AGNICO EAGLE

MELIADINE GOLD PROJECT

Water Management Plan

AUGUST 2019
VERSION 7
6513-MPS-11

EXECUTIVE SUMMARY (ENGLISH)

Agnico Eagle Mines Limited (Agnico Eagle) is developing the Meliadine Gold Project (the Mine), located approximately 25 kilometres (km) north of Rankin Inlet, and 80 km southwest of Chesterfield Inlet in the Kivalliq Region of Nunavut. The Mine Plan proposes open pit and underground mining methods for the development of the Tiriganiaq gold deposit, with two open pits (Tiriganiaq Pit 1 and Tiriganiaq Pit 2) and one Underground Mine.

The water management objectives are to minimize potential impacts to the quantity and quality of surface water at the Mine. Water management structures (surface ponds, water retention dikes/berms, water diversion channels and culverts) are in place and will be constructed as needed to contain and manage the contact water from the areas affected by the Mine or mining activities. The major water management infrastructure includes: water containment ponds, water retention dikes, berms, channels, a potable Water Treatment Plant (WTP), a Sewage Treatment Plant (STP), a Saline Water Treatment Plant (SWTP), a Reverse Osmosis (RO) Plant, and an Effluent Water Treatment Plant (EWTP).

During mine Construction and Operations, contact water originating from affected areas on surface will be intercepted, diverted and collected within the various containment ponds. The collected water at the Mine will be eventually pumped and stored in Containment Pond 1 (CP1), where the contact water will be treated by the EWTP for removal of Total Suspended Solids (TSS) prior to discharge to the outside environment or as make-up water by the Process Plant. Contact water from the Underground Mine will be collected in underground storage stopes and sumps. Some water from Underground will be reused for underground operations. In addition, due to high saline content, some underground mine water will be stored for treatment at the SWTP or discharged to sea.

The long-term, post-closure water quality in the containment ponds and in the flooded open pit lakes will meet Metal and Diamond Mining Effluent Regulations (MDMER) , Canadian Council of Ministers of the Environment Water Quality Guidelines (CCME-WQG) for the protection of aquatic life and/or the Site Specific Water Quality Objectives (SSWQO's) developed for the Mine.

During mine closure, the water management infrastructure on site will remain in place until mine closure activities are completed and monitoring demonstrates that the water quality is acceptable for environmental discharge without treatment.

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ᐊᒡᓃᑰ ᐋᒍ ᐅᔭᕋᒃᑕᕆᐊᒃᑯᑦ (ᐊᒡᓃᑰᒃᑯᑦ) ᑕᓯᕐᔪᐊᕐᒥᑦ ᐅᔭᕋᒃᑕᕆᐊᓕᐅᖅᐸᓪᓕᐊᔪᑦ (ᐅᔭᕋᒃᑕᕆᐊᖅ), 25 ᑭᓛᒥᑕᓂᒃ ᐅᖓᓯᒃᑎᒋᔪᖅ ᐅᐊᖕᓇᖓᓂᑦ ᑲᖏᖅᖠᓂᐅᑉ, ᐊᒻᒪᓗ 80 ᑭᓛᒥᑕᓂᒃ ᐅᖓᓯᒃᑎᒋᑉᓗᓂ ᓂᒡᒋᐊᓂᑦ ᐱᖓᓐᓇᖅᐸᓯᐊᓂᑦ ᐃᒡᓗᓕᑦᕌᑉ ᕿᕙᓪᓕᕐᒥᑦ ᓄᓇᕗᒻᒥᑦ. ᐅᔭᕋᒃᑕᕆᐊᕐᒧᑦ ᐸᕐᓇᐅᑎ ᐅᔭᕋᒃᑕᕐᓂᕐᒧᑦ ᐱᓕᕆᐊᖃᕈᒪᔪᑦ ᓄᓇᒥᑦ ᐅᒃᑯᐃᖓᔪᒥᑦ ᐊᒻᒪᓗ ᐊᑐᖅᑕᐅᓂᐊᖅᑐᓂᒃ ᐱᕙᓪᓕᐊᓗᒍ ᑎᑎᕋᓂᐊᖅ ᒨᓗᑕᓕᒃ, ᒪᕐᑮᖕᓂᒃ ᓄᓇᒥᑦ ᐅᒃᑯᐃᖓᔪᓂᑦ (ᑎᑎᕋᓂᐊᖅ 1 ᐊᒻᒪᓗ ᑎᑎᕋᓂᐊᖅ 2) ᐊᒻᒪᓗ ᐊᑕᐅᓯᖅ ᓄᓇᐅᑉ ᐃᓗᐊᓂᑦ ᐅᔭᕋᒃᑕᕐᓂᖅ.

ᐃᒪᕐᒥᒃ ᐊᐅᓚᑦᑎᓂᕐᒧᑦ ᐸᓕᕆᐊᖑᔪᒪᔪᑦ ᒥᑭᓪᓕᒃᑰᖅᑎᓪᓗᒋᑦ ᐊᒃᑐᖅᓯᓂᐅᔪᖕᓇᖅᑐᑦ ᐃᒪᖃᖅᑎᒋᓂᖓ ᐊᒻᒪᓗ ᖃᓄᐃᓐᓂᖓᑕ ᖄᖓᓃᑦᑐᑦ ᐃᒪᐃᑦ ᐅᔭᕋᒃᑕᕆᐊᕐᒥᑦ. ᐃᒪᕐᒥᒃ ᐊᐅᓚᑦᑎᓂᕐᒧᑦ ᐋᖅᑭᐅᒪᔪᑦ (ᓄᓇᐅᑉ ᖄᖓᓂᑦ ᐃᒪᖅᓯᐃᑦ, ᐃᒪᕐᒥᒃ ᐸᐸᑦᑎᓂᕐᒧᑦ ᐊᕙᓗᐃᑦ, ᐃᒪᕐᒥᒃ ᓴᖑᑎᑦᑎᓂᕐᒧᑦ ᓱᐸᓗᐃᑦ ᐊᒻᒪᓗ ᓱᐸᓗᓖᑦ) ᑕᐃᒪᐅᔪᑦ ᐊᒻᒪᓗ ᓴᓇᔭᐅᓂᐊᖅᑐᑦ ᐱᔭᕆᐊᖃᕐᒪᑕ ᓄᖅᑲᖓᑎᓪᓗᒍ ᐊᒻᒪᓗ ᐊᐅᓚᑦᑎᓂᕐᒧᑦ ᐊᒃᑐᖅᑕᐅᔪᑦ ᐃᒪᐃᑦ ᐃᓂᐅᔪᓂᑦ ᐊᒃᑐᖅᑕᐅᓯᒪᔪᓂᑦ ᐅᔭᕋᒃᑕᕆᐊᕐᒥᑦ ᐅᕝᕙᓘᓐᓃᑦ ᐅᔭᕋᒃᑕᖅᑎᓪᓗᒋᑦ. ᐊᖏᓛᖑᔪᑦ ᐃᒪᕐᒥᒃ ᐊᐅᓚᑦᑎᓂᕐᒧᑦ ᐱᕐᑯᑎᒋᔭᐅᔪᓂᑦ ᐃᓚᐅᔪᑦ: ᐃᒪᕐᒥᒃ ᓄᖅᑲᖓᑎᑦᑎᓂᕐᒧᑦ ᑕᓯᕋᔭᐃᑦ, ᐃᒪᕐᒥᒃ ᐸᐸᑦᑎᓂᕐᒧᑦ ᐊᕙᓗᐃᑦ, ᓱᐸᓗᐃᑦ, ᐊᒻᒪᓗ ᐃᒪᓕᕆᔾᔪᑎ (WTP), ᕿᕐᕕᖕᒥᙱᖅᑐᓕᕆᔾᔪᑎ (STP), ᑕᕆᐅᓕᖕᒥᒃ ᐃᒪᓕᕆᔾᔪᑎ, ᐃᒪᑦᑎᐊᕙᓕᐅᕐᕕᒃ (SWTP), ᐃᒪᑦᑎᐊᕙᓕᐅᕆᕝᕕᒃ, ᐊᒻᒪᓗ ᐃᒪᕐᒥᒃ ᑯᕕᔪᓕᕆᕝᕕᒃ (EWTP).

ᐅᔭᕋᒃᑕᕆᐊᕐᒥᑦ ᓴᓇᕙᓪᓕᐊᑎᓪᓗᒋᑦ ᐊᒻᒪᓗ ᐊᐅᓚᖅᑎᑦᑎᓂᐅᑎᓪᓗᒍ, ᐊᑐᖅᑕᐅᔪᖅ ᐃᒪᖅ ᐊᒃᑐᖅᑕᐅᓯᒪᔪᓂᑦ ᐃᓂᐅᔪᓂᑦ ᖃᖓᓂᑦ ᓄᖅᑲᖅᑎᑕᐅᓂᐊᖅᑐᑦ, ᓴᖑᑎᑕᐅᓗᑎᒃ ᐊᒻᒪᓗ ᑲᑎᑕᐅᓗᑎᒃ ᐊᔾᔨᒌᙵᒋᑦᑐᓄᑦ ᑕᓯᕋᔭᖓᓄᑦ. ᑲᑎᑕᐅᔪᑦ ᐃᒪᖅ ᐅᔭᕋᒃᑕᕆᐊᕐᒥᑦ ᑯᕕᑎᑕᐅᕙᑦᑕᕐᓗᓂ ᑐᖅᑯᖅᑕᐅᓗᓂᓗ ᑕᓯᕋᔭᒃ 1-ᒧᑦ (CP1), ᐊᑐᖅᑕᐅᔪᖅ ᐃᒪᖅ ᐱᓕᕆᐊᖑᓂᐊᕐᓗᓂ EWTP-ᒧᑦ ᐲᕐᓂᐊᕐᓗᒋᑦ ᑲᑎᓯᒪᔪᑦ ᑖᓕᖅᓱᖅᑐᑦ ᓯᑎᔪᐃᑦ (TSS) ᑯᕕᑎᑕᐅᖅᑳᖅᑎᓐᓇᒍ ᓯᓚᒧᑦ ᐅᕝᕙᓘᓐᓃᑦ ᐊᑐᖅᑕᐅᓂᐊᕐᓗᓂ ᐃᒪᖅ ᐱᓕᐅᕆᕝᕕᖕᒥᑦ. ᐊᑐᖅᑕᐅᔪᖅ ᐃᖅ ᓄᓇᐅᑉ ᐃᓗᐊᓂᑦ ᐅᔭᕋᒃᑕᕆᐊᕐᒥᑦ ᑲᑎᑕᐅᓂᐊᖅᑐᖅ ᓄᓇᐅᑉ ᐃᓗᐊᓂᑦ ᑐᖅᑯᖅᓯᓯᒪᕝᕕᖕᓄᑦ ᐊᒻᒪᓗ ᑯᕕᖅᑕᐃᕝᕕᖕᓄᑦ. ᐃᓚᖓ ᐃᒪᖅ ᓄᓇᐅᑉ ᐃᓗᐊᓂᑦ ᐊᑐᖅᑕᐅᒃᑲᓂᕐᓂᐊᖅᑐᖅ ᓄᓇᐅᑉ ᐃᓗᐊᓂᑦ ᐊᐅᓛᖅᑎᑦᑎᓂᕐᓄᑦ. ᐊᒻᒪᓗ, ᑕᕆᐅᖃᓗᐊᕐᓂᕐᒧᑦ, ᐃᓚᖓ ᓄᓇᐅᑉ ᐃᓗᐊᓂᑦ ᐅᔭᕋᒃᑕᕆᐊᕐᒥᑦ ᐃᒪᖅ ᑐᖅᑯᖅᑕᐅᓂᐊᖅᑐᖅ ᐱᓕᕆᐊᖑᓂᐊᕐᓗᓂ SWTP-ᒥᑦ ᐅᕝᕙᓘᓐᓃᑦ ᑯᕕᑎᑕᐅᓗᓂ ᑕᕆᐅᕐᒧᑦ.

ᐊᑯᓂᐅᔪᒥᑦ, ᐅᒃᑯᐊᖅᓯᒪᓕᖅᑎᓪᓗᒍ ᐃᒪᐅᑉ ᖃᓄᐃᓐᓂᖓ ᑐᖅᑯᖅᑕᐅᓯᒪᔪᓂᑦ ᑕᓯᕋᔭᖕᓂᑦ ᐊᒻᒪᓗ ᐃᒥᖅᑐᖅᑕᐅᓯᒪᔪᑦ ᓄᓇᒥᑦ ᐅᒃᑯᐃᖓᔪᒥᑦ ᑕᓯᕐᓄᑦ ᑎᑭᐅᑎᓯᒪᓂᐊᖅᑐᑦ ᓴᕝᕙᖕᓂᒃ ᐊᒻᒪᓗ ᓯᑎᔪᓂᒃ ᐅᔭᕋᕐᓂᒃ ᐅᔭᕋᒃᑕᕆᐊᕐᒥᑦ ᑯᕕᑦᑎᓂᕐᒧᑦ ᒪᓕᒐᕋᓛᓂᒃ (MDMER), ᑲᓇᑕᒥᑦ ᒥᓂᔅᑕᐅᑏᑦ ᑲᑎᒪᔩᑦ ᐊᕐᓂᒥᑦ ᐃᒪᐅᑉ ᖃᓄᐃᓐᓂᖓᓄᑦ ᒪᓕᒃᑕᐅᔫᒃᓴᖏᑦ (CCME-WQG)-ᒥᑦ ᒥᐊᓂᕆᓂᐊᕐᓗᒋᑦ ᐃᒪᕐᒥᐅᑕᐃᑦ ᐊᒻᒪᓗ/ᐅᕝᕙᓘᓐᓃᑦ ᐃᓂᐅᔫᒥᑦ ᐱᔾᔪᑎᖃᖅᑐᒥᒃ ᐃᒪᕐᒧᑦ ᐸᓕᕆᐊᒃᓴᐃᑦ (SSWQO) ᐱᙳᖅᑎᑕᐅᓯᒪᔪᑦ ᐅᔭᕋᒃᑕᕆᐊᕐᒧᑦ.

ᐅᔭᕋᒃᑕᕆᐊᖅ ᐅᒃᑯᐊᖅᐸᓪᓕᐊᑎᓪᓗᒍ, ᐃᒪᕐᒥᒃ ᐊᐅᓚᑦᑎᓂᕐᒧᑦ ᐱᕐᑯᐃᑦ ᐃᓂᐅᔫᓂᐊᖅᑐᑦ ᑭᓯᐊᓂ ᐅᔭᕋᒃᑕᕆᐊᖅ ᐅᒃᑯᐊᖅᑕᐅᕙᓪᓕᐊᓂᖓ ᐱᐊᓂᒃᐸᑕ ᐊᒻᒪᓗ ᖃᐅᔨᒋᐊᖃᑦᑕᕐᓂᒃᑯᑦ ᖃᐅᔨᓇᖅᓯᒃᐸᑦ ᐃᒪᐅᑉ ᖃᓄᐃᓐᓂᖓ ᓈᒻᒪᓕᕐᓂᖓᓄᑦ ᐊᕙᑎᒧᑦ ᑯᕕᑎᓐᓂᐊᕐᓗᒍ ᐱᓕᕆᐊᖑᙱᓪᓗᓂ.

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DOCUMENT CONTROL

Version	Date	Section	Page	Revision	Author
6	March 2019	All	All	Update is to fulfill annual review requirement (NWB)	Environment Department
		1	4	Update to Mine Development Plan information	
		3.1	8-12	Updated Version 6 changes	
		3.2	11-12	Updated existing water management control structures	
		3.3	12-14	Revised structure design semantics; corrections to culvert design; updated CP3, CP4 design parameters and naming convention; removed incorrect artifact pertaining to culvert 1 flow handling	
		3.6	15	Addition of SP3; updates to SP2 design	
		3.8, 3.9	17-21	Included as-built parameter values; updated berm and dike naming convention, thermistor information	
		3.11	21-22	Updated freshwater intake design information; updates to SWTP system; RO management; EWTP monitoring; removed incorrect information pertaining to Freshwater intake	
		4.1, 4.2	25-31	Updated management of saline discharge to sea; revised information proposed in initial design	
		4.6	35	Updated key management activities schedule to include discharge to sea; updated regarding underground inflow management; revised haul road management; revised wash bay management; updated process water quantities	
		6.3	37	Updated impacted waterbodies status	
		7	40	Revised semantics regarding flow paths	
		Figure		Included additional information regarding July 23rd exceedance	
		1.2		Updated Layout to most recent General Mine Site Plan	
		Figure 6.1, 6.2		Specified plan layouts are from feasibility level study	
		Figure 7.1a		Updated Layout with monitoring stations to most recent General Mine Site Plan	
7	August 2019	3.9.4	20	Updated EWTP trigger limit to account for variance introduced by TSS-turbidity correlation strength	
		4.1	26	Updated Key Activities (Table 10) to reflect changes to H19/H20 dewatering schedule	
		4.1.1	27-28	Revised H19/H20 dewatering plan with requirements for advancement in dewatering	

		schedule; Updated dewatering schedule (Table 11)

ACRONYMS

Agnico Eagle	Agnico Eagle Mines Limited
AWAR	All Weather Access Road
CCME-WQG	Canadian Council of Ministers of the Environment Water Quality Guidelines
CIRNAC	Crown-Indigenous Relations and Northern Affairs Canada
CP	Containment Pond
ECCC	Environment and Climate Change Canada
EMPP	Environmental Management and Protection Plan
EWTP	Effluent Water Treatment Plant
GWMP	Groundwater Management Plan
IDF	Inflow Design Flood
Licence	Type A Water Licence 2AM-MEL1631
MDMER	Metal and Diamond Mining Effluent Regulations
NWB	Nunavut Water Board
Mine	Meliadine Gold Project
SD	Support Document
SSWQO	Site Specific Water Quality Objectives
STP	Sewage Treatment Plant
SWTP	Saline Water Treatment Plant
TDS	Total Dissolved Solids
TSF	Tailings Storage Facility
TSS	Total Suspended Solids
WMP	Water Management Plan
WRSF	Waste Rock Storage Facility
WTP	Water Treatment plant

UNITS

%	percent
°C	degrees Celsius
°C/m	degrees Celsius per metre
mg/L	milligram per litre
km	kilometer(s)
km^2	kilo square meter(s)
m	metre
mm	millimetre
m^3	cubic metre(s)
m^3/day	cubic metre per day
m^3/s	cubic metre per second
m^3/hour	cubic metre per hour
m^3/year	cubic metre per year
Mm^3/year	million cubic metre (s) per year
Mm^3	million cubic metre(s)
masl	metres above sea level
Mt	million tonne(s)

SECTION 1 • INTRODUCTION

Agnico Eagle Mines Ltd. (Agnico Eagle) is developing the Meliadine Gold Project (the Mine) located approximately 25 kilometres (km) north of Rankin Inlet (Figure 1.1), Nunavut, and 80 km southwest of Chesterfield Inlet in the Kivalliq Region of Nunavut. The Mine is subject to the terms and conditions of both the amended Project Certificate issued by the Nunavut Impact Review Board (NIRB) in accordance with the Nunavut Land Claims Agreement Article 12.5.12 on February 26, 2019 (NIRB, 2019) and Type A Water Licence No. 2AM-MEL1631 (the Licence), issued by the Nunavut Water Board (NWB) on April 1, 2016 (NWB, 2016). This report presents an updated version of the Water Management Plan (WMP). The purpose of this update is to incorporate changes related to comments received from Crown-Indigenous Relations and Northern Affairs Canada (CIRNAC), and Environment and Climate Change Canada (ECCC), towards Version 5 of the Water Management Plan. Additionally, this update includes all changes related to the approval for discharge to sea that was received with the amended Project Certificate on February 26, 2019.

1.1 Water Management Objectives

The water management objectives are to minimize potential impacts to the quantity and quality of surface water at the Mine and surrounding waterbodies. The purpose of the WMP is to provide information to applicable mine departments (Environment, Engineering, Mine, Energy and Infrastructure, etc.) for sound water management practices, proposed and existing infrastructure, the water balance model, water quality predictions, and for the water quality monitoring plan for the Mine.

Water management structures (culverts, sumps, pipelines, water diversion channels and water retention dikes/berms) are utilized to contain and manage contact water from areas affected by mining activities. Measures have been implemented for the Mine Construction and are being implemented for Mine Operation phases.

1.2 Management and Execution of the Water Management Plan

Revisions of the WMP can be initiated by changes in the Mine Development Plan (Mine Plan), operational performance, personnel or organizational structure, regulatory or social considerations, and/ or design philosophy. The WMP will be reviewed annually by Agnico Eagle and updated as necessary.

SECTION 2 • BACKGROUND

2.1 Site Conditions

The Mine is located in an area of poorly drained lowlands near the northwest coast of Hudson Bay. The dominant terrain in the area consists of glacial landforms such as drumlins (glacial till), eskers (gravel and sand), and many small lakes. The topography is gently rolling with a mean elevation of 65 metres above sea level (masl) and a maximum relief of 20 meters.

The local overburden consists of a thin layer of topsoil overlying silty gravelly sandy glacial till. Cobbles and boulders are present throughout the region at various depths. Bedrock at the Mine site area consists of a stratigraphic sequence of clastic sediments, oxide iron formation, siltstones, graphitic argillite, and mafic volcanic flows (Snowden, 2008; Golder, 2009).

The climate is extreme in the area, with long cold winters and short cool summers, and mean air temperatures of 12°C in July and -31°C in January. The mean annual air temperature at the Mine site is approximately -10.4 °C (Golder, 2012a). Strong winds blow from the north and north-northwest direction more than 30 percent of the time.

The mean annual precipitation in the area is approximately 412 mm and is typically equally split between rainfall and snowfall.

2.1.1 Local Hydrology

The Mine is located within the Meliadine Lake watershed. Meliadine Lake has a water surface area of approximately 107 square kilometres (km^2), a maximum length of 31 km, features a highly convoluted shoreline of 465 km, and has over 200 islands. Unlike most lakes, it has two outflows that drain into Hudson Bay through two separate river systems. It has a drainage area of 560 km^2 upstream of its two outflows. Most drainage occurs via the Meliadine River, which originates at the southwest end of the lake. The Meliadine River flows for a total stream distance of 39 km. The Meliadine River flows through a series of waterbodies, until it reaches Little Meliadine Lake and then continues into Hudson Bay. A second, smaller outflow from the west basin of Meliadine Lake drains into Peter Lake, which discharges into Hudson Bay through the Diana River system (a stream distance of 70 km). At its mouth, the Diana River has a drainage area of 1,460 km^2.

Watersheds in the Mine area are comprised of an extensive network of waterbodies, and interconnecting streams. The hydrology of these watersheds is dominated by lake storage and evaporation.

2.1.2 Ice and Winter Flows

Late-winter ice thicknesses on freshwater lakes in the Mine area range between 1.0 to 2.3 m with an average thickness of 1.7 m. Ice covers usually appear by the end of October and are completely

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formed in early November. The spring ice melt (freshet) typically begins in mid-June and is complete by early July (Golder, 2012b).

2.1.3 Spring Melt (freshet) and Freeze-up Conditions

With the exception of the main outlet of Meliadine Lake, which has been observed to flow continuously throughout the year, outlets of waterbodies near the Mine typically start flowing late May or early June, followed by freshet flows in mid-to-late-June. Flows steadily decrease in July and low flows are ongoing from August to the end of October, prior to winter freeze.

2.1.4 Permafrost

The Mine is located in an area of continuous permafrost. The depth of permafrost is estimated to be in the order of 360 to 495 m. The depth of the active layer ranges from about 1 m in areas with shallow overburden, up to 3 m adjacent to the lakes. The typical permafrost ground temperatures at the depths of zero annual amplitude (typically at the depth of below 15 m) are in the range of -5.0 to -7.5 °C in the areas away from lakes and streams. The geothermal gradient ranges from 0.012 to 0.02 °C/m (Golder, 2012b).

2.1.5 Local Hydrogeology

Groundwater characteristics at areas of continuous permafrost that are generally present in the Mine area include the following flow regimes:

- A shallow flow regime located in an active layer (seasonally thawed) near the ground surface and above permafrost; and,
- A deep groundwater flow regime beneath the base of the permafrost.

From late spring to early autumn, when temperatures are above 0 ˚C, the shallow active layer thaws. Within the active layer, the water table is projected to be a subdued replica of topography. Groundwater in the active layer flows to local depressions and ponds that drain to larger waterbodies. The talik beneath large waterbodies will be open. The open talik will connect to the deep groundwater flow regime beneath the permafrost.

Elongated waterbodies with terraces and a width of 340 to 460 m or greater are expected to have open taliks extending to the deep groundwater flow regime at the Mine. Meliadine Lake and Lake B7 are likely to have open taliks connected to the deep groundwater flow regime (Golder, 2012a). No impact is expected to Lake B7 by mine activities.

2.2 Mine Development Plan

The Mine Plan and key mine development activities, including mine waste management are currently used concurrently with the WMP.

The Mine Plan includes one underground mine (Tiriganiaq Underground Mine) and two open pits (Tiriganiaq Open Pit 1 and Tiriganiaq Open Pit 2) for the development of the Tiriganiaq gold deposit.

The Mine is expected to produce approximately 14.9 million tonnes (Mt) of ore, 31.8 Mt of waste rock, 7.4 Mt of overburden waste, and 14.9 Mt of tailings. The following phased approach is proposed for the development of the Tiriganiaq gold deposit;

- Phase 1: 3.5 years for Mine Construction (Q4 Year -5 to Q2 Year -1);
- Phase 2: 8.5 years for Mine Operations, beginning in 2019 (Q2 Year -1 to Year 8);
- Phase 3: 3 years Mine Closure (Year 9 to Year 11); and;
- Phase 4: Post-Closure (Year 11 forward).

Mining facilities on surface will include a plant site and accommodation buildings, two ore stockpiles, a temporary overburden stockpile, a tailings storage facility (TSF), three waste rock storage facilities (WRSFs), a water management system that includes containment ponds, water diversion channels, retention dikes/berms, and a series of water treatment plants. The general mine site layout plan is shown on Figure 1.2.

SECTION 3 • WATER MANAGEMENT CONTROLS AND STRUCTURES

A network of berms, dikes, containment ponds, channels, culverts and sumps are in place and maintained to facilitate water management. The following sections describe the water management design criteria for the infrastructure used at the Mine.

3.1 Water Management Systems

The water management systems, as shown in Figure 1.2, include the following components:

- Five water containment ponds (CP1, CP3, CP4, CP5, and CP6) and their associated dikes or thermal berms (D-CP1, Berm-CP3, Berm-CP4, D-CP5, and D-CP6)
- Three P-Area containment ponds (P1, P2, and P3) and four containment berms (DP1-A, DP1-B, DP2-A, and DP3-A)
- A surface Saline Pond (SP1) and a second saline storage pond (SP2; yet to be commissioned) to support Agnico Eagle's strategies to store, treat (SWTP) and discharge saline water to sea
- A third saline pond (SP3) for final treatment of saline water prior to discharging to sea
- Three diversion berms (Berm 1, Berm 2, and Berm 3)
- Eight water diversion channels (Channel 1 to Channel 8)
- Sixteen water passage culverts to convey water (Culverts 1 to 8, 10, 11, 13, 14 to 16, 18, 19)
- Five evaporators
- A reverse osmosis (RO) treatment plant
- An effluent water treatment plant (EWTP)
- A saline water treatment plant (SWTP)
- A sewage treatment plant (STP)
- A potable water treatment plant (WTP)
- A network of surface pumps and pipelines
- A freshwater intake causeway
- Three jetties and pumping infrastructure (CP1, CP5 and CP6)
- An effluent diffuser located in Meliadine Lake

The status of construction and planned construction dates of the above are listed in Table 1.

Surface contact water is intercepted, diverted and contained within various containment ponds prior to evaporation or treatment. Water contained in CP5 is treated by an RO treatment plant prior to discharging to CP1. Water collected in the P-area is temporarily stored and then actively evaporated. At CP1, the water is treated for total suspended solids (TSS) at the EWTP and discharged through the diffuser located in Meliadine Lake. Water treated through the RO treatment plant at CP5 is moved to CP1 prior to treatment through the EWTP.

Contact water from the Underground Mine is collected in underground sumps and stored in the underground water stope and the saline pond to be recirculated for use in various underground operations. The second saline pond will be used as additional underground water storage, pending commissioning (Section 3.5). Underground contact water that is not used for operations is treated for discharge.

Hatch (2013) investigated groundwater treatment options for the site and concluded that a combination chemical reverse osmosis (RO) and mechanical vapour compression evaporator plant would be the most efficient method of treating excess groundwater for discharge. Agnico Eagle has since acquired and constructed a Salt Water Treatment Plant (SWTP) consisting of two evaporator crystallizers (SaltMakers) and a chemical RO unit that will be used to treat groundwater. Treatment details are found in Section 3.9.3.

As part of the strategy to manage excess groundwater infiltration of saline water within the underground portion of the mine, Agnico Eagle applied to the Nunavut Impact Review Board for approval to discharge saline water to the sea (Melvin Bay, Rankin Inlet). Agnico Eagle received approval with the amended Project Certificate on February 26, 2019. An overview of management around discharge to sea is found in Section 3.11. Further details are found in Appendix A.

During the mine closure, the water management infrastructure will remain in place until closure activities are completed and monitoring demonstrates that water quality is acceptable for discharge to the environment without treatment.

A list of the water management control structures are presented in Table 1 with each respective construction status. Figure 1.2 shows the location of the respective structures over the development stages (Year – 5 to Year 8) of the mine life. Final design details of these structures will be provided to the Regulators for approval at least 30 days prior to construction, as per the Licence.

Table 1: Water Management Control Structures

Mine Phase	Infrastructure Name	Construction Status
Pre-Production Construction (Y-5 to Y 1)	Channel 1	Constructed
	Channel 2	Constructed
	Channel 3	Constructed
	Channel 4	Q2 2019
	Channel 5	Constructed
	Channel 6	Q3 2019*
	Channel 7	Q3 2019
	Channel 8	Q3 2019
	Culvert 1	Constructed
	Culvert 2	Constructed
	Culvert 3	Constructed

	Culvert 4	Constructed
	Culvert 5	Q3 2019*
	Culvert 6	TBD
	Culvert 7	Q3 2019
	Culvert 8	Q3 2019
	Culvert 10	Q3 2019
	Culvert 11	Q3 2019
	Culvert 13	Constructed
	Culvert 14	TBD
	Culvert 15	Constructed
	Culvert 16	Constructed
	Culvert 18	Constructed
	Culvert 19	Q3 2019
	CP1	Constructed
	CP3	Constructed
	CP4	Q2 2019
	CP5	Constructed
	D-CP1	Constructed
	Berm-CP3	Constructed
	Berm-CP4	Q2 2019
	D-CP5	Constructed
	CP1 Jetty	Constructed
	CP5 Jetty	Constructed
	Saline Pond (SP1)	Constructed
	Saline Pond 2 (SP2)	Q1 2019
	Saline Pond 3 (SP3)	Q2 2019
	Berm 1	Q3 2019*
	Berm 2	Constructed
	Berm 3	Constructed
	Freshwater Intake Causeway & Pump Station	Constructed
	Submerged Diffuser	Constructed
	WTP Intake Causeway	Constructed
Sustaining Construction during Mine Operation (Y1 to Y8)	CP6, CP6 Jetty and D-CP6	2022

* Construction tentative based on future water management strategies

3.2 Water Management Structures Design Criteria

The design of the various water management systems in place will meet the following criteria:

- Water quality will meet regulatory criteria of the Licence (described in Appendix F).
- Design capacity of the EWTP is sufficient to ensure that D-CP1 and CP1 will be able to manage the surface contact water from the entire site for a 1:100 wet year spring freshet, or a 1:2 mean year spring freshet in combination with a 1:1000 return 24-hour extreme rainfall.
- D-CP5 and CP5 will be able to manage the water from its catchment area for 3/7 of a 1:100 wet year spring freshet or a 1:1000 return 24-hour extreme rainfall. This design is based on an allowable 3-day delay in initiation of pumping during a 7-day, 1:100 year freshet. Design capacity of pumping from CP5 to CP1 is sufficient to ensure that remaining freshet inflows to CP5 are managed via pumping to CP1.
- Design pumping capacity of each of the other water management ponds (CP3, CP4, and CP6,) will be able to manage the water from their respective catchment area for 3/7 of a 1:100 wet year spring freshet or a 1:1000 return 24-hour extreme rainfall.
- The daily pumping rate for each of the ponds (CP3 to CP6), Tiriganiaq Pit 1 sump, and Tiriganiaq Pit 2 sump will be designed to have sufficient pumping capacity to handle the runoff water, which would result from one day (24.4 mm) of a 1:100 return wet spring freshet plus a 1:2 return one-hour rainfall (9.8 mm).

Channel 2 to Channel 4 are designed to pass an extreme intensity flow under a 5-minute 1:100 return rainfall of 9.2 mm. Channel 1 and Channel 5 to Channel 8 are designed as internal channels where any water overflowing the channels will remain within the catchment areas of various containment ponds. Hydraulic analyses indicated that very wide channels are required to pass an extreme intensity flow under a 5-minute 1:100 return rainfall of 9.2 mm. As a result, these channels were designed to have a reasonable bottom width to pass a flow with lesser intensity, but the water overflowing the channels can be safely managed by berms or temporarily stored in a lower basin nearby. For example, water overflowing Channel 5 can be contained by Berm 3. Water overflowing Channel 7 and Channel 8 (once constructed) can be stored in the lower basin in the drained Pond H13, and Berm 1 (once constructed) will protect Portal No.2 from flooding. Currently, Portal No.2 is protected by compacted, engineered structural fill, and mass till backfill. Water overflowing Channel 1 will flow through the flat ground between Ore Pad 2 (OP2) and future WRSF2 into CP1. Table 2 presents the design parameters for CP1, CP5 and CP6.

Table 2: Design Parameters for CP1, CP5 and CP6

Pond	CP1	CP5	CP6
Pond Volume for Water Elevation at Projected Maximum Pond Operating Water Elevation under Normal Operating Conditions and Mean Precipitation Years (m^3)	742,075	46,674	19,154
Estimated Maximum Operating Water Elevation (m)	66.2	66.0	63.9

Pond	CP1	CP5	CP6
Dike for Pond	D-CP1	D-CP5	D-CP6
Design Crest Elevation of Dike Containment Element (liner system) (m)	66.50	66.30	64.30
Pond Volume for Water Elevation at Design Crest Elevation of Dike Containment Element (m^3)	778,502	66,231	49,627

CP3 and CP4 will be established through sub-excavation of the original ground to increase water storage capacity and help ensure water levels do not reach the thermal protection berms. The key design parameters for CP3 and CP4 are provided in Table 3 and are discussed in further detail within Tetra Tech (2018).

Table 3: Design Parameters for CP3 and CP4

Pond	CP3	CP4
Elevated Pond Bottom Elevation (m)	56.0	56.0
Estimated Maximum Water Elevation during IDF (m)	63.0	63.0
Pond Volume for Water Elevation at Estimated Maximum Water Elevation during IDF (m^3)	28,800	35,093
Pond Surface Area at Estimated Maximum Water Elevation during IDF (m^2)	6,583	8,805
Thermal Berm for Pond	Berm-CP3	Berm-CP4

3.3 Water Containment ponds

Three water containment ponds (CP1, CP3, and CP5) have been constructed to date as part of the water management infrastructure. Two more water containment ponds, CP4 and CP6, will be constructed in 2019 and 2023, respectively. Table 4 presents the locations and the required operational period of the containment ponds. The locations of the five water containment ponds are shown on Figure 1.2.

Table 4: Location of Containment Pond and Required Operation Periods

Containment Pond	**Relative Location**	**Required Operation Period**
CP1	Pond H17	Year 2017 to Mine closure
CP3	North of Lake B7 and southwest of TSF	Year 2019 to Mine closure
CP4	Southeast of Lake B7 and south of WRSF1	Year 2019 to Mine closure

CP5	North of Tiriganiaq Pit 2	Year 2017 to Mine closure
CP6	Pond H19 and north of WRSF3	Year 2023 to Mine closure

3.4 P-Area Containment Ponds

The P-area consists of three storage ponds, four water containment berms and five evaporators. This area contains surface runoff and is part of the surface water management system dedicated to saline water. The total storage capacity of the P-Area ponds is 46,041 m^3. P1 is divided by a berm and P1-A (6,131.8 m^3) is the southern section of P1 and P1-B (14,649 m^3) is the northern section. P2 is adjacent and located south of P1-A. P3 was constructed east of the existing south access road, with the primary purpose of collecting seepage originating from the P2 confining berm and its abutments. A pumping station was installed to collect and pump any collected water from P3 to P1.

P1, P2 and P3 are contained by berms DP1-A, DP1-B, DP2-A, and DP3-A. Five evaporators have been installed on DP1-B. Table 5 summarizes the as-built capacities for the P-Area ponds and Figure 3.1 illustrates the P-Area plan view. In Q2 of 2019, SP3 will be installed within southwestern portion of P3. SP3 will act as the final treatment pond for saline water that is to be discharged to sea. Thus, P3 volume will be decreased upon SP3 construction. SP3 will have a minimum storage capacity of 5000 m^3 and will be lined with polyethylene geomembrane to prevent seepage between SP3 and P3. Updated P-Area volumes will be included in the 2020 annual report.

A contaminated snow cell was engineered and installed within the northwest extent of P1 in reaction to the April 8th 2017, 30,000 L diesel spill on Site. The contaminated snow cell was used to store contaminated snow from this event. Since then, the snow cell has been used to store snow containing hydrocarbons (i.e., snow on which spills occur) over the 2017 early spring and 2017/2018 winter. Upon snowmelt an oil-water separator was used to treat the water and was moved to P1. The contaminated snow cell is currently in place as a contingency measure for contaminated snow storage over the 2018/2019 winter period (See Freshet Management Plan in Appendix B).

The snow cell is lined with a polyethylene liner to avoid transfer of melting snow into the other ponds part of the P-area. The cell is designed to contain a volume of 1500 m^3 of snow and to contain 930 m^3 of water at a water surface elevation of 69.5 m.

Table 5: As-Built Capacity for P-Area Ponds

Pond	P1	P2	P3
As-built Capacity (m^3)	20,781	6,828	18,432
Maximum Design Water Elevation (m)	68.5	67.5	67.0
Total P-Area Capacity (m^3)	46,041		

Water monitoring protocols for the P-Area have been implemented to include water quality and transfer data, such as locations and flow volumes for water pumped to and from the containment ponds. This is discussed further in Appendix F.

3.5 Saline Ponds

The Saline Pond (SP1) was constructed in Q3 2016 to accommodate excess saline water from the Underground Mine. The Saline Pond is located east of P3 and north of CP5 (Figure 1.2). Table 6 summarizes the Saline Pond capacity for storage and maximum designed operating water levels. The maximum saline water capacity is the volume that can be stored in the Saline Pond prior to winter freeze. Approximately 9,000 m^3 capacity should be available to accommodate precipitation that may accumulate throughout winter and at freshet.

Based on adaptive management strategies, the project requires a second saline water storage pond (SP2). SP2 will be temporary in nature and is being constructed in bedrock within the footprint of Tiriganiaq Pit 2 (Figure 3.2). Saline Pond 2 is designed to have a minimum storage volume of 75,000 m^3. Groundwater will be pumped to Saline Pond 2 where it may then be treated for TDS removal at the SWTP. Water stored in SP2 will also contribute to saline water being discharged to sea (Section 3.11; Appendix A). Inputs to the second saline pond will be similar in chemical nature to those input to the SP1, mainly originating from the underground water storage system.

Table 6: As-Built Storage Capacity for Saline Pond 1

Item	Water Balance Under Mean Precipitation Conditions
Maximum Design Water Elevation (m)	62.9
Maximum Saline Water Capacity (m^3)	23,686
Estimated Maximum Storage Capacity at Maximum Water Elevation (m^3)	32,686 *

* Includes the capacity for saline water to be pumped into Saline Pond 1 from Underground, a combined capacity for net precipitation, and potential seepage water into the pond.

3.6 Water Diversion Channels, Dikes and Berms

3.6.1 Water Diversion Channels

Four water diversion channels (Channels 1, 2, 3, and 5) have been constructed and form part of the water management infrastructure. Four remaining channels (Channels 4, 6, 7, and 8) have yet to be installed. As outlined in Table 1, Channels 4, 7, and 8 are planned to be constructed in Q2 of 2019, Q3 of 2019 and Q3 of 2019, respectively. Construction of Channel 6 is tentative based on future water management strategies downstream of WRSF2. The as-built and design parameters for the water diversion channels are presented in Table 7.

Table 7: As-Built and Design Parameters for Channels

Item	Channel							
	1 (As-Built)	**2 (As-Built)**	**3**	**4**	**5 (As-Built)**	**6**	**7**	**8**
Approximate Total Length (m)	528	269.5	619	710	429†	69	214	315
Bottom Width (m)	3	1.257	1 or 2*	1 or 2*	2.3 to 2.9	1	1	1
Side Slopes	3(H):1(V)**	1.82(H):1(V)	3(H):1(V)	3(H):1(V)	1.9(H):1(V)	3(H):1(V)	3(H):1(V)	3(H):1(V)
Rip-rap Thickness (m)	0.3 to 0.5	0.277	0.3	0.3	0.2	0.3	0.3	0.3
Minimum Bottom Slope Gradient (%)	0.2	0.30†	0.17	0.13	0.17†	0.44	0.42	0.38

* 1 m bottom width for first 100 m upstream section, and 2 m bottom wide for the remaining channel section

** Except from Sta. 0+050 to 0+130: 2(H):1(V)

† As-built parameter values not available; value displayed is from design

3.6.2 Water Retention Dikes and Berms

In general terms, "dikes" will retain continuous water during normal operations and "berms" may retain water during short-term high level water events. At the end of Mine closure, when the water quality in the corresponding pond meets direct discharge criteria, each of the dikes and berms on site (except for Berm 2) will be breached to restore the original natural drainage paths. Berm 2 will remain in place to prevent non-contact water from flowing into the TSF.

Water retention dikes D-CP1, D-CP5, and future D-CP6 have been designed as a zoned earth fill dam with a geomembrane liner keyed into the expected permafrost foundation to limit the seepage through the dike and its foundation. The characteristics of the dikes and berms required for the WMP are summarized in Table 8.

3.6.2.1 Thermal Monitoring

Horizontal Ground Temperature Cables (GTCs) are installed along the key trenches of D-CP1 and D-CP5 at a depth of approximately 3 m below the original ground level. These installations are in place to verify that the foundations remain frozen and dike integrity is not compromised. D-CP1, Berm-CP3 and D-CP5 contain vertical GTCs installed to a minimum depth of 15 m below the crest of each dike. Thermal records collected from these sensors provide temporal analysis of vertical temperature profiles to assess increasing (or decreasing) temperatures within the dike or berm structure.

During 2018, D-CP1 and D-CP5 readings were obtained, recorded, and assessed every 2 – 3 days during freshet and weekly following freshet until freeze-up. Following freeze-up, readings were then taken monthly. Data loggers set to log every 12-hours were installed in October 2018 at D-CP1 and D-CP5 to provide twice-daily records. Reading frequency at Berm-CP3 and Berm-CP4 (upon construction) will be monthly during the first year following construction and yearly thereafter. Reading frequency at D-CP6 will depend on the construction design provided with the D-CP6 design report. The measured readings are consistently analyzed by an Agnico Eagle geotechnical engineer and will be reported in the annual geotechnical inspection report. This will continue into 2019.

In addition to thermal monitoring, visual geotechnical inspections of water management structures are currently performed, as described in Section 3.12 below.

Table 8: Design Parameters for Water Retention Dike/Berm

Item	D-CP1	Berm-CP3	Berm-CP4	D-CP5	D-CP6	DP1-A	DP1-B	DP2-A	DP3-A	Berm1	Berm2	Berm3
Approximate Maximum Height (m)	5.6	2.0	2.0	3.3	1.8	3.7	3.4	4.0	3.4	1.6	2.5	2.76
Maximum Elevation (m)	67.5	66.1	65.4	67.3	65.3	70.5	70.7	69.5	69.0	68.5	varies	67.37
Maximum Head of Water Retained (m)	3.5	0.2	0.1	1.4	0.5	68.5	68.7	67.5	67.0	0	0	0

3.7 Evaporators

Five evaporators are installed on jetties constructed at DP1-B. The evaporator system is designed for vaporizing water contained at the P-Area. The evaporators are installed to accommodate the quantity of excess saline water before saline water treatment options and disposal plans have been implemented at the Mine. Based on data collected during 2016, the efficiency of one evaporator was estimated to be 22 m^3/hr.

3.8 Freshwater Intake

Freshwater usage at the Mine includes potable uses, fire suppression, make-up water for the mill, and other operational requirements, such as drilling water, dust suppression, batch plant use, and use at the washbay. The main freshwater intake is located northeast of the industrial pad in Meliadine Lake, as shown on Figure 1.2 and an additional freshwater intake pump is located at Lake A8. The intakes consist of vertical filtration wells fitted with vertical turbine pumps that supply water on demand. Both intake pipes are fitted with a screen of an appropriate mesh size to ensure that fish will not be entrained and shall withdraw water at a rate such that fish do not become impinged on the screen (NWB, 2016).

3.9 Water Treatment

Contact water will be treated (if necessary) to meet Licence requirements prior to being discharged to the environment. TSS mitigation techniques (i.e., attenuation ponds, silt screens, etc.), oil separation treatment, the STP, the SWTP, the RO Plant and the EWTP are used accordingly at various locations at the Mine prior to water being transferred to containment ponds and/or as effluent discharge to Meliadine Lake. Water quality criteria is discussed in Section 7 and Appendix F.

3.9.1 Freshwater Treatment Plant (WTP)

Freshwater from Meliadine Lake will be treated in the WTP before being directed to the camp areas for potable (domestic) water uses. The design flow rate for freshwater for the main camp and accommodations is 216 m^3/day. In the WTP, freshwater will be pumped through cartridge filters, then pumped through ultraviolet units, and finally treated with sodium hypochlorite (chlorine). The treated water will be stored within a potable water tank. Potable water will be monitored according to the Nunavut Health Regulations for total and residual chlorine and microbiological parameters. Operation and maintenance details for the WTP can be reviewed in the Process and Control Narrative (H2O Innovation, 2016).

3.9.2 Sewage Treatment Plant (STP)

Wastewater from the accommodation complex and from satellite sewage tanks will be treated in the STP before being directed to CP1. Operation and maintenance details for the STP can be reviewed in the Operational & Maintenance Manual – Sewage Treatment Plant (Agnico Eagle, 2017c).

3.9.3 Saline Water Treatment Plant (SWTP)

Saline water generated from the Underground Mine is currently being stored underground and on surface at the P-Area and SP1. SP2 will be an addition to this saline water storage system upon completion of its construction. A Saline Water Treatment Plant (SWTP) was constructed in 2018 and is currently being commissioned. The system will be in full operation during Q2, 2019. The SWTP is located in a dome approximately 50 m to the southeast of Portal 1. The SWTP will be used to treat water from the Underground Mine, P-Area or from the saline ponds.

The SWTP will remove excessive total suspended solids (TSS), calcium chloride ($CaCl_2$), sodium chloride (NaCl), metals, phosphorous (P), and nitrogen compounds from the influent saline water. Effluent from the SWTP is intended to be discharged to CP1. In February 2019, the discharge point was moved, temporarily directing effluent to CP5 while a line extension is performed at the CP1 discharge point. This change will be reverted once the line extension is complete. Pre-treatment groundwater and effluent from the SWTP are monitored every 12 hours (night shift and day shift) for pH and TDS, and weekly for chloride (Cl), ammonia (NH_4), nitrite (NO_2), nitrate (NO_3), TDS, TSS, total phosphorus (P), total cyanide (Cn), total metals and total mercury (Hg). The SWTP Design Report can be found in Appendix E.

The SWTP consists of two parallel units. Each unit can be operated to produce brine or solid by-product. Both units within the SWTP will be operated in Brine Mode for Q1 of 2019. Brine-mode of one unit within the SWTP is expected to operate to the following specs:

- Inlet capacity of 115 m^3/day with a 95% expected operation availability for a corrected average input capacity of 109 m^3/day.
- With an input capacity of 109 m^3/day the effluent and brine will be discharged as follows:
    - 68 m^3/day to CP1
    - 24 m^3/day to Saline Pond as Brine
    - The 17 m^3/day difference is due to evaporation loss through treatment.

Solid-mode of one unit within the SWTP is expected to operate to the following specs:

- Inlet capacity of 69 m^3/day with a 95% expected operation availability for a corrected average input capacity of 66 m^3/day. This full inlet capacity will be discharged to CP1 as effluent
- Decisions regarding the management of solid salt by-product are ongoing by Agnico Eagle. One possible option would be use as a dust suppressant on roads as the material is similar to Calcium Chloride currently approved for such use. Formal approval would be required from the Government of Nunavut Environment Department.

SWTP effluent is currently transferred to CP1 where it will be treated by the EWTP prior to discharge to Meliadine Lake. EWTP effluent discharge to Meliadine Lake was performed in 2018 in accordance with the conditions outlined in Part F, Item 3 of the Water Licence. Discharge to Meliadine Lake is expected to be carried out in 2019. Total discharge to Meliadine Lake, including the treated groundwater, will remain within the permitted daily volume and meet the discharge criteria defined in the License, as well as MDMER discharge limits. Additionally, SSWQO's for EWTP effluent (including treated groundwater) will be met at the edge of the mixing zone in Meliadine Lake. Further details regarding the EWTP are provided in Sections 3.9.4 and Section 4.3 of the WMP.

The saline effluent temperature from the SWTP is expected to be approximately 35 °C (however may be greater during winter months to prevent freezing of pipeline), with an approximate pH of 7.5 (Saltworks 2017). According to pilot testing, SWTP effluent meets the required Water Quality Output Requirements defined in Agnico Eagle's Desalination Water Treatment Plan Design Criteria with the exception of ammonia, nitrite, total cyanide, and selenium (Saltworks 2017). However, weekly sample results from the first months of sampling (December 13, 2018 to February 18, 2019) show the SWTP effluent consistently meets the aforementioned requirements for all constituents aside from ammonia and nitrite. Ammonia exceeded the Water Quality Output Requirement of 35 mg/L on three sampling dates (Jan-16, Jan-18, Feb-10), however the mean ammonia concentration over the sampling period was 24 mg/L. Nitrite exceeded the Water Quality Output requirement of 0.2 mg/L on all (n=9) sampling dates with a mean concentration of 1.2 mg/L. The cause for these exceedances is that the SWTP system remains in the commissioning phase, specifically the chemical RO unit designed to remove constituents such as ammonia and nitrite has not yet been commissioned. Upon commissioning (expected by end of Q1 2019), the SWTP is expected to meet all Water Quality Output Requirements.

SWTP effluent and CP1 water quality will continue to be monitored according to the SWTP Design Report to identify future exceedances and potential impacts to CP1. Pilot testing predicted that TDS concentrations would be approximately 158 mg/L (condensed water after treatment; Saltworks 2017). During commissioning, mean TDS concentration has been 174 mg/L (n=9) to date. As commissioning continues (i.e., process is refined and RO treatment is commissioned), effluent quality will trend towards lower concentrations as the treatment process is refined for optimal treatment quantity and quality. With respect to toxicology, the SWTP effluent passed acute toxicity tests on Rainbow trout, Three-spined stickleback and Daphnia magna (Saltworks 2017).

3.9.4 Effluent Water Treatment Plant (EWTP)

Approximately 642,521m³ of contact water from CP1 was treated and discharged from the EWTP during 2018. The monthly and daily discharge averages are provided in Table 13 and Figure 7.2, respectively. Based on the anticipated water quality (Appendix F) and water quantity, the EWTP will be continue to be used to remove TSS at CP1 in 2019. The volume of water requiring treatment for TSS removal and discharge will increase to a maximum of 798,000 m³ in 2022 and then decrease to 673,000 m³ during the final year of the life of mine (2027). Based on the maximum flow rate of the Actiflo® system model ACP-600R, the EWTP has a maximum capacity of 520 m³/h (nominal flow). The system will have the capacity to treat the anticipated discharge from CP1 for the life of the mine.

TSS mitigation is ongoing with runoff water from ditch systems that have the potential to discharge directly to receiving waters and is described further in the Freshet Action Plan (Agnico Eagle, 2018b).

Beginning July 2018, water stored in pond CP5 was treated through a Reverse Osmosis (RO) system and then pumped through the EWTP for treatment (prior to discharge into Meliadine Lake). The resultant EWTP effluent was continually monitored for turbidity and electrical conductivity as a surrogate for TSS and TDS, respectively. In addition, Agnico Eagle conducted regular sample monitoring in accordance with the Type A Water License and the MDMER.

With respect to TSS monitoring during CP1 discharge events, Agnico has developed triggers for mitigation. Rating curves predicting TSS concentration as a function of turbidity and TDS as a function of conductivity were developed with simple linear regressions. The regressions applied *in situ* conductivity and turbidity readings and MEL-14 sample results. Rating curves are applied to continuous conductivity and turbidity readings taken from internal probes within the EWTP to predict TDS and TSS, respectively. Regarding conductivity, a trigger limit has been set to 1900 µS/cm which corresponds to 1,244 mg/L TDS (See rating curve in Figure 3.3). When this trigger is reached, discharge to Meliadine Lake will be stopped. The correlation strength pertaining to the TDS-conductivity rating curve is R^2 = 0.85. Thus, the trigger limit was set below the maximum allowable concentration (1400 mg/L - TDS limit) to allow for uncertainty associated with the correlation.

Regarding turbidity, two trigger limits have been set. The first is set to 1.2 NTU which corresponds to approximately 15 mg/L TSS (See rating curve in Figure 3.4). When this first trigger is reached, sample frequency will be increased to twice per week for TSS at an accredited lab. The second trigger limit is set to 2.0 NTU which corresponds to approximately 22.5 mg/L TSS. When this second trigger is reached, discharge to Meliadine Lake will be stopped. The correlation strength pertaining to the TSS-turbidity rating curve is R2 = 0.79. Thus, the trigger limit was set below the maximum allowable concentration (15mg/L - TSS Max Ave Concentration and 30 mg/L - TSS Max Grab Concentration) to allow for uncertainty associated with the correlation. AEM reduced the second trigger limit from 2.3 NTU to 2.0 NTU in July 2019 to ensure the second trigger limit is below the 30 mg/L TSS when factoring in a maximum variation in TSS-turbidity correlation strength (21%).

Agnico will continue to gather calibration/confirmatory paired samples in the future to increase the number of data points and thus to strengthen the turbidity-TSS and conductivity-TDS correlations.

3.9.6 Oil Separators

An oil separation treatment system was installed in 2018 at the Maintenance Shop to collect and separate oil from water used for washing mining equipment. A second oil-water separator is installed at Landfarm A. In the event of water accumulation at Landfarm A due to rainfall or snowmelt, the ponded water will be pumped through the oil-water separator to remove PHC residue and will be analyzed for BTEX, lead, and oil and grease prior to discharge to CP1 or used on the windrows to increase moisture content, as required. Water accumulating in the landfarm will not be discharged directly to the receiving environment.

3.10 Discharge Diffuser

The discharge diffuser is the final effluent discharge location for the Mine. The overall purpose of the diffuser is to discharge water from CP1 (at sampling station MEL-14) to Meliadine Lake while providing minimal environmental impacts to the Lake. The effluent mixing will be dependent on ambient currents in Meliadine Lake, driven by wind during the open water period. The diffuser modelling was initially conducted by Golder Associates Ltd. (Golder, 2015) and updated design progress was reported by Tetra Tech EBA (Tetra Tech, EBA 2016).

3.11 Saline Water Discharge to Sea

Based on the current standing of saline water stored on site, the rate at which the SWTP can treat saline water (Section 3.9.3), and the forecasted inflows (Appendix A), it was anticipated that a second discharge location was required for long-term groundwater management. Agnico Eagle proposed to treat groundwater and discharge the saline effluent to Melvin Bay at Itivia Harbour via a storage tank and engineered marine outflow. In 2018, Agnico Eagle applied to the NIRB for approval to discharge saline water to the sea (Melvin Bay, Rankin Inlet). Agnico Eagle received approval for discharge of saline water to sea along with an amended Mine Project Certificate from NIRB on February 26, 2019. A maximum of 800 m^3/day of effluent at a TDS concentration no greater than 39,600 mg/L will be discharged to Melvin Bay at the Itivia Site during the open water seasons of 2019 – 2031. Further details are provided in Appendix A.

Saline effluent quality will meet the Canadian federal end-of-pipe discharge criteria (Metal and Diamond Mining Effluent Regulations – or MDMER [GC 2018]), and Site-Specific Water Quality Objectives, if applicable, at the edge of the mixing zone for the diffuser discharge into Melvin Bay. As per MDMER (GC 2018) Section 9 and Section 10, Agnico Eagle will submit information regarding the final discharge point 60 days before discharge. A preliminary sampling plan is discussed in Appendix A. Refer to section 2.1.3 of Golder's Report: Modelling Assessment of Groundwater Discharge into the Melvin Bay Marine Environment, Rev B for detailed information regarding simulations of the treated groundwater effluent mixing (Appendix A).

3.12 Water Management Structure Monitoring

Pursuant to Part E, Item 15 of the Licence, Agnico Eagle will carry out weekly inspections of all Water management structures during periods of flow and monthly thereafter. The records will be maintained for review upon request of an Inspector. More frequent inspections may be required at the request of an Inspector. Inspections will focus on structures and conditions in Sections 3.12.1 to 3.12.5 to follow. The associated inspection template can be found in Appendix G.

3.12.1 Culvert and Water Crossing Inspections

Culverts listed in Section 3.1, as well as culverts and water crossings along the AWAR, Bypass Road, and at the Itivia site will be inspected for the following conditions. These inspections also satisfy the monitoring procedures outlined in the Sediment and Erosion Management Plan (Appendix D):

- Damage to the inlet or outlet of the culvert which may impede flow capacity;
- Bed erosion upstream and downstream of watercourse crossing structures;
- Scour under bridge abutments and abutment foundations;
- Erosion along cutslopes and fillslopes of embankments (rill and gully erosion);
- Blockages within the culvert including snow, ice, debris; and

- Snow cover or snow piles which would prevent routing of water towards the inlet of the culvert (only applicable prior to freshet).

In the case that any of the above conditions are observed, corrective actions will be taken to optimize culvert/water crossing function and integrity.

3.12.2 Containment Pond Inspections

Water containment ponds discussed in Section 3.3 and P-Area containment ponds discussed in Section 3.4 will be inspected for the following conditions:

- Unplanned inputs via surface runoff which are not part of the water management system; and
- Water level elevation above the operating manual maximum (OMM).

In the case that any of the above conditions are observed, corrective actions will be taken to prevent unaccounted for losses of available water capacity or potential compromise to dike integrity.

3.12.3 Dike Inspections

Dikes discussed in Section 3.6.2 are inspected in order to track natural (expected) movement of the structure. Furthermore, a 'master" sketch of all the issues that were documented in the past is maintained as a means to spot any changes/new issues. Inspections will focus on the upstream slope, the crest, the downstream slope, and downstream toe and observations will include the following:

- New areas of movement/deterioration not previously documented;
- Changes to previously documented areas of movement/deterioration;
- Seepage through the downstream slope;
- Water presence in downstream channel/sump; and
- Areas of movement/deterioration of downstream channel/sump.

Any issues or potential problems identified will be addressed accordingly by a geotechnical engineer in order to mitigate risks and maintain dike integrity.

3.12.4 Water Diversion Channel and Berm Inspections

In addition to the water management structures requiring inspections under the Water Licence, Agnico Eagle will carry out inspections of all channels on site listed within Section 3.6.1 and Table 1 for the following conditions:

- Obstructions to flow (ice, debris);
- Inflows not part of the water management system;
- Structural failure of channel banks;
- Seepage through water diversion berms resulting in water movement to areas not planned within the water management system; and
- Erosion of diversion berms (i.e., undercutting, slope failure).

In the case that any of the above conditions are observed, corrective actions will be taken if there is potential for compromise effectiveness of the channel function or potential for unplanned impact to water quality or quantity in associated containment ponds.

SECTION 4 • WATER MANAGEMENT STRATEGY

There are four major sources of inflow water considered in the Mine water management system; freshwater pumped from Meliadine Lake and Lake A8, natural run off from precipitation, natural groundwater inflow to the Underground Mine and open pits, and water produced during freshet.

A brief summary of the water management strategy for the Mine is presented as follows:

- Contact water from key mine infrastructure will be diverted and/or collected in the containment ponds (CP1, CP3, CP4, CP5, CP6, the Saline Ponds and the P-Area).
- The collected water in CP3 to CP6 will be pumped to CP1. Water collected in CP1 may be reused by the process plant and the excess water will be treated by the EWTP prior to discharge via the diffuser into Meliadine Lake.
- Contact water from the Underground Mine will be contained in underground sumps and the water storage stope and reused for mining operations. Excess water volumes will be stored in the Saline Ponds, treated by the SWTP to be transported to CP1, or will be discharged to Melvin Bay.
- Runoff water in the open pits will be collected in sumps and then pumped to the designated water containment ponds (CP1, CP5).
- Natural flooding of the open pits at end of mining will be supplemented by using freshwater from Meliadine Lake.
- Upon the completion of underground mining, the Underground Mine workings will be allowed to naturally flood by groundwater seepage.

Appendix B presents the Freshet Action Plan, which includes the Freshet Action Procedure and the Snow Management Procedure for the Mine. Table 9 summarizes the overall contact water management plan for the key infrastructure and presents the initial water collection locations and final water destinations. The plans for water management at key areas are described in following sections.

Table 9: Overall Site Surface Contact Water Management Plan

Contact Water Source	Initial Contact Water Collection Location	Final Contact Water Collection Location
Industrial Site Pad Area (camp/process plant area)	CP1	CP1
WRSF1 Area	CP1, CP4 and CP5	
WRSF2 Area	CP1 and CP5	
WRSF3 Area	CP6	
Dry Stack TSF Area	CP1 and CP3	
Ore Stockpiles OP1 to OP2	CP1	
Landfill	CP1	
Landfarm (biopile)	Sump within Landfarm	To CP1 after oil separation
Tiriganiaq Pit 1 Tiriganiaq Pit 2	Open pit sumps	First to CP5 and then to CP1
Tiriganiaq underground	Sumps in underground mine	Sumps in underground mine, surface saline water storage ponds (Saline Pond, P-Area), SWTP to CP1 and/or discharge to sea

The following sections describe the strategy for water management at different areas for the Mine.

4.1 Key Water Management Activities

The activities required for the WMP are summarized in Table 10. Water management activities during closure are described in Section 6.

Table 10: Key Water Management Activities

Mine Year	Major Water Management Activities and Sequence
Q4 of Yr -5 (2015)	• Started to re-use the underground water • Dewatered top 0.5 to 1.0 m of fresh water in Pond H17
Yr -4 (2016)	• Dewatered H17 into Meliadine Lake. • Dewatered Pond A54 in Q3 of Year -4 and pumped the water to CP1. • Started to store the excess groundwater from the underground mine at surface. • Implemented and tested evaporators at P-Area to reduce water volumes stored at surface. • Constructed trenches down gradient from DP1-B and DP3-A to be able to pump collected water and pump back to P1 and P3, respectively.

Mine Year	Major Water Management Activities and Sequence
Yr -3 (2017)	• Started to treat sewage from STP and pump the treated sewage from STP to CP1. • Started to pump the contact water from CP5 to CP1 for treatment (solids removal) • Started to pump water collected in trenches, down gradient from D-CP1, D-CP5, DP1 and DP3 to CP1, CP5, P1 and P3, respectively. • Started to pump the water from the Type A Landfarm to CP1 after oil/water separator treatment. • Started to pump water from washbay to underground for storage until a biological treatment unit for hydrocarbon reduction/removal arrives at the site
Yr -2 (2018)	• Started to pump the water from CP1 to EWTP for treatment prior to discharge via the diffuser to Meliadine Lake. • Pumped the solids sludge from EWTP to CP1. To limit recirculation of the sludge within CP1, the discharge of the sludge was located away from the EWTP intake. • Started diversion of the contact water from industrial pad to CP1 via Channel1 • Constructed and commissioned (in Q4) SWTP to discharge to CP1.
Yr -1 (2019)	• Commission wash bay water treatment unit, monitor water quality monthly and transport treated water to CP1 • Start to pump the contact water in CP3 to the partially drained Pond H13 where the water will flow through Channel1 into CP1 • Discharge up to 800 m^3/day saline water to Melvin Bay at Itivia during the open water season • Start to pump the contact water in CP4 to the partially drained Pond H13 where the water will flow though Channel1 into CP1 • Begin dewatering Ponds H19 and H20 in Q3 of Year -1 and pump the water to the EWTP for discharge to Meliadine Lake
Yr 1 (2020)	• Continue dewatering Ponds H19 and H20 in Q2 and Q3 of Year 1 and pump the water to the EWTP for discharge to Meliadine Lake
Yr 2 (2021)	• Start to pump contact water collected in Tiriganiaq Pit 1 to CP5 • Continue dewatering Ponds H19 and H20 in Q2 and Q3 of Year 2 and pump the water to the EWTP for discharge to Meliadine Lake
Yr 3 (2022)	• Continue dewatering Ponds H19 and H20 in Q2 and Q3 of Year 3 and pump the water to the EWTP for discharge to Meliadine Lake
Yr 4 (2023)	• Start to pump contact water collected in Tiriganiaq Pit 2 to CP5 • Start to pump contact water in CP6 to CP1
Yr 5 (2024)	• Water management plan similar to Year 4
Yr 6 (2025)	• Water management plan similar to Year 4
Yr 7 (2026)	• Water management plan similar to Year 4 • Stop pumping water from the open pits when the pits are mined-out at end of year • Stop pumping excess water from underground when underground mine is completed

Mine Year	Major Water Management Activities and Sequence
Yr 8 (2027)	• Start to fill the mined-out Tiriganiaq Pits 1 and 2 with active pumping from Meliadine Lake • Start natural flooding of Tiriganiaq Underground mine with groundwater seepage • Stop pumping water to process plant when the processing is completed

4.1.1 Pond Dewatering and Displacement

The initial dewatering at Lake H17 and Lake A54 was conducted in 2016 prior to constructing CP1 and CP5, respectively. The water from these ponds was pumped to Meliadine Lake through a temporarily installed diffuser. Preparation for construction of CP4 facility required dewatering of two shallow ponds into CP1, namely B8 and B9 at CP4. Volumes pumped to CP1 from B8 and B9 occurred in Q4 2018 are approximately 2993 m^3 and 6840m^3, respectively. Preparation for CP3 did not require dewatering as B28 contained insufficient volumes to dewater.

