNB) encompassing a total area of approximately 604 hectares with the property identification numbers listed in Table 5.1 and shown on Figure 2. Glencore also owns additional properties outside of the study area shown on Figure 2.

Table 5.1 Study Area Property Identification Numbers

20252680	20780508	20443172	20443214	20441283	20443099
20252318	20443149	20832481	20443115	20443164	20443073
20801619	20443255	20443057	20443222	20443263	20251963
20278339	20445789	20443198	20443230	20443180	20603197
20755302	20443156	20443206	20443123	20443107	20445714
20444840	20442992	20443081	20443248	20277968	20655122

Adjacent and nearby third party industrial properties are owned by Irving Oil, NB Power, New Brunswick Department of Transportation, the Port and Caribou Mining. Two adjacent properties are



also owned by the Roman Catholic Bishop of Bathurst (including the cemetery near the MHW Area). Glencore Canada also owns the Jacquet River Pumphouse property (PID # 50078294) and the Freshwater Reservoir property (PID# 50078260) located approximately 14 km to the southwest of the Site. The Freshwater Supply Line crosses several third-party properties (underground) with right-of-way easement and/or agreements obtained in the mid-1960s (according to SNB files).

Included in the 2019 Closure Plan Update study area are the Glencore properties located south of the Smelter Area. These properties encompass the New Slag Pile and the former air strip property that are owned by Glencore. The access road to the slag pile crosses several of these Glencore owned properties owned but a portion of the slag pile access road is on an existing road named the Belledune Road, (PID #00000003) with no access owner listed on SNB. Glencore may inquire about securing this portion of the NBDTI property to remove a potential access route to the Site.

Information obtained from SNB does not identify Glencore as being the lessee of any specific waterlots. However, SNB does identify Glencore as a lessee of parcel PID #20780508 located on the wharf owned by the Port. This property consists of a portion of the access road and docking area that contains a conveyor system. Glencore representatives also indicated that Glencore currently leases Terminal 1 at the Port for import and export of materials including mineral concentrates.

### 5.3 Easements

There are no known easements associated with the Site infrastructure excluding the easement and/or agreements associated with the Freshwater Supply Line described in Section 5.4.

### 5.4 Third Party Agreements

As discussed in the preceding section, the Jacquet River Pumphouse and property located approximately 14 km southwest of the Site is owned by Glencore. The steel freshwater supply pipeline crosses several third party properties (primarily underground) with right-of-way easement and/or agreements developed in the mid-1960s (according to SNB files). In addition to supplying the Brunswick Smelter with freshwater, the Jacquet River Pumphouse, Freshwater Reservoir and Freshwater Supply Line also supply several third-party organizations, including the Belledune Industrial Park, approximately 30 residences located on Chaleur Drive, the Port and is also used by NB Power as a back-up water supply for the BTGS. For the purposes of 2019 Closure Plan Update, it is assumed that the Jacquet River Pumphouse and associated Freshwater Supply Line and Reservoir will remain in place at the time of closure. The potential transference of ownership of the Jacquet River Pumphouse and infrastructure to a third party was not evaluated as part of the 2019 Closure Plan Update.

SNB files indicated that a multi-party access agreement was signed in 2002 to develop a new Port access road from Highway 134 (Main Street) to the Port terminal. The new access road was reportedly required due to increasing vehicular traffic accessing the Port. The access agreements were established between the Port and the Village of Belledune, the Roman Catholic Bishop of Bathurst and Glencore in relation to the new access road. The access agreement specific to the Site acknowledge that Glencore has an existing haul road crossing, an existing utility road crossing, a sulfuric acid line, a rail crossing, a freshwater line, a salt water line, an overhead electrical line and underground electrical cables (collectively the easements) which cross the Port access road. The



access agreement indicates the Port is to assume liability and responsibility for the maintenance and use of this new access road.

There are no known easements between NB Power and Glencore regarding the four electrical substations at the Site. However, as previously indicated, information provided by Glencore indicates that the Glencore is responsible for decommissioning and demolition of electrical substation buildings, building contents, substation yard fencing and equipment foundations. NB Power owns, and is responsible for the decommissioning and removal of, the transformers and other equipment within the substation yards.

A rail spur line extends northward along the western Site boundary (from the CN main line) and into the Smelter facility to the Car Unloading Building (Figures 2 and 3). SNB shows this spur line property as being owned by Glencore and information provided by Glencore indicates that the Glencore is responsible for maintenance of the spur line. However, the decommissioning and demolition of spur line may require agreement from CN. The potential transference of ownership of the rail spur line property and infrastructure to a third party (i.e., the Port) was not evaluated as part of the 2019 Closure Plan Update. It is noted that there is also a short rail line extending off of the Glencore rail spur line property into the NB Power property.

## 5.5 Access Road Development

Access roads to the Site off of Highway 134 (owned by NBDTI) and the Port access road will be maintained. It is not anticipated that any additional access points will be required at the time of Site closure.

## 6. Ownership

The Brunswick Smelter and its associated infrastructure including the New Slag Pile area is owned by Glencore. Glencore also owns the slag pile located south of the Smelter Area (also referred to as the New Slag Pile) and the Jacquet River Pumphouse and associated freshwater pipeline and reservoir, which are also part of the Closure Plan. As previously indicated, it is GHD's understanding that the Site will be fully demolished and restored to an open space condition with the majority of the Site held in perpetuity by Glencore as a vacant fenced or partially fenced property, with the exception of the Freshwater Supply Infrastructure, which has been assumed to remain in place and operational for the foreseeable future.

Although there is the potential that ownership of some of the infrastructure associated with the Smelter Facility could be sold or transferred to third parties, specifically the Jacquet River Pumphouse and associated infrastructure, the MHW Area, and the rail spur line; for the purposes of the 2019 Closure Plan Update it is assumed that the infrastructure ownership will be retained by Glencore and decommissioning/demolition of this infrastructure has been included in the 2019 Closure Plan Update (excluding the Freshwater Supply Infrastructure which is assumed to remain in place and operational).





## 7. Government and Community Relations

### 7.1 Federal, Provincial and Local Government

#### 7.1.1 Approvals to Operate

The facilities associated with the Brunswick Smelter currently operate under two Approvals to Operate issued by the NBDELG to Glencore. These approvals are outlined below:

- **Certificate of Approval to Operate #I-9010** – Approval to operate the Lead Smelter and MHW Area by the NBDELG pursuant to the Water Quality Regulation 82-126 under the Clean Environment Act. The approval was issued on August 23, 2015 and is valid until August 22, 2020. The Approval to Operate pertains to the discharge of effluent, non-process cooling water, potential leaks from the acid pipeline, overflows of contaminated water associated with heavy rainfall events, spills, and surface water run-off. The approval also contains conditions on materials and wastewater management, discharge limits, testing and monitoring, and reporting requirements.
- **Certificate of Approval to Operate #I-9101** – Approval to operate the Lead Smelter and MHW Area by the NBDELG pursuant to the Air Quality Regulations under the NB Air Quality Regulation 97-133 as part of the Clean Air Act. The approval was issued on November 15, 2015 and is valid until November 14, 2020. The Approval to Operate pertains to the air quality of emissions from the smelter operations and contains conditions on operating conditions, stack testing and air monitoring requirements, emission limits, record keeping and reporting requirements.

The current Approvals to Operate associated with the Facility are included in Appendix F.

#### 7.1.2 Applicable Acts, Regulations, and Guidelines

An overview of the Acts and Regulations that could have a significant impact on future closure requirements of the Brunswick Smelter are provided below. Tables 4A and 4B list applicable Acts, Regulations and Guidelines with potential implications to the closure project. Table 4C list potentially applicable departments and contacts for EIA review or approvals.

##### ***New Brunswick Acts and Regulations***

- Clean Air Act – Applicable regulations under this act include Ozone Depleting Substance and Other Halocarbons Regulation 97-132 and Air Quality Regulation 91-133.
- Clean Environment Act – Applicable regulations under this act include Water Quality Regulation 82-126, Environmental Impact Assessment Regulation 87-83 and Petroleum Product Storage and Handling Regulation 87-97. All petroleum tanks must be decommissioned by a licensed petroleum contractor and a Schedule D form submitted to the NBDELG for approval. A Guide to Environmental Impact Assessment in New Brunswick updated in 2018 also provides a list of designated projects triggering an EIA along with regulation requirements, procedures and timelines.
- Clean Water Act - Applicable regulations under this act include Watercourse and Wetland Alteration Regulation 90-80. Under the NB Clean Water Act, any project that alters a



watercourse or a wetland, or diverts all or part of a watercourse or the water flowing in a watercourse or a wetland, must obtain a watercourse and wetland alteration permit (WAWA) from the Minister of the NBDELG before undertaking or proceeding with the project. The WAWA requirement also applies to any person working within 30 m of a watercourse or wetland. It is noted that two regulated wetlands have been identified by NBDELG to be located within the Study Area, including one immediately adjacent the New Slag Pile.

- In addition, the current Approval to Operate I-9010 under the Clean Water Act indicates that in the event of Facility closure, the Approval holder shall prepare plans for complete Site rehabilitation and submit these plans to the NBDELG a least six months before the planned closure date. These plans are in addition to any requirements under the EIA Regulation.
- Occupational Health and Safety Act - Applicable regulations under this act include Code of Practice for Working with Material Containing Asbestos Regulation 92-106. NBDELG also have a disposal of Friable Asbestos Fact Sheet (April 2014) that would apply to future Facility decommissioning activities.
- Transportation of Dangerous Goods Act - Applicable regulations under this act include General Regulation 89-67.
- Species at Risk Act – Applicable regulations under this act include Regulation 96-26 (applicable to proposed activities where subject species are suspect to be present).
- Provincial Cemetery Companies Act updated in 2018 – Specifies requirements and restrictions on altering gravesites and associated monuments that could apply to the off-Site cemetery.
- NBDELG Guideline for the Management of Contaminated Sites (2003) with Requirements and Review Procedures updated in 2016 to 2018 (various documents) – Updated documents generally limited to new reporting requirements and associated timelines.
- Apprenticeship and Occupational Certification Act - Applicable regulations under this act include Fees 2012-67, Publication of Notice of Orders 2013-52, Compulsory Occupations 2014-133 and Wage 2014-134.
- New Brunswick Construction Standards for Installation and Removal of Petroleum Storage Systems, 1993.
- NBDELG Disposal of Lead Paint and Lead Painted Material Guideline, August 2011.

#### ***Federal Acts and Regulations***

- Fisheries Act, Last Amended June 21, 2019, Current to July 29, 2019 - On June 21, 2019 the new Fisheries Act received royal assent and became law. The new provisions and stronger protections are intended to better support the sustainability of Canada's marine resources for future generations. The harmful alteration, disruption or destruction of fish and fish habitat is prohibited under the Fisheries Act. In addition, the destruction of fish by means other than fishing is also prohibited under the Fisheries Act. As the Site decommissioning work may potentially involve the complete or partial removal of the Salt Water Pumphouse and associated outfall with a portion of the work to be completed below the ordinary high water mark, there is the potential for the Site decommissioning work to impact fish and fish habitat. In order to be in compliance with the above legislation, an authorization from the Department of Fisheries and Oceans (DFO) must be obtained prior to initiating any work below the ordinary high water mark. The issuance of



a Fisheries Act Authorization is conditional on developing habitat compensation and monitoring plans to ensure there will be no net loss in the productive capacity of fish habitat.

- Canadian Environmental Protection Act, 1999. Applicable regulations under this act include Export and Import of Hazardous Waste and Hazardous Recyclable Material Regulations, SOR/2005-149 (Published on March 20, 2004, Last Amended on October 21, 2016, Current to July 1, 2019) and the PCB Regulations, SOR/2008-273 (last amended on January 1, 2015 and current to July 29, 2019). The hazardous waste regulations include substance concentration limits for soil in Schedule 5 – Environmentally Hazardous Substances, and leachate limits for soil in Schedule 6 – Hazardous Constituents Controlled under Leachate Test and Regulated Limits. The PCB regulations prohibit the release, manufacture, processing, use, import, export, offer for sale and the sale of PCBs and products that contain certain concentrations of PCBs. They also have requirements for PCB storage, labelling, reporting and destruction.
- Canadian Environmental Assessment Act (CEAA), 2012 and Impact Assessment Act (IAA) 2019 – In 2012 the federal government introduced the CEAA which included a list of “designated projects” that would potentially require completion of a federal environmental assessment. Included in the list of designated projects is the construction, operation, decommissioning and abandonment of a facility used exclusively for the treatment, incineration, disposal, or recycling of hazardous waste. As the 2008/2009 Closure Plan PFS included the construction of “special waste handling” facilities at the Brunswick Mine Site, there is the potential requirement for the closure project to be registered with the Canadian Environmental Assessment Agency if special waste cell (e.g., hazardous waste landfills) construction is required as part of the closure project. However, June 21, 2019, Bill C-69 received Royal Assent that created a new Impact Assessment Agency of Canada and repealed the CEAA, 2012. The legislated changes and associated procedures policies and guidance documents that are affected by Bill C-69 are yet to be released but could potentially affect future Facility closure activities.
- Migratory Birds Convention Act, 1994 - Under this Act it is a punishable offence to kill, capture, injure, take or disturb migratory birds or to damage, destroy, remove or disturb the nests of migratory birds unless otherwise authorized by the federal Minister of Environment and Climate Change Canada. This legislation is responsible for the general practice of clearing vegetation from large project areas during the non-nesting period for birds which extends from September to May. This Act would also apply to migratory birds that are using buildings, infrastructure or ground surfaces at the Site for nesting or breeding. Migratory birds are known to be present and use the Site for nesting and breeding.
- Health Canada, Canadian Guidelines for the Management of Naturally Occurring Radioactive Materials (NORM) updated in 2013 – Provides the NORM Classification Levels for evaluation of potential NORM containing material in Canada as well as action levels. Updated NORM guidelines are generally consistent with previous guidelines but specific guidance has been added for determining NORM management requirements.
- Navigation Protection Act - Applicable regulations under this act include Navigable Waters Works Regulation. Impacting vessel traffic on navigable waters such as the Chaleur Bay is regulated under the Navigation Protection Act and administered by the Navigation Protection Program of Transport Canada. The foreseeable activities associated with the Site decommissioning project that may potentially impact navigable waters is limited to the removal



of the Salt Water Pumphouse. Given that this structure is primarily limited to shoreline area and future decommissioning activities would be limited to the existing infrastructure footprint, it is not expected that a permit under the Navigation Protection Act will be required in association with future Facility closure activities.

- Canada Consumer Product Safety Act, Asbestos Products Regulations, SOR/2018-196. Proper handling, management and disposal of ACM at the Site would be required as part of future closure activities.
- Natural Resources Canada Explosives Regulations, 2013. This regulation may be applicable in the removal of any remaining explosives stored on-Site (between the Smelter Area and MHW Area) at the time of Facility closure.
- Interprovincial Movement of Hazardous Waste Regulations (SOR/2002-301) and Transport Canada Transportation of Dangerous Goods Act applicable with respect of transportation of certain waste materials within the province and elsewhere in Canada (if required) for disposal.
- National Building Code of Canada, Part 8 and the National Fire Code (including Division B, Section 5.6 – Construction and Demolition Sites) applicable with respect to various aspect of demolition works.

Other specific permits, licenses, approvals, or authorizations that may also be required as part of the decommissioning project include (following the EIA registration):

- Approvals to Construct and Approvals to Operate issued by NBDELG under the Clean Environment, Clean Air and/or Clean Air Acts during the decommissioning period;
- Approval of a Remedial Action Plan from NBDELG in accordance with the “Guideline for the Management of Contaminated Sites, 2003” if any soil or groundwater remediation is required; and
- Municipal Building Permit (for demolition).

In addition to the compliance criteria listed in each Approval to Operate, other applicable criteria for soil, sediment, surface water, stormwater (effluent), and groundwater quality that may apply to decommissioning of the Site are listed below in Section 10.0. The guidelines identified are those used to define potentially impacted areas of the Site, and are used in standard industry practice in Atlantic Canada under the current and intended future land use of the Site.

## 7.2 Indigenous/Aboriginal Considerations

The nearest First Nations communities include: Eel River Bar (located approximately 52 km northwest) and Pabineau (located approximately 47 km south) from Belledune. As such, future decommissioning/demolition activities associated with the Brunswick Smelter property itself is not anticipated to impact Aboriginal culture or land.

In addition, the New Brunswick Department of Tourism, Heritage and Culture was contacted and there are no known First Nation heritage sites (e.g. burial areas, ceremonial grounds, etc.) located on or in close proximity to the Site. As such, specific mitigation measures related to protection of First Nations culture or sensitive sites are not included in the 2019 Closure Plan Update but would likely require further review under the permitting requirements of the provincial EIA process.



One specific future consideration will be the transportation of demolition debris from the Smelter Site to the Brunswick Mine Site for disposal as access to the former mine is by provincial Highway 430 which bisects the northwestern corner of Pabineau First Nation. Consultation with the Pabineau First Nation will likely be required as part of future Facility closure planning activities. Pabineau First Nation and Eel River Bar First Nation are two of seven First Nation communities in northern and eastern New Brunswick who are served by the North Shore Micmac District Council (NSMDC), therefore the council may be helpful in facilitating future consultation with these and other communities in the area, if required.

### 7.3 NB Heritage or Archeological Sites

The Site closure activities are not anticipated to impact archaeology and heritage resources in the area. The Site has been operating as an industrial facility for over 50 years and the land in the vicinity of the Site has been highly disturbed. As indicated in the Section 7.2, New Brunswick Tourism, Heritage and Culture were contacted to provide a list of known heritage resource Sites in the area. They indicated that there are no registered archaeological sites within the mapped area surrounding the Site. However, portions of the area are assessed as having elevated archaeology. NB Tourism, Heritage and Culture indicated that, if the project requires ground disturbance, an archaeological impact assessment may be required.

## 8. Human Resources

### 8.1 Human Resource Requirements for Closure Project

#### 8.1.1 Human Resources Before Execution of the Closure Work

After Facility closure is announced and prior to demolition contractor(s) mobilizing to Site, it is assumed that Glencore personnel will plan and provide support for the removal of all raw concentrate that is stockpiled in various areas of the Site, including re-distributing the concentrate to other Glencore facilities or returning the concentrate to the supplier.

In the 2008/2009 Closure Plan PFS, it was assumed that numerous decommissioning activities would be completed by Glencore personnel prior to demolition contractor(s) mobilizing to Site. However, for the current 2019 Closure Plan Update, it has been assumed that decommissioning activities such as chemical sweep; emptying and disposal of liquids from pipelines, reservoirs, process piping and process equipment; removal and disposal of various residues in buildings, such as sludge and dust accumulations; and general cleaning will be the responsibility of the decommissioning/demolition contractor(s) and will not be completed by Facility personnel.

However, should Glencore identify potential buyers for equipment resale or opportunities to transfer equipment to other Glencore facilities at the time of closure, it is assumed that Facility personnel will plan and provide support for dismantling and shipping of selected major pieces of equipment.

#### 8.1.2 Human Resources During Closure Works

During the decommissioning and demolition period, Glencore will provide project management and contract administration duties with support from an engineering consultant.



The conceptual Facility closure plan and schedule assumes the Site WWTP will operate for a period of approximately 2 to 4 years following completion of final Site grading and construction of engineered wetlands. The conceptual engineered wetlands are being proposed to passively treat surface water run-off associated with the Site, thereby eliminating long-term operation and maintenance costs associated with the WWTP (refer to Section 12.0 for additional description of proposed future water management strategies). The 2 to 4 year operation of the WWTP following final Site grading is to allow for time for the conceptual engineered wetlands to vegetate and to ensure the applicable discharge limits are being met prior to demolishing the WWTP. During the closure activities and for the 2 to 4 year period following the final Site grading activities, two full time WWTP operators will be required for operation of the WWTP, procurement of chemicals, general mechanical maintenance and Site surveillance. The operators would also be responsible for completing environmental monitoring activities associated with applicable Approvals to Construct or Approvals to Operate (groundwater monitoring wells plus collection of surface water samples) during the closure activities. It is assumed that the WWTP operator would typically be working 5 days per week, year round. Additional working time is typically required during critical periods of water treatment such as spring snowmelt and during heavy rain events in summer or fall.

Once the engineered wetlands have fully vegetated and the Site discharge criteria are being met, the WWTP will then be demolished. It has been assumed that Glencore personnel will not be on-Site during the WWTP demolition, as the demolition supervision/contract administration will be completed by an engineering consultant contracted by Glencore and who would report directly to the Brunswick Mine personnel.

### 8.1.3 Human Resources After Closure

After closure of the Facility, the Site will be vacant as a fenced or partially fenced property. As part of post-closure maintenance operations, periodic inspections and limited maintenance will be required for the Site cover, erosion protection measures, ditches, culverts, perimeter fencing, and the engineered wetlands. In addition, it is anticipated that NBDELG will require a post-closure groundwater and surface water monitoring program for a period of 2 to 5 years following completion of the closure activities of the Site. The maintenance, inspection and monitoring operations as well as regulatory reporting will be fulfilled by Brunswick Mine Site personnel.

## 9. Occupational Health, Hygiene and Safety

### 9.1 Safety Risk Identification

Health and safety will be rigorously implemented and enforced for all activities of the closure works, with an objective of zero lost time incidents (injury and work-related illness). Demolition work is known to present risks of lost time incidents which must all be eliminated by severe and stringent implementation of comprehensive health and safety risk identification and mitigation measures. Site workers are at risk of injury due to the nature of demolition work, such as falls from heights, impacts from falling materials, contact with hazardous materials, and noise and vibration hazards. Falling or windblown demolition debris could also cause injury to the public and Site workers. Aside from demolition work, the closure work also involves many other activities for which there are safety risks including mobile heavy equipment, increased truck traffic, and handling of fuels or other liquids. A



comprehensive hazard assessment including work activities task-by-task, hazards, recommended controls and risk ranking will be completed by the demolition contractor prior to the commencement of the decommissioning and demolition activities.

## 9.2 Safety Management

Construction and demolition safety will be a primary consideration in awarding contracts, work planning, and execution. Contractor(s) safety programs and historical safety performance records will be evaluated as part of the procurement process.

A full Health, Safety, Environment and Communities (HSEC) Management Plan and Safe Work Procedures (SWPs), will be developed by the demolition contractor for the Smelter decommissioning and demolition works. The HSEC Management Plan and SWPs will outline specific safety requirements and processes for the decommissioning and demolition works including a safety and health risk or hazard analysis and worker training requirements for each work task and operation. In order to ensure the demolition contractor's HSEC Plan meets the Owner/Consultant's requirements, the demolition tender documents and specifications will outline stringent health and safety requirements, as well as minimum contents of what must be included in the contractor's health and safety programs and plan. Prior to beginning the works, the contractor's HSEC Plan is subject to Owner/Consultant review and approval processes to ensure it meets the requirements. It is noted that a HSEC Management Plan and SWPs will be developed by Glencore for other smaller individual contracts that may occur as part of the closure works, such as earthworks contracts. The health and safety plan presented in the 2008/2009 Closure Plan PFS provides a good basis on the minimum requirements to be included in the future demolition specifications and tender documents, therefore a copy the plan Table of Contents is included in Appendix G as a reference for future development.

A full-time Glencore HSEC coordinator will be present at the Site throughout the closure works to ensure that the demolition contractor(s) are completing the works in accordance with the approved HSEC Management Plan, SWPs and Glencore's requirements. The HSEC coordinator will also review and participate in contractor safety meetings, job safety hazards analysis, and incident reporting/investigations. The demolition tender documents will outline the demolition contractor(s) health and safety requirements during decommissioning which will likely include provisions for a competent Health and Safety Officer who has formal education and/or training in occupational safety and health, and has sufficient working experience in similar demolition activities as the closure works.

## 9.3 Security and Access

The Site is located in an industrial area of Belledune with no close proximity to residential and commercial properties. However, Highway 134 is located directly adjacent to the Smelter Area, allowing for potential for interaction with the public, resulting in the need for mitigation to secure the Site and protect the public. Trespassers could fall into open excavations or basement areas, come into contact with hazardous materials, or be hit by mobile construction equipment and trucks.

The Site is fenced and equipped with security cameras at each access gate. To further restrict unauthorized access or trespassing on the Site, security personnel will monitor the Site 24 hours a day, 7 days a week during the active demolition period. It has been assumed that Glencore will be



responsible for Site security during the first two years of the closure works, and the contractor(s) will be responsible for Site security between years two and five, after which point the Brunswick Mine Site will assume responsibility for Site security. During working hours, security personnel will control vehicular access to the Site via the existing access gates. The existing perimeter chain link fence will be maintained in the current configuration to the extent possible during the project. If demolition activities require removal of portions of the fence, temporary construction grade fencing will be installed to maintain a secure Site perimeter. Following demolition activities, a permanent Site perimeter fence will be reinstated.

It is noted that the Chaleur Bay shoreline along Belledune Point creates a potential beach access to the Site that should be considered in the security plan.

## 10. Environment

### 10.1 Environmental Baseline

Environmental conditions at the Site were determined based on a review of various environmental investigations conducted at the Site between 1988 and 2015 by SNC, CRA, Intrinsik, and Roy between 1988 and 2015. The results of these studies were incorporated into the HGS and DGA conducted by GHD in 2019 in conjunction with the 2019 Closure Plan Update (GHD, 2019). To further evaluate the historical environmental conditions at the Site and to compare conditions of previous studies to the data collected as part of the current HGS and DGA program, the available data has been compiled into an electronic Data Access Tool (eDATpro). This is a customized geographic information system (GIS) software program that integrates site maps and environmental sampling databases with digital photographs, 3D visualizations, monitoring well and borehole logs, and reports to help facilitate data management, spatial interpretation, and overall data interaction. The eDAT for this study contains >30,000 data records extending from August 1988 to October 2019 (the HGS and DGA report is included in Appendix B and the eDAT program will be provided as a separate deliverable to Glencore with the final report).

The following studies were used in the development of the environmental database developed specifically for the Site:

- Hydrogeochemical Investigation at Brunswick Smelting and Fertilizer, Smelter Site, Belledune, Noranda report dated March 17, 1989.
- Soil and Groundwater Sampling Program, Belledune Smelter Site, Belledune, NB, CRA, report dated February 2006.
- Supplemental Phase III Environmental Site Assessment, Belledune Smelter Site, CRA report dated February 2007.
- Plan 2010 – Conceptual, Brunswick Smelter, Belledune, NB, CRA, April 2007.
- Field Program for Hydrology Study, Brunswick Smelter Site, CRA October 2009.
- Port Land Exchange, Metal in Soil Data Compilation, Belledune, NB, CRA, June 2010.





- Groundwater and Soil Characterization Report, Prefeasibility Engineering and Cost Estimating For the Closure Plan of the Brunswick Smelter Complex, completed by CRA on behalf of SNC, November 2008.
- Brunswick Smelter Closure Plan - Prefeasibility Study and Cost Estimating Report, SNC, January 2009.
- Roy Consultants, 2013 Back 40 Drilling Program, Brunswick Smelter, Belledune, NB, January 2014.
- Roy Consultants, Phase II Environmental Site Assessment, Smelter Facility, Belledune, NB, September 2015.
- Ecological Risk Assessment of Off-Site Terrestrial and Freshwater Aquatic Areas Near the Brunswick Smelter, Belledune, NB, Intrinsic, September, 2013.
- Marine Ecological Risk Assessment of Brunswick Smelter, Intrinsic in association with Minnow Environmental Inc., October 30, 2015.

In addition to the above noted reports, several reports specific to evaluating residual NORM levels in the Fertilizer Plant area were also reviewed and the findings incorporated into the NORM and Hazardous Materials Survey completed by GHD in 2019 in conjunction with the 2019 Closure Plan Update (GHD, 2019). The reports reviewed specific to NORM characterization at the Site include:

- Pre-remediation Survey of the Falconbridge Ltd. DAP Facility, completed by Integrated Environmental Management, on behalf of CRA, August 2006.
- Groundwater and Soil Characterization Report, Prefeasibility Engineering and Cost Estimating For the Closure Plan of the Brunswick Smelter Complex, completed by CRA on behalf of SNC, November 2008.

The findings of these NORM specific studies are discussed below and detailed in GHD's 2019 NORM and Hazardous Materials Survey report attached as Appendix C.

An overview of the environmental conditions at the Site based on current and historical soil, groundwater, sediment and surface water data collected from the Site is outlined in the following sections.

#### 10.1.1 Soil

Approximately 400 soil samples have been collected from the Site between 1989 and 2019. The historical and 2019 analytical data indicate that the primary contaminants of potential concern (COPC) in surface and subsurface soil at the Site are metals, petroleum hydrocarbons (BTEX/mTPH) and NORM.

Other COPCs such as PAHs, PCBs, VOCs have been evaluated during past investigations but the concentrations of these COPCs were generally below applicable screening guidelines. Outlined below is an overview of selected COPCs in soil at the Site that will require consideration as part of the 2019 Closure Plan Update.



## *Metals*

Concentrations of metals in soil exceeding CCME Industrial Soil Quality Guidelines (SQGs) were identified at the majority of past (prior to 2019) test locations across the Site, with ore concentrate also previously observed along the rail spur line. Some metal exceedances were also previously reported for soil samples collected near the proposed soil granular cover borrow pit area (Figure 3). Additional samples were therefore collected as part of the 2019 study. Soil leachate testing was also previously completed at localized areas of the Site. Potential leachate generating soils (zinc and cadmium) were generally limited to the old coke fines storage area. These historical soil results were also confirmed by soil samples collected from the Site by GHD in 2019. The 2019 soil sampling program together with historical analytical results indicated that the majority of the Site has metal concentrations, specifically arsenic, cadmium, lead, thallium and zinc.

As part of the 2019 evaluation, analytical results for select metals (arsenic, cadmium, copper, lead, silver, thallium and zinc – as shown on Figures 9A, 9B and 9C) typically associated with the ore concentrate being processed at the Site, were also compared to calculated risk based site-specific target levels (SSTLs) previously developed to evaluate risk to Human Health for an Industrial Worker related to the rail transport of ore concentrate to the Smelter from the Brunswick Mine (CRA, 2013).

The risk based SSTLs for an industrial worker, previously calculated during assessment, remediation and closure of the CN rail line properties over which ore concentrate was transported to the Site from the Brunswick Mine, were used as the primary screening values for typical ore related metals to demonstrate the likely expected areas on-Site that would require remedial action planning work as part of the 2019 Closure Plan Update. It is also noted that a review of these SSTLs was completed with Glencore as part of the regulatory site closure work completed by GHD in 2018, on behalf of CN, for the CN rail line bordering the Site properties owned by Glencore.

The 2019 HGS and DGA investigation estimated aerial extent of metals impacted soil at the Site in excess of the lead SSTLs for protection of human health based on industrial land use (i.e., the metal with the largest footprint) is 92 Ha  $\pm$ 20% including: 71.5 Ha in the Smelter Area and 20.5 Ha in the combined Material Handling West Area and the Fertilizer Plant. The volume of material required to cover the areas of metal impacted soils above industrial land use SSTLs assuming a 0.6 m thick cover to eliminate the human health exposure pathway would be 550,000 m<sup>3</sup>. This volume of cover material would include the terrestrial areas Belledune Point. The area of metal impacted surface soil at the Site that is likely to require remediation or risk management as part of future closure activities is shown on Figure 10.

The 2019 Study also indicated that elevated metal concentrations typically decreased significantly in subsurface soil compared to surface soil. For example lead in samples collected from the Back 40 area were measured at 44,000 mg/kg in the 0-0.15 m depth sample and 640 mg/kg in the 1.2-1.8 m depth sample. Similar to concentrations of metals in soil, concentrations of leachable metals in soil also decreased with depth below surface grade. Using the Back 40 area as an example, the leachable lead was measured at a concentration of 130,000  $\mu$ g/L in the 0-0.15 m depth sample and decreased to 1,400  $\mu$ g/L in the 1.2-1.8 m depth sample located within the shallow groundwater table.

It is also noted that the Back 40 area was (and still is) used as the main in-process material management area which is situated northwest of the Acid Plant. Valuable materials have been managed in the Back 40 area for decades and a significant quantity of product was mixed with the



overburden soils (Roy, 2014). As such, overburden soil in the Back 40 area was excavated and processed at the Facility in 2015 to recover lead and silver.

### *Petroleum Hydrocarbons*

The historical documents also identified modified petroleum hydrocarbons (mTPH) as a COPC for the Site. Soil samples collected from isolated areas of the Site were previously identified to have concentrations of mTPH exceeding Atlantic Risk-Based Corrective Action (RBCA) Tier I Risk Based Screening Levels (RBSLs). Past test locations with elevated mTPH concentrations in soil included Number 1 Short Rotary Furnace (05GW-61 and 62) and Acid Day Tank (05GW-64) as well as the former underground storage tanks (USTs) and current aboveground storage tanks (ASTs) associated with the Warehouses (05GW-66 and 67), as well as 2015 assessment work completed near the former waste oil tank and former No. 2 bulk fuel oil AST north of Lead Refinery (BH-1, 4 and 5); with concentrations ranging from 3,400 to 11,000 mg/kg. The location of past samples with mTPH greater than 3,000 mg/kg (as an indication known or potential exceedance of the Tier I RBSL) is shown below (with blue diamonds). It is expected that the development of site specific risk based guidelines using Atlantic RBCA would significantly reduce (or possibly eliminate) the requirement for remediation of hydrocarbon impacted soil on-Site.



There is also limited information about the storage of petroleum and metal impacted soil, originating from the CN rail yard in Moncton, NB, storage on-Site near the Salt Water substation (Area 47 – Figure 4). This soil reportedly being stored in preparation for processing through the Smelter (CRA, 2007). The closest test location in this area is monitoring well GW-10 installed in 1988 (prior to the placement of soil in this area) and it has not been sampled for petroleum hydrocarbons.

In the summer of 2019, Glencore was completing maintenance work west of the Sinter Building at the Site and diesel impacted soil and groundwater was observed in the trench excavation. GHD proposed a test location in this area of the Site as part of the 2019 HGS and DGA work program to investigate the source of the impacts. However, due to the potential for buried utilities, the drilling of proposed monitoring wells could not be completed and, therefore, collection of soil samples for hydrocarbon analysis was not completed as part of the 2019 HGS and DGA program.



The area and volume of hydrocarbon impacted soil assumed in the 2008/2009 Closure Plan PFS was 8,000 m<sup>3</sup> and to be conservative, this value should be carried forward in the 2019 Closure Plan – Prefeasibility Study 2019 since additional delineation was not possible due to operating Site infrastructure.

### ***NORM***

The historical documents also indicated that NORM should be considered as a COPC in soil at the site, specifically in the Fertilizer Plant portion of the Site. The initial NORM characterization study completed for the Fertilizer Plant area in 2006 identified several building surfaces and adjacent soil areas that contained NORM concentrations above acceptable guidelines that would require specific remediation and/or disposal requirements. A supplemental assessment program completed in 2008 identified concentrations of NORM in soil adjacent to the DAP & PAP buildings that were below applicable guidelines indicating additional soil management or remediation may not be required.

As part of the NORM and Hazardous Materials Survey program completed in 2019 by GHD, a total of 19 soil samples were collected from various areas of the Fertilizer Plant, including the Scrap Yard. The soil samples collected from the Site in 2019 had NORM concentrations below applicable guidelines for Unconditional Derived Release Limits of Diffuse NORM Sources. These results confirmed the findings of the 2019 non-intrusive survey as well as soil samples collected in 2008 and indicate that remediation of soils specific to NORM are likely not required as part of future Site closure activities. However, it is noted that soil samples were not collected from areas directly beneath equipment or piping with elevated NORM concentrations and these areas will require additional assessment at the time of facility closure.

#### 10.1.2 Groundwater

As part of the 2019 HGS and DGA program, GHD completed an existing well survey to determine the number and conditions of groundwater monitoring wells remaining at the Site. A total of 69 monitoring wells were identified to be remaining at the Site and were sampled as part of the HGS and DGA program. In addition, a total of 20 monitoring wells were constructed during the 2019 program to evaluate overburden and bedrock groundwater conditions in the Back 40/Back 50 and Saltwater Lagoon area of the Smelter Area as well as other areas of the Site (Bulk Handling West Area, Fertilizer Plant and New Slag Pile).

The overburden stratigraphy at the Site generally consists brown silty sand and gravel fill overlying clastic sedimentary bedrock (described as red, grey and brown sandstone, grey shale, red and grey siltstone, and conglomerate). In some test locations a layer of highly fractured bedrock was observed above the more competent bedrock. The depth to bedrock is variable across the Site, but is generally 1 to <3 mbgs. The depth to groundwater ranged from 0.17 to 4.39 mbgs. The direction of the shallow groundwater flow at the Site is northeast towards Chaleur Bay. The direction of the bedrock groundwater flow in the Back 40 and Back 50 area is also northeast towards Chaleur Bay. The groundwater velocity for the shallow groundwater table is estimated to be 10 m/year. The groundwater velocity for the bedrock groundwater table in the Back 40 and Back 50 areas is estimated to be 6 m/year. The groundwater velocity can also be locally influenced by preferential pathways such as buried utilities.



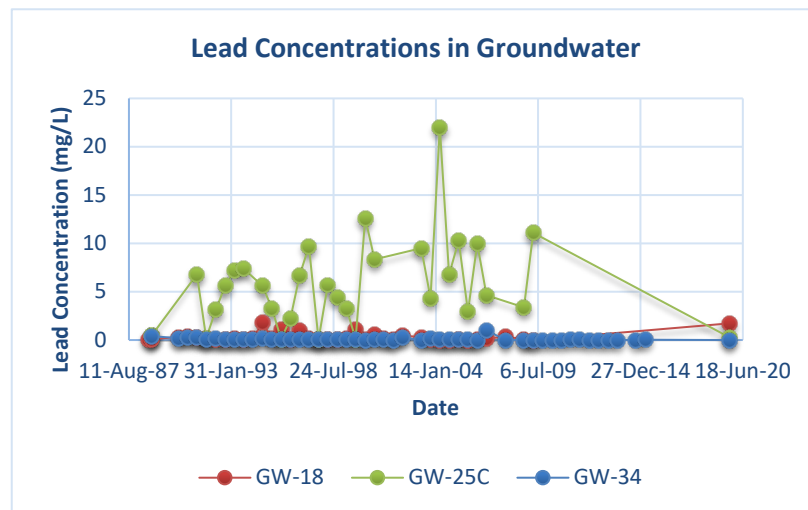
It is expected that tidal influence could impact some of the static water levels in monitoring wells close to Chaleur Bay. Salinity levels were measured in the groundwater to determine potential tidal influence in the groundwater quality. The salinity data indicates that shallow groundwater within Belledune Point area (north of the rail lines) is  $\geq 3$  parts per thousand (ppt or 0.3%) whereas salinity south of this area is typically  $\leq 2$  ppt (0.2 %) (Figure 11A). For comparison, the Saltwater Lagoon has a salinity of 20 ppt (2.0%).

Outlined below is an overview of selected COPCs in groundwater at the Site that will require consideration as part of the 2019 Closure Plan Update.

### Metals

As the Site is considered non-potable, human exposure pathways to metals in groundwater (i.e., ingestion) is generally considered to be incomplete. As such, groundwater samples collected from the Site in 2019 were screened against guidelines based on groundwater discharging from the Site to marine surface water body (Chaleur Bay) and protection of marine ecological receptors. Concentrations of metals in groundwater samples collected directly adjacent to the Chaleur Bay shoreline in 2019 were generally below applicable screening guidelines for the protection of marine aquatic life. In addition, groundwater in production areas of the Site such as the Back 40/Back 50 were identified to have the highest concentrations of metals in groundwater but a significant decrease (orders of magnitude) in metal concentrations is observed in groundwater as it flows from the Smelter Area towards Belledune Point. Figures 11B to 11D provide a visual representation of certain dissolved metals in groundwater with concentrations exceeding guidelines for the protection of marine aquatic life.

The graph below shows the concentrations of lead recorded in groundwater samples collected from monitoring well GW-25C located in the Process Sludge Storage compared to lead concentrations in monitoring wells GW-18 and GW-34 located approximately 150 and 350 metres to the northeast, respectively. The graph shows that a significant decrease in lead concentrations (one to two orders of magnitude) in groundwater have consistently been observed over the last 40 years as the groundwater flows from the Site to the Saltwater Lagoon (and Chaleur Bay).





Although significant attenuation of dissolved metal concentrations in groundwater is observed as the groundwater flows southwest to northeast across the Site (from the Smelter Area towards the Saltwater Lagoon), concentrations of metals in groundwater directly adjacent to the Saltwater Lagoon exceed applicable screening guidelines for protection of marine aquatic life. In particular, groundwater samples collected from four existing and newly drilled monitoring wells (GW-30, GW-34 and 19GW-125) directly south of the Saltwater Lagoon had dissolved concentrations of arsenic, cadmium, lead, thallium and zinc in groundwater exceeding guidelines for the protection of marine aquatic life. Concentrations of these metals in monitoring wells GW-30, GW-34 and 19GW-125 located on the south side of the Saltwater Lagoon are summarized below (see Table 10.1 below). For comparison purposes, surface water analytical data collected from the Saltwater Lagoon in 2019 is also included in the Table.

Table 10.1 Shallow Groundwater and Saltwater Lagoon Results

Analyte	Unit	Groundwater Well Locations Nearest to Saltwater Lagoon				Saltwater Lagoon Surface Water Samples (2019)		
		GW 30A	GW-30C	GW-34	19GW-125	19SW-3	19SW-4	19SW-5
pH	pH	7.00	7.51	7.25	7.66	7.97	7.89	7.99
Salinity	N/A	<2	<2	2.9	<2	20	20	20
Dissolved Arsenic	µg/L	354	1.31	581	26.8	16.0	16.5	14.8
Total Arsenic	µg/L	Na	na	na	Na	19.8	26.3	22.8
Dissolved Cadmium	µg/L	3790	0.167	2300	1550	127	200	170
Total Cadmium	µg/L	na	na	na	Na	115	208	169
Dissolved Copper	µg/L	3.95	0.57	3.3	7.94	8.17	6.25	4.42
Total Copper	µg/L	na	na	na	Na	10.7	12.1	10.8
Dissolved Lead	µg/L	6.35	3.04	12.9	237	53.7	34.4	34.5
Total Lead	µg/L	na	na	na	Na	94.3	99.8	92.7
Dissolved Thallium	µg/L	3140	0.54	796	1130	78.8	129	100
Total Thallium	µg/L	na	na	na	Na	69.8	135	98.5
Dissolved Zinc	µg/L	18,200	8.2	12,900	6,420	520	700	614
Total Zinc	µg/L	na	na	na	Na	498	771	629

Based on the 2019 groundwater data collected, concentrations of dissolved metals in groundwater along the Chaleur Bay shoreline were generally below applicable guidelines for protection of marine aquatic life. However, there is the potential that elevated concentrations of metals in groundwater could be discharging into the Saltwater Lagoon area of the Site and will likely require additional consideration as part of future Site closure activities.

#### **Petroleum Hydrocarbons**

Free phase petroleum product was not observed in the 53 monitoring wells sampled at the Site in 2019 (18 of the monitoring wells were dry). As noted above, in the summer of 2019, Glencore was completing maintenance work west of the Sinter Building and diesel impacted groundwater was observed in the trench excavation.

Concentrations mTPH in groundwater exceeding the Tier I RBSL of 20 mg/L were previously detected in the following test locations (shown with blue diamonds) from the Smelter area of the Site.

Location	Sample Date	Result (mg/L)
GW-66	11/23/2005	21
GW-62	11/23/2005	28
GW-71	11/23/2005	31
GW-64	11/23/2005	47
MW-1	7/2/2015	220
MW-3	7/2/2015	530



Concentrations of petroleum hydrocarbons (BTEX/mTPH) in groundwater samples collected in 2019 from selected test locations in the area shown above were also within the RBCA Tier I RBSLs for an industrial site with non-potable water use and coarse grained soil (i.e., <20 mg/L mTPH). The area and volume of hydrocarbon impacted groundwater will need to be assumed in the 2019 Closure Plan Update since delineation was not possible due to operating Site infrastructure. However, groundwater samples collected as part of the HGS and DGA for monitoring wells located near certain hydrocarbon source areas have reduced some of the uncertainty in the volume estimates.

The estimated volume of hydrocarbon (product) impacted groundwater, based on the results of the past studies and the 2019 HGS and DGA, is 500,000 litres and this value should be carried forward in the 2019 Closure Plan Update. It is also noted that the management / remediation of the product impacted soil, after Facility closure, will also serve to remediate the associated localized shallow groundwater impacts.

### **NORM**

Groundwater samples were collected from seven monitor wells located in Fertilizer Plant area in 2008 for gamma spectroscopy analysis (08GW-79, 08GW-80, 08GW-92 to 08GW-95 and 08GW-98). Results of the laboratory analysis indicated the concentrations of NORM in the groundwater samples were below current Canadian guidelines of diffuse NORM in liquids (radioactive isotopes of uranium, radium, etc.) that may be released unconditionally (i.e., without regard for radiological ramifications). However, the laboratory analysis noted the samples did not meet required preservation standards at the time of analysis (pH <2) and the results may not accurately reflect the concentration of NORM at the time of sampling (SNC Lavalin, 2008).

In 2019 six groundwater samples were collected from monitor wells (19GW-118, 19GW-120, 19GW-122, 19GW-124, 08GW-95, and 09GW-102) located in the Fertilizer Plant area and submitted for gamma spectrometry. Groundwater samples collected from the Fertilizer Plant area did not contain detectable concentrations of NORM indicating groundwater in the area has not been



impacted with NORM and does not require additional evaluation or remediation as part of future Site closure activities.

### 10.1.3 Sediment

A total of 9 sediment samples (19SED-1 to 19SED-9) were collected from the Saltwater Lagoon and submitted for metals analysis as part of the 2019 HGS and DGA program. The purpose of the sampling was to gather information on current sediment conditions of Belledune Point following the removal of 526,000 m<sup>3</sup> of slag from the “old” slag pile to the New Slag Pile in 2011-2012. This work was completed under the Approval to Construct I-7784 (Glencore, September 2013).

During the 2019 investigation, black slag, as well as brown/black silt and sand, was observed at the base of the lagoon. Concentrations of arsenic, cadmium, copper and lead and zinc exceeded ecological guidelines for the protection of aquatic life (CCME guidelines). This is not unexpected given that residual slag is currently visible in the lagoon. The ranges of concentrations observed for selected metals in the sediment included:

- Arsenic: 210 to 2,400 mg/kg (average 942 mg/kg);
- Cadmium: 130 to 750 mg/kg (average 291 mg/kg);
- Copper: 590 to 4,100 mg/kg (average 2,200 mg/kg);
- Lead: 6,600 to 41,000 mg/kg (average 18,830 mg/kg);
- Thallium: 19 to 620 mg/kg (average 190 mg/kg); and
- Zinc 10,000 to 99,000 mg/kg (average 55,200 mg/kg).

The 2019 sediment analytical results are presented in the HGS and DGA study report (Appendix C). Additional assessment or remedial considerations specific to Belledune Point are further discussed in Section 10.5.

### 10.1.4 Surface Water

Three surface water samples were collected from the Saltwater Lagoon (19SW-3 to 19SW-5) as part of the 2019 HGS and DGA program. The dissolved metal concentrations in the surface water samples collected from the Saltwater Lagoon had concentrations of arsenic, cadmium and/or mercury exceeding the applicable guidelines for the Protection of Marine Aquatic Life. As previously indicated, the Saltwater Lagoon likely receives shallow groundwater from a portion of the Smelter Area including the Back 40 and Back 50 areas and is also influenced by tides in Chaleur Bay. Two additional surface water samples were collected from the Site as part of the 2019 HGS and DGA program including 19SW-1 (from the ditch in the Back 50 and Back 40 area) and 19SW-2 (from the channel leading to the Saltwater Lagoon from the Saltwater Pumphouse). A summary of the surface water analytical results is presented below.

Temperature was observed to be elevated in 19SW-1 and 19SW-2 and conductivity was similar in all five samples. Concentrations of arsenic, cadmium and/or mercury exceeded the CCME WQGs for the Protection of Marine Aquatic Life, long term screening levels and/or the Nova Scotia Environment Pathway Specific Standards (NSE PSS).

- Dissolved arsenic concentrations ranged from 14.2 µg/L to 16.5 µg/L;





- Dissolved cadmium concentrations ranged from 34.2 µg/L to 208 µg/L; and
- Dissolved mercury was not detected (<0.013 µg/L) in samples 19SW-2, 4 and 5. Mercury was detected in 19SW-1 at a concentration of 0.015 µg/L in 19SW-1 (within the CCME WQG) and 0.018 µg/L in 19SW-3 (slightly exceeding the CCME WQG).

Concentrations of other metals such as copper, lead, thallium and zinc also exceeded the NSE PSS.

In addition to the surface water samples collected by GHD in 2019, as part of the on-going environmental effects monitoring program associated with the Site, Glencore representatives collect surface water samples from both the West Diversion Ditch and East Diversion Ditch prior to discharge to Chaleur Bay. Glencore monitoring data from September 2019 is presented below.

Glencore Surface Water Monitoring								
Date	As (mg/L)	Cd (mg/L)	Cu (mg/L)	Fe (mg/L)	Pb (mg/L)	Tl (mg/L)	Zn (mg/L)	pH
<b>East Diversion Ditch</b>								
2019-09-10	0.03	0.01	0.03	0.73	0.66	<0.02	0.17	7.20
2019-09-27	0.06	0.01	0.01	0.07	0.19	<0.02	0.06	7.33
<b>West Diversion Ditch</b>								
2019-09-10	<0.02	<0.01	0.01	0.01	0.06	na	0.03	8.03
2019-09-27	0.05	0.01	0.01	0.02	0.08	na	0.03	8.13

#### 10.1.5 Hazardous Material

The decommissioning of the Brunswick Smelter will generate regulated hazardous wastes through the cessation of smelting operations as well as in the preparation for the demolition of structures. The standard of practice as the Facility nears decommissioning is to complete a hazardous material inventory to compile a detailed, quantitative, pre-demolition inventory of hazardous substances that may be found in structures in addition to previous inventories completed and provided by Glencore.

The hazardous material inventory is typically enhanced by completing a hazardous materials sweep to collect any containerized hazardous materials within containers across the Facility, and to inventory any larger, in-use hazardous materials. The hazardous material inventory will need to be completed at a further stage of decommissioning, typically completed nearer to the decommissioning date for the Site.

GHD has completed a review of all structures and processes to identify both existing materials that will need to be managed and properly disposed of prior to demolition, as well as those processes and equipment that will require some level of cleaning prior to demolition. In addition, in preparation of this report, GHD completed a NORM and Hazardous Materials Survey specific to the Fertilizer Plant area of the Site (Appendix C). Material management and cleaning requirements along with NORM impacted building materials or equipment specific considerations are discussed in detail below.

#### ***Asbestos Containing Materials and Regulated Wastes***

There are certain materials found within the structures and process operations that occur with such frequency that they are regarded as universal wastes and include ACM. Glencore has provided GHD with the following inventories of regulated materials:



- Inventory of friable ACM from the Asbestos Management Program, Brunswick Smelter, prepared by Glencore, June 21, 2016;
- Inventory of chemicals currently stored at the Facility; and
- Inventory of oil-filled transformers from the 2008/2009 Closure Plan PFS.

Inventories of chemicals, asbestos and PCB sources are considered to be current but will likely require additional assessment prior to decommissioning activities. ACM requires abatement prior to demolition and Glencore has routinely abated ACM as part of on-going facility maintenance. Consequently the amount and location of existing ACM at the Facility may change prior to the decommissioning/demolition activities. Inventories of mercury sources and ozone depleting substances (ODS) are either absent or incomplete, and will likely require additional assessment prior to decommissioning activities.

The following regulated materials are located throughout the Site:

#### ***Universal Wastes***

- Radionuclides (Smoke Detectors);
- Lighting Ballasts;
- Lighting Bulbs (fluorescent and HID);
- ODS;
- Mercury Devices;
- Batteries;
- Lab Pack (unused raw and waste chemical materials);
- Transformer Oil (Non-PCB containing);
- Hydrogen Peroxide;
- Carbon Dioxide;
- Liquid Nitrogen;
- Liquid Oxygen;
- Catalyst;
- Sinter Dust;
- Sulfuric Acid (H<sub>2</sub>SO<sub>4</sub>);
- WWTP Filter Media; and
- Electronic waste (including computers and circuit boards containing lead and mercury).

#### ***ACM***

- ACM Thermal Insulation (on pipes, equipment, cable trays and tanks);
- ACM Transite Paneling;
- ACM Drywall Joint Compound;



- ACM Floor Tile and Mastics;
- ACM Duct Sealant; and
- ACM Parging debris.

### ***Bulk Solid Wastes***

As indicated in Section 3.2.1, the Back 40 area is used as the main in-process material management area for the stock-piling of valuable materials potentially available for re-processing at the Facility. As part of the data collection program completed as part of the 2019 Closure Plan Update, Glencore representatives indicated that approximately 14,000 tonnes of in-process material (identified as New Pond Dredge) is currently stockpiled in the Back 40, Back 50 and other areas north of the Acid Plant. This material has been identified to contain approximately 37% lead but also contains 1,600 parts per million (ppm) mercury and, therefore, cannot be processed at the Facility. Glencore representatives indicated that alternative uses and processing of this material is being reviewed (i.e., the Car Cover Removal Building houses rented pilot test equipment for removal of mercury from the Smelter residues).

In addition to the New Pond Dredge material, there is approximately 3300 tonnes of copper dross and copper speiss being stored at the Facility (in the Dross Plant and the MHW, respectively) that will also require off-Site disposal as hazardous waste if alternative re-processing options cannot be identified.

In addition to the in-process materials stockpiled at the Site, the following bulk solid wastes are also present:

- Acid Product/Residue in Pipelines/Tanks;
- Petroleum Product/Residue in Pipelines/Tanks;
- Sludge from the CRP;
- Sludge generated from cleaning ditches;
- Sludge/Residue from Acid Plant Old Mist Precipitators (containing PCBs between 2 ppm and 50 ppm);
- Ceramic and Plastic Saddles;
- Refractory Brick; and
- Creosote/pressure treated timber products (rail ties).

Also common throughout the Site are the presence of miscellaneous containers of raw materials, products, cleaning supplies, cylinders of compressed gases (including fire extinguishers), aerosol cans, and other materials. These materials, if not completely used or returned, will become waste upon decommissioning of the Site.

### ***Explosives***

The area between the Smelter Area and MHW Area is used for storage of lime and explosives. The removal of any remaining explosives stored on-Site will be required at the time of Facility closure.



#### 10.1.6 Decommissioning Cleaning Wastes

The removal of process equipment and storage tanks will require a level of decontamination or cleaning in order to ensure the surfaces and internal components are free of product residue. This decommissioning cleaning will generate both solid and liquid wastes, depending on the process systems.

In addition, the cleaning of pits, sumps, and trenches will result in the generation of wastewater and some accumulated solid waste, depending on the current condition. Cleaning wastewater may be processed through the existing WWTP, however, during decommissioning quantities of wastewater (e.g., oily water) may exceed treatment capabilities in which case pre-treatment or off-Site treatment will be required. Cleaning wastewater generated through cleaning of NORM-impacted equipment will require special handling and disposal/treatment and is further discussed in Section 11.0.

Based on information presented in the 2008/2009 PFS Closure Plan, the majority of the buildings at the Site may have accumulated metal impacted dust and will require off-Site disposal. For the purpose of the 2019 Closure Plan Update, it is assumed that the majority of the demolition debris and accumulated process waste associated with the Smelter Site will be disposed of at the Mine Site open pit. In addition, approximately 15,000 tonnes of sludge material dredged from the CRP is currently stockpiled directly east of the CRP and mixed brick, refractory and other debris material is stockpiled in the Back 40, Back 50 and north of the Acid Plant. For the purposes of the 2019 Closure Plan Update, it is also assumed that this dredge material and other brick/refractory material can be disposed of at the Mine Site. However, as indicated in the previous section, there is over 17,300 tonnes of in-process materials stockpiled in the Back 40, Back 50 and other areas north of the Acid Plant that are not considered suitable for disposal at the Mine Site due to the presence of mercury and will require disposal at a hazardous waste landfill or re-processing. A summary of the currently stockpiled materials at the Site and the assumed disposal location is presented in Table 8.

#### 10.1.7 Painted Surfaces

Consideration has been given to the presence of lead-based paint on floors and walls constructed prior to the ban of lead in paint in the 1980s. In the context of demolition, there are no known federal or provincial regulations that require the removal of lead-based paint prior to, or in conjunction with, demolition activities. However, management of suspected lead-based paint is the subject of health and safety considerations of personnel exposure and proper dust control during the demolition process, and also in consideration of waste management regulations or guidelines that address management of lead impacted and lead leachable wastes. NBDELG guideline "Disposal of Lead Paint & Lead Painted Material, 2011" outlines the disposal requirements for lead painted materials.

Given the age of the Smelter Site and based on information provided in the 2008/2009 PFS Closure report, it is considered likely that lead based paint is present on building materials and equipment at the Site. However, the Site currently operates under a HSEC Management Plan and Safe Work Procedures SWPs specific to the protection of workers related to lead containing dust (and other contaminants) which will be incorporated into the decommissioning/demolition health and safety plan. In addition, non-recyclable demolition debris associated with the Smelter Site (concrete, wood, drywall, etc.) will be disposed of at the Brunswick Mine Site that is specifically designed to capture and treat metal impacted leachate, specifically lead.



Further consideration of exposure to lead based paint during the decommissioning/demolition activities or disposal of non-recyclable building materials potentially containing lead based paint is not considered required in the context of developing the 2019 Closure Plan Update.

#### 10.1.8 PCB-Containing Equipment

Information provided to GHD as part of the Closure Plan indicated that an extensive PCB removal program has been previously undertaken by Glencore at the Smelter Site. As part of this program, known or suspected equipment containing PCB oils, such as transformers and capacitors, were drained and the PCB-containing oil transported off-Site for disposal. The transformer oil was subsequently replaced with mineral oil or other suitable non-hazardous oil. The PCB removal program also included the removal of all interior light ballasts that contained PCB oils. However, bushings on oil-filled transformers may also contain oil with residual concentrations of PCBs and the transformer carcasses may contain PCBs. In accordance with the PCB regulations (SOR/2008-273) of the Canadian *Environmental Protection Act* (2008 and amended in 2015), equipment containing oil with PCB concentrations greater than 2 mg/kg (but less than 50 mg/kg) require special handling by a licensed handling facility before being recycled.

Subject to verification as part of a pre-demolition survey and following de-energization of the Facilities, oil filled transformers will require further characterization to identify any potential wastes requiring disposal as PCB containing. For the purposes of the 2019 Closure Plan Update, it has been assumed that the oil remaining in on-Site transformers contain PCB concentrations below 2 mg/kg and can be recycled or reused without special handling. An inventory of transformers at the Site is provided in Table 5.

As part of historical investigations as well as the investigations completed by GHD in 2019, soil samples were collected in the vicinity of on-Site substations and former PCB Storage Building. Results of the soil sampling program did not identify detectable concentrations of PCBs in on-Site soil. Similarly, concrete samples collected from the two transformer pads in the Fertilizer Plant area in 2019 did not contain detectable concentrations of PCBs and do not require specific handling or disposal requirements as part of future Site closure activities.

#### 10.1.9 NORM Impacted Materials

The Fertilizer Plant area of Site was constructed in 1967 and operated until approximately 1995. The phosphate rock used to feed the process was mined in the southeastern and western United States, and in the African countries of Togo and Morocco. It contained oxides of phosphorus and calcium, with trace amounts of NORM impurities such as Uranium 238 (U 238) and Thorium 232 (Th 232), along with their various progeny (i.e., Ra 226). The initial NORM characterization study completed for this area of the Brunswick Smelter in 2006 by Integrated Environmental Management (IEM) identified several building surfaces that contained NORM concentrations above acceptable guidelines that would require specific remediation and/or disposal requirements. In 2019, GHD completed a supplemental assessment of NORM at the Fertilizer Plant. The purpose of the 2019 characterization survey is to provide Glencore with updated information on current concentrations of NORM inside the DAP and PAP buildings and to quantify NORM impacted material that will require specific remedial planning as part of future Facility closure activities.



Results of the 2019 NORM study indicated the following with respect to NORM impacted building materials or equipment:

- The gamma readings recorded in the PAP and DAP buildings were generally consistent with NORM background soil conditions in area ( $0.05 \mu\text{Sv/hr}$ ) or within 2 to 3 times background conditions ( $0.1$  to  $0.2 \mu\text{Sv/hr}$ ) which is similar to the 2006 findings. These results indicate the remaining structures and equipment within the historical PAP or DAP operation areas will likely not warrant NORM mitigation during demolition of these former units. However, GHD was unable to perform NORM screening surveys on the filter pans located on the 4th floor of the historical PAP building due to inaccessibility during the 2019 Site visit. As such, there is no current data regarding NORM associated with these specific items.
- Although the non-intrusive NORM screening survey did not identify elevated gamma readings in the PAP building, residual bulk product samples collected from the PAP building 19BP-1 (Filtrate Sump) and 19BP-2 (PAP building Conveyor Feeding Mill) had concentrations of diffuse NORM exceeding applicable Canadian NORM guidelines. As such, this residual bulk product remaining in the PAP building would require removal and disposal at an approved facility as part of future building decommissioning activities. Approximately  $6 \text{ m}^3$  of residual bulk product is estimated that will require removal and disposal as NORM.
- The non-intrusive NORM screening survey conducted on the Gypsum Line piping being stored in the Smelter Area identified NORM measurements consistent with background conditions. However, a bulk sample of residual gypsum accumulated in the annular space between the plastic inner sleeve and the outer wood sheath had NORM concentrations exceeding applicable Canadian NORM guidelines for Unconditional Derived Release Limits of Diffuse NORM Sources. As such, the former gypsum piping being stockpiled in the Smelter Area will likely require cleaning or disposal at an approved facility as part of future Site closure activities. There is approximately 225 metres of 0.6 metre diameter piping currently being stored at the Site that has the potential to be impacted with NORM. The volume of residual gypsum accumulated in the annular space between the inner plastic sleeve and the outer wood sheath is estimated to be  $<0.1 \text{ m}^3$ .
- The majority of materials and equipment found within the Scrap Yard were identified to have gamma readings above the NORM Management (Dose Management) Threshold and will likely require management (cleaning or off-Site disposal, whichever is most cost-effective) as part of future Site closure activities. Approximately  $145 \text{ m}^3$  of NORM impacted materials and equipment is located in the Scrap Yard.
- The non-intrusive NORM survey measurements recorded from the DAP building were generally consistent with the established background ( $0.05 \mu\text{Sv/hr}$ ) for this area. One measurement was not considered consistent with the absolute value of the background for this area (the measurement recorded from the historical reactor area,  $0.1 \mu\text{Sv/hr}$ ). However, this measurement is within the Site specific NORM management measurement of  $0.5 \mu\text{Sv/hr}$  above background and is protective of human health and the environment.
- Results of the leachate testing indicated that residual NORM levels identified bulk product samples collected from the Fertilizer Plant are not leachable.



As indicated above, the 2019 NORM study indicated that only NORM impacted material at the Site requiring cleaning or off-Site disposal as part of future Site closure activities is generally limited to equipment stored in the Scrap Yard area, former Gypsum Line piping stockpiled in the Smelter Area and minor amounts of residual bulk product in the PAP building. Further evaluation of the most technically and financially feasible options for remediation and/or disposal of the NORM impacted materials remaining at the Site is evaluated in Section 11.2.

## 10.2 Other Environmental Investigations

In addition to soil, groundwater, sediment and surface water quality at the Site described in the preceding section, several other reports describing environmental conditions or environmental remediation programs previously completed at the Site were reviewed and the findings summarized below.

### ***Plan 2010 – Conceptual, Brunswick Smelter, Belledune, NB, CRA, April, 2007***

In 2007, Glencore commissioned CRA to prepare a conceptual plan (Plan 2010) for the potential closure of the Brunswick Smelter complex upon closure of the Brunswick #12 mine, which was anticipated to close in 2010. Plan 2010 examined the costs related to action required in 2010 under two scenarios. The first scenario was complete closure and demolition of the smelter complex in preparation for use by a future industrial user. The second scenario assumed that the Short Rotary Furnace and related infrastructure would be retained for a reduced intensity operation at the site. These two concepts included the use of human health risk assessment (HHRA) to determine necessary remedial actions and the use of the Brunswick #12 mine site for final placement of soils and demolition materials resulting from remediation and facility demolition. Regulatory authorities also agreed, at the time, that the adjacent fertilizer plant and concentrate receiving facility could be considered independent of the Smelter. Therefore Plan 2010 addressed the area in the immediate vicinity of the Smelter complex in addition to the Remote Slag Impoundment Area (25-acre) located approximately one kilometre south of the smelter facility and Highway 134.

The remedial action proposed as part of Plan 2010 maximized the implementation of on-site solutions through land use controls (industrial use only) and limiting receptor exposure through installation of protective soil covers. Future industrial use of the site was not significantly limited by this approach. Remedial costs for both Options included gross dust removal, asbestos removal, infrastructure demolition and transport to Brunswick #12, construction and operation of landfill disposal cells at Brunswick Mine Site, cover repairs at the Old Slag Pile located north of the Smelter on Belledune Point (now the Saltwater Lagoon), cover/hydroseeding at the New Slag Pile south of the Smelter and cover/hydroseeding of 70 Ha (57 Ha under Option 2) of the Site.

### ***Belledune Point Rehabilitation Plan, Final Report, Brunswick Smelter, A Glencore Company, September, 2013***

Between 1967 and the early 1980s, slag associated with the Facility was pumped as slurry and stockpiled in a saltwater wetland on Belledune Point. It was estimated that one million tonnes of slag were stored on Belledune point. In 1980 due to the limited storage capacity at Belledune Point and as part of an overall site water management program it Glencore decided to develop a new Slag Management area south of the Smelter and the Belledune Point Slag Pile was closed, capped and vegetated. In 2011, a trade-off study completed for the Old Slag Pile in Belledune Point determined



that removal of the Old Slag Pile eliminated the environmental risks and further financial liabilities. Between the fall of 2011 and the fall of 2012, Brunswick Smelter began trucking slag from the Old Slag Pile and placed the material in an isolate area within the New Slag Management Area. In total 526,000 m<sup>3</sup> of slag was moved to the New Slag Management Area and represents approximately 1,052,000 tonnes of material.

Following the slag excavation program, the Old Slag Pile area was allowed to re-develop naturally as a salt water lagoon or marsh with the amendment of organic soils in the shallow tidal area at the south east corner of the lagoon. In addition, a small island was created in the area to promote tern colonization. Although the island was not favoured by the terns, the island is used by a variety of sea birds including gulls and cormorants.

Various government agencies, including the NBDELG Coastal and Marine Management as well as Approvals, the Department of Fisheries and Oceans, the Canadian Wildlife Service and the Department of Energy and Mines (Coastal Geomorphology) were involved in the development corrective action plan and Belledune Point Rehabilitation program.

#### ***Gypsum Bed Characterization, Minnow Environmental Inc., January 2015***

The Brunswick Smelter historically operated a Fertilizer Plant that produced DAP using by-products from the Smelter Facility. Until closure of the Fertilizer Plant in May 1996, a gypsum-based slurry, produced as an effluent waste product from the plant, was discharged into the Chaleur Bay just north of a breakwater that currently bounds the Port of Belledune. Although gypsum (i.e., calcium sulphate) generally exhibits high solubility in seawater, dispersion of the slurry at the outfall location was insufficient to achieve complete gypsum dissolution resulting in the historical development of a relatively insoluble gypsum bed in the vicinity of the discharge. In 2014, Minnow Environmental Inc. conducted an evaluation of the Chaleur Bay gypsum bed with the objectives of quantifying the surficial dimensions of the current gypsum bed and to evaluate changes in the size of the gypsum bed relative to previous assessments. Overall, the surface area of gypsum bed (i.e., 86,985 m<sup>2</sup>) and the total volume of material in the original gypsum bed area was lower in 2014 compared to 2002, suggesting erosion/dissipation of gypsum in Chaleur Bay at the area of the former Fertilizer Plant outfall since 2002.

#### ***Ecological Risk Assessment of Off-Site Terrestrial and Freshwater Aquatic Areas Near the Brunswick Smelter, Belledune, NB, Intrinsik, September, 2013***

Glencore commissioned Intrinsik Environmental Sciences Inc. (hereafter referred to as Intrinsik) to conduct an ecological risk assessment (ERA) of off-site terrestrial and freshwater aquatic areas near the Smelter. The study was conducted over 5 years, and involved a team of consultants who conducted field sampling, biological surveys, and risk assessment to evaluate potential risks in the environment associated with historical releases from the Smelter Site. The key smelter-related sources of COPC considered in the ERA were atmospheric deposition of Smelter air emissions and fugitive dust emissions from the slag pile.

To determine the Principal sampling area, data gathered in previous studies of the area were considered, including:

- Shore Road Soil Study (Intrinsik et. al, 2008);
- The Biodiversity Study (LGL, 2008); and





- Glencore Environmental Monitoring Program (various years).

Based on data and information from the above mentioned studies, the area within a 7 km radius of the Smelter Site (called the Principal sampling area) was selected to investigate whether soils in ecological areas surrounding the Smelter may be potentially influenced by smelter releases. In addition, an area of crown lands upwind of the smelter was located approximately 21 km due west of the Smelter Site which served as a suitable reference location. Following initial soil sampling in this 7 km area and reference areas, the area requiring further study in the ERA was determined to be restricted to within a 3 to 4 km radius of the Smelter. This area underwent additional sampling to characterize metals levels in soils, soil invertebrates, sediments and surface waters, as well as biological field surveys to characterize abundance, diversity and fledgling success of breeding birds, vegetation community diversity and health, small mammals abundance and diversity and tissue organ levels of specific metals, soil nutrient levels, soil invertebrate community abundance and diversity, fish habitat and abundance and diversity.

The outcomes of the comprehensive ERA on terrestrial and freshwater environments south of the Smelter were as follows:

- Risks to vegetation are considered to be low, with the exception of near-field areas immediately South – South-West of the facility, where they were considered moderate. The effects on vegetation South and South-West of the facility were considered to be likely related to a number of factors, including site disturbance, soil contamination, possible SO<sub>2</sub> in the near-field, salt spray and nutrient deficiency, amongst others.
- Risks to soil invertebrates and soil micro-organisms were considered to be low. Based on the results of the assessment, the report indicated that some individual level effects could be occurring in some species, but community level effects within the vicinity of the Smelter as a result of Smelter operations were considered unlikely.
- Risks to avian species (herbivorous, carnivorous or insectivorous) were considered to be low. Based on the results of the assessment, the report indicated that some individual level effects could be occurring in some species, but population level effects within the vicinity of the Smelter as a result of Smelter operations were considered unlikely.
- Risks to herbivorous and carnivorous mammalian species were considered to be negligible, whereas risks to insectivorous small mammals were considered to be low. Based on the results of the assessment, the report indicated that some individual level effects could be occurring in some species, but population level effects within the vicinity of the Smelter as a result of Smelter operations were considered unlikely.
- Risks to freshwater aquatic life in Hendry Brook were considered to be negligible to low, whereas risks to freshwater aquatic life in an Unnamed Brook were considered to be low for freshwater pelagic species and moderate for benthos, largely due to the influence of the slag storage area in a portion of that brook.
- Based on the available information, risks to sensitive species known to be present on the Site (which are limited in number) were considered to likely be low (possible effects on some individuals expected, but effects were not considered adverse or measurable). The report indicated that there was considerable uncertainty in this conclusion, but the limited number of



sensitive species and limited size of areas with significant contamination suggests that this is likely a reasonable conclusion.

Therefore, based on the outcomes of this study, the report concluded that risks associated with exposures to metals and SO<sub>2</sub> near the Glencore smelter facility were considered to be low to negligible for the terrestrial and freshwater environments. Based on these findings, the uncertainties in this study and the various studies that comprised this work, the report suggested that Glencore conduct a review of their environmental monitoring program, and revise accordingly.

***Marine Ecological Risk Assessment of Brunswick Smelter, Intrinsic in association with Minnow Environmental Inc., October 30, 2015***

In addition to the terrestrial and freshwater aquatic ERA described above, Glencore also commissioned Intrinsic to conduct an ERA of the marine areas, and species foraging in those areas, near the Smelter. The primary releases of interest from the Smelter, considered in the study, related to current treated effluent discharge, former fertilizer plant gypsum-based effluent discharge, atmospheric discharges, and possible contributions related to erosion of the former slag disposal area on Belledune Point. The main receptor groups of interest included aquatic species (marine phytoplankton and pelagic invertebrates, benthic invertebrates, and marine fish species) as well as avian species living at or near the facility and foraging in the marine environment and the associated shoreline. The ERA program included field evaluations of benthic invertebrate communities, shellfish health assessment (involved deploying mussels), fish health assessment, fish and invertebrate tissue analysis, beach sand chemistry and bioaccessibility analysis, and sampling of common tern chick organ tissues and eggs. Based on the data and assessments conducted, the following conclusions were drawn in the report:

- Risks to marine phytoplankton and pelagic invertebrates were considered to be negligible to low, based on comparison of measured water quality metals concentrations to marine water quality guidelines and reference, as well as other toxicology data and information.
- Risks to marine benthic community were considered to be low in the area of the former gypsum line effluent outfall (adjacent to the Port facility) and other off-shore areas. However, risks were considered moderate for the area surrounding the WWTP effluent discharge location based on the existing chemistry data and the benthic density, diversity and richness data. In the 2015 survey, increased sediment metals concentrations and lower benthic invertebrate density and differences in community structure, relative to surveys conducted in 2008 and 2004 at the effluent outfall location, were noted, which was not linked to effluent discharge quality or flow volume. Rather, the report indicated that these changes appear to be related to either erosion of the former slag disposal area at Belledune Point as a result of a large storm event in 2010, or to the recently completed Belledune Harbor dredging project.
- Risks to marine shellfish were considered to be low, based on the available data and studies conducted. Survival was not considered to be influenced in the study area, relative to reference. Growth was actually greater in the study area mussels at several sites, than in reference areas. While tissue metals were significantly higher in the exposure group for arsenic, cadmium, copper, lead, selenium, silver, strontium and zinc, the results of the survival, growth and condition endpoints indicate no adverse effects in blue mussels near the Smelter.



- Risks marine fish were considered to be low, based on assessment of water quality, survival, growth/condition, reproduction and tissue residue data. No critical effect sizes were exceeded for any endpoint with the exception of egg size. Smaller egg size in smelter-exposed fish was hypothesized to reflect natural variability in spawning timing between the exposure and reference fish populations.
- Risk to avian species nesting or foraging in the area were considered to be low as described below:
  - Common tern nest on the Smelter property annually, and forage in both the near shore and far shore areas adjacent to the smelter. Based on the weight of evidence, the report indicated that risk potential to the common tern colony that nest on the Smelter property and forage in both the near shore and far shore areas is considered low. Modelled exposures suggested low risk potential to the common tern colony, with only iron having 95th percentile Hazard Quotients (HQs) > 1. Clutch counts from 2010 suggest the colony is within the range of clutch counts in other areas of New Brunswick. Measured residues in eggs, kidney and liver were below toxicity thresholds (where they were available), with the exception of lead in a number of kidney and liver samples. While exceedance of toxicity thresholds for lead in some samples suggests a high potential for adverse effects in those individuals, a limited number of dead chicks were found following extensive daily surveys of the colony in 2014, and many of the metals residues within tissues were below toxicity thresholds suggestive of clinical or severe effect levels. Weighing the available information, the report indicated that some individuals within the colony have a high potential for adverse effects from exposures to lead, but there appears to be a low probability of effects on the colony as a whole, based on the numbers of chick tissue samples exceeding toxicity thresholds, relative to the number of eggs reported in previous colony counts. The colony has returned to nest at the smelter year after year, and anecdotal observations suggest it is increasing in size. The report indicated there is uncertainty in this conclusion related to specific clutch size for 2014, and exposures to chicks which were not sampled.
  - Black-crowned night heron forage on and near the Smelter property (Belledune Point), but the report indicated nesting pairs have not been observed in previous surveys conducted. Risk potential for this species was considered to be negligible to low, based on low probability of Hazard Quotients exceeding 1, with the exception of iron, lead, and to a lesser extent, strontium and thallium. Lead and zinc concentrations in beach sand along Belledune Point were elevated relative to concentrations of sediments considered to be protective of waterfowl in other areas. The dominant exposure pathway was identified to be diet, but considering that there would be a limited number of individuals present in this area, population level effects were considered unlikely near the Smelter. The report indicated that lead would be considered the substance with greatest risk potential, based on the available data.
  - Sandpiper forage along the shore of the beach on the Smelter property, and four nesting pairs were reported on Belledune Point in surveys conducted in 2009. When the survey was updated in 2015, a total of 6 nesting pairs were confirmed in the shoreline area adjacent to the Site and immediately southeast of the Site with 4 possible additional nesting pairs identified. Risk potential for this species was considered to range from low to moderate, depending upon proximity to the Smelter. On Belledune Point, risks were considered to



range from low to moderate based on the high probability of multiple Hazard Quotients exceeding 1 (aluminum, copper, iron, lead, selenium, thallium and zinc). Lead was identified to represent the substance of greatest concern. The report indicated that Belledune Point is the area with highest exposure potential, due to the presence of slag along the beach/shoreline, and concentrations of lead and zinc in this area were also found to exceed concentrations reported as being protective of waterfowl in other published literature. Areas further down the shoreline to the east of the facility were identified to represent a low risk potential. The risk potential for the shoreline overall was considered to be low as diet was found to be the most important exposure pathway in all areas considered (and bioaccessibility in diet was assumed to be 100%). The report stated that adverse effects in some individuals could be occurring on Belledune Point, but are considered less likely in areas adjacent to the Site. The report concluded that, depending on exposures and population size, an effect on the local population could be possible, but is unlikely.

### 10.3 Effluent Water

As part of the Certificate of Approval to Operate (I-9010) Glencore completes test monitoring of wastewater and effluent including the analysis of pH, iron, copper, lead, zinc, cadmium, and arsenic from the smelter effluent treatment plant, polishing pond, cooling water discharge, slag pond, east and west diversion ditches, and groundwater monitoring wells in accordance with the Approval to Operate. Glencore provides a Monthly Environmental Report to the NBDELG pertaining to the effluent water quality testing and monitoring, a summary of any significant events such as discharges which exceed the limits with mitigation taken, a summary of the total water intake from the Jacquet River in accordance with the approval to operate. An annual Water Quality Summary Report is also submitted by January 30 of each year.

As outlined in the Approval to Operate (I-9010), the following are the concentration limits for effluents discharging to the environment (the effluent discharged from the WWTP is also to have a pH >7.0 and <10.5):

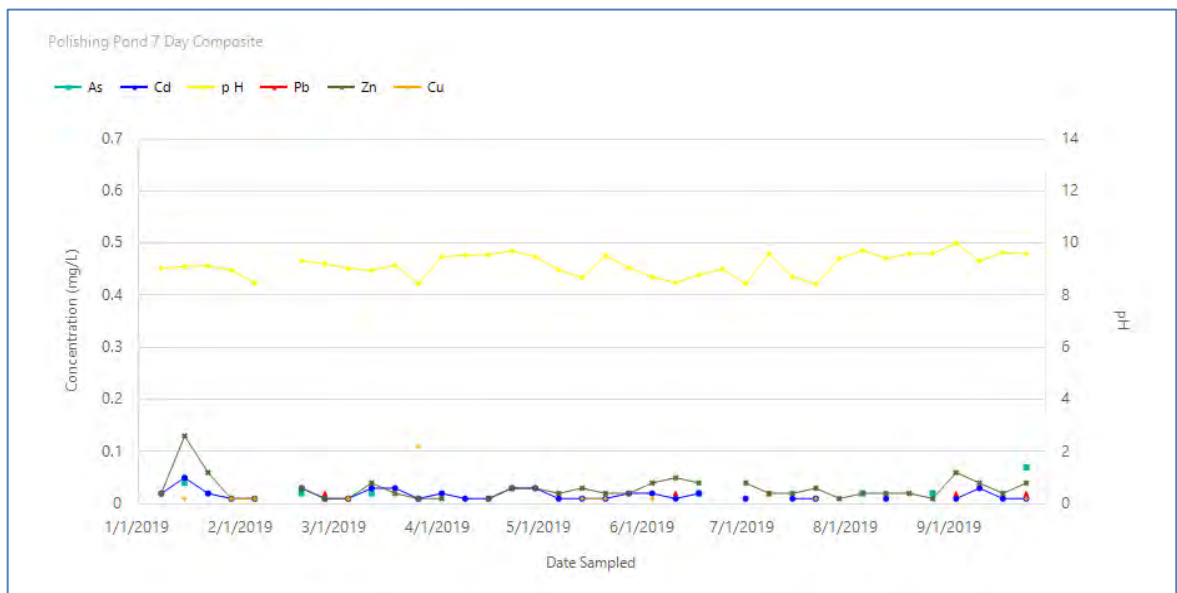
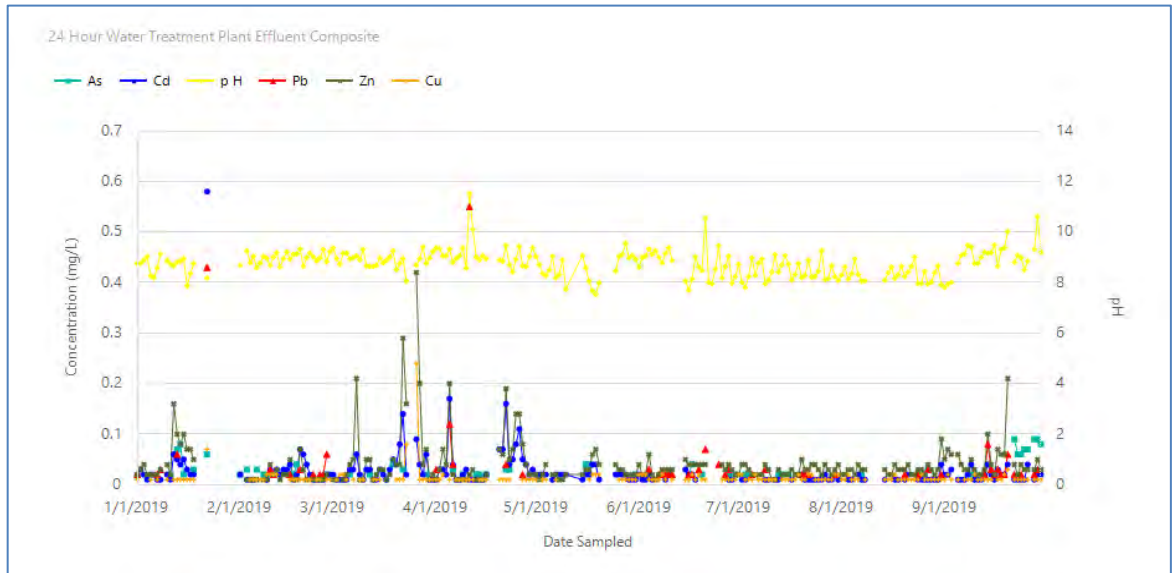
Parameter & Unit	Maximum Monthly Average	Maximum Weekly	Instantaneous
Cadmium / mg/L	0.050	0.100	0.100
Lead / mg/L	0.200	0.300	0.400
Arsenic / mg/L	0.500	0.750	1.000
Copper / mg/L	0.300	0.450	0.600
Zinc / mg/L	0.500	0.750	1.000

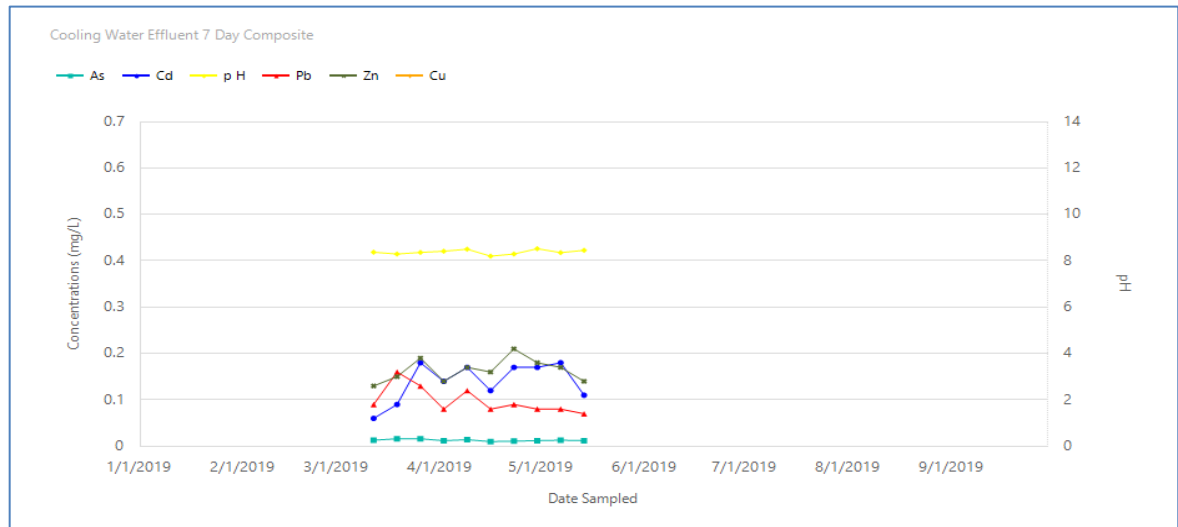
Notes:

- Column 1 maximum arithmetic mean concentration of the seven (7) day composite samples taken in a calendar month.
- Column 2 is the maximum concentration in the seven (7) day composite sample.
- Column 3 is the maximum concentration in a final effluent grab sample.



In 2019, effluent samples were collected from the Polishing Pond, the WWTP and the Cooling Water Effluent. There were no reported discharge from the MHW or New Slag Pond monitoring locations during the 2019 sampling events. Results of the monitoring program provided to GHD for 2019 indicate effluent quality is within discharge limits set in the Approval to Operate. Below are the 2019 data graphs of the 24 hour composite samples for the WWTP and the 7 day composite samples for the Polishing Pond and the Cooling Water effluents, respectively.





A review or testing of the water quality in Chaleur Bay (effluent receiving waters) was not completed in association with the 2019 Closure Plan Update. However, as previously indicated, Intrinsik completed an evaluation of risk to marine receptors from exposure to COPCs in marine waters (and sediment) adjacent to the Site (Intrinsik, 2015). Results of the study indicated that concentrations of metals in Chaleur Bay adjacent to the Site are within applicable screening guidelines or are similar to background conditions in the area excluding aluminum, barium, boron, iron, lithium, manganese, silicon, thallium and uranium. While several of these metals may be associated with Facility releases, many may not, and some are considered to be within natural variability ranges. In addition, further evaluation of the metals exceeding screening guidelines or background conditions for the area were identified not to be a concern with respect to protection of marine receptors.

#### 10.4 Air

Glencore currently has an Approval to Operate (I-9101) from NBDELG for the purpose of operating the Brunswick Smelter and MHW Area. The NBDELG issued this Air Quality Permit pursuant to the Air Quality Regulations 97-133 under the Clean Air Act. This Approval to Operate contains conditions on operating, emissions limits, stack testing requirements, ash disposal requirements, record keeping and reporting requirements, in accordance with the Approval to Operate and as detailed in this section.

The Approval to Operate indicates that the operation of the plant equipment must maintain the emission rate of particulate matter to the atmosphere from the Facility to achieve the design criteria of less than 46 mg/Nm<sup>3</sup> for the Ducon scrubbers and less than 22 mg/Nm<sup>3</sup> for the baghouses.

Glencore must operate the acid and sinter plants so that emissions from these stacks are maintained within the following levels:

- Less than 1100 ppmv over a 24 hour rolling average (2883 mg/Nm<sup>3</sup>) for the acid plant.
- Less than 800 ppmv over a 24 hour rolling average (2097 mg/Nm<sup>3</sup>) for the sinter plant baghouse.
- Based on the emission targets and flow ratios of 5:1 (sinter plant: acid plant), the emission limit for these stacks will be the combined weighted average of the two = 885 ppmv combined monthly average (2226 mg/Nm<sup>3</sup>).



The total emission of sulphur dioxide to the atmosphere from the Facility must be less than 13,000 tonnes per calendar year. In addition, Glencore must ensure that the emissions originating from the operations are controlled to prevent the exceedance of the maximum permissible ground level concentrations outlined in Schedule B of the Air Quality Regulation – Clean Air Act.

All monitoring, testing, and reporting must be in accordance with the Approval to Operate. Glencore must advise the NBDELG in writing before any changes in the operation of the Facility are made, including facility re-design or expansion, and closure plans.

## 10.5 Belledune Point

Belledune Point and the old slag pile area have been previously referred to as a Low Exposure Land Use area (SNC, 2009). The old slag pile area located on Belledune Point was rehabilitated to become a Saltwater Lagoon as outlined in the Belledune Point Rehabilitation Plan (Brunswick Smelter, 2013). The rehabilitation plan was developed in collaboration with several federal/provincial agencies including the NBDELG, DFO, Canadian Wildlife Service and Department of Energy and Mines. In addition, the Belledune Point rehabilitation work was completed in accordance with the Approval to Construct I-7784 issued by the NBDELG.

In 2012, Atlantic RBCA implemented an ecological screening protocol for contaminated sites that has been adopted by the NBDELG as part of the provincial Guideline for the Management of Contaminated Sites. Under this protocol, it is likely that the Belledune Point area and the Saltwater lagoon created by the relocation of the old slag pile would be considered ecological habitat potentially requiring additional evaluation of contaminants in soil, surface water or sediment with respect to risk to ecological receptors. However, the information provided in the Belledune Point Rehabilitation Plan Final Report along with results of the Marine Ecological Risk Assessment of Brunswick Smelter (Intrinsik, 2015) indicate that concentrations of metals in shoreline sand of Belledune Point are unlikely to pose a significant risk to ecological populations. Based on discussions with Glencore personnel, it is assumed that additional rehabilitation works of Belledune Point, for the purposes of the protection of ecological receptors, will not be required as part of future Site closure activities and has therefore not been considered further in this Closure Plan - Prefeasibility Study 2019 Update.

Although further consideration of risk to ecological receptors is not specifically included in the 2019 Closure Plan Update, a total of 31 soil samples (including duplicates) were collected from Belledune Point as part of the 2019 HGS and DGA study. Surface soil samples (19SS-1 to 19SS-10), from 0-0.05 m depth and 0.05-0.3 m depth, were collected from 10 locations at Belledune Point and the associated metal concentrations are summarized as follows:

- Arsenic: 46 to 1,300 mg/kg (average 300 mg/kg);
- Cadmium: 1.9 to 58 mg/kg (average 21 mg/kg);
- Copper: 81 to 2,900 mg/kg (average 725 mg/kg);
- Lead: 740 to 24,000 mg/kg (average 8,046 mg/kg);
- Thallium: 1.2 to 14 mg/kg (average 5.5 mg/kg); and
- Zinc: 490 to 86,000 mg/kg (average 15,082 mg/kg).



Metal concentrations in soil samples collected from Belledune Point were generally below risk-based SSTLs or CCME SQGs for an industrial land use, excluding arsenic and lead. Concentrations of these two metals exceeded SSTLs for industrial land use at several locations on Belledune Point. As such, for the purposes of estimating potential remedial requirements, the area of Belledune Point identified to contain concentrations of metals exceeding SSTLs for protection of human health were included in the area of the Site requiring soil cover to mitigate risks to human health through direct contact/ingestion of surface soil.

In addition to metal impacts in soil above human health based guidelines and SSTLs, elevated concentrations of metals in surface water and sediment samples collected from the Saltwater Lagoon (which was created by the removal of the former slag pile in 2011-2012) were also identified. Slag was also observed to be present in the Saltwater Lagoon and associated shoreline during the 2019 investigations.

Given the uncertainties associated with future land use of the Belledune Point area and potential regulatory requirements at the time of closure, it is considered likely that additional evaluation of risk to human health and ecological receptors from exposure to metals in various media of Belledune Point will be required. Potential additional assessment and remediation of Belledune Point has been identified as a risk item in the project risk registry (see Section 16.0).

## 10.6 Regulated Wetlands

Wetlands in New Brunswick are managed by the NBDELG. The management is guided by the New Brunswick Wetlands Conservation Policy (Policy) (NBDNRE and NBDELG, 2002). The Policy aims to promote stewardship and securement of wetlands and to manage human activity on or near wetlands in a manner which will achieve no loss of Provincially Significant Wetland habitat and no net loss of wetland function for all other wetlands. Legislation that supports the Policy includes the New Brunswick Clean Water Act and associated Watercourse and Wetland Alteration regulations (90-80), along with the New Brunswick Clean Environment Act and associated EIA Regulation.

NBDELG and SNB maintain the official map of known regulated wetlands in the province, available to the public on the GeoNB website (<http://www.snb.ca/geonb1/e/apps/wetlands-E.asp>). As of November 2011, NBDELG considers the GeoNB map to represent the extent of “regulated wetlands” within the province. Any activity, involving disturbance of the soil/ ground or cutting of trees, in or within 30 metres of the wetland boundary shown requires a permit. Any wetlands labelled as “Provincially Significant Wetlands” in this database are subject to a greater level of protection, as outlined in the New Brunswick Wetland Conservation Policy (NBDNRE and NBDELG 2002).

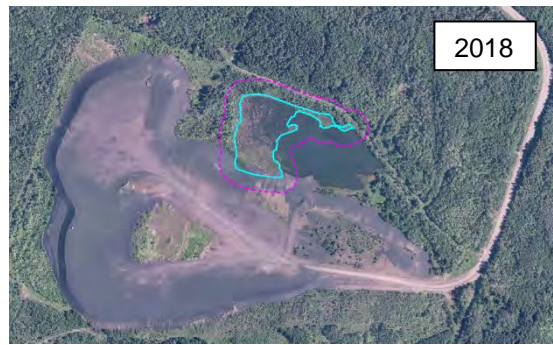
The GeoNB wetlands map viewer (using what is believed to be 2007 aerial photography as the base map), identifies a regulated wetland located adjacent to the New Slag Pile, on Glencore properties PID #20443172 and #20832481. This wetland is associated with the retention pond constructed as part of the New Slag Pile design. This wetland was created through construction of the New Slag Pile (earthen holding dam, overflow, etc.) and was formerly a mix of agricultural fields and forest covered land in 1963.

This wetland covers an area of approximately 1.6 hectares. Drainage from the wetland is primarily by a drainage ditch that directs water northward towards Highway 134 and then flows through a culvert beneath Highway 134 and bisects the Smelter Area to the west side of the Back 50. The



drainage from this wetland ultimately discharges to Chaleur Bay south west of the Salt Water Pumphouse. It is noted that the “regulated wetland” is not designated as a “Provincially Significant Wetland”.

As illustrated below, the GeoNB map viewer (using 2007 aerial photography) shows the northern edge of the adjacent slag pile extending into the 30 metre buffer area around the wetland, but the slag pile does not appear to encroach into the regulated wetland. Also illustrated below, is the wetland and buffer area overlain onto the most recent 2018 aerial photography, this shows that the northern edge of the New Slag Pile extends slightly further into the wetland area.



July 2019  
View of the eastern edge of the wetland, taken from the edge of the New Slag Pile



As indicated in Section 2.3, a primary assumption of the 2019 Closure Plan Update is that the limit of cover for the New Slag Pile is the current footprint (21 hectares). The New Slag Pile has a maximum operational capacity of 35 Ha under the current NBDELG Approval to Operate (I-9010) and includes the regulated wetland. Based on historical production rates at the Smelter, the New Slag Pile would not be expected to reach the approved operational capacity until approximately 2030 (personnel communication with Roy Consultants).

Another key assumption associated with the closure of the New Slag Pile included in the 2019 Closure Plan Update is that the existing earthen dam will be retained as part of the New Slag Pile closure concept and serve as a component of surface water management for the area. Given the New Slag Pile is located directly adjacent to the regulated wetland, the slag pile closure activities will require permitting under the NBDELG WAWA regulation. In addition, part of the 2019 Closure Plan



Update includes the potential creation of a passive engineered wetland system north of the New Slag Pile, in the proposed Borrow Pit area. This conceptual wetland would also serve as a component of the surface water management plan for the area by receiving surface water run-off from the New Slag Pile post-closure prior to discharging to the Bay through an open ditch and culvert system.

## 10.7 Environmental Criteria for the Closure Project

In addition to the compliance criteria listed in each Certificate of Approvals or Permits, which will no longer be applicable following closure of the facility, other applicable criteria for stormwater, effluent, soil, groundwater, sediment and surface water quality that may apply to decommissioning of the Brunswick Smelter are listed below. The guidelines identified are those used to define potentially impacted areas of the Site, and are used in standard industry practice in Atlantic Canada under the current and intended future land use of the Site.

As previously noted, the current and intended future land use of the Site is industrial and the Site is surrounded by industrial properties, with the exception of the adjacent cemetery property. The overburden stratigraphy at the Site generally consists brown silty sand and gravel fill overlying bedrock. The Site is serviced by water from the Glencore Jacquet River Pumphouse and potable water wells are not located on-Site or adjacent off-Site properties. For the purposes of selecting applicable assessment criteria, the Site is considered to be industrial, with non-potable groundwater use and coarse-grained soil. Since the majority of the Site is developed for industrial use, significant ecological habitat are not present and the guidelines presented below are based primarily on the protection of human health.

The exception would be Belledune Point - which has been previously identified several plant species including: *Stellaria longipes* Goldie, *Zigadenus elegans* Pursh (White Camass) and *Draba arabisans* Mixhx. (Rock Whitlow-Grass) that are considered to be rare locally (CRA, 2007) and also provides habitat for migratory birds. However, based on information provided in the Belledune Point Rehabilitation Plan Final Report, along with results of the Marine ERA completed by Intrinsic (2015), which includes the shoreline of Belledune Point, it is assumed that additional rehabilitation works of Belledune Point will not be required as part of future Site closure activities. The assumption that Belledune Point will not require additional assessment or remediation specific to the protection of ecological receptors is being carried forward in the risk registry for the 2019 Closure Plan Update.

The New Brunswick Guidelines for the Management of Contaminated Sites (Version 2, November 2003) indicate that the guidelines provided in the Atlantic Risk Based Corrective Action (RBCA) document for petroleum impacted sites should be applied for petroleum hydrocarbons and CCME guidelines should be used for non-petroleum contaminants. In the absence of applicable screening values from CCME, the NB Guidelines also indicate that screening values sourced from other jurisdictions may be considered. Therefore, the Nova Scotia Tier 1 Environmental Quality Standards have also been referenced below, where no applicable RBCA or CCME screening values are available.

The various guidelines used in this study are as follows:



## Soil

### **Parameters: Metals**

**Guideline:** Analytical results for select metals (arsenic, cadmium, copper, lead, silver, thallium and zinc) typically associated with the ore concentrate being processed at the Site, are compared to calculated risk based SSTLs (related to the rail transport of ore concentrate to the Smelter from the Brunswick Mine) for the Protection of Human Health for an Industrial Worker (CRA, 2013).

**Rationale:** The risk based SSTLs for an industrial worker, previously calculated during assessment, remediation and closure of the CN rail line properties over which ore concentrate was transported to the Site from the Brunswick Mine, were used as the primary screening values for typical ore related metals to demonstrate the likely expected areas on-Site that would require remedial action planning work as part of the 2019 Closure Plan Update. It is also noted that a review of these SSTLs was completed with Glencore as part of the regulatory site closure work completed by GHD in 2018, on behalf of CN, for the CN rail line bordering the Site properties owned by Glencore.

As the science for risk assessment is evolving, the SSTLs presented in this report are being used specifically for environmental closure estimation items in the Closure Plan - Prefeasibility Study 2019 Update, and that Brunswick Smelter specific SSTLs would be required as part of a remedial action plan. For example, other metals (such as antimony) would also require site-specific consideration in a risk assessment application at the Smelter.

**Guideline:** For metals other than those listed above, the main criteria referenced are the CCME SQG using the associated CCME Factsheets (accessed online, October 2019). The criteria for Industrial Land Use, based on the most conservative applicable human health pathway (Soil Ingestion, Particulate Inhalation or Off-Site Migration Check) are applied.

**Rationale:** The CCME SQGs were used as the primary screening values for other metals, in the absence of SSTLs, as these standards are based on multiple pathway analysis considering human exposure pathways including soil ingestion / dermal contact, particulate inhalation and off-site migration. Interim CCME SQGs (1991) are not referenced as they are not human health risk-based.

**Guideline:** In the absence of an applicable CCME SQG, the NSE Tier 1 EQS for soil, Industrial Land Use, non-potable groundwater and coarse-grained soil are also referenced (July 6, 2013).

**Rationale:** The NSE Tier I EQS standards are also based on multiple pathway analysis considering human health, but do not include the particulate inhalation or off-site migration check.

**Guideline:** Leachable metals in soil concentrations were compared to screening levels provided in the Canadian Environmental Protection Act (CEPA), Export and Import of Hazardous Waste and Hazardous Recyclable Material Regulations, Current to July 1, 2019.



*Rationale:* The CEPA leachate screening levels were used as the primary screening values for metals in leachate, as these standards are used to determine if the soil would be considered a hazardous waste under the Export and Import of Hazardous Waste and Hazardous Recyclable Material Regulations, to evaluate disposal options. The leachate screening levels can also give an indication as to how likely the metal in soil is to leach from soil to groundwater.

***Parameters:* Petroleum Hydrocarbons (BTEX/mTPH)**

*Guideline:* RBCA Tier 1, Atlantic RBCA for Petroleum Impacted Sites in Atlantic Canada, Version 3, User Guidance, Appendix 3 – Table 4a: Tier I Risk-Based Screening Level (RBSL), July 2012, revised January 2015. Industrial Receptor, non-potable groundwater use, coarse-grained soil type (as applicable based on soil stratigraphy) for the protection of human health.

*Rationale:* The Tier I RBSL are based on multiple pathway analyses considering human health in an industrial setting which includes adult receptors. This is the standard guideline for petroleum hydrocarbons used throughout Atlantic Canada. Non-potable groundwater use has been chosen as the Site and surrounding properties are supplied with water by an off-site source (Glencore Jacquet River Pumphouse).

***Parameters:* PAHs**

*Guideline:* For PAHs, the main criteria referenced are the CCME SQG, CCME Factsheets (accessed online, October 2019). The criteria for non-potable Industrial Land Use, based on the most conservative applicable human health pathway (Soil Ingestion, Particulate Inhalation or Off-Site Migration Check) are applied.

*Rationale:* The CCME SQGs were used as the primary screening values for other PAHs, as these standards are based on multiple pathway analysis considering human exposure pathways including soil ingestion/ dermal contact, particulate inhalation and off-site migration. CCME only provides human health based guidelines for carcinogenic effects of PAHs, using the benzo(a)pyrene total potency equivalent (B(a)P TPE), and recommends consulting other jurisdictions for protection of human health from non-carcinogenic effects.

*Guideline:* In the absence of an applicable CCME SQG, the NSE Tier 1 EQS for soil, Industrial Land Use, non-potable groundwater and coarse grained soil (July 6, 2013) are referenced for PAHs.

*Rationale:* The NSE Tier I EQSs are also based on multiple pathway analysis considering human health, but do not include the particulate inhalation or off-site migration check.

***Parameters:* PCBs**

*Guideline:* CCME SQG, CCME Factsheets accessed online, October 2019. Non-potable, Industrial Land Use, based on the most conservative applicable human health pathway (Soil Ingestion, Particulate Inhalation or Off-Site Migration Check).

*Rationale:* The CCME SQGs were used as the primary screening values as these standards are also based on multiple pathway analysis considering human exposure pathways



including soil ingestion/ dermal contact, particulate inhalation and off-site migration. CCME does not provide a human health based guideline for PCBs.

**Guideline:** In the absence of an applicable CCME SQG, the NSE Tier 1 EQS for soil, Industrial Land Use, non-potable groundwater and coarse-grained soil are referenced (July 6, 2013).

**Rationale:** The NSE Tier I EQSs are also based on multiple pathway analysis considering human health, but do not include the particulate inhalation or off-site migration check.

**Parameters:** **NORM**

**Guideline:** *Canadian Guidelines for the Management of NORM, 2013, ISBN: 978 1 100 23019 1, Cat. No.: H129 34/2013E PDF 130465; (hereafter referred to as the Canadian NORM Guidelines).*

**Rationale:** The Canadian NORM Guidelines lists the concentration of diffuse NORM in solids (radioactive isotopes of uranium, radium, etc.) that may be released unconditionally (i.e., without regard for radiological ramifications). The Canadian NORM guidelines for diffuse NORM in liquids were also applied to soil samples submitted for NORM leachate analysis to determine potential disposal requirements (if applicable).

### **Groundwater**

**Parameters:** **Metals and PCBs**

**Guideline:** For non-petroleum hydrocarbon parameters in groundwater, the primary guidelines referenced are the NSE PSS (July 6, 2013) for Groundwater at a Non-Potable Site – coarse grained soil, Industrial land use (July 6, 2013) and the Federal Interim Groundwater Quality Guidelines (FIGQGs) for Commercial and Industrial Land Uses, Tier 2 – Inhalation (human health), coarse-grained soil (Version 4, June 2016). For metals and PCBs, there are no applicable NSE PSSs or FIGQGs for human health, as the only applicable exposure pathway is inhalation and metals as well as PCBs are non-volatile, resulting in no exposure.

**Rationale:** The NSE PSS and FIGQGs for Commercial and Industrial Land Uses, Tier 2 – Inhalation (human health) are used for screening purposes as these standards were adopted from Canadian jurisdictions, where available, and are based on pathway specific analysis for human health.

**Guideline:** For groundwater sampling locations located along the boundary of the Site with Chaleur Bay, the NSE PSS and FIGQGs Tier 2 for Groundwater Discharge to Surface Water, Discharge to Marine Water (July 6, 2013) would also apply. However, given the lack of applicable screening criteria for protection of human health, the NSE PSS were used for screening metals and PCBs in groundwater at the Site.

**Rationale:** The NSE PSS for Groundwater Discharge to Surface Water, Discharge to Marine Water are used for screening purposes where groundwater is potentially discharging to a marine aquatic environment, in order to evaluate potential effects to nearby marine aquatic life. The NSE PSS for Groundwater Discharge to Surface Water



>10 m from a Marine Surface Water Body are applied to boundary groundwater sampling locations at 10 m or greater from Chaleur Bay. Similarly, the FIGQG Tier 2 – Marine Life guidelines are also used for screening purposes where groundwater at 10 m or greater from a receiving water body is potentially discharging to the water body, in order to evaluate potential effects to nearby marine aquatic life.

**Parameters: Petroleum Hydrocarbons (BTEX/mTPH)**

*Guideline:* For petroleum hydrocarbon parameters in groundwater, the main criteria referenced are the RBCA Tier 1, Atlantic RBCA for Petroleum Impacted Sites in Atlantic Canada, Version 3, User Guidance, Appendix 3 – Table 4b: Tier I RBSL, July 2012, revised January 2015, Industrial Receptor, non-potable groundwater use, coarse-grained soil type for human health.

*Rationale:* The Table 4b RBCA Tier I RBSLs for groundwater are based on multiple pathway analyses considering human health in an industrial setting which includes adult receptors. These are the standard guidelines for petroleum hydrocarbons used throughout Atlantic Canada. Non-potable groundwater use has been chosen as the Site and surrounding properties are supplied with water by an off-Site source.

*Guideline:* For groundwater sampling locations located along the boundary of the Site with Chaleur Bay, the RBCA Tier 1 Atlantic RBCA for Petroleum Impacted Sites in Atlantic Canada, Version 3, User Guidance, Appendix 2 – Table 3a – Groundwater Ecological Screening Levels (ESLs) for the Protection of Freshwater and Marine Aquatic Life, are referenced as the primary screening levels to assess potential impacts to nearby aquatic life.

*Rationale:* The Table 3a Tier 1 RBSLs for groundwater are for use in evaluating groundwater quality at sampling locations at 10 m or more from a freshwater or marine aquatic water body. Where groundwater locations are situated less than 10 m from an aquatic water body, RBCA recommends use of the Table 3a Surface Water screening levels.

*Guideline:* Where the boundary groundwater sampling locations are located greater than 10 m from the Chaleur Bay, RBCA Tier 1 Table 3b is referenced for guidelines adjusted for distance to receiving aquatic environments.

*Rationale:* Where groundwater locations are situated more than 10 m from an aquatic water body, RBCA recommends the use of Table 3b screening levels, which have been adjusted for distance to the receiving water body.

Due to the highly developed nature of the industrial site, the pathway from shallow groundwater to plants and soil Invertebrates is not considered applicable.

**Parameters: PAHs**

*Guideline:* For non-petroleum hydrocarbon parameters in groundwater, the primary guidelines referenced are the NSE Tier 1 EQS for Groundwater at a Non-Potable Site – coarse grained soil, Industrial land use (July 6, 2013) and the FIGQGs for Commercial and



Industrial Land Uses, Tier 2 – Inhalation (human health), coarse-grained soil (Version 4, June 2016).

*Rationale:* The NSE Tier 1 EQS and FIGQGs for Commercial and Industrial Land Uses, Tier 2 – Inhalation (human health) are used for screening purposes as these standards were adopted from Canadian jurisdictions, where available, and are based on pathway specific analysis for human health.

*Guideline:* For groundwater sampling locations located along the boundary of the Site with Chaleur Bay, the NSE PSS (July 6, 2013) and FIGQGs Tier 2 for Groundwater Discharge to Surface Water, Discharge to Marine Water (July 6, 2013) would also apply.

*Rationale:* The NSE PSS and FIGQG Tier 2 – Marine Life guidelines are used for screening purposes where groundwater at 10 m or greater from a receiving water body is potentially discharging to the water body, in order to evaluate potential effects to nearby marine aquatic life.

**Parameters:** NORM

*Guideline:* Canadian NORM Guidelines

*Rationale:* The Canadian NORM Guidelines lists the concentration of diffuse NORM in liquids (radioactive isotopes of uranium, radium, etc.) that may be released unconditionally (i.e., without regard for radiological ramifications).

### **Sediment**

**Parameters:** Metals

*Guideline:* For metals, the CCME Sediment Quality Guidelines (SeQGs) for the Protection of Aquatic Life, Marine, Interim Sediment Quality Guidelines (ISQGs) and Probable Effects Levels (PELs), CCME Factsheets (accessed online, October 2019) were used for comparison purposes. In addition, the NSE EQS for marine sediment were also referenced.

*Rationale:* The CCME ISQGs and PELs were used as the primary screening values, as these sediment quality guidelines are the standard sediment screening levels for use in Canada. The CCME SeQGs adopted by the federal government were developed using a two-tiered approach. The CCME ISQGs include a set of contaminant concentrations that were derived on the basis of the threshold effect level. This value represents the concentration below which adverse biological effects are rarely expected. The CCME guidelines also specify a PEL, which defines the level above which adverse effects in biota are expected to occur frequently. It should be noted that the SeQGs were derived using conservative assumptions; exceedances of these guidelines at a particular site indicate a need for further assessment but are not necessarily indicative of ecological effects.



### *Surface Water*

**Parameters: Metals**

*Guideline:* For non-petroleum hydrocarbon parameters in surface water, such as metals, the main criteria referenced are the CCME Canadian Water Quality Guidelines (WQGs) for the Protection of Aquatic Life, Marine Life, long term screening levels, CCME Factsheets (accessed online, October 2019). The NSE EQS for marine water were also applied.

*Rationale:* The CCME WQGs for marine life were used as the primary screening values, as these guidelines are the standard marine surface water screening levels for use in Canada. The CCME WQGs adopted by the federal government were derived on the basis of the lowest estimates of toxicity of chemicals to fish, invertebrates and plants. This value represents the concentration below which adverse biological effects are rarely expected. For parameters that CCME does not have screening values, the NSE adopted surface water guidelines from other jurisdictions in the development of the NSE PSS. In New Brunswick, the NSE PSS values are typically used in the absence of CCME WQGs and are endorsed by the NBDELG. It should be noted that the CCME WQGs and NSE PSS were derived using conservative assumptions; exceedances of these guidelines at a particular site indicate a need for further assessment but are not necessarily indicative of ecological effects.

### *Transformer Oil*

**Parameters: PCBs**

*Guideline:* Part 2 of the PCB regulations (SOR/2008-273) of the Canadian Environmental Protection Act, 2008 and amended in 2015.

*Rationale:* The PCB regulations of the Canadian Environmental Protection Act identify specific concentrations of PCBs in oil of equipment that above which, require specific handling, storage, transportation and disposal. These guidelines are used across Canada to define equipment that contains PCBs or equipment that is considered to be "PCB-free".

Specific criteria and guidelines are also presented in the HGS and DGA report as well as the NORM and Hazardous Materials Survey report prepared in conjunction with the 2019 Closure Plan Update (Appendix B and C).

## 10.8 Environmental Mitigation Measures

Based on the data collected from the Site in 2019 as well as historical investigation, the general environmental mitigations proposed as part 2008/2009 Closure Plan PFS such as soil cover, New Slag Pile Cover, groundwater treatment and long term surface water management. The following provides an overview of the primary environmental mitigation measures included in the 2008/2009 PFS and amendments to the mitigation measures recommended as part of the 2019 Closure Plan Update. Other specific amendments included in the 2019 Closure Plan Update compared to the 2008/2009 Closure Plan PFS are provided in the technical memorandums provided in Appendix A.





### *Residue Piles*

The 2008/2009 Closure Plan PFS indicates that above ground piles of material except the slag piles will be removed by Glencore. However, as noted in GHD technical memorandum 11198639-Memorandum-7 (Appendix A), Glencore representatives indicated that 2019 Closure Plan Update should include transportation and off-Site disposal of materials that are not suitable for disposal at the Brunswick Mine Site, including stockpiled materials such as imported or and process sludge. In December 2019, Glencore representatives provided GHD with quantity estimates and characterization data for stock-piled material that is not suitable for disposal at the Brunswick Mine Site (see Table 8). Transportation and off-Site disposal of the stock-piled residue materials at an approved facility has been included in the 2019 Closure Plan Update.

### *Building Materials*

The 2008/2009 Closure Plan PFS indicates that four types of demolition debris from the Brunswick Smelter Complex are expected to be disposed of at Brunswick Mine Site (non-impacted demolition debris (that cannot be left in place), metal-impacted demolition debris with Site-specific native heavy metals, metal-impacted demolition debris with non-native heavy metals and NORM impacted demolition debris. During the August 1, 2019 Alternatives Evaluation meeting, the concept of “non-native” metal debris was discussed and Glencore representatives indicated the concept of “non-native” metal impacted materials should be re-evaluated as part of the 2019 Closure Plan Update. Glencore representatives indicated that metal impacted demolition debris present at the Site could be disposed of at the existing demolition debris open pit area of the Brunswick Mine Site. The only “non-native” material that would not be suitable for disposal at the Brunswick Mine Site is process sludge or unprocessed feedstock (discussed above). The elimination of non-native metal impacted demolition debris eliminates the design and permitting of a special waste landfill at the Brunswick Mine Site which was included in the 2008/2009 Closure Plan PFS. A special waste landfill has not previously been permitted in the Province of New Brunswick and its undertaking would require evaluation under the provincial Environmental Impact Assessment regulation. Construction of a hazardous waste landfill is also listed as a designated project under the current federal Canadian Environmental Assessment Act (2012).

The 2008/2009 Closure Plan PFS also indicates that most of the concrete (approximately 88%) will be cleaned and acceptable for re-use as backfill on-Site with the remainder being disposed at the Brunswick Mine Site. This is a significant assumption given the anticipated effort to complete an industrial cleaning of the concrete (e.g. high pressure washing) followed by specific testing. In addition, there is only a small volume of voids that will require backfilling and the 2008/2009 Closure Plan assumed that the remainder of the concrete would be crushed and used as part of the Site cover. GHD notes that it may be more economical to complete a “wash down” of the concrete for dust control during demolition followed by transport to Brunswick Mine Site demolition debris open pit without crushing the material. This was reviewed with Glencore representatives during the August 1, 2019 meeting, and Glencore representatives advised that the cleaning methodologies proposed in the 2008/2009 Closure Plan assumed complete cleaning along with swab testing, which is no longer the preferred closure concept. Glencore concurred with the GHD approach of a dust control “wash down” of the concrete and the assumption that the concrete would be considered as demolition debris suitable for disposal at the demolition debris open pit at Brunswick Mine Site. This dust control “wash down” approach for the concrete followed by disposal at the Brunswick Mine Site



will be carried forward in the current study update and the concrete disposal quantities will be adjusted.

The 2008/2009 Closure Plan PFS also identified the requirement to construct a special waste landfill at the Brunswick Mine Site for disposal of NORM impacted building materials, equipment and soil at the associated with the Fertilizer Plant. As previously indicated, a NORM survey was completed specific to the Fertilizer Plant area in 2019 (GHD, 2019) to verify the quantity of building materials and/or soil that is impacted with NORM above specific levels that would require special handling. Based on the 2019 survey results, the NORM impacted materials requiring special handling or disposal was generally limited to equipment stored in the Scrap Yard area, former Gypsum Line piping stockpiled in the Smelter Area and minor amounts of residual bulk product in the PAP building. As such, it is considered unlikely a special waste landfill would be constructed at the Brunswick Mine Site for this small quantity of NORM impacted material. A preliminary quantitative Trade-off Study related to cleaning and disposal options of NORM-impacted material is provided in Section 11.2.

#### ***Soil Cover – Smelter Area and MHW Area***

The 2008/2009 PFS Closure Report proposed placing a vegetated soil cover over heavy metal impacted soil and building foundations in the Smelter Area, MHW, Fertilizer Plant and the New Slag Pile. The vegetated soil cover reportedly required for the Smelter Area was approximately 68 Ha and over 31 Ha for the MHW Area (including the Fertilizer Plant). The protective soil cover area proposed in the 2008/2009 PFS Closure report was based on SSTLs developed as part of a risk assessment completed for the Site in 2007. The document also indicates that specific screening criteria for metals in soil are not available for New Brunswick and soil would be covered if concentrations exceed the SSTLs developed for the protection of human health.

