BARITE MUD SERVICES INC.

P.O. Box 338
BUCHANS, NL
A0H 1G0

May 14, 2014

Mr. Bas Cleary
Director
Environmental Assessment Division
Department of Environment and Conservation
P.O. Box 8700
St. John's, NL A1B 4J6

Dear Mr. Clearly,

Enclosed please find the Environmental Registration documentation for our proposed Buchans Barite Harvest and Processing Operation. As required, 10 paper copies and an electronic copy of our submission are attached, as is a cheque for $226.00 covering the registration fee.

Please call or email me if there are any questions or concerns.

Thank you very much.

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Mike Rose
President, Barite Mud Services Inc.
(709) 765 – 1000
mike.rose@baritemudservices.com

c.c. Mike O'Brien, C.O.O.
Barite Mud Services Inc.

BARITE MUD SERVICES INC.

Environmental Registration

Buchans Barite Harvest and Processing Operations

A Comprehensive Environmental Plan for Re-Activation of Buchans Development Corporation's Barite Operation in Buchans

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May 2014

Table Contents

NAME OF UNDERTAKING

The name of this undertaking is: **Buchans Barite Harvest and Processing Operation**

PROPONENT

i) Name of Corporate Body

BARITE MUD SERVICES INC.

ii) Address

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Buchans, NL
A0H 1G0

iii) President
Mike Rose, BA, MA
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THE UNDERTAKING

Name of the Undertaking

Buchans Barite Harvesting and Processing Operations

Purpose and Rationale

The purpose of this undertaking is to re-start the Buchans Development Corporation (BDC) owned barite operation in Buchans, in order to recycle remaining Base-Metal Tailings from ASARCO's Buchans Mine, and, in particular, extract and concentrate barite for sale and use as drilling mud to be used in Newfoundland and Labrador's offshore industry.

Significantly, the proposed operation will also serve to advance environmental improvements of the tailings ponds and their effect on the surrounding environment. This will be achieved by removing nearly all sulphide metal materials from the main tailings ponds, in addition to separating the barite. Past barite operations have placed remaining sulphides back into the

tailings ponds. Sulphide removal and eventual concentration will increase upfront operational costs, but will result in major environmental improvements over the existing reality associated with these tailings ponds. This will also be to the benefit of the people in the Buchans region and the Government of Newfoundland and Labrador which holds liabilities for these properties. Regarding operations, there is the longer term possibility of revenue benefits as the modest amount of sulphides are concentrated and sold.

By agreement with the BDC, Barite Mud Services Inc. (BMSI), a Newfoundland and Labrador owned and operated company, proposes to reactivate the operation to supply the oil and gas drilling markets. Recent finds suggest huge oil and gas offshore fields with extraordinary potential and there are general expectations that increased drilling will occur in the immediate future.

The offshore industry relies on a great deal of drilling to discover, expand, and define the major and highly valuable oil and gas reserves. Highly crucial to this drilling are drilling muds used for downhole drilling pressure and taking away cuttings, particularly Barite ($BaSO_4$) given its high specific gravity and unique electronegativity properties as a non-metallic mineral.

The Buchans barite plant was operated by ASARCO Incorporated in 1982 and 1984, and it produced Barite – "Drilling Grade Mud" - used for drilling offshore Newfoundland and Labrador. In the mid-1980's exploration drilling offshore was discontinued and the local market vanished. After 1984, the Buchans Barite Plant lay dormant until United Bolero Development Corporation (UBDC) attempted re-activation in 1998. In 2004, Pennecon's subsidiary Atlantic Barite Ltd. (ABL) bought out UBDC's interests at Buchans, and commenced seasonal operation of the Barite Plant between 2005 and 2009. ABL produced various annual tonnages of Barite product, ranging from 500 tonnes to 2,500 tonnes (2005 to 2008), and finally approximately 7,000 tonnes in 2009, their last year of operation.

Unfortunately, in late 2009, just as ABL was ramping up its production, it was brought to the attention of the Government of Newfoundland and Labrador that the 40 year old tailings pond dam wall of Tailings Pond 1 was showing signs of weakness and potential failure. The Provincial Government - which had ultimate responsibility for the site associated with expropriation of the assets of Abitibi-Bowater - repaired the tailings pond dam in late 2010 and the water levels were raised back to normal. Due to significant planning uncertainties, however, ABL made a business decision to cease operations indefinitely in the spring of 2010.

BMSI and BDC are both keenly aware that reactivation of the barite extraction operation in Buchans will provide much needed employment, social, economic, and local taxation benefits desperately required in this rural region. Furthermore, in addition to supporting BMSI's commercial objectives, we are firmly committed to the pursuit and creation of the important environmental benefits to be gained by this mineral recycling operation.

Ever since 1986, and especially since 2009, the BDC has led local initiatives aimed at economic revitalization of Buchans. The significance and importance of this opportunity to reopen the barite operation cannot be overstated for the Town and region for a range of social and economic

reasons. As indicated in the Exploits Valley Economic Development Association's **Strategic Economic Plan 2011-2013** (page 3), Badger, Buchans, Buchans Junction and Millertown have been traditionally dependent on mining and forestry.

BMSI has developed a very positive working relationship with the BDC, including a long-term agreement to lease BDC's plant. BMSI is proceeding in partnership with this economic development organization in order to serve the interests of the community and local economy. Furthermore, BMSI is proceeding with the full knowledge of the Town of Buchans, as confirmed by the letter of support attached at **Appendix A.** BMSI will pursue a constructive and open dialogue in order to address any concerns that may arise among the Buchans residents regarding our operation.

DESCRIPTION OF THE UNDERTAKING

Geographic Location

The Buchans mine site adjoins the town of Buchans in central Newfoundland, approximately 200 km from Gander airport and 530 km from the port St. John's. Access to St John's is along the TransCanada Highway via the 72 km paved two-lane Buchans highway (route 370). St. John's is the main service center for the off shore oil industry on the Canadian East Coast and a major shipping port.

Figure 1- Location of Buchans on Island of Newfoundland

Physical Features

The site of Buchans Mill and Tailings is directly adjacent to the Town of Buchans, on the edge of the Buchans Plateau, approximately 900-1000 feet above sea level.

This is a brownfield industrial site. The ASARCO Buchans Mine operated from 1928 to 1984. ASARCO mined approximately 16 million tonnes from five ore bodies, with an average mill head grade of 14.51% zinc, 7.56% lead, 1.33% copper, 126 g/t silver and 1.37 g/t gold.

From 1928 to 1965, the mill tailings from this operation flowed down Buchans River into Red Indian Lake, and mostly settled on the area known as the Buchans River Delta.

In 1965, however, the first of two tailings ponds was constructed very near the mill site. It was the new site for tailings deposition. This original tailings pond is called "Tailings Pond 1" or TP1. It was reinforced in 2010.

In the early 1970s, a second tailings pond was constructed directly south of the original tailings pond. This was called "Tailings Pond 2" or TP2.

In addition to ASARCO's tailings disposal ponds 1 and 2, a third smaller tailings pond, eventually known as the "ABL tailings pond" or ABL pond, was constructed in 1998 by United Bolero; it is adjacent to TP1 and shares a common dam on its western boundary.

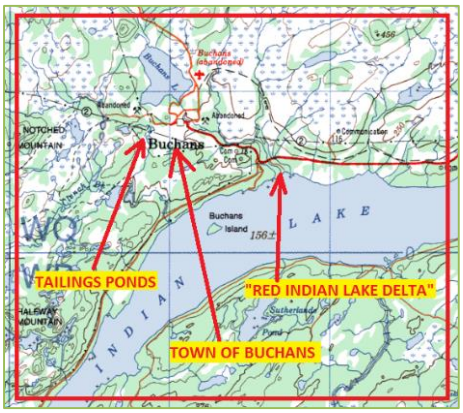


Figure 2- Location of Buchans and Barite Resources.

N.B. - BMSI's plan and objectives do not include the Red Indian Lake deposit in any way.

This is a brownfield operation, and thus the reactivation of the barite plant will not impact any new areas. BMSI is well aware of possible additional effects on existing impacted or brownfield sites, particularly Tailings Pond 1 (TP1). The recovery of tailings for feed for the plant will be from this pond. The mining of the tailings will be via dredging within the pond itself. This pond (TP1) discharges out onto bog land adjacent to the town of Buchans, and eventually runs north-west-west through the Town of Buchans (via underground drain construction) to Buchans River which eventually runs into Red Indian Lake.

This operation has cleared environmental screening twice - CEA Agency Registry # 05-01-11064 and 06-01-2073 – related to reactivation of the operation (2005) and production expansion to 15,000 tonnes annually (2006). The conclusion in both cases was *"***the authority is of the opinion that the project is not likely to cause significant adverse environmental effects**." Certificate of Approval AA06-065483 was issued on June 5, 2006, by the Newfoundland and Labrador Department of Environment and Conservation.

Photo i - Overhead View of Tailings Ponds and edge of Town (top right)

The Old Filter Shed of the former ASARCO Buchans Mill (hereafter referred to as the mill building), much of the equipment contained therein, and the surrounding lands, including the #1 and #2 tailings ponds (TP1 & TP2), are owned by the Buchans Development Corporation (BDC) and have been leased by ABL. This Lease has expired, and BMSI have now entered into a long-term lease agreement with BDC.

The right to the harvest barite contained in the tailings ponds is currently held by ABL (Pennecon) under the Mining Leases 158 and 198 (see Photo 2, next page) issued by the Department of Natural Resources – Mines Branch. During its period of operation, ABL extracted barite intermittently from the former Buchans Minerals Tailings Pond #1 (TP1).

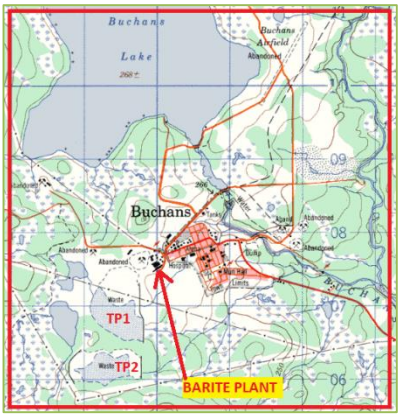
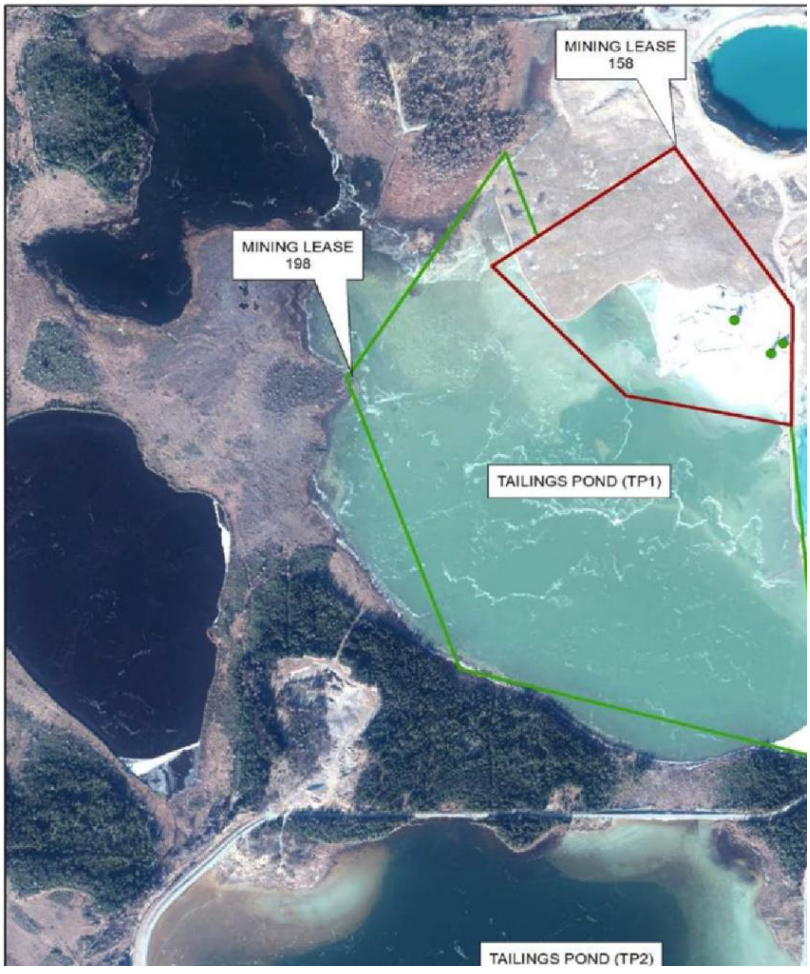


Figure 3 - Plant Relative to Town of Buchans

Mining Leases 158 & 198 are to be transferred to BMSI by ABL (Pennecon), with the approval of the Government of Newfoundland and Labrador.

Photo ii - Mining Leases 158 & 198 illustrated



The choice of location and design of the facilities makes complete sense in that they are existing and well structured, specifically designed for the very same purpose as BMSI intends. No new construction is required, which is preferred for financial viability and limited environmental impacts for the operation.

Barite Resource Estimates

The resource estimates, for Tailings Pond 1, Tailings Pond 2, and Red Indian Lake Delta, are:

Total Estimated Reserves (in tonnes)	
Tailings Pond 1	1,336,617 tonnes
Tailings Pond 2	816,017 tonnes
Red Indian Lake	*1,914,589* tonnes
Grand Total	**4,067,225 Tonnes**

Sulphides Resource Estimates

The sulphide resource estimates, for Tailings Pond 1, Tailings Pond 2, and Red Indian Lake Delta are as follows:

		Average Grades in TP1, TP2 and RI Lake Delta				
Location	Tonnage	***Zn***	***Pb***	***Cu***	***Au***	***Ag***
TP1	1,336,617	1.070%	0.370%	0.102%	196 ppb	18 ppm
TP2	816,017	1.070%	0.370%	0.102%	196 ppb	18 ppm
RI Lake Delta	1,914,589	2.190%	0.591%	0.336%	863 ppb	37 ppm
	TP1	14,302	4,945	1,363	8,557.74 OZ	785.91 OZ
	TP2	8,731	3,019	832	5,224.58 OZ	479.81 OZ
	RI Lake Delta	41,929	11,315	6,433	53,973.72 OZ	2,314.05 OZ
	TOTALS (tonnes)	***64,963***	***19,280***	***8,629***	***67,756 OZ***	***3,580 OZ***
	(Troy Ounces for Au & Ag)					

Resource Estimate Sources:

i. NL Baroid Feasibility Study 1980, V. Castelli.
ii. Mill Tailings Assessment Buchans Area, M. J. Collins and P. C. Legrow, April 1990.
iii. ASARCO Operation Barite Production Information (Buchans Enterprises Ltd.)
iv. ABL Operation Barite Production Information, provided by Pennecon.

Construction

With respect to reactivating the operation in Buchans, **no new construction is required.** The infrastructure is in place with only refurbishment of existing facilities and reliability upgrading of various equipment installations in the existing facility required.

Operation

Although the BDC has persevered with its objective of reopening the operation for the benefit of the community and region since 2010, it has always been cognizant of the need to ensure environmentally acceptable methods for harvesting the available barite and sulphide resources. In February 2014, following discussions with BMSI about the possibility of reopening in 2014, the BDC engaged SNC-Lavalin Inc. (SNC) to perform a tailings disposal options analysis related to tailings recovery and processing at the Buchans site. SNC's report - **Buchans Mine Tailings Disposal Options Analysis** - is attached as **Appendix B.** This report has strongly influenced BMSI's barite operational and environmental management plans, in particular BMSI's choice of TP1 as the primary operational site with effective mitigation measures.

Sulphides Removal

Strengthened by the analysis and observations contained in the SNC-Lavalin report - **Buchans Mine Tailings Disposal Options Analysis (Appendix B)** - BMSI concludes the most effective and sustainable path forward must include capture and containment of the sulphides, e.g., copper, lead, zinc, silver, gold, and other metals. First and foremost, this is an advancement compared to past practices in the region and, in the absence of other waste site clean-up plans, represents a new and productive opportunity to generate a sustainable project with net-positive environmental benefits. BMSI will obviously attempt to benefits in the longer term through sulphide concentration and sales, but is willing at this stage to take the necessary steps to ensure as little unwanted wastes are left behind in the historic tailings ponds. Regarding sulphide capture methods, see Process Overview below.

Harvesting Plan

The general harvest plan is to dredge out into the pond as far as the tailings goes to the deepest parts of the pond, and work our way back to shallow waters year by year. Eventually, we will need to dredge inland, where water will follow the dredge. The operational, closure and rehabilitation plans for the first five years do not require exposure of ground material. In year 5, as operations include inland harvesting, BMSI's annual plans will reflect progress and changes.

Photo iii - Sketch of Dredge Harvest Plan

The density of the in-situ tailings are roughly 3.20 tonnes/m^3, and we will need ~40,000-50,000 tonnes per season to make 10,000 tonnes of Barite product. The tailings, sample drilled in 1989/90 by Collins/Legrow at 4m depths, has an average of roughly 2 meter tailings depth throughout the

mining lease area. We calculate that an area of 150m x 50m will be required each season for extraction and annual production. Minus 75 micron material is pumped to the plant feed thickener. Plus 75 micron material is placed or pumped back to the mining hole in TP1 along with the coarse oversize from the banana screen.

Since the dredge cannot operate constantly and will be subject to scheduled maintenance and unscheduled repairs, a second source for feed is required to make the operation constant in what is usually a short operating season. Previous dry-feed setup is less desirable, since a clean-up of the shore has been completed since the operation closed. Therefore, an option for feeding the plant is being designed/commissioned to be a singular submersible dredge slurry pump that attached to an excavator at the shoreline so as to mine the shoreline while the dredge is being repaired. This is simply to ensure that the flotation plant does not have interruptions for lack of feed. Feed options under consideration and to be determined by factors such as availability, consistency, etc., are a stationary dredge pump within a steel pit in which feed will be agitated and pumped in a slurry, or a dredging attachment for excavator while the dredge is being repaired or repositioned. In any case, the feed will be wet, as no dry stockpiling of any kind will take place.

BMSI is conscious that excavation and stockpiling tailings feed is undesirable in that it may tend to dry out and become a potential source of dust. BMSI will avoid this method of operation. This has been a point of discussion (February 2014) with the Buchans Town Council.

Process Overview

The operation will be carried out using a suction head cutter 8” Swinging Ladder Dredge. Positioning of the Dredge is by simple GPS and movement of the dredge is controlled by spud legs, spud cables and hydraulic power. The dredge is free from the shore save from its connection to the process via 8” HDPE piping. The dredge will function in 150m x 50m sections as possible. Tailings from the existing #1 pond are then recovered from under water via cutting, suction, and pumping slurry to the cyclone tower located onshore.

Tailings material is slurried and pumped directly onto a primary screen equipped with 1/8” slotted plate to remove large trash. Coarse sand which flows over the screen is combined with the underflow from the cyclone tower and pumped back into TP1 below water level. Water for the spray bars on the primary screen is made up of reclaim water from the #9 thickener at the plant and a small flow of make-up water pumped from TP1 is used to help clean cyclone underflow boxes via sprays. The cyclones are 19 inch, 1 Bar cyclones to cut the feed at ~75 microns going to the mill for flotation processing.

Once at the mill, it is thickened in a feed thickener and pumped to the sulphides flotation Conditioner where it is mixed with reagents designed to collect and float the sulphides metals. It is then sent to the sulphides Flotation cells, where sulphides are floated off and the Barite stream continues in the underflow.

The underflow of the sulphides Flotation is sent to the Barite Conditioner, where reagents for collecting and floating the Barite are mixed with the feed. It then goes through Barite Flotation,

where the overflow is nearly pure Barite Concentrate slurry, next flowing by gravity to the Barite Product Thickener. Once thickened in the Barite Product Thickener, it is pumped to a Drum Filter, where the material is reduced to ~7-9% moisture in the form of a filtercake. This filtercake is dried as more dry storage becomes available.