The 2014 FEIS and 2019 AEM Water Management Plan state that dewatering of lakes H19 and H20 is scheduled to begin September/October 2022 in advance of D-CP6 construction in 2023. Specifically, lake H19 is to be dewatered to facilitate construction of D-CP6, while lake H20 will be dewatered prior to placement of waste rock/overburden within the drained lake basin.

In September 2018, dewatering of lake B9 occurred prior to construction of Pond CP4. Lake B9 was a much smaller footprint than either H19 (0.63 ha versus 2.91 ha) or H20 (0.63 ha versus 9.58 ha), but of a similar maximum water depth (1.4 m versus 1.4 m to 1.6 m). Mechanical excavation (free-digging with an excavator) for Pond CP4 construction began in the former lake B9 footprint in October/November 2018. During this construction, free-dig depths of greater than 4.0 m below ground surface were achieved and documented by the Construction team, indicating the presence of shallow talik conditions underneath the lake. Based on these experiences, comparable talik conditions are expected in the H19 and H20 footprints.

Due to the size and depth of H19 and H20, these talik conditions were expected during the preliminary thermal analysis of the WRSFs conducted during the 2014 FEIS. The thermal analyses conducted in 2014 found that underlying ground temperatures are predicted to be warmer in both the short and long term in WRSF3 compared with the other WRSFs, with an assumed deep active layer of 2.5 m below WRSF3. This thermal analysis is in the process of being updated to reflect the latest climate change predictions and observed site conditions and it is anticipated that the updated scenarios may show both a deeper than expected active layer and warmer temperature conditions.

AEM is therefore proposing the progressive dewatering of lakes H19 and H20 ahead of the original 2022 date scheduled in the FEIS report in order to promote permafrost aggradation within the lake footprint areas. An initial dewatering of lakes H19 and H20 would occur over the summer of 2019 (starting August 2019) and continue each subsequent year until construction of D-CP6 and WRSF3 begins as the aggradation process is expected to take several seasons. The success of aggradation promotion program will be measured by AEM through monitoring of an historical ground temperature cable (GTC) currently located between H19 and H20, as well as the addition of two more GTCs within the WRSF3 footprint area.

Progressive dewatering of H19 and H20 will be directed to the EWTP directly for TSS treatment prior to be discharge through the diffuser in Meliadine lake

Table 11 summarizes the estimated dewatering plan and estimated volume of water to be dewatered for future construction.

Table 11: Estimated Pond Dewatering Plan

Pond	H20	H19
Maximum Pond Water Depth (m)	1.6	1.4
Existing Pond Surface Area (ha)	9.58	2.91
Dewatering Schedule	Aug. to Oct. of Year -1; Jul. to Oct. of Year 1; Jul. to Oct. of Year 2; Jul. to Oct. of Year 3	Aug. to Oct. of Year -1; Jul. to Oct. of Year 1; Jul. to Oct. of Year 2; Jul. to Oct. of Year 3
Estimated Total Volume of Water to be Dewatered (m^3)	90,307	16,431

4.1.2 Underground Water Management

The Underground Mine will extend approximately 650 m below the ground surface and part of the underground workings will be operated below the base of continuous permafrost. The underground excavations will act as a sink for groundwater flow during mining, with water induced to flow through the bedrock to the Underground Mine workings once the Mine has advanced below the base of the permafrost.

Underground contact water is contained within underground sumps and the underground water stope. Excess underground water is pumped to surface to be managed in Saline Pond 1 (SP1). A second Saline Pond (SP2) will be added to the storage system pending commissioning of the structure. Beginning December 2018, the SWTP began treating groundwater to reduce stored saline water on Site (See Section 3 for details). Furthermore, as part of the strategy to manage excess groundwater infiltration of saline water within the underground portion of the mine, Agnico Eagle applied to the

Nunavut Impact Review Board for approval to discharge saline water to the sea (Melvin Bay, Rankin Inlet). Agnico Eagle received approval with the amended Project Certificate on February 26, 2019 (See Section 3.11 and Appendix A for details).

The estimated volume of water to be managed is expected to range from a minimum of about 0.11 Mm^3/year to a maximum of 0.18 Mm^3/year depending on the production. Details of the underground dewatering system are provided in the Mine Plan (Agnico Eagle, 2017a).

Table 12 presents the predicted groundwater inflow rates estimated by Golder (2016) for passive groundwater inflow to the Underground Mine. Details pertaining to model inputs and assumptions are found in Appendix A. Values presented in Table 12 do not include grouting efforts or ventilation loss. Net inflow values to the Underground Mine, which included the impact of grouting, ventilation losses, loss of water in waste rock pore space, treatment by the SWTP, and loss due to re-use of water in mining operations, were estimated based on changes in water volumes stored in the underground water storage system. Changes in storage were calculated on a daily basis and used to produce monthly values of mean daily net inflow rate. Based on these monthly estimates of mean daily inflow, mean net inflow rate over 2018 was 51 m^3/day. This is not the groundwater inflow rate to the mine but rather the balance of inflows, the aforementioned water losses, and water used for operations. Thus, the 51 m^3/day estimate is the surplus of inflows that was placed in storage.

It should be noted that the net inflow rate generally increased over 2018. During Q4 of 2018 the mean daily net inflow rate was approximately 105 m^3/day. The increasing trend is the result of the progression of development, especially development approaching the lower fault (in the vicinity of the ore body), where hydraulic conductivities are expected to be relatively high (1x10-7 m/s). Going forward, daily net inflow rates will increase when stoping within the cryopeg begins (Q1 of 2019). This is because greater surface area of rock will be exposed and stoping will proceed within the ore body where water-bearing structures exist, and grouting of inflows will not be possible within stopes.

Table 12: Predicted Groundwater Inflow to the Underground Mine (2017 to 2032)

Period	Predicted Groundwater Inflow (m^3/day)
2017	230
2018	300
2019	280
2020	300
2021	340
2022	340
2023-2024	420
2025-2026	380
2027-2028	390
2029-2030	380
2031-2032	360

Source: Updated Predictions of Groundwater Inflow to Tiriganiaq Underground Mine (Golder 2016).

4.1.3 Water Management for Haul Road

A network of haul roads are to provide access to infrastructure at the Mine. The majority of the roadways servicing the mining area are located so that drainage is directed by berms, channels and culverts towards CP1, CP3 and CP5. As shown in Appendix C, water diverted to CP3, CP4, CP5 and CP6 will eventually be transferred to CP1. Detailed information about water management on roads is described in the Roads Management Plan (Agnico Eagle, 2019).

4.1.4 Water Management for Landfarm and Landfill

Any water that accumulates at the onsite Landfarm will be pumped through an oil/water separator prior to discharge into CP1. Additional details for Landfarm water management are described in the Landfarm Management Plan (Agnico Eagle, 2015b).

Leachate from the Landfill is anticipated to non- hazardous and non- toxic due to the controls placed on materials acceptable for the landfill. Drainage from the Landfill is expected to freeze within the WRSF with minimal amounts of leachate reporting to the water collection infrastructure placed around the WRSF. Annual Landfill operations will involve clearing of snow prior to spring melt. However, in the event there is leachate from the Landfill due to periods of heavy rainfall or spring freshet, the runoff will be collected, controlled and treated, if necessary (Agnico Eagle, 2015a), and sent to CP1.

4.1.5 Water Management for Emulsion Plant Area

Freshwater will be trucked to the emulsion plant and used for manufacturing emulsion as well as for washing vehicles. Water within the emulsion plant will be re-used when feasible, and excess water will be collected and disposed of either through the onsite STP or in the P-Area holding ponds.

4.1.6 Water Management for the Batch Plant

Freshwater is pumped from Lake A8 to the Batch Plant and used for concrete production. Water used in the Batch Plant will be re-used when feasible and excess used water will be collected and disposed of in the P-Area containment ponds.

4.1.7 Water Management for the Wash Bay

Water used in the Wash Bay is re-used when feasible and excess water is recycled through a biological treatment system designed to reduce or remove hydrocarbons. Waste from the treatment process is removed in the form of solids and disposed of appropriately (landfarm or landfill).

4.2 Freshwater and Sewage Management

Additional freshwater usage and sewage management is described in the following sections.

4.2.1 Freshwater Management

Major freshwater usages on site include potable use, fire suppression, a portion of make-up water for the mill, and other operational needs, such as drilling. Freshwater is sourced from Meliadine Lake through a freshwater intake and pump system. For dust suppression, water is sourced from any ponded water located along the All Weather Access Road (AWAR), small ponds proximal to the road and/or from the Meliadine River.

Freshwater is pumped through an overland pipeline to an insulated main storage tank located at the plant site. Under the Licence, up to 62,000 m^3/year of freshwater may be used during the construction phase. Approximately 318,000 m^3/year of freshwater is permitted during operation phase. Additionally, approximately 4,000,000 m^3 of freshwater is permitted per year to fill the mined-out open pits during the mine closure. These quantities are inclusive of water needs for dust suppression.

The design flow rate for the potable water for the main camp and accommodations (kitchen, laundry) is 136 m^3 per day (based on a 680-people camp capacity and a nominal consumption of 200 L/day/person). There is an onsite Potable Water Treatment System. Treated potable water is piped to areas in the process plant, service complex, and other facilities requiring potable water.

4.2.2 Sewage Management

Sewage is collected from the camp and change-room (dry) facilities and pumped to the STP. The objective of the STP is to treat sewage to an acceptable level for discharge to CP1 via a sewage water discharge pipeline. The STP is housed in a prefabricated (modular) structure, located at south-east of the service complex at the Industrial Pad, as shown in Figure 1.2. The sewage treatment system is designed based on a flow rate of 200 L per day per worker for a peak load of 680 people, for an average daily flow rate of 136 m^3 (5.67 m^3/h).

The STP for the camp facilities is designed to meet appropriate guidelines for wastewater discharge (Agnico Eagle, 2017c). Details regarding STP specifications and operation can be found in the Operation & Maintenance Manual Sewage Treatment Plant (Agnico Eagle, 2017c).

4.2.3 Process Water Management

Process water will be required in the mill for ore processing. Both contact water from CP1 and sludge water from the EWTP may be used as process water. When possible, water from CP1 will be the main source of water for the ore process. Additional water needs will be supplied by freshwater from Meliadine Lake. Approximately 600 m^3/day of process water will be required in Year 1 to Year 3 operations and approximately 770 m^3/day of process water will be required in Year 4 to Year 8.

4.3 Meliadine Lake Diffuser Effluent Flow Rates

Effluent is discharged from the EWTP into Meliadine lake via a diffuser at a design rate of 11,688 m^3/day (a water treatment rate of 12,000 m^3/day minus 312 m^3/day of sludge returned back to CP1).

The pump does not operate continuously. The amount of effluent flow released over each month and over each year was based on the overall water balance for the feasibility study (Tetra Tech EBA, 2016).

Table 13 shows the estimated total volume of effluent released per month per year along with effluent released per month in 2018. Daily effluent discharge rates are provided in Figure 7.2 and discussed in Section 7.

Table 13: Estimated Effluent Flow Rates over Mine Operating Life

Year	Effluent Released Over the Course of the Month (m^3)				
	June	July	August	September	October
Year -2: 2018	134,262	352,551	153,066	2,632	0
Year -1: 2019	175,320	303,888	105,192	93,504	35,064
Year 1: 2020	175,320	292,200	105,192	163,632	70,128
Year 2: 2021	175,320	350,640	128,568	105,192	35,064
Year 3: 2022	175,320	350,640	128,568	93,504	35,064
Year 4: 2023	175,320	350,640	128,568	93,504	35,064
Year 5: 2024	175,320	350,640	128,568	93,504	35,064
Year 6: 2025	175,320	280,512	105,192	81,816	35,064
Year 7: 2026	175,320	292,200	116,880	93,504	35,064
Year 8: 2027	175,320	292,200	116,880	93,504	35,064
Year 9: 2028	175,320	280,512	116,880	93,504	35,064
Year 10: 2029	-	-	-	-	-
Year 11: 2030	-	-	-	-	-

SECTION 5 • WATER BALANCE

5.1 Global Water Balance

A water balance model was developed to assist in the evaluation of the water management infrastructure and estimation of the pumping requirements over the life of the Mine and under closure conditions. The model includes a water balance conducted on both a monthly and yearly basis. The model focuses specifically on contact water management infrastructure and areas that are affected by mining activities.

A monthly site-wide water balance was conducted for CP1, CP3, CP4, CP5, CP6, Tiriganiaq Pit 1, Tiriganiaq Pit 2, water in the underground mine operation, make-up water for the mill, water for the WTPs, and freshwater during mine construction period to mine closure under mean precipitation years.

The following sections present the parameters and assumptions adopted in the water balance model as well as a 2019 model update along with a summary of the water balance results.

5.2 Water Balance Framework

The water balance framework developed for the site-wide water balance model was presented in Version 1 of the WMP (Agnico Eagle, 2015a). To simulate a range of conditions, the model was run for the proposed mine life and closure conditions.

5.3 Water Balance Assumptions

The water balance was based on the following:

- snow accumulates throughout the months of November to May, and thaws in June during the annual spring freshet period;
- average precipitation year climate conditions;
- the open pits and water containment ponds (CP3 to CP6) are not to be used for long-term storage of water during operations;
- the water collection sumps and ponds are empty in the autumn prior to the spring freshet each year; and,
- other water management assumptions described in Section 4 of this WMP.

A general water management flow sheet illustration is presented in Appendix C.

5.4 Water Balance Results

The estimated maximum annual water input/output from each of the various water management facilities under mean precipitation conditions are summarized in Table 14. Results were also provided for 1:100 year wet and dry conditions, with corresponding basis and assumptions, in a separate technical memorandum (Tetra Tech EBA, 2015). Results of the 2019 water balance update are provided in Appendix H of the plan.

Table 14: Estimated Maximum Annual Volumes from Mine Site Water Balance

Item	Maximum Annual Water Volume (Mm^3)
Contact Water from CP1	0.800
Contact Water from CP3	0.088
Contact Water from CP4	0.087
Contact Water from CP5	0.240
Contact Water from CP6	0.076
Water Pumped from CP1 to EWTP for Treatment	0.798
Fresh Water Pumped from Meliadine Lake during Construction	0.062
Fresh Water Pumped from Meliadine Lake during Operation	0.318
Treated Water from EWTP to be Discharged to Outside Environment	0.730
Underground Water Pumped to Underground TSS Removal Plant	0.696
Excess Water from Underground Mine to be Stored on Surface	0.155
Fresh Water Pumped from Meliadine Lake to Fill Mined-out Tiriganiaq Pit 1	3.068
Fresh Water Pumped from Meliadine Lake to Fill Mined-out Tiriganiaq Pit 2	0.749

5.5 Waterbody Inventory

Three watersheds (Watershed A, Watershed B and Watershed H) will be impacted by the Mine activities. Table 15 presents the waterbodies that are impacted by mining activities. Watersheds and waterbodies in proximity to the Mine location and waterbodies affected by Mine infrastructure are shown on Figure 5.1.

5.6 2019 Water Balance Update

An update to the water balance model was generated to provide monthly water balance and water quality forecasts (Section 7.3) for the 2019 year. The purpose of this update is to identify potential changes to the site water balance as the mine transitions to commercial operation (Appendix H).

The 2019 water balance update is specific to waterbodies that will be affected by the commencement of operations and operational activities taking place throughout the remainder of the 2019 calendar year. The water containment facilities included in this update are CP1, CP3, CP5, Saline Pond, underground mine operation, and P-Area. Results of the water balance update are provided in Appendix H.

The framework of the 2019 water balance update was designed with the following assumptions:

- Precipitation is based off an average climate scenario;
- The Mine will not discharge saline water to Melvin Bay;
- Additional saline water storage on surface (i.e. Saline Pond 2) is not included;
- The SWTP will be used to treat saline water from the underground mine;
- Winter inputs (snow dumping activities) to CP1 are not accounted for; and
- TSF runoff includes a component of waste rock runoff originating through the waste rock cover.

Table 15: Inventory of Waterbodies Impacted by Mining Activities

Watershed	Waterbody	Maximum Lake Water Depth, m	Total Area (ha)	Water Volume (m^3)	Notes
A	A9	N/A	0.18	-	Flow regimes impacted by the development of Tiriganiaq Pit 1
	A10	0.67	0.26	-	Ponds removed by development of Tiriganiaq Pit 1
	A11	0.45	0.40	-	
	A12	0.87	0.47	-	Pond drained due to construction of Channel 5
	A13	0.30	0.26	-	
	A17	0.30	0.16	-	Covered by WRSF 1
	A38	N/A	0.05	-	Flow regimes impacted by the development of Tiriganiaq Pit 2
	A39	0.48	0.12	-	Ponds removed by development of Tiriganiaq Pit 2
	A54	1.3	5.99	34,545	Dewatered for CP5
	A58	0.50	0.43	-	Covered by WRSF 2
B	B8	0.8	1.43	-	As part of CP4/Berm-CP4
	B9	1.40	0.64	-	Dewatered for CP4
	B10	0.8	0.33	-	Ponds removed by development of Tiriganiaq Pit 1
	B28	N/A	0.45	-	As part of CP3/D-CP3
H	H6	0.58	0.75	-	As part of CP1
	H7	0.67	0.11	-	
	H8	0.59	0.38	-	Partially covered by WRSF2 and haul road
	H9	0.40	0.42	-	Partially covered by WRSF2 and OP2
	H10	0.11	0.10	-	Partially covered by WRSF2 and OP2, drained due to construction of Channel1
	H11	0.27	0.28	-	
	H12	0.81	0.97	-	Drained due to construction of Channel1 and partially covered by OP2
	H13	1.04	3.49	-	Drained due to construction of Channel1 and partially covered by industrial pad
	H14A	0.37	0.15	-	Covered by industrial pad
	H15D	0.30	0.15	-	Partially covered by TSF
	H15G	0.40	0.38	-	
	H17	1.70	15.8	195,700	Dewatered for CP1
	H17A	1.50	0.13	1,365	Dewatered for Meliadine esker
	H17B	1.50	0.69	10,350	Dewatered for Meliadine esker
	H17C	1.50	0.23	3,450	Dewatered for Meliadine esker
	H18	0.67	0.74	-	Covered by OP2
	H19	1.40	2.91	16,431	Dewatered for CP6
	H20	1.60	9.58	90,307	Covered by WRSF3

Watershed	Waterbody	Maximum Lake Water Depth, m	Total Area (ha)	Water Volume (m^3)	Notes
"-" indicates that data not available or not applicable		Ponds to be drained		Ponds to be dewatered	

SECTION 6 • WATER MANAGEMENT DURING CLOSURE

The detailed Mine closure and reclamation activities are provided in the Preliminary Closure and Reclamation Plan (Agnico Eagle, 2015d).

Water management during closure and reclamation will involve flooding the open pits using precipitation and freshwater from Meliadine Lake, flooding the Underground Mine workings with groundwater inflows (groundwater seepage), and maintaining contact water management systems on site until monitoring results demonstrate that water quality are acceptable for discharge of all contact water to the environment without further treatment. Once water quality meets the discharge criteria, the water management systems will be decommissioned to allow the water to naturally flow to the environment.

The key water management activities during Mine closure are summarized in Table 16. Figures 6.1 and 6.2 illustrate the WMP during and after Mine closure, respectively. Additional details for the activities are described in the following sections.

Table 16: Key Water Management Activities during Mine Closure

Mine Year	Figure	Key Water Management Activities and Sequence
Yr 9 to 11 (2028 to 2030)	6.1	• Finish flooding the mined-out Tiriganiaq Pit 1 and Tiriganiaq Pit 2 by Q4 of Year 10 • Continue to collect and manage the contact water in CP1, CP3, CP4, CP5 and CP6 • Continue to pump the contact water in CP1 to EWTP, if required, for treatment before being discharged to the outside environment • Remove non-essential site infrastructure • Pump the underflow sludge water from EWTP to CP1 • Continue natural flooding of Tiriganiaq Underground Mine with groundwater seepage • Remove Meliadine Lake pumping system
Post-Closure	6.2	• Treat the contact water until water quality meet direct discharge criteria and then decommission the water management system • Continue natural flooding of Tiriganiaq Underground (progressive reclamation since Year 8) • Breach water retention dikes D-CP1, D-CP3, D-CP4, D-CP5, and D- CP6 once water quality monitoring results meet discharge criteria to allow water to naturally flow to outside environment • Remove culverts and breach remaining water retention dikes/berms in Year 18

6.1 Open Pits Flooding

When flooding the open pits for closure, the maximum pumping rate from Meliadine Lake shall not exceed 4,000,000 m^3/year during closure of the Mine, as stated in Part E Item 2 of the Licence. The planned pumping period will occur during the open water season from mid-June to end of September for each year. Table 17 summarizes the pit volume and expected water elevations at the completion of flooding activities. It will take approximately three years to fill the pits with an assumed pumping rate of 0.44 m^3/s (38,300 m^3/day). The assumed pumping rate of 0.44 m^3/s from Meliadine Lake during closure will have negligible effect to Meliadine Lake when compared to the average outflow rate at the outlet of Meliadine Lake. The pumping rate will be evaluated further to validate that any possible negative effects to Meliadine Lake do not occur.

Table 17: Pit and Underground Flooding

Pit	Volume (Mm^3)	Final Water Elevation (masl)	Water Source
Tiriganiaq Pit 1	9.20	64.14	Freshwater from Meliadine Lake
Tiriganiaq Pit 2	2.25	64.38	Freshwater from Meliadine Lake
Tiriganiaq Underground	1.4	Groundwater level	Groundwater seepage

The water quality model results indicated that water quality in the flooded pits will meet the discharge criteria and post closure treatment will not be required. The water quality within the pits will be monitored during flooding to verify the prediction of the water quality model. The information will be used to develop a strategy to minimize contamination of the regional surface water system.

6.2 Underground Mine Flooding

Passive flooding of the Tiriganiaq Underground Mine will occur following the completion of mining. The estimated total flooding volume of the underground workings is 1,372,000 m^3. Seepage water into the Underground Mine will be the main water source for flooding. At the predicted seepage rate it is estimated to take 6 years to flood the Underground Mine.

6.3 Containment Ponds, Dikes and Berms

The containment ponds, dikes and berms will remain in place to collect the surface runoff water and seepage from the Mine until the water quality meets discharge criteria. Once the water quality meets discharge criteria, dikes/berms will be breached to allow runoff to follow natural (topographically induced) flow paths. Dikes/berms breaching will involve the removal of a portion of the dikes to a minimum depth of 1 m below average water level or back to original ground levels. Consideration will be given to breach staging, with the above water portions of the dike/berm in the breach area removed during winter periods, when there will be little surface water flow, thereby minimizing the potential release of sediments to the neighbouring waterbodies. The remainder of the breach would be conducted during the open water season following freshet. Turbidity curtains would be deployed to minimize any potential sediment release to surface water.

6.3 Channels and Sumps

Once monitoring results have indicated that contact water conveyed in channels and sumps meets acceptable water quality, the infrastructure will be graded and/or surface treated according to site-specific conditions to minimize wind-blown dust and erosion from surface runoff, if required. This closure activity is intended to enhance site area development for re-colonization by native plants and wildlife habitat.

SECTION 7 • WATER QUALITY

Water quality monitoring is an important part of the Water Management Plan to verify the predicted water quality trends, conduct adaptive management should differing trends be observed, and to ensure all water quality limits at discharge points are met (i.e., effluent to Meliadine Lake and Melvin Bay). Water quality results and water transfers (i.e., origin, destination, rate) at the Mine are monitored and documented pursuant the Licence.

Water quality monitoring was initiated at the pre-development stage and continued through construction. Monitoring will continue into operations, closure, and post-closure. Monitoring occurs at three levels:

1. Regulated discharge monitoring that occurs at monitoring points specified in the Licence or MDMER regulations.
2. Verification monitoring that is undertaken for operational and water management purposes by Agnico Eagle.
3. General monitoring that is commonly included in the Licence, specifying what is to be monitored according to a schedule. This monitoring is subject to compliance assessment to confirm sampling was carried out using established protocols, included quality assurance/quality control provisions, and addressing identified issues. General monitoring is subject to change as directed by an Inspector, or by the Licensee, subject to approval by the NWB.

Appendix F details the Water Quality and Flow Monitoring Plan, which will be further defined as the Mine advances. Figure 7.1a and Figure 7.1b depict Monitoring Program Stations on Site and at Itivia.

Water quality predictions for the Mine were generated using the GoldSim database management and simulations code (Version 11.1.2) where Mine contact water flows derived from the Meliadine water balance are combined with chemistry data from materials exposed in mine infrastructure (tailings storage facility, waste rock piles, etc.), and site baseline information. Where site-specific information is not available, data collected at other mine sites in the north were used to supplement input data.

Water quality estimates were generated for the operational and post-closure periods for effluent to Meliadine Lake, each contact water containment pond (CP1, CP3, CP4, CP5, and CP6), for sumps in the two open pits and for the two fully flooded open pit lakes post-closure. These results were submitted with the 2015 Water Management Plan.

The sensitivity of water quality to an added TSS load was evaluated outside of the GoldSim mass balance model. Total parameter concentrations were evaluated at ponds that discharge to the receiving environment (i.e., CP1 during operations, and CP1, CP3, CP4, and CP6 post-closure) based on an addition of 15 mg/L TSS. Given the uncertainties associated with the modelling exercise (i.e., the development stage of the Mine, laboratory-based input values, assumptions where data do not exist and consideration of an average climate year), the predicted concentrations are considered to be order-of-magnitude estimates. The estimates are sensitive to the assumptions and design elements considered.

Table 18 shows the various MEL-14 (effluent to Meliadine Lake) water quality limits listed under Part F, Item 3 of the Licence, the 2018 water quality results for MEL-14, and the predicted maximum values during operations with respect to end-of-pipe concentrations for MEL-14. As stated above, updated predictions of maximum MEL-14 values will be provided as an addendum to the Water Management Plan when completed.

7.1 Summary of Regulatory Guidelines

Water quality results are compared to MDMER criteria and effluent quality limits listed in the Licence. Water quality pertaining to MEL-14 will be compliant to Part F, Item 3 of the Licence prior to discharging to Meliadine Lake. All surface runoff and/or discharge from drainage management systems associated with the Mine, including laydown areas and All-Weather Access Road, where flow may directly or indirectly enter a Water body, shall not exceed the Effluent quality limits listed in Part D, Item 18 of the Licence. Furthermore, all waters from natural water body dewatering activities shall be directed to Meliadine Lake and shall not exceed the Effluent quality limits listed in Part D, Item 12.

Post-closure discharge water quality will be compared to Canadian Council of Ministers of the Environment Water Quality Guidelines (CCME-WQG) guidelines or the Meliadine SSWQO developed for aluminum, fluoride, and iron (Golder 2013a, 2013b, 2014). The Meliadine SSWQO criteria was developed as a conservative protection to the aquatic receiving environment and was developed by Golder (2013a, 2014) to assess whether waste rock consisted of a deleterious substance according to Environment Canada (2013). The outcome of the assessment was that Meliadine waste rock is not a deleterious substance (Environment Canada 2014).

7.2 Construction

7.2.1 2018 Discharge to Meliadine Lake (MEL-14) Results

With respect to discharge from CP1 to Meliadine Lake (MEL-14), there was one exceedance of the maximum grab sample total aluminum concentration in effluent under Part F, Item 3 of the Licence (3 mg/L; Table 18). This exceedance was reported to the GN. The sample was taken on July 23rd and produced total aluminum concentrations equal to 4.39 mg/L. Results of the adjacent sampling events, July 15th and July 29th, produced concentrations equal to 1.23 mg/L and 0.811 mg/L, respectively. On July 23rd, results showed a relatively high TSS concentration (21 mg/L) and total aluminum was made up of only 2.1% dissolved aluminum. Thus, the exceedance may be attributed to uncommonly high TSS on the sampling date or a lab error. A re-analysis could not be performed as there was no additional water left from this sample. There were no other exceedances under Part F, Item 3 of the Licence during Construction.

Daily MEL-14 discharge volumes over 2018 are shown in Figure 7.1 and monthly totals are provided in Table 13. Discharge began on June 21st and ended on September 3rd. Daily discharge ranged from 103 m^3/day during the late-season (late-August to early-September) to 18,998 m^3/day during peak discharge (mid- to late-July). Average discharge rate was 9,409 m^3/day between June 21st and September 3rd.

7.2.2 2018 Surface Runoff (MEL-SR-1 to MEL-SR-14) Results

With respect to surface runoff associated with the Mine, there were five TSS exceedances of maximum concentrations of any grab sample listed under Part D, Item 18 of the Licence (100 mg/L TSS). One of these occurred at MEL-SR-1 (500 mg/L TSS) and one at MEL-SR-9 (670 mg/L TSS) on May 27th, and on June 17th, respectively. The remaining three occurred at MEL-SR-11 (1200 mg/L TSS, 420 mg/L TSS, 160 mg/L TSS) on May 27th, June 3rd and June 10th. The high levels of TSS present during these sampling events caused the moving averages to fall above the maximum average TSS concentration limit listed under Part D, Item 18 of the Licence (50 mg/L). Thus, there were four exceedances of maximum average TSS concentration, one at MEL-SR-1 (143 mg/L TSS) and three at MEL-SR-11 (450 mg/L TSS, 154 mg/L TSS, 56 mg/L TSS). The maximum average TSS concentration exceedances were all the direct result of grab sample maximum concentrations exceedances, which were reported to the GN. Once the moving average calculations progressed beyond the inclusion of the grab sample exceedances, the moving average decreased well below the 50 mg/L limit. Thus, the exceedances of average TSS values were not the result of consistently high TSS values, but rather the result of temporally discrete instances of high TSS results.

Visual assessment and upstream sampling suggests the main TSS source to the MEL-SR-1 exceedance originated from infrastructure to the East and Northeast of the Itivia Site, outside of the site boundaries. Upon 2019 snowmelt, sediment control methods (i.e., silt fences, straw logs) will be strategically installed to prevent sediment transport into and through the Itivia site to MEL-SR-1. Agnico Eagle is currently planning permanent structures for sediment control at Itivia. With respect to MEL-SR-11, the cause for the exceedances and source of runoff was sediment-rich snow piles accumulated during construction of the Bypass Road. The snow piles were located to the Southwest of the Itivia fuel storage tanks. Construction of the Bypass Road is now complete and snow will not be placed in this area over the 2018/2019 winter. Furthermore, based on 2018 runoff patterns snow will be managed strategically to prevent sediment rich snow piles and runoff with the potential to entrain TSS (Refer to Snow Management Procedure within the Freshet Management Plan; Appendix B).

7.3 2019 Water Quality Forecast Update

Results from the 2019 model update (Section 5.4) include TDS concentrations for CP1, CP3, CP5, Saline Pond, underground mine operation, and P-Area. These results were calculated through a mass balance model developed in conjunction with the 2019 water balance model update. Pending the commissioning of additional treatment options, the water quality model will be updated to include all additional parameters outlined in Part F of the licence. The results of the mass balance model are provided alongside the water balance results in Appendix H.

Model predictions exhibit heightened instances of TDS loading across the containment ponds. These values can be attributed to several factors. In general, forecasted precipitation and runoff inflow volumes to all containment ponds is considered to be conservative. There is assumed to be a reduced accounting for freshwater inflows, as precipitation values through winter months is misrepresentative of the overall captured snow and ice melt within the catchment areas. This results in reduced TDS concentrations within all containment ponds and in particular, CP1, due to the size of the catchment area. There is also a lack of accounting for freshwater volumes received due to snow removal stockpiling within CP1. Additionally, CP3 TDS concentrations are assumed to be highly conservative due to the static TDS concentration applied to all runoff volumes within the TSF. As such, the results provide more relative concentrations compared to what has been observed in previous years and are better suited to reflect the magnitude of TDS concentrations that can be expected in 2019.

Table 18: Effluent Characteristics of MEL-14 (CP1 to Meliadine Lake)

	MDMER and Licence Part F, Item 3 Maximum Concentrations		**2018 MEL-14 End-of-Pipe Concentrations**		**Maximum MEL-14 End-of-Pipe Concentrations Predictions based on Tiriganiaq Monthly Average**	
	Maximum MEL-14 Average Concentration [mg/L]	Maximum MEL-14 Concentration of Any Grab Sample [mg/L]	Maximum MEL-14 Average Concentration [mg/L]	Maximum MEL-14 Concentration Grab Sample [mg/L]	Dissolved Concentration[mg/L]	Total Used in the Model (Dissolved + 15 mg/L TSS) [mg/L]
pH	6 to 9.5	6 to 9.5	7.1 to 7.4	6.8 to 7.5	-	-
Total Dissolved Solids	1400	1400	1254	1430*	204	204
Total Suspended	15	30	12	21	-	15
Total Ammonia as Nitrogen	14	18	2.4	4.1	4.6	4.6
Phosphorus (total)	2	4	0.0475	0.099	0.4	0.4
Total cyanide	0.5	1.0	<0.005	<0.005	0.005	0.005
Aluminum	2	3	1.8	4.39*	0.09	1.20
Arsenic	0.3	0.6	0.002	0.002	0.101	0.191
Copper	0.2	0.4	0.003	0.009	0.0011	0.0037
Lead	0.2	0.4	0.0003	0.0003	0.0011	0.0049
Nickel	0.5	1.0	0.003	0.003	0.0023	0.0032
Zinc	0.4	0.8	0.007	0.009	0.009	0.010
Radium-226	0.37 Bq/L	1.11 Bq/L	0.0058 Bq/L	0.008 Bq/L	-	-
Total Petroleum Hydrocarbon	5	5	1.2	1.8	-	-

*Exceeds effluent quality limit listed under Part F, Item 3 of the Licence (2AM-MEL1631).

Table 19: MEL-SR-1 to MEL-SR-14 runoff quality characteristics - Licence requirements & 2018 results

		TSS (mg/L)	Oil and Grease	pH
Licence Part D, Item 18 Maximum Concentrations	Max. Average Concentration	50	No Visible Sheen	6.0 - 9.5
	Max. Concentration of Any Grab Sample	100	No Visible Sheen	6.0 - 9.5
MEL-SR-1	Max. Average Concentration	143*	No Visible Sheen	7.8 - 8.0
	Max. Concentration of Any Grab Sample	500*	No Visible Sheen	7.5 - 8.1
MEL-SR-2	Max. Average Concentration	N/A[a]	No Visible Sheen	N/A[a]
	Max. Concentration of Any Grab Sample	38	No Visible Sheen	7.6
MEL-SR-7	Max. Average Concentration	12	No Visible Sheen	7.8
	Max. Concentration of Any Grab Sample	42	No Visible Sheen	8.0
MEL-SR-8	Max. Average Concentration	N/A[a]	No Visible Sheen	N/A[a]
	Max. Concentration of Any Grab Sample	3	No Visible Sheen	7.9
MEL-SR-9	Max. Average Concentration	N/A[a]	No Visible Sheen	N/A[a]
	Max. Concentration of Any Grab Sample	670*	No Visible Sheen	8.0
MEL-SR-11	Max. Average Concentration	450*	No Visible Sheen	7.9 - 8.0
	Max. Concentration of Any Grab Sample	1200*	No Visible Sheen	7.8 - 8.1
MEL-SR-12	Max. Average Concentration	N/A[a]	No Visible Sheen	N/A[a]
	Max. Concentration of Any Grab Sample	15	No Visible Sheen	7.0
MEL-SR-13	Max. Average Concentration	N/A[a]	No Visible Sheen	N/A[a]
	Max. Concentration of Any Grab Sample	3	No Visible Sheen	8.0
MEL-SR-14	Max. Average Concentration	N/A[a]	No Visible Sheen	N/A[a]
	Max. Concentration of Any Grab Sample	17	No Visible Sheen	7.9

[a] Insufficient quantity of sample results to calculate an average as it is defined in the Licence (requires 4 sample dates for moving average).
*Exceeds effluent quality limit listed under Part F, Item 3 of the Licence (2AM-MEL1631).

7.2.3 Dewatering and Other Monitoring Program Stations

There were no dewatering activities applicable to Part D, Item 12 of the Licence. Dewatering of Lake B8 and Lake B9 produced modest volumes (Section 4.1.1) and was directed to CP1.

The remaining Monitoring Program Station results will be provided in the 2018 Annual Water Licence Report where the stations have sufficient data to report. These stations are not final discharge points and thus do not have effluent quality limits applied within the Licence. A discussion of these results and trends will be provided in the 2018 Annual Water Licence Report where applicable.

7.3 Operations

According to model predictions, CP3 arsenic concentration may exceed MDMER on occasion if precipitation events or the freshet flows generate drainage from the TSF (Golder, 2012c). The main source of arsenic in CP3 is predicted to be from residual process water that is assumed to be present in the filtered tailings. Arsenic transfer from process water to CP3 water will be minimized by effective dewatering of the tailings prior to placement into the TSF, and from freezing of the tailings in the TSF. Frozen tailings will act to limit infiltration and seepage. Water from CP3 will be pumped to CP1 where it will mix with other site waters before discharge. Dissolved arsenic concentration in CP1 is predicted to meet the MDMER monthly average maximum concentration. All other chemical parameters in CP3 and all chemical parameters in CP1, CP4, CP5, and CP6 are predicted to meet MDMER limits for chemical constituents.

7.4 Post-Closure

Long-term, post-closure water quality in the containment ponds (CP1, CP3, CP4, CP5, and CP6) and in the flooded open pit lakes are anticipated to meet MDMER limits and CCME-WQG for the protection of aquatic life or the SSWQO developed for the Mine for aluminum, fluoride, and iron. Arsenic concentrations in CP3 could slightly exceed the SSWQO post-closure, a criteria that is conservatively protective of the receiving aquatic environment (Golder, 2013a). Concentrations that exceed predictions are minor, much less than the mixing capacity in the receiving environment. These arsenic concentrations (Golder, 2013a) are within the tolerance levels that have been deemed non-deleterious by Environment Canada for the Mine (Environment Canada, 2014).

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FIGURES

Figure 1.1 General Mine Site Location Plan

Figure 1.2 General Mine Site Plan Layout

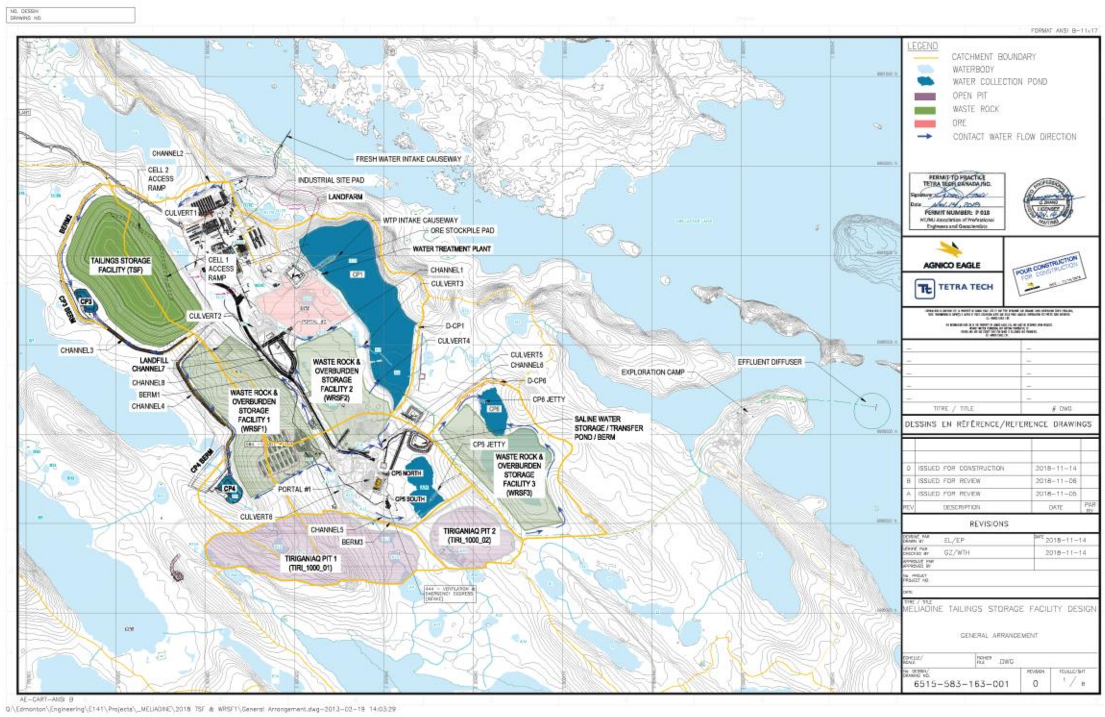


Figure 3.1 P-Area Plan View

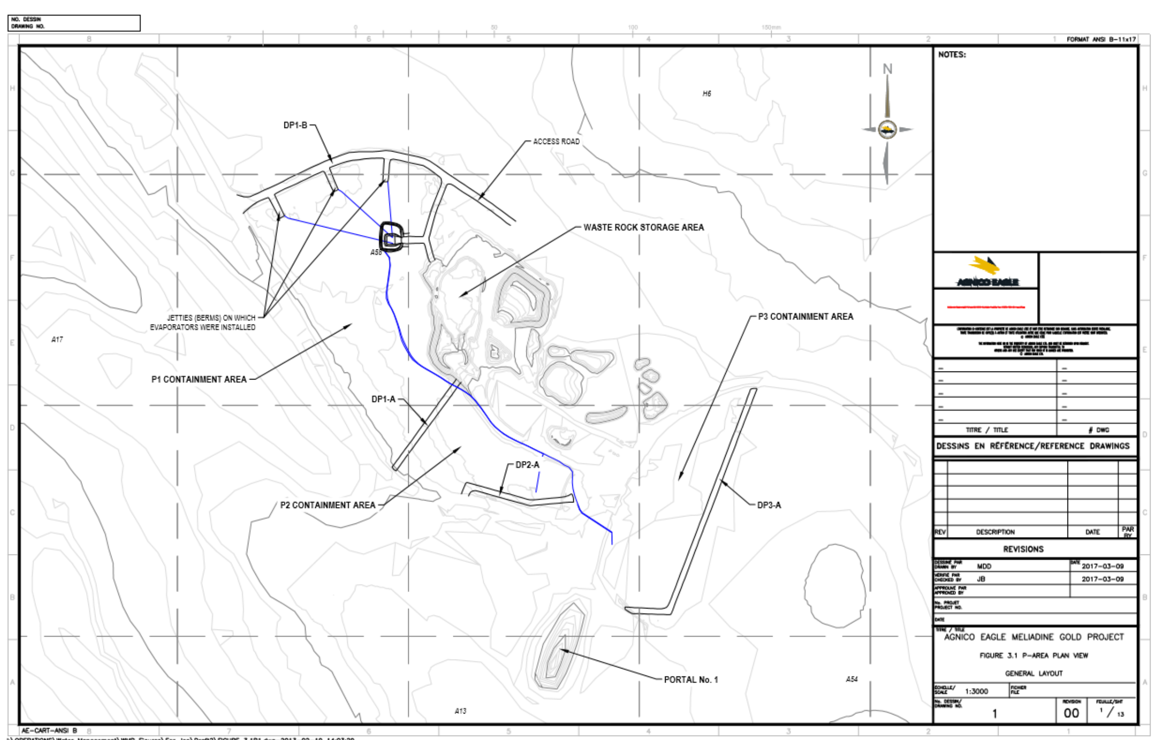


Figure 3.2 Location of Saline Pond 2 within Tiriganiaq Pit 2

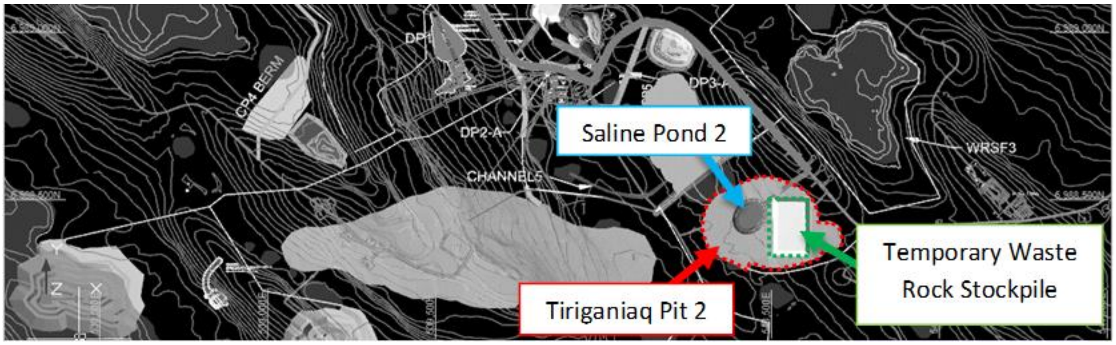


Figure 3.3 Rating curve applied to estimate TDS from conductivity

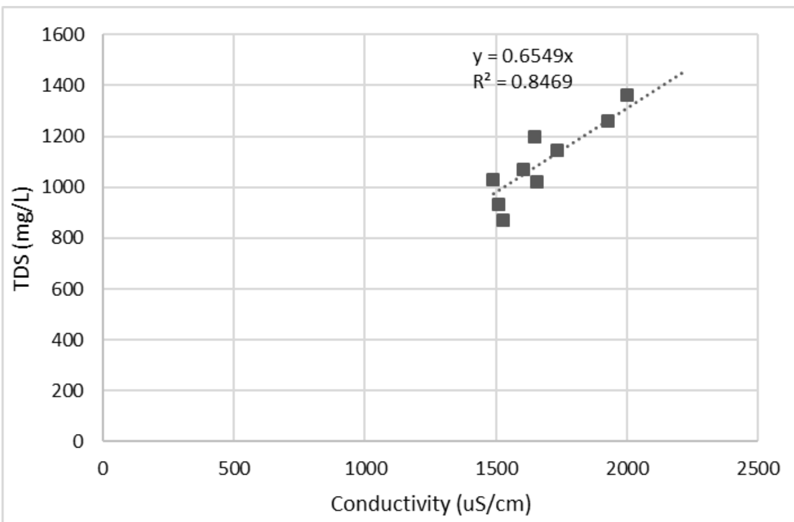


Figure 3.4 Rating curve applied to estimate TSS from turbidity

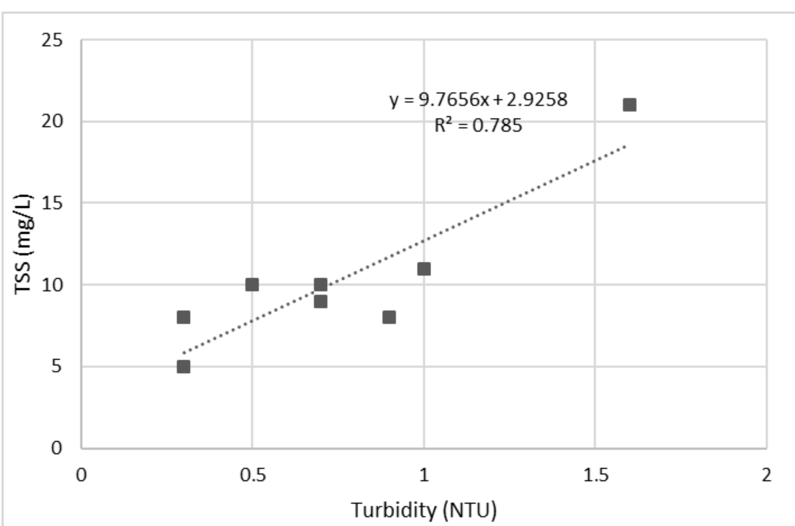


Figure 5.1 Watersheds and Waterbodies in Proximity of Mine Site

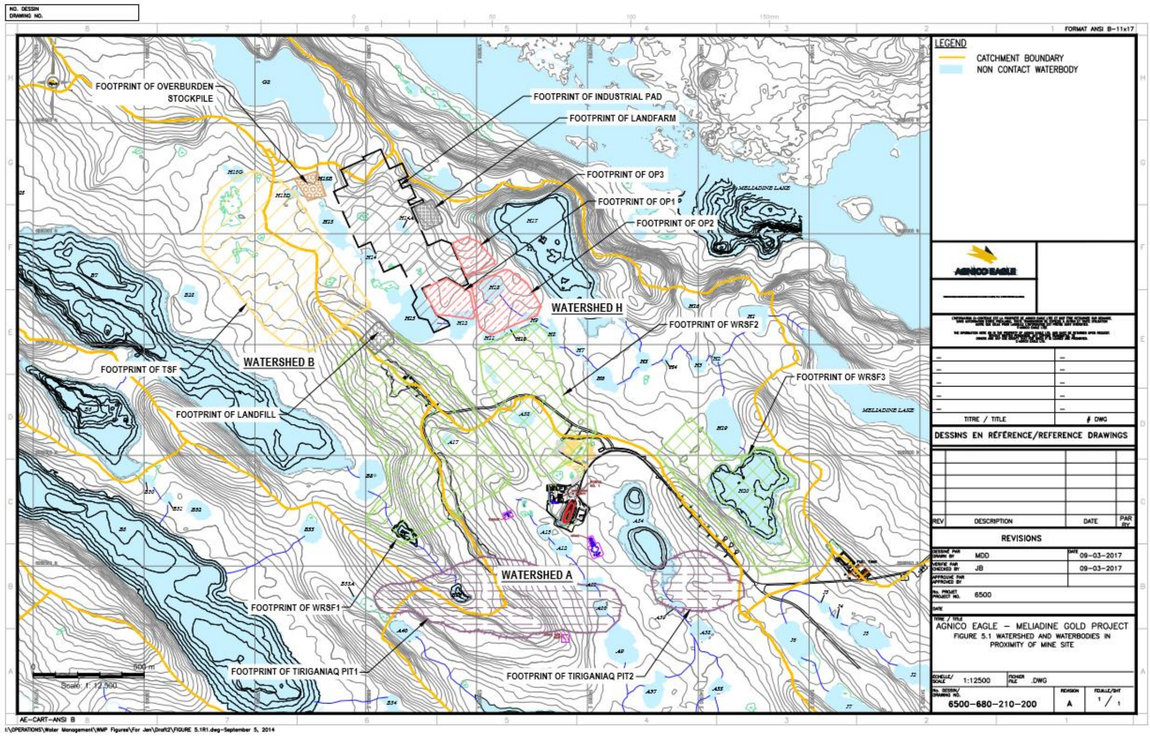


Figure 6.1 Mine Site Layout for Water Management During Closure from Feasibility Level Study. (TetraTech, 2014).

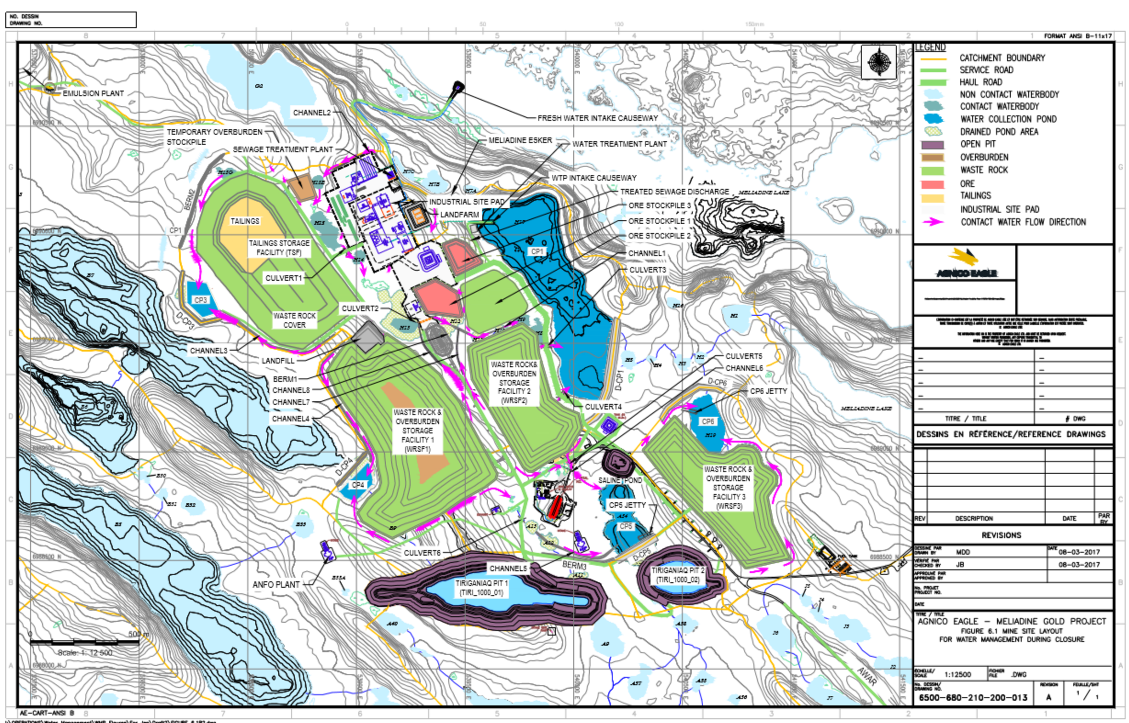


Figure 6.2 Mine Site Layout After Closure from Feasibility Level Study. (TetraTech, 2014).

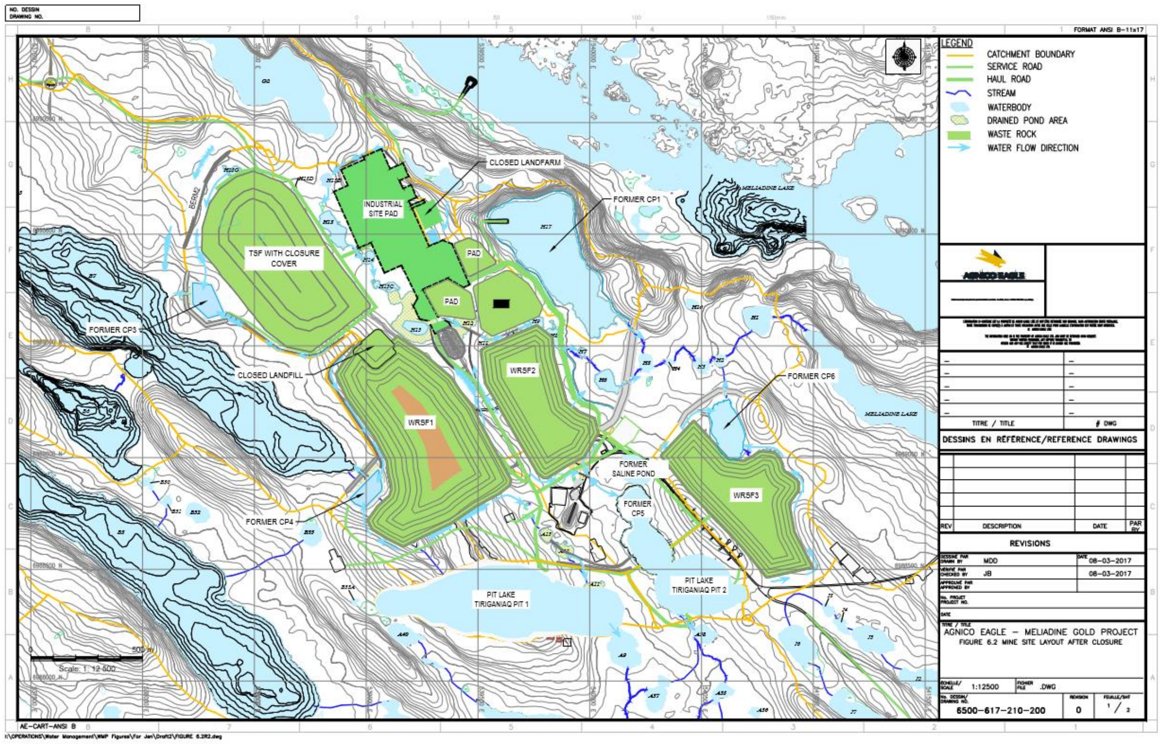


Figure 7.1a Water Quality Monitoring Locations on Site

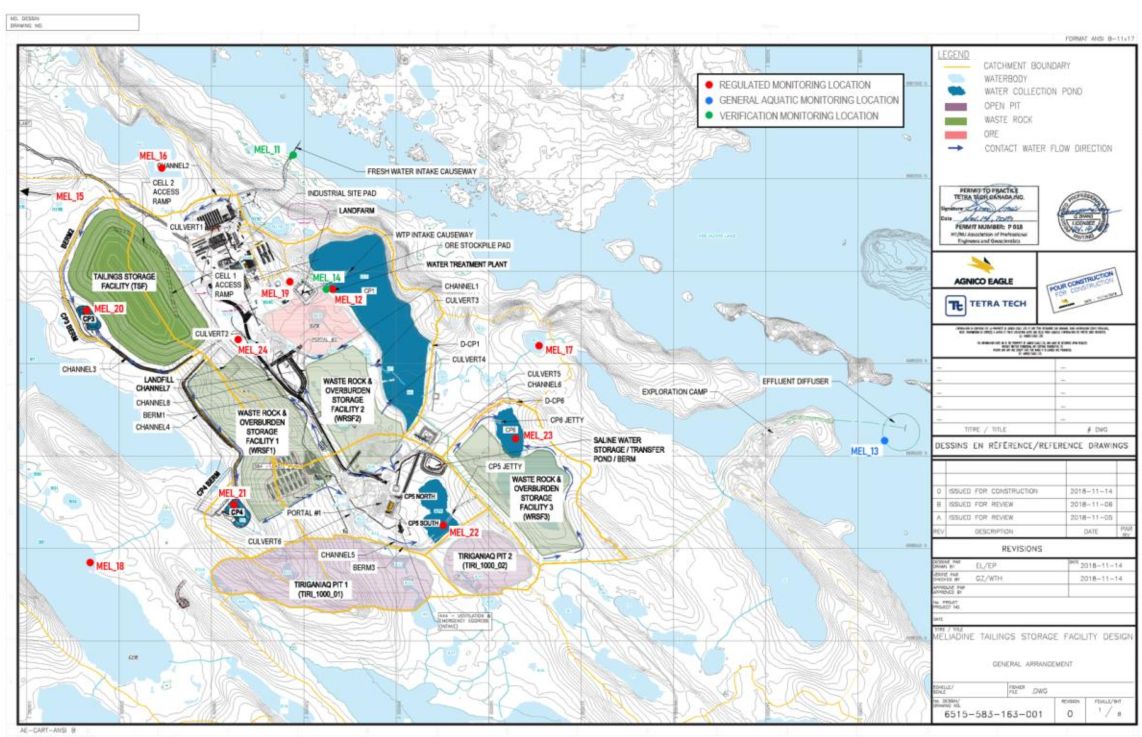
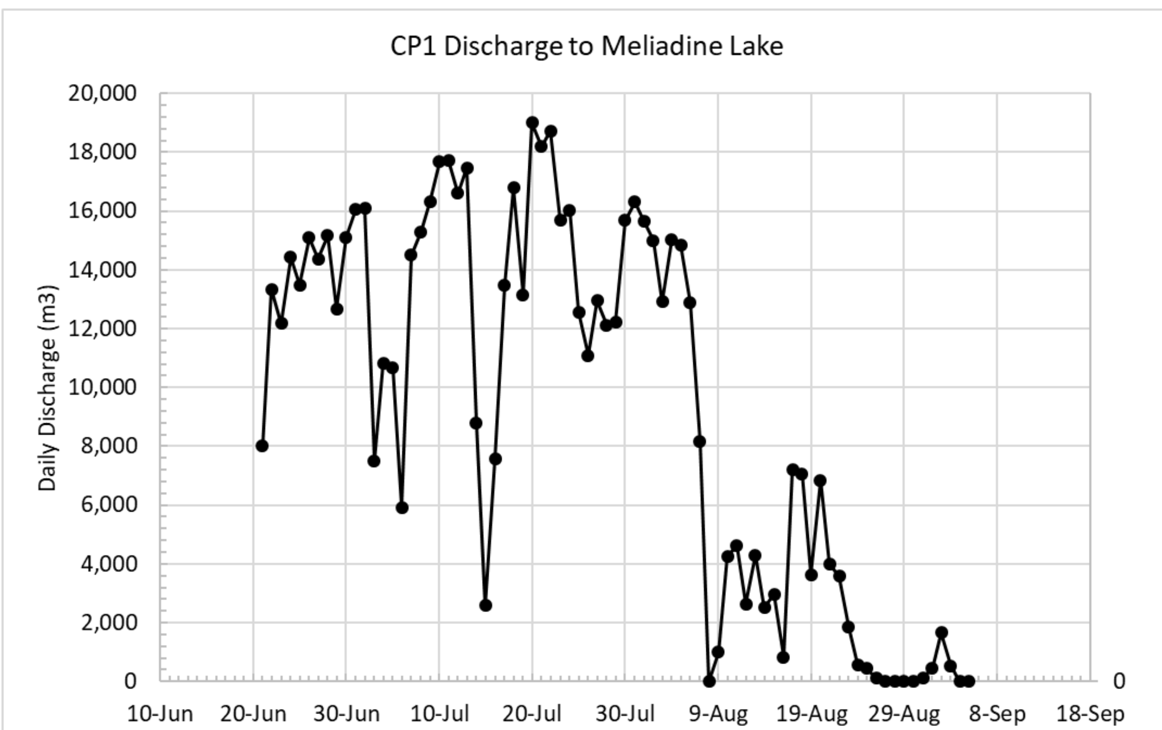


Figure 7.1b Water Quality Monitoring Locations at Itivia

Note – MEL-12 is located to the Northwest along the Bypass road but could not be effectively included in this map due to its distance from Itivia.

Figure 7.2 Daily discharge volumes from through the EWTP at CP1 to Meliadine Lake



APPENDIX A • MELIADINE GROUNDWATER MANAGEMENT PLAN

AGNICO EAGLE

MELIADINE GOLD MINE

Groundwater Management Plan

MARCH 2019
VERSION 4

EXECUTIVE SUMMARY

Agnico Eagle Mines Limited (Agnico Eagle) is developing the Meliadine Gold Mine (the Mine), located approximately 25 kilometres (km) north of Rankin Inlet, and 80 km southwest of Chesterfield Inlet in the Kivalliq Region of Nunavut.

The Mine Plan proposes mining methods for the development of the Tiriganiaq gold deposit, with two open pits (Tiriganiaq Pit 1 and Tiriganiaq Pit 2) and one Underground Mine. Based on the current Mine Plan, the Mine will produce approximately 14.9 million tonnes (Mt) of ore, 31.4 Mt of waste rock, 7.1 Mt of overburden waste, and 14.9 Mt of tailings (Agnico Eagle 2019). There are four phases to the development of the Mine; just over 4 years of construction (Q4 Year -5 to Q2 Year -1)), 8.5 years of Mine operation (Q2 Year 1 to Year 8), 3 years of closure (Year 9 to Year 11), and post-closure (Year 11 forwards).

Tiriganiaq Underground Mine is planned to extend to approximately 625 m below the ground surface; therefore, part of the Underground Mine will operate below the base of the continuous permafrost. The underground excavations will act as a sink for groundwater flow during operation, with water induced to flow through the bedrock to the Underground Mine workings once the Mine has advanced below the base of the permafrost. Over 2018, there was a net positive balance of stored underground water. The mean daily addition to underground water storage was estimated at 51 m^3/day. Groundwater quality data from samples taken underground 2017 through 2018 from diamond drillholes (DDHs) indicate TDS concentrations are less than predicted at an average concentration of 56,000 mg/L.

Saline water generated from the Underground Mine is currently stored underground and on surface at the P-Area and in Saline Pond 1 (SP1). A second containment pond, Saline Pond 2 (SP2), is being constructed in Q1 2019 and will be an addition to the surface saline water containment system. Saline groundwater stored on site is currently pumped to the Saline Water Treatment Plan (SWTP) for treatment and discharge to CP1. As part of the strategy to manage excess groundwater infiltration of saline water within the underground portion of the mine, Agnico Eagle received approval from the Nunavut Impact Review Board to discharge saline water to the sea (Melvin Bay, Rankin Inlet). Total dissolved solids of water discharged to sea and daily discharge volumes will not exceed 39,600 mg/L and 800 m^3/day, respectively.

This document presents the Groundwater Management Plan (GWMP) for the collection, treatment, storage and discharge of saline groundwater in accordance with Agnico Eagle's Type A Water Licence 2AM-MEL1631, Part E, Item 14.

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ᐊᒡᓃᑯ ᐃᒎ ᐅᔭᕋᒃᑕᕆᐊᒃᑯᑦ (ᐊᒡᓃᑯᒃᑯᑦ) ᑕᓯᕐᔪᐊᕐᒥᑦ ᐅᔭᕋᒃᑕᕆᐊᓕᐅᖅᐸᓪᓕᐊᔪᑦ (ᐅᔭᕋᒃᑕᕆᐊᖅ), 25 ᑭᓛᒥᑕᓂᒃ ᐅᖓᓯᒃᑎᒋᔪᖅ ᐅᐊᓐᓇᖓᓂᑦ ᑲᖏᖅᖠᓂᐅᑉ, ᐊᒻᒪᓗ 80 ᑭᓛᒥᑕᓂᒃ ᐅᖓᓯᒃᑎᒋᑉᐳᓂ ᓂᒡᒋᐊᓂᑦ ᐱᖓᓐᓇᖅᐸᓯᐊᓂᑦ ᐃᒃᐳᓕᒫᕐᔫᑉ ᑭᕙᓪᓕᕐᒥᑦ ᓄᓇᕗᒻᒥᑦ.