Based on results of the 2019 HGS and DGA and re-screening the metal concentrations in surface soil against recent risk based SSTLs developed in relation to the rail transport of ore concentrate to the Smelter from the Brunswick Mine for the Protection of Human Health for an Industrial Worker (CRA, 2013), the estimated aerial extent of metal impacted soil at the Site requiring covering is approximately 92 hectares (ha)  $\pm$ 20% including:

- 71.5 Ha in the Smelter Area (includes Belledune Point); and
- 20.5 Ha in the combined Materials Handling West Area and Fertilizer Plant.

In addition, 2008/2009 Closure Plan PFS document indicated that the cover thickness will be 0.3 m, however, in several other sections of the 2008/2009 Closure Plan PFS report, the cover thickness is listed at 0.6 m. As noted in GHD technical memorandum 11198669-Memo-7, this inconsistency was reviewed with Glencore representatives during the August 1, 2019 meeting and it has been confirmed that the cover thickness is assumed to be 0.6 m for purposes of the 2019 Closure Plan Update.

The estimated volume of material required for cover the areas of metal impacted soils above current industrial land use SSTLs, assuming a 0.6 m thick cover to eliminate the human health exposure pathway would be 550,000 m<sup>3</sup> (including 415,000 m<sup>3</sup> of granular borrow material and 135,000 m<sup>3</sup> of organic topsoil [0.15 m thick]). This volume of cover material would include the terrestrial areas Belledune Point (as shown on Figure 10).



The areas presented above do not include slag contained in the New Slag Pile area (a description of slag samples collected during the HGS and DGA is included in Section 4.6).

An alternative option for management of metal impacted soil in the Smelter Area and MHW Area is excavation and off-Site disposal of the impacted soil. For the purposes of the 2019 Closure Plan Update, application of soil cover has been assumed consistent with the 2008/2009 Closure Plan PFS. However, a trade-off study is recommended as part of the additional pre-decommissioning engineering studies to evaluate potential future environmental liabilities associated with covering the metal impacted soil compared to excavation and off-Site disposal.

### ***Soil Cover – Slag Piles***

The 2008/2009 Closure Plan PFS document indicates that a vegetative soil cover will be placed on the Old and New Slag Piles. The Old Slag Pile formerly located on Belledune Point area of the Site (now the location of the Saltwater Lagoon) has since been relocated to the New Slag Pile located to the south of Route #134. The 2008/2009 Closure Plan PFS estimated the New Slag Pile area requiring covering at 15 Ha. However, the New Slag Pile area requiring covering has significantly increased since 2009 and is currently estimated to be 21 Ha.

In 2018, Roy Consultants (Roy) prepared a conceptual closure plan in 2018 for the New Slag Pile area; which presents a different cover system than proposed in the 2008/2009 Closure Plan PFS. The updated closure New Slag Pile closure plan previously prepared by Roy will be carried forward in the 2019 Closure Plan Update. In particular, the 2008/2009 Closure Plan PFS assumed the earthen dam would be removed which will likely affect hydrology of the wetland and potential habitat compensation. As such, the 2019 Closure Plan Update includes retaining the earthen dam and incorporation of the regulated wetland into the conceptual closure plan for the New Slag Pile. In addition, the conceptual plan includes the creation of an engineered wetland in the borrow pit area of the Site, designed to receive run-off from the covered slag pile before discharging to Chaleur Bay. Details of the closure plan specific to the New Slag Pile and conceptual engineered wetland area are provided in Section 11.3.

### ***Soil and Groundwater Treatment – Petroleum Hydrocarbons***

For the purposes of the 2019 Closure Plan Update, it has been assumed that the hydrocarbon impacted soil and groundwater are likely present in certain areas on-Site and that assessment of these areas will only be possible after the Smelter is closed due to the potential for buried utilities and existing building infrastructure near storage tanks. It also assumed that the volume of impacted materials may have been reduced since 2009 given the reduction in use of petroleum hydrocarbons in the Smelter operations (i.e., conversion to a propane fuel source).

Section 10.1 describes past test locations with elevated mTPH (ranging from 3,400 to 11,000 mg/kg) in soil at various locations within the Smelter area. Concentrations mTPH in groundwater exceeding the Tier I RBSL of 20 mg/L were previously detected in several test locations within the Smelter area. Free phase petroleum product was not observed in the 53 monitoring wells sampled at the Site in 2019 and mTPH was <20 mg/L in monitoring wells that historically contained hydrocarbon concentrations exceeding applicable guidelines (i.e., MW-1 and located near the former No. 2 bulk fuel oil AST north of Lead Refinery). In addition, diesel impacted groundwater was observed in a 2019 trench excavation west of the Sinter Building.



The area and volume of hydrocarbon impacted soil assumed in the 2008/2009 Closure Plan PFS was 8,000 m<sup>3</sup> and estimated volume of hydrocarbon (product) impacted groundwater is 500,000 litres and these volumes are recommended to be carried forward in the 2019 Closure Plan Update. It is also noted that the management / remediation of the hydrocarbon impacted soil, after Facility closure, will also serve to remediate the associated localized shallow groundwater impacts.

A cost effective strategy for on-Site management and remediation of mTPH impacted soil and groundwater includes the use of selected, remaining concrete building floor slab(s), with any floor drains sealed, to be used as bio-treatment pads for the impacted soil.

Soil will be excavated from the various locations transported to the bio-treatment pads to a thickness of 0.6 to <1 m. Soil nutrients consisting of nitrogen and phosphorous nutrients (fertilizer) will be blended into the soil. The soil will be mechanically turned the following year and then tested for mTPH to document quality against applicable Tier I RBSLs and/or Tier II SSTLs. After the treated soil is confirmed to meet the screening level it will be covered in place with 0.15 m of organic soil and seeded.

Product impacted groundwater encountered in the excavations will also be treated on-Site using a vacuum truck, a Frac storage tank and granular activated carbon (GAC) treatment system. Product sheening in the groundwater in the open excavations will be skimmed using the vacuum, allowed to settle in the Frac tank (so that the product floats to the surface). The water in the tank will be routed through the GAC, periodically tested to confirm quality and discharged on-Site.

#### ***Metal Impacted Groundwater – Back 40, Back 50 and Process Sludge Storage Areas***

A cost effective strategy for on-Site management and remediation of metal impacted shallow groundwater likely to be present within the Back 40, Back 50 and Process Sludge Storage Areas following closure is to utilize and enhance a portion of an existing surface drainage controls.

The ditch located along the south side of the rail line will be lengthened approximately 300 m and deepened to intersect the shallow groundwater table under low flow conditions. The base and sides of the new ditch will be armored with rip-rap stone and graded to the planned engineered treatment wetland (in the CRP area) to reduce dissolved metal concentrations naturally before the water flows by gravity to Chaleur Bay (see below and also Section 11 – *Engineered Wetlands*). Prior to, and during the wetland construction, the water will need to be pumped to the WWTP for treatment before being discharged to Chaleur Bay.

This remedial strategy will remove long term requirements for power consumption and equipment maintenance. The remedial option will require further hydrological engineering to ensure proper grades can be maintained as well as treatability studies to ensure the engineered wetland can naturally attenuate the metal concentrations of the influent water.

#### ***Surface Water***

The water management section of the 2008/2009 Closure Plan PFS was subdivided into two main sections covering the scope of surface water management after closure and the water management and infrastructures during execution of closure works. A third, supporting section provides a hydrological study update and the supporting values used in conceptual design work. The fourth and final section of the plan addressing the old slag pile erosion control was not considered for the 2019



Closure Plan Update as the old slag pile has since been moved to the new slag pile and is no longer a part of the decommissioning work.

The 2008/2009 Closure Plan PFS assumes that retention ponds will remain at the Site post-closure and the water management after closure will be limited to surface water drainage system consisting of drainage ditches. In addition, the previous closure plan assumed the WWTP at the Site would remain operational for a period of five to ten years post closure to treat collected surface water (and groundwater) until discharge criteria at the effluent points are reached. The surface water management plan for the 2019 Closure Plan Update is similar to the previous plan in that surface water at the Site post-closure (post soil cover) will be collected by drainage ditches and existing catch basins or stormwater drains will be removed to the extent possible. However, one key difference to the 2019 Water Management Plan will be the construction of engineered wetlands (conceptual) in the Smelter Area (conversion of the CRP to a wetland), the MHW Area (utilizing the existing Storm Water Holding Pond, then to a new engineered treatment wetland to be constructed in the current location of the Bulk Acid Storage Tanks), and the New Slag Pile (utilizing the borrow pit or a portion thereof).

The construction of engineered wetlands (conceptual) is considered to be an alternative passive treatment option for remediating metal impacted water potentially associated with the Site post-closure instead of operating the WWTP for an undetermined period of time. GHD has successfully applied this passive water treatment concept at other industrial facilities in New Brunswick that has limited long term operational and maintenance costs associated with traditional mechanical or chemical water treatment technologies.

Details on the water management plan during Facility decommissioning activities and post-closure are provided in Section 12.0.

## 10.9 Environmental Management of Construction/Demolition

As part of the final Facility demolition designs (i.e., final demolition methodology and sequencing), an Environmental Management Plan (EMP) will be prepared to effectively mitigate potential environmental impacts associated with the closure activities. The EMP will include protocols for specific activities such as refuelling equipment, leak and spill prevention plans, work near surface water bodies, domestic and sanitary waste collection, erosion and sedimentation control plans, contingency plans including spill notification and clean-up protocols, Facility access plans, stormwater management plans, a noise control plan, and a dust control plan. A project-specific PCB work plan will be created, if required. In addition, an ACM Abatement Plan, ODS removal plan and other hazardous removal plans will also be developed as part of the EMP. Glencore's HSEC representative will be responsible to ensure the EMP is being followed by other Glencore personnel and contractors working at the Facility for the duration of the closure works. Further details on the environmental management measures that will be implemented during the closure activities are provided in Section 14.0.



# 11. Demolition and Management of Demolition Material and Wastes

## 11.1 Current Infrastructure Inventory

GHD conducted a detailed walk-through inventory of each structure comprising the Brunswick Smelter in conjunction with a detailed review of existing construction drawings and other equipment information detailed in the 2008/2009 Closure Plan PFS or information provided by Glencore personnel. The material quantities in the 2008/2009 Closure Plan PFS are considered accurate and complete, and the 2008/2009 quantities were utilized in the current study update. As such, detailed material take offs from field measurements and drawings were not conducted for all Facility infrastructure requiring decommissioning. However, as conditions at the Site have changed since the completion of the 2008/2009 Closure Plan PFS due to on-going operations and maintenance activities, the quantities of demolition debris, regulated materials and recyclable materials were adjusted accordingly.

The purpose of the infrastructure inventory was to develop a reasonable and approximate estimate of the types of materials that exist at the Site. Through development of the material inventory, an approximate estimation of the quantities associated with decontamination and industrial cleaning of the Site in advance of demolition, and the volume of voids that would require infilling following demolition, were also determined.

This section provides the classifications, descriptions, and an estimate of the quantity of materials and waste that would be generated if the Site is closed and demolished. Backup for the adjusted material quantity calculations are provided in Appendix H.

### 11.1.1 Classification, Description, and Quantity of Materials

The types of potential demolition materials have been categorized into four principal types, specifically: hazardous and regulated wastes, bulk solid waste, demolition debris, and recyclable materials. Hazardous and regulated wastes and bulk solid waste must be disposed of in accordance with applicable federal and provincial regulations. Non-hazardous and metal-impacted demolition debris will be disposed of in the demolition debris open pit at the Brunswick Mine Site. Recyclable materials have inherent asset value and may be shipped off-Site for material recycling. A description of the waste and waste classification of materials to be addressed during decommissioning was developed based on infrastructure identified in Table 6.

#### *Hazardous and Regulated Materials*

Estimated quantities for the hazardous and regulated wastes for the Site previously identified in Section 10.1.5 are detailed in Table 7.

An inventory outlining the amount, type and location of chemicals and ACM was provided by Glencore (summarized in Appendix H). The number of other regulated wastes such as HID lamps, light ballasts, ODS, mercury devices, and batteries were estimated based on quantities provided by Glencore, based on professional experience at other similar industrial facilities and from GHD's Site visits, and are included for estimating purposes only. As detailed in Section 10.1.5, these inventories



are assumed based on the information available at the time of the closure plan but may be incomplete and may require additional assessment prior to completing decommissioning activities.

In some cases, the volume of wastes generated during decommissioning is speculative, being dependent on the volume of residuals in process equipment and structures at the time of decommissioning.

### ***Demolition Debris***

Demolition debris is considered waste that is not regulated and has no inherent recyclable value. Estimated quantities for the following demolition debris for the Facility are detailed in Table 7, specifically:

- Wood;
- Non-ACM Insulation;
- Roofing Materials; and
- Non-recyclable Concrete and Concrete Block.

Demolition debris will be disposed of at the existing open pit at the Brunswick Mine Site.

### ***Bulk Solid Wastes***

Quantities of processed raw materials, imported ore and process sludge, as well as a process tank inventory (included in Appendix H and summarized in Table 7) and an estimate of residual materials requiring handling and disposal (provided as Table 8) were provided by Glencore. For the purposes of estimating, GHD has carried the “Most Likely Inventory” quantities provided by Glencore.

The following bulk solid wastes are present at the Facility and will require off-Site disposal at a licensed facility:

- In-process materials stockpiled in the Back 40/50 and North of the Acid Plant;
- Blast Furnace in-process materials;
- Acid Product/Residue in Pipelines/Tanks;
- Petroleum Product/Residue in Pipelines/Tanks; and
- Sludge/Residue from Acid Plant Old Mist Precipitators (containing PCBs between 2 ppm and 50 ppm).

The following bulk solid wastes will be disposed of at the Brunswick Mine Site:

- Sludge from the CRP;
- Sludge generated from cleaning ditches;
- Ceramic and Plastic Saddles;
- Refractory Brick; and
- Creosote/pressure treated timber products (rail ties).



### ***Recyclable Materials***

Quantities for the following recyclable materials for the Facility are detailed in Table 7, specifically:

- Plate and Structural Standard Carbon Steel;
- Standard Carbon Steel (pipes, cladding, ducting);
- Stainless Steel (tanks, pipes, tubing); and
- Copper (wiring).

#### **11.1.2 Decommissioning Cleaning Quantities**

Most of the Brunswick Smelter facility infrastructure will require industrial cleaning. The following sections provide industrial cleaning details.

##### **11.1.2.1 Hazardous Industrial Cleaning**

Hazardous cleaning will be required in some of the buildings and infrastructure at the Facility that have been exposed to dust and/or residue containing elevated concentrations of heavy metals or hazardous materials such as sulfuric acid and battery acid. The areas will need to be assessed as part of the pre-demolition engineering activities to determine the extent of cleaning required and develop specific methods and health and safety procedures to be followed during the cleaning.

An estimate of process tank residual product and sludges in process tanks, pipelines, pits, trenches and sumps requiring industrial cleaning is provided in Table 9. The areas identified to require hazardous cleaning includes the following:

##### ***Smelter Area***

- SRF Building;
- Lead Refinery;
- Furnace Building;
- Metal Storage Building;
- Dross Building;
- Silver Refinery;
- Sinter Plant;
- Crusher Building;
- Charge Preparation Building;
- WESP;
- Proportioning Plant;
- Sinter and Furnace Baghouses and stacks;
- Acid Plant and associated tanks/pipelines;
- Acid Stack;





- RMS Building;
- Car Unloading Building;
- Thaw Shed;
- Quonset Storage Dome;
- SRF, Secondary Lead, and Sinter Storage Domes;
- Smelter Conveyor System and Transfer Houses;
- WWTP including Settling Basin, Dewatering Pad and Pumphouse; and
- RPW System including building, clarifier, ponds and pool.

#### ***MHW Area***

- Battery Recycling Plant;
- Battery Storage Building;
- DAP Storage Building;
- Acid Pumphouse;
- Acid Building;
- Process Acid Tanks;
- Concentrate Storage Silos;
- Bulk Acid Tanks (#1 and #3);
- Railcar and Truck Unloading Building;
- Concentrate Storage Domes; and
- MHW Conveyor System and Transfer Houses.

#### ***Fertilizer Plant***

- DAP Building; and
- PAP Building (in addition to residues and dust containing heavy metals, the PAP Building also contains equipment that is potentially impacted with NORM. The management of the NORM impacted equipment are further discussed in Section 11.2.).

#### **11.1.2.2 Non-Hazardous Industrial Cleaning**

Non-hazardous cleaning will be required for the interior of various support buildings at the Smelter and MHW Areas, including the Maintenance Shop, Garage, Sandblasting, Changehouse, Saltwater Pumphouse, etc. The areas will need to be assessed as part of the pre-demolition engineering activities to determine the extent of cleaning required.

#### **11.1.2.3 Other Cleaning Activities**

Based on information provided to GHD the transformers are PCB-free. However NBDELG may require that all transformers be retested before leaving the Facility. Testing of all transformers will be



completed as part of the pre-demolition engineering activities. Results of the transformer testing program will dictate transformer oil draining and disposal requirements to be implemented as part of the Facility decommissioning work.

Various process tanks associated with the Facility will be cleaned through pressure washing as part of the decommissioning activities.

A general wash down cleaning of the building interiors will also be required to remove residual surface dust. This cleaning will be conducted with hoses to get building components free of dust residue prior to transport as either recyclable material to a scrap yard or general demolition debris to the Brunswick Mine open pit.

### 11.1.3 Below Grade Voids

There are a number of underground void spaces and pipe trenches associated with the Site services and include:

- Approximately 2,100 m of various diameters underground piping for process water and other services;
- Approximately 900 m of salt water intake lines (diameter ranging from 0.4 m to 0.9 m) servicing the Smelter infrastructure and 900 m of 0.45 m salt water intake line servicing the PAP building from the Salt Water Pumphouse;
- Approximately 325 m of 1.8 m diameter salt water/storm water discharge lines;
- Approximately 684 m of underground fuel lines;
- Approximately 270 m of 0.4 m diameter underground concrete freshwater pipeline on the MHW Area of the Site; and
- Approximately 1,000 m of 0.76 m diameter underground freshwater pipeline on the Smelter Area of the Site.

Other void spaces include tunnels, trenches, pits and sumps and small voids. It is estimated that demolition of the Site will create void space of 13,402 m<sup>3</sup> as summarized in Table 10 (detailed calculation provided in Appendix H). It is assumed that any on-Site underground pipes that are greater than 0.5 m in diameter will be removed/crushed as part of future closure activities to limit the risk of subsidence causing damage to the protective soil cover. Underground pipes on-Site that are less than 0.5 m in diameter will be abandoned in place and volumes for those pipes have been omitted from the void calculations.

## 11.2 NORM Trade-Off Study

As part of the 2008/2009 PFS Closure Plan, a NORM characterization study was completed for the Fertilizer Plant area of the Brunswick Smelter in 2006 (CRA, 2006). This initial NORM characterization study identified several building surfaces and adjacent soil areas that contained NORM concentrations above acceptable Canadian NORM guidelines that would require specific remediation and/or disposal requirements. However, a supplemental assessment program completed in 2008 identified concentrations of NORM in soil adjacent to the DAP and PAP buildings that were below applicable guidelines indicating additional soil management or remediation may not



be required. As the previous NORM data is over ten years old, a NORM characterization study was completed 2019 by GHD as part of the 2019 Closure Plan Update scope of work. The 2019 NORM characterization survey was completed to obtain updated information on current concentrations of NORM inside the DAP and PAP buildings as well as in soil and groundwater adjacent to these buildings. The characterization study was also intended to quantify NORM impacted material that will require specific remedial planning as part of future facility closure activities.

Results of the 2019 NORM characterization study are provided in Appendix C. In general, the materials remaining at the Site that have concentrations of diffuse NORM exceeding applicable Canadian NORM guidelines is limited to the following:

- Although the non-intrusive NORM screening survey did not identify elevated gamma readings in the PAP building, residual bulk product samples collected from the PAP building (19BP-1 (Filtrate Sump) and 19BP-2 (PAP building Conveyor Feeding Mill) had concentrations of diffuse NORM exceeding applicable Canadian NORM guidelines. As such, this residual bulk product remaining in the PAP building would require removal and disposal at an approved facility as part of future building decommissioning activities. Approximately 6 m<sup>3</sup> of residual bulk product is estimated that will require removal and disposal as NORM.
- The non-intrusive NORM screening survey conducted on the Gypsum Line piping being stored in the Smelter Area identified NORM measurements consistent with background conditions. However, a bulk sample of residual gypsum accumulated in the annular space between the plastic inner sleeve and the outer wood sheath had NORM concentrations exceeding applicable Canadian NORM guidelines for Unconditional Derived Release Limits of Diffuse NORM Sources. As such, the former gypsum piping being stockpiled in the Smelter Area will likely require cleaning or disposal at an approved facility as part of future Site closure activities. There is approximately 225 metres of 0.6 metre diameter piping currently being stored at the Site that has the potential to be impacted with NORM (approximately 63 m<sup>3</sup>). The volume of residual gypsum accumulated in the annular space between the inner plastic sleeve and the outer wood sheath is estimated to be <0.1 m<sup>3</sup>.
- The majority of materials and equipment found within the Scrap Yard were identified to have NORM measurements above the NORM Management (Dose Management) Threshold and will likely require management (cleaning and recycling or off-Site disposal, whichever is most cost-effective) as part of future Site closure activities. Approximately 145 m<sup>3</sup> of NORM impacted materials and equipment is located in the Scrap Yard.

The gamma readings recorded in the PAP and DAP buildings and surrounding soil areas were generally consistent with background soil conditions in the area (0.05 µSv/hr) or within 2 to 4 times background conditions (0.1 to 0.2 µSv/hr) which is similar to the 2006 findings. These results indicate the remaining structures and equipment within the historical PAP or DAP operation areas will likely not warrant NORM mitigation during demolition of these former units. However, GHD was unable to perform NORM screening surveys on the filter pans located on the 4<sup>th</sup> floor of the historical PAP building due to inaccessibility during the 2019 Site visit. The filter pans located in the Scrap Yard contained NORM readings above applicable Canadian NORM guidelines and, therefore, for the purposes of the 2019 Closure Plan Update, it is assumed that the filter pans on 4<sup>th</sup> floor of the PAP building also contain residual NORM levels above applicable guidelines. This assumption



would need to be confirmed prior to completing building decommissioning and demolition activities. The volume of NORM impacted filter pans on the 4<sup>th</sup> floor of the PAP building is estimate at 14 m<sup>3</sup>.

For the purposes of the trade-off study, it has been assumed that the filter pans on the 4<sup>th</sup> floor of the PAP building will require removal from the building and then processed as NORM impacted material. To remove the filter pans, the deteriorated roof will likely require partial demolition and then the filter pans removed by crane subsequent NORM management. It is acknowledged that at the time of the decommissioning, the filter pans could potentially be cleaned in their current location (by manual or other means) and then processed as regular demolition debris. However, at this time, the effectiveness of potential in-situ cleaning methods to reduce the NORM levels to acceptable levels is not known. Removal of the filter pan equipment as NORM impacted material for subsequent cleaning and/or disposal exterior to the building envelope is considered a worst-case scenario and carried forward in the trade-off study.

The presence of diffuse NORM measurements above the NORM Management (Dose Management) Threshold on equipment and in residual product in the Fertilizer Plant indicates that these materials will likely require specific management measures as part of future Site closure activities. The total estimated volume of materials considered NORM impacted and requiring specific management measures is approximately 230 m<sup>3</sup> (current in-place volume). Three options were identified for the handling and disposal of the NORM impacted materials as described below:

1. Special Waste Landfill Construction - Construction of a special waste landfill at Brunswick Mine Site for disposal of building NORM impacted building materials, equipment and soils was included in the 2008/2009 PFS Closure Plan. The proposed special waste landfill for NORM materials included a double geomembrane liner with leachate collection and an impermeable cover system. The NORM-impacted materials landfill included in the 2008/2009 Closure Plan PFS had a total capacity of approximately 3300 m<sup>3</sup> and covered an area of 31 m by 45 m. Construction of a special waste landfill at the Brunswick Mine Site was also included in the current NORM trade-off study but the volume of material requiring disposal at the landfill would be significantly reduced compared to the 2008/2009 evaluation. For the purposes of this evaluation, the volume of NORM impacted materials anticipated to require off-Site disposal is 345 m<sup>3</sup> (230 m<sup>3</sup> in-place volume plus a 1.5 times bulking factor). Assuming a 25% contingency for unidentified NORM impacted materials, the total capacity of the special waste landfill would be approximately 430 m<sup>3</sup>. It is also noted that a construction of a hazardous waste landfill has not historically been permitted in the Province of New Brunswick and this disposal option may incur significant regulatory review including the potential for the preparation of a federal impact assessment.
2. Off-Site Disposal at an Approved Facility - Instead of construction of a special waste landfill at Brunswick Mine Site, there are three licensed disposal facilities in Western Canada (Saskatchewan and Alberta) which are approved to accept NORM contaminated materials. Given the relatively limited volume of NORM impacted material remaining at the Site, this option would eliminate long term liability and maintenance of a special waste landfill proposed in Option 1.
3. Equipment Cleaning - There is the potential that NORM impacted equipment stored in the Scrap Yard as well as the filter pans in the PAP building and Gypsum Piping at the Smelter Area could be cleaned of residual NORM and acceptable for recycling as scrap metal or for disposal at the



open pit at Brunswick Mine Site. For off-Site recycling or disposal as general waste, the NORM impacted materials would require cleaning so that residual NORM measurements are below the Dose Management Threshold of 0.5  $\mu\text{Sv/hr}$  which is also the radiation alarm levels set at scrap metal dealers in Eastern Canada (personal communication with American Iron and Metals (AIM) representatives). The general process of cleaning NORM impacted materials would be establishment of a containment area, cleaning of equipment using high pressure washers or HEPA vacuums and manual scraping followed by collection and off-site disposal of waste water. For the purpose of this evaluation, it is considered reasonable to assume that only 50% of the equipment can be cleaned thoroughly enough to meet NORM Dose Management Threshold limits rendering the material acceptable for recycling or general waste disposal. It is assumed the remaining 50% of the materials will not be sufficiently cleaned of residual NORM and will require off-Site disposal at an approved facility. The limitation on cleaning efficiencies is based on GHD's NORM management experience at other industrial facilities in North America and are similar to the assumptions included in the 2008/2009 PFS Closure Report.

Option 2 was chosen as the preferred method for disposal and handling of NORM impacted materials given the relatively small volume of NORM impacted material present at the Site, very similar anticipated costs between the options, and limitations on future liabilities compared to cleaning the equipment on-Site (Option 3). In addition, Option 1 poses significant risks to the project schedule, budget and future Glencore liabilities given the uncertainties associated with the construction and permitting of a hazardous waste landfill in the Province of New Brunswick.

### 11.3 Decommissioning Plan

The decommissioning plan for the Brunswick Smelter has been divided into the three following categories of activities: building infrastructure, civil infrastructure, and remediation of environmental impacts. The decommissioning objectives, activities, and sequencing requirements for each category are discussed below. A comprehensive hazard assessment to include work activities task-by-task, hazards, recommended controls and risk ranking will be completed by the demolition contractor prior to the commencement of the decommissioning and demolition activities.

#### 11.3.1 Building infrastructure

##### 11.3.1.1 Decommissioning Objectives

As part of the decommissioning of the Brunswick Smelter, the Facility associated structures, equipment, and support facilities will become inactive. If decommissioned, it is the intent of Glencore to safely remove these facilities through a demolition program that will meet the following specific objectives:

- Fully demolish and restore the Site to an open space condition with the majority of the Site held in perpetuity by Glencore as a vacant but fenced or partially fenced property;
- Minimize waste disposal through maximizing economic opportunities for reuse and recycling of materials; and
- Remove infrastructure to match existing grade. Slabs-on-grade and below-grade foundations to remain and above-grade concrete foundations will be removed to match existing grade.



### **11.3.1.2 Decommissioning Activities and Sequencing Requirements**

The decommissioning activities required for the building decommissioning are discussed below. The sequencing of the activities, where imperative to implementation, is also discussed. Prior to initiating Site decommissioning activities, the demolition contractor will set up Site offices and access points. Throughout the decommissioning and demolition, the contractor will also designate areas of the Site for equipment and salvage storage.

#### ***Glencore Decommissioning Activities***

After Facility closure is announced and prior to demolition contractor(s) mobilizing to Site, it is assumed that Glencore personnel will plan and provide support for the removal of all raw concentrate that is stacked on various areas of the Site, including re-distributing the concentrate to other Glencore facilities or returning the concentrate to the supplier.

In the 2008/2009 Closure Plan PFS, it was assumed that numerous decommissioning activities would be completed by Glencore personnel prior to demolition contractor(s) mobilizing to Site. However, as part of the 2019 Closure Plan Update, it has been assumed that decommissioning activities such as chemical sweep; emptying and disposal of liquids from pipelines, reservoirs, process piping and process equipment; removal and disposal of various residues in buildings, such as sludge and dust accumulations; and/or general cleaning will not be completed by Facility personnel prior to mobilization of decommissioning/demolition contractor(s).

However, should Glencore identify potential buyers for equipment resale or opportunities to transfer equipment to other Glencore facilities at the time of closure, it is assumed that Facility personnel will plan and provide support for dismantling and shipping of selected major pieces of equipment.

#### ***Chemical Sweep***

Prior to demolition, a thorough "sweep" will be made of all Facility buildings by the demolition contractor to ensure that all containerized materials have been accumulated and temporarily stored at a central collection point. Once the sweep is complete, a commercial waste disposal firm will be retained for the proper packaging, transportation, and disposal of the chemical wastes in accordance with provincial regulations.

#### ***Universal Waste Removal***

The removal, collection, and handling of each of the universal wastes will be required prior to demolition. Batteries will be recycled from battery banks as well as batteries that are found in emergency lights and exit signs. Light bulbs and fixture ballasts will be removed and recycled or disposed of in accordance with applicable regulations. ODS will be removed from refrigeration equipment and recycled. Cylinders of compressed gases will be returned to the supplier. Mercury-containing and radioactive devices will be collected and properly recycled or disposed of in accordance with applicable regulations. Computers and electronic waste such as circuit boards containing lead and mercury will be removed and recycled or disposed of in accordance with applicable regulations. Proper safety measures will be defined and a labour force will be employed that is trained in the removal and handling of these materials. Transportation and disposal will occur at a Glencore approved recycling site.



### ***Asbestos Abatement***

Prior to demolition, the removal of ACM must be completed. This work is to be performed by a licensed asbestos abatement contractor and consists of removal of friable ACM such as insulation for mechanical equipment, drywall compound, piping and pipe fittings and removal of non-friable ACM such as transite wall panels and floor tiles.

In preparation for asbestos abatement activities, the asbestos inventory prepared for the Facility in 2016 will be updated and verified. This is required due to on-going asbestos abatement performed by Glencore. The updated asbestos audit will be used as the basis to define the scope of work for ACM abatement.

Abatement of the vessel, larger piping, drywall compound and other equipment insulation will be within individual constructed containment areas around the equipment. Alternatively, glove bagging may be used for individual pipe fittings, elbows, and smaller piping. A third technique allows glove bagging at both ends of a long section of pipe. The pipe is then cut on the clean, insulation-free sections and lowered. This technique, termed "cut and wrap", requires that the entire lowered pipe section be wrapped in plastic and disposed of as ACM waste. Although this technique increases abatement productivity, it also requires the transportation and disposal of greater volumes of ACM waste. Mechanically lowering and removal of the pipe sections also presents a potential safety issue, as well as a loss of revenue given the salvage value of the pipe. For drywall compound abatement in the offices, laboratories and changehouses it is assumed that several large enclosures will be constructed to encompass several offices and rooms to cut down on enclosure construction costs and time.

All hazardous dust and concentrate residue accumulated in the working areas and on top of any asbestos will be cleaned prior the start of the asbestos removal. During abatement of the friable ACM, third party area-wide air monitoring will be conducted. Air monitoring is required to verify that no release of asbestos fibers has occurred from any containment, and within the containment to determine that the interior of the containment is "adequately cleaned" before removal.

All transite wall siding will be removed using either hand tools or mechanical equipment prior to demolition. For the majority of the exterior transite siding, it is anticipated that it will be removed by mechanical equipment with shear attachments and then lowered to the ground for the abatement crew to process and package for preparation to transport to the Brunswick Mine open pit. Any floor tiles within the buildings will be removed with hand held manual tools prior to demolition commencing. No power tools or abrasive methods will be used during the removal of any non-friable ACM.

A summary of the estimated ACM quantities within each area at the Site is presented in Appendix H.

### ***Decommissioning Cleaning***

As part of the decommissioning of the Brunswick Smelter, various equipment, bulk storage and process tanks, piping, ducts, pits, floor trenches, sumps, and surfaces will be purged, rinsed, and otherwise cleaned prior to demolition. This cleaning will remove accumulated solid residue and oils or other liquids that otherwise may be released during demolition activities. No free liquid may remain in equipment reservoirs or piping that will be released during demolition. Accumulated tank sludge must be removed and properly handled after equipment is taken out of service. The level of



cleaning will also be determined by the need to remove hazardous dust and residue. Cleaning will render the recyclable materials free of gross process residue, enabling shipment of salvageable materials.

Techniques for cleaning will include low volume, high-pressure water blasting, steam cleaning, washing with detergent or degreasing soap, and other means and methods. Wastewater will be contained and collected.

Cleaning would typically be completed in two stages. Initial cleaning would consist of cleaning that may occur while the facility is energized, such as cleaning of pipes and ductwork. Final cleaning would consist of cleaning that requires the area to be de-energized prior to cleaning such as washing of the interior building walls. During final cleaning, temporary power would be required for lighting and washing equipment operations.

In the 2008/2009 Closure Plan PFS, it was assumed that building concrete would be cleaned of metal impacted dust/residue and crushed for use as on-Site backfill and cover material. However, a significant cleaning effort would likely be required to render the concrete suitably clean for on-Site cover material. Therefore, it has been assumed that for the purposes of the 2019 Closure Plan Update, building concrete will only be “washed down” with hoses to get rid of dust residue, dirt and grime for dust control during demolition and transport to Brunswick Mine Site demolition debris open pit without crushing the material.

Process and storage tanks will be cleaned before being demolished. The interior of the tanks will be accessed by cold cutting an opening in the tank wall. Additional openings will be created as required to help control atmospheric conditions in the tank. Decommissioning activities will commence with the bulk removal of residual products (e.g., acid, petroleum, etc.) and sludge from the tanks. Interior piping, walls, and floor will be pressure washed to remove residual waste. Tanks will be verified empty prior to release for demolition. All petroleum tanks will be cleaned by a licensed petroleum contractor and transported off-Site for disposal (or re-certification and re-use).

Wastewater generated by cleaning activities will be directed to the CRP via the existing drainage network or collected and transported to the CRP via vacuum truck, for processing at the WWTP prior to discharging to Chaleur Bay. Cleaning wastewater will be segregated, collected and disposed off-Site if certain contaminants are anticipated (i.e., washwater containing acids, petroleum impacted washwater, or if any PCB-contaminated surfaces should be identified).

### ***Equipment Removal***

Prior to demolition, all equipment and parts will be drained of free liquids and removed from the buildings.

### ***Building Demolition***

Demolition will commence once the structures have been abated, regulated materials and wastes have been removed, and decommissioning cleaning has been completed. Demolition will require the use of heavy equipment equipped with specialized demolition attachments, such as grapples, pulverizers and shears. Experienced equipment operators will remove the structures by progressive demolition and the controlled gravitational fall of the structural components.





Given the height of the main buildings, the use of modern "high reach" equipment will be considered. This equipment is engineered and constructed to enable an extended boom to operate demolition attachments. The equipment tracks are spaced further apart than conventional hydraulic excavators. There is also an increase in the counter weight and improvements to the hydraulic systems. This extended boom equipment allows the operator to reach the top of the structures with greater control over the demolition process.

As part of mechanical demolition, demolition debris, concrete, cinderblock, brick, and ferrous and non-ferrous metals will be removed and segregated. The ferrous and non-ferrous metals (including: structural, stainless, and plate steel; and copper) will be sized to either mill sizing or other shipment size depending on the salvage contract to achieve maximum asset value. An on-Site scale may be maintained and certified to track disposition of salvage materials.

The removal of aboveground concrete footings, foundations, pedestals and slabs will occur to match existing grade, with the exception of the old concrete foundation present in the Saltwater Lagoon area, which will be abandoned in place to avoid destruction of ecological habitat. Basement floors will be fractured for drainage.

Safe, efficient operation will be critical to a successful demolition project. The contractor must adhere to high standards of safety and good housekeeping. Applicable NBDELG WAWA Permits will be required for work within 30 m of the coastline.

### ***Acid Stack Demolition***

Demolition of the Acid Stack will most likely be a controlled gravitational free-fall rather than a mechanical demolition by crane or mast climber. Given its size, it is unlikely that the use of heavy equipment would be feasible, unless a wrecking ball is used from an extended boom crane. A controlled collapse would likely be generated through the use of explosive charges. In the interest of safety, the demolition of the stack will be sequenced to occur once most other demolition activities are complete, and the approved fall area will be away from infrastructure to remain. To limit dust generation and dispersion of metal impacted soil on the Smelter Area Site, the approved fall area will be covered with granular material from the borrow area prior to the controlled collapse.

#### 11.3.2 Material Disposal

As summarized in Table 7, the decommissioning of Brunswick Smelter will generate quantities of various materials and wastes. A portion of these materials may be considered assets, in that they have recyclable value either for re-use or re-sale elsewhere. The recyclable value of these assets will be used to offset the costs of the Brunswick Smelter decommissioning program. The handling and disposition of assets at the Brunswick Smelter is discussed further in Sections 11.3.2.1.

Although some materials will be of little value, proper management will minimize their removal costs. Other materials identified in Section 11.1.1 are regulated and must be properly handled and disposed of in accordance with all applicable federal and provincial regulations. The detailed listing of materials to be generated by decommissioning the Brunswick Smelter is listed in Table 6, with the approach for the disposition of these materials discussed in the following subsections.

As previously indicated, for the purpose of the 2019 Closure Plan update, it has been assumed that metal impacted demolition debris present at the Site could be disposed of at open pit area of the



Brunswick Mine Site. The only “non-native” material that would not be suitable for disposal at the Brunswick Mine Site is process sludges, residues, un-processed feedstock, or material with contaminants other than metals such as hydrocarbons, PCBs, or NORM.

It is noted that there has been ground settlement at the Brunswick Mine Site in the area of the No. 12 Open Pit access road, which has rendered the pit road inaccessible (with alternate route accessible). There is a slight risk that occurrences of ground settlement may inhibit access to the open pit area or regulatory approval of material disposal at the Brunswick Mine Site, however this item has been carried forward in the Risk Registry (see Section 16.0).

#### **11.3.2.1 Equipment and Material Assets**

Maximizing the value of existing assets is a significant aspect of project cost reduction. During decommissioning, the option exists to sell selected pieces of equipment for reuse rather than dispose for scrap metal value which could potentially be to Glencore's financial advantage. For conservative purposes, credit for resale of equipment and material assets has not been included in the 2019 Closure Plan Update and are considered for salvage value only.

Equipment and material assets that may be removed from the Facility prior to demolition include such items as cranes, compressors, and motors. Options for the disposition of equipment and material assets include:

- Re-allocation and distribution at other Glencore operational facilities;
- Individual sale of component parts within the smelting industry;
- Auctioning of equipment and related component parts inventory; and
- Regional auctioning of smaller reusable items, such as office furniture, maintenance tooling, lifts, and miscellaneous equipment.

Glencore representatives have indicated that the new WESPs, recently installed for the Acid Plant, are modular units in good condition and should be easily relocated to another Glencore facility or sold given their current condition. Therefore, industrial cleaning of the WESPs and disassembling and preparing the equipment for transport has been included in the 2019 Closure Plan Update. However, credit for resale or steel salvage value of the WESPs has not been included for conservative purposes.

In the 2008/2009 Closure Plan PFS, several additional pieces of infrastructure were identified as potentially saleable, including the Acid Plant, SRFs, kettles, crushers, pouring and moulding equipment and the silver refinery. Credit for resale of this infrastructure has not been included in the 2019 Closure Plan Update for conservative purposes and are considered for salvage value only.

#### **11.3.2.2 Raw Material and Consumable Product Assets**

The Brunswick Smelter operates with an inventory of raw concentrate material and other consumable products. To the extent possible, it has been assumed the remaining raw concentrate will be consumed during the operational life of the Facility prior to commencing decommissioning activities. After Facility closure is announced and prior to demolition contractor(s) mobilizing to Site, it is assumed that Glencore personnel will plan and provide support for the removal of all raw



concentrate that is stock-pile in various areas of the Site, including re-distributing the concentrate to other Glencore facilities or returning the concentrate to the supplier.

Other materials associated with current plant operations are raw materials that have recycle/reuse value include:

- Compressed gases (e.g., argon, oxygen, etc.);
- Chemical additives and flocculent;
- Lab packs (unused raw and waste chemical materials); and
- Hydraulic and lubricating oils.

The volume of these materials varies with the demand for their use. Inventory management of raw material assets is the best option available to Glencore to reduce the volume of material that will remain at the time the Facility operations cease. All unused bulk materials may be reclaimed, reused, or recycled.

Raw material will be removed for sale or re-use as part of post-shutdown activities. Suppliers may be notified and where possible, unused raw materials may be returned for credit. If this is not possible, the products will be recycled as part of the decommissioning activities by the contractor.

#### **11.3.2.3 Miscellaneous Containerized Materials**

Throughout the Facility there are individual containers of various products and chemicals. The amount, sizes, and types vary, including aerosol cans, small cans, pails and drums of paints, lubricants, grease, and cleaning agents. These materials also include laboratory chemicals used as testing reagents.

The miscellaneous materials will be collected as a specific decommissioning activity. The materials will be properly identified and handled in a manner that is in compliance with all provincial and federal regulations. Wherever possible, these materials will be consumed prior to decommissioning the Brunswick Smelter. Surplus containers will occur, however, and these materials must be inventoried and segregated by type.

The reuse options for the miscellaneous materials are limited. The materials may be sent for use at other Glencore facilities, and it is conceivable that some materials, such as cleaning supplies, may be distributed elsewhere. The final option is collection and packaging for disposal as chemical waste. This would be at considerable cost, and therefore, the minimization of containerized materials should be a management goal prior to and during the shutdown of the Facility operations.

#### **11.3.2.4 Regulated and Hazardous Wastes**

##### ***Universal Wastes***

Within the Brunswick Smelter structures, materials exist that must be properly handled during closure of the Facility. These materials are identified in Section 10.1 and Table 6, and their quantities are summarized in Table 7.



The removal, collection, and proper handling of each of the universal waste materials will be a specific decommissioning activity, and will be conducted in accordance with provincial and federal regulations. Recycling options exist for the majority of these materials.

Prior to demolition, the removal and packaging of the universal wastes will be required. Proper safety measures will be defined and a labour force will be employed that is trained in the removal and handling of these materials. Transportation and disposal will occur at a recycling site approved by Glencore.

### ***Asbestos-Containing Material Waste***

The friable ACM insulating material on vessels, tanks, piping, and other equipment, as well as containment materials and disposable personal protective equipment, will be double-bagged and placed in lined roll-off containers for disposal at a licensed off-Site facility authorized to accept friable ACM waste. Other non-friable ACM, such as roofing materials and transite wall panels will also be placed in a segregated lined roll-off container for disposal at the Brunswick Mine Site demolition debris open pit.

### ***Bulk Solid Wastes***

Solid wastes will be characterized for disposal in accordance with provincial and federal regulations. The following bulk solid wastes will require off-Site disposal at a licensed facility:

- In-process materials stockpiled in the Back 40/50 and North of the Acid Plant;
- Blast Furnace in-process materials;
- Acid Product/Residue in Pipelines/Tanks;
- Petroleum Product/Residue in Pipelines/Tanks; and
- Sludge/Residue from Acid Plant Old Mist Precipitators (containing PCBs between 2 ppm and 50 ppm).

The following bulk solid wastes will be disposed of at the Brunswick Mine Site:

- Sludge from the CRP;
- Sludge generated from cleaning ditches;
- Ceramic and Plastic Saddles;
- Refractory Brick; and
- Creosote/pressure treated timber products (rail ties).

### ***PCB Containing Equipment***

Information provided to GHD as part of the Closure Plan indicated that all known or suspected equipment containing PCB oils, such as transformers and capacitors, were historically drained and the PCB-containing oil transported off-Site for disposal and all interior light ballasts that contained PCB oils have been removed. However, bushings on oil-filled transformers may also contain oil with residual concentrations of PCBs and the transformer carcasses may contain PCBs. In accordance with the PCB regulations (SOR/2008-273) of the Canadian *Environmental Protection Act* (2008 and



amended in 2015), equipment containing oil with PCB concentrations greater than 2 mg/kg (but less than 50 mg/kg) require special handling by a licensed handling facility before being recycled.

Subject to verification as part of a pre-demolition survey and following de-energization of the Facilities, oil filled transformers will require further characterization to identify any potential wastes requiring disposal as PCB containing. For the purposes of the 2019 Closure Plan Update, it has been assumed that the oil remaining on-Site transformers contain PCB concentrations below 2 mg/kg and can be recycled or reused without special handling.

### ***Demolition Debris***

Non-recyclable demolition material will be handled and disposed of as debris. The non-recyclable materials consist of wood, non-asbestos containing insulation and roofing materials. The demolition debris will be disposed of at the Brunswick Mine Site demolition debris open pit.

### ***Recyclable Materials***

Demolition of the structures and equipment will include the segregation and processing, and recycling of a variety of ferrous and non-ferrous metals. Substantial value exists in the quantity of recyclable metals, which will be determined by the international market at the time of demolition.

### ***Decommissioning Cleaning Wastewater***

Wastewater is anticipated from decommissioning cleaning of the Facility in preparation for demolition. The use of the on-Site WWTP for the treatment and disposal of the majority of wastewater is anticipated. Wastewater generated by cleaning activities will be directed to the CRP via the existing drainage network or collected and transported to the CRP via vacuum truck, for processing at the WWTP prior to discharging to Chaleur Bay. Cleaning wastewater will be segregated, collected and disposed off-Site if certain contaminants are anticipated (i.e., washwater containing acids, petroleum impacted washwater, or if any PCB-contaminated surfaces should be identified). Glencore representatives indicated that future cleaning activities will need to be restricted during the spring melt as the WWTP is nearing capacity related to surface water run-off during this time of year. It is noted that Site drainage from the MHW Area is pumped to a drainage ditch for conveyance to the Smelter WWTP and is not operable in winter conditions. Therefore, the Acid Retention Pond could be utilized for collection and trucking of decommissioning wastewater during winter conditions.

Glencore representatives will continue to operate the WWTP during decommissioning. The continued operation of this facility for receiving wastewater will be sequenced into the decommissioning plan. This will require that electrical "cuts and caps" segregate the WWTP; and the final cleaning of the WWTP would be sequenced accordingly. It is anticipated that the WWTP will need to remain operational throughout the closure activities and for a period of 2 to 4 years following completion of final Site grading and construction of engineered wetlands (conceptual) to allow for time for the engineered wetlands to vegetate and to ensure the applicable discharge limits are being met prior to demolishing the WWTP. Wastewater generated during decommissioning of the WWTP will be transported off-Site for disposal.



### 11.3.3 Civil Infrastructure

#### 11.3.3.1 Decommissioning Objectives

The decommissioning objectives for civil infrastructure at the Facility include the following:

- Develop an open space condition with the majority of the Site held in perpetuity by Glencore as a vacant but fenced or partially fenced property with the potential for industrial re-development with some limiting conditions.
- Decommission Site services (i.e., stormwater, process water and electrical), and Salt Water Pumphouse and Outlet infrastructure to minimize long-term maintenance and post-closure care. For the purpose of the 2019 Closure Plan Update it has been assumed the Freshwater Supply Line will cut and capped at the Smelter property boundary but the remainder of the line will remain in place and operational for other current users of the freshwater supply.
- Manage surface water run-off from the Site in a manner that is protective of human health and the environment and minimizes long-term maintenance and health and safety concerns.
- Facility infrastructure is to be removed to match existing grade. Slabs-on-grade and below-grade foundations to remain and above-grade concrete foundations will be removed to match existing grade. Concrete pads shall be left in place with final grading designed to provide an approximate 0.6 m soil cover (actual thickness to be determined during detailed design).
- Perimeter Site access roads will remain.

#### 11.3.3.2 Decommissioning Activities

Decommissioning of the civil infrastructure at the Facility consists of Site services, ponds, the New Slag Pile, and final Site grading and surface water infrastructure. The decommissioning activities associated with each civil component are discussed below.

##### *Site Services*

The underground services with pipes less than 0.5 m in diameter (generally including sanitary sewer, process water and fire suppression infrastructure) at the Site will generally remain in place with service connections to the buildings being abandoned and capped in place. Each service connection will be abandoned through cutting and capping of the piping outside of the building(s) footprint and will be marked using wood posts prior to backfilling; GPS coordinates will also be recorded. Abandoning of service connections will be completed prior to building demolition.

The underground services with pipes greater than 0.5 m in diameter (generally including the saltwater intake, effluent piping, storm sewer, and some sanitary sewer infrastructure) at the Site will be excavated and crushed (for concrete materials) or removed (for steel materials) in order to prevent future ground subsidence causing damage to the protective Site cover following Site closure.

As part of Facility decommissioning, the water mains will be shut-off at the main shutoff valves at the property limits in accordance with the local municipal requirements. The freshwater line between the Jacquet River Pumphouse and the Site is assumed to remain in place and operational post Facility closure. However, the 1,000 m long portion of the 0.76 m diameter freshwater line on the Smelter



Area will not be operational and will be removed to limit the risk of subsidence causing damage to the protective soil cover.

The Plant Site uses electricity generated by NB Power. Electrical services to the Smelter Area, Fertilizer Plant, MHW Area, including any pad or pole-mounted transformers, will be disconnected prior to decommissioning activities. Electrical services to the Jacquet River Pumphouse and associated infrastructure will remain connected and energized.

### ***Building and Tunnel Voids***

The Car Unloading Building in the Smelter Area as well as the Railcar/Truck Unloading Building located in the MHW Area have hopper basements and associated conveyor tunnels that require backfilling. Following removal of the buildings and associated infrastructure, the below-ground portions will be backfilled with imported borrow material from the on-Site borrow pit source. The concrete foundations will be left in place and covered with fill material as part of the final Site grading. The conveyor tunnels will be excavated, crushed and filled with backfill to prevent risk of future subsidence. Total building and tunnel void estimates are summarized in Table 10 and detailed calculations are provided in Appendix H.

### ***Ponds***

As part of the Site decommissioning work, the below-grade Concentrate Storage Holding Pond at the MHW Area will be decommissioned. The Concentrate Storage Holding Pond decommissioning will consist of removal of the liner and inlet structures and backfilling with imported on-Site borrow.

The MHW Stormwater Storage Pond and RPW Ponds will not require backfilling as the Stormwater Pond will be maintained post-closure (including the potential installation of an impermeable liner) and the RPW Pond is above ground and will be removed during the decommissioning work. The CRP is proposed to be converted to a wetland to treat the Site run-off post-closure, and therefore will not require backfilling. Total pond void estimates are summarized in Table 10 and detailed calculations are provided in Appendix H.

As previously indicated, the Retention Pond located directly north of the New Slag Pile and created during construction of the New Slag Pile will be retained as part of closure activities and incorporated into the long-term storm water management plan for the area. The pond is currently classified as a regulated wetland by the NBDELG (see Section 10.6) and subject to the WAWA Regulation of the Clean Water Act for activities within 30 metres of its boundary.

### ***Engineered Wetlands***

Surface water and shallow groundwater associated with Site will need to be managed for a period of time following closure of the Facility. The 2008/2009 Closure Plan PFS assumed that water treatment at the Site would be required for 10 years post closure through the operation of the existing WWTP. For the 2019 Closure Plan Update, it has been assumed that the WWTP would operate for 2 years post-closure followed by a 5 year post WWTP closure monitoring and passive water treatment period. As part of the Prefeasibility Study, two treatment options were considered for long term water management following decommissioning activities in the MHW Area and Smelter Area of the Brunswick Smelter. Anticipated impacts are generally related to metals in soil at the Site that have the potential to leach to surface water or groundwater. Typical metals associated with the



Site include arsenic, cadmium, copper, lead, thallium, and zinc. Treatment alternatives requiring active pumping and/or ongoing operation and maintenance were not considered feasible over the long term, and were therefore not carried forward to the quantitative analysis as part of this study.

The two treatment options carried forward in the qualitative conceptual option analysis and include:

1. Passive Wetland System; and
2. Passive Media Filter with Polishing Wetland System.

Passive treatment has the benefit of minimizing long-term operation and maintenance costs including energy consumption. The hydrology and existing grades at the Site appear to be supportive for passive treatment, with the current topography conducive to the installation of surface flow constructed wetlands. In addition, the existing network of drainage or diversion ditches, the location of the existing MHW Area holding pond and Smelter Area CRP, as well as the proposed excavation activities within the Borrow Area are all supportive for integration of passive treatment systems at the Site. The caveat is invert elevation of the existing drainage ditches, specifically the MHW Area holding pond outlet, which may necessitate alterations to the conceptual design of the inlet structures proposed for the wetlands. As detailed later in this section, completion of a Site survey (to verify invert elevations of ponds, ditches, outlets, etc.) is recommended as part of the Feasibility Study to be completed prior to initiating detailed design.

Similarly, as with most treatment systems, a treatability study would need to be completed to confirm the suitability of the passive treatment technologies, and to adequately size the system components. The quantitative assessment completed for the two passive treatment technologies will be based on GHD's expertise in the industry, available literature, design flows applicable to the Site, and best management practices. The treatability study will be completed for both treatment options to verify the effectiveness / appropriateness of the selected technologies.

### ***Passive Wetland System***

Wetland systems rely on natural sources of energy to lower aquatic contaminant loads and concentrations through physical, chemical, and biological assimilative processes. The primary mechanism of metals removal in the proposed passive wetland systems is adsorption by the wetland root system.

Surface flow constructed wetland systems are typically shallow basins, densely vegetated by a variety of rooted emergent plant species. Substrates are comprised of flooded organic or mineral soils; the emergent plants take up nutrients in stormwater flows and provide a substrate for the growth of microbial, algal, and invertebrate populations that assimilate constituents in the stormwater through uptake, transformation, and sedimentation processes.

Surface water (and potentially groundwater) will be conveyed to the wetland system by open channel drainage ditch (or by pipe), and will enter the wetland through an inlet structure, with the structure invert (i.e., rock structure or pipe) set at the maximum design level (i.e., high water level) of the system. The inlet structure will be located to create the longest flowpath possible between the inlet and outlet control structures to minimize short circuiting; design elevations will be confirmed during the detailed design phase and following completion of an elevation survey.





While sizing and configuration of the proposed wetland systems is somewhat dictated by the designated space available at the Site (i.e., the CRP footprint for Wetland 1, or the existing soil containment berm for Wetland 2), the Length:Width aspect ratios are within the recommended 3:1 to 5:1 range to minimize short-circuiting.

For construction of the wetland, approximately 0.3 to 0.6 m of organic soil will be placed over the base of the wetland to facilitate plant growth and help maintain moisture during dry seasons. Baffles will be constructed within the passive wetland system to lengthen the flow path and extend the retention time of the water within the wetland. The base and sides of the wetland will be seeded with vegetative species selected based on the results of the treatability study. Native wetland plant species will be utilized in accordance with NBDELG requirements. Treated water will be discharged via a rock outlet structure and/or pipe to the existing surface water drainage ditch downstream of the wetland. Typically, the elevation of the effluent structure will be established to retain approximately 0.6 m to 1 m of water within the passive wetland system at all times. In addition, deeper areas in the central portion of the wetlands may be constructed based on elevation requirements and to ensure adequate water retention times are maintained. An overflow weir will also be established to prevent flooding of the wetland. Design elevations will be confirmed during the detailed design phase following a Site survey.

#### ***Passive Media Filter with Polishing Wetland***

The second treatment option carried forward in the qualitative option analysis is a passive media filter with polishing wetland technology. Essentially, it utilizes the same wetland system identified above, but has the added feature of a passive media filter for pre-treatment.

Using the passive media filter with polishing wetland technology, collected surface water and groundwater from the Smelter Area (and Back 40/50) would be conveyed through the reactive media system containing zero-valent iron (ZVI). ZVI is typically used as a filter medium to remove heavy metal contaminants in groundwater, and therefore is well-suited for application at the Site for removal of [arsenic, cadmium, copper, lead, thallium and zinc]. ZVI has a high removal capacity, primarily through means of sorption or co-precipitation. The main mechanism for metals removal using ZVI is sorption onto the iron oxide surface. Alternatively, ZVI reduces the metal, which can subsequently be removed from solution by co-precipitation. Through this sorptive process, leachate passing through the filter media exhibits significantly reduced concentrations of metals prior to entering the polishing wetland. Once all the available sorption sites in the ZVI media are full, its treatment capacity is exhausted and the media must be replaced. For the purpose of this study, five media change-outs were assumed to be required during the 50-year operational period under consideration.

The filter media would be containerized in a sealed below-grade chamber creating an anaerobic condition. The subsurface chamber would permit the inflow of potentially impacted surface water, and allow effluent discharge to the wetland by gravity. Sizing of the chamber will be finalized as part of a treatability study along with anticipated media change-out rates. For the purposes of the 2019 Closure Plan Update, it has been assumed the media will require replacement 5 times over a 50 year operational period (assumed). Assuming the media supplied at 50 percent ZVI would be mixed with well graded sand at a ratio of 1:4 (media : sand) to help prevent metal clogging in the filter bed, minimally a custom pre-cast concrete chamber or cast in-place concrete structure (or series of chambers) with a combined capacity of 100 cubic meters would be required. Treated effluent from



the filter would be conveyed to the wetland via below grade pipes. Within the wetland, further metal removal would be achieved through adsorption in the wetland root system. The polishing wetland construction for this system would be consistent with the conceptual passive wetland system previously described.

Specific conceptual design details regarding the proposed Passive Wetland Systems are provided below.

### ***Wetland 1 – Smelter Area***

Conceptual Wetland 1 would be a Passive Media Filter with Polishing Wetland. Located within the footprint of the former CRP, Wetland 1 would treat potentially impacted surface water and groundwater collected and conveyed from Smelter Area by the existing drainage ditch located on the south side of the rail line (to be extended and deepened as part of the 2019 Closure Plan Update). While the CRP is reportedly clay-lined, the current condition of the liner is unknown; it is expected that the existing liner would be removed prior to construction.

Proposed Wetland 1 measures approximately 19,000 m<sup>2</sup> (250 m by 75 m in plan view); this passive wetland system includes pre-treatment using a media filter followed by the conversion of the CRP to a passive wetland cell (polishing wetland).

As previously indicated in Section 10 and further discussed in Section 12.3, modifications to the existing drainage ditch system of the Smelter Area are anticipated so that the existing diversion ditch also serves as a groundwater interceptor trench for the Smelter Area. Additional modifications would also likely be required to direct potentially impacted water to and through the passive ZVI media chamber. The ZVI media generally has a life-span of approximately 5 to 10 years but is dependent on metal concentrations in the water being treated as well as flow rates in the chamber. Treated effluent from the filter would be conveyed to the wetland via below-grade pipes. The submerged inlet would be located in the southwest corner of conceptual Wetland 1. A series of alternating baffles at approximately 20 m spacing would maximize the flowpath and residence time within Wetland 1. Treated effluent from the cell would be discharged via a rock outlet structure and open ditch to the proposed outfall to Chaleur Bay.

For the purpose of this evaluation, the conceptual design includes a valve chamber to allow for future media replacement and it has also been assumed that the ZVI media in the pre-treatment chamber will require 5 replacements over the assumed 50-year life span of the passive treatment system. Completion of Feasibility/Treatability Study would be required to accurately predict the media filter life-span as well as the wetland efficiency. The conceptual layout of the Wetland 1 is provided on Figures 12A and 12B.

### ***Wetland 2 – MHW Area***

Conceptual Wetland 2 will be a Passive Wetland System constructed within the footprint of the soil containment berm of the two Bulk Acid Tanks. Located in the northeast portion of the MHW Area, Wetland 2 would treat potentially impacted stormwater collected from the Fertilizer Plant, Bulk Handling, and Coke Site areas. Note that decommissioning and disposal of the Bulk Acid Tanks was considered separately in the 2019 Closure Plan Update but the Wetland 2 construction would include excavation of soil within the containment berm for re-use on-Site.



Proposed Wetland 2 measures approximately 10,800 m<sup>2</sup> (180 m by 60 m in plan view); this passive wetland system does not include pre-treatment as the area currently contains a holding pond that would be utilized as a sedimentation pond prior to water flowing into the passive wetland system.

Modifications to the existing holding pond outfall and MHW drainage ditches would be required to direct surface water run-off to Wetland 2 as outlined in Section 12.3 and Figure 12C. For the purpose of this evaluation, separate inlets into the conceptual wetland would be required and include: Inlet 1 would be located in the southeast corner of Wetland 2, and would receive run-off from the eastern drainage ditch in the MHW Area; Inlet 2 would be located in the southwest corner of Wetland 2, and would receive run-off/stormwater from the existing holding pond, as well as the central drainage ditch within the MHW. A series of alternating longitudinal baffles at approximately 15 m spacing will maximize the flowpath and residence time within Wetland 2. Treated effluent from the wetland would be discharged via a rock outlet structure and open ditch to the proposed outfall to Chaleur Bay.

The conceptual layout of the Wetland 2 is provided on Figure 12C but would require completion of a Feasibility/Treatability Study as part of future detailed design.

#### ***Wetland 3 – Borrow Pit Area***

Conceptual Wetland 3 would be a Passive Wetland System located north of the New Slag Pile within the proposed Borrow Pit Area. Wetland 3 would treat potentially impacted water collected from the perimeter of the New Slag Pile and conveyed north via an existing drainage ditch (West Diversion Ditch), that extends to the west side of the Smelter Area and discharges to Chaleur Bay.

Proposed Wetland 3 measures approximately 81,000 m<sup>2</sup> (450 m by 180 m in plan view) and does not include pre-treatment. The purpose of the wetland would be to provide supplementary treatment (if required) of run-off from the New Slag Pile and associated retention pond. Modifications to the existing drainage ditch would be required to direct potentially impacted surface water associated with the New Slag Pile to the wetland inlet structure located in the southeast corner of Wetland 3. A series of alternating longitudinal baffles at approximately 60 m spacing would maximize the flowpath and residence time within Wetland 3. Treated effluent from the cell would be discharged via a rock outlet structure to the existing West Diversion Ditch which bisects the Smelter Site and discharges to Chaleur Bay.

The conceptual layout of the Wetland 3 is provided on Figure 12D but would require completion of a Feasibility/Treatability Study as part of future detailed design.

#### ***Treatability Study***

As with most leachate treatment systems, a treatability study would need to be completed to confirm the suitability of the treatment technology for the specific leachate and to adequately size the system components. As such, GHD recommends that treatability study be completed to confirm the suitability and effectiveness of the proposed treatment options prior to final selection and development in the Detailed Design Stage. At a minimum, this treatability study should include influent characterization, column tests, media consumption rates, and reporting.



### *Feasibility Study*

Similarly, prior to initiation of detailed design, detailed hydraulic and hydrologic studies will be required during the Feasibility Study phase. At a minimum, this feasibility study should include determination of influent flow rates, flow velocities and hydraulic retention times within the cells (to verify required sizing of piping, valves, chambers, and the wetland itself), inlet/outlet invert elevations (including Site survey), treatment cell sizing, and reporting.

### *Final Site Grading and Cover*

Following Facility demolition activities, the Site will be graded to match into the existing access roads and to convey stormwater run-off via a ditch network to engineered wetlands prior to discharging to Chaleur Bay. The conceptual post-closure Site plans are shown on Figures 12A through 12D. The conceptual plan for post-closure surface water management is further discussed in Section 12.0.

As previously discussed in Section 10.0, the 2019 HGS and DGA identified metal concentrations in soil above human health and ecological SSTLs that will require remediation and/or risk management post-closure. Excavation, removal and disposal of the metal-impacted soils would incur significant costs. However, NBDELG has previously accepted the use of risk-based management approaches at similar facilities, including the placement of a protective site cover over impacted soils and applying land-use restrictions at the time of Site closure. Therefore, in order to eliminate human health and ecological receptor exposure pathways to the metal impacted soils, the provision for constructing a protective cover over the areas with metal concentrations exceeding SSTLs has been included in the 2019 Closure Plan Update. A protective cover must be structurally stable and require little to no maintenance, not be susceptible to erosion by wind or water, and have the ability to sustain vegetation growth. The cover does not have to prevent infiltration of water or groundwater movements.

Therefore, upon completion of final grading activities, the graded areas will be covered with 0.45 m of granular material and top dressed with 0.15 m of organic topsoil and hydroseeded. Based on the conceptual Site cover plan (Figures 10 and 12A to 12D), approximately 420,000 m<sup>3</sup> of granular material will be required to cover the metal-impacted areas and approximately 140,000 m<sup>3</sup> of organic topsoil is required. It is noted that actual cover thickness developed during future detailed design phases may vary depending on elevation requirements, concentrations of contaminants in soil and future land uses for specific areas of the Site. Application of soil cover has been assumed for the purposes of the 2019 Closure Plan Update and consistent with the 2008/2009 Closure Plan PFS. However, a trade-off study is recommended as part of the additional pre-decommissioning engineering studies to evaluate potential future environmental liabilities associated with covering the metal impacted soil compared to excavation and off-Site disposal.

A borrow investigation program conducted by SNC as part of the 2008/2009 Closure Plan PFS has revealed the presence nearby of at least 460,000 m<sup>3</sup> of a well graduated sand and gravel with less than 10% silt and a natural water content close to the optimum within the on-Site borrow pit. Therefore, it is not anticipated that importation of granular materials from off-Site sources will be required for the Smelter Site cover. However, the 2008/2009 Closure Plan PFS borrow investigation program identified only 120,000 m<sup>3</sup> of organic soil within the on-Site borrow pit. Therefore, an additional 20,000 m<sup>3</sup> organic topsoil may be required to be imported for off-Site sources. Options to compensate for the organic soil shortfall could be the use of organic waste to produce organic soil



material or manufactured soil from commercial producers. It is noted that Envirem Technologies have a soil recycling facility very close to the Site and could supply large volumes of organic soil.

For the purposes of the 2019 Closure Plan Update, it has been assumed that all concrete generated from the Site demolition activities is metal impacted and will be transported to the Brunswick Mine Site open pit for disposal and will not be used for backfill on-Site. However, there is the possibility that some of the concrete will be clean and may be utilized as backfill on-Site, reducing concrete transportation costs and lowering the quantity of granular material required from the borrow pit. This option may be further evaluated closer to actual decommissioning. For the purposes of this evaluation, the conservative option of transporting concrete to the Brunswick Mine open pit has been carried in the 2019 Closure Plan Update.

As described in Section 10, the results of the 2019 HGS and DGA identified elevated concentrations of soil on portions of Belledune Point. Therefore, for conservative purposes, GHD has included placement of soil cover over Belledune Point. However, GHD recommends completing further risk assessment and/or discussions with NBDELG, which may result in the elimination of cover requirement in this area. Management of the impacted soils in Belledune Point are further discussed in Section 13.0. There are rare plant species known to be present in the Belledune Point area which will require protection during placement of the Site cover, such as protecting and excluding the area of rare plants from the cover or relocation of the plants during covering activities.

It is noted that scheduling and sequencing of Site cover placement should include considerations for shore birds or other migratory bird species known to be present at the Smelter Site as ground disturbance activities may be restricted during breeding/nesting periods in specific areas of the Site.

Sediment and erosion controls will be required until planted vegetation is established to minimize sediment laden run-off into the ditches and receiving waters. Long term integrity monitoring of the cover system will likely be a requirement of NBDELG's approval of utilizing Site cover as a risk mitigation method. It has been assumed that the Brunswick Mine Site personnel will conduct the long term monitoring of the Brunswick Smelter Site post-closure.

### ***New Slag Pile Cover***

A component of the 2019 Closure Plan Update includes the capping and closure of the New Slag Pile. The designated area for storing slag at the New Slag Pile (including the retention pond) is approximately 35 Ha. The existing footprint of area actually containing slag, is approximately 21 Ha.

The proposed slag pile closure plan considers the following:

- The current footprint of the New Slag Pile is the area requiring cover and additional slag material will not be added to the site which are based on:
  - The footprint of the New Slag Pile is based on available information at the time of this report preparation and assumptions will need to be validated during detailed design;
  - The slag pile cannot extend to the west beyond 60 m from the property limit;
  - Maximum slopes of two (2) horizontals to one (1) vertical along the outside perimeter of the cells;



- Maximum thickness of slag material must remain lower than the existing tree line; and
- Minimum slopes of 1% on top of the slag pile to maintain drainage.
- Grading of slag is assumed to be required at the time of closure. This considers that the shaping of the pile will be performed by the contractor as part of the closure work.
- The existing retention pond will remain in-place along with the earthen dam structure and incorporated into the New Slag Pile closure plan. The existing configuration of the New Slag Pile currently encroaches into the retention pond, therefore, it is anticipated excavation and grading work will be required to create a buffer between the pond and the slag pile toe of slope.

Drawing 178-19-SK1 in Appendix I for the various components are described below.

Minimum slopes of 1% on top of the New Slag Pile were chosen to maintain drainage due to the large surface of the slag pile. However, slopes significantly greater than 1% on top of the slag pile would incur significant excavation and additional material grading. In addition, due to the natural slope of the terrain, which is close to 1% toward Chaleur Bay, it would be technically difficult to generate slopes significantly greater than 1% on top of the pile without significantly increasing the footprint of the pile and keeping the elevation of the pile below the existing tree line. For the purpose of the 2019 Closure Plan Update, 1% to 2% slopes on the top of the New Slag Pile have been assumed that maintain minimum drainage and consider the slag material is unlikely to settle over time.

The conceptual capping plan involves covering the top of the pile with 0.3 m of granular borrow material, 0.15 m of organic cover and hydro-seeding. Since the nature of the slag material make the slopes unstable, it is recommended the slopes are stabilized by adding 1.0 m thick rock fill. The cover thickness and rock fill requirements on side slopes will require validation as part of detailed engineering.

The conceptual New Slag Pile cell closure plan also includes maintaining the existing dam and associated retention pond as well as the construction of an access road around the base of the pile. The retention pond is currently mapped as a provincially regulated wetland by the NBDELG and receives storm water run-off from the slag pile.

The construction of the slag pile access road along with maintaining the existing retention pond will also serve as a component of surface water management for the area. The inside ditch of the access road will direct surface water generated from the slag pile to the retention pond which will then be discharged to the existing West Diversion Ditch. Outside access road ditches will divert surface water collected from outside the slag pile footprint to vegetated areas surrounding the site, thereby limiting the volume of water to be treated at the retention pond.

The top of the New Slag Pile to be covered with granular borrow and organic soil is approximately 18.7 Ha. The remaining footprint for the slopes is approximately 2.3 Ha. Approximately 2,700 m<sup>3</sup> of granular borrow will be taken from the construction of the access road. An additional 84,600 m<sup>3</sup> of imported granular material, either from the on-Site borrow area or an alternate off-Site source, will be required to build the cap. Similarly, 6,200 m<sup>3</sup> of organic soil will be recovered from the grubbing of the slag pile access road. An additional 21,850 m<sup>3</sup> of



organic soil will have to be imported from an outside source. Rock fill and granular sub-base will be provided by local quarries located within 2 km of the Smelter Site.

The following work is also to be included in the New Slag Pile closure:

- Re-profiling and cleaning of the existing outlet ditch that will direct surface water generated within the New Slag Pile site to the conceptual wetland (Wetland 3);
- Dismantling of the decant structure;
- Dismantling of the pressure chamber;
- Capping of the 150 mm steel pipeline (to be left in place);
- Re-profiling the top of the dam and reconstruction of the spillway;
- Replacement of the culverts crossing the dam; and
- Maintenance of the haul road.

During construction, sediment and erosion controls will be implemented and maintained until planted vegetation is established.

There are several limitations with the New Slag Pile cover design, including that the recommendations provided herein that consider that the slag material is non-leachable. The proposed cover will therefore serve as an anti-erosion barrier and not an impervious liner. It is recommended that the final design of the rock fill on the side slopes include a slope stability analysis that would look into the physical properties of the slag material.

A portion of the retention pond located directly north of the New Slag Pile that was created by the dam structure is now classified as a regulated wetland and subject to the WAWA Regulation of the Clean Water Act. As such, future closure activities associated with the New Slag Pile (grading and capping) will likely require a WAWA permit as physical activities will be completed directly adjacent to or within 30 metres of the wetland.

#### ***Post-Demolition Conceptual Site Layout***

The post-demolition conceptual Site layout and re-grading area is provided on Figures 12A to 12D. These figures also shows the post-decommissioning infrastructure including the covered New Slag Pile, engineered treatment wetlands, access roads and ditches.

#### **11.3.4 Energy Supply after Closure**

All Glencore infrastructure will be sold, decommissioned and/or demolished as part of the closure activities, therefore it is not anticipated that any energy supply will be required after closure. The Smelter infrastructure will be de-energized for facility decommissioning and demolition. However, the WWTP will need to remain operational throughout the closure activities and for a period of 2 to 4 years following completion of final Site grading and construction of engineered wetlands. The operation of the WWTP is to allow for time for the engineered wetlands to vegetate and to ensure the applicable discharge limits are being met prior to demolishing the WWTP. Therefore a new or isolated electrical feed will need to be established for the WWTP for approximately four years post-closure.



## 12. Water Management Infrastructures

### 12.1 Previous Water Management Studies

As part of the 2008/2009 Closure Plan PFS, SNC evaluated the drainage modifications required for the surface water management during and after closure by conducting a hydraulic and hydrological study to determine peak flows and flow velocity in the proposed Site ditches, to determine ditch dimensions and riprap protection sizing. SNC carried out hydraulic calculations to evaluate peak flows in the ditches, flow capacity of the existing culverts, and flow velocities for the riprap sizing. In addition, SNC evaluated surface water management during the execution of closure works to determine the modifications to the drainage system and infrastructures in order to collect and treat potentially contaminated water during decommissioning and cleaning activities.

In general, GHD agrees with the approach and supporting hydrological data used to perform calculations but noted several instances where the calculations results do not correspond with values that would typically be expected based on current industry practices. Riprap sizing, in general, appears to be 50% below the size expected for the calculated water velocities listed in the 2008/2009 Closure Plan PFS study. However, the velocities listed in the 2008/2009 Closure Report PFS are much higher than would be expected for the Site, therefore, the riprap may in fact be adequately sized based on surface water velocities and flows that would be expected to occur at the Site.

The hydrology and hydraulic data used to develop the proposed water management concepts for the 2008/2009 Closure Plan PFS are ten years old and outdated. Climate data has changed (with an expected 3 to 5% increase in precipitation) and Site infrastructure has been modified (including an extensive transformation of the drainage system at the MHW Area in 2018/2019). Therefore, as part of the review of the 2008/2009 Closure Plan PFS, GHD recommended updating hydrology and hydraulic studies be completed for the Site, with a specific focus on confirmation of predicted water velocities that determine appropriate riprap sizing and updating the post-closure Site characteristics to permeable soil cover conditions (see Technical Memorandum 11198639-Memo-13-Section 14.0 in Appendix A). However, GHD also noted that the updated hydraulic and hydrologic studies could be delayed until the Feasibility Engineering stage, as engineered wetlands are now being considered in the conceptual closure plans for the Site and detailed designs of the wetlands (i.e., wetland elevations, inlets, outlets, etc.) would be required for inclusion in the hydraulic study. Depending on the wetland design, modifications to drainage ditch sizing and layouts may be required for the proposed post-closure water management interventions proposed in the current 2019 Closure Plan Update. As such, for the purposes of the 2019 Closure Plan Update, GHD carried forward the riprap sizing specified in the 2008/2009 Closure Plan PFS and added hydraulic and hydrologic studies to the list of future work plans (see Section 17.0).

SNC also reviewed the capacity of the existing CRP and WWTP in the 2008/2009 Closure Plan PFS, and determined that the WWTP will likely have the capability to manage water generated by demolition works (cleaning of contaminated structures), run-off and other potential contaminated water (i.e., from a groundwater collecting system). Glencore has reported that the WWTP was designed for 90 m<sup>3</sup>/hr but has operated up to 150-200 m<sup>3</sup>/hr on occasion. Glencore also indicated surface water inputs account for approximately 30% of the volume of water being treated by the WWTP. Therefore, at shutdown, 70% of the WWTP capacity will be available for treatment of





wastewater generated by facility decommissioning cleaning activities. Glencore also indicated that the WWTP has adequately handled cleaning wastewaters during historical cleaning activities. However, Glencore representatives indicated that future cleaning activities may need to be restricted during the spring melt as the WWTP is nearing capacity related to surface water run-off during this time of year.

In addition, SNC reviewed the cover stability under heavy rain conditions. It was evaluated that gully erosion may occur at the Smelter Area and MHW Area and no gully erosion is expected on the New Slag Pile. SNC estimated that, to avoid any gully erosion effects in these areas, the maximum sub-drainage area allowed is 6 Ha. GHD recommends that as part of the detailed design, hydrology be updated to account for climate change. Preliminary calculations suggest a change in peak flow can be expected in order of magnitude of approximately 5% and may be higher (see Appendix J). The maximum sub-drainage areas should also be confirmed and final areas of drainage cells be evaluated during subsequent detailed design phases.

## 12.2 Water Management during Closure Activities

As part of the decommissioning of the Smelter, various equipment, bulk storage and process tanks, piping, ducts, pits, floor trenches, sumps, and surfaces will be purged, rinsed, and cleaned prior to demolition. This cleaning will remove accumulated solid residue and oils or other liquids that may be released during demolition activities. Techniques for cleaning will include low volume, high-pressure water blasting, bulk dust removal using fire hosing, steam cleaning, washing with detergent or degreasing soap, and other methods (as required). Wastewater will be contained and collected for treatment at the CRP and WWTP. Cleaning wastewater will be segregated if certain contaminants are anticipated (i.e., NORM impacted washwater, petroleum impacted washwater, or if any PCB-contaminated surfaces should be identified).

Cleaning would typically be completed in two stages. Initial cleaning would consist of cleaning that may occur while the facility is energized, such as cleaning of tanks, pipes, ducts, and equipment. Final cleaning would consist of cleaning that requires the area to be de-energized prior to cleaning such as washing of the interior building walls. During final cleaning, temporary power would be required for lighting and washing equipment operations. Prior to Facility de-energization, a separate electrical feed for the WWTP will need to be constructed to allow the WWTP to keep operating during the decommissioning and demolition activities. Similarly, an electrical feed may also be needed to pump water from the MHW Area to the WWTP located at the Smelter Area.

In addition to water generated by the cleaning works, surface water run-off generated by rain on lands not yet covered and groundwater collected with the groundwater interceptor trench will require treatment through the CRP and WWTP during the decommissioning works. Therefore, cleaning activities will need to be restricted during the spring freshet as the CRP and WWTP is nearing capacity related to surface water run-off during this time of year.

The existing stormwater collection system will be maintained throughout the remainder of the decommissioning and demolition activities to collect and treat surface water run-off across the uncovered Site, as well as from run-off in areas of stockpiled materials that are potentially impacted with metals. The demolition contractor(s) decommissioning and demolition plan must include consideration for stockpile locations to ensure any run-off from these areas is collected and directed to the WWTP for treatment.



Upon completion of the demolition activities and in conjunction with final Site grading, the existing stormwater catchbasins and piping will be decommissioned. First, the stormwater system will be flushed using high-pressure wash and vacuum trucks, with the washwater being treated through the CRP and WWTP. Once the stormwater system is clean, the stormwater piping will be capped at each building foundation and catchbasin to prevent future subsidence, and the catchbasins will be backfilled. The stormwater system decommissioning and construction of the final Site cover should be completed from west to east to allow continued water treatment from uncovered areas of the Site. It is noted that depending on the extent of residues built up in the stormwater system, flushing may not adequately clean the stormwater system and excavation and disposal of some stormwater piping may be required. A pilot test is recommended as part of the detailed designs to determine an appropriate stormwater system decommissioning methodology.

#### 12.2.1 Smelter Area

During the cleaning works in the Smelter Area, washwater will be either directed to the CRP and WWTP via overland flow utilizing the existing stormwater collection system, contained and pumped into a vacuum truck for disposal into the CRP and WWTP and/or transported off-Site for disposal. The anticipated cleaning method of the buildings assumes a wash down cleaning only, to remove residual surface dust, so that the building debris is suitable for transport to the Brunswick Mine open pit. In addition, it has been assumed that the cleaning contractor would make use of temporary modular water holding tanks to store the washwaters (and potentially recycle the washwaters for cleaning to the extent possible) prior to transport and disposal into the CRP and WWTP.

The proposed method of cleaning was previously reviewed with Glencore personnel and it was indicated that the on-Site WWTP could adequately process the typical volumes of water generated from such cleaning activities based on historical cleaning operations at the Site.

#### 12.2.2 MWH Area and Fertilizer Plant

Similar to the Smelter Area, during the cleaning works in the MHW Area, washwater will be either directed to the CRP and WWTP via overland flow utilizing the existing stormwater collection system, or contained and pumped into a vacuum truck for disposal into the CRP and WWTP or transported off-Site for disposal. The MHW Area also contains two lined ponds which could be used for storage and would be capable of pumping to the CRP and WWTP through the existing forcemain with very few modifications. Both ponds also have areas for truck/tanker connections allowing the ponds to be emptied if the forcemain is not in use (i.e. winterized). The MHW Area Stormwater Storage Pond located north of DAP Storage Building would require the installation of a liner prior to using the pond for short or long term storage of cleaning waters or containment of contaminated run-off caused by decommissioning activities. The anticipated cleaning method of the MWH Area and Fertilizer Plant buildings is the same as the method described above for the Smelter Area.

During the cleaning works specific to the Fertilizer Plant, washwater that is expected to be NORM impacted will be contained and pumped into a vacuum truck for off-Site disposal. A mobile treatment plant may also be utilized for the treatment of NORM impacted washwater, however for the purposes of 2019 Closure Plan, off-Site disposal has been assumed. Based on the results of the NORM survey completed in 2019, NORM impacted building materials or equipment is generally limited to equipment in the Scrap Yard area as well as Gypsum Line piping stockpiled in the Smelter Area. As such, the generation of NORM impacted washwater is considered to be limited to washing



these specific pieces of equipment. In addition, the NORM Trade-off study (Section 11.2) recommended transporting the NORM impacted equipment and materials directly to an off-Site disposal location which would eliminate the generation of NORM impacted washwater.

During decommissioning operations at the MHW Area, the newly constructed Storm Water Storage Pond forcemain is inoperable during freezing/winter conditions. As such, cleaning activities to be completed at the MHW Area / Fertilizer Plant during winter conditions will require containment and transport to the Smelter WWTP via vacuum truck. There is the potential that the existing concrete Acid Holding Pond could be utilized for temporary containment during freezing conditions. The Concentrate Storage Containment Pond could also be used for storage of washwater but this collected water would need to be trucked to the Smelter Area WWTP and CRP for treatment.

### 12.3 Water Management after Closure

As discussed in Section 11.3.3, for the purposes of the 2019 Closure Plan Update it is assumed that following Facility demolition activities, metal impacted areas of the Site will be covered with a 0.6 m thick soil cover consisting of 0.45 m granular material topped with 0.15 m of topsoil and vegetated (approximate). The Site will be graded to convey storm water by overland flow and ditching to one of three outfalls to the Chaleur Bay. Sediment and erosion controls will be constructed and maintained until planted vegetation is established to minimize sediment laden run-off into the ditches and receiving waters.

As metal impacted soil is to be covered and remain on-Site, there is the potential surface water run-off generated post-closure will not be suitable for direct discharge into Chaleur Bay. Therefore, as discussed in Section 11.3, for the purposes of the 2019 Closure Plan Update, the conceptual plan for post-closure surface water management includes construction of several passive engineered wetlands to treat surface water run-off prior to discharging to Chaleur Bay. An overview of the conceptual storm water management plan for the Site after closure is shown on Figure 12A and details provided in Appendix I.

#### 12.3.1 Smelter Area

Surface water run-off from the Smelter Area would be directed by overland flow and ditching to a new engineered treatment wetlands constructed in the CRP footprint, and then discharged to Chaleur Bay through an outfall located directly north of the CRP. The existing ditching system would provide basis of the surface water conveyance system in this portion of the Site, with some modifications required. The modifications are further described below and a conceptual surface water management plan for the Smelter Area is provided in Appendix I.

Modifications would be made to an existing interception ditch located at the northern side of the main Smelter Area. This ditch would be extended to the East and West in order to capture surface water run-off in the Smelter Area (from South to North). The ditch would be sloped towards the proposed wetland. Any required piping to provide access from the South side of the ditch to the North side of the ditch would be sized according to new drainage design flows developed as part of detailed design. The extended interception ditch would also be tied into the current cooling water drainage ditch and act as a capture point for metal impacted water mixed with shallow groundwater flow through the Back 40 and 50 areas. A single outlet located at the wetland would release treated water to Chaleur Bay. New portions of the ditch would be lined with riprap, approximately R<sub>25</sub> in size



in order to prevent erosion to the ditch and lower the maintenance requirements of the proposed interception ditch.

A phased approach would be taken to decommission the existing WWTP at the end of its' life and create a wetland (Wetland 1) in its place by either separating the CRP and phasing out the treatment plant or by using existing retention areas on-Site, and along the conveyance path to the WWTP, to provide enough storage to convert the CRP into Wetland 1 in a single step. Further review of this process would be required during the detailed design phase.

A conceptual surface water management plan for the Smelter Area is provided Figure 12B and in Appendix I.

### ***New Slag Pile***

As previously described, the existing earthen dam and retention pond at the New Slag Pile would be incorporated into the closure activities with conveyance infrastructure up-graded as required. Run-off from the New Slag Pile would be directed to the retention pond and then carried through the existing drainage ditch (with some modifications including vegetation removal and re-grading) and directed to the new engineered wetland proposed in the borrow pit area (Wetland 3). The wetland (if required) would be controlled by an outlet structure and tied into the existing off-take system for that watershed which passes under Highway 134, through the Back 40 and Back 50 areas and into Chaleur Bay (West Diversion Ditch). In the event that the run-off contributed to this area is not enough to sustain the proposed wetland, there are opportunities to acquire additional water volume from the west side of Highway 134 and route the flow through a series of culverts to discharge into the wetland which will occupy the contours of the proposed borrow area. For the purpose of the 2019 Closure Plan Update it has been assumed new ditching would have a 1 m bottom with minimum 1.5H:1V side slopes and be lined with R<sub>25</sub> riprap to avoid potential erosion caused by excess water velocity (similar to the 2008/2009 Closure Plan PFS approach). However, as previously indicated, ditching and rip-rap sizing to be determined as part of detailed designs following completion of a detailed hydraulic and hydrology evaluation.

The development of a borrow pit directly north of the New Slag Pile and directly south of Highway 134 will lower the ground elevation by approximately 1.5 meters. For the borrow pit reclamation purposes, drainage modifications of the existing West Diversion Ditch and possibly the East Diversion Ditch and associated culverts are likely required. The existing downstream part of the West Diversion Ditch would be re-profiled during the protection cover set-up. A riprap protection would cover the entire section of the re-profiled ditch to protect the vegetal cover from erosion. As this ditch collects water from several watersheds in the area (see figures in Appendix I), a design to manage the total flow is required and should be evaluated as part of future hydrology and hydraulic evaluations and detailed design phases.

A conceptual surface water management plan for the New Slag Pile and borrow pit area is provided on Figure 12D and in Appendix I.

### **12.3.2 MHW Area and Fertilizer Plant**

Surface water run-off from the MHW Area and Fertilizer Plant would be directed by overland flow and ditching to the existing Storm Water Holding Pond, then to a new engineered treatment wetland to be constructed in the current location of the Bulk Acid Storage Tanks, and then discharged to



Chaleur Bay through an existing outfall in the off-take ditch between the Site and the Port property to the north of the MHW Area. It is noted that an agreement with the Port would likely be required to utilize this outfall. The existing ditching system would provide basis of the surface water conveyance system in this portion of the Site, with minor modifications required.

The MHW Area would be completely covered by a 0.6 m thick vegetated cover (approximate thickness). The post-closure configuration of the MHW Area included maintaining the existing Storm Water Storage Pond but elimination of the existing Concentrate Storage Containment Pond. As such, the upstream portion of the existing drainage ditch that feeds the Storm Water Storage Pond would be re-profiled during the protective cover implementation including extending the ditch to the western portion of the MHW Area near the storage domes. A riprap protection would cover the entire section of the re-profiled ditch to protect the vegetal cover from erosion.

The ditch draining the MHW Area will have to be excavated in order to be extended. The entire ditch is assumed to be re-profiled with a base width of 1 m, height of 1.5 m, lateral slope of 1.5H: 1V and protected with riprap sized to R<sub>25</sub>. Actual ditching and rip-rap sizing to be determined as part of detailed designs following completion of a detailed hydraulic and hydrology evaluation. Furthermore the independent storm management system at the dome storage site will need to be decommissioned after cleaning operations. A large amount of underground water management infrastructure has reportedly been removed since 2009, however, the remaining infrastructure should also be removed as encountered. It is noted that previous jet rodding and power flushing of infrastructure was attempted as part of the 2017 to 2019 water management upgrade work and was limited due to the amount of compacted sediment present within the existing underground piping.

As described in Section 11, included in the future water management plan for the MHW Area and Fertilizer Plant is the construction of an engineered treatment wetland (Wetland 1). Upon completion of the Site decommissioning, water collected in the newly constructed or re-profiled drainage ditch would be directed to the existing Storm Water Storage Pond and/or the newly constructed engineered wetland prior to be discharged to Chaleur Bay.

A conceptual surface water management plan for the MHW Area and Fertilizer Plant is provided on Figure 12C and in Appendix I.

## 13. Management of Contaminated Soil

The specific objectives for management of contaminated soils at the Site include the following:

- Ensuring that the Site is closed in a manner that is protective of human and ecological health and in compliance with NBDELG regulatory requirements; and
- Minimizing long-term maintenance requirements.

### *Petroleum Hydrocarbon Impacted Soil*

Section 10.1 describes past test locations with elevated mTPH concentrations (ranging from 3,400 to 11,000 mg/kg) in soil at various locations within the Smelter Area. Concentrations of mTPH in groundwater exceeding the Tier I RBSL of 20 mg/L were previously detected in several test locations within the Smelter Area but free phase petroleum product was not observed in the 53



monitoring wells sampled at the Site in 2019. In addition, mTPH was <20 mg/L in monitoring wells sampled as part of the 2019 HGS and DGA program including locations that historically contained hydrocarbon concentrations exceeding the applicable guidelines (i.e., MW-1 and located near the former No. 2 bulk fuel oil AST north of Lead Refinery).

The area and volume of hydrocarbon impacted soil assumed in the 2008/2009 Closure Plan PFS was 8,000 m<sup>3</sup>. GHD estimates the volume of hydrocarbon (product) impacted groundwater is 500,000 litres as diesel impacted groundwater was reportedly observed in a 2019 trench excavation west of the Sinter Building. These volumes were carried forward in the 2019 Closure Plan Update, however it is noted that the volume of impacted materials may have been reduced since 2009 given the reduction in use of petroleum hydrocarbons in the Smelter operations (i.e., conversion to a propane fuel source).

For the purposes of the 2019 Closure Plan Update, it has been assumed that hydrocarbon impacted soil and groundwater is likely present in certain areas on-Site and that assessment of these areas will only be possible after the Facility is closed due to the potential for buried utilities and existing building infrastructure near storage tanks. The following are areas of potential concern for petroleum hydrocarbon impacted soil:

- The soil around and under existing and former petroleum storage tanks and the underground fuel pipeline (see Table 2 and Section 3.2); and
- Former storage of CN Moncton petroleum contaminated soil (as described in Section 10).

In addition, there could be unknown decommissioned USTs left in place at the Site which could also represent a potential concern. Further testing, after Site closure, would be required to provide an accurate estimate of hydrocarbon impacted soil/groundwater remaining at the Site. As described in Section 10.8, a cost effective strategy for on-Site management and remediation of mTPH impacted soil and groundwater includes the use of selected, remaining concrete building floor slab(s), with any floor drains sealed, to be used as bio-treatment pads for the impacted soil. Soil will be excavated from the various locations transported to the bio-treatment pads to a thickness of 0.6 to <1 m. Soil nutrients consisting of nitrogen and phosphorous nutrients (fertilizer) will be blended into the soil. The soil will be mechanically turned / tilled the following year and then tested for mTPH to document quality against applicable Tier I RBSLs and/or Tier II SSTLs. After the treated soil is confirmed to meet the screening level it will be covered in place with 0.15 m of organic soil and seeded. This option is considered to be feasible given:

- The available on-Site areas (including concrete floor slabs) for the spreading of the soil in thin layers (0.6 m to <1 m);
- That time is not a constraint for bioremediation processed (2 summer seasons could be required);
- Remediation does not require an aggressive treatment process; and
- Since the treated soil can remain in place on-Site.

### ***Metal Impacted Soil - Site***

The cover concept is detailed in Section 11.0. Based on the data collected from the Site in 2019 as well as historical investigation, the general environmental mitigations proposed for metal impacted



soil (in the 2008/2009 Closure Plan PFS and the 2019 Closure Plan Update) is the application of a protective soil cover. Metal impacted soils above applicable screening levels are shown on Figure 10. Metal concentrations in soil samples collected from Belledune Point were generally below risk-based SSTLs or CCME SQGs for an industrial land use, excluding arsenic and lead. As such, for the purposes of estimating, the area of Belledune Point identified to contain concentrations of metals exceeding screening levels and was also included in the area of the Site requiring soil cover. Similarly, the MHW Area and a small isolated area between the MHW Area and the Smelter area were also identified as requiring cover for the protection of human health. However, an alternative option would be the excavation of surficial soil in the MHW Area for disposal at the Smelter Area that may reduce or eliminate the requirement for soil cover in this area of the Site. This potential cost savings opportunity is further discussed in Section 16.1.

The provision for constructing a protective cover over the areas with metal concentrations exceeding SSTLs has been included in the 2019 Closure Plan Update. A protective cover must be structurally stable and require little to no maintenance, not be susceptible to erosion by wind or water, and have the ability to sustain vegetation growth. The cover does not have to prevent infiltration of water or groundwater movements. Upon completion of final grading activities, the graded areas will be covered with 0.45 m of granular material and top dressed with 0.15 m of organic topsoil and hydroseeded. Approximately 420,000 m<sup>3</sup> of granular material will be required to cover the metal-impacted areas and approximately 140,000 m<sup>3</sup> of organic topsoil is required. It is noted that actual cover thickness developed during future detailed design phases may vary depending on elevation requirements, concentrations of contaminants in soil and future land uses for specific areas of the Site.

This remedial approach has previously been accepted by the NBDELG for the protection of human health to mitigate risks to human health through direct contact/ingestion of surface soil. As noted above, GHD has assumed that portions of Belledune Point will need to be covered (but not the lagoon areas). This is considered to be conservative assumption as further risk assessment may demonstrate that remedial action is not required. In addition, an alternative option for management of metal impacted soil in the Smelter Area and MHW Area is excavation and off-Site disposal of the impacted soil. A trade-off study is recommended as part of the additional pre-decommissioning engineering studies to evaluate potential future environmental liabilities associated with covering the metal impacted soil compared to excavation and off-Site disposal.

#### ***Metal Impacted Ballast – Rail Spur Line***

The portion of the rail spur line extending 2.3 km from the CN main line to Shannon Drive is assumed to remain. It is noted that there is also a short rail line extending off of the Glencore spur line property into the NB Power property. SNB shows this spur line property as being owned by Glencore (Figure 2) and information provided by Glencore indicates that Glencore is responsible for maintenance of the spur line. However, the decommissioning and demolition of the spur line may require agreement from CN and NB Power. The potential transference of ownership of the rail spur line property and infrastructure to a third party (i.e., the Port) was not evaluated as part of the 2019 Closure Plan Update.

Ore concentrate was previously observed along portions of the rail spur line related to the transport of ore concentrate prior to March 2013 (when the Brunswick Mine Site ceased operations). The proposed remedial approach for ore concentrate impacted ballast on the spur line assumes the use



of specialized rail equipment (LORAM Rail Vacuum) and rail engineering contractor. The remedial work would include the excavation of the ballast rock to a depth of 0.3 m within the gauge of rail (1.4 m) by 2.3 km in length and assumes the transport of 3,000 tonnes metal impacted ballast material to the Brunswick Mine Site open pit for disposal. The excavated ballast rock would be replaced for continued safe operation of the spur line.

It is noted that this work would require long lead time for securing / scheduling rail contractors and involve advance communications with CN and NB Power with respect to connected rail lines on these properties.

### ***NORM Impacted Soil***

As part of the NORM and Hazardous Materials Survey program completed in 2019 by GHD (Appendix 3), a total of 19 soil samples were collected from various areas of the Fertilizer Plant, including the Scrap Yard. The soil samples collected from the Site in 2019 had NORM concentrations below applicable guidelines for Unconditional Derived Release Limits of Diffuse NORM Sources. These results confirmed the findings of the 2019 non-intrusive survey as well as soil samples collected in 2008 and indicate that remediation of soils specific to NORM are likely not required as part of future Site closure activities. However, it is noted that soil samples were not collected from areas directly beneath equipment or piping with elevated NORM concentrations and these areas will require additional assessment at the time of facility closure (see also Sections 10.1 and 11.2). It is also noted that groundwater samples collected from the Fertilizer Plant area did not contain detectable concentrations of NORM indicating groundwater in the area has not been impacted with NORM and does not require additional evaluation or remediation as part of future Site closure activities.

### ***PCB Impacted Soil***

As part of historical investigations as well as the investigations completed by GHD in 2019, soil samples were collected in the vicinity of on-Site substations and former PCB Storage Building. Results of the soil sampling program did not identify detectable concentrations of PCBs in on-Site soil. Similarly, concrete samples collected from the two transformer pads in the Fertilizer Plant area in 2019 did not contain detectable concentrations of PCBs and do not require specific handling or disposal requirements as part of future Site closure activities.

Although soil on-Site does not appear to be impacted with PCBs, only limited testing of potential PCB source areas has been conducted to date. Various sources of PCBs have been used at the Site in the past and potential PCB impacted soil could be found in the vicinity of current or former electrical substations in the course of demolition work. Additional testing may be required to confirm concentrations in these areas at the time of Site closure. If any minor quantities of local impacted soils with PCBs are found at the Site, they could be stored in drums and transported off-Site for disposal at a licensed facility.

## 14. Project Execution Plan

The following subsections form a Project Execution Plan to guide the implementation of the Facility closure works such that the overall objective of closing the Brunswick Smelter in a manner that is





environmentally and economically sound and in compliance with applicable provincial and federal regulations and standards is met.

## 14.1 Planning and Scheduling

A conceptual decommissioning schedule is presented on Figure 13. The schedule shows decommissioning activities and pre-decommissioning engineering identified in Section 11 and 14.3, respectively. The duration and sequencing of each activity is based on GHD's professional experience, best management practices, and on current market conditions. The duration of each activity will ultimately be dependent on the selected contractor's availability, resources (i.e., equipment and human resources) and their selected means and methods; and the sequencing will partially be dependent on the selected contractor's preference and the contractor's ability to execute multiple decommissioning activities in a safe manner. Additionally, the schedule may be adjusted to maximize:

- Utilization of Glencore personnel to the extent practical;
- Potential sale of equipment in lieu of salvage for scrap value; and
- Matching scrap material recycling to optimum market conditions.

The key internal (Glencore) dependencies for which major grouping of activities are based include:

- ID-2 Glencore Pre-Decommissioning Engineering (including stakeholder engagement, topographic survey, hazmat inventory update and other additional engineering studies, tender period and contractor selection): Year 1;Qtr 1 through Year 3;Qtr 1; and
- ID-10 Glencore Planning & Management Activities (including asset management planning, raw material inventory management, relocation of valuable equipment to other Glencore facilities, initial cleaning activities and cessation of Glencore personnel site activities) : Year 1;Qtr 2 through Year 2;Qtr 4.

External dependencies for which major grouping of activities are based include:

- ID-17 & 18 Demolition Contractor decommissioning activities (including contractor submittals and approvals, mobilization to Site and initial Site inspections) : Year 3;Qtr 1 through Year 3;Qtr 2;
- ID-19 Building Decommissioning and Demolition activities (including abatement activities, demolition of buildings and associated infrastructure) : Year 3;Qtr 2 through Year 5;Qtr 2;
- ID-66 Civil Infrastructure remediation activities (including abandonment and decommissioning of Site utilities and infrastructure and final Site grading and cover) : Year 3;Qtr 3 through Year 6;Qtr 2;
- ID-82 Site remediation activities (including remediation of environmental impacts, construction of wetlands and monitoring of wetland treatment efficiency) : Year 4;Qtr 3 through Year 10;Qtr 4; and
- ID-86 WWTP Closure (includes cessation of WWTP treatment activities, decommissioning cleaning and demolition of WWTP and associated infrastructure): Year 10; Qtr 4 through Year 11;Qtr 4.



## 14.2 Pre-Decommissioning Engineering

In order to obtain the necessary approvals for decommissioning the Brunswick Smelter, and to prepare tender documents to retain contractor(s) to implement the decommissioning activities, the following pre-decommissioning engineering is required:

- Stakeholder Consultation;
- Topographic Survey and Updated Hydrologic/Hydraulic Studies;
- Additional Environmental Sampling;
- NBDELG EIA Reporting and Approvals;
- Hazardous Materials Update & Additional Engineering Studies; and
- Detailed Design and Preparation of Tender Document(s).

### 14.2.1 Stakeholder Consultation

Stakeholder consultation will be required to determine final decommissioning activities for the:

- Decommissioning and removal of the conveyors, transfer houses and gantry extending to Terminal 1 in consultation with the Port;
- Removal of the on-Site spur line with CN and remediation of the rail spur line between the CN main line and the Site (Shannon Drive) with input and consultation from Port and NB Power;
- Decommissioning of the substations in consultation with NB Power;
- Potential remedial activities on the cemetery property currently owned by the Roman Catholic Bishop of Bathurst; and
- Location of MHW Area engineered wetland discharge outfall in consultation with the Port.

### 14.2.2 Topographic Survey and Updated Hydrologic/Hydraulic Study

A topographic survey will be required to verify existing grades for use in the preparation of a detailed final grading and surface water management plans, cut/fill requirements, landfill cover requirements, and tender quantities. It is recommended that updated hydrologic and hydraulic studies be completed as part of the pre-engineering activities to refine the surface water management plans based on Site and climate conditions at the time of closure.

### 14.2.3 Additional Environmental Sampling

Sampling will be required as follows:

- Hydraulic monitoring to verify groundwater levels in the vicinity of soil borrow areas;
- Sampling of oils, bushings and carcasses for PCB analysis from on-Site transformers;
- Treatability testing for the selection and sizing of the long-term passive engineered wetland treatment options;
- Source testing of aggregates to determine physical and chemical properties for materials to be imported for use in the works; and



- Hydrocarbon impacted soil and groundwater delineation following Site closure and petroleum storage tank removals.

#### 14.2.4 NBDELG Environmental Impact Assessment Reporting and Approvals

To obtain the NBDELG approval on the decommissioning methodology and requirements, Glencore will be required to submit an EIA registration to the NBDELG. In addition, the current Approval to Operate I-9010 indicates that in the event of Facility closure, Glencore shall prepare plans for complete Site rehabilitation and submit these plans to the NBDELG a least six months before the planned closure date. These plans are in addition to any requirements under the EIA Regulation.

Upon submission of the closure plans and successful approval of the EIA, including public consultation and First Nation engagement, a Certificate of Determination will be issued by NBDELG. For the purpose of this report, it is assumed the Facility closure will be approved through the more stream-lined Determination Review process and that a Comprehensive EIA will not be required. It is anticipated that conditions on the Certificate of Determination will include but are not limited to the following engineering requirements:

- Obtain a WAWA Permit from the Sustainable Development, Planning and Impact Evaluation Branch of NBDELG;
- Prepare a site-specific Environmental Management Plan and submit to the Environmental Assessment Section of NBDELG for approval;
- Prepare a Surface Water Control Plan and Erosion and Sediment Control Plan and submit to the Environmental Assessment Section of NBDELG for approval;
- Prepare a PCB Source Removal and Disposal Plan and submit to the Environmental Assessment Section of NBDELG for approval;
- Prepare an ODS (and other Halocarbons) Removal Action Work Plan and submit to the Environmental Assessment Section of NBDELG for approval;
- Prepare a Remedial Action Plan and submit to the Remediation and Materials Management Section, Impact Management Branch of NBDELG for approval; and
- Consultation and preparation of an Engineered Traffic Management Plan for routing of equipment, materials, wastes, and oversized equipment.

#### 14.2.5 Hazardous Materials Update & Additional Engineering Studies

Hazardous materials typically included in Site reconnaissance survey as well as information obtained from Glencore includes (but are not limited to) ACM, ODS, nuclear substances (smoke detectors), mercury sources, batteries, oils, and chemicals.

A Facility inventory of ACM is currently available in sufficient detail to likely satisfy the EIA registration requirements, however, inventories of ODS, nuclear sources, chemicals, mercury and PCB sources are either absent or incomplete and will likely require additional assessment as part of the EIA registration document preparation. In particular, as part of the EIA registration requirements, all transformers, transformer bushings, circuit breakers, etc. containing oils must be tested for PCBs.



A supplemental Hazardous Material Inventory survey will need to be completed to confirm the presence of all hazardous and regulated wastes prior to decommissioning. Hazardous materials, universal wastes, and decommissioning cleaning wastes identified will need to be managed in accordance with applicable regulations.

Additional engineering studies including a detailed hydraulic/hydrology study, surface water management planning and structural reviews of building infrastructure will be required prior to preparing detailed design and tender documents.

#### 14.2.6 Detailed Design and Tender Document Preparation

Detailed design of the decommissioning work is required, including preparation of tender documents, following which the tender package will be issued for tender such that Glencore may obtain competitive quotes for implementation of the Facility closure activities. The tender documents will include instructions to bidders, contract requirements, general and technical specifications, detailed design drawings, and form of bid. As part of the detailed design scope of work, a Class 2 Engineer's Estimate for decommissioning activities may also be completed for bid comparison purposes.

### 14.3 Procurement and Contracts

Contractor selection will likely include a pre-qualification process to short-list a number of contractors who have the required qualifications and can validate that they have the technical and management expertise to complete the decommissioning and demolition of the Brunswick Smelter safely, efficiently and with minimal disruption to the public. Bid submissions received will be reviewed for bidder qualifications, exceptions to the specified requirements of the bid documents, and non-submission or incomplete submission of requested information. Construction and demolition safety will be a primary consideration in awarding contracts, work planning, and execution. Contractor(s) safety programs and historical safety performance records will be evaluated as part of the procurement process. Bid submissions will also be reviewed on the basis of accuracy, and adherence to project specifications. A recommendation of a selected bid submission will be based on the results of the reviews and evaluations identified above, and overall contract price.

When developing a contract strategy and defining construction packages, there are a number of items to consider including Owner's package management resources, construction/demolition labour savings, scheduling requirements, and package interface/overlap considerations. Based on GHD's experience on similar demolition projects, preference is given to limiting the number of construction packages on demolition projects in order to limit health and safety risks and Owner's liabilities, limit the risk of cost overruns due to package overlaps or gaps, and maximizing schedule efficiency. For the purposes of the 2019 Closure Plan Update, it is assumed that the works will be divided into the following construction packages:

- Initial Decommissioning Cleaning;
- Decommissioning and Demolition of Smelter Area/MHW Area/Fertilizer Plant infrastructure excluding WWTP;
- Earthworks including Site Cover, New Slag Pile Cover, Drainage Upgrades, and Wetland Construction; and



- Demolition of WWTP.

#### 14.4 Construction/Demolition

To ensure the contractor(s) have a strong understanding of all special considerations for the closure works, the contract and technical specifications will require the contractor(s) to prepare and submit a number of submittals and comprehensive plans. These plans will be subject to Owner/Consultant review and approval processes to ensure they meet the requirements prior to starting the works.

The submittals and plans that will be required include the following:

- Site-Specific HSEC Management Plan including SWPs, Physical Hazard Control Records, Fall Protection and Prevention Plan, Health and Safety Officer Qualifications, Material Safety Data Sheets, Respirator Fit Testing and Medical Surveillance Proof, Employee/Equipment Operator Training Certificates and Licenses, Erosion Control Plan, and Equipment Repair, Servicing, and Refueling Plan;
- Project Management documents including Detailed Working Schedule, Project Organization Charts, Manpower and Construction Equipment Forecast, Cash Flow Estimate, Progress Reports;
- Comprehensive Decommissioning, Cleaning, and Demolition Plan, including Blasting Plan, Demolition Blasting Specialist and Structural Engineer Qualifications, Above Ground and Underground Storage Tank Removal Plan, Asbestos Abatement Plan (Including Employee Qualifications) and Shop Drawings as required;
- Pre-Blast Survey and Post-Blast Records;
- Waste Management Plan including Treatment, Storage, and Disposal Facility Operating Licenses and Permits and Blank Sample Forms of Proposed Shipping and Disposal Documents;
- Geotechnical Testing Firm Qualifications and Materials Sources, as required; and
- "As Built" drawings and documents.

#### 14.5 Occupational Health, Hygiene, Safety, Security and Public

The closure activities will follow the Safety Management processes outlined in Section 9.2 and will comply with all requirements of the New Brunswick Occupational Health and Safety Act and regulations, National Fire Code, and the National Building Code of Canada.

Site workers will be trained of the potential risks and hazards present on the Site and outfitted with personal protective equipment (PPE) applicable for each decommissioning and demolition activity. At a minimum, all workers will don a hard hat, safety glasses, high visibility safety vest and safety boots. Based on the current Site-specific HSEC Management Plan, additional levels of protection (e.g., respirator, breathing apparatus, cover-all, Tyvek suit, etc.) will also likely be required on a routine basis as included in the standard PPE requirements for the Site. Additional levels of protection will be added based on the hazards identified for specific tasks.

Asbestos abatement will be completed by contractors who are licensed in NB and the employees will have completed courses in asbestos abatement. During asbestos abatement activities, negative air pressure will be maintained within abatement containment areas. Real time air monitoring for



asbestos content will be completed within as well as outside of the containment areas to ensure asbestos fibres are not being released to the environment. Should asbestos fibres be detected outside of the containment areas, abatement work will immediately cease and measures will be implemented to eliminate any further releases.

As discussed in Section 9.3, the Site is fenced and equipped with security cameras at each access gate. To further restrict unauthorized access or trespassing on the Site, security personnel will monitor the Site 24 hours a day, 7 days a week during the active demolition period. During working hours, security personnel will control vehicular access to the Site via the existing access gates. The existing perimeter chain link fence will be maintained in the current configuration to the extent possible during the project (and potentially post-closure).

## 14.6 Environmental

As discussed in Section 10.9, an EMP will be developed as part of the final Facility demolition designs (i.e., final demolition methodology and sequencing) to effectively mitigate potential environmental impacts associated with the closure activities. The EMP will include protocols for specific activities such as refuelling equipment, leak and spill prevention plans, work near surface water bodies, domestic and sanitary waste collection, erosion and sedimentation control plans, contingency plans including spill notification and clean-up protocols, Facility access plans, traffic control plan, stormwater management plans, and a noise control plan. In addition, a specific component of the EMP will include a dust control plan as surface soils and dusts at the Site contain elevated concentrations of heavy metals and release of air-borne particulate matter to the atmosphere may cause adverse effects to the surrounding environment. The EMP will outline specific parameters, particulate monitoring methods, action levels, and mitigation measures that will be implemented during the closure activities to control releases of fugitive dust. Real time dust monitoring is recommended at Site boundaries with electronic alert system. If air quality exceeds the threshold limits established as part of the EMP (dust, silica, lead or asbestos), work will immediately cease and additional dust suppression measures will be implemented.

Glencore's HSEC representative will be responsible to ensure the EMP is being followed by Glencore personnel and contractors working at the Facility for the duration of the closure works. It is recommended that the EMP be updated on a regular basis to reflect changes in Site conditions as the closure works progress.

## 14.7 Risk Management

As part of the 2008/2009 Closure Plan PFS, SNC and Glencore developed a Risk Register for the overall closure project. As part of the current study update, GHD and Glencore reviewed and updated the previous Risk Register (refer to Section 16.0 for further details). However, in addition to the overall closure project Risk Register, it is recommended that contract-specific risk registers be developed for the various work packages at the time of contract award. Contract-specific risk registers allow for more detailed review of risks and mitigation measures regarding the technical aspects associated with the works. It is recommended that the Owner, contractor and consultant all have input and review the risk register on a regular basis as the works progress.



## 15. Site Long-Term Operation Plan

The overall closure concept for the Brunswick Smelter is to limit future liability, operations and maintenance requirements. The Site will be fully demolished and restored to an open space condition with the majority of the Site held in perpetuity by Glencore as a vacant property. All Glencore infrastructure to be sold/decommissioned/demolished.

After closure of the Facility, the Site will be vacant as a fenced or partially fenced property. As part of post-closure maintenance operations, periodic inspections and limited maintenance will be required for the Site cover, erosion protection measures, ditches, culverts, perimeter fencing, and the engineered wetlands. In addition, it is anticipated that NBDELG will require a post-closure groundwater and surface water monitoring program for a period of approximately five years following completion of the closure activities of the Site. It has been assumed for the purpose of the 2019 Closure Plan Update that the maintenance, inspection and monitoring operations as well as regulatory reporting will be fulfilled by Brunswick Mine Site personnel.

## 16. Risk Assessment and Management

As part of the 2008/2009 Closure Plan PFS, SNC and Glencore developed a Risk Register for the overall closure project. As part of the current study update, GHD and Glencore reviewed and updated the Risk Register during a Risk Assessment meeting held on October 25, 2019. During the meeting, Glencore and GHD agreed to re-format the risk registry into specific risk categories which included the following:

- Planning Assumption Risks;
- Health and Safety Risks;
- Engineering Design Risks;
- Environmental Risks;
- First Nation and Heritage Risks; and
- Facility Demolition Risks.

In addition, during the October 25<sup>th</sup> meeting specific changes to previously identified risk items were reviewed such as changes in Site conditions as well as newly identified risks. Risks were identified and listed for each area covered by the scope of the prefeasibility study.

The conclusions of the Risk Assessment evaluation identified as part of the 2019 Closure Plan Update are as follows:

- 42 very low level risks are ranked “green”;
- 16 low level risks are ranked “yellow” at this point of the project;
- 3 medium level risks are ranked “orange” at this point of the project; and
- 0 high level (“red”) risk remains at this point of the project.



It should be noted that at this point of the project, several additional risks presented in the Risk Register are not rated for one of the following reasons:

- The risk was outside of the area included in the project scope of work; and
- The risk was found to be an opportunity rather than a risk.

The risk register is provided on Table 11 and is to be reviewed and updated on a regular basis, as the Closure Project progresses.

## 16.1 Opportunities

The 2008/2009 Closure Plan PFS identifies several cost savings opportunities in the closure concepts including but not limited to using risk assessment in the closure planning process and the potential to transfer of the MHW Area to the Port. These same closure opportunities are considered viable as part of the 2019 Closure Plan Update.

However, one opportunity not identified in the previous study is the potential that the Jacquet River Pumphouse, Freshwater Pipeline and associated reservoir could be sold or turned over to a third party such as the Port or NB Power. The Freshwater Pipeline and associated infrastructure supply freshwater to multiple third parties including a residential area (Townsite), small industrial park, NB Power and the Port. One or all of these entities would likely take ownership of the infrastructure in order to maintain their supply of freshwater. As previously indicated, for the purpose of the 2019 Closure Plan Update it has been assumed that the Freshwater Supply Infrastructure will remain in place and operational by Glencore for the foreseeable future.

During the August 1, 2019 Alternatives Evaluation Meeting, GHD identified the potential to remediate a portion of the Site adjacent to Port lands for potential re-sale with limited land use restrictions (excavate impacted soil from the MHW area and dispose of the soil in the Smelter area prior to covering with clean granular fill). In order to be conservative, Glencore requested that the 2019 Closure Plan Update includes covering all areas of the Site that have metal concentrations exceeding applicable risk based screening guidelines and buildings in these areas also be removed/demolished. It is reasonable to assume that the Port could potentially lease (or buy) the buildings and equipment associated with the MHW Area for potential future use. Consideration of continued future industrial usage of the MHW Area in association with remediation of surface soil in this area of the Site would be another opportunity to reduce future Site closure costs.

Transportation and off-Site disposal of hazardous waste, specifically the 14,000 tonnes of New Pond Dredge stockpiled in the Back 40 and Process Sludge Storage areas area along with residual sulphuric acid in the Bulk Acid Tanks in the MHW Area are anticipated to incur significant costs to the closure project. The re-use or re-processing of this material on-Site or at another off-Site facility could realize significant savings to the overall Facility closure cost. Further evaluation of possible re-use or re-processing of the stock-piled residue material as well as residual sulphuric acid is considered warranted considering the high costs associated with the disposal of this material as hazardous waste.