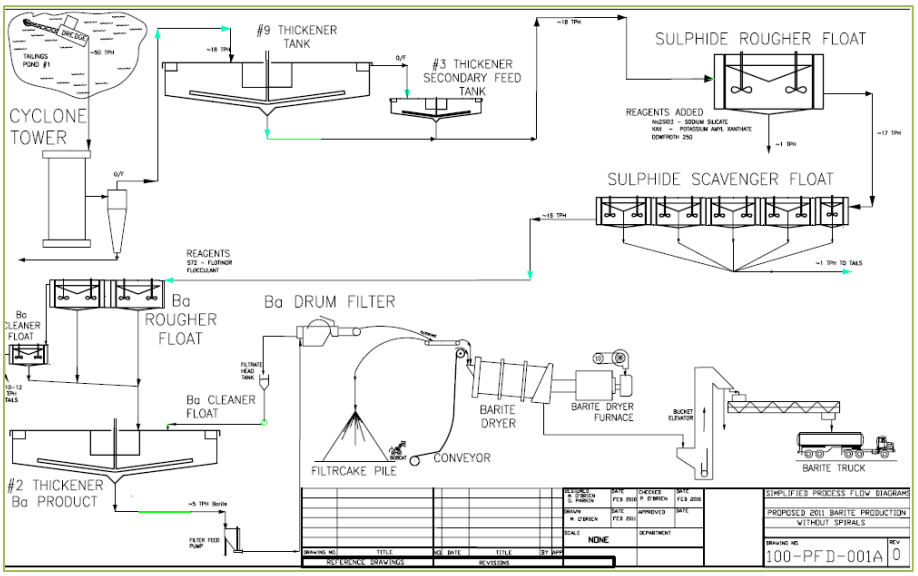


Diagram 1 - Basic Process Flow Diagram

The sulphides flotation product (overflow) will then be fed by gravity to a product thickener, wherein it will be stored and thickened until sufficient quantities allow for further separation over a series of gravity shaking tables in closed-circuit. Once separated on these gravity shaking tables, each concentrate (copper, lead & Zinc with added Gold and Silver values) will be each thickened and pumped to a drum filter to remove moisture. The filtercake concentrate will be stored indoors as concentrate until shipping to markets.

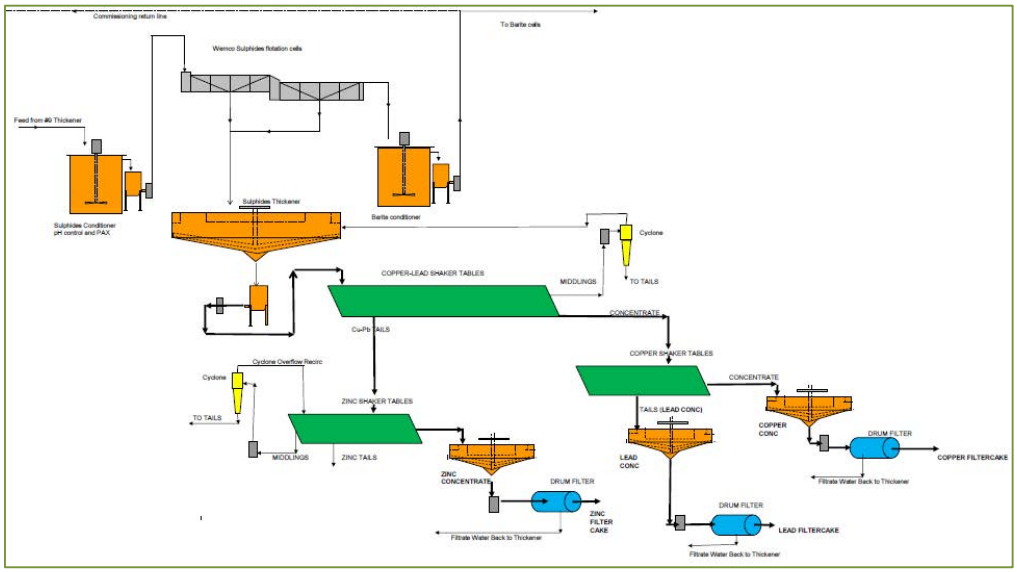


Diagram 2 - Sulphides Concentration Flow Diagram

Upon completion of the start-up work, the operation will commence to produce up to 120 tonnes barite concentrate per day of flotation product to API specifications. The sulphides production will be roughly 5 tonnes per day. Production will continue on a seasonal basis, e.g., from May to October each year, with sufficient barite product being produced and stockpiled as filtercake to ensure that the off-shore market requirements can be met until the following May. This is planned to be approximately 10,000 tonnes of product annually. On closure of the flotation plant in October of the year, production will continue using filtercake stored in the mill building, by drying and grinding (only if/when necessary) this filtercake to meet API specs. Such work will be carried out on a one or two day per week basis.

For commercial operations, assuming annual production of 10,000 tonnes of barite, BMSI expects to remove around 50,000 tonnes of tailings from the pond each year. While BMSI will be putting the coarse washed tailings right back into TP1, the net material transfer from TP1 should equate to little more than the percentage barite content in the feed.

Production Schedule – Harvesting / Concentrator

Extraction and flotation operations will commence in early May and continue until late October annually. It will be a 24/7 operation, with scheduled shutdowns and shift-work operation during production period. Upon completion of the reactivation work, the operation will commence to produce up to ~90-120 tonnes per day of flotation product to API specifications. Production will continue on a seasonal basis (May to October), with sufficient product being produced and stockpiled as filtercake to ensure that the targeted 10,000 tonnes is available to meet market requirements until the following May. On closure of the flotation plant in October, production will continue using filtercake stored in the mill building by drying and grinding this filtercake to meet API specs. Such work will be carried out on a one day per week basis.

For commercial operations, with a production tonnage of ~10,000 tonnes of barite produced annually, BMSI would expect to extract around ~50,000 tonnes of tailings from TP1 each year at a rate of ~8,000+ tonnes per month. BMSI will then wash out the fine feed material and place the coarse washed tailings right back in TP1.

A metallurgical balance is provided in **Appendix C**. Feed material from the dam to the Cyclone Tower on the dam is typically 25-32% Barite. Fine sands from the Cyclone Tower to the flotation plant are expected to be around ~35% barite. Barite product is floated to API specifications containing approximately 90%+ $BaSO_4$ and less than 1000 ppm Pb, among other API specifications for sizing and content.

BMSI's Proactive Policy - Monitoring, Mitigations and Contingencies Plan

In order to prevent or minimize possible negative operational impacts, BMSI has prepared a detailed **Monitoring, Mitigations and Contingencies Plan -** attached at **Appendix D**.

Even though the operation will take place on a long-standing industrial 'brownfield' environment, BMSI acknowledges that there will be certain risks associated with harvesting and production. It

is BMSI's policy and clear objective, however, that the reactivation process and all future on-site activities will have no significant additional negative impacts on the environment. In fact, barite removal from the tailings pond, as well as BMSI's plans to separate and remove other sulphides, is expected to provide net environmental benefits because it effectively contributes to cleaning up pollution left by the legacy mine operations.

Potential Sources of Pollution

BMSI recognizes that with an operation of this sort, there are a number of potential sources of pollution. BMSI has every intention of identifying and mitigating these potential sources so as to prevent harmful effects on the environment.

Noise

During re-commissioning and general operations, BMSI recognizes that the operation of heavy equipment, pumps, tools and motors will all contribute to noise pollution in the work area. From an occupational health and safety viewpoint, workers and visitors will be required to wear hearing protection when in close proximity to harsh noise sources. There will also be potential noise reaching the Town of Buchans, but no more than would have been present, for example, between 2005 and 2009. BMSI is committed to work closely with the Town of Buchans to address any concerns that may arise related to noise, e.g., scheduling, seasonality, etc. Impacts on wildlife will be highly localized as the undulating terrain and, in places, vegetation will attenuate sharp noises.

Exhaust from Heavy Equipment

During re-commissioning and general operations, BMSI recognizes that the operation of heavy equipment, generators, and barite dryer, all of which burn diesel, and the operation of light vehicle traffic which burn regular octane gasoline, will ultimately produce exhaust which will be emitted to the environment. This includes the dredge (which will potentially operate 24 hours per day, 7 days per week, through 5-6 months of the year as the season permits), and other equipment that will only be operated sporadically, e.g., excavator, wheel loader, and rubber-tire back-hoe. The greenhouse gas produced from these operations are limited to CO_2 (Carbon Dioxide) and will essentially amount to far less than that produced by light vehicle traffic within the Town of Buchans itself. For all vehicles and equipment, BMSI plans an aggressive and consistent maintenance program which will ensure machinery operates to manufacturers' recommendations.

Road and Soil Dust

During re-commissioning and general operations, BMSI recognizes that the operation has the potential to cause dust. This is secondary to the use of heavy equipment and light vehicles on unpaved roads, dredging excavation that may expose/create dry earth, and the operation of the baghouse dust collection system when drying barite. Dusty conditions can be an occasional

nuisance for workers at the dredging site and plant, although past experience has demonstrated that dusty conditions are a very manageable workplace safety issue.

Because we are in close proximity to the Town of Buchans, there is always the potential for increasing dust levels to residents of the Town of Buchans. Extreme dusty conditions may also have the possibility of causing broader environmental harm, e.g. tree, plants, waterways, etc. The Town Council and Mayor of Buchans have identified this as their **only** issue of concern, but they understand this is a highly manageable issue.

BMSI will work closely with the council to ensure this does not become an issue for the residents of Buchans. Among the measures to be taken are:

Potential dust caused by vehicle traffic on the unpaved roads between the dredging site and the mill will be mitigated by keeping the roads dampened on dry days by use of a water truck before the roads can become dusty.

Potential dust caused by operation of heavy equipment and any excavated dry earth will be mitigated by tamping these areas after disturbance, and if necessary dampening the areas affected. Dry excavation and stockpiling of tailings (shown to be problem in the past) will never be a part of BMSI's operational plan.

Potential dust caused by operation of the baghouse dust collection system when drying barite will be mitigated by checking the baghouse prior to drying sessions to ensure there are no holes in the bags or cages out of alignment, as this has the potential to allow barite dust to escape into the environment through the system's stack.

Hazardous Waste – Spill Prevention and Containment

During re-commissioning and general operations, BMSI recognizes that the use of oil, gasoline, diesel fuel and grease creates the potential for spillage of these materials into the environment. These materials will be labelled clearly and stored at BMSI's enclosed facilities within the Barite Plant in Buchans. Once used, the waste material will be stored in appropriate receptacles, with adequate separation where necessary, and will be disposed of as Provincial and Federal regulations require. All appropriate environmental safeguards against spills and release will be put in place, including having Emergency Response Kits (including handling and storage equipment, plastic liners, cover sheets, absorbing materials, protective clothing and instructions) spill kits on site at all times and workers trained for proper use.

These hazardous materials will be stored separately within the mill buildings which have impermeable floors, complete with curbs separating each area, and without floor drains so as to contain any potential spills. These bunded areas provide in excess of 110% of the storage tank capacity of the largest container, or 100% of the capacity of the largest container plus 10% of the aggregate capacity of all additional containers (whichever is greater). BMSI will make strategic use of this large facility to safely contain the relatively small amount of hazardous material required for this operation.

Storage of diesel fuel on site will be provided by the supplier of the diesel fuel for the operation, and this supplier will be required, both by BMSI as well as the appropriate provincial and federal authorities, to comply with the *Storage and Handling of Gasoline and Associated Products Regulations, 2003*. They will register their storage tanks with the Government Service Centre, all aboveground storage tanks shall be clearly and visibly labelled with their GAP registration numbers.

All tanks and fuel delivery systems shall be inspected to appropriate American Petroleum Institute standards.

All inventory of diesel and chemical storage will be submitted to the Department of Environment and Conservation prior to commencement of production of barite or use of said diesel fuel in the commissioning of operation for production.

Solid and Domestic Waste

BMSI will obtain all required permits (approvals and authorizations) as required for the commissioning and operation. Specifically, BMSI will identify and obtain permission to use established Waste Disposal Areas for garbage and waste disposal.

Solid waste will consist primarily of office and lunch room waste, plus oils and sludge from equipment maintenance facilities. These waste materials will be disposed of in a manner conforming to the appropriate Provincial and Federal Regulations. Domestic and office related solid waste will be sorted, bagged and hauled periodically to Central Waste Management's facility at Buchans Junction via dump truck.

Sewage Treatment

Domestic waste water flows by gravity to The Town's sewage system.

Surface Water Hydrology

The operational area is located in the Buchans River Watershed, which drains generally southward to Red Indian Lake and the Exploits River. The drainage areas upstream of the Buchans site is relatively undisturbed, while the drainage area below the tailings dams has been impacted from past mining and milling operations. The immediate impact area, classified as "Tailings Spill Area" by the Government of Newfoundland and Labrador, which drains into what was commonly known as "The Mucky Ditch" has been remediated in 2010 by Government of Newfoundland and Labrador. BMSI is cognizant of this newly remediated area and will in no way impact this area negatively.

Water Management and Waste Dump Plan

Water Supply

The process water, when the plant last operated, came from the town water supply, which is supplied from their pump station on Buchans River. That is BMSI's intention as well, i.e., to use Town water.

BMSI will require a maximum of 350 USGPM during operation, and is coordinating with the Town to ensure this demand will never negatively affect the town supply.

Tailings and Effluent Management

BMSI will discharge mill effluent, tailings, etc. to Tailings Pond #1 (TP1), and all piping transporting effluent and tailings will be maintained so that there is no leakage, spillage or other release, except at the point where effluent or tailings are designated for discharge. Placement of tailings shall be such to maintain adequate water cover at all times. These lines will be inspected on a daily basis.

As per the recommendations of SNC Lavalin, in their report commissioned by the BDC to establish the most viable solution for Tailings/Effluent Management, BMSI intends to deposit its oversized "coarse rejects" back underwater into TP1, as was the method of the previous operator, ABL.

Once barite is separated and produced at the plant, we intend the tailings from the barite plant to be pumped and deposited underwater on the southwest end of TP1. These tailings will have most of the barite and copper, lead, zinc, i.e., sulphides, for concentrates production at the plant.

As TP1 is a discharging pond, BMSI has outlined detailed methods for managing the quality of the water being discharged from TP1, in BMSI's **Monitoring, Mitigations and Contingencies Plan**.

Water Discharge – Suspended and Dissolved solids

BMSI is certain that monitoring water quality discharge form TP1 will be of utmost importance. During operations the dredging operations and re-deposition of material during sizing and after barite is removed at the plant, there is potential to increase Total Suspended Solids (TSS) in the water column and total zinc concentration levels in the pond.

As seen in the photo below, the final point of discharge of process water to the environment from the Buchans barite harvesting operation will be at Tailings Pond 1 spillway, located at the southeast most corner of Tailings Pond 1.

Photo 4 – TP1 Spillway illustrated

There is a full and expert environmental analysis and opinion pertaining to the best path forward for this operation contained in the SNC-Lavalin's **Buchans Mine Tailings Disposal Options Analysis** (**Appendix B**). In particular, SNC-Lavalin has outlined in careful analysis the ways and means to control this issue with least impact on the surrounding environment and possible future improvements. Therefore, BMSI has adopted a diligent mitigation strategy for this potential pollution risk based on the SNC-Lavalin recommendations. Our mitigation program is thoroughly detailed in the *Tailings and Effluent Management* section of BMSI's **Monitoring, Mitigations and Contingency Plan.**

It is important to recognize that this is a brownfield operation and that certain water quality discharge already exists and discharges to the environment. The fact that this operation is the reactivation of a former operating tailings recycling facility, rather than the construction of a new operation, reduces the overall impact considerably. Infrastructure has been in place for many years and serious disruption of the environment has already occurred over the course of decades. BMSI views the planned activity as an improvement to the existing impacted "brownfield" site, by making valuable use of what would otherwise may be considered, at best, a damaged area, and most notably by removing the sulphide metals from Tailings Pond 1, and eventually Tailings Pond 2 (which could have great benefits for the Tailing 2 aquatic environment according to SNC-Lavalin's **Buchans Mine Tailings Disposal Options Analysis,** see page 19, Appendix B).

Water and Sediment Control

Control of water and elevated sediment loadings, i.e., turbidity in TP1 discharge (primarily), will be exercised during the reactivation and operation of the plant. Any mineral-contaminated drainage will be directed back to the tailings pond. Thus, sediment control should be regarded as

a controllable impact at the Buchans barite plant if required. This reactivation work will not require changing any existing drainage patterns. The tailings pond (TP1) will allow for settlement of suspended solids to within regulatory limits, through the use of turbidity curtains in strategic locations, and dissolved metals in Tailings Pond 1 will be mitigated by discharge pH control, as recommended by SNC-Lavalin. This two-pronged approach, coupled with the fact that we are removing Sulphide metals from the pond, will therefore provide very reliable control relative to surface drainage from the plant/service area and this material will have sufficient opportunity to settle within TP1. BMSI will mitigate TP1 overflow levels accordingly as part of its proactive **Monitoring, Mitigations and Contingency Plan**.

Fish and Fish Habitat

The reactivation and general operation of the property will have minimal impact on fish or fish habitat. In the first instance, given the many decades of intensive industrial waste deposits in these man-made ponds, there are no fish or fish habitat in the ponds. Furthermore, while the discharging water of the pond we operate in firstly flows over/through bog land, and eventually to the Buchans River and Red Indian Lake, it is important to note that these waters enter the Buchans River at almost precisely the same point as the Town of Buchans' sewage discharge. That has always been the point of sewage discharge for nearly a century and it stills enters the Buchans River there.

For greater certainty and to minimize and/or eliminate the possibility of negatively affecting downstream fish habitat, i.e., beyond the inert tailings ponds due to spillage, BMSI will conduct mitigation programing as mentioned above and outlined in our **Monitoring, Mitigations and Contingency Plan.** BMSI recognizes and respects the guiding 'Net Gain' principle under the "Policy for the Management of Fish Habitat" administered by the Department of Fisheries and Oceans (DFO). Negotiations with DFO will not be required to determine the need for compensation or additional mitigation because no existing fish habitat will be altered, disturbed or destroyed.

Reagent Handling

During general operations, reagents are added to the pulp to assist in the extraction of the barite during the milling process. These reagents are listed below with their use described:

Soda Ash
Occasionally added to Sulphides Conditioner in the event that Alkaline Conditioning is required (pH adjustment, when required, rare).

Sodium Silicate
Added at Sulphides Conditioner to disperse the silica slimes.

KAX (Potassium Amyl Xanthate)
Collector used to gather the Sulphide Metal Constituents, so as to remove them before moving on to Barite Flotation.

Dowfroth 250

Frother used for floating hydrophobic constituents collected at the sulphide metal flotation stage.

Flotinor S72

Used for floating and collecting Barite in the Barite Rougher/Cleaner Flotation stages.

All reagents will be stored and mixed within the mill building. All appropriate environmental safeguards against spills and release will be put in place, including spill kits on site at all times and workers trained for proper use.

Transportation, storage and handling of reagents will conform to regulatory policies that are in force at the time of use of the products.

Material Safety Data Sheets (MSDS) will be obtained for all reagents stored and used on site. Storage, handling, consumption and disposal will conform to MSDS directives. Copies of all MSDS data will be held on file at the mill office for all materials on site.

General Environmental / Safety Hazard Prevention

Environmental management planning includes all aspects of environmental protection during the planning, reactivation, operation, and eventually closure of the operation.

All necessary measures shall be taken to ensure compliance with all applicable acts, regulations, policies and guidelines, including the following, or their successors in future:

- *Environmental Protection Act 1999;*
- *Water Resources Act;*
- *Air Pollution Control Regulations 2004;*
- *Environmental Control Water and Sewage Regulations, 2003;*
- *Federal Halocarbon Regulations, 2003;*
- *Storage and Handling of Gasoline and Associated Products Regulations, 2003*
- *Used Oil Control Regulations*
- *Accredited and Certified Laboratory Policy*

BMSI's policy to this end is to protect the environment in areas where work is conducted, as well as related (downstream) adjacent areas. To ensure protection of the environment, the operation will be subject to regular inspection by BMSI management and relevant provincial and federal government agencies. Additionally, BMSI will consult with appropriate government agencies during the commissioning and operation of this site.

BMSI will ensure that its employees, contractors, subcontractors, and agents comply with all applicable environmental laws, regulations, permits and requirements of federal and provincial authorities, and other such corporate rules and requirements that BMSI have established to limit its environmental footprint.