ᐅᔭᕋᒃᑕᕆᐊᕐᒧᑦ ᐸᕐᓇᐅᑎ ᐅᔭᕋᒃᑕᕐᓂᕐᒧᑦ ᐱᓕᕆᐊᖃᕈᒪᔪᑦ ᐊᑐᖅᑕᐅᓂᐊᖅᑐᓂᒃ ᐱᕙᓪᓕᐊᓗᒍ ᑎᕆᒐᓂᐊᖅ ᒎᑐᑕᓕᒃ, ᒪᕐᑮᖕᓂᒃ ᓄᓇᒥᑦ ᐅᒃᑯᐃᖓᔪᓂᑦ (ᑎᕆᒐᓂᐊᖅ 1 ᐊᒻᒪᓗ ᑎᕆᒐᓂᐊᖅ 2) ᐊᒻᒪᓗ ᐊᑕᐅᓯᖅ ᓄᓇᐅᑉ ᐃᓗᐊᓂᑦ ᐅᔭᕋᒃᑕᕐᓂᖅ. ᒪᓕᒃᑯᒎ ᓖᓐᓇᐅᔪᖅ ᐅᔭᕋᒃᑕᕆᐊᕐᒧᑦ ᐸᕐᓇᐅᑎ, ᐅᔭᕋᒃᑕᕆᐊᖅ 14.9 ᒥᓕᔭᓐ ᑕᓐ-ᓗᐊᓂᒃ ᐅᔭᕋᒃᑕᖃᑦᑕᕐᓂᐊᖅᑐᑦ, 31.4 ᒥᓕᔭᓐ ᑕᓐ-ᓂᒃ ᐊᒃᑕᑰᖅᑕᐅᔪᓂᒃ ᐅᔭᖅᑲᓂᒃ, 7.1 ᒥᓕᔭᓐ ᑕᓐ-ᓂᒃ ᐅᖓᑕᐅᑦᑎᔪᓂᒃ ᐊᒃᑕᑰᖅᑕᐅᔪᓂᒃ, ᐊᒻᒪᓗ 14.9 ᒥᓕᔭᓐ ᑕᓐ-ᓂᒃ ᑭᒪᒃᑎᑦᑐᓂᒃ (ᐊᒡᓃᑯᒃᑯᑦ 2019). ᓯᑕᒪᐅᓕᖓᓂᐊᖅᑐᖅ ᐱᕙᓪᓕᐊᓂᖅ ᐅᔭᕋᒃᑕᕆᐊᕐᒥᑦ; ᓯᑕᒪᓄᑦ ᐅᑭᐅᖏᓐᓇᕐᓄᑦ ᓴᓇᔭᐅᓗᓂ (Q4 ᐅᑭᐅᖅ - 5-ᒥᑦ Q2 ᐅᑭᐅᖅ - 1-ᒧᑦ)), 8.5 ᐅᑭᐅᓂᒃ ᐊᐅᓚᕐᓗᓂ ᐅᔭᕋᒃᑕᕆᐊᕐᓂᖅ (Q2 ᐅᑭᐅᖅ 1-ᒥᑦ ᐅᑭᐅᖅ 8-ᒧᑦ), ᐱᖓᓱᓂᒃ ᐅᑭᐅᓂᒃ ᐅᒃᑯᐊᖅᐸᓪᓕᐊᓗᒍ (ᐅᑭᐅᖅ 9-ᒥᑦ ᐅᑭᐅᖅ 11-ᒧᑦ), ᐊᒻᒪᓗ ᐅᒃᑯᐊᖅᓯᒪᓕᖅᑎᓪᓗᒍ (ᐅᑭᐅᖅ 11-ᒥᑦ ᐅᖓᑖᓄᑦ).

ᑎᕆᒐᓂᐊᖅ ᓄᓇᐅᑉ ᐃᓗᐊᓂᑦ ᐅᔭᕋᒃᑕᕐᓂᖅ ᐊᑦᑎᒃᓯᕆᐊᖅᑕᐅᒃᑲᓂᕐᓂᐅᔭᖅᑐᖅ 625 ᒦᑕᓂᒃ ᓄᓇᐅᑉ ᖃᖓᑕ ᐊᑖᓄᑦ; ᑕᐃᒪᓐᓇᒧᑦ, ᐃᓚᖓ ᓄᓇᐅᑉ ᐃᓗᐊᓂᑦ ᐅᔭᕋᒃᑕᕆᐊᖅ ᐊᐅᓚᕐᓂᐊᖅᑐᖅ ᑭᒡᓕᒋᔭᐅᔪᖅ ᖁᐊᖑᐃᓐᓇᐅᔭᖅᑑᑉ ᐊᑖᓂᑦ. ᓄᓇᐃᔭᐃᓂᖅ ᓄᓇᐅᑉ ᐃᓗᐊᓂᑦ ᐃᒻᒥᖅᑐᕐᓂᐊᖅᑐᖅ ᑯᕙᔪᒥᒃ ᐃᒪᕐᒥᒃ ᐊᐅᓚᖅᑎᑦᑎᓂᐅᑎᓪᓗᒍ, ᐃᒪᖅ ᑯᕙᑎᑕᐅᓗᓂ ᐅᔭᕋᕐᒧᑦ ᓄᓇᐅᑉ ᐃᓗᐊᓂᑦ ᐅᔭᕋᒃᑕᕆᐊᕐᒥᑦ ᐱᓕᕆᕝᕙᐅᔨᒥᑦ ᖁᐊᖑᐃᓐᓇᐅᔭᖅᑑᑉ ᐊᑖᓄᑦ ᐅᔭᕋᒃᑕᕆᐊᖅ ᓯᕗᒻᒧᒃᓯᒪᓕᖅᑎᓪᓗᒍ. 2018-ᒥᑦ, ᐋᖅᓯᕝᕙᐅᖅᑳᖅᑎᓪᓗᒍ ᐱᐅᔪᒥᒃ ᓄᓇᐅᑉ ᐃᓗᐊᓂᑦ ᑐᖅᑯᖅᑕᐅᓯᒪᔪᖃᓚᐅᖅᑐᖅ ᐃᒪᕐᒥᒃ. ᖃᐅᑕᒫᒃᑯᑦ ᐃᓚᕗᓪᓕᐊᔪᖅ ᓄᓇᐅᑉ ᐃᓗᐊᓃᑦᑐᒧᑦ ᐃᒪᕐᒧᑦ ᑐᖅᑯᖅᓯᒪᔪᖅ ᓇᓚᐅᑦᑖᖅᑕᐅᔪᖅ 51 m^3-ᖑᑉᓗᓂ/ᖃᐅᑕᒥᖅ. ᓄᓇᐅᑉ ᐃᓗᐊᓂᑦ ᐃᒪᐅᑉ ᖃᓄᐃᓐᓂᖓᓄᑦ ᓈᓴᐅᑏᑦ/ᑎᑎᖅᑲᐃᑦ ᐆᒃᑐᕋᕈᑎᓂᑦ ᐱᔭᐅᔪᑦ ᓄᓇᐅᑉ ᐃᓗᐊᓂᑦ 2017-ᒥᑦ 2018-ᒧᑦ ᓯᑎᔪᓂᒃ ᐅᔭᖅᑲᓂᒃ ᐃᑰᑕᖅᑕᐅᓯᒪᔪᓂᑦ, ᓇᓗᓇᐃᖅᓯᔪᑦ TDS ᑲᑎᑎᓯᒪᔪᑦ ᐊᒥᓲᖏᓐᓂᖅᓴᐅᓂᖏᓐᓄᑦ ᓇᓚᐅᑦᑖᖅᑕᐅᓚᐅᖅᑐᓂᐅᖓᓂᑦ ᐊᑕᐅᓯᖖᒍᖅᓱᒎ ᓈᓴᐅᑎ ᑲᑎᓯᒪᔪᓂᑦ 56,000 mg/L-ᖑᑉᓗᓂ.

ᑕᕆᐅᓕᒃ ᐃᒪᖅ ᐱᔪᖅ ᓄᓇᐅᑉ ᐃᓗᐊᓂᑦ ᐅᔭᕋᒃᑕᕆᐊᕐᒥᑦ ᓖᓐᓇᐅᔪᖅ ᑐᖅᑯᖅᑕᐅᖃᑦᑕᖅᑐᖅ ᓄᓇᐅᑉ ᐃᓗᐊᓂᑦ ᐊᒻᒪᓗ ᖃᖓᓂᑦ P-ᐃᓂᐅᔪᒧᑦ ᐊᒻᒪᓗ ᑕᕆᐅᓕᒃ ᑕᓯᕋᔭᒃ 1-ᒧᑦ (SP1). ᑐᒡᓕᐊ ᑕᓯᕋᔭᒃ, ᑕᕆᐅᓕᒃ ᑕᓯᕋᔭᒃ 2 (SP2), ᓴᓇᔭᐅᕙᓪᓕᐊᔪᖅ Q1 2019-ᒥᑦ ᐊᒻᒪᓗ ᐃᓚᓕᐅᑎᔭᐅᓂᐊᖅᑐᖅ ᖃᖓᓂᑦ ᑕᕆᐅᓕᒃ ᐃᒪᖃᐅᓯᕝᕕᖓᒍᑦ. ᑕᕆᐅᓕᒃ ᓄᓇᒥᑦ ᐃᒪᖅ ᑐᖅᑯᖅᑕᐅᓂᐊᖅᑐᖅ ᐅᔭᕋᒃᑕᕆᐊᕐᒥᑦ ᑯᕙᑎᑕᐅᖃᑦᑕᖅᑐᖅ ᑕᕆᐅᓕᒃ ᐃᒪᓕᕆᕝᕕᖓᒧᑦ (SWTP) ᐱᓕᕆᐊᖑᓂᐊᕐᓗᓂ ᐊᒻᒪᓗ ᑯᕙᑎᑕᐅᓗᓂ CP1-ᒧᑦ. ᐃᓚᒋᔭᐅᑉᓗᓂ ᖃᓄᖅᑑᕆᓂᕐᒧᑦ ᐊᐅᓚᓐᓂᐊᕐᓗᒍ ᐱᑕᖃᓗᐊᕐᓂᖅ ᓄᓇᒥᑦ ᐃᒪᖅ ᓴᓗᒪᐃᔭᐃᑦᔨᑎ ᑕᕆᐅᓕᖕᒥᑦ ᐃᒪᕐᒥᒃ ᓄᓇᐅᑉ ᐃᓗᐊᓂᑦ ᐅᔭᕋᒃᑕᕆᐊᕐᒥᑦ, ᐊᒡᓃᑯᒃᑯᑦ ᓈᒻᒪᒋᔭᐅᔪᒥᒃ ᐱᓚᐅᖅᑐᑦ ᐊᑭᑎᓕᕆᔾᑯᓐᓂᑦ ᑯᕙᑎᓐᓂᐊᕐᓗᒍ ᑕᕆᐅᓕᒃ ᐃᒪᖅ ᑕᕆᐅᕐᒧᑦ (ᐃᑎᕝᕙᐊᓄᑦ, ᑲᖏᖅᖠᓂᕐᒥᑦ). ᑲᑎᖕᒍᕆᑦ ᓄᖑᑎᖅᓯᒪᔪᑦ ᓯᑎᔪᐃᑦ ᐃᒪᕐᒥᑦ ᑯᕙᔭᐅᔪᖅ ᑕᕆᐅᕐᒧᑦ ᐊᒻᒪᓗ ᖃᐅᑕᒫᑦ ᑯᕙᔪᑦ ᐅᖓᑕᐅᑦᑎᔾᔮᙱᑦᑐᑦ 39,600 mg/ᓖᑕᓂᒃ ᐊᒻᒪᓗ 800 m^3/ᐅᓪᓗᑕᒫᑦ.

ᑖᒃᑕ ᑎᑎᖅᑲᖅ ᐱᔾᔪᑎᖃᖅᑐᖅ ᓄᓇᒥᑦ ᐃᒪᕐᒥᒃ ᐊᐅᓚᑦᑎᓂᕐᒧᑦ ᐸᕐᓇᐅᑎᒥᒃ ᑲᑎᖅᓯᐃᓂᕐᒧᑦ, ᐱᓕᕆᐊᕆᓗᒍ, ᑐᖅᑯᕐᓗᒍ ᐊᒻᒪᓗ ᑯᕙᑎᓪᓗᒍ ᑕᕆᐅᓕᒃ ᓄᓇᒥᑦ ᐃᒪᖅ ᒪᓕᒡᓗᒋᑦ ᐊᒡᓃᑯᒃᑯᑦ Type A ᐃᒪᕐᒧᑦ ᓚᐃᓴᓐᓯᖓᑦ 2AM-MEL1631, ᐊᕝᓯᒪᓂᖓ E, ᑎᑎᕋᖅᓯᒪᔪᖅ 14.

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DOCUMENT CONTROL

Version	Date	Section	Page	Revision	Author
1	February 2018	All		In compliance with Agnico Eagle's Type A Water Licence 2AM-MEL1631, Part E, Item 14	Golder Associates Ltd. on behalf of Agnico Eagle Mines Limited
2	June 2018	4		In compliance with ECCC comments from 16 March 2018	Golder Associates Ltd. on behalf of Agnico Eagle Mines Limited
3.	December 2018	All		In compliance with Agnico Eagle's Type A Water Licence 2AM-MEL1631, Part E, Item 11	Agnico Eagle Mines Ltd.
		Exec Summary		Updated dates and quantities	
		2.4		Revised mine development plan bullets	
		3.3		Updated saline GW quality	
		3.4		Updated groundwater management strategies	
		4.1		Updated GW monitoring program quantity and quality data	
		4.4		Expanded table 5 monitoring to include SWTP	
4.	March 2019	All		In compliance with Agnico Eagle's amended No. 006 Project Certificate, Condition No. 25	Agnico Eagle Mines Ltd.
		Exec Summary		Updated to include discharge to sea approval	
		1	1-2	Update to include requirements of No. 006 Project Certificate Condition No. 25	
		2.4	5	Addition of SWTP and discharge to sea	
		3.1	6-7	Section revision	
		3.1.1	7-8	Addition of inflow model assumptions/uncertainties	
		3.2	8-9	Updated with discharge to sea	
		3.3	9-10	Interpretation added and table Aug-18 results corrected	
		3.4	11-15	Addition of discharge to sea and update of SWTP performance	
		3.6	16-18	Addition of mitigation measures under greater than expected inflows	
		4.2	19	Addition of second pumping line from UG	
		4.3	21-23	Addition of discharge to sea related sampling/monitoring	

ACRONYMS

Agnico Eagle	Agnico Eagle Mines Limited
ANFO	Ammonium Nitrate/Fuel Oil
CP	Collection Pond
DDH	Diamond Drillhole(s)
EMPP	Environment Management and Protection Plan
EWTP	Effluent Water Treatment Plant
FEIS	Final Environmental Impact Statement
GWMP	Groundwater Management Plan
MDMER	Metal and Diamond Mining Effluent Regulations
NIRB	Nunavut Impact Review Board
NWB	Nunavut Water Board
Mine	Meliadine Gold Mine
QA	Quality Assurance
QC	Quality Control
RO	Reverse Osmosis
SD	Support Document
SSWQO	Site Specific Water Quality Objectives
SWTP	Saltwater Treatment Plant
TDS	Total Dissolved Solids
TSS	Total Suspended Solids
WMP	Water Management Plan

UNITS

%	percent
°C	degrees Celsius
°C/m	degrees Celsius per metre
ha	hectare(s)
mg/L	milligram(s) per litre
km	kilometer(s)
km^2	kilo square meter(s)
m	metre(s)
m/day	metre(s) per day
mm	millimetre(s)
m^3	cubic metre(s)
m^3/day	cubic metre(s) per day
m^3/s	cubic metre(s) per second
m^3/hour	cubic metre(s) per hour
m^3/year	cubic metre(s) per year
Mm^3/year	million cubic metre(s) per year
Mm^3	million cubic metre(s)
t	tonne(s)
tpd	tonne(s) per day
Mt	million tonne(s)

SECTION 1 • INTRODUCTION

Agnico Eagle Mines Limited (Agnico Eagle) is developing the Meliadine Gold Mine (Mine), located approximately 25 kilometres (km) north of Rankin Inlet, and 80 km southwest of Chesterfield Inlet in the Kivalliq Region of Nunavut. The Mine is subject to the terms and conditions of both the Mine Project Certificate (No. 006) issued by the Nunavut Impact Review Board in accordance with the Nunavut Agreement Article 12.5.12 on February 26, 2015 and Nunavut Water Board Type A Water Licence (No. 2AM-MEL1631, 2016) issued by the Nunavut Water Board (NWB) on April 1, 2016.

This document presents the Groundwater Management Plan (GWMP) for the collection, treatment, storage and discharge of saline groundwater in accordance with the Type A Water Licence 2AM-MEL1631 (Licence) and in accordance with Condition No. 25 of the amended Mine Project Certificate. The overall water management plan for the life of the Mine and post-closure is described in the Agnico Eagle Meliadine Gold Mine 2019 Water Management Plan (WMP) (Version 6). The WMP provides descriptions of the Mine water control structures and associated design criteria. The WMP was updated in March 2019 and reflects the groundwater management strategy presented in this document.

1.1 Concordance

The Mine is subject to the land and resource management processes established by the Nunavut Agreement and other Federal laws and regulations. Agnico Eagle submitted a Licence Application for a Mining and Milling Undertaking (Application) required to use water and to deposit waste in development of the Mine, in accordance with the *Nunavut Waters and Nunavut Surface Rights Tribunal Act* and Nunavut Water Regulations.

The Licence was issued on April 1, 2016 and signed by the Minister on May 19, 2016. The GWMP reflects the commitments made with respect to submissions provided during the technical review of the Application, as well as final submissions and issues raised during the Public Hearing Process, where applicable, to comply with Part B Section 13, and Part E Section 14 of the Licence.

In 2018, Agnico Eagle submitted a Saline Effluent Discharge proposal to the Nunavut Impact Review Board (NIRB). NIRB provided approval and issued the amended Mine Project Certificate for the Meliadine Gold Mine Project to Agnico Eagle on February 26, 2019. The GWMP reflects the revised Condition No. 25, which states the Proponent shall submit a detailed Groundwater Management Plan to the NIRB that includes mitigation measures under greater than expected groundwater inflow rates, treatment and disposal methods for discharge to sea, and details of its plan to monitor saline water at site.

1.2 Objectives

The objective of the GWMP is to provide consolidated information on groundwater management for the Meliadine Gold Mine. The GWMP is divided into the following components:

- Introductory section (Section 1);
- A brief summary of the physical setting at the mine site and the mine development plan (Section 2);
- A description of groundwater inflow forecasts and management strategies (Section 3); and
- A description of the groundwater monitoring program (Section 4);
- A description of the measures in place to ensure quality control and quality assurance is maintained in groundwater monitoring (Section 5).

The GWMP will be updated as required to reflect any changes in operations or economic feasibility that occurs, and to incorporate new information and latest technology, where appropriate, to comply with Part B Section 15 of the Licence.

SECTION 2 • BACKGROUND

2.1 Site Conditions

The Mine is located in an area of poorly drained lowlands near the northwest coast of Hudson Bay. The dominant terrain in the Mine area consists of glacial landforms such as drumlins (glacial till), eskers (gravel and sand), and many small lakes. The topography is gently rolling with a mean elevation of 65 metres above sea level (masl) and a maximum relief of 20 metres (m).

The local overburden consists of a thin layer of topsoil overlying silty gravelly sand glacial till. Cobbles and boulders are present throughout the region at various depths. Bedrock at the mine site area consists of a stratigraphic sequence of clastic sediments, oxide iron formation, siltstones, graphitic argillite and mafic volcanic flows (Snowden 2008; Golder 2009).

The climate is extreme in the area, with long cold winters and short cool summers, and mean air temperatures of 12 °C in July and -31 °C in January. The mean annual air temperature at the Mine site is approximately -10.4 °C (Golder 2012a). Strong winds blow from the north and north-northwest direction more than 30 percent of the time.

The mean annual precipitation in the area is approximately 412 mm and is typically equally split between rainfall and snowfall.

Late-winter ice thicknesses on freshwater lakes in the mine site area were recorded from 1998 to 2000. The measured data indicated that ice thickness ranges from 1.0 to 2.3 m with an average thickness of 1.7 m. Ice covers usually appear by the end of October and are completely formed in early November. The spring ice melt typically begins in mid-June and is complete by early July (Golder 2012b).

2.2 Local Hydrology

The Mine is located within the Meliadine Lake watershed. Meliadine Lake has a surface water area of approximately 107 square kilometres (km^2), a maximum length of 31 km, features a highly convoluted shoreline of 465 km and has over 200 islands. Unlike most lakes, it has two outflows that drain into Hudson Bay through two separate river systems. It has a drainage area of 560 km^2 from its two outflows. Most drainage occurs via the Meliadine River, which originates at the southwest end of the lake. The Meliadine River flows for a total stream distance of 39 km. The Meliadine River flows through a series of waterbodies, until it reaches Little Meliadine Lake and then continues into Hudson Bay. A second, smaller outflow from the west basin of Meliadine Lake drains into Peter Lake, which discharges into Hudson Bay through the Diana River system (a stream distance of 70 km). At its mouth, the Diana River has a drainage area of 1,460 km^2.

Watersheds in the Mine area are comprised of an extensive network of waterbodies, and interconnecting streams. The hydrology of these watersheds is dominated by lake storage and evaporation.

2.3 Hydrogeology

The Mine is located in an area of continuous permafrost. Based on thermal studies and measurements of ground temperatures, the depth of permafrost at the mine site is estimated to be in the order of 360 to 495 m. The depth of the active layer ranges from about 1 m in areas with shallow overburden, up to about 3 m adjacent to the lakes. The depth of the permafrost and active layer varies depending on proximity to the lakes, overburden thickness, vegetation, climate conditions, and slope direction (Golder 2012b). The typical permafrost ground temperatures at the depths of zero annual amplitude are in the range of -5.0 to -7.5 °C in the areas away from lakes and streams. The geothermal gradient ranges from 0.012 to 0.02 °C/m (Golder 2012c).

Groundwater characteristics at the Mine are detailed in Final Environmental Impact Statement (FEIS) Volume 7, Section 7.2 Hydrogeology and Groundwater, and in an updated hydrogeological assessment completed for the Mine (Golder 2016). The groundwater characteristics for the Mine are briefly summarized herein.

Two groundwater flow regimes in areas of continuous permafrost are generally present:

- a deep groundwater flow regime beneath the base of the permafrost; and
- a shallow flow regime located in an active (seasonally thawed) layer near the ground surface.

From late spring to early autumn, when temperatures are above 0 ˚C, the active layer thaws. Within the active layer, the water table is expected to be a subdued replica of topography, and is expected to parallel the topographic surface. Mine area groundwater in the active layer flows to local depressions and ponds that drain to larger lakes.

Taliks exist beneath waterbodies that have sufficient depth such that they do not freeze to the bottom over the winter. Beneath small waterbodies that do not freeze to the bottom over the winter, a talik bulb that is not connected to the deep groundwater flow regime will form (a closed talik). Elongated waterbodies with terraces (where the depth is within the range of winter ice thickness), a central pool(s) (where the depth is greater than the range of winter ice thickness), and a width of 340 to 460 m or greater are expected to have open taliks extending to the deep groundwater flow regime at the Mine site. A review of bathymetric data, ice thickness data, and results of thermal modelling suggests that Meliadine Lake and Lake B7 are likely to have open taliks connected to the deep groundwater flow regime (Golder 2012a).

Tiriganiaq Underground Mine is planned to extend to approximately 625 m below the ground surface; therefore, part of the underground mine will be operated below the base of the frozen permafrost (top of the cryopeg). The underground excavations will act as a sink for groundwater flow during operation, with water induced to flow through the bedrock to the underground mine workings once the mine has advanced below the base of the frozen permafrost.

Both Tiriganiaq Pit 1 and Tiriganiaq Pit 2 will be mined within the frozen permafrost, therefore, groundwater inflows to the open pits is expected to be negligible and were not considered in the WMP.

2.4 Mine Development Plan

The Mine Plan proposes mining methods for the development of the Tiriganiaq gold deposit, with two open pits (Tiriganiaq Pit 1 and Tiriganiaq Pit 2) and one Underground Mine. Based on the current Mine Plan, the Mine will produce approximately 14.9 million tonnes (Mt) of ore, 31.4 Mt of waste rock, 7.1 Mt of overburden waste, and 14.9 Mt of tailings (Agnico Eagle 2019). The following phased approach is proposed for the development of the Tiriganiaq gold deposit:

- Tiriganiaq underground mine will be developed and operated from Year -5 to Year 7;
- Tiriganiaq Pit 1 will be mined from Year 2 to Year 7; and
- Tiriganiaq Pit 2 will be mined from Year 4 to Year 7.

Mine facilities on surface include a plant site and accommodation buildings, two ore stockpiles, a temporary overburden stockpile, a tailings storage facility, three waste rock storage facilities, a water management system that includes containment ponds, water diversion channels, retention dikes/berms, a final Effluent Water Treatment Plant (EWTP) and a Saline Water Treatment Plant (SWTP). An additional treatment plant to apply break-point chlorination, oil and grease, and total suspended solids (TSS) removal will be added by end of Q2, 2019 as part of the saline effluent discharge to sea management system.

SECTION 3 • GROUNDWATER MANAGEMENT STRATEGY

3.1 Groundwater Volumes

In the WMP of the water licence application (Agnico Eagle 2015a) it was stated that supplemental hydrogeological investigations were to be undertaken to provide additional information on potential volumes and quality of the saline groundwater to be managed. These investigations were undertaken in 2015 and 2016 and are summarized in Golder (2016). They included the completion of 24 packer tests, two pumping tests, two injection tests, 11 groundwater samples, and seven surface water samples. The work plan for the fieldwork was developed in consultation with two independent technical advisors, Dr. Shaun K. Frape and Dr. Walter A. Illman (both of the University of Waterloo).

The additional hydraulic conductivity measurements resulted in a refined interpretation on the variability of hydraulic conductivity between geological formations and data on the storage properties of the bedrock. A summary of predicted groundwater inflows between 2017 and 2032, based on this refined interpretation, are provided in Table 1. A revision of the modelled inflow volumes is currently being conducted and is scheduled to be completed by the end of April 2019. The purpose of this update is to provide more accurate estimates, thereby increasing informative capabilities regarding planning of management strategies. The results will be submitted in the 2020 WMP or as an addendum to the 2019 WMP.

Table 1: Predicted Groundwater Inflow to Underground Mine (2017 to 2032)

Period	Predicted Groundwater Inflow (m^3/day)
2017	230
2018	300
2019	280
2020	300
2021	340
2022	340
2023-2024	420
2025-2026	380
2027-2028	390
2029-2030	380
2031-2032	360

Source: Updated Predictions of Groundwater Inflow to Tiriganiaq Underground Mine (Golder 2016).

The groundwater inflow predictions presented in Table 1 do not account for grouting currently being conducted as a mitigation to reduce groundwater inflows to the underground development, water being removed in waste rock, or potential losses through the ventilation system. Both mechanisms reduce the actual groundwater inflows to the Underground Mine relative to that which was predicted. As such, these predicted inflows to the underground development represent unmitigated estimates.

Actual inflow values to the Underground Mine, which included the impact of grouting, ventilation losses, loss of water in waste rock pore space, treatment by the SWTP, and loss due to re-use of water in mining operations were estimated based on changes in water volumes stored in the underground water storage system. Changes in storage were calculated on a daily basis and used to produce monthly values of mean daily net inflow rate. Based on these monthly estimates of mean daily inflow, mean net inflow rate over 2018 was 51 m^3/day. This is not the groundwater inflow rate to the mine but rather the balance of inflows, the aforementioned water losses, and water used for operations. Thus, the 51 m^3/day estimate is the surplus of inflows that was placed in storage.

It should be noted that the net inflow rate generally increased over 2018. During Q4 of 2018 the mean daily inflow rate was approximately 105 m^3/day. The increasing trend is the result of the progression of development, especially development approaching the lower fault (near the ore body), where hydraulic conductivities are expected to be relatively high ($1x10^{-7}$ m/s). Going forward, daily net inflow rates will increase when stoping within cryopeg begins (Q1 of 2019), as greater surface area of rock will be exposed, stoping will proceed within the ore body where water bearing structures exist, and grouting of inflows will not be possible within stopes.

3.1.1 Groundwater Inflow Predictions – Assumptions and Uncertainties

Hydraulic conductivities of both the Hanging Wall and Footwall units are assumed to be reduced by an order of magnitude between the top of the basal cryopeg and the bottom of the cryopeg. This assumption reflects that this portion of the permafrost, which will contain unfrozen groundwater due to freezing point depression (salinity and pressure induced), is expected to have reduced hydraulic conductivity relative to the unfrozen bedrock because of the presence of isolated pockets of frozen groundwater within this zone. Linearly decreasing hydraulic conductivity with temperature is assumed within this zone, with a full order of magnitude decrease assumed at the top of the basal cryopeg, and hydraulic conductivity equivalent to the unfrozen rock at the bottom of the cryopeg.

In crystalline rocks, fault zones may act as groundwater flow conduits, barriers, or a combination of the two in different regions of the fault depending on the direction of groundwater flow and the fault zone architecture. These zones, termed Enhanced Permeability Zones (EPZs), were assigned hydraulic conductivity values based on both field measurements and testing conducted at similar faulting in various locations within the Canadian Shield. Furthermore, EPZs were assumed not to be impacted by isolated freezing in the cryopeg and were therefore assigned similar hydraulic conductivity values within and below the cryopeg. The latter assumption along with the assumption that all faults are considered EPZs is considered conservative. For instance, observations made at other gold mines in the Canadian Shield indicate not all faults are EPZs (Golder, 2016).

Based on the geometry of water bodies, it was assumed that Lake B7, Lake D7, and Meliadine Lake possess open taliks connected to the deep groundwater flow regime. It was conservatively assumed that the surface water/groundwater interaction through open taliks is not impeded by lower-permeability lakebed sediments that may exist.

Combined, the assumptions discussed above result in the following sources of uncertainty in the groundwater inflow model:

- If there is a lack of reduction in hydraulic conductivity between the top of the basal cryopeg and the bottom of the cryopeg, it is likely that greater than expected inflows upon stoping will occur in the cryopeg (300 to 450 m below ground surface).
- If faults within the model do not act as EPZs, then it is expected that inflows resulting from development near these structures will be less than expected. The degree of deviation from expected inflows and timing will be dependent on the location of the structure in relation to development.
- If hydraulic conductivity of faults within the cryopeg are impacted by isolated freezing, then lower than expected inflows will be observed when development in the cryopeg progresses near the structures. The degree of deviation from expected inflows and timing will be dependent on the location of impacted EPZs in relation to development.
- If significant thicknesses of lakebed sediments with relatively low permeability exist within in the flow path connecting surface water to groundwater through open taliks, it is likely that mine-wide inflows will be less than expected due to a reduction in expected recharge to the groundwater flow regime.

Quantification of the uncertainty associated with the realization of the listed scenarios has not been conducted. As the invalidity of the above assumptions would result in less than expected inflows, the model is considered conservative and quantification of associated uncertainty is not required.

3.2 Existing Groundwater Management Control Structures

Contact water in the Underground Mine is contained within underground sumps and the Saline Pond. A proportion of the underground water is recirculated as make-up water for underground drilling. The remaining underground water is stored for treatment by the SWTP. During the open water season of 2019, saline water treated to remove TSS, oil and grease, and ammonia will be discharged to sea at Melvin Bay (Section 3.4.3).

Calcium chloride is currently not added to the underground water but has been used in the past to prevent freezing in drill holes when drilling in permafrost with low salinity drill water. The potential for use again in the future is low due to the existing calcium chloride levels in the groundwater that is used for drilling.

Groundwater inflows to the Underground Mine since 2015 have not been discharged to the environment and are being stored underground and in the surface storage pond, Saline Pond 1. Based on adaptive management strategies, the project requires a second saline water storage pond, Saline Pond 2 (SP2). Saline Pond 2 is to be temporary in nature and is being constructed in bedrock within the footprint of Tiriganiaq Pit 2. Saline Pond 2 has an initial storage estimate of 78,862 m^3 which will be added to the saline water storage system in Q1 of 2019. Details of the underground dewatering system are provided in the Mine Plan (Agnico Eagle 2015a) and details of the ponds are provided in the WMP (Agnico Eagle 2019). The pond capacities and maximum water elevation for storage of the saline water are presented in Table 2.

Table 2: Salt Water Storage Capacity at the Mine for Groundwater and Water Primarily Influenced by Underground Workings

Surface Pond	Capacity (m^3)	Maximum Water Elevation (m)
Saline Pond	32,686	62.9
Saline Pond 2 (Q1, 2019)	78,862	62.5
P1	20,781	68.5
P2	6,828	66.5
P3	18,432*	67.0

Source: Agnico Eagle (2017).
* Volume excludes Saline Pond 3 capacity (Section 3.4.3.1).

3.3 Groundwater Quality

Groundwater investigations suggested that total dissolved solids (TDS) concentrations are relatively consistent below the permafrost at approximately 64,000 mg/L (Golder 2016). Groundwater quality data from samples taken underground 2017 through 2018 from diamond drillholes (DDHs) indicate mostly stable concentrations for several parameters (Table 3) and indicate that TDS concentrations are less than predicted at an average concentration of 56,000 mg/L. The discrepancy between expected and observed TDS levels is potentially due to the difference of sampling depth between pre-development testing and samples collected during development. Pre-development samples were collected below permafrost (>450 m below ground surface), whereas the bulk of samples collected to-date have been collected in the basal cryopeg (280 m to 450 m below ground surface). Samples and trends will continue to be assessed as development progresses below the cryopeg. It should also be noted that mining operations include drill-and-blast excavation for the development of the Underground Mine, which results in certain parameters in groundwater to be influenced by explosives (particularly ammonia and nitrate due to emulsion explosives).

With respect to high nitrate, nitrite and ammonia concentrations in February 2017, the anomaly is due to one sampling event (Feb. 24) believed to be conducted without proper flushing of the DDH. Thus, the results from this sampling event are similar to those observed in underground contact water (i.e., sump water). The February 24, 2017 DDH sample produced nitrate, nitrite and ammonia results of 344 mg/L, 23.5 mg/L and 300 mg/L, respectively. Whereas Sump 125 (contact water) results from February 12, 2017 show nitrate, nitrite and ammonia concentrations equal to 435 mg/L, 27.2 mg/L and 400 mg/L, respectively. Considering the similarity, it can be assumed that the February 24, 2017 DDH sample was contaminated with drilling water.

Table 3: Average Saline Groundwater Quality

Source: Groundwater quality data from DDH sample location (Agnico Eagle, December 2018)

Representative Months (average per month)		Jan-17	Feb-17	Mar-17	Apr-17	May-17	Jun-17	Jul-17	Aug-17	Sep-17	Oct-17	Nov-17	Dec-17	Jan-18	Feb-18	Mar-18	Apr-18	May-18	Jun-18	Jul-18	Aug-18	Sep-18	Oct-18	Nov-18
Parameters (total metal)	**Units**																							
pH	pH	7.08	6.87	7.11	7.32	7.38	7.27	8.27	7.45	7.33	7.41	7.26	7.18	7.35	7.49	7.80	7.26	7.26	7.79	7.08	7.72	6.99	7.02	7.28
Alkalinity	mg/L	57	61.7	51	64.5	68	68	75	68.2	64	64	69	66	73	73	78	70	62	67	65	85	71	67	57
Conductivity	µmhos/cm	77000	76500	77000	79000	79000	76308	74385	72200	72667	78667	85000	80667	81083	82667	81200	83000	69500	83125	83333	83000	78000	69571	81000
Total Hardness (as $CaCO_3$)	mg/L	13200	18267	12700	18400	12433	12623	12500	12583	11700	12600	14100	12733	13164	14367	12680	13550	13100	13538	13450	13925	13500	11131	16500
Turbidity	NTU	123.75	69	88	90	51	75	61	47.02	104.33	55.00	30.00	53.00	74.83	72.89	27.18	49.33	75.50	27.51	52.00	27.5	83.95	69.43	52
Total Dissolved Solids (TDS)	mg/L	54350	66433	54900	57500	57300	55123	57815	57520	54567	57867	62000	55133	53975	52233	55460	51367	56900	58325	55917	60975	56900	49229	57600
Total Suspended Solids (TSS)	mg/L	45	75.7	63	248.5	102.7	102.2	156	86	102	316.7	30.0	56.0	181.8	108.1	31.0	38.7	37.5	85.4	58.5	50.0	216.0	42.4	46
Aluminum (Al)	mg/L	0.21	0.1	6.02	1.29	0.51	1.45	0.73	0.97	1.75	2.063	0.150	0.250	2.979	1.466	0.270	0.290	0.128	0.798	0.245	0.261	4.145	0.353	0.15
Ammonia Nitrogen (NH_3-NH_4)	mg/L	4.125	7.9	4.5	4.95	5.2	5.508	11.08	4.87	4.7	6.100	4.800	4.700	5.825	4.711	5.180	4.800	4.300	5.250	4.233	6.925	4.550	5.714	6.55
Arsenic (As)	mg/L	0.003	0.005	0.01	0.008	0.004	0.016	0.016	0.102	0.013	0.047	0.006	0.009	0.027	0.057	0.009	0.010	0.004	0.024	0.006	0.005	0.011	0.009	0.0138
Barium (Ba)	mg/L	0.06	0.61	0.1	0.27	0.07	0.09	0.25	0.1	0.07	0.113	0.082	0.094	0.109	0.109	0.098	0.072	0.073	0.100	0.058	0.073	0.170	0.110	0.163
Beryllium (Be)	mg/L	0.003	0.002	0.01	0.002	0.002	0.005	0.008	0.01	0.01	0.008	0.005	0.008	0.010	0.009	0.009	0.007	0.004	0.004	0.006	0.004	0.005	0.009	0.005
Boron (B)	mg/L	1.6	4.98	5	4.9	1.5	2.7	3.97	5	2.5	4.17	2.50	4.17	4.79	4.72	4.50	3.33	2.10	2.28	2.92	2.35	2.80	4.64	3
Total Organic Carbon (TOC)	mg/L	2.23	11.67	2.1	2.95	2.63	3.2	5.3	2.57	2.5	16.27	3.00	2.67	2.50	2.42	2.36	2.47	2.20	3.00	1.97	2.4	2.95	2.73	5.3
Dissolved Organic Carbon	mg/L	1.9	10.17	1.7	2.3	2.37	2.7	4.9	2.32	2.1	13.70	2.80	2.33	2.38	2.27	2.36	2.27	1.90	2.55	1.90	2.4	2.55	2.53	5
Calcium (Ca)	mg/L	1710	3777	1650	3737	1593	1608	1771	1610	1565	1720	1770	1587	1646	1777	1656	1737	1690	1748	1653	1715	2165	1487	2960
Cadmium (Cd)	mg/L	0.0003	0.0002	0.001	0.0003	0.0002	0.0005	0.001	0.001	0.002	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0005
Chloride (Cl - dissolved)	mg/L	31250	38000	31000	31500	32000	31385	31538	32800	29333	32333	34000	33000	33833	34444	34800	34333	32500	33875	33333	36250	33500	27143	35000
Chromium (Cr)	mg/L	0.025	0.017	0.01	0.02	0.017	0.05	0.075	0.1	0.88	0.083	0.050	0.083	0.096	0.094	0.090	0.067	0.035	0.043	0.058	0.043	0.052	0.093	0.05
Copper (Cu)	mg/L	0.01	0.008	0.05	0.01	0.01	0.02	0.04	0.05	0.03	0.042	0.025	0.032	0.048	0.048	0.045	0.028	0.018	0.021	0.029	0.021	0.040	0.046	0.025
Cyanide (Cn)	mg/L	0.005	0.19	0.005	0.028	0.005	0.006	0.01	0.005	0.008	0.005	0.025	0.015	0.017	0.033	0.021	0.012	0.025	0.005	0.005	0.005	0.005	0.005	–
Iron (Fe)	mg/L	4.76	8.96	3.6	8.78	6.19	9.81	6.33	8.24	4.1	10.67	6.46	6.50	14.84	12.79	5.50	5.37	6.36	5.94	7.96	5.36	18.80	5.64	6.81
Lead (Pb)	mg/L	0.005	0.005	0.02	0.004	0.003	0.009	0.015	0.02	0.018	0.017	0.010	0.017	0.020	0.019	0.018	0.013	0.007	0.009	0.012	0.009	0.010	0.019	0.01
Magnesium (Mg)	mg/L	2168	2150	2080	2200	2050	2092	1962	2105	1975	2017	2350	2150	2208	2411	2078	2220	2150	2229	2267	2335	1970	1800	2200
Mercury (Hg)	mg/L	0.00001	0.00001	0.00001	0.000001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001
Molybdenum (Mo)	mg/L	0.025	0.055	0.01	0.25	0.026	0.047	0.075	0.1	0.17	0.083	0.050	0.083	0.096	0.094	0.090	0.067	0.035	0.043	0.058	0.043	0.050	0.093	0.061
Nickel (Ni)	mg/L	0.025	0.04	0.1	0.07	0.017	0.05	0.08	0.1	0.35	0.083	0.050	0.083	0.096	0.094	0.090	0.067	0.035	0.043	0.058	0.043	0.050	0.093	0.05
Nitrate (NO_3) as N	mg/L	0.5	116.39	0.1	2.58	0.23	0.89	4.35	0.17	0.34	0.293	0.100	0.213	2.015	0.376	0.240	0.297	0.300	0.420	0.517	0.608	0.455	2.929	0.1
Nitrite (NO_2) as N	mg/L	0.05	8.01	0.1	0.125	0.086	0.14	0.391	0.042	0.027	0.032	0.024	0.023	0.120	0.043	0.042	0.028	0.030	0.044	0.052	0.065	0.039	0.109	0.061
Total Kjeldahl Nitrogen (TKN)	mg/L	3.78	8.7	4.6	5.2	7.83	7.4	12	72.02	4.5	9.00	5.60	4.87	6.12	4.97	5.90	5.27	4.95	5.54	4.18	7.5	4.60	6.77	6.5
Phosphorous (P)	mg/L	0.07	0.14	0.04	0.13	0.12	0.08	0.09	0.1	—	0.390	0.080	0.080	0.075	0.083	0.162	0.073	0.200	0.173	0.118	0.175	0.420	0.154	0.1
Potassium (K)	mg/L	496	595	407	609	433	463	518	488	763	502	528	465	490	532	512	479	474	500	491	539	444	391	680
Radium-226 (Ra 226)	mg/L	0.49	0.33	0.3	1.2	1.95	1.8	1.9	2.2	0.29	2.200	2.400	1.673	1.853	3.678	3.880	2.633	2.050	1.938	1.833	2.450	0.670	0.906	1.8
Selenium (Se)	mg/L	0.003	0.002	0.01	0.002	0.002	0.005	0.0075	0.01	0.007	0.008	0.005	0.008	0.010	0.009	0.009	0.007	0.004	0.004	0.006	0.016	0.005	0.009	0.005
Silver (Ag)	mg/L	0.001	0.0003	0.002	0.0009	0.0004	0.0012	0.0018	0.0002	0.018	0.003	0.001	0.002	0.002	0.004	0.002	0.001	0.001	0.001	0.001	0.001	0.002	0.002	0.001
Sodium (Na)	mg/L	14625	14700	13400	15400	13900	14369	14654	14417	9433	14900	17000	15300	15183	16389	14860	14967	14750	15725	15333	16450	13550	12629	16600
Strontium (Sr)	mg/L	43.1	171	38.4	136	40	39	43.5	36.5	23.6	40.03	35.10	35.70	37.24	37.30	37.14	40.10	47.65	43.85	40.00	41.33	61.90	47.40	83.4
Sulphate (SO_4 – dissolved)	mg/L	3125	2700	3100	3100	3233	3169	2969	3120	3067	3200	3500	3433	3367	3500	3320	3367	3350	3250	3467	3625	3200	2829	3200
Thallium (Tl)	mg/L	0.001	0.001	0.001	0.0002	0.0002	0.0005	0.001	0.001	0.002	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.000	0.000	0.001	0.000	0.001	0.001	0.0005
Uranium (U)	mg/L	0.003	0.002	0.01	0.006	0.002	0.005	0.008	0.01	0.09	0.008	0.005	0.008	0.010	0.009	0.009	0.007	0.004	0.004	0.006	0.006	0.005	0.009	0.005
Vanadium (V)	mg/L	0.13	0.08	0.5	0.1	0.08	0.23	0.38	0.5	0.33	0.417	0.250	0.417	0.479	0.472	0.450	0.333	0.175	0.213	0.292	0.213	0.250	0.464	0.25
Zinc (Zn)	mg/L	0.125	0.1	0.5	0.12	0.08	0.23	0.38	0.5	0.34	0.417	0.250	0.417	0.479	0.472	0.450	0.333	0.175	0.259	0.292	0.213	0.250	0.464	0.25

3.4 Groundwater Management Strategy and Associated Control Structures

Based on the Type A Water Licence 2AM-MEL1631 Terms and Conditions, Part E: Conditions Applying to Water Use and Management, No. 14, Agnico Eagle has reviewed the Mine alternatives to apply to the GWMP. Condition No. 14 specifically states:

> *"The Licensee shall submit a Groundwater Management Plan to the Board for approval in writing, at least six (6) months prior to the discharge of any Groundwater. The Plan shall take into consideration all comments raised and commitments made with respect to submissions received during the technical review of the Application as well as final submissions and issues raised during the Public Hearing Process, where applicable."*

Furthermore, based on the NIRB Project Certificate No. 006 Terms and Conditions: Hydrogeology and Groundwater Quantity and Quality, No. 25, Agnico Eagle has updated the groundwater management strategy sections for submission to NIRB within 90 days of receiving the amended Mine Project Certificate. Condition No. 25 specifically states:

> *"The Proponent shall submit a detailed Groundwater Management Plan to the NIRB which includes mitigation measures designed to address the potential for higher-than-predicted volumes of saline water inflows into the underground mine, treatment and disposal methods, and details of its plan to monitor saline water at site. The plan must identify uncertainties pertaining to predictions for groundwater quality and quantity and inform adaptive management strategies for the site. CIRNAC should be consulted with respect to the contents of the Plan and any required mitigation measures."*

Groundwater management strategies were considered for the Mine based on the potential range of groundwater flows and quality that could be generated (Agnico Eagle 2015a).

Based on the groundwater inflow volume, the following options were considered and form part of the short and long-term management of groundwater inflows to the Underground Mine:

- Short-term Strategy: treat saline groundwater and store/use the brine from the treatment process on-site (Section 3.4.1)
- Current Long-term Strategy: treated discharge to receiving environment in Meliadine Lake (Section 3.4.2) and Discharge to sea (see Section 3.4.3).

The short and long-term groundwater management strategies are described below.

3.4.1 Short-Term Management Strategy - Treat and Store/Use Groundwater On-site

This alternative was considered as part of the Type A Water Licence Application and is currently implemented on site as part of the short-term management of groundwater inflow. It involves storing all excess groundwater in underground sumps and in surface water ponds at the Mine. As outlined in the WMP (Agnico Eagle 2019), a total of ten water containment ponds are planned on Site at the Mine surface (CP1, CP3, CP4, CP5, CP6, the P-Area [P1, P2, and P3], SP1 and SP2), seven of which have been constructed and are in use (CP1, CP3, CP5, P-Area [P1, P2, and P3], and SP1). SP2 is presently being constructed and will be commissioned by the end of Q1 2019. Additional to this are all associated water retention dykes, water diversion berms, channels, and culverts, to manage surface water and underground water (Appendix A).

Five saltwater evaporators have been in-use on site since mid-2017 at P1 to reduce saline groundwater volumes stored in surface water ponds. While evaporators have been used with some success, the combined volumes of realized groundwater inflows with anticipated surface water volumes influenced by underground waste rock to be managed is greater than the available long-term storage at the Mine, and therefore, discharge to environment is required.

3.4.2 Current Long-Term Management Strategy - Treated Groundwater Discharge to Meliadine Lake

Hatch (2013) investigated groundwater treatment options for the site and concluded that a combination chemical reverse osmosis (RO) and mechanical vapour compression evaporator plant would be the most efficient method of treating excess groundwater for discharge. Agnico Eagle has since acquired and constructed a Salt Water Treatment Plant (SWTP) consisting of two evaporator crystallizers (SaltMakers) that will be used to treat groundwater. The SWTP will remove excessive total suspended solids (TSS), calcium chloride ($CaCl_2$), sodium chloride (NaCl), metals, phosphorous (P), and nitrogen compounds from the influent saline water.

The SWTP consists of two parallel units. Each unit can be operated to produce brine or solid by-product. Brine-mode of one unit within the SWTP is expected to operate to the following specifications:

- Inlet capacity of 115 m^3/day with a 95% expected operation availability for a corrected average input capacity of 109 m^3/day.
- With an input capacity of 109 m^3/day the effluent and brine will be discharged as follows:
  - 68 m^3/day to CP1
  - 24 m^3/day to Saline Pond as Brine
  - The 17 m^3/day difference is due to evaporation loss through treatment

Solid-mode of one unit within the SWTP is expected to operate to the following specifications:

- Inlet capacity of 69 m3/day with a 95% expected operation availability for a corrected average input capacity of 66 m3/day. This full inlet capacity will be discharged to CP1 as effluent
- Decisions regarding the management of solid salt by-product are ongoing by Agnico Eagle. One possible option would be use as a dust suppressant on roads as the material is similar to calcium chloride currently approved for such use. Formal approval would be required from the Government of Nunavut Environment Department.

SWTP effluent is currently transferred to CP1 where it will be treated by the EWTP prior to discharge to Meliadine Lake. EWTP effluent discharge to Meliadine Lake was performed in 2018 in accordance with the conditions outlined in Part F, Item 3 of the Water Licence. Discharge to Meliadine Lake is expected to be carried out in 2019. Total discharge to Meliadine Lake, including the treated groundwater, will remain within the permitted daily volume and meet the discharge criteria defined in the License, as well as MDMER discharge limits. Additionally, SSWQOs for EWTP effluent (including treated groundwater) will be met at the edge of the mixing zone in Meliadine Lake. Further details regarding the EWTP are provided in Sections 3.9.4 and Section 4.3 of the WMP.

The saline effluent temperature from the SWTP is expected to be approximately 35 °C, with an approximate pH of 7.5 (Saltworks 2017). According to pilot testing, SWTP effluent meets the required Water Quality Output Requirements defined in Agnico Eagle's Desalination Water Treatment Plan Design Criteria with the exception of ammonia, nitrite, total cyanide, and selenium (Saltworks 2017). However, weekly sample results from the first months of sampling (December 13, 2018 to February 18, 2019) show the SWTP effluent consistently meets the aforementioned requirements for all constituents aside from ammonia and nitrite. Ammonia exceeded the Water Quality Output Requirement of 35 mg/L on three sampling dates (Jan-16, Jan-18, Feb-10), however the mean ammonia concentration over the sampling period is 24 mg/L. Nitrite exceeded the Water Quality Output requirement of 0.2 mg/L on all (n=9) sampling dates with a mean concentration of 1.2 mg/L. The cause for these exceedances is that the SWTP system remains in the commissioning phase, specifically, the chemical RO unit designed to remove constituents such as ammonia and nitrite has not yet been commissioned. Upon commissioning (expected by end of Q1 2019), the SWTP is expected to meet all Water Quality Output Requirements.

SWTP effluent and CP1 water quality will continue to be monitored according to the SWTP Design Report to identify future exceedances and potential impacts to CP1. Pilot testing predicted that TDS concentrations would be approximately 158 mg/L (condensed water after treatment; Saltworks 2017). During commissioning, mean TDS concentration has been 174 mg/L (n=9) to date. As commissioning continues (i.e., process is refined and RO treatment is commissioned), effluent quality will trend towards lower concentrations as the treatment process is refined for optimal treatment quantity and quality. With respect to toxicology, the SWTP effluent passed acute toxicity tests on Rainbow trout, Three-spined stickleback and Daphnia magna (Saltworks 2017).

3.4.3 Current Long-Term Management Strategy - Treated Groundwater Discharge to Melvin Bay at Itivia Harbour

Based on the current standing of saline water stored on site, the rate at which the SWTP can treat saline water (Section 3.4.2) and the forecasted inflows (Section 3.1), it is anticipated that a second discharge location will be required for long-term groundwater management. Agnico Eagle proposed to treat groundwater for TSS, oil and grease, and ammonia and discharge it as saline effluent to the ocean, either as a direct discharge and/or after temporary on-site storage in one or more of the water containment ponds at the Mine. In 2018, Agnico Eagle applied to the NIRB for approval to discharge saline water to the sea (Melvin Bay, Rankin Inlet). Agnico Eagle received approval for discharge of saline water to sea with an amended Mine Project Certificate from NIRB on February 26, 2019.

3.4.3.1 Discharge to Sea Methods for Disposal and Treatment

Treatment, storage and haulage

As discussed in Section 3.4.1, saline water will be stored on surface or underground. Saline water will then be transported to a treatment plant (to be named) for treatment. Initial treatment will be for oil and grease removal via an oil-water separator. The water will then enter a Multiflo system for TSS removal. Next, break-point chlorination treatment will be applied to remove elevated ammonia levels, which are inferred to be the result of the use of emulsion and washing of development faces/muck underground. Excess free chlorine will be removed with activated carbon filters. Following break-point chlorination, water will merge with EWTP effluent prior to entering Saline Pond 3 (SP3) for final settling and storage. Treatment rates and expected treatment performance are currently being assessed and will be provided 30 days prior to operation of the treatment plant.

Treated saline water stored in SP3 will hauled by tanker trucks to Itivia. Truck loads will be up to 50 m^3 per truck and will be unloaded using a flexible 4" HDPE suction pipe. The truck discharge pump will transfer the treated effluent into the 6'' discharge HDPE pipeline and through the diffuser. The truck discharge pump will also be used to transfer effluent into the storage tank until the next day, before it is pumped into sea when necessary.

Pumping and Diffusion Plan

The flow rate to be discharged to Melvin Bay will not exceed 800 m^3/d with a TDS of 39,600 mg/L (Appendix B). The discharge facility will include a 778 m pipeline extending to an engineered diffuser located 20 m below surface in Melvin Bay to ensure proper mixing and prevent interference with traditional activities (See Appendix X for design drawings). Pumping will occur during the open water season from 2019 to 2031. The saline effluent will be discharged in a controlled manner through the diffuser to allow for maximum dilution and minimum environmental impact to the marine environment. Environmental monitoring is discussed in Section 4.3.3.

Agnico Eagle intends to engage with the Kangiqliniq Hunters and Trappers Organization (HTO) and the community of Rankin Inlet to:

- confirm the commencement and end of the open water season for marine effluent discharge each year,
- develop a procedure for monitoring of saline effluent temperature going into the subsea pipeline,
- ice thickness on Melvin Bay in the vicinity of the discharge and determining appropriate communication and safety protocols applicable for travel by community members through Itivia and Melvin Bay.

The effluent discharge system will consist of a truck discharge pump, a back-up discharge truck pump, a 100 000-litre storage tank, as well as suction and discharge pipelines. The 100 000-litre storage tank will only be used to contain the treated effluent until the next day, if the 800 m^3/d discharge limit is attained upon a truck's arrival. The storage tank will be installed on a containment area, built on a geomembrane with underlying and overlying granular materials and surrounded by berms. The construction drawings are shown in the Appendix B.

A pumping station including two pumps will be installed on the containment area. The truck discharge pump will be used to transfer the effluent from the trucks directly into the sea (or to storage tank). A by-pass pipeline will be installed parallel to the main discharge pipe in case the discharge truck pump malfunctions or maintenance is required. The back-up truck discharge pump will be used to pump the effluent into the by-pass pipe, though the 6'' discharge HDPE pipe and out the diffuser, if necessary.

Treated groundwater effluent quality is required to meet the Canadian federal end-of-pipe discharge criteria (per the amended MDMER; GC 2018) and to be non-acutely lethal. Treated groundwater will be discharge into Melvin Bay via an engineered diffuser (refer to Appendix D or Section 3.5 of the FEIS Addendum; Agnico Eagle 2018g) to meet Canadian Surface Water Quality Guidelines (WQG; CCME 2003), or background concentrations for parameters without guidelines, at the edge of the mixing zone. For information regarding background concentrations and expected mixing zone diffusion, refer to Appendix D (the Conceptual Ocean Discharge Monitoring Plan). Sampling will meet MDMER (GC 2018) requirements, and is outlined in Section 4.3.3, and detailed in Appendix D. A modelling assessment of groundwater discharge into the Melvin Bay marine environment was conducted by Golder (2019) and is included within Appendix B).

3.5 Discharge Schedule

Table 4 outlines the timeline for key activities on the Mine related to the management of saline groundwater, including tasks and facilities for the current short-term and long-term management strategies for discharge to Meliadine Lake (Section 3.4.1 and 3.4.2). A detailed Mine schedule for the overall Mine Water Management (e.g., building of culverts, berms and containment ponds) are presented in the 2019 WMP.

Table 4: High Level Mine Schedule

Activity	Timeline	Notes
On-site water storage	Ongoing	—
Update Groundwater Management Plan (Current Document)	Six months prior to discharge	Type A Water Licence 2AM-MEL1631 requirement
Commissioning of Salt Water Treatment Plants (SaltMaker #1 and #2)	Q4-2018 to Q1-2019	—
Discharge saline water to the sea (Melvin Bay, Rankin Inlet)	2019 open water season (Q2)	

Activity	Timeline	Notes
Active Discharge to Meliadine lake	Annually May thru October to 2031	—
Operation of Salt Water Treatment Plant	24 hr. a day / 7 days a week, year round	In-service as required
Inactive Discharge	Annually November thru April to 2031	Water will be stored underground and in surface containment ponds during the winter
Final Effluent Discharge to Meliadine Lake	End of Mine life 2031	—

Source: Agnico Eagle (2017).

3.6 Mitigation Measures regarding Greater than Expected Inflows

It is possible that realized groundwater inflow rates to the underground mine will be greater than modelled inflow rates. Specifically, this would arise from error in hydraulic conductivities assigned to geological units/structures and invalidity of assumptions listed in Section 3.1.1. Furthermore, it is possible that groundwater TDS levels will deviate from the past and current trends and produce greater than expected concentrations of TDS in groundwater to be managed. Considering both the Golder (2015) TDS forecasts agreeing with the realized groundwater TDS concentrations and the multitude (n = 133) of groundwater samples contributing to the to-date mean concentrations of TDS in groundwater surrounding the Mine, it is unlikely that groundwater TDS concentrations will increase as development and stoping progresses. In the unlikely case that TDS does increase, groundwater discharged to sea will be decreased as less raw groundwater will contribute to the saline water volumes being discharged to sea (due to TDS limit in effluent of 39,600 m^3; Section 3.4.3.1). Thus, greater than expected inflow rates and/or greater than expected TDS values would result in greater than expected groundwater volumes to manage. The following sections discuss mitigations under the occurrence of these scenarios.

3.6.1 Mitigation Measures – Contingency Storage Units

Upon the occurrence of greater than expected groundwater inflows to the underground mine, Agnico Eagle will utilize contingency saline water storage units until inflows can be reduced or SWTP treatment rates are increased to reduce required storage (Section 3.6.2). As of March 2019, the collective contingency saline water storage units produce a total potential storage of approximately 131,000 m^3. These storage units and corresponding capacities are listed below and will be filled in the following order, if required:

1. Level 350 West Block (5,766 m^3)
2. Ramp 1 extending from Level 425 to Level 450 (7,216 m^3)
3. Ramp 3 extending from Level 375 to Level 400 (17,298 m^3)
4. Ramp 3 extending from Level 350 to Level 375 (48,576 m^3)

5. Level 425 (50,530 m^3)

The contingency storage features listed above are not intended for long-term storage. The use of these will affect production, as portions of the mine will be unavailable to operations. Thus, if these units are required then adaptive management practices focused on increasing desalination rates will be implemented by Agnico Eagle in order to empty the features and allow production to continue optimally.

3.6.2 Mitigation Measures – Increased Storage and SWTP Treatment Rate

With respect to volumes of infiltrated groundwater to be managed, Agnico Eagle will apply adaptive management practices focused on increasing desalination rates. Prior to implementation of any changes to groundwater management, Agnico Eagle will submit a proposal for an amendment to the Mine Project Certificate or Water License, as applicable. The following are preliminary plans concerning the ability for Agnico Eagle to manage greater than expected saline water volumes stored on site.

In a scenario when modest increases above expected inflows (< 100 m^3/day) occur and are anticipated to persist, Agnico Eagle will assess the feasibility of running the SWTP in brine-mode (Section 3.4.2). Operating the SWTP in brine-mode rather than solid mode would provide an increase in treatment rate of approximately 86 m^3/day. As discussed in Section 3.4.2, brine would be added to the saline water storage system on site and freshwater effluent would be discharged to CP1 to be further treated to removed TSS prior to discharge to Meliadine Lake.

The addition of SP2 (approximately 75,000 m^3) to the saline water storage system provides further mitigation to greater than expected inflows by providing storage for saline water until inflows can be reduced or treatment can be increased. It will be the goal of Agnico Eagle to reduce the amount of saline water stored in SP1, SP2 and underground as much as possible during the open water season (through discharge to sea) in order to maximize storage potential.

3.6.1 Mitigation Measures – Hydraulic monitoring

As a strategy to increase the confidence of groundwater inflow modelling and decrease uncertainty, seven (7) vibrating wire piezometers are currently installed in the rock mass surrounding the underground mine. These piezometers are currently, and will continue to be applied to, assess response of the groundwater pressure (pressure head) to groundwater inflows. The data records produced by these piezometers will be used to approximate recharge rates and changes thereof, which may then be applied to the groundwater inflow model. Going forward, several additional piezometers will be installed in the rock mass (targeting major water bearing structures) to provide further insight into recharge rates and better inform modelling efforts. Agnico Eagle anticipates installing at least three (3) more piezometers over 2019.

3.6.2 Mitigation Measures – Groundwater Quality Monitoring

Raw groundwater and underground mine water in the underground storage system are sampled monthly. The sample analysis results are used to identify trends and improve predictions regarding groundwater inflow chemistry. This information is used to improve operational performance at the SWTP and act as a trigger for revision of the groundwater quality predictions. If raw groundwater samples (i.e., from flushed drillholes) collected indicate that the TDS is more than 20% higher than the estimated 64,000 mg/L (Section 3.3), the water quality predictions for underground will be reviewed and results considered as part of the adaptive management of the groundwater quantity contribution to the WMP.

SECTION 4 • GROUNDWATER MONITORING PROGRAM

4.1 Water Quality and Quantity Monitoring

Water quality monitoring is an important part of the Mine water management to verify the predicted water quality and quantity trends and conduct adaptive management should differing trends be observed. Water quality and quantity monitoring has been initiated and will continue during construction, operations, closure and post-closure. Monitoring will occur at three levels:

- Regulated discharge monitoring that occurs at monitoring points specified in the Licence or regulations.
- Verification monitoring that is carried out for operational and water management purposes by Agnico Eagle. This monitoring data will not be reported to the Regulators in the Annual Water License Report, but can be provided upon request by the Regulators.
- General monitoring that is included in the Licence requirements and is subject to compliance assessment to confirm sampling was carried out using established protocols, including quality assurance/quality control provisions, and addressing identified issues. General monitoring is subject to change as directed by an Inspector, or by the Licensee, subject to approval by the NWB.

All three types of monitoring is used at the Mine. The WMP and Water Quality and Flow Monitoring Plan present the conceptual water quality monitoring plan during construction, operations and closures and more detailed information on monitoring programs.

The groundwater quality monitoring plan summarized in Section 4.4, will be further defined as the Mine advances and will be conducted in agreement with the WMP for the Mine (Agnico Eagle 2019). Required monitoring and frequency for pre- and post- treatment (i.e., monitoring above ground) is presented in the WMP (Agnico Eagle 2019).

4.2 Water Quantity

The volume of groundwater inflow being collected and transferred to surface water management systems is measured using a flow meter installed at the Portal 1 entrance and is fed by Water Stope 75. A second pumping system was commissioned in 2019 to pump directly from Level 300 to surface. Currently this line is used to pump to the SWTP where inflow volumes are tracked via a water level sensor. A flow meter will be installed within this line prior to discharging directly to surface (expected Q2 2019). This data is supplemented by monthly seepage surveys in which visually observed groundwater inflows in the Underground Mine are recorded.

Observed groundwater inflow rates are compared to model predictions (Table 1) on an annual basis. If significant variations from model predictions are observed, the assumptions behind the analysis will be reviewed and the analysis updated if required. In addition, updates to the groundwater model may be required based on operational changes as the Underground Mine advances.

Variations that would be considered significant and would indicate the need to consider recalibrating the model and updating the inflow analysis include:

- Groundwater inflows to the mine, based on a monthly average of inflow over six consecutive months, is 80% of the model predictions while active grouting is being utilized to mitigate groundwater inflows.
- Groundwater inflows to the mine, based on a monthly average of inflow over six consecutive months, is 30% higher than the predicted groundwater inflows once grouting is ceased.

Changes in underground storage were calculated on a daily basis and used to produce monthly net inflow rate estimates. Based on these monthly averages, mean net inflow rate over 2018 was 51 m^3/day. Golder (2016) predicted a gross inflow rate of 300 m^3/day (Table 1).