## 17. Future Work Plan

The next step of the closure plan should be a Basic Engineering study. At that stage it is anticipated that several studies will be necessary to further develop the closure concept and to refine the Risk Register. The following future works are outlined below:

- Complete a topographic survey (in the area of the slag pile, borrow pits, ditches and culvert inverts, as well as proposed locations of the engineered wetlands, etc.) to verify existing grades for use in the preparation of a detailed final grading and surface water management plans, cut/fill requirements, soil cover requirements, and tender quantities.
- Complete a trade-off study to evaluate potential future environmental liabilities associated with covering the metal impacted soil compared to excavation and off-Site disposal.
- Complete a detailed hydrologic and hydraulic study as part of the pre-engineering activities to refine the surface water management plan(s) based on Site and climate conditions at the time of closure. This study would also incorporate engineered wetlands as part of the conceptual Site closure plan.
- Complete detailed designs of the wetlands (i.e., wetland elevations, inlets, outlets, etc.) required for inclusion in the hydraulic study and depending on the wetland design, modifications to drainage ditch sizing and layouts may also be required.
- Complete a wetland treatability study to confirm the suitability and effectiveness of the proposed treatment options prior to final selection and development in the detailed design stage. At a minimum, this treatability study should include influent characterization, column tests, media consumption rates, sizing of system components and reporting.
- Complete a pilot test, as part of the detailed design stage, to determine an appropriate stormwater system decommissioning methodology. It is noted that depending on the extent of residues built up in the stormwater system, flushing may not adequately clean the stormwater system and excavation and disposal of some stormwater piping may be required.
- Conduct a slope stability and physical property analysis of the material in the New Slag Pile to ensure the conceptual anti-erosion cover design provides adequate protection and limits the potential for future failure.
- Prepare plans for Site rehabilitation and submit the plans to the NBDELG (at least six months before the planned Closure date) as part of the current Approval to Operate I-9010 under the Clean Water Act. It is noted that these plans are in addition to EIA Regulation requirements.
- Continue correspondence with DFO to determine if the 2019 revisions to the Fisheries Act will affect future closure work or environmental monitoring requirements.
- Facilitate consultation with Pabineau First Nation and Eel River Bar First Nation as part of future Facility closure planning activities (Pabineau First Nation and Eel River Bar First Nation are two of seven First Nation communities in northern and eastern New Brunswick who are served by the North Shore Micmac District Council). One specific future consideration will be the transportation of demolition debris from the Smelter to the Brunswick Mine Site for disposal; as the access to the mine is via Highway 430 which bisects the northwestern corner of Pabineau First Nation.



- Determine Site-specific risk based screening levels for the primary contaminants of concern including metals and petroleum hydrocarbons in soil and groundwater. It is expected that the development of site specific risk based guidelines using Atlantic RBCA would significantly reduce (or possibly eliminate) the requirement for remediation of hydrocarbon impacted soil on-Site. As the science for risk assessment is evolving, the SSTLs presented in this report are being used specifically for environmental closure estimation items and that Brunswick Smelter specific SSTLs would be required as part of a remedial action plan. For example, other metals (such as antimony) would also require site-specific consideration in a risk assessment application at the Smelter. Since potable water is supplied from an off-Site source, it is assumed the focus of the screening levels will be for protection of ecological receptors. It is noted that ecological considerations, specifically Belledune Point, were not evaluated in the 2008/2009 Closure Plan PFS but ecological considerations are likely now required based on changes in applicable guidance documents.
- Conduct a review of the environmental monitoring program being undertaken by Glencore and revise accordingly to remove uncertainties prior to Site closure.
- Complete testing of all transformers, bushings and the transformer carcasses (will likely be required by the NBDELG), as part of the pre-demolition engineering activities to confirm they are PCB-free, before transporting off-Site for disposal. The results of the transformer testing program will dictate oil draining and disposal requirements to be implemented as part of the decommissioning work. Potential PCB impacted soil could be found in the vicinity of current or former electrical substations in the course of demolition work. Additional testing may be required to confirm concentrations in these areas at the time of Site closure.
- Update the hazardous waste inventory for the Site, specifically the asbestos inventory that was previously prepared in 2016.
- Identify sources of supplementary granular borrow materials and organic soil material for Site cover.
- Establish a management goal to minimize the volume of stockpiled process materials (i.e., the Back 40 and Process Sludge Storage areas) and containerized materials requiring disposal. In particular, further evaluate possible re-use or re-processing options of the stockpiled residue material as well as residual sulphuric acid that have the potential to significantly reduce future Facility closure costs.
- Review spot scrap metal prices, prior to issuing the decommissioning tender package(s), and update the estimated value of scrap metal to be generated as part of the decommissioning project.
- Review and update the risk register on a regular basis as the Closure Project progresses.



## 18. Closure

All of Which is Respectfully Submitted,

GHD

A handwritten signature in blue ink that reads "Troy Small". The signature is written in a cursive style with a large initial 'T'.

Troy Small, M.Sc., CE

A handwritten signature in blue ink that reads "M. G. Gallahue". The signature is written in a cursive style with a large initial 'M'.

Mike Gallahue, P.Eng.

A handwritten signature in blue ink that reads "Cherie Babineau". The signature is written in a cursive style with a large initial 'C'.

Cherie Babineau, P.Eng.

A handwritten signature in blue ink that reads "Robert Turner". The signature is written in a cursive style with a large initial 'R'.

Robert Turner, M.A.Sc., P.Geo.

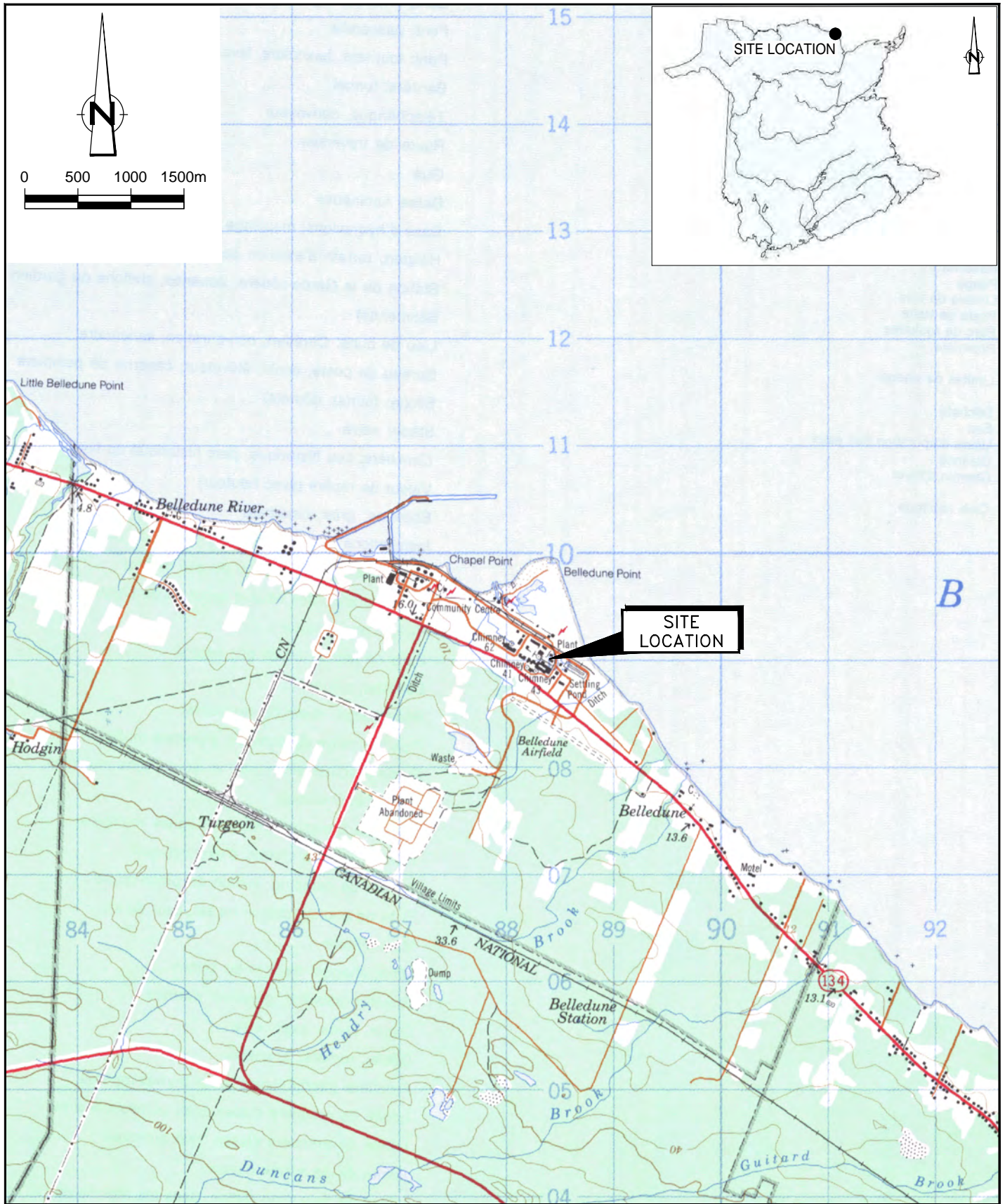


## 19. References

- Atlantic RBCA (Risk-Based Corrective Action) V For Petroleum Impacted Sites in Atlantic Canada, Version 3, User Guidance (July 2012, revised January 2015).
- Climate-Data.org Belledune Climate: Average Temperature, weather by Month, Belledune Weather Averages, (<https://en.climate-data.org/north-america/canada/new-brunswick/belledune-227346/>), Accessed Nov. 1, 2019.
- Conestoga-Rovers & Associates, Closure Plan - Stage 1, Noranda Brunswick Smelter, Belledune, NB, July 2004 (CRA Reference #031871).
- Conestoga-Rovers & Associates, Soil and Groundwater Sampling Program, Belledune Smelter Site, Belledune, NB, February 15, 2006 (CRA Reference #810447).
- Conestoga-Rovers & Associates, Pre-Remediation Survey of the Falconbridge Ltd. DAP Facility, August 24, 2006.
- Conestoga-Rovers & Associates, Supplemental Phase III Environmental Site Assessment, Belledune Smelter Site, Belledune, NB, February 22, 2007 (CRA Reference #045976).
- Conestoga-Rovers & Associates, Plan 2010 - Conceptual, Belledune Smelter, Belledune, NB, April 2007 (CRA Reference #031871).
- Conestoga-Rovers & Associates, Basis of Estimate, Plan 2010 - Conceptual Action, Brunswick Smelter, Belledune, NB, April 25, 2007 (CRA Reference #031871).
- Conestoga-Rovers & Associates, Conceptual Demolition Estimate, Xstrata Zinc DAP Fertilizer Plant Facility, Belledune, NB, May 4, 2007 (CRA Reference #045905).
- Conestoga-Rovers & Associates, Sand and Gravel Sample Results, Brunswick Smelter Complex, Belledune, NB, October 2, 2008 (CRA Reference #052664).
- Conestoga-Rovers & Associates, Groundwater and Soil Characterization Report, Prefeasibility Engineering and Cost Estimating For the Closure Plan of the Brunswick Smelter Complex, completed by CRA on behalf of SNC, November 2008.
- Conestoga-Rovers & Associates, Risk Assessment/Closure Report, Renviro Park Site, Belledune, NB, May 12, 2009 (CRA Reference #048190).
- Conestoga-Rovers & Associates, Field Program for Hydrology Study, Brunswick Smelter Site, Belledune, NB, October 2009 (CRA Reference #056690).
- Conestoga-Rovers & Associates, Port Land Exchange, Metal in Soil Data Compilation, Belledune, NB, June 16, 2010 (CRA Reference #070874).
- Glencore, 2013. Belledune Point Rehabilitation Plan, Final Report, Brunswick Smelter, A Glencore Company, September 2013.



- Glencore, 2016. Safe Work Practice / Standard Operating Procedure - Environment Department, Asbestos Management Program, Brunswick Smelter, A Glencore Company, June 2016.
- Intrinsik, Ecological Risk Assessment of Off-Site Terrestrial and Freshwater Aquatic Areas Near the Brunswick Smelter in Belledune, NB, September 2013.
- Intrinsik, Marine Ecological Risk Assessment of Brunswick Smelter in Belledune, NB, Intrinsik in association with Minnow Environmental Inc. October 2015.
- Minnow, 2015. Baie des Chaleurs 2014 Gypsum Bed Characterization, Minnow Environmental Inc., January 2015.
- New Brunswick Department of Environment and Local Government (NBDELG), 2011. Disposal of Lead Paint & Lead Painted Material Guideline. 2011 (Reviewed 2014).
- New Brunswick Department of Environmental and Local Government, Impact Management Branch, Facility Profile, Glencore Canada Corporation, Brunswick Smelter, May 2015.
- New Brunswick Department of Natural Resources and Energy (NBDNRE) and New Brunswick Department of Environment and Local Government (NBDELG), New Brunswick Wetlands Conservation Policy, July, 2002.
- Noranda Technology Centre (E.K. Yanful and R.S. Siwik), Hydrogeochemical Investigation at Brunswick Smelting and Fertilizer, Smelter Site, Belledune, N.B., March 17, 1989.
- Nova Scotia Environment, Environmental Quality Standards for Contaminated Sites, Rationale and Guidance Document, April 2014.
- Rampton, V.N., 1984. Generalized Surficial Geology Map of New Brunswick. Department of Natural Resources and Energy, Minerals, Policy and Planning Division. NR-8 (scale 1:500,000).
- Roy Consultants, 2013 Back 40 Drilling Program, Brunswick Smelter, Belledune, NB, January 2014.
- Roy Consultants, Phase II Environmental Site Assessment, Smelter Facility, Belledune, NB, September 2015.
- SNC Lavalin, Brunswick Smelter Closure Plan - Prefeasibility Study and Cost Estimating Report, January 2009.
- Wilson, R.A., 2006. Geology of Northern New Brunswick (NTS 21 O, parts 21 P, 22 B). New Brunswick Department of Natural Resources; Minerals, Policy and Planning Division, Plate NR-3 (second edition).



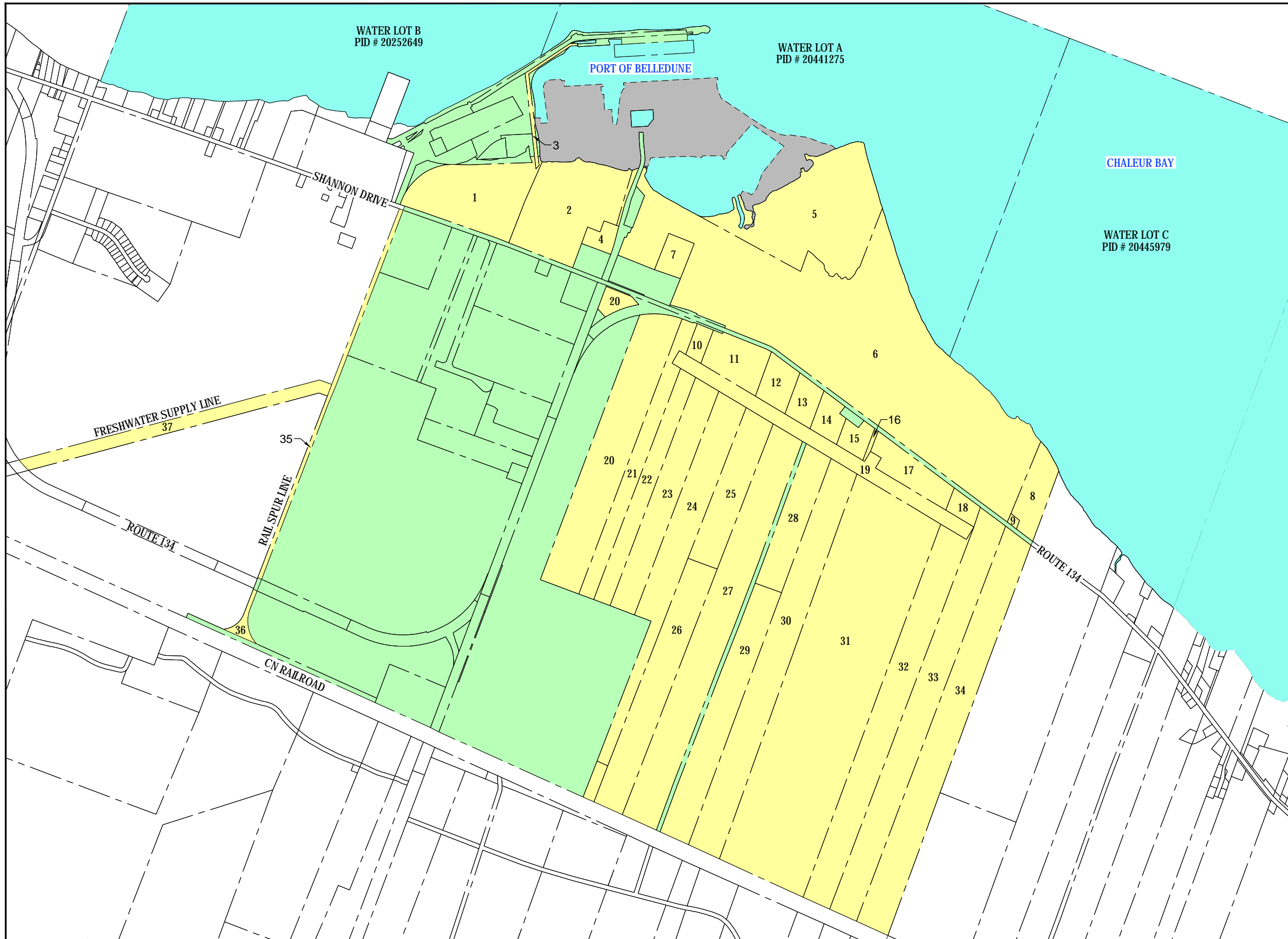
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 BRUNSWICK SMELTER, BELLEDUNE, NEW BRUNSWICK  
 CLOSURE PLAN - PREFEASIBILITY STUDY 2019 UPDATE

11198639-01(004)

Jan 6, 2020

SITE LOCATION

FIGURE 1



**GLENCORE OWNED PROPERTIES:**

PROVINCIAL PROPERTY IDENTIFICATION NUMBER	
1	20444844
2	20278339
3	20780508
4	20755302
5	20252318
6	20252680
7	20801619
8	20251963
9	20603197
10	20445789
11	20442992
12	20443057
13	20443081
14	20443115
15	20443123
16	20441283
17	20443164
18	20443180
19	20277968
20	20443149
21	20443255
22	20443156
23	20443172
24	20832481
25	20443198
26	20443206
27	20443214
28	20443222
29	20443230
30	20443248
31	20443263
32	20443107
33	20443099
34	20443073
35	20445714
36	20655122
37	20616314

Source: High Resolution Aerial Imagery from New Brunswick Dept of Natural Resources, Acquisition Date: 2018.

**LEGEND**

- PROPERTY LINES
- GLENCORE PROPERTIES - STUDY AREA (TOTAL AREA = 602 ha)
- THIRD PARTY PROPERTIES
- CROWN OWNED RECLAIMED LAND
- CROWN OWNED WATER LOT PROPERTIES

0 200 400 600m



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 CLOSURE PLAN - PREFEASIBILITY STUDY 2019 UPDATE

PROPERTY PLAN

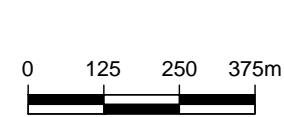
11198639-01(004)

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FIGURE 2



Source: High Resolution Aerial Imagery from New Brunswick Dept of Natural Resources, Acquisition Date: 2018.



**LEGEND:**

<span style="color: red;">- - - - -</span>	SMELTER AREA
<span style="color: cyan;">- - - - -</span>	FERTILIZER PLANT
<span style="color: green;">- - - - -</span>	MATERIALS HANDLING WEST AREA



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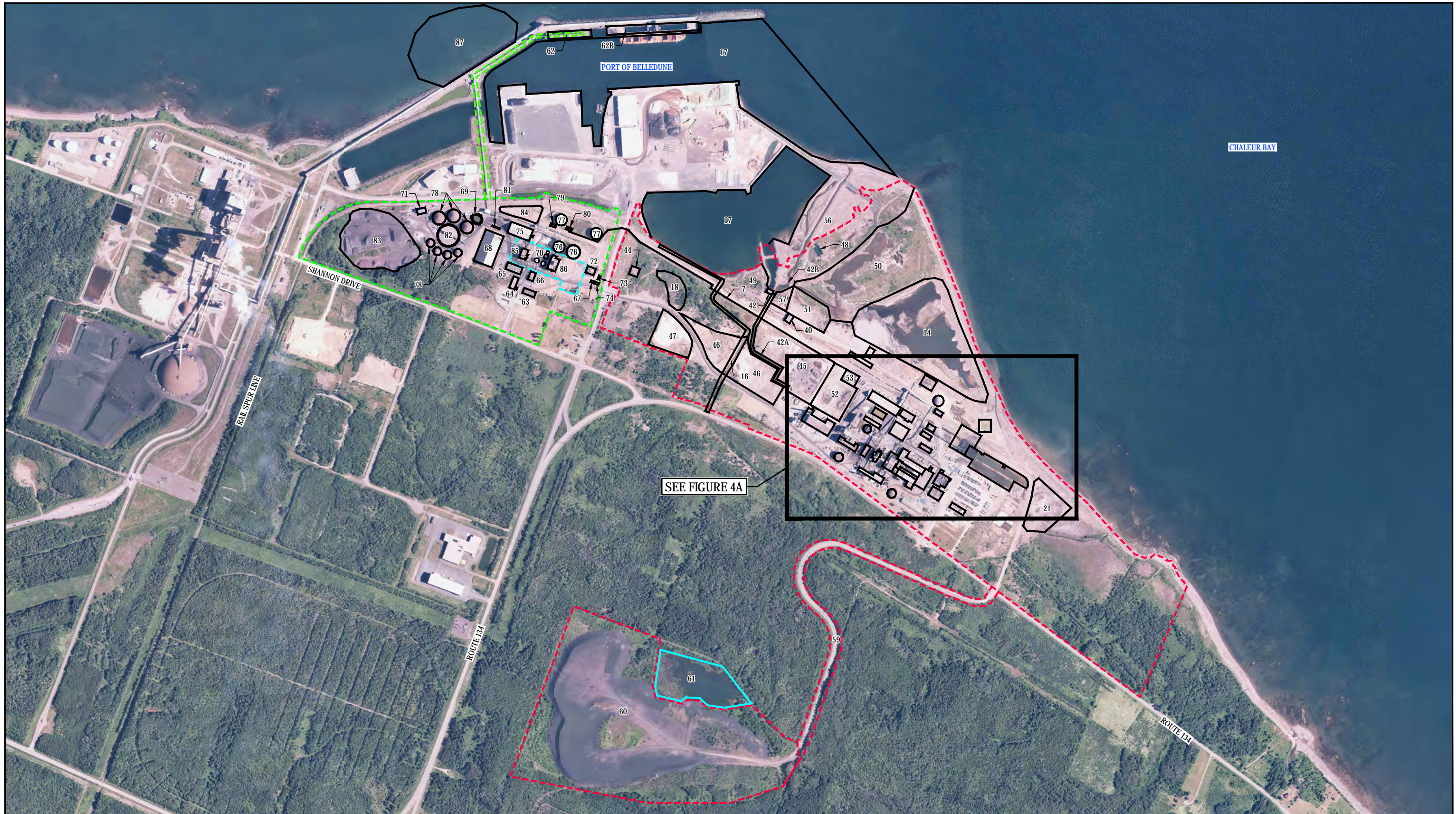
OVERALL SITE PLAN

11198639-01(004)

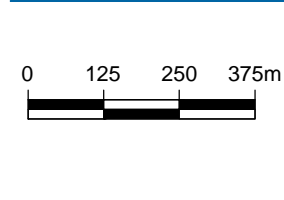
Jan 6, 2020

FIGURE 3





Source: High Resolution Aerial Imagery from New Brunswick Dept of Natural Resources, Acquisition Date: 2018.



**LEGEND:**

<span style="color: red;">- - -</span>	SMELTER AREA
<span style="color: cyan;">- - -</span>	FERTILIZER PLANT
<span style="color: green;">- - -</span>	MATERIALS HANDLING WEST AREA
<span style="border: 1px solid black; display: inline-block; width: 20px; height: 2px;"></span>	SITE FEATURES

NOTE: REFER TO TABLE 1 FOR DESCRIPTIONS OF IDENTIFIED FEATURES



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SITE FEATURES

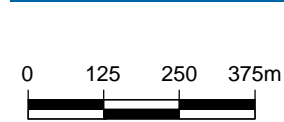
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FIGURE 4



Source: High Resolution Aerial Imagery from New Brunswick Dept of Natural Resources, Acquisition Date: 2018.



**LEGEND:**

- - - SMELTER AREA
- - - FERTILIZER PLANT
- - - MATERIALS HANDLING WEST AREA
- SITE FEATURES

NOTE: REFER TO TABLE 1 FOR DESCRIPTIONS OF IDENTIFIED FEATURES



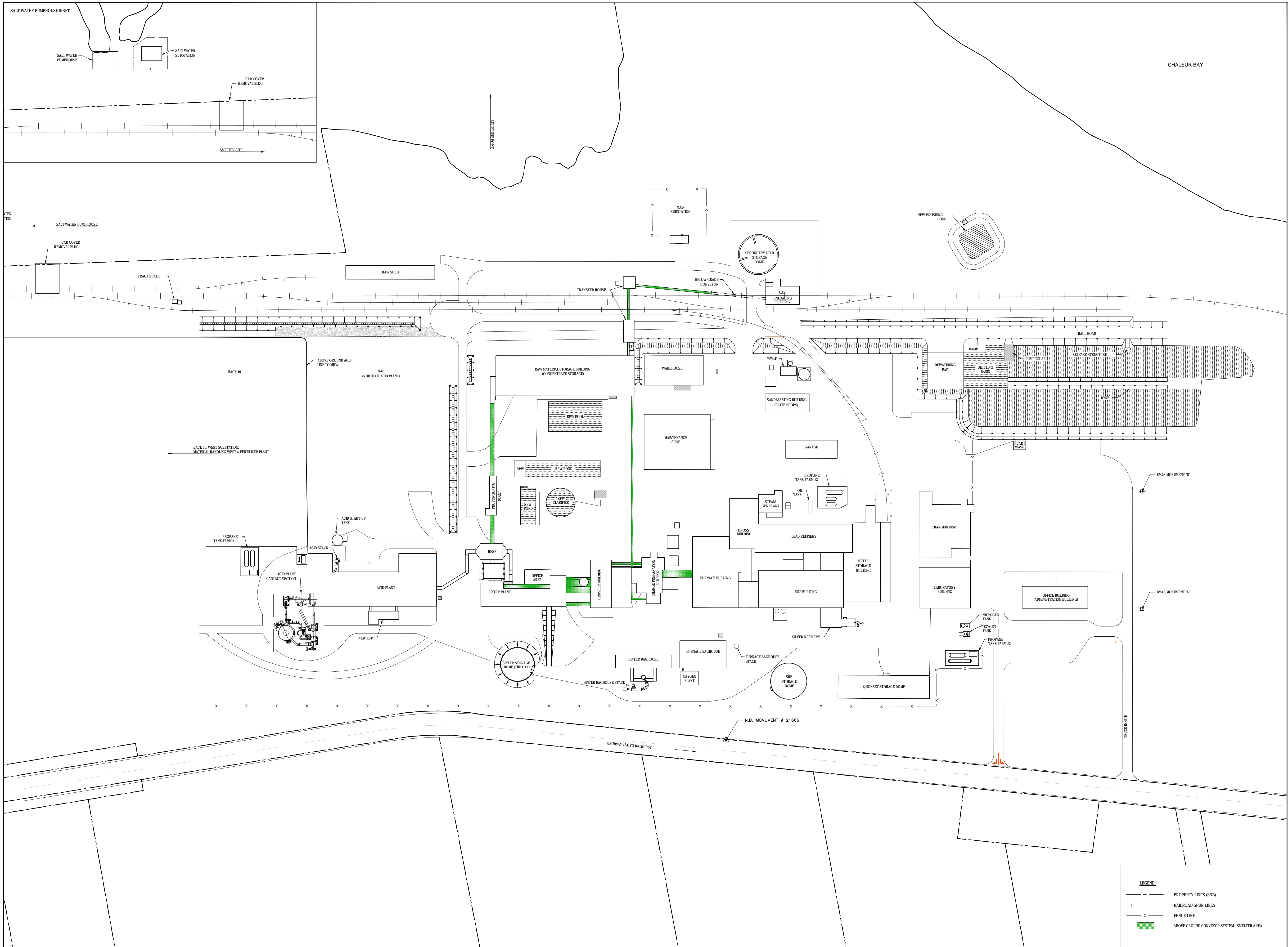
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SITE FEATURES - SMELTER CLOSEUP

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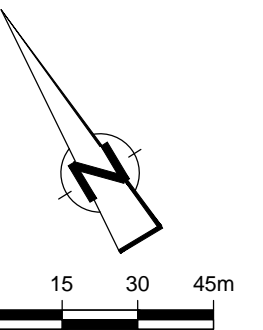
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FIGURE 4A



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**Project**  
 CLOSURE PLAN - PREFEASIBILITY  
 STUDY 2019 UPDATE

No.	Issue	Drawn	Approved	Date

Drawn	P. ARSENEAULT	Designer	C. BABINEAU
Drafting	C. BABINEAU	Design Check	C. BABINEAU
Project Manager	TROY SMALL	Date	Jan 6, 2020
Original Size	ANSI D		
Scale	1:1500		
Bar is 20mm on original size drawing	0 20mm		

Project No. 11198639-01

**SITE PLAN  
 SMELTER AREA**

Sheet No.  
**FIGURE 5A**

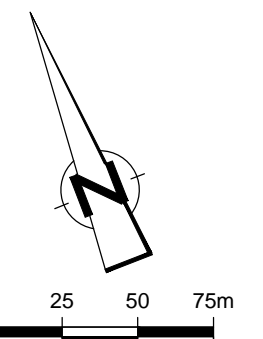
**LEGEND:**

- - - - - PROPERTY LINES (SNB)
- - - - - RAILROAD SPUR LINES
- - - - - FENCE LINE
- - - - - ABOVE GROUND CONVEYOR SYSTEM - SMELTER AREA



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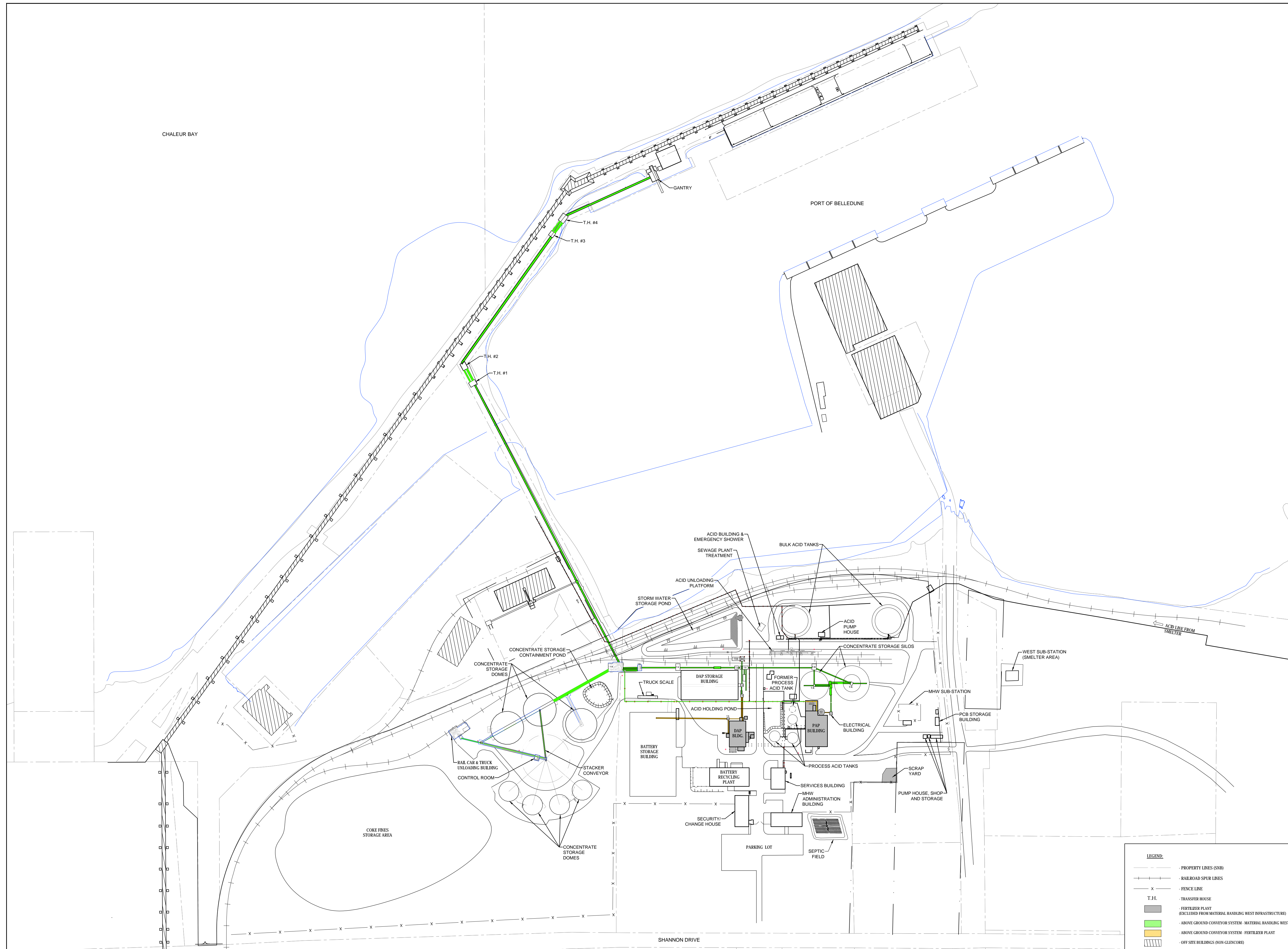
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Project Manager	TROY SMALL	Date	Jan 6, 2020
Original Size	Bar is 20mm on original size drawing		
ANSI D	0 20mm		

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**SITE PLAN**  
**MATERIAL HANDLING**  
**WEST AREA**

Sheet No.  
**FIGURE 5B**



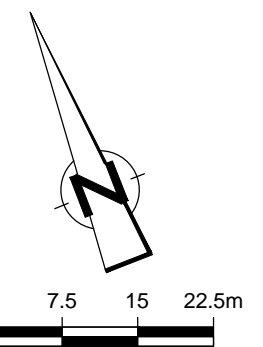
**LEGEND:**

	PROPERTY LINES (SNB)
	RAILROAD SPUR LINES
	FENCE LINE
	TRANSFER HOUSE
	FERTILIZER PLANT (EXCLUDED FROM MATERIAL HANDLING WEST INFRASTRUCTURE)
	ABOVE GROUND CONVEYOR SYSTEM - MATERIAL HANDLING WEST
	ABOVE GROUND CONVEYOR SYSTEM - FERTILIZER PLANT
	OFF SITE BUILDINGS (NON-GLENCORE)



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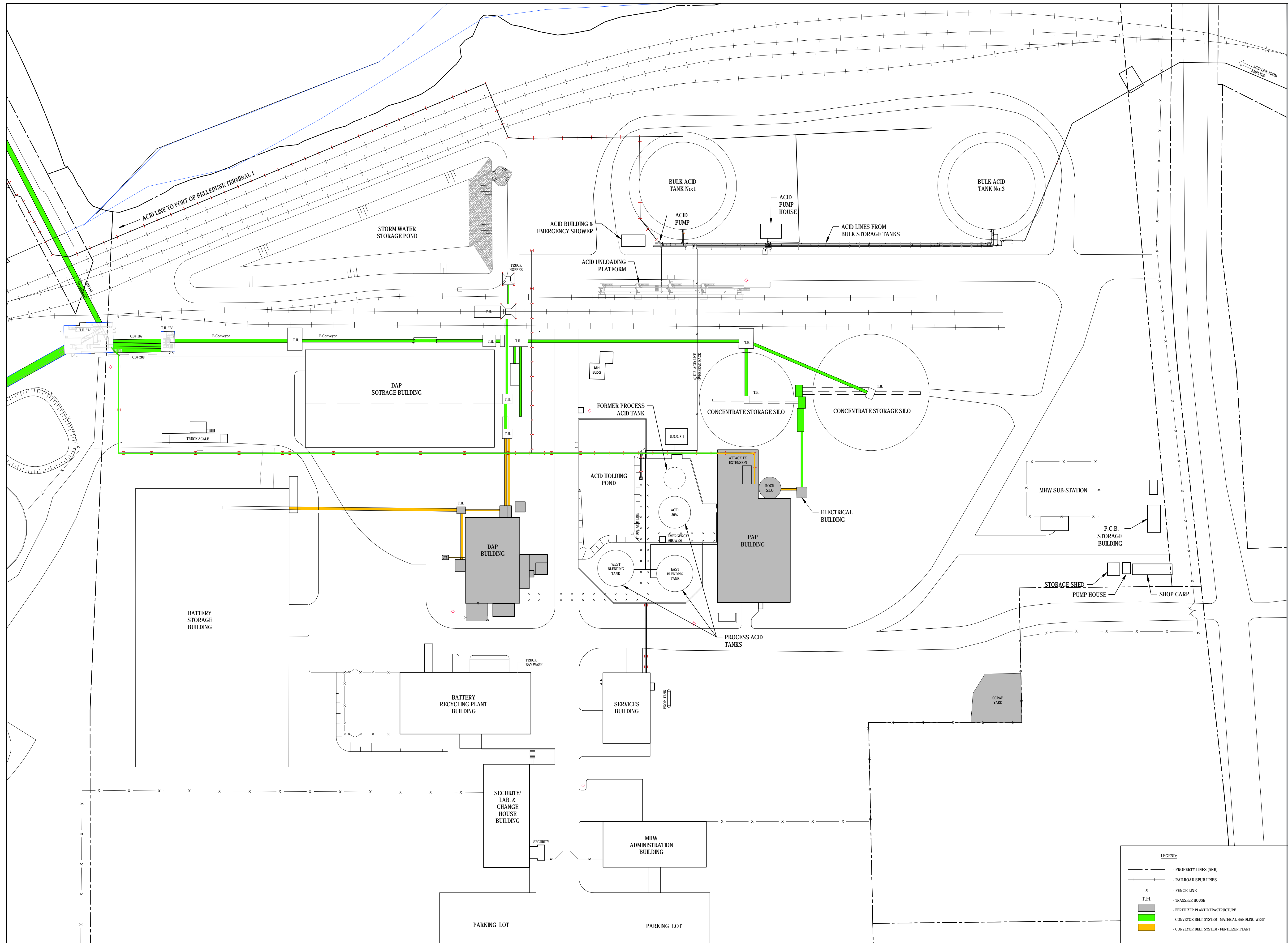
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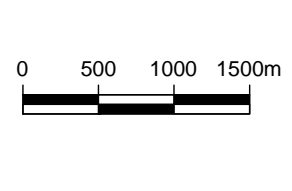
Title  
**SITE PLAN  
 FERTILIZER PLANT**

Sheet No.  
**FIGURE 5C**



**LEGEND:**

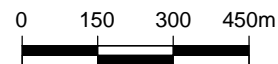
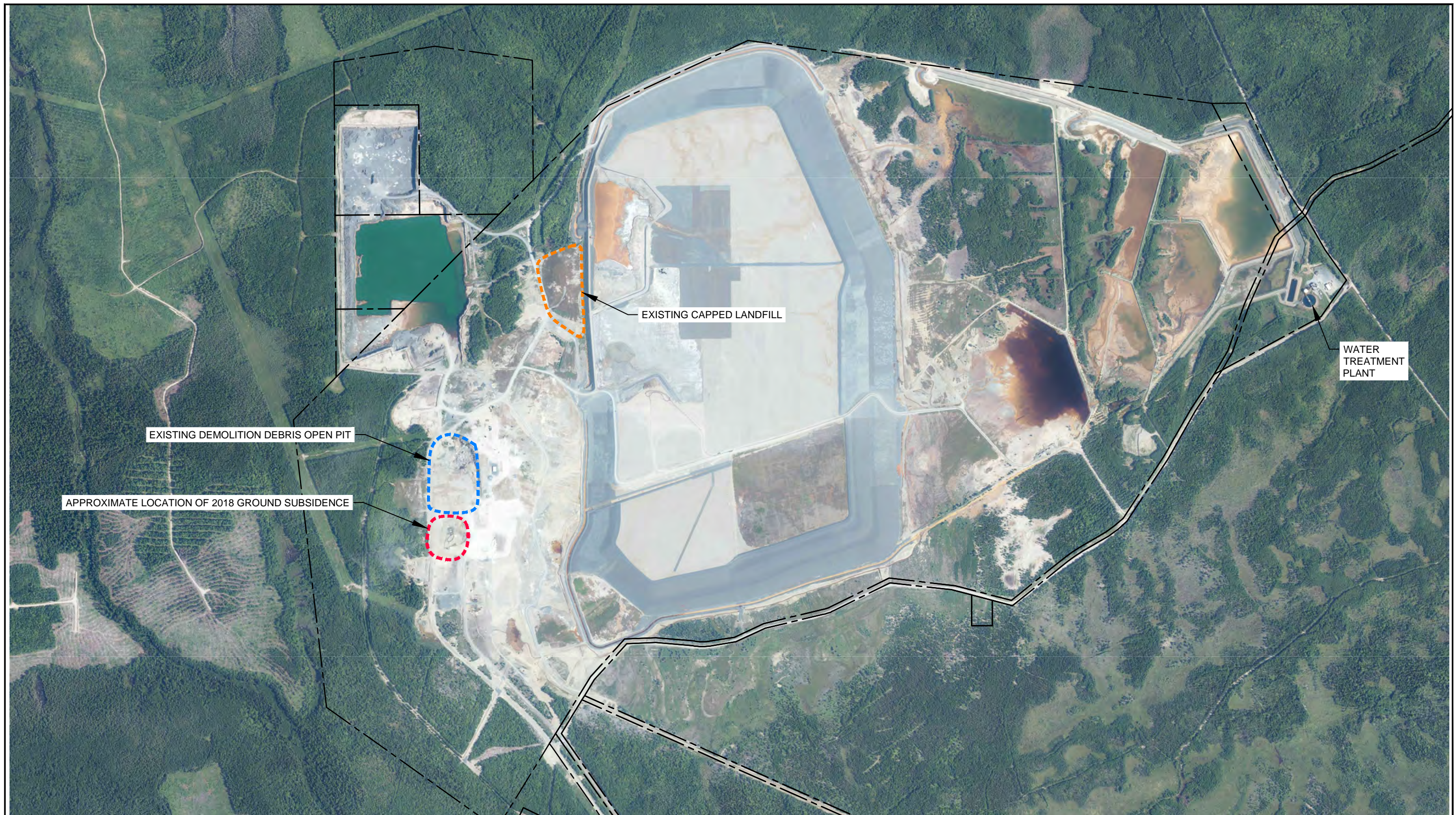
- PROPERTY LINES (SNB)
- RAILROAD SPUR LINES
- x- FENCE LINE
- T.H. TRANSFER LINE
- TRANSFER HOUSE
- FERTILIZER PLANT INFRASTRUCTURE
- CONVEYOR BELT SYSTEM - MATERIAL HANDLING WEST
- CONVEYOR BELT SYSTEM - FERTILIZER PLANT



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 CLOSURE PLAN - PREFEASIBILITY STUDY 2019 UPDATE  
 SITE PLAN - FRESHWATER SUPPLY FROM  
 JACQUET RIVER TO THE BRUNSWICK SMELTER

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FIGURE 5D



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 CLOSURE PLAN - PREFEASIBILITY STUDY 2019 UPDATE

BRUNSWICK MINE SITE - SITE PLAN

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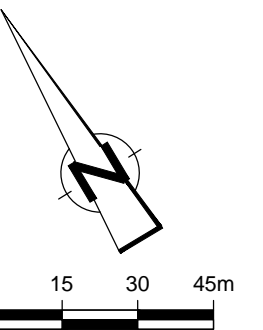
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FIGURE 6



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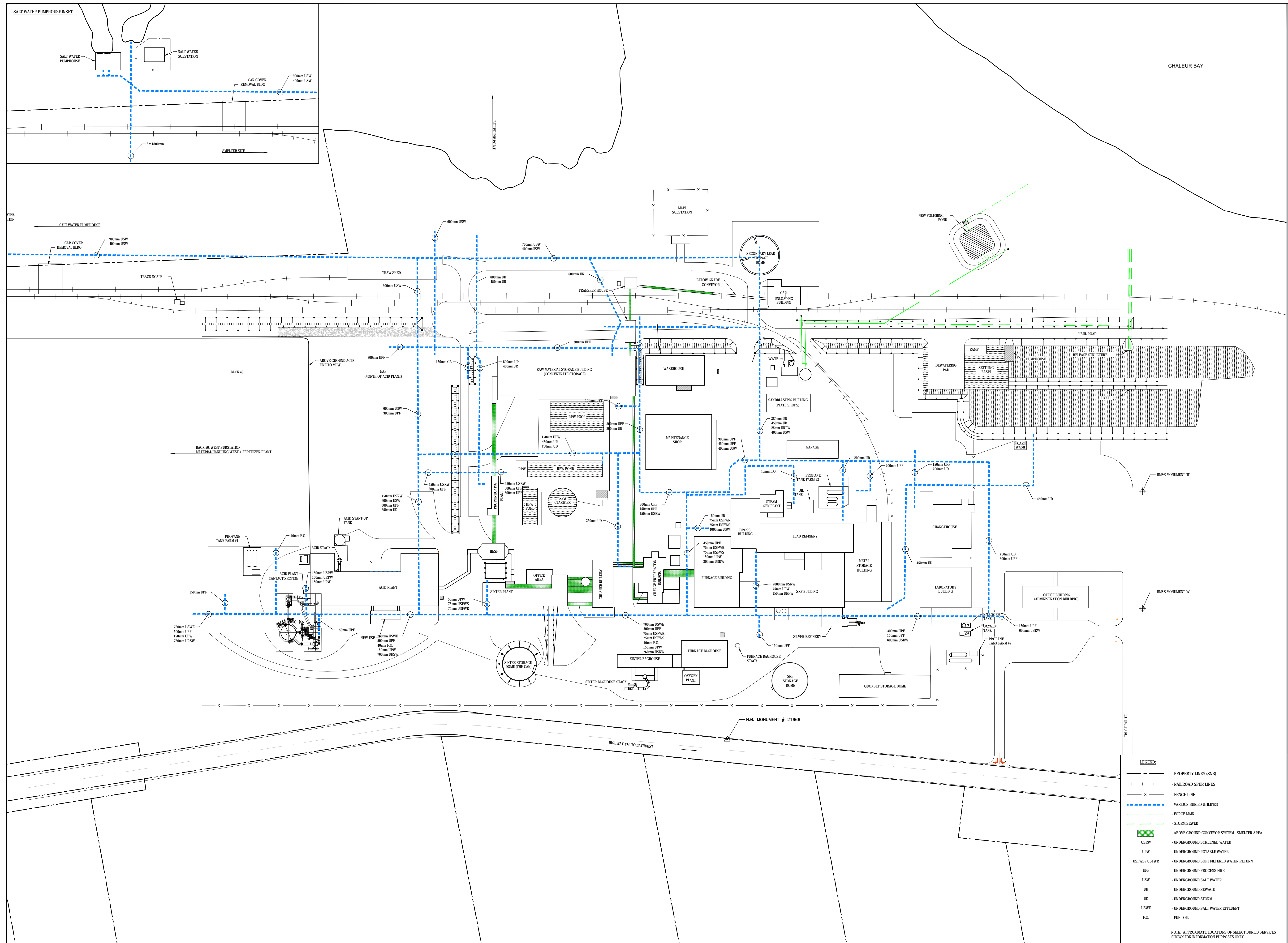
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ANSI D	Scale	1:1500	
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Project No. 11198639-01  
 Title

**SITE PLAN**  
**SMELTER AREA**  
**BURIED UTILITIES**

Sheet No.  
**FIGURE 7A**

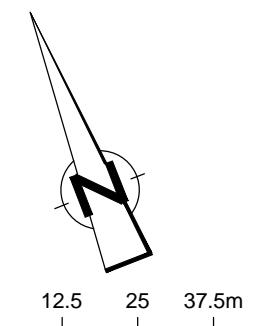






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 STUDY 2019 UPDATE

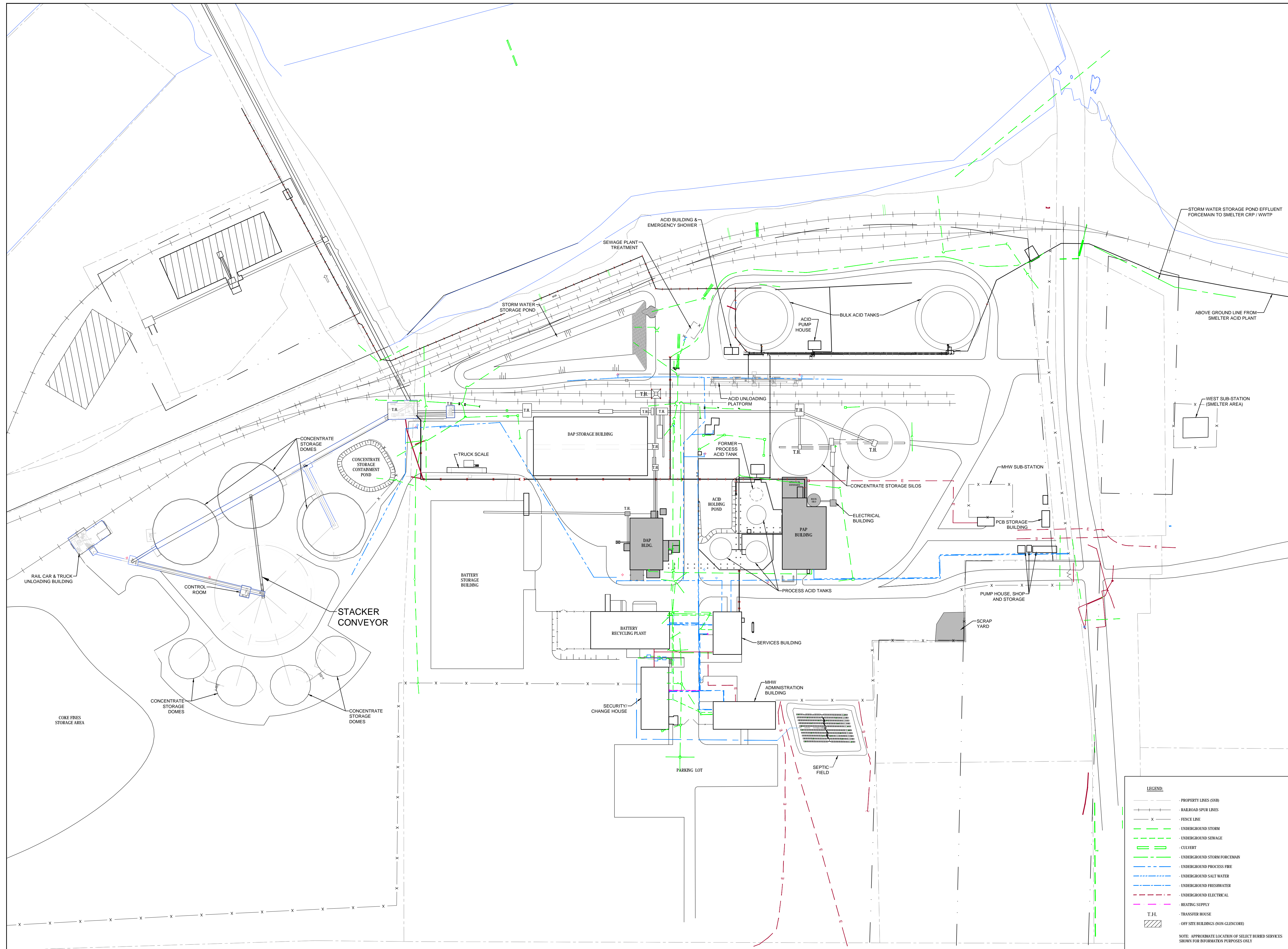
No.	Issue	Drawn	Approved	Date

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Drafting	C. BABINEAU	Design Check	C. BABINEAU
Project Manager	TROY SMALL	Date	Jan 6, 2020
Original Size	ANSI D		Bar is 20mm on original size drawing 0 20mm

Project No. 11198639-01

**SITE PLAN  
 MATERIAL HANDLING WEST &  
 FERTILIZER PLANT BURIED UTILITIES**

Sheet No.  
**FIGURE 7B**



**LEGEND:**

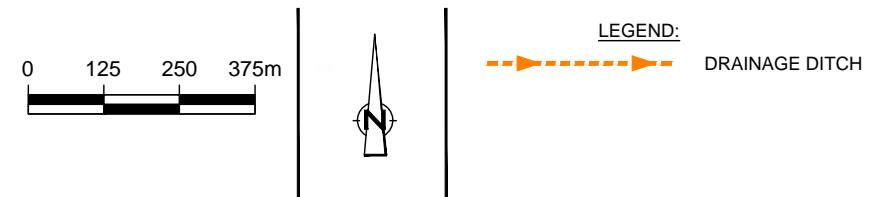
- PROPERTY LINES (S/N)
- RAILROAD SPIR LINES
- - - FENCE LINE
- - - UNDERGROUND STORM
- - - UNDERGROUND SEWAGE
- - - CULVERT
- - - UNDERGROUND STORM FORCEMAIN
- - - UNDERGROUND PROCESS FIRE
- - - UNDERGROUND SALT WATER
- - - UNDERGROUND FRESHWATER
- - - UNDERGROUND ELECTRICAL
- - - HEATING SUPPLY
- - - TRANSFER HOUSE
- - - OFF SITE BUILDINGS (ON GLENCORE)

T.H.  
 TRANSFER HOUSE  
 OFF SITE BUILDINGS (ON GLENCORE)

NOTE: APPROXIMATE LOCATION OF SELECT BURIED SERVICES SHOWN FOR INFORMATION PURPOSES ONLY



Source: High Resolution Aerial Imagery from New Brunswick Dept of Natural Resources, Acquisition Date: 2018.



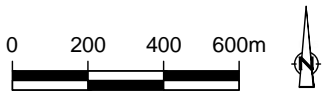
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 CLOSURE PLAN - PREFEASIBILITY STUDY 2019 UPDATE

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Jan 6, 2020

EXISTING SURFACE WATER DITCHING LAYOUT

FIGURE 8



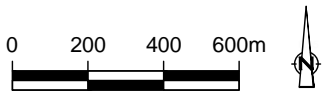
Source: High Resolution Aerial Imagery from New Brunswick Dept of Natural Resources, Acquisition Date: 2018.



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**CLOSURE PLAN - PREFEASIBILITY STUDY 2019 UPDATE**  
**SUMMARY OF SOIL EXCEEDANCES**  
**- METALS: ARSENIC & CADMIUM**

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 Jan 6, 2020

**FIGURE 9A**



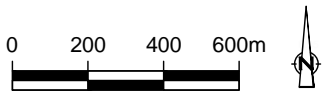
Source: High Resolution Aerial Imagery from New Brunswick Dept of Natural Resources, Acquisition Date: 2018.



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**SUMMARY OF SOIL EXCEEDANCES**  
**- METALS: COPPER & LEAD**

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**FIGURE 9B**



Source: High Resolution Aerial Imagery from New Brunswick Dept of Natural Resources, Acquisition Date: 2018.



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**CLOSURE PLAN - PREFEASIBILITY STUDY 2019 UPDATE**  
**SUMMARY OF SOIL EXCEEDANCES**  
**- METALS: THALLIUM & ZINC**

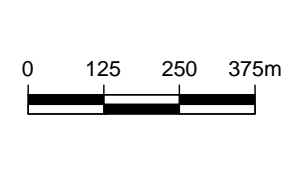
11198639-01(004)



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**FIGURE 9C**



Source: High Resolution Aerial Imagery from New Brunswick Dept of Natural Resources, Acquisition Date: 2018.



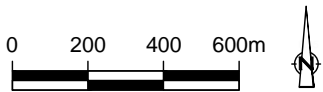
**LEGEND:**  
 PROPOSED SITE COVER AREAS  
 PROPOSED SPUR LINE REMEDIATION AREA



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 CLOSURE PLAN - PREFEASIBILITY STUDY 2019 UPDATE  
 CONCEPTUAL SITE COVER PLAN

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FIGURE 10



Source: High Resolution Aerial Imagery from New Brunswick Dept of Natural Resources, Acquisition Date: 2018.



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**CLOSURE PLAN - PREFEASIBILITY STUDY 2019 UPDATE**  
**SUMMARY OF GROUNDWATER QUALITY**  
**- SALINITY AND pH**

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**FIGURE 11A**



Source: High Resolution Aerial Imagery from New Brunswick Dept of Natural Resources, Acquisition Date: 2018.

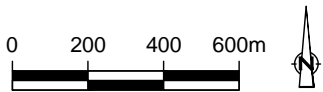
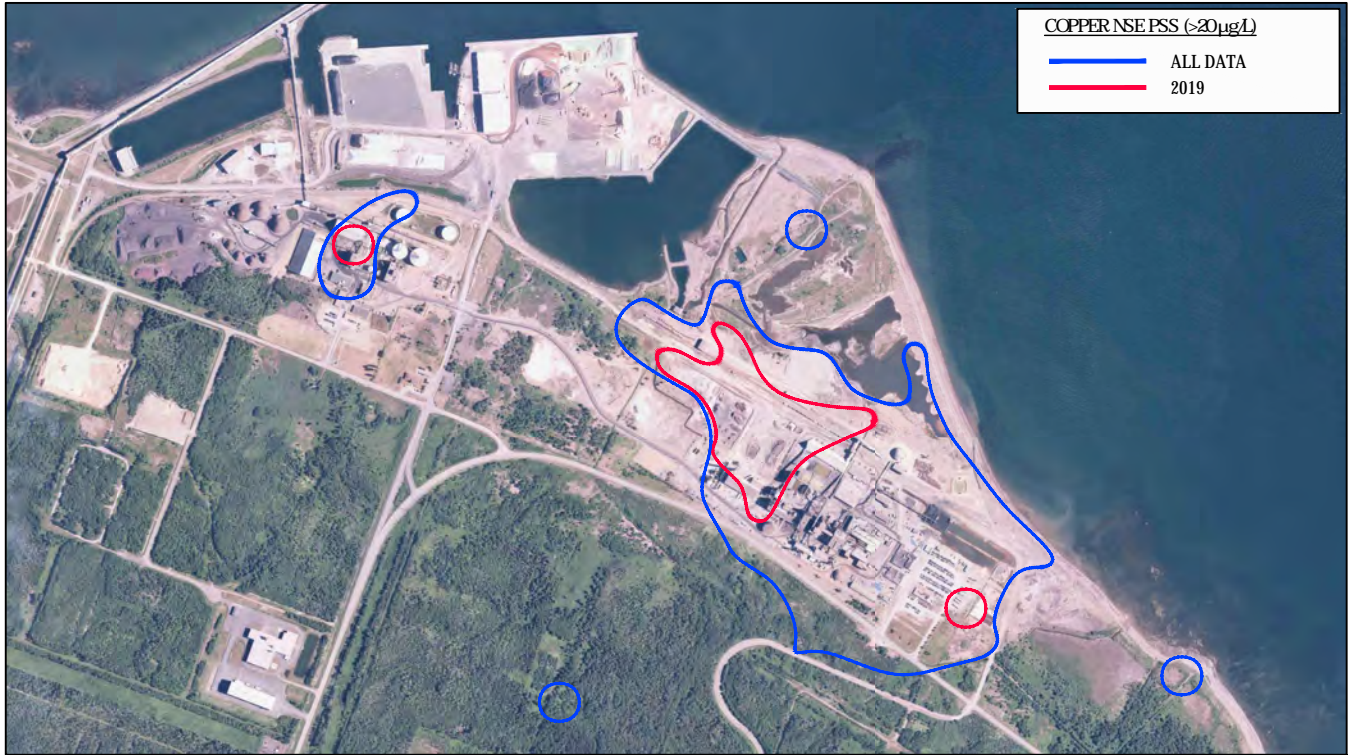


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**CLOSURE PLAN - PREFEASIBILITY STUDY 2019 UPDATE**  
**SUMMARY OF GROUNDWATER EXCEEDANCES**  
**- METALS: ARSENIC & CADMIUM**

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 Jan 6, 2020

**FIGURE 11B**





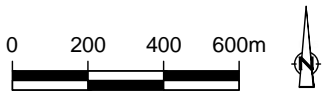
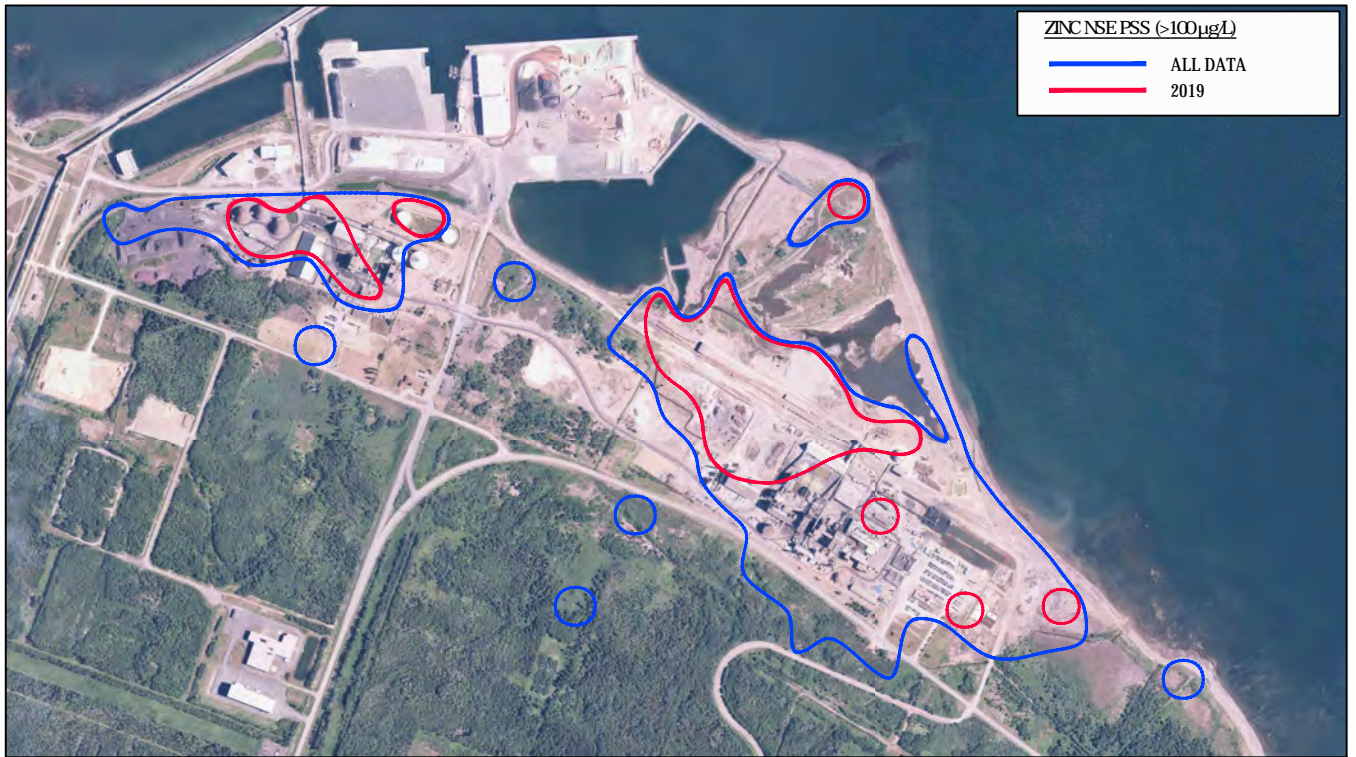
Source: High Resolution Aerial Imagery from New Brunswick Dept of Natural Resources, Acquisition Date: 2018.



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**CLOSURE PLAN - PREFEASIBILITY STUDY 2019 UPDATE**  
**SUMMARY OF GROUNDWATER EXCEEDANCES**  
**- METALS: COPPER & LEAD**

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 Jan 6, 2020

**FIGURE 11C**



Source: High Resolution Aerial Imagery from New Brunswick Dept of Natural Resources, Acquisition Date: 2018.

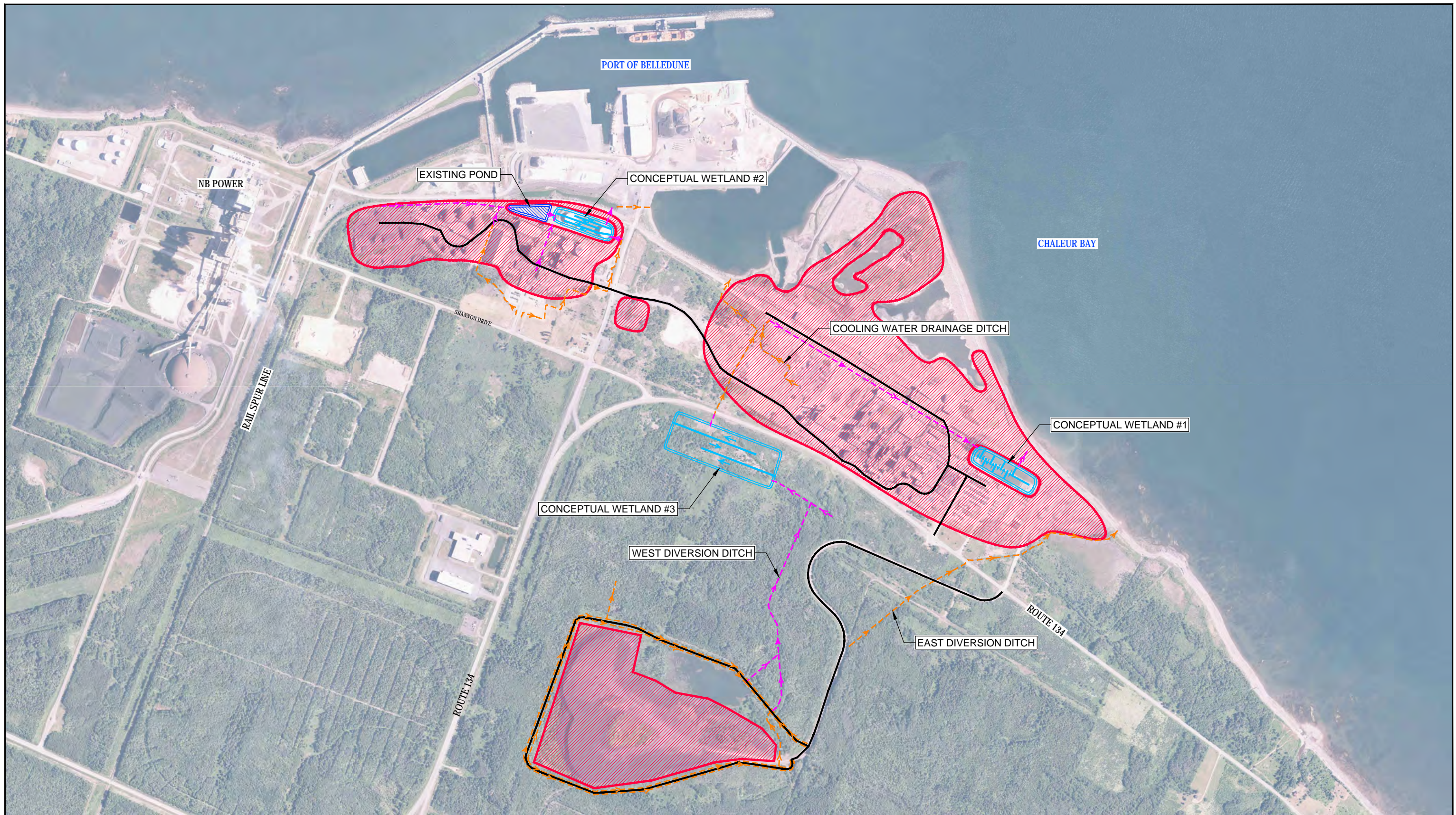


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**CLOSURE PLAN - PREFEASIBILITY STUDY 2019 UPDATE**  
**SUMMARY OF GROUNDWATER EXCEEDANCES**  
**- METALS: THALLIUM & ZINC**

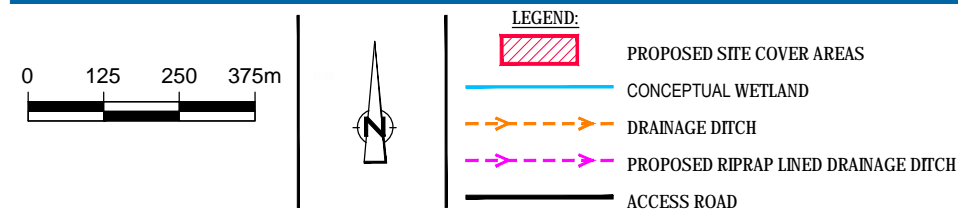
11198639-01(004)

Jan 6, 2020

**FIGURE 11D**



Source: High Resolution Aerial Imagery from New Brunswick Dept of Natural Resources, Acquisition Date: 2018.



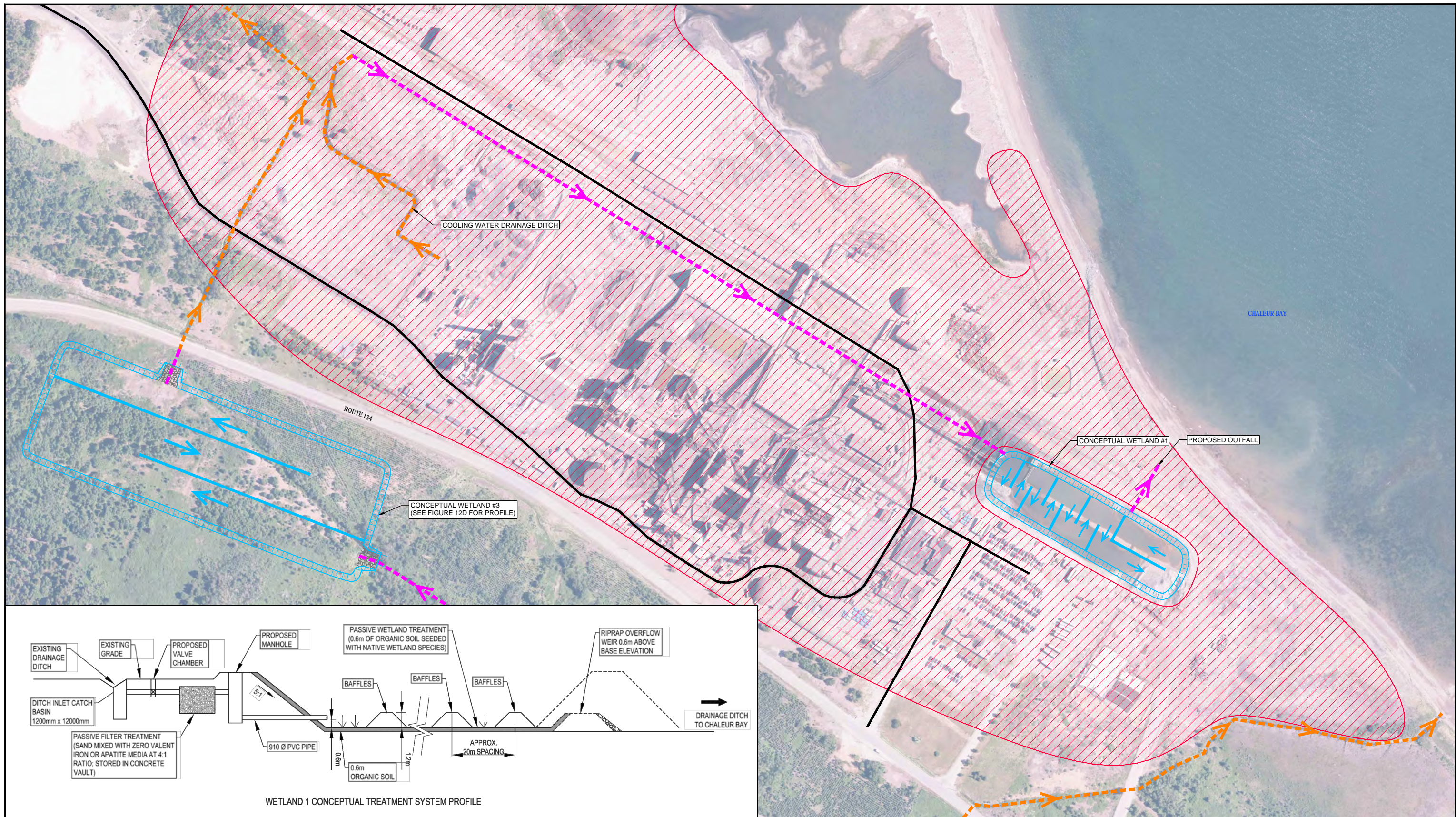
GLENCORE CANADA CORPORATION  
 BRUNSWICK SMELTER, BELLEDUNE, NEW BRUNSWICK  
 CLOSURE PLAN - PREFEASIBILITY STUDY 2019 UPDATE

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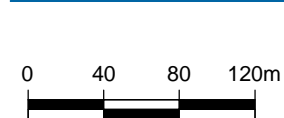
Jan 6, 2020

POST-DECOMMISSIONING CONCEPTUAL SITE LAYOUT

FIGURE 12A



Source: High Resolution Aerial Imagery from New Brunswick Dept of Natural Resources, Acquisition Date: 2018.



**LEGEND:**

- PROPOSED SITE COVER AREAS
- CONCEPTUAL WETLAND
- DRAINAGE DITCH
- PROPOSED RIPRAP LINED DRAINAGE DITCH
- ACCESS ROAD

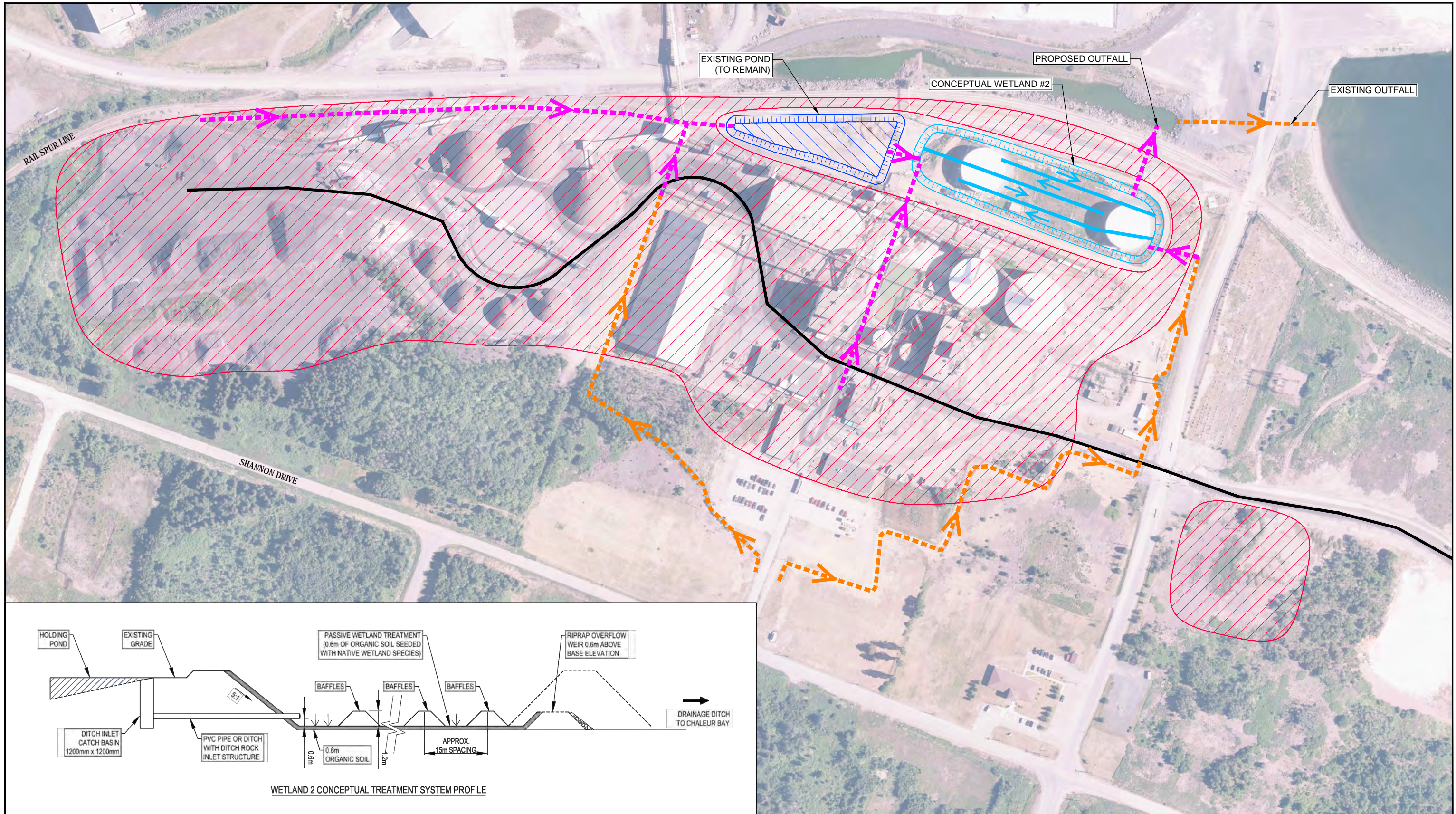


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 CLOSURE PLAN - PREFEASIBILITY STUDY 2019 UPDATE  
 POST-DECOMMISSIONING CONCEPTUAL SITE LAYOUT  
 SMELTER AREA

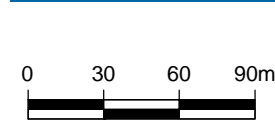
11198639-01(004)

Jan 6, 2020

**FIGURE 12B**



Source: High Resolution Aerial Imagery from New Brunswick Dept of Natural Resources, Acquisition Date: 2018.



**LEGEND:**

- PROPOSED SITE COVER AREAS
- CONCEPTUAL WETLAND
- DRAINAGE DITCH
- PROPOSED RIPRAP LINED DRAINAGE DITCH
- ACCESS ROAD

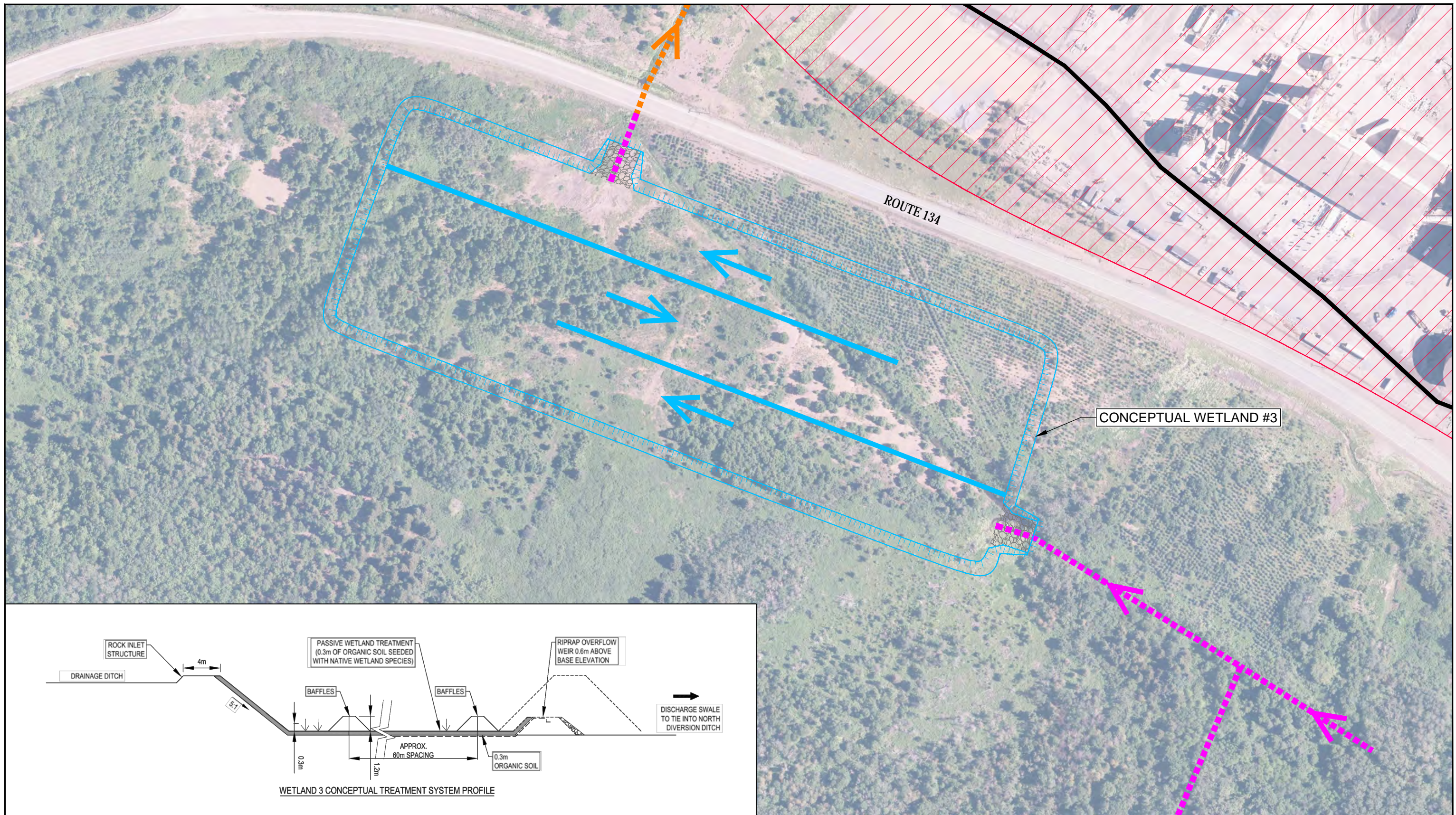


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 BRUNSWICK SMELTER, BELLEDUNE, NEW BRUNSWICK  
 CLOSURE PLAN - PREFEASIBILITY STUDY 2019 UPDATE  
**POST-DECOMMISSIONING CONCEPTUAL SITE LAYOUT**  
**MATERIAL HANDLING WEST AND FERTILIZER PLANT**

11198639-01(004)

Jan 6, 2020

**FIGURE 12C**



Source: High Resolution Aerial Imagery from New Brunswick Dept of Natural Resources, Acquisition Date: 2018.



**LEGEND:**

- PROPOSED SITE COVER AREAS
- CONCEPTUAL WETLAND
- DRAINAGE DITCH
- PROPOSED RIPRAP LINED DRAINAGE DITCH
- ACCESS ROAD

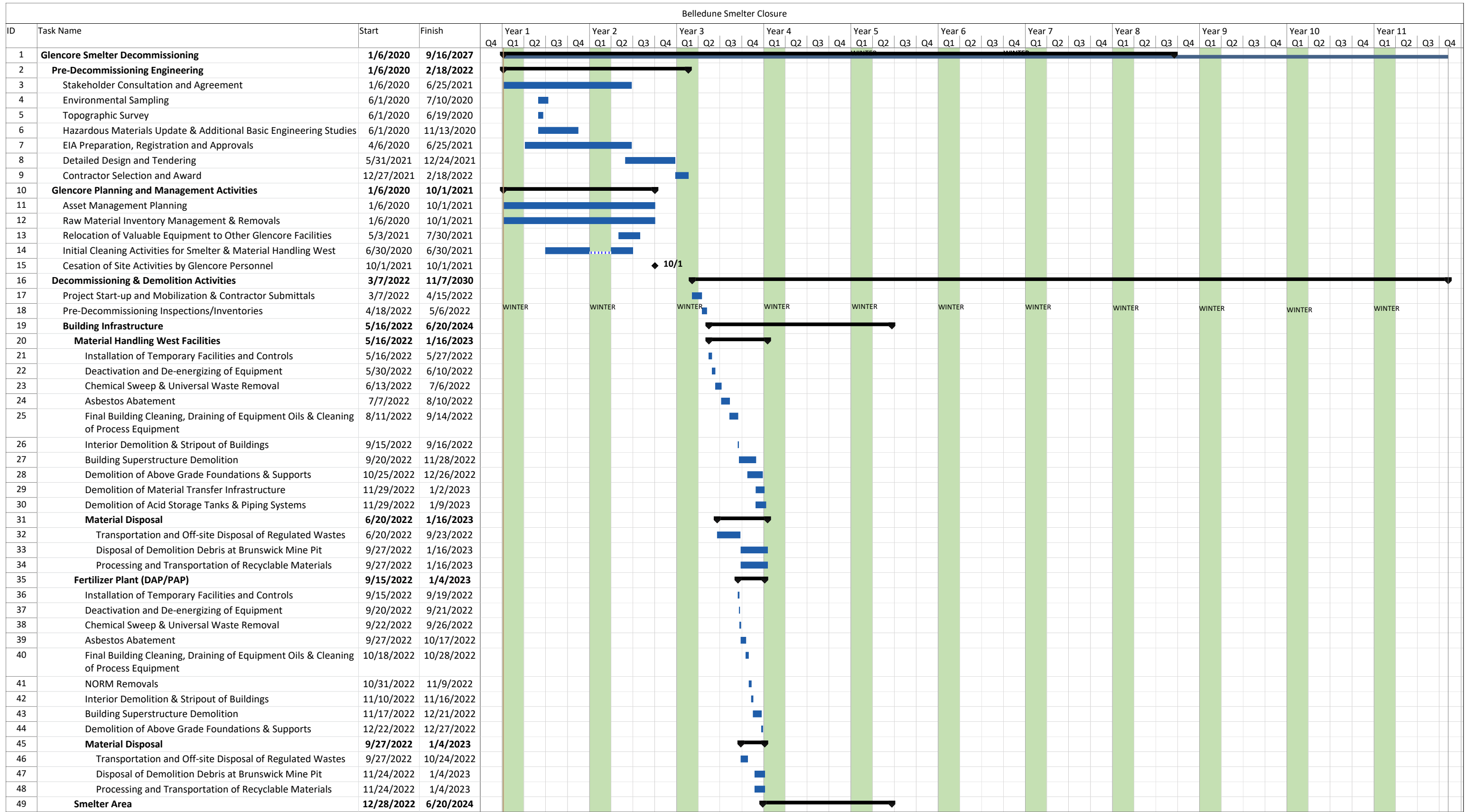


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 BRUNSWICK SMELTER, BELLEDUNE, NEW BRUNSWICK  
 CLOSURE PLAN - PREFEASIBILITY STUDY 2019 UPDATE  
 POST-DECOMMISSIONING CONCEPTUAL SITE LAYOUT  
 BORROW PIT AREA

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FIGURE 12D



Task [blue bar] Milestone [diamond] Summary [arrow]





**Table 1**  
**Inventory of Infrastructure**  
**Closure Plan - Prefeasibility Study 2019 Update**  
**Brunswick Smelter, Belledune, NB**

ID	Name	AKA	Dimensions
<b>Smelter Area</b>			
1	Sintering Plant		72 m by 26 m
2	Proportioning Plant		32 m by 6 m
3	Furnace Building	Blast Furnace	33 m by 50 m
4	Lead Refinery	Dross Plant	Lead 79.5 m by 22.5 m, Dross 26 m by 43 m
5	Short Rotary Furnace	#1 & #2 SRF, Former Zinc Refinery Location	71.5 m by 19.5 m
6	Acid Plant		92 m by 27 m, 32 m by 14 m and 17.5 m by 49 m
7	A/G Acid Line to Acid Storage Tanks (6)		1270 m Long
8	Former Bunker/#2 Fuel oil AST		80,000 Litre
9	Recycled Process Water System	RPW	11 m by 13.5 m
9A	RPW Clarifier	Clarifier	24 m Diameter
9B	RPW Ponds		46 m by 23 m
10	Cooling Recycle Pond	CRP	272 m by 42 m
11	Sandblasting	Plate/Brick Shop	35 m by 18 m
12	Polishing Pond	Treatment plant effluent pipe	31 m by 31 m
13	Polishing Pond Discharge Location	Treatment plant final effluent	-----
14	Salt Water Lagoon (Former Old Slag Pile)		52,875 m <sup>2</sup>
15	Former 500 gal UST at Former Garage (Removed 1996)		-----
16	West Diversion Ditch		570 m Long
17	Former Lobster Control Zone		-----
18	Old Industrial Dump Site - Covered (C&D 1966-1990)		-----
19	Secondary Lead Storage Dome	Concentrate Dome	34 m Diameter
20	Raw Material Storage Building	Concentrate Storage, Church	115 m by 35 m
21	Old Coke Fines Storage Pile	Former Zinc Plant Burial	-----
22	Current Scrap Steel - Active		-----
23	Baghouse (Sinter and Furnace)		45 m by 10 m, 38 m by 22 m
24	Short Rotary Furnace Dome	SRF Dome	34 m Diameter
25	Sinter Dome		25 m Diameter
26	Screening and Crushing Plant	Crusher Building	17 m by 40 m
27	Charge Prep		21 m by 21 m
28	Maintenance Shops		55 m by 48 m
29	Warehouse		50 m by 25 m
29A	Former USTs, current ASTs (gas and diesel) at Warehouse		-----
30	Quonset Storage Dome	Dust Storage, Reagent Storage	78 m by 20 m
31	Metal Storage Building	Casting Wheel/Refined Lead	34 m by 65 m
32	Change house		46 m by 45 m
33	Laboratory Building		45 m by 30 m
34	Administration Building	Office Building	56 m by 18.5 m
34A	Current UST at Administration Building		
35	Mobile Equipment Garage	Heavy Equipment Maintenance, Garage	50 m by 18 m
36	Former Bulk #2 Oil Tank (100,000 gal), Current 80,000 L Diesel Tank		-----
36A	Underground (U/G) oil/water (O/W) separator at #2 Oil Tank	O/W Separator	-----
37	Propane		-----
38	Former Number 6 Oil Tank	#6 Oil Tank, Bunker C Tank	-----
39	Railcar Unloading Building	Car Dump, Concentrate Off-Loading Area	30 m by 16 m
40	Car Cover Removal Building		25 m by 18 m
41	Thaw Shed		75 m by 11.5 m
41A	Former Day AST for #2 Fuel Oil at Thaw Shed		-----
42	Salt Water Pumphouse		21 m by 12 m
42A	Acid Plant Cooling Water Discharge Ditch	Salt Water Effluent Trench	422 m
42B	Cooling Effluent Sampling Station	Salt Water Effluent Sampling Station	-----
43	Main Electrical Substation		16.5 m by 6.5 m
44	West Electrical Substation		5 m by 10 m
45	Back 40/Back 50	Reprocessing Materials Storage Area	-----
46	Old Reprocessing Materials Staging Area	Old Back 40 (not in use since 1997)	-----
47	Current Construction & Demolition Debris Disposal Area		-----
48	Former Dry Dock		43 m by 20 m
49	Former Unloading Area (Concentrate and Coke)		-----
50	Former RPW/Sewage Effluent Area (Untreated)		-----
51	Former Concentrate/Coke Fines/Secondary Material Storage		-----
52	North Dross Storage	North of Acid Plant	-----
53	Concrete Foundation	Million Dollar Foundation	58 m by 23 m
54	Waste Water Treatment Plant	WWTP	14 m by 7 m
55	Former Coke Fines Storage Area (Old)		-----
56	Former Storage and Staging Area (sheds, surface storage)		-----
57	Salt Water Substation/Former storage of CN Moncton Petroleum Contaminated Soil		-----
58	Former location of Untreated RPW/Sewage effluent pipe to tidal lagoon		-----
59	Access Road to New Slag Pile		-----
60	New Slag Pile (Post-1980)	Current Slag Impoundment	-----
61	New Slag Pile Pond	Slag Pile Runoff, Regulated Wetland	-----
<b>Material Handling West Area</b>			
62	Wharf Unloading Facility - Glencore Berth	Terminal 1	147 m by 32 m
62B	Wharf Unloading Facility - NB Power Berth	Terminal 2	170 m by 32 m
63	MHW Administration Building		43 m by 18 m
64	Security/Changehouse		18.5 m by 42 m
65	Battery Recycling Plant		53 m by 25 m
66	Services Building		18.5 m by 31.2 m
67	Storage Shed		5 m by 6 m
68	Battery Storage Building		65 m by 115 m
69	Concentrate Storage Containment Pond		27 m by 30 m
70	Process Acid Tanks		9 m to 14 m Diameter
71	Railcar and Truck Unloading Building		27.5 m by 11 m
72	MHW Substation		14 m by 7 m
73	PCB Storage Building		Shipping Container
74	Carpenter Shop/Pump House		16.8 m by 5 m
75	DAP Storage Building		79.5 m by 37 m
76	Concentrate Storage Silos		41 m to 48 m Diameter
77	Bulk Acid Tanks		37 m Diameter
78	Concentrate Storage Domes		28 m and 49 m Diameter
79	Acid Building and Emergency Shower		10 m by 2.5 m
80	Acid Pumphouse		9 m by 5 m
81	Truck Scale		6.5 m by 7.5 m
82	Control Room		6.5 m by 7.5 m
83	Coke Fines Storage Area		-----
84	Storm Water Storage Pond		110 m by 38 m (x2), 30 m by 35 m
<b>Fertilizer Plant</b>			
85	Diamonium Phosphate Plant	DAP	27.5 m by 21 m
86	Phosphoric Acid Plant	PAP	30 m by 48 m
87	Former Fertilizer plant discharge location		-----

**Table 2**  
**Petroleum Storage Tank Inventory**  
**Closure Plan - Prefeasibility Study 2019 Update**  
**Brunswick Smelter, Belledune, NB**

<b>Tank ID</b>	<b>General Area</b>	<b>Specific Area/Location</b>	<b>Content</b>	<b>Type</b>	<b>Capacity (L)</b>
BT192 (PL #17)	MHW	Maintenance Shop BHO	Waste oil	Steel AST	1,443
(PL#20)	MHW	Maintenance Shop	Diesel Fuel	Steel AST	900
BT891 (PL#15)	MHW	Material Handling West	Diesel Fuel	Composite AST	3,785
BT894 (PL #18)	MHW	Battery Recycling Plant	Regular Oil, Gasoline	Steel AST	3,800
BT004 (PL#19)	Smelter	Acid Plant / Acid Out West End	Furnace Oil	Composite AST	37,800
BT351 (PL#21)	Smelter	Warehouse	Regular Oil, Gasoline	Steel AST	9,100
BT353 (PL#22)	Smelter	Warehouse	Diesel Fuel	Steel AST	9,100
BT740 (PL#28)	Smelter	Garage / Behind Garage	Waste oil	Steel AST	4,500
BT333 (PL#29)	Smelter	Lead Refinery / Adjacent to the Old Boiler Room	Furnace Oil	Steel AST	80,000
BT205 (PL#15)	Smelter	North of Furnace Generator Tank	Diesel Fuel	Composite AST	1,890
(PL#18)	Smelter	Thaw Shed	Furnace Oil	Steel AST	23,261
(PL#30)	Smelter	FCE Bag House Winter Heater	Furnace Oil	Steel AST	2,250
(PL#23)	Smelter	SRF Winter Heater	Furnace Oil	Steel AST	2,380
BT206 (PL#24)	Smelter	Proportioning Winter Heater	Furnace Oil	Steel AST	4,500
(PL#25)	Smelter	Acid Plant Winter Heater	Furnace Oil	Steel AST	4,500
(PL#26)	Smelter	North of Sinter Plant Winter Heater	Furnace Oil	Steel AST	4,745
(PL#27)	Smelter	South of Sinter Plant Winter Heater	Furnace Oil	Steel AST	4,745
(PL#17)	Smelter	Sinter Baghouse	Furnace Oil	Composite AST	22,710

**Table 3**  
**Chemical Tank Inventory**  
**Closure Plan - Prefeasibility Study 2019 Update**  
**Brunswick Smelter, Belledune, NB**

Tank ID	Specific Area/Location	Tank Description	Content	AST Type	Capacity
<b>Smelter Area</b>					
AT005	Acid Plant		RPW	FRP	36000 L
		Cooling Water Sump Tank			
AT021	Acid Plant	Absorber Tower	Sulfuric Acid	Brick Lined CS	57161 L
AT022	Acid Plant	Drying Tower	Sulfuric Acid	Brick Lined CS	1,17979 L
AY001	Acid Plant	Venturi Scrubber	RPW	FRP	9911 L
AY002	Acid Plant	Venturi Scrubber	RPW	FRP	9911 L
AY003	Acid Plant	Venturi Scrubber	RPW	FRP	9911 L
AY004	Acid Plant	Venturi Scrubber	RPW	FRP	9911 L
BT002	Acid Plant	Absorber Tower Sump	Sulfuric Acid	Brick Lined CS	23184 kg
BT003	Acid Plant	Acid Start Up Tank	Sulfuric Acid 70% 100%	Steel	1536000 kg
BT006	Acid Plant	Dosing Tank	Hydrogen Peroxide (50%)	316 SST	164 L
BT007	Acid Plant	Peroxide Storage Tank	Hydrogen Peroxide (50.5%)	304 SST	35958 L
BT008	Acid Plant	Drying Tower Boot	Sulfuric Acid	Brick Lined CS	56308 Kg
BT009	Acid Plant	Acid Bleaching Tank	Sulfuric Acid	Brick lined 316 L SST	55751 Kg
BT010	Acid Plant	Acid Bleaching #2 Tank	Sulfuric Acid	304 L SST	66169 Kg
BT250	Acid Plant	East Tank Farm #1-2	Liquid Propane	Steel	113562 L
BT251	Acid Plant	West Tank Farm #1-1	Liquid Propane	Steel	113562 L
AC028	Acid Plant	Converter	Catalyst	Unknown	175207 L
BT241	Propane Bulk Plant	Propane Tank South	Propane	Steel	89553 L
BT242	Propane Bulk Plant	Propane Tank Center	Propane	Steel	89553 L
BT243	Propane Bulk Plant	Propane Tank North	Propane	Steel	136383 L
BT211	WWTP	Treatment Tank #2	Wastewater	Steel	34,000 L
BT212	WWTP	Treatment Tank #1	Wastewater	Steel	34,000 L
BT213	WWTP	Sludge Recycle Tank	Sludge	Fiberglass	Unknown
BT214	WWTP	Flash Mix Tank	Wastewater	Steel	2,800 L
BT217	WWTP	Slurry Tank Lime Silo	Lime slurry	Steel	Unknown
BT301	Plate Shop	Abrasive Tank	Sand	Steel	184 L
BT252	Laboratory	Propane Tank South Tank Farm #2-2	Propane	Steel	113562 L
BT253	Laboratory	Propane Tank North Tank Farm #2-1	Propane	Steel	113562 L
BT016	Acid Plant	Mist Precip. flushing recirculation Tank	RPW	FRP	17448 L
BT413	Sinter Baghouse	Fuller Tank East	Sinter Dust	Steel	425 L
BT414	Sinter Baghouse	Fuller Tank Center East	Sinter Dust	Steel	425 L
BT415	Sinter Baghouse	Fuller Tank Center West	Sinter Dust	Steel	425 L
BT416	Sinter Baghouse	Fuller Tank West	Sinter Dust	Steel	425 L
BT501	Screen & Crush Bldg.	Slurry Tank	RPW	Unknown	4757 L
BT621	Furnace Baghouse	Slurry Mixing Tank		Steel AST	906 L

**Table 3**  
**Chemical Tank Inventory**  
**Closure Plan - Prefeasibility Study 2019 Update**  
**Brunswick Smelter, Belledune, NB**

Tank ID	Specific Area/Location	Tank Description	Content	AST Type	Capacity
BT801	SRF Baghouse	Slurry Tank		Unknown	0
Carbon Dioxide	East Of WWTP		Carbon Dioxide	Unknown	1633 kg
Oxygen Tank #9301078	Near Oxygen Plant		Liquid Oxygen (Owned by Praxair)	Steel	49210 L
Oxygen Tank #9303739	Near Oxygen Plant		Liquid Oxygen (Owned by Praxair)	Steel	56403 L
Liquid Nitrogen tank	South of Laboratory		Liquid Nitrogen(Owned by Air Product)	Steel	41640 L
Oxygen Tank	South of Laboratory		Liquid Oxygen(Owned by Praxair)	Steel	5678 L
	Sinter building	RPW North Pond	RPW	Unknown	1,196,739 L
		RPW South Pond	RPW	Unknown	1,196,739 L
		RPW New Pond	RPW	Unknown	1,196,739 L
		Hockey Rink	RPW	Unknown	1,529,110 L
BC501	Clarifier building	80 ft diameter	RPW	Steel AST	1,522,618 L
<b>MHW Area</b>					
BT261	Acid shipping	H2SO4 #1 Acid Storage Tank	Sulfuric Acid 70% 100%	Steel	10,869,565 L
BT263	Acid shipping	H2SO4 #3 Acid Storage Tank	Sulfuric Acid 70% 100%	Steel	10,869,565 L
BT388	Acid shipping	70% Acid Tank East	Sulfuric Acid 70% 100%	Steel	1,358,696 L
BT389	Acid shipping	70% Acid Tank West	Sulfuric Acid 70% 100%	Steel	1,358,696 L
BT026	Bulk handling	Clarifier With Rake		SST	9150 L
BT021	Battery recycling	Battery Pant Water Storage Tank	Process Water	SST	26600 L
BT022	Battery recycling	Battery Plant Overflow Tank	Process Water	SST	135 L
BT023	Battery recycling	Water Plant Water Storage Tank	Process Water	Unknown	13,638 L
BT024	Battery recycling	BR Clean Water Tank (Center)	Water	Unknown	13,638 L
BT025	Battery recycling	Battery Caustic Storage Tank	Process Water	Unknown	31822 L
BT191	General services	Maintenance Shop Propane Tank	Propane	Steel	4546 L
BT591	General services	Changehouse Propane Tank	Propane	Steel	4546 L
BT592	General services	Changehouse Propane Tank	Propane	Steel	4546 L
30% Acid Tank		Not in Use	30% Acid	Steel	Not in use
PO004	Acid shipping	Pond Commercial Tank Dyke	Sulfuric Acid	Concrete & HDPE	2,230,000 L

Table 4A: List of Acts and Regulations with Potential Application to Closure

Act	Regulation	Section	Issue	Application to Smelter Complex	Permit or CofA Req'd	GHD Recommendations / Comments
NB Clean Environment	87-83 Environmental Impact Assessment	Section 3, Section 5, Appendix A	Section 3 defines an undertaking as extension, abandonment demolition or rehabilitation.  Section 5-Requires registration of an Undertaking.	Umbrella legislation that requires multi-departmental review process before any individual environmental permits or C of As will be issued. Will involve provincial and federal departments in EIA Review. Demolition of complex and creation of new landfills require EIA registration and review. See Figure 1 for simplified NB EIA Process. This project is considered a Category 1 Undertaking. New landfills (at Brunswick 12) have mandatory comprehensive EIA requirements. Other aspects of Closure may be screened out with conditions. Closure (excluding landfills) is likely to be screened out with many conditions.	Yes. Must register Closure for NB EIA Review. Review outcome can be screening out with conditions or mandatory Comprehensive EIA. Both processes require a public process but Comprehensive EIA is much more extensive in technical and public participation requirements. Following EIA process the EIA Review document will specify conditions and need to obtain specific permits under other provincial regulations as mechanism to control closure to provincial standards.	New Brunswick has no precedents on smelter closures. Major pulp and paper mills that have closed have not been demolished and serve as no precedent. NB Environment is generally open to proposals that meet generally good environmental management principles especially if they have no specifically related guidelines or regulations. Therefore the potential is available for Glencore to submit proposed closure methods and disposal options that meet good environmental principles. Glencore must provide sufficient back up data to convince regulators that the surrounding environment is suitably protected after closure and that the site is potentially available for future industrial land use. If convinced, regulators should be inclined to accept the Glencore proposals instead of generating their own requirements. Almost all critical discussions on closure requirements will occur during the EIA process.  In 1995, J.D. Irving proposed constructing a new industrial landfill to dispose of materials that would be of less concern than Glencore materials but in a more public area. The project was directed to Comprehensive Review and was abandoned by the proponent. Comprehensive Review process for the proposed landfills can be expected to take 18-24 months.
NB Clean Environment	82-126 Water Quality	3(1), 3(2), 3(3), 3(5)	Required to have an approval to discharge or operate, construct, modify (includes demolish) a source of contamination.  Required to have an Approval to operate a Waterworks if flow is greater than 50 m <sup>3</sup> per day.	Most aspects of Closure under NB Environment control will be dictated by Terms of a C of A issued for Closure after the EIA process is completed. Probably include treatment plant discharge quality, non-point discharges like area groundwater, off-site air and water quality during demolition, cover material pits on Glencore lands, approval of soil cover concept for closure.	Yes, if point source discharge. Yes, to cover aspects of closure.	Approvals would come after EIA process is complete. Treatment plant discharge criteria will probably be based on federal MMER. As many activities as possible will probably be combined into a single Water Quality Regulation Industrial Discharge Approval in the format used during operation.
NB Clean Environment	87-97 Petroleum Storage	Section 3	Approval (Permit) required for installation, alteration or removal / decommissioning of petroleum storage tanks.	Controls process for removal of petroleum infrastructure. Glencore should have a list of all existing petroleum storage tanks registered with NB Environment. New tanks required for closure or existing tanks to be decommissioned on closure must be installed/removed by a tank installer registered with NB Environment.	No but work must be supervised by a provincially licensed tank installer.	This should be a minor financial / technical issue on closure but it is highly regulated so needs to be done to the regulations.
NB Clean Environment	90-79 Water Well	Section 27	Must decommission any groundwater wells no longer required, to departmental standards.	Controls method of monitor well decommissioning. Over 50 monitor wells on site. Must decide which are required for long term groundwater monitoring (post-closure) and which are to be decommissioned.	Not specifically. Anticipate a clause covering this in a global C of A issued for all closure aspects under Water Quality Reg 86-126.	Minor issue with low financial implications. Normal decommissioning of 50 cm monitor wells requires pulling casing and filling space with bentonite.
NB Clean Air	97-133 Air Quality regulation	Section 3	Required to have an approval to discharge contaminants to the air.	Control of fugitive air emissions created during demolition.	Yes	Fugitive air emissions may or may not be considered necessary to permit in a C of A that could be issued under the Water Quality Regulation or Air Quality Regulation. Probably set quality limits at property boundary.
NB Clean Water	90-80 Watercourse and Wetland Alteration Regulation	Section 8	No person shall carry out alteration of a wetland or watercourse without a Permit. Applies to freshwater or estuarine watercourses but not marine areas.	Controls any work within 30 metres of a freshwater or estuarine watercourse. Applies to Jacquet River pumphouse if within 30 metres of a freshwater or estuarine watercourse and if any demolition is proposed. Also applies to work within 30 metres of a registered wetland, such as that located adjacent to the New Slag Pile. Does not apply in completely marine water locations.	Yes, if Jacquet River pumphouse or related infrastructure within 30 metres of a watercourse was demolished. Yes, if any work planned in the area of the New Slag Pile.	None
NB Occupational Health & Safety		Section 32	General conditions related to worker safety that Glencore is currently subject to. Section 32 says that when an Officer is of the opinion that unsafe or unhealthy working conditions exist, he may suspend work, etc.	Controls worker safety during operation and Closure. Will also apply to all contractors involved in site closure and post-closure operations. Any Codes of Practice that Glencore has been required to develop under legislation during operation may continue to apply during closure.	No	Not really familiar with how WHSCC enforces worker safety but regular inspections would be expected during closure work. Glencore history with WHSCC is the best measure of how involved this department will get. They have direct enforcement responsibility for the friable Asbestos removal regulation 92-106.
NB Occupational Health & Safety	92-106 Code of Practice for Working with Material Containing Asbestos	Section 3, Section 4.1, Section 7.2.4	Section 3 requires bulk sampling and identification of asbestos prior to demolition. Section 4.1 requires the owner to have a written asbestos management plan. Sec 7.2.4 provides clearance sampling concentration of 0.05 fibres/cm <sup>3</sup> .	Appears to be directed at friable asbestos which is defined as "can be crumbled by hand". This definition would seem to exclude asbestos paneling. <b>There does not seem to be sufficient clarity in the Act and Code of Practice to determine if destructive removal of asbestos paneling would be met with an Order from an Officer to suspend work or if establishing a perimeter where the clearance sampling concentration was met would be acceptable.</b>	No	See above
NB Occupational Health & Safety	91-191 General	Section 24-25, Section 58, Section 273	Sec 24-25-Where concentration of contaminants exceeds 50% of TLV conduct air tests, if TLV is exceeded, provide PPE. Sec 58 Designation of hazardous materials employee, Sec 273- Protect workers from hazardous fumes when cutting materials.	Methodology of demolition may be affected by regulation.	No	WHSCC Inspector can shut down a work site. If Glencore does not specify Contractor demolition methods, site may be closed down due to poor Contractor actions. Glencore contract language should be worded to protect them from low Contractor bids based on dangerous work procedures.

Table 4A: List of Acts and Regulations with Potential Application to Closure

Act	Regulation	Section	Issue	Application to Smelter Complex	Permit or CofA Req'd	GHD Recommendations / Comments
NB Quarriable Substances Act		Section 5(1), 23	If Glencore opens a quarry for cover material.	Requirement for quarry permit if opening new quarry for closure aggregate needs.	No, unless opening quarry with blasting.	Quarry operation is not expected. Cover material should be sourced from aggregate pits with no blasting requirement.
NB Crown Lands & Forests Act			Province claims ownership of the marine area below the normal high water mark and requires users to obtain their approval.	Potential application when upgrading erosion control on old slag pile and when decommissioning structures at the shore line like outfalls or sea water pump stations.	Yes if marine in-water work is conducted below the mean high water mark. Permit or lease is required.	NBDNR will involve DFO in review of projects below high water mark. DFO and DNR favour bank stabilization projects that use large angular rock with maximum 45 degree slope. Most bank stabilization projects are approved without a HADD for DFO.
NB Topsoil Preservation Act		Section 3	Need permit to remove topsoil.	Cover Material	Yes	Act and regulation remove the option of obtaining topsoil from provincial lands. See comment below on rehabilitation.
NB Topsoil Preservation Act	General Regs 95-66	Section 12 (f) (g)	Need to rehabilitate after removal of topsoil (maintain re-vegetation for 2 years).	Cover Material	Yes	Regulation requires rehabilitation after removal of topsoil by re-vegetation and maintenance of vegetation for 2 years. This limits the topsoil removal to areas where re-vegetation is possible after topsoil removal. Very few lands will provide this possibility due to the shallow nature of topsoil in the area.
Federal Canadian Environmental Assessment Act (CEAA)	Comprehensive Study Reg		Level of effort and time to complete. Cost of decisions made by federal gov't.	Non-point groundwater to marine environment and landfills at Brunswick 12. If federal CEAA is triggered by these issues, the level of effort to complete the EIA will be significantly increased in time, cost and scope. First potential trigger area is the historical marine impacts adjacent the smelter, BFL and BHO (sediment and groundwater). Second potential trigger area is the potential impact of groundwater from proposed Brunswick 12 landfills on surface water habitat outside the Glencore land lease.	No but potential for project parts to be captured under CEAA.	Capture by CEAA would have major cost and time downside. Unsure of how to minimize this potential. DFO is only federal department that might want to bring the project into CEAA to provide leverage for their bargaining in HADD projects. Glencore staff have greatest ability from historical discussions with DFO to estimate this risk.
Federal Canadian Environmental Protection Act	SOR/2002-301 Interprovincial Movement of Hazardous Waste	Section 1, Sec 2, Sec 3	Section 1- Hazardous waste includes materials intended for disposal or recycling, Sec 2- Applies to quantities over 5 kg that fail federal leach test, Sec 3- Inter-provincial shipments must be manifested, carried by an authorized carrier to an authorized destination.  <b>Additional requirements may be imposed by the destination province or provinces en route under their legislation.</b>	If recyclables are shipped out of province that contain metal dust that fails the federal leach test.	Yes. Generator permit.	Applies only if leachable waste such as metal dust is transported across provincial borders for recycling. Only requirement is proper manifesting. No significant cost implications to this legislation.
Federal Fisheries Act		Sections 34 & 35	34: No deposit of deleterious substance, 35: No deleterious alteration of fish habitat.	This issue is connected to the concern over potential application of CEAA. If CEAA is not triggered, DFO concerns related to marine impacts near Smelter Complex and downgradient of Brunswick 12 may be raised in Provincial EIA Review process. Need to control quality of any point or non-point (groundwater) discharges to surface waters so as not to have deleterious effect.	No but may be included in Provincial EIA Review Conditions.	Point source discharges may be excluded from prosecution under these statutes if in compliance with MMER but legal opinion of this would be required.
Federal Fisheries Act	SOR/2002-2222 Metal Mining Effluent Regulation administered by Env Can		MMER criteria will be applied by NB Environment in any point source discharge approvals granted.	Will be used by provincial C of A process to set limits on point source discharge quality for metal parameters during operation, closure activities and post closure point source discharges.	Yes but from Province under Water Quality Regulation noted above.	
Federal Fisheries Act			In February 2018, the Government of Canada introduced Bill C-68, which reflected a commitment to review the changes made in 2012 to the Fisheries Act, in order to restore lost protections and incorporate modern safeguards/ On June 21, 2019 the modernized Fisheries Act (Bill C-68) received royal assent and became law. However, provisions and regulations within the Act for protection of fish and fish habitat have not come into force.			
NB Cemetery Companies Act		Section 5	No person shall establish, alter or extend a cemetery, either public or private without approval.	Requirements would affect any work done at the adjacent cemetery.	Yes approval from Minister, Lieutenant Governor or local government.	Applies if cover material is to be added to the cemetery area.

Table 4B: List of Potentially Applicable Guidelines

Department	Guideline	Year	Scope	Application to Smelter Complex	Permit or CofA Req'd	GHD Recommendations / Comments
NB Environment	A Guide to Environmental Impact Assessment in New Brunswick	2007 2018 update	Describes steps in EIA Review process including public involvement, fees, submission requirements, and approval or denial process. Provides list of designated projects triggering EIA along with regulation requirements, procedures and timelines.	First regulatory step for Closure which guides all later provincial permits.	EIA Process produces a Minister's decision on the proponent's EIA Registration. Decision will specify conditions on proponent moving forward and obtaining permits. Will involve some federal departments.	
NB Environment	Additional Information Requirements for Waste Disposal Facilities	2004	Describes the information suggested for an EIA Registration for construction of a landfill. Content applies to a municipal solid waste type waste stream even though it mentions industrial landfills.  Leachable heavy metals wastes may be subject to a higher standard of liner and leachate collection.	Proposed leachate collection landfills at Brunswick 12 for Smelter Complex materials.	Yes under Water Quality Regulation.	
NB Environment	Site Selection Guidelines for Municipal and Industrial Sanitary Landfills	1993	Describes size, setback, hydrogeological and native soils requirements to be used when selecting a landfill site.	Minor	Yes under Water Quality Regulation as above.	Remote location of Brunswick 12 should address all issues in this guideline.
NB Environment	Design Guidelines for Sanitary and Industrial Landfills (Draft)	2003	Describes engineering aspects of design requirements for single and double liner landfills.	Will control design requirements of single liner landfills at Brunswick 12.	Yes under Water Quality Regulation as above.	Unclear if high lead and arsenic content waste will require single or double liner landfill at Brunswick 12. Location chosen and groundwater regime may mitigate double liner requirement.
NB Environment	Guideline for the Management of Contaminated Sites, Version 2	2003 2016-2018 updates	Describes the process to be used for corrective action for contaminated sites including endorsement of human and ecological risk assessment methods for determining remedial criteria. Updated documents generally limited to new reporting requirements and associated timelines.	Applicable methodology for determining soil quality criteria on closure.  Specifies qualification of Site Professional.  Specifies reporting process.	Yes. Requires submission of a Remedial Action Plan for review and approval by Department. After the Approved Remedial Action Plan is completed, NB Environment will issue an Acknowledgement of the Record of Site Condition prepared by the Site Professional.	Human health risk assessment previously accepted by NB Environment for determination of soil criteria for closure, however, soil criteria would likely be required to be updated due to changes in guidelines and risk assessment methods.
Atlantic PIRI Committee	Atlantic RBCA Version 2.0 for Petroleum Impacted Sites in Atlantic Canada, User Guidance, Updated March 2007	2007 2015 Update 2019 Draft under public review	Describes the methodology for human health risk assessment in the determination of remedial criteria for petroleum hydrocarbon impacted soil and groundwater. The updated guidelines also include methodology for ecological risk assessment in the determination of remedial criteria for impacted soil, groundwater, sediment and surface water. Atlantic RBCA Version 3.1 currently under public review (2019).	Directly applicable to determination of site- specific remedial criteria for on-site hydrocarbon impacts.	No. Approval is through NB Guideline for the Management of Contaminated Sites, Version 2.	2007 version used to derive non-hydrocarbon closure criteria in Plan 2010 – Conceptual. Risk based criteria will likely need to be updated based on the Atlantic RBCA updates.
NB Environment	NB EIA Final Guidelines for Proposed JD Irving Industrial Landfill (not constructed)	2005	Describes what could be expected as requirements for Comprehensive EIA covering proposed landfills at Brunswick 12.	Expect landfills at Brunswick 12 will be subject to Comprehensive NB EIA process.	Yes. Comprehensive NB EIA process.	Time estimate for Comprehensive EIA could be 12 to 24 months.
NB Environment	Guidelines for the Siting and Operation of a Construction and Demolition (C&D) Debris Disposal Site	2002	Specifies type of material qualifying as C&D Debris, setback distances, interim and final cover, monitoring and public notification.	Most economic method of low risk materials for disposal.	Yes under Water Quality Regulation.	Negotiation with NB Environment may permit variances on types of materials permitted pending demonstration of groundwater capture by Brunswick 12 treatment system. For example - non- friable asbestos might be negotiated.
NB Environment	Sand and Gravel Pits Environmental Guidelines	2007	Describes siting, setbacks, air and water controls and closure. Prohibits blasting.	Required for any Glencore property borrow pits for cover. If cover obtained from other parties, they may require permits.	Small pits not normally permitted but if Glencore develops a pit, the size would likely be large enough to require a permit.	Slope stabilization of pit required on closure.
Health Canada	Federal Contaminated Site Risk Assessment in Canada, Part I: Guidance on Human Health Preliminary Quantitative Risk Assessment	2004 2012 update	Describes methodology for conducting human health risk assessment in Canada for numerous different chemicals and could affect results of the risk assessment previously completed for the Site.	Methodology generally accepted by NB Environment for non-- petroleum hydrocarbon contaminants since it is generally consistent with CCME guidance but more specific.	No. Approval is through NB Guideline for the Management of Contaminated Sites, Version 2.	Previously calculated site specific criteria (referencing 2007 version) may need to be updated to reflect updates to Health Canada guidance, in addition to ARBCA.
Health Canada	Canadian Guidelines for the Management of Naturally Occurring Radioactive Materials (NORM)	2000 2013	Provides guidance on acceptable radioactivity levels from various types of materials affected by NORM. Update provides the NORM Classification Levels for evaluation of potential NORM containing material in Canada as well as action levels. Updated NORM guidelines are generally consistent with previous guidelines but specific guidance has been added for determining NORM management requirements.	Provides the only Canadian guidance on management of NORM.	No. Guideline will probably be used by the province in consideration of NORM management proposed by Glencore.	Used in CRA assessment of DAP & PAP NORM impacts. Assessment may need to be updated to meet updated guidelines.
NB DNR	Provincial Crown Land Pit and Quarry Policy Operating Standards	Unknown	Describes hours, setbacks, blasting, dust, noise and reclamation.	Applies only if borrow material comes from Crown Land.	If pit on Crown land a Crown land Lease would be required.	
NS Environment	Nova Scotia Environmental Quality Standards	2013	Provides human health and ecological standards for contaminants in soil, groundwater, surface water and sediment.	Applicable under regulation in Nova Scotia, but often used as screening criteria in other Atlantic Provinces including New Brunswick.	No. Standards may be applied as screening criteria in New Brunswick.	Referenced by GHD in Hydrogeology Report.