Elements already covered and included in the planning efforts are:

- Project / Operational planning and Design – as indicated in this document
- Mitigation of Impacts and Conflicts – see BMSI's **Monitoring, Mitigations and Contingency Plan**
- Contingency Planning – see BMSI's **Monitoring, Mitigations and Contingency Plan**
- Monitoring Programs – see BMSI's **Monitoring, Mitigations and Contingency Plan**

Contingency Plan

BMSI's Contingency Plan is embodied in our detailed **Monitoring, Mitigations and Contingency Plan**, attached here in **Appendix D.** In this regard, and under the cover of this Environmental Assessment registration document, it is hereby submitted to the Department of Environment and Conservation. This plan focuses on the most likely immediate concerns, such water management and quality strategies, hazardous material management and emergency hazardous material spill contingency planning, and it also examines potential long-term effects and risks of the operation such as operational water quality discharge and the measures to be adopted by BMSI. If BMSI's plans can be improved we will work diligently to achieve objectives or plan revisions which may be recommended by the Department of Environment and Conservation.

Community Impact

The reactivation phase of the project will require a labour force of 12 people for 3 weeks, ramping up to 27 people into commissioning and production. This will provide economic and employment benefits. BMSI intends to use locally recruited labour, but also to engage with employees and citizens of the community on a regular basis to address any possible concerns people may have with the reactivation of this industry. This will minimize any possible unforeseen negative impact of the reactivation on the community while providing maximum benefits to the local economy.

Closure and Rehabilitation Plan

BMSI's Closure and Rehabilitation Plan, outlined here, will comply with applicable provincial legislation and permits issued under both *The Mining Act SNL 1999, Chapter M-15.1,* and *Environmental Protection Act, SNL 2002, Chapter E-14.2,* and any terms and conditions that may be identified by the Department of Environment and Conservation.

Generally, BMSI will progressively engage in reclamation of disturbed areas. Primary measures to be taken upon closure and rehabilitation are as follows:

- Reduce or eliminate potential adverse environmental effects associated with the operation and post-operation monitoring
- Decommission and rehabilitate the site to suitable condition in compliance with applicable regulatory standards
- Return the property to the BDC and the Crown for long term care and future usage after monitoring demonstrates closure objectives have been met.

BMSI's Closure and Rehabilitation Plan is approached against a background of significant environmental disturbance already on site. For example, when ABL took over the barite recovery operation in 2005, it was acknowledged and agreed by the Provincial Department of Environment and Conservation that the site of the barite operation was brown field, heavily marked by over nearly a century of heavy industrial use. Consequently, it was agreed that the Province would not hold ABL responsible for the existing long-term environmental liabilities on the Buchans properties. Instead, ABL was only held liable for any damage that might reasonably be caused by their operation, as judged against a January 2005 Baseline Environmental Site Assessment report completed by AMEC Earth and Environmental.

BMSI feels similar reasonable understanding should be applied to its proposal. In fact, not only does BMIS intend to hold negative impacts at baseline, its objectives (through sulphide removals) include net-positive environmental improvements over time. BMSI will proactively enhance the site where possible through operation and closure. BMSI intends on creating and maintaining a healthy workplace during operation and, ultimately, leaving a positive post-operations social, economic, and environmental legacy.

Since BMSI intends to deposit its tailings, once sulphides and barite are removed, underwater at the west side of TP1, BMSI's Closure and Rehabilitation Plan will consist primarily of taking the following actions following shutdown of its operations:

i. ***Ensure that no tailings material is exposed to the air by:***
   a. Either
      i. Submerging tailings below the operational waterline of TP1
   b. or
      i. Capping any exposed beach tailings BMSI would possibly have disturbed with glacial till livable soil and hydroseeding.

ii. ***Maintaining mitigations, including all turbidity curtains and pH control measures, for TP1 discharge post-operation for at least one year such that the T-Zn, T-Pb and TSS levels, as well as pH, are at least back to background levels.***

iii. ***Following the closure of BMSI Operations, <u>monitoring and mitigations for one year</u> will ensure the closure design is effective. Monitoring and Mitigations post-closure shall represent approximately 1 year of BMSI's Tailings Management Operational Costs to confirm the integrity of the mitigations from BMSI operations up to that point, and to ensure discharge quality is returned to pre-existing conditions. If this cannot be achieved in 1 year after closure, an additional year will be implemented, and so on if necessary.***

iv. ***As required, arrange for the posting of a bond of sufficient value to ensure site reclamation costs are covered.***

Remediation at the site of the dredged feed material at TP1 will be progressive, with coarse material being returned to TP1 underwater where the volume is such that the material is stored in a flooded state. The edges of the hole are contoured as dredging proceeds and the current material cap on the TP1 surface is left in place.

Pipelines and external plant equipment will be removed on plant closure and excess reagents disposed of at approved disposal points.

Since we are conscious of any remote possibility of the tailings having potential acid generative properties, the preferred method of reclamation will remain, as recommended in the past, to cap any exposed tailings beaches with impervious fill and then to store the bulk of the remaining tailings under water.

A contingency for the possible event that exposed tailings are exposed for any period before they can be capped by soil/seeded, BMSI will utilize Entac® (or some other approved product) in order to keep any exposed tailings from drying out and causing dust to blow from the site.

Annual Environmental Report (Closure and Rehabilitation Plan Updates)

Adhering to the principle that BMSI must be responsible for any damage it causes, over and above the background levels, BMSI will monitor current or most recent activities, i.e., operational footprint, by way of an annual environmental report on operations. In particular, this report will feature an updated Closure and Rehabilitation Plan forecast and update. BMSI will submit its annual environmental update to the Department of Environment and Conservation for review and consideration by January 31st of each year.

This will ensure that any major deviations or occurrences are captured and reported upon in a timely manner. The Closure and Rehabilitation Plan will be revised, if necessary, to accurately reflect unanticipated events or changes. Any deviation from BMSI's plan for operation as outlined here will be submitted officially to the Department of Environment and Conservation for review, consideration, and, if necessary, approval to continue if a major event has been identified.

BMSI anticipates little or no onshore environmental impacts at TP1. Specifically, for years 1 through 5, BMSI's dredging operations will take place away from the shore of TP1. Therefore, there will be no onshore tailings disturbances or exposures during these years. Beyond the fifth year, BMSI intends that still no tailings need be exposed, such that mining will require to dredge inland to recover the abundant tailings reserve known to exist there under what is now an engineered soil/grassed cap. It is expected that the soil/grassed cap would need to be carefully repealed at that time, only in front of the dredge's progression. Before BMSI proceeds with this inland dredging, i.e., after the fifth year of operation, it will carefully plan, develop and execute the safest possible approach in order to minimally remove some grass/soil (and replant elsewhere in the meantime) in a corridor format in advance of the dredge's inward path. This will prevent exposed tailings since water will follow the dredge and keep the mined area submerged.

The planning, development and execution plans for inland dredging will be presented in BMSI's Annual Environmental Report before year 6 when it proposes inland dredging. A major highlight of this document will be the inclusion and updating of the Closure and Rehabilitation Plan.

OCCUPATIONS

In terms of economic benefits, the recycling of tailings and production of barite alone, there will be direct employment for at least 32 people for 15 years or longer.

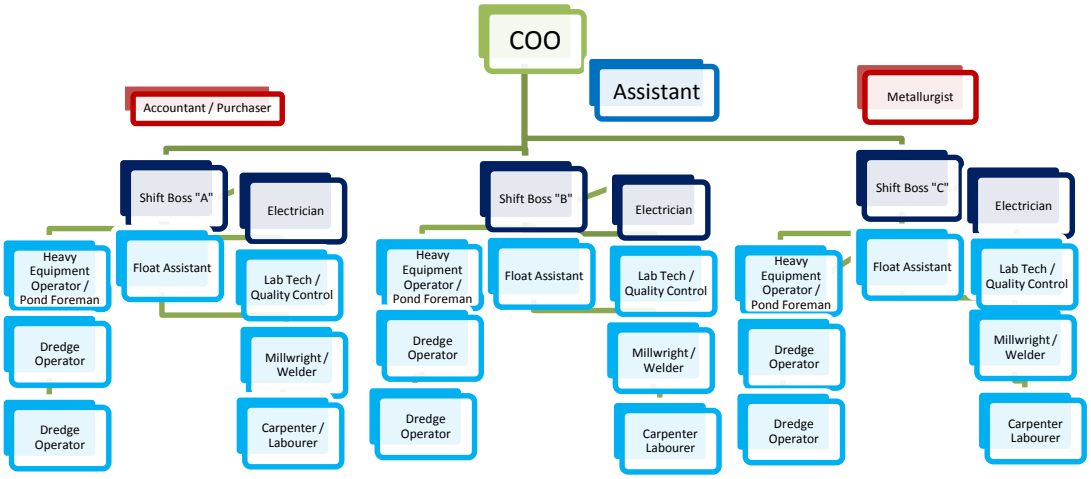
BMSI will operate a three-shift, 24/7 seasonal operation. This is a meaningful and significant employment boost for Buchans and the surrounding area, and BMSI is proud to become one of the significant employers in the Buchans region.

In addition to senior managers and occasional required professional services, e.g., metallurgy, engineering, accounting, etc.), the following occupations will be required on each shift:

1. Shift Boss
2. Float Assistant
3. Dredge Operators (2)
4. Heavy Equipment Operator
5. Labourer
6. Electrician
7. Maintenance
8. Lab Technician
9. Truck drivers (not required on every shift)

In terms of broader economic impacts it may be argued that a reasonable employment multiplier effect for this project could be 1.5 to 1. In other words, for every direct job that is created by BMSI another 1.5 jobs could be created through indirect and induced employment, rendering up to 45-50 jobs as a result of this program. The prospect of maintaining workers and their families in Buchans, especially attracting younger workers, greatly supports the social and economic fabric of the community, as well as its sustainable nature.

The three-shift structure, with the addition of periodic consultants/managerial support not reflected, will be structured as follows:



Employment equity is important to BMSI and every effort will be made to employ a diverse and energetic crew every step of the way. Hiring locally will be especially important for successful operations in Buchans, and BMSI will hire 100% locally if possible, as long as the qualifications are available locally (which we believe they are). BMSI's agreement with BDC features a local preference hiring clause.

BMSI is an equal opportunity employer related to age and gender. It is expected several older (60-70 years of age) will be employed based on their past experience at the barite operation. Historically there have been no women employed at the operation, but there is no reason that women will not be employed if they are qualified and apply.

APPROVALS

The Barite Operation has previously received full permitting for mining (Department of Natural Resources) and Certificate of Approval (Department of Environment) - see attached. Moreover, in 2005 and 2006 the operation has passed two Canadian Environmental Assessment screenings - CEA Agency Registry # 05-01-11064 and 06-01-2073 – related to reactivation of the operation (2005) and production expansion to 15,000 tonnes annually (2006). The conclusion in both cases was *"***the authority is of the opinion that the project is not likely to cause significant adverse environmental effects**." The nature of operations will be similar to that reviewed in 2005 and 2006, expect with major planned environmental improvements, i.e., sulphide removals. In this regard, BMSI is highly confident that the operation will proceed without adverse environmental effects.

To facilitate smooth Regulatory transition, ABL has agreed, with the approval of the Government of Newfoundland and Labrador, to transfer their operational mining leases to BMSI, i.e., Mining Leases 158 and 198, as originally undertaken in September 2004 and maintained ever since. These leases will confer upon BMSI the right to proceed with their proposed barite operations, subject to this environmental approval by the Department of Environment and Conservation.

BMSI has developed a complete business plan based on the various findings and commitments associated with this history and background. The intention is for BMSI to commence reactivation of harvesting and milling operations beginning as early as July 1, 2014, if possible. Preparations for start-up will take approximately two months and the goal is to start production by mid-August 2014 or earlier.

BMSI looks forward to working diligently to achieve the approvals required to commence and operate in 2014, and to recognizing and satisfying the Government of Newfoundland and Labrador's stringent requirements to ensure a safe and environmentally friendly area of operation. BMSI is determined to improving the operational areas beginning in 2014 and every year into the future.

SCHEDULE

It is BMSI's intention to commence construction/re-commissioning by July 1, 2014, if approved to proceed.

Start-up modifications

During the start-up phase, a general clean-up of the plant and surrounding area and some construction on minor modifications of the process will take place. This should take 4-5 weeks.

Commissioning

During Commissioning, the crew will energize the motors and equipment, and complete trials for pumping and feed processing in order to quantify the precise flow rates and pressures, and ensure parallel systems are available at each point.

During the latter part of this phase, some training is required for crew to learn key operational procedures, especially the mining operation wherein operation of the Dredge would need to be learned by all new pond crew. But also, we intend to start training all crew members for other positions to cover ourselves in the case that a crew member becomes unavailable for work, then interim coverage can be covered by the other crew members on their shift.

This phase should take no more than 3-4 weeks, ramping up to round-the-clock shifts in the final week of this phase.

Production

Production is intended to start on or about August 15, 2014, and run 24 hours per day, 7 days per week, with scheduled monthly shutdowns, until the end of October 2014. There is a possibility of producing Barite into November, but BMSI recognizes that the onset of

winter will cause freeze-ups and unsafe operating conditions, as well as increase operating costs beyond viability to continue.

Annually, the operation is to commence as soon as the ice is out of TP1 in order to begin dredging. BMSI anticipates this to be around May of each season. We envision ending the season in October most years, depending on the weather and conditions in TP1.

Winter Months

Once it becomes undesirable to operate past October, a week or so of decommissioning is necessary before BMSI settles into the winter months. The operation then closes, except for periodic drying of filtercake for dry storage as Barite is shipped out.

FUNDING

Barite Mud Services Inc. is a privately owned company, and estimates an investment requirement of approximately $2.5 Million to refurbish and to sustain operations/working capital into the 2015 production season.

BMSI is investing a substantial amount of private money upfront. In addition, it will also seek additional investment supports from ACOA (BDP programs), IBRD (Business Investment programs), and the Research & Development Corporation (RDC).

Regarding RDC, it is critical to note the risk being taken on by BMSI because this barite operation has, in fact, never been profitable in the past. BMSI firmly believes that the operation can be successful as long as efficiency and technology improvements are introduced. For example, BMSI is asking RDC to assist BMSI's planning efforts to introduce gravity separation processes which will potentially increase production rates and reduce requirements for reagents and flotation at the plant. This and other planned technology improvements, e.g., sulphides separation, will provide the Buchans operation with advantages that were previously lacking and provide BMSI sustainable methods for controlling costs, increasing mineral processing potential, and continuously driving environmental improvements.

CLOSING REMARKS

BMSI is pleased to present this report and associated documents to the Department of Environment for **Environmental Registration for Re-activation of the Barite Operation in Buchans**.

We look forward to being a responsible corporate citizen in Buchans, specifically, and Newfoundland and Labrador, generally. We acknowledge and recognize that certain mitigation measures must be employed and monitored to ensure maximum protection for the surrounding environment, and we are very confident that all known issues are manageable. BMSI will maintain focused and proactive efforts in all such matters.

BMSI welcomes and encourages any and all feedback regarding this submission. In particular, BMSI looks forward to any and all advisory remarks from the people of Buchans and Provincial Government Departments which we would take on as invaluable advice supporting a successful and sustainable operation.

Date: May 14, 2014

Mike Rose
President

Appendix A

Letter of Support from Town of Buchans

Town of Buchans
P.O. Box 190
Buchans, NL A0H 1G0
Tel: 709-672-3972 Fax: 709-672-3702
E-Mail: townofbuchans@nf.aibn.com
Web Page: www.townofbuchans.nf.ca

May 1, 2014

Mr. Mike Rose
Barite Mud Services Inc.
74 O'Leary Avenue
St. John's, NL
A1B 2C7

Dear Mr. Rose,

Thank you very much for taking the time to meet with us at the Town office recently.

We are very pleased to hear that your company is continuing its efforts to develop the barite resource here in Buchans. We strongly support your team because we recognize the significant social and economic benefits that reopening the mine will bring to our Town and region. The addition of 20-25 long term jobs in our community, as well as the associated economic side benefits that reopening the mine will bring, is very much needed, and it will be most welcomed.

In particular, thank you for setting the stage for an 'open door' policy between your company and our Town. While every industrial activity involves issues and challenges from time to time, we believe that solutions can only be found if we work together to prevent or solve them.

Given the industrial experience here in Buchans, including the past barite operation, we fully understand the nature of your proposed facility. It is very good for us to know that Mike O'Brien will be the Chief Operating Officer here in Buchans. We know that he is readily accessible and committed to working with us to solve any concerns that may arise from time to time.

As discussed, we extend an invitation for you to provide a more current presentation to our Council. We are very interested in hear more from you about your plans for 2014 and beyond.

Please let me know if our Council can help you in any way. We look forward to continuing to work with you in this very important matter that will positively affect the Town of Buchans.

Sincerely,
TOWN OF BUCHANS

Derm Corbett, Mayor

c.c. Dave Whelan, Town Manager

Appendix B

SNC-Lavalin: Buchans Mine Tailings Disposal Options Analysis

N.B. - This report is final in all aspects, except for completion of section 2.3.7. **Tailings Disposal Option – Cost Estimate of Preferred Option which is** being finalized.

Report author:
Andrew Peach, P. Geo., EP.
Senior Engineering Geologist
SNC-Lavalin Inc.
Infrastructure Engineering

SNC·LAVALIN

BUCHANS MINE TAILINGS DISPOSAL OPTIONS ANALYSIS

Buchans Development Corporation

MINING AND METALLURGY

2014 | 05 | 14

REPORT > ORIGINAL
Internal ref. 617626-GEOT-4GER-0001_PC

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1.0 INTRODUCTION

1.1 *Background, Objective & Methodology*

SNC - Lavalin Inc. (SLI) was engaged in February of 2014 by the Buchans Development Corporation (BDC) to perform a tailings disposal options analysis related to the BDC's proposed tailings recovery and processing project in Buchans, NL. The BDC plans to have the tailings currently contained within Tailings Pond #1 (TP1) recycled, with a further option being to recycle the tailings contained within Tailings Pond #2 (TP2) – see Figure 1 in **Appendix A**. Details regarding the operational plan for the dredging and processing of the Barite from the existing tailings can be found within the Operator's Environmental Registration Document. It should be noted that the tailings disposal options analysis contained herein assumes that any sulphides which are currently present in the tailings are not going to be separated as a concentrate and that they will be disposed of along with the rest of the processed tailings.

The current undertaking would see the reprocessing of previously mined tailings in order to extract Barite, which would be sold as concentrate. The tailings, on average, contain approximately 30.9% Barite. The tailings disposal options analysis has been proactively undertaken by the BDC and has been included as an attachment to the Environmental Registration Document for the proposed undertaking.

The scope of work for this project was outlined in SLI's proposal (615613-002_02) dated January 24, 2014. The objective of the current work is to demonstrate to the Environmental Assessment Committee that the Buchans Development Corporation has considered different disposal options related to the aforementioned activities and that the best available option for disposal of the reprocessed tailings has been selected.

The tailings will be conducted from the mill via a HDPE pipe and will be discharged via point discharge. The HDPE is flexible enough that the discharge point can be moved to ensure that the tailings are deposited evenly with the disposal area.

BDC's decision to mine the tailings in TP2 will not be made for several years and will depend on the Barite market at the time and future market trends. However, it would be extremely beneficial if a disposal option was available that would see the total amount of tailings that may require disposal accounted for within a single option, particularly if it meant removing all existing tailings from either TP1 or TP2 or both. This in effect would mean that TP1 and TP2 would be remediated during the mining process, with the hope being that these ponds might one day be returned close to their original condition and, more importantly, there would be an improvement in the biodiversity and productivity of these areas.

The options analysis presented in this report is semi-quantitative in nature and evaluates short term and long term impacts associated with each disposal alternative while taking into account

environmental, technical and socio-economic considerations. Based on the results of the analysis the best available disposal option i.e., the preferred option, is then identified and briefly discussed in more detail. A ± 50% cost estimate of the preferred option and required infrastructure has also been presented in the appropriate section.