Identification of a potential long-term effect associated with the groundwater flow is to be conducted and based on a detailed examination of the groundwater data to assess the potential causes of greater than expected groundwater quantity. If the greater than predicted flows could be correlated to a short term effect such as freshet or transient drainage of a high storage feature, then no further action would be required. However, if the greater than predicted flows could not be correlated to a short term effect, than the effect would be considered to be potentially long term. The duration of six months is based on observed seasonal variations in inflow quantities in mines situated permafrost regions.

If model re-calibration is deemed necessary, future groundwater inflow quantity would be predicted using this re-calibrated model and results considered as part of the adaptive management of the groundwater quantity contribution to the WMP. Currently, an update to the numerical model is underway. The update is not the result of either of the two conditions listed above, but rather is intended to provide more accurate estimates to better inform planning of management strategies.

4.2.1 Underground Water Management System

The underground water management system is designed to prevent water from affecting the workings or production. The system contains a series of sumps (generally one at the access of each level) designed to capture groundwater inflows and runoff from mining operations (i.e., drilling). Presently, underground water is managed by pumping from sump to sump from the lower levels to Level 125. Water collected in Level 125 sump is then moved to the Water Stope to be distributed for mining operation requirements or moved to surface (Section 4.2).

Beginning in approximately Q2 2019, a new pumping system will be implemented underground as follows:

- All groundwater inflows and water used for operations from Level 300 to the bottom of the mine will be pumped to storage containers on Level 300.
- All groundwater inflows and water used for operations on Level 275 to surface will be transported to storage tanks on Level 300. Movement will be directed by gravity from sump to sump via boreholes connecting the sumps.
- Water that is stored on Level 300 will be clarified using a Mudwizard (flocculation) system as a means to ensure pumping efficiency and prevent damage to the system.
- Following clarification, water will be fed by gravity to Level 350, where a main pumping station will move the water to Level 200.
- A second main pumping station on Level 200 will move the water to the SWTP or Saline Ponds on surface (Section 4.2).

4.3 Water Quality

4.3.1 Underground Mine Sump Water and Groundwater Inflows

Water accumulating in sumps underground is sampled on a monthly basis at Sump 125, which is the main collection sump prior to recirculation for underground use. Sump water samples are analyzed for the following parameters: conductivity, TDS, pH, temperature, oil and grease, major anions, radium 226, dissolved and total metals, nitrate and nitrite, ammonia, volatile organic compounds (i.e., benzene, xylene, ethylene, and toluene).

Groundwater quality is also monitored at mine seeps and/or diamond drill holes (DDHs) to verify the quality of formation water flowing into the mine prior to contact and potential contamination by mining and drilling fluids. The DDHs consist of underground holes drilled in advance of mining for ore body delineation purposes. These DDHs are sampled if there is sufficient flow to flush the borehole prior to initiation of grouting. Flushing and sampling techniques used to ensure samples are taken without contamination are described in Section 2.2.3 of the Quality Assurance/Quality Control Plan. Samples are collected quarterly at a minimum but actual sampling frequency may be greater depending on rate of progress, frequency of water intersects, and observed trends in groundwater quality with time. Water samples are analyzed for the following parameters: conductivity, TDS, pH, temperature, major anions, radium 226, dissolved and total metals and toxicity testing.

If water samples are collected that indicate that the TDS is more than 20% higher than the estimated 64,000 mg/L, the water quality predictions for underground will be reviewed and results considered as part of the adaptive management of the groundwater quantity contribution to the WMP.

4.3.2 Saline Water Treatment Plant Influent and Effluent

Water samples are currently collected weekly at both the inlet and outlet of the SWTP. The results of the sample analysis are used by SWTP operators to fine-tune the treatment process and ensure its optimal performance. Samples taken at the outlet of the SWTP are analyzed to provide the quality of treated water produced by the SWTP that is transferred to CP1.

Water samples are analyzed for the following parameters: pH, electrical conductivity, temperature, Total Suspended Solids (TSS), Total Dissolved Solids (TDS), chloride, ammonia, nitrite, nitrate, total phosphorus, total metals, total cyanide, and total mercury.

4.3.3 Discharge to Sea

Prior to haulage of saline water from the Meliadine Site to Itivia for discharge to sea, Agnico Eagle will measure pH, electrical conductivity, and temperature of the effluent as a means to continually advise discharge operations and help ensure discharge parameters are met. Agnico Eagle will also collect weekly samples to be analyzed by an accredited laboratory. Samples will be analyzed for the full suite and Group 3 (MDMER) parameters as listed in the Water License and the Water Quality and Flow Monitoring Management Plan appended to the WMP.

Effluent water at the final discharge point (end-of-pipe) will be measured for pH and analyzed for concentrations of deleterious substances listed in MDMER Schedule 4 (GC 2018). End-of-pipe brine effluent will be sampled once per month for acute lethality testing per MDMER requirements. Acute lethality testing will be conducted on Three-spine stickleback in accordance with the procedures set out in sections 5 or 6 of Reference Method EPS 1/RM/10 (ECCC 2018). Effluent characterization samples (Section 4.1.3) will be collected at the same time to aid in interpretation of acute lethality test results.

Effluent characterization will be conducted once per calendar quarter at least one month apart. Effluent will be sampled and analyzed for the following parameters:

- General parameters, including pH, TDS, TSS, hardness, alkalinity, electrical conductivity, salinity, and temperature;
- Anions including sulphate and chloride; and
- Nutrients, including ammonia and nitrate.
- Total metals and dissolved metals including those listed in MDMER Schedule 4 and Schedule 5 paragraph s. 4.

Sublethal toxicity testing of brine effluent will be conducted twice a year at least one month apart, at the beginning and at the end of discharge for three years, and once a year after the third year. The following tests will be conducted:

- Fish early life stage development test on inland silverside (Menidia beryllina) or topsmelt (Atherinops affinis) (US EPA 2002)
- Invertebrate reproduction test on echinoids (sea urchins or sand dollars) (Environment Canada 1992)
- Algae toxicity test on barrel weed (Champia parvula) (US EPA 2002)

These tests will be conducted on aliquots of the same sample collected for effluent characterization.

Agnico Eagle will adhere to MDMER EEM requirements for fish population surveys, water and sediment quality, and benthic invertebrate community assessments. The sampling plan is conceptually outlined in Table 5. Fish tissue monitoring will be conducted if triggered by MDMER conditions. A study design will be provided to ECCC according to the MDMER requirements (GC 2018), which includes all proposed monitoring locations.

Starting March 2019, a monthly under-ice sampling program was initiated in the area anticipated to be influenced by Agnico Eagle discharge to sea. The sampling program will extend to May 2019. The program included three sampling locations selected to correspond with the location of potential exposure to diffuser discharge In Melvin Bay. The purpose of the sampling program is to develop a baseline for water quality parameters within the potential exposure area prior to initiation of discharge. Details are found in Appendix D.

Further information regarding sampling locations, QA/QC, water quality benchmarks, sediment quality benchmarks, and environmental effect thresholds is provided in the Conceptual Ocean Discharge Monitoring Plan (Appendix D).

Table 5: Conceptual Ocean Discharge Monitoring Program Sampling Summary

Monitoring Component	Sampling Frequency	Monitoring Location	Sample Replication and Number of Samples
Deleterious Substances (MDMER Schedule 4)	Every week	FDP (end-of-pipe)	One grab sample
Acute lethality	Every month (sampled concurrently with effluent characterization)	FDP (end-of-pipe)	One grab sample
Effluent characterization	Four times a year, one month apart during discharge	FDP (end-of-pipe)	One grab sample
Sublethal toxicity	Twice a year, one month apart at the start and finish of the discharge	FDP (end-of-pipe)	One grab sample
In situ Water Column Measurements	Four times a year, once a month during discharge	Exposure and reference areas	7 stations in the Exposure Area, 3 stations in each reference area. One vertical profile per station
Water Quality	Four times a year, once a month during discharge	Exposure and reference areas	7 stations in the Exposure Area, 3 stations in each reference area. One sample @1m below the surface and one sample @5 m above the bottom at each station.
Benthic Invertebrate Communities, and sediment quality	Every 3 years in August if triggered by MDMER	Exposure and reference areas	6 stations in the Exposure area and 5 stations in each reference area. Three subsamples per station
Fish population	Every 3 years in August if triggered by MDMER	Exposure and reference areas	20 sexually mature males and 20 sexually mature females of two fish species in each sampling area

Monitoring Component	Sampling Frequency	Monitoring Location	Sample Replication and Number of Samples
Fish tissue	Every 3 years in August if triggered by MDMER	Exposure and reference areas	8 samples of a single species from each sampling area

Notes:

Amended Metal and Diamond Mining Effluent Regulations (MDMER; GC 2018) will be adhered to. Metal Mining Effluent Regulations (MMER) will be adhered to as a minimum while MDMER come into effect.

FDP = Final Discharge Point

4.4 Groundwater Monitoring Plan

Table 6 presents a summary of the underground monitoring plan presented in Sections 4.2 and 4.3. Additional sampling at the surface will be conducted, including pre- and post- SWTP sampling as outlined in the WMP and the Water Quality and Flow Monitoring Plan.

Table 6: Groundwater Monitoring Plan

Monitoring Type	Monitoring Location	Purpose	Frequency
Verification	Portal Water Stope L75	Quantity - Monitor underground water quantity pumped to surface.	Totalized Flow Tabulated Monthly
Verification	Underground Seeps	Quantity - Seepage survey to verify underground flow estimates.	Monthly
Verification	Sump 125	Quality - Monitor underground water quality prior to recirculation for underground use.	Monthly
Verification	Underground seeps/DDHs	Quality – Verify quality of groundwater flowing into underground	Quarterly
Verification	SWTP Inlet and Outlet	Quality – Verify quality of groundwater being treated and monitor final treated effluent prior to continued transfer to CP1	Weekly

Source: Agnico Eagle (2018).

SECTION 5 • QUALITY ASSURANCE/QUALITY CONTROL PROCEDURES

Quality Assurance (QA) refers to plans or programs that encompass a wide range of internal and external management and technical practices designed to ensure the collection of data of known quality that matches the intended use of the data. Quality Control (QC) is a specific aspect of QA that refers to the internal techniques used to measure and assess data quality. Specific QA and QC procedures that will be followed during sampling performed for the Groundwater Monitoring Program are described in Section 5.1 and 5.2.

5.1 Quality Assurance

Quality assurance protocols are diligently followed so data are of known, acceptable, and defensible quality. There are three areas of internal and external management, which are described in the following three sections.

5.1.1 Field Staff Training and Operations

To make certain that field data collected are of known, acceptable, and defensible quality, field staff are trained to be proficient in standardized field groundwater sampling procedures, data recording, and equipment operations applicable to the Groundwater Monitoring Program. All field work will be completed according to specified instructions and established technical procedures for standard sample collection, preservation, handling, storage, and shipping protocols.

5.1.2 Laboratory

To make sure that high quality data are generated, accredited laboratories have been selected for sample analysis. Accreditation programs are utilized by the laboratories so that performance evaluation assessments are conducted routinely for laboratory procedures, methods, and internal quality control.

5.1.3 Office Operations

A data management system is utilized so that an organized consistent system of data control, data analysis, and filing will be applied to the Groundwater Monitoring Program. Relevant elements will include, but are not limited to the following:

- all required samples are collected;
- chain-of-custody and analytical request forms are completed and correct;
- proper labelling and documentation procedures are followed, and samples will be delivered to the appropriate locations in a timely manner;
- laboratory data will be promptly reviewed once they are received to validate data quality;
- sample data entered into a Mine-specific groundwater quality database will be compared to final laboratory reports to confirm data accuracy; and

- appropriate logic checks will be completed to ensure the accuracy of the calculations.

5.2 Quality Control

The QC component consists of applicable field and sample handling procedures, and the preparation and submission of two types of QC samples to the various laboratories involved in the program. The QC samples include blanks (e.g., travel, field, equipment) and duplicate/split samples.

Sample bottle preparation, field measurement and sampling handling QC procedures include the following:

- Sample bottles are kept in a clean environment, capped at all times, and stored in clean shipping containers. Samplers keep their hands clean, wear gloves, and refrain from eating or smoking while sampling.
- Where sampling equipment must be reused at multiple sampling locations, sampling equipment is cleaned appropriately between locations.
- Temperature, pH, and specific conductivity are measured in the field using hand held meters. Samples are cooled to between 4 °C and 10˚C as soon as possible after collection. Care is taken when packaging samples for transport to the laboratory to maintain the appropriate temperature (between 4°C and 10˚C) and minimize the possibility of rupture. Where appropriate, samples are treated with preservatives to minimize physical, chemical, biological processes that may alter the chemistry of the sample between sample collection and analysis.
- Samples are shipped to the laboratory as soon as reasonably possible to minimize sample hold times. If for any reason, samples do not reach the laboratory within the maximum sample hold time for individual parameters, the results of the specific parameters will be qualified, or the samples will not be analysed for the specific parameters.
- Chain of custody sample submission forms are completed by field sampling staff and submitted with the samples to the laboratory.
- Only staff with the appropriate training in the applicable sampling techniques conduct water sampling.

Quality control procedures implemented consist of the preparation and submission of QA/QC samples, such as field blanks, trip blanks, and duplicate water samples. These are defined as follows:

- Field Blank: A sample prepared in the field using laboratory-provided deionized water to fill a set of sample containers, which is then submitted to the laboratory for the same analysis as the field water samples. Field blanks are used to detect potential sample contamination during collection, shipping and analysis.
- Travel Blank: A sample prepared and preserved at the analytical laboratory prior to the sampling trip using laboratory-provided deionized water. The sample remains unopened

throughout the duration of the sampling trip. Travel blanks are used to detect potential sample contamination during transport and storage.

- Duplicate Sample: Two samples collected from a sampling location using identical sampling procedures. They are labelled, preserved individually and submitted for identical analyses. Duplicate samples are used to assess variability in water quality at the sampling site. Duplicates are collected and submitted for analyses at approximately, 10% of sampling locations. For smaller batches of samples (less than 10), at least one duplicate will be collected and submitted for analysis.

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APPENDIX A • SITE LOCATION AND MINE SITE LAYOUT

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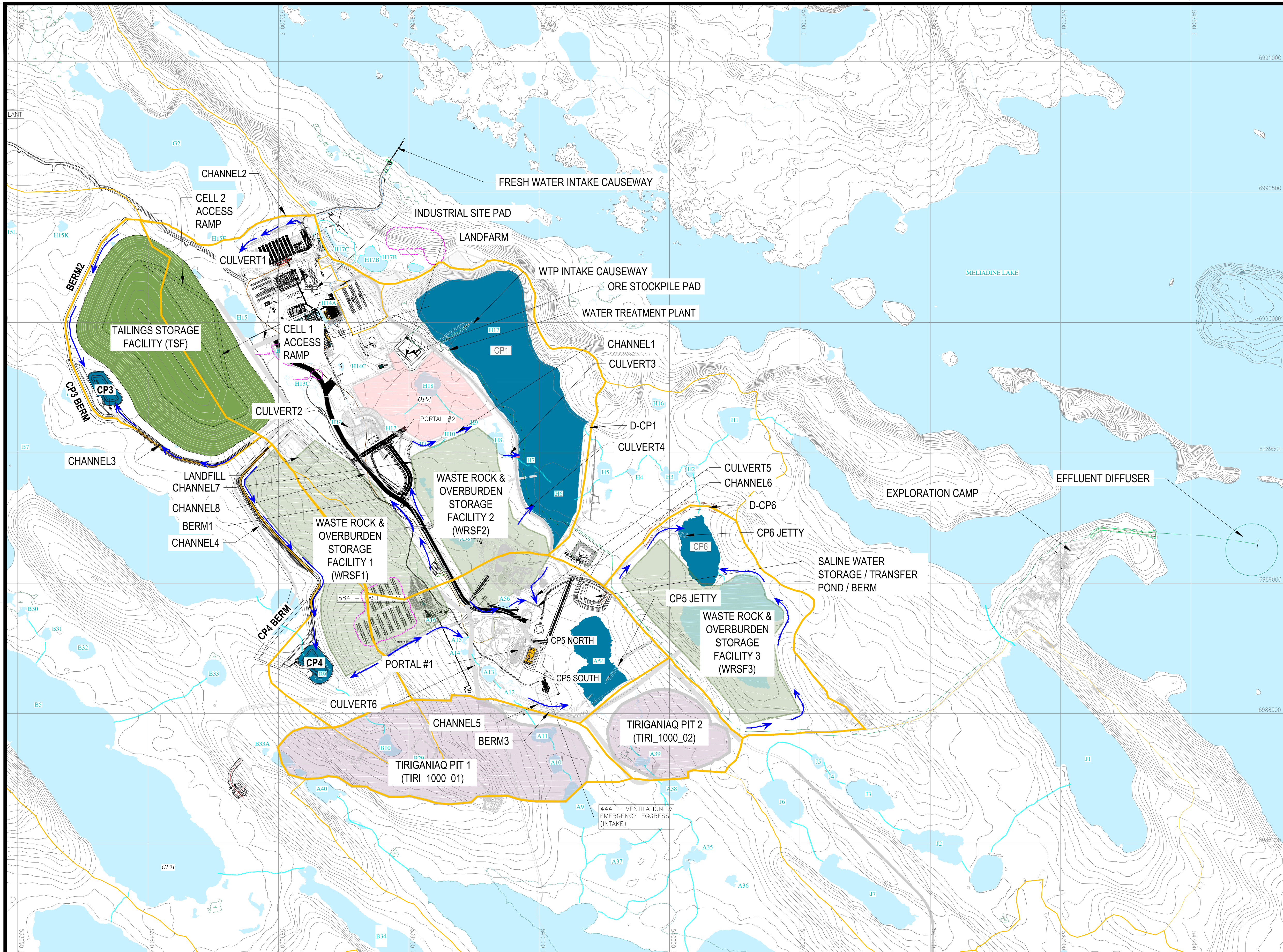
DRAWING NO.

FORMAT ANSI B-11x17



LEGEND

- CATCHMENT BOUNDARY
- WATERBODY
- WATER COLLECTION POND
- OPEN PIT
- WASTE ROCK
- ORE
- CONTACT WATER FLOW DIRECTION

PERMIT TO PRACTICE
TETRA TECH CANADA INC.
Signature
Date Nov. 14, 2018
PERMIT NUMBER: P 018
NT/NU Association of Professional Engineers and Geoscientists

REGISTERED PROFESSIONAL ENGINEER G. ZHANG LICENSEE NWT/NU Nov. 14, 2018

AGNICO EAGLE

TETRA TECH

POUR CONSTRUCTION
FOR CONSTRUCTION
DATE: 11/14/2018

TITRE / TITLE	# DWG
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DESSINS EN RÉFÉRENCE/REFERENCE DRAWINGS

REV	DESCRIPTION	DATE	PAR BY
0	ISSUED FOR CONSTRUCTION	2018-11-14	
B	ISSUED FOR REVIEW	2018-11-06	
A	ISSUED FOR REVIEW	2018-11-05	

REVISIONS

DESSINÉ PAR / DRAWN BY	EL/EP	DATE 2018-11-14
VÉRIFIÉ PAR / CHECKED BY	GZ/WTH	2018-11-14
APPROUVÉ PAR / APPROVED BY		
No. PROJET / PROJECT NO.		
DATE		

TITRE / TITLE
MELIADINE TAILINGS STORAGE FACILITY DESIGN

GENERAL ARRANGEMENT

ÉCHELLE/SCALE
FICHIER FILE .DWG

No. DESSIN/DRAWING NO. 6515-583-163-001
REVISION 0
FEUILLE/SHT 1 / 8

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APPENDIX B • DESIGN REPORT SALINE EFFLUENT DISCHARGE TO MARINE ENVIRONMENT

February 2019

Design Report
Saline Effluent Discharge to Marine Environment

6528-680-132-REP-001

In accordance with NIRB Project No.006 Condition 128

Prepared by:
WSP Canada Inc.

February 2019

DOCUMENT CONTROL

Version	Date (YMD)	Section	Page	Revision
0	2019-02-15			Design report

Prepared By: Phillip Sidorenko, ing. #5063140

Phillip Sidorenko, P. Eng.

Verified by:

Ugo Banville, P. Eng.

Approved by:

Manon Turmel

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1 INTRODUCTION

1.1 SITE LOCATION AND ACCESS

WSP Canada Inc. (WSP) was retained by Agnico Eagle Mines Limited (Agnico Eagle) to prepare the Design Report of the proposed saline effluent discharge to the marine environment near Rankin Inlet, Nunavut. As part of their long-term groundwater management strategy, Agnico Eagle is planning to collect groundwater from the Meliadine underground mine, treat the influent with respect to quality standards and discharge the treated groundwater effluent into Melvin Bay.

The Meliadine Mine is located approximately 25 km North of Rankin Inlet (63°1’23.8’’ N, 92°13’6.42’’ W), Nunavut.

The proposed discharge point for the saline groundwater effluent is in Melvin Bay just west of Rankin Inlet. Agnico Eagle will access the area using a bypass road. The area is also accessible by Itivia Street, a gravel road linking the Agnico Eagle Fuel Storage Facility at the Itivia Harbour and Rankin Inlet.

1.2 EXISTING AND FUTURE SITE FACILITIES

Agnico Eagle owns and operates the existing Fuel Storage Facility and plans to use this property to install the saline effluent discharge system. This projected effluent discharge system consists of truck discharge pump, a back-up discharge truck pump, a 100 000-litre storage tank, as well as suction and discharge pipelines. The 100 000-litre storage tank will only be used to contain the treated effluent until the next day, if the 800 m^3/d discharge limit is attained upon a truck’s arrival. The storage tank will be installed on a containment area, built on a geomembrane with underlying and overlying granular materials and surrounded by berms. The construction drawings are shown in the Appendix A.

A pumping station including two pumps will be installed on the containment area. The truck discharge pump will be used to transfer the effluent from the trucks directly into the sea (or to storage tank). A back-up truck discharge pump will be installed to by-pass the first pump, if necessary. The truck-discharge pump is connected to a 778 m long HDPE pipeline to pump the effluent from the trucks to 20m below sea level in Melvin Bay. A diffuser is connected at the end of the pipe to ensure effective dilution of the saline effluent into the marine environment. The ballast weights will be attached to the pipe to sink and hold it onto the seabed.

For more detailed information, refer to the construction drawings shown in the Appendix A.

1.3 PURPOSE OF THE DOCUMENT

The purpose of the report is to outline the final design and construction drawings for the saline effluent discharge system which includes the storage tank, the pumping station, the discharge pipe as well as the diffuser that will release the treated groundwater effluent into Melvin Bay.

This report has been prepared in accordance with Condition 128 of NIRB Project Certificate No.006:

‘‘The Proponent shall provide the NIRB with a detailed design for the system that includes the location of the pipeline in relation to the saline effluent storage tank at Itivia, the location of submerged collars supporting the pipeline and the design of the diffuser.’’

The final design was presented to the local stakeholders including the Kangiqliniq Hunters and Trappers Organization (KHTO), the Hamlet of Rankin Inlet and the Government of Nunavut - Nunavut Airports Division and Community and Government Services Department on January 24th, 2019 for final review.

This design report refers to Golder’s Report which assessed the environmental guidelines characterizing Melvin Bay at the location of the proposed diffuser and conducted the numerical modelling to design the diffuser. Golder’s Report was published in February 2019 and is shown in Appendix D.

1.4 SCOPE OF WORK

WSP was retained by Agnico Eagle to design the pumping station and pipeline while Golder was responsible for the assessment of the groundwater effluent plume with respect to environmental guidelines. This report describes the design of the pumping station, the pipeline and the diffuser.

2 GENERAL SITE CONDITIONS AND OTHER DATA INPUT FOR DESIGN

2.1 MODELLING FOR DIFFUSER DESIGN

The model calculates numerical simulations of the treated groundwater effluent mixing in the proposed marine environment. The modelling of the groundwater effluent plume dispersion allows the user to assess the dilution behaviour.

The ambient environmental conditions (e.g. winds, currents, etc.) and treated groundwater effluent characteristics are necessary to calculate numerical simulations of the mixing.

The proposed diffuser pipeline is to extend from the storage tank to be located south of the Aginco Eagle’s Fuel Storage Facility, to south-south-west in Melvin Bay. The diffuser port will be installed on the seabed at a depth of 20 m, to ensure proper mixing and prevent interference with traditional activities.

Refer to section 2.1.3 of Golder’s Report: Modelling Assessment of Groundwater Discharge into the Melvin Bay Marine Environment, Rev B, for detailed information (Golder, 2019).

2.2 ENVIRONMENTAL DATA

For detailed information on the environmental data used, refer to section 2.1.1 of Golder’s Report.

2.3 CHARACTERISTICS OF THE EFFLUENT

For detailed information on the characteristics of the effluent, refer to Appendix B of Golder's Report.

3 DESIGN OF THE STORAGE AND PUMPING STATIONS

3.1 GENERAL

After treatment, the excess groundwater will be stored on site at the Meliadine Mine, before being hauled by tanker trucks to Itivia Harbour. Trucks will unload their treated groundwater effluent by connecting on a flexible 4'' HDPE suction pipe. The truck discharge pump will transfer the treated effluent into the 6'' discharge HDPE pipeline and through the diffuser. The truck discharge pump will also be used to transfer effluent into the storage tank until the next day, before it is pumped into sea when necessary.

A by-pass pipeline will be installed parallel to the main discharge pipe in case the discharge truck pump malfunctions or maintenance is required. The back-up truck discharge pump (spare) will be used to pump the effluent into by-pass pipe, though the 6'' discharge HDPE pipe and out the diffuser, if necessary.

3.2 PUMP NARRATIVE

The flow rate to be discharged to Melvin Bay will not exceed 800 m^3/d with a TDS of 39 600 mg/L (Golder, 2019). The discharge will only occur during open water season. For more detailed information on the modelling scenarios and the input parameters, refer to section 2.1.2 of Golder's Report.

3.3 PUMPING STATION ENCLOSURES

The pumping station will be enclosed inside a heated container to protect the mechanical and electrical equipment from cold temperatures before Winter and at freshet. This precaution will decrease the risks of malfunctions in the system.

3.4 STORAGE TANKS

A 100 000-litre horizontal double wall storage tank will only be used to store the treated groundwater effluent until the next day if the daily discharge limit is attained upon a truck's arrival.

3.5 PIPING

The piping manifold for pumping stations within the container will be made of chlorinated polyvinyl chloride (CPVC) with Victaulic connections to facilitate the dismantlement during maintenance operations.

The 4’’ suction and 6’’ discharge pipelines outside of the heated container will be made of HDPE DR-9 pipe.

3.6 CONTROLS

The pumping station was designed to control the high and low water levels in the storage tank. The water level in the storage tank will be regulated with an ultrasonic transmitter located in the storage tank. When the water reaches the high level, the pump will automatically start to discharge the treated effluent to Melvin Bay.

A flow meter will be installed downstream of the pumping station to measure the flow rate before discharging into the marine environment. The pH, conductivity and the temperature levels of the effluent will be measured at the Chlorination Treatment Plant before arrival to Agnico Eagle Fuel Storage Facility. This equipment will allow Agnico Eagle to control the discharge operations and to respect the base parameters. This is in accordance with the commitments during the Final Environmental Impact Statement (FEIS) process.

A valve will be installed downstream of the storage tank to allow the sampling according to the Metal and Diamond Effluent Regulation.

The pumping station is designed to facilitate the user’s operations and maintenance. The design allows a local control at the pumping station.

4 DESIGN OF THE HDPE PIPELINES

4.1 GENERAL

The present section of the report describes the main components of the effluent discharge pipeline and provides the reader with further details on its design and functionalities.

The groundwater effluent pipeline was designed to prevent interference with local transportation including snowmobiling, boating and ATV’s. Our design proposes an ATV and snowmobile crossing constructed over a section of the onshore pipeline and parallel to the laydown area fence line. Furthermore, drawing 65-100-210-200 illustrates the location of the proposed ATV and snowmobile crossing.

The design will not affect the use of traditional land during construction and operation.

4.2 ABOVE-GROUND PIPELINE

4.2.1 ONSHORE

The onshore pipe will be installed permanently on the undisturbed natural ground. Signage will be installed in both directions of the traffic near the onshore pipe to indicate the obstacle and the crossing to motorized vehicles.

4.2.2 SUBMARINE PIPELINE

Unlike the conceptual design presented during the FEIS process, Agnico Eagle is proposing not to bury the pipeline located in the intertidal zone. This proposed design will result in reducing the impacts on the environment and community (i.e. eliminate need to re-open the Itivia quarry, reduce risk of erosion and sedimentation into Melvin Bay during pipe installation and reduce risk of pipe being moved by ice during winter).

The submarine pipeline is segmented into two sections, a temporary (removable) and a permanent section. The first 150 m long section located south of the crossing must be removed from the Melvin Bay before Winter since the formation of ice could damage the pipe. The temporary section will be re-installed at freshet once the ice has broken up. The temporary pipe is removable by its flanges located at the extremities of the 150 m section.

On the other hand, the permanent section of the submarine pipeline will be at least 6 m below sea level and will stay in place year-round. A diffuser is connected at the end of the pipe.

4.3 MATERIAL

4.3.1 PIPELINES

The effluent discharge pipeline will be made of Sclairpipe HDPE DR-9 PE4710. Also, the pipeline will be welded using a fusion welding machine except at it’s flanges. The pipe’s dimension ratio was selected based on the need for high rigidity. The chemical properties of HDPE pipes make it highly resistant to saline water. Finally, HDPE pipelines are easier to install in a marine environment compared to other materials (e.g. steel).

4.3.2 FLANGES, VALVES AND ACCESSORIES

The pipeline’s temporary section has two HDPE flanges at its extremities to enable it to be removed and installed again, when necessary. A back-up ring will be inserted in-between each flange connections and then mechanically fastened to ensure tightness. The ring will be designed to resist low water temperatures as well as salinity.

4.3.3 BALLAST WEIGHTS

The ballast weights will be installed at a 1.52 m interval along the submarine pipeline. The ballast weights must weigh 67.6 pounds to keep the pipeline floating when filled with air, until it is in the projected alignment. Once the pipeline is filled with water, the ballast weights will sink and hold the pipeline onto the seabed. The ballast weight will allow the installation of the pipeline underwater.

4.4 EQUIPMENT

4.4.1 FLOWMETER

As mentioned in section 3.6, a flowmeter will be installed downstream of the pumping station to measure the flow rate before discharge into the marine environment.

5 DESIGN OF DIFFUSER AND MODELLING RESULTS

5.1 DIFFUSER CONFIGURATION

The optimized diffuser has the following configuration:

- Diffuser connection with outfall through a 6'' five-way cross;
- Length of the diffuser: 0.9 m;
- Diameter of the diffuser: 150 mm, DR-9 (nominal);
- Diffuser depth: 20 m (based in 2017 bathymetry survey of Melvin Bay);
- Discharge type: single port;
- Horizontal angle of discharge: Perpendicular to bathymetric contours;
- Vertical angle of discharge: 90°;
- Port diameter: 75 mm, DR-9 (nominal);
- Port height from seabed: 1 m.

For more detailed information, refer to construction drawing 65-100-210-200 in Appendix A.

6 CONSTRUCTION

6.1 GENERAL

Construction is expected to begin in May 2019 and end in August 2019.

6.1.1 PIPELINE

The pipeline sections will be welded on shore into three major segments; the onshore segment as well as the temporary and permanent submarine segments.

The ballast weights will be installed onshore only when the submarine segments are welded together. Initially, the ballast weights will be stockpiled adjacent to the work station. Then, a ramp or skid way, including railroad tracks or steel beams, will be placed to facilitate moving the weights along with the pipe.

The pipeline is ready for launching when all the ballast weights are fixed to the pipeline. To keep the pipeline floating until the sinking operation, the pipe ends are blocked to prevent water from entering the pipe. This will be accomplished by installing a flange assembly with a blind flange at each end.

Before the launch, the ramp of the skidway will extend deep enough into the water so that the weights can be supported by the floating pipe. In case of high currents, an anchorage system will be installed to hold the pipe while it is being launched. A boat with a winch and cable system will be used to move the pipeline into the water. It may be necessary to install guide cables and shore anchors to hold the system over the alignment when it is being sunk.

The sinking process consists of filling the pipe with water at one end and evacuating the air out of the other end.

The construction of the pipeline onshore and under water will not interfere with the local community activities. During construction, vertical lighting signs will be installed onshore to alert incoming traffic at Itivia Harbor. The lighting will be oriented with caution, towards the working area and away from the airstrip take off and landing area.

6.1.2 STORAGE TANK

The installation of the storage tank will require the use of a lifting mobile equipment. The storage tank measures 12.2 m long x 3.3 m wide and weighs 15 m.t. It will be set in place with the M & T KoneCrane ReachStacker Model SMV 4531. Its maximum vertical extension is 18.2 m but just to lift the storage tank off a flat bed and set in place, it would be extended about two thirds that height.

6.1.3 CONTAINMENT PAD (NEAR ITIVIA FUEL STORAGE FACILITY)

The Containment pad will be built to minimize land disturbance and environmental risks. Therefore, the pad is to be built 31 m away from the Highest High Water Large Tide (HHWLT).

Once the subgrade is prepared, an HDPE geomembrane is installed with underlying and overlying granular material. Also, berms are to be constructed around and higher than the containment pad. This gives the pad the capacity to contain the volume of effluent inside the storage tank in case of spillage.

The pad will facilitate daily operations such as maneuvering the tanker trucks to unload the groundwater effluent into the storage tank.

The construction of the containment pad will require an excavator, tandem trucks, a spread dozer and a compactor. The tallest heavy equipment on site will be the CAT 330 excavator. It has a maximum vertical reach of 10.7 m but will not be deployed to this height since the work will occur at ground level only.

6.2 MATERIAL SPECIFICATIONS

All the materials used to fabricate the facility are non-potentially acid generating (NPAG) materials. The granular materials that will be used for building the containment pad will be sourced from a nearby borrow pit.

6.3 CONSTRUCTION QUALITY CONTROL AND SURVEY

Agnico Eagle is responsible for conducting quality control and surveying during construction.

6.4 TESTING AND INSPECTION

Agnico Eagle is responsible for testing and inspecting the saline discharge effluent system according to the manufacturer's recommendations before its start-up. After the pipeline installation, diver's will verify that the ballasts holding the pipeline are all properly sitting on the bottom contours and that the pipeline is not resting on any rocks, debris or material that could cause damage.

7 OPERATIONS

7.1 REMOVABLE AND PERMANENT PIPE

As stated in section 4.2.2, operation of the saline effluent discharge requires installing and removing a temporary segment of the pipeline at freshet and Winter, respectively. The temporary segment will be removed and stored away before the bay freezes up.

The temporary section of pipe can be disconnected from the system at its flanges and will have to be pulled out using heavy equipment. Agnico Eagle is responsible for storing this pipeline segment on their property during Winter.

7.2 MAINTENANCE PROGRAM

Agnico Eagle will have in place a maintenance program based on manufacturer's recommendations. The system will be inspected according to the manufacturer's recommendations and repaired when needed to keep the system in good working condition.

8 REFERENCES

Agnico Eagle. 2018a. Meliadine Gold Project Groundwater Management Plan. Version 1. February 2018.

Golder. 2019. Modelling Assessment of Groundwater Discharge into the Melvin Bay Marine Environment, Rev B. February 2019.

Agnico Eagle (Agnico Eagle Mines Limited). 2014. Final Environmental Impact Statement (FEIS) - Meliadine Gold Project, Nunavut from: ftp://ftp.nirb.ca/02REVIEWS/ACTIVE%20REVIEWS/11MN034-AgnicoEagle%20MELIADINE/2-REVIEW/09-FINAL%20EIS/FEIS Accessed on November 2014.

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Appendix A: Construction drawings

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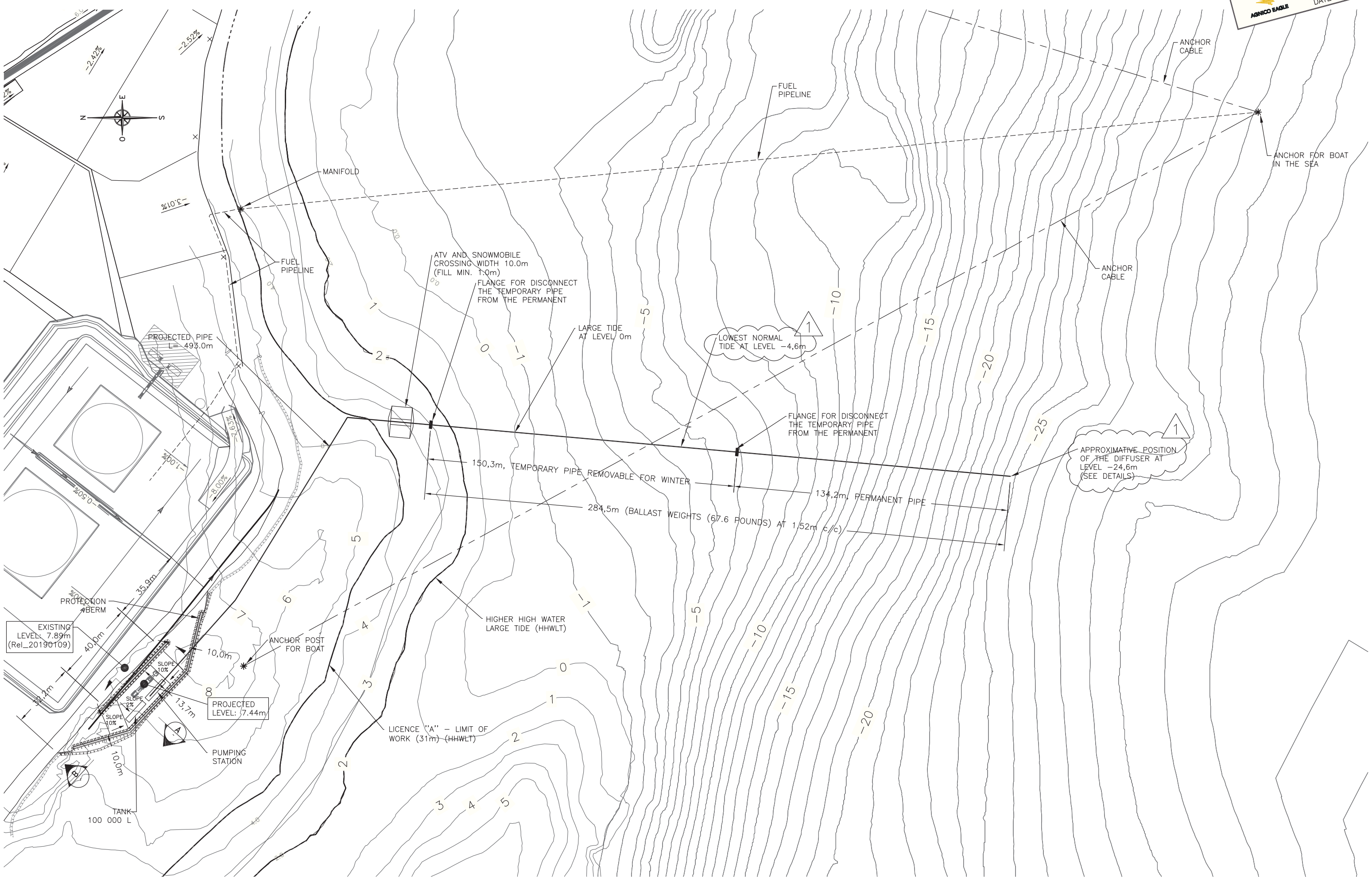

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POUR CONSTRUCTION
FOR CONSTRUCTION
DATE : 2019-02-14

PLAN CLÉ / KEY PLAN

wsp

Ref. 181-15686-00

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AGNICO EAGLE

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0	2019-02-06	ISSUED FOR CONSTRUCTION	J.C.	S.D.	

REVISIONS

Stéphan Dupuis 139669 QUÉBEC — S. DUPUIS LICENSEE NT/NU — 2019-02-14

TITRE / TITLE
AGNICO EAGLE - MELIADINE DIVISION
180 - SALINE EFFLUENT DISCHARGE SYSTEM
230 - GENERAL EARTH WORKS
SALINE WATER STORAGE FACILITY
RANKIN INLET
PLAN VIEW

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VERIFIÉ PAR / CHECKED BY	YOUSSEF HESSANI, Ing.	2019-02-06
APPROUVÉ PAR / APPROVED BY	STEPHAN DUPUIS, P. Eng.	2019-02-14
ÉCHELLE / SCALE	INDICATED	DATE 2018-12-12

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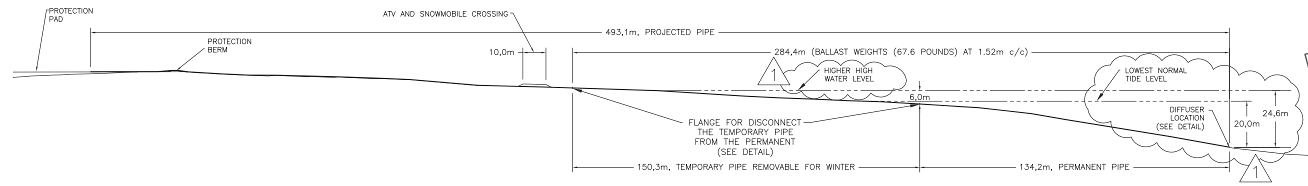

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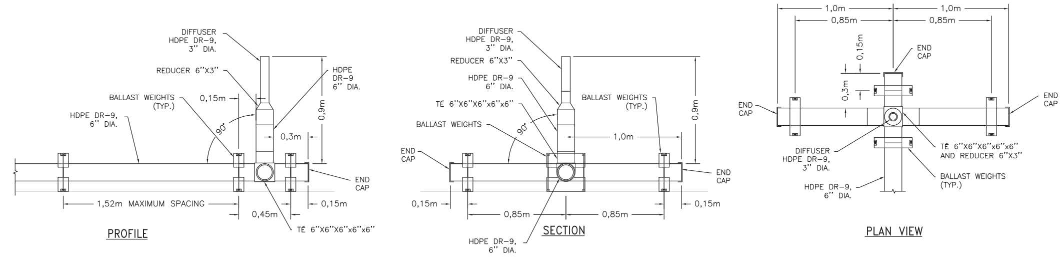
POUR CONSTRUCTION
FOR CONSTRUCTION
DATE : 2019-02-14



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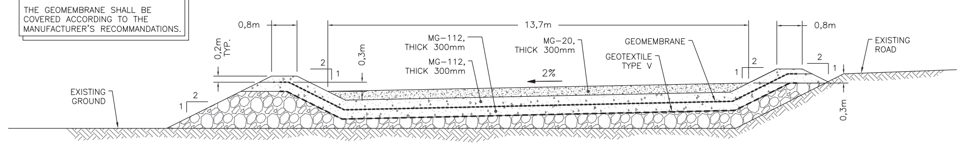

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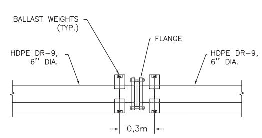

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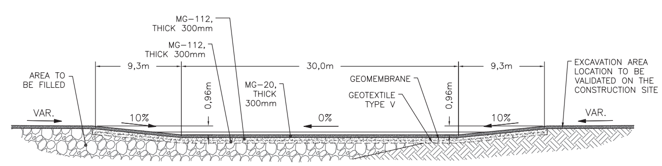

SECTION "B" – PAD
Scale: 1: 250

NOTES:

1) FOR THE INSTALLATION, THE CONTRACTOR NEED TO REFER TO THE HANDBOOK OF PE PIPE CHAPTER 10, MARINE INSTALLATION. EACH SECTION OF PIPE MUST BE JOINT BY FUSION, EXCEPT FOR THE TEMPORATY PIPE REMOVABLE FOR WINTER THEY ARE CONNECTING TO THE PERMANENT PIPES WITH FLANGE FUSED AT EACH END BACK-UP RING.

2) POST-INSTALLATION SURVEY

UPON COMPLETION OF THE INSTALLATION OF A SUBMERGED PIPELINE, IT IS ADVISABLE TO HAVE THE COMPLETE LINE SURVEYED BY A COMPETENT DIVER TO ENSURE THAT:

- THE PIPELINE IS LOCATED WITHIN THE PRESCRIBED RIGHT-OF-WAY;
- THE BALLASTS HOLDING THE PIPELINE ARE ALL PROPERLY SITTING ON THE BOTTOM CONTOUR AND THAT THE LINE IS NOT FORCED TO BRIDGE ANY CHANGES IN ELEVATION;
- THE PIPE IS NOT RESTING ON ANY ROCKS, DEBRIS OR MATERIAL THAT COULD CAUSE DAMAGE;
- ANY AUXILIARY LINES, SUCH AS HOSES, ROPES, BUOYANCY BLOCKS OR ANY OTHER EQUIPMENT USED DURING THE INSTALLATION HAS BEEN REMOVED;
- WHERE REQUIRED, THE PIPE HAS BEEN BACKFILLED AND THE BACKFILLING WAS DONE PROPERLY;
- ALL OTHER INSTALLATION REQUIREMENTS ESTABLISED BY THE DESIGNER FOR THE SUBJECT APPLCATION HAVE BEEN COMPLIED WITH.

PLAN CLÉ / KEY PLAN

wsp

Ref. 181-15686-00

NOTES GÉNÉRALES / GENERAL NOTES

DESSINS EN RÉFÉRENCE / REFERENCE DRAWINGS

TITRE / TITLE	# DWG
INDUSTRIAL SITE – GROUND LEVELING / FINISHED GRADE ELEVATION	65-000-230-207_R0

AGNICO EAGLE

REV.	DATE	DESCRIPTION	PAR/BY	APP.	CLIENT
1	2019-02-14	ISSUED FOR CONSTRUCTION	J.C.	S.D.	
0	2019-02-06	ISSUED FOR CONSTRUCTION	J.C.	S.D.	

REVISIONS

TITRE / TITLE
AGNICO EAGLE – MELIADINE DIVISION
180 – SALINE EFFLUENT DISCHARGE SYSTEM
230 – GENERAL EARTH WORKS
SALINE WATER STORAGE FACILITY
RANKIN INLET
DETAILS

DESSINÉ PAR / DRAWN BY	JULIE.CROTEAU, tech.	DATE 2018-12-12
VÉRIFIÉ PAR / CHECKED BY	YOUSSEF HESSANI, Ing.	2019-02-06
APPROUVÉ PAR / APPROVED BY	STEPHAN DUPUIS, P. Eng.	2019-02-14
ÉCHELLE / SCALE	INDICATED	DATE 2018-12-12

NO. DESSIN / DRAWING NO. 65-180-230-200-2

NO. PROJET / PROJECT NO.	REVISION	FEUILLE / SHT
6528	1	2 / 2

AE-CART-ARCH D

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FILE NO. 65-180-230-200-2_R1.dwg

NO. DESSIN
DRAWING NO. 65-180-205-200_R0

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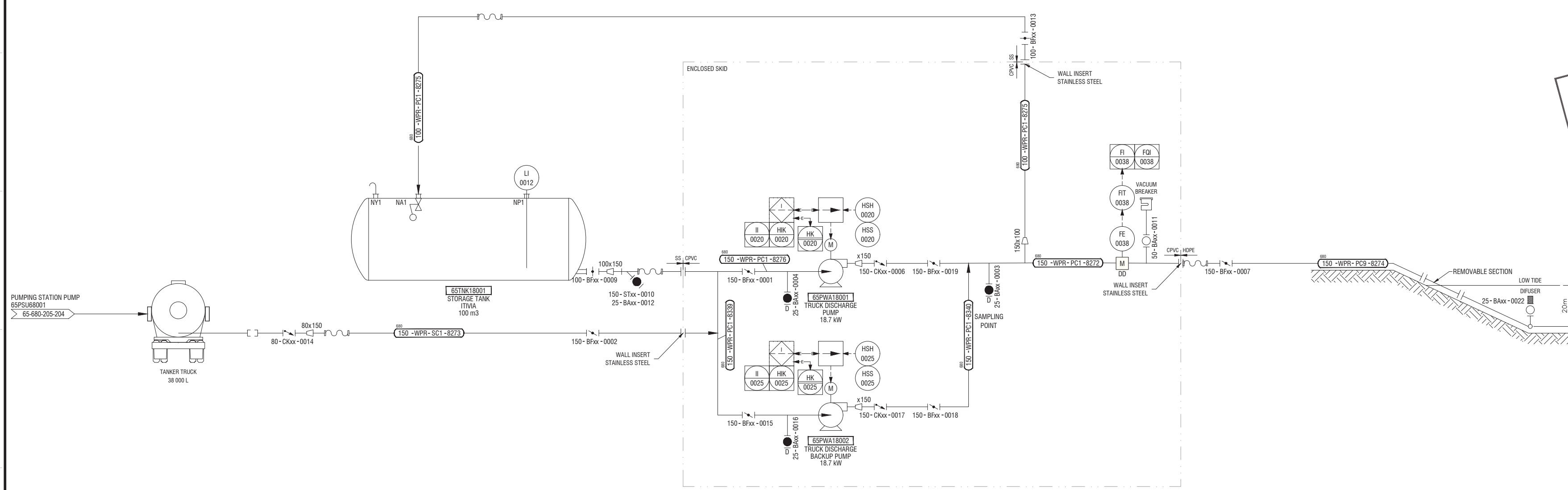


PLAN CLÉ
KEY PLAN

NOTES GÉNÉRALES / GENERAL NOTES

NE PAS UTILISER POUR CONSTRUCTION
NOT FOR CONSTRUCTION
AGNICO EAGLE
DATE : 19-02-07

DESSINS EN RÉFÉRENCE / REFERENCE DRAWINGS

TITRE / TITLE	# DWG
–	–
–	–
–	–
–	–
–	–
–	–

AGNICO EAGLE

REV.	DATE	DESCRIPTION	PAR/BY	APP.	CLIENT
0	2019-02-07	ISSUED FOR TENDER	S.P.	E.L.	

REVISIONS

L2899
E. LAVOIE
LICENSEE
08/02/2019

TITRE / TITLE
AGNICO EAGLE – MELIADINE DIVISION
180 – SALINE EFFLUENT DISCHARGE SYSTEM
205 – PIPING & INSTRUMENTATION DIAGRAM
RANKIN INLET
ITIVIA

DESSINÉ PAR / DRAWN BY	JONATHAN LAVOIE	DATE 2019-01-17
VÉRIFIÉ PAR / CHECKED BY	SÉBASTIEN PERRON	2019-02-07
APPROUVÉ PAR / APPROVED BY	ÉRIC LAVOIE, P. Eng.	2019-02-07
ÉCHELLE / SCALE	NO SCALE	DATE 2019-01-23

NO. DESSIN / DRAWING NO. 65-180-205-200

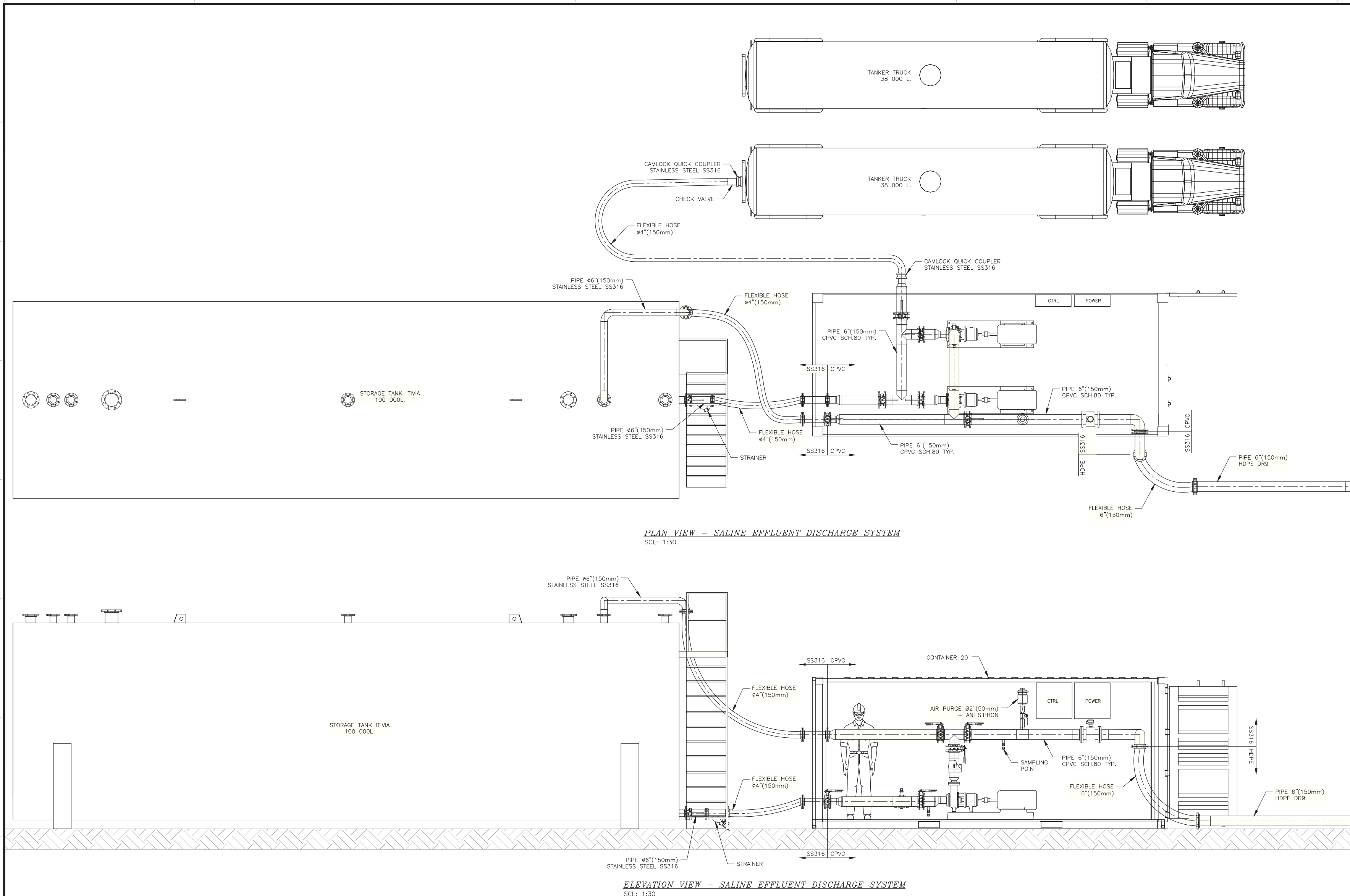
NO. PROJET / PROJECT NO.	REVISION	FEUILLE / SHT
6528	0	1 / 1

AE-CART-ARCH D

FILE NO. 65-180-205-200_R0.dwg

NO. DESSIN
DRAWING NO. 65-180-210-200_R0

FORMAT ARCHD



PLAN CLÉ
KEY PLAN

WSP
1075, 3e AVENUE EST
VAL-D'OR (QUÉBEC) CANADA J9P 0J7
TÉL. : 819 825-4274 | TÉLÉC. : 819 824-1514 | WWW.WSPGROUP.COM
Ref. 181-15686-00

NOTES GÉNÉRALES / GENERAL NOTES

POUR SOUMISSION
FOR TENDER
DATE : 2019-02-05

NE PAS UTILISER
POUR CONSTRUCTION
NOT FOR CONSTRUCTION
DATE : 2019-02-05

DESSINS EN RÉFÉRENCE / REFERENCE DRAWINGS

TITRE / TITLE	# DWG
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–	–
–	–
–	–
–	–

AGNICO EAGLE

REV.	DATE	DESCRIPTION	PAR/BY	APP.	CLIENT
0	2019-02-06	ISSUED FOR TENDER	C.G.	D.R	

REVISIONS

INGÉNIEUR - ENGINEER
Dominique Richard
5034681
QUÉBEC

REGISTERED PROFESSIONAL ENGINEER
D. RICHARD
NT/NU
L4044

TITRE / TITLE
AGNICO EAGLE – MELIADINE DIVISION
180 – SALINE EFFLUENT DISCHARGE SYSTEM
210 – GENERAL ARRANGEMENT
RANKIN INLET
ITIVIA

DESSINÉ PAR / DRAWN BY	CLAUDIA GILBERT	DATE 2019-01-30
VERIFIÉ PAR / CHECKED BY	SYLVAIN DÉFOSSÉ	2019-02-05
APPROUVÉ PAR / APPROVED BY	DOMINIQUE RICHARD, Eng.	2019-02-05
ÉCHELLE / SCALE	INDICATED	DATE 2019-01-30

NO. DESSIN
DRAWING NO. 65-180-210-200

NO. PROJET / PROJECT NO.	REVISION	FEUILLE / SHT
6515	0	1 / 1

AE-CART-ARCH D

\\cavdo1dat01\Projet_18X-XXXX-XX\181-15686-00\01-COMM\Envoyé_AEM\WSP-AEM-181-15686-00-074 (Saline Effluent Discharge System for Tender)\65-180-210-200_R0.dwg-2019-02-05 17:12:58

FILE NO. 65-180-210-200_R0.dwg

Appendix B: Pumping Station Functional Description

Functional Description

Saline Effluent Discharge at Sea

6528-680-132-REP-001 – Appendix 2

			Sébastien Perron Instrumentation 2019.02.13 17:12:45 -06'00'	Alain Corriveau Signature numérique de Alain Corriveau DN : cn=Alain Corriveau Date : 2019.02.13 18:04:58 -05'00'	Eric Lavoie 2019.02.14 08:24:33 -05'00'
2019-02-14	R0	Design Report	Sébastien Perron	Alain Corriveau	Éric Lavoie
Date	**Rev.**	**Status**	**Prepared By**	**Checked By**	**Accepted By**

Table of Contents

1. Document objective **1**

2. Description **1**

2.1 System description – Saline water truck unloading, storage and discharge at sea 1
2.2 Control description – Saline water truck unloading pump 1

1. Document objective

This document describes the programming of the control logic to be implemented for the control system of the discharging at sea of the treated saline effluent water coming from Meliadine site. The system will be installed close to the existing fuel deposit in Rankin Inlet, near the shore of Melvin Bay. The project is for Agnico Eagle's Meliadine mine.

2. Description

2.1 System description – Saline water truck unloading, storage and discharge at sea

Truck loaded with up to 50 000 liters of treated water ready to discharge at the sea will connect their load to a flexible pipe 150mm in diameter. Once connected, the operator will turn on the pump for about 15 to 30 minutes to transfer the water into a 100 000 liters storage tank or by changing the manual valves, directly to the diffuser in the sea. Overflow of the tank will be prevented by a float valve on the filling port. A mechanical level indicator will be installed on the tank. A flowmeter/totalizer will be installed on the sea discharge line in order to double check the volume of water discharged in sea.

The system will be powered by the existing electrical room at the fuel deposit.

2.2 Control description – Saline water truck unloading pump

Start/Emergency Stop button stations will be installed near the pumps.

Operator will open and close the valves in order to choose:

1. Main Pump or Back up Pump
2. Unload truck to tank, unload truck to sea or unload tank to sea

END OF SECTION

Appendix C: Sclairpipe Technical Specification

uponor

Sclairpipe®

VERSATILE HIGH DENSITY POLYETHYLENE PIPE

Sclairpipe

Sclairpipe® high density polyethylene (HDPE) pipe represents the latest advances in both material and manufacturing techniques. Since 1968, Sclairpipe has been proven in a wide range of municipal and industrial piping applications. It has been used extensively in the municipal market for gravity sewers, sewage forcemains, and pressure water systems. Uponor Infra has special expertise in marine installations of Sclairpipe, including river and lake crossings; and river, lake and deep ocean intakes and outfalls.

Lighter. Stronger. Chemical Resistant.

Sclairpipe is a tough, lightweight, solid wall pipe with a smooth internal surface. Available in various diameters from 4″ to 48″ it can handle internal pressures of up to 380 psi (PE 4710). It is a well suited alternative to copper, PVC, ductile iron and concrete pipe in a variety of applications.

Sclairpipe weighs approximately 1/10 that of a similar sized concrete pipe. Handling requires a minimum of heavy equipment and Sclairpipe can easily be assembled on ice or through wet marshy areas. It will not corrode, tuberculate or support biological growth, making it the material of choice in harsh environments. Sclairpipe is inert to salt water and to chemicals likely to be present in sanitary sewage effluent.

Sclairpipe has a smooth ID and maintains its flow capability over time - Hazen Williams C Factor remains 150, even after years of use.

Easier to Transport and Install. Leak Proof.

Sclairpipe is much easier to handle and install than heavier, rigid concrete pipe, offering potential cost savings during the construction process. It is structurally designed to withstand impact, especially in cold weather installations when other pipes are prone to cracks and breaks. Sclairpipe will float even when full of water. For marine applications long lengths of pipe can be assembled on shore and then floated into position.

Thermal butt fusion provides an economical and fast method of delivering a complete, long, continuous length of pipe. Thermal fusion eliminates potential leak points every 8-20 feet commonly found with gasketed (or bell or spigot) pipe materials. The fused joints provide a continuous leak proof system that eliminates the risk of joint leakage due to ground shifting. Fused joints are fully restrained and as such may reduce or eliminate the need for expensive thrust blocks. With Sclairpipe infiltration and exfiltration problems are eliminated.

Sclairpipe Advantages

- Leak Proof
- Corrosion Resistant
- Chemical Resistant
- Long Life
- Fatigue Resistant
- Impact Resistant
- Lightweight
- Flexible
- UV Resistant
- Environmentally Friendly

Cost Effective. Permanent.

Sclairpipe offers distinct advantages. It can be cold bent to a radius as small as 25 times the pipe's nominal pipe diameter, and the installed bend radius can be as small as 50 times the nominal pipe diameter. Scalirpipe, installed on a radius, eliminates many of the fittings that would be required for directional changes when using other pipe materials. In addition, the flexibility of Sclairpipe allows it to adapt to uneven ground, unconsolidated river bottoms and excavated underwater trenches without the need for expensive foundations or minor degree elbows. It is well suited for dynamic soils and areas prone to earthquake.

Sclairpipe is cost effective in both the short and long term. The fact that it is lightweight makes it easier to transport and install. It is leak proof and fatigue resistant means there will be years of maintenance free use. The Plastics Pipe Institute estimates the service life for HDPE pipe to conservatively be 50-100 years.

Proven performance in a wide range of applications

Since its development in 1955, large diameter HDPE pipe has been successfully used in many installations worldwide. In North America, Sclairpipe high density polyethylene pipe was first introduced in 1968. Since then it has been installed for river, lake and salt water crossings, municipal and industrial fresh and salt water intakes and effluent outfalls. Sclairpipe has also been used extensively for pipeline repair and rehabilitation.

Some popular applications of Sclairpipe include:

- Potable Water Distribution
- Pressure Water Systems
- Sewage Systems
- Water Mains
- Sliplining
- Fire Mains
- Directional Drilling
- Trenchless Technologies
- Slurry Pipe
- Mining
- Marine Pipelines & Crossings
- Deep Water Intakes
- Deep Water Outfalls
- Irrigation Lines
- Biofilters
- Gas Gathering

Potable Water

Sclairpipe is used for both new water main installations and to rehabilitate deteriorated piping systems made from other materials. It can accept repetitive pressure surges that far exceed the static pressure rating of the pipe. Sclairpipe is easy to handle and is available in long lengths that cut down on jointing time. Thermal fusion on site reduces installation time and ensures leakproof joints that eliminate infiltration and exfiltration problems. Sclairpipe is well suited for dynamic soils and areas prone to earthquake.

Sewage Systems

After more than 35 years of use in municipal and industrial sewer applications, Sclairpipe has proven to be a reliable, cost effective, long-term solution for sewer and wastewater systems. It offers resistance to corrosion and chemicals with durability and strength that rigid concrete, PVC or ductile iron pipes can't duplicate. Lightweight Sclairpipe is easy-to-install, extremely flexible and does not corrode or tuberculate over time.

Industry

Long-term reliable piping solutions are always in demand by industry. Sclairpipe offers resistance to corrosion, abrasion and chemicals resulting in a durable, strong and cost-effective installation.

Mining

Sclairpipe solid wall HDPE pipe is commonly used in mining applications for tailings disposal and water management including: river water diversion, reclamation lines, culvert, sewer and sub-drainage systems and slurry pipe. It is lightweight, flexible, durable and abrasion resistant. It is virtually leak proof, and can withstand corrosive chemicals, acids or salts commonly found in mines. Sclairpipe combines strength and durability in above ground applications and is UV resistant.

Irrigation

Sclairpipe is a cost effective solution for irrigation and agricultural drainage applications such as river and canal diversion, agricultural irrigation systems and pipelines, and water conservation. It is lightweight, flexible and leak proof, resistant to corrosion and salt water, and joints can be heat-fused on site for ease of installation. A Sclairpipe irrigation system will withstand the test of time.

Heating & Cooling

Sclairpipe has proven to be a strong, leak proof and chemically inert solution for district cooling applications including dual-purpose projects providing cooling and potable water. It can be assembled on shore in a continuous flexible length, floated on the water's surface and then sunk by a controlled process. The pipe can also be manufactured in specific lengths and connected on site by flanges with the aid of marine divers. Sclairpipe's resistance to both corrosion and zebra mussel fouling makes it an ideal solution.

Choose the size that's right for you

Sclairpipe is available in standard Dimensional Ratio's (DR's), in sizes ranging from 4″ to 48″ in diameter. Sclairpipe is available in PE 3608 and PE 4710. With the higher allowable stress rating of PE 4710, the pipe wall can be thinner for the same pressure rating (higher DR).

The Dimensional Ratio relates the minimum wall thickness of the pipe to its outside diameter, and is important to define the pressure rating of a particular pipe. The maximum continuous operating pressure stated is based on the allowable hydrostatic design stress of each specific material (per ASTM D3350 and PPI's TR-3), and the pipe wall thickness (DR), at a service temperature of 73.4°F.