**Table 4C: List of Potentially Applicable Departments and Contacts for EIA Review or Approvals**

<b>Authorities</b>	<b>Address</b>	<b>Phone Number</b>	<b>Contact Name and Title</b>
NB Department of Health, Office of Chief Medical Officer of Health (North Region) <i>Activity expected to be limited to input to NB Environment during Environmental Impact Assessment process.</i>	165 St. Andrew Street, Bathurst, NB E2A 1C1	506-549-5550	Dr. Mariane Pâquet Medical Health Officer
NB Department of Health, Activity expected to be limited to input to NB Environment during Environmental Impact Assessment process.	HSBC Place, Floor: 5, PO Box 5100, Fredericton, NB E3B 5G8	506-457-4800	To Be Determined
NB Department of Public Safety, Technical Safety and Corporate Services Divisio, Technical Inspection Services Branch <i>Activity will be minimal – limited to ensuring stoppage of power, etc. – no financial or work delay implications.</i>	Gibson Place, Floor: 2, 12 McGloin Street, PO Box 6000, Fredericton, NB E3A 5T8	506-453-2336	To Be Determined
Worksafe NB Bathurst Regional Office <i>Regular inspections expected to ensure general conditions of worker safety are adequate. Have control over friable asbestos removal and handling – not disposal. Can shut down job for unsafe work conditions.</i>	1300 St. Peter Avenue, Suite 220, Bathurst, NB	506-547-7300	To Be Determined – May also involve Head Office, 1 Portland Street, Saint John, NB, 506-632-2200
Fisheries & Oceans Canada Habitat Protection & Sustainable Development <i>Can have substantive impact on provincial EIA process and could be a possibility of triggering a Federal EIA requirement under CEAA. Will have particular concerns over marine sediment and water quality during and after closure at Smelter. Will have concerns over potential surface water quality impacts of landfill disposal of waste materials at Brunswick Mine 12.</i>	343 University Avenue, Moncton, NB E1C 9B6	506-851-2978	Francois Plante Habitat Assessment Biologist



**Table 4C: List of Potentially Applicable Departments and Contacts for EIA Review or Approvals**

<b>Authorities</b>	<b>Address</b>	<b>Phone Number</b>	<b>Contact Name and Title</b>
NB Natural Resources Department <i>Can be expected to be included in provincial EIA process specifically related to disposal of waste materials at Brunswick Mine 12.</i>	1350 Regent Street, Fredericton, NB E3C 2G6	506-453-3675	Corey Neuman Reclamation Engineer
NB Department of Environment and Local Government <i>Lead agency coordinating provincial EIA regulation, approving Closure Plan, contaminated site criteria, issuing permits for pits and quarry, watercourse alteration and effluent treatment.</i>	20 McGloin Avenue, Fredericton, NB E3A 5T8	506-453-7945	Paul Vanderlaan Director, Environmental Science & Protection Division, Environmental Impact Assessment Branch
		506-453-7945	Michel Poirier, Authorizations Branch, Engineer
			Others To Be Determined
Environment and Climate Change Canada <i>Will input to provincial EIA process and be supportive of DFO positions.</i>	45 Alderney Drive, Dartmouth NS B2Y 2N6	1-800-668-6767	To Be Determined
Village of Belledune <i>No legislative jurisdiction. Have interest in obtaining rights to water in pipeline from Jacquet River.</i>	2330 Main Street, Belledune, NB E8G 2X9	506-522-3700	Mayor Joe Noel
Belledune District Planning Commission <i>Will issue demolition permit but will be guided by position of NB Environment.</i>	702 rue Principal, Petit Rocher, NB	506-542-2688	Marc Bouffard
Canadian Environmental Assessment Agency <i>May be included in provincial EIA Review panel for proposed landfills at Brunswick Mine 12. If aspects of Closure project are considered CEAA triggers, they would be equal participant in joint EIA Review panel with province.</i>	1801 Hollis Street, Suite 200, Halifax, NS B3J 3N4	902-426-0564	To Be Determined

**Table 5**  
**Onsite Transformers**  
**Closure Plan - Prefeasibility Study 2019 Update**  
**Brunswick Smelter, Belledune, NB**

Location	Input Volts	Output Volts	Input AMPs	Output AMPs	KVA	Type	Weight	Unit Sub	Phase	Connection	Age	Total
Lead Ref	4.16 KV AC	600 VAC			1000	DRY	7000 LBS	Y	3	DELTA / WYE	40+	1
Lead Ref	4.16 KV AC	600 VAC			1000	DRY	7000 LBS	Y	3	DELTA / WYE	10+	1
Change House	4.16 KV AC	600 VAC			1000	DRY	7000 LBS	Y	3	DELTA / WYE	40+	1
Furnace MCC #1	4.16 KV AC	600 VAC			1000	DRY	7000 LBS	Y	3	DELTA / WYE	40+	2
Furnace MCC #2	4.16 KV AC	600 VAC			1000	DRY	7000 LBS	Y	3	DELTA / WYE	40+	2
Switch House	4.16 KV AC	600 VAC			1000	DRY	7000 LBS	Y	3	DELTA / WYE	40+	1
F.B.H.	4.16 KV AC	600 VAC			1000	DRY	7000 LBS	Y	3	DELTA / WYE	40+	1
Sinter	4.16 KV AC	600 VAC			1000	DRY	7000 LBS	Y	3	DELTA / WYE	40+	4
Acid	4.16 KV AC	600 VAC			1000	DRY	7000 LBS	Y	3	DELTA / WYE	40+	2
RPW	4.16 KV AC	600 VAC			1000	DRY	7000 LBS	Y	3	DELTA / WYE	40+	1
RMS	4.16 KV AC	600 VAC			1000	DRY	7000 LBS	Y	3	DELTA / WYE	40+	1
Salt Water	4.16 KV AC	600 VAC			1000	DRY	7000 LBS	Y	3	DELTA / WYE	10+	1
Acid Mist Precip	500 VAC	78000 VDC	88 AAC	.8 DCA		Oil	Total Weight 1040 KG Oil Weight 515 KG		1	Rectifier Set	40+	3
Acid Mist Precip	500 VAC	78000 VDC	160 AAC	1.4 DCA		Oil	Total Weight 1240 KG Oil Weight 565 KG		1	Rectifier Set	40+	1
Sinter Dry Precip	575 VAC	55 KVAC	102 AAC	750 MADC		Oil 110 Gallons Each			1	Rectifier Set	20+	9
Old Silver Induction Furnace	574 VAC	440 VAC			400	DRY	2700 LBS		3	Step Down Transformer	15+	1
Outside, Salt Water Pumphouse	12,470 VAC	600 VAC			300	114 Gals Oil Outside Transformer With Tap Changer	3215 LBS		3	Can Be Connected For Different Combinations of Delta / WYE	25+	1

**Notes:**

Unit Sub - Enclosure with an incoming isolation switch on the high voltage side feeding a transformer which reduces the voltage and a set of low voltage breakers on the output side to feed equipment. The majority of the unit subs are ITE model with the newer ones being Siemens. Step down units.

Rectifier Set - And enclosure with a transformer and diode bridge. This unit uses oil for cooling; these unit steps up the voltage and changes it to DC to be used with a precipitator. The new sets used in the dry precipitator are NWL make and the older ones in the mist precipitator are siemens make.

There is also a set of 600 volts / 1000 AMPS transfer switches in the #2 MCC but they are also 40 + years old. We have 2 smaller and newer ones in the lead REF and silver plant that could be sold.

**Table 6**  
**Classification and Description of Demolition Materials**  
**Closure Plan - Prefeasibility Study 2019 Update**  
**Brunswick Smelter, Belledune, NB**

Structure/Operation	Brunswick Smelter - Facility Decommissioning/Demolition		
	Hazardous and Regulated Materials	Non-Hazardous Demolition Materials	Recyclable Materials
<b>Smelter Area</b>			
SRF Building	common universal wastes associated with structures, mercury devices, oil and other petroleum based fluids, ACM transite panel, metal-impacted dust	demolition debris including non-ACM insulation, and other non-recyclable materials, roofing materials, concrete and concrete block	structural steel, carbon steel, insulated copper
Lead Refinery	common universal wastes associated with structures, mercury devices, oil and other petroleum based fluids, friable ACM, ACM transite panel, metal-impacted dust	demolition debris including non-ACM insulation, and other non-recyclable materials, roofing materials, concrete and concrete block	structural steel, carbon steel, insulated copper
Furnace Building	common universal wastes associated with structures, mercury devices, oil and other petroleum based fluids, friable ACM, ACM transite panel, metal-impacted dust	demolition debris including non-ACM insulation, and other non-recyclable materials, roofing materials, concrete and concrete block	structural steel, carbon steel, insulated copper
Metal Storage Building	common universal wastes associated with structures, mercury devices, oil and other petroleum based fluids, ACM transite panel, metal-impacted dust	demolition debris including non-ACM insulation, and other non-recyclable materials, roofing materials, concrete and concrete block	structural steel, carbon steel, insulated copper
Dross Building	common universal wastes associated with structures, mercury devices, oil and other petroleum based fluids, ACM transite panel, metal-impacted dust	demolition debris including non-ACM insulation, and other non-recyclable materials, roofing materials, concrete and concrete block	structural steel, carbon steel, insulated copper
Sinter Plant	common universal wastes associated with structures, mercury devices, oil and other petroleum based fluids, friable ACM, ACM transite panel, metal-impacted dust	demolition debris including non-ACM insulation, and other non-recyclable materials, roofing materials, concrete and concrete block	structural steel, carbon steel, insulated copper
Silver Refinery	common universal wastes associated with structures, mercury devices, oil and other petroleum based fluids, metal-impacted dust	demolition debris including non-ACM insulation, and other non-recyclable materials, roofing materials, concrete and concrete block	structural steel, carbon steel, insulated copper
Crusher Building	common universal wastes associated with structures, mercury devices, oil and other petroleum based fluids, ACM transite panel, metal-impacted dust	demolition debris including non-ACM insulation, and other non-recyclable materials, roofing materials, concrete and concrete block	structural steel, carbon steel, insulated copper
Charge Preparation Building	common universal wastes associated with structures, mercury devices, oil and other petroleum based fluids, friable ACM, ACM transite panel, metal-impacted dust	demolition debris including non-ACM insulation, and other non-recyclable materials, roofing materials, concrete and concrete block	structural steel, carbon steel, insulated copper
Acid Plant and Acid Stack	common universal wastes associated with structures, mercury devices, sulfuric acid, oil and other petroleum based fluids, ACM transite panel, metal-impacted dust	demolition debris including non-ACM insulation, and other non-recyclable materials, roofing materials, concrete and concrete block	structural steel, carbon steel, stainless steel, insulated copper
Sinter Baghouse and Stack	common universal wastes associated with structures, mercury devices, oil and other petroleum based fluids, metal-impacted dust	demolition debris including non-ACM insulation, and other non-recyclable materials, roofing materials, concrete and concrete block	structural steel, carbon steel, insulated copper
Furnace Baghouse and Stack	common universal wastes associated with structures, mercury devices, oil and other petroleum based fluids, metal-impacted dust	demolition debris including non-ACM insulation, and other non-recyclable materials, roofing materials, concrete and concrete block	structural steel, carbon steel, insulated copper
Oxygen Plant	common universal wastes associated with structures, mercury switches, residual oxygen	demolition debris including non-ACM insulation, and other non-recyclable materials, roofing materials, concrete and concrete block	structural steel, carbon steel, insulated copper
SRF and Secondary Lead Storage Domes	common universal wastes associated with structures, mercury devices, metal-impacted dust	demolition debris including wood, roofing materials, concrete and concrete block	none expected
Sinter Storage Dome	common universal wastes associated with structures, mercury devices, metal-impacted dust	demolition debris including concrete and concrete block	structural steel, carbon steel
Office Building	common universal wastes associated with structures, mercury devices	demolition debris including wood, non-ACM insulation, and other non-recyclable materials, roofing materials, concrete and concrete block	structural steel, insulated copper
Changehouse	common universal wastes associated with structures, mercury devices, friable ACM	demolition debris including wood, non-ACM insulation, and other non-recyclable materials, roofing materials, concrete and concrete block	structural steel, insulated copper
Laboratory Building	common universal wastes associated with structures, lab pack, misc. chemicals, mercury devices, friable ACM	demolition debris including wood, non-ACM insulation, and other non-recyclable materials, roofing materials, concrete and concrete block	structural steel, insulated copper
Maintenance Shop	common universal wastes associated with structures, mercury devices, oil and other petroleum based fluids, misc. chemicals, friable ACM	demolition debris including non-ACM insulation, and other non-recyclable materials, roofing materials, concrete and concrete block	structural steel, carbon steel, insulated copper

**Table 6**  
**Classification and Description of Demolition Materials**  
**Closure Plan - Prefeasibility Study 2019 Update**  
**Brunswick Smelter, Belledune, NB**

Structure/Operation	Brunswick Smelter - Facility Decommissioning/Demolition		
	Hazardous and Regulated Materials	Non-Hazardous Demolition Materials	Recyclable Materials
Garage	common universal wastes associated with structures, mercury devices, oil and other petroleum based fluids, misc. chemicals	demolition debris including wood, non-ACM insulation, and other non-recyclable materials, roofing materials, concrete and concrete block	structural steel, carbon steel, insulated copper
Sandblasting Building	common universal wastes associated with structures, mercury devices, oil and other petroleum based fluids, misc. chemicals, metal-impacted dust	demolition debris including non-ACM insulation, and other non-recyclable materials, roofing materials, concrete and concrete block	structural steel, carbon steel, insulated copper
Warehouse	common universal wastes associated with structures, mercury devices, oil and other petroleum based fluids, misc. chemicals	demolition debris including non-ACM insulation, and other non-recyclable materials, roofing materials, concrete and concrete block	structural steel, carbon steel, insulated copper
Quonset Storage Dome	common universal wastes associated with structures, mercury devices, oil and other petroleum based fluids, misc. chemicals	demolition debris including concrete and concrete block	structural steel, carbon steel, insulated copper
Raw Material Storage Building (Concentrate Storage)	common universal wastes associated with structures, mercury devices, ACM transite panel, metal-impacted dust	demolition debris including concrete and concrete block	structural steel, carbon steel, insulated copper
Car Unloading Building	common universal wastes associated with structures, mercury devices, oil and other petroleum based fluids, metal-impacted dust	demolition debris including roofing materials, concrete and concrete block	structural steel, carbon steel, insulated copper
Proportioning Plant	common universal wastes associated with structures, mercury devices, oil and other petroleum based fluids, ACM transite panel, metal-impacted dust	demolition debris including non-ACM insulation, and other non-recyclable materials, roofing materials, concrete and concrete block	structural steel, carbon steel, insulated copper
Main, West and Salt Water Substations	common universal wastes associated with structures, mercury devices, oil and other petroleum based fluids	demolition debris including wood, non-ACM insulation, and other non-recyclable materials, roofing materials, concrete and concrete block	structural steel, carbon steel, insulated copper
Steam Generating Plant	common universal wastes associated with structures, mercury devices, oil and other petroleum based fluids, metal-impacted dust	demolition debris including non-ACM insulation, and other non-recyclable materials, roofing materials, concrete and concrete block	structural steel, carbon steel, insulated copper
Thaw Shed	common universal wastes associated with structures, mercury devices, ACM transite panel, metal-impacted dust	demolition debris including non-ACM insulation, and other non-recyclable materials, roofing materials, concrete and concrete block	structural steel, insulated copper
Car Cover Removal Building	common universal wastes associated with structures, mercury devices, oil and other petroleum based fluids, metal-impacted dust	demolition debris including non-ACM insulation, and other non-recyclable materials, roofing materials, concrete and concrete block	structural steel, carbon steel, insulated copper
Salt Water Pumphouse	common universal wastes associated with structures, mercury devices, oil and other petroleum based fluids	demolition debris including non-ACM insulation, and other non-recyclable materials, roofing materials, concrete and concrete block	structural steel, carbon steel, insulated copper
RPW Building, Ponds, Pool, Clarifier	common universal wastes associated with structures, mercury devices, oil and other petroleum based fluids, metal-impacted dust, RPW residue	demolition debris including non-ACM insulation, and other non-recyclable materials, roofing materials, concrete and concrete block	structural steel, carbon steel, insulated copper
Settling Basin Pumphouse	common universal wastes associated with structures, mercury devices, oil and other petroleum based fluids	demolition debris including wood, non-ACM insulation, and other non-recyclable materials, roofing materials, concrete and concrete block	none expected
WWTP	common universal wastes associated with structures, mercury devices, oil and other petroleum based fluids, metal-impacted dust, WWTP residue	demolition debris including wood, non-ACM insulation, and other non-recyclable materials, roofing materials, concrete and concrete block	structural steel, carbon steel, insulated copper
Smelter Conveyor System and Transfer Houses	common universal wastes associated with structures, mercury devices, oil and other petroleum based fluids, ACM transite panel, metal-impacted dust	demolition debris including non-ACM insulation, and other non-recyclable materials, roofing materials, concrete and concrete block	structural steel, carbon steel, insulated copper
<b>Material Handling West Area</b>			
MHW Administration Building	common universal wastes associated with structures, mercury devices, friable ACM	demolition debris including wood, non-ACM insulation, and other non-recyclable materials, roofing materials, concrete and concrete block	structural steel, carbon steel, insulated copper
Security / Changehouse	common universal wastes associated with structures, mercury devices, friable ACM	demolition debris including wood, non-ACM insulation, and other non-recyclable materials, roofing materials, concrete and concrete block	structural steel, carbon steel, insulated copper
Services Building	common universal wastes associated with structures, mercury devices, oil and other petroleum based fluids, ACM transite panel, metal-impacted dust	demolition debris including wood, non-ACM insulation, and other non-recyclable materials, roofing materials, concrete and concrete block	structural steel, carbon steel, insulated copper
Battery Recycling Plant	common universal wastes associated with structures, mercury devices, friable ACM, oil and other petroleum based fluids, metal-impacted dust, acid residue	demolition debris including wood, non-ACM insulation, and other non-recyclable materials, roofing materials, concrete and concrete block	structural steel, carbon steel, insulated copper

**Table 6**  
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**Brunswick Smelter, Belledune, NB**

Structure/Operation	Brunswick Smelter - Facility Decommissioning/Demolition		
	Hazardous and Regulated Materials	Non-Hazardous Demolition Materials	Recyclable Materials
Battery Storage Building	common universal wastes associated with structures, mercury devices, oil and other petroleum based fluids, ACM transite panel, metal-impacted dust, acid residue	demolition debris including concrete and concrete block	structural steel, carbon steel, insulated copper
DAP Storage Building	common universal wastes associated with structures, mercury devices, oil and other petroleum based fluids, ACM transite panel, metal-impacted dust	demolition debris including concrete and concrete block	structural steel, carbon steel, insulated copper
Storage Shed	none expected	demolition debris including wood, non-ACM insulation, and other non-recyclable materials, roofing materials, concrete and concrete block	none expected
Carpenter Shop / Pump House	none expected	demolition debris including wood, non-ACM insulation, and other non-recyclable materials, roofing materials, concrete and concrete block	none expected
PCB Storage Building	none expected	none expected	carbon steel
Acid Pumphouse	common universal wastes associated with structures, mercury devices, oil and other petroleum based fluids, acid residue	demolition debris including wood, non-ACM insulation, and other non-recyclable materials, roofing materials, concrete and concrete block	none expected
Acid Building and Emergency Shower	common universal wastes associated with structures, mercury devices, acid residue	demolition debris including wood, non-ACM insulation, and other non-recyclable materials, roofing materials, concrete and concrete block	structural steel, carbon steel, insulated copper
Process Acid Tanks	acid residue	demolition debris including concrete and concrete block	structural steel, carbon steel, insulated copper
Concentrate Storage Silos	common universal wastes associated with structures, mercury devices, metal-impacted dust	demolition debris including wood, concrete and concrete block	structural steel, carbon steel
Bulk Acid Tanks	acid residue	none expected	structural steel, carbon steel
Railcar and Truck Unloading Building	common universal wastes associated with structures, mercury devices, oil and other petroleum based fluids, metal-impacted dust	demolition debris including wood, non-ACM insulation, and other non-recyclable materials, roofing materials, concrete and concrete block	structural steel, carbon steel, insulated copper
Concentrate Storage Domes	common universal wastes associated with structures, mercury devices, metal-impacted dust	demolition debris including wood, concrete and concrete block	none expected
Control Room	common universal wastes associated with structures, mercury devices	demolition debris including wood, non-ACM insulation, and other non-recyclable materials, roofing materials, concrete and concrete block	structural steel, carbon steel, insulated copper
Truck Scale	none expected	demolition debris including concrete and concrete block	carbon steel
MHW Substation	common universal wastes associated with structures, mercury devices	demolition debris including wood, non-ACM insulation, and other non-recyclable materials, roofing materials, concrete and concrete block	structural steel, carbon steel, insulated copper
MHW Conveyor System and Transfer Houses	common universal wastes associated with structures, mercury devices, oil and other petroleum based fluids, ACM transite panel, metal-impacted dust	demolition debris including wood, non-ACM insulation, and other non-recyclable materials, roofing materials, concrete and concrete block	structural steel, carbon steel, insulated copper
<b>Fertilizer Plant</b>			
DAP Building	common universal wastes associated with structures, mercury devices, oil and other petroleum based fluids, friable ACM, ACM transite panel, metal-impacted dust	demolition debris including wood, non-ACM insulation, and other non-recyclable materials, roofing materials, concrete and concrete block	structural steel, carbon steel, insulated copper
PAP Building	common universal wastes associated with structures, mercury devices, oil and other petroleum based fluids, friable ACM, ACM transite panel, metal-impacted dust, NORM impacted equipment	demolition debris including wood, non-ACM insulation, and other non-recyclable materials, roofing materials, concrete and concrete block	structural steel, carbon steel, insulated copper

**Table 7**  
**Quantitative Summary of Demolition Materials**  
**Closure Plan - Prefeasibility Study 2019 Update**  
**Brunswick Smelter, Belledune, NB**

Area of Facility	Approximate Total Mass [Metric Tonnes (MT)]	Approximate Bulk Volume (m <sup>3</sup> )	Disposal Location	GHD Notes
<b>Smelter</b>				
<b>Regulated &amp; Hazardous Materials</b>				
<i>Universal Waste</i>				
Ozone Depleting Substances	0.010	--	Off-Site Disposal Facility	Estimated quantity based on field observations.
Mercury Devices (lamps and thermostat)	3	48	Off-Site Disposal Facility	Quantity carried forward from 2008 SNC Report. Assumes 1739 lights and 218 drums @ 0.22 m <sup>3</sup> /drum.
Lab Pack (unused raw and waste chemical materials)	50	--	Off-Site Disposal Facility	Estimated quantity based on field observations.
Transformer Oil	2	2	Off-Site Disposal Facility	Quantity carried forward from 2008 SNC Report. Assumed to contain < 50 ppm PCB concentration. Based on 1L of oil = 0.001m <sup>3</sup> and 1L of oil = 1.1kg
Other Oil (unused diesel, fuels and oils)	--	83	Off-Site Disposal Facility	Quantity based on tank inventory provided by Glencore.
Hydrogen Peroxide	--	29	Off-Site Disposal Facility	Quantity based on tank inventory provided by Glencore.
Carbon Dioxide	--	907	Off-Site Disposal Facility	Quantity based on tank inventory provided by Glencore.
Liquid Nitrogen	--	17	Off-Site Disposal Facility	Quantity based on tank inventory provided by Glencore.
<i>ACM Waste</i>				
Friable ACM Waste	--	42	Off-Site Disposal Facility	Quantity of friable asbestos based on quantities provided in June 2016 asbestos management report provided by Glencore. Bulking factor includes packaging materials.
Asbestos Cement Panels (non-friable asbestos)	--	404	Brunswick Mine Site Open Pit	Quantity from 2008 SNC report carried forward.
<i>Bulk Solid Waste</i>				
Oil/Fuel Sludge from Petroleum Tanks/Pipelines	12	11	Off-Site Disposal Facility	Estimated quantity based on tank inventory provided by Glencore and site observations. Assumes 10% sludge by volume for tanks containing oils and fuels. Assumes 1m <sup>3</sup> of sludge = 1.1MT.
Metal Impacted Sludge from Pits, Trenches & Sumps	20	18	Off-Site Disposal Facility	Estimated quantity based on site observations. Assumes 0.05m sludge in trenches, pits and sumps. Assumes 1m <sup>3</sup> of sludge = 1.1MT.
Sludge & Residue from Old Mist Precipitators (containing PCB's between 2ppm and 50ppm)	12	--	Off-Site Disposal Facility	Estimated quantity based on site observations and information provided by Glencore.
Sulfuric Acid Residual Product/Sludge	182	102	Off-Site Disposal Facility	Quantities based on tank inventory provided by Glencore.
Hg Bleed Sludge	14,100	--	Off-Site Disposal Facility	Quantity Provided by Glencore.
Free Material Dredging	7,000	--	Brunswick Mine Site	Quantity Provided by Glencore.
Sludge from CRP Dredging and Cleaning Ditches	8,500	--	Brunswick Mine Site	Quantity Provided by Glencore.
Refractory Brick	200	--	Brunswick Mine Site Open Pit	Quantity Provided by Glencore.
Catalyst	19	158	Off-Site Disposal Facility	Quantity Provided by Glencore.
Plastic Saddle	625	500	Brunswick Mine Site Open Pit	Quantity from 2008 SNC report carried forward. Assumes unit weight of plastic is 1250 kg/m <sup>3</sup> .
Ceramic Saddle	450	300	Brunswick Mine Site Open Pit	Quantity from 2008 SNC report carried forward. Assumes unit weight of ceramic is 1500 kg/m <sup>3</sup> .
WIP Dredging of NAP Berms	3,000	--	Brunswick Mine Site	Quantity Provided by Glencore.
Sweeper Wash Pad Cleanup Materials	100	--	Brunswick Mine Site	Quantity Provided by Glencore.
Old Garbage	200	--	Brunswick Mine Site Open Pit	Quantity Provided by Glencore.
HGP Dust	100	--	Off-Site Disposal Facility	Quantity Provided by Glencore.
CRP Sludge During Remediation	55,000	--	Brunswick Mine Site	Quantity Provided by Glencore.
Copper Dross in Corral (Solid)	1,000	--	Off-Site Disposal Facility	Quantity Provided by Glencore.
<b>Demolition Debris</b>				
Wood (creosote timbers from the rail tracks)	574	1,435	Brunswick Mine Site Open Pit	Quantity carried forward from 2008 SNC Report. Assumes unit weight of creosote timbers of 700 kg/m <sup>3</sup> .
Conveyor Belt (Rubber)	190	188	Brunswick Mine Site Open Pit	Quantity carried forward from 2008 SNC Report. Assume rubber belt weighs 1522 kg/m <sup>3</sup> .
Debris from Interior of Building	4,830	11,040	Brunswick Mine Site Open Pit	Quantity carried forward from 2008 SNC Report. Assumes average weight of interior debris such as drywall, wood framing, etc. = 700kg/m <sup>3</sup> .
Fibreglass Insulation	261	7,545	Brunswick Mine Site Open Pit	Quantity carried forward from 2008 SNC Report. Assumes unit weight of fibreglass insulation is 38kg/m <sup>3</sup> .
Bricks and Cinder Block	8,447	7,114	Brunswick Mine Site Open Pit	Quantity carried forward from 2008 SNC Report. Assumes unit weight of concrete block and brick of 1.9 MT/m <sup>3</sup> .
Concrete	95,417	63,611	Brunswick Mine Site Open Pit	Quantity carried forward from 2008 SNC Report. Assumes unit weight of concrete of 2.4MT/m <sup>3</sup> .
<b>Steel/Other Metals &amp; Equipment</b>				
Structural Steel	11,599	--	Recycling	Quantity carried forward from 2008 SNC Report.
Equipment	7,439	--	Recycling	Quantity carried forward from 2008 SNC Report.
Stainless Steel	49	--	Recycling	Quantity carried forward from 2008 SNC Report.
Copper	163	--	Recycling	Quantity carried forward from 2008 SNC Report.
<b>Material Handling West Area</b>				
<b>Regulated &amp; Hazardous Materials</b>				
<i>Universal Waste</i>				
Ozone Depleting Substances	0.010	--	Off-Site Disposal Facility	Estimated quantity based on field observations.
Mercury Devices (lamps and thermostat)	1	17	Off-Site Disposal Facility	Quantity carried forward from 2008 SNC Report. Assumes 1200 lights and 75 drums @ 0.22 m <sup>3</sup> /drum.
Lab Pack (unused raw and waste chemical materials)	20	--	Off-Site Disposal Facility	Estimated quantity based on field observations.
Propane	--	271	Off-Site Disposal Facility	Quantity Provided by Glencore.
Other Oil (hydraulic, lubrication)	--	1.7	Off-Site Disposal Facility	Quantity based on tank inventory provided by Glencore. Total of 1,493 L of product.
<i>ACM Waste</i>				
Friable ACM Waste	--	39	Off-Site Disposal Facility	Quantity of friable asbestos based on quantities provided in June 2016 asbestos management report provided by Glencore. Bulking factor includes packaging materials.
Asbestos Cement Panels (non-friable asbestos)	--	244	Brunswick Mine Site Open Pit	Quantity from 2008 SNC report carried forward.
<i>Bulk Solid Waste</i>				
Oil/Fuel Sludge from Petroleum Tanks/Pipelines	1	1	Off-Site Disposal Facility	Estimated quantity based on tank inventory provided by Glencore and site observations. Assumes 10% sludge by volume for tanks containing oils and fuels. Assumes 1m <sup>3</sup> of sludge = 1.1MT.
Metal Impacted Sludge from Pits, Trenches & Sumps	6	5	Off-Site Disposal Facility	Estimated quantity based on site observations. Assumes 0.05m sludge in trenches, pits and sumps. Assumes 1m <sup>3</sup> of sludge = 1.1MT.
Sulfuric Acid Residual Product/Sludge	2,642	1,480	Off-Site Disposal Facility	Quantity Provided by Glencore.
Iron Borings	120	--	Brunswick Mine Site	Quantity Provided by Glencore.
Sand	1,300	--	To be spread on-site	Quantity Provided by Glencore.
Limestone	100	--	To be spread on-site	Quantity Provided by Glencore.
Copper Speiss	2,275	--	Off-Site Disposal Facility	Quantity Provided by Glencore.

**Table 7**  
**Quantative Summary of Demolition Materials**  
**Closure Plan - Prefeasibility Study 2019 Update**  
**Brunswick Smelter, Belledune, NB**

Area of Facility	Approximate Total Mass [Metric Tonnes (MT)]	Approximate Bulk Volume (m <sup>3</sup> )	Disposal Location	GHD Notes
<b>Demolition Debris</b>				
Wood (creosote timbers from the rail tracks)	532	1,330	Brunswick Mine Site Open Pit	Quantity carried forward from 2008 SNC Report. Assumes unit weight of creosote timbers of 700 kg/m <sup>3</sup> .
Conveyor Belt (Rubber)	114	113	Brunswick Mine Site Open Pit	Quantity carried forward from 2008 SNC Report. Assume rubber belt weighs 1522 kg/m <sup>3</sup> .
Debris from interior of building	4,378	10,006	Brunswick Mine Site Open Pit	Quantity carried forward from 2008 SNC Report. Assumes average weight of interior debris such as drywall, wood framing, etc. = 700kg/m <sup>3</sup> .
Fibreglass Insulation	22	626	Brunswick Mine Site Open Pit	Quantity carried forward from 2008 SNC Report. Assumes unit weight of fibreglass insulation is 38kg/m <sup>3</sup> .
Concrete	28,286	18,858	Brunswick Mine Site Open Pit	Quantity carried forward from 2008 SNC Report. Assumes unit weight of concrete of 2.4MT/m <sup>3</sup> .
<b>Steel/Other Metals &amp; Equipment</b>				
Structural Steel	5,881	--	Recycling	Quantity carried forward from 2008 SNC Report.
Equipment	1,855	--	Recycling	Quantity carried forward from 2008 SNC Report.
Stainless Steel	20	--	Recycling	Quantity carried forward from 2008 SNC Report.
Copper	31.8	--	Recycling	Quantity carried forward from 2008 SNC Report.
<b>Fertilizer Plant (DAP &amp; PAP)</b>				
<b>Regulated &amp; Hazardous Materials</b>				
<i>Universal Waste</i>				
Mercury Devices (lamps and thermostat)	0.25	4	Off-Site Disposal Facility	Estimate 300 lights based on site observations. Assumes 20 drums @ 0.22 m <sup>3</sup> /drum.
Other Oil (hydraulic, lubrication)	0.45	0.5	Off-Site Disposal Facility	Estimated quantity of residual hydraulic oil and lubricants in equipment.
<i>ACM Waste</i>				
Friable ACM Waste	--	18	Off-Site Disposal Facility	Quantity of friable asbestos based on quantities provided in June 2016 asbestos management report provided by Glencore. Bulking factor includes packaging materials.
Asbestos Cement Panels (non-friable asbestos)	--	117	Brunswick Mine Site Open Pit	Quantity from 2008 SNC report carried forward.
<i>Bulk Solid Waste</i>				
Potential Product/Residue in Pipelines/Tanks, Equipment, Conveyors, Silos, Trenches, Sumps, Pits		190	Brunswick Mine Site Open Pit	Estimate based on site observations.
Soils/Sludge (NORM Impacted)	--	6	Brunswick Mine 12 Special Waste Landfill	Quantity calculated from 2019 NORM Survey.
<b>Demolition Debris</b>				
Conveyor Belt (Rubber)	38	38	Brunswick Mine Site Open Pit	Quantity carried forward from 2008 SNC Report. Assume rubber belt weighs 1522 kg/m <sup>3</sup> .
Debris from Interior of Building	477	1,090	Brunswick Mine Site Open Pit	Quantity carried forward from 2008 SNC Report. Assumes average weight of interior debris such as drywall, wood framing, etc. = 700kg/m <sup>3</sup> .
Concrete	5,201	3,467	Brunswick Mine Site Open Pit	Quantity carried forward from 2008 SNC Report. Assumes unit weight of concrete of 2.4MT/m <sup>3</sup> .
NORM Impacted Process Equipment & Piping		224	Off-Site Disposal Facility	Quantity calculated from 2019 NORM Survey.
<b>Steel/Other Metals &amp; Equipment</b>				
Structural Steel	1,096	--	Recycling	Quantity carried forward from 2008 SNC Report.
Equipment	700	--	Recycling	Quantity carried forward from 2008 SNC Report.
Stainless Steel	13	--	Recycling	Quantity carried forward from 2008 SNC Report.
Copper	15	--	Recycling	Quantity carried forward from 2008 SNC Report.

**Table 8**  
**Estimate Residue Disposal Quantities**

**GE Risk Matrix**

Onsite Material Liability (closure plan)
Original Dated October 25, 2010
Last Revision Date: 12/18/19
Original Team Members: K. Longval, E. Cabrera, B. Butler, J. Daigle
Updated by Kelly Longval

#	Department Areas	Material	Category	Actual Inventory December 2019 [wmt]	Most Likely Inventory [wmt]	Destination
9	Back 40-50 & NAP	Free Material Dredge	Free Material	7000	7000	Brunswick Mine
10	Back 40-50 & NAP	New Pond Dredging (Hg Bleed)	Free Material	14100	14100	Landfill
11	Back 40-50 & NAP	Old Garbage	Waste	200	200	Brunswick Mine
14	Back 40-50 & NAP	Mixed Bricks and Refractories	WIP	200	200	Brunswick Mine
16	Back 40-50 & NAP	Work In-Process Dredging - NAP Berms	WIP	3000	3000	Brunswick Mine
19	Blast Furnace	Blast Furnace In-process Cleanup - Day Bins	WIP	0	0	N/A
21	Dross Plant	Cu Dross (Chunky) in Corral	WIP	1000	1000	Landfill
35	MHW	Copper Speiss	Finished Goods	2275	2275	Landfill
37	MHW	CRT	Raw Material	N/A	0	Landfill
44	MHW	Iron Borings	Reagent	120	120	Brunswick Mine
45	MHW	Sand	Reagent	1300	1300	Spread on-Site
46	MHW	Limestone	Reagent	100	100	Spread on-Site
47	CRP Ponds	CRP Sludge Dredging	Free Material	8000	8000	Brunswick Mine
48	CRP Ponds	Sweeper - Wash Pad Cleanup	WIP	100	100	Brunswick Mine
49	Plant Wide	Ditches Clean	Free Material	N/A	500	Brunswick Mine
58	Sinter	Hot Gas Precip Dust (in process)	Waste	100	100	Landfill
60	CRP Ponds	Sludge at Pond Remediation	Free Material	55000	55000	Brunswick Mine



**Table 9**  
**Estimated Industrial Cleaning Quantities**  
**Closure Plan - Prefeasibility Study 2019 Update**  
**Brunswick Smelter, Belledune, NB**

Area	Approximate Liquid Removal Total (L)	Approximate Removal Total (m <sup>3</sup> )
<b>Smelter</b>		
Oil/Fuel Sludge from Process Tanks, Pipelines		11
Metal Impacted Sludge from Pits, Trenches & Sumps		18
Sulfuric Acid 70-100%	102,000	102
Hydrogen Peroxide	28,776	29
Carbon Dioxide	1,610	907
Liquid Nitrogen	16,656	17
Furnace Oil	75,714	76
Propane	271,306	271
Liquid Propane	113,562	114
Regular Oil, Gasoline	910	1
Diesel Fuel	4,000	4
Catalyst	157,686	158
<b>Material Handling West Area</b>		
Oil/Fuel Sludge from Process Tanks, Pipelines		1.0
Metal Impacted Sludge from Pits, Trenches & Sumps		5
Sulfuric Acid 70-100%	1,480,000	1,480
Propane	5,678	6
Diesel Fuel	1,278	1.3
Regular Oil, Gasoline	380	0.4

**Table 10**  
**Summary of Voids Created Through Demolition**  
**Closure Plan - Prefeasibility Study 2019 Update**  
**Glencore Brunswick Smelter**  
**Belledune, NB**

Area	Approximate Total, m <sup>3</sup>
<b>Smelter Area</b>	
Rail Car Unloading Building	2,928
Cooling Recycling Pond (to be converted to wetland)	0
Underground Utility Piping	2,195
Manholes	163
<b>SUB-TOTAL</b>	<b>5,286</b>
<b>Materials Handling West Area</b>	
Rail Car/Truck Unloading Building	3,660
Rail Car/Truck Unloading U/G Conveyor	592
Concentrate Storage Holding Pond	2,438
Stormwater Storage Pond (Assume to remain)	0
Manholes	47
Acid Holding Pond	1,380
<b>SUB-TOTAL</b>	<b>8,117</b>
<b>TOTAL</b>	<b>13,402</b>

Notes:

Underground pipes to be removed with diameters >0.5m; volumes account for crushed pipes and placement as backfill in trenches

No voids requiring backfill in Fertilizer Plant

**Table 11: Closure Plan Risk Register**

**Project :** Brunswick Smelter Closure Plan 2019 Update  
**Date :** Friday, October 25, 2019  
**Team members** Kelly Longval, Bob Butler, Florian Reher, Eduardo Cabrera, Marc Duchesne of Glencore  
 Troy Small, Rob Turner, Cherie Babineau, Byron Webber of GHD

AREA	Item	Risk <i>Something occurs</i>	Impacts <i>leading to...</i>	Causes <i>caused by...</i>	Controls <i>controlled by...</i>	Risk Owner	Inherent Risk			Potential Expense/Risk Allowance (\$m)	Treatment actions	Risk Control Effectiveness	Residual Risk		
							Consequence Rating	Likelihood Rating	Risk Rating				Residual Consequence Rating	Residual Likelihood Rating	Residual Risk Rating
<b>Planning Assumptions</b>															
All	Permitting	Risk of non-approval of the closure plan (land cover).	Increased closure costs.	Government Policy, Public Opinion.			4	2	III		Use wording in text to indicate that Closure Design is intended to permit future industrial slab-on-grade buildings and other industrial uses, probably related to the adjacent Port. Explore options to re-purpose assets.	High	4	1	II
		Risk of non-approval for extraction of cover material (borrow pit development).	Increased costs with sourcing cover material.	Government Policy.			2	1	I		Potential to obtain fill material from other pits and quarries in the area.		2	1	I
		Special permitting requirements for soil cover in cemetery	Increased permitting costs	Government Policy, Third Party.			2	1	I		Costs for hand removal of surficial soil and replacement with topsoil from off-Site source included in the updated cost estimate.		1	1	I
		Risk of project triggering the federal CEAA.	Increased regulatory permitting costs and schedule delays	Change in regulation.			4	2	III		Develop a communication and consultation strategy with DFO and Environment Canada prior to Closure. Eliminating the construction of Special Waste Landfills at Brunswick Mine Site.	Medium	3	2	II
		Assumption that all metal-impacted demolition debris can be disposed of in open pit disposal area and special waste landfill not required	Increased closure costs, permitting costs, schedule delays	Government Policy, Public Opinion.			4	2	III		Develop a communication and consultation strategy with NBDELG prior to Closure. Demolition materials previously disposed of at Mine Site with approval from NBDELG.	Medium	3	2	II
	Need to upgrade the treatment plant at Mine 12 for Thallium and Arsenic.	Increased closure costs.	Government Policy, Public Opinion.			3	2	II		Considered unlikely but currently not treatment action.	Medium	3	2	II	
Project Cost Forecasting	Inaccurate capital cost estimates including volatile scrap value	Increased closure costs				3	2	II		Lower confidence of the average scrap value prices used in cost estimate for conservatism.	Medium	2	1	I	
	Inaccurate Owner's costs including future property taxes, insurance, costs to relocate personnel, contingency, etc. Based on in-house team.	Increased closure costs				3	2	II			Medium	3	2	II	
MHW	Agreements	Rail Spur Line owned by Glencore but CN has rights to decide usages. Port may require track to stay in-place or be re-instated. Spur Line also includes rail access to NB Power	Development of third party agreements/consultation. Potential for impacts to schedule and costs	Historical agreements.			3	2	II		Glencore reviewed agreement requirements with legal. Costs to remove spur line on MHW included in Costs. Costs to remediate remainder of Spur Line (from CN main line to Shannon Drive) included in cost estimate.	High	2	1	I
Smelter	Production	Risk of losing the process capabilities.	Loss of Opportunity.						#N/A						#N/A
MHW	Cost Reductions	Opportunity to sell MHW infrastructure	Loss of Opportunity.						#N/A		Develop plan to recover saleable material from the Site.		0	0	#N/A
		Opportunity to resell concentrate.	Loss of Opportunity.						#N/A		Develop plan to recover saleable material from the Site.		0	0	#N/A
Freshwater Pipeline	Land/Equipment Transfer	Opportunity to transfer ownership and operations of FW pipeline to third party property owners (Port, NB Power, etc.)							#N/A		Develop plan to recover saleable material from the Site.		0	0	#N/A
Out of Scope Areas	Marine Sediments	Risk originated by EIA results.	Increased Closure Costs.						#N/A						#N/A
		Risk of dredging harbour.	Increased Closure Costs.						#N/A						#N/A
		Necessity to remove phospho-gypsum.	Increased Closure Costs.						#N/A						#N/A
<b>Health and Safety</b>															
All	Demolition and Waste Management	Risk of workers being exposed to asbestos during the works.	Potential overexposure and occupational illness.	Inaccurate Asbestos Inventory.			3	3	III		Asbestos Survey (inventory of Asbestos Containing Material) performed by a specialized company. Implementation of safe work procedures whenever they may be a risk of exposure to asbestos dust and air borne fibres. Supervision of the work by competent and experienced supervisors. Elaboration and implementation of a biological monitoring program, a periodic health assessment program and an industrial hygiene monitoring program (use Glencore protocols developed for Operations). Elaboration and implementation of training programs for workers and supervision. Use appropriate PPEs based on range of exposure to contaminants. HSE coordinator on-Site to manage HSE programs. Follow DOE Criteria for Asbestos Handling.	High	1	2	I
	Demolition and Waste Management	Risk of workers being exposed to metals during the works.	Potential overexposure and occupational illness.	Inadequate H&S Plan, Inadequate controls, behaviours.			3	4	IV		Health and safety program in place (Use the same program in place at the smelter). Blood test program. Adequate trained supervisor on-Site. Health and safety coordinator on-Site in all time. Elaborate HS Program for smelter closure activities. Elaborate specific work procedures for exposure to metals. Elaborate and implement biological monitoring program, periodic health assessment program and industrial hygiene monitoring program (use Glencore protocols developed for Operations). Elaborate and implement training program for workers and supervision. Use appropriate PPEs based on range of exposure to contaminants. HSE coordinator on-Site to manage HSE programs.	High	2	2	I
	Demolition and Waste Management	Workers' safety during demolition works.	Risk of personal injuries.	Inadequate H&S Plan, Inadequate controls, behaviours.			3	3	III		Review and approval of the work methodology by an expert. Health and safety program in place, adequate competent supervisor to follow the work, adequate planning of the work. JSA. Safety meeting. Safe work procedures elaborated in collaboration with expert engineers. HS program to be elaborated and implemented by Principal Contractor. Safe work procedures to be elaborated by Subcontractors, reviewed and approved by Principal Contractor. Perform job safety analysis, issue work permits for high-risk activities. Daily safety meetings held by supervisors with their crew to communicate hazards and control measures associated with work activities. Training of workers and supervision.	High	2	2	I
	Transport	Heavy traffic (risk of accident).	Risk of a Health and Safety incident, within the community.	Inadequate traffic control plan, behaviours.			3	2	II		Traffic control plan to be implemented during planning phase in consultation with NBDTI.	Medium	2	2	I
Fertilizer Plant	Demolition and Waste Management	Risk of workers being exposed to NORM and other hazardous materials during the works.	Potential overexposure and occupational illness.	Inadequate characterization of NORM impacted materials.			2	3	II		Updated NORM study completed in 2019 to characterize NORM impacted materials requiring special handling and disposal.	Medium	2	2	I
	Demolition and Waste Management	Structural integrity of DAP/PAP buildings as well as other condemned buildings affect decommissioning and demolition methodologies.	Risk of personal injuries, increased costs, schedule delays.	Inadequate designation of restricted areas.			2	3	II		Engineer to review structural integrity and develop mitigation plans for restricted access.	Medium	2	2	I
MHW	Working Near Water	Risk of spillage during cleaning and demolition over the water at Port property.	Risk of a spill to the environment.				3	2	II		Develop Decommissioning Plan specific to working at the Port.	Medium	2	2	I
	Working Near Water	Work near and above water at Port property.	Risk of employee injury and risk of a spill to the environment.				3	2	II		Develop Decommissioning Plan specific to working at the Port.	Medium	2	2	I
	Working Near Water	Equipment falling in the water at Port.	Risk of employee injury and risk of a spill to the environment.				3	1	I		Develop Decommissioning Plan specific to working at the Port.	Medium	2	2	I

Table 11: Closure Plan Risk Register

Project : Brunswick Smelter Closure Plan 2019 Update  
 Date : Friday, October 25, 2019  
 Team members Kelly Longval, Bob Butler, Florian Reher, Eduardo Cabrera, Marc Duchesne of Glencore  
 Troy Small, Rob Turner, Cherie Babineau, Byron Webber of GHD

AREA	Item	Risk <i>Something occurs</i>	Impacts <i>leading to...</i>	Causes <i>caused by...</i>	Controls <i>controlled by...</i>	Risk Owner	Inherent Risk			Potential Expense/Risk Allowance (\$m)	Treatment actions	Risk Control Effectiveness	Residual Risk		
							Consequence Rating	Likelihood Rating	Risk Rating				Residual Consequence Rating	Residual Likelihood Rating	Residual Risk Rating
<b>Engineering Design</b>															
Smelter and MHW	Cover	Availability of cover material (borrow).	Increased costs with sourcing cover material.				3	3	III		Borrow search indicated likely insufficient quantity of fill but alternate sources of fill available in area.	High	2	1	I
	Cover	Availability of cover material (top soil).	Increased costs with sourcing cover material.				3	3	III		Borrow search confirmed not sufficient material but alternate sources of topsoil available in the area.	High	2	1	I
	Water Management & Treatment	Seasonal restrictions or equipment malfunction disrupting water transportation capabilities.	Potential for a spill to the environment, increased water treatment costs.				1	4	I		MHW water management system recently upgraded for discharge to WWTP. Implement seasonal restrictions on water generation activities during the decommissioning/demolition activities.	Medium	2	1	I
	Water Management & Treatment	Lack of buffer capacity for a rain event occurring during the execution of closure works.	Potential for a spill to the environment.				3	3	III		Holding pond recently constructed in the MHW to buffer significant rain event.	Medium	3	2	II
	Effluent Lines	Risk of pipe collapsing.	Site Safety - Post Closure.				2	2	I		Decommissioning Planning, Pipes greater than 0.5 metre diameter will be crushed in-place or removed.	High	1	2	I
	Electrical Disconnect	Disconnecting electrical sub-station that may also serve WWTP and/or MHW Facility.	Potential for disruptions and delays to schedule and increased costs.				3	3	III		Decommissioning Planning, review electrical configurations and NB Power requirements prior to closure.	Medium	2	3	II
Fertilizer Plant	Electrical Disconnect	Risk of unidentified electrical and mechanical disconnects and re-routing requirements if DAP and PAP demolished separately from remainder of Site.	Risk of personal injuries, increased costs, schedule delays.				2	3	II		Electrical tracing indicated that separate electrical design to be completed only if DAP and PAP demolished separately from Site.	High	2	1	I
New Slag Pile	Cover	Closure costs based on current slag volumes not adequate for future size of slag pile at time of closure	Increased closure costs.				2	2	I		Closure Plan design based on current volumes at time of Facility closure.	High	2	1	I
	Cover	Design criteria for closure concept does not meet regulatory requirements. Design criteria assumes slag is non-leachable.	Increased closure costs.				4	2	III		Slag has historically been identified as non-leachable and down-gradient GW + SW within applicable guidelines.	High	3	1	I
	Water Management	Permitting requirements to complete closure activities within 30 metres of existing regulated wetland. Slag also present directly in wetland.	Increased closure costs.				3	2	II		Constructing engineered wetland in borrow pit area to provide secondary treatment of slag pile run-off (if required).	High	2	1	I
	Water Management	Risk of having to treat water from slag pile.	Increased closure costs, Risk of a Spill to the Environment.				1	2	I		Unlikely based on available monitoring data. Construction of engineered wetland also possible in borrow pit area to provide additional water treatment if required.	High	1	1	I
Mine Site	Waste Management	Continued subsidence at Mine Site near Open Pit limiting future access/disposal.	Increased closure costs, schedule delays.				3	3	III		Additional evaluation of subsidence to be completed in 2019.	Medium	2	2	I
<b>Environmental Risks</b>															
All	Waste Management	Risk of inaccurate friable asbestos quantity.	Increased closure costs.				3	3	III		Inventory of friable material on-Site.	Medium	2	1	I
	Demolition and Waste Management	Uncontrolled releases of contaminants to the environment (metals, hydraulic fluids, acids, etc.).	Off-Site Environmental Impacts and/or fines/penalties.	Inadequate environmental controls. Inadequate demolition plan.			3	3	III		Adequate cleaning. Adequate work procedure in place. Adequate Supervision of the work. Perform adequate cleaning and verify cleaning efficiency. Elaborate safe work procedures for demolition and waste management in order to confine contaminants. Perform environmental surveys and implement industrial hygiene monitoring program. Training of the personnel involved. Develop SOP for Cleaning and Demolition during basic engineering phase of the project.	High	3	2	II
	Transport of Material	Risk of material loss during transport.	Risk of an environmental incident, within the community.				3	2	II		Decommissioning Plan and Transport Plan.	Medium	2	2	I
	Water Management & Treatment	Old Zinc Refinery Site not adequately defined or characterized.	Increased closure costs.	Inadequate characterization.			3	2	II		No treatment.	Low	3	2	II
Smelter and MHW	Cover	Authorities impose a heavy metal cover criteria more stringent than risk based criteria used in pre-feasibility.	Increase cover cost.	Government Policy.			2	1	I		Risk Based SSTLs utilized from recent project in the area that were approved by NBDELG.	Medium	2	1	I
	Water Management	Authorities impose the reduction of contaminant transport by groundwater to the ocean.	Groundwater collection and treatment required. Increased long term maintenance costs.	Government Policy.			4	3	IV		Groundwater collection trench included in closure plan for treatment in engineered wetland.	Medium	3	3	III
	Water Management	Authorities impose a surface water criteria more stringent than CoA.	Need for water treatment.	Government Policy.			3	3	III		Construction of engineered wetlands for treatment of surface water runoff.	Medium	3	2	II
	Contaminated Soils	Authorities impose the removal of all accessible sources of contaminants on-Site.	Increased closure costs.	Government Policy.			4	1	II		No Treatment action as unlikely given current government policies and the acceptable for risk assessment.	Medium	2	2	I
	Water Management & Treatment	Increased groundwater contamination.	Potential for a spill to the environment.	Insufficient decontamination techniques.			3	3	III		Groundwater treatment (If required, install cut off walls and impervious cover).	High	2	2	I
	Water Management & Treatment	Risk of not meeting the WWTP discharge limits during closure operations.	Off-Site Environmental Impacts and/or fines/penalties, Increased closure costs, potential for a spill to the environment.				4	2	III		Upgrade the water treatment system or implement restrictions on discharges to WWTP during closure activities.	High	3	1	I
	Water Management & Treatment	Risk of not meeting the regulation criteria post closure (Non point groundwater discharge and surface water point discharge).	Increased closure costs. Potential for a spill to the environment.				4	2	III		Mitigation measures for GW and SW collection along with passive wetland treatment included in closure plan.	Medium	3	2	II
Smelter	Underground Tanks and Pipes	Risk of spills from U/G pipes.	Potential overexposure and occupational illness, as well as the potential for a spill to the environment.	Unknown concentrations and quantities in pipes, unknown condition of pipes.			1	2	I		Decommissioning Planning.	Low	1	2	I
	Underground Tanks and Pipes	Risk of finding unidentified buried equipment, pipes, wastes & spills.					2	2	I		Decommissioning Planning.	Low	1	2	I
	Contaminated Soils	Risk of treatment technology for petroleum impacted soils to be threatened by high metal concentrations.	Increased costs and hazards with increased waste management.	Unknown concentrations and quantities currently on-Site.			2	2	I		Pilot test hydrocarbon removal efficiency.	Medium	2	2	I
	Contaminated Soils, Underground Tanks and Pipes	Risk of underestimating exact volume of hydrocarbon contaminated to remove (unknown extent of landfarm).	Increased costs and hazards with increased waste management.	Unknown concentrations and quantities currently on-Site.			2	2	I		Impacted hydrocarbon areas anticipated to be overestimated in closure plan based on additional data collected in 2019.	Medium	2	2	I

Table 11: Closure Plan Risk Register

Project : Brunswick Smelter Closure Plan 2019 Update  
 Date : Friday, October 25, 2019  
 Team members Kelly Longval, Bob Butler, Florian Reher, Eduardo Cabrera, Marc Duchesne of Glencore  
 Troy Small, Rob Turner, Cherie Babineau, Byron Webber of GHD

AREA	Item	Risk <i>Something occurs</i>	Impacts <i>leading to...</i>	Causes <i>caused by...</i>	Controls <i>controlled by...</i>	Risk Owner	Inherent Risk			Potential Expense/Risk Allowance (\$m)	Treatment actions	Risk Control Effectiveness	Residual Risk		
							Consequence Rating	Likelihood Rating	Risk Rating				Residual Consequence Rating	Residual Likelihood Rating	Residual Risk Rating
Fertilizer Plant	Waste Management	Unidentified areas with NORM impacts and uncontrolled release of NORM to the environment.	Potential for a spill to the environment and exposure to workers.	Insufficient characterization of impacts			3	2	II		NORM survey updated in 2019.	Medium	2	2	I
	Waste Management	Decontamination of NORM waste (not being able to decontaminate enough to reuse).	Increased costs and hazards with increased hazardous waste management.				3	3	III		Costs in updated closure plan assume all NORM impacted material will be disposed of at an approved off-Site disposal facility.	High	2	2	I
	Contaminated Soil	Risk of not knowing exact volume of NORM contaminated soils to remove.	Increased costs and hazards with increased hazardous waste management.				2	3	II		NORM survey updated in 2019.	Medium	2	2	I
MHW	Working Near Water	Risk of spillage during cleaning and demolition over the water at the Port property.	Risk of a spill to the environment.				3	2	II		Demolition plan specific to working at the Port property.	Medium	2	2	I
Belledune Point	Land Use	Assumption that Belledune Point (specifically Salt Water Lagoon) does not require additional risk management or remediation.	Increased closure costs, regulatory permitting, schedule delays.				4	3	IV		Costs for covering terrestrial areas of Belledune Point included in closure plan.	Medium	3	3	III
	Coastal Erosion	Change in coastal morphology due to climate change, sea level rise, storm events.	Future off-Site remediation.				3	2	II		No current treatment.	Low	3	2	II
	Land Use	Destruction of rare plants during soil covering or remediation.					3	2	II		Develop mitigation plan if remediation of Belledune Point required.	Low	3	2	II
<b>First Nations and Heritage</b>															
All		Identification of archeological and/or First Nations historic Sites.	Increased closure costs, permitting, schedule delays.				3	2	II		Provincial Department of Heritage contacted and no known heritage or First Nation-Sites at the Facility.	Medium	2	2	I
		Impact to First Nations community on transport route.	Risk of a Health and Safety incident, within the community. Increased closure cost.				3	3	III		Develop First Nation communication plan, specifically for Pabineau First Nation for transportation of materials from Smelter to the Mine Site.	Medium	3	3	III
<b>Facility Demolition</b>															
All	Migratory Birds	Limitations on decommissioning, demolition and Site grading due to presence of migratory birds.	Increased closure costs, permitting, schedule delays.				3	3	III		Decommissioning and Demolition schedule will need to include restrictions on closure activities in areas known or suspected to have migratory birds or implement mitigation measures to deter birds from nesting/breeding at the Site.	Medium	3	2	II
	Weather	Weather delays disrupting demolition production and increased safety requirements.	Increased closure costs, schedule delays.				3	3	III		Allow for weather delays in project schedule.	Medium	3	2	II
	Demolition and Waste Management	Lack of availability of contractors to perform works.	Project delays and/or cost increases.	Lack of skilled labour in area.				2	1	I		No current treatment.	Low	2	1
Smelter and MHW	Water Management	Risk of WWTP capacity to treat dust-laden washwater (volume and concentration).	Increased closure costs.				3	3	III		Reduce water usage and identify periods when water generation activities are restricted (spring freshet). Segregate uncontaminated water.	Medium	3	2	II
	Demolition and Waste Management	Unidentified hazardous waste in buildings.	Increased costs and hazards with increased hazardous waste management. Potential overexposure and occupational illness, as well as the potential for a spill to the environment.	Inadequate decommissioning of plan unknown concentrations and quantities.			3	4	IV		Elaboration and implementation of a sampling program at closure of smelter operations. Use housekeeping protocols developed by Glencore for Smelter Operations. Minimize quantities of material, by cleaning and processing as much of the material as possible.	High	2	2	I
	Demolition and Waste Management	Risk of remaining contaminants in pipes.	Potential overexposure and occupational illness, as well as the potential for a spill to the environment.	Inadequate decommissioning of plan Unknown concentrations and quantities in pipes, unknown condition of pipes.				2	4	III		Develop decommissioning plans to remove and neutralize and de-energize all lines, tanks and systems in their area during the basic engineering phase.	medium	2	1
MHW	Operations	Risk of interrupting Port operation during closure activities.	Loss of Image.				2	1	I		Develop decommissioning plans specific to working at Port.	medium	2	1	I

**Note:**

- No risk owner and/or no risk rating
- Opportunity or loss of opportunity rather than a risk

**Table 11: Closure Plan Risk Register**

Project : Brunswick Smelter Closure Plan 2019 Update  
 Date : Friday, October 25, 2019  
 Team members : Kelly Longval, Bob Butler, Florian Reher, Eduardo Cabrera, Marc Duchesne of Glencore  
 Troy Small, Rob Turner, Cherie Babineau of GHD

<b>X Risks</b>	<b>Initial Ratings</b>	<b>Revised Ratings</b>																																																					
	<table border="1"> <tr><td rowspan="4" style="writing-mode: vertical-rl; transform: rotate(180deg);">Likelihood</td><td>0</td><td>2</td><td>6</td><td>0</td><td>0</td></tr> <tr><td>0</td><td>3</td><td>0</td><td>0</td><td>0</td></tr> <tr><td>0</td><td>0</td><td>7</td><td>0</td><td>0</td></tr> <tr><td>0</td><td>0</td><td>1</td><td>0</td><td>1</td></tr> <tr><td></td><td colspan="5" style="text-align: center;">Consequence</td></tr> </table>	Likelihood	0	2	6	0	0	0	3	0	0	0	0	0	7	0	0	0	0	1	0	1		Consequence					<table border="1"> <tr><td rowspan="4" style="writing-mode: vertical-rl; transform: rotate(180deg);">Likelihood</td><td>0</td><td>0</td><td>1</td><td>0</td><td>0</td></tr> <tr><td>0</td><td>3</td><td>0</td><td>0</td><td>0</td></tr> <tr><td>0</td><td>0</td><td>8</td><td>0</td><td>0</td></tr> <tr><td>0</td><td>2</td><td>5</td><td>0</td><td>1</td></tr> <tr><td></td><td colspan="5" style="text-align: center;">Consequence</td></tr> </table>	Likelihood	0	0	1	0	0	0	3	0	0	0	0	0	8	0	0	0	2	5	0	1		Consequence			
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Frequency Rating	Risk Matrix				
	1	2	3	4	5
1	I	I	I	II	II
2	I	I	III	III	IV
3	I	III	IV	IV	IV
4	I	IV	IV	IV	IV

**Risk Levels and Action Plans**

Risk Ranking	Description - X Risks
I	VERY LOW - No mitigation required
II	LOW - Verify Controls/safeguards in place
III	MEDIUM - Risk Reduction required within appropriate period
IV	HIGH - Risk Reduction required < 6 months or as required for project execution

Risk Ranking	Description - O Risks
I	No potential negative effect in next year or on the NPV of the project
II	Potential negative effect less than \$10 million
III	Potential negative effect between \$10 and \$100 million
IV	Potential negative effect > than \$100 million

**X Risk Types**

X.1	Health and Safety - Employees & Contractors
X.2	Health and Safety - General Public
X.3	Capital/Asset/Facility/Equipment Loss
X.4	Environmental Loss
X.5	Production Loss
X.6	Market Share Loss
X.7	Internal & Accounting Controls
X.8	Reputation Loss/Outrage

**O Risk Types**

O.1	Movement in Key Financial Drivers
O.2	Strategic Risks Inherent to O.1 Mitigation
O.3	Risks Inherent to Poor Assumptions

Appendix A  
Technical Memorandums – GHD Review of  
2008/2009 Closure Plan PFS



# Memorandum

Revision 1

To: Kelly Longval (Glencore) Ref. No.: 11198639

From: <sup>TS</sup> Troy Small (GHD) Date: October 9, 2019

cc: Bob Butler, Florian Reher, Rick Schwenger (Glencore)  
Rob Turner, Cherie Babineau, Mike Gallahue (GHD)

**Subject: Memorandum-1**

**Review of 2009 SNC-Lavalin Brunswick Smelter Closure Plan Prefeasibility Study and Cost Estimating Report – Section 2.0 - Regional Settings**

## 1. Introduction

Glencore Canada Corporation (Glencore) has retained GHD Limited (GHD) to update the 2009 Brunswick Smelter Closure Plan Prefeasibility Study (PFS) and Cost Estimating Report (also referred to as the “2008/2009 Closure Plan PFS”), which was completed by SNC-Lavalin. As part of the 2019 Closure Plan PFS Update, Glencore has requested GHD to review and validate the information presented in the 2008/2009 Closure Plan PFS in order to update the capital cost estimate for the 2019 Closure Plan PFS Update at a +/-20% accuracy for the Brunswick Smelter. The Brunswick Smelter includes the Smelter site, Material Handling West Area, and the Fertilizer Plant (collectively referred to as the “Site”). A slag pile and the Jacquet River Pumpouse and associated freshwater pipeline are also part of the closure plan.

GHD has reviewed the 2008/2009 Closure Plan PFS to determine if the information presented is valid, timely and complete, and has provided recommendations to Glencore as to whether an update should be executed, where applicable. In conjunction with the document reviews, GHD completed an existing conditions investigation at the Site in July 2019 to understand Site infrastructure, identify changes that have occurred at the Site since 2008/2009 and identify any data gaps that require additional Site investigations.

Glencore requested GHD to complete a separate technical memorandum for each section of the 2008/2009 Closure Plan PFS report detailing the report review findings. This memorandum outlines the findings of GHD’s review specifically for **Section 2.0 – Regional Settings** of the 2008/2009 Closure Plan PFS along with items discussed during the Alternatives Evaluation Meeting held on August 1, 2019.

## 2. Review Findings and Recommendations

Section 2.0 of the 2008/2009 Closure Plan PFS provided a general overview of the Site location, use of the Site and surrounding areas, and a brief history of the Smelter. In addition, the section outlines the geology, hydrogeology, topography and drainage for the Brunswick Smelter Site. In general, GHD agrees with the overall information presented but noted that some of the Site-specific information is now outdated. The following items require consideration for updating or validation as part of the 2019 Closure Plan PFS Update:





**Land Use**

- The document indicates that the smelting operation processes combinations of lead concentrates originating from Brunswick Mine Site and imported concentrates from offshore sources. However, Brunswick Mine Site ceased operations in 2013. Now, the smelting operation processes only imported concentrates from offshore sources. This change will be carried forward in the current study update as part of GHD’s current Scope of Work.
- Table 2-1 in the document briefly lists the Smelter history. There have been several events at the Smelter since the 2008/2009 Closure Study PFS, as detailed in the 2019 Closure Plan PFS Update Request for Proposal documents, will be added to the Smelter history, including the following:

Date	Event
Date To be provided by Glencore	<ul style="list-style-type: none"> <li>• New Slag Pile area increased from 15 Hectares (Ha) to 35 Ha.</li> <li>• Legacy Plastic and Rubber Pile was removed and disposed of in Brunswick Mine Site open pit.</li> <li>• A new water management system was established at the Material Handling West (MHW), and all water is collected and gravity fed to a holding pond and pumping system. Waste is then pumped to the Smelter Wastewater Treatment Plant for treatment.</li> <li>• The area between the Smelter and MHW used for storage of lime and explosives.</li> <li>• Recovered and processed some of the contaminated product buried in soils at the Back 40. The Back 40 continues to be used for storage of in-process materials.</li> </ul>
2012	<ul style="list-style-type: none"> <li>• The Old Slag Pile was relocated to the New Slag Pile area. The Old Slag Pile area is now a salt water lagoon.</li> <li>• New Silver Refinery was constructed.</li> </ul>
2013	<ul style="list-style-type: none"> <li>• A rock wave barrier was built at the polishing pond adjacent to the old slag pile.</li> <li>• Installed two new propane tank farms at the Smelter site.</li> <li>• Brunswick Mine Site ceased operations. Closure activities began at the mine site. The waste disposal area was reshaped, covered and revegetated in 2013.</li> </ul>
2014	<ul style="list-style-type: none"> <li>• The main 2,000,000 litre fuel storage tank at the Smelter site was removed and replaced with a smaller 80,000 litre tank.</li> </ul>
2016	<ul style="list-style-type: none"> <li>• 187 Ha of the Brunswick Mine Site was regraded and vegetated.</li> </ul>
2017	<ul style="list-style-type: none"> <li>• Brunswick Mine Site closure activities completed. The final tailings basin regrading and cover was completed with exception of a portion of the mini-pond, which is currently used to dispose of Iron Speiss.</li> </ul>
2018	<ul style="list-style-type: none"> <li>• A septic system was built at MHW.</li> <li>• New Wet Electrostatic Precipitator (WESP) and electrical building constructed.</li> <li>• Ground settlement occurred at Brunswick Mine Site in the area of the open pit access road, rendering the pit access road inaccessible.</li> </ul>

- The document includes several figures that are based on circa 1996/1997 aerial photographs as well as old infrastructure layout plans that do not document changes which have occurred at the Site since the 2008/2009 Closure Study PFS. GHD recommends updating the figures listed below as part

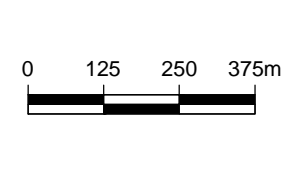


of the current study update, utilizing the most recent high resolution aerial photographs available from the Province of New Brunswick (2018) and updated site layout plans available from Glencore.

- Site Location Plan
- General Project Layout
- Proposed Land Use Areas
- DAP Fertilizer Plant Facility Site Plan
- Close Up of Smelter Operations Site
- Figure 020120-000-4EDD-0002-00 “Proposed Land Use Areas”, included in the document, outlines two land use areas, Low Exposure Land Use and Industrial Land Use. As further discussed in GHD technical memorandum 11198639-Memo-2 and 11198639-Memo-7 that discusses the Regulatory Framework and Design Basis for Closure Project included in the 2008/2009 Closure Study PFS, respectively, the old slag pile area located on Belledune Point was rehabilitated to become a salt water lagoon as outlined in the Belledune Point Rehabilitation Plan Final Report (dated September 2013). The rehabilitation plan was developed in collaboration with several federal/provincial agencies including New Brunswick Department of Environment and Local Government (NBDELG), Department of Fisheries and Oceans (DFO), Canadian Wildlife Service and Department of Energy and Mines. In addition, the Belledune Point rehabilitation work was completed in accordance with an Approval to Construct I-7784 issued by the NBDELG. In 2012, Atlantic RBCA implemented an ecological screening protocol for contaminated sites that has been adopted by NBDELG as part of the provincial Guideline for the Management of Contaminated Sites. Under this protocol, it is likely that the Belledune Point area and salt water lagoon created by the relocation of the old slag pile would be considered ecological habitat potentially requiring additional evaluation of contaminants in soil, surface water or sediment with respect to risk to ecological receptors. Based on information provided in the Belledune Point Rehabilitation Plan Final Report along with results of the Marine Ecological Risk Assessment of Brunswick Smelter completed by Intrinsik which includes the shoreline of Belledune Point (report dated October 30, 2015), it is assumed that additional rehabilitation works of Belledune Point will not be required as part of future Facility closure activities. As such, GHD recommends carrying this item forward in the risk registry for the current study update. In addition, as part of the proposal for the hydrogeological study of the Site, confirmation of environmental conditions at Belledune Point and the salt water lagoon, including sampling of soil, sediment and surface water in the lagoon, were proposed and submitted to Glencore under separate cover. Results of the confirmatory sampling will be carried forward in the current study update.
- On drawing 020120-0000-4GDD-0001 “General Project Layout”, the BHO project area outline on the drawing does not include the conveyors and load-out infrastructure going to the wharf. GHD recommends modifying the drawing to include this infrastructure.



Source: High Resolution Aerial Imagery from New Brunswick Dept of Natural Resources, Acquisition Date: 2018.



GLENCORE CANADA CORPORATION  
 BELLEDUNE, NEW BRUNSWICK  
 MEMORANDUM - 1

SITE PLAN

11198639-01  
 Oct 9, 2019

FIGURE 1



# Memorandum

Revision 1

To: Kelly Longval (Glencore) Ref. No.: 11198639

From: <sup>TS</sup> Troy Small (GHD) Date: October 9, 2019

cc: Bob Butler, Florian Reher, Rick Schwenger (Glencore)  
Rob Turner, Cherie Babineau, Mike Gallahue (GHD)

**Subject: Memorandum - 2**  
**Review of 2009 SNC-Lavalin Brunswick Smelter Closure Plan Prefeasibility Study and Cost Estimating Report – Section 3.0 – Regulatory Framework Applicable to the Closure Project**

## 1. Introduction

Glencore Canada Corporation (Glencore) has retained GHD Limited (GHD) to update the 2009 Brunswick Smelter Closure Plan Prefeasibility Study (PFS) and Cost Estimating Report (also referred to as the “2008/2009 Closure Plan PFS”), which was completed by SNC-Lavalin. As part of the 2019 Closure Plan PFS Update, Glencore has requested GHD to review and validate the information presented in the 2008/2009 Closure Plan PFS in order to update the capital cost estimate for the 2019 Closure Plan PFS Update at a +/-20% accuracy for the Brunswick Smelter. The Brunswick Smelter includes the Smelter site, Material Handling West Area, and the Fertilizer Plant (collectively referred to as the “Site”). A slag pile and the Jacquet River Pumphouse and associated freshwater pipeline are also part of the closure plan.

GHD has reviewed the 2008/2009 Closure Plan PFS to determine if the information presented is valid, timely and complete, and has provided recommendations to Glencore as to whether an update should be executed, where applicable. In conjunction with the document reviews, GHD completed an existing conditions investigation at the Site in July 2019 to understand Site infrastructure, identify changes that have occurred at the Site since 2008/2009 and identify any data gaps that require additional Site investigations.

Glencore requested GHD to complete a separate technical memorandum for each section of the 2008/2009 Closure Plan PFS report detailing the report review findings. This memorandum outlines the findings of GHD’s review specifically for **Section 3.0 – Regulatory Framework Applicable to the Closure Project** of the 2008/2009 Closure Plan PFS along with items discussed during the Alternatives Evaluation Meeting held on August 1, 2019.

## 2. Review Findings

The section provided a general overview for the provincial and federal regulatory framework including Acts, Regulations and Guidelines considered applicable to the demolition and closure of the Site. The document



also provided an overview of regulatory correspondence pertaining to the 2008/2009 Closure Plan PFS project. In general, GHD agrees with the overall concept and regulatory framework proposed but noted that some specific regulations and associated guidelines have been updated since completion of the 2008/2009 Closure Plan PFS. Items that GHD considers requiring further consideration and updating are presented below.

The following items will need to be updated or validated as part of the 2019 Closure Plan PFS Update:

### **Background**

- The document indicates the Site operates under two NB Provincial Certificates of Approval to Operate (C of A); a Water Quality Approval and an Air Quality Approval with each existing Approval requiring submission of a plan for “complete site rehabilitation” at least six (6) months prior to closure. It is GHD’s understanding that the Site is currently operating under these same Approvals (updated every 5 years). The current C of As and associated operating/closure requirements are to be reviewed and included in the 2019 Closure Plan PFS Update.

### **Project Context**

- The closure concept design was based on two specific land uses: Industrial Land and Low Exposure Land. Both of these land use scenarios were developed for the protection of human health. However, the old slag pile area located on Belledune Point was rehabilitated to become a salt water lagoon as outlined in the Belledune Point Rehabilitation Plan Final Report (dated September 2013). The rehabilitation plan was developed in collaboration with several federal/provincial agencies including New Brunswick Department of Environment and Local Government (NBDELG), Department of Fisheries and Oceans (DFO), Canadian Wildlife Service and Department of Energy and Mines. In addition, the Belledune Point rehabilitation work was completed in accordance with an Approval to Construct I-7784 issued by the NBDELG. In 2012, Atlantic RBCA implemented an ecological screening protocol for contaminated sites that has been adopted by NBDELG as part of the provincial Guideline for the Management of Contaminated Sites. Under this protocol, it is likely that the Belledune Point area and salt water lagoon created by the relocation of the old slag pile would be considered ecological habitat potentially requiring additional evaluation of contaminants in soil, surface water or sediment with respect to risk to ecological receptors. Based on information provided in the Belledune Point Rehabilitation Plan Final Report along with results of the Marine Ecological Risk Assessment of Brunswick Smelter completed by Intrinsik which includes the shoreline of Belledune Point (report dated October 30, 2015), it is assumed that additional rehabilitation works of Belledune Point will not be required as part of future Facility closure activities. As such, GHD recommends carrying this item forward in the risk registry for the current study update. In addition, as part of the proposal for the hydrogeological study of the Site, confirmation of environmental conditions at Belledune Point and the salt water lagoon, including sampling of soil, sediment and surface water in the lagoon, were proposed and submitted to Glencore under separate cover. Results of the confirmatory sampling will be carried forward in the current study update.
- A hydrogeological study of the Back 40 area is part of the 2019 Closure Plan PFS Update scope of work. The proposed hydrogeological study includes the collection of soil, sediment and surface water samples from the Back 40/Back 50 and the Salt Water Lagoon area of the Site was submitted by GHD to



Glencore on July 29, 2019. The recommended hydrogeological evaluation included the collection of soil, sediment and surface water samples from Belledune Point are being proposed specific for evaluation of risk to ecological receptors and the information obtained will be used in the 2019 Closure Plan PFS Update. In addition, Intrinsik recently completed a Marine Ecological Risk Assessment of Brunswick Smelter (report dated October 30, 2015) which includes information on avian species nesting and foraging in the Belledune Point area. The Intrinsik document was provided to GHD by Glencore on August 2, 2019, and the information provided in the report will be included in the 2019 Closure Plan PFS Update.

- Closure objective stated in document is to leave the Site with the vegetated cover without fencing. Based on discussions during the August 1, 2019 Alternatives Evaluation meeting, the Site is to remain fenced post closure.

### **Regulatory Process**

- In general, the overview of provincial regulations identified in Section 3 of the 2008/2009 Closure Plan PFS document remain relevant. However, in addition to the Clean Environment Act and the Clean Air Act, it is expected that the closure project will require compliance with the *Watercourse and Wetland Alteration (WAWA) Regulation of the Clean Water Act* as a provincially regulated wetland is located directly south of the new slag pile (see attached figure). Specific activities to be completed within 30 metres of this wetland will require permitting under the WAWA.
- In January 2018, the NBDELG released an updated “A Guide to Environmental Impact Assessment in New Brunswick”. The provincial Environmental Impact Assessment (EIA) process presented in the 2008/2009 Closure Plan PFS is generally accurate and consistent with the information provided in the updated provincial EIA guidance document. However, the 2008/2009 Closure Plan PFS has limited information as to whether the Smelter Closure project would trigger the federal EIA process. In 2012, the federal government introduced the Canadian Environmental Assessment Act (CEAA) which included a list of “designated projects” that would potentially require completion of a federal environmental assessment. Included in the list of designated projects is the construction, operation, decommissioning and abandonment of a facility used exclusively for the treatment, incineration, disposal, or recycling of hazardous waste. As the 2008/2009 Closure Plan PFS included the construction of “special waste handling” facilities at the Brunswick Mine Site, there is the potential requirement for the closure project to be registered with the Canadian Environmental Assessment Agency if special waste cell (e.g., hazardous waste landfills) construction is required as part of the closure project.
- In addition to the CEAA requirements noted above, it is also noted that on June 21, 2019, Bill C-69 received Royal Assent that created a new Impact Assessment Agency of Canada and repealed the *Canadian Environmental Assessment Act, 2012*. The legislated changes and associated procedures policies and guidance documents that are affected by Bill C-69 are yet to be released but will be reviewed as part of the 2019 Closure Plan PFS Update (if available).

### **Opportunities**

- The document indicates a multi-departmental regulators meeting held in 2002 advised Glencore (formerly Xstrata) that closure materials from the Brunswick Smelter would be considered acceptable for



disposal at Brunswick Mine if they were similar in nature to materials at the Brunswick Mine Site. Based on this historical information and the Alternatives Evaluation meeting held on August 1, 2019, it is considered reasonable to assume that demolition debris at the Site that is potentially impacted with metals is acceptable for disposal at the Brunswick Mine Site. However, there is significant inherent risk in assuming that materials impacted with naturally occurring radioactive material (NORM) or other waste types such as process sludges or raw feedstock could be disposed of at the Mine Site as these waste types are not similar to materials at the Mine Site. In addition, a special waste landfill has not previously been permitted in the Province of New Brunswick and its undertaking will require review and approval under the provincial EIA regulation and/or the federal CEAA process (or future regulations under the newly assented Impact Assessment Agency).

- During the August 1, 2019 Alternatives Evaluation meeting, it was agreed that process sludges and raw feedstock would not be acceptable for disposal at the Brunswick Mine Site and would require disposal at an approved off-Site facility. For NORM impacted material, the 2019 Closure Plan PFS Update includes completion of a Trade-off Study that evaluates potential NORM disposal alternatives (Brunswick Mine disposal versus off-Site disposal at a specialized facility).
- A NORM characterization study of the Fertilizer Plant area, specifically the Diammonium Phosphate Plant and the Phosphoric Acid Plant buildings (DAP & PAP buildings), was identified as potentially being required in the 2019 Closure Plan PFS Update Scope of Work. As part of GHD's review of the 2008/2009 Closure Plan PFS and discussions held during the August 1, 2019 Alternatives Evaluation meeting, GHD recommended that an updated NORM characterization study should be completed to provide Glencore with updated information on current concentrations and quantities of NORM associated with the Fertilizer Plant buildings. This information is critical to determining appropriate remediation and/or disposal requirements and associated costs to be developed as part of the Trade-off Study. Recommendations to complete a NORM survey are provided in GHD's technical memorandums 11198639-Memorandum-6 and 11198639-Memorandum-7. A separate scope of work proposal to complete a NORM survey at the Fertilizer Plant area was provided to Glencore on August 12, 2019.

### **Cautions**

- The document indicates that environmentally sound landfill design for special waste at the Brunswick Mine may result in a reduced EIA review process (Determination Review instead of a Comprehensive Review). GHD agrees with this statement in theory but given that special or hazardous waste landfills have not previously been permitted in the province, there is inherent risk that the proposed special-waste landfill may not be approved by the province. Potential alternatives for disposal of process sludges, raw feed-stock and NORM impacted materials will be reviewed as part of the 2019 Closure Plan PFS Update.
- The document discusses limitations on sourcing up to 100 hectares of fill and topsoil under the NB Topsoil Preservation Act. GHD agrees with these limitations but also cautions there may be several limitations on covering certain areas of the Site. In particular, the provincial Cemetery Companies Act (February 2018) has specific requirements and restrictions on altering gravesites and associated monuments. During the documentation review and existing conditions evaluation completed by GHD in 2019, it was identified that a cemetery exists at the Site that is currently owned by L'Eveque Catholique Romain de Bathurst. This cemetery area was identified as requiring soil cover in the 2008/2009 Closure



Plan PFS. Specific implications of the Cemetery Companies Act will require review and incorporation in the 2019 Closure Plan PFS Update.

### References

- Table 7-1 lists the applicable departments and contacts that may be involved with the EIA review and approval process. In general, the specific departments listed will remain the same for the current study but the contact names and titles for most departments have likely changed since completion of the 2008/2009 Closure Plan PFS.
- Tables 7-2 and 7-3 (attached) lists applicable Acts, Regulations and Guidelines with potential implication to the closure project. The primary Acts, Regulations and Guidelines have been amended or enacted since the 2008/2009 Closure Plan PFS and could have a significant impact on the future closure requirements of the Site (as listed below).
  - **Canadian Environmental Assessment Act (CEAA) updated in 2012** – Act identifies the construction of a hazardous waste landfill as a designated project that may require environmental assessment under the federal process.
  - **Impact Assessment Agency formed in 2019** – The CEAA was repealed in June 2019 and new Impact Assessment Agency created. New policies/regulations under this new agency are yet to be released.
  - **Canadian Federal Fisheries Act updated in 2012** - In February 2018, the Government of Canada introduced Bill C-68, which reflected a commitment to review the changes made in 2012 to the Fisheries Act, in order to restore lost protections and incorporate modern safeguards. On June 21, 2019 the modernized Fisheries Act (Bill C-68) received royal assent and became law. However, provisions and regulations within the Act for the protection of fish and fish habitat have not come into force.
  - **Health Canada, Federal Contaminated Site Risk Assessment in Canada, Part I: Guidance on Human Health Preliminary Quantitative Risk Assessment (PQRA), Version 2.0, 2010 and revised in 2012** - Describes methodology for conducting human health risk assessment in Canada for numerous different chemicals and could affect results of the risk assessment previously completed for the Site.
  - **Environment Canada, Federal Contaminated Sites Action Plan (FCSAP), Ecological Risk Assessment, March 2012** - Describes methodology for conducting ecological risk assessment in Canada for numerous different chemicals and could apply to ecological habitat created on Belledune Point following reclamation of the old slag pile.
  - **Health Canada, Canadian Guidelines for the Management of Naturally Occurring Radioactive Materials (NORM) updated in 2013** – Provides the NORM Classification Levels for evaluation of potential NORM containing material in Canada as well as action levels. Updated NORM guidelines are generally consistent with previous guidelines but specific guidance has been added for determining NORM management requirements.
  - **Provincial Cemetery Companies Act updated in 2018** – Specifies requirements and restrictions on altering gravesites and associated monuments that will apply to the on-Site cemetery.





- **A Guide to Environmental Impact Assessment in New Brunswick updated in 2018** – Provides list of designated projects triggering an EIA along with regulation requirements, procedures and timelines.
- **NBDELG Guideline for the Management of Contaminated Sites (2003) with Requirements and Review Procedures updated in 2016 to 2018** (various documents) – Updated documents generally limited to new reporting requirements and associated timelines.
- **Atlantic RBCA Version 3 revised in 2015** - Describes the methodology for human health risk assessment in the determination of remedial criteria for petroleum hydrocarbon impacted soil and groundwater. The updated guidelines also include methodology for ecological risk assessment in the determination of remedial criteria for impacted soil, groundwater, sediment and surface water. Atlantic RBCA Version 3.1 currently under public review (2019).
- **Nova Scotia Environmental Quality Standards enacted in 2013** – Provides human health and ecological guidelines for contaminants in soil, groundwater, surface water and sediment which have been adopted (in practice) by NBDELG. Contaminants include petroleum hydrocarbons, metals, PCBs, and PAHs among others.

The 2019 Closure Plan PFS Update will include a revision of Tables 7-2 and 7-3 with the following (but not limited to) updated regulatory documents and processes.

### 3. Recommendations

Based on the information presented above and items discussed with Glencore representatives during the August 1, 2019 Alternatives Evaluation Meeting, GHD recommends the following be completed to assess how changes in applicable Acts, Regulations, and Guidelines may impact future closure planning for the Site:

- As indicated above, an updated hydrogeological study and NORM survey for the Fertilizer Plant area has been recommended as part of GHD's Technical Review of the 2008/2009 Closure Plan PFS. Following completion of these studies in 2019, GHD recommends scheduling a meeting with provincial regulators to confirm previous communications and agreements outlined in the 2008/2009 Closure Plan PFS. The meeting should specifically discuss the use of a risk based approach for the Site closure, the use of the Brunswick Mine Site for disposal of metal impacted demolition debris and the construction of special waste landfills at the Brunswick Mine Site (if required). The meeting would also be intended to verify the provincial EIA process and potential harmonization agreements with the Canadian Environmental Assessment Agency or the new Impact Assessment Agency, which could reduce the risk of completing a federal EIA.
- A review of the findings of the ground settlement study (Spring 2019) in the open pit area at Brunswick #12 mine site to verify the area is suitable for the placement of disposal cells for NORM impacted waste materials (if required).
- GHD recommends completing a review of the Site-Specific Target Levels previously developed as part of the 2008/2009 Closure Plan PFS given the changes in applicable guidance documents and standards that are currently being utilized in New Brunswick to evaluate risk to human health as well as ecological receptors (specifically Atlantic RBCA, Health Canada, Environment Canada and NS EQS). It is noted

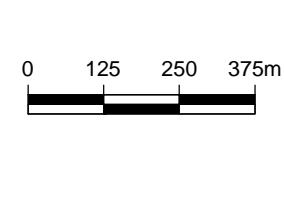


that ecological considerations, specifically Belledune Point, were not evaluated in the 2008/2009 Closure Plan PFS but ecological considerations are now required based on changes in applicable guidance documents.

- The provincial Cemetery Companies Act (February 2018) has specific requirements and restrictions on altering gravesites and associated monuments that were not included in the 2008/2009 Closure Plan PFS cover requirements. GHD recommends reviewing the current agreement between Glencore and L'Eveque Catholique Romain de Bathurst regarding the adjacent off-Site cemetery and how this agreement along with the Cemetery Companies Act could affect the placement of cover at the Site and future access.



Source: High Resolution Aerial Imagery from New Brunswick Dept of Natural Resources, Acquisition Date: 2018.



GLENCORE CANADA CORPORATION  
 BELLEDUNE, NEW BRUNSWICK  
 MEMORANDUM - 2

SITE PLAN

11198639-01  
 Oct 9, 2019

FIGURE 1

**Table 7-2 - List of Acts and Regulations with potential application to Closure**

Act	Regulation	Section	Issue	Application to Smelter Complex	Permit or CoFA Req'd	CRA Recommendations / Comments
NB Clean Environment	87-83 Environmental Impact Assessment	Section 3, Section 5, Appendix A	Section 3 defines an undertaking as extension, abandonment demolition or rehabilitation. Section 5-Requires registration of an Undertaking.	Umbrella legislation that requires multi-departmental review process before any individual environmental permits or C of As will be issued. Will involve provincial and federal departments in EIA Review. Demolition of complex and creation of new landfills require EIA registration and review. See Figure 1 for simplified NB EIA Process. This project is considered a Category 1 Undertaking. New landfills (at Brunswick 12) have mandatory comprehensive EIA requirements. Other aspects of Closure may be screened out with conditions. Closure (excluding landfills) is likely to be screened out with many conditions.	Yes. Must register Closure for NB EIA Review. Review outcome can be screening out with conditions or mandatory Comprehensive EIA. Both processes require a public process but Comprehensive EIA is much more extensive in technical and public participation requirements. Following EIA process the EIA Review document will specify conditions and need to obtain specific permits under other provincial regulations as mechanism to control closure to provincial standards.	New Brunswick has no precedents on smelter closures. Major pulp and paper mills that have closed have not been demolished and serve as no precedent. NB Environment is generally open to proposals that meet generally good environmental management principles especially if they have no specifically related guidelines or regulations. Therefore the potential is available for Glencore to submit proposed closure methods and disposal options that meet good environmental principles. Glencore must provide sufficient back up data to convince regulators that the surrounding environment is suitably protected after closure and that the site is potentially available for future industrial land use. If convinced, regulators should be inclined to accept the Glencore proposals instead of generating their own requirements. Almost all critical discussions on closure requirements will occur during the EIA process.  In 1995, J.D. Irving proposed constructing a new industrial landfill to dispose of materials that would be of less concern than Glencore materials but in a more public area. The project was directed to Comprehensive Review and was abandoned by the proponent. Comprehensive Review process for the proposed landfills can be expected to take 18-24 months.
NB Clean Environment	82-126 Water Quality	3(1), 3(2), 3(3), 3(5)	Required to have an approval to discharge or operate, construct, modify (includes demolish) a source of contamination. Required to have an Approval to operate a Waterworks if flow is greater than 50 m <sup>3</sup> per day.	Most aspects of Closure under NB Environment control will be dictated by Terms of a C of A issued for Closure after the EIA process is completed. Probably include treatment plant discharge quality, non-point discharges like area groundwater, off-site air and water quality during demolition, cover material pits on Glencore lands, approval of soil cover concept for closure.	Yes, if point source discharge. Yes, to cover aspects of closure.	Approvals would come after EIA process is complete. Treatment plant discharge criteria will probably be based on federal MMR. As many activities as possible will probably be combined into a single Water Quality Regulation Industrial Discharge Approval in the format used during operation.
NB Clean Air	97-133 Air Quality regulation	Sec 3	Required to have an approval to discharge contaminants to the air.	Control of fugitive air emissions created during demolition.	Yes	Fugitive air emissions may or may not be considered necessary to permit in a C of A that could be issued under the Water Quality Regulation or Air Quality Regulation. Probably set quality limits at property boundary.
NB Clean Environment	87-97 Petroleum Storage	Section 3	Approval (Permit) required for installation, alteration or removal / decommissioning of petroleum storage tanks.	Controls process for removal of petroleum infrastructure. Glencore should have a list of all existing petroleum storage tanks registered with NB Environment. New tanks required for closure or existing tanks to be decommissioned on closure must be installed/removed by a tank installer registered with NB Environment.	No but work must be supervised by a provincially licensed tank installer.	This should be a minor financial / technical issue on closure but it is highly regulated so needs to be done to the regulations.
NB Clean Environment	90-79 Water Well	Section 27	Must decommission any groundwater wells no longer required to departmental standards.	Controls method of monitor well decommissioning. Over 50 monitor wells on site. Must decide which are required for long term groundwater monitoring (post-closure) and which are to be decommissioned.	Not specifically. Anticipate a clause covering this in a global C of A issued for all closure aspects under Water Quality Reg 86-126.	Minor issue with low financial implications. Normal decommissioning of 50 cm monitor wells requires pulling casing and filling space with bentonite.
NB Clean Water	90-80 Watercourse and Wetland Alteration Regulation	Section 8	No person shall carry out alteration of a wetland or watercourse without a Permit. Applies to freshwater or estuarine watercourses but not marine areas.	Controls any work within 30 metres of a freshwater or estuarine watercourse. Applies to Jacquet River pumphouse if within 30 metres of a freshwater or estuarine watercourse and if any demolition is proposed. Does not apply in completely marine water locations. Applies to a portion of the retention pond located directly north of the New Slag Pile that was created by the dam structure, and is now classified as a regulated wetland.	Yes, future closure activities associated with the New Slag Pile (grading and capping) will likely require a WAWA permit as physical activities will be completed directly adjacent to or within 30 metres of the wetland.	Approvals would come after EIA process is complete with retention of existing dam structure and associated pond (wetland) to be incorporated into closure plan.

Table 7-2 - List of Acts and Regulations with potential application to Closure

Act	Regulation	Section	Issue	Application to Smelter Complex	Permit or CofA Req'd	CRA Recommendations / Comments
NB Occupational Health & Safety		Section 32	General conditions related to worker safety that Glencore is currently subject to. Section 32 says that when an Officer is of the opinion that unsafe or unhealthy working conditions exist, he may suspend work, etc.	Controls worker safety during operation and Closure. Will also apply to all contractors involved in site closure and post-closure operations. Any Codes of Practice that Glencore has been required to develop under legislation during operation may continue to apply during closure.	No	Not really familiar with how WHSCC enforces worker safety but regular inspections would be expected during closure work. Glencore history with WHSCC is the best measure of how involved this department will get. They have direct enforcement responsibility for the friable Asbestos removal regulation 92-106.
NB Occupational Health & Safety	92-106 Code of Practice for Working with Material Containing Asbestos	Section 3, Section 4.1	Section 3 requires bulk sampling and identification of asbestos prior to demolition. Section 4.1 requires the owner to have a written asbestos management plan. Sec 7.2.4 provides clearance sampling concentration of 0.05 fibres/cm <sup>3</sup> .	Appears to be directed at friable asbestos which is defined as "can be crumbled by hand". This definition would seem to exclude asbestos paneling. <b>There does not seem to be sufficient clarity in the Act and Code of Practice to determine if destructive removal of asbestos paneling would be met with an Order from an Officer to suspend work or if establishing a perimeter where the clearance sampling concentration was met would be acceptable.</b>	No	See above.
NB Occupational Health & Safety	91-191 General	Section 24-25, Sec 58, Sec 273	Sec 24-25-Where concentration of contaminants exceeds 50% of TLV conduct air tests, if TLV is exceeded, provide PPE. , Sec 58 Designation of hazardous materials employee, Sec 273- Protect workers from hazardous fumes when cutting materials.	Methodology of demolition may be affected by regulation.	No	WHSCC Inspector can shut down a work site. If Glencore does not specify Contractor demolition methods, site may be closed down due to poor Contractor actions. Glencore contract language should be worded to protect them from low Contractor bids based on dangerous work procedures.
NB Quarriable Substances Act		Section 5(1), 23	If Glencore opens a quarry for cover material.	Requirement for quarry permit if opening new quarry for closure aggregate needs.	No, unless opening quarry with blasting.	Quarry operation is not expected. Cover material should be sourced from aggregate pits with no blasting requirement.
NB Crown Lands & Forests Act			Province claims ownership of the marine area below the normal high water mark and requires users to obtain their approval.	Potential application when upgrading erosion control on old slag pile and when decommissioning structures at the shore line like outfalls or sea water pump stations.	Yes if marine in-water work is conducted below the mean high water mark. Permit or lease is required.	NBDNR will involve DFO in review of projects below high water mark. DFO and DNR favour bank stabilization projects that use large angular rock with maximum 45 degree slope. Most bank stabilization projects are approved without a HADD for DFO.
NB Topsoil Preservation Act		Sec 2	Need permit to remove topsoil.	Cover Material	Yes	Act and regulation remove the option of obtaining topsoil from provincial lands. See comment below on rehabilitation.
NB Topsoil Preservation Act	General Regs 95-66	Sec 12 (f) (g)	Need to rehabilitate after removal of topsoil (maintain re-vegetation for 2 years).	Cover Material	Yes	Regulation requires rehabilitation after removal of topsoil by re-vegetation and maintenance of vegetation for 2 years. This limits the topsoil removal to areas where re-vegetation is possible after topsoil removal. Very few lands will provide this possibility due to the shallow nature of topsoil in the area.

**Table 7-2 - List of Acts and Regulations with potential application to Closure**

Act	Regulation	Section	Issue	Application to Smelter Complex	Permit or CofA Req'd	CRA Recommendations / Comments
Federal Canadian Environmental Assessment Act (CEAA)	Comprehensive Study Reg		Level of effort and time to complete. Cost of decisions made by federal gov't.	Non-point groundwater to marine environment and landfills at Brunswick 12. If federal CEAA is triggered by these issues, the level of effort to complete the EIA will be significantly increased in time, cost and scope. First potential trigger area is the historical marine impacts adjacent the smelter, BFL and BHO (sediment and groundwater). Second potential trigger area is the potential impact of groundwater from proposed Brunswick 12 landfills on surface water habitat outside the Glencore land lease.	No but potential for project parts to be captured under CEAA.	Capture by CEAA would have major cost and time downside. Unsure of how to minimize this potential. DFO is only federal department that might want to bring the project into CEAA to provide leverage for their bargaining in HADD projects. Glencore staff have greatest ability from historical discussions with DFO to estimate this risk.
Federal Canadian Environmental Protection Act	SOR/2002-301 Interprovincial Movement of Hazardous Waste	Sec 1, Sec 2, Sec 3	Sec 1- Hazardous waste includes materials intended for disposal or recycling, Sec 2- Applies to quantities over 5 kg that fail federal leach test, Sec 3- Inter-provincial shipments must be manifested, carried by an authorized carrier to an authorized destination. <b>Additional requirements may be imposed by the destination province or provinces en route under their legislation.</b>	If recyclables are shipped out of province that contain metal dust that fails the federal leach test.	Yes. Generator permit.	Applies only if leachable waste such as metal dust is transported across provincial borders for recycling. Only requirement is proper manifesting. No significant cost implications to this legislation.
Federal Fisheries Act		Sections 34 & 35	34: No deposit of deleterious substance, 35: No deleterious alteration of fish habitat.	This issue is connected to the concern over potential application of CEAA. If CEAA is not triggered, DFO concerns related to marine impacts near Smelter Complex and downgradient of Brunswick 12 may be raised in Provincial EIA Review process. Need to control quality of any point or non-point (groundwater) discharges to surface waters so as not to have deleterious effect.	No but may be included in Provincial EIA Review Conditions.	Point source discharges may be excluded from prosecution under these statutes if in compliance with MMER but legal opinion of this would be required.
Federal Fisheries Act	SOR/2002-2222 Metal Mining Effluent Regulation administered by Env Can		MMER criteria will be applied by NB Environment in any point source discharge approvals granted.	Will be used by provincial C of A process to set limits on point source discharge quality for metal parameters during operation, closure activities and post closure point source discharges.	Yes but from Province under Water Quality Regulation noted above.	

Table 7-3 - List of potentially applicable Guidelines

Department	Guideline	Year	Scope	Application to Smelter Complex	Permit or CoFA Req'd	CRA Recommendations / Comments
NB Environment	A Guide to Environmental Impact Assessment in New Brunswick	2007	Describes steps in EIA Review process including public involvement, fees, submission requirements, and approval or denial process.	First regulatory step for Closure which guides all later provincial permits.	EIA Process produces a Minister's decision on the proponent's EIA Registration. Decision will specify conditions on proponent moving forward and obtaining permits. Will involve some federal departments.	
NB Environment	Additional Information Requirements for Waste Disposal Facilities	2004	Describes the information suggested for an EIA Registration for construction of a landfill. Content applies to a municipal solid waste type waste stream even though it mentions industrial landfills. Leachable heavy metals wastes may be subject to a higher standard of liner and leachate collection.	Proposed leachate collection landfills at Brunswick 12 for Smelter Complex materials.	Yes under Water Quality Regulation.	
NB Environment	Site Selection Guidelines for Municipal and Industrial Sanitary Landfills	1993	Describes size, setback, hydrogeological and native soils requirements to be used when selecting a landfill site.	Minor	Yes under Water Quality Regulation as above.	Remote location of Brunswick 12 should address all issues in this guideline.
NB Environment	Design Guidelines for Sanitary and Industrial Landfills (Draft)	2003	Describes engineering aspects of design requirements for single and double liner landfills.	Will control design requirements of single liner landfills at Brunswick 12.	Yes under Water Quality Regulation as above.	Unclear if high lead and arsenic content waste will require single or double liner landfill at Brunswick 12. Location chosen and groundwater regime may mitigate double liner requirement.
NB Environment	Guideline for the Management of Contaminated Sites, Version 2	2003	Describes the process to be used for corrective action for contaminated sites including endorsement of human and ecological risk assessment methods for determining remedial criteria.	Applicable methodology for determining soil quality criteria on closure. Specifies qualification of Site Professional.	Yes. Requires submission of a Remedial Action Plan for review and approval by Department. After the Approved Remedial Action Plan is completed, NB Environment will issue an Acknowledgement of the Record of Site Condition prepared by the Site	Human health risk assessment previously accepted by NB Environment for determination of soil criteria for closure.
Atlantic PIRI Committee	Atlantic RBCA Version 2.0 for Petroleum Impacted Sites in Atlantic Canada, User Guidance, Updated March 2007	2007	Describes the methodology for human health risk assessment in the determination of remedial criteria for petroleum hydrocarbon impacted soil and groundwater.	Directly applicable to determination of site-specific remedial criteria for on-site hydrocarbon impacts.	No. Approval is through NB Guideline for the Management of Contaminated Sites, Version 2	Used to derive non-hydrocarbon closure criteria in Plan 2010 - Conceptual
NB Environment	NB EIA Final Guidelines for Proposed JD Irving Industrial Landfill (not constructed)	2005	Describes what could be expected as requirements for Comprehensive EIA covering proposed landfills at Brunswick 12.	Expect landfills at Brunswick 12 will be subject to Comprehensive NB EIA process.	Yes. Comprehensive NB EIA process.	Time estimate for Comprehensive EIA could be 12 to 24 months.
NB Environment	Guidelines for the Siting and Operation of a <b>Construction and Demolition</b> (C&D) Debris Disposal Site	2002	Specifies type of material qualifying as C&D Debris, setback distances, interim and final cover, monitoring and public notification.	Most economic method of low risk materials for disposal.	Yes under Water Quality Regulation.	Negotiation with NB Environment may permit variances on types of materials permitted pending demonstration of groundwater capture by Brunswick 12 treatment system. For example - non-friable asbestos might be negotiated.
NB Environment	Sand and Gravel Pits Environmental Guidelines	2007	Describes siting, setbacks, air and water controls and closure. Prohibits blasting.	Required for any Glencore property borrow pits for cover. If cover obtained from other parties, they may require permits.	Small pits not normally permitted but if Glencore develops a pit, the size would likely be large enough to require a permit.	Slope stabilization of pit required on closure.
Health Canada	Federal Contaminated Site Risk Assessment in Canada, Part I: Guidance on Human Health Preliminary Quantitative Risk Assessment	2004	Describes methodology for conducting human health risk assessment in Canada for numerous different chemicals.	Methodology generally accepted by NB Environment for non-petroleum hydrocarbon contaminants since it is generally consistent with CCME guidance but more specific.	No. Approval is through NB Guideline for the Management of Contaminated Sites, Version 2.	
Health Canada	Canadian Guidelines for the Management of Naturally Occurring Radioactive Materials (NORM)	2000	Provides guidance on acceptable radioactivity levels from various types of materials affected by NORM.	Provides the only Canadian guidance on management of NORM.	No. Guideline will probably be used by the province in consideration of NORM management proposed by Glencore.	Used in CRA assessment of DAP & PAP NORM impacts.
NB DNR	Provincial Crown Land Pit and Quarry Policy Operating Standards	UK	Describes hours, setbacks, blasting, dust, noise and reclamation.	Applies only if borrow material comes from Crown Land.	If pit on Crown land a Crown land Lease would be required.	



# Memorandum

To: Kelly Longval (Glencore) Ref. No.: 11198639

From: <sup>TS</sup> Troy Small (GHD) Date: October 9, 2019

cc: Bob Butler, Florian Reher, Rick Schwenger (Glencore)  
Rob Turner, Cherie Babineau, Mike Gallahue (GHD)

**Subject: Memorandum-3**

**Review of 2009 SNC-Lavalin Brunswick Smelter Closure Plan Prefeasibility Study and Cost Estimating Report – Section 4.0 - Ownership**

## 1. Introduction

Glencore Canada Corporation (Glencore) has retained GHD Limited (GHD) to update the 2009 Brunswick Smelter Closure Plan Prefeasibility Study (PFS) and Cost Estimating Report (also referred to as the “2008/2009 Closure Plan PFS”), which was completed by SNC-Lavalin. As part of the 2019 Closure Plan PFS Update, Glencore has requested GHD to review and validate the information presented in the 2008/2009 Closure Plan PFS in order to update the capital cost estimate for the 2019 Closure Plan PFS Update at a +/-20% accuracy for the Brunswick Smelter. The Brunswick Smelter includes the Smelter site, Material Handling West Area, and the Fertilizer Plant (collectively referred to as the “Site”). A slag pile and the Jacquet River Pumpouse and associated freshwater pipeline are also part of the closure plan.

GHD has reviewed the 2008/2009 Closure Plan PFS to determine if the information presented is valid, timely and complete, and has provided recommendations to Glencore as to whether an update should be executed, where applicable. In conjunction with the document reviews, GHD completed an existing conditions investigation at the Site in July 2019 to understand Site infrastructure, identify changes that have occurred at the Site since 2008/2009 and identify any data gaps that require additional Site investigations.

Glencore requested GHD to complete a separate technical memorandum for each section of the 2008/2009 Closure Plan PFS report detailing the report review findings. This memorandum outlines the findings of GHD’s review specifically for **Section 4.0 – Ownership** of the 2008/2009 Closure Plan PFS along with items discussed during the Alternatives Evaluation Meeting held on August 1, 2019.

## 2. Review Findings and Recommendations

Section 4.0 of the 2008/2009 Closure Plan PFS provides a brief description of the ownership of the Site and the facilities considered in the scope of the 2008/2009 Closure Plan PFS. In general, GHD agrees with the overall information presented but noted that some of the Site-specific information is now outdated. The following items require consideration for updating or validation as part of the 2019 Closure Plan PFS Update:





- The document states “The Brunswick Smelter Complex is owned by the Xstrata Zinc Canada, Division of the Xstrata Canada Corporation”. However, in 2013, Glencore Canada Corporation merged with Xstrata, and the Brunswick Smelter Complex is now owned by Glencore Canada Corporation. This change will be carried forward in the current study update as part of GHD’s current Scope of Work.
- Drawing 020120-0000-4GDD-0001 “General Project Layout”, included in the document, outlines the Belledune Point and the old slag pile as Low Exposure Land Use. As further discussed in GHD technical memorandum 11198639-Memo-2 and 1119869-Memo-7 that discusses the Regulatory Framework and Design Basis for Closure Project included in the 2008/2009 Closure Study PFS, respectively, the old slag pile area located on Belledune Point was rehabilitated to become a salt water lagoon as outlined in the Belledune Point Rehabilitation Plan Final Report (dated September 2013). The rehabilitation plan was developed in collaboration with several federal/provincial agencies including New Brunswick Department of Environment and Local Government (NBDELG), Department of Fisheries and Oceans (DFO), Canadian Wildlife Service and Department of Energy and Mines. In addition, the Belledune Point rehabilitation work was completed in accordance with an Approval to Construct I-7784 issued by the NBDELG. In 2012, Atlantic RBCA implemented an ecological screening protocol for contaminated sites that has been adopted by NBDELG as part of the provincial Guideline for the Management of Contaminated Sites. Under this protocol, it is likely that the Belledune Point area and salt water lagoon created by the relocation of the old slag pile would be considered ecological habitat potentially requiring additional evaluation of contaminants in soil, surface water or sediment with respect to risk to ecological receptors. Based on information provided in the Belledune Point Rehabilitation Plan Final Report along with results of the Marine Ecological Risk Assessment of Brunswick Smelter completed by Intrinsik which includes the shoreline of Belledune Point (report dated October 30, 2015), it is assumed that additional rehabilitation works of Belledune Point will not be required as part of future Facility closure activities. As such, GHD recommends carrying this item forward in the risk registry for the current study update. In addition, as part of the proposal for the hydrogeological study of the Site, confirmation of environmental conditions at Belledune Point and the salt water lagoon, including sampling of soil, sediment and surface water in the lagoon, were proposed and submitted to Glencore under separate cover. Results of the confirmatory sampling will be carried forward in the current study update.
- In addition, Drawing 020120-0000-4GDD-0001 “General Project Layout” is based on circa 1996/1997 aerial photographs as well as old infrastructure layout plans that do not document changes which have occurred at the Site since the 2008/2009 Closure Study PFS. GHD recommends updating the drawing as part of the current study update, utilizing the most recent high resolution aerial photographs available from the Province of New Brunswick (2018). In addition, GHD notes that the BHO project area outline on the drawing does not include the conveyors and load-out infrastructure going to the wharf. GHD recommends updating the drawing to include this infrastructure.



# Memorandum

To: Kelly Longval (Glencore) Ref. No.: 11198639

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From: <sup>TS</sup> Troy Small (GHD) Date: October 9, 2019

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CC: Bob Butler, Florian Reher, Rick Schwenger (Glencore)  
Rob Turner, Cherie Babineau, Mike Gallahue (GHD)

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**Subject: Memorandum-4**

**Review of 2009 SNC-Lavalin Brunswick Smelter Closure Plan Prefeasibility Study and Cost Estimating Report – Section 5.0 – Government Relations**

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## 1. Introduction

Glencore Canada Corporation (Glencore) has retained GHD Limited (GHD) to update the 2009 Brunswick Smelter Closure Plan Prefeasibility Study (PFS) and Cost Estimating Report (also referred to as the “2008/2009 Closure Plan PFS”), which was completed by SNC-Lavalin. As part of the 2019 Closure Plan PFS Update, Glencore has requested GHD to review and validate the information presented in the 2008/2009 Closure Plan PFS in order to update the capital cost estimate for the 2019 Closure Plan PFS Update at a +/-20% accuracy for the Brunswick Smelter. The Brunswick Smelter includes the Smelter site, Material Handling West Area, and the Fertilizer Plant (collectively referred to as the “Site”). A slag pile and the Jacquet River Pumphouse and associated freshwater pipeline are also part of the closure plan.

GHD has reviewed the 2008/2009 Closure Plan PFS to determine if the information presented is valid, timely and complete, and has provided recommendations to Glencore as to whether an update should be executed, where applicable. In conjunction with the document reviews, GHD completed an existing conditions investigation at the Site in July 2019 to understand Site infrastructure, identify changes that have occurred at the Site since 2008/2009 and identify any data gaps that require additional Site investigations.

Glencore requested GHD to complete a separate technical memorandum for each section of the 2008/2009 Closure Plan PFS report detailing the report review findings. This memorandum outlines the findings of GHD’s review specifically for **Section 5.0 – Government Relations** of the 2008/2009 Closure Plan PFS along with items discussed during the Alternatives Evaluation Meeting held on August 1, 2019.



## 2. Review Findings and Recommendations

Section 5.0 of the 2008/2009 Closure Plan PFS provides a list of Governmental Agencies, locations, contact names and Agency's specific scope as it relates to the closure project. The table included in the document is an exact copy of the table provided in Section 3.0 – Regulatory Framework of the 2008/2009 Closure Plan PFS. As indicated in GHD memorandum 11198639-Memo-2 pertaining to Section 3.0 of the 2008/2009 Closure Plan PFS, the information provided in the table is over ten years old and it is unlikely that the contact names, phone numbers, nor addresses remain valid for the listed authorities. Updated regulatory authority information will be included, where possible, as part of the current study update.



# Memorandum

To: Kelly Longval (Glencore) Ref. No.: 11198639

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From: <sup>TS</sup> Troy Small (GHD) Date: October 9, 2019

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cc: Bob Butler, Florian Reher, Rick Schwenger (Glencore)  
Rob Turner, Cherie Babineau, Mike Gallahue (GHD)

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**Subject: Memorandum-5**

**Review of 2009 SNC-Lavalin Brunswick Smelter Closure Plan Prefeasibility Study and Cost Estimating Report – Section 6.0 – Human Resources**

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## 1. Introduction

Glencore Canada Corporation (Glencore) has retained GHD Limited (GHD) to update the 2009 Brunswick Smelter Closure Plan Prefeasibility Study (PFS) and Cost Estimating Report (also referred to as the “2008/2009 Closure Plan PFS”), which was completed by SNC-Lavalin. As part of the 2019 Closure Plan PFS Update, Glencore has requested GHD to review and validate the information presented in the 2008/2009 Closure Plan PFS in order to update the capital cost estimate for the 2019 Closure Plan PFS Update at a +/-20% accuracy for the Brunswick Smelter. The Brunswick Smelter includes the Smelter site, Material Handling West Area, and the Fertilizer Plant (collectively referred to as the “Site”). A slag pile and the Jacquet River Pumphouse and associated freshwater pipeline are also part of the closure plan. A site plan is attached as Figure 1.

GHD has reviewed the 2008/2009 Closure Plan PFS to determine if the information presented is valid, timely and complete, and has provided recommendations to Glencore as to whether an update should be executed, where applicable. In conjunction with the document reviews, GHD completed an existing conditions investigation at the Site in July 2019 to understand Site infrastructure, identify changes that have occurred at the Site since 2008/2009 and identify any data gaps that require additional Site investigations.

Glencore requested GHD to complete a separate technical memorandum for each section of the 2008/2009 Closure Plan PFS report detailing the report review findings. This memorandum outlines the findings of GHD’s review specifically for **Section 6.0 – Human Resources** of the 2008/2009 Closure Plan PFS along with items discussed during the Alternatives Evaluation Meeting held on August 1, 2019.

## 2. Review Findings and Recommendations

Section 6.0 of the 2008/2009 Closure Plan PFS provides a brief description of Glencore’s human resource requirements prior to and after closure. In general, GHD agrees with the overall information presented but noted that some of the closure concepts that affect Glencore’s human resource requirements are no longer



valid. The following items require consideration for updating or validation as part of the 2019 Closure Plan PFS Update:

#### *Human Resources after Closure*

- The document indicates that the only operation that will be required after closure of the Site will be periodic inspections of ditches, culverts and cover/erosion protection material. However, during the August 1, 2019 Alternatives Evaluation Meeting, Glencore agreed with GHD's recommendation to maintain a perimeter fence around the facility post-closure to limit trespassing events. Also during the August 1, 2019 meeting, Glencore concurred with GHD's recommended conceptual approach of creating passive engineered wetlands, specifically at the Material Handling West area, Wastewater Treatment Plant (WWTP) Cooling Recycling Pond and on-Site borrow pit area (see attached Figure 1). Therefore, GHD recommends adding periodic inspections of the perimeter fencing and the engineered wetlands to the post-closure maintenance operations.
- The document indicates that one full time WWTP operator (or superintendent) will be required during the transitional phase when the WWTP is operated after the majority of infrastructure has been removed until the discharge criteria at the effluent points are reached. GHD recommends that Glencore consider the addition of a second WWTP operator (perhaps part time) to cover illness, vacations and to assist during critical periods of water treatment such as the spring freshet.