2.0 MATERIAL DISPOSAL OPTIONS

2.1 *Disposal Alternatives*

The options for disposal of the reprocessed tailings dredged from the mining area in the northeast portion of Tailings Pond #1 (TP1) – see Figure 2 in **Appendix A** – have been evaluated and a thorough review of the possible locations for tailings disposal was undertaken by SLI. In total, there were five (5) possible disposal options considered and evaluated:

1. Glory Hole
2. ABL Pond
3. Newly Constructed Tailings Impoundment Area
4. Tailings Pond #1
5. Tailings Pond #2

2.2 *Volume Requirement*

In order to quantifiably evaluate the requirements of the disposal options, the volumes (m^3) of reprocessed tailings that will be produced from Tailings Pond #1 and Tailings Pond #2 were calculated. All calculations were based on various percentages derived from the example of 55,000 – 60,000 tonnes of tailings being dredged to produce 10,000 tonnes of concentrated barite and containing 30,000 tonnes of oversize material, with the given total tonnages of tailings/reserves contained with TP1 and TP2 being 1.2 million and 690,000 tonnes, respectively (Castelli, 1980; Michael O'Brien, Personal Communication, February 12, 2014). It is important to note that the tailings to be disposed of were divided into two portions; first of all, approximately 52% of the overall tailings will be rejected at the mill as oversize, and sent straight to disposal without being processed. Another 29% will comprise the used, reprocessed tailings, and will be sent to disposal after having most of the barite removed. These portions need to be considered separately due to the fact that they are composed of a different distribution of chemical constituents; therefore, they have different densities and will require differing volumes for disposal. The list of constituents and their individual specific gravities for both portions of tailings, as reported by Buchans Enterprises Limited (BEL) and provided to SLI,

are presented in **Appendix B**. Overall specific gravities were calculated using weighted averages. It is assumed that the processing efficiency that can be achieved, and therefore the densities, of both portions of the tailings contained within TP2 are the same as those in TP1. Table 2-1 presents the values for all relevant variables in the volume calculations.

Table 2-1: Volume Calculation Variables.

		Specific Gravity	*Density*	*Mass*	*Volume*
Tailings Pond #1 (Based on overall weight of 1.2 M tonnes)	*Reject Tailings (oversize)*	3.5143	3514.3 kg/m^3	624,000,000 kg	177,560 m^3
	Reprocessed Tailings	3.3698	3369.8 kg/m^3	344,347,826 kg	102,186 m^3
				Total Required:	**279,747 m^3**
Tailings Pond #2 (Based on overall weight of 690,000 tonnes)	*Reject Tailings (oversize)*	3.5143	3514.3 kg/m^3	358,800,000 kg	102,097 m^3
	Reprocessed Tailings	3.3698	3369.8 kg/m^3	198,030,000 kg	58,766 m^3
				Total Required:	**160,863 m^3**

The disposal options analysis presented herein will focus on the requirements associated with mining Tailings Pond #1 in the early stages of the project, which will dictate a necessary available disposal volume of approximately **279,747 m^3**. The second phase of the project, i.e., the mining of Tailings Pond #2, will require that approximately **160,863 m^3** of tailings be disposed of. The combined requirements associated with mining both Tailings Pond #1 and Tailings Pond #2 dictate a necessary available disposal volume of approximately **440,610 m^3**.

2.3 *Evaluation of Material Disposal Options*

A detailed evaluation of the above alternatives was carried out. The options assessment included both short term and long term impacts of each alternative, from the construction and operation phase, through to eventual abandonment/closure of the site. The options were evaluated using a semi-qualitative comparative matrix which included:

- Environmental considerations;

- Technical considerations; and
- Socio-Economic considerations.

The results of the evaluation are presented in Tables 2-2, 2-3 and 2-4 and a detailed discussion of each alternative is presented in the following sections. It should be noted that SLI has made several assumptions with respect to the evaluation. The first is that neither the ABL pond, Tailings Pond #1, Tailings Pond #2 nor the Glory Hole contain fish habitat and/or can be considered productive wildlife habitat. This assumption is based on the fact that the ABL Pond, Tailings Pond #1 and Tailings Pond #2 have been previously approved by Government as tailings disposal sites; in addition, the ABL Pond is a man made pond and has only ever been used to store tailings. Likewise the Glory Hole is an open pit mine and has no surficial inflow or outflow. It is also assumed that there are no habitats associated with species at risk that will be impacted by any of the proposed options. The second assumption, as touched upon in section 2.2, is that the chemistry of the re-processed tailings will not markedly differ from the tailings currently deposited in TP1 or TP2, with the exception that tailings that eventually make their way from the mill will contain a lower percentage of Barite once processed. It has been communicated to SLI by BEL (Michael O'Brien, Personal Communication, March 14, 2014) that there will be no flocculant added to the tailings and that all reagents (e.g., Sodium Silicate, Potassium Amyl Xanthate and Dowfroth 250) used in the flotation and milling processes will be burned off prior to the reprocessed tailings being released into the environment.

2.3.1. Glory Hole

The option of using the Glory Hole to hold the reprocessed tailings is an attractive option, i.e., returning the tailings to the large open pit would be very high on the list as a preferred option. However, the Glory Hole still holds viable ore and depositing the reprocessed tailings material in the Glory Hole would make the remaining ore inaccessible and this would be considered "sterilizing" the resource. The Department of Natural Resources would likely not support this option and therefore it is not open for consideration at this time. However, it has been included in the options analysis for completeness.

2.3.2. ABL Pond

The ABL Pond was originally built by United Bolero Development Corporation, in 1998, and involved the construction of the north, south and east portions of the dam (Michael O'Brien, Personal Communication, February 12, 2014). The western portion of the dam, encasing the ABL Pond, has been referred to in many of the available documents as the ABL Dam and/or the Common Dyke, which is shared with TP1 and was constructed during the Buchans mining operations. For the purposes of this report, the western portion of the dam which is shared with TP1 will be referred to as Dam 1. All the structures related to the ABL pond are depicted on Figure 1 in **Appendix A.** To our knowledge there are no valuable tailings contained within the

ABL Pond. This tailings pond was used by ABL between 2006 and 2009 to contain excess water used in the flotation method by which barite was extracted from tailings solids originating from TP1 and to store re-processed tailings during that brief period of mining.

The ABL Pond is a closed loop water system with zero discharge. An emergency spillway has been constructed, and was sized to safely convey a peak flow of 0.50 m^3/s, while limiting the depth of flow at the control section to 0.2 m (Michael O'Brien, Personal Communication, February 12, 2014). This provides the spillway with a freeboard of 0.25 m. The spillway channel is lined with a 60 mm HDPE liner, underlain by a prepared sand base, and anchored by a compacted granular backfill berm, along with a thick rock fill blanket upstream. Outflow is channelled into a drainage ditch at the downstream toe of the structure. There are no original construction or design details available for the Common Dyke. In 2006, the five (5) remaining dykes enclosing the ABL Pond to the north, south and east, were raised by ABL. This was done in order to accommodate the re-processed tailings generated during ABL's three year stint of Barite mining operations. The structures were raised from 281.2 m to 289.6 m, to match the crest elevation of shared dam between TP1 and the ABL Pond.

The ABL Pond is reported as having an area of 45,033 m^2, and a tailings capacity of 90,000 m^3 or 200,000 tonnes, with a finished water level elevation of 289.10 m (Michael O'Brien, Personal Communication, February 12, 2014; based on bathymetric data collected by Stantec Inc. in 2013). This includes a minimum water cover of 0.5 m, and freeboard of 0.4 m. Based on modelling carried out by SLI using ArcGIS software, the bathymetric data provided allows for a volume of only 31,468 m^3 (at a finished water level elevation of 289.1 m), which does not include any water cover. For comparison, a volume was calculated taking a uniform depth based on the average value of the bathymetric data (not including any water cover), which worked out to be 48,756 m^3. Regardless of which value is chosen to represent the volume of the ABL Pond, neither comes close to accommodating the calculated predicted volume of reprocessed tailings that will be produced during the lifespan of the barite mining taking place in the northeast portion of TP1 or TP2, let alone the two combined.

Because of this shortfall, the ABL Pond cannot be considered a realistic disposal option since it would not be able to house the volume of reprocessed tailings from TP1 alone. In addition, the overall stability of the dams of the ABL Pond is unknown as it is our understanding that a formal Dam Safety Review including stability analyses has never been completed for the dam. Therefore, additional work would be required in order to assess the current condition of the ABL Pond, which would need to be followed by more studies in order to determine if the size of the ABL Pond could be increased in order to accommodate the volume of tailings that will require disposal. Increasing the footprint of the ABL pond would mean the additional loss of terrestrial habitat.

2.3.3. Newly Constructed Tailings Impoundment Area

The construction of a new Tailings Impoundment Area (TIA) would require a major construction effort and associated cost in order to build a facility large enough to contain the calculated volume of tailings that would be generated through the mining of Tailings Pond 1 and Tailings Pond 2. There is relativity little topographic relief in the vicinity of the ABL Pond, which would be the likely location of a new TIA. Due to the lack of topographic relief in this area there would be a requirement to build one or more large rock fill dams in order to contain the tailings. From an environmental standpoint, this option would likely require the use of a large area of currently undisturbed land (loss of terrestrial habitat) in the immediate vicinity of the ABL Pond.

Due to the amount of environmental disturbance that has already occurred in the area associated with the mining of Barite, it is anticipated that the public and government regulators would not be very supportive of this option, particularly when it appears that more environmentally friendly options are available, as will be presented shortly. This option would, however, have the benefit of creating some additional employment in the area through the utilization of local contractors, and the TIA could be designed such that the tailings could be contained to ensure that environmental release is minimized, i.e., the TIA could be lined to prevent seepage, etc. However, there would also be post closure costs associated with the management and upkeep of the TIA as well.

2.3.4. Tailings Pond #1

Tailings Pond #1 (TP1) was originally used by ASARCO to dispose of mineral tailings from the old Buchans mine, the majority of which are concentrated towards the northeast corner, as seen on Figure 1 and Figure 2 in **Appendix A**. The north-eastern portion of TP1 is the main designated mining area targeted by the BDC and contains approximately 1.2 million tonnes of tailings. As such, the option of using TP1 as a reprocessed tailings pond would involve directing the reprocessed tailings towards the southern portion of TP1, away from the valuable, barite-containing tailings being actively dredged. If the mine development plan is created such that tailings are first mined at the extreme south/south-eastern portion of the designated Mining Area as depicted in Figure 1, with dredging then proceeding in a northerly direction, it would be possible to begin depositing the tailings at the extreme southeast of TP1. This is also the deepest area of TP1, and would therefore be considered the furthest point away from the active mining area. As mining progresses north, the south/south-eastern portion of TP1 would be filled in with reprocessed tailings, also in a northerly progression, but with a large separation distance between the two migrating fronts. A separator berm would not be required in order to separate the new reprocessed tailings from the old, based on there being sufficient distance between the southern boundary of the Mining Area and the southern shoreline of TP1 (where reprocessed tailings will first be deposited), and the constant creation of new available space as tailings are mined and the Mining Area shrinks.

Historical research (Lorax, 2009) has shown that total zinc concentration in the waters contained within TP1 is positively correlated to increases in turbidity / total suspended solids (TSS), and decreases in fresh water input. Mining activities taking place in the northeast portion of TP1 and deposition of reprocessed tailings in the southern portion of TP1 will have the potential to increase TSS in the water column and therefore can potentially increase total zinc concentration levels in the pond (Lorax, 2009). Mitigation of this issue would involve the installation of a dual floating boom turbidity system near the outlet of TP1 (see Figure 2). Two Type II DOT turbidity curtains would be installed in parallel, roughly 10 m apart. The approximate required depths in this these locations are 1.5 m and 1.0 m, and the lengths are 95 m and 75 m, respectively. The curtain material would be vinyl polyester, which can withstand a water velocity of up to 0.92 m/s. This would be a key factor in maintaining acceptable water quality downstream of TP1. Discharge from TP1 exits into a tributary of Buchans Brook, which empties into Red Indian Lake; therefore, fish and/or water fowl habitat would be of concern. Other potential concerns include atmospheric issues related to dust and airborne particles; however, with a water cover of 0.1 m above the deposited reprocessed tailings, these issues are not anticipated to be of large consequence.

Using bathymetric data originally collected by AMEC Americas Limited (ABL, 2009) and provided to SLI by BEL, and based on the minimum water cover of 0.5 m cited in previous analyses of ponds on the Site, the available volume within the southern portion of TP1 outside of the Mining Area that may be used as a potential disposal site for reprocessed tailings is approximately 365,431 m^3. This is comfortably larger than the predicted volume of reprocessed tailings that will be produced during the lifespan of the Barite mining taking place in the northeast portion of TP1. Although the 0.5 m of water cover has been used as a threshold in previous studies, it is unclear where the value originates from, or whether it is significant. A smaller, yet still reasonable depth of 0.1 m water cover was subsequently used to calculate the available volume for reprocessed tailings disposal within TP1, which generated a value of 486,324 m^3. This would comfortably accommodate the calculated predicted volume of reprocessed tailings that will be produced during the lifespan of the barite mining taking place in both the northeast portion of TP1 and the east and west lobes of TP2. It is important to reiterate that the volumes calculated and presented above are based on fixed areas, which do not actually reflect the effect of the progressively expanding area that will be available in TP1 for use as disposal space. As previously stated, as mining continues, the southern boundary of the mining area will migrate northward, freeing up more and more volume which then becomes available for reprocessed tailings. It is therefore not unreasonable to state that a larger water cover depth could easily be accommodated if at some point a more definite requirement for water cover is proposed.

Figure 2 shows the divisions between the mining area, the potential reprocessed tailings disposal site, as well as the location of the spillway and discharge routes. Before selection of this site could be finalized, the BDC would have to approve the plans, and determine legal

ownership of the designated portion of TP1 that would be used for reprocessed tailings disposal. Installation of mitigative measures would be required prior to any dredging works and/or reprocessed tailings disposal, and downstream water quality would need to be monitored and maintained year-round. Contingencies would include supplementary turbidity barriers, as previously discussed, and the ability to adjust the flow of reprocessed tailings into TP1. If the downstream water quality cannot be adequately managed then installation of additional treatment options would need to be considered at that time.

Based on the information available to date and the results from the comparative matrix, Tailings Pond 1 is the preferred site for tailings disposal.

Water Quality

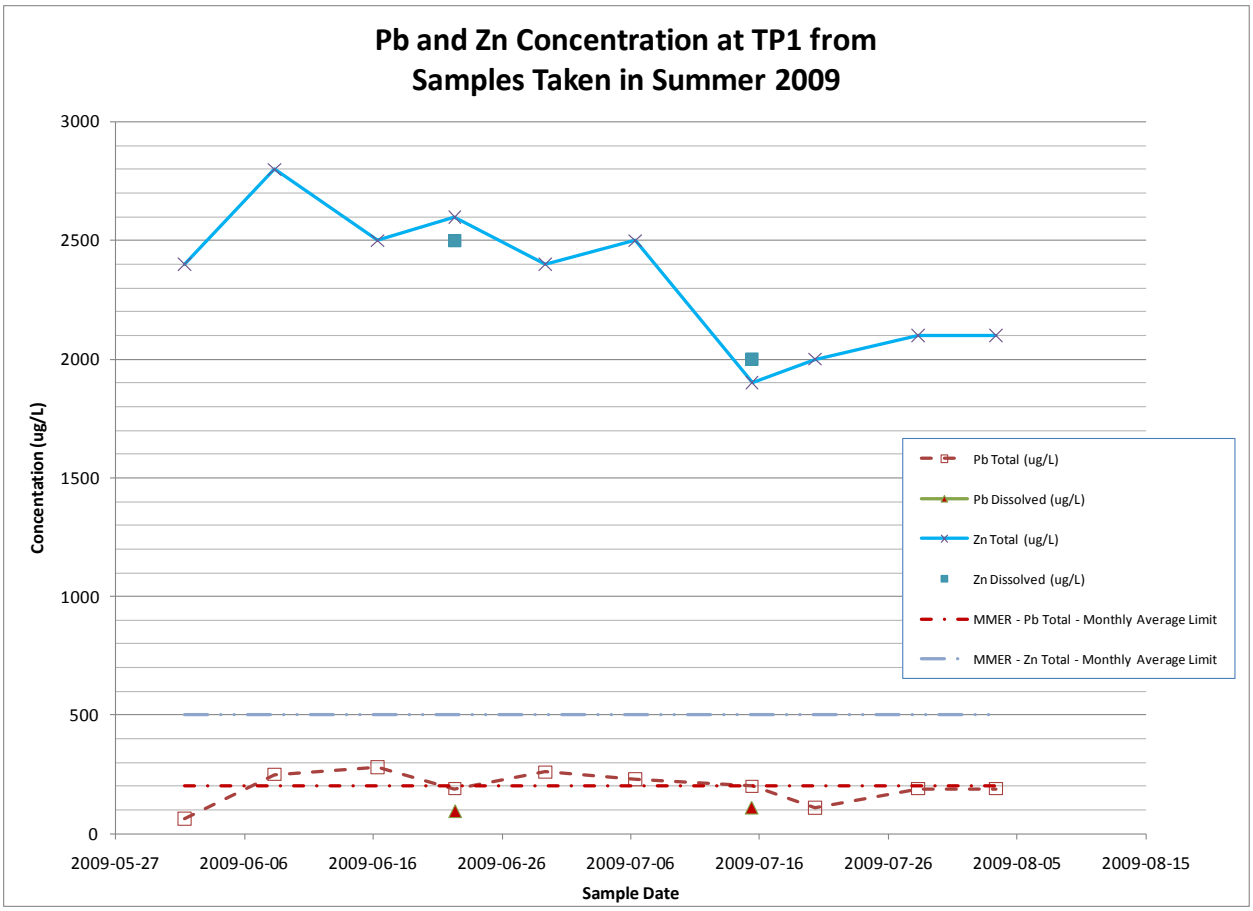
To expand on the brief discussion of water quality previously presented in this section, it is important to note that from June to August 2009, water samples were taken at the spillway of Tailings Pond #1 and analysed for pH, TSS and total metals. During this same period, additional water samples were taken twice within the Tailings Pond #1 mining area, as well as at the outlet of the tailings discharge line (ABL Pond) and the monitoring wells around the ABL pond. A complete analysis of the surface water samples was performed by SNC-Lavalin and the results presented herein.

The following review focuses on the samples taken at the spillway of Tailings Pond #1, the mining area and the tailings discharge line (ABL Pond). A summary of the water quality results for pH, TSS, lead and zinc are presented in the following table. TP1 spillway results for lead (Pb), zinc (Zn) and total suspended solids (TSS) are also shown in the following figure.

It should also be noted that the following review has been made using the Metal Mine Effluent Regulations (MMER) and the mining of barite is not considered a metal mine operation and therefore the metal mine regulations are not applicable. However, it is anticipated that the Certificate of Approval for this project would rely on the MMER for allowable concentrations with respect to TSS, Zn, and Pb and the allowable concentrations as per the MMER have been presented in the following table.

				Pb		Zn	
Date	Sample	pH	TSS	Total	Dissolved	Total	Dissolved
			mg/L	ug/L	ug/L	ug/L	ug/L
	MMER - Monthly Avg Conc.	*6 to 9.5*	*15*	*200*		*500*	
	MMER - Max Conc.		*30*	*400*		*1000*	
2009-06-01	TP1 Spillway	7.25	0	63		2400	
2009-06-08	TP1 Spillway	7.26	0	250		2800	

				Pb		Zn	
Date	Sample	pH	TSS	Total	Dissolved	Total	Dissolved
			mg/L	ug/L	ug/L	ug/L	ug/L
	MMER - Monthly Avg Conc.	*6 to 9.5*	*15*	*200*		*500*	
	MMER - Max Conc.		*30*	*400*		*1000*	
2009-06-16	TP1 Spillway	7.3	0	280		2500	
2009-06-22	TP1 Spillway	7.29	12	190	95	2600	2500
2009-06-29	TP1 Spillway	7.07	8	260		2400	
2009-07-06	TP1 Spillway	7.21	2	230		2500	
2009-07-15	TP1 Spillway	7.48	2	200	110	1900	2000
2009-07-20	TP1 Spillway	7.58	0	110		2000	
2009-07-28	TP1 Spillway	7.39	1	190		2100	
2009-08-03	TP1 Spillway	7.38	2	190		2100	
2009-06-22	Mining Area	7.34	10	180	120	2500	2400
2009-07-15	Mining Area	7.4	24	370	99	2000	1800
2009-06-22	Tailings Line Discharge (ABL Pond)	7.63	55	240	57	510	160
2009-07-15	Tailings Line Discharge (ABL Pond)	7.82	150	1200	25	2700	62



Based on the results obtained from the water samples taken at the spillway of TP1, the following observations can be made:

1. pH and TSS concentration were below the Metal Mining Effluent Regulations (MMER) for the monthly average discharge criteria of these parameters.