Uponor, Sclairpipe Product Range, IPS Size, PE3608

	PE3608			DR32.5 (50 psi)			DR26 (64 psi)			DR21 (80 psi)		
Nominal Pipe Size	Minimum Outside Diameter *(inches)*	Maximum Outside Diameter *(inches)*	Average Outside Diameter *(inches)*	Average Inside Diameter *(inches)*	Minimum Wall Thickness *(inches)*	Average Weight *(lbs/ft)*	Average Inside Diameter *(inches)*	Minimum Wall Thickness *(inches)*	Average Weight *(lbs/ft)*	Average Inside Diameter *(inches)*	Minimum Wall Thickness *(inches)*	Average Weight *(lbs/ft)*
4	4.48	4.52	4.50	4.21	0.138	0.83	4.13	0.173	1.03	4.05	0.214	1.26
5	5.54	5.59	5.56	5.20	0.171	1.27	5.11	0.214	1.57	5.00	0.265	1.93
6	6.60	6.65	6.63	6.19	0.204	1.80	6.08	0.255	2.23	5.96	0.315	2.73
7	7.09	7.16	7.13	6.66	0.219	2.08	6.54	0.274	2.58	6.41	0.339	3.16
8	8.59	8.66	8.63	8.06	0.265	3.05	7.92	0.332	3.78	7.75	0.411	4.63
10	10.70	10.80	10.75	10.05	0.331	4.74	9.87	0.413	5.87	9.66	0.512	7.19
12	12.69	12.81	12.75	11.92	0.392	6.66	11.71	0.490	8.26	11.46	0.607	10.12
13	13.31	13.44	13.38	12.50	0.412	7.33	12.28	0.514	9.09	12.02	0.637	11.14
14	13.94	14.06	14.00	13.09	0.431	8.03	12.86	0.538	9.95	12.59	0.667	12.20
16	15.93	16.07	16.00	14.96	0.492	10.49	14.70	0.615	13.00	14.38	0.762	15.94
18	17.92	18.08	18.00	16.83	0.554	13.28	16.53	0.692	16.46	16.18	0.857	20.17
20	19.91	20.09	20.00	18.70	0.615	16.39	18.37	0.769	20.32	17.98	0.952	24.90
22	21.90	22.10	22.00	20.56	0.677	19.83	20.21	0.846	24.58	19.78	1.048	30.13
24	23.89	24.11	24.00	22.43	0.738	23.60	22.04	0.923	29.25	21.58	1.143	35.85
26	25.88	26.12	26.00	24.30	0.800	27.70	23.88	1.000	34.33	23.38	1.238	42.08
28	27.87	28.13	28.00	26.17	0.862	32.13	25.72	1.077	39.82	25.17	1.333	48.80
30	29.87	30.14	30.00	28.04	0.923	36.88	27.55	1.154	45.71	26.97	1.429	56.02
32	31.86	32.14	32.00	29.91	0.985	41.96	29.39	1.231	52.01	28.77	1.524	63.74
36	35.84	36.16	36.00	33.65	1.108	53.11	33.06	1.385	65.82	32.37	1.714	80.67
40	39.82	40.18	40.00	37.39	1.231	65.56	36.74	1.538	81.26	35.96	1.905	99.59
42	41.81	42.19	42.00	39.26	1.292	72.28	38.58	1.615	89.59	37.76	2.000	109.80
48	47.78	48.22	48.00	44.87	1.477	94.41	44.09	1.846	117.02	43.15	2.286	143.42

Pipe dimensions are in accordance with ASTM F714 and AWWA C906
Pressure Ratings are for water at 73.4 deg F.
Some of the pipe sizes and DR's above are available only on request. Check with your representative for availability.
Other dimensions and DR's not listed may be available upon special request.
All dimensions are in inches unless otherwise noted.
Weights are calculated by the methodology established in PPI's TR-7 and are applicable to PE 3608.

The standard stocked length of Sclairpipe pipe is 50 feet, in sizes above 4″ in diameter with longer lengths available on request.

Please visit our web site (www.uponor.ca) and use our online design tools to determine the pipe size best suited to your specific application.

DR17 (100 psi)			DR13.5 (128 psi)			DR11 (160 psi)			DR9 (200 psi)			DR7.3 (254 psi)		
Average Inside Diameter *(inches)*	Minimum Wall Thickness *(inches)*	Average Weight *(lbs/ft)*	Average Inside Diameter *(inches)*	Minimum Wall Thickness *(inches)*	Average Weight *(lbs/ft)*	Average Inside Diameter *(inches)*	Minimum Wall Thickness *(inches)*	Average Weight *(lbs/ft)*	Average Inside Diameter *(inches)*	Minimum Wall Thickness *(inches)*	Average Weight *(lbs/ft)*	Average Inside Diameter *(inches)*	Minimum Wall Thickness *(inches)*	Average Weight *(lbs/ft)*
3.94	0.265	1.54	3.79	0.333	1.90	3.63	0.409	2.29	3.44	0.500	2.73	3.19	0.616	3.26
4.87	0.327	2.35	4.69	0.412	2.91	4.49	0.506	3.50	4.25	0.618	4.18	3.95	0.762	4.99
5.80	0.390	3.33	5.58	0.491	4.12	5.35	0.602	4.96	5.06	0.736	5.92	4.70	0.908	7.08
6.24	0.419	3.85	6.01	0.528	4.77	5.75	0.648	5.74	5.45	0.792	6.85	5.06	0.976	8.18
7.55	0.507	5.65	7.27	0.639	6.99	6.96	0.784	8.41	6.59	0.958	10.04	6.12	1.182	11.99
9.41	0.632	8.77	9.06	0.796	10.86	8.68	0.977	13.07	8.22	1.194	15.59	7.63	1.473	18.63
11.16	0.750	12.34	10.75	0.944	15.28	10.29	1.159	18.38	9.75	1.417	21.94	9.05	1.747	26.21
11.71	0.787	13.58	11.27	0.991	16.81	10.80	1.216	20.23	10.22	1.486	24.14	9.49	1.832	28.84
12.25	0.824	14.88	11.80	1.037	18.42	11.30	1.273	22.17	10.70	1.556	26.45	9.93	1.918	31.60
14.00	0.941	19.44	13.49	1.185	24.06	12.92	1.455	28.95	12.23	1.778	34.55	11.35	2.192	41.27
15.76	1.059	24.60	15.17	1.333	30.45	14.53	1.636	36.64	13.76	2.000	43.72	12.77	2.466	52.23
17.51	1.176	30.37	16.86	1.481	37.59	16.15	1.818	45.24	15.29	2.222	53.98	14.19	2.740	64.48
19.26	1.294	36.75	18.55	1.630	45.48	17.76	2.000	54.74	16.82	2.444	65.31	15.61	3.014	78.02
21.01	1.412	43.74	20.23	1.778	54.13	19.37	2.182	65.14	18.35	2.667	77.73	17.03	3.288	92.85
22.76	1.529	51.33	21.92	1.926	63.52	20.99	2.364	76.45	19.88	2.889	91.22	18.45	3.562	108.97
24.51	1.647	59.53	23.60	2.074	73.67	22.60	2.545	88.66	21.40	3.111	105.80	19.87	3.836	126.38
26.26	1.765	68.34	25.29	2.222	84.57	24.22	2.727	101.78	22.93	3.333	121.45			
28.01	1.882	77.75	26.97	2.370	96.22	25.83	2.909	115.80	24.46	3.556	138.19			
31.51	2.118	98.41	30.35	2.667	121.78	29.06	3.273	146.57						
35.01	2.353	121.49	33.72	2.963	150.35	32.29	3.636	180.95						
36.76	2.471	133.94	35.40	3.111	165.76	33.91	3.818	199.49						
42.01	2.824	174.94	40.46	3.556	216.50									

Sclair IPS Cut Sheet_PE3608_r201407

- All dimensions are in inches unless otherwise specified.
- Pressure ratings are based on load durations of 50 years at a service temperature of 73.4F. The HDS (pipe wall allowable stress) for PE 3608 and PE 4710 are 800 psi and 1,000 psi respectively.
- Dimensions and tolerances per ASTM F714. Pipe weights calculated using PPI TR-7 using PE3608 density of 0.953 gm/cc and 0.958 gm/cc for PE4710 materials.
- The ASTM D3350 cell classifications conform to the requirements of the applicable pipe specification (ASTM F714, AWWA C906, etc.).
- Contact Uponor Infra for sizes, DR's and DIPS offering not shown.

Uponor, Sclairpipe Product Range, IPS Size, PE4710												
	PE4710			DR32.5 (64 psi)			DR26 (80 psi)			DR21 (100 psi)		
Nominal Pipe Size	Minimum Outside Diameter *(inches)*	Maximum Outside Diameter *(inches)*	Average Outside Diameter *(inches)*	Average Inside Diameter *(inches)*	Minimum Wall Thickness *(inches)*	Average Weight *(lbs/ft)*	Average Inside Diameter *(inches)*	Minimum Wall Thickness *(inches)*	Average Weight *(lbs/ft)*	Average Inside Diameter *(inches)*	Minimum Wall Thickness *(inches)*	Average Weight *(lbs/ft)*
4	4.48	4.52	4.50	4.21	0.138	0.840	4.13	0.173	1.030	4.05	0.214	1.27
5	5.54	5.59	5.56	5.20	0.171	1.280	5.11	0.214	1.580	5.00	0.265	1.94
6	6.60	6.65	6.63	6.19	0.204	1.81	6.08	0.255	2.24	5.96	0.315	2.75
7	7.09	7.16	7.13	6.66	0.219	2.09	6.54	0.274	2.59	6.41	0.339	3.18
8	8.59	8.66	8.63	8.06	0.265	3.07	7.92	0.332	3.80	7.75	0.411	4.66
10	10.70	10.80	10.75	10.05	0.331	4.77	9.87	0.413	5.91	9.66	0.512	7.24
12	12.69	12.81	12.75	11.92	0.392	6.70	11.71	0.490	8.31	11.46	0.607	10.18
13	13.31	13.44	13.38	12.50	0.412	7.38	12.28	0.514	9.14	12.02	0.637	11.21
14	13.94	14.06	14.00	13.09	0.431	8.08	12.86	0.538	10.02	12.59	0.667	12.28
16	15.93	16.07	16.00	14.96	0.492	10.56	14.70	0.615	13.08	14.38	0.762	16.04
18	17.92	18.08	18.00	16.83	0.554	13.36	16.53	0.692	16.56	16.18	0.857	20.29
20	19.91	20.09	20.00	18.70	0.615	16.49	18.37	0.769	20.44	17.98	0.952	25.06
22	21.90	22.10	22.00	20.56	0.677	19.96	20.21	0.846	24.74	19.78	1.048	30.32
24	23.89	24.11	24.00	22.43	0.738	23.75	22.04	0.923	29.44	21.58	1.143	36.08
26	25.88	26.12	26.00	24.30	0.800	27.87	23.88	1.000	34.55	23.38	1.238	42.34
28	27.87	28.13	28.00	26.17	0.862	32.33	25.72	1.077	40.07	25.17	1.333	49.11
30	29.87	30.14	30.00	28.04	0.923	37.11	27.55	1.154	46.00	26.97	1.429	56.37
32	31.86	32.14	32.00	29.91	0.985	42.22	29.39	1.231	52.34	28.77	1.524	64.14
36	35.84	36.16	36.00	33.65	1.108	53.44	33.06	1.385	66.24	32.37	1.714	81.18
40	39.82	40.18	40.00	37.39	1.231	65.98	36.74	1.538	81.77	35.96	1.905	100.22
42	41.81	42.19	42.00	39.26	1.292	72.74	38.58	1.615	90.16	37.76	2.000	110.49
48	47.78	48.22	48.00	44.87	1.477	95.01	44.09	1.846	117.76	43.15	2.286	144.32

Pipe dimensions are in accordance with ASTM F714 and AWWA C906
Pressure Ratings are for water at 73.4 deg F.
Some of the pipe sizes and DR's above are available only on request. Check with your representative for availability.
Other dimensions and DR's not listed may be available upon special request.
All dimensions are in inches unless otherwise noted.
Weights are calculated by the methodology established in PPI's TR-7 and are applicable to PE4710

Product innovation and quality assurance

For 50 years Uponor Infra has been a leader in the design, development, manufacture and support of polyethylene piping systems. Uponor Infra's experienced engineers can offer design and engineering assistance, assuring you of a dependable piping system designed to meet your needs. Visit our website (www.uponor.ca) and see how our innovative online calculator can assist you. Extensive R&D in the early 1960's led us to produce 16″ diameter polyethylene pipe at a time when many considered large diameter polyethylene pipes a technical impossibility. Today Uponor Infra produces solid wall Sclairpipe in sizes up to 48″.

All Uponor Infra products are manufactured from special, high strength resins with complete quality control maintained from raw material to finished pipe product. Uponor Infra was the first North American manufacturer of polyethylene pipe and fittings to have its Quality Management System registered to the ISO 9001:2008 level.

Our strict manufacturing specifications are verified daily, using precise dimensional controls and accelerated long term hydrostatic testing. A continuous quality control process assures you of long-term pipe performance. We certify that the pipe resin used to extrude Sclairpipe has a minimum cell classification of PE 345464C or PE445474C respectively, when classified in accordance with ASTM D3350. Sclairpipe's material classification is based on PPI's (Plastic Pipe Institute) method of determining and validating the Long-Term Hydrostatic Stress (LTHS) of polyethylene pipe.

DR17 (125 psi)			DR13.5 (160 psi)			DR11 (200 psi)			DR9 (250 psi)			DR7.3 (317 psi)		
Average Inside Diameter *(inches)*	Minimum Wall Thickness *(inches)*	Average Weight *(lbs/ft)*	Average Inside Diameter *(inches)*	Minimum Wall Thickness *(inches)*	Average Weight *(lbs/ft)*	Average Inside Diameter *(inches)*	Minimum Wall Thickness *(inches)*	Average Weight *(lbs/ft)*	Average Inside Diameter *(inches)*	Minimum Wall Thickness *(inches)*	Average Weight *(lbs/ft)*	Average Inside Diameter *(inches)*	Minimum Wall Thickness *(inches)*	Average Weight *(lbs/ft)*
3.94	0.265	1.55	3.79	0.333	1.91	3.63	0.409	2.30	3.44	0.500	2.75	3.19	0.616	3.28
4.87	0.327	2.36	4.69	0.412	2.93	4.49	0.506	3.52	4.25	0.618	4.20	3.95	0.762	5.02
5.80	0.390	3.35	5.58	0.491	4.15	5.35	0.602	4.99	5.06	0.736	5.96	4.70	0.908	7.12
6.24	0.419	3.88	6.01	0.528	4.80	5.75	0.648	5.78	5.45	0.792	6.89	5.06	0.976	8.23
7.55	0.507	5.68	7.27	0.639	7.03	6.96	0.784	8.47	6.59	0.958	10.10	6.12	1.182	12.07
9.41	0.632	8.83	9.06	0.796	10.93	8.68	0.977	13.15	8.22	1.194	15.69	7.63	1.473	18.75
11.16	0.750	12.42	10.75	0.944	15.37	10.29	1.159	18.50	9.75	1.417	22.08	9.05	1.747	26.37
11.71	0.787	13.67	11.27	0.991	16.92	10.80	1.216	20.36	10.22	1.486	24.29	9.49	1.832	29.02
12.25	0.824	14.98	11.80	1.037	18.53	11.30	1.273	22.31	10.70	1.556	26.62	9.93	1.918	31.79
14.00	0.941	19.56	13.49	1.185	24.21	12.92	1.455	29.13	12.23	1.778	34.76	11.35	2.192	41.53
15.76	1.059	24.76	15.17	1.333	30.64	14.53	1.636	36.87	13.76	2.000	44.00	12.77	2.466	52.56
17.51	1.176	30.56	16.86	1.481	37.82	16.15	1.818	45.52	15.29	2.222	54.32	14.19	2.740	64.89
19.26	1.294	36.98	18.55	1.630	45.77	17.76	2.000	55.08	16.82	2.444	65.72	15.61	3.014	78.51
21.01	1.412	44.01	20.23	1.778	54.47	19.37	2.182	65.55	18.35	2.667	78.22	17.03	3.288	93.44
22.76	1.529	51.65	21.92	1.926	63.92	20.99	2.364	76.93	19.88	2.889	91.80			
24.51	1.647	59.90	23.60	2.074	74.13	22.60	2.545	89.22	21.40	3.111	106.46			
26.26	1.765	68.77	25.29	2.222	85.10	24.22	2.727	102.42	22.93	3.333	122.22			
28.01	1.882	78.24	26.97	2.370	96.83	25.83	2.909	116.53						
31.51	2.118	99.02	30.35	2.667	122.55	29.06	3.273	147.49						
35.01	2.353	122.25	33.72	2.963	151.29									
36.76	2.471	134.78	35.40	3.111	166.80									
42.01	2.824	176.04												

Uponor_Sclair_IPS_PE4710_r201407

Innovative joining methods and equipment

Sclairpipe piping systems can be assembled by heat fusion (butt, electrofusion, socket and saddle fusion), flanged connections, compression couplings and various mechanical couplings. The superior performance of Sclairpipe results from the combination of pipe and fittings designed to work together as a complete system. A full range of pressure rated fittings is available to suit any application.

The most popular method of joining Sclairpipe is thermal butt fusion. This fast and economical technique permits the quick assembly of long continuous lengths and the joining of fittings to the pipe. The fused joints are as reliable and strong as the pipe itself, fully restrained, providing continuous leak proof systems.

Ordering & shipping information

Uponor Infra welcomes your inquiries for non-standard sizes, lengths and pressure ratings of Sclairpipe pipe.

We can meet most special packaging requirements and provide custom pipe fittings. Please contact your local Uponor Infra representative or visit our web site.

The charts below outline standard shipment sizes for straight length and coiled pipe.

Standard Shipments - Straight Lengths

IPS PIPE				
PIPE SIZE	AVG OD	BUNDLE QTY	TRUCK LOAD QTY	CONTAINER QTY
4"	4.50	38	380	480
5"	5.563	23	276	320
6"	6.625	20	200	208
7"	7.125	17	136	180
8"	8.625	14	112	120
10"	10.750	11	66	80
12"	12.750	4	56	52
13"	13.375	42		48
14"	14.000	42		42
16"	16.000	30		30
18"	18.000	25		25
20"	20.000	20		20
22"	22.000	16		16
24"	24.000	16		14
26"	26.000	9		9
28"	28.000	9		9
30"	30.000	9		9
800mm	31.594	9		9
32"	32.000	9*		8
36"	36.000	4		6
1000mm	39.469	4		4
42"	42.000	4		4
1200mm	47.382	4		3
48"	48.000	4*		3

Notes:
* Bunks required
** Drop deck trailer - maximum 42' length
Pipe lengths range from 40 to 50 feet in size

Sclairpipe general specifications & material standards

Pipe and Fittings

REFERENCE SPECIFICATIONS

ASTM F714: Standard Specification for Polyethylene (PE) Plastic Pipe (SDR-PR). Based on outside diameter.
CSA B137.1: Polyethylene Pipe, Tubing and Fittings for Cold Water Pressure Services.
ASTM D3350: Standard Specification for Polyethylene Plastics Pipe and Fittings Materials.
AWWA C901: Polyethylene (PE) Pressure Pipe and Tubing, 1/2 in. Through 3 in. for Water Service.
ASTM D3035: Standard Specification for Polyethylene (PE) Plastic Pipe (SDR-PR). Based on Controlled Outside Diameter
ISO 9001:2008: Model for Quality Assurance in Production and Installation.
AWWA C906: Standard for Polyethylene (PE) Pressure Pipe and Fittings 4 in. Through 63 in., for Water Distribution.NSF 14, 61

MATERIAL

The pipe shall be made from polyethylene resin compound with a minimum cell classification of PE 345464C for PE 3608 materials and PE445474C for PE 4710 materials in accordance with ASTM D3350. This material shall have a Long Term Hydrostatic Strength of 1600 psi when tested and analyzed by ASTM D2837, and shall be a Plastic Pipe Institute (PPI) TR4 listed compound. The raw materialshall contain a minimum of 2%, well dispersed, carbon black. Additives, which can be conclusively proven not to be detrimental to the pipe may also be used, provided that the pipe produced meets the requirements of this standard. The pipe shall contain no recycled compound except that generated in the manufacturer's own plant from resin of the same specification and from the same raw material supplier. Compliance with the requirements of this paragraph shall be certified in writing by the pipe supplier, upon request. Manufacturer's Quality System shall be certified by an appropriate independent body to meet the requirements of the ISO 9001:2008 Quality Management Program.

PIPE DESIGN

The pipe shall be designed in accordance with the relationships of the ISO-modified formula (see ASTM F714).

$$P = \frac{2S}{(D^\circ/t) - 1}$$

where,

S	=	**Hydrostatic Design Stress (psi)**
P	=	**Design Pressure Rating (psi)**
D°	=	**ODavg for IPS Pipe**
		ODmin for ISO Pipe
t	=	**Minimum Wall Thickness**
D°/t	=	**Dimension Ratio**

The design pressure rating P shall be derived using the formula above, expressed in pounds per square inch.
The Hydrostatic Design Stress for PE 3608 materials is 800 psi and for the PE4710 materials is 1000 psi.
The pipe dimensions shall be as specified in manufacturer's literature.

MARKING

The following shall be continuously printed on the pipe or spaced at intervals not exceeding 5 feet:
Name and/or trademark of the pipe manufacturer.
Nominal pipe size.
Dimension ratio.
The letters PE followed by the polyethylene grade per ASTM D3350, followed by the Hydrostatic Design stress in 100's of psi e.g. PE 3608.
Manufacturing Standard Reference e.g. ASTM F 714
A production code from which the date and place of manufacture can be determined.

JOINING METHODS

Whenever possible, polyethylene pipe should be joined by the method of thermal butt fusion as outlined in ASTM F2620, Standard Practice for Heat Fusion Joining of PE Pipe and Fittings. Butt fusion joining of pipe and fittings shall be performed in accordance with the procedures recommended by the manufacturer. The temperature of the heater plate should be between 400°F and 450°F. Follow the recommendations of ASTM F2620 regarding interfacial pressures for pipe wall thickness less than or equal to 1.5". Follow the manufacturer's recommendations regarding interfacial pressures for pipe walls thicker than 1.5".

Polyethylene pipe may be connected to fittings or other piping systems by means of a flanged assembly consisting of a polyethylene flange adapter or stub end, and a metal backup ring that has a bolting pattern meeting the dimensional requirements of Class 150, ANSI B16.1/B16.5 in sizes up through 24", and meeting Class 150 Series A, ANSI B16.47 or AWWA C207 Class B for larger sizes. Follow the manufacturer's recommendations regarding bolting techniques and the use of gaskets. Pipe or fittings may be joined by butt fusion only by technicians who have been trained and qualified in the use of the equipment.

GENERAL REQUIREMENTS

The pipe manufacturer shall provide, upon request, an outline of quality control procedures performed on polyethylene system components.

Uponor Infra Ltd.
6507 Mississauga Rd.
Mississauga ON L5N 1A6
Canada
Tel: 1-866-594- 7473
Fax: (905)-858-0208
Web: www.uponor.ca
E-mail: nainfra-sales@uponor.com

uponor

Appendix D: Modelling Assessment of Groundwater Discharge into Melvin Bay Marine Environment, Rev B (Golder, 2019)

GOLDER

TECHNICAL MEMORANDUM

DATE February 1, 2019

Project No. Doc718_1773384 _Rev0

TO Manon Turmel
Agnico Eagle Mines Ltd.

CC Ryan Vanengen, Carolina Leseigneur Torres

FROM Shouhong Wu and Bruce Dean, Golder Associates Ltd.

EMAIL bruce_dean@golder.com

MODELLING ASSESSMENT OF GROUNDWATER DISCHARGE INTO THE MELVIN BAY MARINE ENVIRONMENT, REV B

1.0 INTRODUCTION

Golder Associates Ltd. (Golder) was retained by Agnico Eagle Mines Limited (Agnico Eagle) to undertake a modelling assessment of groundwater discharge into the marine environment near Rankin Inlet. This modelling assessment consisted of nearshore oceanographic modelling of the discharge. The study did not include geotechnical, structural or hydraulic engineering assessments of the outfall. This technical memorandum was updated to account for an additional modelling scenario and updated baseline data collected by Golder from Melvin Bay in September 2018 as well as to account for increased discharge velocity resulting from a change to the diffuser port size. This memorandum should be read in conjunction with "Important Information and Limitations of this Report".

1.1 Scope of Work

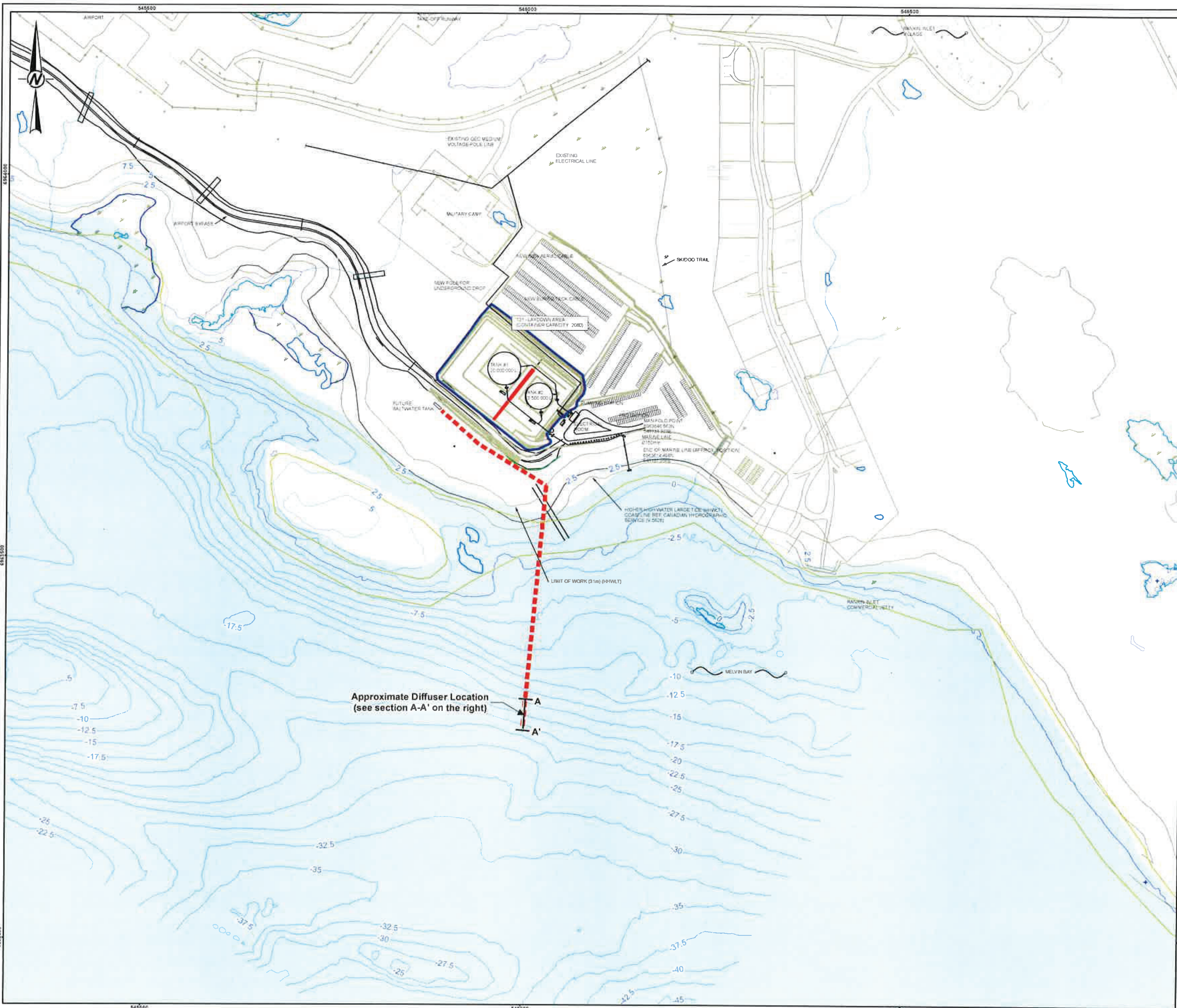
The objective of this work is to assess the near field mixing of the treated groundwater effluent disposal with respect to relevant environmental guidelines. The scope of the work includes:

- Near field modelling of dispersion of treated groundwater effluent plume using CORMIX (Doneker and Jirka 2007).
- Assess the plume dilution behavior.

For the purpose of this scope of this work, it is assumed that the discharges will consists of only pumped water at quantities and qualities per the estimated underground inflow volumes (Golder 2016) and estimated groundwater inputs to surface storage for management (Agnico Eagle 2017). Section 2.1 describes the modelling conditions.

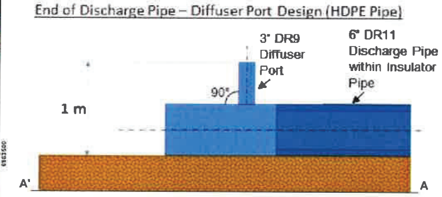
1.2 Physical Setting

In September 2018, a field program was conducted by Golder in Melvin Bay. Field parameters measured included temperature, conductivity, pH, dissolved oxygen, salinity, and oxidation-reduction potential. The measurement depth ranged from 0.3 m to 26.7 m at three different locations in Melvin Bay (i.e., the exposure area and two new reference areas). The field measurement results are summarized in Appendix A. Nearshore bathymetry (Agnico Eagle 2017 data) and the approximate discharge location is shown in Figure 1, to the south of the Tank Farm at the Itivia Fuel Storage Facility. Based on the bathymetry of Melvin Bay at Itivia Harbour, the diffuser would be placed on the seabed at a depth of approximately 20 m, to ensure an unconstrained mixing zone and to avoid interference with use of Itivia Harbour by ships and boats at high and low tide.



LEGEND

- GENERAL AREA FOR THE DIFFUSER LOCATION
- CROSS SECTION LOCATION
- WATERCOURSE
- WATERBODY
- REEF



NOT FOR CONSTRUCTION

0 100 200

1:5,000 METRES

REFERENCE(S)
BASE DATA OBTAINED FROM AGNICO EAGLE MINES LIMITED.
DATUM: NAD 83 PROJECTION: UTM ZONE 15

CLIENT
AGNICO EAGLE
AGNICO EAGLE MINES LIMITED

PROJECT
MELIADINE GOLD MINE
NUNAVUT

TITLE
SITE LAYOUT
ITIVIA HARBOUR SITE

CONSULTANT
GOLDER

YYYY-MM-DD	2019-02-14
DESIGNED	CLT
PREPARED	CDB/MH
REVIEWED	BD
APPROVED	MT

PROJECT NO	CONTROL	REV	FIGURE
1773384	9000	0	1

2.0 NEAR FIELD MODELLING

The Cornell Mixing Zone Expert System (CORMIX; Doneker and Jirka 2007) was applied to calculate numerical simulations of the near-field mixing and dilution behavior of treated groundwater effluent entering the nearshore coastal receiving environment in Melvin Bay. CORMIX is one of the most extensively applied models for predicting near-field discharge plume mixing and dilution of both conservative and non-conservative substances in surface water bodies. CORMIX calculates plume boundary interactions to estimate plume fate in terms of dilution and geometry relative to mixing zone regulations (Doneker and Jirka 2007). Nearshore ambient and treated groundwater effluent characteristics required to implement the mixing model are presented in the sections that follow.

2.1 Conditions for Modelling

2.1.1 Ambient Conditions

Assumptions made to characterize the ambient conditions of the receiving marine waters are as follows:

- Weak current: Ambient current velocity of 0.01 m/s and zero wind velocity were considered for this scenario which represented a slack tide condition during ice covered season.
- Mean current: Current speed of 0.2 m/s with no wind was used for this scenario.
- Open water condition: The water temperature and TDS (salinity) were considered to be 0°C (to account for the start and end of the open water season) and 33,300 mg/L, respectively.
- Water depth at discharge location is 20 m.

2.1.2 Discharge Conditions

Following discharge conditions based on estimated underground inflows were used for the near field mixing analysis:

- Flow rate of 800 m^3/d discharged over a 12 hour period (for an equivalent flow rate of 1,600 m^3/day), with TDS of 39,600 mg/L.
- Treated groundwater effluent temperature: 0°C.
- Outfall length: 230 m from the shoreline as shown.
- A single nozzle for discharge which has inside diameter of 68.07 mm (standard 3.0 inch port, DR9 (PE 4710), 252 psi) was used.
- Nozzle elevation from seabed: 1 m.
- Direction of discharge is perpendicular to the bathymetry contour and 90° vertical angle (upward port).

2.1.3 Modelling Scenarios

Table 1 lists the combination of effluent flow rate and ambient current speed in two simulation scenarios. Table 2 lists the CORMIX model input parameters. The target dilution at the edge of the near-field mixing zone is 11 as per analysis presented in Appendix B.

Table 1: Modelling Scenarios

Parameter	Scenario	
	1	2
Treated Groundwater Effluent Rate (m^3/d)[1]	1,600	1,600
Ambient Current Speed (m/s)	0.01	0.20
Discharge Velocity (m/s)	5.1	5.1

Note: 1. Daily flow rate is 800 m^3/day but this volume will be discharged over 12 hours for an equivalent flow rate of 1,600 m^3/day.

Table 2: CORMIX Model Input Parameters

Parameter	Value	Source
Depth at Discharge	20 m	Based on 2017 bathymetry survey completed by Agnico Eagle
Coastal Current (Velocity)	Low = 0.01 m/s Mean = 0.2 m/s	Based on CCG (2008) and assumed
Roughness Value	0.020	Assumed (equivalent to minimum roughness value of similar seabed). This value does not affect vertical jet results.
Wind Speed	0 m/s	Assumed
Water Condition	Saline, non-stratified	Based on Agnico Eagle (2014) and confirmed through Sep. 2018 sampling
Ambient water temperature	Open water season (start and end condition): 0°C	Conservative estimate to capture the start and end of the open water season for discharge
Effluent Flow Rate	1,600 m^3/d[1]	Per underground inflow and storage estimates (Agnico Eagle 2014; Golder 2016)
Effluent Temperature	0°C	Based on Diamond Drill Hole groundwater data (Agnico Eagle 2017)
Effluent Concentration	100%	Assumed
Discharge Type	Single Port	Assumed
Distance from Nearest Bank	230 m	Assumed
Horizontal Angle of Discharge	Perpendicular to bathymetric contour	Assumed
Vertical Angle of Discharge	90°	Assumed
Port Height above Seabed	1.0 m	Assumed
Port Diameter	0.0681 m	Assumed (3.0" port, DR 9, 252 psi)

Note: 1. Daily flow rate is 800 m^3/day but this volume will be discharged over 12 hours for an equivalent flow rate of 1,600 m^3/day.

3.0 RESULTS

Figures 2 and 3 present the near-field treated groundwater effluent plume dilution for a discharge of 800 m^3/day (an effective effluent rate of 1,600 m^3/d) in weak and mean ambient current conditions respectively, via the diffuser. For weak ambient current conditions, the maximum plume (centreline) height is 11.1 m from the seabed. For mean current conditions, the maximum plume (centreline) height is 5.6 m above the seabed. After reaching the maximum height, the negatively buoyant plumes settle towards the bottom as gravity starts to dominate over the initial jet momentum, and this is illustrated by the plume centrelines of Figures 2 and 3. For both scenarios, the plume centreline dilution factor reaches 11 within 1 m horizontal distance and 6 m vertical distance above the port. At

100 m distance from the diffuser, the dilution factors are 70 and 470 for scenarios 1 and 2 respectively, which are much higher than the required dilution of 11.

Figure 4 shows the changes in chloride concentration along the centrelines of the plumes, illustrating that at less than 5 m distance from the diffuser, the chloride concentration meets the required criteria. Figure 5 shows the changes in TDS concentration along the centrelines of the plumes, illustrating that at less than 1 m distance from the diffuser, the TDS concentration meets the required criteria.

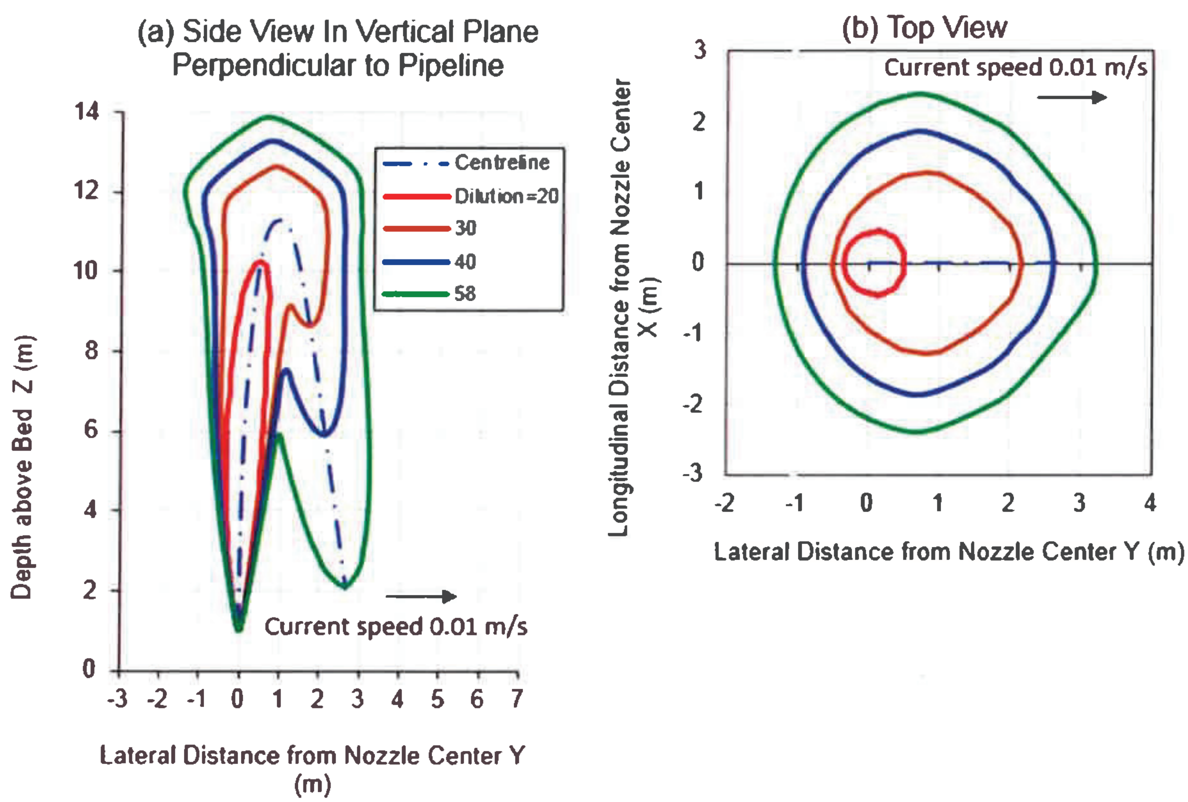


Figure 2: Dilution contours for a flow rate of 800 m³/day (effective effluent flow rate of 1,600 m³/d) in weak ambient current

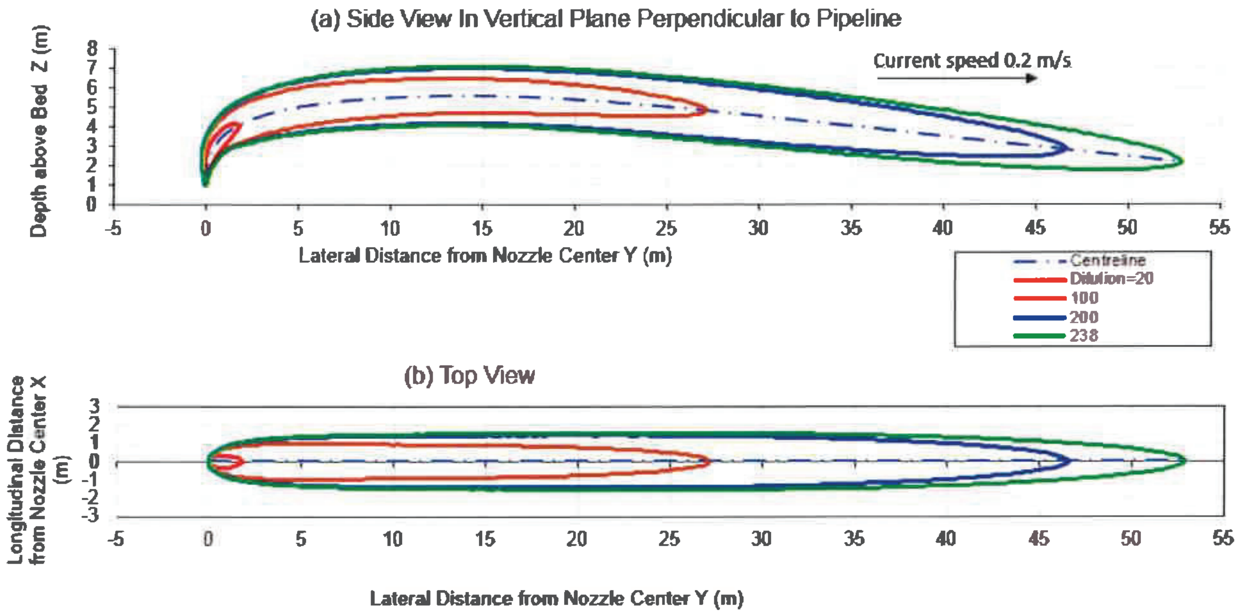


Figure 3: Dilution contours for a flow rate of 800 m³/day (effective effluent flow rate of 1,600 m³/d) in mean ambient current

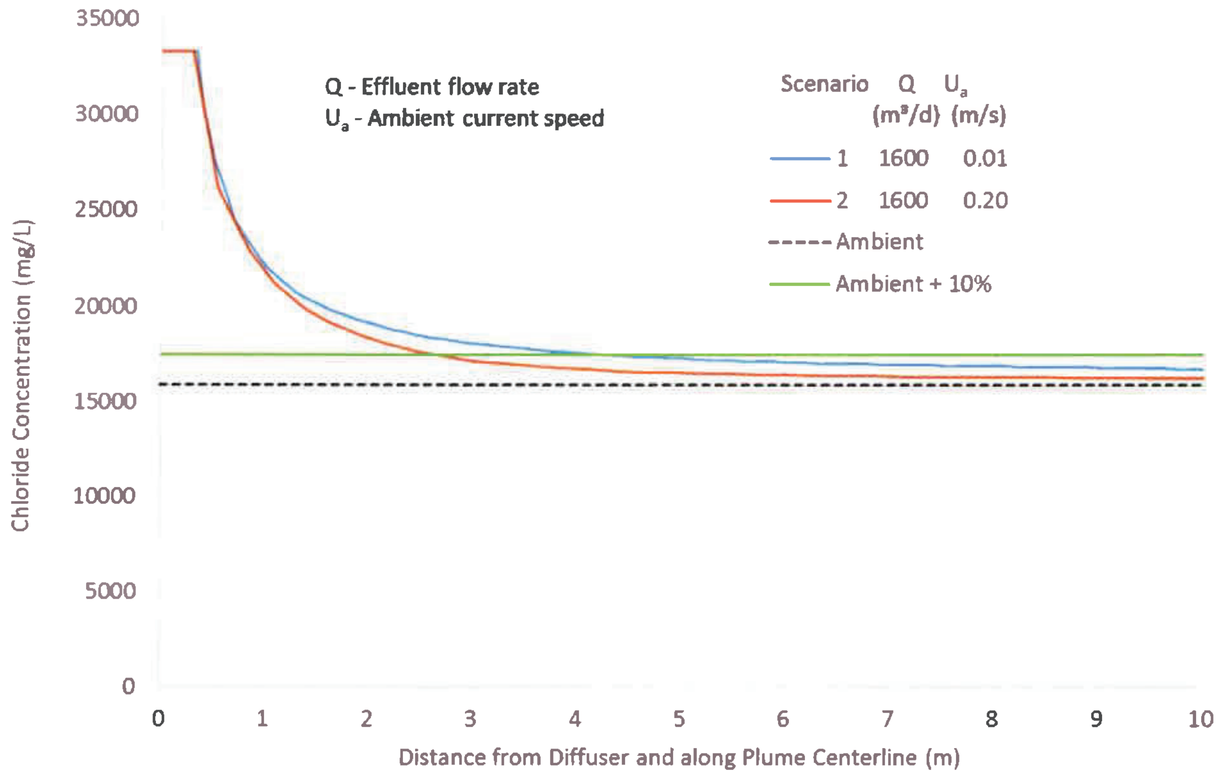


Figure 4: Chloride concentration along the plume centreline for both scenarios

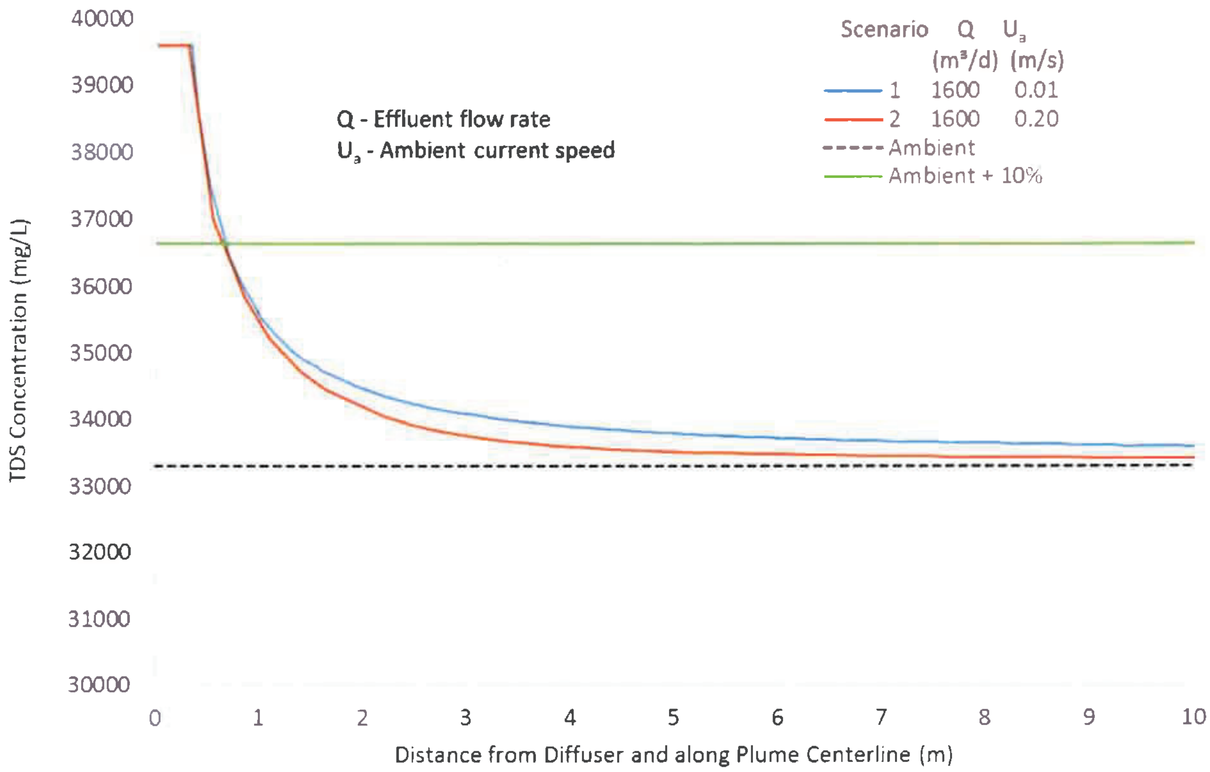


Figure 5: TDS concentration along the plume centreline for both scenarios

3.1 Temperature Sensitivity Analysis

For the simulated scenarios (800 m^3/day discharged over 12 hours for an effective flow rate of 1,600 m^3/day under weak and mean ambient current conditions), a sensitivity analysis simulation was conducted to review the effect of effluent and ambient temperature changes. The simulation conditions were otherwise identical to those for scenarios 1 and 2 except that the effluent temperature was increased to 20°C, and the ambient water temperature was increased to 8.5°C. The 20°C effluent temperature is understood to be the highest (though not expected) possible effluent temperature, as communicated by Agnico Eagle in November 2018. The 8.5°C was the water temperature measured in August 2011 at depth of 13 m below water surface (Stantec 2012).

The effluent temperature change results in effluent density change from 1031.85 kg/m^3 to 1028.30 kg/m^3, and the ambient water temperature change results in ambient water density change from 1026.76 kg/m^3 to 1025.89 kg/m^3. The temperature changes result in a slight change of the density difference between effluent and ambient water from 5.09 kg/m^3 to 2.41 kg/m^3. The plumes remain negatively buoyant with this temperature change, but not as strongly negative as under the original temperature assumptions for the ambient and effluent temperatures (both 0°C).

Table 3 summarizes the simulation results for sensitivity analysis on temperature change for the two scenarios. This table illustrates the following:

- The plumes rise to higher elevations than the plumes with the originally assumed temperature of 0°C due to reduced negative buoyancy.
- Similar to the original discharge plumes, the required dilution is met at less than 1 m distance from the diffuser.
- At an effective flow rate of 1,600 m³/day, the dilution factors at 100 m from the diffuser are increased due to accelerated plume mixing.

Table 3: Summary of simulation results for effluent temperatures of 20°C and ambient temperature of 8.5°C

Parameter	Scenario	
	1	2
Effluent flow rate (m^3/d)[1]	1,600	1,600
Ambient current velocity (m/s)	0.01	0.2
Horizontal distance (m) from diffuser where required dilution of 11 is met	<1	<1
Maximum plume (centerline) height (m)	16.2	6.3
Dilution factor at 100 m from diffuser	163	563
Simulation results for originally assumed temperatures of 0°C		
Maximum plume (centerline) height (m)	11.1	5.6
Dilution factor at 100 m from diffuser	70	470

Note: 1. Daily flow rate is 800 m³/day but this volume will be discharged over 12 hours for an equivalent flow rate of 1,600 m³/day.

4.0 CONCLUSIONS

Mixing analysis was conducted for a diffuser designed for Melvin Bay, Rankin Inlet NWT. The simulation results show the following:

1) Dilution of the treated groundwater effluent plume is achieved within 5 m of the diffuser under the assumed conditions for the ambient and discharge conditions tested under assumed and increased temperatures.

2) After initial mixing, the plume migrates along the seabed under gravity and achieves further dilution and mixing with ambient water; concentrations within the 100 m regulatory mixing zone will thus meet discharge criteria per regulatory requirements and/or background concentrations for non-regulated parameters per the modelled conditions.

3) The results are valid for placement of the diffuser in Melvin Bay in water depths of at least 20 m.

4) Sensitivity analysis was performed for increased effluent and ambient temperatures. The required dilution of 11 is met within 1 m of the diffuser and dilution factors at 100 m from the diffuser were increased from the base case.

CLOSURE

Should you require any further information, please contact the undersigned.

Golder Associates Ltd.

Prepared by:

Shouhong Wu, Ph.D.
Senior Water Resources Specialist

Reviewed By:

REGISTERED PROFESSIONAL ENGINEER
K. B. DEAN
LICENSEE
NT/NU

Feb 8/19

K. Bruce Dean, M.Sc., P.Eng.
Principal, Senior Coastal Engineer

SW/BD/vm/tt

https://golderassociates.sharepoint.com/sites/17491g/deliverables/diffuser memo/modelling assessment draft/doc718_1773384_modelling assessment of groundwater discharge_final.docx

PERMIT TO PRACTICE
GOLDER ASSOCIATES LTD.
Signature
Date 8 Feb 2019
PERMIT NUMBER: P 049
NT/NU Association of Professional Engineers and Geoscientists

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APPENDIX A

Field Measurements

Table A1: Results for September 2018 Measurements

Parameter	Minimum	Maximum	Average
pH (pH)	7.96	7.98	7.97
Salinity (psu)	29.7	30.5	30.0
TSS (mg/L)	<2	3.8	2.4
TDS (mg/L)	33,300	36,000	34,727
Hardness (as (CaCO3) (mg/L)	4,890	5,180	5,000
Conductivity (uS/cm)	45,400	46,500	45,782
Temperature (°C)	5.80	6.13	5.92
Chloride (mg/L)	15,900	17,400	16,655

Source: Golder (2018)

APPENDIX B

Environmental Guidelines

The intention of the treated groundwater effluent discharge objectives is to set the allowable effluent concentrations at the end-of-pipe and edge of a regulatory mixing zone. These allowable concentrations can then be used to design the diffuser to achieve the required dilution within the mixing zone. There is no specific definition for size of a mixing zone for discharges to Canadian coastal and estuarine waters. However, a radius of 100 m from the point of discharge is widely used for environmental compliance assessments. For example, the Guidelines for the Discharge of Treated Municipal Wastewater in the Northwest Territories (NWT 1992) provide guidance that the limits of initial mixing zone are 100 m from all points of discharge. For the current study, a 100 m regulatory mixing zone was applied.

Final effluent quality included in the model and assessment was based on measured groundwater quality from the borehole samples (see Section 3.4.2, Table 3 of the FEIS Addendum) and constrained by various regulations and guidelines to achieve non-acutely lethal effluent that will meet chronic guidelines or background concentrations at the edge of the regulatory mixing zone. The regulations and guidelines considered included:

- The proposed Metal and Diamond Mining Effluent Regulations (MDMER; GC 2017).
- Acute water quality guidelines for protection of marine aquatic life (CCME 2003; BC MOE 2017a, b).
- Fisheries and Oceans Canada Measures to Avoid Causing Harm to Fish and Fish Habitat (DFO 2013).

Table B1: Meliadine Mine – Assumed Treated Groundwater Effluent Discharge Criteria

Parameter	Units	Discharge Criteria	
		Standard Based (1)	95 UCLM (2)
pH (pH units)	pH units	-	7.634
Alkalinity (as $CaCO_3$)	mg/L	-	71.35
Total Hardness (as $CaCO_3$)	mg/L	-	14101
Turbidity	NTU	-	90.54
Total Dissolved Solids (TDS)	mg/L	-	58,165
Total Suspended Solids (TSS)	mg/L	15	159.4
Aluminium	mg/L	-	1.832
Ammonia (as N)	mg/L	5.91	35.47
Antimony	mg/L	-	0.0047
Arsenic	mg/L	0.0125	0.0193
Barium	mg/L	-	0.299
Beryllium	mg/L	-	0.00165
Bicarbonate (as $CaCO_3$)	mg/L	-	69.09
Boron	mg/L	-	2.389
Total Organic Carbon (TOC)	mg/L	-	6.448
Dissolved Organic Carbon (DOC)	mg/L	-	5.69
Cadmium	mg/L	-	5.83E-04
Calcium	mg/L	-	2164
Chloride (dissolved)	mg/L	-	33274
Chromium	mg/L	-	<0.1(3)
Copper	mg/L	0.003	0.113

Table B1: Meliadine Mine – Assumed Treated Groundwater Effluent Discharge Criteria

Parameter	Units	Discharge Criteria	
		Standard Based (1)	95 UCLM (2)
Cyanide (free)	mg/L	0.001	0.0494
Iron	mg/L	-	13.37
Lead	mg/L	0.14	0.00369
Lithium	mg/L	-	3.33
Magnesium	mg/L	-	2129
Manganese	mg/L	-	1.076
Mercury	mg/L	-	4.01E-05
Molybdenum	mg/L	-	0.0181
Nickel	mg/L	0.5	0.0208
Nitrate (as N)	mg/L	1500	35.65
Nitrite (as N)	mg/L	-	2.156
Total Kjeldahl Nitrogen (TKN)	mg/L	-	55.4
Phosphorus	mg/L	-	0.069
Potassium	mg/L	-	514.2
Radium-226 (Ra 226)	Bq/L	0.37	2.498
Selenium	mg/L	-	0.0457
Silica (reactive)	mg/L	-	19.77
Silver	mg/L	0.003	8.10E-04
Sodium	mg/L	-	14784
Strontium	mg/L	-	65.21
Sulfate	mg/L	-	3160
Thallium	mg/L	-	3.57E-04
Tin	mg/L	-	<0.5(3)
Titanium	mg/L	-	0.187
Uranium	mg/L	-	0.00168
Vanadium	mg/L	-	<0.5(3)
Zinc	mg/L	0.055	0.133

Notes:
"<" Concentration is below the reported detection limit (RDL).
(1) End of pipe discharge criteria is based on the minimum of the following (refer to Tables 8 and 9 of the FEIS Addendum):
Amended Metal and Diamond Mining Effluent Regulations (MDMER; GC 2017) Schedule 4 Authorized Limits of Deleterious Substances - Maximum Authorized Monthly Mean Concentration.
Canadian Council of Ministers of the Environment (CCME 2003) Short-term Water Quality Guidelines (WQG) for the Protection of Aquatic Life - Marine.
British Columbia Ministry of Environment (BC MOE 2017a) Approved Water Quality Guidelines for Marine Aquatic Life (Short-Term).
BC MOE Working Water Quality Guidelines for Marine Aquatic Life (BC MOE 2017b).
(2) 95% Upper Confidence Level of the Mean (UCLM) of the August 2016 to September 2017 diamond drillhole groundwater data provided by Agnico Eagle. 95% UCLM calculated using the US EPA ProUCL Version 5.1 software. Agnico Eagle will monitor groundwater quality and criteria will be updated as necessary based on observed changes.
(3) A 95% UCLM could not be calculated due to low detection rates within the dataset. The maximum concentration has been used for conservative purposes.

In addition to the above and since chloride ions mainly constitute the salt content in the marine water and ultimately the treated groundwater effluent plume, chloride guidelines are used to assess the near-field mixing zone. No local or federal guideline was available for chloride discharges in the marine environment, and therefore, the guideline published by the BC MOE (2017a) was used for the analysis. The guideline states:

> *"Human activities should not cause the chloride of marine and estuarine waters to fluctuate by more than 10% of the natural chloride expected at that time and depth".*

This indicates that the chloride concentration at the mixing zone boundary should not exceed the ambient chloride concentration of 15,900 mg/L by 1,590 mg/L (10%). The behavior of the discharge in the marine environment is influenced by density. For the purposes of this assessment, it is assumed that treatment of the groundwater will be such as to achieve a TDS concentration of the treated groundwater effluent that is +/- 10% (in line with the BC MOE 2017a guideline) of the maximum TDS concentration of 36,000 mg/L measured in September 2018 at Melvin Bay. Therefore, the assumed effluent TDS concentration will be up to approximately 39,600 mg/L. It is conservatively assumed that the chloride concentration of 33,300 mg/L remains unchanged in the treated groundwater effluent.

To reach a chloride concentration difference of no more than 10% at the edge of regulatory mixing zone, the required plume dilution factor via the diffuser is 11, per the equation below:

$$S = \frac{C_{eff}-C_a}{C_{edg}-C_a} = \frac{C_{eff}-C_a}{110\%C_a-C_a} = \frac{33{,}300-15{,}900}{110\%*15{,}900-15{,}900} = 11$$

where S is required dilution factor, C_{eff} is effluent chloride concentration (33,300 mg/L), C_a is ambient chloride concentration (15,900 mg/L), and C_{edg} is chloride concentration at the edge of regulatory mixing zone. Per the BC MOE (2017a) guideline, the upper bound of C_{edg} is 10% greater than ambient chloride concentration.

There are also no federal or provincial specific criteria for mixing zone discharges regarding thermal changes to the marine environment. However, per the BC MOE (2017a) guideline:

> *"Temperature at the mixing zone boundary should not change by more or less than 1°C from natural ambient background temperatures, and the hourly rate of change should not exceed 0.5°C."*

This is taken into consideration for the model, which conservatively assumes treated groundwater effluent discharge and ambient ocean temperatures of 0°C, to account for start and end of temperatures for the open water season.

APPENDIX C • SPECIFIC WORK INSTRUCTIONS FOR UNDER-ICE MARINE WATER QUALITY SAMPLING PROGRAM – WINTER 2019

Specific Work Instructions	SWI-001
Project:	Meliadine Gold Mine
Client:	Agnico Eagle Mines Ltd.
Project No.	1773384
Dates for Field Work:	March, April and May 2019
Author:	Arman Ospan
Technical Review by:	K. Bruce Dean
To:	Manon Turmel

SPECIFIC WORK INSTRUCTIONS FOR UNDER-ICE MARINE WATER QUALITY SAMPLING PROGRAM - WINTER 2019 - MELIADINE GOLD MINE

1.0 PURPOSE

The purpose of this document is to provide Specific Work Instructions (SWI) for water quality sample collection at the Meliadine Project Area in Melvin Bay, Rankin Inlet, NWT during under-ice conditions in March, April, and May 2019.

2.0 FIELD PROGRAM

2.1 Marine Environment

The marine monitoring study area for the under-ice marine water quality survey includes the area anticipated to be potentially influenced by Project activities. The exposure stations to be monitored were selected to correspond with the location of potential exposure to diffuser discharge In Melvin Bay. The exposure area will be monitored at three sampling stations. Station MWE-1/WC, MWE-2/WN and MWE-3/WS are located at, north (offshore) and south (inshore) of the location of the proposed diffuser discharge.

Detailed information on the sampling station locations and sampling parameters is provided in Table 1. Maps illustrating the location of the sampling locations are provided in Figure 1.

Table 1: Sampling Stations and Sampling Parameters for Under-Ice Marine Water Quality Sampling Program

Station ID	NAD 83, 15 V		Expected Water Depth (m)	Sample Depth (m)	No. of Samples by Sample Type	
	Easting (m)	Northing (m)			Discrete Water Quality (a)	In situ profiles
MWE-1/WC	546002	6963295	20	1 at 1 m; 1 at 5 m above the bottom	2	1
MWE-2/WN	546014	6963391	10	1 at 1 m; 1 at 5 m above the bottom	2	1
MWE-3/WS	545981	6963176	25	1 at 1 m; 1 at 5 m above the bottom	2	1

(a) Includes 10% blind duplicates for QA/QC.

LEGEND

- SAMPLE LOCATION
- STUDY AREA
- WATERCOURSE
- WATERBODY

DRAFT

0 0.5 1

1:25,000 KILOMETRES

REFERENCE(S)

1. BASE DATA OBTAINED FROM AGNICO EAGLE MINES LIMITED.
2. DATUM: NAD83 PROJECTION UTM ZONE 15

CLIENT

AGNICO EAGLE

AGNICO EAGLE MINES LIMITED

PROJECT

MELIADINE GOLD MINE
UNDER-ICE MARINE WATER QUALITY SAMPLING PROGRAM - WINTER 2019

TITLE

WINTER SAMPLING STATIONS

CONSULTANT

GOLDER

YYYY-MM-DD	2019-02-25
DESIGNED	AO
PREPARED	CN
REVIEWED	
APPROVED	

PROJECT NO.	CONTROL	REV.	FIGURE
18103567	5000/5001	A	1

The following data will be collected at each sampling station (Table 1):

- Measurements of snow cover (m), ice-thickness (m), total water depth (m), and the height of the water head in the augered hole (m).
- In situ vertical physico-chemical profiles at 0.5 m depth intervals throughout the water column.
- Winkler test for confirmation of dissolved oxygen (DO) concentrations if YSI readings fall outside the acceptable ranges.
- Collection and processing of discrete water quality samples at targeted depths for detailed water chemistry analyses.

Standard QC samples (including field duplicates, field blanks, trip blanks, and equipment blanks) will be collected in accordance with established quality assurance (QA) procedures (see Section 3.3).

3.0 PROCEDURES

Each sampling area will be accessed by snowmobile.

Specific sampling stations will be located using a Global Positioning System (GPS) device loaded with Universal Transverse Mercator (UTM) coordinates for each station (North American Datum [NAD] 83, Zone 13V).

At each sampling station, a hole will be drilled through the ice using an ice auger. The diameter of the hole should be wide enough to allow deployment of the sampling equipment. All snow and loose ice will be cleared from the hole with a slotted spoon prior to commencement of sampling.

3.1 Physico-Chemical Profile Measurements

In situ parameters measured at each location included water depth, temperature, conductivity (salinity), dissolved oxygen, turbidity, and chlorophyll concentration (optional). Vertical profiles will be collected using a conductivity / temperature / depth (CTD) probe (e.g. RBR XR-620) or multi-meter probe (e.g. YSI) equipped with dissolved oxygen, turbidity and fluorometer sensors.

Maintenance and calibration of a CTD profiler and associated sensors are normally performed by the instrument provider and are usually completed immediately prior to the reconnaissance program. No field quality checks of any of the parameters are required beyond the cast acceptability check and range checks.

Multi-meter probes, such as YSI, may require calibration on-site.

Multi-meter Calibration

A YSI multi-parameter water quality meter (multi-meter) will be used for conducting in-situ water quality field sampling. This multi-meter is factory-calibrated once per year for pH, water temperature, specific conductivity, and DO concentrations. Calibration records must be maintained.

Prior to collecting field samples, the multi-meter should be tested indoor in a stable environment for DO, pH, and specific conductivity. The multi-meter should be calibrated every four days or if readings are outside of the acceptable ranges, as determined by the parameter headings on the field datasheet (Appendix A). Refer to the YSI manual for further information on calibration.

Calibrate the multi-meter according to accepted protocols and record all necessary data in the multi-meter calibration log and/or field book. Note all out-of-range data in the field notebook and provide this information to the project field coordinators as soon as possible.