#### *Human Resources before Execution of the Closure Work*

- The document indicates that numerous tasks will be carried out by Brunswick Smelter personnel before a demolition contractor mobilizes to the Site. The tasks listed include:
  - Emptying and disposal of liquids from pipelines, reservoirs, process piping and process equipment
  - Removal and disposal of various residues in buildings, such as sludge, dust accumulations, and general cleaning
  - Planning of equipment resale and providing support to potential equipment buyers for dismantling selected major pieces of equipment
  - Removal of concentrate material that is stacked on various areas on site
  - Internal cleaning plan to limit the quantity of dust at closure

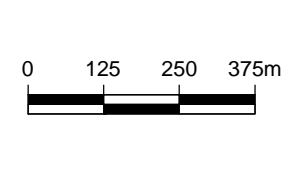
However, based on discussions with Glencore during the August 1, 2019 Alternatives Evaluation Meeting, it is considered unlikely Glencore representatives would complete these tasks following announcement of the Site closure. As such, the 2019 Closure Plan PFS Update will assume Glencore will not be conducting any of the above tasks prior to a demolition contractor arriving on-Site and costs to complete these decommissioning activities will be carried in the current study update. During the August 1, 2019 meeting, Glencore agreed to provide GHD with a process tank inventory, an estimate of residual materials requiring handling and disposal, listing of process piping requiring cleaning, and quantities and characterization data (where available) for residues and stockpiled concentrate materials for inclusion in the closure study update.



- Although not detailed in Section 6.0 of the 2008/2009 Closure Plan PFS, GHD acknowledges there will be a number of human resource requirements throughout the closure works, and that Glencore will be providing Owner's costs to GHD for inclusion in the current study update. GHD recommends that Glencore considers detailing the human resource requirements throughout closure in the 2019 Closure Plan PFS Update report for completeness.



Source: High Resolution Aerial Imagery from New Brunswick Dept of Natural Resources, Acquisition Date: 2018.



GLENCORE CANADA CORPORATION  
 BELLEDUNE, NEW BRUNSWICK  
 MEMORANDUM - 5

SITE PLAN

11198639-01  
 Oct 9, 2019

FIGURE 1



# Memorandum

Revision 1

To: Kelly Longval (Glencore) Ref. No.: 11198639

From: <sup>TS</sup> Troy Small (GHD) Date: October 9, 2019

cc: Bob Butler, Florian Reher, Rick Schwenger (Glencore)  
Rob Turner, Cherie Babineau, Mike Gallahue (GHD)

**Subject: Memorandum-6**

**Review of 2009 SNC-Lavalin Brunswick Smelter Closure Plan Prefeasibility Study and Cost Estimating Report – Section 7.0 – Health & Safety during Execution of Closure Work**

## 1. Introduction

Glencore Canada Corporation (Glencore) has retained GHD Limited (GHD) to update the 2009 Brunswick Smelter Closure Plan Prefeasibility Study (PFS) and Cost Estimating Report (also referred to as the “2008/2009 Closure Plan PFS”), which was completed by SNC-Lavalin. As part of the 2019 Closure Plan PFS Update, Glencore has requested GHD to review and validate the information presented in the 2008/2009 Closure Plan PFS in order to update the capital cost estimate for the 2019 Closure Plan PFS Update at a +/-20% accuracy for the Brunswick Smelter. The Brunswick Smelter includes the Smelter site, Material Handling West Area, and the Fertilizer Plant (collectively referred to as the “Site”). A slag pile and the Jacquet River Pumphouse and associated freshwater pipeline are also part of the closure plan.

GHD has reviewed the 2008/2009 Closure Plan PFS to determine if the information presented is valid, timely and complete, and has provided recommendations to Glencore as to whether an update should be executed, where applicable. In conjunction with the document reviews, GHD completed an existing conditions investigation at the Site in July 2019 to understand Site infrastructure, identify changes that have occurred at the Site since 2008/2009 and identify any data gaps that require additional Site investigations.

Glencore requested GHD to complete a separate technical memorandum for each section of the 2008/2009 Closure Plan PFS report detailing the report review findings. This memorandum outlines the findings of GHD’s review specifically for **Section 7.0 – Health & Safety during Execution of Closure Work** of the 2008/2009 Closure Plan PFS along with items discussed during the Alternatives Evaluation Meeting held on August 1, 2019.

## 2. Review Findings and Recommendations

Section 7.0 of the 2008/2009 Closure Plan PFS presents a comprehensive plan for health and safety for the closure works. The plan summarizes the health and safety procedures that could be implemented during the Smelter closure activities. The following items require consideration for updating or validation as part of the 2019 Closure Plan PFS Update:





- The document indicates that it was considered important and value added to prepare the health and safety plan at the Prefeasibility Engineering level. GHD acknowledges the utmost importance of robust health and safety protocols during demolition and closure works. However, the responsibility to develop a full Health, Safety, Environment and Communities (HSEC) Management Plan and Safe Work Procedures (SWPs), is typically held by the demolition contractor for an Engineering, Procurement, and Contract Management (EPCM) project such as the Smelter closure works. If an Owner or Consultant were to develop and implement the HSEC Plan and SWPs for the demolition contractor, the liability for health and safety management may change to the Owner or Consultant, rather than the contractor. It is noted that a HSEC Management Plan and SWPs will be developed by Glencore for other smaller contractors such as earthworks contracts.

In order to ensure the demolition contractor's HSEC Plan meets the Owner/Consultant's requirements, the demolition tender documents and specifications would outline stringent health and safety requirements, as well as minimum contents of what must be included in the contractor's health and safety programs and plan. Prior to beginning the works, the contractor's HSEC Plan is subject to Owner/Consultant review and approval processes to ensure it meets the requirements.

Although the information presented in the health and safety plan in Section 7.0 provides a good basis on the minimum requirements to be included in the future demolition specifications and tender documents, GHD recommends not carrying forward the existing plan in the 2019 Closure Plan PFS Update report as the "ready for implementation" HSEC Plan, and instead, append it as a reference for future development.

- GHD recommends maintaining the existing information in the health and safety plan in Section 7.0 and not completing any updates at this time. The closure date of the Site is currently unknown and regulations, protocols, and demolition methodologies may change by the time the demolition specifications are developed, and the closure works proceed. It is not anticipated that any changes would significantly affect the closure planning and cost estimating associated with the current study update. However, one change noted in Glencore's Site health and safety protocols is the recent requirement to don respirators at all times on the Site. In addition, several Glencore requirements that are beyond the requirements of the New Brunswick Occupational Health and Safety Act include fall protection required at heights of 2 metres, additional scaffolding requirements, and more stringent protocols for critical lifts. These requirements will be carried forward in the current study update.



# Memorandum

Revision 1

To: Kelly Longval (Glencore) Ref. No.: 11198639

From: <sup>TS</sup> Troy Small (GHD) Date: October 9, 2019

cc: Bob Butler, Florian Reher, Rick Schwenger (Glencore)  
Rob Turner, Cherie Babineau, Mike Gallahue (GHD)

**Subject: Memorandum-7**

**Review of 2009 SNC-Lavalin Brunswick Smelter Closure Plan Prefeasibility Study and Cost Estimating Report – Section 8.0 – Design Basis for Closure Project**

## 1. Introduction

Glencore Canada Corporation (Glencore) has retained GHD Limited (GHD) to update the 2009 Brunswick Smelter Closure Plan Prefeasibility Study (PFS) and Cost Estimating Report (also referred to as the “2008/2009 Closure Plan PFS”), which was completed by SNC-Lavalin (SNC). As part of the 2019 Closure Plan PFS Update, Glencore has requested GHD to review and validate the information presented in the 2008/2009 Closure Plan PFS in order to update the capital cost estimate for the 2019 Closure Plan PFS Update at a +/-20% accuracy for the Brunswick Smelter. The Brunswick Smelter includes the Smelter site, Material Handling West Area, and the Fertilizer Plant (collectively referred to as the “Site”). A slag pile and the Jacquet River Pumphouse and associated freshwater pipeline are also part of the closure plan. A Site Plan is provided in Figure 1.

GHD has reviewed the 2008/2009 Closure Plan PFS to determine if the information presented is valid, timely and complete, and has provided recommendations to Glencore as to whether an update should be executed, where applicable. In conjunction with the document reviews, GHD completed an existing conditions investigation at the Site in July 2019 to understand Site infrastructure, identify changes that have occurred at the Site since 2008/2009 and identify any data gaps that require additional Site investigations.

Glencore requested GHD to complete a separate technical memorandum for each section of the 2008/2009 Closure Plan PFS report detailing the report review findings. This memorandum outlines the findings of GHD’s review specifically for **Section 8.0 – Design Basis for Closure Project** of the 2008/2009 Closure Plan PFS along with items discussed during the Alternatives Evaluation Meeting held on August 1, 2019.

## 2. Review Findings

Section 8.0 of the 2008/2009 Closure Plan PFS provided a general overview for the design basis and criteria to be followed for the closure of the Site. The overall concept was to demolish all infrastructure to grade level and leave a flat, vegetated area that could be suitable for future alternative industrial development. In general, GHD agrees with the overall concept proposed but noted that some concepts require additional



consideration as Site-specific information for several key components are now outdated and several environmental guidelines used in the 2008/2009 Closure Plan PFS have been revised. Items that GHD considers requiring further consideration and updating along with the assumptions that have been validated by Glencore are presented below.

### ***Project Objectives and Scope of Work***

- The document indicates that Closure works must meet "Xstrata Closure Criteria". This item has been reviewed with Glencore and it has been confirmed that Glencore does not have any specific Closure Criteria guidelines that will need to be implemented as part of the current study.
- The document indicates the scope excludes dredging of sediments and aboveground piles of material except slag. Based on previous information provided by Glencore, further evaluation or remediation of sediment in Chaleur Bay adjacent to the Site is not required. As such, costs for additional evaluation or remediation of sediments adjacent to the Site will not be included in the 2019 Closure Plan PFS Update unless specified by Glencore.
- Regarding aboveground piles of material (process sludge, raw product, etc.), during the August 1, 2019 meeting, Glencore representatives indicated that the 2019 Closure Plan PFS Update should include transportation and off-Site disposal of materials that are not suitable for disposal at the Brunswick Mine Site. Specific examples of stockpiled material not suitable for disposal at the Brunswick Mine Site would be unprocessed raw materials, imported ore and process sludge. Glencore indicated that quantities and characterization data will be provided to GHD for inclusion in the current study update for consideration of appropriate disposal requirements and costs.
- The document indicates that the Effluent Treatment Plant (also known as the Wastewater Treatment Plant) will be used during the decommissioning process. It is noted that the Effluent Treatment Plant now includes a polishing pond (see Figure 1). This will need to be reviewed further with Glencore to determine at what point the pond can be phased out during the closure process, and costs and planning for decommissioning the pond will need to be evaluated as part of the current study update.

### ***Closure Philosophy and Concept***

- The document states that ground level floors are excluded from removals. However, in Section 11, page 12 of SNC Technical Memo 020120-0000-4DEN-001, page 12 of SNC Technical Memo 020120-000-4DEN-0002, and page 10 of SNC Technical Memo 020120-000-4DEN-0003 state that "During demolition activities, concrete rubble coming from the demolition of the interior of the building, including floors, elevated slabs, concrete curbs, etc. will be encountered", which reads as that demolition of slab-on-grades were included. This inconsistency has been reviewed with Glencore representatives during the August 1, 2019 meeting and it has been confirmed that slab-on-grades and below-grade foundations are to be left in-place and un-fractured post-closure. Above-ground foundations are to be demolished to grade. GHD concurs with this approach for a site such as the Brunswick Smelter.
- The document notes the on-Site Effluent Treatment Plant will be used during the decommissioning process but a long-term treatment option for surface water or groundwater discharging to Chaleur Bay was not included in the closure plan. During the Alternatives Review meeting held on August 1, 2019,



the option to create several engineered wetlands was discussed to treat surface water run-off prior to discharging to Chaleur Bay. Glencore concurred with the approach and a conceptual plan for construction of passive engineered wetlands, specifically at the Material Handling West area, the Cooling Recycling Pond and on-Site borrow pit area (see Figure 1), will be reviewed and included in the current study update.

- The document indicates the old slag pile would be kept in place and covered. However, the old slag pile has previously been re-located to the new slag pile and covering of the old slag pile area will be excluded from the 2019 Closure Plan PFS Update. The old slag pile area located on Belledune Point was rehabilitated to become a salt water lagoon as outlined in the Belledune Point Rehabilitation Plan Final Report (dated September 2013). The rehabilitation plan was developed in collaboration with several federal/provincial agencies including New Brunswick Department of Environment and Local Government (NBDELG), Department of Fisheries and Oceans (DFO), Canadian Wildlife Service and Department of Energy and Mines. In addition, the Belledune Point rehabilitation work was completed in accordance with an Approval to Construct I-7784 issued by the NBDELG. In 2012, Atlantic RBCA implemented an ecological screening protocol for contaminated sites that has been adopted by NBDELG as part of the provincial Guideline for the Management of Contaminated Sites. Under this protocol, it is likely that the Belledune Point area and salt water lagoon created by the relocation of the old slag pile would be considered ecological habitat potentially requiring additional evaluation of contaminants in soil, surface water or sediment with respect to risk to ecological receptors. Based on information provided in the Belledune Point Rehabilitation Plan Final Report along with results of the Marine Ecological Risk Assessment of Brunswick Smelter completed by Intrinsic which includes the shoreline of Belledune Point (report dated October 30, 2015), it is assumed that additional rehabilitation works of Belledune Point will not be required as part of future Facility closure activities. As such, GHD recommends carrying this item forward in the risk registry for the current study update. In addition, as part of the proposal for the hydrogeological study of the Site, confirmation of environmental conditions at Belledune Point and the salt water lagoon, including sampling of soil, sediment and surface water in the lagoon, were proposed and submitted to Glencore under separate cover. Results of the confirmatory sampling will be carried forward in the current study update.

### ***Dams Stability Criteria***

- The dam stability criteria discussion is specific to the water retention dam at the new slag pile if this dam is to remain post-facility closure. The majority of the referenced regulations and standards have been revised since completion of the 2008/2009 Closure Plan PFS and will need to be updated as part of the current study. In particular, the document references the 2007 Dam Safety Guidelines from the Canadian Dam Association (CDA) but the CDA Dam Safety Guidelines were revised in 2013. The updated guidelines along with associated dam specifications will require inclusion in the 2019 Closure Plan PFS Update.
- The dam stability criteria only apply if the earth dam at the new slag pile is to remain post-facility closure. The 2008/2009 Closure Plan PFS assumed this dam would be removed as part of the Site closure activities. However, the sedimentation pond located directly north of the new slag pile that was created by the dam structure is now classified as a regulated wetland by the New Brunswick Department of



Environment and Local Government (NBDELG) and is subject to the *Watercourse and Wetland Alteration (WAWA) Regulation of the Clean Water Act* (see Figure 1). As such, Glencore instructed GHD to assume the dam structure and associated regulated wetland will remain and be incorporated into the future new slag pile closure plan. Future closure activities associated with the new slag pile (grading and capping) will still likely require a WAWA permit as physical activities will be completed directly adjacent to or within 30 metres of the wetland. In addition, during the August 1, 2019 meeting, GHD recommended that Glencore consider creating an engineered wetland in the borrow pit area of the Site, designed to receive run-off from the covered slag pile before discharging to Chaleur Bay. Glencore representatives concurred and a conceptual plan for creation of engineered wetlands in the borrow pit area will be carried forward in the current study update.

### **Water Management**

- The Certificate of Approval (C of A) referenced in the document is outdated. The current C of A's for the Site will need to be provided by Glencore for GHD to review and include in the 2019 Closure Plan PFS Update.
- The document references the Fisheries Act, specifically Sections 34 and 35 as well as the Metal Mining Regulation and associated amendments. The Canadian Federal Fisheries Act was updated in 2012. In February 2018, the Government of Canada introduced Bill C-68, which reflected a commitment to review the changes made in 2012 to the Fisheries Act, in order to restore lost protections and incorporate modern safeguards. On June 21, 2019, the modernized Fisheries Act (Bill C-68) received royal assent and became law. However, provisions and regulations within the Act for the protection of fish and fish habitat have not come into force. Changes to the Fisheries Act and regulations within the Act will require review as part of the 2019 Closure Plan PFS Update.
- The 2008/2009 Closure Plan PFS states that "Culverts shall be designed for a 100-year return period rain event with a maximum headwater elevation (measured from the inlet invert) not exceeding 1.5 times the culvert height or pipe diameter". GHD recommends reducing the allowable headwater elevation to 1.2 times the culvert height or pipe diameter, as slug flow (which can vibrate pipes and reduce overall flow capacity) can occur at 1.2 times the headwater elevation.

### **Surface Water and Groundwater Quality Criteria**

- The 2008/2009 Closure Plan PFS states "It is assumed that since there are no groundwater and surface water quality standards for metals in New Brunswick Legislation". However, the NBDELG recently has adopted the Environmental Quality Standards (EQS) developed by the Nova Scotia Department of Environment (NSE) for evaluating metals in groundwater and surface water. In particular, the NSE guidelines specify screening values for metals in groundwater that have the potential to discharge to a surface water body (freshwater or marine). This change in environmental screening is a significant shift from the assumption included in the 2008/2009 Closure Plan PFS. As such, GHD has provided Glencore with a proposal to complete a hydrogeological evaluation and additional data gap evaluation for the Site with a specific emphasis on evaluating contaminants in groundwater and surface water for comparison to the NSE EQS.



- The C of A referenced in the document is outdated and the Current C of A's will need to be evaluated as part of the 2019 Closure Plan PFS Update to confirm effluent discharge limits in cited in 2008/2009 Closure Plan PFS are still valid.

### ***Management of Potential Impacted Soils***

- Section 5 - Management of Impacted Soils identifies three types of potential impacted soils are present at the Site [total petroleum hydrocarbons (TPH), metals and naturally occurring radioactive materials (NORM)]. The guidelines governing total petroleum hydrocarbons and NORM in New Brunswick have been revised since the 2008/2009 Closure Plan PFS. Specifically, the Atlantic Risk-Based Corrective Action (Atlantic RBCA) guidelines that have been adopted by NBDELG for evaluating TPH were updated in 2015 and are currently under review. Health Canada updated the Canadian Guidelines for the Management of NORM in 2013. Similarly, the area of metal impacted soil present at the Site is based on Site-specific target levels (SSTLs) developed as part of a human health risk assessment completed in 2007 with the primary metal constituent being lead. Various regulatory jurisdictions have revised the approach and toxicity information specific to lead which could change the SSTLs previously developed for the Site. In addition, SSTLs for zinc were not carried forward in the 2008/2009 Closure Plan PFS. Although the guidelines for the three types of impacted soil have been updated since the 2008/2009 Closure Plan PFS was completed, it is not anticipated that the new regulations will have a significant impact on the overall design closure concept but the new guidelines could result in changes to overall quantities and disposal and/or cover requirements for the contaminated materials.
- The assumption that existing impacted soils can be left in place and covered with a protective soil cover at closure will be approved by the regulators has a significant impact on the closure costs and planning. Therefore, GHD recommends that following completion of the hydrogeological study, a meeting be held with regulators to review the proposed closure concept and to gain an understanding if the proposed closure concept is likely to be approved. Regulatory rejection of the proposed concept could have a significant impact on the closure costs and planning.
- The document assumes cover material will be placed over the entire Site (in general). However, the provincial Cemetery Companies Act (February 2018) has specific requirements and restrictions on altering gravesites and associated monuments. As a cemetery owned by L'Eveque Catholique Romain de Bathurst is present within the Site boundaries (see Figure 1), specific implications of the Cemetery Companies Act will require review and incorporation into the current study update.

### ***Cover Design***

- The document indicates that the cover thickness must be 300 mm, however, in several other sections of the cover thickness is listed at 600 mm. The cost estimate associated with the 2008/2009 Closure Plan PFS report (Work Breakdown Structure Item 11600) had two layers of 300 mm cover, resulting in 600 mm of cover, plus an organic layer. Based on previous experience with closure projects at sites similar to the Brunswick Smelter, GHD would recommend proceeding with at least 600 mm of cover. This inconsistency has been reviewed with Glencore representatives during the August 1, 2019 meeting and it has been confirmed that the cover thickness is assumed to be 600 mm for purposes of the current closure study. However, it will be noted in the PFS report that the actual cover thickness developed



during future detailed design phases may vary depending on elevation requirements, concentrations of contaminants in soil and future land uses for specific areas of the Site.

- Wave action protection consisting of riprap armour stone is referenced in the document. It is assumed the wave action protection was required for covering the old slag pile which has since been relocated. It is assumed wave action protection of cover material will not be required as part of the 2019 Closure Plan PFS Update. During the August 1, 2019 meeting, Glencore representatives indicated that climate change impacts to the Site cover would be considered a risk in the Closure Project Risk Register, and will not be reviewed as part of the current closure study.

**Demolition**

- The regulations and guidelines referenced in Table 7-1 will need to be expanded as there are several other regulations that are applicable to demolition activities. The following are several additional regulations that apply to the Site decommissioning and demolition that will need to be reviewed and included in the current closure study:

NEW BRUNSWICK
Clean Air Act
Clean Water Act
New Brunswick Transportation of Dangerous Goods Act
Apprenticeship and Occupational Certification Act
Disposal of Friable Asbestos, 2014
New Brunswick Regulation 2004-130 – Under the Occupational Health and Safety Act
Water Quality Regulation 82-126
Construction Standards for Installation and Removal of Petroleum Storage Systems, 1993
Disposal of Lead Paint and Lead Painted Material Guideline, 2011
Guideline for the Management of Contaminated Sites, 2003
Species at Risk Act
FEDERAL
Canada Consumer Product Safety Act, Asbestos Products Regulations, SOR/2018-196
Canadian Environmental Protection Act, PCB Regulations, SOR/2008-273 (amended) 2015
Environment Canada Guideline, Identification of Lamp Ballasts Containing PCBs, EPS 2/CC/2 (revised) 1991
Interprovincial Movement of Hazardous Waste Regulations (SOR/2002-301)
Migratory Birds and Convention Act
National Building Code of Canada, Part 8



National Fire Code (including Division B, Section 5.6 – Construction and Demolition Sites)
Transport Canada Transportation of Dangerous Goods Act
Transportation of Dangerous Good Regulations

- In addition to the Acts and Regulations listed above, the Federal Explosives Regulations identified in the 2008/2009 Closure Plan PFS were updated in 2013 and the updated regulation will require review and inclusion in the current closure study.
- The document indicates that four types of demolition debris from the Brunswick Smelter Complex are expected to be disposed of at Brunswick Mine Site (non-impacted demolition debris (that cannot be left in place), metal-impacted demolition debris with Site-specific native heavy metals, metal-impacted demolition debris with non-native heavy metals and NORM impacted demolition debris). During the August 1, 2019 Alternatives Evaluation meeting, the concept of “non-native” metal debris was discussed and Glencore representatives indicated the concept of “non-native” metal impacted materials should be re-evaluated as part of the 2019 Closure Plan PFS Update. Glencore representatives indicated that metal impacted demolition debris present at the Site could be disposed of at the existing demolition debris open pit area of the Brunswick Mine Site. The only “non-native” material that would not be suitable for disposal at the Brunswick Mine Site is process sludge or un-processed feedstock. The elimination of non-native metal impacted demolition debris has the potential for eliminating the design and permitting of a special waste landfill at the Brunswick Mine Site which was included in the 2008/2009 Closure Plan PFS. A special waste landfill has not previously been permitted in the Province of New Brunswick and its undertaking will require evaluation under the provincial Environmental Impact Assessment regulation. Construction of a hazardous waste landfill is also listed as a designated project under the current federal Canadian Environmental Assessment Act (2012). The requirement for a special waste landfill will be further reviewed and validated with Glencore as part of the 2019 Closure Plan PFS Update. Based on initial evaluations, there is the potential that most of the debris previously identified as non-native could be re-classified and considered acceptable for disposal in the demolition debris pit area of the Brunswick Mine Site, eliminating the requirement for a special waste landfill for this waste stream.
- The document indicates that “Non-native” heavy metals include any metal that actually cannot be treated by the Brunswick Mine Site Water Treatment Plant (WTP) and includes metals such thallium, arsenic and mercury. However, during the August 1, 2019 meeting, Glencore representatives indicated that the Brunswick Mine Site WTP could treat metals that would be typically associated with demolition debris from the Smelter Site. As previously indicated, the non-native materials that would not be acceptable for disposal at the Brunswick Mine Site are process sludges, residues and unprocessed feedstock. During the August 1, 2019 meeting, Glencore agreed to provide GHD with an estimate of raw bulk products and process sludge volumes likely to require alternative disposal options (not suitable for disposal the Brunswick Mine Site) along with chemical composition of material.
- The document indicates that friable ACM will be put in barrels and disposed of with demolition debris at Brunswick Mine Site. Based on current practices, it is unknown if this will be allowable by the province therefore GHD recommends planning for friable ACM to require disposal at a licensed municipal landfill (e.g., Red Pine).





- The document indicates that Glencore will clean all equipment and remove all greases, sludges and oils from pits, sumps, trenches, pipes, tanks and vessels prior to demolition. Based on discussions with Glencore during the August 1, 2019 meeting, it is unlikely Glencore representatives would complete this work following announcement of the Site closure. As such, the 2019 Closure Plan PFS Update will assume Glencore will not be conducting any cleaning prior to a demolition contractor arriving on-Site and costs will be carried for these decommissioning activities. During the August 1, 2019 meeting, Glencore agreed to provide GHD with a process tank inventory, an estimate of residual materials requiring handling and disposal, and listing of process piping requiring cleaning for inclusion in the closure study update.
- A septic field has been installed on the BHO site since the last study. However, as stated in the 2008/2009 Closure Plan PFS, there are no specific regulations or guidelines that govern the decommissioning of on-site sewage disposal systems. The 2016 New Brunswick Technical Guidelines for On-site Sewage Disposal Systems Legislation (Version 5) and the New Brunswick Public Health Act only details requirements for the installation, operation, and replacement of on-site sewage disposal systems.

#### **Landfill Criteria**

- The document indicates that Brunswick Mine Site currently uses a disposal area on its site for daily disposal of its solid waste. However, this is no longer valid as Brunswick Mine Site ceased operation in 2013 and mine site closure activities were completed in 2017. However, as noted above and during the August 1, 2019 meeting, Glencore representatives indicated that metal impacted demolition debris present at the Site could be disposed of at the existing demolition debris pit area of the Brunswick Mine Site.
- The documents indicates that the proposed disposal area at Brunswick Mine Site must be within the watershed that flows to the on-Site WTP and all water (surface and groundwater) upstream of the WTP will be collected and treated by the WTP. However, the 2008/2009 Closure Plan PFS does not provide details on whether the WTP has the capacity and/or ability to treat run-off from the disposal areas, nor does the document confirm if the disposal areas are within the watershed that flows to the WTP. During the August 1, 2019 meeting, Glencore representatives indicated that the Brunswick Mine Site WTP could treat metals that would be typically associated with demolition debris from the Smelter Site, and that the proposed disposal areas are within the watershed that flows to the Mine Site WTP. No further assessment of the Brunswick Mine Site WTP or watershed catchment area is planned as part of the current study update.
- The document states “Special Waste Landfills are expected to be subject to the full Environmental Impact Assessment process in New Brunswick. A landfill construction and operation require C of A’s from NB Department of the Environment and Local Government”. However, construction of a hazardous waste landfill is also listed as a designated project under the current federal Canadian Environmental Assessment Act (2012), which could substantially affect the costs and likelihood of approval. However, based on initial evaluations, there is the potential that most of the debris previously identified as non-native could be re-classified and considered acceptable for disposal in the demolition debris pit area of the Brunswick Mine Site, eliminating the requirement for a special waste landfill for non-native



materials. In addition, as part of the current Scope of Work, GHD will be completing a Trade-off Study for the disposal of NORM, which may also eliminate the requirement for a special waste landfill. The requirement for special waste landfills will be further reviewed and validated with Glencore as part of the 2019 Closure Plan PFS Update.

- The 2019 Closure Plan PFS Update Request for Proposals document indicates that there has been ground settlement in the area of the No. 12 Open Pit access road, which has rendered the pit road inaccessible (with alternate route accessible). During the August 1, 2019 meeting, GHD identified that occurrences of ground settlement may inhibit regulatory approval of material disposal at the Brunswick Mine Site, particularly related to the construction of Special Waste Landfills, as ground settlements occurring within or near engineered landfills may damage liner and/or leachate collection systems. However, Glencore representatives indicated that the existing ground settlement is located 1.5 kilometres from the proposed disposal areas and are related to former infrastructure voids in those locations. Glencore representatives indicated the risk of regulator disapproval of material disposal at Brunswick Mine Site specifically due to ground settlement is low. Therefore, the occurrence of ground settlement is considered unlikely to affect the closure concepts for material disposal at the Brunswick Mine Site for the purposes of the current study update.

### 3. Recommendations

In addition to the items discussed in the preceding memorandum sections and during the August 1, 2019 Alternatives Evaluation Meeting, GHD recommends the following closure concepts be further considered by Glencore:

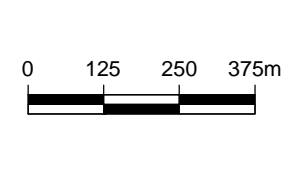
- It is assumed that future rehabilitation works of the Belledune Point area will not be required as part of future Facility closure activities. However, GHD recommends carrying this item forward in the risk registry for the current study update. In addition, as part of the proposal for the hydrogeological study of the Site, confirmation of environmental conditions at Belledune Point and the salt water lagoon, including sampling of soil, sediment and surface water in the lagoon, was proposed and submitted to Glencore under separate cover. Results of the hydrogeological study will be carried forward in the current study update.
- The C of A referenced in the document is outdated. The current C of A's for the Site will need to be provided by Glencore for GHD to review and include in the 2019 Closure Plan PFS Update. GHD will complete the review under the current Scope of Work and any potential changes to the closure concepts due to changes in the C of A's will be discussed further with Glencore during the current study update.
- The Canadian Federal Fisheries Act was recently amended in June 2019. Changes to the Fisheries Act and regulations within the Act will require review as part of the 2019 Closure Plan PFS Update. Glencore representatives previously indicated correspondence with Department of Fisheries and Oceans (DFO) pertaining to the Site is on-going. GHD recommends Glencore continue the correspondence with DFO to determine if revisions to the Act is anticipated to change any previous agreement/concerns associated with the Site. GHD will also complete the regulatory review under the current Scope of Work and any potential changes to the closure concepts due to regulatory changes will be discussed further with Glencore during the current study update.



- For the hydraulic design criteria for future culvert design at closure, GHD recommends reducing the allowable headwater elevation to 1.2 times the culvert height or pipe diameter from 1.5, as slug flow (which can vibrate pipes and reduce overall flow capacity) can occur at 1.2 times the headwater elevation. Upon receiving Glencore's approval, GHD will carry the reduced allowable headwater elevation forward in the current study update as part of the current Scope of Work.
- The requirement for a special waste landfill will be further reviewed and validated with Glencore as part of the 2019 Closure Plan PFS Update, under GHD's current Scope of Work. Based on initial evaluations, there is the potential that most of the demolition debris previously identified as non-native could be re-classified and considered acceptable for disposal in the demolition debris pit area of the Brunswick Mine Site, eliminating the requirement for a special waste landfill for this waste stream. As part of the current Scope of Work, GHD will be completing a Trade-off Study related to disposal options of NORM impacted material, which may also eliminate the requirement for a special waste landfill. To complete the Trade-off Study, GHD is recommending a NORM Survey along with a hazardous materials inventory be completed for the Fertilizer Plant area of the Site. Quantifying soil, feedstock, building materials, and other substances that have NORM concentrations exceeding current guidelines is critical to accurately assess that most technically and financially viable remediation and/or disposal options for these materials. A proposed NORM survey assessment program has been submitted to Glencore under a separate cover on August 12, 2019.
- The document indicates that all friable ACM will be put in barrels and disposed of with demolition debris at the Brunswick Mine Site. Based on current practices, it's unknown if this practice will be approved by the province in the future and GHD recommends planning for all friable ACM to require disposal at a licensed municipal landfill (e.g. Red Pine). Upon receiving approval from Glencore, GHD will carry the revised friable ACM disposal concept forward in the current study update.
- Glencore representatives indicated that the existing ground settlements are located 1.5 kilometres away from the proposed disposal areas and are related to former infrastructure voids in those locations and unlikely to affect future regulatory approval of material disposal at Brunswick Mine Site, specifically the construction of special waste landfills (if required). As such, the occurrence of ground settlement will not likely affect the closure concepts for material disposal at the Brunswick Mine Site for the current study update, however, GHD recommends that this item be included in the project risk registry.
- GHD recommends that following completion of the hydrogeological study and NORM trade-off study, a meeting be held with regulators to review the proposed closure concepts [e.g., construction of special waste landfills (if required), disposal of demolition debris in the pit area, leaving impacted soil in place and placing a protective soil cover]. The objective of the meeting will be to discuss previous correspondence between Glencore and the province as well as to gain an understanding if the currently proposed closure concepts are likely to be approved. Regulatory rejection of the proposed concepts could have a significant impact on the closure costs and planning.
- The provincial Cemetery Companies Act (February 2018) has specific requirements and restrictions on altering gravesites and associated monuments. As a cemetery owned by L'Eveque Catholique Romain de Bathurst is present adjacent off-Site, GHD recommends that the Cemetery Companies Act be reviewed and incorporation into the current study update.



Source: High Resolution Aerial Imagery from New Brunswick Dept of Natural Resources, Acquisition Date: 2018.



GLENCORE CANADA CORPORATION  
 BELLEDUNE, NEW BRUNSWICK  
 MEMORANDUM - 7

SITE PLAN

11198639-01  
 Oct 9, 2019

FIGURE 1



# Memorandum

Revision 1

To: Kelly Longval (Glencore) Ref. No.: 11198639

From: <sup>TS</sup> Troy Small (GHD) Date: October 9, 2019

CC: Bob Butler, Florian Reher, Rick Schwenger (Glencore)  
Rob Turner, Cherie Babineau, Mike Gallahue (GHD)

**Subject: Memorandum-8**

**Review of 2009 SNC-Lavalin Brunswick Smelter Closure Plan Prefeasibility Study and Cost Estimating Report – Section 9.0 – Existing Closure Concept Review**

## 1. Introduction

Glencore Canada Corporation (Glencore) has retained GHD Limited (GHD) to update the 2009 Brunswick Smelter Closure Plan Prefeasibility Study (PFS) and Cost Estimating Report (also referred to as the “2008/2009 Closure Plan PFS”), which was completed by SNC-Lavalin. As part of the 2019 Closure Plan PFS Update, Glencore has requested GHD to review and validate the information presented in the 2008/2009 Closure Plan PFS in order to update the capital cost estimate for the 2019 Closure Plan PFS Update at a +/-20% accuracy for the Brunswick Smelter. The Brunswick Smelter includes the Smelter site, Material Handling West Area, and the Fertilizer Plant (collectively referred to as the “Site”). A slag pile and the Jacquet River Pumphouse and associated freshwater pipeline are also part of the closure plan.

GHD has reviewed the 2008/2009 Closure Plan PFS to determine if the information presented is valid, timely and complete, and has provided recommendations to Glencore as to whether an update should be executed, where applicable. In conjunction with the document reviews, GHD completed an existing conditions investigation at the Site in July 2019 to understand Site infrastructure, identify changes that have occurred at the Site since 2008/2009 and identify any data gaps that require additional Site investigations.

Glencore requested GHD to complete a separate technical memorandum for each section of the 2008/2009 Closure Plan PFS report detailing the report review findings. Therefore, this memorandum outlines the findings of GHD’s review specifically for **Section 9.0 – Existing Closure Concept Review** of the 2008/2009 Closure Plan PFS along with items discussed during the Alternatives Evaluation Meeting held on August 1, 2019.

## 2. Review Findings

Section 9.0 of the 2008/2009 Closure Plan PFS provided the results of SNC’s review of previous closure concepts proposed for the Site. SNC’s closure concept review included a detailed review of the previous closure plan concept prepared by Conestoga-Rovers & Associates [CRA, (now known as GHD)] in 2007. Section 9.0 contains significant details regarding SNC’s review of the previous CRA closure concept and a



summary of SNC's review is presented in the series of tables located in Section 2 of the Design Review memorandum (020120-0000-40EN-0005) of the 2008/2009 Closure Plan PFS. The SNC review presented in memorandum 020120-0000-40EN-0005 formed the basis for the revised closure concepts for the 2008/2009 Closure Plan PFS. Although GHD reviewed the 2007 CRA closure concepts, GHD focused the detailed review on the SNC's Design Review memorandum. The findings of GHD's review outlined in the following sections focus on the closure concepts carried forward in the 2008/2009 Closure Plan PFS. For example, the 2007 CRA closure concept included two potential closure scenarios: Complete Closure versus Partial Closure with Retention of the Short Rotary Furnace. The 2008/2009 Closure Plan PFS only carried forward the Complete Closure option and, therefore, a review of the 2007 CRA closure concept for retention of the short rotary furnace option was not considered applicable for the 2019 Closure Plan PFS Update.

In general, GHD agrees with the overall information presented Section 9.0 – Existing Closure Concept Review of the 2008/2009 Closure Plan PFS but noted that some of the design review items for the closure concepts require additional consideration and updating. The following items require consideration for updating or validation as part of the 2019 Closure Plan PFS Update:

#### ***Design Review Memo – General Environmental Closure Objectives***

- The document indicates that above ground piles of material except the slag piles will be removed by Xstrata (now Glencore). However, as noted in GHD technical memorandum 11198639-Memorandum-7, Glencore representatives indicated that 2019 Closure Plan PFS Update should include transportation and off-Site disposal of materials that are not suitable for disposal at the Brunswick Mine Site, including stockpiled materials such as imported or and process sludge. Glencore indicated that quantities and characterization data will be provided to GHD for inclusion in the current study update along with appropriate disposal requirements and costs.

#### ***Design Review Memo – Design Criteria for Proposed Concept***

- The Certificate of Approval referenced in the document is outdated. The current Certificates of Approvals for the Site will need to be provided by Glencore for GHD to review and include in the 2019 Closure Plan PFS Update.
- The document references the Fisheries Act. As noted in GHD technical memorandum 11198639-Memorandum-7, the Canadian Federal Fisheries Act was updated in June 2019. Changes to the Fisheries Act and regulations within the Act will require review as part of the 2019 Closure Plan PFS Update.
- The document indicates the design criteria for maximum acceptable metal concentration in surface soil for dermal contact or ingestion by adults is based on the Site-specific Target Levels (SSTLs) developed as part of a risk assessment completed for the Site in 2007. The document also indicates that specific screening criteria for metals in soil are not available for New Brunswick and soil would be covered if concentrations exceed the SSTLs developed for the protection of human health. However, since the completion of the 2008/2009 Closure Plan PFS, the province of New Brunswick has adopted the Environmental Quality Standards (EQS) developed by Nova Scotia Environment (NSE). In addition, as noted in GHD technical memorandum 11198639-Memorandum-7, various regulatory jurisdictions have revised the approach and toxicity information specific to lead which could change the SSTLs previously



developed for the Site. Although the guidelines for metal impacted soil have been updated since the 2008/2009 Closure Plan PFS was completed, it is not anticipated that the new regulations will have a significant impact on the overall closure concepts but the new guidelines could result in changes to overall quantities, disposal and/or cover requirements for the contaminated materials.

- The document states that foundations and slabs are excluded from removals. However, other sections in the 2008/2009 Closure Plan PFS indicate that concrete floors will be demolished. As noted in GHD technical memorandum 11198639-Memorandum-7, this inconsistency has been reviewed with Glencore representatives during the August 1, 2019 meeting and it has been confirmed that slab-on-grades and below-grade foundations are to be left in-place and un-fractured post-closure. Above-ground foundations will be demolished to grade.
- The document indicates that all construction and demolition waste contaminated with asbestos, phosphate or radiological waste will be disposed at Brunswick Mine Site in lined cells. Based on current practices, it is unknown if regulators would approve disposal of friable asbestos at the Brunswick Mine Site. Similarly, a special waste landfill for radiological waste (specifically naturally occurring radioactive material (NORM)) or other non-native waste has not previously been permitted in the Province of New Brunswick and its undertaking will require evaluation under the provincial Environmental Impact Assessment regulation and possibly the federal environmental assessment process. In addition, as part of the current Scope of Work, GHD will be completing a Trade-off Study to review the NORM remediation and/or disposal options, which may also eliminate the requirement for a lined special waste landfill. The requirement for special waste landfills will be further reviewed and validated with Glencore as part of the 2019 Closure Plan PFS Update.
- The document indicates that the cover thickness must be greater than 300 mm, however, in several other sections of the 2008/2009 Closure Plan PFS report the cover thickness is listed at 600 mm. As noted in GHD technical memorandum 11198639-Memorandum-7, this inconsistency has been reviewed with Glencore representatives during the August 1, 2019 meeting and it has been confirmed that the cover thickness is assumed to be 600 mm for purposes of the current closure study. However, it will be noted in the PFS report that the actual cover thickness developed during future detailed design phases may vary depending on elevation requirements, concentrations of contaminants in soil and future land uses for specific areas of the Site. Site cover is discussed further in 11198639-Memorandum-12.
- The document indicated that the old slag pile requires erosion protection from the adjacent marine environment. The slag pile has since been relocated to the new slag pile. It is assumed wave action protection of cover material will not be required as part of the 2019 Closure Plan PFS Update. During the August 1, 2019 meeting, Glencore representatives indicated that climate change impacts to the Site cover would be considered a risk in the Closure Project Risk Register, and will not be reviewed as part of the current closure study.
- The document indicates that the old slag pile area is proposed to be a low-exposure land use post-closure.

However, the old slag pile has previously been re-located to the new slag pile and covering of the old slag pile area will be excluded from the 2019 Closure Plan PFS Update. The old slag pile area located on Belledune Point was rehabilitated to become a salt water lagoon as outlined in the Belledune Point



Rehabilitation Plan Final Report (dated September 2013). The rehabilitation plan was developed in collaboration with several federal/provincial agencies including New Brunswick Department of Environment and Local Government (NBDELG), Department of Fisheries and Oceans (DFO), Canadian Wildlife Service and Department of Energy and Mines. In addition, the Belledune Point rehabilitation work was completed in accordance with an Approval to Construct I-7784 issued by the NBDELG. In 2012, Atlantic RBCA implemented an ecological screening protocol for contaminated sites that has been adopted by NBDELG as part of the provincial Guideline for the Management of Contaminated Sites. Under this protocol, it is likely that the Belledune Point area and salt water lagoon created by the relocation of the old slag pile would be considered ecological habitat potentially requiring additional evaluation of contaminants in soil, surface water or sediment with respect to risk to ecological receptors. Based on information provided in the Belledune Point Rehabilitation Plan Final Report along with results of the Marine Ecological Risk Assessment of Brunswick Smelter completed by Intrinsik which includes the shoreline of Belledune Point (report dated October 30, 2015), it is assumed that additional rehabilitation works of Belledune Point will not be required as part of future Facility closure activities. As such, GHD recommends carrying this item forward in the risk registry for the current study update. In addition, as part of the proposal for the hydrogeological study of the Site, confirmation of environmental conditions at Belledune Point and the salt water lagoon, including sampling of soil, sediment and surface water in the lagoon, were proposed and submitted to Glencore under separate cover. Results of the confirmatory sampling will be carried forward in the current study update.

#### ***Design Review Memo – Risk Associated with the Proposed Concept***

- The closure concept review did not include off-Site assessment and does not address the identification of impacted third party properties (as per requirements of the current NB Guideline for the Management of Contaminated Sites). However, following completion of the 2008/2009 Closure Plan PFS, an ecological risk assessment for off-Site terrestrial and freshwater aquatic areas was completed by Intrinsik in 2013 (report dated September 2013) and an off-Site human-health risk assessment (i.e., Shore Road Soil Study) was conducted in residential areas near the Site by Intrinsik in 2008. In addition, the 2008/2009 Closure Plan PFS identified the potential of contaminant transport by groundwater to off-Site areas as a risk item which would have a cost impact on the original closure concept. The requirements of the New Brunswick Guideline for the Management of Contaminated Sites, which includes the assessment of potential off-site impacts through groundwater, will need to be included in the current study update. GHD has provided Glencore with a proposal to complete a hydrogeological evaluation and additional data gap evaluation for the Site with a specific emphasis on evaluating contaminants in groundwater flowing to off-Site surface water.
- GHD agrees with the assumption that existing impacted soils can be left in place and covered with a protective soil cover at closure but regulatory rejection of the proposed concept would have a significant impact on the closure costs and planning.

### **3. Recommendations**

- The Certificate of Approval referenced in the document is outdated. The current Certificates of Approvals for the Site will need to be provided by Glencore for GHD to review and include in the 2019 Closure Plan





PFS Update. GHD will complete the review under the current Scope of Work and any potential changes to the closure concepts due to approval changes will be discussed further with Glencore during the current study update.

- The Canadian Federal Fisheries Act was recently amended in June 2019. Changes to the Fisheries Act and regulations within the Act will require review as part of the 2019 Closure Plan PFS Update. Glencore representatives previously indicated correspondence with Department of Fisheries and Oceans (DFO) pertaining to the Site is on-going. GHD recommends Glencore continue the correspondence with DFO to determine if revisions to the Act is anticipated to change any previous agreement/concerns associated with the Site. GHD will also complete the regulatory review under the current Scope of Work and any potential changes to the closure concepts due to regulatory changes will be discussed further with Glencore during the current study update.
- GHD recommends completing a review of the SSTLs previously developed as part of the 2008/2009 Closure Plan PFS given the changes in applicable guidance documents and standards that are currently being utilized in New Brunswick to evaluate risk to human health as well as ecological receptors (specifically Atlantic Risk Based Corrective Action, Health Canada, Environment Canada and NS EQS). Recent SSTLs for metals were developed and utilized for closure of the rail line bordering the Site in December 2018. These SSTLs could potentially be used to replace the SSTLs developed in 2008.
- The requirement for a special waste landfill will be further reviewed and validated with Glencore as part of the 2019 Closure Plan PFS Update, under GHD's current Scope of Work. GHD will be completing a Trade-off Study related to disposal options of NORM-impacted material, which may also eliminate the requirement for a special waste landfill. To complete the Trade-off Study, GHD is recommending a NORM Survey along with a hazardous materials inventory be completed for the Fertilizer Plant area of the Site. Quantifying soil, feedstock, building materials, and other substances that have NORM concentrations exceeding current guidelines is critical to accurately assess that most technically and financially viable remediation and/or disposal options for these materials. For the purposes of the current study, GHD also recommends planning for all friable asbestos to require disposal at a licensed municipal landfill (e.g., Red Pine).
- GHD recommends that following completion of the hydrogeological study and NORM trade-off study, a meeting be held with regulators to review the proposed closure concepts [e.g., construction of special waste landfills (if required), disposal of demolition debris in the open pit at the Brunswick Mine Site, use of a protective soil cover, etc.] and to gain an understanding if the proposed closure concepts are likely to be approved. Regulatory rejection of the proposed concepts could have a significant impact on the closure costs and planning.



# Memorandum

Revision 1

To: Kelly Longval (Glencore) Ref. No.: 11198639

From: <sup>TS</sup> Troy Small (GHD) Date: October 9, 2019

cc: Bob Butler, Florian Reher, Rick Schwenger (Glencore)  
Rob Turner, Cherie Babineau, Mike Gallahue (GHD)

**Subject: Memorandum - 9**

**Review of 2009 SNC-Lavalin Brunswick Smelter Closure Plan Prefeasibility Study and Cost Estimating Report – Section 10.0 – Site Characterization**

## 1. Introduction

Glencore Canada Corporation (Glencore) has retained GHD Limited (GHD) to update the 2009 Brunswick Smelter Closure Plan Prefeasibility Study (PFS) and Cost Estimating Report (also referred to as the “2008/2009 Closure Plan PFS”), which was completed by SNC-Lavalin. As part of the 2019 Closure Plan PFS Update, Glencore has requested GHD to review and validate the information presented in the 2008/2009 Closure Plan PFS in order to update the capital cost estimate for the 2019 Closure Plan PFS Update at a +/-20% accuracy for the Brunswick Smelter. The Brunswick Smelter includes the Smelter site, Material Handling West Area, and the Fertilizer Plant (collectively referred to as the “Site”). A slag pile and the Jacquet River Pumphouse and associated freshwater pipeline are also part of the closure plan.

GHD has reviewed the 2008/2009 Closure Plan PFS to determine if the information presented is valid, timely and complete, and has provided recommendations to Glencore as to whether an update should be executed, where applicable. In conjunction with the document reviews, GHD completed an existing conditions investigation at the Site in July 2019 to understand Site infrastructure, identify changes that have occurred at the Site since 2008/2009 and identify any data gaps that require additional Site investigations.

Glencore requested GHD to complete a separate technical memorandum for each section of the 2008/2009 Closure Plan PFS report detailing the report review findings. This memorandum outlines the findings of GHD’s review specifically for **Section 10.0 – Site Characterization** of the 2008/2009 Closure Plan PFS along with items discussed during the Alternatives Evaluation Meeting held on August 1, 2019.

## 2. Review Findings

Section 10.0 of the 2008/2009 Closure Plan PFS provided a general overview of the historical Site characterization findings. GHD noted that some site characterization items require additional consideration as Site-specific information for several key components are now outdated and several environmental



guidelines used in the 2008/2009 Closure Plan PFS have been revised. The subsection below provides a brief summary of the information presented in Section 10.0 of the 2008/2009 Closure Plan PFS.

#### ***Summary of Site Characterization from 2008/2009 Closure Plan PFS***

- The documents indicated that various historical environmental site assessment and site characterization work has been completed at the Site since 1988-89. The following is a summary of the number of groundwater monitor wells (MWs) that have been installed on the Site (as shown on the attached Figure):
  - 36 MWs installed 1988
  - 32 MWs installed in 2005
  - 20 MWs installed in 2008 (BHO, DAP and PAP areas) and
- The documents indicate that numerous soil samples have been collected across the Site for metal analyses. Concentrations of metals exceeding Canadian Council of Ministers of the Environment (CCME) Industrial Soil Quality Guidelines (SQGs) were identified at all soil sample locations across the Site with ore concentrate also previously observed along rail spur line. Some metal exceedances were also reported for soil samples collected near the proposed soil granular cover borrow pit area. Risk based site-specific target levels (SSTLs) were previously calculated in 2007 for various metals at the Site. Soil leachate testing was also previously completed at localized areas of the Site using three lab methods. Potential leachate generating soils (zinc and cadmium) were generally limited to the old coke fines storage area. Sediment samples previously collected from the Site also had elevated concentrations of various metals.
- The documents identified modified petroleum hydrocarbons (mTPH) as a contaminant of concern (COC) for the Site. Soil and groundwater have had concentrations of mTPH exceeding provincial Tier I Risk Based Screening Levels at various locations on-Site including Number 1 Short Rotary Furnace and Acid Day Tank as well as the former underground storage tanks (USTs) and current aboveground storage tanks (ASTs) associated with the Warehouses (as well as the former waste oil tank and No. 2 fuel oil AST north of Lead Refinery). The area and volume of hydrocarbon impacted soil and groundwater was assumed in the 2008/2009 Closure Plan PFS since delineation was not possible due to operating Site infrastructure. Some sediment samples previously collected from the Site also had elevated concentrations of mTPH.
- The documents indicate that polycyclic aromatic hydrocarbons (PAHs) were detected in various soil and sediment samples and therefore PAHs are considered a COC at the Site.
- The documents indicate that polychlorinated biphenyls (PCBs) were also identified as a potential COC in various areas of the Site, including the electrical substations and the former PCB storage container area.
- The documents indicate that Naturally Occurring radioactive materials (NORM) are also identified as a COC for a portion of the Site (specifically the Diammonium Phosphate Plant (DAP) and the Phosphoric Acid Plant (PAP) buildings of the Fertilizer Plant). The initial NORM characterization study completed for this area of the Site in 2006 identified several building surfaces and adjacent soil areas that contained NORM concentrations above acceptable guidelines that would require specific remediation and/or



disposal requirements. A supplemental assessment program completed in 2008 identified concentrations of NORM in soil adjacent to the DAP & PAP buildings that were below applicable guidelines indicating additional soil management or remediation may not be required.

### *Review Findings*

GHD agrees with the information presented in Section 10.0 of the 2008/2009 Closure Plan PFS, but noted that some items require additional consideration as Site-specific information for several key components are now outdated. Items that GHD considers requiring further consideration and updating along with the assumptions that have been validated by Glencore during the August 2, 2019 Alternatives Evaluation meeting are presented below.

- As noted in the 2019 Closure Plan PFS Update Request for Proposal documents, Glencore has identified that the environmental conditions for the Back 40 area north of the Acid Plant as a significant cost and regulatory risk item and requested a review of the hydrogeological model and sampling program for the Back 40 area. Therefore, GHD has provided Glencore with a proposal to complete a hydrogeological study for the Site, which includes the Back 40 area.
- During the existing conditions investigations, Glencore representatives indicated that many of the historical wells have been damaged or destroyed (note: 69 MWs were identified to be remaining intact including 3 MWs were installed in 2015 (former waste oil tank and No. 2 fuel oil AST north of Lead Refinery)). Construction of additional MWs outside of the Back 40 area were also included as part of the hydrogeological study proposed for the Site to gain an understanding of the current Site-wide environmental conditions.
- During the August 1, 2019 meeting, Glencore representatives indicated that groundwater samples were collected from 29 of the remaining MWs in May 2019. This additional groundwater data is to be provided to GHD for inclusion in the current study.
- During the existing conditions investigation, Glencore representatives advised GHD that diesel impacted soil was observed during an exploration trench dug near the cooling pipe area of the Site. GHD has proposed environmental testing at this location of impacted soil as part of the recommended hydrogeological study at the Site.
- As noted in GHD's technical memorandum 11198639-Memorandum-2, several environmental guidelines used in the 2008/2009 Closure Plan PFS have been updated since the completion of the 2008/2009 Closure Plan PFS. Various regulatory jurisdictions have revised the approach and toxicity information specific to lead (Pb) which could change the SSTLs previously developed for the Site. In addition, SSTLs for zinc were not carried forward in the 2008/2009 Closure Plan PFS. The new guidelines could result in changes to overall quantities, disposal and/or cover requirements for the contaminated materials.
- The New Brunswick Department of Environment and Local Government (NBDELG) recently has adopted the Environmental Quality Standards (EQS) developed by the Nova Scotia Department of Environment (NSE) for evaluating metals in soil, sediment, groundwater and surface water. In particular, the NSE guidelines specify screening values for metals in groundwater that have the potential to discharge to a surface water body (freshwater or marine). This change in environmental screening is a significant shift



from the assumption included in the 2008/2009 Closure Plan PFS. The old slag pile area located on Belledune Point was rehabilitated to become a salt water lagoon as outlined in the Belledune Point Rehabilitation Plan Final Report (dated September 2013). The rehabilitation plan was developed in collaboration with several federal/provincial agencies including New Brunswick Department of Environment and Local Government (NBDELG), Department of Fisheries and Oceans (DFO), Canadian Wildlife Service and Department of Energy and Mines. In addition, the Belledune Point rehabilitation work was completed in accordance with an Approval to Construct I-7784 issued by the NBDELG. In 2012, Atlantic RBCA implemented an ecological screening protocol for contaminated sites that has been adopted by NBDELG as part of the provincial Guideline for the Management of Contaminated Sites. Under this protocol, it is likely that the Belledune Point area and salt water lagoon created by the relocation of the old slag pile would be considered ecological habitat potentially requiring additional evaluation of contaminants in soil, surface water or sediment with respect to risk to ecological receptors. Based on information provided in the Belledune Point Rehabilitation Plan Final Report along with results of the Marine Ecological Risk Assessment of Brunswick Smelter completed by Intrinsic which includes the shoreline of Belledune Point (report dated October 30, 2015), it is assumed that additional rehabilitation works of Belledune Point will not be required as part of future Facility closure activities. As such, GHD recommends carrying this item forward in the risk registry for the current study update. In addition, as part of the proposal for the hydrogeological study of the Site, confirmation of environmental conditions at Belledune Point and the salt water lagoon, including sampling of soil, sediment and surface water in the lagoon, were proposed and submitted to Glencore under separate cover. Results of the confirmatory sampling will be carried forward in the current study update.

- Past testing of soil and groundwater for radionuclides in the Fertilizer Plant area was not conclusive and remains a data gap. GHD also concurs with the recommendation in the 2008/2009 Closure Plan PFS that the previous NORM characterization survey at the DAP/PAP should be re-done to gain an understanding of current conditions.

### 3. Recommendations

In addition to the items discussed in the preceding memorandum sections and during the August 1, 2019 Alternatives Evaluation Meeting, GHD recommends the following site characterization items be further considered by Glencore:

- Existing environmental conditions at the Back 40 area has been identified as a significant risk by Glencore. In addition, review of existing conditions at Belledune Point and the salt water lagoon created from the old slag pile is recommended as part of the 2019 Closure Plan PFS Update. Completion of a hydrogeological study of the Site, which includes evaluation of environmental conditions at the Back 40 area, other areas of environmental concern, Belledune point and the salt water lagoon, was previously recommended and the additional scope of work has been approved by Glencore. Results of the hydrogeological study will be carried forward in the current study update.
- Glencore representatives indicated that groundwater samples were collected from 29 on-Site MWs in May 2019. GHD recommends carrying forward the historical data, recent groundwater monitoring data (May 2019) as well as new data to be collected in 2019 as part of the hydrogeological study into the

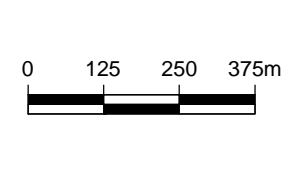


current study update in order to provide a good distribution of groundwater quality data (historical and current) across the Site.

- GHD recommends completing a review of the SSTLs previously developed as part of the 2008/2009 Closure Plan PFS given the changes in applicable guidance documents and standards that are currently being utilized in New Brunswick to evaluate risk to human health as well as ecological receptors (specifically Atlantic RBCA, Health Canada, Environment Canada and NS EQS). Recent SSTLs for metals were developed and utilized for closure of the rail line bordering the Site in December 2018. These SSTLs could potentially be used to replace the SSTLs developed in 2008.
- GHD is recommending a NORM Survey, including groundwater sampling, along with a hazardous materials inventory be completed for the Fertilizer Plant area of the Site. Quantifying soil, feedstock, building materials, and other substances that have NORM concentrations exceeding current guidelines is critical to accurately assess the most technically and financially viable remediation and/or disposal options for these materials. A proposed NORM survey assessment program was previously submitted to Glencore under a separate cover on August 12, 2019.
- Although not included in the 2008/2009 Closure Plan PFS, GHD notes that an GIS database (eDAT) was previously prepared for the Site by Conestoga-Rovers & Associates [(CRA), now GHD] and includes environmental data collected from the Site prior to 2005 (GHD notes that the summer 2008 data was not included in the 2008/2009 Closure Plan PFS). GHD recommends that the eDAT be updated as part of the hydrogeological study to include Site characterization data post-2005 (including the environmental data collected in the summer and fall of 2019) and utilizing the updated data set in the 2019 Closure Plan PFS Update.



Source: High Resolution Aerial Imagery from New Brunswick Dept of Natural Resources, Acquisition Date: 2018.



**LEGEND**  
 - - - - - PROPERTY LINES  
 ● EXISTING MONITOR WELL LOCATION



GLENCORE CANADA CORPORATION  
 BELLEDUNE, NEW BRUNSWICK  
 MEMORANDUM - 9  
 MONITOR WELL LOCATIONS

11198639-01  
 Aug 15, 2019

FIGURE 1



# Memorandum

Revision 1

To: Kelly Longval (Glencore) Ref. No.: 11198639

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From: <sup>TS</sup> Troy Small (GHD) Date: October 9, 2019

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cc: Bob Butler, Florian Reher, Rick Schwenger (Glencore)  
Rob Turner, Cherie Babineau, Mike Gallahue (GHD)

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**Subject: Memorandum-10**

**Review of 2009 SNC-Lavalin Brunswick Smelter Closure Plan Prefeasibility Study and Cost Estimating Report – Section 11.0 – Demolition of Buildings/Infrastructures**

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## 1. Introduction

Glencore Canada Corporation (Glencore) has retained GHD Limited (GHD) to update the 2009 Brunswick Smelter Closure Plan Prefeasibility Study (PFS) and Cost Estimating Report (also referred to as the “2008/2009 Closure Plan PFS”), which was completed by SNC-Lavalin. As part of the 2019 Closure Plan PFS Update, Glencore has requested GHD to review and validate the information presented in the 2008/2009 Closure Plan PFS in order to update the capital cost estimate for the 2019 Closure Plan PFS Update at a +/-20% accuracy for the Brunswick Smelter. The Brunswick Smelter includes the Smelter site, Material Handling West Area, and the Fertilizer Plant (collectively referred to as the “Site”). A slag pile and the Jacquet River Pumphouse and associated freshwater pipeline are also part of the closure plan. A Site plan is provided as Figure 1.

GHD has reviewed the 2008/2009 Closure Plan PFS to determine if the information presented is valid, timely and complete, and has provided recommendations to Glencore as to whether an update should be executed, where applicable. In conjunction with the document reviews, GHD completed an existing conditions investigation at the Site in July 2019 to understand Site infrastructure, identify changes that have occurred at the Site since 2008/2009 and identify any data gaps that require additional Site investigations.

Glencore requested GHD to complete a separate technical memorandum for each Section of the 2008/2009 Closure Plan PFS report detailing the report review findings. Therefore, this memorandum outlines the findings of GHD’s review specifically for **Section 11.0 – Demolition of Buildings/Infrastructures** of the 2008/2009 Closure Plan PFS along with items discussed during the Alternatives Evaluation Meeting held on August 1, 2019.

## 2. Review Findings

Section 11.0 of the 2008/2009 Closure Plan PFS provided details on demolition means and methods and management of demolition material wastes during the demolition of the buildings and infrastructure at the Brunswick Smelter site. The Section was broken out into a short overview Section followed by four separate





technical memos that covered the three main plant areas (the Smelter Area, the Bulk Handling Operations (BHO) area and the Di-Ammonium Phosphate (DAP) & Phosphoric Acid Plan (PAP) area), as well as an Inventory of Major Pieces of Equipment at the Smelter Complex.

In general, GHD agrees with the overall demolition concepts proposed but noted some concepts require additional consideration or updating. Due to infrastructure that has changed, been added or removed since the 2008/2009 Closure Plan PFS, GHD notes that revisions to the overall demolition debris quantities will be required as part of the current study update. Items that GHD considers requiring further consideration and updating along with the assumptions that have been validated by Glencore during the August 1, 2019 Alternatives Evaluation meeting are presented below.

### **General Overview**

#### *Site Infrastructure after Closure*

- The Section indicates that two zones of closure were proposed in the original concept: industrial and low exposure. However, as indicated in GHD memorandums 11198639-Memorandum-2, 11198639-Memorandum-7 and 11198639-Memorandum-9, consideration of risk to ecological receptors from exposure to contaminants in soil, groundwater, sediment and surface water of the Belledune Point area will also be required and included in the current study.
- The old slag pile located on Belledune Point was re-located to the new slag pile following completion of the 2008/2009 Closure Plan PFS.

#### **Four Technical Memos (Smelter Area, BHO area, DAP & PAP area and Inventory of Major Pieces of Equipment at the Smelter Complex)**

##### *Buildings and Infrastructure*

- For the Smelter Area, BHO and DAP/PAP the proposed decommissioning method for underground pipes is to cap the pipes at the bay side to limit contamination transport through the pipes. However, if there are cracks in the pipes/damage, this may not inhibit contaminant transport. In addition, this method does not limit the risk of subsidence. Some of the existing pipes are greater than 1.2 metres (m) in diameter and may only be buried approximately 1.2 m below grade surfaces (based on information provided by Glencore personnel). If these large diameter pipes were to collapse in the future, this could create surficial subsidence and potential damage the cover material being proposed for the Site (see GHD technical memorandums 11198639-Memorandum-7 and 11198639-Memorandum-12). Similarly, water infiltration/exfiltration and ground subsidence may occur through the unsealed pipe voids at the foundation walls or slabs. Recommendations for decommissioning of buried piping are provided in Section 3.0 of this memorandum.
- The Smelter Area Memo (020120-0000-4DEN-0001) indicates that the aerial Section of the freshwater pipeline that crosses the Belledune River crossing must be demolished. However, this demolition item does not appear to have been included in the cost estimate. Decommissioning costs associated with this infrastructure would likely include access, working over water, temporary controls, provincial *Watercourse and Wetland Alteration (WAWA)* permit requirements, etc. In addition, costing has not been included for decommissioning of the Section of the freshwater pipeline that runs underneath Route 11.



Glencore indicated that the updated closure plan should assume the Jacquet River Pump house and associated freshwater supply line will remain in-place and operational post Facility closure excluding portions of the supply line on the Smelter property.

- The Smelter Area Memo (020120-0000-4DEN-0001) and the BHO Area Memo (020120-0000-4DEN-0002) indicate that 1.5 km and 179 m, respectively, of electrical lines are included in the infrastructure to be demolished. However, it was not clear whether these lines are included in the copper recyclable tonnage. Based on discussions during the August 1, 2019 meeting, GHD will assume that copper from these lines has been included in the copper recyclable tonnages provided with the 2008/2009 Closure Plan PFS. In addition, the electrical lines from west side substation to main grid were not included in the previous study and the memo indicates that further investigation is needed to determine if this Section of line should be included. Glencore has confirmed to GHD that this Section of electrical line should not be included in the current study, as these lines are owned by NB Power.
- The Smelter Area, BHO and DAP/PAP memos (020120-0000-4DEN-0001, 020120-0000-4DEN-0002 and 020120-0000-4DEN-0003, respectively) all indicate that “during demolition activities, concrete rubble coming from the demolition of the interior of the building, including floors, elevated slabs, concrete curbs, etc. will be encountered”, which reads as that demolition of slab-on-grades were included. Other sections of the 2008/2009 Closure Plan PFS indicate that ground level floors are excluded from removals. This inconsistency has been reviewed with Glencore representatives during the August 1, 2019 meeting and it has been confirmed that slab-on-grades and below-grade foundations are to be left in-place and un-fractured post-closure. Above-ground foundations will be demolished to existing grade. GHD concurs with this approach for a site such as the Brunswick Smelter.
- The Smelter Area, BHO and DAP/PAP memos (020120-0000-4DEN-0001, 020120-0000-4DEN-0002 and 020120-0000-4DEN-0003, respectively) indicate that most of the concrete (approximately 88%) will be cleaned and acceptable for re-use as backfill on-Site and the remainder will be disposed of at the Brunswick Mine Site. This is a major assumption given the cost to clean the concrete with no guarantee that it can be cleaned to the extent required to ensure metal concentrations remaining on the concrete do not impact the Site. In addition, there is only a small volume of voids that will require backfilling and the 2008/2009 Closure Plan PFS assumed that the remainder of the concrete would be crushed and used as part of the Site cover. GHD notes that it may be more economical to complete a “washdown” of the concrete for dust control during demolition/transport and transport to Brunswick Mine Site demolition debris open pit without crushing the material. This was reviewed with Glencore representatives during the August 1, 2019 meeting, and Glencore representatives advised that the cleaning methodologies proposed in the 2008/2009 Closure Plan assumed complete cleaning along with swab testing, which is no longer the preferred closure concept. Glencore concurred with the GHD approach of a dust control “washdown” of the concrete and the assumption that the concrete would be considered as demolition debris suitable for disposal at the demolition debris open pit at Brunswick Mine Site. This dust control “washdown” approach for the concrete followed by disposal at the Brunswick Mine Site will be carried forward in the current study update.
- The Smelter Area Memo (020120-0000-4DEN-0001) and the BHO Area Memo (020120-0000-4DEN-0002) indicate that the rail tracks would be removed by CN and credit for steel



salvage was not included. Based on GHD's previous experience with local decommissioning projects, removal of the Site spur line may be Glencore's responsibility. If so, this would incur additional costs/time in the closure budget which are currently not allocated for in the 2008/2009 Closure Plan PFS.

- The Smelter Area Memo (020120-0000-4DEN-0001) includes a list of transformers present at the Site. During the August 1, 2019 meeting, Glencore confirmed the oil in the on-site transformers do not currently contain Polychlorinated biphenyls (PCBs). However, GHD notes that due to the age of the transformers, they could have historically contained PCBs and there is potential that the transformer core and carcass is impacted and not viable for recycling (i.e., require cleaning/treatment).
- In the Smelter Area, BHO and DAP/PAP memos (020120-0000-4DEN-0001, 020120-0000-4DEN-0002 and 020120-0000-4DEN-0003, respectively), it is not clear if the lengths of conveyors have been included in the steel take-offs for recycling. During the August 1, 2019 meeting, Glencore confirmed that GHD should assume that the quantities were included in the steel take-offs for recycling. In addition, it is stated that the car-unloading tunnel will not be demolished but would be filled with crushed concrete debris once the conveyor equipment had been removed for recycling. However, removing the top of the tunnel would likely be required to fill the tunnel with concrete debris. Therefore, for the purposes of the current study update, it will be assumed the top of the tunnel will be exposed and crushed, and then the tunnel backfilled. A cost comparison will also be investigated as part of the current study to determine whether it is more economical to remove the conveyor equipment from the tunnel or simply clean the equipment and leave it buried in the tunnel.
- In the Smelter Area, BHO and DAP/PAP memos (020120-0000-4DEN-0001, 020120-0000-4DEN-0002 and 020120-0000-4DEN-0003, respectively), quantities of regulated materials such as photoluminescent exit signs, Ozone Depleting Substances (ODS), chemical sweep materials, lab pack or residual acids are not provided as it was assumed that hazardous and regulated materials would be removed by Glencore prior to closure. However, during the August 1, 2019 meeting, Glencore indicated to GHD that the costs to collect and remove these materials are to be included in the current study update. GHD will discuss with Glencore the estimated quantities of these materials to be assumed in the current study to determine handling and disposal costs.
- The documents indicate that an allowance has been included to cover scraping of lead paint flakes for 20% of the building surfaces. However, it is not clear in the 2008/2009 Closure Plan PFS cost estimate that this has been included, nor does there appear to be disposal costs for the lead paint scrapings. As part of the current study update, GHD will review with Glencore, whether such an allowance is required based on the new closure concept.
- The 2008/2009 Closure Plan PFS assumed the earthen dam at the new slag pile would be removed as part of the Site closure activities. However, the sedimentation pond located directly north of the new slag pile that was created by the dam structure is now classified as a regulated wetland by the New Brunswick Department of Environment and Local Government (NBDELG) and is subject to the *WAWA Regulation of the Clean Water Act*. As such, Glencore instructed GHD to assume the dam structure and associated regulated wetland will remain and be incorporated into the future new slag pile closure plan. Future closure activities associated with the new slag pile (grading and capping) will still likely require a WAWA permit as physical activities will be completed directly adjacent to or within 30 metres of the



wetland. In addition, during the August 1, 2019 meeting, GHD recommended that Glencore consider creating an engineered wetland in the borrow pit area of the Site, designed to receive run-off from the covered slag pile before discharging to Chaleur Bay. Glencore representatives concurred and a conceptual plan for creation of engineered wetlands in the borrow pit area will be carried forward in the current study update.

- The Smelter Area Memo (020120-0000-4DEN-0001) indicated that an old concrete foundation present in the salt water lagoon area would be demolished. During the existing conditions investigations, GHD reviewed the foundation location and determined access roads for heavy equipment are not available in the area and destruction of ecological habitat would be required to demolish the foundation. The documents indicated that there has previously been rare plants identified in the area. Therefore, GHD recommends that the old concrete foundation be abandoned in place. During the existing conditions assessment and subsequent Alternatives Evaluation meeting on August 1, 2019, Glencore representatives concurred with the recommendation and it will be assumed the old concrete foundation will be abandoned in place for the purposes of the current study update.
- The Smelter Area, BHO and DAP/PAP memos (020120-0000-4DEN-0001, 020120-0000-4DEN-0002 and 020120-0000-4DEN-0003, respectively), indicate that the Conveyor Belt will be sent to the Brunswick Mine Site for disposal. However, during the 2019 existing conditions investigations, Glencore representatives indicated that this material currently goes to an out-of-province hazardous waste landfill for disposal. Glencore has advised GHD that the conveyor will be disposed of at the open pit demolition disposal area as part of the closure activities.
- The Smelter Area, BHO and DAP/PAP memos (020120-0000-4DEN-0001, 020120-0000-4DEN-0002 and 020120-0000-4DEN-0003, respectively), provide quantities of dust that require cleaning and disposal. However, the cleaning methodologies proposed in the 2008/2009 Closure Plan PFS consist of washing the dust and treating the wash water at the Smelter Wastewater Treatment Plant (WWTP). With this cleaning methodology, it is anticipated that significant bulk quantities of dust will not require off-Site disposal. In addition, Glencore representatives advised GHD that periodic washdowns are completed within the Site buildings, and dust volumes may have changed since the previous study. The dust volumes are also subject to change due to future cleaning programs and may be different at the time of closure. As the discussed during the August 1, 2019 meeting, cleaning methodologies of building wash downs with limited off-Site disposal of dust will be carried forward in the current study update.
- The documents do not provide details on the required electrical disconnects specific to the DAP/PAP buildings. During the existing conditions investigations, GHD noted that several areas of the Site may require electrical re-routing as part of future decommissioning activities. In particular, as part of the proposed DAP demolition, several lengths of conveyors will need to be removed (as they are supported by the DAP building) and these conveyors also support numerous electrical lines. The energy status, origin or load of these electrical lines is currently not known. In addition, GHD noted that there are several active acid lines that are attached to the acid tanks designated to remain that will require relocation prior to the demolition. During the August 1, 2019 meeting, Glencore representatives indicated that GHD is to carry design fees and relocation of electrical and acid piping in the current study update.



### *Steel Take-Offs and Credits*

- The document indicates that independent detailed quantity take offs were completed as part of the 2008/2009 Closure Plan PFS and that there were variances from previous material take offs conducted by other consultants, including structural steel quantities. However, breakdowns of these quantities are not provided in the 2008/2009 Closure Plan PFS and only an overall summary of quantities is provided for the Smelter area, BHO area and the Fertilizer Plant area. Glencore provided GHD with the breakdown of quantities provided in Conestoga-Rovers and Associates [(CRA), now GHD] Plan 2010 estimate (completed in 2007, prior to the 2008/2009 Closure Plan PFS) to determine if the previous material breakdowns could be utilized. GHD has compared the quantities in the 2008/2009 Closure Plan to CRA's Plan 2010 quantities and confirmed there are variances in the quantities. The variances and lack of quantity breakdowns were discussed with Glencore during the August 1, 2019 meeting. Glencore indicated GHD should assume the material quantities in the 2008/2009 Closure Plan are accurate and complete, and to proceed with utilizing the quantities in the current study update without completing 10% verification on the quantities.
- The 2008/2009 Closure Plan PFS identifies several cost savings opportunities in the closure concepts. However, one opportunity for a credit not identified in the previous study is the potential that the Jacquet River Pumphouse, Freshwater Pipeline and associated reservoir could be sold or turned over to a third party such as the Port. The Freshwater Pipeline and associated infrastructure supply freshwater to multiple third parties including a residential area (Townsite), a sawmill, and the Port. One or all of these entities would likely take ownership of the infrastructure in order to maintain their supply of freshwater. Glencore advised GHD to assume the freshwater supply infrastructure would not be transferred to third parties but to assume the freshwater supply infrastructure is to remain in-place and operational excluding the supply line on the Smelter site. GHD will assume the freshwater supply infrastructure will be operated by Glencore for the foreseeable but will also highlight this as a potential cost savings opportunity in the 2019 Closure Plan PFS Update report.
- The Smelter Area Memo indicates that the Acid Stack is lined with firebrick, and that the brick liner has been included in the Brick and Cinder Block take off quantities for disposal. However, based on Drawing 8031-36-4015 and on information provided by Glencore representatives, the stack is actually lined with a carbon steel liner.
- Table 2-12 of the Smelter Memo (020120-0000-4DEN-0001) includes the former 2,000,000 Litre (L) Bulk No. 2 tank for decommissioning, and the tank steel was carried in the salvageable steel quantities. This tank has since been removed by Glencore and replaced with a much smaller 80,000 L tank. GHD will adjust the quantities and credit values for the scrap metal associated with this change in infrastructure as part of the current study update.
- The BHO memo (020120-0000-4DEN-0002) indicates that conveyor quantities have been halved due to uncertainty over the decision to transfer ownership to the Port. During the August 1, 2019 meeting, Glencore representatives advised for the current study, it should be assumed the Port will not take over the BHO area in order to be conservative. As detailed breakdowns of conveyor quantities were not provided, it is not known if the closure costs and associated steel quantities account for all of the conveyors or only half of the quantities.



- The DAP & PAP memo (020120-0000-4DEN-0003) indicates that the substation copper quantity is included in the DAP& PAP quantities. However, based on observations during GHD's existing conditions investigations, the substation will need to remain active for continued operation of the BHO area, which is designated to remain following removal of the DAP & PAP buildings.
- In the Inventory of Major Pieces of Equipment memo (020120-0000-4DEN-0001), an inventory of equipment that had potential re-sale value was provided. The following items were identified to have potential resale value on the open market:
  - a) Acid Plant (\$1 to \$5 million (M) if sold while still operating)
  - b) The short rotary furnaces
  - c) 10 of the 19 Kettles (\$0.5 to \$1M)
  - d) The 2 crushers
  - e) Pouring and moulding equipment at refinery
  - f) The silver refinery could have significant resale value

This list of equipment will be reviewed as part of the current study to determine if the equipment is currently suitable for resale given an additional 10 years of depreciation value has occurred. Glencore representatives have indicated that the new Wet Electrostatic Precipitators (WESPs) that were recently installed for the Acid Plant are modular units and should be easily resold or re-located to another Glencore facility given their current condition. GHD will review with Glencore how to value these units as part of the current study update.

### *Cleaning*

- The Smelter Area memo states that further investigation on capacity and compatibility of the Smelter WWTP is required to determine if it can handle the wastewaters that will be generated as part of the cleaning operations. During the August 1, 2019 meeting, the WWTP capacity was discussed with Glencore representatives. Glencore indicated that the WWTP was designed for 90 m<sup>3</sup>/hr but has operated up to 150-200 m<sup>3</sup>/hr on occasion. Glencore also indicated surface water inputs account for approximately 30% of the volume of water being treated by the WWTP. Therefore, at shutdown, 70% of the WWTP capacity will be available for treatment of wastewater generated by facility decommissioning cleaning activities. Glencore also indicated that the WWTP has adequately handled cleaning wastewaters during historical cleaning activities. However, Glencore representatives indicated that future cleaning activities will need to be restricted during the spring melt as the WWTP is nearing capacity related to surface water run-off during this time of year. Therefore, for the current study update, GHD will assume that the Smelter WWTP is capable of treating wastewater generated during future decommissioning activities, except for works which will generate contaminants outside of the WWTP's operational design [i.e., Naturally Occurring Radioactive Materials (NORM) impacted wash water].
- The BHO memo (020120-0000-4DEN-0002) does not list quantities of dust for conveyors and transfer houses. It is anticipated that conveyors and transfer houses would have some quantifiable volume of dust requiring cleaning.
- The documents indicate that the closure concepts assume Glencore will clean all equipment and remove all greases, sludges and oils from pits, sumps, trenches, pipes, tanks and vessels prior to demolition.



Based on discussions with Glencore during the August 1, 2019 meeting, it is considered unlikely Glencore representatives would complete this work following announcement of the Site closure. As such, the current study will assume Glencore will not be conducting any cleaning activities prior to a demolition contractor arriving on-Site. Costs for a demolition contractor to complete these decommissioning cleaning activities will be carried in the updated cost estimate. During the August 1, 2019 meeting, Glencore agreed to provide GHD with a process tank inventory, an estimate of residual materials requiring handling and disposal as well as a listing of process piping requiring cleaning for inclusion in the closure study update.

### *Asbestos*

- The documents indicate that the quantities of friable asbestos containing materials (ACM) were not known during the 2008/2009 Closure Plan PFS, so a 25 % contingency was applied. During the existing conditions investigation, Glencore advised GHD that since the previous study, Glencore has developed an asbestos inventory and management plan with most of the friable ACM being removed from the Site. GHD has reviewed the current asbestos inventory documentation and it was noted that some destructive testing was not completed behind walls and inside equipment and other non-accessible areas.
- The documents indicate that friable ACM will be placed in barrels and disposed at the Brunswick Mine Site. Based on current practices, it is unknown if this will the Province will approve disposal of friable ACM at the Brunswick Mine Site.
- The documents indicate that ACM removal will need to be completed as a Type 3 removal whenever there is more than 30 ft<sup>3</sup> of ACM (friable or non-friable). Type 3 removals requires special enclosures, negative air pressure, and air monitoring amongst other mitigation measures and is significantly more costly than Type 1 removal. However, the *Code of Practice for Working with Materials Containing Asbestos in New Brunswick* only requires Type 3 (i.e., Class 3) removal procedures for friable ACM. Removal of non-friable ACM such as the exterior transite siding panels, found on many of the site buildings, would be considered as a Type 1 (i.e., Class 1) removal under the *Code of Practice for Working with Materials Containing Asbestos in New Brunswick*.

### *NORM Management*

- The DAP&PAP Memo (020120-0000-4DEN-0002) indicates that the NORM survey should be redone in an effort to establish the quantities and locations of NORM impacted materials under current conditions. GHD concurs with this recommendation to allow for a detailed review of cleaning and disposal options. The 2008/2009 Closure Plan PFS carried substantial costs for extensive cleaning of steel and debris that may be potentially NORM impacted utilizing specialized cleaning methods such as dry ice cleaning. As part of the current Scope of Work, GHD will be completing a Trade-off Study related to cleaning and disposal options of NORM impacted material. A proposed NORM survey assessment program has been submitted to Glencore under a separate cover on August 12, 2019. Quantifying soil, feedstock, building materials, and other substances that have NORM concentrations exceeding current guidelines is critical to accurately assess that most technically and financially viable remediation and/or disposal options for these materials. Based on results of Trade-off Study, GHD will discuss with Glencore the recommended



remediation/disposal alternative for NORM impacted material and other associated contingencies to be included in the 2019 Closure Plan PFS Update.

### 3. Recommendations

In addition to the items discussed in the preceding memorandum sections and during the August 1, 2019 Alternatives Evaluation Meeting, GHD recommends the following be further considered by Glencore:

- GHD recommends that Glencore consider alternate decommissioning methodologies for the large diameter piping, such as excavating, crushing, and backfilling the pipes in order to reduce the risk of ground subsidence and/or contaminant transport. Large piping decommissioning methods will be discussed further with Glencore during the current study update.
- GHD recommends including capping of all pipes/utilities at the building foundations/slabs in the current study update in order to prevent flooding and future subsidence within the building footprints. In order to determine associated costs for inclusion in the current study update, a desktop study would be required to estimate the number of pipe/utility connections and level of effort to complete the capping.
- Cleaning methodologies including building wash downs are expected to limit the requirement of off-Site disposal of dust. GHD recommends not carrying forward bulk dust volumes from the 2008/2009 Closure Plan PFS to the 2019 Closure Plan PFS Update report.
- Several lengths of conveyors will need to be removed (as they are supported by the DAP building) and these conveyors also support numerous electrical lines. The energy status, origin or load of these electrical lines is currently not known. Therefore, GHD is recommending an electrical tracing survey be completed for both DAP and PAP buildings. A separate scope of work for completion of an electrical tracing survey was submitted to Glencore on August 13, 2019.
- Glencore representatives confirmed the on-Site stack is lined with a carbon steel liner and not firebrick brick as indicated in the 2008/2009 Closure Plan PFS. GHD recommends completing a detailed quantity take-off to remove the brick liner from the concrete disposal quantities and add the steel liner to the salvageable material quantities.
- The documents are not clear if the closure costs and steel quantities for the BHO area in the 2008/2009 Closure Plan PFS include the full length or only half of conveyors. GHD recommends assuming that the overall quantities and demolition costs provided 2008/2009 Closure Plan PFS only include half of the length of conveyors, and completing additional quantity take-offs to estimate the quantities of demolition debris, recyclable materials, and demolition costs for the remainder of the conveyors.
- GHD recommends reallocating the substation copper quantity which was previously included in the DAP & PAP area to the BHO area quantities for the current study update. This substation will need to remain active with the BHO infrastructure following demolition of the DAP & PAP buildings. In addition, Glencore to confirm if the electrical lines from west side substation to main grid line are to be included in the current study.
- The documents indicate that the rail tracks would be removed by CN and credit for steel was not included in the 2008/2009 Closure Plan PFS. Based on experience, GHD recommends that



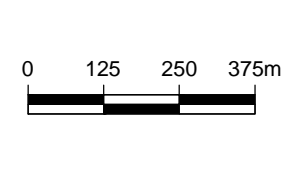


consideration should be given to including costs for the rail line removal as part of the current study update.

- GHD notes that due to their age, the transformers at the Site could have historically contained PCBs rendering the core and carcass not suitable for recycling (i.e., require cleaning/treatment). GHD recommends adding this as a potential risk item in the current study update.
- GHD recommends that quantities and associated costs for cleaning of dust within conveyors and transfer houses at the BHO be included in the current study update, as it anticipated that these structures will contain residual dust at the time of closure.
- GHD recommends the ACM removal methods and associated cost estimates be revised in accordance with the *Code of Practice for Working with Materials Containing Asbestos in New Brunswick* as part of the current study update. Specifically, non-friable ACM removal should be considered as Type 1 removal.
- The 2008/2009 Closure Plan PFS carried a 25% contingency for friable ACM abatement, as the quantity of friable ACM was not known. GHD recommends additional discussions will be required with Glencore to determine acceptable contingencies to be allocated for the remaining unidentified friable ACM.
- The documents indicate that friable ACM will be put in barrels and disposed of with demolition debris at Brunswick Mine Site. Based on current practices, it is unknown if this will be approved by the province. GHD recommends planning for friable ACM to require disposal at a licensed municipal landfill (e.g. Red Pine).
- As part of the current Scope of Work, GHD will be completing a Trade-off Study related to cleaning and disposal options of NORM impacted material. To complete the Trade-off Study, GHD is recommending a NORM Survey along with a hazardous materials inventory be completed for the Fertilizer Plant area of the Site. A proposed NORM survey assessment program has been submitted to Glencore under a separate cover on August 12, 2019.



Source: High Resolution Aerial Imagery from New Brunswick Dept of Natural Resources, Acquisition Date: 2018.



GLENCORE CANADA CORPORATION  
 BELLEDUNE, NEW BRUNSWICK  
 MEMORANDUM - 10

SITE PLAN

11198639-01  
 Oct 9, 2019

FIGURE 1



# Memorandum

Revision 1

To: Kelly Longval (Glencore) Ref. No.: 11198639

From: Troy Small (GHD) Date: October 9, 2019

cc: Bob Butler, Florian Reher, Rick Schwenger (Glencore)  
Rob Turner, Cherie Babineau, Mike Gallahue (GHD)

**Subject: Memorandum - 11**

**Review of 2009 SNC-Lavalin Brunswick Smelter Closure Plan Prefeasibility Study and Cost Estimating Report – Section 12.0 – Waste Management**

## 1. Introduction

Glencore Canada Corporation (Glencore) has retained GHD Limited (GHD) to update the 2009 Brunswick Smelter Closure Plan Prefeasibility Study (PFS) and Cost Estimating Report (also referred to as the “2008/2009 Closure Plan PFS”), which was completed by SNC-Lavalin (SNC). As part of the 2019 Closure Plan PFS Update, Glencore has requested GHD to review and validate the information presented in the 2008/2009 Closure Plan PFS in order to update the capital cost estimate for the 2019 Closure Plan PFS Update at a +/-20% accuracy for the Brunswick Smelter. The Brunswick Smelter includes the Smelter site, Material Handling West Area, and the Fertilizer Plant (collectively referred to as the “Site”; see Figure 1). A slag pile and the Jacquet River Pumphouse and associated freshwater pipeline are also part of the closure plan.

GHD has reviewed the 2008/2009 Closure Plan PFS to determine if the information presented is valid, timely and complete, and has provided recommendations to Glencore as to whether an update should be executed, where applicable. In conjunction with the document reviews, GHD completed an existing conditions investigation at the Site in July 2019 to understand Site infrastructure, identify changes that have occurred at the Site since 2008/2009 and identify any data gaps that require additional Site investigations.

Glencore requested GHD to complete a separate technical memorandum for each section of the 2008/2009 Closure Plan PFS report detailing the report review findings. This memorandum outlines the findings of GHD’s review specifically for **Section 12.0 – Waste Management** of the 2008/2009 Closure Plan PFS along with items discussed during the Alternatives Evaluation Meeting held on August 1, 2019.

## 2. Review Findings

Section 12.0 of the 2008/2009 Closure Plan PFS provided details on waste management during the closure of the Brunswick Smelter site. The Section was broken out into a short overview section followed by three separate technical memos that covered proposed strategies for management of demolition material wastes



and impacted soils during the closure activities, and proposed prefeasibility designs for an off-Site demolition debris disposal area and two special waste landfills.

In general, GHD agrees with the waste management concepts proposed but noted some concepts require additional consideration or updating. Due to infrastructure that has changed, been added or removed since the 2008/2009 Closure Plan PFS, GHD notes that revisions to the overall demolition debris quantities will be required as part of the current study update. Items that GHD considers requiring further consideration and updating along with the assumptions that have been validated by Glencore during the August 1, 2019 Alternatives Evaluation meeting are presented below.

***General Comments for the Three Technical Memorandums (Management of Demolition Wastes and Impacted Soils, Off-Site Demolition Debris Disposal Area, Off-Site Special Waste Landfills)***

- The document indicates that four types of demolition debris from the Brunswick Smelter Complex are expected to be disposed of at Brunswick Mine Site (non-impacted demolition debris (that cannot be left in place), metal-impacted demolition debris with Site-specific native heavy metals, metal-impacted demolition debris with non-native heavy metals and natural occurring radioactive material (NORM) impacted demolition debris). During the August 1, 2019 Alternatives Evaluation meeting, the concept of “non-native” metal debris was discussed and Glencore representatives indicated the concept of “non-native” metal impacted materials should be re-evaluated as part of the 2019 Closure Plan PFS Update. Glencore representatives indicated that metal impacted demolition debris present at the Site could be disposed of at the existing demolition debris open pit area of the Brunswick Mine Site. The only “non-native” material that would not be suitable for disposal at the Brunswick Mine Site is process sludge or unprocessed feedstock. The elimination of non-native metal impacted demolition debris has the potential for eliminating the design and permitting of a special waste landfill at the Brunswick Mine Site which was included in the 2008/2009 Closure Plan PFS. A special waste landfill has not previously been permitted in the Province of New Brunswick and its undertaking will require evaluation under the provincial Environmental Impact Assessment regulation. Construction of a hazardous waste landfill is also listed as a designated project under the current federal Canadian Environmental Assessment Act (2012). The requirement for a special waste landfill will be further reviewed and validated with Glencore as part of the 2019 Closure Plan PFS Update. Based on initial evaluations, there is the potential that most of the debris previously identified as non-native could be re-classified and considered acceptable for disposal in the demolition debris open pit area of the Brunswick Mine Site, eliminating the requirement for a special waste landfill for this waste stream.
- The 2008/2009 Closure Plan PFS indicates that the NORM survey should be redone in an effort to establish the quantities and locations of NORM impacted materials under current conditions. GHD concurs with this recommendation to allow for a detailed review of cleaning and disposal options. The 2008/2009 Closure Plan PFS carried substantial costs for cleaning of steel and debris that may be potentially NORM impacted utilizing specialized methods such as dry ice cleaning. As part of the current Scope of Work, GHD will be completing a Trade-off Study related to cleaning and disposal options of NORM-impacted material. A proposed NORM survey assessment program has been submitted to Glencore under a separate cover on August 12, 2019. Quantifying soil, feedstock, building materials, and other substances that have NORM concentrations exceeding current guidelines is critical to accurately



assess that most technically and financially viable remediation and/or disposal options for these materials. Based on results of Trade-off Study, GHD will discuss with Glencore the recommended remediation/disposal alternative for NORM-impacted material and other associated contingencies to be included in the 2019 Closure Plan PFS Update.

- The document indicates that “Non-native” heavy metals include any metal that actually cannot be treated by the Brunswick Mine Site Water Treatment Plant (WTP) and includes metals such thallium, arsenic and mercury. However, during the August 1, 2019 meeting, Glencore representatives indicated that the Brunswick Mine Site WTP could treat metals that would be typically associated with demolition debris from the Smelter Site. As previously indicated, the non-native materials that would not be acceptable for disposal at the Brunswick Mine Site are process sludges, residues and unprocessed feedstock. During the August 1, 2019 meeting, Glencore agreed to provide GHD with an estimate of raw bulk products and process sludge volumes likely to require alternative disposal options (not suitable for disposal the Brunswick Mine Site) along with chemical composition of material.
- The documents identify three types of potential impacted soils are present at the Site [total petroleum hydrocarbons (TPH), metals and NORM]. The guidelines governing TPH and NORM in New Brunswick have been revised since the 2008/2009 Closure Plan PFS. Specifically, the Atlantic Risk-Based Corrective Action (Atlantic RBCA) guidelines that have been adopted by New Brunswick Department of Environment and Local Government (NBDELG) for evaluating TPH were updated in 2015 and are currently under review. Health Canada updated the Canadian Guidelines for the Management of NORM in 2013. Similarly, the area of metal impacted soil present at the Site is based on Site-specific target levels (SSTLs) developed as part of a human health risk assessment completed in 2007 with the primary metal constituent being lead. Various regulatory jurisdictions have revised the approach and toxicity information specific to lead which could change the SSTLs previously developed for the Site. Although the guidelines for the three types of impacted soil have been updated since the 2008/2009 Closure Plan PFS was completed, it is not anticipated that the new regulations will have a significant impact on the overall design closure concept but the new guidelines could result in changes to overall quantities, disposal and/or cover requirements for the contaminated materials.
- The documents indicate that most of the concrete (approximately 88%) will be cleaned and acceptable for re-use as backfill on-Site with the remainder being disposed at the Brunswick Mine Site. This is a significant assumption given the anticipated cost to complete an industrial cleaning of the concrete (e.g. high pressure washing) followed by specific testing. In addition, there is only a small volume of voids that will require backfilling and the 2008/2009 Closure Plan PFS assumed that the remainder of the concrete would be crushed and used as part of the Site cover. GHD notes that it may be more economical to complete a “washdown” of the concrete for dust control during demolition followed by transport to Brunswick Mine Site demolition debris open pit without crushing the material. This was reviewed with Glencore representatives during the August 1, 2019 meeting, and Glencore representatives advised that the cleaning methodologies proposed in the 2008/2009 Closure Plan assumed complete cleaning along with swab testing, which is no longer the preferred closure concept. Glencore concurred with the GHD approach of a dust control “washdown” of the concrete and the assumption that the concrete would be considered as demolition debris suitable for disposal at the demolition debris open pit at Brunswick Mine Site. This dust control “washdown” approach for the concrete followed by disposal at the Brunswick Mine



Site will be carried forward in the current study update and the concrete disposal quantities will be adjusted.

- Overall, GHD is in agreement with the conceptual design of the special waste landfills proposed in the 2008/2009 Closure Plan PFS for the “non-native” impacted demolition debris and NORM impacted debris (double geomembrane liner). In addition, the GHD project team reviewed the suitability of the Brunswick Mine Site for potential future construction of special waste landfills in July 2019. The existing conditions evaluation indicated that a potential suitable location for construction of the special waste landfills within the Brunswick Mine Site WTP catchment area is currently available (see Figure 2). However, GHD notes that quantities of debris requiring disposal at Brunswick Mine Site are subject to change based on the assumption metal impacted concrete and other debris associated with the Smelter Site is suitable for disposal at the existing demolition debris pit of the Brunswick Mine Site. In addition, results of the NORM Trade-off study will identify the most technically viable and feasible option for disposal of NORM impacted materials. Proposed changes to design/size of landfills (if required) will be reviewed with Glencore during the current study update.
- The document indicates that independent detailed quantity take-offs were completed as part of the 2008/2009 Closure Plan PFS and that there were variances from previous material take offs conducted by other consultants, including structural steel quantities. However, breakdowns of these quantities are not provided in the 2008/2009 Closure Plan PFS and only overall summary quantities are provided for each the Smelter area, Material Handling West Area and the Fertilizer Plant area. Glencore provided GHD with the breakdown of quantities provided in Conestoga-Rovers and Associates [(CRA), now GHD] Plan 2010 estimate (completed in 2007, prior to the 2008/2009 Closure Plan PFS) to determine if the previous material breakdowns could be utilized. GHD has compared the quantities in the 2008/2009 Closure Plan to CRA’s Plan 2010 quantities and confirmed there are variances in the quantities. The variances and lack of quantity breakdowns were discussed with Glencore during the August 1, 2019 meeting. Glencore indicated for GHD to assume the material quantities in the 2008/2009 Closure Plan are accurate and complete.
- The documents indicate that all friable asbestos containing materials (ACM) will be put in barrels and disposed of with demolition debris at Brunswick Mine Site. Based on current practices, it is unknown if this will be approved by the province.

### ***Comments Specific to Technical Memorandum 020120-0000-4EEN-0003 Management of Demolition Wastes and Impacted Soils***

#### ***Waste Management***

- The documents state that tunnels will be left in place. However, in Section 11.0 of the 2008/2009 Closure Plan PFS, the documents state that the tunnels would be backfilled. Removing the top of the tunnel would likely be required to fill the tunnel with concrete debris. Therefore, for the purposes of the current study update, it will be assumed the top of the tunnel will be exposed and crushed, and then the tunnel backfilled. A cost comparison will also be investigated as part of the current study to determine whether it is more economical to remove the conveyor equipment from the tunnel or simply clean the equipment and leave it buried in the tunnel.



- Table 2-1 to Table 2-3 present inventories of copper. However, Section 11.0 of the 2008/2009 Closure Plan PFS provides lengths of electrical lines included in the infrastructure to be demolished. However, it was not clear whether these electrical lines are included in the copper recyclable tonnage. Based on discussions during the August 1, 2019 meeting, GHD will assume that copper from these lines has been included in the copper recyclable tonnages provided with the 2008/2009 Closure Plan PFS. In addition, the electrical lines from the west side substation to the main grid were not included in the previous study and the SNC memo indicates that further investigation is needed to determine if this section of line should be included. Glencore to confirm as to whether or not this section of electrical line should be included in the current study, which may affect the copper quantities listed in the 2008/2009 Closure Plan PFS.
- Table 2-1 to Table 2-3 present inventories of copper. Section 11.0 of the 2008/2009 Closure Plan PFS indicates that the substation copper quantity is included in the Diammonium Phosphate (DAP) and Phosphoric Acid (PAP) Fertilizer Plant quantities. However, based on observations during GHD's existing conditions investigations, the substation will need to remain active for continued operation of the Material Handling West Area, which is designated to remain following removal of the DAP & PAP buildings.
- Table 2-1 to Table 2-3 present inventories of steel. However, in the 2008/2009 Closure Plan PFS, it is not clear if the lengths of conveyors have been included in the steel take-offs for recycling. During the August 1, 2019 meeting, Glencore confirmed that GHD should assume that the quantities were included in the steel take-offs for recycling.
- In the 2008/2009 Closure Plan PFS, quantities of regulated materials such as photoluminescent exit signs, Ozone Depleting Substances (ODS), chemical sweep materials, lab pack or residual acids are not provided as it was assumed that hazardous and regulated materials would be removed by Glencore prior to closure. However, during the August 1, 2019 meeting, Glencore indicated to GHD that the costs to collect and remove these materials are to be included in the current study update. GHD will discuss with Glencore the estimated quantities of these materials to be assumed in the current study to determine handling and disposal costs.
- Section 11.0 of the 2008/2009 Closure Plan PFS indicates that an allowance has been included to cover lead paint flakes for 20% of the building surfaces. However, quantities of flaked lead paint requiring disposal are not included in Tables 2-1 through Table 2-3. It is not clear in the 2008/2009 Closure Plan PFS cost estimate that this item has been included, nor does there appear to be disposal costs for the lead paint scrapings. As part of the current study update, GHD will review with Glencore, whether such an allowance is required based on the new closure concept.
- Table 2-1 to Table 2-3 present inventories of Conveyor Belt that will be sent to the Brunswick Mine Site for disposal. However, during the existing conditions investigations, Glencore representatives indicated that this material currently goes to an out-of-province hazardous waste landfill for disposal. Glencore has advised GHD that the conveyor will be disposed of at the open pit demolition disposal area as part of the closure activities.
- Table 2-1 to Table 2-3 present inventories of tanks for disposal. However, Section 11.0 of the 2008/2009 Closure Plan PFS indicates that demolition includes the former 2,000,000 Litre (L) Bulk No. 2 tank for



decommissioning, and the tank steel was carried in the salvageable steel quantities. This tank has since been removed by Glencore and replaced with a much smaller 80,000 L tank. GHD will adjust the quantities and credit values for the scrap metal for this change as part of the current study update.

- Table 2-1 to Table 2-3 present inventories of steel. However, Section 11.0 of the 2008/2009 Closure Plan PFS indicates that conveyor quantities have been halved due to the uncertainty over the decision to transfer ownership to the Port of Belledune (Port). During the August 1, 2019 meeting, Glencore representatives indicated the current study update should assume the Port will not take control of the Material Handling West Area and all infrastructure will be decommissioned/demolished for conservatism. As detailed breakdowns of conveyor quantities were not provided, it is not known if the closure costs and associated steel quantities account for all of the conveyors or only half of the conveyor quantities.
- Table 2-1 to Table 2-3 present inventories of dust that require disposal off-Site at an external disposal facility. However, the cleaning methodologies proposed in Section 11.0 of the 2008/2009 Closure Plan PFS consist of washing the dust and treating the wash water at the Smelter Site WTP. With this cleaning methodology, it is anticipated that significant bulk quantities of dust will not require off-Site disposal. In addition, Glencore representatives advised GHD that periodic washdowns are completed within the Site buildings, and dust volumes likely have changed since completion of the previous study. The dust volumes are also subject to change due to future cleaning programs and may be different at the time of closure. As discussed during the August 1, 2019 meeting, cleaning methodologies of building wash downs with limited off-Site disposal of dust will be carried forward in the current study update.
- Table 2-1 indicates that the proposed decommissioning method for underground pipes is to cap the pipes at the bay side to limit contamination transport through the pipes. However, if there are cracks in the pipes/damage, this may not inhibit contaminant transport. In addition, this method does not limit the risk of subsidence. Some of the existing pipes are greater than 1.2 metres (m) in diameter and may only be buried approximately 1.2 m below grade surfaces (based on information provided by Glencore personnel). If these large diameter pipes were to collapse in the future, this could create surficial subsidence and potentially damage the cover material being proposed for the Site (see GHD technical memorandums 11198639-Memorandum-7 and 11198639-Memorandum-12). Similarly, water infiltration/exfiltration and ground subsidence may occur through the unsealed pipe voids at the foundation walls or slabs. Recommendations for decommissioning of buried piping to prevent potential subsidence and/or contaminant transport are provided in GHD's memorandum 11198639-Memorandum-10 as well as Section 3 of this memorandum.
- Residual greases, sludges and oils in pits, sumps, trenches, pipes, tanks and vessels were not specifically identified as a waste requiring removal or disposal in this section of the 2008/2009 Closure Plan PFS. However, Section 11.0 of the 2008/2009 Closure Plan PFS indicates that the closure concepts were based on the assumption that Glencore will clean all equipment and remove all associated residual product prior to demolition. Based on discussions with Glencore during the August 1, 2019 meeting, it is unlikely Glencore representatives would complete this work following announcement of the Site closure. As such, the current study will assume Glencore will not be conducting any cleaning prior to a demolition contractor arriving on-Site and costs will be carried for these decommissioning cleaning activities included disposal of associated residual waste products. During the August 1, 2019





meeting, Glencore agreed to provide GHD with a process tank inventory, an estimate of residual materials requiring handling and disposal, and listing of process piping requiring cleaning for inclusion in the closure study update.

- The documents indicate that the quantities of friable ACM were not known during the 2008/2009 Closure Plan PFS, so a 25 % contingency was applied. During the existing conditions investigation, Glencore advised GHD that following the 2008/2009 Closure Plan PFS, Glencore has developed an asbestos inventory and management plan and has removed almost all of the friable ACM. GHD has reviewed the current asbestos inventory documentation and it was noted that some destructive testing was not completed behind walls and inside equipment and other non-accessible areas, which creates a minor data gap.
- The document indicates that the rail tracks would be removed by others and credit for steel salvage was not included. Based on GHD's previous experience with local decommissioning projects, removal of the Site spur line may be Glencore's responsibility. If so, this would incur additional costs/time in the closure budget which are currently not allocated for in the 2008/2009 Closure Plan PFS.
- Table 2-1 to Table 2-3 present inventories of concrete and brick. However, Section 11.0 of the 2008/2009 Closure Plan PFS indicates that the Acid Stack is lined with firebrick, and that the brick liner has been included in the Brick and Cinder Block take off quantities for disposal. However, based on Drawing 8031-36-4015 and on information provided by Glencore representatives, the stack contains a carbon steel liner.
- During the August 1, 2019 meeting, Glencore representatives indicated that the 2019 Closure Plan PFS Update should include transportation and off-Site disposal of aboveground piles of material (process sludge, raw product, etc.), that are not suitable for disposal at the Brunswick Mine Site. Specific examples of stockpiled material not suitable for disposal at the Brunswick Mine Site would be unprocessed raw materials, imported ore and process sludge. Glencore indicated that quantities and characterization data will be provided to GHD for inclusion in the current study update for consideration of appropriate disposal requirements and costs.
- The document indicates that oil containing polychlorinated biphenyls (PCBs) is not expected to be present in on-Site transformers. During the August 1, 2019 meeting, Glencore confirmed the oil in the on-site transformers do not currently contain PCBs. However, GHD notes that due to the age of the transformers, they could have historically contained PCBs and there is potential that the transformer core and carcass material is impacted with PCBs and not viable for recycling (i.e., require cleaning/treatment).

#### *Management of Contaminated Soils*

- The remedial criteria used for evaluation of petroleum hydrocarbons and metals in soil at the Site were based on a risk assessment completed in 2007. However, as indicated in GHD memorandums 11198639-Memorandum-2 and 11198639-Memorandum-7, updated pathway specific screening values are available from Atlantic RBCA (petroleum hydrocarbons) and Nova Scotia Environment (metals) which are endorsed by the NBDELG. In addition, various regulatory jurisdictions have revised the approach and toxicity information specific to lead which could change the SSTLs previously developed for the Site. It is not anticipated that the new guidelines or target levels will have a significant impact on



the overall design closure concept but the new guidelines could result in changes to overall quantities and disposal and/or cover requirements for the contaminated materials.

- The document identified two primary areas of hydrocarbon impacted soil but due to limited soil sample results, further testing of petroleum impacted soils would be required to obtain a more accurate quantity of on-Site contamination. GHD has included assessment for petroleum hydrocarbon impacts in the hydrogeological and environmental data gap study proposed for the Site.
- The documents indicates that the main objective of environmental risk assessment was to determine the risk for adult workers. However, as indicated in GHD memorandums 11198639-Memorandum-2, 11198639-Memorandum-7 and 11198639-Memorandum-9, consideration of risk to ecological receptors from exposure to contaminants in soil, groundwater, sediment and surface water of the Belledune Point area will also be required and included in the current study.
- Similar to petroleum hydrocarbons, the characterization of NORM in soil surrounding the DAP and PAP buildings was based on Health Canada guidance developed in 2000 but this document was subsequently updated in 2011. The screening criteria for diffuse NORM in solids (including soil) is relatively unchanged between the documents but the characterization of NORM in soils surrounding the DAP and PAP buildings in 2006 and 2008 was inconclusive in determining if the soil requires risk management or remediation. The 2008/2009 Closure Plan PFS recommended a more detailed NORM characterization study be completed in the DAP and PAP area of the Site. As previously indicated, a proposed NORM survey program has been submitted to Glencore under a separate cover on August 12, 2019. Results of the survey would be used to estimate the volume of contaminated soil (if any) requiring risk management or remediation as part of the Trade-off Study to be completed as part of the 2019 Closure Plan PFS Update.
- The document indicates that PCB impacted soils may be present in the vicinity of electrical substations. GHD has included assessment for PCB impacted soils in the hydrogeological and environmental data gap study proposed for the Site.

#### ***Comments Specific to Technical Memorandum 020120-0000-41EN-0001 Off-Site Demolition Debris Disposal Area***

- The document indicates that non-impacted demolition debris (that cannot be left in place) and metal-impacted demolition debris with Site-specific metals would be disposed of in a Demolition Debris Disposal Area at the Brunswick Mine Site. As described previously in this technical memorandum, during the August 1, 2019 Alternatives Evaluation meeting, Glencore representatives indicated that non-impacted and metal impacted demolition debris present at the Site could be disposed of at the existing demolition debris open pit area of the Brunswick Mine Site, which was created during the Brunswick Mine Site closure activities (see Figure 2). Utilizing the existing open pit area would eliminate the need for design and permitting of a separate Demolition Debris Disposal Area at the Brunswick Mine Site. As such, the 2019 Closure Plan PFS Update will assume disposal of non-impacted and metal-impacted demolition debris from the Smelter Site will be in the demolition debris pit at the Brunswick Mine Site.



### *Comments Specific to Technical Memorandum 020120-0000-41EN-0002 Off-Site Special Waste Landfills*

- The document indicates that separate special waste landfills were proposed for non-native metal-impacted demolition debris as well as NORM-impacted debris. As described previously in this technical memorandum and during the August 1, 2019 Alternatives Evaluation meeting, Glencore representatives indicated the concept of “non-native” metal impacted materials should be re-evaluated as part of the 2019 Closure Plan PFS Update. The only “non-native” material that would not be suitable for disposal at the Brunswick Mine Site is process sludge, ore or unprocessed feedstock. The elimination of non-native metal impacted demolition debris has the potential for eliminating the design and permitting of a special waste landfill at the Brunswick Mine Site which was included in the 2008/2009 Closure Plan PFS.
- In addition, as part of the current Scope of Work, GHD will be completing a Trade-off Study related to cleaning and disposal options of NORM-impacted material. Based on results of Trade-off Study, the requirement for a Special Waste Landfill at the Brunswick Mine Site specifically for disposal of NORM-impacted material may be eliminated. GHD will discuss with Glencore the recommended remediation/disposal alternatives for NORM-impacted material as part of the current study. In general, GHD is in agreement with the special waste landfill preliminary design included in the 2008/2009 Closure Plan PFS. However, the existing Brunswick Mine Site WTP is not designed to treat NORM leachate and the 2008/2009 Closure Plan PFS indicates “mobile treatment units” will be required to treat leachate generated from the special waste landfills. However, the leachate potential of NORM impacted materials, applicable leachate quality criteria and design requirements of the “mobile treatment units” are currently not known or specified in the 2008/2009 Closure Plan PFS. Once the requirements for creation of special waste landfills are fully determined, GHD will review the proposed design criteria with Glencore in further detail. In addition, assessment of the leachate potential of NORM impacted material at the Smelter Site, specifically the DAP and PAP buildings, was included in the NORM survey assessment program submitted to Glencore under a separate cover on August 12, 2019.
- The 2019 Closure Plan PFS Update Request for Proposals document indicates that there has been ground settlement in the area of the No. 12 Open Pit access road, which has rendered the south side of the pit road inaccessible (with alternate route accessible). During the August 1, 2019 meeting, GHD identified that occurrences of ground settlement may inhibit regulatory approval of material disposal at the Brunswick Mine Site, particularly related to the construction of special waste landfills, as ground settlements occurring within or near engineered landfills may damage liner and/or leachate collection systems. However, Glencore representatives indicated that the existing ground settlement is located approximately 0.5 to 1.5 kilometres from the proposed landfill areas and is related to former infrastructure voids at that specific location. Glencore representatives indicated the risk of regulator disapproval of material disposal at Brunswick Mine Site specifically due to ground settlement is low. In addition, the proposed location for construction of the special waste landfills within the Brunswick Mine Site WTP catchment area was confirmed by the GHD project team in July 2019. Therefore, the occurrence of ground settlement is considered unlikely to affect the closure concepts for material disposal at the Brunswick Mine Site for the purposes of the current study update.



- The documents indicates that the proposed disposal area at Brunswick Mine Site must be within the watershed that flows to the on-Site WTP and all water (surface and groundwater) upstream of the WTP will be collected and treated by the WTP. However, the 2008/2009 Closure Plan PFS does not provide details on whether the WTP has the capacity and/or ability to treat run-off from the disposal areas, nor does the document confirm if the disposal areas are within the watershed that flows to the WTP. During the August 1, 2019 meeting, Glencore representatives indicated that the Brunswick Mine Site WTP could treat metals that would be typically associated with demolition debris from the Smelter Site, and that the proposed disposal areas are within the watershed that flows to the Brunswick Mine Site WTP. No further assessment of the Brunswick Mine Site WTP or watershed catchment area is planned as part of the current study update.

### 3. Recommendations

In addition to the items discussed in the preceding memorandum sections and during the August 1, 2019 Alternatives Evaluation Meeting, GHD recommends the following be further considered by Glencore:

- GHD recommends the requirement for a special waste landfill will be further reviewed and validated with Glencore as part of the 2019 Closure Plan PFS Update, under GHD's current Scope of Work. Based on initial evaluations, there is the potential that most of the demolition debris previously identified as non-native could be re-classified and considered acceptable for disposal in the demolition debris pit area of the Brunswick Mine Site, eliminating the requirement for a special waste landfill for this waste stream. As part of the current Scope of Work, GHD will be completing a Trade-off Study related to disposal options of NORM impacted material, which may also eliminate the requirement for a special waste landfill. To complete the Trade-off Study, GHD is recommending a NORM Survey along with a hazardous materials inventory be completed for the Fertilizer Plant area of the Site. Included with the NORM survey, GHD is recommending that leachate testing of potentially NORM impacted soil and residual product in vessels be completed to determine future special waste landfill leachate treatment requirements (if any). A proposed NORM survey assessment program has been submitted to Glencore under a separate cover on August 12, 2019.
- In addition to the NORM survey, GHD previously recommended completion of a hydrogeological study of the Site, which includes evaluation of specific data gaps identified in the 2008/2009 Closure Plan PFS such as potential areas of hydrocarbon and/or PCB impacted soil. Results of the hydrogeological study will be carried forward in the current study update to refine the volume of impacted soil requiring remediation or risk management.
- GHD recommends completing a review of the SSTLs previously developed as part of the 2008/2009 Closure Plan PFS given the changes in applicable guidance documents and standards that are currently being utilized in New Brunswick to evaluate risk to human health as well as ecological receptors (specifically Atlantic RBCA, Health Canada, Environment Canada and Nova Scotia Environment).
- Cleaning methodologies including building wash downs are expected to limit the requirement of off-Site disposal of dust. GHD recommends not carrying forward bulk dust volumes from the 2008/2009 Closure Plan PFS to the 2019 Closure Plan PFS Update report.



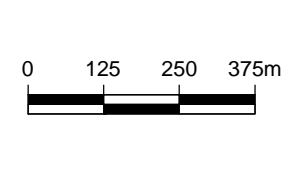
- GHD recommends that Glencore consider alternate decommissioning methodologies for the large diameter piping, such as excavating, crushing, and backfilling the pipes in order to reduce the risk of ground subsidence and/or contaminant transport. Large piping decommissioning methods will be discussed further with Glencore during the current study update.
- Glencore representatives confirmed the on-Site stack is lined with a carbon steel liner and not firebrick brick as indicated in the 2008/2009 Closure Plan PFS. GHD recommends completing a detailed quantity take-off to remove the brick liner from the concrete disposal quantities and add the steel liner to the salvageable material quantities.
- The documents are not clear if the closure costs and steel quantities for the Material Handling West Area in the 2008/2009 Closure Plan PFS include the full length or only half of conveyors. GHD recommends assuming that the overall quantities and demolition costs provided 2008/2009 Closure Plan PFS only include half of the length of conveyors, and completing additional quantity take-offs to estimate the quantities of demolition debris, recyclable materials, and demolition costs for the remainder of the conveyors.
- GHD recommends reallocating the substation copper quantity which was previously included in the DAP & PAP area to the Material Handling West Area quantities for the current study update. This substation will need to remain active with the Material Handling West Area infrastructure following demolition of the DAP & PAP buildings. In addition, Glencore to confirm if the electrical lines from west side substation to main grid line are to be included in the current study.
- The documents indicate that the rail tracks would be removed by CN and credit for steel was not included in the 2008/2009 Closure Plan PFS. Based on recent experience, GHD recommends that consideration should be given to including costs for the rail line removal as part of the current study update.
- The 2008/2009 Closure Plan PFS carried a 25% contingency for friable ACM abatement, as the quantity of friable ACM was not known. Based on the available ACM inventory, GHD recommends reducing the contingency allocated for the remaining unidentified friable ACM.
- The documents indicate that all friable ACM will be put in barrels and disposed of with demolition debris at Brunswick Mine Site. Based on current practices, it is unknown if this will be approved by the province. GHD recommends planning for all friable ACM to require disposal at a licensed municipal landfill (e.g. Red Pine).
- The occurrence of ground settlement will not likely affect the closure concepts for material disposal at the Brunswick Mine Site for the current study update, however, GHD recommends that this item be included in the project risk registry.
- GHD recommends that following completion of the hydrogeological study and NORM Trade-off Study, a meeting be held with regulators to review the proposed closure concepts [e.g., construction of special waste landfills (if required), disposal of demolition debris in the pit area, leaving impacted soil in place and placing a protective soil cover]. The objective of the meeting will be to discuss previous correspondence between Glencore and the province as well as to gain an understanding if the currently



proposed closure concepts are likely to be approved. Regulatory rejection of the proposed concepts could have a significant impact on the closure costs and planning.



Source: High Resolution Aerial Imagery from New Brunswick Dept of Natural Resources, Acquisition Date: 2018.