2. Pb total concentrations were slightly above (June) and below (July) the MMER monthly average discharge criteria, but were below the maximum concentration for all samples. The dissolved fractions for all samples, where applicable, were below the monthly discharge criteria.

3. Zn total concentrations were above the MMER monthly average discharge criteria for both months (June/July) as well as the maximum discharge criteria. The dissolved concentrations for Zn were shown to be close to the total concentration values. This indicates that most of the Zn was present in the discharge water as a dissolved element.

The above observations indicate that total lead concentrations are borderline with respect to their monthly average concentrations (June/July) and the discharge criteria and it should be possible to lower the total lead concentration by reducing the amount of suspended solids reaching the Tailings Pond #1 spillway.

The exceedances associated with the total zinc concentration present at the spillway of Tailings Pond #1 are due to the dissolved fraction, indicating that controlling the amount of suspended solids reaching the spillway will not help much with respect to decreasing the total concentration.

The observations also indicate that there are currently water quality issues, particularly with respect to zinc that are independent of any future mining that may take place in the north-eastern portion of TP1.

When comparing the results of the water samples taken at the Tailings Pond #1 spillway and the mining area, the following observations can be made:

1. TSS was higher in the mining area than at the Tailings Pond #1 spillway. This is to be expected since dredging was taking place in that area. However, the increase in the TSS concentration in the mining area doesn't appear to increase the TSS concentration measured at the Tailings Pond #1 spillway.

2. Total lead concentration for one of the samples was notably higher in the mining area. This was probably due to the higher TSS in the mining area. However, the increase in the total lead concentration in the mining area doesn't appear to increase the total lead concentration measured at the Tailings Pond #1 spillway. The dissolved lead concentrations at the Tailings Pond #1 spillway and the mining area were very similar.

3. The total and dissolved zinc concentrations at the Tailings Pond #1 spillway and the mining area were very similar.

According to these results, the dredging operation in the mining area does not seem to cause an increase in total or dissolved lead and zinc concentrations measured at the Tailings Pond #1 spillway. For instance, the values (total and dissolved) for zinc within the mining area remain comparable to the levels measured at the Tailings Pond #1 spillway during the sampling period. Also, the values for dissolved lead remain similar to the levels measured at the Tailings Pond #1 spillway and the values for total lead were either similar or lower at the Tailings Pond #1 spillway compared to the mining area for the sampling period.

When comparing the results of the water samples taken at the Tailings Pond #1 spillway and the water samples taken at the outlet of the tailings discharge line (ABL Pond), the following observations can be made:

1. TSS was higher at the tailings discharge line (ABL Pond) than at the Tailings Pond #1 spillway.

2. On average the total lead concentration was higher at the outlet of the tailings discharge line (ABL Pond) compared to the Tailings Pond #1 spillway.

3. The total lead present at the outlet of the tailings discharge line (ABL Pond) was present mostly as suspended solids, i.e., more than 75%.

4. On average the total zinc concentration was higher at the Tailings Pond #1 spillway compared to the outlet of the tailings discharge line (ABL Pond).

5. The total zinc present at the outlet of the tailings discharge line (ABL Pond) was present mostly as suspended solids, i.e., more than 68%.

Based on these results, it is expected that as long as the suspended solids associated with future tailings being discharged into Tailings Pond #1 are afforded sufficient residence time to allow them to settle in the tailings pond, then the total zinc concentration would not be expected to show a large increase at the Tailings Pond #1 spillway compared to background levels, although some increase may be anticipated.

With respect to the total concentration of lead, allowing the suspended solids associated with the future tailings to settle within Tailings Pond #1 will definitely help to control the total concentration that will be seen at the Tailings Pond #1 spillway. However, with respect to background levels at the Tailings Pond #1 spillway, there may be an increase in total lead concentration depending on how much of the suspended fraction is removed by the turbidity barriers and how much the dissolved fraction within Tailings Pond #1 increases due to the input of dissolved lead coming from the processed tailings.

The parameters of concern with regards to any future effluent discharged from the Tailings Pond #1 spillway include Total Suspended Solids (TSS) concentration, total and dissolved lead concentrations, and total and dissolved zinc concentrations.

To ensure that the TSS continues to remain below the MMER discharge criterion for this parameter, there are several measures that can be carried out. First of all, it will be important to discharge the tailings as far as possible from the Tailings Pond #1 spillway. The tailings should be deposited in such a way as to ensure that they do not accumulate near the spillway. As previously mentioned, the installation of turbidity barriers upstream of the spillway would help to form a polishing area and ensure that tailings do not accumulate close to the spillway. By controlling the TSS at the spillway, the concentration of TSS that gets released into the environment, as well as lead and zinc concentrations that are mainly associated with suspended solids should be greatly reduced.

Most of the zinc measured at the Tailings Pond #1 spillway is present as a dissolved element and there may be an increase in the dissolved concentration at the spillway due to the input of processed tailings into Tailings Pond #1. The magnitude of the increase is not known at this time, but any increase is expected to be small with respect to background levels measured at the spillway sampling location. The installation of turbidity barriers should successfully mitigate any increases in total zinc due to increased TSS, however, the turbidity barriers will not help to lower the dissolved concentration. To remove the zinc from the water, it has to be precipitated out by increasing the effluent water pH to 9.5 with lime of sodium hydroxide and allowing the zinc hydroxide to precipitate and settle out of the water prior to discharge. The pH at the treated effluent should always be below 9.5 in order to meet the MMER guidelines for this parameter.

The water currently discharging from the Tailings Pond #1 spillway does not meet MMER, therefore it is recommended that once the processed tailings start to be deposited into Tailings Pond #1, the water at the spillway should be carefully monitored in order to identify any deterioration in water quality with respect to total zinc background levels. If an increase in total zinc, with respect to background levels, is measured, then the relative contribution of each fraction (dissolved and suspended) needs to be evaluated and additional mitigation measures will need to be put in place. This would be done in consultation with the Pollution Prevention Division of the Department of Natural Resources. It is also anticipated that because the current discharge at the spillway is four to five times the MMER criterion for the monthly average discharge value, the Pollution Prevention Division would need to set a new threshold limit. One possibility might be to limit the discharge concentration for total zinc to within 10% of the background level.

Approximately half of the lead measured at the Tailings Pond #1 spillway seems to be present as a dissolved element. Previous samples have shown that total Pb concentrations were slightly above (June) and below (July) the MMER monthly average discharge criteria and the dissolved fractions for both months were below the monthly discharge criteria. As such, under current conditions, if a turbidity barrier was installed it should be possible to greatly reduce the amount of suspended solids and therefore ensure compliance with the monthly discharge limit. Any suspended sediments associated with the input of processed tailings should also be successfully mitigated with the turbidity barriers, the only unknown is how much the dissolved fraction associated with the processed tailings might increase the background concentration (dissolved) previously measured at the spillway sample location. If the effect is minimal it may be possible that although there is an increase in the dissolved fraction due to the input of processed tailings, the total lead concentration in the spillway samples may actually decrease due to the effective removal of suspend solids. Because the exact effect that tailings deposition and reducing the TSS via the turbidity barriers will have on the water leaving the spillway is unknown it is recommended that the total lead concentration at the Tailings Pond #1 spillway be carefully monitored to ensure that the monthly averages for total lead are below the MMER discharge criteria. If exceedances are noted then the relative contribution of each fraction (dissolved and suspended) needs to be evaluated and additional mitigation measure will need

to be put in place. This would be done in consultation with the Pollution Prevention Division of the Department of Natural Resources. To remove the dissolved lead from the water, it has to be precipitated out by increasing the effluent water pH to 9.0 to 9.5 with lime of sodium hydroxide and allowing the lead hydroxide to precipitate and settle out of the water prior to discharge. The pH at the treated effluent should always be below 9.5 in order to meet the MMER guidelines for this parameter.

As previously mentioned in Section 1.1 the current tailings disposal options analysis was prepared based on the assumption that the sulphides currently present in the tailings are not going to be removed and concentrated. If the sulphides are removed and concentrated before the processed tailings are disposed of, then it is expected that the total concentration of lead and zinc that will be present in the tailings discharge line would be greatly reduce and this would further minimize the potential for an increase in concentration of lead and zinc compared to background levels. If it is found that there is an increase in the total concentration of lead and zinc at the spillway sample location under the current base case scenario, then it is recommended that the option of removing the sulphides be explored further.

2.3.5. Tailings Pond #2

Tailings Pond #2 (TP2) was also originally used to dispose of mineral tailings from the old Buchans mine, the majority of which are concentrated in the eastern and western lobes, as seen on Figure 1 in **Appendix A.** The option of using TP2 as a reprocessed tailings pond would involve directing the reprocessed tailings towards the southern or southwestern portion of TP2, away from the valuable, barite-containing tailings contained in the east and west lobes. There are approximately 690,000 tonnes of valuable tailings contained in TP2 between the two concentrated lobes, and as such, mining these tailings deposits is included as part of the BDC's plan in producing Barite concentrate.

It is also important to note the deposit of re-processed Barite tailings on the southern shore of TP2 which was left behind by ASARCO in the 1980's during a short-lived attempt at mining the tailings in the north-eastern portion of TP1. In considering TP2 as a disposal option for BDC's reprocessed tailings, it would make sense to center the deposition location around this pre-existing reprocessed tailings deposit. It is very close to the point which achieves the furthest distance from valuable tailings in TP2.

Although, compared to TP1, there has not been as much extensive research conducted on and/or data collected from TP2, it is SLI's understanding that the tailings deposits in the east and west lobes are composed of the same material that makes up the tailings deposit in TP1. Based on this criterion, it would follow that the total zinc concentration in the waters contained within TP2 is positively correlated to increases in turbidity / total suspended solids (TSS), and decreases in fresh water input, as it is in TP1. Deposition of reprocessed tailings in the southern portion of TP2 will have the potential to increase TSS in the water column (during dredging and return flow) and therefore can potentially increase total zinc concentration levels in

the pond (Lorax, 2009). Mitigation of this issue would again involve the installation of a turbidity barrier (i.e. silt curtain) at the discharge point of TP2. This would be a key factor in maintaining acceptable water quality downstream of TP2. Discharge from TP2 also exits into a tributary of Buchans Brook, which empties into Red Indian Lake; therefore, fish and/or water fowl habitat would be of concern. Other potential concerns include atmospheric issues related to dust and airborne particles.

The bathymetric data available for TP2 originates from a drawing prepared by United Bolero in 1998. Based on the calculations made using ArcGIS, the zone within TP2 representing available disposal space possesses a surface area of 135,045 m^2. This surface area excludes the east and west lobes of tailings, as well as a 10 m buffer zone along the southern shoreline, and the small ASARCO reprocessed tailings deposit.

Although TP1 and TP2 appear to be quite similar in size from an aerial point of view, the volume of TP2 has been modelled using ArcGIS to be 959,493 m^3. According to the bathymetry data provided on a United Bolero drawing, TP2 has a maximum depth of 5.5 metres (from the surface of the water), and approximately 45% of the total pond area possesses this depth. TP1, in comparison, has a maximum depth of 3 m (from the surface of the water). Based on these calculations, TP2 would be able to provide the necessary volume required to accommodate the reprocessed tailings generated during the entire lifespan of mining activities in both TP1 and the east and west lobes of TP2. This includes a water cover of 0.1 m (as in TP1). With this said, it is important to reiterate that mining will be commencing in TP1 and may or may not shift to TP2 at an undetermined point in the future. This means that the boundaries separating the east and west tailings lobes from the central available volume for reprocessed tailings will not migrate progressively outward as they will in TP1, and possibly not at all. Moreover, the area, and hence the volume that is available in TP2 will be relatively fixed during the mining of TP1, allowing much less flexibility in terms of the tonnage and ratio of oversize to milled tailings that will be produced. The large proportion of the pond area that possesses a comparatively much larger water column to work with would, however, assist with the prevention of mixing between valuable, barite containing tailings in the east and west lobes, and the reprocessed tailings.

It is SLI's opinion that although TP2 does possess the necessary volume to house the reprocessed tailings that will be produced during the lifespan of the barite mining taking place in the northeast portion of TP1 (and TP2); it is not the ideal option. TP2 is further from the Barite mill than TP1 making it a higher cost option in terms of pipeline construction and overall footprint. For this reason, as well as the rigidity of the internal boundaries between mining areas and the available volume for disposal, TP2 has been considered a less desirable option than TP1. It is also important to consider the potential for rehabilitating these ponds to contain productive habitat post-closure and during the rehabilitation phase, in which case removing the tailings from TP2 and combining them with the tailings in TP1, would be much easier than trying to remove all the tailings form TP1 and placing them in TP2.

Table 2-2: Tailings Disposal Options Analysis – Environmental Considerations

No.	Criteria	Disposal Alternatives				
		Glory Hole	ABL Pond	New TMF	Tailings Pond 2	Tailings Pond 1
1	Physical and geochemical characterization of wastes (e.g. acid rock drainage and metal leaching)	3	4	2	3	3
2	Topographical factors (e.g., relief and complexity of topography)	1	5	4	3	2
3	Geotechnical and seismic stability (e.g., depth of permafrost, geology of bedrock)	1	4	2	3	3
4	Hydrology issues (e.g., interference with surface water movement)	1	3	4	4	3
5	Hydrogeological issues (e.g., migration of contaminated groundwater)	4	3	2	3	3
6	Atmospheric issues (e.g., particulates, heavy metals)	1	5	2	1	1
7	Overall affected land footprint size of impoundment (including polishing ponds) and related infrastructure and access roads	1	4	5	3	2
8	Size of affected water body area (e.g., lake, stream) and watershed catchment boundaries	1	3	3	4	4
9	Water quality issues	1	4	2	3	4
10	Water quantity and storage issues	1	5	2	2	2
11	Impacts to fish and their habitats downstream of each alternative	1	3	2	3	3
12	Impacts to aquatic plant and animal species and their habitats related to each alternative	1	1	2	3	3
13	Impacts to terrestrial plant and animal species related to each alternative	1	1	5	1	1
14	Impacts to birds related to each alternative	1	5	5	3	3
15	Impacts to species at risk and their habitats related to each alternative	n/a	n/a	n/a	n/a	n/a
16	Impacts on humans (including air quality, noise, drinking water and contamination of country foods issues, as applicable)	1	4	5	3	3
17	Potential for post-closure/decommissioning recovery and rehabilitation related to environmental vectors related to each alternative	1	4	3	3	3
18	Distance from removal area to disposal area (e.g. carbon footprint)	1	2	3	4	3
19	Failure consequences (e.g., Dam failure)	1	5	5	4	4
20	Dam reliability	1	4	2	2	2
	Sub-Total	**24**	**69**	**60**	**55**	**52**

Score: (1) Most favourable (no or negligible impact); (2) Favourable (minor or insignificant impact); (3) Average (Low to Moderate impact); (4) Slightly unfavourable (Moderate Impact); (5) Unfavourable (High or major Impact

Table 2-3: Tailings Disposal Options Analysis – Technical Considerations

No.	Criteria	Disposal Alternatives				
		Glory Hole	ABL Pond	New TMF	Tailings Pond 2	Tailings Pond 1
1	Containment structure designs (e.g., size, hydraulic capacity, construction materials, substrate, etc.)	1	5	5	3	2
2	Availability of construction materials and volume requirements (e.g., quarry material for containment structures, access road and site drainage)	1	4	5	2	2
3	Possible use of impermeable or geo-textile liner for impoundments	5	4	1	5	5
4	Diversion and other water control structures that may be required	1	3	4	3	3
5	Potential for increased tailings deposition capacity (e.g., likelihood of additional future development)	1	5	3	1	1
6	Feasibility of alternatives to manage tailings as slurry, particularly thickened tailings, pastes tailings or dry stacking	5	5	1	5	5
7	Transportation of materials (e.g., from mine site to proposed TIA)	1	2	3	4	3
8	Chemical and physical characterization of tailings	1	4	3	3	3
9	Design and construction of impermeable covers over wastes	5	3	2	5	5
10	Flexibility with regard to technical and operational uncertainties	1	4	2	3	2
11	Proposed technologies and advantages/disadvantages of the technologies considered, (e.g., proven technology used elsewhere or new)	n/a	n/a	n/a	n/a	n/a
12	Technical feasibility and risks (e.g., unforeseen conditions that may not allow all the material to be disposed of)	1	5	2	4	3
13	Unforeseen technical difficulties (e.g., in terms of foundation complexities for dams, etc.)	1	5	3	3	3
14	Risks associated with requirements for perpetual treatment or maintenance	1	5	3	4	3
15	Post-closure risks and uncertainties	1	5	3	3	4
16	Rehabilitation of aquatic and/or land ecosystems including timeframes	1	4	4	3	1
17	Ratio of dam volume to storage capacity	1	5	2	1	2
18	Dam storage and pipeline (HDPE) footprint	1	2	3	4	3
19	Risks associated with construction	1	5	4	3	2
20	Closure Risks	1	5	3	4	3
	Sub-Total	**31**	**80**	**56**	**63**	**55**

Score: (1) Most favourable (no or negligible impact); (2) Favourable (minor or insignificant impact); (3) Average (Low to Moderate impact); (4) Slightly unfavourable (Moderate Impact); (5) Unfavourable (High or major Impact

Table 2-4: Tailings Disposal Options Analysis – Socio-Economic Considerations

No.	Criteria	Disposal Alternatives				
		Glory Hole	ABL Pond	New TMF	Tailings Pond 2	Tailings Pond 1
1	Capital costs	1	5	5	4	2
2	Operational costs	1	4	5	4	3
3	Closure costs	1	5	4	5	4
4	Post-closure costs, including the costs of perpetual treatment/maintenance should it be required	1	4	4	3	2
5	Fish habitat compensation and monitoring costs	1	3	2	4	4
6	Economic benefits	5	2	1	3	4
7	Closure, post-closure plan risks where some form of perpetual treatment or maintenance is required	1	4	3	4	3
8	Regulatory review and construction timeline costs	1	4	5	3	2
9	Preservation of archeological/cultural sites	n/a	n/a	n/a	n/a	n/a
10	Aboriginal land rights	n/a	n/a	n/a	n/a	n/a
11	Maintenance of traditional lifestyle	n/a	n/a	n/a	n/a	n/a
12	Spiritual well being	2	4	4	3	1
13	Perceived community response	2	4	4	3	1
14	Use of fisheries resources	n/a	n/a	n/a	n/a	n/a
15	Aesthetics	1	5	4	4	2
16	Other uses such as recreation/tourism, industrial, etc.	5	3	3	3	3
17	Contracting opportunities, building community capacity	5	2	1	3	4
18	Safety considerations	1	4	5	3	2
19	Landowner opinion including governments	5	4	4	3	1
20	Overall perceived socio-economic consequences, benefits and relative preferences; and other factors considered significant by the project proponent and reviewers	5	4	3	2	1
	Sub-Total	**38**	**61**	**57**	**54**	**39**
	Total	**93**	**210**	**173**	**172**	**146**

Score: (1) Most favourable (no or negligible impact); (2) Favourable (minor or insignificant impact); (3) Average (Low to Moderate impact); (4) Slightly unfavourable (Moderate Impact); (5) Unfavourable (High or major Impact)

2.3.6. Tailings Disposal Option – Selection of Preferred Option

The results of the detailed evaluation presented in the previous sections show that the Glory Hole is the preferred option for tailings disposal. However, as previously mentioned, using the Glory Hole for tailings disposal is not a realistic option due to the sterilization of ore that would occur if this option were exercised. The next best option is Tailings Pond 1, which achieved the second best score in each of the three evaluation categories and therefore the lowest overall score, with the Glory Hole option excluded. Tailings Pond 1 is a viable option and is the preferred option based on the results presented herein. Tailings Pond 1 is able to hold all the tailings that would require disposal by mining TP1 and TP2, moreover, if the majority of the tailings were removed from TP2 and re-deposited in TP1, there is a real possibility that the aquatic ecosystem in TP2 would be improved and this would be a considerable ecological benefit resulting from the Project. In addition to that benefit, it is SLI's belief that at some point a closure strategy/plan will need to be developed for the ABL Pond, if one does not already exist. Presumably Atlantic Barite Limited would be responsible for closing out the ABL Pond and one possible closure option might be to remove the tailings contained in the ABL Pond and place them back into TP1. If this were to occur, then the site where the ABL Pond currently sits could be remediated and the terrestrial habitat that was originally lost due to construction of the pond reclaimed. This would be an additional ecological benefit to the area. All these scenarios would require careful planning to implement them properly, but the potential is there.