Under-ice Physico-chemical Water Column Profiling

Water quality profile measurements will be collected at each sampling station using the procedure below:

- Record exact coordinates where measurements were taken on the field datasheet (Appendix A).
- Record snow cover depth (m).
- Drill hole and record ice thickness (m) and height of water head in augered hole (m).
- Measure and record water depth using a hand-held depth sounder.
- Collect water column profile measurements (pH, temperature [°C], DO [mg/L and % saturation], and specific conductivity [µS/cm with the reading corrected to 25°C]) before collecting water samples. Record measurements at the following depths:
  - First measurement just beneath ice bottom (0.1 m).
  - Second measurement at 0.5 m below ice bottom.
  - Third measurement at 1.0 m below the ice bottom.
  - All subsequent measurements taken every 0.5 m depth interval until just above (0.5 m) seafloor.
- At each sampling depth, allow the sensors on the multi-meter to stabilize prior to recording the measurements. This will help to avoid hysteresis (differences in readings during downcast and upcast) and will result in more accurate readings. Record measurements on the field datasheet and log all data with the multi-meter.
- If using a CTD, measurements will be taken throughout the water column by lowering the probe from the surface to the bottom at a vertical speed of approximately 0.5 m/sec while the probe is recording measurements at a frequency of 6 Hz (6 measurements per second).
- Immediately following data collection, all data will be checked for erroneous values, outliers and to be certain that all data and configuration files are present and properly named. If the instrument software allows, all data should be reviewed graphically for outliers as well as trends, and to confirm that all sensors are functioning properly during the deployment. All profile data, datasheets and field notes will be saved to a computer and backed up on an external hard drive.

IMPORTANT: Verify that the multi-meter is calibrated and working properly before starting work for the day, and that calibration procedures and schedule are followed during the course of the program.

3.2 Discrete Water Quality Samples

Discrete water quality samples collected w analyzed for a suite of parameters, including:

- conventional parameters (i.e., conductivity, hardness, laboratory pH, total dissolved solids [TDS], total suspended solids [TSS], total organic carbon [TOC], dissolved organic carbon [DOC], and turbidity)
- major ions (i.e., bicarbonate, calcium, carbonate, chloride, fluoride, hydroxide, magnesium, potassium, sodium, sulphate, sulphide, and silicate)
- nutrients (i.e., nitrate, nitrite, total Kjeldahl nitrogen [TKN], total ammonia, total phosphorus [TP], total dissolved phosphorus [TDP], and orthophosphate)
- total and dissolved metals and metalloids (i.e., aluminum, antimony, arsenic, barium, beryllium, bismuth, boron, cadmium, cesium, chromium, cobalt, copper, gallium, iron, lead, lithium, manganese, mercury, molybdenum, nickel,

rhenium, rubidium, selenium, silicon, silver, strontium, tellurium, thallium, thorium, tin, titanium, tungsten, uranium, vanadium, yttrium, zinc, and zirconium)

- total and dissolved mercury

3.2.1 Sample Collection

For the marine environment, collect a water sample at the following target depths:

- At deeper (offshore) stations (water depth > 5 m), collect at 1 m below base of ice layer and in mid-column (5 m above the bottom), unless a pycnocline is present, in which case collect the sample below the pycnocline. Note that stratification is not expected during winter.
- Collect in situ readings (multi-meter) at the sample collection depth.

Water quality sampler (e.g. Niskin bottle or Kemmerer) samplers will be used to collect water samples at each station after the water column profiling is completed.

A few basic protocols should be followed when collecting the samples:

- Wear nitrile gloves when using samplers, and when rinsing and filling all bottles and jugs.
- Do not touch the inside of the bottles or the inside of the caps.
- Keep bottles in a clean environment (e.g., clean cooler) while collecting samples.
- Remember to check that the screws at the top and bottom of the Kemmerer samplers are tightened each time they are used.
- All water quality samples collected must have corresponding multi-meter profile measurements.

Follow these steps to collect the water quality samples:

- Triple-rinse the samplers with sea water.
- Collect a water sample from the required depth using the sampler.
- Record the sampling depth on the field datasheet.
- Fill the laboratory provided bottles (See Table 2) following instructions from the laboratory.
- Label the samples as “Station ID” (Table 1)[1] and depth at which the sample was taken.
- Verify that there are field readings for temperature, pH, specific conductivity, and dissolved oxygen at depths corresponding to the water sample collection.
- Make sure that samples do not freeze after collection (e.g., use coolers, heat packs).

The laboratory-provided bottles (Table 2) will be filled directly in the field from the sampler. Be sure to take the complete set of bottles for each station in the field.

ALS bottles do not need to be triple-rinsed with sample water before filling. The only time rinsing is required is if a sample is being transferred from one bottle to another, or if a bottle will be re-used to hold the filtered sample (e.g., dissolved metals). Information on filtering samples is provided in Section 3.2.2. Alternatively, filtration for dissolved metals can be

[1] Pre-printed labels were created for the bottle sets.

done in the laboratory conditions. In this case no preservatives should be added into the sample bottle and appropriate note should be made on the bottle and chain of custody (COC) form.

Table 2: Bottle Sets for Discrete Water Quality Samples

Bottle Type	Numbers of Bottles in Set	Filter	Preserve	Preservative	Number of Vials for Preservative
Nutrients-total: 120-mL amber glass bottle	1	-	Yes	1 mL H_2SO_4 (sulphuric acid)	1
Nutrients-dissolved: 120-mL amber glass bottle	1	Yes	Yes	1 mL H_2SO_4 (sulphuric acid)	1
Routine: 1-L polyethylene	1	-	-	-	-
Sulfide: 125-Ml HDPE bottle	1	-	Yes	2 mL Zn Acetate	1
Metals-total: 60-mL HDPE bottle	1	-	Yes	3 mL ultra-pure HNO_3 (nitric acid)	1
Metals-dissolved: 60-mL HDPE bottle	1	Yes	Yes	3 mL ultra-pure HNO_3 (nitric acid)	1
TOTAL	**8**	-	-	-	**5**

3.2.2 Sample Processing

At the end of each sampling day, the field and laboratory crew members will process (filter and/or preserve) the samples. Samples that require filtering can be processed at the end of the field day[2].

For samples that do not require filtering, but require preservative, the following protocols apply:

- Always wear nitrile gloves and safety glasses when working with preservatives.
- Add the required preservative (Table 2) and invert the bottle numerous times to mix the preservative with the sample.
- Store water samples in the refrigerators (between 4 and 10°C) at the Camp until ready to ship (see Section 3.4 for packing and shipping instructions). Do not allow the samples to freeze.

Samples that may require filtering are dissolved metals. Dissolved metals samples will be filtered into their respective sample bottles using the Millipore vacuum pump or Nalgene hand pumps, and Millipore 0.45 µm membrane filter. Whatman GF/C filters may be useful for pre-filtering of samples with a large amount of suspended solids, which may have difficulty passing through the Millipore filters; after the sample has been passed through a GF/C filter, follow with a 0.45 µm membrane filter. Take extreme care when handling the filter assembly and when processing the samples to avoid the potential for contamination of the filtered sample.

Alternatively, samples for dissolved metal can be filtered in the laboratory. In this case, no preservatives should be added in the sample bottles and respective notes should be made on sample bottles and COCs.

[2] Note that it is preferable for the field crew to filter and process samples at the end of the sampling day. However depending on the length of the field day, in some cases samples may need to be filtered and processed first thing the next morning. If this is the case samples must be kept cold (not frozen) and in the dark – especially chlorophyll a samples.

When filtering, the following considerations apply:

- Always wear nitrile gloves and safety glasses when working with preservatives.
- Use deionized water to rinse the pump and filter apparatus before use.
- Use a new filter for each sample bottle.
- Fill bottles in the following order: dissolved ultra-low metals and then nutrients.
  - As the filtered water will be added to back to the original bottles, triple rinse the bottles with the filtered water before filling the bottles with the filtered water.
- Add the required preservative (Table 2) and invert the bottle numerous times to mix the preservative with the sample.
- Store water samples in the refrigerators at camp until ready to ship (see Section 3.4 for packing and shipping instructions).

Generate a chain of custody (CoC) record after each day of sampling. See example of CoC in Appendix B.

3.3 Quality Assurance and Quality Control

3.3.1 Water Quality QC Samples

As general objective, the number of QC samples to be collected should represent approximately 10% of the total number of planned field samples. The target of QC samples collected during the under-ice program is one set at MLA [e.g., field duplicate, field blank, trip blank and equipment blank]). These are described as follows:

- **Field duplicate**: A second sample will be collected at a randomly selected station and treated as a separate field sample with regards to filtering and preserving.
- **Field blank**: Sample bottles are filled in the field with de-ionized water provided by the laboratory. These samples are therefore exposed to the sampling environment at the sample site and handled in the same manner as the surface water samples collected during the field program (e.g., preserved, filtered).
- **Trip blank**: These sample bottles come from the laboratory pre-filled with deionized water. Take the bottle set out into the field with you; DO NOT open the bottles. Submit bottles as is with the rest of the field samples.
- **Equipment blanks**:
  - For **total analytes**: Run laboratory-provided deionized water through the Kemmerer sampler as you would for regular field samples and use to fill sample bottles. Preserve as per requirements for that parameter.
  - For **dissolved analytes**: Pour deionized water into the filter tower and fill the dissolved ultra-low metals and dissolved nutrient bottles with the filtered blank water.

Use unique sample ID to identify the QC samples. It is best practice to submit QC samples to the lab as blind samples, but clearly note them in the field notebook.

3.3.2 Other QA/QC Protocols

- Record detailed field notes in waterproof field books and field datasheets, and ensure any critical information (e.g., QC type, location, date and time, etc.) is available at the de-brief meeting after the program.
- Have a second person check data sheets and CoCs at the end of each field day for completeness and accuracy.

- Keep track of station name and date sampled in the field binder/field note book.
- At the end of each day, record all data and when possible save all data (database, CoCs, multi-meter data, shipping memos, etc.) to a computer file and/or external USB device.
- Take photos at each station and download photos daily.
- Do not use any laboratory-supplied bottles that you suspect have been used or contaminated.
- Discard used bottles into a garbage bag; at end of field program put these bottles in coolers and include in shipment back to lab for disposal. Clearly label the cooler as having no samples, and include what it does contain (e.g., used bottles). Unused and unopened bottles can be left in the bottle prep area for the next program.

3.4 Sample Shipping

To ship samples:

- Make sure that the CoC forms are filled out correctly; confirm that Arman Ospan is included on the CoC distribution list. Please see the example CoC in Appendix B.
  - Assign a CoC number: Meliadine-WQ-#.
  - Take a photo of the CoC for our records. E-mail a copy of the photo to Arman Ospan.
- All samples for the water quality program (i.e., discrete samples) will be placed in one set of coolers and shipped together.
- Place the CoC in a Ziploc bag inside each cooler corresponding to the samples included in the cooler. Each COC must match the contents of the cooler in which it is placed.
- Mark "CoC enclosed" on the shipping label of the cooler containing the CoC.
- Mark shipping label for each cooler (i.e., "1 of 1", or in the case of multiple coolers, "1 of 3", "2 of 3", etc.)
- Place shipping labels in Ziploc bags and tape to each cooler.
- Place lots of ice packs and padding in each cooler. Glass bottles should be individually wrapped in bubble wrap.
- Each cooler should not exceed 40 lbs (18 kg) in weight.
- Bind each cooler with tape and add "do not freeze" and "keep cool" stickers.
- Arman Ospan will notify laboratory contacts of sample shipments by e-mail and request confirmation when samples are received; please include Arman on all communications.
- Laboratory samples collected as part of the water quality program are to be shipped to ALS in Yellowknife, where the samples will be logged and shipped to their respective analysis locations (i.e., Edmonton or Burnaby). Ensure that ALS Yellowknife is informed that samples are on their way, when they should arrive, and provide them the location where need to be picked up from.
- Check sample receipt confirmations when received from the laboratory to make sure sample integrity has been preserved (e.g. temperature on receipt, damaged samples) and that the correct analysis has been scheduled by the laboratory (correct analytical package and number of samples). Arman Ospan will check these.
- Ship samples to ALS Yellowknife:

Jessica.Spira@ALSGlobal.com

ALS Environmental
#116 - 314 Old Airport Road
Yellowknife, NWT
Canada X1A 3T3
TEL: 867-873-5593

4.0 LIST OF APPENDICES:

Appendix A: Field Datasheet

Appendix B: Chain of Custody Form (ALS)

APPENDIX A: Field Datasheet

Golder Associates	GROUP		DATE:	
	Water Quality Record (Form #1, Version 4)		TIME:	
	16820 - 107 Ave, Edmonton, AB, T5P 4C3		STATION:	

Project Title: **Project #:** **Phase:** **Page: ___ of ___**

Personnel: ______________________ GPS or Waypoint (13V NAD83): ____________ ____________

Weather: ____________ Water Colour: ____________ Total Depth (m): ____________

Secchi Depth (m): ________ Pressure (mm Hg): ____________ Field Meter(s): ____________

WQ Sample	Depth (m)	Sample ID
Mid		

Winkler taken:	Yes / No		
Collection depth (m)			
Winkler DO 1 (mg/L)		Winkler DO Tap (mg/L)	
Winkler DO 2 (mg/L)		YSI DO Tap (mg/L)	

Zooplankton

Haul 1 Depth (m): ____________

Phytoplankton

Sample Depths: ____________

Phytoplankton Collected? Y N

Chlorophyll-a Y N

Rep 1 Volume Filtered (mL): ________

Rep 2 Volume Filtered (mL): ________

Rep 3 Volume Filtered (mL):

Notes:

Depth (m)	Temperature (°C)	Conductivity (µS/cm)[c] expected range 17,000 to 35,000	Dissolved Oxygen (%) expected range 95 to 105 (acceptable 60 to110)	Dissolved Oxygen (mg/L)[§] expected range 12 to 15	pH expected 6.7 to 8.5
0.1					
0.5					
1.0					
1.5					
2.0					
2.5					
3.0					
3.5					
4.0					
4.5					
5.0					
5.5					

c temperature corrected to 25 °C; § Should not be more than 15 mg/L (supersaturation)

Project Title: **Project #:** **Phase:** **Page: ___ of ___**

Depth (m)	Temperature (°C)				

c temperature corrected to 25 °C; § Should not be more than 15 (supersaturation)

QA check completed by: ____________ Date: ____________ Photo #: ____________

APPENDIX B: Chain of Custody Form (ALS)

Chain of Custody (COC) / Analytical Request Form

www.alsglobal.com

Canada Toll Free: 1 800 668 9878

Affix ALS barcode label here
(lab use only)

COC Number: 17 -

Page of

Report To	Contact and company name below will appear on the final report
Company:	
Contact:	
Phone:	
Company address below will appear on the final report	
Street:	
City/Province:	
Postal Code:	
Invoice To	Same as Report To ☐ YES ☐ NO
	Copy of Invoice with Report ☐ YES ☐ NO
Company:	
Contact:	

Report Format / Distribution

Select Report Format: ☐ PDF ☐ EXCEL ☐ EDD (DIGITAL)

Quality Control (QC) Report with Report ☐ YES ☐ NO

☐ Compare Results to Criteria on Report - provide details below if box checked

Select Distribution: ☐ EMAIL ☐ MAIL ☐ FAX

Email 1 or Fax

Email 2

Email 3

Invoice Distribution

Select Invoice Distribution: ☐ EMAIL ☐ MAIL ☐ FAX

Email 1 or Fax

Email 2

Select Service Level Below - Contact your AM to confirm all E&P TATs (surcharges may apply)

Regular [R] ☑ Standard TAT if received by 3 pm - business days - no surcharges apply

PRIORITY (Business Days)		EMERGENCY	
4 day [P4-20%]	☐	1 Business day [E - 100%]	☐
3 day [P3-25%]	☐	Same Day, Weekend or Statutory holiday [E2 -200% (Laboratory opening fees may apply)]	☐
2 day [P2-50%]	☐		

Date and Time Required for all E&P TATs: dd-mmm-yy hh:mm

For tests that can not be performed according to the service level selected, you will be contacted.

Analysis Request

Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below

Project Information

ALS Account # / Quote #:

Job #:

PO / AFE:

LSD:

Oil and Gas Required Fields (client use)

AFE/Cost Center:	PO#
Major/Minor Code:	Routing Code:
Requisitioner:	
Location:	

ALS Lab Work Order # (lab use only):

ALS Contact:

Sampler:

ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	NUMBER OF CONTAINERS														SAMPLES ON HOLD	SUSPECTED HAZARD (see Special Instructions)

Drinking Water (DW) Samples[1] (client use)

Are samples taken from a Regulated DW System?

☐ YES ☐ NO

Are samples for human consumption/ use?

☐ YES ☐ NO

Special Instructions / Specify Criteria to add on report by clicking on the drop-down list below (electronic COC only)

SAMPLE CONDITION AS RECEIVED (lab use only)

Frozen ☐		SIF Observations	Yes ☐ No ☐
Ice Packs ☐	Ice Cubes ☐	Custody seal intact	Yes ☐ No ☐
Cooling Initiated ☐			

INIITIAL COOLER TEMPERATURES ºC				FINAL COOLER TEMPERATURES ºC			

SHIPMENT RELEASE (client use)			INITIAL SHIPMENT RECEPTION (lab use only)			FINAL SHIPMENT RECEPTION (lab use only)		
Released by:	Date:	Time:	Received by:	Date:	Time:	Received by:	Date:	Time:

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION   WHITE - LABORATORY COPY   YELLOW - CLIENT COPY

NOV 2018 FRONT

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY. By the use of this form the user acknowledges and agrees with the Terms and Conditions as specified on the back page of the white - report copy.

1. If any water samples are taken from a **Regulated Drinking Water (DW) System**, please submit using an **Authorized DW COC form**.

APPENDIX D • CONCEPTUAL OCEAN DISCHARGE MONITORING PLAN

MELIADINE MINE

Conceptual Ocean Discharge Monitoring Plan

JUNE 2018
VERSION 1

EXECUTIVE SUMMARY

Agnico Eagle Mines Limited (Agnico Eagle) is developing the Meliadine Gold Project (the Project), located approximately 25 kilometres (km) north of Rankin Inlet, and 80 km southwest of Chesterfield Inlet in the Kivalliq Region of Nunavut. The mine plan proposes open pit and underground mining methods for the development of the Tiriganiaq gold deposit, with two open pits (Tiriganiaq Pit 1 and Tiriganiaq Pit 2) and one underground mine.

There are four phases to the development of the Mine; just over 4 years of construction (Q4 2015 to 2019), 8 years of Mine operation (2020 to 2027), 3 years of closure (2028 to 2030), and post-closure (2031 forwards). The underground mine is planned to extend to approximately 625 m below the ground surface; therefore, part of the underground mine will operate below the base of the continuous permafrost. The underground excavations will act as a sink for groundwater flow during operation, with water induced to flow through the bedrock to the underground mine workings once the Mine has advanced below the base of the permafrost.

Groundwater from the underground mine workings will be collected and pumped for storage on the surface in the water containment ponds to manage surface and groundwater, as described in the Meliadine Mine Water Management Plan (WMP; Agnico Eagle 2017a). The management of groundwater is further described in the Meliadine Mine Groundwater Management Plan (GWMP; Agnico Eagle 2018), which entails for the discharge of saline groundwater to Meliadine Lake after treatment, in compliance with Agnico Eagle's Type A Water Licence 2AM-MEL1631, Part E, Item 14. As part of long-term water management, excess groundwater will be treated to meet, as applicable, Metal and Diamond Mining Effluent Regulations (MDMER), Canadian Council of Ministers of the Environment Water Quality Guidelines for the Protection of Aquatic Life (Marine; CCME) and/or background conditions at the edge of the mixing zone for discharge into Melvin Bay via an engineered diffuser.

This document presents the conceptual Meliadine Mine Ocean Discharge Monitoring Plan for discharge of treated groundwater effluent into the marine environment. It summarizes the field sampling study design strategy, methods, laboratory requirements, quality assurance and quality control, and reporting.

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DOCUMENT CONTROL

Version	Date	Section	Page	Revision	Author
1	June 2018	All	All	Conceptual Plan developed for the Treated Groundwater Effluent Discharge into Melvin Bay	Golder Associates Ltd.

ACRONYMS

Agnico Eagle	Agnico Eagle Mines Limited
ANOVA	Analysis of variance
CCME	Canadian Council of Ministers of the Environment
CES	Critical effect size
EEM	Environmental Effects Monitoring
FEIS	Final Environmental Impact Statements
FDP	Final discharge point
Golder	Golder Associates Ltd.
GWMP	Groundwater Management Plan
MDMER	Metal and Diamond Mining Effluent Regulations
Mine or Project	Proposed Meliadine Gold Mine
MMER	Metal Mining Effluent Regulations
NIRB	Nunavut Impact Review Board
NWB	Nunavut Water Board
ODMP	Ocean Discharge Monitoring Plan
QA/QC	Quality Assurance and Quality Control
TDS	Total dissolved solid
WMP	Water Management Plan
WQG	Water Quality Guidelines

SECTION 1 • INTRODUCTION

This document presents the conceptual Ocean Discharge Monitoring Plan (ODMP) for the proposed discharge of excess treated groundwater into the marine environment at Itivia Harbour in Melvin Bay.

The overall water management for the life of the Mine and post-closure is described in the Agnico Eagle Meliadine Gold Mine Water Management Plan (WMP; Agnico Eagle 2018b) and the Groundwater Management Plan (GWMP; Agnico Eagle 2018e). The WMP provides descriptions of the Mine water control structures and associated design criteria, while the GWMP describes management of groundwater for discharge to Meliadine Lake.

This conceptual ODMP outlines objectives, rationale, and details of the data collection strategy, analytical methods and ecological thresholds for protection of water/sediment quality and biological components on the marine environment in Melvin Bay. The conceptual ODMP will be updated pending the necessary approvals and authorizations to include any regulatory conditions, as applicable, and further refine methods and/or thresholds.

1.1 Background

Agnico Eagle Mines Limited (Agnico Eagle) is developing the Meliadine Mine, located approximately 25 kilometres (km) north of Rankin Inlet, and 80 km southwest of Chesterfield Inlet in the Kivalliq Region of Nunavut, on Inuit Owned Lands. The Meliadine Mine is located within the Meliadine Lake watershed of the Wilson Water Management Area (Nunavut Water Regulations Schedule 4).

Agnico Eagle has previously completed the environmental assessment for the construction and operation of an All-Weather Access Road (Agnico Eagle 2013) and the Meliadine FEIS (Agnico Eagle 2014), which included nearshore barge operations in Itivia Harbour and seasonal shipping activities in Hudson Bay and Hudson Strait. The projected life of the Meliadine Mine is anticipated to be 13 years but may be extended as exploration continues. This includes an estimated 3 years of construction, 13 years of operations, and 3 years of decommissioning.

The Meliadine Mine proposes mining methods for the development of the Tiriganiaq gold deposit, which includes an underground mine. The underground mine will extend to approximately 625 m below the ground surface, therefore, part of the underground mine will operate below the base of the continuous permafrost. The underground excavations will act as a sink for groundwater flow during operation, with water induced to flow through the bedrock to the underground mine workings once the Mine has advanced below the base of the permafrost. Inflow of groundwater is expected from 2018 until the end of mine life in 2032. The management of groundwater is further described in the Meliadine Mine GWMP (Agnico Eagle 2018e), which entails for the discharge of saline groundwater to Meliadine Lake after treatment, in compliance with Agnico Eagle's Type A Water Licence 2AM-MEL1631, Part E, Item 14.

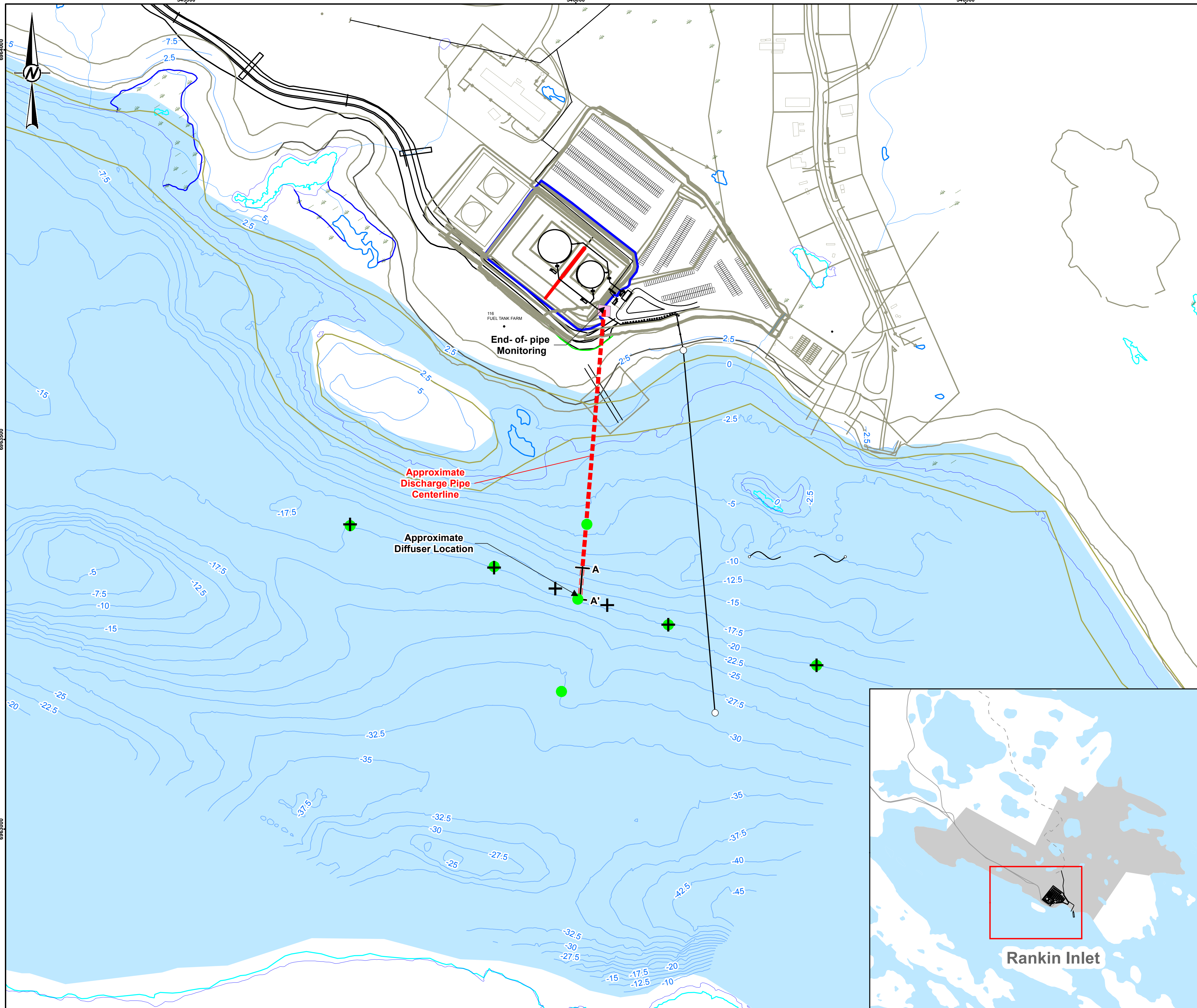
To support long-term groundwater management for the Mine, Agnico Eagle has proposed to directly discharge excess groundwater effluent into Melvin Bay at Itivia Harbour after treatment of the saline underground inflows to meet discharge water quality criteria for Melvin Bay and/or background conditions.

This conceptual ODMP is submitted along with the Final Environmental Impact Statement Addendum (FEIS Addendum) for the proposed discharge of treated groundwater effluent from the underground mine of the Tiriganiaq deposit at the Meliadine Mine into the marine environment at Melvin Bay. The ODMP includes a description on additional requirements to define triggers and threshold for adaptive management, including additional baseline data collection at Melvin Bay ahead of installation of the engineered marine outfall, as required. This plan was developed to fulfil the NIRB Guidelines received for the FEIS Addendum, for stand-alone management and monitoring plans (EIS Guidelines sections 9.3 and 9.4; NIRB 2018). While the ODMP has been developed as a separate and stand-alone plan, the intent is to align it with Environmental Effects Monitoring (EEM) study design requirements to avoid multiple monitoring plans. The components of the ODMP that are not captured in an EEM study design will be incorporated into existing management plans for the Meliadine Mine (for example, as part of the GWMP [Agnico Eagle 2018e]).

1.2 Objectives and Scope

The ODMP has the purpose of assessing the potential effects of the treated groundwater effluent discharge to the marine environment in Melvin Bay. The ODMP will identify potential changes to water and sediment quality caused by the effluent discharge and the effect of these changes to aquatic life, fish habitat, and fish health. To achieve its purpose, the ODMP has the following objectives:

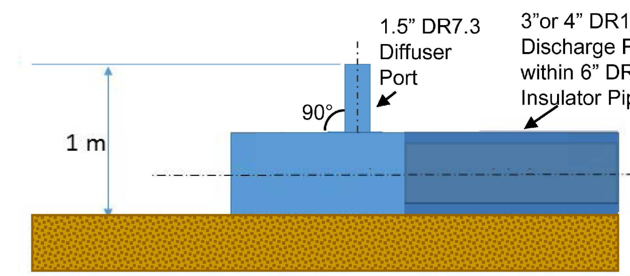
- To detect short- and long-term effects of the discharge on the receiving environment
- To address the NIRB FEIS Addendum Guidelines, the federal Metal and Diamond Mining Effluent Regulations (MDMER, once they come into effect), Canadian Council of Ministers of the Environment (CCME) Guidelines for the Protection of Aquatic Life, as well as requirements that may be requested from regulators during the permit processes
- Identify unforeseen adverse effects and provide early warnings of undesirable changes in the environment
- To inform mitigation



LEGEND

- WATER QUALITY SAMPLING STATION
- BENTHIC INVERTEBRATES AND SEDIMENT QUALITY SAMPLING STATION
- END OF PIPE MONITORING
- GENERAL AREA FOR THE PROPOSED DIFFUSER LOCATION
- CROSS SECTION LOCATION
- WATERBODY

End of Discharge Pipe – Diffuser Port Design (HDPE Pipe)



NOT FOR CONSTRUCTION

0 100 200
1:5,000 METRES

NOTE(S)

AGNICO EAGLE IS CONSIDERING TREATMENT AND MANAGEMENT OPTIONS TO MEET APPLICABLE DISCHARGE CRITERIA AND/OR SITE SPECIFIC WATER QUALITY OBJECTIVES, AS REQUIRED. ACTIVITIES AND FACILITIES PRESENTED HEREIN ARE FOR PLANNING PURPOSES ONLY AND SHOULD NOT BE CONSIDERED FINAL DESIGN.

REFERENCE(S)

BASE DATA OBTAINED FROM AGNICO EAGLE MINES LIMITED.
DATUM: NAD 83 PROJECTION: UTM ZONE 15

CLIENT
AGNICO EAGLE
AGNICO EAGLE MINES LIMITED

PROJECT
MELIADINE MINE
NUNAVUT

TITLE
CONCEPTUAL MARINE MONITORING PLAN
PROPOSED SAMPLING STATIONS

CONSULTANT
GOLDER

YYYY-MM-DD	2018-05-24
DESIGNED	CLT
PREPARED	CDB/JZ
REVIEWED	
APPROVED	

PROJECT NO.	CONTROL	REV.	FIGURE
1773384	1100	A	A-1

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B

SECTION 2 • REGULATORY FRAMEWORK

The Meliadine Mine is located within the Nunavut Territory and is subject to the regulatory approvals established under the applicable laws and regulations of Canada and of Nunavut.

As per the MMER, including the amended MDMER (GC 2017; anticipated to come into effect in 2018-2019), any discharge exceeding 50 cubic metres (m^3) should conduct EEM studies. The studies include effluent characterization and water quality monitoring accompanied by biological studies, which may include benthic invertebrate community, fish population and fish tissue components.

In consultation with the NIRB, Agnico Eagle has prepared the Final Environmental Impact Statement Addendum (FEIS Addendum) for the authorization to carry out discharge of treated groundwater effluent from the underground mine to the marine environment, in accordance with the Guidance for Final Environmental Impact Statement Addendum for the “Saline Effluent Discharge to Marine Environment, Rankin Inlet, Meliadine Gold Mine” (“project proposal” or “proposed Project activities” in this report; NIRB 2018).

The discharge of the treated groundwater effluent into the marine environment is also subject to authorization under the Section 5 of the *Environmental Protection Act* of Nunavut (GN 1988). In addition, other conditions and/or mitigations outlined by regulatory agencies under the following Acts (or applicable licence requirements) should be adhered to:

- *Federal Fisheries Act* (GC 1985a)
- *Navigation Protection Act* (GC 1985b)
- *Species at Risk Act* (GC 2007)

SECTION 3 • RATIONALE

3.1 Discharge Overview

The ODMP concerns management of the discharge of excess groundwater from the underground mine to the marine environment after treatment during the life of the Project to support long-term water management.

Supplemental hydrogeological investigations were undertaken in 2015 and 2016 to provide additional information on potential volumes and quality of saline groundwater inflows to the underground mine to be managed. Per the results obtained, the total volume of the groundwater inflow in the mine is expected to be up to 420 m^3/day (Golder 2016). Adding to the maximum anticipated groundwater volume to be stored at the Meliadine Mine, this will result in a need to discharge up to 800 m^3/day (Agnico Eagle 2018e). Groundwater inflows to the underground mine since 2015 have not been discharged to the environment and are being stored underground, in the Saline Pond, in the P-Area, or actively evaporated during the open water season (Agnico Eagle 2018b).

Total dissolved solid (TDS) concentrations in groundwater are naturally high, expected to range from 50,000 to 64,000 mg/L per groundwater data collected by Agnico Eagle in 2017 (a summary of the groundwater quality is presented in Table 3, Section 3.4.2 of the FEIS Addendum; Agnico Eagle 2018g). Since mining operations include drill-and-blast excavation, certain parameters of groundwater quality are expected to be influenced by explosives (particularly ammonia and nitrate due to ammonium nitrate, fuel oil [ANFO] and emulsion explosives). Chloride, sodium and calcium are also naturally high in concentration in the untreated groundwater, averaging at higher concentrations than those recorded in Melvin Bay (Table 1 and Table 2). Therefore, to minimize effects to the environment, and to comply with the effluent discharge criteria (GC 2017; CCME 2003; BC MOE 2017a; BC MOE 2017b) and objectives, groundwater will be treated prior to discharge.

Table 1: Summary of Melvin Bay Background Marine Water Temperature and Salinity taken in August 2011 and Average Untreated Groundwater Concentrations taken in 2017

	Melvin Bay		Untreated Groundwater
Parameter	Surface	Bottom	
Temperature (°C; n=3)	8.5 to 9.45	7.93 to 9.07	-3.4°C - +3.8°C(1)
Salinity (ppt; n=3)	29.29 to 29.35(2)	29.30 to 29.38(2)	55 to 56(3)

Source: Melvin Bay - Nunami Stantec 2012. Meliadine Mine Groundwater – Agnico Eagle 2017 data.

(1) Average temperatures per observations of DDH samples, as provided by Agnico Eagle. This does not account for the influence of ambient temperature for groundwater stored in containment ponds at the Meliadine Mine.

(2) *In situ* average salinity measured at Melvin Bay. Average Total Dissolved Solids (TDS) measured at Melvin Bay = 34,300 mg/L.

(3) Estimated average groundwater salinity based on average TDS groundwater concentrations presented in FEIS Addendum, Section 3.4.2, Table 3 (55,700 mg/L average TDS; Agnico Eagle 2018g). Salinity from groundwater has not been measured. TDS values are comparable to salinity as TDS represents an estimate of the level of ions, typically salt ions, that are present in the water. This may however overestimate the salinity of the untreated groundwater, as TDS also includes organic solutes (for example, hydrocarbons and urea) in addition to salt ions.

Table 2: Summary of Select Melvin Bay Background Marine Ion Concentrations taken in August 2011 and Average Untreated Groundwater Concentrations taken in 2017

	Melvin Bay			Untreated Groundwater[(1)]
Ion	I1	R1	R2	
Chloride (mg/L)	20,000	20,100	20,300	32,315
Sodium (Na) - Total (mg/L)	11,000	10,800	10,800	14,365
Calcium (Ca) - Total (mg/L)	411	399	402	2,032

Source: Melvin Bay - Nunami Stantec 2012; averages from 3 sampling locations (I1, R1 and R2). Meliadine Mine Groundwater – Agnico Eagle 2017 data (Agnico Eagle 2018g).

(1) Averages per untreated groundwater concentrations presented in FEIS Addendum, Section 3.4.2, Table 3; Agnico Eagle 2018g).

Treated groundwater effluent will be trucked to the discharge facility at the Itivia Fuel Storage Facility for discharge during the open water season (May to October). The discharge facility, located at the Itivia Fuel Storage Facility, will include a storage tank and a pipeline outflow extending to an engineered diffuser located in Melvin Bay. The treated groundwater effluent will be discharged seasonally in a controlled manner through a diffuser to allow for maximum dilution and minimum impact on the marine environment. The Final Discharge Point (FDP) is estimated at a distance of approximately 230 m from the shoreline and a depth of approximately 20 m. Facility layout and diffuser specifications are shown in Figure 1.

Treated groundwater effluent quality is required to meet the Canadian federal end-of-pipe discharge criteria (per the amended MDMER; GC 2017) and to be non-acutely lethal. Treated groundwater will be discharge into Melvin Bay via an engineered diffuser (refer to Section 3.5 of the FEIS Addendum; Agnico Eagle 2018g) to meet Canadian Surface Water Quality Guidelines (WQG; CCME 2003), or background concentrations for parameters without guidelines, at the edge of the mixing zone.

3.2 Environmental Conditions

The receiving environment for the effluent discharge is located in Melvin Bay, northwest Hudson Bay at Rankin Inlet. Hudson Bay, and particularly the area including Melvin Bay, is usually ice-covered from November to June and ice-free from July to October (Stewart and Lockhart 2004; Cohen et al. 1994).

- At Rankin Inlet, the tidal range varies between 2.0 and 4.6 m and mean currents flow southward at around 0.22 m/s. Isobath lines are nearly parallel to coastline and depth rapidly increases reaching more than 20 m within 230 m off the coast.
- Marine environmental baseline studies in the Melvin Bay area were conducted in August 2011 by Nunami Stantec (2012; see Appendix B of the FEIS Addendum, Agnico Eagle 2018g).
- Surveys were conducted at three areas in Melvin Bay: near the effluent discharge location (Impact Area 1 [I1]) and two reference areas, one (Reference Area 1 [R1]) located approximately 0.9 km northeast of Itivia Harbour, and the other (Reference Area 2 [R2]) on the southern shore of Melvin Bay, 1.5 m south from Itivia Harbour.

- Water quality measurements conducted by Nunami Stantec (2012) showed no water column stratification with the mean temperature ranging from 8.9^{o} C at the surface to 8.5^{o}C at the bottom (up to approximately 13 m depth), and the mean salinity ranging from 29.32 ppt at the surface to 29.33 ppt at the bottom. Water was well oxygenated with dissolved oxygen saturation ranging from 113.6 to 115.6% (10.8 to 11.2 mg/L). Nutrients and metals were mostly below detection limits and lower than CCME WQG for the Protection of Aquatic Life (Marine; CCME 2003).
- Sediments in the areas with water depths of up to 6.6 m were dominated by coarse material (cobble and gravel) in most samples (Nunami Stantec 2012).
- Sediment chemistry analysis of the fine substrate fraction revealed concentrations below CCME Interim Sediment Quality Guidelines (CCME 2001) for all parameters except chromium. Chromium concentrations slightly exceeded the CCME ISQG of 52.3 mg/kg for this element at all sample stations with mean concentrations (plus/minus standard deviation) ranging from 55.8 ± 5.89 mg/kg at I1 to 60.2 ± 6.12 mg/kg at R2.
- Phytoplankton abundance, richness, and diversity were similar across all sites within the marine local study area, and a total of 33 taxa were recorded. Dinoflagellates, mainly represented by *Peridinium/Gonyaulax* spp. and *Dinophysis* spp., were the dominant taxonomic group at all sampled locations. Ciliates of order Tintinnida were present at low percentages at two of the sampled locations.
- Zooplankton abundance, richness, and diversity varied among sites, and a total of 44 taxa were recorded. Zooplankton were mostly rotifers and calanoid copepods. An unidentified rotifer species, possibly in the family Notommatidae, was the dominant taxon at all sampled locations.
- Macroflora was sparse within Melvin bay (ranging from 2 to 5% coverage). Rockweeds (*Fucus* spp.) were the dominant species and occupied a small band in the low intertidal zone. Kelp (*Laminaria* spp.) was observed in the subtidal areas of the southern shore of the bay. Seaweeds are not locally harvested in Melvin Bay.
- Benthic invertebrates were dominated by different families of polychaetes with lesser abundance of nematodes and amphipods. Among other taxonomic groups observed were sponges (Porifera), hydrozoans, flatworms (Platyhelminthes), three gastropod, and three bivalve taxa, several crustacean taxa (copepods, amphipods, decapods), and sea squirts (Urochordata).
- In general, benthic invertebrate abundance and diversity in the area is low; in the intertidal zone, benthic communities occur seasonally when the habitat is not influenced by ice (Stewart and Lockhart 2005). Abundance in the subtidal habitat was also low in late summer (August) with most of the organisms observed less than 1 cm in length, suggesting a low biomass (Nunami Stantec 2012).
- Locally harvested shellfish species include blue mussels and clams.

- Several species, including Arctic char, Arctic cod, Greenland cod, Arctic sculpin, slender eel blenny and Greenland halibut, are considered important to the local commercial, recreational, and subsistence fisheries.
- Only six species of fish were identified during the baseline study in 2011 (Nunami Stantec 2012). Greenland cod (*Gadus ogac*) represented over 50% of fish captured, followed by slender eelblenny (27%) and minor contributions of different species of sculpins. Arctic char was not observed during the baseline field study, but was reported to be in the area at the time of the field study (west of Melvin Bay near the Barrier Islands).
- At least 43 species of seabirds, shorebirds, waterfowl, and marine-associated raptors frequent offshore, inshore, intertidal, or salt marsh habitats of the Hudson Bay marine ecosystem (see Table B-2 of Appendix B in the Shipping Management Plan; Agnico Eagle 2018f). Few of these species are year-round residents.
- The baseline study conducted in 2011 indicated that most marine birds that occur in the vicinity of Rankin Inlet are summer residents and no SARA listed marine bird species occur near Rankin Inlet (Nunami Stantec 2012).
- Marine mammals potentially present in the north and northwest Hudson Bay for variable periods of time include 4 species of cetaceans (3 toothed whales and one baleen whale), 6 species of pinnipeds (seals and walrus), and polar bear. (see Table B-3 of Appendix B in the Shipping Management Plan; Agnico Eagle 2018f). Polar bears (*Ursus maritimus* – Special Concern under SARA) are uncommon to the area. A summary of listed marine mammal species with potential to occur in marine RSA is provided in Table B-5 of Appendix B in the Shipping Management Plan (Agnico Eagle 2018f).
- Narwhal (*Monodon Monoceros*, uncommon at Rankin Inlet), bowhead whales (*Balaena mysticetus*, uncommon at Rankin Inlet) and beluga (*Delphinapterus leucas*) are known to overwinter in Hudson Strait and in polynyas within Hudson Bay. Atlantic walrus (*Odobenus rosmarus rosmarus*), bearded seal (*Erignathus barbatus*), ringed seal (*Phoca hispida*), and harbour seal (*Phoca vitulina concolor*) are year-round residents to at least portions of Hudson Bay, but largely uncommon at Rankin Inlet in recent years. Harp seal (*Pagophilus groenlandicus*) have increased in number in recent years near Rankin Inlet. The remainder of marine mammals identified in Hudson Bay / Hudson Strait, namely killer whale (*Ocinus orca*) and hooded seal (*Cysophora cristata*), are migratory and seasonal visitors limited largely by the presence of solid land-fast ice throughout the winter and spring.

3.3 Project Management Plans

Agnico Eagle has developed Management Plans that are applicable to the Meliadine Mine site, the All-Weather Access Road (AWAR), and the Itivia Fuel Storage Facility.

Updates to the plans have been developed, as required, and submitted to the NIRB and NWB throughout development of the Mine. Table 3 lists the management plans for the Meliadine Mine as they apply for the ocean discharge, with indications on any potential changes that may be required in future updates.

Agnico Eagle is committed to adhering to all existing plans that have been developed for the Meliadine Mine as part of NIRB Project Certificate No. 006 and NWB Type A Water Licence 2AM-MEL1631 conditions. This includes reporting requirements required to measure the achievement of objectives as set out by approval conditions or to demonstrate compliance, such as annual reporting on Project monitoring programs.

Table 3: Project Management Plans Applicable to the Proposed Project Activities for Ocean Discharge

Management Plan	Reference	Changes Required due to the Proposed Project Activities
Water Management Plan	FEIS Volume 2, SD 2-6 (Agnico Eagle 2014) Updated and resubmitted (Agnico Eagle 2018b) NWB Doc 1803312AM-MEL-1631	None
Mine Waste Management Plan	FEIS Volume 2, SD 2-6 (Agnico Eagle 2014) Updated and resubmitted (Agnico Eagle 2018c) NWB Doc 1803312AM-MEL-1631	None
Roads Management Plan	FEIS Volume 2, SD 2-9 Nunavut. Doc 235-1314280007 (Agnico Eagle 2014) Updated and resubmitted (Agnico Eagle 2018d) NWB Doc 1803312AM-MEL-1631	None
Hazardous Materials Management Plan	FEIS Volume 2, SD 2-13 (Agnico Eagle 2014) Updated and resubmitted (Agnico Eagle 2018a) NWB Doc 1803312AM-MEL-1631	None
Risk Management and Emergency Response Plan	FEIS Volume 2, SD 2-15 (Agnico Eagle 2014) Updated and resubmitted (Agnico Eagle 2015) NIRB Doc. No. 150623-11MN034	None
Spill Contingency Plan	FEIS Volume 2, SD 2-16 (Agnico Eagle 2014) Updated and resubmitted (Agnico Eagle 2017) NWB Doc 1803312AM-MEL-1631	None
Shipping Management Plan (including the Marine Environmental Management Plan as Appendix D)	FEIS Volume 8, SD 8-1 (Agnico Eagle 2014) Updated and resubmitted (Agnico Eagle 2018f) NIRB Doc. No. 180104-11MN034	None
Groundwater Management Plan	Submitted (Agnico Eagle 2018e, provided in Appendix D of this FEIS Addendum) NWB Doc. No. 180214 2AM-MEL1613	The submission, review, and approval of a Groundwater Management Plan is a requirement of the current Type A Water Licence 2AM-MEL1631 (Part E, Item 14). An updated GWMP will be submitted if appropriate licenses and approvals are obtained prior to ocean discharge.
Ocean Discharge Monitoring Plan	Conceptual plan - provided in Appendix E of this FEIS Addendum.	This document.

Notes:

Updated management plans are resubmitted to the NIRB, and the NWB as appropriate, in compliance with respective NIRB Project Certificate No. 006 or NWB Type A Water Licence (No. 2AM-MEL1631, 2016) conditions, as adaptive management measures or changes are applied as the Project develops.

3.4 Potential Effects

The potential effects from the discharge of treated groundwater effluent to the marine environment were assessed in the FEIS Addendum (Agnico Eagle 2018g). Effect pathways specific to the treated groundwater effluent discharge activity assessed included the following:

- Change in fish habitat quality due to discharge of groundwater effluent
- Change in health and survivorship of fish (including benthic invertebrates) due to the quality of the groundwater effluent discharge
- Change in marine bird and mammal habitat quality due to the quality of the groundwater effluent discharge
- Change in health and survivorship of marine birds and mammals due to the quality of the groundwater effluent discharge
- Accidental release of groundwater effluent from an unknown location along the discharge pipe can have adverse effects on marine water quality and associated indirect effects on marine wildlife (fish, benthic invertebrates, marine birds, marine mammals).

Groundwater will be treated prior to discharge to comply with the effluent discharge criteria (GC 2017; CCME 2003; BC MOE 2017a; BC MOE 2017b). These criteria are set to be protective of the marine aquatic life. For parameters with no regulated guidelines for discharge, the discharged concentration objectives conservatively considered for the assessment are 95% of the Upper Confidence Level of the Mean (UCLM) for groundwater. For most parameters these are below baseline concentrations at Melvin Bay, whereas 11 parameters are expected to exceed baseline concentrations.

The assessment used a numeric simulation to model behaviour of the effluent plume in the marine environment. Modelling has shown that a discharge of 420 m^3/day effluent through the diffuser will reach a dilution factor of 10 or more within 1 m horizontal and 2 m vertical distances from the port at a worst-case scenario. This dilution factor is at least 3 times higher than the requirement for chloride and temperature and the horizontal distance of 1 m is lower than the regulatory mixing zone boundary of 100 m. The plume will have negative buoyancy and the maximum plume height expected is 13.7 m above the seabed.

The assessment concluded that the treated groundwater discharge through the diffuser would result in a minor environmental change, but would have a negligible residual effect on fish and fish habitat and marine birds and marine mammals relative to baseline or guideline values provided that mitigation measures are in place. Mitigation measures include treatment of groundwater to meet regulatory discharge criteria particularly the amended MDMER, once they come into effect (GC 2017), discharge through a diffuser that aids in mixing, and implementation of the EEM program.

SECTION 4 • CONCEPTUAL MONITORING DESIGN

The following are the main components and objectives of the ODMP:

- Effluent monitoring at the FDP (end-of-pipe monitoring) to verify compliance of brine properties with the discharge criteria and to characterize effluent quality under MDMER.
- Environmental effect monitoring studies to assess short- and long-term effects from the discharge of treated groundwater effluent on marine biota that will include:
  - Water quality monitoring
  - Biological monitoring including studies on sediment quality, benthic invertebrate communities and fish

A summary of monitoring components, sampling frequency and design is provided in Table 4.

Table 4: Conceptual Ocean Discharge Monitoring Program Sampling Summary

Monitoring Component	Sampling Frequency	Monitoring Location	Sample Replication and Number of Samples
Deleterious Substances (MDMER Schedule 4)	Every week	FDP (end-of-pipe)	One grab sample
Acute lethality	Every month (sampled concurrently with effluent characterization)	FDP (end-of-pipe)	One grab sample
Effluent characterization	Four times a year, one month apart during discharge	FDP (end-of-pipe)	One grab sample
Sublethal toxicity	Twice a year, at the start and finish of the discharge	FDP (end-of-pipe)	One grab sample
In situ Water Column Measurements	Four times a year, once a month during discharge	Exposure and reference areas	7 stations in the Exposure Area, 3 stations in each reference area. One vertical profile per station
Water Quality	Four times a year, once a month during discharge	Exposure and reference areas	7 stations in the Exposure Area, 3 stations in each reference area. One sample @1m below the surface and one sample @5 m above the bottom at each station.
Benthic Invertebrate Communities, and sediment quality	Every 3 years in August if triggered by MDMER	Exposure and reference areas	6 stations in the Exposure area and 5 stations in each reference area. Three subsamples per station
Fish population	Every 3 years in August if triggered by MDMER	Exposure and reference areas	20 sexually mature males and 20 sexually mature females of two fish species in each sampling area
Fish tissue	Every 3 years in August if triggered by MDMER	Exposure and reference areas	8 samples of a single species from each sampling area

Notes:

Amended Metal and Diamond Mining Effluent Regulations (MDMER; GC 2017) will be adhered to. Metal Mining Effluent Regulations (MMER) will be adhered to as a minimum while MDMER come into effect.

FDP = Final Discharge Point

4.1 Effluent Monitoring

4.1.1 Deleterious Substances

Effluent water at the FDP (end-of-pipe) will be measured for pH and analysed for concentrations of deleterious substances listed in MDMER Schedule 4 (GC 2017).

4.1.2 Acute Lethality

End-of-pipe brine effluent will be sampled once per month for acute lethality testing per MDMER requirements. Acute lethality testing will be conducted on threespine stickleback in accordance with the procedures set out in sections 5 or 6 of Reference Method EPS 1/RM/10 (ECCC 2017). Effluent characterization samples (Section 4.1.3) will be collected at the same time to aid in interpretation of acute lethality test results.

4.1.3 Effluent Characterization

Effluent characterization will be conducted one month apart, four times a year. Effluent will be sampled and analysed for the following parameters:

- General parameters, including pH, TDS, total suspended solids, hardness, alkalinity, electrical conductivity, salinity and temperature
- Anions including sulphate and chloride
- Nutrients, including ammonia and nitrate
- Total metals and dissolved metals including those listed in MDMER Schedule 4 and Schedule 5 paragraph s. 4

4.1.4 Sublethal Toxicity Testing

Sublethal toxicity testing of brine effluent will be conducted twice a year, at the beginning and at the end of discharge, for three years and once a year after the third year. The following tests will be conducted:

- Fish early life stage development test on inland silverside (*Menidia beryllina*) or topsmelt (*Atherinops affinis*) (US EPA 2002)
- Invertebrate reproduction test on echinoids (sea urchins or sand dollars) (Environment Canada 1992)
- Algae toxicity test on barrel weed (*Champia parvula*) (US EPA 2002)

These tests will be conducted on aliquots of the same sample collected for effluent characterization (Section 4.1.3 Effluent Characterization).

4.1.5 Environmental Effects Monitoring

Agnico Eagle will adhere to MDMER EEM requirements for fish population surveys, water and sediment quality and benthic invertebrate community assessments conceptually outlined in Table 4. Fish tissue monitoring will be conducted if triggered by MDMER conditions. A study design will be provided to ECCC according to the MDMER requirements (GC 2017) that includes all proposed monitoring locations.

4.2 Quality Assurance/Quality Control (QA/QC)

Quality Assurance (QA) refers to plans or programs that encompass a wide range of internal and external management and technical practices designed to ensure the collection of data of known quality that matches the intended use of the data. Quality Control (QC) is a specific aspect of QA that refers to the internal techniques used to measure and assess data quality.

Quality assurance protocols will be followed so data are of known, acceptable, and defensible quality. To make certain that field data collected are of known, acceptable, and defensible quality, field staff will be trained to be proficient in standardized sampling procedures, data recording using standardized forms, and equipment operations applicable to the monitoring program. All field work will be completed according to specified instructions and established technical procedures for standard sample collection, preservation, handling, storage, and shipping protocols. Accredited laboratories will be selected for sample analysis. Accreditation programs are utilised by the laboratories so that performance evaluation assessments are conducted routinely for laboratory procedures, methods, and internal quality control. A data management system will be utilized so that an organized consistent system of data control, data analysis, and filing will be applied to the Marine Monitoring Program.

The QC component will consist of applicable field and sample handling procedures, and the preparation and submission of two types of QC samples to the various laboratories involved in the program. The QC samples include blanks (e.g., travel, field, equipment) and duplicate/split samples. Quality control procedures implemented will consist of the preparation and submission of QA/QC samples, such as field blanks, trip blanks, and duplicate water samples.

SECTION 5 • BENCHMARKS AND EFFECT THRESHOLDS

This section sets quality benchmarks and effect thresholds against which conditions of marine environment are monitored and whose exceedance indicate treated effluent discharge-related effects. The following criteria are discussed here:

- A benchmark is a set concentration of a chemical in a medium (water or sediments) that is expected to be protective of aquatic life, e.g., CCME Guidelines for the protection of aquatic life.
- Effect is a statistical difference in effect endpoint values between the exposure and reference areas.
- The effect threshold is a magnitude of environmental change, which, if reached, indicates a higher risk to the environment. A concept of Critical Effect Size (CES) exists for certain effect indicators, e.g., benthic invertebrate communities and fish population, which is used as an effect threshold.

Benchmarks and effect thresholds for each environmental variable are typically below the significance threshold, which is a magnitude of environmental change which, if reached, would indicate a significant effect (WLWB 2010). Exceedance of a benchmarks or effect thresholds will trigger adaptive management actions.

5.1 Water Quality

The benchmarks used for water quality variable are the CCME WQGs for the Protection of Marine Aquatic Life, British Columbia Ministry of Environment (BC MOE 2017a) Approved WQG for Marine Aquatic Life (Short-Term) and BC MOE Working WQG for Marine Aquatic Life (BC MOE 2017b) at the edge of the mixing zone of 100 m from the diffuser. For parameters for which no WQG exist, concentrations from the exposure area will be compared with the baseline concentrations and concentrations in the reference areas.

For each parameter, whether its concentration is elevated in the exposure area in comparison to the baseline or reference data will be determined based on a statistical test (ANOVA) on a 95% confidence interval or whether the mean or median is greater than 2 standard deviations.

Baseline data will be collected from the exposure and reference areas before the start of effluent discharge.

Table 5: Summary of Water Quality Guidelines

Parameter	Unit	CCME[1]		BC MOE[2]	
		Short-term	Long-term	Short-term	Long-term
Ammonia (total)	mg/L as N	-	-	0.71 – 312[3]	0.11 – 47[3]
Arsenic (total)	µg/L	-	12.5	12.5	-
Boron (total)	mg/L	-	1.2	1.5	-
Beryllium (total)	µg/L	-	-	-	100
Cadmium (total)	µg/L	-	-	0.12	-
Chloride	-	-	-	Narrative[4]	-
Chlorine-produced oxidants	µg/L	-	0.5	40	3
Chromium (III)	µg/L	-	-	-	56
Chromium (VI)	µg/L	-	-	-	1.5
Colour (apparent)	Pt-Co	-	-	Narrative[5]	-
Colour (real)	Pt-Co	-	-	Narrative[6]	-
Copper (total)	µg/L	-	-	3	<2
Cyanide	µg/L	-	-	1	
Dissolved Oxygen	mg/L	-	>8 and Narrative[7]	-	-
Fluoride	µg/L	-	-	1.5	-
Lead (total)	µg/L	-	-	140	<2
Manganese (total)	µg/L	-	-	-	100
Mercury (total)	µg/L	-	0.016	-	0.0001 / (MeHg/total Hg)
Nickel	µg/L	-	-	-	8.3
Nitrate	mg/L as N	1500	200	-	3.7
pH	-	-	7.0 - 8.7[8]	7.0 - 8.7	-
Salinity	-	-	Narrative[9]	-	-
Selenium (total)	µg/L	-	-	-	-
Silver (total)	µg/L	7.5	-	3	1
Temperature	degC	-	± 1 change from ambient background	-	± 1 change from ambient background
Turbidity	UNT	-	Narrative[10]	Narrative[11]	-
Total Suspended Solids	mg/L	-	Narrative [12]	Narrative [13]	-
Vanadium (total)	µg/L	-	-	-	50
Zinc	µg/L	-	-	55	10

Notes:

(1) Canadian Council of Ministers of the Environment (CCME 2003) Water Quality Guidelines (WQG) for the Protection of Aquatic Life - Marine.

(2) British Columbia Ministry of Environment (BC MOE 2017a) Approved Water Quality Guidelines for Marine Aquatic Life. BC MOE Working Water Quality Guidelines for Marine Aquatic Life (BC MOE 2017b).

(3) Guideline is salinity, pH and temperature dependent, minimum and maximum values are presented for a salinity of 30.

(4) Human activities should not cause the Cl^- of marine and estuarine waters to fluctuate by more than 10% of the natural Cl^- expected at that time and depth

(5) 30-day average transmission of white light ≥ 80% of background

(6) 30-day average true colour of filtered water samples shall not exceed background levels by more than 5 mg/L Pt in clear water systems or 20% in coloured systems

(7) The CCME guidelines for DO are as follows:
- Depression of DO below the recommended value should only occur as a result of natural processes. When the natural DO level is less than the recommended interim guideline, the natural concentration should become the interim guideline at that site.
- When ambient DO concentrations are >8.0 mg/L, human activities should not cause DO levels to decrease by more than 10% of the natural concentration expected in the receiving environment at that time.

(8) The pH of marine and estuarine waters should fall within the range of 7.0 – 8.7 units unless it can be demonstrated that such a pH is a result of natural processes. Within this range, pH should not vary by more than 0.2 pH units from the natural pH expected at that time. Where pH is naturally outside this range, human activities should not cause pH to change by more than 0.2 pH units from the natural pH expected at that time, and any change should tend towards the recommended range.

(9) Human activities should not cause the salinity (expressed as parts per thousand [‰]) of marine and estuarine waters to fluctuate by more than 10% of the natural level expected at that time and depth.

(10) The CCME WQG for Turbidity are as follows:
- clear flow: Maximum increase of 8 Nephelometric Turbidity Units (NTU) from background levels for a short-term exposure (e.g., 24-h period). Maximum average increase of 2 NTUs from background levels for a longer term exposure (e.g., 30-d period).

- high flow or turbid waters: Maximum increase of 8 NTUs from background levels at any one time when background levels are between 8 and 80 NTUs. Should not increase more than 10% of background levels when background is > 80 NTUs.

(11) The BC MOE WQG for Turbidity are as follows:
- Change from background of 8 NTU at any one time for a duration of 24 h in all waters during clear flows or in clear waters
- Change from background of 2 NTU at any one time for a duration of 30 d in all waters during clear flows or in clear waters
- Change from background of 5 NTU at any time when background is 8 - 50 NTU during high flows or in turbid waters
- Change from background of 10% when background is > 50 NTU at any time during high flows or in turbid waters

(12) The CCME WQG for total suspended solids are as follows:
- clear flow: Maximum increase of 25 mg/L from background levels for any short-term exposure (e.g., 24-h period). Maximum average increase of 5 mg/L from background levels for longer term exposures (e.g., inputs lasting between 24 h and 30 d).
- high flow: Maximum increase of 25 mg/L from background levels at any time when background levels are between 25 and 250 mg/L. Should not increase more than 10% of background levels when background is ≥ 250 mg/L.

(13) The BC MOE WQG for total suspended solids are as follows:
- Change from background of 25 mg/L at any one time for a duration of 24 h in all waters during clear flows or in clear waters
- Change from background of 5 mg/L at any one time for a duration of 30 d in all waters during clear flows or in clear waters
- Change from background of 10 mg/L at any time when background is 25 - 100 mg/L during high flows or in turbid waters
- Change from background of 10% when background is > 100 mg/L at any time during high flows or in turbid waters

5.2 Sediment Quality

The benchmarks used for sediment quality variables are the CCME sediment quality guidelines (SQGs) for the Protection of Marine Aquatic Life (CCME 2003b) (Table 6). For parameters for which no sediment quality guidelines exist, concentrations from the exposure area will be compared with the baseline concentrations and concentrations in the reference areas.

For each parameter, whether its concentration is elevated in the exposure area in comparison to the baseline and reference data will be determined based on a statistical test (ANOVA) on a 95% confidence interval or whether the mean or median is greater than 2 standard deviations.

Baseline data will be collected from the exposure and reference areas before the start of effluent discharge.

Table 6: Summary Sediment Quality Guidelines

Parameter	Unit	CCME(1)	
		ISQG	PEL
Arsenic	mg/kg	7.24	41.6
Cadmium	mg/kg	0.7	4.2
Chromium	mg/kg	52.3	160
Copper	mg/kg	18.7	108
Lead	mg/kg	30.2	112
Mercury	mg/kg	0.13	0.7
Nickel(2)	mg/kg	30	50
Zinc	mg/kg	124	271

Notes:

(1) Canadian Council of Ministers of the Environment (CCME 2001) Sediment Quality Guidelines (SQG) for the Protection of Aquatic Life - Marine.

(2) British Columbia Ministry of Environment (BC MOE 2017b) Working Sediment Quality Guidelines for Marine Aquatic Life.

SECTION 6 • DECISION FRAMEWORK

A decision framework (Figure 2) will used by the Mine to identify an appropriate path through the EEM program, based on the respective situation. The structure of the decision tree is mainly based on the MDMER regulatory requirements and best scientific knowledge and is aimed to prevent or minimize adverse effects on the receiving environment. If any unforeseen adverse effects are identified during the monitoring and their cause is determined, additional mitigation measures will be applied through adaptive management. Mitigation measures developed and implemented with adaptive management will be dependent on the nature and magnitude of the changes observed.

The requirement to conduct the EEM program biological component studies (benthic communities, fish population and fish tissue) can be lifted if no effect has been found during two previous studies. The Mine will continue effluent and water quality monitoring and reporting the results, as required in the MDMER, independently of the biological monitoring studies and reports.