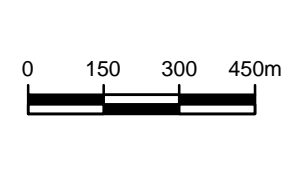
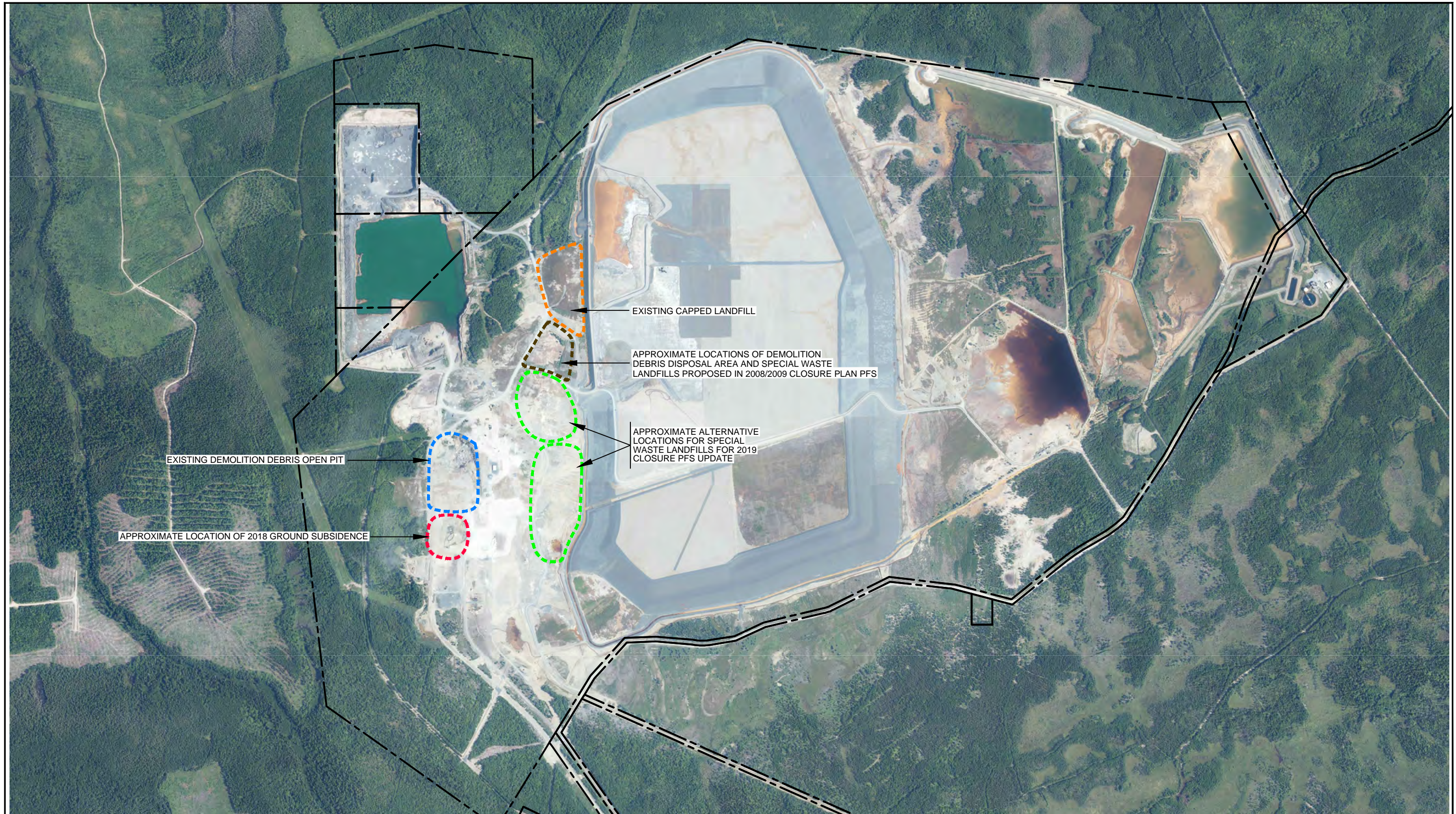


GLENCORE CANADA CORPORATION  
 BELLEDUNE, NEW BRUNSWICK  
 MEMORANDUM - 11

SITE PLAN

11198639-01  
 Oct 9, 2019

FIGURE 1



GLENCORE CANADA CORPORATION  
 BELLEDUNE, NEW BRUNSWICK  
 MEMORANDUM - 11

BRUNSWICK MINE SITE PLAN

11198639-01  
 Aug 22, 2019

FIGURE 2





# Memorandum

Revision 1

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To: Kelly Longval (Glencore) Ref. No.: 11198639

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From: Troy Small (GHD) Date: October 9, 2019

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cc: Bob Butler, Florian Reher, Rick Schwenger (Glencore)  
Rob Turner, Cherie Babineau, Mike Gallahue (GHD)

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**Subject: Memorandum-12**

**Review of 2009 SNC-Lavalin Brunswick Smelter Closure Plan Prefeasibility Study and Cost Estimating Report – Section 13.0 - Cover**

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## 1. Introduction

Glencore Canada Corporation (Glencore) has retained GHD Limited (GHD) to update the 2009 Brunswick Smelter Closure Plan Prefeasibility Study (PFS) and Cost Estimating Report (also referred to as the “2008/2009 Closure Plan PFS”), which was completed by SNC-Lavalin. As part of the 2019 Closure Plan PFS Update, Glencore has requested GHD to review and validate the information presented in the 2008/2009 Closure Plan PFS in order to update the capital cost estimate for the 2019 Closure Plan PFS Update at a +/-20% accuracy for the Brunswick Smelter. The Brunswick Smelter includes the Smelter site, Material Handling West Area, and the Fertilizer Plant (collectively referred to as the “Site”). A slag pile and the Jacquet River Pumphouse and associated freshwater pipeline are also part of the closure plan. A Site Plan is provided in Figure 1.

GHD has reviewed the 2008/2009 Closure Plan PFS to determine if the information presented is valid, timely and complete, and has provided recommendations to Glencore as to whether an update should be executed, where applicable. In conjunction with the document reviews, GHD completed an existing conditions investigation at the Site in July 2019 to understand Site infrastructure, identify changes that have occurred at the Site since 2008/2009 and identify any data gaps that require additional Site investigations.

Glencore requested GHD to complete a separate technical memorandum for each section of the 2008/2009 Closure Plan PFS report detailing the report review findings. This memorandum outlines the findings of GHD’s review specifically for **Section 13.0 – Cover** of the 2008/2009 Closure Plan PFS along with items discussed during the Alternatives Evaluation Meeting held on August 1, 2019.

## 2. Review Findings

Section 13.0 of the 2008/2009 Closure Plan PFS provided a general overview for the conceptual closure concept of placing a vegetated soil cover over heavy metal impacted soil and building foundations in the Bulk Handling Operations (BHO) area (also referred to as the Material Handling West Area), the Smelter area, the



new slag pile, and the old slag pile. The section is divided into four SNC memorandums (020120-0000-4GEN-0001 to 0003 and 020120-000-4EEN-002) that detail the design of the cover, results of a borrow search to find the granular and organic materials required for the cover, a constructability review of different covers, and a revegetation program.

In general, GHD agrees with the overall cover concept proposed but noted that some items require additional consideration as Site-specific information for several key components are now outdated and several environmental guidelines used in the 2008/2009 Closure Plan PFS have since been updated. Items that GHD considers requiring further consideration and updating along with the assumptions that have been validated by Glencore are presented below.

#### ***Memo 020120-0000-4GEN-0001, Cover Design for Smelter, BHO and Slag Pile Areas***

- The document indicates that the cover thickness will be 300 millimetres (mm), however, in several other sections of the 2008/2009 Closure Plan PFS report, the cover thickness is listed at 600 mm. As noted in GHD technical memorandum 11198669-Memo-7, this inconsistency has been reviewed with Glencore representatives during the August 1, 2019 meeting and it has been confirmed that the cover thickness is assumed to be 600 mm for purposes of the current closure study. However, it will be noted in the PFS report that the actual cover thickness developed during future detailed design phases may vary depending on elevation requirements, concentrations of contaminants in soil and future land uses for specific areas of the Site.
- The 2008/2009 Closure Plan PFS report indicated the cover area of the Smelter area is approximately 68 hectares (ha) and over 31 ha for the BHO area. Based on preliminary calculations, this area would require 594,000 cubic metres (m<sup>3</sup>) of granular fill at a 0.6 metre (m) thickness. It is noted that the SNC Borrow Material Technical Memo (020120-000-4EEN-002) indicated that the proposed borrow sources (Areas 1 and 9) had a combined capacity of 460,000 m<sup>3</sup> of granular fill as well as 120,000 m<sup>3</sup> of organic stockpile (Figure 1). Therefore, there is a potential cover shortfall (not including potential granular fill cover that may be required for the new slag pile area as described later in this memo). It is not known if the New Brunswick Department of Environment and Local Government (NBDELG) will require cover material over the low exposure land use areas. If so, this will significantly increase the cover material shortfall. Upon confirmation of the cover closure concepts proposed for 2019 Closure Plan PFS Update, GHD will confirm the required fill volumes and review potential shortfalls with Glencore.
- The area requiring cover at the Site was developed based on Site-specific target levels (SSTLs) developed as part of a human health risk assessment (HHRA) completed in 2007 with the primary metal constituent being lead. Various regulatory jurisdictions have revised the approach and toxicity information specific to lead which could change the SSTLs previously developed for the Site. If the HHRA is updated based on new guidelines / Site information, the areas exceeding SSTLs and requiring protective cover may change. Recent SSTLs for metals were developed and utilized for closure of the rail line bordering the Site in December 2018. These SSTLs could potentially be used to replace the SSTLs developed in 2008.
- During the August 1, 2019 Alternatives Evaluation Meeting, GHD identified the potential to remediate a portion of the Site adjacent to Port of Belledune lands for potential re-sale with limited land use



restrictions (excavate impacted soil from the BHO area and dispose of the soil in the Smelter area prior to covering with clean granular fill). In order to be conservative in cost allocation, Glencore requested that the 2019 Closure Plan PFS Update includes covering all areas of the Site that have metal concentrations exceeding applicable risk based screening guidelines. Similarly, Option 2 (partial cover of the BHO) presented in the 2008/2009 Closure Plan PFS report was also discussed during the August 1, 2019 meeting, and this option for soil cover will not be carried forward in the 2019 Closure Plan PFS Update.

- The cover area will need to be refined as part of the 2019 Closure Plan PFS Update (areas are shown on the attached Figure 1). The cemetery located between the BHO and Smelter Site areas to be covered in the 2008/2009 Closure Plan PFS report was not discussed (and the figures are not clear as to the cover intent by the cemetery). As noted in GHD technical memorandum 11198669-Memo-2, there are specific New Brunswick regulations for cemeteries that should be taken into consideration in the future recommended cover plan.
- The figures in the 2008/2009 Closure Plan PFS report also do not show soil cover of the Main and West electrical substations. However, soil cover is shown for the electrical substation at the BHO (Figure 1). Soil cover was not previously proposed for the Salt Water electrical substation. As noted in GHD technical memorandum 11198669-Memorandum-10, the electrical substations were to be removed as part of the 2008/2009 Closure Plan PFS. As noted above, upon confirmation of the cover closure concepts, GHD will confirm the required fill volumes and review potential borrow area shortfalls with Glencore.
- The 2008/2009 Closure Plan PFS report notes that the cover eliminates the direct contact pathway between humans and the contaminants. As noted in GHD technical memorandum 11198669-Memorandum-2, new regulatory requirements for protection of ecological receptors also have to be considered as the future final cover will include a vegetated surface that will promote ecological use of the property. In addition, risk to ecological receptors will also need to be considered in the 2019 Closure Plan PFS Update for areas that are not being covered such as Belledune Point.
- The document indicates that the cover will be placed on the old and new slag piles. The old slag pile formerly located on Belledune Point area of the Site (now the location of the salt water lagoon) has since been relocated to the new slag pile located to the south of Route 134. The areas and volumes of the cover required for the new slag pile (formerly estimated to be 15 hectares in 2008/2009) will need to be revised as part of the 2019 Closure Plan PFS Update as the new slag pile area has significantly increased since 2009. Glencore has advised GHD to assume that the area of the new slag pile that will require cover is to be based on current conditions. It is noted that Roy Consultants (Roy) prepared a conceptual closure plan in 2018 for the new slag pile area; which presents a different cover system than proposed in the 2008/2009 Closure Plan PFS.
- Rare plant species known to be present in the Belledune Point are not discussed in the SNC technical memo related to soil cover.
- Shore birds (Tern) and other migratory bird species known to be present at the Smelter Site are not discussed in the SNC technical memo. However, the presence of migratory birds could impact scheduling of the soil cover activities in some areas of the Site. For example, the ground disturbance



activities or placement of soil cover may not be permitted in known or suspected nesting areas during the nesting or breeding season (May to August).

- The slag material consists of homogeneous bead particles of fine sand size. This material is very unstable during earthworks. The existing slopes at the new slag pile are very loose, so shaping the slopes will be difficult. The 2008/2009 Closure Plan PFS proposed 2.5 H to 1 V slopes for the slag pile at closure. During the existing conditions evaluation completed in July 2019, Roy personnel indicated that investigations completed subsequent to the 2008/2009 Closure Plan PFS suggested slope stability analyses be performed and suggested slopes should be tapered and benched (AMEC report dated 2013). In 2018, Roy completed a conceptual closure plan specific to the new slag pile and recommended that final slopes be stabilized with rock fill (as was done with the tailings at the Brunswick Mine). Recommendations provided in the AMEC and Roy reports specific to closure of the new slag pile will be reviewed and incorporated in the 2019 Closure Plan PFS Update.
- The documents indicate that cover for Smelter area includes 0.1 m of crushed non-contaminated demolition debris (concrete, bricks and cinder blocks). However, as discussed in 11198639–Memo–7, it is understood that this material will be transported to the Brunswick Mine Site for disposal in the existing demolition debris pit as part of the 2019 Closure Plan PFS Update.
- The document indicates the earthen dam at the new slag pile would be removed as part of the Site closure activities. However, the sedimentation pond located directly north of the new slag pile that was created by the dam structure is now classified as a regulated wetland by the NBDELG and is subject to the *Watercourse and Wetland Alteration (WAWA) Regulation of the Clean Water Act*. As such, Glencore instructed GHD to assume the dam structure and associated regulated wetland will remain and be incorporated into the future new slag pile closure plan. Future closure activities associated with the New Slag Pile (grading and capping) will still likely require a WAWA permit as physical activities will be completed directly adjacent to or within 30 metres of the wetland. In addition, during the August 1, 2019 meeting, GHD recommended that Glencore consider creating an engineered wetland in the borrow pit area of the Site, designed to receive run-off from the covered slag pile before discharging to Chaleur Bay. Glencore representatives concurred and a conceptual plan for creation of engineered wetlands in the borrow pit area will be carried forward in the current study update.
- During the existing conditions investigation it was noted that there is a current issue with slag encroaching into the above noted regulated wetland (sedimentation pond at the new slag pile). Any future works in this area will present safety risks due to the instability of the slopes and working near water as well as requiring a WAWA permit. The encroachment of the slag into the mapped wetland boundary will likely require discussions with the NBDELG for acceptance of the final cover plan.
- The 2008/2009 Closure Plan PFS indicated the “old” slag is stable and non-leachable but still needed to be covered to prevent erosion by sea and wind. However, the old slag pile was relocated to the new slag pile and conditions at the new slag pile have changed since the 2008/2009 Closure Plan PFS. In particular, the slag generated from ore processing following closure of the Brunswick Mine Site (e.g. ore received from off-shore sources) may demonstrate different chemical or leachability properties than identified in the 2008/2009 Closure Plan PFS.



- The 2008/2009 Closure Plan PFS report notes that the final condition of the property is as an unfenced site. The SNC memo recommended a 6 ha surface drainage area network to protect the soil cover. No other cover protections were discussed in the SNC report (such as defined access routes, trespasser prevention (i.e. unauthorized use of ATVs, etc.)). These items were discussed with Glencore during the August 1, 2019 meeting, and determined the 2019 Closure Plan PFS Update will assume the Site is to remain fenced with a Site access road.
- The 2008/2009 Closure Plan PFS report does not discuss the use of an engineered soil cover as a risk management method that will likely require some amount of long monitoring by Glencore to ensure the cover retains its integrity over time (no soil erosion or other damage).

#### ***Memo 020120-0000-4GEN-0002, Borrow Investigation***

- GHD notes that soil sampling for metal analysis was not completed for proposed Borrow Area 1 along Belledune Road (Area 1, granular fill).
- This document indicates soil sampling for metal analysis (three samples TP-30, TP-124 and TP-131) was completed for proposed Borrow Area 9 (former airstrip location) in 2008. Metals were within Canadian Council of Ministers of the Environment (CCME) soil quality guidelines (SQGs); when comparing arsenic to the human health SQG of 31 mg/kg. However, surface soil samples collected from this area in 2006 (including samples G-G-21A-S1, S2 and S3) exceeded many metal SQGs; with arsenic concentrations up to 1,000 mg/kg and lead concentrations up to 30,000 mg/kg. These soil results were not presented in the SNC technical memo.
- The document indicates that wet granular material is expected to be found at the bottom of the deposits in Areas 1 and 9, near the fractured bedrock contact. Removal of fill materials from these areas may create wet areas/ponds. As noted in 11198639-Memo-7, possible creation of wetland habitat is recommended in the borrow pit area(s) for potential additional treatment of run-off from the new slag pile following closure. This concept was reviewed with Glencore representatives during the August 1, 2019 meeting and agreement confirmed with this approach.

#### ***Memo 020120-0000-4GEN-0003, Constructability Review of Soil Covers and Landfills***

- Section 2.3 of the memo indicates that a 4H to 1V slope be utilized to facilitate placement of the cover over the new slag pile. It is recommended that the proposed slope be modeled incorporating the assessed geotechnical properties. It is noted that Roy prepared a conceptual closure plan in 2018 for the new slag pile area; which presents a different cover system. Roy (2018) recommended that final slopes be stabilize with rock fill (similar to what was done with the tailings at the Brunswick Mine's site). GHD is in agreement with this recommended approach.
- Section 2.5 of this memo indicates that there is a projected organic soil shortfall by nearly 70,000 m<sup>3</sup>. This shortfall assumes the old and new slag piles were to be covered with soil. The organic soil shortfall may be reduced if the new slag pile is covered with rock. However, as noted above, there is the unknown potential of requiring additional soil cover in low exposure land use areas (such as portions of Belledune Point). Options to compensate for the organic soil shortfall could be the use of organic waste to produce organic soil material or manufactured soil from commercial producers. It is noted that



Envirem Technologies have a soil recycling facility very close to the Site and could supply large amounts of organic soil.

- Section 3.1: indicates that the “clay content of the till to be used in the cover should be measured as a high clay may indicate a high plasticity of the material which would be detrimental to the slope stability.” It is noted that high plasticity tills are not common in this region of New Brunswick.
- Section 3.2: The use of photodegradable erosion control mat may not be needed and could be potentially substituted with mulch and hydro-seeding.

#### ***Memo 020120-0000-4GEN-0004, Revegetation Program for Each of the 3 Closure Areas***

- The document notes that the revegetation program must include the definition of both the growing vegetation and the underlying organic substrate layer. The memo noted the objective is to meet CCME SQGs (1999) but does not specify for which contaminants of concern. GHD recommends that the screening objective be revised to include the risk based SSTLs and/or the Nova Scotia Department of Environment (NSE) Environmental Quality Standards (EQS) for Soils at a non-potable site (as described in GHD’s technical memo 11198639-Memo-2).
- The document recommends agronomic soil analysis of organic material, organic soil biological analysis and an evaluation of the native vegetation diversity around the Smelter Site and the need to revegetate the areas that are not planned to be covered. The memo recommends vegetation species with low root depths and known to be phyto-excluders. This item was discussed with Glencore during the August 1, 2019 meeting and determined not to be required as part of the 2019 Closure Plan PFS Update.
- The document notes preventing erosion of the underlying granular cover is required but does not describe this requirement in any detail. As noted above, the use of an engineered soil cover as a risk management method will require some amount of long monitoring by the NBDELG to ensure its integrity over time.
- The document recommends long term sampling of the cover vegetation for metal analyses and if contamination is found, vegetation will need to be harvested and disposed on an authorized site. This item was discussed with Glencore during the August 1, 2019 meeting, and consideration of bioaccumulation of metals in vegetation or long term sampling is not considered required as part of the 2019 Closure Plan PFS Update.

### 3. Recommendations

In addition to the items discussed in the preceding memorandum sections and during the August 1, 2019 Alternatives Evaluation Meeting, GHD recommends the following closure concepts for Site cover be further considered by Glencore:

- Upon confirmation of the cover closure concepts proposed for 2019 Closure Plan PFS Update, GHD will confirm the required fill volumes and will review potential cover material shortfalls with Glencore along with alternatives.
- The cover plan should include considerations for the cemetery located between the BHO and Smelter Site. Specifically, soil quality in the cemetery needs to be confirmed to determine if risk management



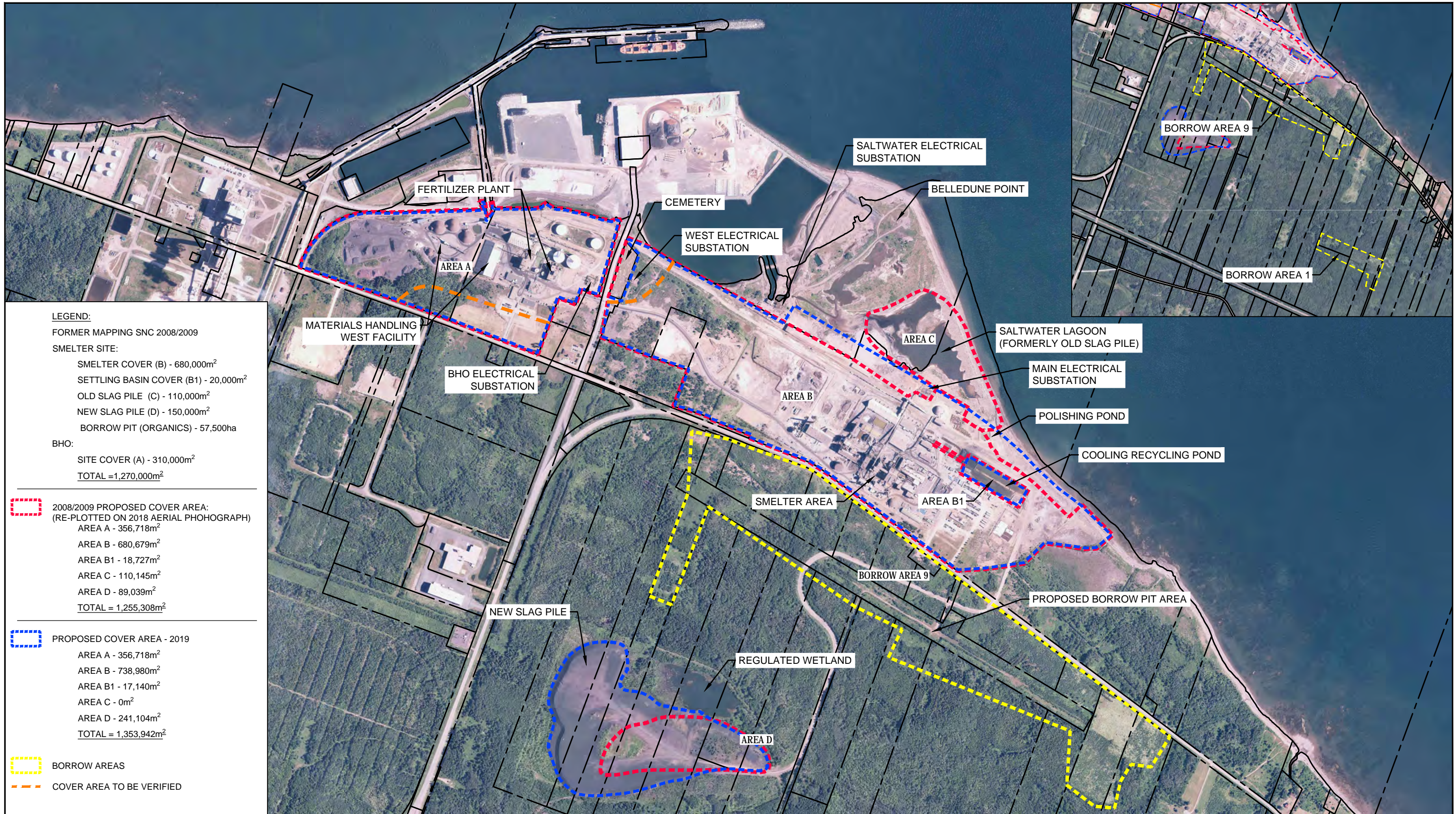
(soil cover) is required for this off-Site area. Specific mitigation measures will likely be required for conformance with the provincial Cemetery Companies Act (February 2018) if soil cover or other risk management activities are required for this off-Site area.

- The cover plan should include the three electrical substations that are planned for decommissioning/demolition as part of future Site closure activities.
- The cover plan should include considerations for rare plant species known to be present in the Belledune Point area.
- The cover plan should include considerations for shore birds or other migratory birds species known to be present at the Smelter Site as ground disturbance activities may be restricted during breeding/nesting periods in specific areas of the Site.
- GHD recommends soil quality (metal concentrations) of Borrow Area 1 be evaluated to ensure the soil is acceptable for use as cover at the Site. Similarly, elevated concentrations of metals in soil at Borrow Area 9 were identified in 2006 but not included in the 2008/2009 Closure Plan PFS. GHD recommends soil quality in Borrow Area 9 be further evaluated as part of the cover plan for the 2019 Closure Plan PFS Update to ensure this material is suitable for future use as granular cover material (i.e. potentially determine and document an exposure point concentration (EPC) in soil cover material).
- Consider the creation of an engineered wetland in the borrow pit area of the Site to receive run-off from the covered slag pile before discharging to Chaleur Bay. Glencore representatives concurred and a conceptual plan for creation of engineered wetlands in the borrow pit area will be carried forward in the current study update.
- The cover plan should include considerations for long term integrity monitoring of the cover system as this will likely be a requirement of the NBDELG for implementation of this specific risk management method.
- As the old slag pile was relocated to the new slag pile and conditions at the new slag pile have changed since the 2008/2009 Closure Plan PFS, GHD recommends assessing the quality of the “new” slag produced at the Site from off-shore ore. The purpose of the assessment is to ensure the chemical composition of the “new” slag currently being produced at the Site is stable and not leachable.

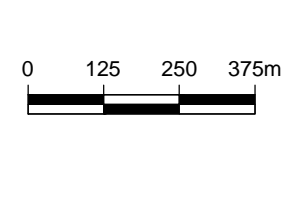


- GHD recommends that the quality objective for cover material be revised to risk based SSTLs and/or the NSE EQS for Soils at a non-potable site. New regulatory requirements for protection of ecological receptors also have to be considered as the future final cover will include a vegetated surface that will promote ecological use of the property.
- Although vegetation management is not anticipated to be required by regulators, GHD recommends adding this to the project risk registry.





Source: High Resolution Aerial Imagery from New Brunswick Dept of Natural Resources, Acquisition Date: 2018.



GLENCORE CANADA CORPORATION  
BELLEDUNE, NEW BRUNSWICK  
MEMORANDUM - 12

SITE PLAN

11198639-01

Oct 9, 2019

FIGURE 1



# Memorandum

Revision 1

To: Kelly Longval (Glencore) Ref. No.: 11198639

From: <sup>TS</sup> Troy Small (GHD) Date: October 9, 2019

cc: Bob Butler, Florian Reher, Rick Schwenger (Glencore)  
Rob Turner, Cherie Babineau, Mike Gallahue (GHD) Matthew  
Sullivan (Roy Consultants)

**Subject: Memorandum-13**

**Review of 2009 SNC-Lavalin Brunswick Smelter Closure Plan Prefeasibility Study and Cost Estimating Report – Section 14.0 – Water Management**

## 1. Introduction

Glencore Canada Corporation (Glencore) has retained GHD Limited (GHD) to update the 2009 Brunswick Smelter Closure Plan Prefeasibility Study (PFS) and Cost Estimating Report (also referred to as the “2008/2009 Closure Plan PFS”), which was completed by SNC-Lavalin. As part of the 2019 Closure Plan PFS Update, Glencore has requested GHD to review and validate the information presented in the 2008/2009 Closure Plan PFS in order to update the capital cost estimate for the 2019 Closure Plan PFS Update at a +/-20% accuracy for the Brunswick Smelter. The Brunswick Smelter includes the Smelter site, Material Handling West Area, and the Fertilizer Plant (collectively referred to as the “Site”). A Site Plan is provided in Figure 1. A slag pile and the Jacquet River Pumphouse and associated freshwater pipeline are also part of the closure plan.

GHD has reviewed the 2008/2009 Closure Plan PFS to determine if the information presented is valid, timely and complete, and has provided recommendations to Glencore as to whether an update should be executed, where applicable. In conjunction with the document reviews, GHD completed an existing conditions investigation at the Site in July 2019 to understand Site infrastructure, identify changes that have occurred at the Site since 2008/2009 and identify any data gaps that require additional Site investigations.

Glencore requested GHD to complete a separate technical memorandum for each section of the 2008/2009 Closure Plan PFS report detailing the report review findings. This memorandum outlines the findings of GHD’s review specifically for **Section 14.0 – Water Management** of the 2008/2009 Closure Plan PFS along with items discussed during the Alternatives Evaluation Meeting held on August 1, 2019.

## 2. Review Findings

Section 14.0 of the 2008/2009 Closure Plan PFS provides details on water management during the closure of the Brunswick Smelter Site. The section is subdivided into two main sections covering the scope of



surface water management after closure and the water management and infrastructures during execution of closure works. A third, supporting section provides a hydrological study update and the supporting values used in conceptual design work. The fourth and final section addressing the old slag pile erosion control will be omitted from this memorandum as the old slag pile has since been moved to the new slag pile and is no longer a part of the decommissioning work.

In general, GHD agrees with the approach and supporting hydrological data used to perform calculations but have noted several instances where the calculations results do not correspond with values that would be typically be expected based on current industry practices. In particular, several aspects of the water management plan were identified to be potentially under-designed based on current industry practices, which require additional consideration and validation in order to provide an accurate closure cost estimate. Items that GHD considers requiring further consideration and updating along with the assumptions that have been validated by Glencore are presented below.

### **Overview**

- The document indicates that the existing drainage layout at the time of the study was shown on Drawing 020120-0000-4HDD-0001. Drainage infrastructure has been modified since the completion of the 2008/2009 Closure Plan PFS, for example, the construction of a holding pond at the Bulk Handling Operations Area (BHO; also referred to as the Material Handling West Area) was completed in 2018/2019. An updated drainage layout drawing will be developed utilizing available Site drawings as part of the 2019 Closure Plan PFS Update report.

### **Comments Specific to Technical Memorandum 020120-0000-4HEN-0001 Scope of Surface Water Management after Closure**

#### **Data and Methodology**

- The document indicates that for the water management structures, the design criteria was drawn from the Design Basis technical note 020120-000-4GEN-0001-Rev. In general, the design criteria is acceptable for this type of project, however, accommodation climate change was not included in the design bases. During the August 1, 2019 meeting, Glencore representatives indicated that climate change impacts to the Site cover would be considered a risk in the Closure Project Risk Register, and will not be reviewed as part of the current closure study.
- The document indicates that water retaining structures will not remain on Site after closure. However, during the Alternatives Review meeting held on August 1, 2019, the option to create several engineered wetlands was discussed to treat surface water run-off prior to discharging to Chaleur Bay. Glencore concurred with the approach and a conceptual plan for construction of passive engineered wetlands to remain on Site after closure, specifically at the Material Handling West area, the Cooling Recycling Pond and on-Site borrow pit area (see Figure 1), will be reviewed and included in the current study update.
- The 2008/2009 Closure Plan PFS assumed the earthen dam at the new slag pile would be removed as part of the Site closure activities. However, the sedimentation pond located directly north of the new slag pile that was created by the dam structure is now classified as a regulated wetland by the New Brunswick Department of Environment and Local Government (NBDELG) and is subject to the



*Watercourse and Wetland Alteration (WAWA) Regulation of the Clean Water Act.* As such, Glencore instructed GHD to assume the dam structure and associated regulated wetland will remain and be incorporated into the future new slag pile closure plan. Future closure activities associated with the new slag pile (grading and capping) will still likely require a WAWA permit as physical activities will be completed directly adjacent to or within 30 metres of the wetland. In addition, during the August 1, 2019 meeting, GHD recommended that Glencore consider creating an engineered wetland in the borrow pit area of the Site, designed to receive run-off from the covered slag pile before discharging to Chaleur Bay. Glencore representatives concurred and a conceptual plan for creation of engineered wetlands in the borrow pit area will be carried forward in the current study update.

- Statistical precipitation or various duration and return periods were calculated and presented in this technical note and used for the calculation of all peak flows and design velocities. However, the precipitation data is ten years old, and if these values are re-calculated with current climate data, the precipitation values are likely to be 3 to 5% higher than those utilized in the 2008/2009 Closure Plan PFS, which may impact the proposed water management concepts. In addition, monthly climate normal should be adjusted to reflect the most recent temperature, precipitation and annual precipitation.

#### *Hydraulic Calculations*

- Detailed hydraulic calculations or associated assumptions were not provided in the SNC technical memorandum making it difficult to the procedures and final design values used as part of the 2008/2009 Closure Plan PFS. Future hydrological evaluations should be review, in their entirety, the SNC design values to ensure their accuracy and compliance with current industry practices.
- Due to the Site changes between 2009 and 2019, specifically the construction of the holding pond at the BHO area, a revision to the watershed modeling is recommended to ensure that the Site drainage layout is accurate. Specific layout characteristics should also be updated based on current Site conditions.
- The approach taken by SNC to assess watershed characteristics appears to account for Site conditions pre-closure (with numerous areas with impervious surfaces with high runoff characteristics) and the hydraulic calculations are not representative of proposed Site conditions after the closure (a permeable soil cover with low runoff characteristics). A comparative based approach to assess current conditions versus future Site conditions should be taken into account when calculating watersheds and assessing their independent characteristics. By omitting a comparative approach, Site features such as ditches, pipes, and ponds may be oversized or undersized for final closure conditions.
- A range of peak flow calculations is given in the 2008/2009 Closure Plan PFS between 1.8 m/s and 14.3 m/s. A peak flow of 14.3 m/s may be a typographical error in the report, as the value is extremely high for this type of Site. This value is reported for the West Diversion Ditch and supporting design information expressed under flow velocities for riprap sizing does not correspond with the type of flow being expressed. In addition, in Section 3.3 of the SNC Technical Memorandum the flow velocity for the West Diversion Ditch is reported as 3.3 m/s. This finding further supports the recommendation to review all previous hydraulic calculations in detail (if available) or to complete a new hydraulic study for future design works.



- Riprap sizing, in general, appears to be 50% below the size expected for the calculated water velocities listed in the 2008/2009 Closure Plan PFS study. However, as the velocities listed in the 2008/2009 Closure Report PFS are much higher than would be expected for the Site, the riprap may in fact be adequately sized based on surface water velocities that would be expected to occur at the Site. The method of riprap being sized for a range of velocities do not match standard practice sizing and this pattern suggests that the results obtained by SNC should be reviewed as riprap can be a significant cost on any project, depending on the quantity being placed.

#### *Drainage Modifications*

- All of the drainage interventions provided in the document were developed based on outdated climate data that is ten years old and associated hydraulic calculations. It is anticipated that values used in the 2008/2009 Closure Plan PFS are 3 to 5% below the expected rainfall values. Therefore, all drainage interventions proposed in the previous study should be re-evaluated based on revised hydraulic calculations based on the current climate data. The revised calculations may lead to additional recommendations or a reduced intervention requirements, depending on the findings.
- The document details drainage interventions for the BHO area. However, during the existing conditions evaluation completed in July 2019, it was identified that the surface water drainage and collection system in BHO area was re-configured in 2018/2019. Under current conditions, surface water in the area is gravity fed to a newly constructed holding pond and then pumped to the Smelter Water Treatment Plant (WTP). As such, the drainage interventions included in the 2008/2009 Closure Plan PFS are likely not applicable. Any intervention to the BHO area will be revised to match the existing conditions at this Site. The extensive water management upgrade at the BHO area, including construction of a holding pond in 2018/2019 will be reviewed and incorporated into any future conceptual designs at the Site as part of the current study update.
- The old slag pile located on Belledune Point was re-located to the new slag pile following completion of the 2008/2009 Closure Plan PFS. Any design that was completed to accommodate the old slag pile will not be carried forward as part of the current study update as it is no longer applicable.
- Borrow pit areas at the Site will need to be re-assessed to determine if these areas can be converted to an engineered wetland(s) for water treatment as part of the final closure plan. As discussed during the August 1, 2019 Alternatives Evaluation meeting, there is the potential the proposed borrow pit area could be converted to a wetland to treat surface water run-off from the new slag pile.

#### ***Comments Specific to Technical Memorandum 020120-0000-4HEN-0002 Water Management and Infrastructures during Execution of Closure Work***

Numerous review findings for this technical memorandum are similar to the review findings already presented in the preceding subsections of this memorandum. Items that GHD considers requiring further consideration and updating along with the assumptions that have been validated by Glencore are presented below.



### *Water Management after Closure*

- Revise the closure plan phasing based on the removal of the Fertilizer Plant buildings (DAP and PAP buildings) at the BHO area prior to decommissioning the Smelter area. With the new water management infrastructure at the BHO area, the phasing out of the BHO area should be accommodated by the infrastructure. The existing design at the BHO area is an overland drainage approach, which would be easily modified to accommodate any additional flow during or post Smelter closure.
- The document does not include accommodations for phasing the modifications to the water management infrastructure during closure activities. As part of the current study update, GHD will consider that all water management infrastructure required during the closure be phased to accommodate an efficient transition from current water management to the final water management infrastructure after closure.

### *Sequence of the Drainage System Modification*

- A complete review of the new water management infrastructure at the BHO site should be completed in order to address significant upgrades to the system between 2009 and 2019. Furthermore, the pumping system from the BHO site to Smelter site should be analyzed in detail to determine the feasibility and requirements for an upgrade to this line in order to provide the necessary water treatment during decommissioning work.
- Phasing out the Smelter site will require modifications to existing water management infrastructure. Any underground piping should be considered, for all intents and purposes, negligible and overland flow should be encouraged when phasing out infrastructure. Based on information gathered during the existing conditions evaluation completed in July 2019, the existing water collection system is damaged in many places and would require extensive cleaning/upgrades to be made operable.
- With the new infrastructure at the BHO Area, completing demolition from West to East may no longer be a specific requirement. As run-off from the BHO area is now directed to the Smelter WTP, decommissioning/closure of the BHO Area could be completed concurrently with the Smelter Site assuming the WTP remains operational for the duration of the closure project. However, the run-off from the BHO area is pumped to a drainage ditch for conveyance to the Smelter WTP and is not operable in winter conditions. Therefore, GHD will include consideration for utilizing the Acid Retention Pond for collection and trucking of decommissioning wastewater during winter conditions.

### *Water Treatment Plant Capacity during Closure Works*

- The document indicates that further investigation on capacity and compatibility of the Smelter WTP is required to determine if it can handle the wastewaters that will be generated as part of the cleaning operations. During the August 1, 2019 meeting, the WTP capacity was discussed with Glencore representatives. Glencore indicated that the WTP was designed to treat water at a rate of 90 m<sup>3</sup>/hr but has operated up to 150-200 m<sup>3</sup>/hr on occasion. Glencore also indicated surface water inputs account for approximately 30% of the volume of water being treated by the WTP. Therefore, at shutdown, 70% of the WTP capacity will be available for treatment of wastewater generated by facility decommissioning cleaning activities. Glencore also indicated that the WTP has adequately handled cleaning wastewaters



during historical cleaning activities. However, Glencore representatives indicated that future cleaning activities will need to be restricted during the spring melt as the WTP is nearing capacity related to surface water run-off during this time of year. Therefore, for the current study update, GHD will assume that the Smelter WTP is capable of treating wastewater generated during future decommissioning activities, except for works which will generate contaminants outside of the WTP's operational design [i.e., Naturally Occurring Radioactive Materials (NORM) impacted wash water].

- The Critical Scenario should be reviewed based on the new infrastructure associated with the BHO area and surface water drainage configuration.
- Normal Conditions should be revised to match the latest climate and precipitation data which will be revised as part of the 2019 Closure Plan PFS Update. Further revisions should be made to address additional water arriving to the WTP from the BHO area without being stored. With the adjustment to hydrological data, assumptions and statements should be confirmed.

#### ***Comments Specific to Technical Memorandum 020120-0000-4HEN-0003 Hydrological Study***

In addition to review findings already presented in the preceding subsections of this memorandum, items that GHD considers requiring further consideration and updating along with the assumptions that have been validated by Glencore are presented below.

#### ***Data and Methodology***

- The document indicates that the study used daily precipitation data available near Belledune for a period between 1967 and 2007 provided by Environment Canada. However, Environment Canada now provides daily precipitation data up to 2019. All data available since the previous study was completed should be included in the current study to ensure the most accurate and representative climate data is being analyzed for water management purposes.
- The document indicates the study used Intensity-Duration-Frequency (IDF) curves for the period between 1959 and 2001; however, Environment Canada now provides IDF curve information for the period between 1959 and 2013. All IDF curves available since the previous study will be utilized in the hydrologic study update.

#### ***Climatological Data***

- The document indicates that the two climate stations in Charlo, NB were combined to produce 39 valid years of data collected between 1967 and 2008. There is an additional 10 years of data available from Environment Canada for the Charlo Auto station, which should be incorporated in the hydrologic study update to have the longest data set possible to carry out a representative statistical analysis.
- The List of Climatological Stations provided in Table 2-2 in the 2008/2009 Closure Plan PFS is outdated. A preliminary draft of the updated List of Climatological Stations for inclusion in the current study update is presented below:



**List of Climatological Stations (Revised August 2019)**

Climatological Station		Distance (km)	Location			Period of Available Data	Valid Years
No	Nom		Latitude N	Longitude O	Elevation (m)		
<b>Brunswick Smelter (Belledune)</b>							
-	<b>Belledune (combined)</b>	0	47°54,0'	65°49,8'	7,6	1971-2002	23
8100880	Belledune	0	47°54,0'	65°49,8'	7,6	1971-1990	17
8100885	Belledune CS	0	47°54,0'	65°49,8'	7,6	1991-2002	6
-	<b>Charlo (combined)</b>	31	47°58,8'	66°19,8'	42,0	1967-2018	49
8100880	Charlo A	31	47°58,8'	66°19,8'	42,0	1967-2003	35
8100885	Charlo Auto	31	47°58,8'	66°19,8'	42,0	2003-2018	14
<b>Brunswick Mine 12</b>							
8103500	Nepisiguit Falls	11	47°24,0'	65°46,8'	106,1	1922-2006	+80

*Hydrometeorological Conditions*

- The current study method uses climate normals obtained from Environment Canada for the period between 1971 and 2000. Currently, Environment Canada also provides climate normals for the period between 1981 and 2010. The most recent climate normals should be used for a more accurate representation of the recent climate in the Belledune area. Climate normals are not available for the Belledune station for the period between 1981 and 2010, however, the previous study utilized the Charlo A station data where the Belledune station data has been unavailable. Therefore, the Charlo A station climate normals should be representative of the Belledune area. A preliminary draft table and figure of the most recent climate normals available from Environment Canada for inclusion in the current study update is presented below :

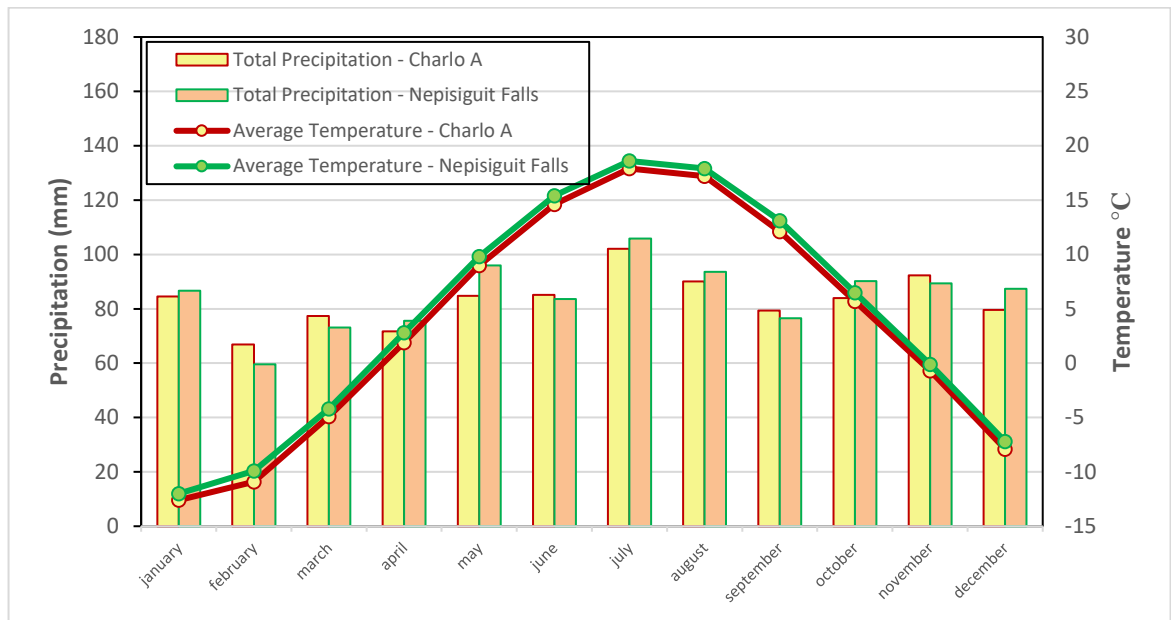




**Precipitations and Temperatures Monthly Normals – Stations Charlo A and Nepisiguit Falls  
(Revised August 2019)**

Monthly Climate Normals (Environment Canada, ref. 1)														
	unit	Months												Year
		Jan.	Feb.	Mar.	Apr.	May	June	Jul.	Aug.	Sept.	Oct.	Nov.	Dec.	
Charlo A (8100880)														
Daily Average Temperature	°C	-12.6	-10.9	-4.9	1.9	9.0	14.6	17.9	17.2	12.1	5.7	-0.7	-7.9	-
Total Precipitation (snow and rainfall)	mm	84.5	66.9	77.4	71.7	84.8	85.1	102.1	90.1	79.3	84.0	92.3	79.6	997.6
Monthly Percentage of annual Precipitation	%	8.5	6.7	7.8	7.2	8.5	8.5	10.2	9.0	7.9	8.4	9.3	8.0	100
Nepisiguit Falls (near Brunswick Mine 12) (8103500)														
Daily Average Temperature	°C	-12.0	-9.9	-4.2	2.8	9.8	15.4	18.6	17.9	13.1	6.5	-0.1	-7.2	-
Total Precipitation (snow and rainfall)	mm	86.6	59.6	73.1	75.6	96.0	83.6	105.8	93.6	76.5	90.2	89.4	87.4	1017.3
Monthly Percentage of annual Precipitation	%	8.5	5.9	7.2	7.4	9.4	8.2	10.4	9.2	7.5	8.9	8.8	8.6	100

**Precipitation and Temperature Monthly Normals – stations Charlo A (8100880) and Nepisiguit Falls (8103500) (Revised August 2019)**





- In the 2008/2009 Closure Plan PFS, the average annual precipitation of the complete Belledune data set, the annual climate normal for yearly precipitation for Belledune, and the annual precipitation value were compared to data provided by the Hydrological Atlas of Canada (Atlas) to ensure the calculated values are in the same order of magnitude as listed in the Atlas. For consistency, GHD will compare the updated climate normal and average annual precipitation to the Atlas to ensure the values are in the same order of magnitude.

*Summer-Fall Rainfall Events*

- Based on new, available data, the Charlo A station should be updated and based on 54 years of data (from 1959 to 2013) to include the most recent information provided by Environment Canada. New IDF values for the Belledune area will need to be calculated from the updated data set using the Gumbel distribution expression, as proposed in the *Frequency and Risk Analyses in Hydrology* used in the 2008/2009 Closure Plan PFS. Alternatively, the new IDF methodology available to update IDF curves could be applied in this area to produce more accurate results specific to the Belledune area and not rely on data from the Charlo area, approximately 50 km away, to normalize and calibrate the IDF curves.
- The Precipitation for Durations up to 24 hours data will need to be updated to include the new IDF values calculated from the extended data set. A preliminary draft of the updated Precipitation for Durations up to 24 hours for inclusion in the current study update is presented below:

**Precipitation for Durations up to 24 hours (Revised August 2019)**

Duration	Mean X	Standard Deviation S	Precipitation (mm) for the Return Period					
			2 years	5 years	10 years	25 years	50 years	100 years
<i>K Factor</i>			-0.164272	0.7194574	1.3045632	2.0438459	2.592288	3.1366806
5 min	5.8	2.4	5.4	7.5	8.9	10.6	11.9	13.2
10 min	8.3	3.7	7.7	11.0	13.1	15.8	17.8	19.8
15 min	10.1	4.4	9.4	13.3	15.9	19.2	21.6	24.0
30 min	13.0	5.5	12.1	16.9	20.1	24.2	27.2	30.2
1 hr	16.2	6.3	15.2	20.7	24.4	29.1	32.5	35.9
2 hr	21.5	8.8	20.0	27.8	32.9	39.4	44.2	49.0
6 hr	34.9	15.7	32.3	46.2	55.3	66.9	75.5	84.1
12 hr	44.9	17.2	42.1	57.3	67.3	80.1	89.5	98.8
24 hr	55.0	18.6	51.9	68.4	79.3	93.0	103.3	113.4

- A new statistical analysis will need to be carried out on the maximum annual values of the updated daily precipitation data set. The previous study used the Ajuste2 software developed by INRS-eau in 1995 for the statistical analysis in order to obtain precipitation values for various return periods. The software used 5 different distributions (Normal, Log Normal, Gumbel, General Extreme Value and Log Pearson type III) for comparison, and retained the Gumbel distribution since it offered the best fit for return periods from 2 to 100 years. A new comparison with the updated data set should be completed in order to determine if the Gumbel distribution is the most fitting analysis for return periods from 2 to 100 years. The option of using newer methods would also be applicable and readily available for application. The



data for Precipitation for Various Durations and Returns Periods presented in Table 4-2 in the previous study would require an update to include the new precipitation values determined from the statistical analysis for various durations and return periods.

- The data for Adopted Statistical Precipitations presented in Table 4-3 and Figure 4-1 in the previous study should be updated. The information should include the updated statistical precipitation values for various return periods based on the daily precipitation data, and the updated precipitation values based on the extended IDF curve values.
- The Summer-Fall Rainfall Hyetographs and Summer-Fall Rainfall Cumulative Hyetographs presented as Figures 4-2 and 4-3 in the previous study should be updated, as these are based on the outdated Adopted Statistical Precipitations.
- The 24-hour duration summer-fall Probable Maximum Precipitation (PMP) for the Belledune area will need to be recalculated based on the updated precipitation data.
- The Rainfall Amounts at Belledune for Various Duration of PMP presented as Table 4-4 and Figure 4-4 in the previous study should be updated, as these are based on the outdated Adopted Statistical Precipitations.

### 3. Recommendations

As presented above in this memorandum, data gaps were identified in Section 14.0 of the 2008/2009 Closure Plan PFS with the following recommendations as part of the 2019 Closure Plan PFS Update:

- The hydrology and hydraulic data used to develop the proposed water management concepts for the 2008/2009 Closure Plan PFS are ten years old and outdated. Climate data has changed (with an expected 3 to 5% increase in precipitation) and Site infrastructure has been modified (including an extensive transformation of the drainage system at the BHO area in the past two years). Therefore, GHD is recommending updated hydrology and hydraulic studies be completed for the Site, with a specific focus on confirmation of predicted water velocities that determine appropriate riprap sizing and updating the post-closure Site characteristics to permeable soil cover conditions.
- Alternatively, the updated hydraulic and hydrologic studies could be delayed until the Feasibility Engineering stage and added to the risk register, as engineered wetlands are now being considered in the conceptual closure plans for the Site and detailed designs of the wetlands (i.e., wetland elevations, inlets, outlets, etc.) would be required for inclusion in the hydraulic study. Depending on the wetland design, modifications to drainage ditch sizing and layouts may be required for the post-closure water management interventions proposed in the current study update. If updates to the hydraulic and hydrologic studies are not completed as part of the 2019 Closure Plan PFS Update, GHD will carry forward the riprap sizing specified in the 2008/2009 Closure Plan PFS as part of the current study update and add this item to the risk register.
- With climate change at the forefront of most water management decisions, at a minimum, climate change should be addressed within this section of the report. Completing a rough comparison between current conditions and future data could identify critical areas within the Water Management concept



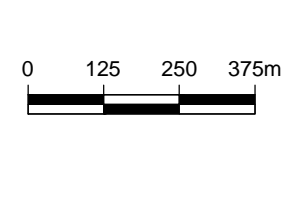
susceptible to climate change and would be addressed in future design. During the August 1, 2019 meeting, Glencore representatives indicated that climate change impacts to the Site cover would be considered a risk in the Closure Project Risk Register, and will not be reviewed as part of the current closure study.

GHD recommends the following be considered at the time of completion of the updated hydraulic and hydrological studies:

- Any additional precipitation data available from Environment Canada for the Charlo Auto station since the completion of the previous study should be incorporated in the updated studies, as it is ideal to have the longest data set possible to carry out a representative statistical analysis.
- The IDF curves available from Environmental Canada should be updated. By extending the data set, a more representative summer-fall rainfall hyetograph can be generated. The new IDF values for the Belledune area should be calculated from the updated data set using the Gumbel distribution expression, as proposed in the Frequency and Risk Analyses in Hydrology. In addition, Western University has recently developed a computerized web-based tool for calculating IDFs. GHD recommends using this tool over the Gumbel distribution utilized in the 2008/2009 Closure Plan PFS as the computerized tool will produce IDF curves that are based on a combination of climate modeling outputs as locally observed weather data.
- Updated climate normals available from Environment Canada should be utilized in the updated studies. Since climate is continuously changing, using the most recent data available will provide a better representation of the current climate in the Belledune area.
- A new statistical analysis should be carried out on the maximum annual values of the updated daily precipitation data set. The 2008/2009 Closure Plan PFS used the Ajuste2 software developed by INRS-eau in 1995 in order to obtain statistical precipitation values for various return periods. A new comparison with the updated data set should be completed in order to determine if the Gumbel distribution is the most fitting analysis for return periods from 2 to 100 years.
- All Tables and Figures would need to be updated to include values calculated based on the extended daily precipitation data sets, and the extended maximum annual precipitation for different durations data set.



Source: High Resolution Aerial Imagery from New Brunswick Dept of Natural Resources, Acquisition Date: 2018.



GLENCORE CANADA CORPORATION  
 BELLEDUNE, NEW BRUNSWICK  
 MEMORANDUM - 13

SITE PLAN

11198639-01

Oct 9, 2019

FIGURE 1



# Memorandum

Revision 1

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To: Kelly Longval (Glencore) Ref. No.: 11198639

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From: <sup>TS</sup> Troy Small (GHD) Date: October 9, 2019

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cc: Bob Butler, Florian Reher, Rick Schwenger (Glencore)  
Rob Turner, Cherie Babineau, Mike Gallahue (GHD)

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**Subject: Memorandum - 14**

**Review of 2009 SNC-Lavalin Brunswick Smelter Closure Plan Prefeasibility Study and Cost Estimating Report – Section 15.0 – Long Term Water Quality**

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## 1. Introduction

Glencore Canada Corporation (Glencore) has retained GHD to update the 2009 Brunswick Smelter Closure Plan Prefeasibility Study (PFS) and Cost Estimating Report (also referred to as the “2008/2009 Closure Plan PFS”), which was completed by SNC-Lavalin. As part of the 2019 Closure Plan PFS Update, Glencore has requested GHD to review, validate, and update the information presented in the 2008/2009 Closure Plan PFS in order to update the capital cost estimate for the 2019 Closure Plan PFS Update at a +/-20% accuracy for the Brunswick Smelter, including the Smelter site, Material Handling West Area, and the Fertilizer Plant (collectively referred to as the “Site”). A slag pile and the Jacquet River Pumphouse and associated freshwater pipeline are also part of the closure plan.

GHD has reviewed the 2008/2009 Closure Plan PFS to determine if the information presented is valid, timely and complete, and has provided recommendations to Glencore as to whether an update should be executed, where applicable. In conjunction with the document reviews, GHD completed an existing conditions investigation at the Site in July 2019 to understand Site infrastructure, identify changes that have occurred at the Site since 2008/2009 and identify any data gaps that require additional Site investigations.

Glencore requested GHD to complete a separate technical memorandum for each Section of the 2008/2009 Closure Plan PFS report detailing the report review findings. Therefore, this memorandum outlines the findings of GHD’s review specifically for **Section 15.0 – Long Term Water Quality** of the 2008/2009 Closure Plan PFS along with items discussed during the Alternatives Evaluation Meeting held on August 1, 2019.

## 2. Review Findings

Section 15.0 of the 2008/2009 Closure Plan PFS provided information on long term water quality and discusses the potential for long-term contamination of groundwater and surface water following closure of the Site.



In general, GHD agrees with the information presented but notes that some concepts require additional consideration as Site-specific information for several key components are now outdated. The purpose of the 2008 technical note 020120-0000-4EEN-0004 was “to provide early information on potential long-term contamination of groundwater and surface water following closure of the Brunswick Smelter...”

The following items that require consideration for updating or validation as part of the 2019 Closure Plan PFS Update:

### *Criteria and Standards*

- As noted in GHD’s technical memorandum 11198639-Memorandum-2, several environmental guidelines used in the 2008/2009 Closure Plan PFS have been revised. Various regulatory jurisdictions have also revised the approach and toxicity information specific to lead (Pb) which could change the site-specific target levels (SSTLs) previously developed for the Site. In addition, SSTLs for zinc were not carried forward in the 2008/2009 Closure Plan PFS.
- The New Brunswick Department of Environment and Local Government (NBDELG) also recently adopted the Environmental Quality Standards (EQS) developed by the Nova Scotia Department of Environment (NSE) for evaluating metals in soil, sediment, groundwater and surface water. In particular, the NSE guidelines specify screening values for metals in groundwater that have the potential to discharge to a surface water body (freshwater or marine). This change in environmental screening is a significant shift from the assumption included in the 2008/2009 Closure Plan PFS. The old slag pile area located on Belledune Point was rehabilitated to become a salt water lagoon as outlined in the Belledune Point Rehabilitation Plan Final Report (dated September 2013). The rehabilitation plan was developed in collaboration with several federal/provincial agencies including New Brunswick Department of Environment and Local Government (NBDELG), Department of Fisheries and Oceans (DFO), Canadian Wildlife Service and Department of Energy and Mines. In addition, the Belledune Point rehabilitation work was completed in accordance with an Approval to Construct I-7784 issued by the NBDELG. In 2012, Atlantic RBCA implemented an ecological screening protocol for contaminated sites that has been adopted by NBDELG as part of the provincial Guideline for the Management of Contaminated Sites. Under this protocol, it is likely that the Belledune Point area and salt water lagoon created by the relocation of the old slag pile would be considered ecological habitat potentially requiring additional evaluation of contaminants in soil, surface water or sediment with respect to risk to ecological receptors. Based on information provided in the Belledune Point Rehabilitation Plan Final Report along with results of the Marine Ecological Risk Assessment of Brunswick Smelter completed by Intrinsik which includes the shoreline of Belledune Point (report dated October 30, 2015), it is assumed that additional rehabilitation works of Belledune Point will not be required as part of future Facility closure activities. As such, GHD recommends carrying this item forward in the risk registry for the current study update. In addition, as part of the proposal for the hydrogeological study of the Site, confirmation of environmental conditions at Belledune Point and the salt water lagoon, including sampling of soil, sediment and surface water in the lagoon, were proposed and submitted to Glencore under separate cover. Results of the confirmatory sampling will be carried forward in the current study update.



### *Available Information Sources and Data*

- The document indicates that the water and soil data available for the Site is based on data collected before 2009. During the August 1, 2019 meeting, Glencore indicated that groundwater monitoring at the Site has been on-going with the most recent groundwater monitoring event completed in the spring of 2019. In addition, surface water quality monitoring of various conveyance ditches and discharge locations is on-going as part of the current Approval to Operate. The analytical data collected during the most recent water monitoring programs will be provided to GHD for inclusion in the 2019 Closure Plan PFS Update.

### *Review of Available Data - Surface Water*

- The document indicates that surface water at the Material Handling West Area is discharged to the Chaleur Bay via a drainage ditch or directed to the Bulk Pond (see Figure 1). However, during the existing conditions evaluation completed in July 2019, it was identified that the surface water drainage and collection system in this area of the Site was re-configured in 2018. Under current conditions, surface water in the area is gravity fed to a newly constructed holding pond and then pumped to the Smelter Water Treatment Plant (WTP). As such, the surface water data included in the 2008/2009 Closure Plan PFS is likely not representative of current conditions. An overview of the changes to the water management system, specifically the Bulk Handling West Area, is provided in GHD memorandum 11198639-Memo-13.
- As noted in the 2019 Closure Plan PFS Update Request for Proposal documents, Glencore has identified that the environmental conditions for the Back 40 area, north of the Acid Plant, as a significant cost and regulatory risk item and requested a review of the hydrogeological model and sampling program for the Back 40 area. This risk is consistent with the 2008/2009 Closure Plan PFS which indicates further study is required to evaluate the potential for groundwater entering the surface water collection system, its impact on surface water quality during the dry and wet seasons and treatment requirements. Therefore, GHD has provided Glencore with a separate proposal for conducting a hydrogeological study for the Site which includes sampling specific surface water collection systems and evaluating potential groundwater discharge to surface water.
- A significant assumption of the 2008/2009 Closure Plan PFS is that surface water collected at the Site will be suitable for direct discharge into Chaleur Bay. However, as metal impacted soil is to be covered and remain on-Site, there is the potential surface water run-off generated post-closure is not suitable for direct discharge into the bay. During the Alternatives Review meeting held on August 1, 2019, the option to create several engineered wetlands was discussed to treat surface water run-off prior to discharging to Chaleur Bay. Glencore concurred with the approach and a conceptual plan for construction of passive engineered wetlands, specifically at the Material Handling West area, the Cooling Recycling Pond and on-Site borrow pit area (see Figure 1), will be reviewed and included in the current study update.

### *Review of Available Data - Soil*

- As noted above, the soil quality data was based on risk to human health but evaluation of risk to ecological receptors will also be required for specific areas of the Site such as Belledune Point as well as specific contaminants of concern such as zinc.





- The documents indicate that there were elevated concentrations of various metals at the old slag pile. However, the old slag pile has since been relocated to the new slag pile and the old slag pile area was converted to a salt water lagoon. The current conditions in the salt water lagoon are not currently known, but assessment of soil, sediment and surface water in the salt water lagoon area is included as part of the proposed hydrogeological study for the Site.
- Limited soil leachate testing was previously completed at localized areas of the Site using three laboratory methods. Potential leachate generating soils (zinc and cadmium) were generally limited to the old coke fines storage area. Due to the limited leachate testing previously completed, GHD has included soil leachate analysis as part of the proposed hydrogeological evaluation for the Site to confirm existing conditions.
- The document identifies soil in several areas of the Site that have the potential to generate metal leachate that could negatively impact groundwater. The 2008/2009 Closure Plan PFS indicates that these areas with leachable metals in soil (approximately 5,650 m<sup>3</sup>) would be excavated for disposal at the Brunswick Mine Site. GHD agrees with this provision and assumes the soil would be disposed of in the demolition debris pit at the Brunswick Mine Site based on the information provided during the August 1, 2019 Alternatives Evaluation Meeting.

#### *Review of Available Data - Groundwater*

- The document indicates that the applicable criteria for groundwater was not determined at the time of the 2008/2009 Closure Plan PFS. However, the NBDELG has recently adopted the NS EQS for evaluating groundwater under various exposure scenarios (potable water, groundwater discharge to an aquatic receptor, shallow groundwater exposure, etc.) and these standards will be used in the 2019 Closure Plan PFS Update for screening purposes.
- For purposes of the 2008/2009 Closure Plan PFS, it was assumed that the groundwater was not impacted with radioactivity. However, past testing of groundwater for radionuclides in the Fertilizer Plant area was not conclusive and remains a data gap. GHD concurs with the recommendation in the 2008/2009 Closure Plan PFS that the previous NORM characterization survey at the DAP/PAP should be repeated and/or expanded to gain an understanding of current conditions.
- The documents do not discuss groundwater impacted with petroleum hydrocarbons, which is known to be present in several locations of the Site. For example, Glencore representatives advised GHD that diesel-impacted soil was observed during an exploration trench dug near the cooling pipe area of the Site. GHD has proposed testing for petroleum hydrocarbons in groundwater as part of the recommended hydrogeological study at the Site.
- The documents do not provide recommendations for addressing contaminated groundwater encountered at the Concentrate Storage Area or Battery Plant. GHD has included assessment of groundwater conditions near these areas as part of the hydrogeological study at the Site. Recommendations on addressing contaminated groundwater in various areas of the Site (if required) will be included in the current study update.
- The 2008/2009 Closure Plan PFS assumes that three collecting wells will be installed in the vicinity of the sulphuric acid tanks in the Bulk Handling West area, and three collecting wells will be installed in the



Smelter area to pump contaminated groundwater to the Smelter WTP. However, the documents indicated that the long-term fate of groundwater contamination should be evaluated further in a dedicated hydrogeology study. GHD concurs with this statement and the recommended hydrogeological study at the Site includes collection of data likely to be required for investigating future groundwater collection and treatment systems at the Site (if required).

- The documents indicated that off-site groundwater delineation work has not been undertaken. It is noted that the hydrogeological study proposed for the Site includes assessment of potential off-Site impacts through groundwater.

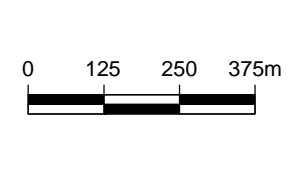
### 3. Recommendations

As described above in this memorandum, data gaps were identified in Section 15.0 of the 2008/2009 Closure Plan PFS with the following recommendations as part of the 2019 Closure Plan PFS Update:

- Existing environmental conditions at the Back 40 area has been identified as a significant risk by Glencore. In addition, review of existing conditions at Belledune Point and the salt water lagoon created from the old slag pile is recommended as part of the 2019 Closure Plan PFS Update. Completion of a hydrogeological study of the Site, which includes evaluation of environmental conditions at the Back 40 area, other areas of environmental concern, Belledune point and the salt water lagoon, was previously recommended and the additional scope of work has been approved by Glencore. Results of the hydrogeological study will be carried forward in the current study update.
- GHD is recommending a NORM Survey, including groundwater sampling, along with a hazardous materials inventory be completed for the Fertilizer Plant area of the Site. Quantifying soil, feedstock, building materials, and other substances that have NORM concentrations exceeding current guidelines is critical to accurately assess that most technically and financially viable remediation and/or disposal options for these materials. A proposed NORM survey assessment program has been submitted to Glencore under a separate cover on August 12, 2019.
- GHD notes that based on the results of the hydrogeological study for the Site, GHD recommends the development of risk based SSTLs for groundwater on-Site. Since potable water is supplied from an off-Site source, it is assumed the focus of the screening levels will be for protection of ecological receptors. GHD notes that the timing for the development, and approval by the NBDELG, of risk based screening levels is beyond the scope of the 2019 Closure Plan PFS Update and therefore assumptions will need to be made as part of the current study update.
- With respect to Long Term Water Quality, GHD recommends that a plan to convert key monitor wells (MWs) to long term sentinel wells across the Site and proper decommissioning of other MWs be considered as part of the 2019 Closure Plan PFS Update. Similarly, future surface water monitoring points should be established based on the findings of the 2019 field programs (and past studies) as well as the surface drainage network within the soil cover design.
- Based on the results of the hydrogeological evaluation, GHD recommends that the requirement for and functionality of a long-term groundwater collection and treatment system be evaluated.



Source: High Resolution Aerial Imagery from New Brunswick Dept of Natural Resources, Acquisition Date: 2018.



GLENCORE CANADA CORPORATION  
 BELLEDUNE, NEW BRUNSWICK  
 MEMORANDUM - 14

SITE PLAN

11198639-01

Oct 9, 2019

FIGURE 1

# Appendix B

## Hydrogeological Study and Data Gap Assessment Report (2019)

[\(Link to Appendix B\)](#)

Appendix C  
NORM and Hazardous Material Survey  
Report (2019)

[\(Link to Appendix C\)](#)

# Appendix D

## Site Photographs



Photo #1: Looking at SRF Building from inside the Refinery.



Photo #2: One of two Short Rotary Furnaces.



Photo #3: Refinery Building.



Photo #4: Inside view of the Refinery.



Photo #5: View of the Furnace Building.



Photo #6: Bottom level of the Furnace Building.



Photo #7 View of the Metal Storage Building.



Photo #8: Inside view of the Metal Storage Building.



Photo #9: View of underneath Sinter Plant.



Photo #10: View of the top of Sinter Plant.



Photo #11: View of the Silver Refinery.



Photo #12: Inside view of Silver Refinery.





Photo #13: Exterior view of the Crusher Building.



Photo #14: Bottom of the Crusher Building.



Photo #15: View of the Charge Preparation Building.



Photo #16: View of the bottom of Charge Preparation Building.



Photo #17: View of the Acid Plant.



Photo #18: Interior view of the Acid Plant.



Photo #19: Bottom view of the Sinter Baghouse.



Photo #20: Bottom view of the Furnace Baghouse.



Photo #21: Front view of plant with Sinter Baghouse and Furnace Baghouse.



Photo #22: Inside view of the Maintenance Shop.



Photo #23: View of the Warehouse Building.



Photo #24: View of the Metal Quonset Building.



Photo #25: View of the RMS Building.



Photo #26: Inside view of the RMS Building.



Photo #27: View of the Car Unloading Building.



Photo #28: View of the rail dump area.



Photo #29: View of the HESP and Sinter Building.



Photo #30: View of the Thaw Shed.



Photo #31: View of one side of the Thaw Shed.



Photo #32: View of the Car Cover Removal Building.



Photo #33: View of the RPW Pool.



Photo #34: Inside view of the WWTP.



Photo #35: View of Transfer Houses (Typ.).



Photo #36: View of Conveyors at rear of DAP Building (Typ.).



Photo #37: View of the Back 40 Area.



Photo #38: View of the Salt Water Pumphouse.



Photo #39: Inside view of the Jacquet River Pumphouse.



Photo #40: View of the New Slag Pile.



Photo #41: View of the pond at the New Slag Pile.



Photo #42: View of the Battery Recycling Plant.



Photo #43: Inside view of the Battery Recycling Plant.



Photo #44: View of the Battery Storage Building.



Photo #45: View of the DAP Storage Building.



Photo #46: Inside view of the Carpenter Shop.



Photo #47: View of the Acid Process Tanks (three of the four).



Photo #48: View of the PAP Building with Storage Silos in the background.



Photo #49: View of the Railcar and Truck Unloading Building.



Photo #50: View of the Concentrate Storage Domes (three of seven).



Photo #51: View of the Coke Fines Storage Area.



Photo #52: View of the Jacquet River Pumphouse



Photo #53: View of freshwater pipeline crossing Belledune River.



Photo #54: View of freshwater reservoir tank.

# Appendix E

## Service New Brunswick Access Agreements



THIS INDENTURE made this 24<sup>th</sup> day of *Sept.* A. D., 1965,

BETWEEN:

MRS. FLORENCE O'NEIL of the Parish of Durham in the County of Restigouche and Province of New Brunswick, hereinafter referred to as the GRANTOR,

OF THE FIRST PART,

- and -

CHALEUR DEVELOPMENT LIMITED, a body corporate duly incorporated under the laws of the Province of New Brunswick and having its head office at Saint John in the County of Saint John and Province of New Brunswick, hereinafter referred to as the GRANTEE,

OF THE SECOND PART.

RECORDED & FILED  
*Nov 15* A. D. 19 *65*  
AT THE HOUR OF *9:30 Am.*  
*958*  
*[Signature]*  
REGISTER

WITNESSETH that in consideration of the sum of *Five* -  
*Five* Dollars (*50.00*) now paid by the Grantee to the Grantor the receipt whereof is hereby acknowledged, the Grantor doth grant, convey, release, assign and confirm unto the Grantee, its successors and assigns, the right, at any time to enter upon the lands hereinafter described, for the purpose of laying down and constructing pipes for water conduits for wires of all kinds, in, under and upon the said lands, and of keeping and maintaining the same at all times in good condition and repair and for every such purpose the Grantee shall have access to the said lands at all times, by its servants, employees and workmen.

The lands to be affected by this easement are as follows:

All that certain lot, piece or parcel of land having a length of five hundred forty-three (543) feet and a uniform perpendicular width of fifty (50) feet, extending twenty-five (25) feet north of, and twenty-five (25) feet south of the centre line of the Waterline Right of Way, and extending from the eastern boundary of property owned or allegedly owned by William Lawlor to the western boundary of the Culligan Road, situate, lying, and being in the Parish of Durham, County of Restigouche

and the Province of New Brunswick, and having its centre line as it crosses the aforesaid O'Neil property, more particularly described as follows:


Beginning at the intersection of the eastern boundary of property owned or allegedly owned by William Lawlor with the centre line of the Waterline Right of Way as surveyed. Thence from the place of beginning on a New Brunswick Co-ordinate Bearing of north eighty-eight degrees, thirty-one minutes, twenty-six seconds east (N 88° 31' 26") along the aforesaid centre line a distance of five hundred forty-three (543) feet or to the western boundary of the Culligan Road. The hereinbefore described Right of Way being shown coloured red on a plan showing the Waterline Right of Way on Lot No. E 1/2 of 65 E prepared by Hughes Surveys Ltd., dated August 12, 1965, a copy of which is attached hereto and forms a part hereof.

IN WITNESS WHEREOF the Grantor has hereunto set her hand and seal the day and year firstly hereinbefore written.

SIGNED, SEALED and DELIVERED )

in the presence of )

*Eugene R. [unclear]* )  
..... )

*Mrs. Florence O'Neil* ) 

)  
)  
)

PROVINCE OF NEW BRUNSWICK  
 COUNTY OF Restigouche  
~~GLoucester~~

I, Eugene McHenry, a Notary Public, duly appointed, commissioned and sworn in and for the Province of New Brunswick, and residing and practising in the Town of Bathurst in said Province, DO HEREBY CERTIFY that on the 24<sup>th</sup> day of September A. D., 1965 at Cartigny, Parish of Durham in said Province, personally came and appeared before me the said Notary Public, MRS. FLORENCE O'NEIL, the Grantor named in the within Easement, and she acknowledged that she executed the within Indenture as and for her act and deed freely and and voluntarily for the uses and purposes therein expressed and contained.

IN TESTIMONY WHEREOF, I, the said Notary Public, have hereunto set my hand and affixed my Notarial Seal at the Town of Bathurst, afore said, the day and year in this certificate above

Eugene McHenry

NOTARY PUBLIC  
 NEW BRUNSWICK



I CERTIFY that the within Easement is duly entered and registered in the Registry Office for the County of Restigouche, New Brunswick at 9.30 o'clock A. M. of the 15<sup>th</sup> day of December A. D. 1965 as Number 64534 in Book Number 708 Page Number 731-733

Laura Lavoie, Sgnt Registrar of Deeds

THIS INDENTURE made this 7<sup>th</sup> day of October A.D., 1965,

BETWEEN: WILLIAM LAWLOR and his wife, ADA LAWLOR of the Parish of Durham, in the County of Restigouche, in the Province of New Brunswick, hereinafter referred to as the GRANTORS,

OF THE FIRST PART,

- and -

RECEIVED & FILED  
Dec 15 A. D. 1965  
AT THE HOUR OF 9:20 AM  
#954  
J M Cragg

CHALEUR DEVELOPMENT LIMITED, a body corporate, duly incorporated under the laws of the Province of New Brunswick and having its head office at Saint John, in the County of Saint John and Province of New Brunswick, hereinafter referred to as the GRANTEE,

OF THE SECOND PART.

WITNESSETH that in consideration of the sum of Thirty Dollars (30<sup>00</sup>) now paid by the Grantee to the Grantors, the receipt whereof is hereby acknowledged, the Grantors do grant, convey, release, assign and confirm unto the Grantee, its successors and assigns, the right, at any time to enter upon the lands hereinafter described, for the purpose of laying down and constructing pipes for water conduits for wires of all kinds, in, under and upon the said lands, and of keeping and maintaining the same at all times in good condition and repair and for every such purpose the Grantee shall have access to the said lands at all times, by its servants, employees and workmen.

The lands to be affected by this easement are as follows:  
All that certain lot, piece or parcel of land having a length of two hundred, sixty (260) feet and a uniform perpendicular width of fifty (50) feet, extending twenty-five (25) feet north of, and twenty-five (25) feet south of the centre line of the Waterline Right of Way, and extending from the eastern boundary of property owned or allegedly owned by Gerald Culligan to the western boundary of property owned or allegedly owned by Mrs. Florence O'Neil, situate, lying and being in the Parish of Durham, County of Restigouche and Province of New Brunswick, and having its centre line as it crosses

the aforesaid Lawlor property, more particularly described as follows:

Beginning at the intersection of the eastern boundary of property owned or allegedly owned by Gerald Culligan with the centre line of the Waterline Right of Way as surveyed. Thence from the place of beginning on a New Brunswick Co-ordinate Bearing of north eighty-eight degrees, thirty-one minutes, twenty-six seconds east (N 88° 31' 26"E) along the aforesaid centre line a distance of two hundred sixty (260) feet or to the western boundary of property owned or allegedly owned by Mrs. Florence O'Neil. The hereinafter described Right of Way being shown coloured red on a Plan showing the Waterline Right of Way on Lot No. E½ of 65 N.W. prepared by Hughes Surveys Ltd., dated August 12, 1965, a copy of which is attached hereto and forms a part hereof.

IN WITNESS WHEREOF the Grantors have hereunto set their hands and seals the day and year firstly hereinbefore written.

SIGNED, SEALED and DELIVERED )

in the presence of )

*Eugene W. Sibley* )  
..... )

*[Signature]* )  
..... )

)  
)  
)  
)

*Mrs. Ada Lawlor* )  
..... )

PROVINCE OF NEW BRUNSWICK  
 COUNTY OF *Restigouche*

I, *EUGENE McFARLAND* a Notary Public duly appointed, commissioned and sworn in and for the Province of New Brunswick, and residing and practising in the Town of Bathurst in said Province, DO HEREBY CERTIFY that on the *7<sup>th</sup>* day of *October* A. D., 1965 at *CAULLESTAN* in said Province, personally came and appeared before me the said Notary Public, WILLIAM LAWLOR and ADA LAWLOR his wife, the Grantors named in the within Easement, and they acknowledged that they executed the within Indenture, as and for their acts and deeds freely and voluntarily for the uses and purposes therein expressed and contained.

IN TESTIMONY WHEREOF, I,  
 the said Notary Public,  
 have hereunto set my hand  
 and affixed my Notarial  
 seal at the Town of  
 Bathurst aforesaid, the  
 day and year in this  
 certificate above written.

*Eugene McFarland*  
 NOTARY PUBLIC  
 NEW BRUNSWICK



I CERTIFY that the within *Easement*  
 is duly entered and registered in the Registry Office for the County of Restigouche,  
 New Brunswick at *9:30* o'clock A. M. of the *15th*  
 day of *December* A. D. 1965 as number *64535*  
 in Book Number *108* Page Number *734-736*

*Laura Lavoie, Deputy* Registrar of Deeds

THIS INDENTURE made this 11<sup>th</sup> day of *October* A.D., 1965

BETWEEN:

*DINAH*  
GERALD CULLIGAN and DINAH CULLIGAN  
his wife, of the Parish of Durham  
in the County of Restigouche in  
the Province of New Brunswick,  
hereinafter referred to as the  
GRANTORS,

*Dec 15 1965*  
AT THE TIME OF *9:30 AM*

OF THE FIRST PART,

- and -

*# 960*  
*J.M. Cragg*

CHALEUR DEVELOPMENT LIMITED, a  
body corporate duly incorporated  
under the laws of the Province of  
New Brunswick and having its head  
office at Saint John in the County  
of Saint John and Province of New  
Brunswick, hereinafter referred  
to as the GRANTEE,

OF THE SECOND PART.

WITNESSETH that in consideration of the sum of *Twenty-*  
*Five* Dollars (*25<sup>00</sup>*) now paid by the Grantee to

the Grantors, the receipt whereof is hereby acknowledged, the Grantors do grant, convey, release, assign and confirm unto the Grantee, its successors and assigns, the right, at any time to enter upon the lands hereinafter described, for the purpose of laying down and constructing pipes for water conduits for wires of all kinds, in, under and upon the said lands, and of keeping and maintaining the same at all times in good condition and repair and for every such purpose the Grantee shall have access to the said lands at all times, by its servants, employees and workmen.

The lands to be affected by this easement are as follows:

All that certain lot, piece or parcel of land having a length of two hundred fifty (250) feet and a uniform perpendicular width of fifty (50) feet, extending twenty-five (25) feet north of and twenty-five (25) feet south of the centre line of the Waterline Right of Way, and extending from the eastern boundary of property owned or allegedly owned by Urban Devereaux to the western boundary of property owned or allegedly owned by William Lawlor, situate, lying and being in the Parish of Durham, County of Restigouche and the Province of New Brunswick, and having its centre line as it crosses the aforesaid Culligan property, more

particularly described as follows:

Beginning at the intersection of the eastern boundary of property owned or allegedly owned by Urban Devereaux with the centre line of the Waterline Right of Way as surveyed. Thence from the place of beginning on a New Brunswick Co-ordinate Bearing of south seventy-eight degrees, forty-eight minutes, thirty-four seconds east (S 78° 48' 34" E) along the aforesaid centre line a distance of one hundred eighty (180) feet to a bend in the said centre line. Thence north eighty-eight degrees, thirty-one minutes, twenty-six seconds east (N 88° 31' 26" E) and continuing along the said centre line a distance of seventy (70) feet or to the western boundary of property owned or allegedly owned by William Lawlor. The hereinbefore described Right of Way being shown coloured red on a Plan showing the Waterline Right of Way on Lot No. W 1/2 Lot 65 N.W. prepared by Hughes Surveys Ltd., dated August 12, 1965, a copy of which is attached hereto and forms a part hereof.

IN WITNESS WHEREOF the Grantors have hereunto set their hands and seals the day and year firstly hereinbefore written.

SIGNED, SEALED and DELIVERED )

in the presence of )

*George W. Kelly* )  
..... )

*Gerald Colligan* ○

*Diana Colligan* ○

)



PROVINCE OF NEW BRUNSWICK  
COUNTY OF RESTIGOUCHE

I, *Eugene McGinley*, a Notary Public duly appointed commissioned and sworn in and for the Province of New Brunswick, and residing and practising in the Town of Bathurst in said Province, DO HEREBY CERTIFY that on the *11th* day of *October*, A. D., 1965 at the Town of *Carleton Place, Ontario* in said Province, personally came and appeared before me the said Notary Public, GERALD CULLIGAN and DINAH CULLIGAN, his wife, the Grantors named in the within Easement and they acknowledged that they executed the within Indenture, as and for their acts and deeds freely and voluntarily for the uses and purposes therein expressed and contained.

IN TESTIMONY WHEREOF, I, the said Notary Public, have hereunto set my hand and affixed my Notarial Seal at the Town of Bathurst aforesaid, the day and year in this certificate above written.

*Eugene McGinley*

NOTARY PUBLIC  
NEW BRUNSWICK



I CERTIFY that the within *Easement* is duly entered and registered in the Registry Office for the County of Restigouche, New Brunswick at *9:30* A. M. of the *15th* day of *December* A. D. 1965 as Number *64536* in Book Number *108* Page Number *737-739*

*Laura Lavoie, Notary* Registrar of Deeds

THIS INDENTURE made this <sup>15</sup> day of Dec A. D., 1965,

BETWEEN:

URBAN DEVEREAUX and his wife,  
HELEN DEVEREAUX of the Parish of  
Durham in the County of Resti-  
gouche in the Province of New  
Brunswick, hereinafter referred  
to as the GRANTORS,

OF THE FIRST PART,

- and -

CHALFUR DEVELOPMENT LIMITED, a  
body corporate duly incorporated  
under the laws of the Province  
of New Brunswick and having its  
head office at Saint John in the  
County of Saint John, in the  
Province of New Brunswick, here-  
inafter referred to as the GRANTEE,

OF THE SECOND PART.

RECEIVED & FILED

Dec 15 A. D. 1965  
AT THE HOUR OF 9:30 AM

# 961  
J. M. Cragg

WITNESSETH that in consideration of the sum of Thirty  
Dollars (30 =) now paid by the Grantee

to the Grantors, the receipt hereof is hereby acknowledged, the Grantors do grant, convey, release, assign and confirm unto the Grantee, its successors and assigns, the right, at any time to enter upon the lands hereinafter described, for the purpose of laying down and constructing pipes for water conduits for wires of all kinds, in, under and upon the said lands, and of keeping and maintaining the same at all times in good condition and repair and for every such purpose the Grantee shall have access to the said lands at all times, by its servants, employees and workmen.

The lands to be affected by this easement are as follows:

All that certain lot, piece or parcel of land having a length of two hundred seventy (270) feet and a uniform perpendicular width of fifty (50) feet, extending twenty-five (25) feet north of, and twenty-five (25) feet south of the centre line of the Waterline Right of Way, and extending from the eastern boundary of property owned or allegedly owned by William Godin to the western boundary of property owned or allegedly owned by Gerard Culligan, situate, lying and being in the Parish of Durham, County of Restigouche and the Province of New Brunswick,

and having its centre line as it crosses the aforesaid Devereaux property, more particularly described as follows:

Beginning at the intersection of the eastern boundary of property owned or allegedly owned by William Godin with the centre line of the Waterline Right of Way as surveyed. Thence from the place of beginning on a New Brunswick Coordinate Bearing of south seventy-eight degrees, forty-eight minutes thirty-four seconds east (S 78° 48' 34"E) along the aforesaid centre line a distance of two hundred seventy (270) feet or to the western boundary of property owned or allegedly owned by Gerard Culligan. The hereinbefore described Right of Way being shown coloured red on a Plan showing the Waterline Right of Way on Lot No. 66E prepared by Hughes Surveys Ltd., dated August 12, 1965, a copy of which is attached hereto and forms a part hereof.

IN WITNESS WHEREOF the Grantors have hereunto set their hands and seals the day and year firstly hereinbefore written.

SIGNED, SEALED and DELIVERED )

in the presence of )

*Eugene H. Kelly*  
..... )

*W. H. Devereaux*  
..... )

*Mr. Bill Stinson*  
..... )



PROVINCE OF NEW BRUNSWICK  
COUNTY OF *Restigouche*

I, *EUGENE MCGILLI*, a Notary Public, duly appointed, commissioned and sworn in and for the Province of New Brunswick, and residing and practising in the Town of Bathurst in said Province, DO HEREBY CERTIFY that on the *15<sup>th</sup>* day of *December* A. D., 1965 at the ~~Town of~~ *Collège P.Q.* in said Province, personally came and appeared before me the said Notary Public, URBAN DEVEREAUX and HELEN DEVEREAUX, his wife, the Grantors named in the within Easement and they acknowledged that they executed the within Indenture as and for their acts and deeds freely and voluntarily for the uses and purposes therein expressed and contained.

IN TESTIMONY WHEREOF, I, the said Notary Public, have hereunto set my hand and affixed my Notarial Seal at the Town of Bathurst aforesaid, the day and year in this certificate above written.

*Eugene McGill*  
NOTARY PUBLIC  
NEW BRUNSWICK



I CERTIFY that the within *Easement* is duly entered and registered in the Registry Office for the County of Restigouche, New Brunswick at *9:30* o'clock *A. M.* of the *15<sup>th</sup>* day of *December* A. D. 19*65* in Book Number *108* Page Number *440-742* *64537*

*Laurie Lavoie, Esq.* Registrar of Deeds

THIS INDENTURE made this 15<sup>th</sup> day of December A.D., 1965,

BETWEEN:

WILLIAM GODIN, single man, of the Parish of Durham, in the County of Restigouche in the Province of New Brunswick, hereinafter referred to as the GRANTOR,

OF THE FIRST PART,

- and -

CHALEUR DEVELOPMENT LIMITED, a body corporate, duly incorporated under the laws of the Province of New Brunswick, hereinafter referred to as the GRANTEE,

OF THE SECOND PART.

RECORDED & FILED  
Dec 15 1965  
AT THE HOUR OF 9:30 AM  
# 962  
J.M. Cragg

WITNESSETH that in consideration of the sum of Eighty -

Five Dollars (\$85.00) now paid by the Grantee

to the Grantor, the receipt whereof is hereby acknowledged, the Grantor doth grant, convey, release, assign and confirm unto the Grantee, its successors and assigns, the right, at any time to enter upon the lands hereinafter described, for the purpose of laying down and constructing pipes for water conduits for wires of all kinds, in, under and upon the said lands, and of keeping and maintaining the same at all times in good condition and repair and for every such purpose the Grantee shall have access to the said lands at all times, by its servants, employees and workmen.

The lands to be affected by this easement are as follows:

All that certain lot, piece or parcel of land having a length of eight hundred thirty-five (835) feet and a uniform perpendicular width of fifty (50) feet, extending twenty-five (25) feet north of, and twenty-five (25) feet south of the centre line of the Waterline Right of Way, and extending from the eastern boundary of property owned or allegedly owned by Alfred Shannon to the western boundary of property owned or allegedly owned by Urban Devereaux, situate, lying, and being in the Parish of Durham, County of Restigouche and the Province of New Brunswick, and having its centre line as it crosses the aforesaid Godin property, more particularly described as follows:

Beginning at the intersection of the eastern boundary of property owned or allegedly owned by Alfred Shannon with the centre line of the Waterline Right of Way as surveyed. Thence from the place of beginning on a New Brunswick Co-ordinate Bearing of south seventy-eight degrees, forty-eight minutes, thirty-four seconds east (S 78° 48' 34"E) along the aforesaid centre line a distance of eight hundred thirty-five (835) feet or to the western boundary of property owned or allegedly owned by Urban Devereaux. The hereinbefore described Right of Way being shown coloured red on a Plan showing the Waterline Right of Way on Lot No1 66W prepared by Hughes Surveys Ltd., dated August 12, 1965, a copy of which is attached hereto and forms a part hereof.

IN WITNESS WHEREOF the Grantor has hereunto set his hand and seal the day and year firstly hereinbefore written.

SIGNED, SEALED and DELIVERED )

in the presence of )

*Eugene M. Searby* )  
 ..... )

*William Godin* ..... )



PROVINCE OF NEW BRUNSWICK  
COUNTY OF *Le Restigouche*

I, *Edouard McTavish* a Notary Public, duly

appointed, commissioned and sworn in and for the Province of New Brunswick, and residing and practising in the Town of Bathurst in said Province, DO HEREBY CERTIFY that on the *1<sup>st</sup>* day of *December* A. D., 1965 at the Town of Bathurst, in the said Province, personally came and appeared before me the said Notary Public, WILLIAM GODIN, the Grantor named in the within Easement and he acknowledged that he executed the within Indenture as and for his acts and deeds freely and voluntarily for the uses and purposes therein expressed and contained.

IN TESTIMONY WHEREOF, I, the said Notary Public, have hereunto set my hand and affixed my Notarial Seal at the Town of Bathurst aforesaid the day and year in the certificate above written

*Edouard McTavish*  
NOTARY PUBLIC  
NEW BRUNSWICK



I CERTIFY that the within *Easement* is duly entered and registered in the Registry Office for the County of Restigouche, New Brunswick at *9:30* o'clock *A.M.* of the *15<sup>th</sup>* day of *December* A. D. 1965 as Number *64538* in Book Number *108* Page Number *743-745*

*Laura Lavoie, Actif* Registrar of Deeds

THIS INDENTURE made this 2<sup>nd</sup> day of *November* A.D., 1965,

BETWEEN:

CLETUS SHANNON and his wife,  
JEANMARIE SHANNON, of the Parish  
of Durham in the County of  
Restigouche, in the Province of  
New Brunswick, hereinafter referred  
to as the GRANTORS,

OF THE FIRST PART,

RECEIVED & FILED

- and -

*Dec 15* A. D. 19 *65*  
AT THE HOUR OF *9:30 AM*  
*# 963*  
*P. M. Cragg*  
REGISTRAR

CHALEUR DEVELOPMENT LIMITED, a body  
corporate, duly incorporated under  
the laws of the Province of New  
Brunswick and having its head office  
at Saint John in the County of Saint  
John and Province of New Brunswick  
hereinafter referred to as the GRANTEE

OF THE SECOND PART.

WITNESSETH that in consideration of the sum of *Five* —

*Five* Dollars ( *95.00* ) now paid by the Grantee to

the Grantors the receipt whereof is hereby acknowledged, the  
Grantors do grant, convey, release, assign and confirm unto the  
Grantee, its successors and assigns, the right, at any time to  
enter upon the lands hereinafter described, for the purpose of  
laying down and constructing pipes for water conduits for wires  
of all kinds, in, under and upon the said lands, and of keeping  
and maintaining the same at all times in good condition and repair  
and for every such purpose the Grantee shall have access to the  
said lands at all times, by its servants, employees and workmen.

The lands to be affected by this easement are as follows:

All that certain lot, piece or parcel of land having a length  
of nine hundred twenty-two (922) feet and a uniform perpendicular  
width of fifty (50) feet, extending twenty-five (25) feet north of,  
and twenty-five (25) feet south of the centre line of the Waterline  
Right of Way, and extending from the eastern boundary of property  
owned or allegedly owned by Robert Killoran to the western boundary  
of property owned or allegedly owned by William Godin, situate,  
lying and being in the Parish of Durham, County of Restigouche and  
the Province of New Brunswick, and having its centre line as it  
crosses the aforesaid Shannon property more particularly described  
as follows:




Beginning at the intersection of the eastern boundary of property owned or allegedly owned by Robert Killoran with the centre line of the Waterline Right of Way as surveyed. Thence from the place of beginning on a New Brunswick Co-ordinate Bearing of south seventy-eight degrees, forty-eight minutes, thirty-four seconds east (S 78° 48' 34"E) along the aforesaid centre line a distance of nine hundred twenty-two (922) feet or to the western boundary of property owned or allegedly owned by William Godin. The hereinbefore described Right of Way being shown coloured red on a Plan showing the Waterline Right of Way on Lot No. H prepared by Hughes Surveys Ltd., dated August 12, 1965, a copy of which is attached hereto and forms a part hereof.

IN WITNESS WHEREOF the Grantors have hereunto set their hands and seals the day and year firstly hereinbefore written.

SIGNED, SEALED and DELIVERED )

in the presence of )

  
..... )

 .....



 .....



)  
)  
)  
)

PROVINCE OF ONTARIO  
COUNTY OF *York*

I, *Cyril Orban* a Notary Public, duly appointed, commissioned and sworn in and for the Province of Ontario, and residing and practising in the <sup>*City*</sup> ~~Town~~ of *Toronto* in said Province, DO HEREBY CERTIFY that on the *2<sup>nd</sup>* day of *November* A. D., 1965, at the <sup>*City*</sup> ~~Town~~ of *Toronto* in the said Province, personally came and appeared before me the said Notary Public, <sup>*CLETUS*</sup> ~~ARTHUR~~ SHANNON and JEAN MARIE SHANNON, his wife, the Grantors named in the within Easement and they acknowledged that they executed the within Indenture as and for their acts and deeds freely and voluntarily for the uses and purposes therein expressed and contained.

IN TESTIMONY WHEREOF, I, the said Notary Public, have hereunto set my hand and affixed my Notarial Seal at the <sup>*City*</sup> ~~Town~~ of *Toronto* aforesaid, the day and year in this indicate above written.

*[Signature]*  
NOTARY PUBLIC  
ONTARIO



I CERTIFY that the within *Easement* is duly entered and registered in the Registry Office for the County of Restigouche, New Brunswick at *9:30* o'clock *A.M.* of the *15<sup>th</sup>* day of *December* A. D. 1965 as Number *64539* in Book Number *108* Page Number *746-748*

*Laura Lavoie, Deputy* Registrar of Deeds

THIS INDENTURE made this 12<sup>th</sup> day of October A. D., 1965,  
BETWEEN:

ROBERT KILLORAN and GERTRUDE KILLORAN  
of the Parish of Durham, in the County  
of Restigouche, in the Province of New  
Brunswick, hereinafter referred to as  
the GRANTORS,

OF THE FIRST PART,

- and -

CHALEUR DEVELOPMENT LIMITED, a body  
Corporate, duly incorporated under  
the laws of the Province of New  
Brunswick, having its head office  
at Saint John, in the County of Saint  
John and the Province of New Brunswick  
hereinafter referred to as the GRANTEE

OF THE SECOND PART.

RECEIVED & FILED  
Dec 15 A. D. 1965  
AT THE OFFICE OF THE REGISTRAR  
# 964  
J. M. Cragg

WITNESSETH that in consideration of the sum of *One Hundred*  
*Ninety* Dollars (*190<sup>00</sup>*) now paid by the Grantee to the  
Grantors, the receipt whereof is hereby acknowledged, the Grantors go  
grant, convey, release, assign and confirm unto the Grantee, its  
successors and assigns, the right, at any time to enter upon the  
lands hereinafter described, for the purpose of laying down and  
constructing pipes for water conduits for wires of all kinds, in,  
under and upon the said lands, and of keeping and maintaining the  
same at all times in good condition and repair and for every such  
purpose the Grantee shall have access to the said lands at all times  
by its servants, employees and workmen.

The lands to be affected by this easement are as follows:

All that certain lot, piece or parcel of land having a length  
of one thousand, eight hundred eighty-one (1,881) feet and a uniform  
perpendicular width of fifty (50) feet, extending twenty-five (25)  
feet north of, and twenty-five (25) feet south of the centre line of  
the Waterline Right of Way, and extending from the eastern boundary  
of the Quinn Road to the western boundary of property owned or  
allegedly owned by Alfred Shannon, situate, lying, and being in the  
Parish of Durham, County of Restigouche and the Province of New  
Brunswick, and having its centre line as it crosses the aforesaid  
Killoran property, more particularly described as follows:

Beginning at the intersection of the eastern boundary of The Quinn Road with the centre line of the Waterline Right of Way as surveyed. Thence from the place of beginning on a New Brunswick Co-ordinate Bearing of south seventy-eight degrees, forty-eight minutes, thirty-four seconds east (S 78° 48' 34"E) along the aforesaid centre line a distance of one thousand, eight hundred and eighty-one (1,881) feet or to the western boundary of property owned or allegedly owned by Alfred Shannon. The hereinbefore described Right of Way being shown coloured red on a Plan showing the Waterline Right of Way on Lot No. 68 R prepared by Hughes Surveys Ltd., dated August 12, 1965, a copy of which is attached hereto and forms a part hereof.

IN WITNESS WHEREOF the Grantors have hereunto set their hands and seals the day and year firstly hereinbefore written.

SIGNED, SEALED and DELIVERED )

in the presence of )

*Eugene W. Sully*  
.....

*Robert Killoran* ○

*Mrs. Beatrice Killoran* ○

PROVINCE OF NEW BRUNSWICK  
COUNTY OF *Restigouche*

I, *Eugene McGinley* a Notary Public, duly appointed, commissioned and sworn in and for the Province of New Brunswick, and residing and practising in the Town of Bathurst in said Province, DO HEREBY CERTIFY that on the *12th* day of *October* A. D., 1965, at ~~the Town of~~ *Callaghan Point of Bathurst* in the said Province, personally came and appeared before me the said Notary Public, ROBERT KILLORAN and GERTRUDE KILLORAN, his wife, the Grantors named in the within Easement and they acknowledged that they executed the within Indenture as and for their acts and deeds freely and voluntarily for the uses and purposes therein expressed and contained.

IN TESTIMONY WHEREOF, I, the said Notary Public, have hereunto set my hand and affixed my Notarial Seal at the Town of Bathurst aforesaid, the day and year in this certificate above written.

*Eugene McGinley*

NOTARY PUBLIC  
NEW BRUNSWICK



I CERTIFY that the within *Easement* is duly entered and registered in the Registry Office for the County of Restigouche, New Brunswick at *9:30* o'clock *P.* M. of the *15th* day of *December* A. D. 1965 as Number *64540* in Book Number *108* Page Number *749-751*

*Laura Lavoie, Deputy* Registrar of Deeds

THIS INDENTURE made this 12<sup>th</sup> day of October A.D., 1965,  
BETWEEN:

PATRICK ULTICAN, single man, of  
the Parish of Durham, in the  
County of Restigouche, in the  
Province of New Brunswick, here-  
inafter referred to as the GRANTOR

RECEIVED & FILED

Dec 15 A. D. 19 65  
AT THE HOUR OF 9:30 AM

# 965  
J. M. Cragg  
REGISTRAR

OF THE SECOND PART,

- and -

CHALEUR DEVELOPMENT LIMITED, a body  
corporate duly incorporated under  
the laws of the Province of New  
Brunswick and having its head office  
at Saint John, in the County of  
Saint John and Province of New  
Brunswick, hereinafter referred to  
as the GRANTEE

WITNESSETH that in consideration of the sum of Fifty -  
Five Dollars (\$55.00) now paid by the Grantee to  
the Grantor, the receipt whereof is hereby acknowledged, the  
Grantor doth grant, convey, release, assign and confirm unto the  
Grantee, its successors and assigns, the right, at any time to  
enter upon the lands hereinafter described, for the purpose of  
laying down and constructing pipes for water conduits for wires  
of all kinds, in, under and upon the said lands, and of keeping  
and maintaining the same at all times in good condition and  
repair and for every such purpose the Grantee shall have access  
to the said lands at all times, by its servants, employees and  
workmen.

The lands to be affected by this easement are as follows:

All that certain lot, piece or parcel of land having a length  
of five hundred twenty (520) feet and a uniform perpendicular width  
of fifty (50) feet, extending twenty-five (25) feet north of, and  
twenty-five (25) feet south of the centre line of the Waterline  
Right of Way, and extending from the eastern boundary of property  
owned or allegedly owned by Herman Ultican to the western boundary  
of the Quinn Road, situate, lying, and being in the Parish of  
Durham, County of Restigouche and the Province of New Brunswick,  
and having its centre line as it crosses the aforesaid Ultican  
property, more particularly described as follows:

Beginning at the intersection of the eastern boundary of property owned or allegedly owned by Herman Ultican with the centre line of the Waterline Right of Way as surveyed. Thence from the place of beginning on a New Brunswick Co-ordinate Bearing of south seventy-eight degrees, forty-eight minutes, thirty-four seconds east (S 78° 48' 34"E) along the aforesaid centre line a distance of five hundred twenty (520) feet or to the western boundary of the Quinn Road. The hereinbefore described Right of Way being shown coloured red on a Plan showing the Waterline Right of Way on Lot No. 1, E prepared by Hughes Surveys Ltd., dated August 12, a copy of which is attached hereto and forms a part hereof.

IN WITNESS WHEREOF the Grantor has hereunto set his hand and seal the day and year firstly hereinbefore written.

SIGNED, SEALED and DELIVERED )

in the presence of )

*Eugene M. Dunlop* )  
..... )

*Herman Ultican* )  
..... )

)  
)  
..... )

)

PROVINCE OF NEW BRUNSWICK  
COUNTY OF RESTIGOUCHE

I, *Eugene McInley*, a Notary Public, duly appointed,  
commissioned and sworn in and for the Province of New Brunswick,  
and residing and practising in the Town of Bathurst in said  
Province, DO HEREBY CERTIFY that on the *12th* day of *October*,  
A. D., 1965, at the ~~Town of~~ *Levesque* in the said Province  
personally came and appeared before me the said Notary Public,  
PATRICK ULTICAN, the Grantor named in the within Easement and  
he acknowledged that he executed the within Indenture as and for  
his act and deed freely and voluntarily for the uses and purposes  
therein expressed and contained.

IN TESTIMONY WHEREOF, I, the  
said Notary Public have here-  
unto set my hand and affixed  
my Notarial Seal at the Town  
of Bathurst aforesaid, the  
day and year in this certifi-  
cate above written.

*Eugene McInley*  
NOTARY PUBLIC  
NEW BRUNSWICK



I CERTIFY that the within *Easement*  
is duly entered and registered in the Registry Office for the County of Restigouche,  
New Brunswick at *9:30* o'clock *A.M.* of the *15th*  
day of *December* D. 19*65* as Number *64541*  
in Book Number *108* Page Number *752-754*

*Laura Lavoie*, Registrar of Deeds  
*copy*



THIS INDENTURE MADE this 7<sup>th</sup> day of October A.D., 1965,

BETWEEN:

HERMAN ULTICAN and JOSEPHINE ULTICAN  
his wife, of the Parish of Durham,  
in the County of Restigouche, in the  
Province of New Brunswick, herein-  
after referred to as the GRANTORS,

OF THE FIRST PART,

- and -

CHALEUR DEVELOPMENT LIMITED, a body  
Corporate duly incorporated under  
the laws of the Province of New  
Brunswick and having its head office  
at Saint John in the County of Saint  
John and Province of New Brunswick  
hereinafter referred to as the  
GRANTEE,

OF THE SECOND PART.

RECEIVED & FILED  
Dec 15 A. D. 1965  
AT THE HOUR OF 9:30 AM

# 966  
J. M. Cragg  
S. P. (NOTARY)

WITNESSETH that in consideration of the sum of Fifty —  
50 Dollars (50) now paid by the Grantee to

the Grantors; the receipt whereof is hereby acknowledged, the  
Grantors do grant, convey, release, assign and confirm unto the  
Grantee, its successors and assigns, the right, at any time to  
enter upon the lands hereinafter described, for the purpose of  
laying down and constructing pipes for water conduits for wires  
of all kinds, in, under and upon the said lands, and of keeping  
and maintaining the same at all times in good condition and  
repair and for every such purpose the Grantee shall have access  
to the said lands at all times, by its servants, employees and  
workmen.

The lands to be affected by this easement are as follows:

All that certain lot, piece or parcel of land having a length  
of five hundred eleven (511) feet and a uniform perpendicular width  
of fifty (50) feet, extending twenty-five (25) feet north of, and  
twenty-five (25) feet south of the centre line of the Waterline  
Right of Way, and extending from the eastern boundary of property  
owned or allegedly owned by Roger Flannagan to the western boundary  
of property owned or allegedly owned by Patrick Ultican, situate,  
lying, and being in the Parish of Durham, County of Restigouche  
and the Province of New Brunswick, and having its centre line as  
it crosses the aforesaid Ultican property, more particularly  
described as follows:

Beginning at the intersection of the eastern boundary of property owned or allegedly owned by Roger Flannagan with the centre line of the Waterline Right of Way as surveyed. Thence from the place of beginning on a New Brunswick Co-ordinate Bearing of south seventy-eight degrees, forty-eight minutes, thirty-four seconds east (S 78° 48' 34"E) along the aforesaid centre line a distance of five hundred eleven (511) feet or to the western boundary of property owned or allegedly owned by Patrick Ultican. The hereinbefore described Right of Way being shown coloured red on a Plan showing the Waterline Right of Way on Lot No. 1W prepared by Hughes Surveys Ltd., dated August 12, 1965, a copy of which is attached hereto and forms a part hereof.

IN WITNESS WHEREOF the Grantors have hereunto set their hands and seals the day and year firstly hereinbefore written.

SIGNED, SEALED and DELIVERED )

in the presence of

*Edward W. Kelly*  
.....

) *Thomas Ultican* ○  
.....

) *Joseph Louis Ultican* ○  
.....


PROVINCE OF NEW BRUNSWICK

COUNTY OF Restigouche

I, *EUGENE McGINLEY* a Notary Public, duly appointed  
 commissioned and sworn in and for the Province of New Brunswick,  
 and residing and practising in the Town of Bathurst in said  
 Province, DO HEREBY CERTIFY that on the *21<sup>st</sup>* day of *October*  
*C. S. L. L. J. A. N.*  
 A. D., 1965, at the ~~Town of~~ Bathurst in the said Province person-  
 ally came and appeared before me the said Notary Public, HERMAN  
 ULTICAN and JOSEPHINE ULTICAN, the Grantors named in the within  
~~EASEMENT~~  
 Indenture as and for their acts and deeds freely and voluntarily  
 for the uses and purposes therein expressed and contained.

IN TESTIMONY WHEREOF, I, the  
 said Notary Public have here-  
 unto set my hand and affixed  
 my Notarial Seal at the Town  
 of Bathurst aforesaid, the  
 day and year in this ~~Indenture~~ Indenture  
 above written.

*Eugene Mc*  
 NOTARY PUBLIC  
 NEW BRUNSWICK



I CERTIFY that the within *Easement*  
 is duly entered and registered in the Registry Office for the County of Restigouche,  
 New Brunswick at *9:30* A. M. of the *15<sup>th</sup>*  
 day of *December* A. D. 1965. *64542*  
 in Book Number *108* Page Number *755-757*

*Laura Lewis, Spt.* Registrar of Deeds

758

64543

THIS INDENTURE made this 11<sup>th</sup> day of October A.D., 1965,

BETWEEN:

ROGER FLANNAGAN, single man, of the parish of Durham, in the County of Restigouche, in the Province of New Brunswick, hereinafter referred to as the GRANTOR,

OF THE FIRST PART,

- and -

CHALEUR DEVELOPMENT LIMITED, a body Corporate duly incorporated under the laws of the Province of New Brunswick and having its head office at Saint John, in the County of Saint John and province aforesaid, hereinafter referred to as the GRANTEE

OF THE SECOND PART.

RECEIVED & FILED

Dec 15 A. D. 1965  
AT THE HOUR OF 9:30 AM

# 967  
J.M. Cragg  
REGISTRAR

WITNESSETH that in consideration of the sum of Five

Five Dollars ( 55<sup>00</sup> ) now paid by the Grantee

to the Grantor, the receipt whereof is hereby acknowledged, the Grantor doth grant, convey, release, assign and confirm unto the Grantee, its successors and assigns, the right, at any time to enter upon the lands hereinafter described, for the purpose of laying down and constructing pipes for water conduits for wires of all kinds, in, under and upon the said lands, and of keeping and maintaining the same at all times in good condition and repair and for every such purpose the Grantee shall have access to the said lands at all times, by its servants, employees and workmen.

The lands to be affected by this easement are as follows:

All that certain lot, piece or parcel of land having a length of five hundred fourteen (514) feet and a uniform perpendicular width of fifty (50) feet, extending twenty-five (25) feet north of, and twenty-five (25) feet south of the centre line of the Waterline Right of Way, and extending from the eastern boundary of property owned or allegedly owned by Andrew Flannagan to the western boundary of property owned or allegedly owned by Herman Ultican, situate, lying, and being in the Parish of Durham, County of Restigouche and the Province of New Brunswick, and having its centre line as it crosses the aforesaid Flannagan property, more particularly described as follows:

Beginning at the intersection of the eastern boundary of property owned or allegedly owned by Andrew Flannagan with the centre line of the Waterline Right of Way as surveyed. Thence from the place of beginning on a New Brunswick Co-ordinate Bearing of south seventy-eight degrees, forty-eight minutes, thirty-four seconds, east (S 78° 48' 34"E) along the aforesaid centre line a distance of five hundred fourteen (514) feet or to the western boundary of property owned or allegedly owned by Herman Ultican. The hereinbefore described Right of Way being shown coloured red on a Plan showing the Waterline Right of Way on Lot No. 70E prepared by Hughes Surveys Ltd., dated August 12, 1965, a copy of which is attached hereto and forms a part hereof.

IN WITNESS WHEREOF the Grantor has hereunto set his hand and seal the day and year firstly hereinbefore written.

SIGNED, SEALED and DELIVERED )

in the presence of )

*Lynn M. Stanley*  
..... )

*Roger Flannagan* ○

..... ○

)

PROVINCE OF NEW BRUNSWICK  
 COUNTY OF *RESTIGOUCHE*

I, *Eugene McKeenley*, a Notary Public, duly appointed, commissioned and sworn in and for the Province of New Brunswick, and residing and practising in the Town of Bathurst in said Province, DO HEREBY CERTIFY that on the *11th* day of *October*, A. D., 1965 at *Collège, Rivière de Durham* in said Province, personally came and appeared before me the said Notary Public, ROGER FLANNAGAN, single man, the Grantor named in the within Easement, and he acknowledged that he executed the within Indenture as and for his acts and deeds freely and voluntarily for the uses and purposes therein expressed and contained.

IN TESTIMONY WHEREOF, I, the said Notary Public, have hereunto set my hand and affixed my Notarial Seal at the Town of Bathurst, aforesaid, the day and year in this certificate above

*Eugene McKeenley*

NOTARY PUBLIC  
 NEW BRUNSWICK



I CERTIFY that the within *Easement* is duly entered and registered in the Registry Office for the County of Restigouche, New Brunswick at *9:30* o'clock *A*. M. of the *15th* day of *December* A. D. 1965 as Number *64543* in Book Number *108* Page Number *758-760*

*Laura Kossie*  
 Registrar of Deeds

THIS INDENTURE made this 11<sup>th</sup> day of October A.D., 1965,

BETWEEN:

ANDREW FLANNAGAN and CLARA FLANNAGAN,  
his wife, of the Parish of Durham,  
in the County of Restigouche in the  
Province of New Brunswick, herein-  
after referred to as the GRANTORS,

OF THE FIRST PART,

- and -

CHALEUR DEVELOPMENT LIMITED, a body  
corporate duly incorporated under  
the laws of the Province of New  
Brunswick, and having its head  
office at Saint John in the County  
of Saint John and Province of New  
Brunswick, hereinafter referred  
to as the GRANTEE,

RECORDED  
Dec 15 65  
AT THE REGISTRY 9:30 AM  
# 968  
J. M. Cragg  
REGISTRY

WITNESSETH that in consideration of the sum of Fifty  
Five Dollars (55<sup>00</sup>) now paid by the Grantee to  
the Grantors, the receipt whereof is hereby acknowledged, the  
Grantors do grant, convey, release, assign and confirm unto the  
Grantee, its successors and assigns, the right, at any time to  
enter upon the lands hereinafter described, for the purpose of  
laying down and constructing pipes for water conduits for wires  
of all kinds, in, under and upon the said lands, and of keeping  
and maintaining the same at all times in good condition and  
repair and for every such purpose the Grantee, shall have access  
to the said lands at all times, by its servants, employees and  
workmen.

The lands to be affected by this easement are as follows:

All that certain lot, piece or parcel of land having a length  
of five hundred ten (510) feet and a uniform perpendicular width  
of fifty (50) feet, extending twenty-five (25) feet north of,  
and twenty-five (25) feet south of the centre line of the  
Waterline Right of Way, and extending from the eastern boundary  
of property owned or allegedly owned by Roger Flannagan to the  
eastern boundary of property owned or allegedly owned by the said  
Andrew Flannagan, situate, lying, and being in the Parish of  
Durham, County of Restigouche and the Province of New Brunswick,

and having its centre line as it crosses the aforesaid Flannagan property, more particularly described as follows:

Beginning at the intersection of the eastern boundary of property owned or allegedly owned by Roger Flannagan with the centre line of the Waterline Right of Way as surveyed. Thence from the place of beginning on a New Brunswick Co-ordinate Bearing of south eighty degrees, eighteen minutes, thirty-four seconds east (S 80° 18' 34"E) along the aforesaid centre line a distance of three hundred ninety (390) feet to a bend in the said line. Thence south seventy-eight degrees, forty-eight minutes thirty-four seconds east (S 78° 48' 34"E) continuing along the aforesaid centre line a distance of one hundred twenty (120) feet, or to the western boundary of property owned or allegedly owned by Roger Flannagan. The hereinbefore described Right of Way being shown coloured red on a Plan showing the Waterline Right of Way on Lot No. 70W prepared by Hughes Surveys Ltd., dated August 12, 1965, a copy of which is attached hereto and forms a part hereof.

IN WITNESS WHEREOF the Grantors have hereunto set their hands and seals the day and year firstly hereinbefore written.

SIGNED, SEALED and DELIVERED )

in the presence of )

*Eugene M. Gully*..... )

) *J. Andrew Flannagan*..... )

) *Clara E. Flannagan*..... )



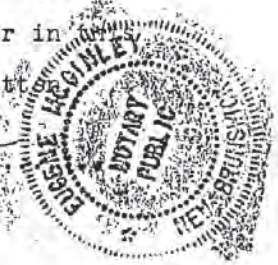
PROVINCE OF NEW BRUNSWICK

COUNTY OF

I, *Edgar McWanney* a Notary Public, duly appointed, commissioned and sworn in and for the Province of New Brunswick, and residing and practising in the Town of Bathurst in said Province, DO HEREBY CERTIFY that on the *11<sup>th</sup>* day of *October* A. D., 1965 at *Callaghan, Parish of P. P. P.* in said Province, personally came and appeared before me the said Notary Public, ANDREW FLANNAGAN, and his wife, CLARA FLANNAGAN, the Grantor named in the within Easement, and they acknowledged that they executed the within Indenture as and for their acts and deeds freely and voluntarily for the uses and purposes therein expressed and contained.

IN TESTIMONY WHEREOF, I, the said Notary Public, have hereunto set my hand and affixed my Notarial Seal at the Town of Bathurst, aforesaid, the day and year in certificate above written.