The following section details some of the construction costs (± 50% estimate) that would be associated with the utilization of TP1 for tailings disposal.

2.3.7. Tailings Disposal Option – Cost Estimate of Preferred Option

This section is currently being prepared.

3.0 CLOSURE

This report has been prepared exclusively for the Buchans Development Corporation (the Client). The quality of information, conclusions and estimates contained herein is consistent with the level of effort involved in SLI's services and based on: i) information available at the time of preparation, ii) data supplied by outside sources, and iii) the assumptions, conditions and qualifications set forth in this report. Unless expressly stated otherwise, any assumptions, data and information supplied by, or gathered from other sources (including the Client, other consultants, testing laboratories, etc.) upon which SLI's opinion as set out herein is based has not been verified by SLI; SLI makes no representation as to its accuracy and disclaims all liability with respect thereto.

This report is intended to be used by the Buchans Development Corporation subject to the terms and conditions of its contract with SLI and may not be used by a third party without the

expressed written consent of SLI and the Client. Any other use of, or reliance on, this report by a third party is at that party's sole risk.

Preparation of this report, and all associated work, has been carried out in accordance with the normally accepted standard of care in the province of execution for the specific professional service provided to the Client. No other warranty, expressed or implied, is made.

We trust this draft report meets with your current requirements and please do not hesitate to contact the undersigned should you have any questions or concerns.

Respectfully submitted,

SNC-LAVALIN INC.

Prepared by:

(Draft not signed)

Andrew Peach, P. Geo., EP.
Senior Engineering Geologist
SNC-Lavalin Inc.
Infrastructure Engineering

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FIGURES

APPENDIX A

SNC·LAVALIN
1133 TOPSAIL RD.,
MOUNT PEARL, NL, A1N 5G2
TEL: (709) 368-0118, FAX: (709) 368-3541

Figure 1: Site Overview Map - DRAFT

Project: **TAILINGS DISPOSAL OPTIONS ANALYSIS (BUCHANS, NL)**

Client: BUCHANS DEVELOPMENT CORPORATON

Project: 617626

Created By: S. HILL

Date: Mar 20, 2014

Legend

- Dams
- Discharge Route
- Barite Plant
- Tailings Lobe
- Shoreline

Figure 2: Tailings Pond #1 (TP1) - DRAFT

SNC·LAVALIN
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MOUNT PEARL, NL, A1N 5G2
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Project: **TAILINGS DISPOSAL OPTIONS ANALYSIS (BUCHANS, NL)**
Client: BUCHANS DEVELOPMENT CORPORATON
Project: 617626
Created: S. HILL
Date: Mar 18, 2014

N

0 50 100 150 200 250
Meters
Map Scale 1:6,000

Figure 3: Tailings Pond #2 (TP2) - DRAFT

SNC·LAVALIN
1133 TOPSAIL RD.,
MOUNT PEARL, NL, A1N 5G2
TEL: (709) 368-0118, FAX: (709) 368-3541

Project: **TAILINGS DISPOSAL OPTIONS ANALYSIS (BUCHANS, NL)**
Client: BUCHANS DEVELOPMENT CORPORATON
Project: 617626
Created: S. HILL
Date: Apr 10, 2014

N

0 50 100 150 200 250
Meters
Map Scale 1:7,000

TAILINGS COMPOSITION

APPENDIX B

Distribution of Chemical Constituents for Rejected Oversize Tailings

Formula	Name	Percentage (%)	Specific Gravity
SiO	Silicon Oxide	40.77	2.65
$BaSo_4$	Barite	30.89	4.5
Al_2O_3	Aluminum Oxide	7.75	1.52
Fe_2O_3	Ferric Oxide	5.86	5
FeO	Ferrous Oxide	4.62	6.02
MgO	Magnesium Oxide	2.02	1.94
LOI	Lost in Ignition	1.7	N/A
K_2O	Potassium Oxide	1.50	1.35
CaO	Calcium Oxide	1.43	3.34
Zn	Zinc	1.07	7.13
Na_2O	Sodium Oxide	1.02	2.27
Pb	Lead	0.38	11.35
TiO_2	Titanium Dioxide	0.35	3.77
Sr	Strontium	0.1345	2.54
Cr	Chromium	0.13	7.19
Cu	Copper	0.10	8.96
P_2O_5	Phosphorus Pentoxide	0.10	2.39
MnO	Manganese Oxide	0.09	4.5
V	Vanadium	0.0072	6.11
Zr	Zirconium	0.0070	6.506
Cd	Cadmium	0.00492	8.65
Mo	Molybdenum	0.0030	10.22
Rb	Rubidium	0.0029	1.532
Ga	Gallium	0.0021	5.9
Ni	Nickel	0.0014	8.9
Li	Lithium	0.00132	0.534
Y	Yttrium	0.0011	4.457
La	Lanthanum	0.0010	6.166
Co	Cobalt	0.0006	8.9
Th	Thorium	0.0005	11.72
Be	Beryllium	0.00011	1.848
Nb	Niobium	0.0001	8.57
Au	Gold	0.0000196	19.32
Ag	Silver	0.0000018	10.5

Distribution of Chemical Constituents for Reprocessed Tailings

Formula	Name	Percentage (%)	Specific Gravity
SiO_2	Silicon Dioxide	65.80	2.65
Fe_2O_3	Ferric Oxide	14	5
$BaSo_4$	Barium Sulfate	11	4.5
$CaCO_3$	Calcium Carbonate	4.40	3.34
Zn	Zinc	1.30	7.13
Pb	Lead	1.10	11.35
Al_2O_3	Aluminum Oxide	0.91	1.52
LOI	Loss on Ignition	0.86	N/A
$SrSO_4$	Strontium Sulfate	0.43	3.96

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Appendix C

Metallurgical Balance

Table 1 **Metallurgical Balance**

		% Weights	% $BaSO_4$	$BaSO_4$	% $SrSO_4$	$SrSO_4$	% SiO2	SiO2	% Pb	Pb	% Zn	Zn	% Fe_2O_3	% Al_2O_3	% $CaCO_3$
				%Distrib		%Distrib		%Distrib		%Distrib		%Distrib			
ROM	+250	183.0	25.00	100.0						100.0					
Feed	**-75 micr**	**100.00**	**38.80**	**85.00**	**0.94**		**26.30**		**0.60**	**40.00**	**0.80**		**10.38**	**5.10**	**3.40**
Sulphide 1		20.10	18.8	7.6	0.5	8.9	17.4	17.0	2.8	85.0	3.0	79.4	24.9	3.8	2.0
Sulphide 2		6.50	24.8	3.3	0.6	3.8	22.2	7.0	0.6	5.8	0.9	7.4	20.9	4.7	2.6
Sulphide 3		5.40	39.2	4.3	0.8	4.4	25.9	6.8	0.3	2.6	0.7	4.7	10.1	5.7	3.1
Total to Sulphide T		**32.00**	**27.6**	**15.1**	**0.6**	**17.1**	**21.8**	**30.8**	**1.2**	**93.4**	**1.5**	**91.5**	**18.6**	**4.7**	**2.6**
Feed to Barite Flotation based on Atlantic Barite performance															
Ba FEED		68.00	38.0												
Ba Rougher Tails		17.40	5.6	2.0	0.1	1.3	60.0	50.7	0.1	2.4	0.2	4.7	4.9	11.2	7.5
Cleaner 1 Tails		3.70	8.9	0.7	0.3	0.9	57.8	10.4	0.1	0.7	0.3	1.2	5.2	10.3	7.3
Cleaner 2 Tails		1.50	18.8	0.6	0.5	0.7	50.0	3.6	0.2	0.4	0.3	0.6	5.3	9.0	6.8
Cleaner 3 Tails		1.30	34.5	0.9	0.9	1.1	33.7	2.1	0.2	0.4	0.3	0.6	4.4	6.2	5.1
Cleaner 4 Tails		2.00	73.7	3.0	1.4	2.7	9.6	0.9	0.1	0.4	0.2	0.4	1.2	1.9	2.0
Final Product		**42.10**	**91.9**	**78.0**	**1.9**	**76.1**	**0.8**	**1.6**	**0.0**	**2.6**	**0.0**	**1.6**	**-**	**0.2**	**0.2**

Table 2 **Buchans Barite Tailings Feed Testing** **(From initial screen analysis of sand in Tailings Pond)**

Screen	**Weight**	**Cumulative**			**Individual fractions**		
microns	grammes	% By weight	Density	% $BaSO_4$ Contained	% By weight	Density	% $BaSO_4$ Contained
+1250	5.30	0.4	2.60	0	0.4	2.6	0
-1250+16	395.60	30.5	2.79	9.87	30.1	2.79	10
-160+75	590.60	75.4	2.98	19.98	44.9	3.11	26.8
-75+45	181.50	89.1	3.10	26.17	13.8	3.74	60
-45	142.80	100	3.17	29.84	10.9	3.74	60
Total	1,315.8	100			100		

- These tables were prepared from a combination of the operating data for 2008, 2009 and metallurgical testwork.
- Analysis table 1 shows that ABL recover's 78% by weight of the barite from the flotation feed when cut at 75 micron in the cyclone tower at the dam.
- However, the cyclone tower loses 15% of the contained barite in the feed, so total Recovery for the whole process is 78% of 85% or 66.3% of $BaSO_4$ in dam.
- ABL combined lead cons. with barite tailings, and the combined tailings contains 1.18% lead compared with 0.65% Pb in the feed.
- If we can do something else with the lead con. the barite tailings are quite acceptable at 950 ppm.

TAILS MAKEUP	% Weights	% $BaSO_4$	% $SrSO_4$	% SiO2	% Pb	% Zn	% Fe_2O_3	% Al_2O_3	% $CaCO_3$
Sulphide 1	20.10	18.8%	0.5%	17.4%	2.8%	3.0%	24.9%	3.8%	2.0%
Sulphide 2	6.50	24.8%	0.6%	22.2%	0.6%	0.9%	20.9%	4.7%	2.6%
Sulphide 3	5.40	39.2%	0.8%	25.9%	0.3%	0.7%	10.1%	5.7%	3.1%
Ba Rougher Tails	17.40	5.60%	0.08%	60%	0.09%	0.21%	4.90%	11.20%	7.50%
Cleaner 1 Tails	3.70	8.90%	0.25%	57.80%	0.12%	0.25%	5.20%	10.30%	7.30%
Cleaner 2 Tails	1.50	18.80%	0.50%	50.0%	0.16%	0.31%	5.30%	9.0%	6.80%
Cleaner 3 Tails	1.30	34.50%	0.90%	33.70%	0.19%	0.33%	4.40%	6.20%	5.10%
Cleaner 4 Tails	2.00	73.70%	1.40%	9.60%	0.12%	0.15%	1.20%	1.90%	2%

Appendix D

Monitoring, Mitigations and Contingencies Plan

BARITE MUD SERVICES INC.

Buchans Barite Harvest and Processing Operations

MONITORING, MITIGATIONS & CONTINGENCIES PLAN

May 2014

BUCHANS, NEWFOUNDLAND AND LABRADOR

Preface

The following Monitoring, Mitigations and Contingencies Plan for extraction and flotation of barite from the existing tailings deposits at the old Buchans mine in Central Newfoundland has been prepared by Barite Mud Services Inc. (BMSI) in anticipation of re-starting the barite processing facilities in Buchans on behalf of and in agreement with the Buchans Development Corporation (BDC). This re-opening follows a period of operational dormancy since the 2009 closure of the operation by Atlantic Barite Ltd. (ABL), a Pennecon Limited company, which operated from 2005-2009.

This document provides an overview of BMSI's plans to eliminate or control potential risks to the surrounding environment from the proposed barite operations in Buchans, including background information, monitoring outline, mitigation outlines and contingency planning.

Michael O'Brien, B. Eng.
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PROJECT BACKGROUND

The tailings resource at Buchans, located in Tailings Pond 1 (TP1), Tailings Pond 2 (TP2), and Red Indian Lake Buchans River Delta, was accumulated between 1927 and 1984 during ASARCO's Zinc-Copper-Lead Operations in Buchans, Newfoundland and Labrador. Near the end of ASARCO's operation, it was determined the mine tailings contained a significant quantity and grade of Barite ($BaSO_4$). It was realized this resource could be re-processed, concentrated and sold for use as a weighing agent in drilling fluids in the then new and promising Newfoundland and Labrador offshore drilling market. This new industrial activity was attempted in the early 1980s by ASARCO/NL Baroid, but was set back when the oil and gas industry fizzled at that time. The barite resources was re-visited again in 1998 by United Bolero (unsuccessfully) and most recently from 2005-2009 by Atlantic Barite Ltd. (ABL). The Buchans Barite Plant is owned by the Buchans Development Corporation (BDC), a non-profit economic development body, and has the capacity to produce 10,000 to 15,000 tonnes of Barite per year with an expected minimum mine life of 15 years.

PROCESS OVERVIEW

The Operation uses a dredging system to remove the tailings solids from TP1. Extracted tailings are slurrified and pumped to a cyclone tower, where it is separated by particle size to concentrate the finer material (<75 µm) for pumping to the mill. Once pumped to the mill, it is thickened in a thickener. From the thickener, it is pumped to a conditioner where the material is conditioned with reagents for flotation. The flotation first removes sulphide metal constituents, then barite is floated and concentrated, thickened in a product thickener. From here it is pumped to a drum filter, to make a ~7-9% moisture filtercake, which can be stored as a filtercake, but is primarily sent to a drier to remove all moisture.

Upon removal of the sulphide metal constituents at flotation, BMSI intends to not return this to tailings as previously operated. We feel this will greatly improve our environmental impact, and possibly contribute to the economic viability of the operation. BMSI intends to isolate the sulphides and keep as a filtercake in a safe storage area within the mill building, developing its plan to separate into three different concentrates: Lead, Copper and Zinc.

REVIEW OF EXISTING DATA

Since the closure of the Buchans Mine in 1984, and until Government expropriation of the mine area in 2008, the original mine/mill owner(s) (ASARCO/ Abitibi) maintained a presence to monitor and mitigate the impacts of its operations at Buchans, focusing mainly on the tailings management areas and the effect of discharging water on the local environment.

ASARCO's final General Manager for their Buchans Unit, Mr. George N. Neary, remained after closure of the operation as a consultant and managed these monitoring and mitigation activities from 1984 until his passing in 2005. After that, Buchans Enterprises Ltd. continued these efforts, and stored all information regarding the existing impacts of the ASARCO operation and the monitoring and mitigations activities to date.

Buchans Enterprises Ltd. has made all of the information regarding these activities available to BMSI for the purposes of best minimizing any additional impacts to the area with reactivation of the Barite Operation. (Paul O'Brien, P. Eng., Owner/Manager Buchans Enterprises Ltd., 2013).

Records of official correspondence between Buchans Enterprises Ltd. and ASARCO/Abitibi Manager Mr. Neary confirm a number of important facts:

- "The Buchans ore contained only ~4% Pyrite, making it negligibly acid generating as compared to most sulphide ores." – George N. Neary, 1998, correspondence to Buchans Enterprises Ltd.
- "The water in TP1 historically has a minimum pH of 6.6 – 6.8. This is higher than the natural ponds in the area. These ponds are much more acidic (pH 5.0-5.5) because most of the water collected in these ponds comes from surrounding bogs that are acidic." – George N. Neary, 1998, correspondence to Buchans Enterprises Ltd.

- "Since there is very little acid generation from the tailings, and the pH is very close to neutral, the water in the pond has a lead content of less than 100 PPB, the copper is also insignificant, only Zinc is of concern for allowable discharge quantities from TP1. Keeping turbidity down addresses this almost completely, when done properly." George N. Neary, 1998, correspondence to Buchans Enterprises Ltd.

- "The water discharging from TP1 historically does not pass Bioassay testing (LC_{50} 96 hrs historical average), *in order to pass the bioassay test the water must be diluted by adding approximately 1/3 more water to the discharge."* George N. Neary, 1998, correspondence to Buchans Enterprises Ltd.

This provides highly relevant insight to mitigating and monitoring the potential impact of TP1 discharge. Since Zinc is the primary significant parameter of concern as the pond historically and currently exists, the primary focus of BMSI's monitoring, mitigations and contingencies will be to proactively address and eliminate or control this concern, as well as address any potential TSS and Lead increases as a result of BMSI's plans to mine and re-deposit tailings back into TP1.

As a matter of perspective, examination of the historical data is important, focusing on Zinc and TSS as being the primary background existing condition at TP1, is a starting point for eliminating additional impact from operating here.

Time series data for flow and total zinc (T-Zn) concentration at the TP1 discharge were monitored by ASARCO and later examined by Buchans Enterprises Ltd. to assess past trends in water quality and to assess the controls governing total zinc concentrations and loadings in TP1 discharges. Specific objectives of examining this data were to:

i) Delineate effects (if any) to water quality from previous operations in TP1; and

ii) Use the data to aid in the development of mitigations, monitoring and contingency objectives for on-going barite operations.

ZINC CHARACTERISTICS

Total Zinc (T-Zn) levels in TP1 effluents encompass both dissolved and particulate fractions, the dissolved fraction being considered the more toxic fraction, while particulate fractions are relatively innocuous. Dissolved Zn Values are indicative of metal leaching processes that will be associated with remobilization of Zn within the pond environment (dissolution of tailings solids), as well as dissolved loadings derived from other sources beyond the pond boundaries (via groundwater and/or surface water inputs). In contrast, particulate Zn levels are primarily associated with suspended sediments resulting from disturbance of bottom substrates, e.g., wind-driven re-suspension, dredging operations, etc., as well as overland erosion of sub-aerial tailings (precipitation events).

HISTORICAL ZINC LEVELS IN TAILINGS POND 1

Figure 1 shows T-Zn and flow values over the period 1988-2007 inclusive. As can be seen from the graph, T-Zn concentrations show both short-term (seasonal) and longer-term (inter-annual) trends over the period of record. Seasonal minima are observed between April and May of each year. These observations can be explained by a high proportion of lower salinity melt waters at the pond surface during these times. With regards to inter-annual trends, there are several noticeable features. Between 1988 and the end of 1998, mean annual T-Zn levels remain relatively constant (mean T-Zn = 1,600 ppb). Over the period 1999 to 2000, T-Zn values exhibit an increase, with mean annual values for 1999 and 2000 increasing to 2,800 ppb and 3,600 ppb, respectively.

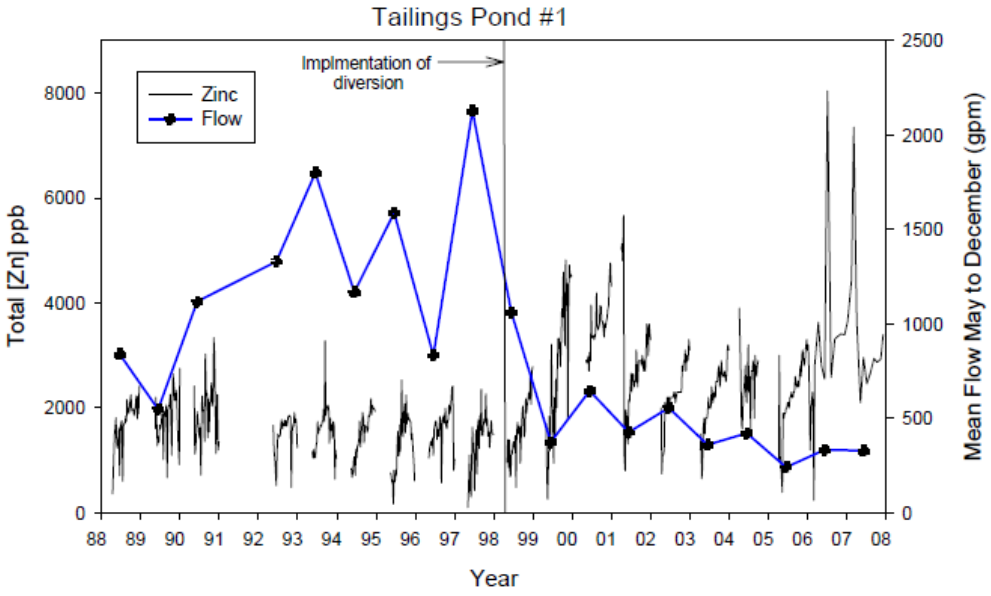

Figure 1. Time series profiles of total zinc and mean annual flow (May to December) for Tailings Pond 1 for period January 1988 to December 2007.