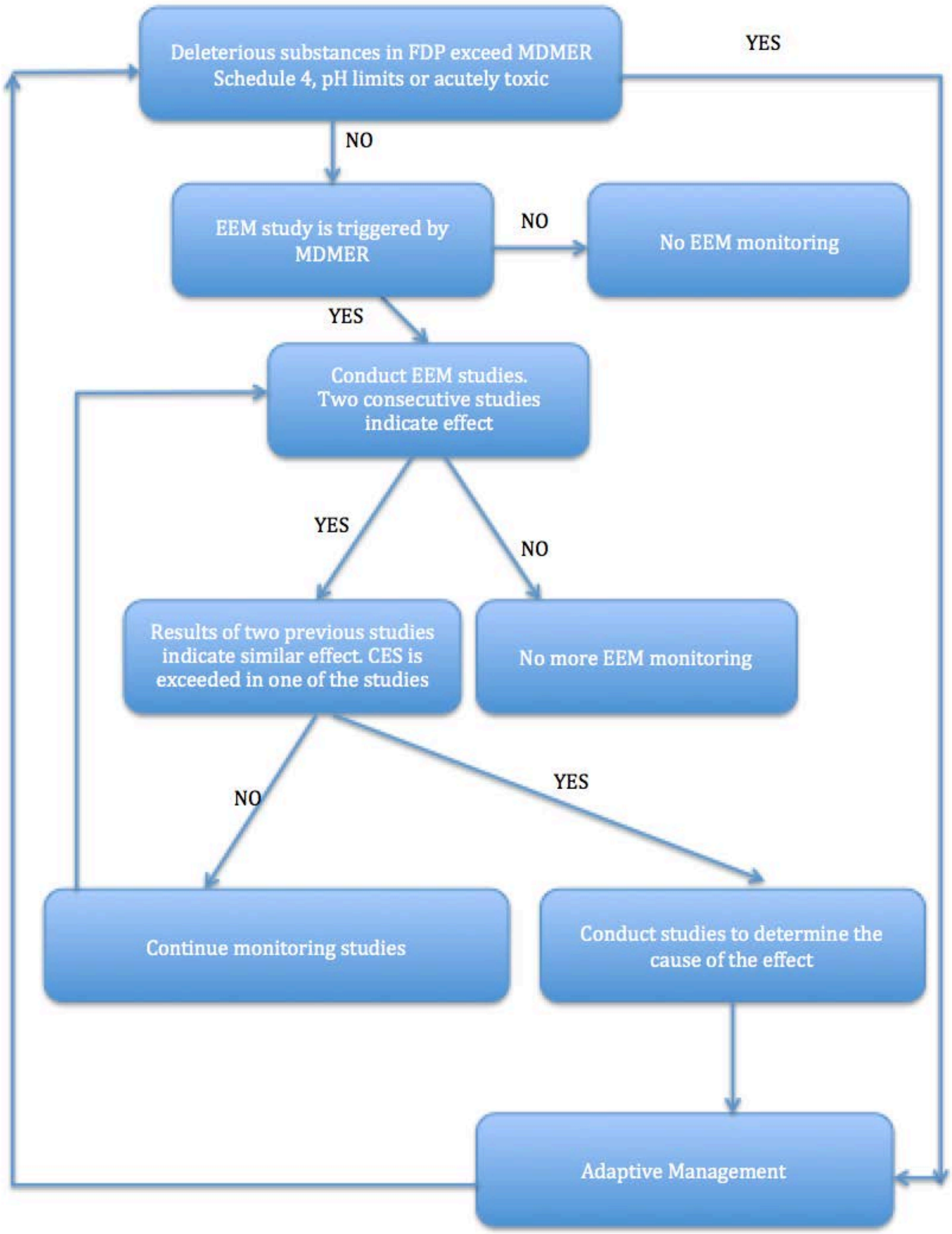


Figure 2: Ocean Discharge Monitoring Plan Decision Tree

SECTION 7 • REPORTING

Reporting will include all the raw data obtained during sampling campaigns, followed by data interpretation, graphical presentation and comparison to applicable guidelines, baseline data and literature data. Results for each component will be synthesized in an integrated manner to evaluate the overall direction of change to the marine ecosystem. The report will have a scientific approach similar to the other documents such as the Aquatic Effects Monitoring Program or EEM reporting and other environmental studies conducted for the Mine.

Comprehensive reports will be prepared and delivered to Environment and Climate Change Canada (as per the MDMER requirements) on the EEM reporting schedule and to NIRB and NWB annually following the discharge of treated groundwater effluent to the marine environment. Reports will be available on the public registry for regulator and stakeholder review and input. Reports filed with ECCC will be reviewed by a Technical Advisory Panel to satisfy the biological components of the MMER EEM program. Data on fish and lower trophic level monitoring will be entered to a federal government website for integration into a national dataset on biological monitoring at metal mines (EC 2012).

SECTION 8 • REFERENCES

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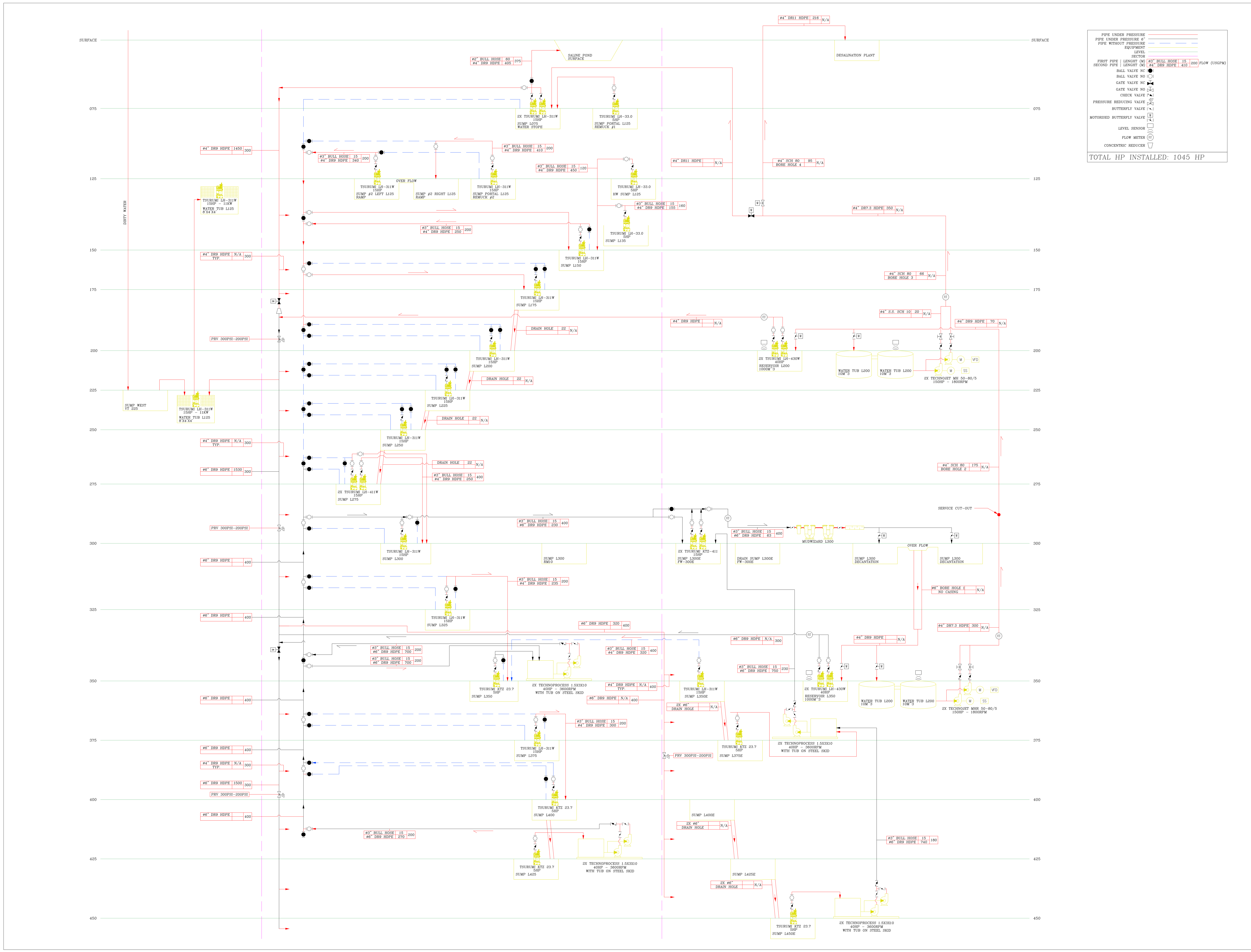
APPENDIX E • UNDERGROUND SUMP FLOW SHEET DIAGRAM



NOTE:

- ESTIMATED LENGTH OF PIPING, TO BE CONFIRMED BY COSTUMER.

NE PAS UTILISER POUR CONSTRUCTION (NOT FOR CONSTRUCTION)

POUR APPROBATION (FOR APPROVAL) DATE : 2018-08-02

REV	DATE	DESCRIPTION	INIT.	INIT.
D	2018-11-15	ISSUED FOR COMMENTS	A.L.	A.L.
C	2018-09-26	ISSUED FOR COMMENTS	P.B.	M.B.
B	2018-09-18	ISSUED FOR COMMENTS	P.B.	M.B.
A	2018-08-08	ISSUED FOR COMMENTS	P.B.	A.L.

ÉMISSION/ISSUED FOR

Technosub

CLIENT:

AGNICO EAGLE

MELIADINE

PROJET/PROJECT:

WATER MANAGEMENT AUDIT

P1806201

TITRE/TITLE:

FLOWSHEET DIAGRAM
MID TERME
NOVEMBER 2018

CONÇU PAR/DESIGNED BY: A. Labbe, P. Eng. — INIT.

DESSIN PAR/DRAWN BY: P. Bellerose — INIT.

VERIFIÉ PAR/CHECKED BY: A. Labbe, P. Eng. — INIT.

APPROUVÉ PAR/APPROVED BY: A. Labbe, P. Eng. — INIT.

ÉCHELLE/SCALE: N/A

DATE DE CRÉATION/CREATION DATE: 2018-08-08

DE PROJET/PROJECT #: P1806201

DE DESSIN/DRAWING #: P1806201-0002

REVISION: D

ÉCHELLE DE TRACÉ/PLOT SCALE: 0.037902

APPENDIX B • FRESHET ACTION PLAN AND SNOW MANAGEMENT PLAN

AGNICO EAGLE

MELIADINE GOLD PROJECT

FRESHET ACTION PLAN

MARCH 2019
VERSION 5

DOCUMENT CONTROL

Revision				Pages Revised	Remarks
#	Prepared by	Revised	Date		
01	AGNICO EAGLE	Internally	March 2016	All	
02	AGNICO EAGLE	Internally	March 2017	All	
03	AGNICO EAGLE	Internally	March 2018	All	
04	AGINICO EAGLE	Internally	December 2018	All	
05	AGNICO EAGLE	Internally	March 2019	All 2 3 5-6 9-10 13 Figure 1 Figure 2 Appendix A	Update to reflect transitional changes to Operations phase Include DCP-1 and DCP-5 in areas of risk during Freshet Update section 2.1.2/2.1.3 noting 5 evaporators and discuss SP3 Update Section 2.8, discuss time of pond construction. Update Section 3.1, discussion of SP3 and update on inspections. Update Section 3.6., 3.7, 4 to reflect changes in freshet management. Updated to include structure names Updated to include SP3 Update to include emulsion pad to inspection list

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1 INTRODUCTION

The purpose of this Freshet Action Plan (Plan) is to provide Agnico Eagle with specific management and mitigation measures to address and manage water associated with the freshet season (Freshet), a response plan and procedures to prevent and to minimize potential negative impacts to the surrounding environment at the Meliadine Site (Site).

The term freshet refers to spring thaw, which can result in inundation of floodplains. Freshet at Meliadine typically takes place between May 15 and July 30. In some years, Freshet can also happen in early fall, when freezing re-occurs (mid-October) and then thaws. There are areas at the Site that are vulnerable to excess water produced during Freshet; the objective of this document is to identify those areas, and to develop a plan with defined roles and responsibilities to manage excess water produced on site.

The following guiding principles are applicable to the Plan:

- To ensure that mine contact water from runoff or seepage is managed to prevent adverse environmental impacts;
- To ensure the health and safety of Agnico Eagle employees and contractors; and
- To ensure the Site is in compliance with the Nunavut Water Board (NWB) Type A Water Licence No.: 2AM-MEL1631 (Type A Licence).

The Plan identifies areas of risk during Freshet, risk management and the procedures necessary to address potential concerns.

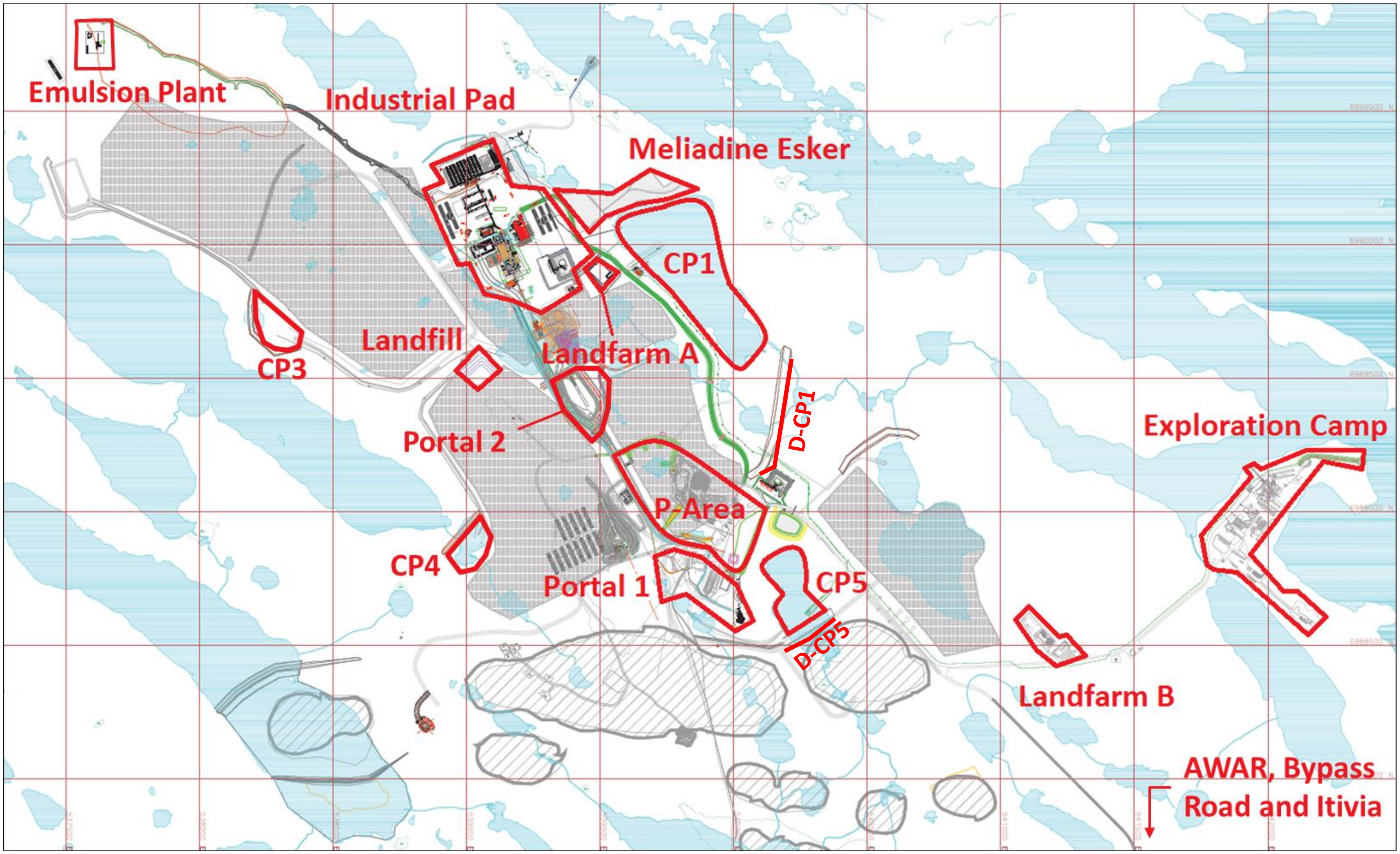
2 AREAS OF RISK DURING FRESHET

The key areas of risk during Freshet at the Site include the following:

- P-Area
- Portal 1 Sump 1 (Sump LV50)
- Portal 2 Sump 1 (Sump LV50)
- New (Type A) and old (Type B) Landfarms
- Landfill
- All Weather Access Road (AWAR) and Quarries along the road
- Infrastructure Areas; including the Exploration Camp area, Portal 1 & 2 and the Industrial Pad Areas
- Containment Pond 1 (CP1), Containment Pond 3 (CP3), Containment Pond 4 (CP4), and Containment Pond 5 (CP5)
- D-CP1 and D-CP5
- Meliadine Esker Quarry
- Bypass Road
- Itivia laydown and fuel handling facility (Itivia)

Identified areas of risk at Site are shown in Figure 1, and are described in the following section.

Figure 1: Site Plan View with Areas of Risk at Site during Freshet



2.1 P-Area

The P-Area is the initial containment area identified for precipitation events; snow melt or Freshet water that has come in contact with mine waste rock or surface works in the area of the Underground Portals (contact water).

The P-Area includes three containment areas (Figure 2); P1 Containment Area (P1), P2 Containment Area (P2), and P3 Containment Area (P3) and has a cumulative capacity of 46,041 m^3. Periodic pumping to P1, from P2 and P3, is planned to manage water levels and to assist with active evaporation at P1.

2.1.2 P1

P1 is the largest containment of the three ponds that make up the P-Area (20,781 m^3). Precipitation, water drainage from the adjacent waste rock pile, and any water pumped from P2 or P3 will also be contained within P1. Five evaporators are installed at P1 to assist with active evaporation of water contained at P1 during the open water season at Site.

2.1.3 P2

P2 is directly adjacent and down-gradient to P1. P2 allows for additional contact water, precipitation and waste rock drainage water management with a capacity of 6,828 m^3. Additionally, P2 is the main containment area for water pumped to surface from underground Sump 1 (LV50). LV50 is the receptor of surface water that flows from the surface to Portal 1. Water from P2 is pumped to P1 to be actively evaporated.

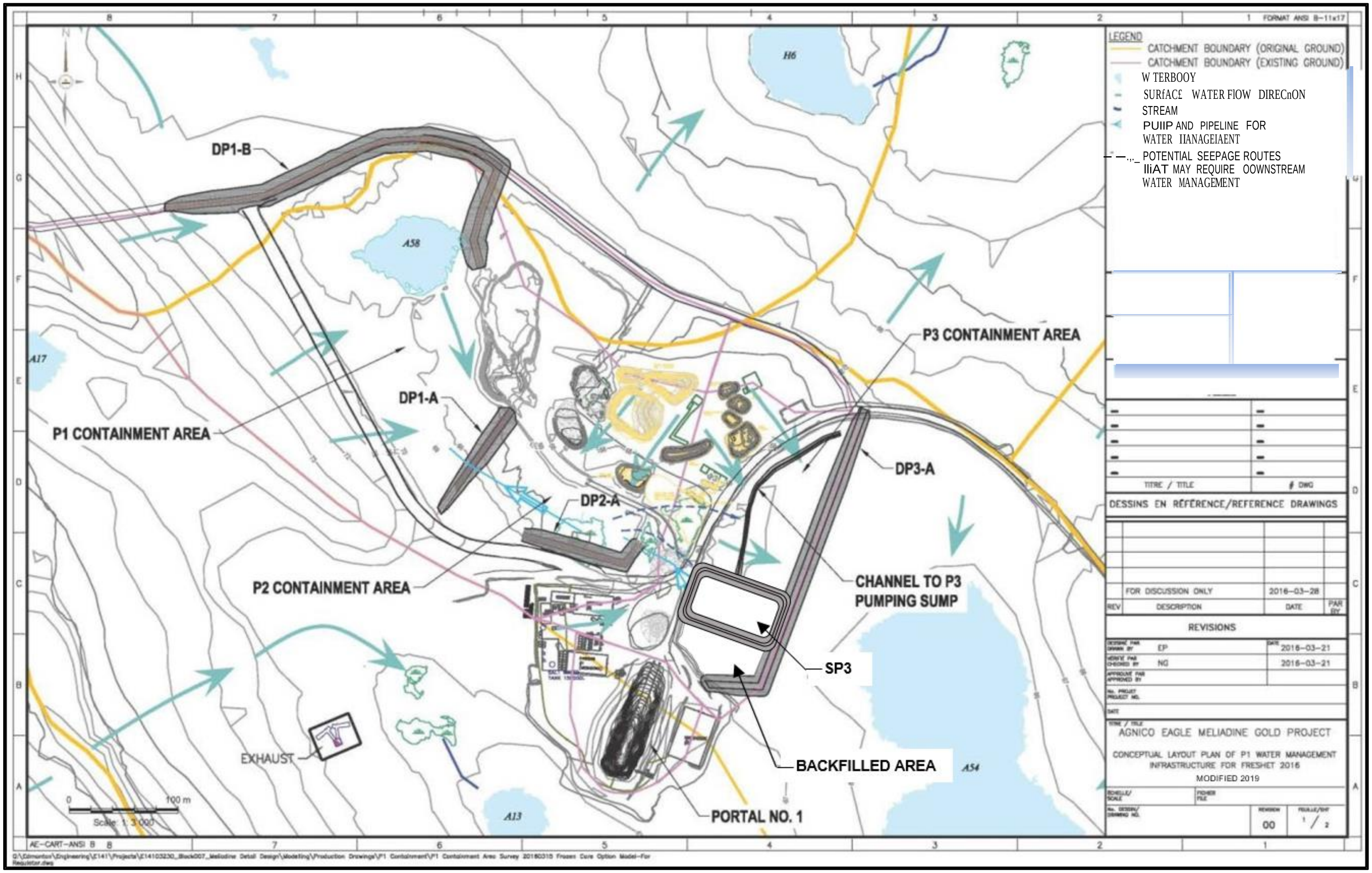
2.1.3 P3

P3 is down-gradient to P1 and P2. P3 contains surface runoff from the surrounding portal entrance surface area, precipitation, and inflow water from Waste Rock Storage Facility 2 (WRSF2) and temporary ore piles to the north-northwest of P3. Snow removed from the selected areas at the Site throughout winter months, will be directed to P3. Water from P3 is pumped to P1 to be actively evaporated.

2.1.4 Saline Pond 3

Saline Pond 3 (SP3) will be constructed within the containment area of P3 and will have a minimum storage capacity of 5000 m^3. The design of the containment structure will use an elevated dike approximately 2 m higher than the adjacent road surface. As such, runoff water in this area should not flow into SP3, but is expected to be contained by the remaining containment area of P3.

Figure 2: P-Area Plan View



2.3 PORTAL 1 SUMP 1 (LV50 SUMP)

LV50 is located 50 meters below grade (mbg) and is the first sump, closest to the entrance of Portal 1. Snowmelt and surface run-off that flows to the portal entrance (the lowest elevation at the Site), down the underground haulage ramp to sump LV50, is pumped from LV50 to the P-Area. The overall capacity for Portal 1 Sump 1 is 29 m^3. Water pumped from Portal 1 Sump 1 to P2 is measured with a volumetric flow meter and recorded daily.

2.4 PORTAL 2 SUMP 1 (LV50 SUMP)

LV50 is located 50 meters below grade (mbg) and is the first sump, closest to the entrance of Portal 2. Snowmelt and surface run-off that flows to the portal entrance, down the underground haulage ramp to sump LV50 is pumped from LV50 to Channel 1. The overall capacity for Portal 2 Sump 1 is 55 m^3. Water pumped from Portal 2 Sump 1 to Channel 1 is measured with a volumetric flow meter and recorded daily.

2.5 LANDFARM

The Type A Licence Landfarm is located adjacent and east of the Industrial Site Pad and is designed to receive soils, rock, snow, and ice contaminated with petroleum hydrocarbons. This will include light hydrocarbons such as diesel and gasoline (Agnico Eagle 2016). It was assumed that an annual volume of 500 m^3 of contaminated ice and snow would require management and the landfarm has been designed to account for this volume.

The Landfarm has geotextile liners and is filled with soil. Water that pools, collects or flows from the Landfarm needs to be collected for monitoring and treated before it is discharged to CP1.

2.6 ALL WEATHER ACCESS ROAD (AWAR)

The All-Weather Access Road (AWAR) was built in 2013 to connect the Site to the hamlet of Rankin Inlet. The road is approximately 23.8 km long with twenty-two water crossings; three bridge crossings and nineteen culverts installed (Figure 3).

2.7 INFRASTRUCTURE AREAS

Infrastructure Areas represent buildings, pads and towers installed at the Site and include the Industrial Pad, Exploration Camp, and Emulsion Plant (Figure 1).

2.8 CP1, CP3, CP4 AND CP5

Engineered water containment dikes constructed in 2017 at lakes A54 and H17 were developed as CP5 and CP1, respectively. The dikes are designed to contain contact water within the footprint of the Site and prevent pollution provisions of the *Fisheries Act*. Both CP1 and CP5 will be used for Site contact water and snow and ice collection prior to Freshet. CP1 and CP5 are illustrated in Figure 1 and discussed in Section 4 of this report.

CP3 and CP4 are containment ponds designed to collected runoff from the Tailings Storage Facility (TSF) area and Waste Rock Storage Facility 1 (WRSF1) area, respectively. CP3 construction was completed in Q4 of 2018 and CP4 construction is scheduled to be complete prior to freshet 2019. CP3 and CP4 design plans implement engineered thermal protection berms. Maximum operating levels within CP3 and CP4 are such that D-CP3 and D-CP4 will not be required to retain water (see Water Management Plan).

2.9 BYPASS ROAD

The Bypass Road is a 5.9 km access road that provides a means to divert site-related traffic around the community of Rankin Inlet. The Bypass Road spans from the northwest margin of Itivia to km 2.9 on the AWAR (Figure 4).

2.9 ITIVIA

Itivia is located in Rankin Inlet and is accessed by Site from the AWAR and Bypass Road. In combination with the Bypass Road, Itivia is intended to support the Site to divert site-related traffic around the community of Rankin Inlet. Itivia is also used for fuel storage and as a laydown area for barge shipments. The location of Itivia is shown on Figure 3 and the plan view of the Itivia Site is presented as Figure 5. A culvert is installed to divert runoff around the Itivia Site and to allow passage of run-off from the Itivia laydown area (Figure 5).

Figure 3: AWAR Map Showing Water Crossing Location

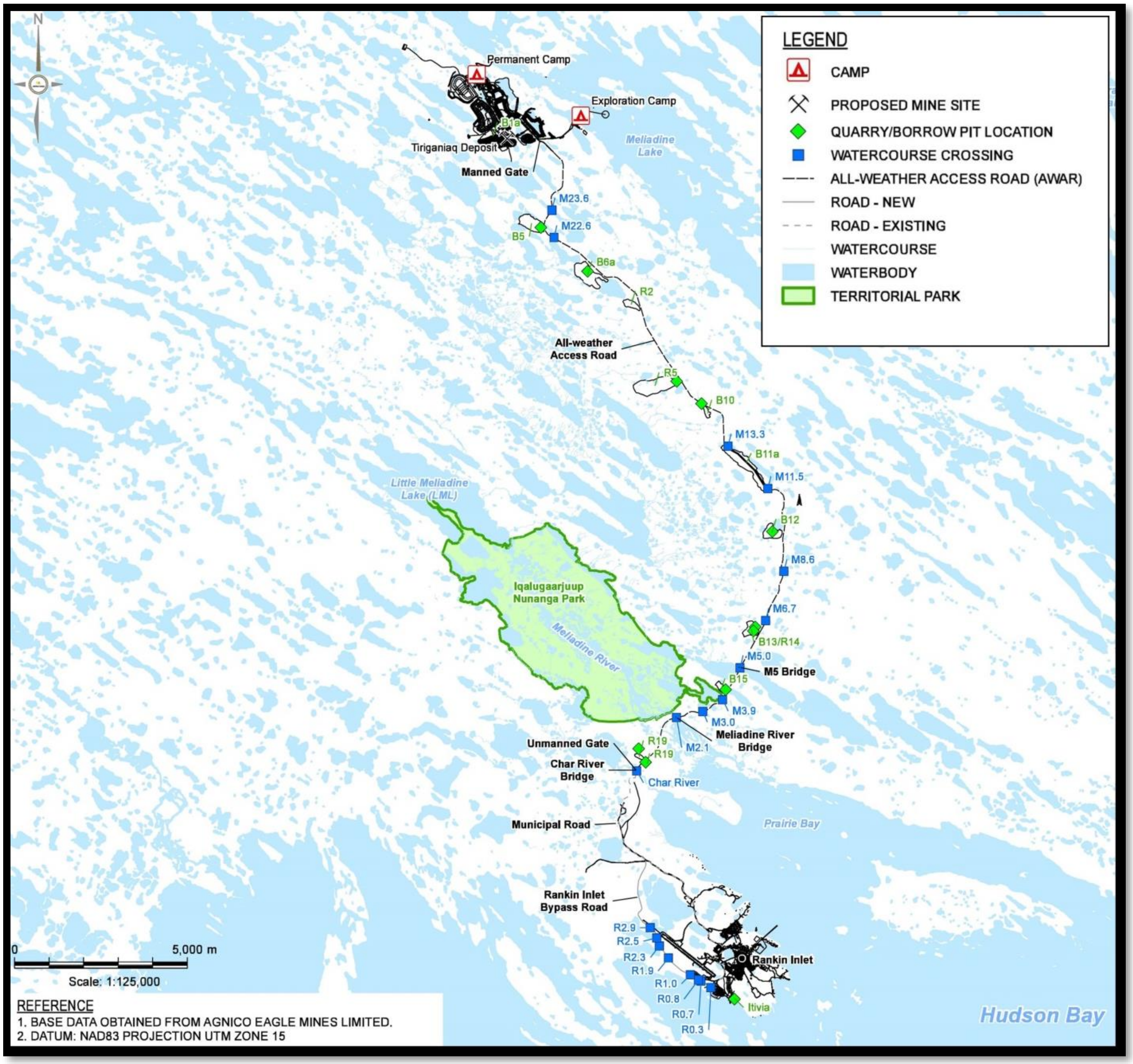
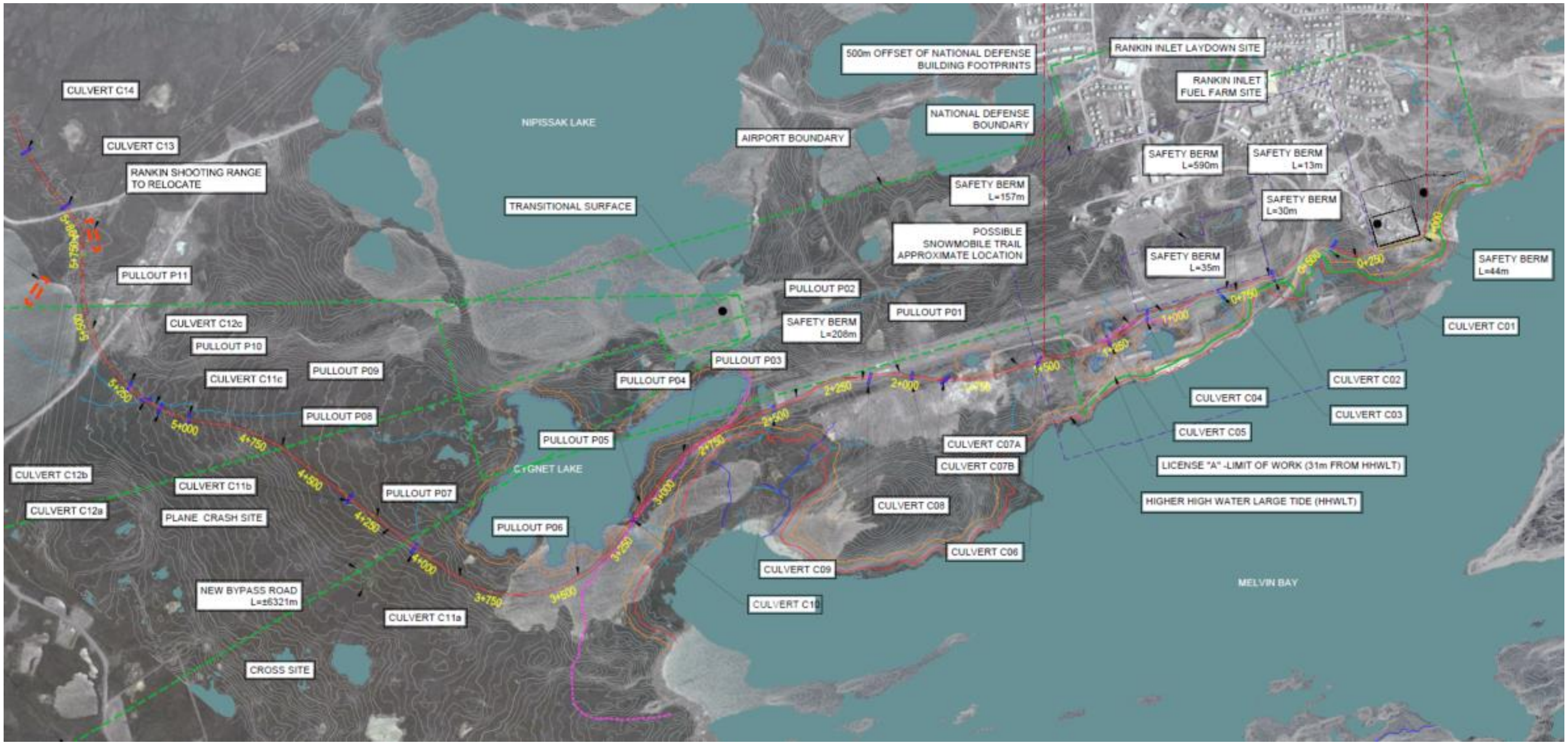


Figure 4: Bypass Road and Culvert Locations



3 FRESHET RISK MANAGEMENT

Managing the risks prior to Freshet is a primary objective at Site. Planning and preparing before Freshet alleviates some of the risk from excess water that may suddenly occur, and ensures compliance with applicable regulations. This is managed by removing water (pumping) at containment pond areas prior to winter freeze (fall) to allow for increased capacity from precipitation, snow and ice removal on roads, road water crossings, culverts, ditches, and select containment ponds after winter freeze and before Freshet (winter and spring).

Risk management for the Site areas during Freshet are described below and Appendix A presents the Freshet Action Plan Procedure for preparation prior to, during and after Freshet. Section 4 describes snow management at Site and Appendix B presents the Snow Management procedure.

3.1 P-AREA RISK MANAGEMENT

The following management practices are maintained at the P-Area during Freshet and are described in more detail in Appendix A:

- Water levels will be monitored. The water level will not exceed the maximum design elevation in any of the three containment ponds (P1, P2 or P3). P3 water levels will be kept as minimal as possible to keep water from affecting the base of Saline Pond 3 (SP3), which will be constructed in the southwest portion of P3 prior to freshet 2019 (see Water Management Plan for details).
- Agnico Eagle will conduct daily visual inspections of the P-Area. These will include visually monitoring the base of the downstream side of dikes DP1-B and DP3-A (see Figure 2) for seepage, sedimentation deposition, and erosion. If seepage or water with increased total suspended solids (TSS) is noted during inspections, water will be sampled, contained, and pumped back to the P-Area. These volumes pumped will be recorded and documented.
- Agnico Eagle will conduct weekly structural inspections of the dikes and note observed seepage. Inspections will also include monitoring the base of SP3 for settling, slumping and cracking.
- Weekly thermistor readings within P-Area berms will be taken and assessed by Engineering to monitor the potential for seepage through the containment berms.
- Active evaporation from use of the evaporators will contribute to managing the quantity of water contained at P-Area.
- Weekly water sampling during Freshet.

If an emergency occurs, such as the dikes/berms indicating compromised integrity, Agnico Eagle will discharge the water to CP5.

If CP5 does not have the capacity for water from the P-Area, water will be diverted to Saline Pond 1 (SP1) or to the Underground Water Stope for storage until a system for suitable water treatment to meet the Type A Licence and/or MMER discharge criteria. Water may also be diverted to Saline Pond 2 (SP2), pending the commissioning of the facility.

3.2 PORTAL 1 SUMP 1 RISK MANAGEMENT

If the P-Area becomes filled to capacity and LV50 sump needs to be pumped, the water from LV50 will flow down gradient to the Underground Water Stope.

3.3 Landfarm Risk Management

If there is any excess water collected at the Landfarm during freshet and treatment is not immediately possible, the excess volume will be transferred to the contaminated snow cell located in the Northeast extent of P1. If the snow cell is at capacity and the Landfarm contains excess water, the water will be sampled and, pending acceptable results, the water will be moved to CP1. If results do not allow transfer to CP1, water will be stored in totes until treatment is possible.

In the event that the water sample results do not allow transfer to CP1, potential treatment methods are as follows:

- Oil/water Separator
- CI Agent E-VAC Waste Water Filter System
- Carbon Filter System

If a suitable treatment cannot be completed, the water will be shipped south in totes or bladders for disposal in a certified disposal facility.

3.4 AWAR, Bypass Road and CP3/CP4 access road Risk Management

The following management practices are maintained to ensure the integrity of the AWAR, Bypass Road and CP3/CP4 access roads before and during the Freshet and are described in further detail in Appendix A:

- Large culverts will be heated/steamed as necessary to allow the free flow of Freshet water.
- Prior to Freshet, water crossings and culverts will have snow removed from ice surface on the up and downstream side of the crossing to allow free flow of water.
- Visual inspections of AWAR will be undertaken as to the structural integrity of the abutments and road integrity by the E&I Supervisor.
- Weekly (minimum) written inspections throughout freshet and daily during excessive rainfall response including TSS transport, culvert/crossing function, flow rates, and integrity of roads will be completed by the Environment Department in conjunction with the E&I Department.

If soil erosion or ground surface scouring are observed, the E&I Department will be notified for repairs. TSS barriers, silt fences, straw logs or other sediment control methods will be implemented as required.

3.5 Infrastructure Areas

Risk management practices for the main Infrastructure Areas at the Site during Freshet are described in the following sections.

3.5.1 Camp Pads and Surroundings

Risk management practices are maintained at the Exploration Camp, Main Camp and surrounding camp areas as follows:

- Clearing off ice and debris from culverts prior to and during freshet;
- Daily visual inspections for excessive water pooling. If pooled water is observed to flow into a water body, a water sample will be collected and monitored for TSS. Follow-up samples will be collected on a weekly basis thereafter;
- Daily visual inspections for snowmelt runoff. If runoff is observed to flow into a water body, a water sample will be collected and monitored for TSS. Follow-up samples will be collected on a weekly basis thereafter;
- Daily visual inspections to ensure flow through culverts and along channels is not impeded; and

- TSS transport will also be monitored at the culvert beside the garage that flows straight to Meliadine Lake. This area will be monitored for TSS, and preventative measures (install straw wattles and/or booms) will be installed to prevent deleterious substances from entering Meliadine Lake.

3.5.2 Industrial Pad and Access Road

The following management practices are maintained to ensure the integrity of the industrial pad and access road:

- This area will be monitored for turbidly and preventative measures (install straw wattles and/or booms) will be implemented to prevent deleterious substances from entering Meliadine Lake.

3.6 CP1, CP3, CP4, CP5, AND QUARRIES

Risk management practices for CP1, CP3, CP4, CP5, the Meliadine Esker and Quarries include discharging/pumping the water prior to winter freeze to be treated and/or discharged as per the Type A Water Licence and the Water Management Plan. If water is observed to be flowing or ponding, it will be sampled to ensure deleterious substances and TSS is not released to surrounding water bodies (Part I, Item 11 of the Type A Water Licence). Inspections of CP1, CP3, CP4 and CP5, and associated water management structures or thermal protection berms, will be conducted following Part E Item 15 of the Type A Water Licence and Section 3.12 of the Water Management Plan.

The south side of D-CP5 acts as a natural sump due to it formerly being part of Lake A54, and has the potential to impound water against the rear-side of D-CP5. To mitigate potential impact of any impounded water against the dike, snow will be removed from the downstream slope/toe of D-CP5. Daily inspections will be performed at this location and pumping rates will be maintained to ensure potential impacts are mitigated.

Culvert 3, which is designed to connect flow from Channel 1 to CP1, is prone to blockage due to its elevation relative to CP1 and due to drifting of snow along the roadside. Culvert 3 will be cleared mechanically and/or thermally prior to freshet to ensure flow from Channel 1 to CP1. Culvert 3 will be monitored daily during freshet to ensure flow passage is maintained.

3.7 ITIVIA

The following management practices are maintained to ensure the integrity of Itivia and the Bypass Road:

- The culvert installed between the Itivia laydown and the existing laydown areas (Figure 4) will be cleared of snow and ice prior to freshet and will be monitored closely for TSS transport;
- Rip rap was installed around the culvert to control erosion and a decantation sump will be maintained downstream to collect suspended sediment;
- The upstream and downstream extents of the culvert area will be monitored for turbidity and preventative measures (install straw wattles and/or booms) will be implemented to prevent deleterious substances from entering Hudson's Bay; and
- Weekly water sampling at locations of runoff.

4 SNOW MANAGEMENT

Proper snow management during the winter contributes to risk mitigation from excess water during Freshet and prevents possible environmental impacts. *The Snow Management Procedure* (Procedure Number MEL-ENV-0017) (Appendix B) presents the plan to efficiently manage snow at the Site.

Snow that is collected and moved from the fuel farm, landfarm, the area surrounding the Portal 1 and Portal 2 entrances, waste rock piles and surrounding P-Area will be moved and collected at P3. During construction of SP3, snow and ice within the southwest portion of P3 will be moved to P2. Snow and ice from the other areas at the Site are removed from roadways with a snow blower or plow and /or collected and transported to the CP1 or CP5. Figure 6 illustrates the locations for snow collection during the winter and prior to Freshet. Figure 7 illustrates the snow management and storage areas for Itivia.

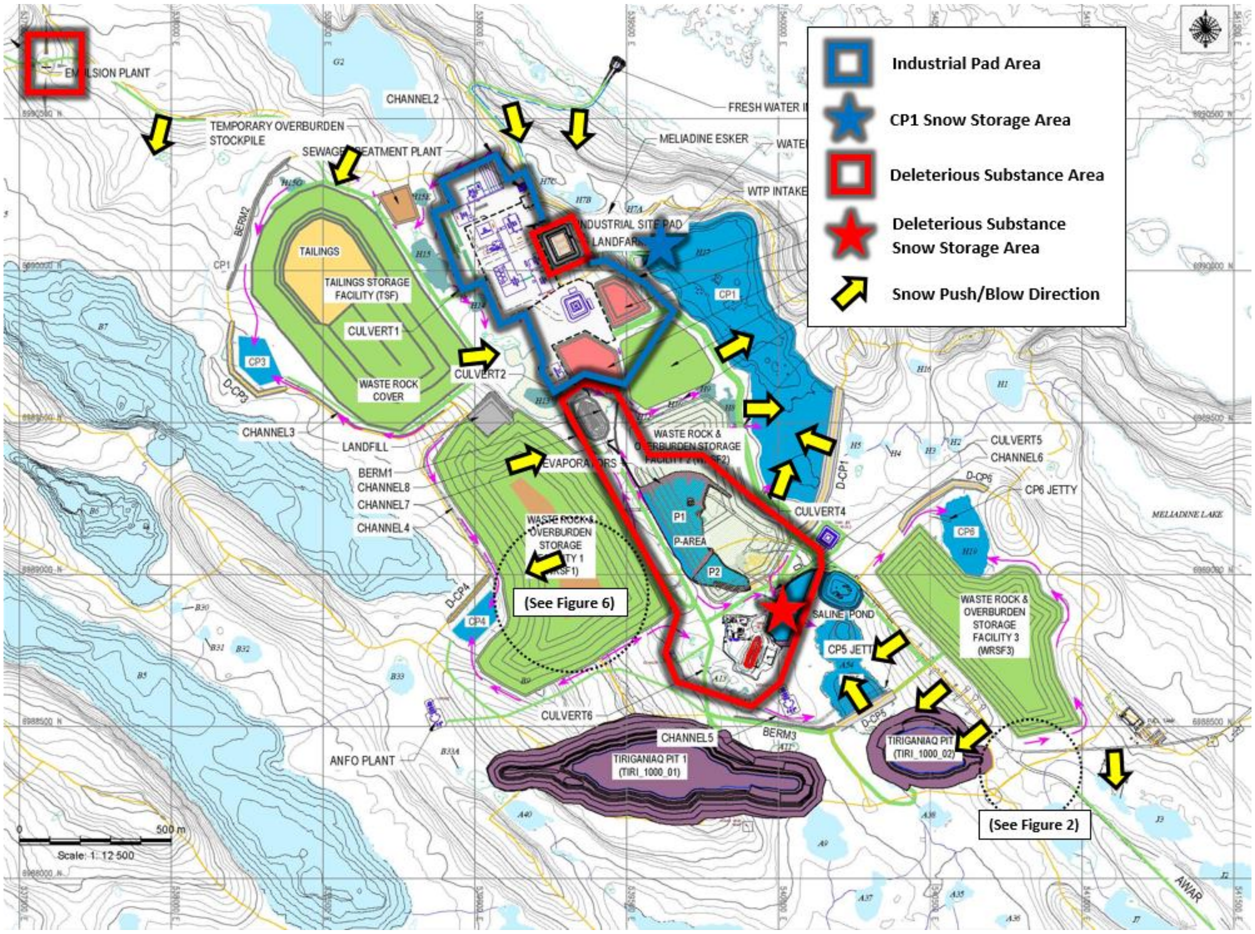


Figure 5: Snow Management Plan on Site

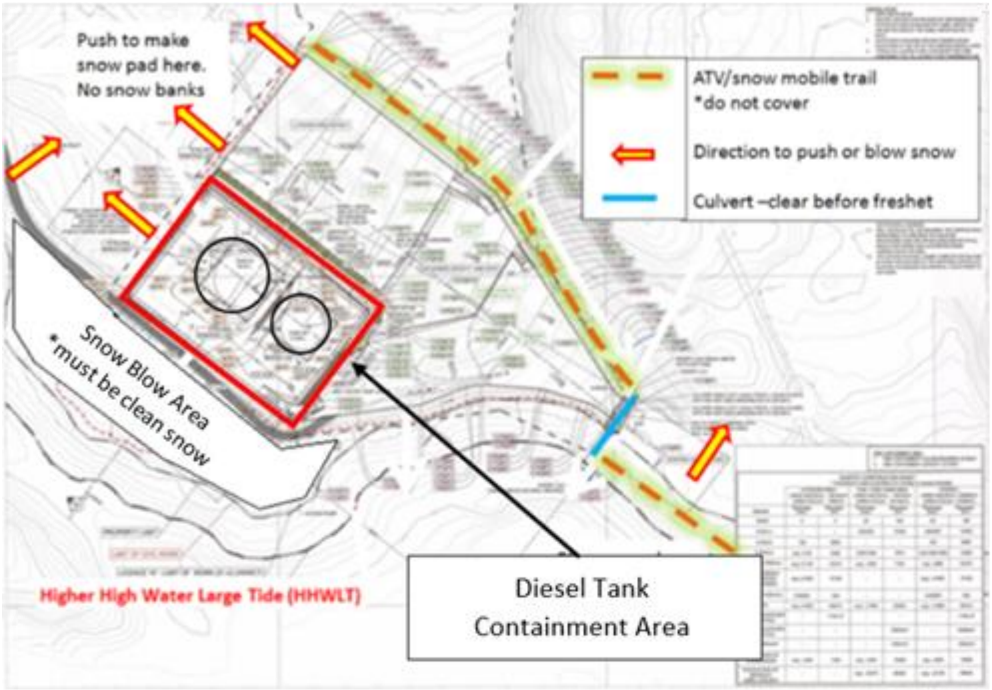


Figure 6: Itivia Snow Management Areas

5 REFERENCES

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Agnico Eagle. 2016. Meliadine Gold Project: Water Management Plan. Version 2. March 2017.

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APPENDIX A: FRESHET ACTION PLAN PROCEDURE

	DOCUMENT ID: MEL-ENV-Freshet Management Plan Procedure
People concerned: Agnico Eagle employees, contractors, visitors on the Meliadine site	**Effective Date: March 28, 2018**

This procedure corresponds to the required minimum standard. Each and everyone also have to comply with the rules and regulations of the Nunavut Government in terms of health and safety at work.

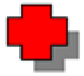
Rev #	Date	Description	Initiator
1	2018-03-28	Change to Intelex Format	Matt Gillman
2	2018-12-14	Updated for 2019 Season	Matt Gillman
3	2019-03-12	Updated for 2019 Season, updated snow procedure spreadsheet to include D-CP5 and SP2	Matt Gillman

Objective:

- To provide a plan to prevent potential environmental incidents at the Meliadine Site (Site) caused by the freshet season (Freshet) by recognizing specific areas for risk at the Site, possible actions to be undertaken and the departmental responsibilities to address the required actions.

Definitions (If applicable):

Tool/Equipment Required	PPE Required
• N/A	• N/A

<table>
<tr><th colspan="6">Procedure</th></tr>
<tr><th colspan="5">Winter and Spring – Preparation Prior to Freshet[1]</th><th>Risks/ Impacts</th></tr>
<tr><th colspan="2">Area for Risk</th><th>Action</th><th>Responsible Department</th><th>Approximate Dates</th><td rowspan="12">


</td></tr>
<tr><td>P-Area</td><td>P1, P2 & P3</td><td>• Snow must not be stockpiled to be greater than the containment capacity</td><td>Environment to coordinate with Energy & Infrastructure, Engineering and Construction</td><td>March - May</td></tr>
<tr><td rowspan="4">AWAR, Bypass Road & CP3/CP4 Service Roads</td><td rowspan="2">Culverts</td><td>• Weekly Inspections</td><td>Environment</td><td>March - May</td></tr>
<tr><td rowspan="3">• Snow and ice clearing[1], including ice and snow that may impede free water flow through culverts (including the culvert at Itivia) and at major water crossings
• Effort is to be made to ensure road surface material is not removed during snow clearing.
• Ensure snow is not stockpiled along roadside
• Repairs (mark culvert locations, add armouring at downstream around culverts and bridges, replace pipe as needed, and document maintenance and repairs)
• Monitor signs of erosion (especially downstream at culverts 14.9 and 16 Km on AWAR)
• Notify the Environmental Department about any areas for concern[2, 3]</td><td rowspan="3">Energy & Infrastructure</td><td rowspan="7">Winter Freeze to May (start of thaw)</td></tr>
<tr><td>Major Crossings</td></tr>
<tr><td>Overall Roads</td></tr>
<tr><td rowspan="4">Industrial Pad & Emulsion Pad</td><td rowspan="2">Culverts</td><td>• Weekly Inspections</td><td>Environment</td></tr>
<tr><td rowspan="3">• Snow and ice clearing[1], including ice and snow that may impede free water flow through culverts and at major water crossings
• Repairs any erosion
• Notify the Environmental Department about any areas for concern[2, 3]</td><td rowspan="3">Energy & Infrastructure</td></tr>
<tr><td>Channels and ditches</td></tr>
<tr><td>Access Road</td></tr>
<tr><td colspan="2">Quarries</td><td>• Snow and ice clearing[1], including ice and snow that may impede free water flow through culverts and at major water crossings
• Re-grade disturbed areas to provide appropriate drainage</td><td>Construction
Environment (for Sampling)</td><td>Winter Freeze to May (start of thaw)</td></tr>
<tr><td colspan="2">D-CP5</td><td>• Snow will carefully be cleared from the downstream toe of D-CP5.
• Care will be taken not to destroy pump control station</td><td>Energy & Infrastructure</td><td>2-3 weeks prior to freshet (late-April to early-May)</td></tr>
</table>

Note:
[1] See the *Snow Management Procedure* (Procedure No.: MEL-ENV-0017) for additional information for snow removal at the Site.
[2] The Environmental Department will assess the area of concern and action will be undertaken to comply with the Nunavut Water Board (NWB) Water Licence No.: 2AM-MEL1631 (Licence)(i.e. collect field parameters or water samples for analysis of total suspended solids, turbidity, or any deleterious substance).
[3] Areas of concern are defined as high water areas on roads, near the up gradient opening of a culvert, flowing water with sediment, spills, wildlife, etc.

Spring and Summer – During Freshet or During Heavy Rainfall				***Risks/ Impacts***
Area for Risk	**Action**	**Responsible Department**	**Approximate Dates**	
P-Area				
P1, P2, and P3	• Daily visual inspection • Daily monitor and record water levels • Weekly written inspection • Water sampling	Environment	May - October	
	• If water levels or structural integrity of berms are observed to be compromised, immediate action is required. Notify Supervisor	Engineering		
	• P2 and P3 water volume should be kept as minimal as possible. Pumping of this water should occur regularly (daily) • Measure and record pumping volumes daily and report to Environment weekly	Energy & Infrastructure		
Evaporators	• Commission after sub-zero temperatures no longer occur • Operate as efficient as possible	Energy & Infrastructure		
DP1 and DP3 Trenches /Seep	• Install pump and flow meter at trench to collect seep • Pump water to respective containment area (P1 or P3) • Measure and record pumping volumes daily and report to Environment weekly	Energy & Infrastructure		
AWAR, Itivia, Bypass Road, CP3/CP4 Access Roads				
Culverts	• Inspections for free flow water through culverts and major crossings, pooling water on road, and integrity of road and abutments (Weekly (minumum) or after heavy rainfall between May and October and daily during peak flow) • Sample as required[2]	Environment	May - October	
AWAR Major Crossings Overall Roads and Itivia	• Snow and ice clearing[1], including ice and snow that may impede free water flow through culverts and at major water crossings • Repairs and erosion/sediment control implementation • Notify the Environmental Department about any areas for concern [2, 3]	Energy & Infrastructure Environment (for Sampling)		
Quarries	• Repairs and erosion/sediment control implementation • Re-grade disturbed areas to provide appropriate drainage • Notify the Environmental Department about any areas for concern [2, 3]	Construction Environment (for Sampling)		

Spring and Summer – During Freshet or During Heavy Rainfall			
New Camp Pad/Industrial Pad			
Culverts	• Daily inspections for free flow water through culverts and major crossings, pooling water on road, and integrity of road and abutments	Construction Environment (for Sampling)	May - October
Channels and Ditches Access Road	• Snow and ice clearing[1], including ice and snow that may impede free water flow through culverts and at major water crossings • Repairs and erosion/sediment control implementation • Notify the Environmental Department about any areas for concern [2, 3]	Construction Environment (for Sampling)	May - October
Infrastructure Pads			
Exploration Camp	• Daily visual inspections • Water sampling as required	Environment	May - June
Landfarm Structure	• Daily inspection of the landfarm retaining wall • Daily visual inspection for seepage • Collect a seepage water sample for hydrocarbon analysis. If seepage is present it should be immediately sampled and the seep be controlled. Whether by creating a sump and pumping back the water or by other methods.	Environment	
Landfarm	• Visually monitor excess water in containment area • Monitor seep (weekly) and collect water sample • Sample water according to the Licence	Environment	Mid-June and September
	• If excess water is present and cannot be treated immediately, sample in preparation for discharge to CP1		10 days prior to pumping
	• Once sample results have received, and if water is acceptable to be pumped to CP1 meets, water can be pumped to CP1 at a low flow to avoid erosion • Measure and record pumped volume	Energy & Infrastructure	Mid-June and September
Garage (Agnico Eagle)	• Install sump to contain excess water • Install straw wattles for sediment control on the other side of the road	Energy & Infrastructure	May
	• Daily monitoring of TSS and turbidity and possible contaminant runoff	Environment	May - June
Core Box Cemetery and Culvert	• Install straw wattles for sediment control on the other side of the road	Energy & Infrastructure	May
	• Daily monitoring of TSS and turbidity and possible contaminant runoff	Environment	May - June
Emulsion Plant Pad	• Weekly Inspections • Water sampling of runoff as required for ammonia, nitrates, turbidity and TSS	Environment	May - June
	• Daily visual inspection for pooling water and water run off form pad to tundra, if noticed immediately contact environment department	Dyno Nobel	

Note:

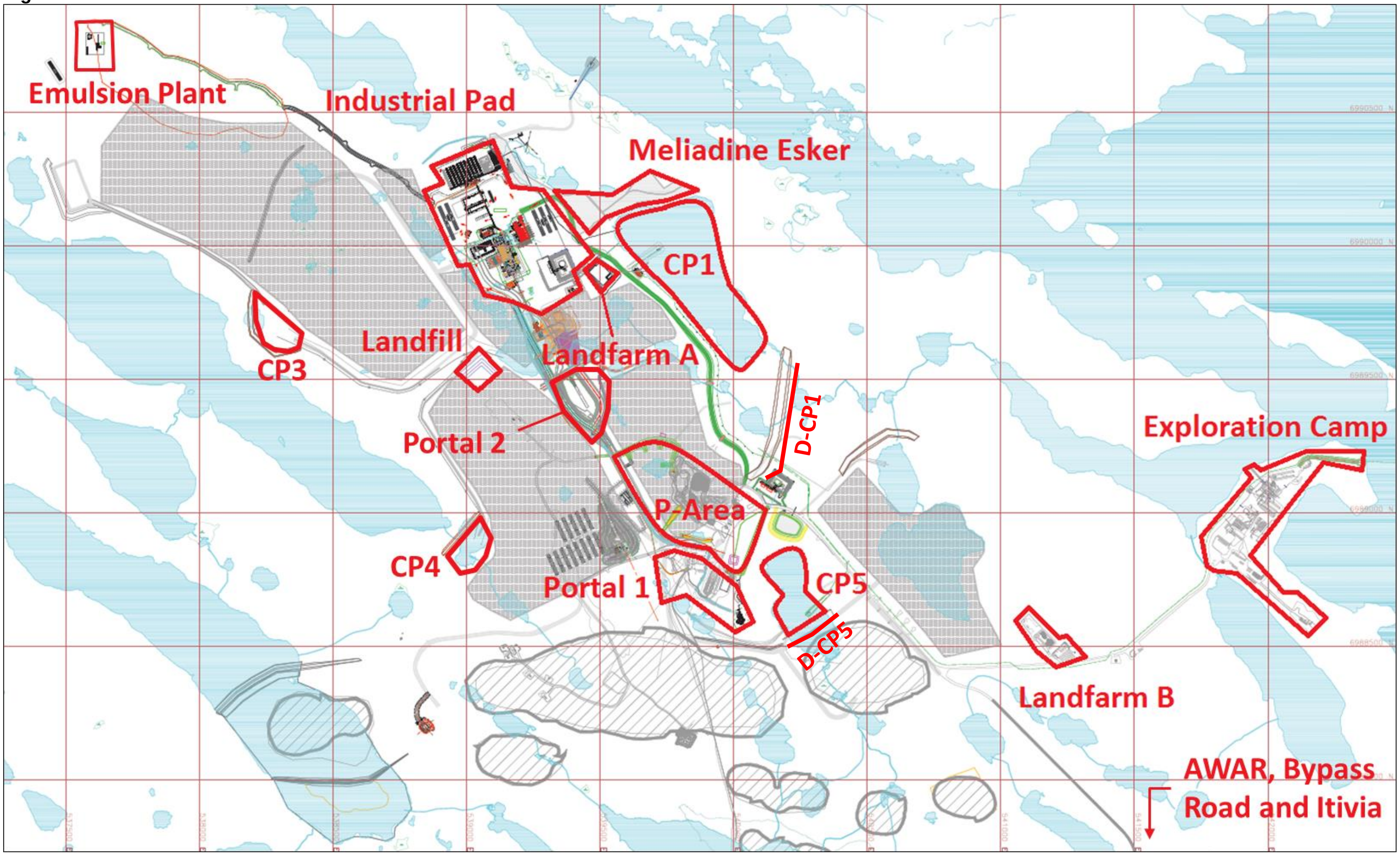
[1] See the *Snow Management Procedure* (Procedure No.: MEL-ENV-0017) for additional information for snow removal at the Site.

[2] The Environmental Department will assess the area of concern and action will be undertaken to comply with the Nunavut Water Board (NWB) Water Licence No.: 2AM-MEL1631 (Licence)(i.e. collect field parameters or water samples for analysis of total suspended solids, turbidity, or any deleterious substance).

[3] Areas of concern are defined as high water areas on roads, near the up gradient opening of a culvert, flowing water with sediment, spills, wildlife, etc.

Fall – Preparation Prior to Winter Freeze					Risks/ Impacts
Area for Risk		**Action**	**Responsible Department**	**Approximate Dates**	
LV50		• Survey water level and calculate water volume and provide to Environment, and/or • Measure and record flow meter volume prior to pumping and after pumping and provide to Environment • Remove pumps and prepare equipment for maintenance and winter storage	Mining	Prior to pumping to P2 (Late September)	
		• Pump to P2		Late September/Early October	
Lv75/Water Stope		• Pump to SP1, SP2 (pending approval), or SWTP		June - September	
P-Area	P2 and P3	• Pump water to P1 for active evaporation	Energy & Infrastructure	June - September	
	P1, P2 & P3	• Remove pumps and prepare equipment for maintenance and winter storage		At beginning of winter freeze	
	Evaporators	• Decommission for winter and prepare equipment for maintenance and winter storage		Prior to any sub-zero temperatures	
A8		• Move pump house/pump closer to Site		Late September	
CP1		• Weekly (during flow) or monthly (baseflow) written inspection • Water sampling	Environment	June - September	
		• Pump water to discharge at Meliadine Lake	Process Plant		
		• Remove pumps and prepare equipment for maintenance and winter storage		Late September/Early October	
Downstream D-CP1		• Pump water to CP1	Energy & Infrastructure	June - September	
		• Remove pumps and prepare equipment for maintenance and winter storage		Late September/Early October	
CP5/D-CP5		• Restrict vehicle access on D-CP5 to prevent instrument damage • Pump water to CP1/SWTP		Late September	
Downstream D-CP5		• Pump water to CP5		June - September	
		• Remove pumps and prepare equipment for maintenance and winter storage		Late September/Early October	
Saline Ponds		• Remove pumps and prepare equipment for maintenance and winter storage		First week of October	

Figure 1: Areas of Risk



Related Documentation (If applicable):
• 2018 Freshet Management Plan • MEL-ENV-0017 - Snow Management Procedure

References (If applicable):
• N/A

Authorization (Print Name)			
Approved:	____________________ Name JOHSC Worker Rep.	Date:	____________
Approved:	____________________ Name Department Superintendent / Delegate	Date:	____________
Approved:	____________________ Name Health & Safety Superintendent / Delegate	Date:	____________

APPENDIX B: SNOW MANAGEMENT PROCEDURE

	DOCUMENT ID: MEL-ENV-Snow Management DRAFT
People concerned: All Departments	**Effective Date: 24 November, 2018**
This procedure corresponds to the required minimum standard. Each and every person must comply with the rules and regulations of the Nunavut Government in terms of health and safety at work.	

Rev #	Date	Description	Initiator
1	2018-03-28	Change to Intelex Format	Matt Gillman
2	2018-09-30	Updated for next season	John Baechler Matt Gillman
3	2018-10-11	Updated to include changes to snow management methods at Itivia, bypass road, CP3 and CP4 access roads, and Itivia Gas Boy.	Dan Gorton John Baechler

Objective:

The overall purpose of the snow management procedure (SMP) is to provide an outline for snow management that will assist with preventing adverse environmental impacts to the Meliadine Project (Site) and to mitigate risks from excess water during the freshet season (Freshet).

Definitions (If applicable):

Snow pad area - an area where snow can be pushed and compacted over an existing structure, such as an access road or a rock pad.

Snow storage area - an area where snow can be taken from another area and stockpiled without causing a negative impact at the freshet.

Negative impact of snow melting during freshet - the transport of fine sediments or deleterious substances from Site to the natural environment, body of water, or within 31 m of a water body.

Tool/Equipment Required	PPE Required
• Snow blower • Shovel and haul truck • Grader	• Standard site PPE

Specific Training Requirements
• Equipment operator training

Procedure
Snow Removal at Meliadine Site 1. Prior to starting any snow removal, supervisors and snow removal equipment operators must discuss a removal plan based on the criteria outlined in this procedure. 2. If uncertain, supervisors or snow removal equipment operators must receive authorization from the Environment Department to move snow to a non-designated area. If access is required on dikes or berms, contact Engineering to ensure instrumentation is not damaged. 3. Supervisors must determine if the snow receiving location is: • Safe for the snow removal equipment operators • Outside a 31 m buffer zone around any water body • A designated snow storage area • A safety sensitive area 4. Designated snow storage areas are as follows (see Figure 1 in the Appendices): • Snow collected from areas of potential contact with contaminants (i.e. the Fuel Farm, Landfarm, Gas Boy, Emulsion Plant, Waste Rock Storage Facility 2 (WRSF2), areas surrounding the Portal 1 and Portal 2 entrances, and areas surrounding the P-Area) must be stockpiled in P3. • Clean snow from other areas at Site must be removed from roadways with a snow blower or plow, and/or collected and stockpiled at CP1.

5. The Fuel Farm, Gas Boy locations, Landfarm, and Itivia Diesel Tanks are safety sensitive areas. The valves and piping/hosing must be protected and available for inspection at all times. Snow must NOT be removed with a snow plow or heavy equipment. To improve safety and reduce risk of any contact with fuel tanks, valves, or equipment within these areas, snow must be removed by hand shovelling. The area surrounding the fuel tank valves must be carefully hand shovelled.
6. Snow accumulated at Channel 2 must be left to melt at freshet, as the use of snow removal or plow equipment can damage the geotextile that is installed.
7. Snow storage areas are not authorized along any roadways, including the All Weather Access Road (AWAR), and CP3 and CP4 service roads. Efforts must be made to ensure road surface material is not removed during snow clearing. Snow must be blown, plowed, or maintained as a snow pad area to reduce snow drifts across the road and allow for increased visibility. A level snow pad area may be created over the tundra provided that:
    - Clean snow is used for the pad construction
    - The surface is cleaned after use
    - Is not obstructing existing culverts, structures, or roadways
    - Is within the footprint of the mine
8. Snow storage areas are not authorized at the Exploration Camp. Snow must be maintained as a snow pad, as not to create long-term snow banks (Figure 2). Any snowbanks must be plowed and leveled.
9. Snow between the Main Camp dormitory wings must be removed to mitigate drifting against the wings, which creates confined space under the camp and wildlife habitats. (Figure 3).
10. Snow removed by Contractors at their designated worksite will be stockpiled at the worksite and subsequently removed by the Energy and Infrastructure department (E&I). E&I will collaborate with the Environment department to determine the correct location of the storage area if it is not outlined within this procedure.
11. Snow removal from the Tiriganiaq esker must be pushed or blown to the west side of the road running north-south. Snow from the Batch Plant must be padded on the north side, and any excess snow removed and stockpiled in the south end of P1 (Figure 4).

Snow Removal at Itivia Site

1. Snow storage areas are not authorized at the Itivia Laydown. Snow at the Laydown must be maintained as a snow pad area as not to create-long term snow banks. Any snowbanks must be plowed and leveled. Efforts must be made to ensure road surface material is not removed during snow clearing. The existing ATV/snowmobile trail must not be blocked by snow removal (Figure 5).

2. Snow along the bypass road will be removed by blowing. Operators will adjust the skid height of the snow blower to ensure a sufficient layer of snow remains to create an ice road. Operators will then scarify the road with a grader to improve traction. Sand will not be used along the Bypass road as the blown snow must be clean and free of debris.
3. Snow removal from the Itivia Diesel Tank Farm secondary contaminant area must not be done using heavy equipment as to not damage the installed synthetic liner.
4. Snow accumulated in the Gas Boy secondary containment is to be removed using suitable equipment, to maintain capacity for fuel spill mitigation. Diesel contaminated snow will be disposed of appropriately at the snow cell or landfarm.