*Edgar McWanney*  
 NOTARY PUBLIC  
 NEW BRUNSWICK



I CERTIFY that the within *Easement* is duly entered and registered in the Registry Office for the County of Restigouche, New Brunswick at *9:30* o'clock A. M. of the *15<sup>th</sup>* day of *December* A. D. 19*65* in Book Number *64544* in Book Number *108* Page Number *761-762*

*Laura Lavoie, Deputy* Registrar of Deeds

THIS INDENTURE made this 11<sup>th</sup> day of October A. D., 1965,

BETWEEN:

ROGER FLANNAGAN, single man and  
JOSEPH FLANNAGAN and his wife,  
BARBARA FLANNAGAN of the Parish of  
Durham, County of Restigouche and  
Province of New Brunswick, herein-  
after referred to as the GRANTORS,

OF THE FIRST PART;

- and -

CHALEUR DEVELOPMENT LIMITED, a body  
corporate duly incorporated under  
the laws of the Province of New  
Brunswick, having its head office  
at Saint John in the County of Saint  
John, and Province of New Brunswick,  
hereinafter referred to as the  
GRANTEE,

OF THE SECOND PART.

RECEIVED & FILED

Dec 15 A. D. 1965  
AT THE HOUR OF 9:30 A.M.

# 969

J. M. Cragg.

WITNESSETH that in consideration of the sum of

Dollars ( ) now paid by the Grantee to  
the Grantors, the receipt whereof is hereby acknowledged, the  
Grantors do grant, convey, release, assign and confirm unto the  
Grantee, its successors and assigns, the right, at any time to enter  
upon the lands hereinafter described, for the purpose of laying  
down and constructing pipes for water conduits for wires of all  
kinds, in, under and upon the said lands, and of keeping and  
maintaining the same at all times in good condition and repair and  
every such purpose the Grantee shall have access to the said lands  
at all times, by its servants, employees and workmen.

The lands to be affected by this easement are as follows:

All that certain lot, piece or parcel of land having a length  
of four hundred five (405) feet and a uniform perpendicular width  
of fifty (50) feet, extending twenty-five (25) feet north of, and  
twenty-five (25) feet south of the centre line of the Waterline  
Right of Way, and extending from the eastern boundary of property  
owned or allegedly owned by Bernard Duivenvoorden to the western  
boundary of property owned or allegedly owned by Andrew Flannagan,  
situate, lying and being in the Parish of Durham, County of  
Restigouche and the Province of New Brunswick, and having its  
centre line as it crosses the aforesaid Flannagan property, more  
particularly described as follows:

Beginning at the intersection of the eastern boundary of property owned or allegedly owned by Gerard Duivenvoorden with the centre line of the Waterline Right of Way as surveyed. Thence from the place of beginning on a New Brunswick Co-ordinate Bearing of south eighty degrees, eighteen minutes, thirty-four seconds east (S 80° 18' 34"E) along the aforesaid centre line a distance of four hundred five (405) feet or to the western boundary of property owned or allegedly owned by Andrew Flannagan. The hereinbefore described Right of Way being shown coloured red on a Plan showing the Waterline Right of Way on Lot No. 71E prepared by Hughes Surveys Ltd., dated August 12, 1965, a copy of which is attached hereto and forms a part hereof.

IN WITNESS WHEREOF the Grantor has hereunto set his hand and seal the day and year firstly hereinbefore written.

SIGNED, SEALED and DELIVERED )

in the presence of )

*Eugene M. Hales*  
..... )

*Joseph Flannagan*

*Mrs. Barbara Flannagan*  
*Roger Flannagan*



PROVINCE OF NEW BRUNSWICK  
COUNTY OF ~~GLoucester~~ *Restigouche*

I, *Eugene McSibley*, a Notary Public, duly appointed, commissioned and sworn in and for the Province of New Brunswick, and residing and practising in the Town of Bathurst in said Province, DO HEREBY CERTIFY that on the *11th* day of *October*, A. D., 1965 at *Collin, Parish of Durham* in said Province, personally came and appeared before me the said Notary Public, ROGER FLANNAGAN, single man, the Grantor named in the within Easement, and he acknowledged that he executed the within Indenture as and for his act and deed freely and voluntarily for the uses and purposes therein expressed and contained.

IN TESTIMONY WHEREOF, I, the said Notary Public, have hereunto set my hand and affixed my Notarial Seal at the Town of Bathurst, aforesaid, the day and year in this certificate above written.

*Eugene McSibley*

NOTARY PUBLIC  
NEW BRUNSWICK



I CERTIFY that the within *Easement* is duly entered and registered in the Registry Office for the County of Restigouche, New Brunswick at *9:30* o'clock *PM* of the *15th* day of *December* A. D. 19*65* as Number *64545* in Book Number *108* Page Number *764-766*

*Laura Lavoie, Deputy* Registrar of Deeds

THIS INDENTURE made this <sup>15</sup> day of Dec. A. D., 1965,

BETWEEN:

GERARD DUIVENVOORDEN and his wife,  
ADRIANNA DUIVENVOORDEN of the  
Parish of Durham in the County of  
Restigouche and Province of New  
Brunswick, hereinafter referred  
to as the GRANTORS,

OF THE FIRST PART,

- and -

CHALEUR DEVELOPMENT LIMITED, a  
body corporate duly incorporated  
under the laws of the Province  
of New Brunswick and having its  
head office at Saint John in the  
County of Saint John and Province  
of New Brunswick, hereinafter  
referred to as the GRANTEE,

OF THE SECOND PART,

RECORDED & FILED

Dec. 15<sup>th</sup> 1965  
AT THE HOUR OF 9:30 AM

# 970

*J. M. Cragg*  
REGISTRAR

WITNESSETH that in consideration of the sum of *Ninety*  
\_\_\_\_\_ Dollars ( *90* ) now paid by the Grantee

to the Grantors, the receipt whereof is hereby acknowledged,  
the Grantors do grant, convey, release, assign and confirm unto  
the Grantee, its successors and assigns, the right, at any time  
to enter upon the lands hereinafter described, for the purpose  
of laying down and constructing pipes for water conduits for  
wires of all kinds, in, under and upon the said lands, and of  
keeping and maintaining the same at all times in good condition  
and repair and for every such purpose the Grantee shall have  
access to the said lands at all times, by its servants, employees  
and workmen.

The lands to be affected by this easement are as follows:

All that certain lot, piece or parcel of land having a  
length of eight hundred ninety-three (893) feet and a uniform  
perpendicular width of fifty (50) feet, extending twenty-five  
(25) feet north of, and twenty-five (25) feet south of the centre  
line of the Waterline Rightoof Way, and extending from the eastern  
boundary of property owned or allegedly owned by Edward Roy to  
the western boundary of property owned or allegedly owned by  
Roger Flannagan, situate, lying and being in the Parish of

Durham, County of Restigouche and the Province of New Brunswick,  
and having its centre line as it crosses the aforesaid

Duivenvoorden property; more particularly described as follows:

Beginning at the intersection of the eastern boundary of property owned or allegedly owned by Edward Roy with the centre line of the Waterline Right of Way as surveyed. Thence from the place of beginning on a New Brunswick Coordinate Bearing of south eighty degrees, eighteen minutes thirty-four seconds east (S 80° 18' 34"E) along the aforesaid centre line a distance of eight hundred ninety-three (893) feet or to the western boundary of property owned or allegedly owned by Roger Flannagan. The hereinbefore described Right of Way being shown coloured red on a Plan showing the Waterline Right of Way on Lot No. 71W & 71E prepared by Hughes Surveys Ltd., dated August 12, 1965, a copy of which is attached hereto and forms a part hereof.

IN WITNESS WHEREOF the Grantors have hereunto set their hands and seals the day and year firstly hereinbefore written.

SIGNED, SEALED and DELIVERED )

in the presence of )

*Eugene M. Suley* )  
..... )

*[Signature]* )  
..... )

) *Mrs. J. Duivenvoorden* )  
)  
)



PROVINCE OF NEW BRUNSWICK

COUNTY OF *Restigouche*

I, *EUGENE MCGINLEY* a Notary Public, duly appointed, commissioned and sworn in and for the Province of New Brunswick, and residing and practising in the Town of Bathurst in said Province, DO HEREBY CERTIFY that on the *1<sup>st</sup>* day of *DEC* A. D., 1965 at *Joynt Haven* in said Province, personally came and appeared before me the said Notary Public, GERARD DUIVENVOORDEN and ADRIANNA DUIVENVOORDEN his wife, the Grantors named in the within Easement, and they acknowledged that they executed the within Indenture as and for their acts and deeds freely and voluntarily for the uses and purposes therein expressed and contained.

IN TESTIMONY WHEREOF, I, the said Notary Public, have hereunto set my hand and affixed my Notarial Seal at the Town of Bathurst, aforesaid, the day and year in this certificate above written.

*Eugene McGinley*

NOTARY PUBLIC  
NEW BRUNSWICK



I CERTIFY that the within *Easement* is duly entered and registered in the Registry Office for the County of Restigouche, New Brunswick at *9:30* o'clock A. M. of the *15<sup>th</sup>* day of *December* A. D. 19 *65* as Number *64546* in Book Number *108* Page Number *767-769*

*Laura Lavoie, Spty* Registrar of Deeds

THIS INDENTURE made this 15<sup>th</sup> day of December A. D., 1965,

BETWEEN:

EDWARD ROY and MARGARET ROY, his wife of the Parish of Durham in the county of Restigouche in the Province of New Brunswick, herein-after referred to as the GRANTORS,

RECORDED & FILED  
Dec 15 A. D. 1965  
AT THE HOUR OF 9:30 AM

OF THE FIRST PART,

- and -

# 971  
J.M. Cragg  
SOLICITOR

CHALEUR DEVELOPMENT LIMITED, a body corporate duly incorporated under the laws of the Province of New Brunswick, hereinafter referred to as the GRANTORS,

OF THE SECOND PART.

WITNESSETH that in consideration of the sum of One Hundred Dollars (\$100.00) now paid by the Grantee to the Grantors, the receipt whereof is hereby acknowledged, the Grantors do grant, convey, release, assign and confirm unto the Grantee, its successors and assigns, the right, at any time to enter upon the lands hereinafter described, for the purpose of laying down and constructing pipes for water conduits for wires of all kinds, in, under and upon the said lands, and of keeping and maintaining the same at all times in good condition and repair and for every such purpose the Grantee shall have access to the said lands at all times, by its servants, employees and workmen.

The lands to be affected by this easement are as follows:

All that certain lot, piece or parcel of land having a length of nine hundred eighty-five (985) feet and a uniform perpendicular width of fifty (50) feet, extending twenty-five (25) feet north of, and twenty-five (25) feet south of the centre line of the Waterline Right of Way, and extending from the eastern boundary of property owned or allegedly owned by Peter Lawlor to the western boundary of property owned or allegedly owned by Gerard Duivenvoorden, situate, lying, and being in the Parish of Durham, County of Restigouche and the Province of New Brunswick, and having its centre line as it crosses the aforesaid Roy property, more particularly described as follows:



Beginning at the intersection of the eastern boundary of property owned or allegedly owned by Peter Lawlor with the centre line of the Waterline Right of Way, as surveyed. Thence from the place of beginning on a New Brunswick Coordinate Bearing of south eighty degrees, eighteen minutes, thirty-four seconds east (S 80° 18' 34"E) along the aforesaid centre line a distance of nine hundred eighty-five (985) feet or to the western boundary of property owned or allegedly owned by Gerard Duivenvoorden. The hereinbefore described Right of Way being shown coloured red on a Plan showing the Waterline Right of Way on Lot No. 72 R prepared by Hughes Surveys Ltd., dated August 12, 1965, a copy of which is attached hereto and forms a part hereof.

IN WITNESS WHEREOF the Grantors have hereunto set their hands and seals the day and year firstly hereinbefore written.

SIGNED, SEALED and DELIVERED )

in the presence of )

*Eugene W. Gully* )

*Edward Pau* ) ○

*Margaret Roy* ) ○

PROVINCE OF NEW BRUNSWICK  
County of ~~Gloucester~~ *Restigouche*

I, *EUGENE McQUINLEY* a Notary Public, duly appointed, commissioned and sworn in and for the Province of New Brunswick, and residing and practising in the Town of Bathurst in said Province, DO HEREBY CERTIFY that on the *15<sup>th</sup>* day of *Dec* A.D., 1965 at *Jacques River* in said Province, personally came and appeared before me the said Notary Public, EDWARD ROY and his wife, MARGARET ROY, the Grantors named in the within Easement, and they acknowledged that they executed the within Indenture as and for their acts and deeds freely and voluntarily for the uses and purposes therein expressed and contained.

IN TESTIMONY WHEREOF, I, the said Notary Public, have hereunto set my hand and affixed my Notarial Seal at the Town of Bathurst, aforesaid, the day and year in this certificate above

*Eugene McQuinley*

NOTARY PUBLIC  
NEW BRUNSWICK



I CERTIFY that the within *Easement* is duly entered and registered in the Registry Office for the County of Restigouche, New Brunswick at *9:30* o'clock *A.* M. of the *15<sup>th</sup>* day of *December* A. D. 19*65* as Number *64547* in Book Number *108* Page Number *770-772*

*Laura Lavoie, Deputy* Registrar of Deeds

THIS INDENTURE made this 9<sup>th</sup> day of October A.D., 1965,

BETWEEN:

PETER LAWLOR and OLIVE LAWLOR, his wife, of the Parish of Durham in the County of Restigouche, in the Province of New Brunswick, hereinafter referred to as the GRANTORS

OF THE FIRST PART,

- and -

CHALEUR DEVELOPMENT LIMITED, a body corporate, duly incorporated under the laws of the Province of New Brunswick, having its head office at Saint John, in the County of Saint John, hereinafter referred to as the GRANTEE,

OF THE SECOND PART.

RECORDED & FILED  
Dec 15 1965  
AT THE HOUR OF 9:30 AM  
# 972  
J. M. Cragg

WITNESSETH that in consideration of the sum of Five Dollars (\$55<sup>00</sup>) now paid by the Grantee to

the Grantors, the receipt whereof is hereby acknowledged, the Grantors do grant, convey, release, assign and confirm unto the Grantee, its successors and assigns, the right, at any time to enter upon the lands hereinafter described, for the purpose of laying down and constructing pipes for water conduits for wires of all kinds, in, under and upon the said lands, and of keeping and maintaining the same at all times in good condition and repair and for every such purpose the Grantee shall have access to the said lands at all times, by its servants, employees and workmen.

The lands to be affected by this easement are as follows:

All that certain lot, piece or parcel of land having a length of five hundred ninety-seven (597) feet and a uniform perpendicular width of fifty (50) feet, extending twenty-five (25) feet north of and twenty-five (25) feet south of the centre line of the Water-line Right of Way, and extending from the eastern boundary of property owned or allegedly owned by Michael Lawlor to the western boundary of property owned or allegedly owned by Edward Roy, situate, lying, and being in the Parish of Durham, County of Restigouche and the Province of New Brunswick, and having its centre line as it crosses the aforesaid Lawlor property, more

particularly described as follows:

Beginning at the intersection of the eastern boundary of property owned or allegedly owned by Michael Lawlor with the centre line of the Waterline Right of Way as surveyed. Thence from the place of beginning on a New Brunswick Co-ordinate Bearing of south eighty degrees, eighteen minutes, thirty-four seconds east (S 80° 18' 34"E) along the afore-said centre line a distance of five hundred ninety-seven (597) feet or to the western boundary of property owned or allegedly owned by Edward Roy. The hereinbefore described Right of Way being shown coloured red on a Plan showing the Waterline Right of Way on Lot No. 73E prepared by Hughes Surveys Ltd., dated August 13, 1965, a copy of which is attached hereto and forms a part hereof.

IN WITNESS WHEREOF the Grantors have hereunto set their hands and seals the day and year firstly hereinbefore written.

SIGNED, SEALED and DELIVERED )

in the presence of )

*Eugene M. Gully*  
..... )

*Peter Hunter*



*Olive Lawlor*  
..... )  
)  
)



PROVINCE OF NEW BRUNSWICK  
COUNTY OF *Restigouche*

I, *Eugene McKinley*, a Notary Public, duly appointed, commissioned and sworn in and for the Province of New Brunswick, and residing and practising in the Town of Bathurst in said Province, DO HEREBY CERTIFY that on the *7<sup>th</sup>* day of *October* A. D., 1965 at *Lequet River* in said Province, personally came and appeared before me the said Notary Public, PETER LAWLOR, and his wife, OLIVE LAWLOR, the Grantors named in the within Easement, and they acknowledged that they executed the within Indenture as and for their acts and deeds freely and voluntarily for the uses and purposes therein expressed and contained.

IN TESTIMONY WHEREOF, I, the said Notary Public, have hereunto set my hand and affixed my Notarial Seal at the Town of Bathurst, aforesaid, the day and year in this certificate above written.

*Eugene McKinley*



NOTARY PUBLIC  
NEW BRUNSWICK

I CERTIFY that the within *Easement* is duly entered and registered in the Registry Office for the County of Restigouche, New Brunswick at *9:30* o'clock *A.M.* of the *15<sup>th</sup>* day of *December* A. D. 19*65* s Number *64548* in Book Number *108* Page Number *773-775*

*Laurie Lavoie, Aptg* Registrar of Deeds

THIS INDENTURE made this 12<sup>th</sup> day of *June* A. D., 1965,  
BETWEEN:

MICHAEL LAWLOR, of the Parish of Durham, County of Restigouche and Province of New Brunswick, hereinafter referred to as the GRANTORS

OF THE FIRST PART,

- and -

CHALEUR DEVELOPMENT LIMITED, a body corporate duly incorporated under the laws of the Province of New Brunswick and having its head office at Saint John in the County of Saint John and Province of New Brunswick, hereinafter referred to as the GRANTEE,

OF THE SECOND PART.

RECORDED & FILED  
*Dec 15* A. D. 1965  
AT THE HOUR OF *9:30 AM*  
# 973  
*McCrory*

*Concession Lawlor  
to  
Chaleur Development  
Ltd.*

WITNESSETH that in consideration of the sum of *Ninety*  
\_\_\_\_\_ Dollars (*90.00*) now paid by the Grantee to the Grantors, the receipt whereof is hereby acknowledged, the Grantors do grant, convey, release, assign and confirm unto the Grantee, its successors and assigns, the right, at any time to enter upon the lands hereinafter described, for the purpose of laying down and constructing pipes for water conduits for wires of all kinds, in, under and upon the said lands, and of keeping and maintaining the same at all times in good condition and repair and for every such purpose the Grantee shall have access to the said lands at all times, by its servants, employees and workmen.

The lands to be affected by this easement are as follows:

All that certain lot, piece or parcel of land having a length of four hundred twenty (420) feet and a uniform perpendicular width of fifty (50) feet, extending twenty-five (25) feet north of, and twenty-five (25) feet south of the centre line of the Waterline Right of Way, and extending from the eastern boundary of the Lawlor Road to the western boundary of property owned or allegedly owned by Peter Lawlor, situate, lying, and being in the Parish of Durham, County of Restigouche and the Province of New Brunswick, and having its centre line as it crosses the aforesaid Lawlor property, more particularly described as follows:

Beginning at the intersection of the Eastern boundary of Lawlor Road with the centre line of the Waterline Right of Way as surveyed. Thence from the place of beginning on a New Brunswick Co-ordinate Bearing of south eighty degrees, eighteen minutes, thirty-four seconds east (S 80° 18' 34"E) along the aforesaid centre line a distance of four hundred twenty (420) feet or to the western boundary of property owned or allegedly owned by Peter Lawlor. The hereinbefore described Right of Way being shown coloured red on a Plan showing the Waterline Right of Way on Lot No. 73 W prepared by Hughes Surveys Ltd., dated August 13, 1965, a copy of which is attached hereto and forms a part hereof.


It is hereby understood and agreed as a condition of the granting of this easement that upon completion of laying down and construction of the pipeline the cleared lands to be affected by this easement shall be restored to original grade and condition, including topsoil. And it is further understood and agreed that after completion there shall be no thoroughfare over the within right-of-way except as may be necessary from time to time for repair and servicing of the pipe-line, in which event the Grantor is to be compensated for any land or crop damage occasioned thereby.


IN WITNESS WHEREOF the Grantors have hereunto set their hands and seals the day and year firstly hereinbefore written.

SIGNED, SEALED and DELIVERED )

in the presence of )

*Eugene Mc Linty*  
..... )

) *Michael Lawlor* ) 

) *Elizabeth Luciani* ) 

)

PROVINCE OF NEW BRUNSWICK  
 COUNTY OF *RESTIGOUCHE*

I, *Eugene McGinley*, a Notary Public, duly appointed, commissioned and sworn in and for the Province of New Brunswick, and residing and practising in the Town of Bathurst in said Province, DO HEREBY CERTIFY that on the *12th* day of *October*, A. D., 1965 at *Parish of D'Arbouville* in said Province, personally came and appeared before me the said Notary Public, MICHAEL LAWLOR, and his wife, EVANGELINE LAWLOR, the Grantors named in the within Easement, and they acknowledged that they executed the within Indenture as and for their acts and deeds freely and voluntarily for the uses and purposes therein expressed and contained.

IN TESTIMONY WHEREOF, I, the said Notary Public, have hereunto set my hand and affixed my Notarial Seal at the Town of Bathurst, aforesaid, the day and year in this certificate above written.

*Eugene McGinley*  
 NOTARY PUBLIC  
 NEW BRUNSWICK



I CERTIFY that the within *Easement* is duly entered and registered in the Registry Office for the County of Restigouche, New Brunswick at *9:30* o'clock *A. M.* of the *15th* day of *December* A. D. 19*65* as Number *64549* in Book Number *108* Page Number *776-778*

*Laura Lavoie, Spty* Registrar of Deeds



THIS INDENTURE made this 11<sup>th</sup> day of October A.D., 1965,

BETWEEN:

DELPHIS LEGACY and REGINA LEGACY  
his wife, of the Parish of Durham  
in the County of Restigouche and  
Province of New Brunswick, here-  
inafter referred to as the GRANTORS

OF THE FIRST PART,

- and -

CHALEUR DEVELOPMENT LIMITED, a  
body corporate duly incorporated  
under the laws of the Province of  
New Brunswick and having its head  
office at Saint John in the County  
of Saint John and Province of New  
Brunswick, hereinafter referred  
to as the GRANTEE,

OF THE SECOND PART.

*Dec 15, 1965*  
*AT THE TIME OF 9:30 AM*  
*# 974*  
*J. McCagg*

WITNESSETH that in consideration of the sum of *Seventy-*  
*Five* Dollars (*75<sup>00</sup>*) now paid by the Grantee to

the Grantors the receipt whereof is hereby acknowledged, the Grantors do grant, convey, release, assign and confirm unto the Grantee, its successors and assigns, the right, at any time to enter upon the lands hereinafter described, for the purpose of laying down and constructing pipes for water conduits for wires of all kinds, in, under and upon the said lands, and of keeping and maintaining the same at all times in good condition and repair and for every such purpose the Grantee shall have access to the said lands at all times, by its servants, employees and workmen.

The lands to be affected by this easement are as follows:

All that certain lot, piece or parcel of land having a length of seven hundred fifteen (715) feet and a uniform perpendicular width of fifty (50) feet, extending twenty-five (25) feet north of, and twenty-five (25) feet south of the centre line of the Waterline Right of Way, and extending from the eastern boundary of property owned or allegedly owned by Mildred Dempsey to the western boundary of Lawlor Road, situate, lying and being in the Parish of Durham, County of Restigouche and

the Province of New Brunswick, and having its centre line as it crosses the aforesaid Legacy property, more particularly described as follows:

Beginning at the intersection of the eastern boundary of property owned or allegedly owned by Mildred Dempsey with the centre line of Waterline Right of Way as surveyed. Thence from the place of beginning on a New Brunswick Co-ordinate Bearing of north seventy-three degrees, forty-one minutes, twenty-six seconds east (N 73° 41' 26"E) along the aforesaid centre line a distance of three hundred forty (340) feet to a bend in the said centre line. Thence north forty-one degrees, thirty-six minutes, five seconds east (N 41° 36' 05"E) continuing along the said centre line a distance of three hundred forty (340) feet to another bend. Thence south eighty degrees, eighteen minutes, thirty-four seconds east (S 80° 18' 34"E) continuing along the aforesaid centre line a distance of thirty-five (35) feet or to the western boundary of the Lawlor Road. The hereinbefore described Right of Way being shown coloured red on a Plan showing the Waterline Right of Way on Lot No. 74E prepared by Hughes Surveys Ltd., dated August 13, 1965, a copy of which is attached hereto and forms a part hereof.

IN WITNESS WHEREOF the Grantors have hereunto set their hands and seals the day and year firstly hereinbefore written.

SIGNED, SEALED and DELIVERED )

in the presence of )

*Ernest W. Bailey*  
.....

) *Delphus A. Legacy* ○  
)  
) *Mrs Delphus Legacy* ○  
)  
)

PROVINCE OF NEW BRUNSWICK  
COUNTY OF RESTIGOUCHE

I, *Eugene McGinley*, a Notary Public, duly appointed, commissioned and sworn in and for the Province of New Brunswick, and residing and practising in the Town of Bathurst in said Province, DO HEREBY CERTIFY that on the *11th* day of *October*, A. D., 1965 at *Jacques River* in said Province, personally came and appeared before me the said Notary Public, DELPHIS LEGACY, and REGINA LEGACY, his wife, the Grantors named in the within Easement, and they acknowledged that they executed the within Indenture as and for their acts and deeds freely and voluntarily for the uses and purposes therein expressed and contained.

IN TESTIMONY WHEREFO, I, the said Notary Public, have hereunto set my hand and affixed my Notarial Seal at the Town of Bathurst, aforesaid, the day and year in this certificate above written.

*Eugene McGinley*

NOTARY PUBLIC  
NEW BRUNSWICK



I CERTIFY that the within *Easement* is duly entered and registered in the Registry Office for the County of Restigouche, New Brunswick at *9:30* o'clock *A.M.* of the *15th* day of *December* A. D. 1965 as Number *64550* in Book Number *108* Page Number *779-781*

*Laura Lavoie, Sptg* Registrar of Deeds

THIS INDENTURE made this 12<sup>th</sup> day of October A. D., 1965,  
BETWEEN:

MILDRED DEMPSEY, widow of Wilbur Dempsey of the Parish of Durham, County of Restigouche and Province of New Brunswick, hereinafter referred to as the GRANTOR,

OF THE FIRST PART,

- and -

Dec 15<sup>th</sup> 1965  
AT THE HOUR OF 9:30 AM  
# 975  
J. McCagg  
SOLICITOR

CHALEUR DEVELOPMENT LIMITED, a body corporate duly incorporated under the laws of the Province of New Brunswick and having its head office at Saint John in the County of Saint John and Province of New Brunswick, hereinafter referred to as the GRANTEE,

OF THE SECOND PART.

WITNESSETH that in consideration of the sum of Five -  
Five Dollars ( 55 ) now paid by the Grantee to the Grantor, the receipt whereof is hereby acknowledged, the Grantor doth grant, convey release, assign and confirm unto the Grantee, its successors and assigns, the right, at any time to enter upon the lands hereinafter described, for the purpose of laying down and constructing pipes for water conduits for wires of all kinds, in, under and upon the said lands, and of keeping and maintaining the same at all times in good condition and repair and for every such purpose the Grantee shall have access to the said lands at all times, by its servants, employees and workmen.

The lands to be affected by this easement are as follows:

All that certain lot, piece or parcel of land having a length of five hundred thirty-eight (538) feet and a uniform perpendicular width of fifty (50) feet, extending twenty-five (25) feet north of, and twenty-five (25) feet south of the centre line of the Waterline Right of Way, and extending from the eastern boundary of property owned or allegedly owned by Herman Guitard to the western boundary of property owned or allegedly owned by Delphus Hickey, situate, lying and being in the Parish of Durham, County of Restigouche and the Province of New Brunswick, and

having its centre line as it crosses the aforesaid Dempsey property, more particularly described as follows:

Beginning at the intersection of the eastern boundary of property owned or allegedly owned by Herman Guitard with the centre line of the Waterline Right of Way as surveyed. Thence from the place of beginning on a New Brunswick Co-ordinate Bearing of north seventy-three degrees, forty-one minutes, twenty-six seconds east (N 73° 41' 26") along the aforesaid centre line a distance of five hundred and thirty-eight (538) feet or to the western boundary of property owned or allegedly owned by Delphus Hickey. The hereinbefore described Right of Way shown Coloured red on a Plan showing the Waterline Right of Way on Lot No. 74W prepared by Hughes Surveys Ltd., dated August 13, 1965, a copy of which is attached hereto and forms a part hereof.

IN WITNESS WHEREOF the Grantor has hereunto set her hand and seal the day and year firstly hereinbefore written.

SIGNED, SEALED and DELIVERED )

in the presence of )

) Mrs. M. M. Dempsey (with circular seal)

Eugene M. Stanley )  
..... )

) ..... )

)

PROVINCE OF NEW BRUNSWICK  
 COUNTY OF ~~GLOUCESTER~~ <sup>RESTIGOUCHE</sup>

I, *Eugene McInley*, a Notary Public, duly appointed, commissioned and sworn in and for the Province of New Brunswick, and residing and practising in the Town of Bathurst in said Province, DO HEREBY CERTIFY that on the *12th* day of *October*, A. D., 1965 at *Lequet River* in said Province, personally came and appeared before me the said Notary Public, MRS. MILDRED DEMPSEY, wife of Wilbur Dempsey, the Grantor named in the within Easement, and she acknowledged that she executed the within Indenture as and for her acts and deed freely and voluntarily for the uses and purposes therein expressed and contained.

IN TESTIMONY WHEREOF, I, the said Notary Public, have hereunto set my hand and affixed my Notarial Seal at the Town of Bathurst, afore-said, the day and year in this certificate above

*Eugene McInley*

NOTARY PUBLIC  
 NEW BRUNSWICK



I CERTIFY that the within

*Easement*  
 is duly entered and registered in the Registry Office for the County of Restigouche,  
 New Brunswick at *9:30* o'clock *A*. M. of the *15th*  
 day of *December* A. D. 1965 as Number *64551*  
 in Book Number *108* Page Number *782-784*

*Laura Lavoie, Aptg* Registrar of Deeds

THIS INDENTURE made this 9<sup>th</sup> day of October A. D., 1965,

BETWEEN:

Herman Guitard and Adeline Guitard, his wife, of the Parish of Durham, in the County of Restigouche in the Province of New Brunswick, herein-after referred to as the GRANTORS,

OF THE FIRST PART,

- and -

RECEIVED & FILED  
Dec 15 A. D. 1965  
AT THE HOUR OF 9:30 AM  
# 976  
J. M. Cragg

CHALEUR DEVELOPMENT LIMITED, a body corporate duly incorporated under the laws of the Province of New Brunswick and having its head office at Saint John in the County of Saint John and Province of New Brunswick, hereinafter referred to as the GRANTEE,

OF THE SECOND PART.

WITNESSETH that in consideration of the sum of

*Five*

Dollars (50<sup>00</sup>) now paid by the Grantee to

the Grantors, the receipt whereof is hereby acknowledged, the Grantors do grant, convey, release, assign and confirm unto the Grantee, its successors and assigns, the right, at any time to enter upon the lands hereinafter described, for the purpose of laying down and constructing pipes for water conduits for wires of all kinds, in, under and upon the said lands, and of keeping and maintaining the same at all times in good condition and repair and for every such purpose the Grantee shall have access to the said lands at all times, by its servants, employees and workmen.

The lands to be affected by this easement are as follows:

All that certain lot, piece or parcel of land having a length of five hundred (500) feet and a uniform perpendicular width of fifty (50) feet, extending twenty-five (25) feet north of, and twenty-five (25) feet south of the centre line of the Waterline Right of Way, and extending from the eastern boundary of property owned or allegedly owned by Eugene Legacy to the western boundary of property owned or allegedly owned by Norman Legacy, situate, lying, and being in the Parish of Durham, County of Restigouche and the Province of New Brunswick, and having its centre line as it crosses the aforesaid Guitard property, more particularly described as follows:

Beginning at the intersection of the eastern boundary of property owned or allegedly owned by Eugene Legacy with the Centre line of the Waterline Right of Way as surveyed. Thence from the place of beginning on a New Brunswick Coordinate Bearing of north seventy-three degrees, forty-one minutes, twenty-six seconds east (N 73° 41' 26"E) along the aforesaid centre line a distance of five hundred (500) feet or to the western boundary of property owned or allegedly owned by Norman Legacy. The hereinbefore described Right of Way being shown coloured red on a Plan showing the Waterline Right of Way on Lot No. 75E prepared by Hughes Surveys Ltd., dated August 13, 1965, a copy of which is attached hereto and forms a part hereof.

IN WITNESS WHEREOF the Grantors have hereunto set their hands and seals the day and year firstly hereinbefore written.

SIGNED, SEALED and DELIVERED )

in the presence of )

*Eugene M. Legacy* )  
..... )

*Herman Peitard* ○

*Mrs. Helen Limited* ○



PROVINCE OF NEW BRUNSWICK  
COUNTY OF ~~GLoucester~~ Restigouche

I, Eugene McInley, a Notary Public, duly appointed, commissioned and sworn in and for the Province of New Brunswick, and residing and practising in the Town of Bathurst in said Province, DO HEREBY CERTIFY that on the 9th day of October A. D., 1965 at Joseph River in said Province, personally came and appeared before me the said Notary Public, HERMAN GUITARD and ADELIN GUITARD, his wife, the Grantors named in the within Easement, and they acknowledged that they executed the within Indenture as and for their acts and deeds freely and voluntarily for the uses and purposes therein expressed and contained.

IN TESTIMONY WHEREOF, I, the said Notary Public, have hereunto set my hand and affixed my Notarial Seal at the Town of Bathurst, said, the day and year this certificate above

*Eugene McInley*



NOTARY PUBLIC  
NEW BRUNSWICK

I CERTIFY that the within *Easement* is duly entered and registered in the Registry Office for the County of Restigouche, New Brunswick at *9:30* o'clock *A.M.* of the *15th* day of *December* A. D. 1965 as Number *6455.2* in Book Number *108* Page Number *785-787*

*Laura Lavoie, Aptej* Registrar of Deeds

THIS INDENTURE made this 9<sup>th</sup> day of October A.D., 1965,

BETWEEN:

EUGENE LEGACY, and MARY LEGACY, his wife, of the Parish of Durham, in the County of Restigouche and Province of New Brunswick, hereinafter referred to as the GRANTORS,

OF THE FIRST PART,

- and -

CHALEUR DEVELOPMENT LIMITED, a body corporate duly incorporated under the laws of the Province of New Brunswick and having its head office at Saint John in the County of Saint John and Province of New Brunswick, hereinafter referred to as the GRANTEE,

OF THE SECOND PART.

RECEIVED & FILED

Dec 15 A.D. 1965  
AT THE HOUR OF 9:30 AM

# 977

P. M. Cragg

WITNESSETH that in consideration of the sum of

Forty

Dollars (40.00) now paid by the Grantee

to the Grantors, the receipt whereof is hereby acknowledged, the Grantors do grant, convey, release, assign and confirm unto the Grantee, its successors and assigns, the right, at any time to enter upon the lands hereinafter described, for the purpose of laying down and constructing pipes for water conduits for wires of all kinds, in, under and upon the said lands, and of keeping and maintaining the same at all times in good condition and repair and for every such purpose the Grantee shall have access to the said lands at all times, by its servants, employees and workmen.

The lands to be affected by this easement are as follows:

All that certain lot, piece or parcel of land having a length of three hundred eighty (380) feet and a uniform perpendicular width of fifty (50) feet, extending twenty-five (25) feet north of, and twenty-five (25) feet south of the centre line of the Water-line Right of Way, and extending from the eastern boundary of property owned or allegedly owned by Marinus DeGroot to the Western boundary of property owned or allegedly owned by Herman Guitard, situate, lying, and being in the Parish of Durham, County of Restigouche and the Province of New Brunswick, and having its

centre line as it crosses the aforesaid Legacy property, more particularly described as follows:

Beginning at the intersection of the eastern boundary of property owned or allegedly owned by Marinus DeGroot with the centre line of the Waterline Right of Way as surveyed. Thence from the place of beginning on a New Brunswick Co-ordinate Bearing of north seventy-three degrees, forty-one minutes, twenty-six seconds east (N 73° 41' 26"E) along the aforesaid centre line a distance of three hundred eighty (380) feet or to the western boundary of property owned or allegedly owned by Herman Guitard. The hereinbefore described Right of Way being shown coloured red on a Plan showing the Waterline Right of Way on Lot No. E½ of 54W prepared by Hughes Surveys Ltd., dated August 13, 1965, a copy of which is attached hereto and forms a part hereof.

IN WITNESS WHEREOF the Grantors have hereunto set their hands and seals the day and year firstly hereinbefore written.

SIGNED, SEALED and DELIVERED )

in the presence of )

*Eugene M. Guitard*  
..... )

*Francis E. Legacy*.....○

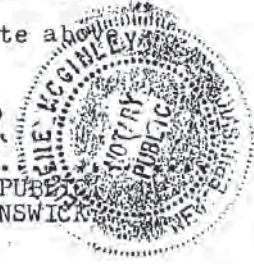
*Mary Kathleen Legacy*.....○

PROVINCE OF NEW BRUNSWICK  
COUNTY OF ~~GLoucester~~ *Pestigouche*

I, *Eugene McInley*, a Notary Public, duly appointed, commissioned and sworn in and for the Province of New Brunswick, and residing and practising in the Town of Bathurst in said Province, DO HEREBY CERTIFY that on the *9<sup>th</sup>* day of *October* A. D., 1965 at *Joseph's River* in said Province, personally came and appeared before me the said Notary Public, EUGENE LEGACY and MARY LEGACY, his wife, the Grantors named in the within Easement, and they acknowledged that they executed the within Indenture as and for their acts and deeds freely and voluntarily for the uses and purposes therein expressed and contained.

IN TESTIMONY WHEREOF, I, the said Notary Public, have hereunto set my hand and affixed my Notarial Seal at the Town of Bathurst, afore-said, the day and year in this certificate above written.

*Eugene McInley*  
NOTARY PUBLIC  
NEW BRUNSWICK



I CERTIFY that the within *Easement* is duly entered and registered in the Registry Office for the County of *Pestigouche*, New Brunswick at *9:30* o'clock *A.M.* of the *15<sup>th</sup>* day of *December* A. D. 19*65* as Number *64553* in Book Number *108* Page Number *788-790*

*Laurie Lavoie, Notary* Registrar of Deeds

64554

THIS INDENTURE made this 30<sup>th</sup> day of November A. D., 1965,

BETWEEN:

REVEREND JAMES DEGROOT and REVEREND CORNELIUS DEGROOT, both of the State of California in the United States of America (by their Attorney, Marinus DeGroot of Shannonvale in the County of Restigouche in the Province of New Brunswick, hereinafter referred to as the GRANTORS

RECEIVED & FILED  
Dec 15 A. D. 1965  
AT THE HOUR OF 9:30 AM  
#978  
J. M. Cragg

OF THE FIRST PART,

- and -

CHALEUR DEVELOPMENT LIMITED, a body corporate duly incorporated under the laws of the Province of New Brunswick and having its head office at Saint John in the County of Saint John, and Province of New Brunswick, hereinafter referred to as the GRANTEE,

OF THE SECOND PART.

WITNESSETH that in consideration of the sum of Ninety Five Dollars ( \$ 9 5 0 0 ) now paid by the Grantee

to the Grantors, the receipt whereof is hereby acknowledged, the Grantors do grant, convey, release, assign and confirm unto the Grantee, its successors and assigns, the right, at any time to enter upon the lands hereinafter described, for the purpose of laying down and constructing pipes for water conduits for wires of all kinds, in, under and upon the said lands, and of keeping and maintaining the same at all times in good condition and repair and for every such purpose the Grantee shall have access to the said lands at all times, by its servants, employees and workmen.

The lands to be affected by this easement are as follows:

All that certain lot, piece or parcel of land having a length of nine hundred twenty-three (923) feet and a uniform perpendicular width of fifty (50) feet, extending twenty-five (25) feet north of, and twenty-five (25) feet south of the centre line of the Waterline Right of Way, and extending from the eastern boundary of property owned or allegedly owned by Edwin McDonnell to the eastern boundary of property owned or

allegedly owned by Eugene Legacy, situate, lying and being in the Parish of Durham, County of Restigouche and the Province of New Brunswick, and having its centre line as it crosses the aforesaid DeGroot property, more particularly described as follows:

Beginning at the intersection of the Eastern Boundary of property owned or allegedly owned by Greta Hayes with the centre line of the Waterline Right of Way as surveyed. Thence from the place of beginning on a New Brunswick Co-ordinate bearing of north eighty-seven degrees, forty-eight minutes, thirty-four seconds east (N 87° 48' 34"E) along the aforesaid centre line a distance of four hundred sixty-two (463) feet to a bend in the said centre line; thence north seventy-three degrees, forty-one minutes, twenty-six seconds east (N 73° 41' 26"E) continuing along the said centreline a distance of four hundred sixty-one (461) feet, or to the western boundary of property owned or allegedly owned by Eugene Legacy. The hereinbefore described right of way being shown coloured red on a Plan showing the Waterline Right of Way on Lot No. 76E, W $\frac{1}{2}$  of 75W prepared by Hughes Surveys Ltd., dated August 13, 1965 a copy of which is attached hereto and forms a part hereof.

IN WITNESS WHEREOF the Grantors by their Attorney, Marinus DeGroot, have hereunto set their hands and seals the day and year firstly hereinbefore written.

SIGNED, SEALED and DELIVERED )  
in the presence of )

*Eugene Legacy*  
..... )

*James DeGroot*  
*Marinus W. DeGroot*  
..... )  
Rev. James DeGroot, by his  
Attorney, Marinus DeGroot  
*Cornelius DeGroot*  
*Marinus W. DeGroot*  
..... )  
Rev. Cornelius DeGroot, by  
his Attorney, Marinus DeGroot  
)  
)



PROVINCE OF NEW BRUNSWICK  
COUNTY OF *Restigouche* GLOUCESTER

I, *E. SENE McTAVLEY* a Notary Public, duly appointed, commissioned and sworn in and for the Province of New Brunswick, and residing and practising in the Town of Bathurst in said Province, DO HEREBY CERTIFY that on the day of *November* ~~15th~~ <sup>30th</sup> A. D., 1965 at *Pal River* in said Province, personally came and appeared before me the said MARINUS DeGROOT, Attorney for the Grantors named in the within Easement, and he acknowledged that he executed the within Indenture as Attorney for the Grantors freely and voluntarily for the uses and purposes therein expressed and contained.

*592 62*

*30th* *Nov*

IN TESTIMONY WHEREOF, I, the said Notary Public, have hereunto set my hand and affixed my Notarial Seal at the Town of Bathurst, aforesaid, the day and year in this certificate above written.

*Eugene M.*

NOTARY PUBLIC  
NEW BRUNSWICK



I CERTIFY that the within *Easement* is duly entered and registered in the Registry Office for the County of Restigouche, New Brunswick at *9:30* o'clock *A.M.* of the *15th* day of *December* A. D. 19*65* as Number *64554* in Book Number *108* Page Number *791-792*

*Laura Davoir, Deputy* Registrar of Deeds

THIS INDENTURE made this 9<sup>th</sup> day of February A.D., 1965,

BETWEEN:

EDWIN McDONNELL and his wife,  
ALFREDA McDONNELL of the Parish  
of Durham in the County of  
Restigouche, in the Province of  
New Brunswick, hereinafter  
referred to as the GRANTORS,

OF THE FIRST PART,

- and -

CHALEUR DEVELOPMENT LIMITED, a  
body corporate duly incorporated  
under the laws of the Province of  
New Brunswick and having its head  
office at Saint John, in the  
County of Saint John, in the  
Province aforesaid, hereinafter  
referred to as the GRANTEE,

OF THE SECOND PART,

WITNESSETH that in consideration of the sum of Twenty

Dollars (20 ) now paid by the Grantee to

the Grantors, the receipt whereof is hereby acknowledged, the Grantors do grant, convey, release, assign and confirm unto the Grantee, its successors and assigns, the right, at any time to enter upon the lands hereinafter described, for the purpose of laying down and constructing pipes for water conduits for wires of all kinds, in, under and upon the said lands, and of keeping and maintaining the same at all times in good condition and repair and for every such purpose the Grantee shall have access to the said lands at all times, by its servants, employees and workmen.

The lands to be affected by this easement are as follows:

All that certain lot, piece or parcel of land having a length of two hundred five (205) feet and a uniform perpendicular width of fifty (50) feet, extending twenty-five (25) feet north of, and twenty-five (25) feet south of the centre line of the Waterline Right of Way, and extending from the eastern boundary of property owned or allegedly owned by Greta Hayes to the western boundary of property owned or allegedly owned by Marinus DeGroot, situate, lying and being in the Parish of Durham, County of Restigouche and the Province of New Brunswick, and having its

RECEIVED & FILED  
Dec 15 1965  
9:30 AM

# 929  
J. M. Cragg



centre line as it crosses the aforesaid McDonnell property,  
more particularly described as follows:


Beginning at the intersection of the eastern boundary of property owned or allegedly owned by Greta Hayes with the centre line of the Waterline Right of Way as surveyed. Thence from the place of beginning on a New Brunswick Co-ordinate Bearing of south eighty-seven degrees, forty-eight minutes, thirty-four seconds east (S 87° 48' 34"E) along the aforesaid centre line a distance of two hundred five (205) feet or to the western boundary of property owned or allegedly owned by Marinus DeGroot. The hereinbefore described Right of Way being shown coloured red on a Plan showing the Waterline Right of Way on Lot No. E portion 76W prepared by Hughes Surveys Ltd., dated August 13, 1965, a copy of which is attached hereto and forms a part hereof.


IN WITNESS WHEREOF the Grantors have hereunto set their hands and seals the day and year firstly hereinbefore written.

SIGNED, SEALED and DELIVERED )

in the presence of )

*Laura M. Gily* )  
..... )

*Edwin M. McDonnell* ) 

*Alfreda M. McDonnell* ) 

)  
)  
)

PROVINCE OF NEW BRUNSWICK  
COUNTY OF RESTIGOUCHE

I, *Eugene McGinley*, a Notary Public, duly appointed, commissioned and sworn in and for the Province of New Brunswick, and residing and practising in the Town of Bathurst in said Province, DO HEREBY CERTIFY that on the *9th* day of *October*, A. D., 1965 at *Laquet River* in said Province, personally came and appeared before me the said Notary Public, EDWIN McDONNELL and ALFREDA McDONNELL his wife, the Grantors, named in the within Deed, and they acknowledged that they executed the within Indenture, as and for their acts and deeds freely and voluntarily for the uses and proposes therein expressed and contained.

IN TESTIMONY WHEREOF, I the said Notary Public, have hereunto set my hand and affixed my Notarial Seal at the Town of Bathurst aforesaid, the day and year in this certificate above written.

*Eugene McGinley*  
NOTARY PUBLIC  
NEW BRUNSWICK



I CERTIFY that the within *Easement* is duly entered and registered in the Registry Office for the County of Restigouche, New Brunswick at *9:30* o'clock *A.M.* of the *15th* day of *December* A. D. 19*65* as Number *64555* in Book Number *108* Page Number *794-796*

*Laure Laviolette*, Registrar of Deeds

THIS INDENTURE made this 4<sup>th</sup> day of October A. D., 1965,

BETWEEN:

MISS GRETA HAYES of the Parish of Durham in the County of Restigouche in the Province of New Brunswick, hereinafter referred to as the GRANTOR,

OF THE FIRST PART,

- and -

CHALEUR DEVELOPMENT LIMITED, a body corporate duly incorporated under the laws of the Province of New Brunswick and having its head office at Saint John in the County of Saint John and Province of New Brunswick, hereinafter referred to as the GRANTEE,

OF THE SECOND PART.

REC 15-11-65  
9:20 AM  
# 980  
O. M. Cragg

WITNESSETH that in consideration of the sum of Thirty -

Five Dollars ( \$ 35.00 ) now paid by the Grantee to

the Grantor, the receipt whereof is hereby acknowledged, the Grantor doth grant, convey, release, assign and confirm unto the Grantee, its successors and assigns, the right, at any time to enter upon the lands hereinafter described, for the purpose of laying down and constructing pipes for water conduits for wires of all kinds, in, under and upon the said lands, and of keeping and maintaining the same at all times in good condition and repair and for every such purpose the Grantee shall have access to the said lands at all times, by its servants, employees and workmen.

The lands to be affected by this easement are as follows:

All that certain lot, piece or parcel of land having a length of three hundred forty (340) feet and a uniform perpendicular width of fifty (50) feet, extending twenty-five (25) feet north of, and twenty-five (25) feet south of the centre line of the Water-line Right of Way, and extending from the eastern boundary of property owned or allegedly owned by Edwin McDonnell to the western boundary of property owned or allegedly owned by Edwin McDonnell, situate, lying, and being in the Parish of Durham, County of

Restigouche and the Province of New Brunswick, and having its centre line as it crosses the aforesaid Hayes property, more particularly described as follows:

Beginning at the intersection of the eastern boundary of property owned or allegedly owned by Edwin McDonnell with the centre line of the Waterline Right-of-Way as surveyed. Thence from the place of beginning on a New Brunswick Coordinate Bearing of north eighty-seven degrees, forty-eight minutes, thirty-four seconds east (N 87° 48' 34" E) along the aforesaid centre line a distance of three hundred forty (340) feet or to the western boundary of property owned or allegedly owned by Edwin McDonnell. The hereinbefore described Right of Way being shown coloured red on a Plan showing the Waterline Right of Way on Lot No. W. P. 76W prepared by Hughes Surveys Ltd., dated August 13, 1965, a copy of which is attached hereto and forms a part hereof.

IN WITNESS WHEREOF the Grantor has hereunto set her hand and seal the day and year firstly hereinbefore written.

SIGNED, SEALED and DELIVERED )

in the presence of )

*Eugene M. Herby* )

*Kate Hayes* ) 

)  
)  
)

PROVINCE OF NEW BRUNSWICK  
COUNTY OF *Restigouche* GLOUCESTER

I, *Eugene McInley*, a Notary Public, duly appointed, commissioned and sworn in and for the Province of New Brunswick, and residing and practising in the Town of Bathurst in said Province, DO HEREBY CERTIFY that on the *4th* day of *October*, A. D., 1965 at *Bathurst New Brunswick* in said Province, personally came and appeared before me the said Notary Public, MISS GRETA HAYES, the Grantor named in the within Easement, and she acknowledged that she executed the within Indenture as and for her acts and deeds freely and voluntarily for the uses and purposes therein expressed and contained.

IN TESTIMONY WHEREOF, I, the said Notary Public, have hereunto set my hand and affixed my Notarial Seal at the Town of Bathurst, aforesaid, the day and year in this certificate above.

*Eugene McInley*  
NOTARY PUBLIC  
NEW BRUNSWICK



I CERTIFY that the within *Easement* is duly entered and registered in the Registry Office for the County of Restigouche, New Brunswick at *9:30* o'clock *A.M.* of the *15th* day of *December* A. D. 19*65* as Number *64556* in Book Number *108* Page Number *797-799*

*Laura Lavoie, A.P.* Registrar of Deeds

THIS INDENTURE made this 9<sup>th</sup> day of October A.D., 1965,

EDWIN McDONNELL and his wife, ALFREDA McDONNELL of the Parish of Durham in the County of Restigouche in the Province of New Brunswick, hereinafter referred to as the GRANTORS,

OF THE FIRST PART,

- and -

CHALEUR DEVELOPMENT LIMITED, a body corporate duly incorporated in the Province of New Brunswick and having its head office at Saint John in the County of Saint John and Province of New Brunswick, hereinafter referred to as the GRANTEE,

OF THE SECOND PART,

RECORDED & FILED  
Dec 15 1965  
AT THE REGISTRY  
#981  
J. M. Cragg

WITNESSETH that in consideration of the sum of

Seventy Dollars (70.00) now paid by the Grantee to

the Grantors, the receipt whereof is hereby acknowledged, the Grantors doth grant, convey, release, assign and confirm unto the Grantee, its successors and assigns, the right, at any time to enter upon the lands hereinafter described, for the purpose of laying down and constructing pipes for water conduits for wires of all kinds, in, under and upon the said lands, and of keeping and maintaining the same at all times in good condition and repair and for every such purpose the Grantee shall have access to the said lands at all times, by its servants, employees and workmen.

The lands to be affected by this easement are as follows:

All that certain lot, piece or parcel of land having a length of seven hundred (700) feet and a uniform perpendicular width of fifty (50) feet, extending twenty-five (25) feet north of, and twenty-five (25) feet south of the centre line of the Waterline Right of Way, and extending from the eastern boundary of property owned or allegedly owned by Lucien Gagnon to the western boundary of property owned or allegedly owned by Greta Hayes, situate, lying and being in the Parish of Durham, County of Restigouche and the Province of New Brunswick, and having its centre line as

it crosses the aforesaid McDonnell property, more particularly described as follows:

Beginning at the intersection of the eastern boundary of property owned or allegedly owned by Lucien Gagnon with the centre line of the Waterline Right of Way as surveyed. Thence from the place of beginning on a New Brunswick Coordinate Bearing of north seventy-seven degrees, eleven minutes, forty-seven seconds east (N 77° 11' 47"E) along the aforesaid centre line a distance of two hundred seventy (270) feet to a bend in the said centre line. Thence south sixty-six degrees, forty-eight minutes, thirty-four seconds east (S 66° 48' 34"E) and containing along the aforesaid centre line a distance of four hundred thirty (430) feet, or to the western boundary of property owned or allegedly owned by Greta Hayes. The hereinbefore described Right of Way being shown coloured red on a Plan showing the Waterline Right of Way on Lot No. 77E prepared by Hughes Surveys Ltd., dated August 13, 1965, a copy of which is attached hereto and forms a part hereof.

IN WITNESS WHEREOF the Grantors have hereunto set their hands and seals the day and year firstly hereinbefore written.

SIGNED, SEALED and DELIVERED )

in the presence of )

*Joyce M. Fisher*  
..... )

*Eileen McDonnell* )

*Alfreda M. McDonnell* )

)  
)  
)

PROVINCE OF NEW BRUNSWICK  
COUNTY OF RESTIGOUCHE

I, *Eugene McGinley*, a Notary Public duly appointed, commissioned and sworn in and for the Province of New Brunswick, and residing and practising in the Town of Bathurst in said Province, DO HEREBY CERTIFY that on the *9th* day of *October*, A. D., 1965 at *Frederic River* in said Province, personally came and appeared before me the said Notary Public, EDWIN McDONNELL and ALFREDA McDONNELL his wife, the Grantors named in the within Deed, and they acknowledged that they executed the within Indenture, as and for their acts and deeds freely and voluntarily for the uses and purposes therein expressed and contained.

IN TESTIMONY WHEREOF, I, the said Notary Public, have hereto set my hand and affixed my Notarial Seal at the Town of Bathurst, aforesaid, the day and year in this certificate above written.

*Eugene McGinley*  
.....  
NOTARY PUBLIC  
NEW BRUNSWICK



I CERTIFY that the within *Assessment* is duly entered and registered in the Registry Office for the County of Restigouche, New Brunswick at *9:30* o'clock *A.* M. of the *15th* day of *December* A. D. 19*65* as Number *64557* in Book Number *108* Page Number *800-802*

*Laura Levoic, Noty* Registrar of Deeds



THIS INDENTURE made this 17<sup>th</sup> day of *October* A. D., 1965,

BETWEEN:

LUCIEN GAGNON and his wife,  
OMERINE GAGNON of the Parish of  
Restigouche in the Province of  
New Brunswick, hereinafter refer-  
red to as the GRANTORS,

OF THE FIRST PART,

- and -

*Dec 15 65*  
*9:30 AM*  
*# 982*  
*J. M. Cragg*

CHALEUR DEVELOPMENT LIMITED, a  
body corporate, duly incorporated  
under the laws of the Province of  
New Brunswick, and having its  
head office at Saint John in the  
County of Saint John and Province  
of New Brunswick, hereinafter  
referred to as the GRANTEE,

OF THE SECOND PART.

WITNESSETH that in consideration of the sum of *thirty -*  
*Five* Dollars (*\$35<sup>00</sup>*) now paid by the Grantee,

to the Grantors, the receipt whereof is hereby acknowledged, the Grantors do grant, convey, release, assign and confirm unto the Grantee, its successors and assigns, the right, at any time to enter upon the lands hereinafter described, for the purpose of laying down and constructing pipes for water conduits for wires of all kinds, in, under and upon the said lands, and of keeping and maintaining the same at all times in good condition and repair and for every such purpose the Grantee shall have access to the said lands at all times, by its servants, employees and workmen.

The lands to be affected by this easement are as follows:

All that certain lot, piece or parcel of land having a length of three hundred twenty (320) feet and a uniform perpendicular width of fifty (50) feet, extending twenty-five (25) feet north of, and twenty-five (25) feet south of the centre line of the Waterline Right of Way, and extending from the eastern boundary of property owned or allegedly owned by Edwin McDonnell to the western boundary of property owned or allegedly owned by Edwin McDonnell, situate, lying, and being in the Parish of Durham, County of Restigouche and the Province of New Brunswick, and having its centre line as it

crosses the aforesaid Gagnon property, more particularly described as follows:

Beginning at the intersection of the eastern boundary of property owned or allegedly owned by Edwin McDonnell with the centre line of the Waterline Right of Way as surveyed. Thence from the place of beginning on a New Brunswick Co-ordinate Bearing of north seventy-seven degrees, eleven minutes, forty-seven seconds east (N 77° 11' 47"E) along the aforesaid centre line a distance of three hundred twenty (320) feet or to the western boundary of property owned or allegedly owned by Edwin McDonnell. The hereinbefore described Right of Way being shown coloured red on a Plan showing the Waterline Right of Way on Lot No. E½ of 77W prepared by Hughes Surveys Ltd., dated August 13, 1965, a copy of which is attached hereto and forms a part hereof.

IN WITNESS WHEREOF the Grantors have hereunto set their hands and seals the day and year firstly hereinbefore written.

SIGNED, SEALED and DELIVERED )

*Eugene M. Sanby* )  
..... )

*Lucien J. Gagnon* ) ○

*M. J. Gagnon* ) ○

)

PROVINCE OF NEW BRUNSWICK  
 COUNTY OF ~~GLoucester~~ <sup>RESTIGOUCHE</sup>

I, *Eugene McGinley*, a Notary Public, duly appointed, commissioned and sworn in and for the Province of New Brunswick, and residing and practising in the Town of Bathurst in said Province, DO HEREBY CERTIFY that on the *9th* day of *October*, A. D., 1965 at *Lacquet River* in said Province, personally came and appeared before me the said Notary Public, LUCIEN GAGNON and OMERINE GAGNON, his wife, the Grantors named in the within Easement, and they acknowledged that they executed the within Indenture as and for their acts and deeds freely and voluntarily for the uses and purposes therein expressed and contained.

IN TESTIMONY WHEREOF, I, the said Notary Public, have hereunto set my hand and affixed my Notarial Seal at the Town of Bathurst, aforesaid, the day and year this certificate above

*Eugene McGinley*  
 NOTARY PUBLIC  
 NEW BRUNSWICK



I CERTIFY that the within *Easement* is duly entered and registered in the Registry Office for the County of Restigouche, New Brunswick at *9:30* o'clock A. M. of the *15th* day of *December* A. D. 1965 as Number *64558* in Book Number *108* Page Number *803-805*

*Laura Lavoie*, Notary Registrar, of Deeds

THIS INDENTURE made this 7 day of October A.D., 1965,

BETWEEN:

EDWIN McDONNELL and his wife ALFREDA McDONNELL of the Parish of Durham, in the County of Restigouche, in the Province of New Brunswick, herein-after referred to as the GRANTORS,

OF THE FIRST PART,

- and -

CHALEUR DEVELOPMENT LIMITED, a body corporate duly incorporated under the laws of the Province of New Brunswick and having its head office at Saint John, in the County of Saint John in the Province of New Brunswick, hereinafter referred to as the GRANTEE,

OF THE SECOND PART,

WITNESSETH that in consideration of the sum of Three Dollars (3<sup>00</sup>) now paid by the Grantee to

the Grantors, the receipt whereof is hereby acknowledged, the Grantors do grant, convey, release, assign and confirm unto the Grantee, its successors and assigns, the right, at any time to enter upon the lands hereinafter described, for the purpose of laying down and constructing pipes for water conduits for wires of all kinds, in, under and upon the said lands, and of keeping and maintaining the same at all times in good condition and repair and for every such purpose the Grantee shall have access to the said lands at all times, by its servants, employees and workmen.

The lands to be affected by this easement are as follows:

All that certain lot, piece or parcel of land having a length of three hundred five and seven tenths (305.7) feet and a uniform perpendicular width of fifty (50) feet, extending twenty-five (25) feet north of, and twenty-five (25) feet south of the centre line of the Waterline Right of Way, and extending from the eastern boundary of property owned or allegedly owned by Irvin Carrier to the western boundary of property owned or allegedly owned by Lucien Gagnon, situate, lying, and being in the Parish of Durham, County of Restigouche and the Province of New Brunswick, and having its centre line as it crosses the

RECORDED & FILED

Dec 15 1965

9:30 AM

# 983  
J.M. Gagnon

aforesaid McDonnell property, more particularly described as follows:

Beginning at the intersection of the eastern boundary of property owned or allegedly owned by William Roy with the centre line of the Waterline Right of Way as surveyed. Thence from the place of beginning on a New Brunswick Co-ordinate Bearing of north eighty-three degrees, thirty-three minutes, nineteen seconds east (N 83° 33' 19"E) along the aforesaid centre line a distance of one hundred forty-five (145) feet to a bend in the said centre line. Thence south thirty-two degrees, nine minutes, five seconds east (S' 32° 09' 05"E) and continuing along the aforesaid centre line a distance of fifty and seven tenths (50.7) feet to another bend. Thence north seventy-seven degrees, eleven minutes forty-seven seconds east (N 77° 11' 47"E) and continuing along the aforesaid centre line a distance of one hundred ten (110) feet or to the western boundary of property owned or allegedly owned by Lucien Gagnon. The hereinbefore described Right of Way being shown coloured red on a Plan showing the Waterline Right of Way on Lot No. 77W prepared by Hughes Surveys Ltd., dated August 13, 1965, a copy of which is attached hereto and forms a part hereof.

IN WITNESS WHEREOF the Grantors have hereunto set their hands and seals the day and year firstly hereinbefore written.

SIGNED, SEALED and DELIVERED )

in the presence of )

*Eugene R. Gault*  
..... )

*Edwin McDonnell*  
..... )



*Lucy M. McDonnell*  
..... )



PROVINCE OF NEW BRUNSWICK  
COUNTY OF RESTIGOUCHE

I, *Eugene McGinley*, a Notary Public duly appointed, commissioned and sworn in and for the Province of New Brunswick, and residing and practising in the Town of Bathurst in said Province, DO HEREBY CERTIFY that on the *9<sup>d</sup>* day of *October*, A. D., 1965 at *Jacquet River* in said Province, personally came and appeared before me the said Notary Public, EDWIN McDONNELL and ALFREDA McDONNELL his wife, the Grantors named in the within Deed, and they acknowledged that they executed the within Indenture, as and for their acts and deeds freely and voluntarily for the uses and proposes therein expressed and contained.

IN TESTIMONY WHEREOF, I, the said Notary Public, have hereunto set my hand and affixed my Notarial Seal at the Town of Bathurst aforesaid, the day and year in this certificate above written.

*Eugene McGinley*  
NOTARY PUBLIC  
NEW BRUNSWICK



I CERTIFY that the within *Assessment* is duly entered and registered in the Registry Office for the County of Restigouche, New Brunswick at *9:30* o'clock *PM* of the *15<sup>th</sup>* day of *December* A. D. 19*65* as Number *64559* in Book Number *108* Page Number *806-808*

*Laura Lussier*, Registrar of Deeds  
*Appl*

64560

THIS INDENTURE made this 14<sup>th</sup> day of October A.D., 1965,  
BETWEEN:

W.R.  
G.R.  
E.N.D.  
N.P.

WILLIAM ROY and his wife BLAIDS  
ROY of the Parish of Durham, County  
of Restigouche in the Province of  
New Brunswick, hereinafter referred  
to as the GRANTORS,

OF THE FIRST PART,

- and -

RECEIVED & FILED  
Dec 15<sup>th</sup> D. 1965  
AT THE HOUR OF 9:30 AM  
#984  
J.M. Cragg  
REGISTRAR

CHALEUR DEVELOPMENT LIMITED, a  
body corporate duly incorporated  
under the laws of the Province of  
New Brunswick, having its head  
office at the City of Saint John  
in the County of Saint John,  
hereinafter referred to as the  
GRANTEE,

OF THE SECOND PART.

WITNESSETH that in consideration of the sum of Three Hundred  
and Fifty Dollars (350) now paid by the Grantee to  
the Grantors, the receipt whereof is hereby acknowledged, the  
Grantors do grant, convey, release, assign and confirm unto the  
Grantee, its successors and assigns, the right, at any time to  
enter upon the lands hereinafter described, for the purpose of  
laying down and constructing pipes for water conduits for wires  
of all kinds, in, under and upon the said lands, and of keeping  
and maintaining the same at all times in good condition and  
repair and for every such purpose the Grantee shall have access  
to the said lands at all times, by its servants, employees and  
workmen.

The lands to be affected by this easement are as follows:

All that certain lot, piece or parcel of land having a  
length of six hundred ninety-four (694) feet and a uniform per-  
pendicular width of fifty (50) feet, extending twenty-five (25)  
feet north of, and twenty-five (25) feet south of the centre  
line of the Waterline Right of Way, and extending from the  
northern boundary of property owned or allegedly owned by  
Joseph Doucett to the western boundary of property owned or  
allegedly owned by Edwin McDonnell, situate, lying, and being  
in the Parish of Durham, County of Restigouche and the Province  
of New Brunswick, and having its centre line as it crosses the

aforesaid Roy property, more particularly described as follows:

Beginning at the intersection of the northern boundary of property owned or allegedly owned by Joseph Doucett with the centre line of the Waterline Right of Way as surveyed. Thence from the place of beginning on a New Brunswick Co-ordinate Bearing of north eighty-three degrees, thirty-three minutes nineteen seconds east (N 83° 33' 19"E) along the aforesaid centre line a distance of six hundred ninety-four (694) feet or to the western boundary of property owned or allegedly owned by Edwin McDonnell. The hereinbefore described Right of Way being shown coloured red on a Plan showing the Waterline Right of Way on Lot No. 78 NW, 78 SE prepared by Hughes Surveys Ltd., dated August 23, 1965, a copy of which is attached hereto and forms a part hereof.

IN WITNESS WHEREOF the Grantors have hereunto set their hands and seals the day and year firstly hereinbefore written.

SIGNED, SEALED and DELIVERED )  
in the presence of )

*Eugene R. Fisher*  
..... )

*William E. Roy*..... ○

*Mrs. Gladys Roy*..... ○



PROVINCE OF NEW BRUNSWICK  
COUNTY OF <sup>Northumberland</sup> GLOUCESTER

I, *Eugene M. [Signature]* a Notary Public, duly appointed, commissioned and sworn in and for the Province of New Brunswick, and residing and practising in the Town of Bathurst in said Province, DO HEREBY CERTIFY that on the *14<sup>th</sup>* day of *October* A. D., 1965 at *Bathurst, Northumberland County* in said Province, personally came and appeared before me the said Notary Public, WILLIAM ROY and *Stelyp* ROY, the Grantors named in the within Easement, and they acknowledged that they executed the within Indenture as and for their acts and deeds freely and voluntarily for the uses and purposes therein expressed and contained.

IN TESTIMONY WHEREOF, I, the said Notary Public, have hereunto set my hand and affixed my Notarial Seal at the Town of Bathurst, aforesaid, the day and year in this certificate above

*Eugene M. [Signature]*  
NEW BRUNSWICK  
NOTARY PUBLIC



I CERTIFY that the within *Easement* is duly entered and registered in the Registry Office for the County of Restigouche, New Brunswick at *9:30* o'clock *A.* M. of the *15<sup>th</sup>* day of *December* M. D. 19*65* as Number *64560* in Book Number *108* Page Number *809-811*

*Laura Lavoie, [Signature]* Registrar of Deeds

THIS INDENTURE made this 14<sup>th</sup> day of October A. D., 1965,

BETWEEN:

JOSEPH DOUCETT and his wife, MARY JANE DOUCETT of the Parish of Durham in the County of Restigouche in the Province of New Brunswick, hereinafter referred to as the GRANTORS,

OF THE FIRST PART,

- and -

RECEIVED & FILED  
 Dec 15 A. D. 1965  
 AT THE HOUR OF 9:30 AM  
 \$ 985  
 J. M. Cragg  
 DEPUTY CLERK

CHALEUR DEVELOPMENT LIMITED, a body corporate duly incorporated under the laws of the Province of New Brunswick, having its head office at Saint John in the County of Saint John in the Province of New Brunswick hereinafter referred to as the GRANTEE,

OF THE SECOND PART,

WITNESSETH that in consideration of the sum of *One Hundred and Sixty* Dollars (*160<sup>00</sup>*) now paid by the Grantee to the Grantors, the receipt whereof is hereby acknowledged, the Grantors do grant, convey, release, assign and confirm unto the Grantee, its successors and assigns, the right, at any time to enter upon the lands hereinafter described, for the purpose of laying down and constructing pipes for water conduits for wires of all kinds, in, under and upon the said lands, and of keeping and maintaining the same at all times in good condition and repair and for every such purpose the Grantee shall have access to the said lands at all times, by its servants, employees and workmen.

The lands to be affected by this easement are as follows:

All that certain lot, piece or parcel of land having a length of three hundred (300) feet and a uniform perpendicular width of fifty (50) feet, extending twenty-five (25) feet north of, and twenty-five (25) feet south of the centre line of the Waterline Right of Way, and extending from the eastern boundary of the Pride Settlement Road to the northern boundary of property owned or allegedly owned by William Roy, situate, lying, and being in the Parish of Durham, County of Restigouche and the Province of New Brunswick, and having its centre line as it crosses the aforesaid Doucett property, more-particularly described as follows:

Beginning at the intersection of the eastern boundary of the Pride Settlement Road with the centre line of the Waterline Right of Way as surveyed. Thence from the place of beginning on a New Brunswick Co-ordinate Bearing of north eighty-three degrees, thirty-three minutes, nineteen seconds east (N 83° 33' 19"E) along the aforesaid centre line a distance of three hundred (300) feet or to the northern boundary of property owned or allegedly owned by William Roy. The hereinbefore described Right of Way being shown coloured red on a Plan showing the Waterline Right of Way on Lot No. 92 prepared by Hughes Surveys Ltd., dated August 23, 1965, a copy of which is attached hereto and forms a part hereof.

IN WITNESS WHEREOF the Grantors have hereunto set their hands and seals the day and year firstly hereinbefore written.

SIGNED, SEALED and DELIVERED )

in the presence of . )

*Eugene M. Parley* )  
..... )

*Joseph F. Doucet* )

*Mrs. Mary Anne Clouett* )

PROVINCE OF NEW BRUNSWICK  
COUNTY OF ~~GLOUCESTER~~ <sup>Restigouche</sup>

I, *EUGENE McGINLEY* a Notary Public, duly appointed, commissioned and sworn in and for the Province of New Brunswick, and residing and practising in the Town of Bathurst in said Province, DO HEREBY CERTIFY that on the *14<sup>th</sup>* day of *October* A. D., 1965 at *Bathurst, Restigouche County* in said Province, personally came and appeared before me the said Notary Public, JOSEPH DOUCETT AND MARY JANE DOUCETT, his wife, the Grantors named in the within Easement, and they acknowledged that they executed the within Indenture as and for their acts and deeds freely and voluntarily for the uses and purposes therein expressed and contained.

IN TESTIMONY WHEREOF, I, the said Notary Public, have hereunto set my hand and affixed my Notarial Seal at the Town of Bathurst, afore-said, the day and year in this certificate.

*Eugene J.*

NOTARY  
NEW BRUNSWICK



I CERTIFY that the within *Easement* is duly entered and registered in the Registry Office for the County of Restigouche, New Brunswick at *9:30* o'clock *A.* of the *15<sup>th</sup>* day of *December* A. D. 1965 as Number *64561* in Book Number *108* Page Number *812-814*

*Laura Lavoie, Spt.* Registrar of Deeds

THIS INDENTURE made this 7<sup>th</sup> day of October A. D., 1965,

BETWEEN:

CALVIN SNYDER and his wife, GENEVIEVE SNYDER of the Parish of Durham, in the County of Restigouche in the Province of New Brunswick, hereinafter referred to as the GRANTORS,

OF THE FIRST PART,

- and -

RECEIVED \$511.00  
Dec 15 1965  
AT THE ... 9:30 AM  
916  
J.M. Cragg

CHALEUR DEVELOPMENT LIMITED, a body corporate, duly incorporated under the laws of the Province of New Brunswick, having its head office at Saint John in the County of Saint John, in the Province of New Brunswick, hereinafter referred to as the GRANTEE,

OF THE SECOND PART.

WITNESSETH that in consideration of the sum of *Five Hundred* Dollars (*\$500.00*) now paid by the Grantee to the Grantors, the receipt whereof is hereby acknowledged, the Grantors do grant, convey, release, assign and confirm unto the Grantee, its successors and assigns, the right, at any time to enter upon the lands hereinafter described, for the purpose of laying down and constructing pipes for water conduits for wires of all kinds, in, under and upon the said lands, and of keeping and maintaining the same at all times in good condition and repair and for every such purpose the Grantee shall have access to the said lands at all times, by its servants, employees and workmen.

The lands to be affected by this easement are as follows:

All that certain lot, piece or parcel of land having a length of two thousand, three hundred fourteen (2,314) feet and a uniform perpendicular width of fifty (50) feet, extending twenty-five (25) feet north of, and twenty-five (25) feet south of the centre line of the Waterline Right of Way, and extending from the eastern boundary of property owned or allegedly owned by Sanford Shannon to the western boundary of The Mitchell Road, situate, lying, and being in the Parish of Durham, County of Restigouche and the Province of New Brunswick, and having its centre line as it

crosses the aforesaid Snyder property, more particularly described as follows:

Beginning at the intersection of the eastern boundary of property owned or allegedly owned by Sanford Shannon with the centre line of the Waterline Right of Way as surveyed. Thence from the place of beginning on a New Brunswick Coordinate Bearing of north eighty degrees, three minutes, nineteen seconds east (N 80° 03' 19"E) along the aforesaid centre line a distance of one thousand, six hundred fifty-eight (1,658) feet to a bend in the said centre line. Thence north eighty-three degrees, thirty-three minutes, nineteen seconds east (N 83° 33' 19"E) and continuing along the aforesaid centre line a distance of six hundred fifty-six (656) feet or to the western boundary of the Mitchell Settlement Road. The hereinbefore described Right of Way being shown coloured red on a Plan showing the Waterline Right of Way on Lot No. 90E & 91 prepared by Hughes Surveys Ltd., dated August 17, 1965, a copy of which is attached hereto and forms a part hereof.

IN WITNESS WHEREOF the Grantors have hereunto set their hands and seals the day and year firstly hereinbefore written:

SIGNED, SEALED and DELIVERED )

in the presence of )

*Eugene M. Gindley* )  
..... )

*Robert Snyder* )

*Mrs. Geneva Snyder* )

PROVINCE OF NEW BRUNSWICK  
COUNTY OF GLOUCESTER

I, *Eugene McWhorter* a Notary Public, duly appointed, commissioned and sworn in and for the Province of New Brunswick, and residing and practising in the Town of Bathurst in said Province, DO HEREBY CERTIFY that on the *7<sup>th</sup>* day of *October* A. D., 1965 at *WILHELM* in said Province, personally came and appeared before me the said Notary Public, CALVIN SNYDER and his wife, GENEVIEVE SNYDER, the Grantors named in the within Easement, and they acknowledged that they executed the within Indenture as and for their acts and deeds freely and voluntarily for the uses and purposes therein expressed and contained.

IN TESTIMONY WHEREOF, I, the said Notary Public, have hereunto set my hand and affixed my Notarial Seal at the Town of Bathurst, aforesaid, the day and year of this certificate as

*Eugene McWhorter*

NOTARY PUBLIC  
NEW BRUNSWICK



I CERTIFY that the within *Easement* is duly entered and registered in the Registry Office for the County of Westmorland, New Brunswick at *9:30* o'clock *A.M.* of the *15<sup>th</sup>* day of *December* A. D. 19 as Number *64562* in Book Number *108* Page Number *315-817*

*Laura Lavoie, A.M.* Registrar of Deeds

THIS INDENTURE made this 14<sup>th</sup> day of October A.D., 1965,

BETWEEN:

SANFORD SHANNON and his wife EDNA SHANNON of the Parish of Durham, in the County of Restigouche and Province of New Brunswick, herein-after referred to as the GRANTORS,

OF THE FIRST PART,

- and -

CHALEUR DEVELOPMENT LIMITED, a body corporate duly incorporated under the laws of the Province of New Brunswick and having its head office at Saint John in the County of Saint John and Province of New Brunswick, hereinafter referred to as the GRANTEE,

OF THE SECOND PART.

RECORDED & FILED  
Dec 15 1965  
AT THE HOUR OF 9:30 A.M.  
#987  
J. M. Cragg  
REGISTRAR

WITNESSETH that in consideration of the sum of One Hundred and Seventy-Five Dollars (\$175<sup>00</sup>) now paid by the Grantee to the Grantors, the receipt whereof is hereby acknowledged, the Grantors do grant, convey, release, assign and confirm unto the Grantee, its successors and assigns, the right, at any time to enter upon the lands hereinafter described, for the purpose of laying down and constructing pipes for water conduits for wires of all kinds, in, under and upon the said lands, and of keeping and maintaining the same at all times in good condition and repair and for every such purpose the Grantee shall have access to the said lands at all times, by its servants, employees and workmen.

The lands to be affected by this easement are as follows:

All that certain lot, piece or parcel of land having a length of one thousand, seven hundred fifty (1,750) feet and a uniform perpendicular width of fifty (50) feet, extending twenty-five (25) feet north of, and twenty-five (25) feet south of the centre line of the Waterline Right of Way, and extending from the eastern boundary of property owned or allegedly owned by Roy Shannon, to the western boundary of property owned or allegedly owned by Calvin Snyder, situate, lying, and being in the Parish of Durham County of Restigouche and the Province of New Brunswick, and



having its centre line as it crosses the aforesaid Shannon property, more particularly described as follows:

Beginning at the intersection of the eastern boundary of property owned or allegedly owned by Roy Shannon with the centre line of the Waterline Right of Way as surveyed. Thence from the place of beginning on a New Brunswick Co-ordinate Bearing of south eighty-seven degrees eleven minutes, forty-one seconds east (S 87° 11' 41" E) along the aforesaid centre line a distance of one hundred thirty (130) feet to a bend in the said centre line. Thence north eighty-three degrees, forty-eight minutes, nineteen seconds east (N 83° 48' 19" E) and continuing along the aforesaid centre line a distance of one thousand, five hundred seventy (1,570) feet to another bend. Thence north eighty degrees, three minutes, nineteen seconds east (N 80° 03' 19" E) and continuing along the aforesaid centre line a distance of fifty feet or to the western boundary of property owned or allegedly owned by Calvin Snyder. The hereinbefore described Right of Way being shown coloured red on a Plan showing the Waterline Right of Way on Lot No. 89, 90W prepared by Hughes Surveys Ltd., dated August 17, 1965, a copy of which is attached hereto and forms a part hereof.

IN WITNESS WHEREOF the Grantors have hereunto set their hands and seals the day and year firstly hereinbefore written.

SIGNED, SEALED and DELIVERED )

*Eugene R. Duly* )  
..... )

*Calvin Shannon* )  
..... )

)  
)  
) *Mrs. Edna Shannon* )  
)  
)

PROVINCE OF NEW BRUNSWICK  
COUNTY OF *Restigouche*

I, \_\_\_\_\_ a Notary Public, duly appointed, commissioned and sworn in and for the Province of New Brunswick, and residing and practising in the Town of Bathurst in said Province, DO HEREBY CERTIFY that on the *14<sup>th</sup>* day of *Oct* A. D., 1965 at *Forest Hill* in said Province, personally came and appeared before me the said Notary Public, SANFORD SHANNON and EDNA SHANNON his wife, the Grantors named in the within Easement, and they acknowledged that they executed the within Indenture as and for their acts and deeds freely and voluntarily for the uses and purposes therein expressed and contained.

IN TESTIMONY WHEREOF, I, the said Notary Public, have hereunto set my hand and affixed my Notarial Seal at the Town of Bathurst aforesaid, the day and year in this certificate above written.

*L. Shannon*

NOTARY PUBLIC  
NEW BRUNSWICK



I CERTIFY that the within *Easement* is duly entered and registered in the Registry Office for the County of Restigouche, New Brunswick at *9:30* o'clock *A. M.* of the *15<sup>th</sup>* day of *December* A. D. 1965 as Number *64562* in Book Number *108* Page Number *818-820*

*Laura Lavoie, Esq.* Registrar of Deeds

THIS INDENTURE made this <sup>14<sup>th</sup></sup> day of October A. D., 1965,  
 BETWEEN: *RS*  
*CS*  
*8<sup>th</sup> N.P.*  
*RAYMOND*  
ROY SHANNON and his wife, CLAUDETTE  
SHANNON of the Parish of Durham,  
 County of Restigouche and Province  
 of New Brunswick, hereinafter  
 referred to as the GRANTORS

OF THE FIRST PART,

- and -

CHALEUR DEVELOPMENT LIMITED, a body  
 corporate duly incorporated under  
 the laws of the Province of New  
 Brunswick, having its head office  
 at the City of Saint John, in the  
 County of Saint John in the  
 Province of New Brunswick, here-  
 inafter referred to as the GRANTEE,

OF THE SECOND PART.

RECORDED & FILED  
*Dec 15 1965*  
 9:30 AM  
*J. M. Ciagg*

WITNESSETH that in consideration of the sum of *Three*  
 Dollars (~~30~~) now paid by the Grantee, to  
 the Grantors, the receipt whereof is hereby acknowledged, the  
 Grantors do grant, convey, release, assign and confirm unto the  
 Grantee, its successors and assigns, the right, at any time to  
 enter upon the lands hereinafter described, for the purpose of  
 laying down and constructing pipes for water conduits for wires  
 of all kinds, in, under and upon the said lands, and of keeping  
 and maintaining the same at all times in good condition and  
 repair and for every such purpose the Grantee shall have access  
 to the said lands at all times, by its servants, employees and  
 workmen.

The lands to be affected by this easement are as follows:

All that certain lot, piece or parcel of land having a  
 length of two hundred seventy (270) feet and a uniform perpen-  
 dicular width of fifty (50) feet, extending twenty-five (25)  
 feet north of, and twenty-five (25) feet south of the centre  
 line of the Waterline Right of Way, and extending from the eastern  
 boundary of property owned or allegedly owned by Ursuline Convent  
 to the western boundary of property owned or allegedly owned by  
 Sanford Shannon, situate, lying and being in the Parish of  
 Durham, County of Restigouche and the Province of New Brunswick,

and having its centre line as it crosses the aforesaid Shannon property, more particularly described as follows:

Beginning at the intersection of the eastern boundary of property owned or allegedly owned by Ursuline Convent with the centre line of the Waterline Right of Way as surveyed. Thence from the place of beginning on a New Brunswick Co-ordinate Bearing of south eighty-seven degrees, eleven minutes, forty-one seconds east (S 87° 11' 41"E) along the aforesaid centre line a distance of two hundred seventy (270) feet or to the western boundary of property owned or allegedly owned by Sanford Shannon. The hereinbefore described Right of Way being shown coloured red on a Plan showing the Waterline Right of Way on Lot No. W portion Lot 89 prepared by Hughes Surveys Ltd. dated August 17, 1965, a copy of which is attached hereto and forms a part hereof.

IN WITNESS WHEREOF the Grantors have hereunto set their hands and seals the day and year firstly hereinbefore written.

SIGNED, SEALED and DELIVERED )

in the presence of )

*Ernest M. Shirley* )  
..... )

*Raymond Shannon* ○

*Mrs. Charlotte Shannon* ○

)

PROVINCE OF NEW BRUNSWICK  
COUNTY OF GLOUCESTER

I, \_\_\_\_\_ a Notary Public, duly appointed, commissioned and sworn in and for the Province of New Brunswick, and residing and practising in the Town of Bathurst in said Province, DO HEREBY CERTIFY that on the 14<sup>th</sup> day of October A. D., 1965 at Joseph St. in said Province, personally came and appeared before me the said Notary Public, ROY SHANNON and his wife *Clara* SHANNON, the Grantors named in the within Easement, and they acknowledged that they executed the within Indenture as and for their acts and deeds freely and voluntarily for the uses and proposes therein expressed and contained.

IN TESTIMONY WHEREOF, I, the said Notary Public, have hereunto set my hand and affixed my Notarial Seal at the Town of Bathurst, aforesaid, the day and year in this certificate above written

*Joseph St.*  
NOTARY PUBLIC  
NEW BRUNSWICK



I CERTIFY that the within *Easement* is duly entered and registered in the Registry Office for the County of Restigouche, New Brunswick at *9:30* o'clock *P.* of the *15<sup>th</sup>* day of *December* A. D. 1965 as Number *64564* in Book Number *108* Page Number *821-823*

*Laura Larocque* Registrar of Deeds

THIS INDENTURE made this 14<sup>th</sup> day of October A. D., 1965,  
BETWEEN:

STEWART McALISTER and MARION ISABEL McALISTER of the Parish of Durham, in the County of Restigouche and Province of New Brunswick, hereinafter referred to as the GRANTORS,

OF THE FIRST PART,

- and -

CHALEUR DEVELOPMENT LIMITED, a body corporate, duly incorporated under the laws of the Province of New Brunswick, having its head office at Saint John in the County of Saint John in the Province of New Brunswick, hereinafter referred to as the GRANTEE

OF THE SECOND PART.

RECEIVED & FILED  
Dec 15 1965  
AT THE HOUR OF 9:30 AM  
989  
J M Cragg

WITNESSETH that in consideration of the sum of *One Hundred and Seventy-Five* Dollars (*\$175<sup>00</sup>*) now paid by the Grantee to the Grantors, the receipt whereof is hereby acknowledged, the Grantors do grant, convey, release, assign and confirm unto the Grantee, its successors and assigns, the right, at any time to enter upon the lands hereinafter described, for the purpose of laying down and constructing pipes for water conduits for wires of all kinds, in, under and upon the said lands, and of keeping and maintaining the same at all times in good condition and repair and for every such purpose the Grantee shall have access to the said lands at all times, by its servants, employees and workmen.

The lands to be affected by this easement are as follows:

All that certain lot, piece or parcel of land having a length of one thousand, seven hundred forty-eight and five tanths (1,748.5) feet and a uniform perpendicular width of fifty (50) feet, extending twenty-five (25) feet north of, and twenty-five (25) feet south of the centre line of the Waterline Right of Way, and extending from the western boundary of property owned or allegedly owned by Ursuline Convent to the eastern boundary of The Pumphouse, situate, lying, and being in the Parish of Durham, County of Restigouche and the Province of

New Brunswick, and having its centre line as it crosses the  
aforesaid McAlister property, more particularly described as  
follows:

Beginning at the intersection of the western boundary of  
property owned or allegedly owned by Ursuline Convent with  
the centre line of the Waterline Right of Way as surveyed.  
Thence from the place of beginning on a New Brunswick Co-  
ordinate Bearing of north eighty-seven degrees, eleven  
minutes, forty-one seconds west (N 87° 11' 41"W) along  
the aforesaid centre line a distance of one thousand one  
hundred forty-five (1,145) feet to a bend in the said  
centre line. Thence south eighty-four degrees, six minutes,  
thirty-three seconds west (S 84° 06' 33"W) and continuing  
along the said centre line a distance of six hundred three  
and five tenths (603.5) feet or to the eastern boundary  
of the Pumphouse lot. The hereinbefore described Right  
of Way being shown coloured red on a Plan showing the  
Waterline Right of Way on Lot No. 3 W prepared by Hughes  
Surveys Ltd., dated August 17, 1965, a copy of which is  
attached hereto and forms a part hereof.

IN WITNESS WHEREOF the Grantors have hereunto set their  
hands and seals the day and year firstly hereinbefore written.

SIGNED, SEALED and DELIVERED )

in the presence of )

*Eugene M. Stanley*  
..... )

*Stewart McAlister*..... )

*By his attorney, Marion J. Marshall*  
*McAl.* )

*Marion J. Marshall McAlister*..... )

)

PROVINCE OF NEW BRUNSWICK

COUNTY OF *Restigouche*

I, *L. J. E. McGINLEY* a Notary Public, duly appointed, commissioned and sworn in and for the Province of New Brunswick, and residing and practising in the Town of Bathurst in said Province, DO HEREBY CERTIFY that on the *14<sup>th</sup>* day of *October* A. D., 1965 at *Le Grand River* in said Province, personally came and appeared before me the said Notary Public, STEWART McALISTER and MARION ISABEL McALISTER his wife, the Grantors named in the within Easement, and they acknowledged that they executed the within Indenture as and for their acts and deeds freely and voluntarily for the uses and purposes therein expressed and contained. *The said Stewart McAlister being executed as within Easement by his attorney, the said Marion Isabel McAlister.*

IN TESTIMONY WHEREOF, I, the said Notary Public, have hereunto set my hand and affixed my Notarial Seal at the Town of Bathurst, aforesaid, the day and year this certificate above

*Ernest J. McGINLEY*



NOTARY PUBLIC  
NEW BRUNSWICK

I CERTIFY that the within *Easement* is duly entered and registered in the Registry Office for the County of Restigouche, New Brunswick at *9:30* o'clock *A.M.* of the *15<sup>th</sup>* day of *December* A. D. 19*65* as Number *64565* in Book Number *108* Page Number *824-826*

*Laure Lavie, Spty* Registrar of Deeds



# Appendix F

## Current Approvals to Operate



## APPROVAL TO OPERATE

**I-9010**

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Pursuant to paragraph 8(1) of the *Water Quality Regulation - Clean Environment Act*, this Approval to Operate is hereby issued to:

**GLENCORE CANADA CORPORATION**  
for the operation of the  
**Brunswick Lead Smelter and Material Handling West**

Description of Source: **LEAD SMELTER AND MATERIAL HANDLING**

Source Classification: **Fees for Industrial Approvals Class 1B**  
**Regulation - Clean Water Act**

Parcel Identifier: **20444840, 20252680, 20278339, 50078294, 20252318,**  
**20801619, 20443255, 20443156, 20443172, 20443198,**  
**20443149**

Mailing Address: **692 Main St.**  
**Belledune, NB E8G 2M1**

Conditions of Approval: **See attached Schedule "A" of this Approval**

Supersedes Approval: **I-8661**

Valid From: **August 23, 2015**

Valid To: **August 22, 2020**

Recommended by:   
Environment Division

Issued by:   
for the Minister of Environment and Local Government

August 21, 2015  
Date

## SCHEDULE "A"

### A. DESCRIPTION AND LOCATION OF SOURCE

GLENCORE CANADA CORPORATION, Brunswick Smelter operates a Lead Smelter and Material Handling West Facility at a site in Belledune. The Smelter produces up to 120,000 tonnes of refined lead per year from lead concentrate, other lead-bearing materials and recyclables. Material Handling West handles up to 500,000 tonnes of bulk products including lead feeds and lead, copper and zinc concentrates, coke, sulphuric acid, recycled batteries, and recycled cathode ray tubes.

The lead concentrate contains sulphur, which is removed during sintering as sulphur dioxide, and converted to sulphuric acid in the Acid Plant. The acid is pumped to Material Handling West where it is stored prior to shipment. In general, the site consists of a Concentrate Handling Facility, Battery Recycling Plant, Material Handling West Wastewater Collection System, Proportioning Plant, Sinter Plant, Blast Furnace, Lead Refinery, Acid Plant, Sulphuric Acid Storage & Handling System, Slag Storage, Smelter Effluent Treatment Plant, Process Water Supply System, and a Fertilizer Plant.

There exist *potential* and *recognized* water quality environmental impacts from:

- i) the emission of air contaminants principally sulphur dioxide, particulate matter and carbon dioxide from approximately 30 stacks of various dimensions located throughout the Smelter and Materials Handling West and associated with various process operations including the Proportioning Plant, Sinter Plant, Lead Refinery, Furnaces, Bulk Storage Domes and Conveyor System;
- ii) the discharge of effluent from the Smelter Effluent Treatment Plant;
- iii) the discharge of non-contact process cooling water from the Lead Smelter;
- iv) leaks from the acid pipeline;
- v) overflows of contaminated water from the Cooling Recycle Pond associated with heavy rainfall events;
- vi) spills during material handling operations at locations including the Battery Recycling Plant and the Concentrate Handling Facility;
- vii) spills and leaks during the transfer of wastewater from Material Handling West to the Lead Smelter Site;
- viii) the phosphogypsum pile.

The Operation of the Smelter and Material Handling West located in the Town of Belledune, County of Gloucester, Province of New Brunswick and identified by Property Identification Numbers 20252680, 20278339, 20444840, 20801619, 20252318, 20443255, 20443156, 20443172, 20443198, 20443149 and 50078294, the latter being in Restigouche County, is hereby approved **under the *Water Quality Regulation - Clean Environment Act* subject to the following Definitions and Conditions:**

**B. DEFINITIONS**

1. **"Approval Holder"** means GLENCORE CANADA CORPORATION.
2. **"Department"** means the New Brunswick Department of Environment & Local Government.
3. **"Minister"** means the Minister of Environment and Local Government and includes any person designated to act on the Minister's behalf.
4. **"Director"** means the Director of the Impact Management Branch of the Department of Environment & Local Government and includes any person designated to act on the Director's behalf.
5. **"Inspector"** means an Inspector designated under the *Clean Air Act*, the *Clean Environment Act*, or the *Clean Water Act*.
6. **"Facility"** means the property, buildings, and equipment as identified in the Description of Source above, and all contiguous property in title to the Approval Holder at that location, including but not limited to:

**LEAD SMELTER**

- a) Proportioning Plant where lead bearing materials such as concentrates, dross, recyclables and battery paste are mixed with sand, limestone, and coke to form a blend suitable for processing through the Sinter Plant.
- b) Sinter Plant where feed from the Proportioning Plant is mixed and then fed into the Sinter Machine where it is roasted to remove sulphur as sulphur dioxide, and to form appropriately sized sintered material which, when combined with coke, is fed to the Blast Furnace. Sulphur dioxide offgas containing 2 to 4 percent sulphur dioxide is piped to the Hot Gas Precipitator. A Wheelabrator Baghouse and Ducon Scrubbers are used to remove particulate from the recirculated sinter return bin and discharge, and the sinter cooling drum.
- c) Hot Gas Precipitator, which removes particulate from the sinter machine offgas. Cleaned offgas is directed to the Acid Plant; removed particulate is returned to the Sinter Plant.
- d) Acid Plant where sulphur dioxide laden offgas from the Sinter Plant is dried, catalytically converted to sulphur trioxide and dissolved in absorber grade sulphuric acid creating metallurgical grade sulphuric acid.

- e) Lead Blast Furnace where sinter and coke are combined with oxygen-enriched air to produce lead bullion. The Blast Furnace has a nominal capacity of 1,100 tonnes per day of total sinter charged; the lead bullion is directed to the Lead Refinery.
- f) Lead Refinery where lead bullion is separated into refined lead and other metallic co-products such as copper, antimony, bismuth and silver. The refinery is divided into several metal-specific operating units including:
  - i) Copper Dross Plant with five kettles and a reverberatory furnace.
  - ii) Antimony Section with two kettles.
  - iii) Silver Section with five kettles, four liquation kettles, two vacuum induction retorts and one bottom-blown oxygen cupel.
  - iv) Bismuth Section with four kettles.
  - v) Final Clean-up Section with 2 kettles producing refined lead.
- g) Short Rotary Furnaces where custom materials such as antimonial slag, battery plates and other lead bearing materials are converted into lead bullion or lead alloys.
- h) Recycled Process Water (RPW) treatment system where all process water from scrubbers, venturis, mist eliminators, other process equipment and wash downs is collected and treated to remove solids. Clarified water is recycled to process; removed solids are returned to the Smelter. RPW overflows are directed to the Cooling Recycle Pond for storage, reuse and/or treatment;
- i) Cooling Recycle Pond (CRP) where slag granulation, surface and process water from both the Smelter and Material Handling West (MHW), and overflows from the RPW are collected and cooled for reuse. Excess water is directed to the Smelter Effluent Treatment Plant for treatment prior to being discharged through the Polishing Pond to the Baie des Chaleurs;
- j) Wastewater Treatment Plant (WWTP) where excess water from the CRP and Domestic Wastewater from the Lead Smelter and MHW is treated by lime neutralization and precipitation to reduce the concentrations of heavy metals. Carbon Dioxide is added to depress the pH of the treated effluent before discharge. WWTP sludge is either transferred to the mine for management or processed on site to recover contained metal;
- k) Engineered Above-Ground Lined Polishing Pond where water from the SETP is subjected to final settling prior to being discharged to the Baie des Chaleurs;
- l) Slag Storage Area, 1.0 km south of the smelter facility. The slag storage area is currently 17.5 hectares but has a design capacity of 35 hectares, with the potential for further expansion if required.

- m) Slag Pond where runoff from the Slag Storage Pile is collected. The Slag Pond is discharged to the Baie des Chaleurs via the West Ditch. Provisions for diverting the flow from the Slag Pond through the SETP prior to discharge, are available, should this be necessary;
- n) East and West Diversion Ditches where surface runoff water is directed around the Smelter to prevent its contamination;

### **MATERIAL HANDLING WEST**

- a) Concentrate Handling Facility where concentrates are received, sulphuric acid and concentrates are stored and shipped to the smelter or the wharf and including:
  - i) Seven concentrate storage domes
  - ii) The New and Old DAP storage buildings
  - iii) BHO Rock Silos
  - iv) Truck and railcar unloading building
  - v) Radial stacking conveyor
  - vi) Underground concentrate conveying system
  - vii) Graded stormwater catchment area and containment lagoon
- b) Wharf Unloading Facility at the Port of Belledune, managed by the Belledune Port Authority, and capable of handling concentrates and other feed materials, metallurgical coke and sulphuric acid. The Port is also equipped to ship out sulphuric acid, refined lead bullion, concentrate ore and other bulk materials.
- c) Battery Recycling Plant (BRP) consisting of an indoor receiving and storage area, a battery breaking area and processing line where used lead acid batteries are recycled for their component parts including lead grid, lead paste, plastic and sulphuric acid.
- d) Sulphuric Acid Storage and Handling System consisting of two 24,000 tonne storage tanks and two 2,600 tonne process tanks, pipelines from the smelter and to the wharf, associated pumping and containment areas, and a railcar/truck loading/unloading facility.
- e) Material Handling West Wastewater Treatment Plant consisting of a collection, transmission, and treatment system. All Domestic Wastewater from the Material Handling West is treated through an on-site septic tank and drainage field. Industrial Wastewater is transferred, either directly (pipeline) or indirectly, for disposal at the CRP System at the Lead Smelter.
- f) CRT Recycling System in the New or Old DAP building for crushing and storage of Cathode Ray Tubes (CRT) for recycling through the Sinter Plant.

### **JACQUET RIVER WATER SUPPLY**

Process Water Supply System where an average of 300 m<sup>3</sup>/h of fresh water is withdrawn from the Jacquet River at a point 3 km upstream of the Baie des Chaleurs and is pumped to the Facility via a 14.4 km, 0.76 meter diameter concrete-lined steel pipeline. Water from this pipeline is currently supplied to Townsite No. 2, the Belledune Industrial Park, Renviro Park and Shaw Resources.

## FERTILIZER PLANT

Phosphoric Acid Plant and a Diammonium Phosphate Plant (DAP), which are not operating.

7. **"environmental emergency"** means a situation where there has been or will be a release, discharge, or deposit of a contaminant or contaminants to the atmosphere, soil, surface water, and/or groundwater environments of such a magnitude or duration that it could cause significant harm to the environment or put the health of the public at risk.
8. **"normal business hours"** means the hours when the Department's offices are open. These include the period between 8:15 a.m. and 4:30 p.m. from Monday to Friday excluding statutory holidays.
9. **"after hours"** means the hours when the Department's offices are closed. These include statutory holidays, weekends, and the hours before 8:15 a.m. and after 4:30 p.m. from Monday to Friday.
10. **"statutory holiday"** means New Years Day, Good Friday, Easter Monday, the day fixed by proclamation of the Governor-in-council for the celebration of the birthday of the Sovereign (Victoria Day), Canada Day, New Brunswick Day, Labour Day, the day fixed by proclamation of the Governor-in-council as a general day of Thanksgiving, Remembrance Day, Christmas Day and Boxing Day. If the Statutory Holiday falls on a Sunday, the following day shall be considered as the Statutory Holiday.
11. **"hazardous waste"** means any waste material intended for disposal or recycling, that is identified as a hazardous waste or hazardous recyclable material by the federal *Export and Import of Hazardous Waste and Hazardous Recyclable Material Regulations*, and/or is included in Class 1 and/or Class 7 of the federal *Transportation of Dangerous Goods Regulations*. This definition excludes any waste(s) for which the Director has issued a written exemption.
12. **"Hazardous Waste Collection and Transportation Network"** means a Hazardous Waste Collection and Transportation Network that is approved by the Department.
13. **"Hazardous Waste Generator"** means an operation where hazardous waste is generated.

14. **"Hazardous Waste Receiver"** means an approved or acceptable business that receives Hazardous Waste from a Hazardous Waste Collection and Transportation Network for transfer, treatment, storage, or disposal.
15. **"acceptable"** means an operation located outside of the Province of New Brunswick, that is approved by, or otherwise operating in conformance with the laws of the applicable jurisdiction.
16. **"properly trained"** means knowledgeable in the following through instruction and practice: (a) relevant waste management legislation, regulations, and guidelines, including the Terms and Conditions of this Approval; (b) major environmental concerns pertaining to the waste to be handled; (c) emergency management procedures for the waste to be handled; (d) use and operation of any equipment to be used; and (e) emergency response procedures and notification.
17. **"Approved Material"** means, for the purposes of this Approval, the following types of feed materials, hazardous wastes and hazardous recyclable materials that are approved to be generated, stored, transferred and/or treated by the Approval Holder:
  - Lead Compounds, including oxides, carbonates, sulphides, sulphates, and chromates
  - Lead Drosses, Skimmings or Ashes
  - Crushed, Broken or Whole Cathode Ray Tubes (CRT)
  - Lead-Acid Batteries
  - Lead Battery Plates
  - Scrap Metallic Lead or Lead Bullion
  - Lead or Precious Metal containing Slags, filter cakes, or residues
  - Miscellaneous Materials Containing Silica, Lime or Iron as Flux or Flux Replacements
  - Miscellaneous Materials Containing Carbon as Fuel or Fuel Replacements
18. **"HSEC (Health, Safety, Environment and Community) Management System"** means the system developed as per the **Glencore 16 HSEC Management Standards**, that establishes the framework for Brunswick Smelter to identify, monitor and manage the Facility's health, safety, environment and community aspects.
19. **"Domestic Wastewater"** means the wastewater originating from toilets or other sanitary facilities.



## C. TERMS AND CONDITIONS

### GENERAL

20. The Approval Holder shall operate the Facility in compliance with the *Water Quality Regulation 82-126* filed under the *Clean Environment Act* of the Province of New Brunswick. Violation of this Approval or any condition stated herein constitutes a violation of the *Clean Environment Act* of the Province of New Brunswick.
21. The issuance of this Approval does not relieve the Approval Holder from compliance with other by-laws, federal or provincial acts or regulations, or any guidelines issued pursuant to regulations.
22. If, in the opinion of the Minister, this operation is causing unacceptable deterioration of environmental conditions, the Minister may revoke this approval and issue a new approval with conditions aimed at improving the protection of the environment.
23. The terms and conditions of this Approval are severable. If any term and/or condition of this Approval is held invalid, is revoked or is modified, the remainder of the Approval shall not be affected.
24. An Inspector, at any reasonable time, has the authority to inspect the Facility and carry out such duties as defined in the *Clean Air Act*, the *Clean Environment Act* and/or the *Clean Water Act*.
25. This Facility has been classified as a **Class 1B** Facility, pursuant to the *Fees for Industrial Approvals Regulation 93-201* filed under the *Clean Water Act*. The Approval Holder shall pay the appropriate fee **on or before April 1 of each year**.
26. **Prior to May 22, 2020**, the Approval Holder shall make application in writing for a renewal of this Approval in a form acceptable to the Minister and advise of any changes in the construction or operation of the source, including full documentation of the operation of the Facility with respect to its ability to meet all requirements listed herein.
27. In addition to any requirements under the Environmental Impact Assessment Regulation, the Approval Holder shall apply in writing for an Approval at least **ninety (90) days** prior to construction or modification of the Facility.
28. In the event of Facility closure, the Approval Holder shall, in addition to any requirements under the *Environmental Impact Assessment Regulation*, prepare plans for complete site rehabilitation. The plans shall be submitted to the Department for review at least six (6) months before the planned closure date. The documentation shall include but not be limited to updated site plans as well as an engineering proposal for the site rehabilitation and closure.

29. The Approval Holder shall ensure that a copy of this Approval, including all attached Schedules, is posted in a prominent location in the office or working area of the Facility.
30. The Approval Holder shall be identified by the following provincial identification generator number whenever hazardous waste is shipped from the Facility:

**NB002177**

For reporting purposes, NBG002177 will also be accepted as the provincial identification generator number.

31. The Approval Holder shall be identified by the following provincial identification receiver number whenever hazardous waste is received at the facility:

**NBR002177**

#### EMERGENCY REPORTING

32. Immediately following the discovery of an environmental emergency, a designate representing the Approval Holder shall notify the Department in the following manner:

During normal business hours, telephone the Department's applicable Regional Office **until personal contact is made** (i.e. no voice mail messages will be accepted) and provide all information known about the environmental emergency. The telephone number for the Regional Office is provided below:

**Bathurst Regional Office (506) 547-2092**

After hours, telephone the Canadian Coast Guard **until personal contact is made** and provide all information known about the environmental emergency. The telephone number for the **Canadian Coast Guard is 1-800-565-1633**.

33. Within 24 hours of the time of initial notification, a copy of a Preliminary Emergency Report shall be faxed, by a designate representing the Approval Holder, to the Department's applicable Regional Office *as well as* the Department's Central Office using the fax numbers provided below. The Preliminary Emergency Report shall clearly communicate all information available at the time about the environmental emergency.

Within five (5) days of the time of initial notification, a copy of a Detailed Emergency Report shall be faxed, by a designate representing the Approval Holder, to the Department's applicable Regional Office *as well as* the Department's Central Office using the fax numbers provided below. The Detailed Emergency Report shall include, as a minimum, the following: i) a description of the problem that occurred; ii) a description of the impact that occurred; iii) a description of what was done to minimize the impact; and iv) a description of what was done to prevent recurrence of the problem.

**Bathurst Regional Office Fax No: (506) 547-7655**  
**Central Office Fax No: (506) 457-7333**

#### FINANCIAL SECURITY AND ASSURANCES

34. The Approval Holder shall maintain, throughout the period of this Approval, Environmental Liability Insurance with coverage of at least one million dollars (\$1,000,000.00) for the operation of the Facility.

#### OPERATIONAL REQUIREMENTS

35. The Approval Holder shall ensure that the Facility is equipped with or has access to all emergency clean-up material required to implement the procedures as per the HSEC Management Plan.
36. The Approval Holder shall ensure that all hazardous waste at the Facility is stored in a dedicated hazardous waste storage system. The system shall be set up to ensure that all hazardous waste is:
- a) away from high traffic areas and protected from vehicle impacts;
  - b) away from electrical panels;
  - c) in a containment area that has secondary containment adequate to contain 110 % of the liquid wastes of the largest container in the containment area;
  - d) in a containment area that is designed to prevent contact between incompatible materials; and
  - e) in a containment area designed to prevent the release or discharge of Hazardous Waste to the environment as a result of a spill.
37. The Approval Holder shall ensure that all Hazardous Waste generated at the Facility is collected and transported by a Hazardous Waste Collection and Transportation Network, as defined in this Approval.
38. The Approval Holder shall ensure that all staff that are involved in functions related to the operation of the Facility are properly trained, as defined in this Approval.

- 39. The Approval Holder shall ensure that only approved materials are accepted at the Facility. Small volumes of non-approved materials may be accepted at the Facility on a case by case basis for special circumstances such as narcotic destruction and small scale research tests.
- 40. The Approval Holder shall ensure that approved materials are only accepted at the Facility for the purposes of transfer, treatment, storage, or disposal.
- 41. The Approval Holder shall ensure that approved materials are only accepted from an approved or acceptable Hazardous Waste Collection and Transportation Network, as defined in this Approval.
- 42. The Approval Holder shall continue to implement and follow the HSEC Management Plan.

LIMITS

- 43. The Approval Holder shall operate the Facility so that all industrial effluents discharged to the environment, including Polishing Pond Effluent and the Cooling Water Effluent, do not exceed the contaminant concentrations outlined in the following table.

Note: Column 1 is the maximum arithmetic mean concentration of the seven (7) day composite samples taken in a calendar month.  
 Column 2 is the maximum concentration in the seven (7) day composite sample.  
 Column 3 is the maximum concentration in a final effluent grab sample.

Concentration limits for:

Parameter & Unit	Maximum Monthly Average	Maximum Weekly	Instantaneous
Cadmium / mg/L	0.050	0.100	0.100
Lead / mg/L	0.200	0.300	0.400
Arsenic / mg/L	0.500	0.750	1.000
Copper / mg/L	0.300	0.450	0.600
Zinc / mg/L	0.500	0.750	1.000

- 44. The Approval Holder shall operate the Facility so that the effluent discharged from the Smelter Effluent Treatment Plant has a pH greater than 7.0 and less than 10.5.
- 45. The Approval Holder shall, with the exception of fire emergencies, restrict the taking of water from the Jacquet River to a maximum monthly average of 450 m3/h.

## EPISODE CONTROL

46. The Approval Holder shall ensure that all industrial effluent exceeding the concentration limits described in the above table are collected for treatment prior to release to the environment.

## FACILITY MANAGEMENT

47. The Approval Holder shall ensure that all pollution control equipment, including but not limited to, the Recycle Process Water (RPW) Treatment System, Smelter Effluent Treatment Plant, Material Handling West Collection System, Polishing Pond Groundwater Well Pumps, and associated equipment are functional and operated at all times when the Facility is in operation in a manner which minimizes discharges to the environment.
48. The Approval Holder shall ensure that any spill, within the Province of New Brunswick, of any raw material, finished product or waste shipped to or from the Facility is cleaned up in accordance with the requirements of the Department.
49. The Approval Holder shall ensure that any additional users of the Jacquet River Water Supply System are approved by the Department.

## MATERIALS MANAGEMENT

50. The Approval Holder shall operate the Battery Recycling Plant (BRP) in accordance with the conditions outlined herein and the "Operating Manual for Battery Breaking and Recycling Plant" dated July 2011 or latest revision. Where a discrepancy exists between the Operating Manual and this approval, the conditions of the approval take precedence.
51. The Approval Holder shall ensure that the plastic chips from the Battery Recycling Plant are recycled by a facility approved by the Department.
52. The Approval Holder shall store all damaged batteries in leakproof containers until they are processed.
53. The Approval Holder shall ensure that no batteries or parts thereof are unloaded, deposited and/or stored other than in the BRP, new DAP or Old DAP storage buildings.
54. The Approval Holder shall stop all shipments of batteries to the plant if any of the products resulting from battery breaking, including all wastes, battery components and shipping and packaging materials, cannot be properly recycled.
55. The Approval Holder shall ensure that any battery requiring special handling, eg. oversize, is processed in the area within the BRP, new DAP or old DAP storage buildings, which is designated for such activity.

56. The Approval Holder shall process all batteries and clean the Battery Recycling Plant to a degree adequate to prevent any lead dust becoming airborne, prior to a shutdown expected to last in excess of one month.
57. The Approval Holder shall ensure that all vehicles leaving the Facility are inspected and visible contamination on the outside of any vehicle is thoroughly cleaned off if used in dedicated contaminant service, before the vehicle leaves the Facility.

**WASTEWATER MANAGEMENT**

58. The Approval Holder shall ensure that all domestic wastewater from Material Handling West is collected and treated through the on-site septic system and drainage field.
59. The Approval Holder shall ensure that all liquid wastes from the Battery Recycling Plant are collected and stored in the industrial effluent holding tanks and that any effluent from the holding tanks is directed to the Cooling Recycle Pond.
60. The Approval Holder shall ensure that laundry service is handled within an approved Facility and that all liquid wastes from the laundry are treated as industrial effluent.
61. The Approval Holder shall ensure that appropriate operational, maintenance and inspection procedures are in place and implemented to prevent leaks and/or spills of wastewater during the use of the retaining structure for the RPW water.

**TESTING AND MONITORING**

62. The Approval Holder shall ensure that pH, iron, copper, lead, zinc, cadmium, and arsenic concentrations are monitored according to the following schedule:

**Smelter**

- a) Smelter Effluent Treatment Plant effluent - daily 24-hour composite and volumetric flow;
- b) Polishing Pond - daily grab sample, seven (7) day composite and quarterly acute lethality (96 hour static test per EPS Reports 1/RM/9 and 1/RM/13, July 90);
- c) Cooling Water discharge and final discharge - weekly composite and volumetric flow;
- d) Slag Pond - twice a month grab sample, when not frozen;
- e) East and West Diversion Ditches - twice a month grab sample; and
- f) Groundwater monitoring wells - twice a year survey.

**Material Handling West**

Battery Recycling Plant

- a) Monitoring well GW-45 - twice a month grab sample;
  - b) Polypropylene plastic chips will be shipped in compliance with all applicable current Transport of Dangerous Goods Regulations and Export and Import of Hazardous Waste and Hazardous Waste Recyclable Materials Regulations.
  - b) Soil samples at the six (6) locations identified in the most recent revision of the Environmental Quality Assurance Manual, Figure 6.11 or an alternate approved Soil Sampling Plan - once per year during the summer months.
63. The Approval Holder shall continue to conduct an Environmental Effects Monitoring Program intended to measure the impact of the operation of the Facility on groundwater, native and cultured mussels, lobsters and benthic organisms. The monitoring shall be carried out as outlined in the Brunswick Smelter Environmental Quality Assurance Manual, Section 6.0 Standard Operating Procedures dated October 17, 2014, or latest revision.
64. The Approval Holder has determined the size and shape of the phosphogypsum pile by delineating both the area covered and topography of the deposit in 2014. The pile shall continue to be inspected annually for any indication of issues or significant changes. Any issues or changes shall be reported to the Department.
65. The Approval Holder shall continuously measure the flow of water from the Jacquet River Water Supply System for all external users.

#### RECORD KEEPING

66. The Approval Holder shall keep a daily record of all hazardous waste received at the Facility. The records are to be kept in the electronic format provided by the Director, or in an alternate format approved by the Director. As a minimum, the information shall include: Hazardous Waste Receiver name and identifying number, Hazardous Waste Collection and Transportation Network name and identifying number, date of receipt, description of the hazardous waste received, class of hazardous waste received (under the federal Transportation of Dangerous Goods Act), and amount of hazardous waste received.
67. The Approval Holder shall keep a daily record of all hazardous waste generated and distributed by the Approval Holder. The records are to be kept in the electronic format provided by the Director, or in an alternate format approved by the Director. As a minimum, the information shall include: Hazardous Waste Generator name and identifying number, Hazardous Waste Collection and Transportation Network name and identifying number, date of collection, description of each hazardous waste collected, the class of each hazardous waste collected (under the federal Transportation of Dangerous Goods Act), the amount of each hazardous waste collected, and the name, location, and identifying number of the intended Hazardous Waste Receiver of each hazardous waste.

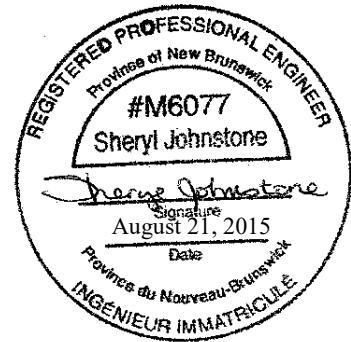
## REPORTING

68. In the event the Approval Holder receives a complaint from the public regarding unfavourable environmental impacts associated with the Facility, the Approval Holder is to report this complaint by electronic mail to the Director of the Bathurst Regional Office and to the Approvals Engineer in the Central Office in Fredericton within one business day of receiving the complaint.
69. In the event the Approval Holder violates any Term and Condition of this Approval or the *Water Quality Regulation*, the Approval Holder is to immediately report this violation by electronic mail to the Director of the Bathurst Regional Office and to the Approvals Engineer in the Central Office in Fredericton. In the event the violation may cause the health or safety of the general public to be at risk and/or significant harm to the environment could or has resulted, the Approval Holder shall follow the Emergency Reporting procedures contained in this Approval.
70. **Within 30 days of the end of each month**, the Approval Holder shall submit electronically to the Department a 'Monthly Environmental Report'. The report shall include:
- a) water quality data for all stations and parameters monitored as required under the Testing and Monitoring section.
  - b) a summary of all significant events concerning compliance with approval conditions including information relating to any discharges which exceed the limits described herein and explanations as to the cause and mitigatory action taken or to be taken to prevent a recurrence.
  - c) the results of any quarterly acute lethality test including the water quality and the rationale for selecting the day for the test.
  - d) a summary of the total water intake from the Jacquet River and by user group as this information becomes available.
  - e) all information required by the "Record Keeping" section of this Approval (in an electronic format approved by the Director).
71. **By January 30 of each year**, the Approval Holder shall submit to the Department a hard copy and electronic "Annual Water Quality Summary Report". The report shall include a description of any process changes, abnormal operating conditions, results of soil testing in the vicinity of the BRP, the result of the annual inspection of the phosphogypsum pile, a summary of all environmental monitoring programs, a summary of the monthly reports, including a summary of the contaminant concentrations and mass discharges from all stations by month, and the total discharge of iron, copper, lead, zinc, cadmium, and arsenic for each station and the facility for the preceding calendar year.