There are two likely reasons for the rise in T-Zn concentration in 1999. First, in 1998 the amount of freshwater reporting to the pond was reduced through the diversion of a brook that historically flowed into the pond. Comparison of the flows between 1990-98 and 1999-2007 suggest that this diversion resulted in a ~70% reduction in flow to the pond system. This reduction in clean flow would lead to an increase in T-Zn values through a decrease in dilution of pond waters.

Second, the elevated levels in 1999-2000 may be, at least in part, also attributed to intense rain events in early 1999 that resulted in the washout of the spillway from Tailings Pond 1. These rain events, in combination with construction activities associated with the commissioning of the new spillway, likely also contributed to elevated T-Zn levels between 1999 and 2000. It is important to note, however, that despite the increase in T-Zn concentration at the discharge, the decrease in flow actually translated to a decrease in the overall Zn loading being discharged to the receiving environment.

In 2001, T-Zn levels decreased to more constant values. With the exception of two spurious Zn values in 2006 and 2007, values between 2001 and 2008 have remained relatively constant (mean = ~2,500 ppb) (figure 1). Regarding July 2006 and March 2007, it showed elevated T-Zn values of ~8,000 ppb and 7,400 ppb, respectively. These peaks are each defined by only one point, and clearly represent the presence of suspended sediments in the sample. Reasons for the spurious peaks are not clear, but relate to either pond-wide elevations in suspended sediments or the inclusion of sediments re-suspended during sample collection.

Inspection of the T-Zn time series in relation to the periods of ABL operations in TP1 shows that the peaks observed in July 2006 and March 2007 did not coincide with barite operations. The July 2006 peak superficially overlaps with the period of activity in the pond (July to October, 2006). However, the July 3rd water sample was collected immediately prior to ABL activities in TP1 of that year (Paul O'Brien, Buchans Enterprises Ltd.). Collectively, the data demonstrate that previous operations, particularly ABL operations between 2005 and 2008, had a negligible influence on T-Zn values in TP1 discharge.

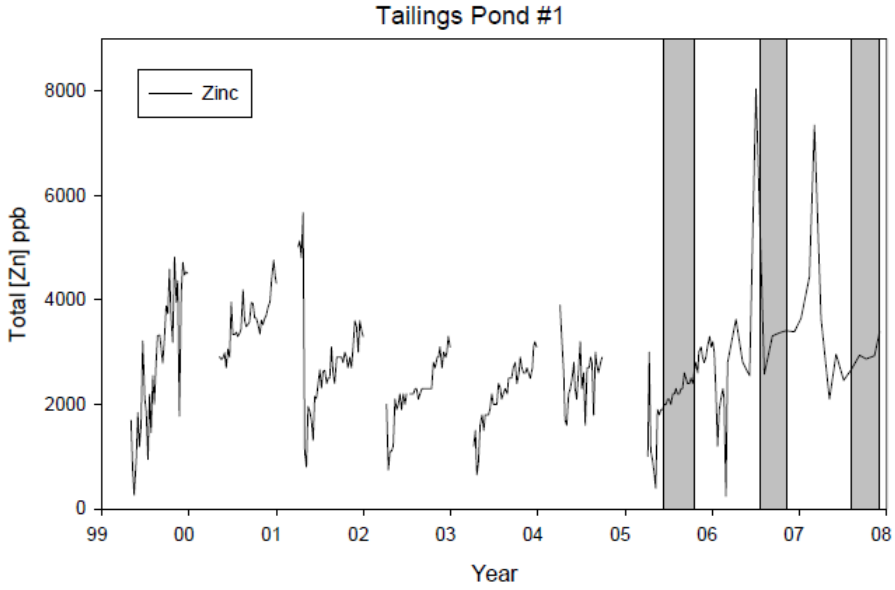

Figure 2. Time series profiles of total zinc for Tailings Pond 1 for period January 1999 to December 2007 showing periods of ABL operations (shaded bars).

ABL Operational Environmental Monitoring (LORAX, ABL 2009, & SNC-Lavalin 2014)

Water Quality

To expand on the brief discussion of water quality previously presented in this section, it is important to note that from June to August 2009, water samples were taken at the spillway of Tailings Pond #1 and analysed for pH, TSS and total metals. During this same period, additional water samples were taken twice within the Tailings Pond #1 mining area, as well as at the outlet of the tailings discharge line (ABL Pond) and the monitoring wells around the ABL pond. A complete analysis of the surface water samples was most recently performed by SNC-Lavalin, by commission of BDC, and the results presented herein.

The following review focuses on the samples taken at the spillway of Tailings Pond #1, the mining area and the tailings discharge line (ABL Pond). A summary of the water quality results for pH, TSS, lead and zinc are presented in the following table. TP1 spillway results for lead (Pb), zinc (Zn) and total suspended solids (TSS) are also shown in the following figure. It should also be noted that the following review has been made using the Metal Mine Effluent Regulations (MMER) and the mining of barite is not considered a metal mine operation and therefore the metal mine regulations are not applicable. However, it is anticipated that the Certificate of Approval for this project would rely on the MMER for allowable concentrations with respect to TSS, Zn, and Pb and the allowable concentrations as per the MMER have been presented in the following table.

				Pb		Zn	
Date	**Sample**	**pH**	**TSS**	**Total**	**Dissolved**	**Total**	**Dissolved**
				ug/L	**ug/L**	**ug/L**	**ug/L**
	MMER – Mthl Avg Conc.	*6 to 9.5*	*15*	*200*		*500*	
	MMER – Max Conc.		*30*	*400*		*1000*	
2009-06-01	TP1	7.25	0	63		2400	
2009-06-08	TP1	7.26	0	250		2800	
2009-06-16	TP1	7.3	0	280		2500	
2009-06-22	TP1	7.29	12	190	95	2600	2500
2009-06-29	TP1	7.07	8	260		2400	
2009-07-06	TP1	7.21	2	230		2500	
2009-07-15	TP1	7.48	2	200	110	1900	2000
2009-07-20	TP1	7.58	0	110		2000	
2009-07-28	TP1	7.39	1	190		2100	
2009-08-03	TP1	7.38	2	190		2100	
2009-06-22	Mining Area	7.34	10	180	120	2500	2400
2009-07-15	Mining Area	7.4	24	370	99	2000	1800
2009-06-22	Tailings Line Discharge (ABL Pond)	7.63	55	240	57	510	160
2009-07-15	Tailings Line Discharge (ABL Pond)	7.82	150	1200	25	2700	62

Table 1 – Data from ABL Operational Observations 2009

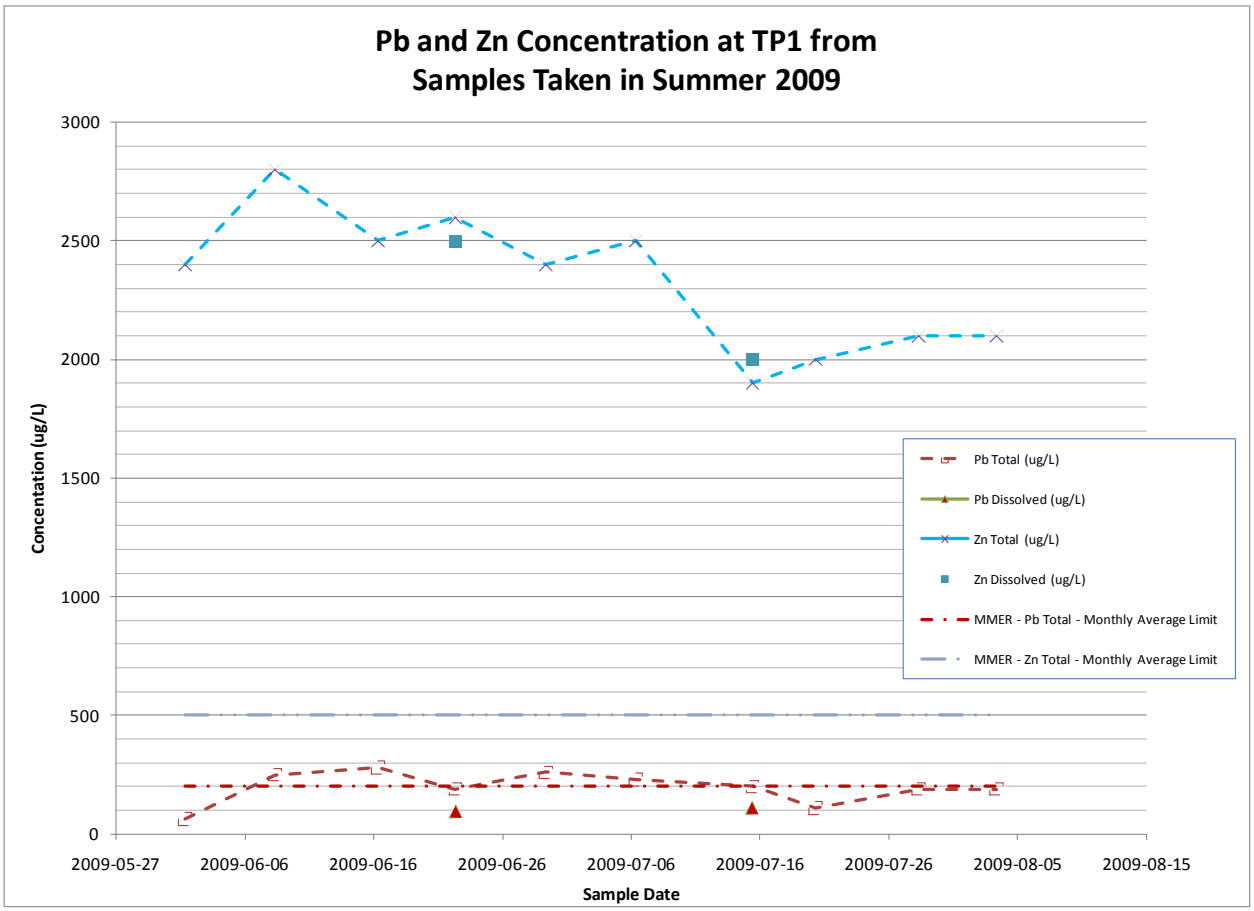

Figure 3 – Pb and Zn Concentrations at TP1 Summer 2009

Observations at TP1, ABL Tailings Discharge Pipe and Dredging/Mining Area

Based on the results obtained from the water samples taken at the spillway of TP1, the following observations can be made:

1. pH and TSS concentration were below the Metal Mining Effluent Regulations (MMER) for the monthly average discharge criteria of these parameters.

2. Pb total concentrations were slightly above (June) and below (July) the MMER monthly average discharge criteria, but were below the maximum concentration for all samples. The dissolved fractions for all samples, where applicable, were below the monthly discharge criteria.

3. Zn total concentrations were above the MMER monthly average discharge criteria for both months (June/July) as well as the maximum discharge criteria. The dissolved concentrations for Zn were shown to be close to the total concentration values. This indicates that most of the Zn was present in the discharge water as a dissolved element.

The above observations indicate that total lead concentrations are borderline with respect to their monthly average concentrations (June/July) and the discharge criteria and it should be possible to lower the total lead concentration by reducing the amount of suspended solids reaching the Tailings Pond #1 spillway.

The exceedances associated with the total zinc concentration present at the spillway of Tailings Pond #1 are due to the dissolved fraction, indicating that controlling the amount of suspended solids reaching the spillway will not help much with respect to decreasing the total concentration.

The observations also indicate that there are currently water quality issues, particularly with respect to zinc that are independent of any future mining that may take place in the north-eastern portion of TP1.

When comparing the results of the water samples taken at the Tailings Pond #1 spillway and the mining area, the following observations can be made:

1. TSS was higher in the mining area than at the Tailings Pond #1 spillway. This is to be expected since dredging was taking place in that area. However, the increase in the TSS concentration in the mining area doesn't appear to increase the TSS concentration measured at the Tailings Pond #1 spillway.

2. Total lead concentration for one of the samples was notably higher in the mining area. This was probably due to the higher TSS in the mining area. However, the increase in the total lead concentration in the mining area doesn't appear to increase the total lead concentration measured at the Tailings Pond #1 spillway. The dissolved lead concentrations at the Tailings Pond #1 spillway and the mining area were very similar.

3. The total and dissolved zinc concentrations at the Tailings Pond #1 spillway and the mining area were very similar.

According to these results, the dredging operation in the mining area does not seem to cause an increase in total or dissolved lead and zinc concentrations measured at the Tailings Pond #1 spillway. For instance, the values (total and dissolved) for zinc within the mining area remain comparable to the levels measured at the Tailings Pond #1 spillway during the sampling period. Also, the values for dissolved lead remain similar to the levels measured at the Tailings Pond #1 spillway and the values for total lead were either similar or lower at the Tailings Pond #1 spillway compared to the mining area for the sampling period.

When comparing the results of the water samples taken at the Tailings Pond #1 spillway and the water samples taken at the outlet of the tailings discharge line (ABL Pond), the following observations can be made:

1. TSS was higher at the tailings discharge line (ABL Pond) than at the Tailings Pond #1 spillway.

2. On average the total lead concentration was higher at the outlet of the tailings discharge line (ABL Pond) compared to the Tailings Pond #1 spillway.

3. The total lead present at the outlet of the tailings discharge line (ABL Pond) was present mostly as suspended solids, i.e., more than 75%.

4. On average the total zinc concentration was higher at the Tailings Pond #1 spillway compared to the outlet of the tailings discharge line (ABL Pond).

5. The total zinc present at the outlet of the tailings discharge line (ABL Pond) was present mostly as suspended solids, i.e., more than 68%.

Based on these results, it is expected that as long as the suspended solids associated with future tailings being discharged into Tailings Pond #1 are afforded sufficient residence time to allow them to settle in the tailings pond, then the total zinc concentration would not be expected to show a large increase at the Tailings Pond #1 spillway compared to background levels, although some increase may be anticipated.

With respect to the total concentration of lead, allowing the suspended solids associated with the future tailings to settle within Tailings Pond #1 will definitely help to control the total concentration that will be seen at the Tailings Pond #1 spillway. However, with respect to background levels at the Tailings Pond #1 spillway, there may be an increase in total lead concentration depending on how much of the suspended fraction is removed by the turbidity barriers and how much the dissolved fraction within Tailings Pond #1 increases due to the input of dissolved lead coming from the processed tailings.

The parameters of concern with regards to any future effluent discharged from the Tailings Pond #1 spillway include Total Suspended Solids (TSS) concentration, total and dissolved lead concentrations, and total and dissolved zinc concentrations.

To ensure that the TSS continues to remain below the MMER discharge criterion for this parameter, there are several measures that can be carried out. First of all, it will be important to discharge the tailings as far as possible from the Tailings Pond #1 spillway. The tailings should be deposited in such a way as to ensure that they do not accumulate near the spillway. As previously mentioned, the installation of turbidity barriers upstream of the spillway would help to form a polishing area and ensure that tailings do not accumulate close to the spillway. By controlling the TSS at the spillway, the concentration of TSS that gets released into the environment, as well as lead and zinc concentrations that are mainly associated with suspended solids should be greatly reduced.

Most of the zinc measured at the Tailings Pond #1 spillway is present as a dissolved element and there may be an increase in the dissolved concentration at the spillway due to the input of processed tailings into Tailings Pond #1. The magnitude of the increase is not known at this time, but any increase is expected to be small with respect to background levels measured at the spillway sampling location. The installation of turbidity barriers should successfully mitigate any increases in total zinc due to increased TSS, however, the turbidity barriers will not help to lower the dissolved concentration. To remove the zinc from the water, it has to be precipitated out by increasing the effluent water pH to 9.5 with lime of sodium hydroxide and allowing the zinc hydroxide to precipitate and settle out of the water prior to discharge. The pH at the treated effluent should always be below 9.5 in order to meet the MMER guidelines for this parameter.

The water currently discharging from the Tailings Pond #1 spillway does not meet MMER, therefore it is recommended that once the processed tailings start to be deposited into Tailings Pond #1, the water at the spillway should be carefully monitored in order to identify any deterioration in water quality with respect to total zinc background levels. If an increase in total zinc, with respect to background levels, is measured, then the relative contribution of each fraction (dissolved and suspended) needs to be evaluated and additional mitigation measures will need to be put in place. This would be done in consultation with the Pollution Prevention Division of the Department of Natural Resources. It is also anticipated that because the current discharge at the spillway is four to five times the MMER criterion for the monthly average discharge value, the Pollution Prevention Division would need to set a new threshold limit. One possibility might be to limit the discharge concentration for total zinc to within 10% of the background level.

Approximately half of the lead measured at the Tailings Pond #1 spillway seems to be present as a dissolved element. Previous samples have shown that total Pb concentrations were slightly above (June) and below (July) the MMER monthly average discharge criteria and the dissolved fractions for both months were below the monthly discharge criteria. As such, under current conditions, if a turbidity barrier was installed it should be possible to greatly reduce the amount of suspended solids and therefore ensure compliance with the monthly discharge limit. Any suspended sediments associated with the input of processed tailings should also be successfully mitigated with the turbidity barriers, the only unknown is how much the dissolved fraction associated with the processed tailings might increase the background concentration (dissolved) previously measured at the spillway sample location.

If the effect is minimal it may be possible that although there is an increase in the dissolved fraction due to the input of processed tailings, the total lead concentration in the spillway samples may actually decrease due to the effective removal of suspend solids. Because the exact effect that tailings deposition and reducing the TSS via the turbidity barriers will have on the water leaving the spillway is unknown it is recommended that the total lead concentration at the Tailings Pond #1 spillway be carefully monitored to ensure that the monthly averages for total lead are below the MMER discharge criteria. If exceedances are noted then the relative contribution of each fraction (dissolved and suspended) needs to be evaluated and additional mitigation measure will need to be put in place. This would be done in consultation with the Pollution Prevention

Division of the Department of Natural Resources. To remove the dissolved lead from the water, it has to be precipitated out by increasing the effluent water pH to 9.0 to 9.5 with lime of sodium hydroxide and allowing the lead hydroxide to precipitate and settle out of the water prior to discharge. The pH at the treated effluent should always be below 9.5 in order to meet the MMER guidelines for this parameter.

SNC-Lavalin's analysis, as initialized by BDC in March of 2014, was originally completely based upon the new operation sending Sulphide Concentrate back to tails, as Atlantic Barite Ltd. did during last operation. However, in reviewing the process in more detail, SNC-Lavalin stated that if the sulphides are removed, concentrated and separated from the tailings going back to the pond, then it is expected that the total concentration of lead and zinc that will be present in the tailings discharge would be greatly reduced and this, coupled with turbidity barriers for suspended solids and pH control for dissolved solids, would further minimize the potential for an increase in concentration of lead and zinc compared to background levels. SNC recommends that the new operator, i.e., BMSI, should first implement the mitigation measures in TP1 with the assumption that sulphides will be returning in full with the tailings after barite removal, but then if it is found that there is an increase in the total concentration of lead and zinc at the spillway sample location, then the new operator should explore further the process of sulphides removal and capture.

BMSI will go one step further. We will do both. Since separating sulphides is the very first stage of flotation at the barite plant, BMSI will not waste this material nor further increase its environmental footprint by sending it back to TP1. We will concentrate the sulphides and store as a concentrate for sale. This, while also applying all mitigations measures as outlined here, should very significantly reduce the risk of deterioration of TP1 discharge water quality.