- 72. **By February 15 of each year**, the Approval Holder shall submit to the Department proof of Environmental Insurance coverage, as required by this Approval.
- 73. **By May 31 of each year**, the Approval Holder shall submit to the Director, for review and approval, a written report detailing the results of the annual Environmental Effects Monitoring.

Prepared by: Sheryl Johnstone  
Sheryl Johnstone, P.Eng.  
Industrial Approvals Engineer, Industrial Processes





## APPROVAL TO OPERATE

**I-9101**

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Pursuant to paragraph 5 (3) (a) of the *Air Quality Regulation - Clean Air Act*, this Approval to Operate is hereby issued to:

**GLENCORE CANADA CORPORATION**  
for the operation of the  
**Belledune Lead Smelter and Material Handling West**

Description of Source: **LEAD SMELTER AND MATERIAL HANDLING WEST**

Source Classification: **Air Quality Regulation** **Class 1A**

Parcel Identifier: **20278339, 50078294, 20252680, 20444840, 20252318, 20801619, 20443255, 20443156, 20443172, 20443198, 20443149**

Mailing Address: **692 Main St.  
Belledune, NB E8G 2M1**

Conditions of Approval: **See attached Schedule "A" of this Approval**

Supersedes Approval: **I-7107**

Valid From: **November 15, 2015**

Valid To: **November 14, 2020**

Recommended by:   
Environment Division

Issued by:   
for the Minister of Environment and Local Government

**November 9, 2015**  
Date

## SCHEDULE "A"

### A. DESCRIPTION AND LOCATION OF SOURCE

Glencore Canada Corporation operates a Lead Smelter and Material Handling West at a site in Belledune. The Smelter produces up to 120,000 tonnes of refined lead per year from lead concentrate, other lead-bearing materials and recyclables. Material Handling West handles up to 750,000 tonnes of bulk products including lead and zinc concentrates, coke, sulphuric acid and recycled batteries.

The lead concentrate contains sulphur which is removed during sintering as sulphur dioxide, and converted into sulphuric acid in the Acid Plant. The acid is pumped to Material Handling West where it is stored prior to shipment. In general, the site consists of a Sinter Plant, Blast Furnace, Lead Refinery, Acid Plant and Material Handling West.

There exist *potential* environmental impacts to the atmosphere from:

- i) the emission of air contaminants principally sulphur dioxide, particulate matter (containing heavy metals) and carbon dioxide from approximately 30 stacks of various dimensions located throughout the Smelter and Material Handling West and associated with various process operations including the Proportioning Plant, Sinter Plant, Lead Refinery, Furnaces, Bulk Storage Domes, Conveyor System and Water Supply; and
- ii) fugitive dust emissions from the unloading, handling and storage of concentrate ore, coke, and silica and limerock fluxes from the lead smelter.

The Operation of the Smelter and Material Handling West located in the Town of Belledune, County of Gloucester, Province of New Brunswick, and identified as Property Identification Numbers 20252680, 20278339, 20444840, 20252318, 20801619, 20443255, 20443156, 20443172, 20443198, 20443149 and 50078294, the latter being in Restigouche County **is hereby approved under the *Air Quality Regulation - Clean Environment Act* subject to the following Definitions, Terms and Conditions:**

### B. DEFINITIONS

1. "**Approval Holder**" means Glencore Canada Corporation.
2. "**Department**" means the New Brunswick Department of Environment & Local Government.
3. "**Minister**" means the Minister of Environment and Local Government and includes any person designated to act on the Minister's behalf.

4. **"Director"** means the Director of the Impact Management Branch of the Department of Environment & Local Government and includes any person designated to act on the Director's behalf.
5. **"Inspector"** means an Inspector designated under the *Clean Air Act*, the *Clean Environment Act*, or the *Clean Water Act*.
6. **"environmental emergency"** means a situation where there has been or will be a release, discharge, or deposit of a contaminant or contaminants to the atmosphere, soil, surface water, and/or groundwater environments of such a magnitude or duration that it could cause significant harm to the environment or put the health of the public at risk.
7. **"Normal business hours"** means the hours when the Department's offices are open. These include the period between 8:15 a.m. and 4:30 p.m. from Monday to Friday excluding statutory holidays.
8. **"after hours"** means the hours when the Department's offices are closed. These include statutory holidays, weekends, and the hours before 8:15 a.m. and after 4:30 p.m. from Monday to Friday.
9. **"statutory holiday"**, for the purpose of this approval, means the following days: New Year's Day, Good Friday, Easter Monday, Victoria Day, Canada Day, New Brunswick Day, Labour Day, Thanksgiving Day, Remembrance Day, Christmas Day and Boxing Day. If the statutory holiday falls on a Sunday, the following day shall be considered to be the statutory holiday.
10. **"Facility"** means the property, buildings, and equipment as identified in the Description of Source above, and all contiguous property in the title of the Approval Holder at that location, including but not limited to:

#### **LEAD SMELTER**

- a) Proportioning Plant where lead bearing materials such as concentrates, dross, battery paste and recyclables are combined with sand and limestone in proportions appropriate for sintering, and conveyed to the Sinter Plant.
- b) Sinter Plant where the feed from the Proportioning Plant is mixed and then fed into the Sinter Machine where it is roasted to remove sulphur as sulphur dioxide, and to form appropriately sized sintered material which when combined with coke is fed to the Blast Furnace. Sulphur dioxide offgas containing 2 to 4 percent sulphur dioxide is piped to the Hot Gas Precipitator. Ducon Scrubbers are used to remove particulate from the recirculated sinter return bin and discharge, and the sinter cooling drum.

- c) Hot Gas Precipitator which removes particulate from the sinter machine offgas. Cleaned offgas is directed to the Acid Plant; removed particulate is returned to the Sinter Plant.
- d) Acid Plant where sulphur dioxide laden offgas from the Sinter Plant is dried, catalytically converted to sulphur trioxide and dissolved in absorber grade sulphuric acid creating metallurgical grade sulphuric acid.
- e) Lead Blast Furnace where sinter, coke and when available, recyclables are combined with oxygen enriched air to produce lead bullion. The Blast Furnace has a capacity of 1,100 tonnes per day of sinter; the lead bullion is directed to the Lead Refinery.
- f) Lead Refinery where lead bullion is separated into refined lead and other metallic co-products such as copper, antimony, bismuth and silver. The refinery is divided into several metal specific operating units including:
  - i) Copper Dross Plant with five kettles and a reverberatory furnace.
  - ii) Antimony Section with two kettles.
  - iii) Silver Section with five kettles, five liquation kettles, two vacuum induction retort, one bottom-blown oxygen cupel and one induction furnace.
  - iv) Bismuth Section with four kettles.
  - v) Final Clean-up Section with 2 kettles producing refined lead.
- g) Short Rotary Furnaces where custom materials such as antimonial slag, battery plates and other lead bearing materials are converted into lead bullion.

## MATERIAL HANDLING WEST

- a) Concentrate Handling Facility where lead and bulk concentrates are received, stored and shipped to the smelter or the wharf and including:
  - i) Seven concentrate storage domes
  - ii) Truck and railcar unloading building
  - iii) Radial stacking conveyor
  - iv) Underground concentrate conveying system
  - v) Graded stormwater catchment area and containment lagoon
- b) Wharf Unloading Facility at the Port of Belledune, managed by the Approval Holder under contract with Belledune Port Authority, and capable of handling concentrate, metallurgical coke, and sulphuric acid. The Port is also equipped to ship out sulphuric acid, refined lead bullion, concentrate ore and other bulk materials.

- c) Battery Recycling Plant where used lead acid batteries are recycled for their component parts including lead grid, lead paste, plastic and sulfuric acid.
- d) Sulphuric Acid Storage and Handling system consisting of two 30,000 tonne storage tanks, pipelines from the smelter and to the wharf, and associated pumping and containment areas.

**JACQUET RIVER WATER SUPPLY**

Containing a diesel-fired back-up pump used only when the electric water pumps are not operational or during periods when testing of the system is conducted.

**FERTILIZER PLANT**

Phosphoric Acid Plant and Diammonium Phosphate Plant, neither of which is operating.

- 11. "normal cubic metre" or "Nm<sup>3</sup>" means, in respect of a gas, the quantity of gas occupying a volume of one cubic metre at 25°C and at a pressure of 101.3 kPa.
- 12. "SWIM" means Environment Canada's Single Window Information Manager, which is a one-window secure online electronic data reporting system accessible at [www.ghgreporting.gc.ca](http://www.ghgreporting.gc.ca) <http://www.ghgreporting.gc.ca>;

**C. EMERGENCY REPORTING**

- 13. Initial Notification

Immediately following the discovery of an environmental emergency, a designate representing the Approval Holder shall notify the Department in the following manner:

During normal business hours, telephone the Department's Bathurst Regional Office **until personal contact is made** (i.e. no voice mail messages will be accepted) and provide as much information that is known about the environmental emergency. The telephone number for the Bathurst Regional Office is provided below:

**Bathurst Regional Office (506) 547-2092**

After hours, telephone the Canadian Coast Guard **until personal contact is made** and provide as much information that is known about the environmental emergency. The telephone number for the **Canadian Coast Guard** is **1-800-565-1633**.

- 14. Follow-Up

Within 24-hours of the time of initial notification, a faxed or electronically mailed copy of a **Preliminary Emergency Report** shall be filed by a designate representing the Approval Holder to the Department's Bathurst Regional Office's Director *as well as* to the Department's Central Office Approvals Engineer using the fax numbers provided below or the electronic mailing address associated with the required contact. The Preliminary Emergency Report shall clearly communicate all information available at the time about the environmental emergency.

Within five (5) days of the time of initial notification, a faxed or electronically mailed copy of a **Detailed Emergency Report** shall be filed by a designate representing the Approval Holder to the Department's Bathurst Regional Office *as well as* to the Department's Central Office:

**Bathurst Regional Office (fax): (506) 547-7655**  
**Central Office (fax): (506) 457-7805**

The **Detailed Emergency Report** shall include, as a minimum, the following:

- i) a description of the problem that occurred;
- ii) a description of the impact that occurred;
- iii) a description of what was done to minimize the impact; and
- iv) a description of what was done to prevent recurrence of the problem.

#### **D. GENERAL INFORMATION**

- 15. The Approval Holder shall operate the Facility in compliance with the *Air Quality Regulation 97-133* filed under the *Clean Air Act* of the Province of New Brunswick. Violation of this Approval or any condition herein stated constitutes a violation of the *Clean Air Act*.
- 16. The issuance of this Approval does not relieve the Approval Holder from compliance with any other applicable federal or provincial acts and regulations as well as local by-laws.
- 17. The terms and conditions of this Approval are severable. If any term or condition of this Approval is held invalid, is revoked or is modified, the remainder of the Approval shall not be affected.
- 18. If, in the opinion of the Minister, the environmental impact of the Facility is unacceptable, the Minister reserves the right to cancel this Approval and issue a new Approval as deemed necessary.
- 19. An Inspector, at any reasonable time, has the authority to inspect the Facility and carry out such duties as defined in the *Clean Air Act*, the *Clean Environment Act* or the *Clean Water Act*.

## E. TERMS AND CONDITIONS

### GENERAL CONDITIONS

20. This Facility has been classified as a **Class 1A** Facility, pursuant to the *Air Quality Regulation, New Brunswick Regulation 97-133* filed under the *Clean Air Act*. The Approval Holder shall pay the appropriate fee **on or before April 1 of each year**.
21. In addition to any requirements under the *Environmental Impact Assessment Regulation - Clean Environment Act*, the Approval Holder shall make application in writing for an Approval at least **two hundred and seventy (270) days** prior to construction or modification of the source. No Approval is required for any modification which does not increase the emissions from the source or result in the emission of any air contaminant which was not previously emitted from the source. The Approval Holder shall make application on a form provided by the Minister.
22. **Prior to February 15, 2020**, the Approval Holder shall make application in writing for a renewal of this Approval in a form acceptable to the Minister and advise of any changes in the construction or operation of the source, including full documentation of the operation of the Facility with respect to its ability to meet all requirements listed herein.
23. In the event of Facility closure, the Approval Holder shall, in addition to any requirements under the *Environmental Impact Assessment Regulation - Clean Environment Act*, prepare plans for complete site rehabilitation. The plans shall be submitted to the Department for review at least six (6) months before the planned closure date. The documentation shall include but not be limited to updated site plans as well as an engineering proposal for the site rehabilitation and closure.

### EMISSION LIMITS

24. The Approval Holder shall operate the equipment such that the emission rate of particulate matter to the atmosphere from the Facility may achieve the design criteria of:
  - a) less than 46 mg/Nm<sup>3</sup> for the Ducon scrubbers
  - b) less than 22 mg/Nm<sup>3</sup> for the baghouses
25. The Approval Holder shall operate the acid plant and sinter plants so that emissions from these stacks are targeted for the following sulphur dioxide concentrations:
  - a) Less than 1100 ppmv over a 24 hour rolling average (2883 mg/Nm<sup>3</sup>) for the acid plant.
  - b) Less than 800 ppmv over a 24 hour rolling average (2097 mg/Nm<sup>3</sup>) for the sinter plant baghouse.

Based on these emission targets and flow rate ratios of 5(sinter):1(acid), the emission limit for the stacks will be the combined weighted average of the two:



$$\frac{\{Sinter\ stack(ppmv) \times 5\} + \{Acid\ stack(ppmv) \times 1\}}{6}$$

$$\frac{\{800\ ppmv \times 5 + \{1100\ ppmv \times 1\}}{6}$$

$$= 850\ ppmv\ combined\ monthly\ average\ (2226\ \frac{mg}{Nm^3})$$

Following shutdowns the sinter and acid plants shall be brought to steady state conditions as quickly as possible and in a manner, which minimizes sulphur dioxide emissions.

26. The Approval Holder shall ensure that the total emission of sulphur dioxide to the atmosphere from the Facility is less than 13,000 tonnes per calendar year.
27. The Approval Holder shall ensure that the emissions originating from the operation of the Facility are controlled to prevent the exceedance of the maximum permissible ground level concentrations outlined in the Schedule B of the *Air Quality Regulation - Clean Air Act* of the province of New Brunswick.

EPISODE CONTROL

28. The Approval Holder shall ensure that all air pollution control equipment, including but not limited to the scrubbers, baghouses, and associated equipment are functional and in operation at all times during which the Facility is in operation.
29. The Approval Holder shall continue to implement the **Air Quality Action Plans**, dated July 6th, 2010 for **Particulate Matter** and December 16th, 2010 for **Sulphur Dioxide**, or the latest approved revision.

TESTING AND MONITORING

30. The Approval Holder shall conduct performance tests on atmospheric emissions of contaminants from the Facility and on ambient air quality at such times and in such manner as the Minister may in writing require.
31. The Approval Holder shall ensure that all performance tests required under this Approval are conducted in accordance with the Department's of Guidance Document for Source Testing dated January 2003 or latest revision.
32. The Approval Holder shall continuously monitor the temperature and concentration of sulphur dioxide from the Acid Plant and Sinter Plant baghouse stacks using techniques acceptable to the Department. Records of the hourly averages of these parameters shall be kept and available for review by an Inspector, quality-assured and retained for a period of three years.

33. The Approval Holder shall continuously monitor particulate matter emissions from the baghouse stacks using opacity meters for the Sinter Plant baghouse stack, Furnace, Short Rotary and Silver Refinery baghouse stacks. Records of the hourly average emissions shall be kept and be available for review by an Inspector, quality-assured and retained for a period of three years.
34. Tests shall be undertaken at least once per year to develop the emission rates for particulate matter from all major emission sources within the Facility. Particulate matter samples shall be analyzed for the concentrations of heavy metals such that estimates may be made of the emission rates of lead, zinc, arsenic, copper, cadmium, bismuth, antimony, thallium, tin, selenium, silver, chromium, tellurium, nickel, beryllium and rhodium. Source testing shall be carried out as a minimum on the stacks associated with the following units; Furnace, Sinter Plant, Short Rotary Furnace, and the Silver Refinery baghouses, and the P-27, P-50 and P-52 Ducon scrubbers. The methodology used shall be equivalent to that described in the Environment Canada Publication "Standard Reference Methods for Source Testing: Measurement of Emissions of Particulate from Stationary Sources EPS 1/RM/8".
35. The Approval Holder shall conduct a yearly audit of the sulphur dioxide continuous emission monitors to verify the accuracy of the concentrations and mass discharges of the sulphur dioxide.
36. The Approval Holder shall conduct annual performance tests to determine the emission rate and concentration of sulphuric acid from the Facility. As a minimum these tests shall be conducted on the Acid Plant stack. The tests shall be conducted in accordance with U.S. EPA Method 8 "Determination of Sulfuric Acid and Sulfur Dioxide Emissions from Stationary Sources" or alternative method(s) approved by the Department.
37. The Approval Holder shall conduct annual performance tests to determine the emission rate and concentration of mercury and its compounds from the Facility. As a minimum these tests shall be conducted on the Acid Plant stack and on any other stacks where the expected emissions of mercury are greater than 5 kg per year. The tests shall be conducted in accordance with U.S. EPA Reference Method 101 "Mercury from Chlor-Alkali Plants" or alternative method(s) approved by the Department.
38. The Approval Holder shall conduct annual performance tests to determine the emission rates and concentrations of chlorinated dioxins and furans, chlorobenzenes and volatile organic compounds from the short rotary furnace, furnace and sinter plant baghouse stacks. These tests shall be conducted in accordance with methods acceptable to the Department.

The tests for chlorinated dioxin and furan and chlorobenzene shall be conducted in accordance with Environment Canada Publication "Reference Method For Source Testing: Measurement of Releases of Selected Semi-volatile Organic Compounds from Stationary Sources EPS Method 1/RM/2" or alternative method(s) approved by the Department.

The tests for volatile organic compounds shall be conducted in accordance with U.S. EPA Method 0030 "Test methods for evaluating solid waste. Volume 2. Field manual physical/chemical methods (3rd edition)" or alternative method(s) approved by the Department.

39. The Approval Holder shall continue to implement the Environmental Effects Monitoring Program as per the Environmental Quality Assurance Manual and update the Program, if necessary, as follows:
  - a) Each year prior to November 30, the Approval Holder shall submit to the Director for review and approval an updated Environmental Effects Monitoring Plan for the following year.
  - b) Following approval of any element of the Plan, the Approval Holder shall implement the revised Environmental Effects Monitoring Program.
  
40. The Approval Holder shall carry out Environmental Effects Monitoring (EEM) to monitor the effects of the operation of the Facility on the environment. The EEM shall be conducted in accordance with the Brunswick Smelter Environmental Quality Assurance Manual (QAM), Section 6.0 Standard Operating Procedures dated October 17th, 2014 or latest approved revision. All results developed under this program shall be quality assured and maintained indefinitely. The EEM shall include, but not necessarily be limited to, the following sub programs:
  - a) continuous monitoring of the ambient sulphur dioxide concentration at the three existing monitoring stations (Boulay, Townsite #2, and Chalmers).
  - b) monitoring of ambient suspended particulate concentrations at the three existing locations (Boulay, Townsite #2, and Chalmers). The three Hi-Vol particulate samplers shall be operated for twenty four continuous hours every sixth day according to the National Air Pollution Surveillance Network High-Volume Sampling Schedule. The sampler filters shall be retained and analysed for concentrations of total suspended particulate, lead, zinc, cadmium, arsenic, thallium and sulphates.
  - c) soil samples to be collected as described in the QAM Section 6.6. The soil samples shall be analysed for concentrations of lead, zinc, cadmium, arsenic and thallium.

- d) forage samples to be collected as described in the QAM Section 6.3. The forage samples shall be analysed for concentrations of lead, zinc, cadmium, arsenic and thallium.
  - e) garden produce samples to be collected as described in the QAM Section 6.3. Samples collected shall be analysed for concentrations of lead, zinc, cadmium, arsenic and thallium.
  - f) continue to operate the Brunswick Smelter meteorological tower, located on the roof of the lab building, measuring wind speed and wind direction.
41. The Approval Holder shall handle and manage internal waste dust at the Facility as per the approved Dust Removal Management Plan.
42. Prior to November 1<sup>st</sup>, 2016, the Approval Holder shall prepare and submit a Greenhouse Gas Management Plan to the Department in accordance with the Guidelines for Greenhouse Gas Management for Industrial Emitters in New Brunswick, July 2015, or as may be updated from time to time. The Greenhouse Gas Management Plan shall be renewed every 5 years, as a minimum.

Beginning in 2017, the Approval Holder shall prepare and submit an Annual Greenhouse Gas Progress Report to the Department by July 1<sup>st</sup> of each year, for the previous calendar year, in accordance with the Guidelines for Greenhouse Gas Management for Industrial Emitters in New Brunswick.

## REPORTING

43. In the event the Approval Holder receives a complaint from the public regarding unfavourable environmental impacts associated with the Facility, the Approval Holder is to report this complaint by electronic mail to the Director of the Bathurst Regional Office and to the Approvals Engineer in the Central Office in Fredericton within one business day of receiving the complaint.
44. In the event the Approval Holder violates any Term and Condition of this Approval or the *Air Quality Regulation*, the Approval Holder is to immediately report this violation by electronic mail to the Director of the Bathurst Regional Office and to the Approvals Engineer in the Central Office in Fredericton. In the event the violation may cause the health or safety of the general public to be at risk and/or significant harm to the environment could or has resulted, the Approval Holder shall follow the Emergency Reporting procedures contained in this Approval.
45. Two weeks prior to the commencement of any performance testing required under this Approval, the Approval Holder shall submit a pre-test plan to the Department for approval.

46. **Within 30 days of the end of each month**, the Approval Holder shall submit to the Department in electronic form a "Monthly Air Quality Report" which is to provide information relating to all significant events relating to air emissions, ambient air quality and compliance with air quality standards and the limits outlined in this Approval. The report shall contain as a minimum the following information:
- a) Date and time of measurements taken.
  - b) Hourly wind speed (km/hr) and direction (degrees) from on-site meteorological station.
  - c) Hourly average and 24-hour rolling average ambient concentrations of sulphur dioxide from the three ambient monitoring stations.
  - d) Hourly and 24-hour rolling average stack concentrations of sulphur dioxide from the Acid Plant and Sinter Plant Baghouse stacks.
  - e) Monthly average concentrations of sulphur dioxide from the Acid Plant and Sinter Plant Baghouse stacks.
  - f) Hourly opacity from the Furnace Baghouse stack, Silver Refinery Baghouse stack, Short Rotary Furnace stack and the Sinter Baghouse stack.
  - g) 24 hour average ambient concentrations of Total Suspended Particulate, lead, cadmium, zinc, arsenic, thallium, and sulphates as determined through Hi-Vol sampling at the three ambient monitoring stations.
  - h) Summary of any exceedances of the individual stack limits or ambient standards along with explanations as to cause and mitigative action taken or to be taken to prevent a recurrence.
  - i) Monthly inventory of each waste dust, as per the Dust Removal Management Plan.

The final report for the year i.e. the December report shall be submitted to the Department in hard copy and electronic form.

47. **By January 31 of each year**, the Approval Holder shall submit to the Department in hard copy and electronic form an "Annual Air Quality Report". The report shall include, as a minimum, a description of any process changes, a summary of abnormal operating conditions, and a summary of the in-plant and ambient results provided in the monthly reports, including the total release to the atmosphere of sulphur dioxide, particulate matter, lead, cadmium, arsenic, thallium, copper and zinc, and the consumption and sulphur content of fuels utilized in the preceding calendar year.

The Report shall also include the annual mass emissions of particulate matter and sulphur dioxide from individual stacks, including the Sinter Plant Baghouse, Silver Refinery, Short Rotary Furnace, Furnace Baghouse, Acid Plant and the wet scrubbers.

- 48. **By January 31 of each year**, the Approval Holder shall submit to the Department the results of the yearly audit of sulphur dioxide continuous emission monitors.
- 49. **By May 31 of each year**, the Approval Holder shall submit to the Department in hard copy and electronic form an update to the "Environmental Effects Monitoring Program".
- 50. **By June 1<sup>st</sup> of each year**, the Approval Holder shall submit a greenhouse gas emissions report, for the previous calendar year, to the Department by means of the SWIM system. Reporting shall be consistent with Environment Canada's Greenhouse Gas Emissions Reporting Program (GHGRP). Reporting requirements are published annually in the Canada Gazette, Part 1 under the authority of subsection 46(1) of the *Canadian Environmental Protection Act, 1999* (CEPA 1999).

Prepared by: Sheryl Johnstone  
 Sheryl Johnstone, P.Eng.  
 Industrial Approvals Engineer, Industrial Processes



Appendix G  
Health and Safety Plan Table of Contents  
from 2008/2009 Closure Plan PFS



**SNC • LAVALIN**

# Mining and Metallurgy

REPORT

**XSTRATA ZINC CANADA  
Brunswick Smelter  
Belledune, New Brunswick**



**Brunswick Smelter Closure Plan  
Prefeasibility and Cost Estimating Report  
Volume 1 of 2**

**File No.: 020120-0000-40RA-0001 Rev. 01  
January 2009**





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 <b>SNC • LAVALIN</b>	<b>BRUNSWICK SMELTER  CLOSURE PLAN – PREFEASIBILITY  AND COST ESTIMATING</b> <b>Health, Safety and Monitoring  Requirements during Closure,  Demolition and after Closure</b>	Revision			 <b>xstrata</b> zinc
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**TITLE: HEALTH, SAFETY AND MONITORING REQUIREMENTS  
DURING CLOSURE, DEMOLITION AND AFTER CLOSURE**

**CLIENT: XSTRATA ZINC**



**PROJECT: XSTRATA ZINC BRUNSWICK SMELTER CLOSURE  
PRE-FEASIBILITY STUDY  
BELLEDUNE, NEW BRUNSWICK**

PREPARED BY: Michaela Ilie, Eng. *M. Ilie* 10/11/2008  
REVIEWED BY: Marie-Andrée Morin, M. Eng., Eng. *Marie-Andrée Morin*  
APPROVED BY: Marie-Andrée Morin, M. Eng., Eng.  
APPROVED BY BRUNSWICK SMELTER: Rick Schwenger, Eng.



 <b>SNC • LAVALIN</b>	<b>BRUNSWICK SMELTER  CLOSURE PLAN – PREFEASIBILITY  AND COST ESTIMATING</b>  <b>Health, Safety and Monitoring  Requirements during Closure,  Demolition and after Closure</b>	Revision			 <b>xstrata</b> zinc
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# Appendix H

## Material Quantity Back-Up

**Table H-1  
Summary of Friable ACM Quantities  
Closure Plan - Prefeasibility Study 2019 Update  
Brunswick Smelter, Belledune, NB**

Asset ID	Location	Level	Component Material	Friability	Listed Quantity	Unit	Estimated Volume		Comments
					Qty		Qty	Units	
<b>Fertilizer Plant</b>									
DAP	Main Area	Level 01-Level 2	Straight Run	Friable	20.0	m			Fittings sampled 2019 ND
DAP	Main Area	Level 2	Insulation Cable Tray	Friable	0.7	m <sup>2</sup>	0.0350	m <sup>3</sup>	2" thick
PAP	Throughout	All	Straight Run	Friable	76.2	m			
PAP	Main Area	1st to 3rd Level	Insulation Evap Tanks	Friable	230.0	m <sup>2</sup>	11.5000	m <sup>3</sup>	2" thick
PAP	Main Area	1st to 3rd Level	Insulation Evap Pipe	Friable	12.2	m	0.6100	m <sup>3</sup>	2" thick
PAP	Main Area	4th Level	Straight Run	Friable	0.3	m			
<b>Sub-Total</b>					<b>230.7</b>	m <sup>2</sup>	<b>12.1</b>	m <sup>3</sup>	
<b>Allowance for Straight Run Piping With No Dimensions Provided in 2016 Report (10%)</b>					<b>23.1</b>	m <sup>2</sup>	<b>1.2</b>	m <sup>3</sup>	
<b>Total Friable ACM</b>					<b>253.8</b>	m	<b>13.4</b>	m <sup>3</sup>	
<b>Smelter Area</b>									
Changehouse	Wash area	Level 01	Fittings-Parging	Friable	0.0	EACH			Unknown number of suspect fittings
Changehouse	Cold Storage	Level 01	Fittings-Parging	Friable	2.0	EACH			
Changehouse	Hall	Level 01	Joint Compound	Friable	9.3	m <sup>2</sup>	0.1488	m <sup>3</sup>	
Changehouse	Vestibule	Level 01	Joint Compound	Friable	2.3	m <sup>2</sup>	0.0368	m <sup>3</sup>	
Changehouse	Vestibule	Level 01	Fittings- Parging	Friable	4.0	EACH			
Changehouse	Office	Level 01	Joint Compound	Friable	23.2	m <sup>2</sup>	0.3712	m <sup>3</sup>	
Changehouse	Union Room	Level 01	Sealant	Friable	NA	m <sup>2</sup>			
Changehouse	Union Room	Level 01	Sealant	Friable	NA	m <sup>2</sup>			
Changehouse	Union Room	Level 01	Sealant	Friable	NA	m <sup>2</sup>			
Changehouse	Hallway	Level 01	Sealant	Friable	NA	m <sup>2</sup>			
Changehouse	Storage	Level 01	Joint Compound	Friable	7.0	m <sup>2</sup>	0.1120	m <sup>3</sup>	
Changehouse	Janitor Room	Level 01	Joint Compound	Friable	7.0	m <sup>2</sup>	0.1120	m <sup>3</sup>	
Changehouse	Stairwell	Level 01	Joint Compound	Friable	28.0	m <sup>2</sup>	0.4480	m <sup>3</sup>	
Changehouse	Office	Level 01	Joint Compound	Friable	46.5	m <sup>2</sup>	0.7440	m <sup>3</sup>	
Changehouse	Office	Level 01	Joint Compound	Friable	46.5	m <sup>2</sup>	0.7440	m <sup>3</sup>	
Changehouse	Office	Level 01	Joint Compound	Friable	27.9	m <sup>2</sup>	0.4464	m <sup>3</sup>	
Changehouse	Office	Level 01	Joint Compound	Friable	27.9	m <sup>2</sup>	0.4464	m <sup>3</sup>	
Changehouse	Hall	Level 01	Joint Compound	Friable	9.3	m <sup>2</sup>	0.1488	m <sup>3</sup>	
Changehouse	Waiting Area	Level 01	Joint Compound	Friable	11.6	m <sup>2</sup>	0.1856	m <sup>3</sup>	
Changehouse	Waiting Area	Level 01	Parging	Friable	0.6	m			
Changehouse	Hall	Level 01	Joint Compound	Friable	37.2	m <sup>2</sup>	0.5952	m <sup>3</sup>	
Changehouse	Office	Level 01	Joint Compound	Friable	37.2	m <sup>2</sup>	0.5952	m <sup>3</sup>	
Changehouse	Office	Level 01	Joint Compound	Friable	37.2	m <sup>2</sup>	0.5952	m <sup>3</sup>	
Changehouse	Washroom	Level 01	Joint Compound	Friable	9.3	m <sup>2</sup>	0.1488	m <sup>3</sup>	
Changehouse	Office	Level 01	Joint Compound	Friable	27.9	m <sup>2</sup>	0.4464	m <sup>3</sup>	
Changehouse	Office	Level 01	Joint Compound	Friable	27.9	m <sup>2</sup>	0.4464	m <sup>3</sup>	
Changehouse	Office	Level 01	Joint Compound	Friable	27.9	m <sup>2</sup>	0.4464	m <sup>3</sup>	
Changehouse	Office	Level 01	Joint Compound	Friable	27.9	m <sup>2</sup>	0.4464	m <sup>3</sup>	
Changehouse	Hall	Level 01	Joint Compound	Friable	NA	m <sup>2</sup>	0.0000	m <sup>3</sup>	
Changehouse	Boiler room	Level 01, 02	Joint Compound	Friable	9.3	m <sup>2</sup>	0.1488	m <sup>3</sup>	
Charge Preparation	General Area	Level 1	Fittings - Parging	Friable	6.0	EACH			
Charge Preparation	Electrical Room	Level 1	Insulation	Friable	18.6	m <sup>2</sup>	0.9300	m <sup>2</sup>	
Charge Preparation	General Area	Level 2	Fittings - Parging	Friable	6.0	EACH			
Charge Preparation	General Area	Level 2	Straight Run	Friable	61.0	m			
Charge Preparation	General Area	Level 3	Fittings - Parging	Friable	16.0	EACH			
Charge Preparation	General Area	Level 3	Straight Run	Friable	67.1	m			
Charge Preparation	General Area	Level 4	Fittings - Parging	Friable	5.0	EACH			

**Table H-1  
Summary of Friable ACM Quantities  
Closure Plan - Prefeasibility Study 2019 Update  
Brunswick Smelter, Belledune, NB**

Asset ID	Location	Level	Component Material	Friability	Listed	Unit	Estimated Volume		Comments
					Quantity		Qty	Units	
Charge Preparation	General Area	Level 4	Straight Run	Friable	76.2	m			
Charge Preparation	General Area	Level 5	Fittings - Parging	Friable	8.0	EACH			
Charge Preparation	General Area	Level 5	Straight Run	Friable	76.2	m			
Furnace Building	Electrical Room	Level 1	Fittings - Parging	Friable	10.0	EACH			
Laboratory Building	Office	Level 1	Joint Compound	Friable	18.6	m <sup>2</sup>	0.2976	m <sup>3</sup>	
Laboratory Building	Office	Level 1	Joint Compound	Friable	18.6	m <sup>2</sup>	0.2976	m <sup>3</sup>	
Laboratory Building	Office	Level 1	Joint Compound	Friable	27.9	m <sup>2</sup>	0.4464	m <sup>3</sup>	
Laboratory Building	Office	Level 1	Joint Compound	Friable	18.6	m <sup>2</sup>	0.2976	m <sup>3</sup>	
Laboratory Building	Lab	Level 1	Joint Compound	Friable	4.6	m <sup>2</sup>	0.0736	m <sup>3</sup>	
Laboratory Building	Lab	Level 1	Joint Compound	Friable	4.6	m <sup>2</sup>	0.0736	m <sup>3</sup>	
Laboratory Building	Washroom	Level 1	Joint Compound	Friable	13.9	m <sup>2</sup>	0.2224	m <sup>3</sup>	
Laboratory Building	Lab	Level 1	Joint Compound	Friable	23.2	m <sup>2</sup>	0.3712	m <sup>3</sup>	
Laboratory Building	Lab Microbalance	Level 1	Joint Compound	Friable	23.2	m <sup>2</sup>	0.3712	m <sup>3</sup>	
Laboratory Building	Acid Storage	Level 1	Joint Compound	Friable	18.6	m <sup>2</sup>	0.2976	m <sup>3</sup>	
Laboratory Building	Electrical Room	Level 1	Joint Compound	Friable	23.2	m <sup>2</sup>	0.3712	m <sup>3</sup>	
Laboratory Building	Lab	Level 1	Joint Compound	Friable	74.3	m <sup>2</sup>	1.1888	m <sup>3</sup>	
Laboratory Building	Lab Balance Room	Level 1	Joint Compound	Friable	18.6	m <sup>2</sup>	0.2976	m <sup>3</sup>	
Laboratory Building	Lab Fire Assay	Level 1	Joint Compound	Friable	23.2	m <sup>2</sup>	0.3712	m <sup>3</sup>	
Laboratory Building	Spectrometer Lab	Level 1	Joint Compound	Friable	32.5	m <sup>2</sup>	0.5200	m <sup>3</sup>	
Laboratory Building	Lab	Level 1	Joint Compound	Friable	23.2	m <sup>2</sup>	0.3712	m <sup>3</sup>	
Laboratory Building	Conference Room	Level 1	Joint Compound	Friable	13.9	m <sup>2</sup>	0.2224	m <sup>3</sup>	
Laboratory Building	Storage Room	Level 1	Joint Compound	Friable	27.9	m <sup>2</sup>	0.4464	m <sup>3</sup>	
Laboratory Building	Stock Room	Level 1	Joint Compound	Friable	37.2	m <sup>2</sup>	0.5952	m <sup>3</sup>	
Laboratory Building	Mechanical Room	Level 1	Joint Compound	Friable	9.3	m <sup>2</sup>	0.1488	m <sup>3</sup>	
Laboratory Building	Lab	Level 1	Joint Compound	Friable	4.6	m <sup>2</sup>	0.0736	m <sup>3</sup>	
Laboratory Building	Office	Level 1	Joint Compound	Friable	2.3	m <sup>2</sup>	0.0368	m <sup>3</sup>	
Laboratory Building	Office	Level 1	Joint Compound	Friable	2.3	m <sup>2</sup>	0.0368	m <sup>3</sup>	
Laboratory Building	Office	Level 1	Joint Compound	Friable	2.3	m <sup>2</sup>	0.0368	m <sup>3</sup>	
Laboratory Building	Office	Level 1	Joint Compound	Friable	2.3	m <sup>2</sup>	0.0368	m <sup>3</sup>	
Laboratory Building	Storage	Level 1	Joint Compound	Friable	9.3	m <sup>2</sup>	0.1488	m <sup>3</sup>	
Laboratory Building	Lab	Level 1	Joint Compound	Friable	37.2	m <sup>2</sup>	0.5952	m <sup>3</sup>	
Laboratory Building	Lab	Level 1	Joint Compound	Friable	46.5	m <sup>2</sup>	0.7440	m <sup>3</sup>	
Laboratory Building	Mechanical Room	Level 1	Joint Compound	Friable	23.2	m <sup>2</sup>	0.3712	m <sup>3</sup>	
Laboratory Building	janitor Room	Level 1	Joint Compound	Friable	18.6	m <sup>2</sup>	0.2976	m <sup>3</sup>	
Laboratory Building	Washroom	Level 1	Joint Compound	Friable	18.6	m <sup>2</sup>	0.2976	m <sup>3</sup>	
Laboratory Building	Lab	Level 1	Joint Compound	Friable	27.9	m <sup>2</sup>	0.4464	m <sup>3</sup>	
Laboratory Building	Hall	Level 1	Joint Compound	Friable	46.5	m <sup>2</sup>	0.7440	m <sup>3</sup>	
Laboratory Building	Hall	Level 1	Joint Compound	Friable	46.5	m <sup>2</sup>	0.7440	m <sup>3</sup>	
Laboratory Building	Hall	Level 1	Joint Compound	Friable	69.7	m <sup>2</sup>	1.1152	m <sup>3</sup>	
Laboratory Building	Hall	Level 1	Spray Fireproofing	Friable	9.3	m <sup>2</sup>	0.1488	m <sup>3</sup>	
Lead Refinery	Exterior	Exterior	Transite	Friable	9.3	m <sup>2</sup>	0.1163	m <sup>3</sup>	
Lead Refinery	Plant	Level 1	Transite	Friable	9.3	m <sup>2</sup>	0.1163	m <sup>3</sup>	
Maintenance Shop	Fire Pump Room	Level 01	Fittings - Parging	Friable	13.0	EACH			
Maintenance Shop	Fire Pump Room	Level 01	Straight Run	Friable	15.0	m			
Furnace/Sinter Baghouses	Electrical Room	2	Sheet Flooring	Friable	23.2	m <sup>2</sup>	0.2900	m <sup>3</sup>	
Furnace/Sinter Baghouses	Electrical Room	2	Sheet Flooring	Friable	23.2	m <sup>2</sup>	0.2900	m <sup>3</sup>	
Sinter Building	Production Area	0	Straight Run	Friable	45.7	m			
Sinter Building	Production Area	0	Elbow	Friable	5.0	EACH			



**Table H-1  
Summary of Friable ACM Quantities  
Closure Plan - Prefeasibility Study 2019 Update  
Brunswick Smelter, Belledune, NB**

Asset ID	Location	Level	Component Material	Friability	Listed	Estimated Volume		Comments	
					Quantity	Unit	Qty		Units
Fibreglass Storage	Storage	Level 01	Insulation	Friable	9.3	m <sup>2</sup>	0.4650	m <sup>2</sup>	2" thick assume
Furnace Switch Room	Switch Room	Level 01	Insulation	Friable	9.3	m <sup>2</sup>	0.4650	m <sup>2</sup>	2" thick assume
Bunker C Tanks	General Area	Level G	Straight Run	Friable	30.5	m		m <sup>3</sup>	
Bunker C Tanks	General Area	Level G	Fittings - Parging	Friable	40.0	EACH			
<b>Sub-Total</b>					<b>1412.7</b>	m <sup>2</sup>	<b>23.6</b>	m <sup>3</sup>	
<b>Allowance for Straight Run Piping &amp; Fittings With No Dimensions Provided in 2016 Report (25%)</b>					<b>353.2</b>	m <sup>2</sup>	<b>5.9</b>	m <sup>3</sup>	
<b>Total Friable ACM</b>					<b>1765.9</b>	m	<b>29.6</b>	m <sup>3</sup>	
<b>Material Handling West Area</b>									
Battery Recycling	Work Shop	Level 01	Transite	Non-friable	46.5	m <sup>2</sup>	0.5813	m <sup>3</sup>	
Battery Recycling	Locker Room	Level 01	Fittings - Parging	Friable	2.0	EACH			
Battery Recycling	Bathroom	Level 02	Fittings - Parging	Friable	3.0	EACH			
Battery Recycling	Janitor's Room	Level 02	Fittings - Parging	Friable	5.0	EACH			
Battery Recycling	Office	Level 02	Fittings - Parging	Friable	2.0	EACH			
Battery Recycling	Storage	Level 02	Fittings - Parging	Friable	1.0	EACH			
Change House/Security	Boiler Room	Level 01	Insulation	Friable	18.5	m <sup>2</sup>	0.9250	m <sup>2</sup>	
Change House/Security	Boiler Room	Level 01	Fittings - Parging	Friable	19.0	EACH			
Main Office	Training Room	Basement	Joint Compound	Friable	23.2	m <sup>2</sup>	0.3712	m <sup>3</sup>	
Main Office	Storage	Basement	Joint Compound	Friable	23.2	m <sup>2</sup>	0.3712	m <sup>3</sup>	
Main Office	Stairwell	Basement	Joint Compound	Friable	23.2	m <sup>2</sup>	0.3712	m <sup>3</sup>	
Main Office	Training Room	Basement	Joint Compound	Friable	23.2	m <sup>2</sup>	0.3712	m <sup>3</sup>	
Main Office	Hall	Basement	Joint Compound	Friable	23.2	m <sup>2</sup>	0.3712	m <sup>3</sup>	
Main Office	Electrical Room	Basement	Joint Compound	Friable	13.9	m <sup>2</sup>	0.2224	m <sup>3</sup>	
Main Office	Stairwell Landing	Basement	Joint Compound	Friable	9.3	m <sup>2</sup>	0.1488	m <sup>3</sup>	
Main Office	Storage	Basement	Joint Compound	Friable	6.7	m <sup>2</sup>	0.1072	m <sup>3</sup>	
Main Office	Storage	Basement	Joint Compound	Friable	23.2	m <sup>2</sup>	0.3712	m <sup>3</sup>	
Main Office	Office	Level 1	Joint Compound	Friable	23.2	m <sup>2</sup>	0.3712	m <sup>3</sup>	
Main Office	Office	Level 1	Joint Compound	Friable	23.2	m <sup>2</sup>	0.3712	m <sup>3</sup>	
Main Office	Office	Level 1	Joint Compound	Friable	23.2	m <sup>2</sup>	0.3712	m <sup>3</sup>	
Main Office	Office	Level 1	Joint Compound	Friable	23.2	m <sup>2</sup>	0.3712	m <sup>3</sup>	
Main Office	Office	Level 1	Joint Compound	Friable	23.2	m <sup>2</sup>	0.3712	m <sup>3</sup>	
Main Office	Office	Level 1	Joint Compound	Friable	23.2	m <sup>2</sup>	0.3712	m <sup>3</sup>	
Main Office	Office	Level 1	Joint Compound	Friable	23.2	m <sup>2</sup>	0.3712	m <sup>3</sup>	
Main Office	Office	Level 1	Joint Compound	Friable	18.6	m <sup>2</sup>	0.2976	m <sup>3</sup>	
Main Office	Office	Level 1	Joint Compound	Friable	18.6	m <sup>2</sup>	0.2976	m <sup>3</sup>	
Main Office	Office	Level 1	Joint Compound	Friable	23.2	m <sup>2</sup>	0.3712	m <sup>3</sup>	
Main Office	Office	Level 1	Joint Compound	Friable	23.2	m <sup>2</sup>	0.3712	m <sup>3</sup>	
Main Office	Stairwell/Foyer	Level 1	Joint Compound	Friable	37.2	m <sup>2</sup>	0.5952	m <sup>3</sup>	
Main Office	Computer Room	Level 1	Joint Compound	Friable	37.2	m <sup>2</sup>	0.5952	m <sup>3</sup>	
Main Office	Stairwell	Level 1	Joint Compound	Friable	14.9	m <sup>2</sup>	0.2384	m <sup>3</sup>	
Main Office	Foyer	Level 1	Joint Compound	Friable	13.9	m <sup>2</sup>	0.2224	m <sup>3</sup>	
Main Office	Hall	Level 1	Joint Compound	Friable	13.9	m <sup>2</sup>	0.2224	m <sup>3</sup>	
Main Office	Office	Level 1	Joint Compound	Friable	18.6	m <sup>2</sup>	0.2976	m <sup>3</sup>	
Main Office	Office	Level 1	Joint Compound	Friable	18.6	m <sup>2</sup>	0.2976	m <sup>3</sup>	
Main Office	Office	Level 1	Joint Compound	Friable	23.2	m <sup>2</sup>	0.3712	m <sup>3</sup>	
Main Office	Washroom	Level 1	Joint Compound	Friable	23.2	m <sup>2</sup>	0.3712	m <sup>3</sup>	
Main Office	Janitor Room	Level 1	Joint Compound	Friable	4.6	m <sup>2</sup>	0.0736	m <sup>3</sup>	
Main Office	Computer Room	Level 1	Joint Compound	Friable	23.2	m <sup>2</sup>	0.3712	m <sup>3</sup>	

**Table H-1  
Summary of Friable ACM Quantities  
Closure Plan - Prefeasibility Study 2019 Update  
Brunswick Smelter, Belledune, NB**

Asset ID	Location	Level	Component Material	Friability	Listed Quantity	Estimated Volume		Comments	
					Qty	Unit	Qty		Units
Main Office	Hall	Level 1	Joint Compound	Friable	69.7	m <sup>2</sup>	1.1152	m <sup>3</sup>	
Main Office	Office	Level 1	Joint Compound	Friable	23.2	m <sup>2</sup>	0.3712	m <sup>3</sup>	
Main Office	Office	Level 1	Joint Compound	Friable	23.2	m <sup>2</sup>	0.3712	m <sup>3</sup>	
Main Office	Foyer	Level 1	Joint Compound	Friable	69.7	m <sup>2</sup>	1.1152	m <sup>3</sup>	
Main Office	Hall	Level 1	Joint Compound	Friable	9.3	m <sup>2</sup>	0.1488	m <sup>3</sup>	
Main Office	Foyer	Level 1	Joint Compound	Friable	7.0	m <sup>2</sup>	0.1120	m <sup>3</sup>	
Main Office	Washroom	Level 1	Joint Compound	Friable	32.5	m <sup>2</sup>	0.5200	m <sup>3</sup>	
Main Office	Office	Level 1	Joint Compound	Friable	23.2	m <sup>2</sup>	0.3712	m <sup>3</sup>	
Main Office	Office	Level 1	Joint Compound	Friable	23.2	m <sup>2</sup>	0.3712	m <sup>3</sup>	
Main Office	Office	Level 1	Joint Compound	Friable	23.2	m <sup>2</sup>	0.3712	m <sup>3</sup>	
Main Office	Office	Level 1	Joint Compound	Friable	23.2	m <sup>2</sup>	0.3712	m <sup>3</sup>	
Main Office	Closet	Level 1	Joint Compound	Friable	18.6	m <sup>2</sup>	0.2976	m <sup>3</sup>	
Main Office	Office	Level 1	Joint Compound	Friable	18.6	m <sup>2</sup>	0.2976	m <sup>3</sup>	
Main Office	Office	Level 1	Joint Compound	Friable	18.6	m <sup>2</sup>	0.2976	m <sup>3</sup>	
Main Office	Sprinkler Room	Level 1	Joint Compound	Friable	4.6	m <sup>2</sup>	0.0736	m <sup>3</sup>	
Main Office	Boiler Room	Level 1	Joint Compound	Friable	9.3	m <sup>2</sup>	0.1488	m <sup>3</sup>	
Main Office	Electrical Room	Level 1	Joint Compound	Friable	37.2	m <sup>2</sup>	0.5952	m <sup>3</sup>	
Main Office	Hall	Level 1	Joint Compound	Friable	69.7	m <sup>2</sup>	1.1152	m <sup>3</sup>	
Main Office	Office	Level 1	Joint Compound	Friable	37.2	m <sup>2</sup>	0.5952	m <sup>3</sup>	
Main Office	Office	Level 1	Joint Compound	Friable	18.6	m <sup>2</sup>	0.2976	m <sup>3</sup>	
Main Office	Office	Level 1	Joint Compound	Friable	23.2	m <sup>2</sup>	0.3712	m <sup>3</sup>	
Main Office	Foyer	Level 1	Joint Compound	Friable	7.0	m <sup>2</sup>	0.1120	m <sup>3</sup>	
Main Office	Storage	Level 1	Joint Compound	Friable	23.2	m <sup>2</sup>	0.3712	m <sup>3</sup>	
Main Office	Office	Level 1	Joint Compound	Friable	23.2	m <sup>2</sup>	0.3712	m <sup>3</sup>	
Main Office	Office	Level 1	Joint Compound	Friable	23.2	m <sup>2</sup>	0.3712	m <sup>3</sup>	
Main Office	Office	Level 1	Joint Compound	Friable	18.6	m <sup>2</sup>	0.2976	m <sup>3</sup>	
Main Office	Office	Level 1	Joint Compound	Friable	18.6	m <sup>2</sup>	0.2976	m <sup>3</sup>	
Main Office	Office	Level 1	Joint Compound	Friable	18.6	m <sup>2</sup>	0.2976	m <sup>3</sup>	
Main Office	Office	Level 1	Joint Compound	Friable	18.6	m <sup>2</sup>	0.2976	m <sup>3</sup>	
Main Office	Office	Level 1	Joint Compound	Friable	18.6	m <sup>2</sup>	0.2976	m <sup>3</sup>	
Main Office	Office	Level 1	Joint Compound	Friable	18.6	m <sup>2</sup>	0.2976	m <sup>3</sup>	
Main Office	Office	Level 1	Joint Compound	Friable	18.6	m <sup>2</sup>	0.2976	m <sup>3</sup>	
Main Office	Office	Level 1	Joint Compound	Friable	18.6	m <sup>2</sup>	0.2976	m <sup>3</sup>	
Main Office	Office	Level 1	Joint Compound	Friable	18.6	m <sup>2</sup>	0.2976	m <sup>3</sup>	
Main Office	Office	Level 1	Joint Compound	Friable	18.6	m <sup>2</sup>	0.2976	m <sup>3</sup>	
Main Office	Hall	Trailer	Joint Compound	Friable	2.3	m <sup>2</sup>	0.0368	m <sup>3</sup>	
<b>Sub-Total</b>					<b>1542.5</b>	m <sup>2</sup>	<b>25.1</b>	m <sup>3</sup>	
<b>Allowance for Straight Run Piping &amp; Fittings With No Dimensions Provided in 2016 Report (10%)</b>					<b>154.3</b>	m <sup>2</sup>	<b>2.5</b>	m <sup>3</sup>	
<b>Total Friable ACM</b>					<b>1696.8</b>	m	<b>27.7</b>	m <sup>3</sup>	

**Notes:**

Assume all transite and flooring to be 12.5mm thick  
Assume all drywall to be 5/8" or 16mm thick.

**Table H-2**  
**Updated Demolition Debris Quantities**  
**Closure Plan - Prefeasibility Study 2019 Update**  
**Brunswick Smelter, Belledune, NB**

Debris Description (Unit)	Original Quantity (Provided in 2008 SNC Report) <sup>1</sup>	Revision to Original Quantity Based on Historical Changes & 2019 Study Results	New Quantity to Be Carried Forward in 2019 Estimate	Bulking Factor	New Bulk Quantity	Comments
<b>Smelter Area</b>						
Creosote wood timber (m <sup>3</sup> )	820	0	820	1.75	1,435	
Non-Friable asbestos (m <sup>3</sup> )	367	0	367	1.1	404	Quantity from 2008 SNC report carried forward.
Friable Asbestos (m <sup>3</sup> )	0	30	30	1.4	42	Quantity of friable asbestos based on quantities provided in June 2016 asbestos management report provided by Glencore. Bulking factor includes packaging materials.
Rubber Conveyor Belt (m <sup>3</sup> )	125	0	125	1.5	188	
Building interior debris (m <sup>3</sup> )	6,900	0	6,900	1.6	11,040	Bulking factor of 2.0 from SNC report was reduced to 1.6.
Fibreglass insulation (m <sup>3</sup> )	6,859	0	6,859	1.1	7,545	
Bricks and cinder block (m <sup>3</sup> )	4,494	(48)	4,446	1.6	7,114	Removed former brick liner for Acid Plant Stack.
Concrete (m <sup>3</sup> )	39,741	16	39,757	1.6	63,611	Includes additional concrete from Silver Refinery constructed since 2008 Study.
Structural Steel (MT)	11,517	82	11,599	-		Includes new structural steel for Silver Refinery.
Equipment Steel - pipes, equipment, grating, etc. (MT)	7,081	358	7,439	-		Includes additional steel for rail line, two new propane tank farms, steel liner for acid stack, equipment in silver refinery and new 80,000L oil storage tank. Removed steel quantity for previously removed 2M litre oil storage tank.
Stainless Steel (MT)	49		49	-		
Copper (MT)	163		163	-		
<b>Material Handling West Area</b>						
Creosote wood timber (m <sup>3</sup> )	760	0	760	1.75	1,330	
Non-Friable asbestos (m <sup>3</sup> )	222	0	222	1.1	244	Quantity from 2008 SNC report carried forward.
Friable Asbestos (m <sup>3</sup> )	0	28	28	1.4	39	Quantity of friable asbestos based on quantities provided in June 2016 asbestos management report provided by Glencore. Bulking factor includes packaging materials.
Rubber Conveyor Belt (m <sup>3</sup> )	75	0	75	1.5	113	
Building interior debris (m <sup>3</sup> )	6,254	0	6,254	1.6	10,006	
Fibreglass insulation (m <sup>3</sup> )	569	0	569	1.1	626	
Concrete (m <sup>3</sup> )	11,786	0	11,786	1.6	18,858	
Structural Steel (MT)	5,881	0	5,881	-		
Equipment Steel - pipes, equipment, grating, etc. (MT)	1,855	132	1,987	-		Includes additional steel for rail line.
Stainless Steel (MT)	21	0	21	-		
Copper (MT)	32	0	32	-		
<b>Fertilizer Plant - DAP &amp; PAP</b>						
Non-Friable asbestos (m <sup>3</sup> )	106	0	106	1.1	117	
Friable Asbestos (m <sup>2</sup> )	0	13	13	1.4	18	Quantity of friable asbestos based on quantities provided in June 2016 asbestos management report provided by Glencore. Bulking factor includes packaging materials.
Rubber Conveyor Belt (m <sup>3</sup> )	25	0	25	1.5	38	
Building interior debris (m <sup>3</sup> )	717	(36)	681	1.6	1,090	
Concrete (m <sup>3</sup> )	2,167	0	2,167	1.6	3,467	
Structural Steel (MT)	1,096	0	1,096	-		
Equipment Steel - pipes, equipment, grating, etc. (MT)	700	0	700	-		
Stainless Steel (MT)	13	0	13	-		
Copper (MT)	15	0	15	-		

1 - Quantities taken from Table 2-1 of technical memo 020120-0000-4EEN-0003 - Management of Demolition Wastes and Impacted Soils in Section 12.0 of the 2008 SNC Report

Table H-3

**Voids Created Through Infrastructure Decommissioning  
Closure Plan - Prefeasibility Study 2019 Update  
Glencore Brunswick Smelter  
Belledune, NB**

Description	Void Dimensions					Quantity	Adjusted Volume (m <sup>3</sup> )	Comments
	Diameter (m)	Length (m)	Width (m)	Area (m <sup>2</sup> )	Height/Depth (m)			
<b>Smelter Area</b>								
Smelter - Rail Car Unloading Building		16	15	240	12.2		2928	
Cooling Recycling Pond				1110			0	No void carried as it is assumed this will be converted to a wetland
36" Salt Water Intake	0.91	450					292.5	
72" Salt Water/Storm Water Outflow	1.83	175					460.1	
72" Salt Water/Storm Water Outflow	1.83	150					394.3	
30" Salt Water Intake	0.762	285					129.9	
24" Salt Water Intake	0.61	255					74.5	
24" Process Fire	0.61	220					64.3	
24" Sewage	0.61	105					30.7	
24" Sewage	0.61	210					61.3	
24" Sewage	0.61	90					26.3	
30" Salt Water Effluent	0.762	450					205.1	
30" Screened Water	0.762	1000					455.8	
Manholes	1.2			1.13	2.44	59	162.7	assumed size and depth
<b>Subtotal Voids for Smelter Area (m<sup>3</sup>)</b>							<b>5,286</b>	
<b>Materials Handling West Area</b>								
Rail Car/Truck Unloading Building		30	10	300	12.2		3660	
Rail Car/Truck Unloading Conveyor Tunnel		3.7	3.2	11.84	50		592	
Concentrate Storage Holding Pond				975	2.5		2438	assumed depth
Stormwater Storage Pond				2000			0	No void carried as it is assumed this will remain post-closure
Manholes	1.2			1.13	2.44	17	46.9	assumed size and depth
Acid Holding Pond				1380	1.0		1380	
<b>Subtotal Voids for Materials Handling West (m<sup>3</sup>)</b>							<b>8,116</b>	
<b>TOTAL VOIDS (m<sup>3</sup>)</b>							<b>13,402</b>	

**Notes:**

Underground pipes to be removed with diameters >0.5m; volumes account for crushed pipes and placement as backfill in trenches  
No voids requiring backfill in Fertilizer Plant

**Sources:**

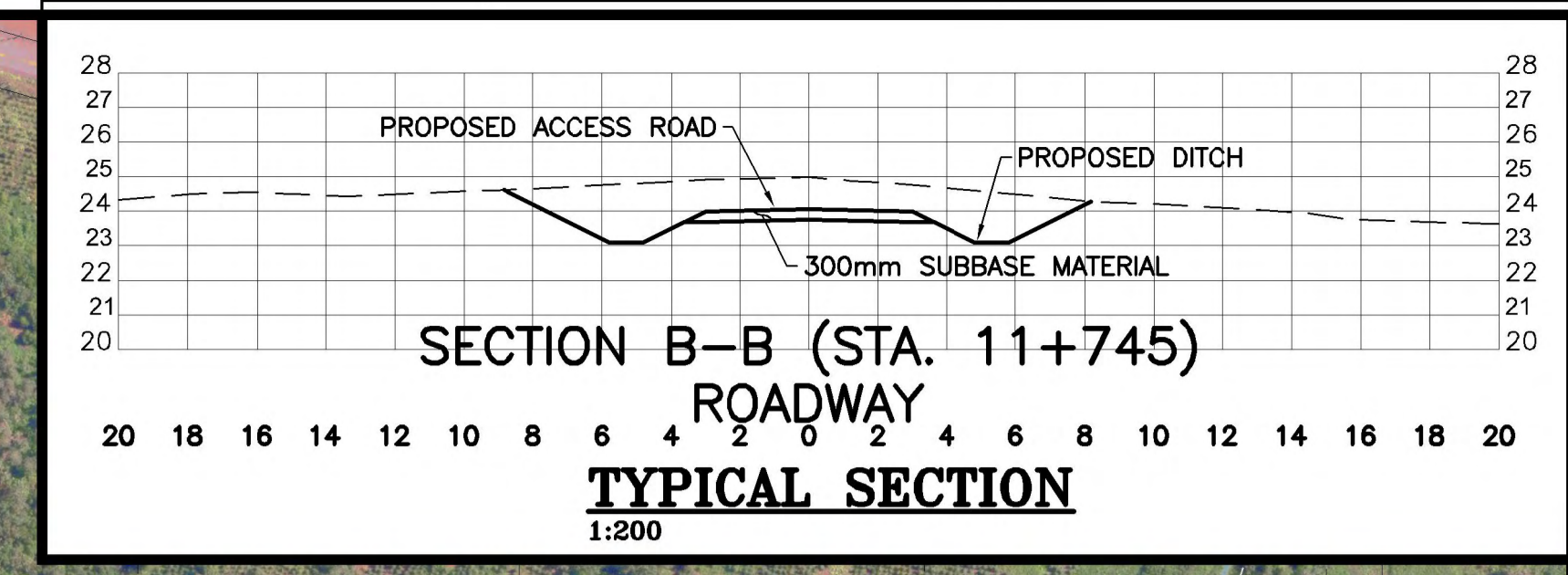
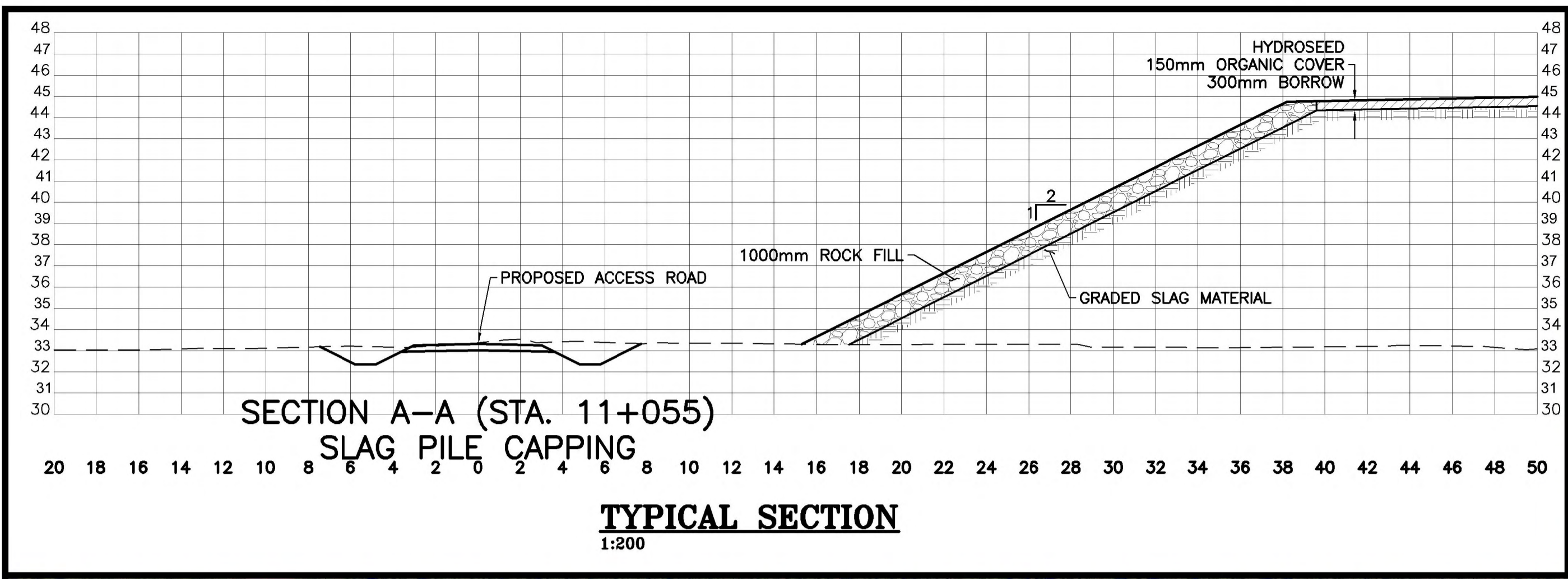
Quantities based on various plans supplied by Glencore, field measurements and observations

## TANK/RESERVOIR INVENTORY

TANK ID	GENERAL AREA	SPECIFIC AREA	LOCATION DESCRIPTION	TANK DESCRIPTION	CONTENT	MOC	CAPACITY (L)	UNITS	COMMENTS	Closure Advanced Notification:		
										2 months	5 months	4 weeks
										Most Likely Volume	Minimum Volume	Maximum Volume
BT240 (PL#1)	Jacket River Pump House	27 JACKET RIVER PUMPHOUSE	JACQUET RIVERU	DIESEL TANK	Diesel Fuel	Steel	4760	L	Above ground	0	0	0
New	Jacket River Pump House	27 JACKET RIVER PUMPHOUSE	JACQUET RIVERU	DIESEL TANK	Diesel Fuel	Steel	1200	L	Above ground	1200	1200	1200
BT261	MHW	AS ACID SHIPPING	ACID STORAGE TANK DYKE	H2SO4 #1 ACID STORAGE TANK	Sulfuric Acid 70%-100% (H2SO4)	Steel	10869565	m3	Above ground	640	640	640
BT263	MHW	AS ACID SHIPPING	YARD EAST	H2SO4 #3 STORAGE TANK	Sulfuric Acid 70%-100% (H2SO4)	Steel	10869565	m3	Above ground	640	640	640
BT388	MHW	AS ACID SHIPPING	BELOEIL TANK EAST	70% ACID TANK (EAST)	Sulfuric Acid 70%-100% (H2SO4)	Steel	1358696	m3	Above ground	100	100	100
BT389	MHW	AS ACID SHIPPING	COMMERCIAL TANK WEST	70% ACID TANK (WEST)	Sulfuric Acid 70%-100% (H2SO4)	Steel	1358696	m3	Above ground	100	100	100
BT026	MHW	BH BULK HANDLING	BATTERY PLANT BUILDING	CLARIFIER c/w RAKE		sst	9150	L	BR BATTERY RECYCLING	0	0	0
BT192 (PL #17)	MHW	BH BULK HANDLING	In maintenance shop BHO	WASTE OIL TANK BHO MAINTENANCE SHOP	Waste oil	Steel	1443	L	Above ground	0	0	0
BT021	MHW	BR BATTERY RECYCLING	PLANT ENTRANCE DOOR	BATTERY PLANT WATER STORAGE TANK	Process Water	sst	26600	L	Above ground	0	0	0
BT022	MHW	BR BATTERY RECYCLING	CENTER WALL	BATTERY PLANT OVERFLOW WATER TANK	Process Water	sst	135	L	Above ground	0	0	0
BT023	MHW	BR BATTERY RECYCLING		BATTERY PLANT WATER STORAGE TANK	Process Water		3000	Gal.	Above ground	0	0	0
BT024	MHW	BR BATTERY RECYCLING		BR CLEAN WATER TANK (CENTER)	Water		3000	Gal.	BR BATTERY RECYCLING	0	0	0
BT025	MHW	BR BATTERY RECYCLING		BATTERY CAUSTIC STORAGE TANK	Process Water		7000	Gal.	Above ground	0	0	0
BT191	MHW	GEN GENERAL SERVICES	MAINTENANCE SHOP	MAINTENANCE SHOP PROPANE TANK 1000 GAL	Propane	Steel	1000	Gal.	P PROPANE	500	500	500
BT591	MHW	GEN GENERAL SERVICES	CHANGEHOUSE	CHANGEHOUSE PROPANE TANK 1000 GAL.(WEST)	Propane	Steel	1000	Gal.	P PROPANE	500	500	500
BT592	MHW	GEN GENERAL SERVICES	CHANGEHOUSE	CHANGEHOUSE PROPANE TANK 1000 GAL.(EAST)	Propane	Steel	1000	Gal.	P PROPANE	500	500	500
(PL#20)	MHW	Material Handling West	MHW Maintenance shop		Diesel Fuel	Steel	900	L	Above ground	900	900	900
BT891 (PL#15)	MHW	Material Handling West			Diesel Fuel	Composite	3785	L	Above ground	378.5	378.5	378.5
BT894 (PL #18)	MHW	Material Handling West	BATTERY RECYCLING PLANT	UNLEADED GAS TANK	Regular Oil, Gasoline	Steel	3800	L	Above ground	380	380	380
30% Acid Tank	MHW			Not in use	30% Acid	Steel			Above ground	0	0	0
PO004	MHW	Acid Shipping	Commercial Tanks	Pond - Commercial Tanks Dyke	Sulfuric Acid	Concrete & HDPE	2230	m3	Spill containment	0	0	0
AT005	Smelter	01 ACID PLANT	ACID EAST END	COOLING TOWER SUMP TANK	RPW	FRP	36000	L	Above ground	0	0	0
AT021	Smelter	01 ACID PLANT	ACID PLANT CENTER NORTH SIDE	ABSORBER TOWER	Sulfuric Acid	Brick Lined CS	57161	kg	Capacity Based on Drawing Acid Runback Level	0	0	0
AT022	Smelter	01 ACID PLANT	ACID PLANT CENTER SOUTH SIDE	DRYING TOWER	Sulfuric Acid	Brick Lined CS	117979	kg	Capacity Based on Full Pump Tank	0	0	0
AY001	Smelter	01 ACID PLANT	ACID EAST END	VENTURI SCRUBBER	RPW	FRP	9911	L	All Ventury Share Same Sump. Total Cap 39644 L	0	0	0
AY002	Smelter	01 ACID PLANT	ACID EAST END	VENTURI SCRUBBER	RPW	FRP	9911	L	All Ventury Share Same Sump. Total Cap 39644 L	0	0	0
AY003	Smelter	01 ACID PLANT	ACID EAST END	VENTURI SCRUBBER	RPW	FRP	9911	L	All Ventury Share Same Sump. Total Cap 39644 L	0	0	0
AY004	Smelter	01 ACID PLANT	ACID EAST END	VENTURI SCRUBBER	RPW	FRP	9911	L	All Ventury Share Same Sump. Total Cap 39644 L	0	0	0
BT002	Smelter	01 ACID PLANT	ACID PLANT	ABSORBER TOWER SUMP	Sulfuric Acid	Brick Lined C.S.	23184	kg	Connected to Absorber Tower	0	0	0
BT003	Smelter	01 ACID PLANT	ACID N/W CORNER OUT	ACID START UP TANK	Sulfuric Acid 70%-100% (H2SO4)	Steel	1536000	kg	Above ground	184000	184000	184000
BT004 (PL#19)	Smelter	01 ACID PLANT	ACID OUT WEST END	FUEL TANK	Furnace Oil	Composite	37800	L	Above ground	37800	37800	37800
BT005	Smelter	01 ACID PLANT	ACID PLANT	SALT WATER TANK C.I.L.	Salt Water	316 SST	24464	L	Above ground	0	0	0
BT006	Smelter	01 ACID PLANT	hydrogen peroxide system	DOSING TANK	Hydrogen Peroxide (50%)	316 SST	164	L	Above ground	0	0	0
BT007	Smelter	01 ACID PLANT	acid plant south side	PEROXIDE STORAGE TANK	Hydrogen Peroxide (50.5%)	304 SST	35958	L	Above ground	28766	28766	28766
BT008	Smelter	01 ACID PLANT	ACID PLANT	DRYING TOWER BOOT	Sulfuric Acid	Brick Lined C.S.	56308	kg	Connected to Drying Tower	0	0	0
BT009	Smelter	01 ACID PLANT	Acid Plant -West Side	ACID BLEACHING TANK (BRICK LINED)	Sulfuric Acid	Brick lined 316L SST	55751	kg	Above ground	0	0	0
BT010	Smelter	01 ACID PLANT	Acid Plant - West Side	ACID BLEACHING TANK (S.S.)#2 TANK)	Sulfuric Acid	304L SST	66169	kg	Replaced in 2017	0	0	0
BT250	Smelter	01 ACID PLANT	Tank farm #1 - West of Acid Plant	PROPANE TANK EAST - TANK FARM #1-2	Liquid Propane	Steel	113562	L	Above ground	56781	56781	56781
BT251	Smelter	01 ACID PLANT	Tank farm #1 - West of Acid Plant	PROPANE TANK WEST - TANK FARM #1-1	Liquid Propane	Steel	113562	L	Above ground	56781	56781	56781
AC028	Smelter	01 ACID PLANT	West of Acid Plant	Converter	Catalyst		175207	L	Catalyst is diatomic earth and contains Vanadium (possible the supplier would take this back, maybe at a cost to us?)	175207	175207	175207
BT241	Smelter	26 PROPANE BULK PLANT	PROPANE PLANT	PROPANE TANK SOUTH	Propane	Steel	89553	L	Above ground	44776.5	44776.5	44776.5
BT242	Smelter	26 PROPANE BULK PLANT	PROPANE PLANT	PROPANE TANK CENTRE	Propane	Steel	89553	L	Above ground	44776.5	44776.5	44776.5
BT243	Smelter	26 PROPANE BULK PLANT	PROPANE PLANT	PROPANE TANK NORTH	Propane	Steel	136383	L	Above ground	68191.5	68191.5	68191.5
BT211	Smelter	29 WASTEWATER TREATMENT	WATER TREAT. BLDG.	TREATMENT TANK (TANK #2)	Wastewater	Steel	34	m <sup>3</sup>		0	0	0
BT212	Smelter	29 WASTEWATER TREATMENT	WATER TREAT. BLDG.	TREATMENT TANK (TANK # 1)	Wastewater	Steel	34	m <sup>3</sup>		0	0	0
BT213	Smelter	29 WASTEWATER TREATMENT	West end of WWTP basement floor	SLUDGE RECYCLE TANK	Sludge	Fiberglass	??			0	0	0
BT214	Smelter	29 WASTEWATER TREATMENT	WATER TREAT. BLDG.	FLASH MIX TANK	Wastewater	Steel	2.8	m <sup>3</sup>		0	0	0
BT217	Smelter	29 WASTEWATER TREATMENT	WATER TREAT. BLDG.	SLURRY TANK LIME SILO	Lime slurry	Steel	??			0	0	0
BT301	Smelter	30 BRICK SHOP	PLATE SHOP	ABRASIVE TANK	Sand	Steel	6.5	ft3		0	0	0
BT252	Smelter	32 LABORATORY	Tank farm #2 - East of Don Dome	PROPANE TANK SOUTH - TANK FARM #2-2	Propane	Steel	113562	L	Above ground	56781	56781	56781
BT253	Smelter	32 LABORATORY	Tank farm #2 - East of Don Dome	PROPANE TANK NORTH - TANK FARM #2-1	Propane	Steel	113562	L	Above ground	56781	56781	56781
BT016	Smelter	01 ACID PLANT	Mist Precip Flushing Building	MIST PRECIP FLUSHING RECIRCULATION TANK	RPW	FRP	17448	L	Above ground	0	0	0
BT351 (PL#21)	Smelter	35 WAREHOUSE	WAREHOUSE	UNLEADED GAS TANK	Regular Oil, Gasoline	Steel	9100	L	Above ground	910	910	910
BT353 (PL#22)	Smelter	35 WAREHOUSE	WAREHOUSE	DIESEL TANK	Diesel Fuel	Steel	9100	L	Above ground	910	910	910
BT413	Smelter	40 SINTER BAGHOUSE	SINTER BAGHOUSE	FULLER TANK EAST	Sinter Dust	Steel	15	ft3	Above ground	0	0	0
BT414	Smelter	40 SINTER BAGHOUSE	SINTER BAGHOUSE	FULLER TANK CENTRE EAST	Sinter Dust	Steel	15	ft3	Above ground	0	0	0
BT415	Smelter	40 SINTER BAGHOUSE	SINTER BAGHOUSE	FULLER TANK CENTRE WEST	Sinter Dust	Steel	15	ft3	Above ground	0	0	0
BT416	Smelter	40 SINTER BAGHOUSE	SINTER BAGHOUSE	FULLER TANK WEST	Sinter Dust	Steel	15	ft3	Above ground	0	0	0
BT501	Smelter	50 SCREEN & CRUSH BLDG	BOTTOM FLOOR- CRUSHER	SLURRY TANK	RPW		168	ft3	Above ground	0	0	0
BT201	Smelter	60 FURNACE BLDG	FURN. SOFTNER ROOM	SOFTNER BRINE TANK	Water/Salt				Not contaminated	0	0	0
BT601	Smelter	60 FURNACE BLDG	Furnace top, below ceiling	HEAD WATER TANK FOR FURNACE COOLING	Water				Not contaminated	0	0	0
BT621	Smelter	67 FURNACE BAGHOUSE	FBH SLURRY ROOM	SLURRY MIXING TANK		Steel	32	ft3		0	0	0
BT740 (PL#28)	Smelter	74 GARAGE	BEHIND GARAGE	WASTE OIL TANK	Waste oil	Steel	4500	L	Above ground	0	0	0
BT801	Smelter	85 SRF BAGHOUSE	SRF BLDG GROUND FLOOR	SLURRY TANK			0		Not in use			
BT333 (PL#29)	Smelter	90 LEAD REFINERY	ADJACENT TO THE OLD BOILER ROOM	80,000 LITRE #2 OIL TANK	Furnace Oil	Steel	80000	L	Above ground	24000	24000	56000
BT910	Smelter	90 LEAD REFINERY	BY NEW CASTING MACHINE	COOLING WATER TANK	Water	Steel	5000	L		0	0	0
BT911	Smelter	90 LEAD REFINERY	SRF bldg upstairs	RETURN WATER TANK FOR CASTING WHEEL	Water	Steel	28500	L		0	0	0
BT912	Smelter	94 SILVER PLANT	ABOVE THE CEILING ENTRANCE TO CONTROL RM	TANK SECONDARY COOLING WATER VIR	Water				CL COOLING	0	0	0
BT913	Smelter	94 SILVER PLANT		VIR # 2 SECONDARY COOLING WATER TANK	Water				AG SILVER PLANT REFINERY	0	0	0
BT914	Smelter	94 SILVER PLANT		VIR # 2 PRIMARY EXPANSION TANK	Water				AG SILVER PLANT REFINERY	0	0	0
BT915	Smelter	94 SILVER PLANT		VIR # 2 CONVERTER EXPANSION TANK	Water				AG SILVER PLANT REFINERY	0	0	0
BT916	Smelter	94 SILVER PLANT		VIR # 2 INSTRUMENT AIR RECEIVER TANK	Air				AG SILVER PLANT REFINERY	0	0	0
Carbon Dioxide	Smelter	East of WWTP			Carbon Dioxide		1633	kg	Above ground	1633	1633	1633
Oxygen Tank #9301078	Smelter	near oxygen plant (backup)			Liquid Oxygen		49210	L	Owned and managed by Praxair	0	0	0
Oxygen Tank #9303739	Smelter	near oxygen plant (backup)			Liquid Oxygen		56403	L	Owned and managed by Praxair	0	0	0
Liquid Nitrogen tank	Smelter	South of laboratory			Liquid Nitrogen		41640	L	Above ground tank, Owned and managed by Air Products	16656	16656	16656
Oxygen Tank	Smelter	South of laboratory			Liquid Oxygen		5678	L	Owned and managed by Praxair	0	0	0
BT205 (PL#15)	Smelter		North of Furnace Generator tank		Diesel Fuel	Composite	1890	L	Above ground	1890	1890	1890
(PL#18)	Smelter		Thaw Shed		Furnace Oil	Steel	23261	L	Above ground	6978.3	6978.3	6978.3
(PL#30)	Smelter		FCE Bag House Winter Heater		Furnace Oil	Steel	2250	L	Above ground	675	675	675
(PL#23)	Smelter		SRF Winter Heater		Furnace Oil	Steel	2380	L	Above ground	714	714	714
BT206 (PL#24)	Smelter		Proportioning Winter Heater		Furnace Oil	Steel	4500	L	Above ground	1350	1350	1350
(PL#25)	Smelter		Acid Plant Winter Heater		Furnace Oil	Steel	4500	L	Above ground	1350	1350	1350
(PL#26)	Smelter		North of Sinter Plant Winter Heater		Furnace Oil	Steel	4745	L	Above ground	1423.5	1423.5	1423.5
(PL#27)	Smelter		South of Sinter Plant Winter Heater		Furnace Oil	Steel	4745	L	Above ground	1423.5	1423.5	1423.5
(PL#17)	Smelter	Sinter Building	Sinter Baghouse		Furnace Oil	Composite	22710	L	Above ground	0	0	0
	Smelter		RPW Pond and Piping	RPW North Pond	RPW		316145	US.GAL	61% solids	316145	316145	316145
	Smelter			RPW South Pond	RPW		316145	US.GAL	81% solids	316145	316145	316145
	Smelter			RPW New Pond	RPW		314182	US.GAL	83% Solids	314182	314182	314182
	Smelter			Hockey Rink	RPW		403948	US.GAL	5% solids	403948	403948	403948
BC501	Smelter	Clarifier Building	Clarifier	80 ft dia clarifier	RPW	Steel	402233	US.GAL	Above ground	402233	402233	402233

# Appendix I

## Conceptual Civil Drawings



ON NE PEUT REPRODUIRE, ENREGISTRER, NI DIFFUSER AUCUNE PARTIE DU PRESENT DOCUMENT, SOUS QUELQUE FORME OU PAR QUELQUE PROCÉDÉ QUE CE SOIT, SANS AVOIR OBTENU AU PRÉALABLE L'AUTORISATION ÉCRITE DE L'AUTEUR.

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NO.	DATE	REVISIONS	BY: PAR:
B	19/12/19	RE-ISSUED FOR REVIEW	A.K.
A	19/10/29	ISSUED FOR REVIEW	M.H.

<b>A</b>	A DETAIL No No DU DETAIL	<b>A</b>
<b>B</b>	B LOCATION DRAWING No SUR DESSIN No	<b>B/C</b>
<b>C</b>	C DRAWING No DESSIN No	

Client  
**BRUNSWICK SMELTER**  
 A GLENCORE COMPANY  
 692 MAIN STREET  
 BELLEDUNE N.B. E8G 2M1

Project  
**SLAG PILE CLOSURE PLAN**  
 BELLEDUNE, NB

**ROY CONSULTANTS**  
 ENGINEERING SERVICES D'INGÉNIERIE  
 588, av. King Ave.  
 Bathurst (NB) E2A 1P7  
 T. 506.546.4884  
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Drawing Title  
 Titre du Plan

**PLAN VIEW AND TYPICAL CROSS SECTION**

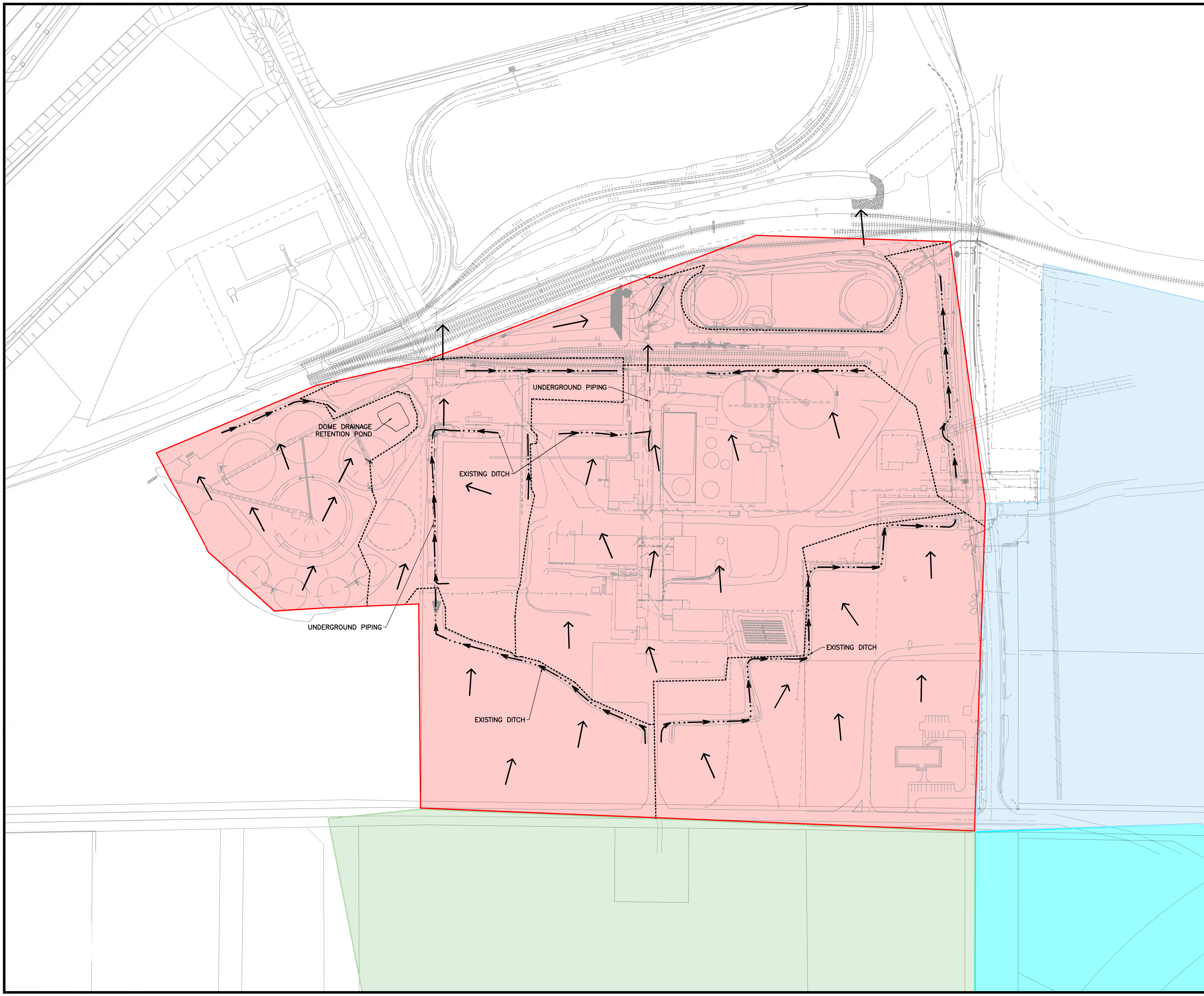
Design by: Design par: S.COMEAU  
 Drawn by: Dessiné par: M.HEBERT  
 Checked by: Vérifié par: Date: OCTOBER 2019  
 Scale: Echelle: AS SHOWN  
 Sheet: Feuille: 1 of/de 1

Drawing Number: Numero du Plan: 178-19-SK1  
 Rev. B

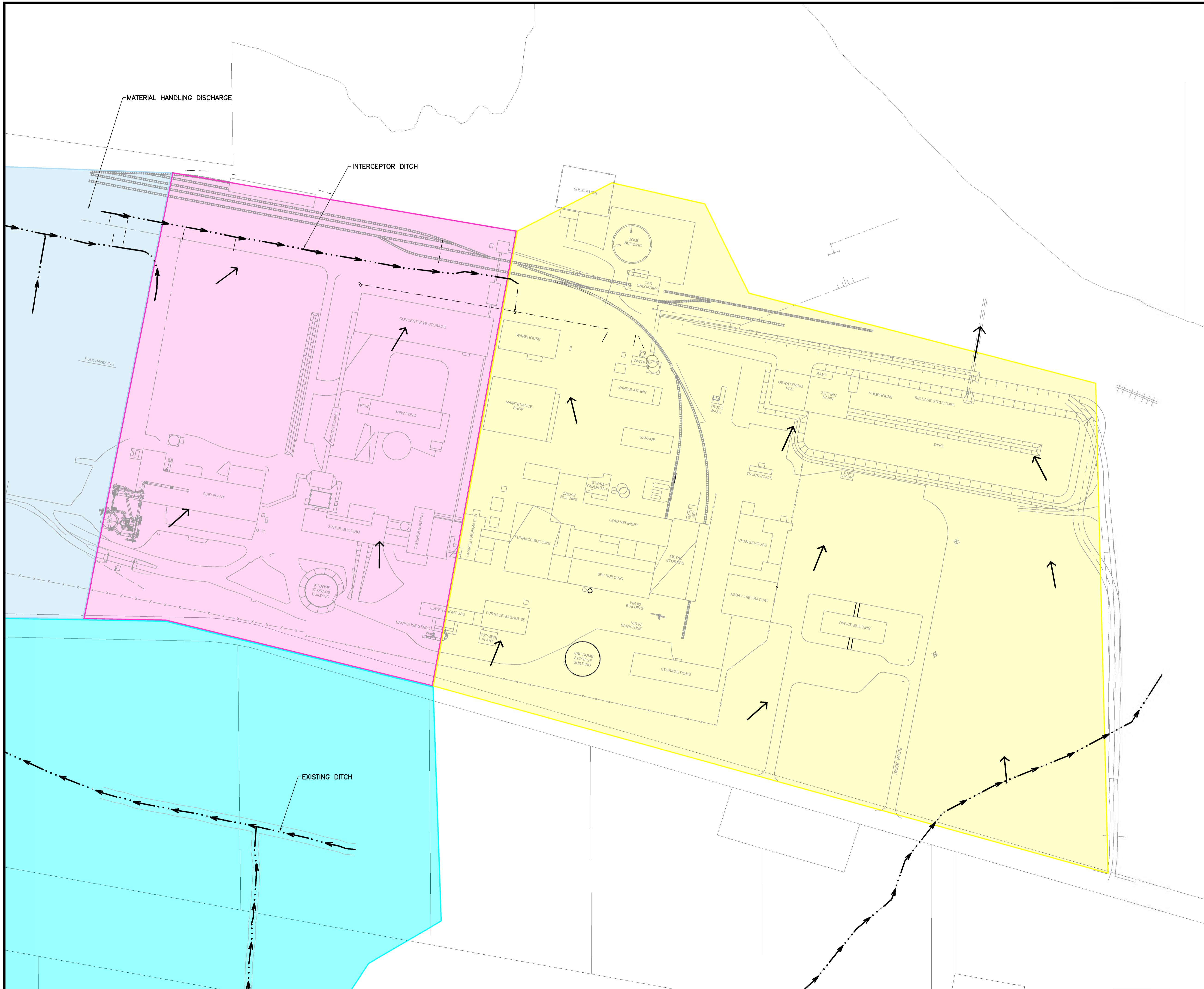




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→	SURFACE WATER FLOW DIRECTION	
A	19/XX/XX	XXXX
NO.	DATE	REVISIONS
		M.H.
		BY: PAR:
A	A DETAIL No	
B	No DU DETAIL	
B LOCATION DRAWING No		
SUR DESSIN No		
C DRAWING No		
DESSIN No		
Client		Client
BRUNSWICK SMELTER		
A GLENORE COMPANY		
692 MAIN STREET		
BELLEDUNE N.B. E8G 2M1		
Project	Projet	
SMELTER CLOSURE PLAN		
BELLEDUNE, NB		
 <b>ROY CONSULTANTS</b> <small>ENGINEERING SERVICES D'INGENIERIE</small>		548, av. King Ave. Bathurst (NB) E2A 1P7 T. 506.546.4484 www.royconsultants.ca
Drawing Title	Titre du Plan	
EXISTING SURFACE WATER MANAGEMENT PLAN		
Design by: Design par:	M.SULLIVAN	Drawn by: Dessine par:
		M.HEBERT
Checked by: Verifie par:		Date:
		OCTOBER 2019
Scale: Echelle:	1:1500	Sheet: Feuille:
		1 of/de 1
Drawing Number: Numero du Plan:	178-19-SK3	Rev. A



**NOTES**

--- DRAINAGE DITCH  
 → SURFACE WATER FLOW DIRECTION

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B C SUR DESSIN No  
C DRAWING No  
B C DESSIN No

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 A GLENCORE COMPANY  
 692 MAIN STREET  
 BELLEDUNE N.B. E8G 2M1

Project **SMELTER CLOSURE PLAN** Projet  
 BELLEDUNE, NB

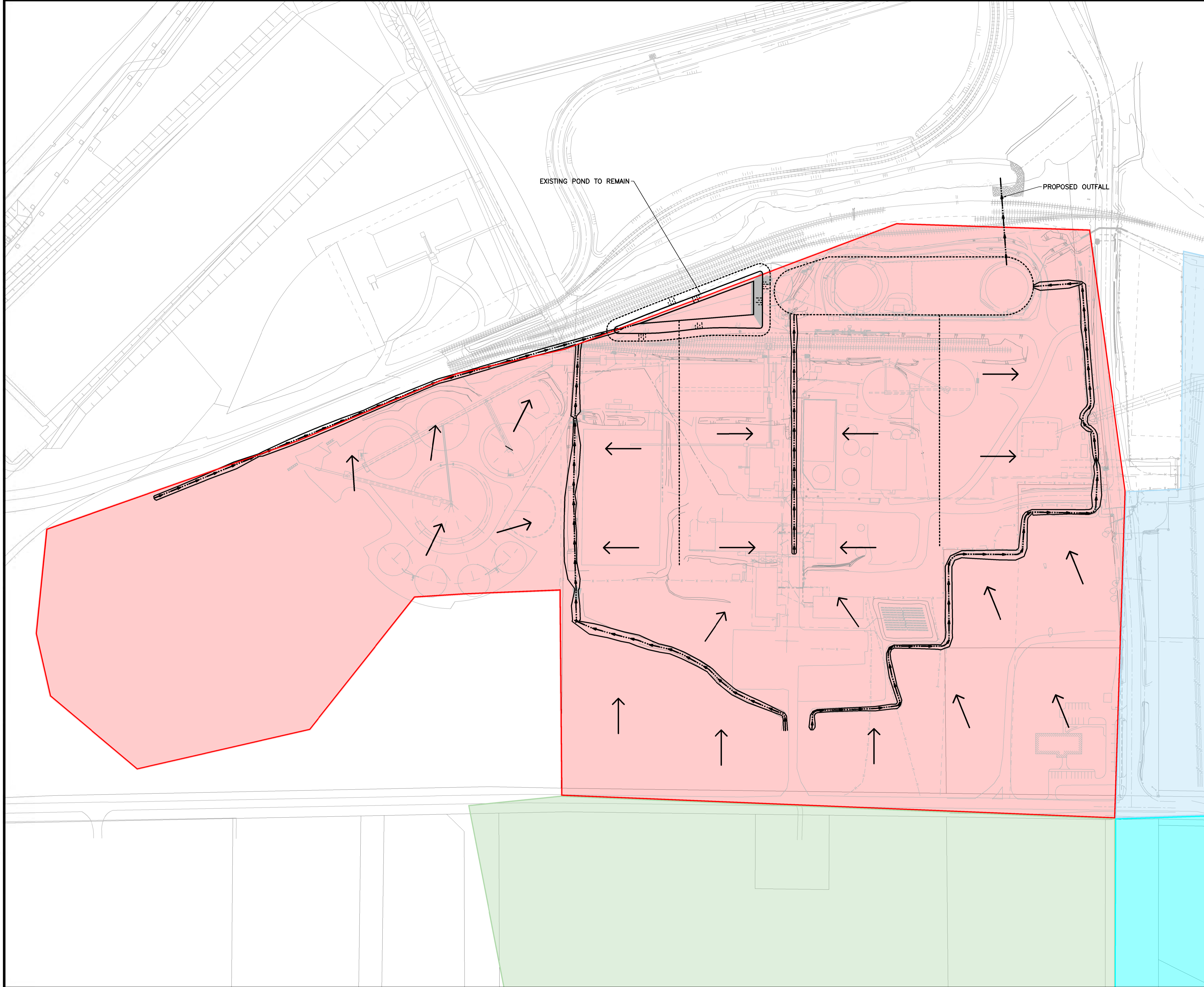
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Drawing Title **EXISTING SURFACE WATER MANAGEMENT PLAN** Titre du Plan

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Drawing Number: 178-19-SK4 Numero du Plan: Rev. A





**NOTES**

- DRAINAGE DITCH
- SURFACE WATER FLOW DIRECTION
- PROPOSED WETLAND AREA

A	19/XX/XX	XXXX	M.H.
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A	A DETAIL No	A
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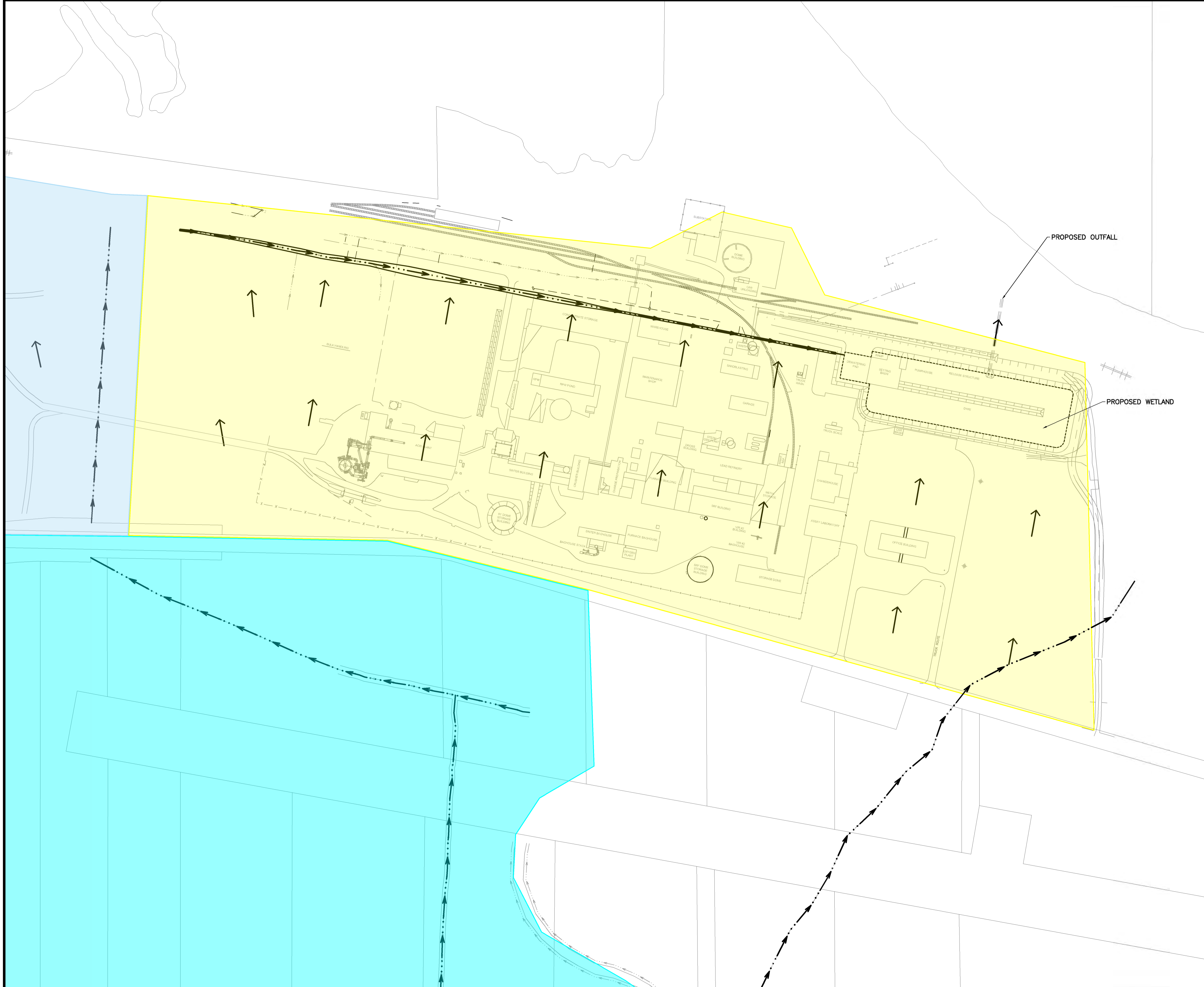
Project **SLAG PILE CLOSURE PLAN** Projet  
 BELLEDUNE, NB

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 Bathurst (NB) E2A 1P7  
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Drawing Title **CONCEPTUAL SURFACE WATER MANAGEMENT PLAN (POST-CLOSURE)** Titre du Plan

Design by: Design par: M.SULLIVAN	Drawn by: Dessiné par: M.HEBERT
Checked by: Verifié par:	Date: OCTOBER 2019
Scale: Echelle: 1:1500	Sheet: Feuille: 1 of/de 1

Drawing Number: **178-19-SK6** Numero du Plan: Rev. **A**



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→	SURFACE WATER FLOW DIRECTION	
·····	PROPOSED WETLAND AREA	
A	19/XX/XX	XXXX
NO.	DATE	REVISIONS
		M.H.
		BY:
		PAR:
A	A DETAIL No	
B	No DU DETAIL	
B LOCATION DRAWING No		
SUR DESSIN No		
C DRAWING No		
DESSIN No		
Client		
BRUNSWICK SMELTER		
A GLENCORE COMPANY		
692 MAIN STREET		
BELLEDUNE N.B. E8G 2M1		
Project		
Projet		
SLAG PILE CLOSURE PLAN		
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Drawing Title		
Titre du Plan		
CONCEPTUAL SURFACE WATER MANAGEMENT PLAN (POST-CLOSURE)		
Design by: Design par:		Drawn by: Dessine par:
M.SULLIVAN		M.HEBERT
Checked by: Verifie par:		Date:
		OCTOBER 2019
Scale: Echelle:	Sheet: Feuille:	
1:2000	1 of/de 1	
Drawing Number: Numero du Plan:		Rev.
178-19-SK7		A

# Appendix J

## Updated Hydrology Data

Summary Table



Drainage Area	Area (km <sup>2</sup> )	c factor existing	QP100 (m <sup>3</sup> /s)
Slag Pile	<b>Missing dam info to calculate peak flow</b>		
MHW	0.258	0.5	1.9
Back 40/50	0.126	0.5	1.05
Smelter #1	0.116	0.75	1.54
Smelter #2	0.232	0.8	2.96
Off-Site	1.118	0.3	2.2
West Diversion Ditch	1.3	0.3	2.75

**Culvert Design**

Smelter Closure Plan - MHW Watershed Existing  
 Roy's Job No. 178-19  
 County: Gloucester  
 Prepared By: MS  
 Belledune Rainfall Data



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**Runoff Calculation**Rational Method

$$Q = 0.28 * C * I * A$$

Q = flow, m<sup>3</sup>/s

C = flow coefficient

I = average precipitation intensity, mm/h

A = drainage area, less than 800 Km<sup>2</sup>

**C factor**

Watersheds including different areas and C factors

A <sub>1</sub> =	0.258 Km <sup>2</sup>	C <sub>1</sub> =	0.5		
A <sub>1</sub> =	Km <sup>3</sup>	C <sub>1</sub> =			
A <sub>2</sub> =	Km <sup>2</sup>	C <sub>2</sub> =			
A <sub>3</sub> =	Km <sup>2</sup>	C <sub>3</sub> =			
A <sub>total</sub> =	0.258 Km <sup>2</sup>	Cave =	0.5	Area (ha)	25.8

**Intensity**1) T<sub>c</sub> - Overland flow (Kerby)

L<sub>o</sub> = distance, less than 100m for Kerby

S<sub>o</sub> = ground slope

n = flow resistance coefficient

$$t_o = (2.2 * n * L_o / S_o^{0.5})^{0.467}$$

L<sub>o</sub> = 100 m

n = 0.100

S<sub>o</sub> = 0.020 m/m

2) T<sub>c</sub> - Stream/Ditch flow (Kirpich)

$$t_{ch} = 0.0195 * L_o^{0.77} * S_o^{-0.385}$$

L<sub>ch</sub> = 476 m

S<sub>ch</sub> = 0.020 m/m

3) T<sub>c</sub> - Pipe flow (Manning)

$$t_f = L * D^2 / (76.3944 * Q)$$

L = 0.000 m

Pente = 0.000 %

d = 0.000 mm

Rugosité = 0.000

D = 0.000 m

Q = 0.000 m<sup>3</sup>/s

Overland flow, t <sub>o</sub>	100 m, max			
	10.6 min	1.0 times		10.6 min
Channelized flow, t <sub>ch</sub>	10.1 min	2 times		20.3 min
Pipe flow, t <sub>c</sub>	0 min	1 times		0.0 min
		Total		30.8 min

Return Period	(year)	2	5	10	25	50	100
Intensity	(mm/h)	21.2	29.8	35.3	42.3	47.4	52.6
<b>Runoff Q</b>	(m <sup>3</sup> /s)	<b>0.7675</b>	<b>1.0753</b>	<b>1.2766</b>	<b>1.5270</b>	<b>1.7109</b>	<b>1.9010</b>
	(l/s)	768	1075	1277	1527	1711	1901
	(cfs)	27.083	37.945	45.048	53.883	60.373	67.080



<b>Runoff Calculation</b>							
<u>Rational Method</u>							
<b>Q = 0.28 * C * I * A</b>				Q = flow, m <sup>3</sup> /s C = flow coefficient I = average precipitation intensity, mm/h A = drainage area, less than 800 Km <sup>2</sup>			
<b>C factor</b>							
Watersheds including different areas and C factors							
A <sub>1</sub> =	0.126	Km <sup>2</sup>	C <sub>1</sub> =	0.5			
A <sub>1</sub> =		Km <sup>3</sup>	C <sub>1</sub> =				
A <sub>2</sub> =		Km <sup>2</sup>	C <sub>2</sub> =				
A <sub>3</sub> =		Km <sup>2</sup>	C <sub>3</sub> =				
A <sub>total</sub> =	0.126	Km <sup>2</sup>	Cave =	0.5	Area (ha)	12.6	
<b>Intensity</b>							
1) Tc - Overland flow (Kerby)				L <sub>o</sub> = distance, less than 100m for Kerby S <sub>o</sub> = ground slope n = flow resistance coefficient			
$t_o = (2.2 * n * L_o / S_o^{0.5})^{0.467}$							
L <sub>o</sub> =	100	m	n =	0.100			
S <sub>o</sub> =	0.027	m/m					
2) Tc - Stream/Ditch flow (Kirpich)							
$t_{ch} = 0.0195 * L_o^{0.77} * S_o^{-0.385}$							
L <sub>ch</sub> =	407	m					
S <sub>ch</sub> =	0.027	m/m					
3) Tc - Pipe flow (Manning)							
$t_f = L * D^2 / (76.3944 * Q)$							
L =	0.000	m	Pente	0.000	%		
d =	0.000	mm	Rugosité	0.000			
D =	0.000	m					
Q =	0.000	m <sup>3</sup> /s					
Overland flow, t <sub>o</sub>	100 m, max						
	9.8 min	1.0 times	9.8 min				
Channelized flow, t <sub>ch</sub>	8.0 min	2 times	16.0 min				
Pipe flow, t <sub>c</sub>	0 min	1 times	0.0 min				
		Total	25.9 min				
Return Period (year)		2	5	10	25	50	100
Intensity (mm/h)		23.7	33.4	39.7	47.6	53.4	59.4
<b>Runoff Q</b> (m <sup>3</sup> /s)		<b>0.4178</b>	<b>0.5889</b>	<b>0.7009</b>	<b>0.8404</b>	<b>0.9428</b>	<b>1.0487</b>
(l/s)		418	589	701	840	943	1049
(cfs)		14.742	20.783	24.734	29.657	33.271	37.006

<b>Runoff Calculation</b>							
<u>Rational Method</u>							
<b>Q = 0.28 * C * I * A</b>		Q = flow, m <sup>3</sup> /s C = flow coefficient I = average precipitation intensity, mm/h A = drainage area, less than 800 Km <sup>2</sup>					
<b>C factor</b>							
Watersheds including different areas and C factors							
A <sub>1</sub> =	0.116	Km <sup>2</sup>	C <sub>1</sub> =	0.75			
A <sub>1</sub> =		Km <sup>3</sup>	C <sub>1</sub> =				
A <sub>2</sub> =		Km <sup>2</sup>	C <sub>2</sub> =				
A <sub>3</sub> =		Km <sup>2</sup>	C <sub>3</sub> =				
A <sub>total</sub> =	0.116	Km <sup>2</sup>	Cave =	0.75	Area (ha)	11.6	
<b>Intensity</b>							
1) Tc - Overland flow (Kerby)				L <sub>o</sub> = distance, less than 100m for Kerby			
				S <sub>o</sub> = ground slope			
				n = flow resistance coefficient			
$t_o = (2.2 * n * L_o / S_o^{0.5})^{0.467}$							
L <sub>o</sub> =	417	m	n =	0.100			
S <sub>o</sub> =	0.011	m/m					
2) Tc - Stream/Ditch flow (Kirpich)							
$t_{ch} = 0.0195 * L_o^{0.77} * S_o^{-0.385}$							
L <sub>ch</sub> =	0	m					
S <sub>ch</sub> =	0.011	m/m					
3) Tc - Pipe flow (Manning)							
$t_f = L * D^2 / (76.3944 * Q)$							
L =	0.000	m	Pente	0.000	%		
d =	0.000	mm	Rugosité	0.000			
D =	0.000	m					
Q =	0.000	m <sup>3</sup> /s					
Overland flow, t <sub>o</sub>	417 m, max						
	23.7 min		1.0 times		23.7 min		
Channelized flow, t <sub>ch</sub>	0.0 min		2 times		0.0 min		
Pipe flow, t <sub>c</sub>	0 min		1 times		0.0 min		
			Total		23.7 min		
Return Period (year)	2	5	10	25	50	100	
Intensity (mm/h)	25.0	35.4	42.2	50.6	56.8	63.2	
<b>Runoff Q</b> (m <sup>3</sup> /s)	<b>0.6095</b>	<b>0.8619</b>	<b>1.0270</b>	<b>1.2330</b>	<b>1.3840</b>	<b>1.5403</b>	
(l/s)	609	862	1027	1233	1384	1540	
(cfs)	21.506	30.413	36.240	43.508	48.839	54.352	

<b>Runoff Calculation</b>							
<u>Rational Method</u>							
<b>Q = 0.28 * C * I * A</b>				Q = flow, m <sup>3</sup> /s C = flow coefficient I = average precipitation intensity, mm/h A = drainage area, less than 800 Km <sup>2</sup>			
<b>C factor</b>							
Watersheds including different areas and C factors							
A <sub>1</sub> =	0.232	Km <sup>2</sup>	C <sub>1</sub> =	0.8			
A <sub>1</sub> =		Km <sup>3</sup>	C <sub>1</sub> =				
A <sub>2</sub> =		Km <sup>2</sup>	C <sub>2</sub> =				
A <sub>3</sub> =		Km <sup>2</sup>	C <sub>3</sub> =				
A <sub>total</sub> =	0.232	Km <sup>2</sup>	Cave =	0.8	Area (ha)	23.2	
<b>Intensity</b>							
1) Tc - Overland flow (Kerby)				L <sub>o</sub> = distance, less than 100m for Kerby S <sub>o</sub> = ground slope n = flow resistance coefficient			
<b>t<sub>o</sub> = ( 2.2 * n * L<sub>o</sub> / S<sub>o</sub><sup>0.5</sup> )<sup>0.467</sup></b>							
L <sub>o</sub> =	575	m	n =	0.100			
S <sub>o</sub> =	0.011	m/m					
2) Tc - Stream/Ditch flow (Kirpich)							
<b>t<sub>ch</sub> = 0.0195 * L<sub>o</sub><sup>0.77</sup> * S<sub>o</sub><sup>-0.385</sup></b>							
L <sub>ch</sub> =	0	m					
S <sub>ch</sub> =	0.011	m/m					
3) Tc - Pipe flow (Manning)							
<b>t<sub>f</sub> = L * D<sup>2</sup> / (76.3944*Q)</b>							
L =	0.000	m	Pente	0.000	%		
d =	0.000	mm	Rugosité	0.000			
D =	0.000	m					
Q =	0.000	m <sup>3</sup> /s					
Overland flow, t <sub>o</sub>	575 m, max						
	27.5 min		1.0 times		27.5 min		
Channelized flow, t <sub>ch</sub>	0.0 min		2 times		0.0 min		
Pipe flow, t <sub>c</sub>	0 min		1 times		0.0 min		
			Total		27.5 min		
Return Period (year)		2	5	10	25	50	100
Intensity (mm/h)		22.8	32.1	38.2	45.7	51.3	57.0
<b>Runoff Q</b>	(m <sup>3</sup> /s)	<b>1.1854</b>	<b>1.6675</b>	<b>1.9829</b>	<b>2.3756</b>	<b>2.6638</b>	<b>2.9618</b>
	(l/s)	1185	1668	1983	2376	2664	2962
	(cfs)	41.830	58.843	69.970	83.827	94.000	104.515

**Culvert Design**

Smelter Closure Plan - Off-Site Watershed Existing  
 Roy's Job No. 178-19  
 County: Gloucester  
 Prepared By: MS  
 Belledune Rainfall Data



<b>Runoff Calculation</b>							
<u>Rational Method</u>							
<b>Q = 0.28 * C * I * A</b>				Q = flow, m <sup>3</sup> /s C = flow coefficient I = average precipitation intensity, mm/h A = drainage area, less than 800 Km <sup>2</sup>			
<b>C factor</b>							
Watersheds including different areas and C factors							
A <sub>1</sub> =	1.118	Km <sup>2</sup>	C <sub>1</sub> =	0.3			
A <sub>1</sub> =		Km <sup>3</sup>	C <sub>1</sub> =				
A <sub>2</sub> =		Km <sup>2</sup>	C <sub>2</sub> =				
A <sub>3</sub> =		Km <sup>2</sup>	C <sub>3</sub> =				
A <sub>total</sub> =	1.118	Km <sup>2</sup>	Cave =	0.3	Area (ha)	111.8	
<b>Intensity</b>							
1) Tc - Overland flow (Kerby)				L <sub>o</sub> = distance, less than 100m for Kerby			
				S <sub>o</sub> = ground slope			
<b>t<sub>o</sub> = ( 2.2 * n * L<sub>o</sub> / S<sub>o</sub><sup>0.5</sup> )<sup>0.467</sup></b>				n = flow resistance coefficient			
L <sub>o</sub> =	100	m	n =	0.600			
S <sub>o</sub> =	0.015	m/m					
2) Tc - Stream/Ditch flow (Kirpich)							
<b>t<sub>ch</sub> = 0.0195 * L<sub>o</sub><sup>0.77</sup> * S<sub>o</sub><sup>-0.385</sup></b>							
L <sub>ch</sub> =	2188	m					
S <sub>ch</sub> =	0.015	m/m					
3) Tc - Pipe flow (Manning)							
<b>t<sub>f</sub> = L * D<sup>2</sup> / (76.3944*Q)</b>							
L =	0.000	m	Pente	0.000	%		
d =	0.000	mm	Rugosité	0.000			
D =	0.000	m					
Q =	0.000	m <sup>3</sup> /s					
Overland flow, t <sub>o</sub>	100 m, max						
	26.1 min		1.0 times		26.1 min		
Channelized flow, t <sub>ch</sub>	36.7 min		2 times		73.3 min		
Pipe flow, t <sub>c</sub>	0 min		1 times		0.0 min		
			Total		99.4 min		
Return Period	(year)	2	5	10	25	50	100
Intensity	(mm/h)	10.3	13.9	16.2	19.1	21.2	23.4
<b>Runoff Q</b>	(m <sup>3</sup> /s)	<b>0.9704</b>	<b>1.3051</b>	<b>1.5242</b>	<b>1.7935</b>	<b>1.9931</b>	<b>2.1990</b>
	(l/s)	970	1305	1524	1793	1993	2199
	(cfs)	34.244	46.053	53.784	63.287	70.331	77.598

**Culvert Design**

Smelter Closure Plan - West Diversion Ditch Existing  
 Roy's Job No. 178-19  
 County: Gloucester  
 Prepared By: MS  
 Belledune Rainfall Data



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<b>Runoff Calculation</b>							
<b>Rational Method</b>							
<b>Q = 0.28 * C * I * A</b>				Q = flow, m <sup>3</sup> /s			
				C = flow coefficient			
				I = average precipitation intensity, mm/h			
				A = drainage area, less than 800 Km <sup>2</sup>			
<b>C factor</b>							
Watersheds including different areas and C factors							
A <sub>1</sub> =	1.3	Km <sup>2</sup>	C <sub>1</sub> =	0.3			
A <sub>1</sub> =		Km <sup>3</sup>	C <sub>1</sub> =				
A <sub>2</sub> =		Km <sup>2</sup>	C <sub>2</sub> =				
A <sub>3</sub> =		Km <sup>2</sup>	C <sub>3</sub> =				
A <sub>total</sub> =	1.3	Km <sup>2</sup>	Cave =	0.3	Area (ha)	130	
<b>Intensity</b>							
1) Tc - Overland flow (Kerby)				L <sub>o</sub> = distance, less than 100m for Kerby			
				S <sub>o</sub> = ground slope			
<b>t<sub>o</sub> = ( 2.2 * n * L<sub>o</sub> / S<sub>o</sub><sup>0.5</sup> )<sup>0.467</sup></b>				n = flow resistance coefficient			
L <sub>o</sub> =	100	m	n =	0.600			
S <sub>o</sub> =	0.015	m/m					
2) Tc - Stream/Ditch flow (Kirpich)							
<b>t<sub>ch</sub> = 0.0195 * L<sub>o</sub><sup>0.77</sup> * S<sub>o</sub><sup>-0.385</sup></b>							
L <sub>ch</sub> =	1815	m					
S <sub>ch</sub> =	0.015	m/m					
3) Tc - Pipe flow (Manning)							
<b>t<sub>f</sub> = L * D<sup>2</sup> / (76.3944*Q)</b>							
L =	0.000	m	Pente	0.000	%		
d =	0.000	mm	Rugosité	0.000			
D =	0.000	m					
Q =	0.000	m <sup>3</sup> /s					
Overland flow, t <sub>o</sub>	100 m, max						
	26.1 min		1.0 times		26.1 min		
Channelized flow, t <sub>ch</sub>	31.7 min		2 times		63.5 min		
Pipe flow, t <sub>c</sub>	0 min		1 times		0.0 min		
			Total		89.5 min		
Return Period (year)		2	5	10	25	50	100
Intensity (mm/h)		11.0	14.9	17.4	20.5	22.8	25.2
<b>Runoff Q</b>	(m <sup>3</sup> /s)	<b>1.2031</b>	<b>1.6239</b>	<b>1.8993</b>	<b>2.2382</b>	<b>2.4891</b>	<b>2.7480</b>
	(l/s)	1203	1624	1899	2238	2489	2748
	(cfs)	42.456	57.305	67.023	78.980	87.835	96.970



## about GHD

GHD is one of the world's leading professional services companies operating in the global markets of water, energy and resources, environment, property and buildings, and transportation. We provide engineering, environmental, and construction services to private and public sector clients.

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