HISTORICAL DATA SUMMARY

As objectively demonstrated by the historical data, T-Zn concentrations in TP1 are predominantly related to both historical changes in water balance and events contributing to elevated turbidity at the discharge that occurred prior to dredging activities in the pond. However, BMSI acknowledges that activities associated with dredging operations in TP1 have the potential to increase pond turbidity (dredging and return tailings flow) and therefore can potentially increase T-Zn levels. As a result, BMSI has developed this monitoring, mitigations and contingency plan to address future operations in Tailings Pond 1. These plans include a more stringent water quality monitoring program, including analyses for total and dissolved zinc and lead, and measures to mitigate potential increases in these levels resulting from re-suspension of sediments and dredging activities.

MITIGATIONS PLAN

In keeping with BMSI's commitment to sustainable operations and continuous improvement, the following areas are identified as having the potential to negatively impact the environment, and therefore require implementation of proactive mitigation measures:

i) Dredging Operations

ii) "Rejects" return (tailings feed > 75 µm returned to pond as "oversized"), "Excess Water" return (thickener overflow)
iii) Barite Operational Tailings (tailings with most of Barite removed)
iv) Logistical Operations

Mitigation plans specific to each component are described below. The plan for each component will be reviewed annually to evaluate effectiveness and to ensure timely adjustments are implemented when or if required.

DREDGING OPERATIONS

Increases in total suspended solids (TSS) and turbidity in the water column of Tailings Pond 1 are possible while dredging operations are occurring. To mitigate the potential for elevated TSS, and hence T-Zn in pond discharges, the following measures are recommended:

- The installation of a dual floating boom turbidity system near the outlet of TP1, i.e., the spillway, on the inside of the pond (see figure 5). These Type II DOT turbidity curtains would be installed in parallel, roughly 10 m apart. The approximate required depths in these locations are 1.5 m and 1.0 m, and the lengths are 95 m and 75 m, respectively. The curtain material would be vinyl polyester, which can withstand a water velocity of up to 0.92 m/s. This would be a key factor in maintaining acceptable water quality downstream of TP1. These will be installed prior to any dredging works and will be placed in a manner to enclose the entire spillway, and therefore minimize TSS migration from the working area of TP1 to the discharge of the pond.

- Once dredging operations are finished for the season and the dredge is removed from TP1, the silt curtain will remain in place until TSS levels have returned to pre-dredging levels for the season.

- BMSI recognizes that installation of a silt curtain may affect flow regimes within TP1, i.e., at the dam and the discharge point. A designated Project Environmental Manager will be on site to monitor general activities, including water levels within TP1. Should it be discovered that water is approaching the top of the dam as a result of the silt curtain, the location of the silt curtain will be adjusted to minimize interference and contingency measures outlined in the Contingencies section, e.g., Straw/hay bales in the spillway, will be implemented until the silt curtain is re-established without impairment to water levels.

Figure 4 – TP1 showing spillway and proposed turbidity barrier location at discharge

- Specifically, the Project Environmental Manager will be required to: 1) be on site on a daily basis during dredging operations, 2) oversee collection of water quality samples, and 3) monitor water levels at the dam and discharge on a weekly basis;

- Dredging will be discontinued should it be determined that work is adversely affecting downstream flow and/or water quality, as directed by the Environmental Manager. If dredging is halted, it can only be restarted under instructions from the Environmental Manager.

"REJECTS" RETURN LINE / "EXCESS WATER" RETURN LINE

Oversized materials (> 75 µm) are returned from the cyclone tower back to TP1 via pipeline (see Figure 5 above). Also, "Excess Water" from overflow of feed thickener is pumped back to the pond, which has the potential to contain a small quantity of fine tailings.

The following mitigation methods will be employed to minimize potential environmental impacts resulting from pipeline transfer activities:

- The Environmental Manager will inspect the pipelines regularly. Any spills will be immediately contained and cleaned-up. Leaky pipes will be repaired and/or replaced as necessary.
- Managing turbidity as described above and below will sufficiently mitigate the minute water quality affects by this portion of the operation, as seen in previous operation.

BARITE OPERATIONAL TAILINGS

Once sulphides are separated in the first stage of flotation and filtered out of solution, and the Barite has been removed, separated and concentrated at the Barite Plant, the remainder gangue material is to be pumped and deposited back at TP1, as per the recommendations of SNC-Lavalin in their ***Buchans Tailings Disposal Options Analysis*** (April 2014) commissioned by BDC. This material is to be pumped as a slurry and deposited under water at the far west part of TP1, where the water is deepest. BMSI acknowledges that this deposition of this material will potentially affect the discharge of TP1, and therefore will take proactive measures to significantly minimize the discharge below that of normal (historical) levels of TP1 for TSS and T-Zn values - values which have been identified as the most concerning for this discharge.

The parameters of concern with regard to the effluent discharged at the spillway TP1 are the following:

1. Total suspended solids (TSS) concentration
2. Total lead concentration
3. Total and dissolved zinc concentration.

As recommended in the SNC Lavalin report, the following steps can be taken to ensure that the TSS continue to remain below the MMER discharge criterion for this parameter:

1) Discharge the tailings as far as possible from the TP1 spillway.
2) Deposit the tails in such a way to ensure it does not accumulate near the spillway TP1.
3) Install a turbidity barrier upstream of the spillway TP1 to form a polishing area and ensure that tailings do not accumulate close to the spillway TP1.

By controlling the TSS at the TP1 spillway, it will help reduce the lead concentrations that are mainly associated with suspended solids.

By controlling the pH, increasing (but not exceeding) 9.5 for water approaching discharge, it will help settle the dissolved portion of zinc, thereby decreasing the total zinc concentrations largely associated with the historical dissolved portion.

Therefore, the following mitigation methods will be employed to minimize potential environmental impacts resulting from pipeline transfer activities:

- A turbidity curtain ***at the site of tailings deposition (away from TP1 discharge)***, similar to the one described above, is the first line of defense against possible increase in turbidity and TSS/T-Zn/T-Pb for TP1 discharge. This can form a polishing area to ensure that tailings do not accumulate close to TP1 spillway.

- The bottom of the silt curtain will be in contact with the pond floor and the top will be above the water surface (see figure 6).

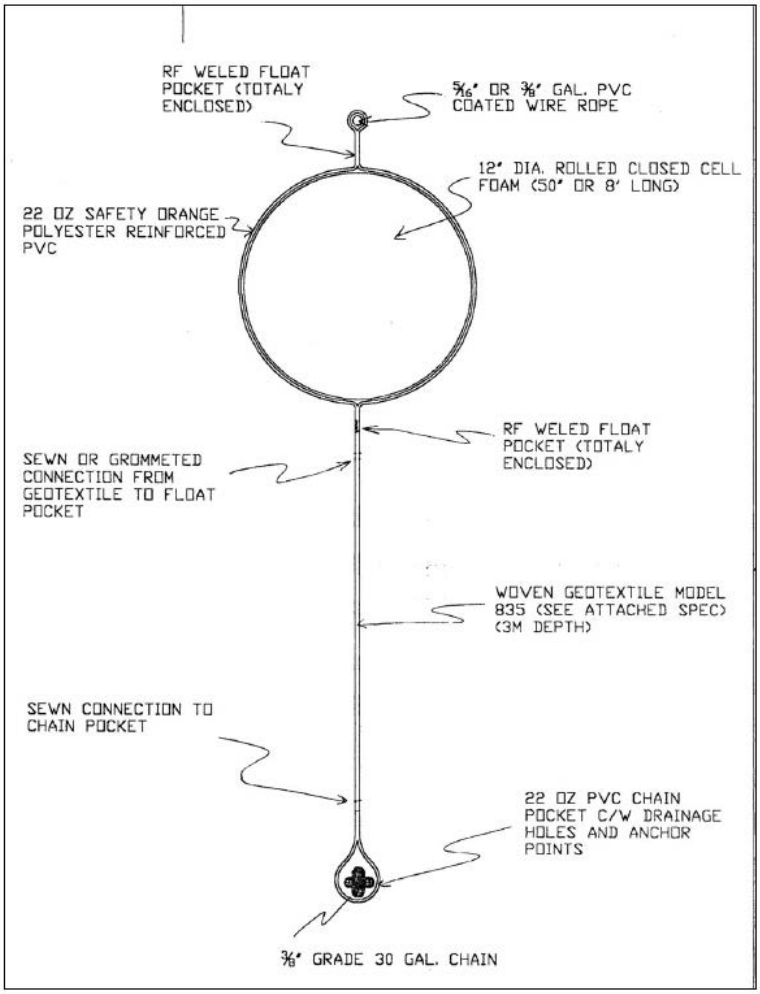

Figure 5 – Typical turbidity barrier

- Additional treatment of the pre-discharge water may also be required in order to take suspended solids, and therefore T-Zn, concentrations down before discharge. Most of the zinc seems present as a dissolved element. To remove the zinc from the water, it has to be precipitated out by increase the effluent water pH to 9.5 with lime of sodium hydroxide and allowing the zinc hydroxide to precipitate and settle out of the water prior to discharge. The pH at the treated effluent should always be below 9.5 in order to meet the MMER guidelines for this parameter.

This two-pronged approach for suspended (turbidity curtains) and dissolved (pH control), coupled with the fact that the total zinc and lead concentrations in barite plant tailings is largely suspended and not dissolved, and the fact that the total zinc concentration were known to be higher at TP1 discharge during most recent operation in 2009, and finally the fact that BMSI does not intend to send the separated sulphide con back to the pond, allows for significant comfort that TP1 discharge can and will be managed properly and in an environmentally sound manner, aiming for overall net benefit to the site.

Logistical Operations

Logistical operations have the potential to affect pond water quality. Traffic, in the form of heavy equipment or otherwise, has the potential to disturb exposed sediment or tailings in proximity to the pond. Minimizing traffic and mechanical disturbances to the surface of exposed tailings where possible will decrease the potential for particulate input from outside sources.

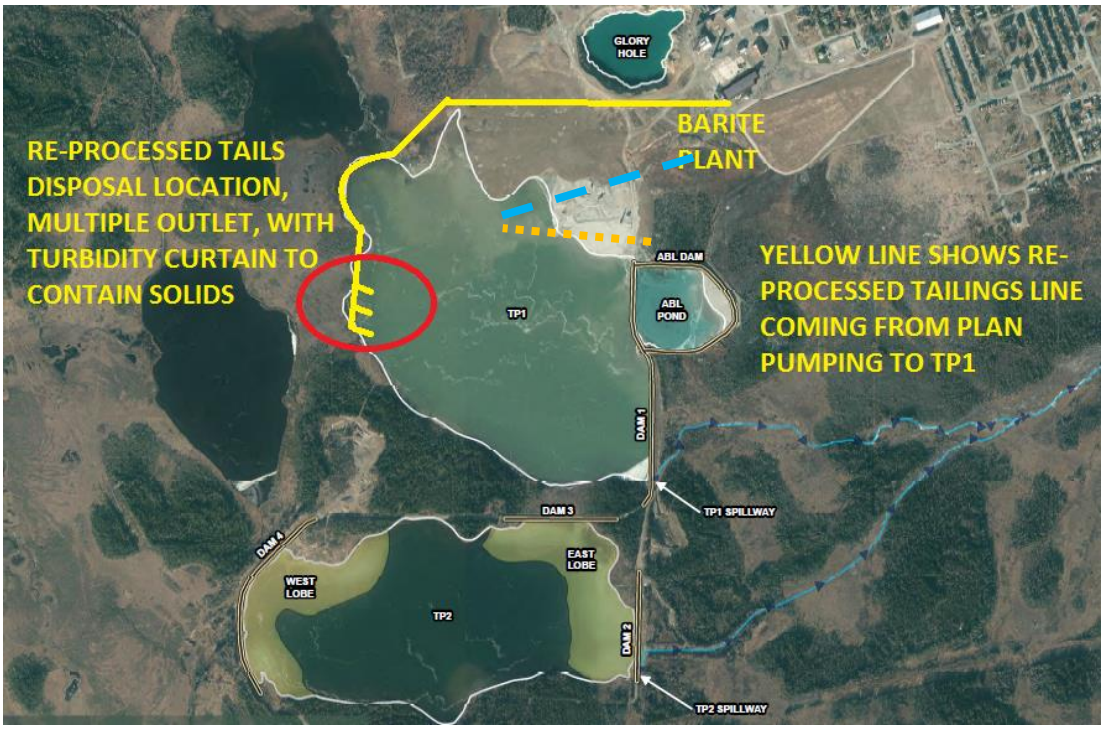

Figure 6 – Approximate locations of "oversize"(orange dashed Line), "Excess Water" (Blue Line) and Mill Tailings Line (Yellow Line)

MONITORING PLAN

The main objective of the water quality monitoring program will be to assess the potential impacts to water quality within the pond and downstream resulting from BMSI's barite operations. This will entail regular water quality monitoring at Tailings Pond 1 and its discharge prior to, during, and after the operational season. Historical data, as well as data collected prior to the start-up of operations, will be used to provide a "baseline" from which to monitor and interpret the effects of barite operations. As well, water quality sampling will be directed towards assessing the effectiveness of proposed mitigation measures.

Water quality monitoring is conducted by analyzing a sample of water to provide information on the concentrations of potential contaminants. Of particular interest to date have been the levels of zinc observed at the discharge point of Tailings Pond 1. It is recommended that future water quality samples analyze for both the dissolved and total fractions of heavy metals, and specifically zinc. As outlined previously, T-Zn values in the pond are predicted to be strongly sensitive to the concentration of suspended particles (Zn-bearing tailings). Accordingly, measurements of both T-Zn and TSS/turbidity will provide an effective measure to assess the particle-dependence of Zn concentrations in the pond. However, given that the biological availability, and hence toxicity, of Zn is more strongly dependent on the dissolved fraction, T-Zn values do not provide a robust indicator of potential environmental impact. In order to assess the potential for an increase in Zn toxicity resulting during operations, dissolved measurements of Zn and other trace elements are also collected.

Given potential Pb increases with this activity, T-Pb will also be monitored. Given addition of Lime for pH control, pH will also be monitored.

Once-monthly water quality samples will be collected from the discharge of TP1, if flow permits, as well as inside the silt curtain, i.e., near the tailings extraction area), at the tailings line discharge, and at a selection of ground-water monitoring wells. These samples will be submitted for analysis as per Provincial *Environmental Control Water and Sewage Regulations* (2003) and Federal *Metal Mining Effluent Regulations* (MMER, 2002). Sampling will commence prior to the start of the dredging program and continue for the duration of the dredging program. The full suite of recommended water quality parameters for monthly analysis is shown in Table 1. In addition, Acute Lethality Testing (ALT) will be completed once-monthly at the TP1 discharge, if flow permits, in accordance with the procedures set out in Environment Canada's Reference Method EPS 1/RM/13 (Environment Canada, 2000a). Finally, weekly water quality samples will be collected at the TP1 discharge for a selection of parameters only (arsenic, copper, lead, nickel, zinc, pH, TSS and flow). Mean concentrations and loading of zinc will be calculated monthly.

A key component of the monitoring program will be to assess the potential for increased turbidity in the pond and in pond discharges. In this regard, a portable meter will be used to collect turbidity readings on a daily basis. Turbidity levels will serve as a proxy for the concentration of total suspended solids. Turbidity data will be collected inside and outside the silt curtain and at the discharge point of TP1 prior to any in-pond activities, during the operational season, and after

works are completed. Such data will demonstrate the efficacy of the silt curtain, as well as provide data on the turbidity regime present in the pond outside operational periods. Understanding the turbidity regime is essential for the implementation and maintenance of effective mitigation measures. Samples will be collected, and silt curtains will remain in place, until turbidity levels have returned to pre-operation levels for the season.

Physical Parameters	Total and Dissolved Metals
pH	Aluminum
Total Suspended Solids	Antimony
Total Dissolved Solids	Arsenic
Conductivity	Barium
Turbidity	Beryllium
Hardness (as CaCO3)	Bismuth
Flow	Boron
Cations	Cadmium
Calcium	Chromium
Magnesium	Cobalt
Potassium	Copper
Sodium	Iron
Anions	Lead
Total Alkalinity (CaCO3)	Manganese
Bromide	Mercury
Chloride	Molybdenum
Fluoride	Nickel
Sulphate	Selenium
Nutrients	Silver
Ammonia as N	Strontium
Nitrate as N	Thallium
Nitrite as N	Tin
Ortho-Phosphate	Titanium
Total Phosphorus	Uranium
Total Cyanide	Vanadium
WAD Cyanide	Zinc

Table 2. Parameter List for Water Quality Monitoring Program at Tailings Pond 1

CONTINGENCY PLAN

A series of contingencies have been investigated for possible implementation should the water quality monitoring program detect a negative impact in the discharge from Tailings Pond 1 secondary to BMSI-related activities.

For the purposes of this discussion, a negative impact is defined as a sustained decrease in water quality over the well-established baseline through historical data. These contingencies are outlined below, and will be considered for implementation as required:

i) To mitigate increased activity from previous operation due to deposition of barite-less tailings into TP1, additional turbidity barriers can be implemented

   a. Straw Wattles – Before and After the primary turbidity curtain, placing Straw Wattle (surface coil from Wheat Straw encased in Natural Jute Netting) in

the area between the primary turbidity curtain and the spillway, as well as in the area of the discharge of the barite-less tailings, will serve to soak suspended solids from the water before it has a chance to discharge to the environment

b. *Hay Bales on Spillway* – Beyond the primary turbidity curtain and the secondary Straw Wattles, Hay/Straw bales placed on the spillway will be a final barrier for turbidity and will act to filter out suspended solids from the discharge.

ii) **Flow Adjustment.** Adjusting the flow at operational inputs, as well as diluting the pre-discharge area with clean water, will serve to decrease potential pond disturbance and increase flow at the discharge, respectively. The latter in an effort to dilute the concentrations of TSS / T-Zn, as recommended by ASARCO Engineer, Mr. George N. Neary, who stated that increasing the flow by only 1/3 is expected to have the desired effect of diluting the discharge to below maximum allowances for T-Zn/TSS concentrations for discharge.

iii) **Water Treatment.** Treating the water before it discharges, for pH control and possibly other acceptable treatment additives will be explored, at full engineering costs and implementation of solution to BMSI.

The above measures may be used singularly or in combination, depending on contingency requirements.

TOXIC OR HAZARDOUS MATERIAL SPILL CONTINGENCY PLAN

In addition to the potential of water discharge quality and contingency planning for that, this section will outline clearly the actions to be taken in the event of a spill of a toxic or hazardous material.

i) Discovery: Notification and Alerting

Upon discovery of a spill of hazardous material, the employee shall first and foremost ensure the protection of the safety of himself and his fellow workers, by notifying all personnel of the occurrence via radio alert. All employees shall be trained to alert the rest of the personnel by stating the following over the radio: “Attention, Attention, Attention: There has been a spill __(LOCATION)___, please avoid this area, approach with extreme caution.”

ii) Eliminate further risks

The employee shall then, provided that it is safe to do so, call another fellow employee toe help and establish barriers for safe distance from the spill, using bright yellow reflective tape, so that other personnel shall not enter this area by mistake. The employees must now ensure there are no ignition sources nearby, as long as safe to do so.

iii) ***Activate Spill Response Team***

As designated on each shift, the Spill Response Team will be called to handle clean-up of the spill

Together, they will concur and identify what the spill material is. They will Identify the source, and stop the spill at the source as long as it is safe to do so.

The team must then obtain Material Safety Data Sheet (to be made available by BMSI at storage and mixing areas of all reagents and hazardous materials), and safely determine the most effective manner for containing and cleaning up this spill.

Spill kits are to be available in each and every storage area, as well as corridors in which the materials will be transported through within the mill building and storage building(s).

iv) Reporting Procedures

BMSI will post, in every storage area and mixing areas, as well as within Spill Kits, the telephone numbers of company officials, off-site response contractors, and government officials who can provide technical assistance.

Also within these postings will be the phone number for reporting a spill to the Department of Environment and Conservation.

If there is any possibility that the public can be affected by the spill, clear signage will be posted, and Town of Buchans Town Clerk will be notified so that residents can be formally informed, as well as the Buchans Fire Department and A.M. Guy Memorial Hospital, for their important input on how to prevent any further risk. If necessary, community members will be made aware via community channel notification and official Town of Buchans Website.

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