Appendix:

Figure 7: Authorized Snow Removal and Snow Storage Areas

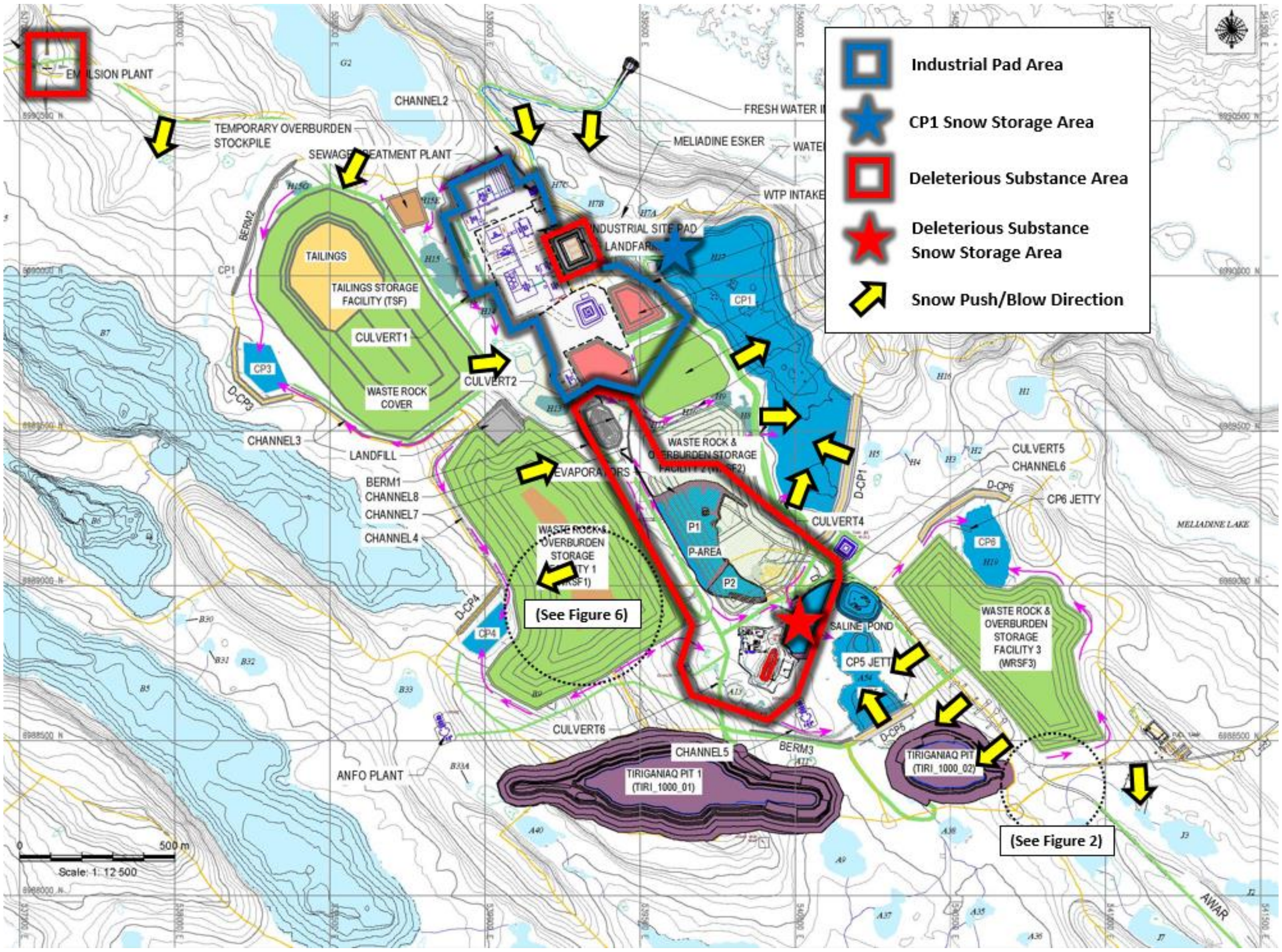


Figure 2: Exploration Camp Snow Pad Area and No Plow Zone Example

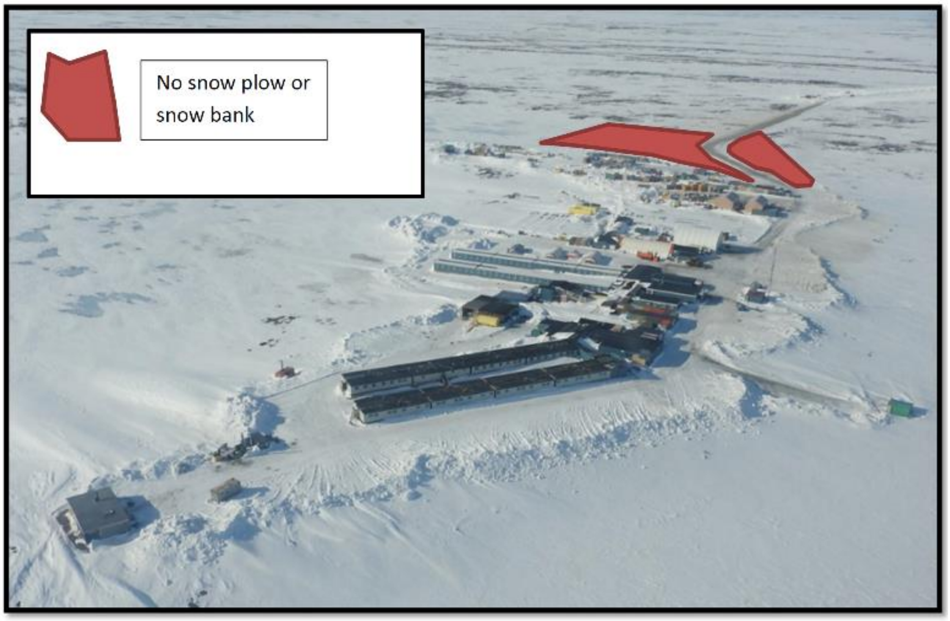


Figure 3: Snow removal from between camp accommodation trailers

Figure 4: Tiriganiaq Esker and Batch Plant Snow Removal Direction

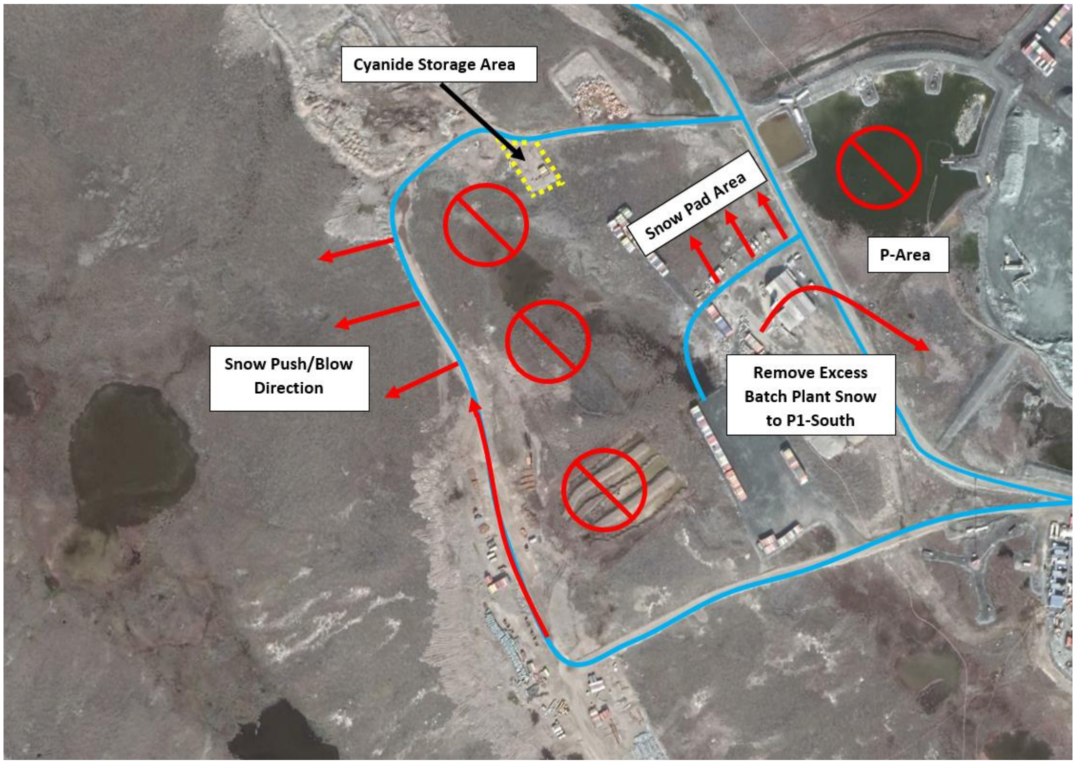
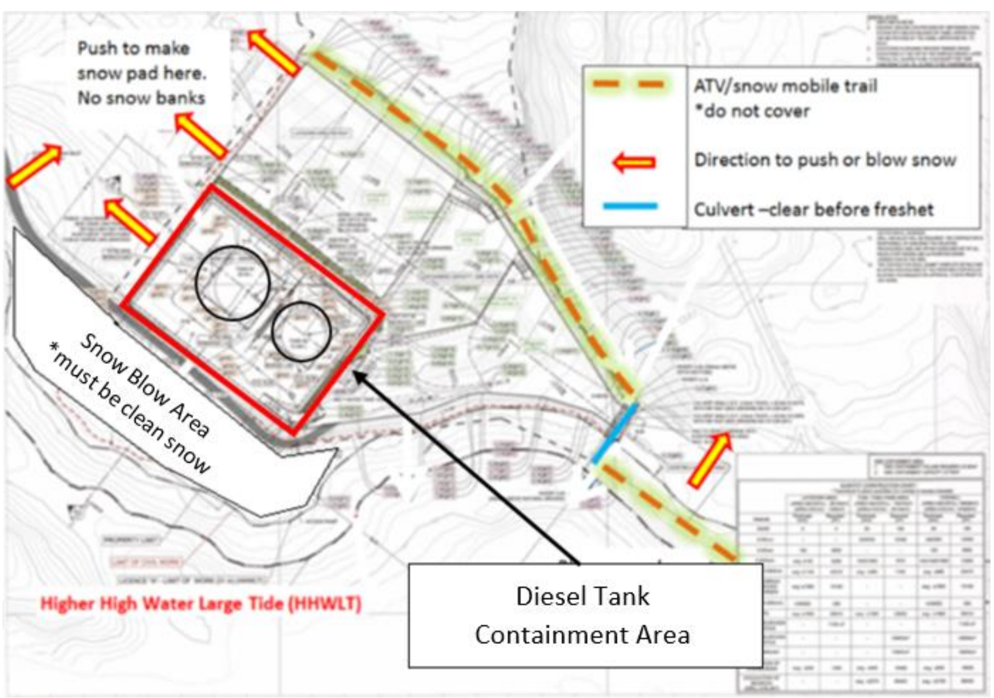
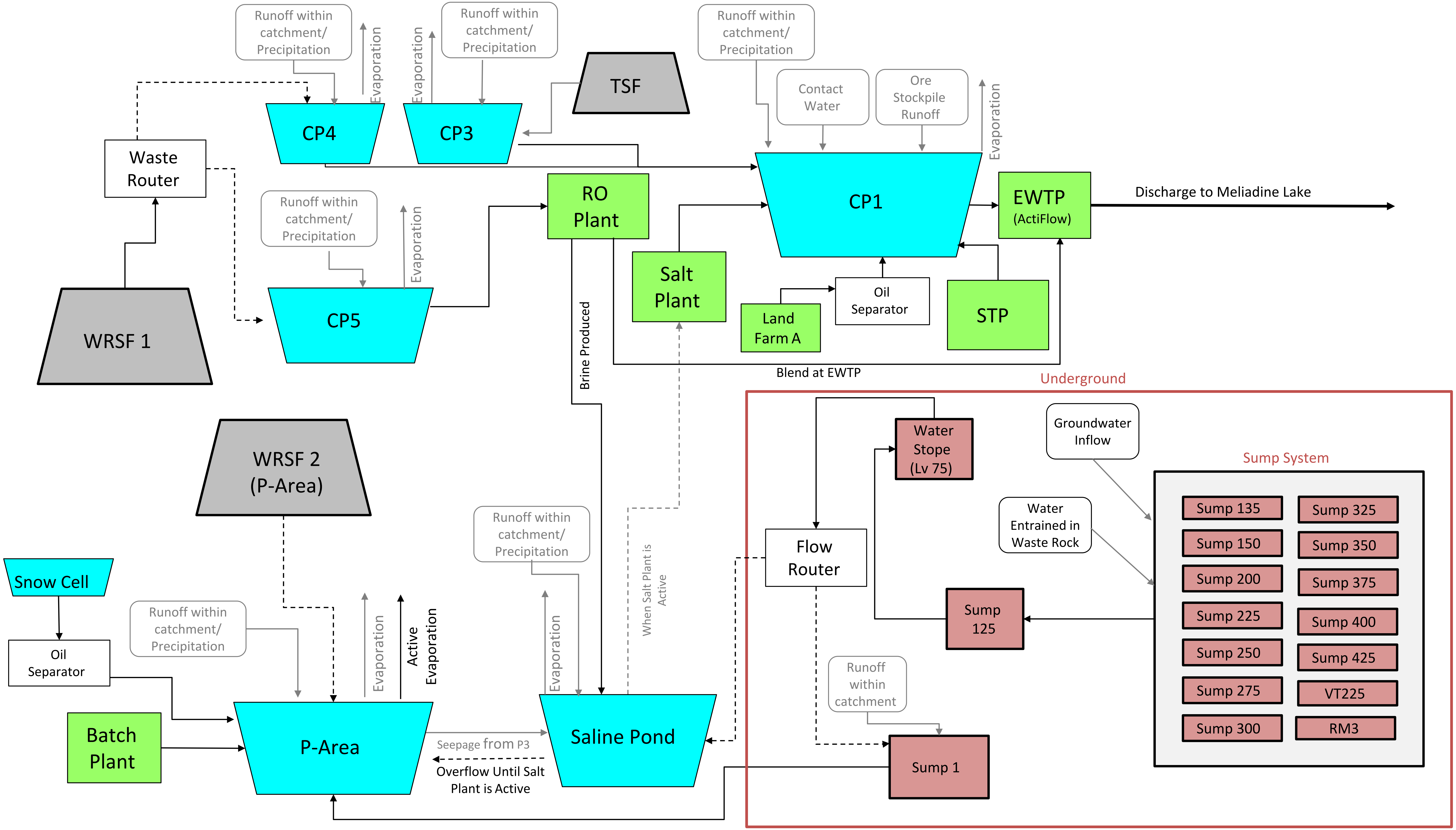


Figure 5: Itivia Snow Pad Area and ATV Access Trail



Authorization (Print Name)	
Approved: ______________________________ Name JOHSC Worker Rep.	Date: ______________
Approved: ______________________________ Name Department Superintendent / Delegate	Date: ______________
Approved: ______________________________ Name Health & Safety Superintendent / Delegate	Date: ______________

APPENDIX C • WATER MANAGEMENT SCHEMATIC FLOW SHEET



Runoff within catchment/ Precipitation
Evaporation
TSF
CP4
CP3
Waste Router
Contact Water
Ore Stockpile Runoff
CP1
EWTP (ActiFlow)
Discharge to Meliadine Lake
RO Plant
Salt Plant
Land Farm A
Oil Separator
STP
CP5
WRSF 1
Brine Produced
Blend at EWTP
Underground
Water Stope (Lv 75)
Groundwater Inflow
Sump System
WRSF 2 (P-Area)
When Salt Plant is Active
Flow Router
Water Entrained in Waste Rock
Sump 135
Sump 325
Sump 150
Sump 350
Sump 200
Sump 375
Sump 225
Sump 400
Sump 250
Sump 425
Sump 275
VT225
Sump 300
RM3
Sump 125
Snow Cell
Oil Separator
Active Evaporation
Runoff within catchment
Batch Plant
P-Area
Saline Pond
Seepage from P3
Overflow Until Salt Plant is Active
Sump 1

APPENDIX D • SEDIMENT AND EROSION MANAGEMENT PLAN

Meliadine Division

Sediment and Erosion Management Plan

MARCH 2019
VERSION 1

EXECUTIVE SUMMARY

This document presents the Sediment and Erosion management plan (the Plan) at the Meliadine Gold Project. The purpose of this Plan is to provide consolidated information on the management and monitoring of potential areas subjected to erosion. This is accomplished by reviewing the potential effects of total suspended solids (TSS) and turbidity, the Federal guidelines and the license requirements, followed by the periods and types of activities subjected to erosion, and the specific monitoring and mitigating measures.

General findings on the effects of TSS on fish and fish habitat have been listed, such as sublethal and lethal effects on fish and their eggs. Federal TSS Guidelines have been cited, distinguishing the short-term and long-term exposure thresholds. Turbidity guidelines are also discussed in the present document. The Plan presents the monitoring and mitigating actions related to three (3) specific periods of activity: Periods of construction near water – during construction and operation; periods of freshet or significant runoff events – during construction, operation and closure; periods of potential impact to waterbodies – during operation. The proposed monitoring and mitigating measures are discussed for those periods of activity.

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ᑎᑎᖃᖅ ᐱᔾᔪᑎᖃᖅᑐᑦ ᐃᒪᐅᑉ ᐊᓗᐊᓄᐊᖅᑐᓂᒃ ᐊᒻᒪᓗ ᓱᕋᒃᐸᓪᓕᐊᓂᕐᒧᑦ ᐸᕐᓇᐅᑎᒥᑦ (ᐸᕐᓇᐅᑎ) ᑕᓯᕐᔪᐊᖅ ᒨᓗᒧᑦ ᐱᓕᕆᕐᒥᑦ. ᐱᔾᔪᑎᖓ ᐸᕐᓇᐅᑎᐅᑉ ᑲᑎᑎᓯᒪᔪᓂᒃ ᑐᑭᓯᐅᒪᔾᔪᑎᓂᒃ ᑐᓂᓯᓂᐊᕐᓗᓂ ᐊᐅᓚᑦᑎᓂᕐᒧᑦ ᐊᒻᒪᓗ ᖃᐅᔨᓯᐊᖃᑦᑕᕐᓂᕐᒧᑦ ᓱᕋᒃᐸᓪᓕᐊᓂᖃᕈᖕᓇᖅᑐᓂᒃ ᐃᓂᐅᔪᓂᒃ. ᑕᒪᓐᓇ ᐱᐊᓂᒃᑕᐅᖃᑦᑕᖅᑐᖅ ᕿᒥᕐᕈᐸᓗᒋᑦ ᖃᓄᐃᖕᒐᓕᖅᑎᑦᑎᓂᐅᔪᖕᓇᖅᑐᑦ ᑲᑎᓗᒃᑖᖅᓱᒋᑦ ᑕᒦᓂᖅᓴᖅᑐᑦ ᓯᑎᔪᐃᑦ (TSS) ᐊᒻᒪᓗ ᑕᕆᐅᖃᓗᐊᕐᓂᖅ, ᑲᓇᑕᒥᑦ ᒪᓕᒃᑕᐅᔪᒃᓴᐃᑦ ᐊᒻᒪᓗ ᓚᐃᓴᓐᓯᒧᑦ ᐱᔭᕆᐊᖃᖅᑐᑦ. ᑭᖑᓂᐊᒧᑦ ᐅᑉᓗᐃᑦ ᐊᒻᒪᓗ ᖃᓄᐃᑦᑑᓂᖏᑦ ᖃᓄᐃᓕᐅᕐᓂᐅᔪᑦ ᓱᕋᒃᐸᓪᓕᐊᓂᕐᒧᑦ ᐱᔪᑦ, ᐊᒻᒪᓗ ᓱᓇᒥᒃ ᖃᐅᔨᓴᐃᓂᕐᒧᑦ ᐊᒻᒪᓗ ᐊᖏᑐᐊᖏᒋᐊᖅᑎᑦᑎᓂᕐᓄᑦ.

ᖃᐅᔨᓴᐅᔪᑦ ᖃᓄᐃᖕᒐᓕᖅᑎᑦᑎᓂᖏᓐᓄᑦ TSS ᐃᖃᓗᖕᓄᑦ ᐃᓂᖏᓐᓄᓪᓗ ᑎᑎᕋᖅᑕᐅᓚᐅᖅᑐᑦ, ᐅᓗᕆᐊᓇᓗᐊᖏᑦᑐᑦ ᐊᒻᒪᓗ ᐅᓗᕆᐊᓇᖅᑐᑦ ᖃᓄᐃᖕᒐᓕᖅᑎᑦᑎᓃᑦ ᐃᖃᓗᖕᓄᑦ ᐊᒻᒪᓗ ᒪᓐᓂᖏᓐᓄᑦ. ᑲᓇᑕᒥᑦ TSS-ᒧᑦ ᒪᓕᒃᑕᐅᔪᒃᓴᐃᑦ ᐅᖃᓕᒫᖅᑕᐅᓯᒪᔪᑦ, ᓇᓗᓇᐃᖅᓱᒋᑦ ᓇᐃᑦᑐᒥᑦ ᐊᒻᒪᓗ ᐊᑯᓂᐅᔪᒥᑦ ᑕᑯᒃᓴᐅᓂᕐᒧᑦ ᑎᑭᐅᑎᓃᑦ. ᑕᕆᐅᖃᕐᓂᕐᒧᑦ ᒪᓕᒃᑕᐅᔪᒃᓴᐃᑦ ᐅᖃᐅᓯᐅᖕᒥᔪᑦ ᑕᕝᕙᓂ ᑎᑎᖃᒥᑦ. ᐸᕐᓇᐅᑎ ᑐᓂᓯᔪᖅ ᖃᐅᔨᓯᐊᖃᑦᑕᕐᓂᕐᒥᒃ ᐊᒻᒪᓗ ᐊᖏᑐᐊᖏᒋᐊᖅᑎᑦᑎᓂᕐᒨᖓᔪᓂᒃ ᐱᖓᓱᓄᑦ ᖃᓄᐃᓕᐅᕐᓂᐅᔪᓄᑦ: ᓴᓇᕙᓪᓕᐊᓂᕐᒥᑦ ᐃᒪᐅᑉ ᖃᓂᑕᖓᓂᑦ - ᓴᓇᕙᓪᓕᐊᑎᓪᓗᒋᑦ ᐊᒻᒪᓗ ᐊᐅᓛᖅᑎᑦᑎᓂᕐᒥᑦ; ᐊᐅᒃᐸᓪᓕᐊᓂᐅᑎᓪᓗᒍ ᐅᕝᕙᓘᓐᓃᑦ ᑰᖕᓂᖃᓗᐊᕐᓂᐅᔪᓂᑦ - ᓴᓇᕙᓪᓕᐊᑎᓪᓗᒋᑦ, ᐊᐅᓛᖅᑎᑦᑎᓂᕐᒥᑦ ᐊᒻᒪᓗ ᐅᒃᑯᐊᖅᐸᓪᓕᐅᓂᕐᒥᑦ; ᐊᒃᑐᖅᑕᐅᓂᖃᑐᐃᓐᓇᓇᐊᖃᕐᓂᖏᓐᓂᒃ ᐃᒪᖃᕐᓂᐅᔪᑦ - ᐊᐅᓪᓛᖅᑎᑦᑎᓂᖃᖅᑎᓪᓗᒋᑦ. ᖃᐅᔨᓯᐊᖃᑦᑕᕐᓂᐅᔪᖅ ᐊᒻᒪᓗ ᐊᖏᑐᐊᖏᒋᐊᖅᑎᑦᑎᓂᕐᒨᖓᔪᑦ ᐅᖃᐅᓯᐅᔪᑦ ᖃᓄᐃᓕᐅᕐᓂᐅᔪᓂᑦ.

DOCUMENT CONTROL

Version	Date (YM)	Section	Page	Revision
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Acronyms

Agnico Eagle	Agnico Eagle Mines Limited – Meadowbank Division
CCME	Canadian Council of Ministers of the Environment
DFO	Fisheries and Oceans Canada
NIRB	Nunavut Impact Review Board
NTU	Nephelometric Turbidity Units
NWB	Nunavut Water Board
Plan	Sediment and Erosion Management Plan
TSS	Total Suspended Solids

UNITS

h	hour
km	kilometre
km^2	square kilometre
mg/L	milligram per litre

SECTION 1 • INTRODUCTION

Agnico Eagle Mines Limited (Agnico Eagle) is developing the Meliadine Gold Project (Project), located approximately 25 kilometres (km) north of Rankin Inlet, and 80 km southwest of Chesterfield Inlet in the Kivalliq Region of Nunavut. Situated on the western shore of Hudson Bay, the Project site is located on a peninsula between the east, south, and west basins of Meliadine Lake (63°1’23.8’’ N, 92°13’6.42"W), on Inuit owned lands. The Project is located within the Meliadine Lake watershed of the Wilson Water Management Area (Nunavut Water Regulations Schedule 4).

As presented in Table 1.1, there are four phases to the development of the Tiriganiaq deposit: 3.5 years construction (Q4 Year -5 to Q2 Year -1), 8.5 years mine operation (Q2 Year -1 to Year 8), 3 years closure (Year 9 to Year 11), and post-closure (Year 11 forwards).

Table 1.1 Overview of Timeline and General Activities

Phase	Year	General Activities
Construction	Year -5 to year -1	• Construct site infrastructure • Develop the underground mine ramp • Stockpile ore
Operations	Year -1 to 8	• Mining operations • Stockpile ore • Dry stack tailing deposition
Closure	Year 9 to 11	• Decommission of underground mine surface opening • Cover on top of tailings • Decommission non-essential mine infrastructure • Fill open pits with active pumping
Post-Closure	Year 11 forwards	• Site and surrounding environment monitoring

This document presents the Sediment and Erosion Management Plan (the Plan). The purpose of this Plan is to provide consolidated information on the management and monitoring of potential areas subjected to erosion. This is accomplished by presenting first a review of the potential effects of total suspended solids (TSS) and turbidity, the Federal guidelines and the license requirements, followed by the periods and type of activities subjected to erosion, and the specific monitoring and mitigating measures.

As per Nunavut Impact Review Board (NIRB) Meliadine Project Certificate No.006 Condition 28, the Sediment and Erosion Management Plan should be developed to prevent or minimize the effects of destabilization and erosion that may occur due to Project activities. The plan should also detail sediment control plans to prevent and/or mitigate sediment loading into surface water within the Project area.

The objectives of the plan are:

- To prevent the release of sediment into streams and waterbodies during construction activities;
- To reduce and mitigate erosion and the release of sediment during operations activities;
- To specify erosion and sediment control measures that, if implemented and maintained, will help Agnico Eagle maintain compliance with the Federal Fisheries Act, specifically with Section 36(3) of the Act, which prohibits the deposition of deleterious substances into waterbodies frequented by fish; and
- To provide references to approvals, relevant standards, control plans and procedures for training, communications, investigation and corrective action, and audits that are required under the Project Agreement.

SECTION 2 • TOTAL SUSPENDED SOLIDS/TURBIDITY EFFECTS, FEDERAL GUIDELINES AND LICENSE REQUIREMENTS

2.1 Effects of Total Suspended Sediments on Fish Habitat

Suspended sediments, and associated effects on water clarity, have the potential to affect fish and fish habitat in a variety of ways, including but not limited to:

- Smothering of deposited eggs or siltation of spawning habitats;
- Smothering of benthic invertebrate communities;
- Decreased primary productivity caused by reduced light penetration;
- Reduced visibility, which may decrease feeding efficiency and/or increase predator avoidance; and
- Clogging and abrasion of gills.

Moreover, the general findings for effects of TSS on fish and fish habitat indicate the following:

- Effects of TSS depend on both the concentration of TSS and duration of exposure;
- Effects of TSS can also be influenced by the size and shape of suspended particles;
- Lethal concentration of TSS on fish over acute exposure ranges from hundreds to hundreds of thousands of mg/L;
- Sublethal effects on fish (reduced growth, changes in blood chemistry, histological changes) associated with chronic exposures tend to be exhibited at TSS concentrations ranging from the tens to hundreds of mg/L;
- There is considerable uncertainty about potential effects of low TSS concentrations over long time periods;
- Overall, the most sensitive group of aquatic organisms to TSS appears to be salmonids, and guidelines are developed to protect this group;
- Adult salmonids are generally more sensitive to short durations of high concentrations of suspended sediments than juvenile salmonids; and
- Low suspended sediment levels are known to cause egg mortality (40 %) to rainbow trout at long durations (7 mg/L at 48 days). Guidelines for long-term exposure reflect these findings.

More details are located in the report from Fisheries and Oceans Canada (DFO) on the effects of sediments on fish and their habitat (Fisheries and Oceans Canada, 1999).

2.2 Federal Guidelines

2.2.1 TSS Guidelines

The Canadian Council of Ministers of the Environment (CCME) specifies separate guidelines for TSS for clear and high flow periods. The guidelines are derived primarily from Caux *et al*. (1997), with application intended mainly for British Columbia streams. In the case of the application to the Meliadine Project lakes, the clear flow guidelines would be most relevant; even during freshet. The lakes would not expect to see large natural fluctuations in TSS except in localized areas for short periods.

The guidelines put forth by the CCME recognize that the severity of effects of suspended sediments is a function of both the concentration of suspended sediments and the duration of exposure. Guidelines are intended to protect the most sensitive taxonomic group and the most sensitive life history stages.

Table 2.1 Existing Federal TSS Guidelines (after Agnico Eagle, 2018)

Source	Short-Term Exposure	Long-Term Exposure
CCME (1999)	Anthropogenic activities should not increase suspended sediment concentrations by more than 25 mg/L over background levels during any short-term exposure period (e.g., 24-h).	For longer term exposure (e.g., 30 days or more), average suspended sediment concentrations should not be increased by more than 5 mg/L over background levels.
MMER (2002)	Maximum authorized concentration in a composite effluent sample = 22.5 mg/L. Maximum authorized concentration in a grab sample of effluent = 30 mg/L.	Maximum authorized monthly mean effluent concentration = 15 mg/L.

2.2.2 Turbidity Guidelines

Turbidity guidelines put forth by the CCME (1999) are based on extrapolation from the TSS guidance above, adjusted by a factor of about 3:1 (a typical average ratio for TSS: turbidity). In the case of turbidity for clear water, CCME (1999) recommends a maximum increase of 8 Nephelometric Turbidity Units (NTU) from background levels for a short-term exposure (e.g., 24-hour period), and a maximum average increase of 2 NTU from background levels for a longer term exposure (e.g., 30-day period).

CCME (1999) notes that in some cases short-term resuspension of sediments and nutrients in the water column can augment primary productivity, and in other cases, changes in light penetration may be inconsequential if a system is limited by other factors such as nutrients. The Caux *et al*. (1997) study considered effects of suspended sediment not only on fish but also on algae and zooplankton. In summary, the recommendations put forth by Caux *et al*. (1997) are based mainly on the most sensitive taxonomic group, which is salmonids.

However, research has shown that widespread, chronic turbidity can result in reduced light penetration and subsequent reductions of primary productivity (Fisheries and Oceans Canada, 1999; Canadian Council of Ministers of the Environment, 1999; Lloyd, Koenings, & Laperriere, 1987). Consequently, water clarity is of concern at broader spatial scales and longer time frames. It should be noted that DFO’s report on effects of sediment on fish and their habitat (DFO, 1999) endorses the guidelines for TSS put forth by the CCME (1999), but does not recommend following guidelines for turbidity. Rather, turbidity may be used as a surrogate for suspended sediment only when the relationship between the two parameters is established for a particular waterbody.

2.3 License Requirements for the Protection of Fish and Fish Habitat at Meliadine

The Nunavut Water Board (NWB) Type A Water License for the Meliadine Project includes:

All surface runoff and/or discharge from drainage management systems, at the Monitoring Program Stations MEL-SR-1 to MEL-SR-TBD referred to in Part I, Item 11, during the Construction/Operation of any facilities and infrastructure associated with this project, including laydown areas and All-weather Access Road, where flow may directly or indirectly enter a Water body, shall not exceed the Effluent quality limits in Table 2.3.

Table 2.3 Effluent Quality Limits

Parameter	Maximum Average Concentration	Maximum Concentration of Any Grab Sample
Total Suspended Solids (TSS) (mg/L)	50.0	100.0
Oil and Grease	No Visible Sheen	No Visible Sheen
pH	Between 6.0 and 9.5	Between 6.0 and 9.5

SECTION 3 • SEDIMENT AND EROSION MONITORING AND MITIGATION

3.1 Sediment and Erosion During Specific Periods

The purpose of the Plan is to ensure that Agnico Eagle will successfully monitor signs of sedimentation and erosion and minimize its resulting effects. This plan presents the monitoring and mitigating actions related to three (3) specific periods of activity for Meliadine:

- Periods of construction near water – during construction and operation;
- Periods of freshet or significant runoff events – during construction, operation and closure;
- Periods of potential impact to waterbodies – during operation.

The construction of water management infrastructure could potentially lead to excess TSS. Therefore, erosion control methods must be considered during construction of water management infrastructure. In addition, erosion control must be considered during any dewatering activity.

The freshet season at Meliadine occurs approximately from mid-May until the end of June. In addition, there can be periods of high water flow due to rainfall events from late May – early October. As most site construction has been completed at the Meliadine site there are new areas and infrastructure that have become potentially vulnerable to excess water during the freshet season and in response to rainfall, such as, but not limited to:

- Culverts and other water management infrastructures;
- Newly constructed embankments, such as roads and berms;
- Water channels; and
- Surface runoff.

Water transfer and water discharge during operation can also lead to erosion and sedimentation.

3.2. Erosion and Sediment Monitoring

In order to monitor potential erosion and sedimentation, smaller water management infrastructure such as culverts, cross drains, surface runoff and ditches are inspected daily during freshet, on a monthly basis thereafter and daily after significant rain events. Larger culverts and bridges are inspected more often if they represent a risk for daily operations, for the receiving environment or for the health and safety of workers. More specifically, the following aspects are monitored during visual inspections:

- Accumulation of debris near the inlet of the crossings, impeding the free flow of water at those locations;
- Bed erosion upstream and downstream of watercourse crossing structures;
- Scour under bridge abutments and abutment foundations; and
- Erosion along cutslopes and fillslopes of embankments (rill and gully erosion), etc.

Newly excavated channels are inspected on a regular basis and after significant rain events. Erosion signs along the channel flow are monitored and documented. Inspections are carried out during the spring when surficial ice moves towards the inlet of the diversion channels to ensure that no ice blockage causes water buildup upstream of the channel, which could lead to subsequent erosion problems. It is important to develop a database to determine if adverse trends are occurring. If adverse trends are observed, then mitigation will be undertaken to prevent a major incident.

The frequency of water and turbidity sampling are in accordance with the requirements of the Type A Water License. The frequency will be increased if required during the freshet season or during heavy rainfall events. Procedures for turbidity monitoring include:

- Collection of water at the site of sediment entrance (exposure), and at a reference site (i.e., in the same watercourse/waterbody in an area unaffected by the sedimentation [upstream, at least 50 m away where water does not appear to be impacted]).
- Analyze samples for turbidity using a field turbidity meter and compare the exposure sample to the reference sample.
- If the exposure sample results are higher than the reference then mitigation will be undertaken (ie installation of silt fencing, silt barrier booms, etc) to prevent any impact to watercourses.

If Agnico Eagle is actively working in an area with elevated turbidity – the work will stop until the level of clarity returns to an acceptable level.

Monitoring will be documented with site photographs and inspection forms.

3.3 Mitigating Measures

The following mitigation measures could be used, if required, to reduce risks associated with erosion and sedimentation.

- Riprap or clean non-acid generating/non-metal leaching rockfill could be used to armor shorelines, bridge abutments, culverts inlets and outlets and toe berms;
- Ditches managing high volumes of water could be armored for erosion control and reduce the speed of water flow;
- Sedimentation basins could be constructed at sensitive locations to allow settlement of finer sediments;
- Ditches, culverts and other water crossing structures should be maintained free of debris to allow free flow of runoff water;
- Installation of erosion control material such as turbidity barriers, silt curtains or straw booms;
- Site-specific erosion issues may arise during the mine operation that require specific local corrective actions;
- In-stream construction during periods when streams are expected to be dry or frozen to the bottom (i.e., during winter or fall). Isolation methods will be used for work below the high water mark for streams with flowing water at the time of construction;
- Materials installed below the high water mark (i.e., riprap) will be cleaned prior to installation to avoid adding deleterious substances to watercourses. Where concrete is installed, it will be allowed to cure fully prior to installation;

- Riparian areas will be maintained whenever possible to minimize erosion and impacts to fish habitat, with vegetation removal limited to the width of the workspace footprint. Disturbed areas along the streambanks will be stabilized and allowed to re-vegetate upon completion of work to minimize future erosion;
- Debris and excess materials resulting from construction will be removed from the work site to prevent them reaching water bodies; and
- When using equipment that creates tracks on the surface, run the equipment slowly to create grooves running perpendicular the slope and not parallel to the slope. This type of texture on slopes can slow the speed of runoff and reduce the amount of erosion and sediment transported downhill. This method must also be combined with an additional method of catching sediment at the base of the slope, such as a silt fence, straw log, etc.

SECTION 6 • REFERENCES

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GNWT-DOT Erosion and Sediment Control Manual (GNWT 2017).

APPENDIX E • SALINE WATER TREATMENT PLAN DESIGN REPORT

Design Report
Saline Water Treatment Plant

6515-E-132-013-105-REP-035

In Accordance with Water Licence 2AM-MEL1631

Prepared by:
Agnico Eagle Mines Limited – Meliadine Division

DOCUMENT CONTROL

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Prepared By: 2018-08-21
Thomas Genty
Water Treatment Specialist

Blandine Arseneault
Project Environment Lead

Approved by:
Normand Ménard
Project Mechanic Lead

2018-08-21
Jessica Huza
Environment General Supervisor

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1 INTRODUCTION

1.1 SITE LOCATION AND ACCESS

Agnico Eagle Mines Limited (Agnico Eagle) is developing the Meliadine Project (the Project), a gold mine located approximately 25 km north of Rankin Inlet, and 80 km southwest from Chesterfield Inlet in the Kivalliq Region of Nunavut. The project site is located on the peninsula between the East, South, and West basins of Meliadine Lake (63°01'23.8"N, 92°13'6.42"W). The area is accessible from the all-weather gravel road linking the Meliadine mine site with Rankin Inlet.

A general location plan for the project is shown in Figure 1.

1.2 SITE FACILITIES

The current mine plan focuses on the development of the Tiriganiaq gold deposit which will be mined using both conventional open-pit and underground mining operations. Current or proposed mining facilities to support this development include a plant site and accommodations, tailings storage facility and water management infrastructures.

Several infrastructures such as water retention dikes, berms, culverts, channels, collection ponds, pumping stations, fresh water intake and water treatment plants are required to manage water during pre-production, operation, and interim mine closure.

Facilities that are planned to be constructed for the operation of the future Meliadine Mine include a process plant, power plant, maintenance facilities, tank farms for fuel storage, water treatment plant, sewage treatment plant, saline water treatment plant (SWTP), accommodations, and kitchen facilities for 520 people.

The Nunavut Water Board (NWB) has issued Type “A” Water License No. 2AM-MEL1631 (Water license “A”) to Agnico Eagle Mines Limited (Agnico Eagle) for the Meliadine Gold Project site authorizing the use of water and the disposal of waste required by mining and milling and associated uses.

Figure 2 shows the location of the future SWTP including the pipeline between the Saline Water Pond pumping station and the SWTP, then to the final discharge into the collection pond named CP1.

1.3 PURPOSE OF DOCUMENT

This report includes the final design and construction drawings for the SWTP, including the feed pump and discharge pump to CP1. The water treated at the SWTP will be sourced from the Saline Water Pond. The effluent water from the SWTP will be pumped back through a pipeline in CP1.

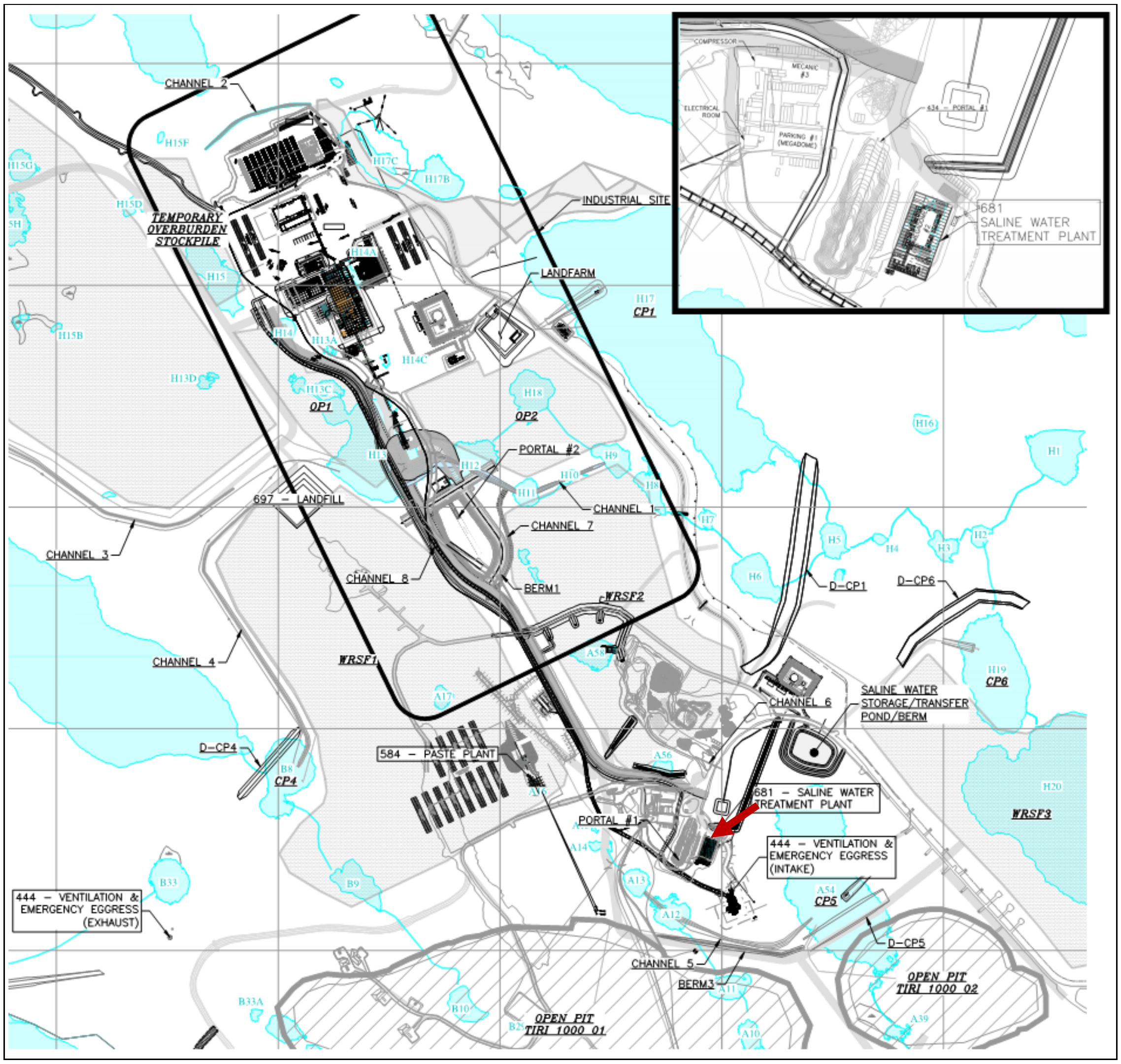

Figure 1 : Location of the SWTP

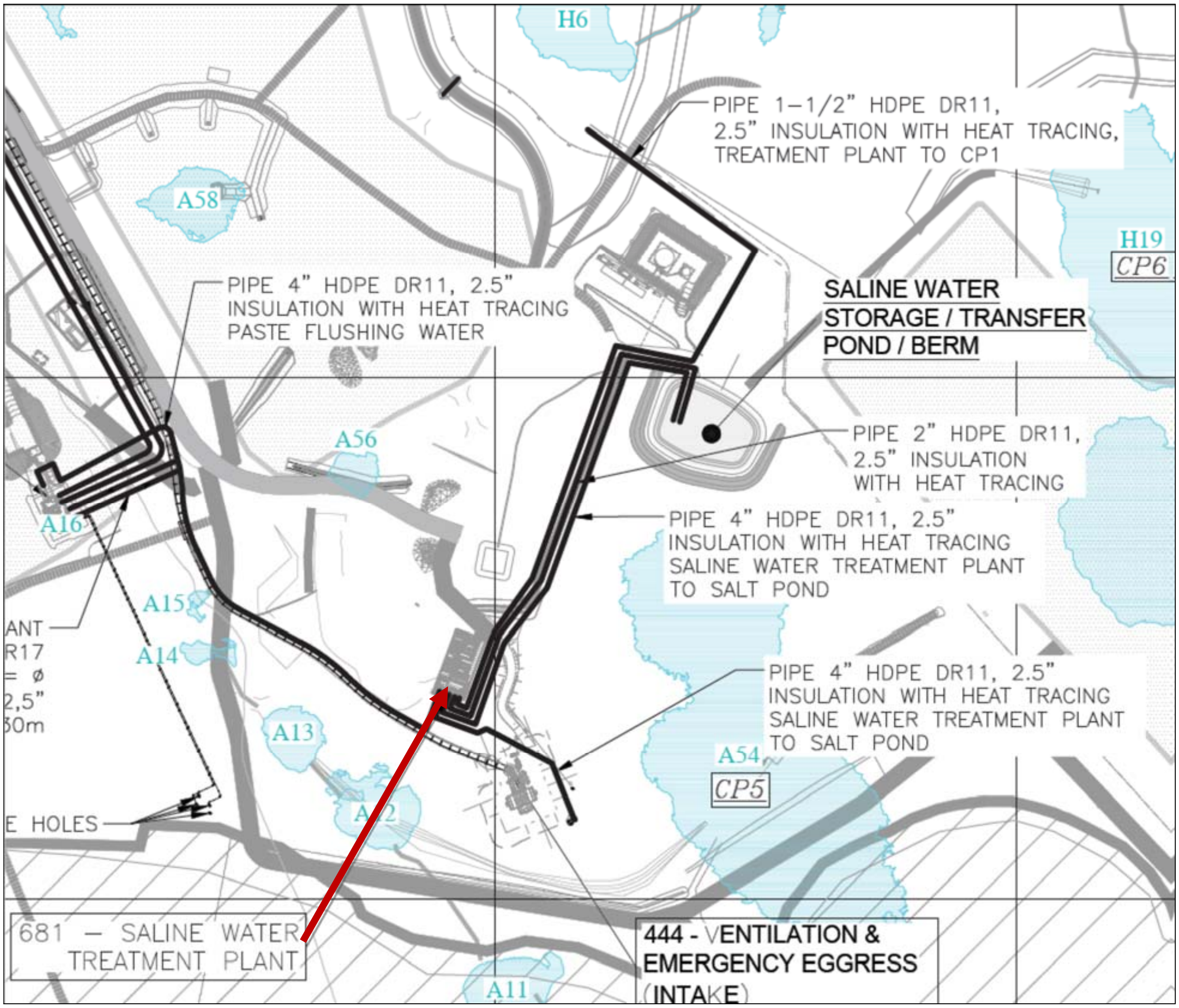

Figure 2 : Location of SWTP and Pipeline

2 DESIGN METHODOLOGY

2.1 SALINE WATER MANAGEMENT STRATEGY

Underground saline water is firstly stored in an underground stope that has a total capacity of approximately 11 000 m^3 and is then transferred to the surface Saline Pond which has a total storage capacity of approximately 33 000 m^3. From there, the saline water will be transferred to the SWTP for treatment. The storage capacity is managed to keep the saline pond and stope volumes as low as possible, in order to have enough space for abnormal flow condition or SWTP shutdown.

2.2 METHODOLOGY

The SWTP design was based on hydrogeology and underground water quality data collected on a regular basis in the underground mine that is currently under development. Effluent quality of the SWTP are set to comply with the Licence A requirements.

2.1 WATER CHARACTERISTICS

The SWTP is designed based on water quality of underground water inflow. Table 1 presents the water quality used for the design of the SWTP.

Table 1 : Feed Water Quality[1]

Representative Months		May 2016	June 2016	August 2016	September 2016	October 2016	November 2016	December 2016	February 2017	March 2017
Parameters (total metal)	**Units**									
Aluminum (Al)	mg/L	9.55	12.5	3.9	0.1	5.85	12.2	6.81	1.2	4.02
Ammonia Nitrogen (NH_3-NH_4)	mg/L	885	827	596	545	230	260	290	400	440
Arsenic (As)	mg/L	6.551	<0.1	0.4	0.22	0.252	0.0646	0.0355	0.011	0.024
Cadmium (Cd)	mg/L	0.00197	0.67	0.37	0.55	0.0002	0.00052	0.00182	<0.0010	0.0017
Chloride	mg/L	86 824	59 000	32 000	39 000	33000	45000	61000	67000	77000
Copper (Cu)	mg/L	0.14	0.15	0.08	0.17	0.014	0.03	0.029	<0.050	<0.050
Iron (Fe)	mg/L	28.5	15.2	1.31	0.37	12.4	23.7	13.4	<1.0	5.4
Lead (Pb)	mg/L	0.0097	0.37	0.32	0.2	0.0081	0.0151	0.0241	<0.020	0.022
Mercury (Hg)	mg/L	0.00154	<0.01	<0.01	<0.01	0.00001	0.00003	<0.00001	nd	<0.00001
Molybdenum (Mo)	mg/L	0.0886	N/A	N/A	N/A	0.059	0.055	0.056	<0.10	<0.10
Nickel (Ni)	mg/L	1.514	0.71	0.41	0.35	0.032	0.061	0.059	<0.10	0.13
Nitrate (NO_3) as N	mg/L	884	928	622	533	235	296	272	435	406
Nitrite (NO_2) as N	mg/L	5.97	71.4	97.5	49	35.9	36.8	31.6	27.2	27.1
Selenium (Se)	mg/L	1.67	0.002	0.002	0.003	0.0025	0.0015	0.008	<0.010	<0.010
Total Dissolved Solids (TDS)	mg/L	144 400*	110 000	62 700	69 000	69 800	74 400	102 000	123 000	163 000
Total Suspended Solids (TSS)	mg/L	806	N/A	136.2	45.4	260	1100	520	1900	260
Thallium (Tl)	mg/L	0.087	0.018	0.005	0.0007	0.00053	0.0155	0.0547	0.0519	0.0872
Uranium (U)	mg/L	0.006	0.006	0.008	0.002	0.0019	0.0029	0.0044	<0.010	<0.010
Zinc (Zn)	mg/L	0.338	0.49	0.43	0.23	0.096	0.091	<0.10	<0.50	<0.50
Silver (Ag)	mg/L	N.A.	<0.01	<0.01	<0.01	0.00023	0.00049	0.00086	<0.0020	<0.0020

Treated water will be sampled for water quality periodically (pH, Total Suspended Solids (TSS), C10-C50, aluminum, arsenic, boron, cadmium, chloride, copper, chromium, mercury, ammonia, nickel, nitrite, nitrate, phosphorus, lead, selenium, total dissolved solids (TDS), thallium, total cyanides and zinc) and sent to a certified laboratory for analysis. Table 2 presents the treatment target which should be reached by the SWTP.

[1] Used for Tender request.

Table 2 : Treatment Objectives of the SWTP[2]

Parameter (Total, mg/L)	Maximum Allowable Salt Plant Effluent Concentration[3]
Aluminum	6
Arsenic	1
Boron	4
Cadmium	0.0003
Chloride	2500
Copper	0.7
Chromium	0.003
Mercury	0.0001
N-NH4	35
Nickel	1.3
N-NO2	0.2
N-NO3	2
Phosphorous	0.1
Lead	0.6
Selenium	0.0025
TDS[4]	1400
Thallium	0.003
Total Cyanide	1.5
Zinc	1.3
pH[5]	5-8
TSS[6]	<10
Temperature[7]	<40ºC

2.2 EFFLUENT FLOW RATE

In order to maintain the saline water balance, a treatment flow rate of 120 m^3/d is required which corresponds to the average inflow of saline water underground.

3 DESCRIPTION

3.1 SALINE WATER TREATMENT PLANT (SWTP)

3.1.1 Process Summary

The purpose of the SWTP is to remove total dissolved solids (TDS), which is also referred to as salinity, in underground saline water. The expected TDS in underground water varies from approximately 60 000 to 160 000 mg/L. The treated water will be discharged into CP1. The equipment has an operational flow rate of 120 m^3/d. It is expected that the SWTP will be in use 24 hours, 7 days per week.

[2] Treatment objective values come from geochemical model made by Golder (2017) for a dry climate, taking into account the dilution occurring into CP1 (Ref: 6515-E-132-013-105-DGC-003).
[3] Treatment objective values come from geochemical model made by Golder (2017) for a dry climate, taking into account the dilution occurring into CP1 (Ref: 6515-E-132-013-105-DGC-003). Theses concentrations are guaranteed by the supplier.
[4] Maximum concentration for the final effluent (ref: Water License No. 2AM-MEL1631).
[5] Possibility to adjust pH if required. Will depend on the CP1 alkalinity.
[6] Value expected to be low since effluent is treated in a reverse osmosis process prior to be discharged to CP1.
[7] Reverse osmosis post treatment should be perform below 35-40ºC .

The treatment concept is presented in Figure 3. Water is pumped from the underground sump to the saline storage pond or directly into the SWTP. Water then flows into the two SaltMaker S125 units. Three products are generated during the process: distilled water, a salt slurry and a high-salinity blowdown.

The distilled water is treated in an oxidation reactor for nitrite removal, followed by a reverse osmosis (RO) step used to remove ammonia. The RO permeate is then discharged into CP1. The RO brine containing high ammonia concentration is stored in a tank and oxidized with chorine before being cycled back to the two SaltMaker S125 units.

The salt slurry is discharged into a big bag rack. Free water is drained from the bag and recycled to the SaltMaker. The expected solid content into the big bag after drainage is estimated at approximately 80%.

The blowdown is a by-product containing high concentrations of nitrate. Evaporation efficiency depends on the viscosity of the water which can be affected by the high concentrations of nitrate that can occur within the SaltMaker due to its high degree of solubility. Nitrate accumulates within the system as a consequence of the different streams being recirculated.

The SWTP will be installed in the third quarter of 2018 and operational in the last quarter 2018.

The SWTP general flow diagram is illustrated in Figure 4.

The following sections describe the SWTP components.

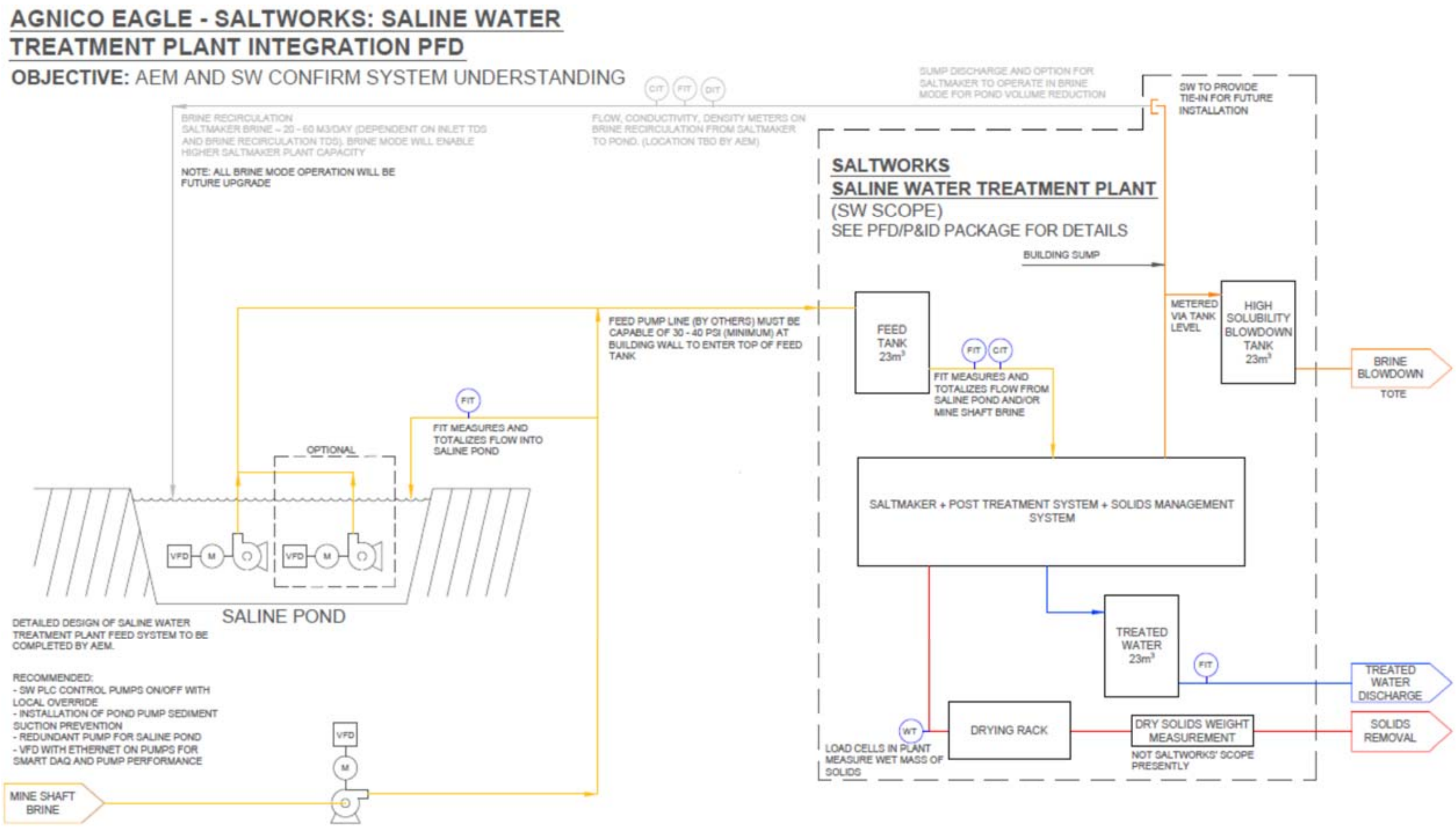

Figure 3 : SWTP Overall Process Concept

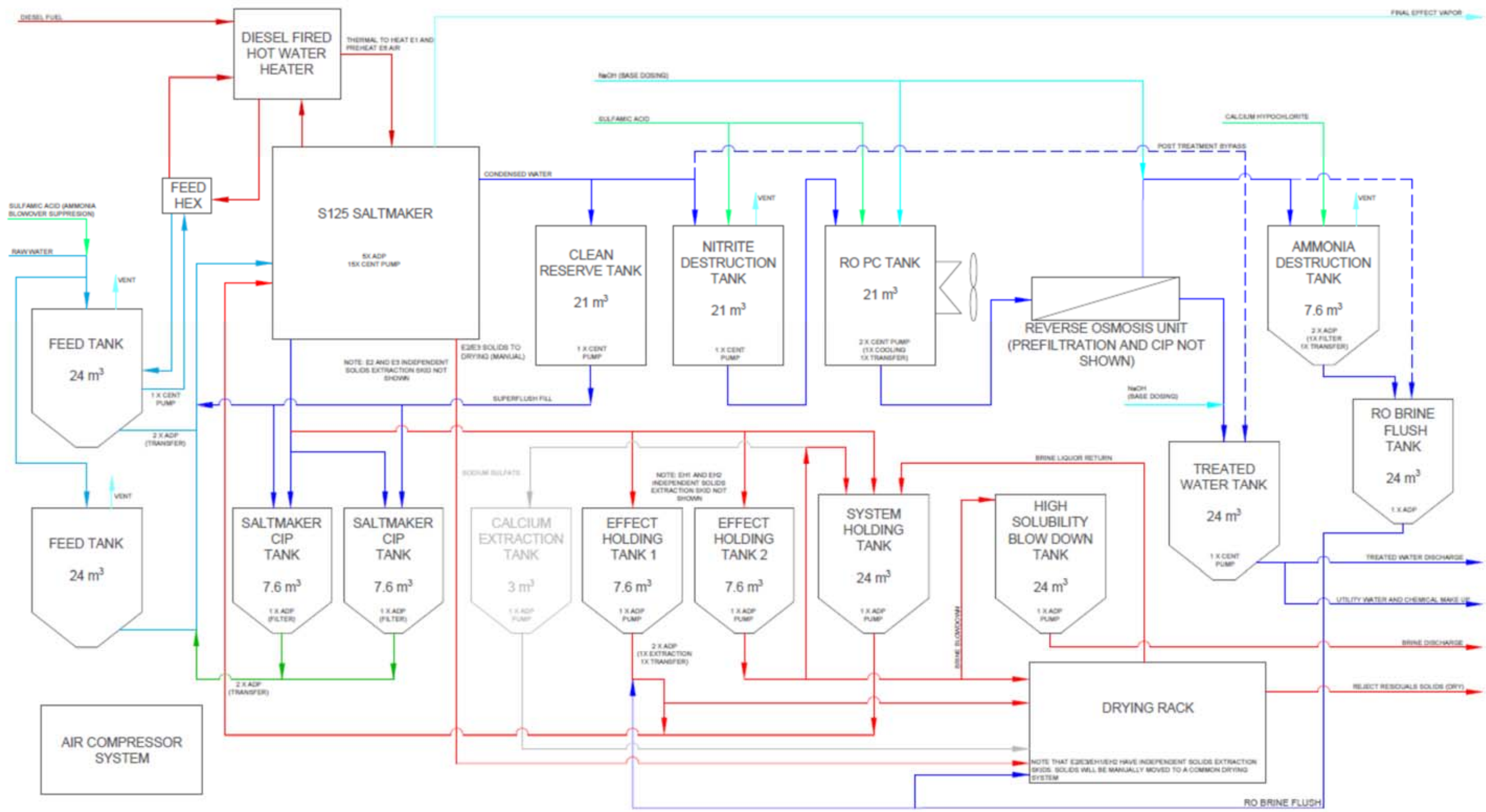

Figure 4 : SWTP Overall Process Flow Diagram

3.2 PRE-TREATMENT

Before being fed to the SaltMaker, water is filtered through strainers, in-line filters and heated to a specific temperature.

3.3 SALTMAKER

The SaltMaker uses a Humidification-Dehumidification (HDH) cycle to concentrate saline water and produce freshwater. The use of a humidified air cycle enables operation at temperatures below 90ºC and pressures near atmospheric (1 bar). These attributes allow the use of engineered plastics in place of more costly corrosion-resistant metallic parts, thereby saving capital cost while also reducing scaling risk due to the much lower surface energy of plastics. In addition, evaporation occurs on a non-heated surface, further reducing scaling and enhancing reliability.

The SaltMaker is a thermally driven plant, producing freshwater and highly concentrated discharge and/or solids via a multiple-effects HDH cycle. The thermal energy is used to evaporate and condense water in successive "effects". The latent heat of condensation is recycled as it is downgraded, with each effect operating at a temperature approximately 15°C lower than the previous one. Each effect produces freshwater and successively concentrates the saline water. The final effect uses the downgraded heat (<40°C) to concentrate brine into solids.

A simplified process diagram is shown in **Erreur ! Source du renvoi introuvable.**. This diagram describes a four-effect concentration in which the first three effects entail a closed air loop and the fourth effect is open to the atmosphere. The S125 for this application is a five-effect plant which recycles the heat an additional time. The final effect can be a closed air loop for zero air emissions and more water recovery.

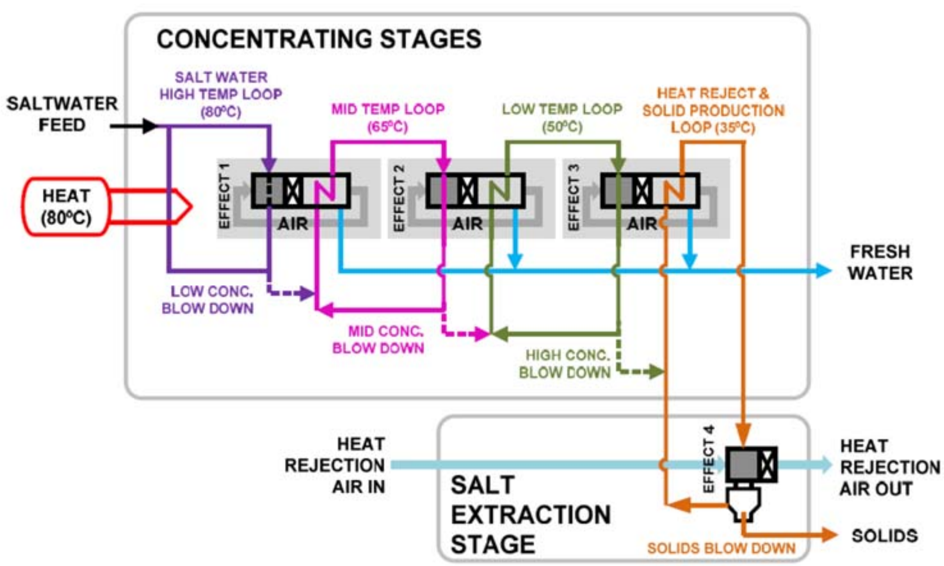

Figure 5 : Conceptual Operation

SaltMaker can accept any wastewater salinity; lower inlet TDS increases system freshwater recovery. Additionally, the scaling potential of the wastewater impacts the frequency of the wash cycles and the plant's production capacity. However, the built-in cleaning systems are flexible enough to accept almost any water type.

The SaltMaker general flow diagram is illustrated in Figure 6.

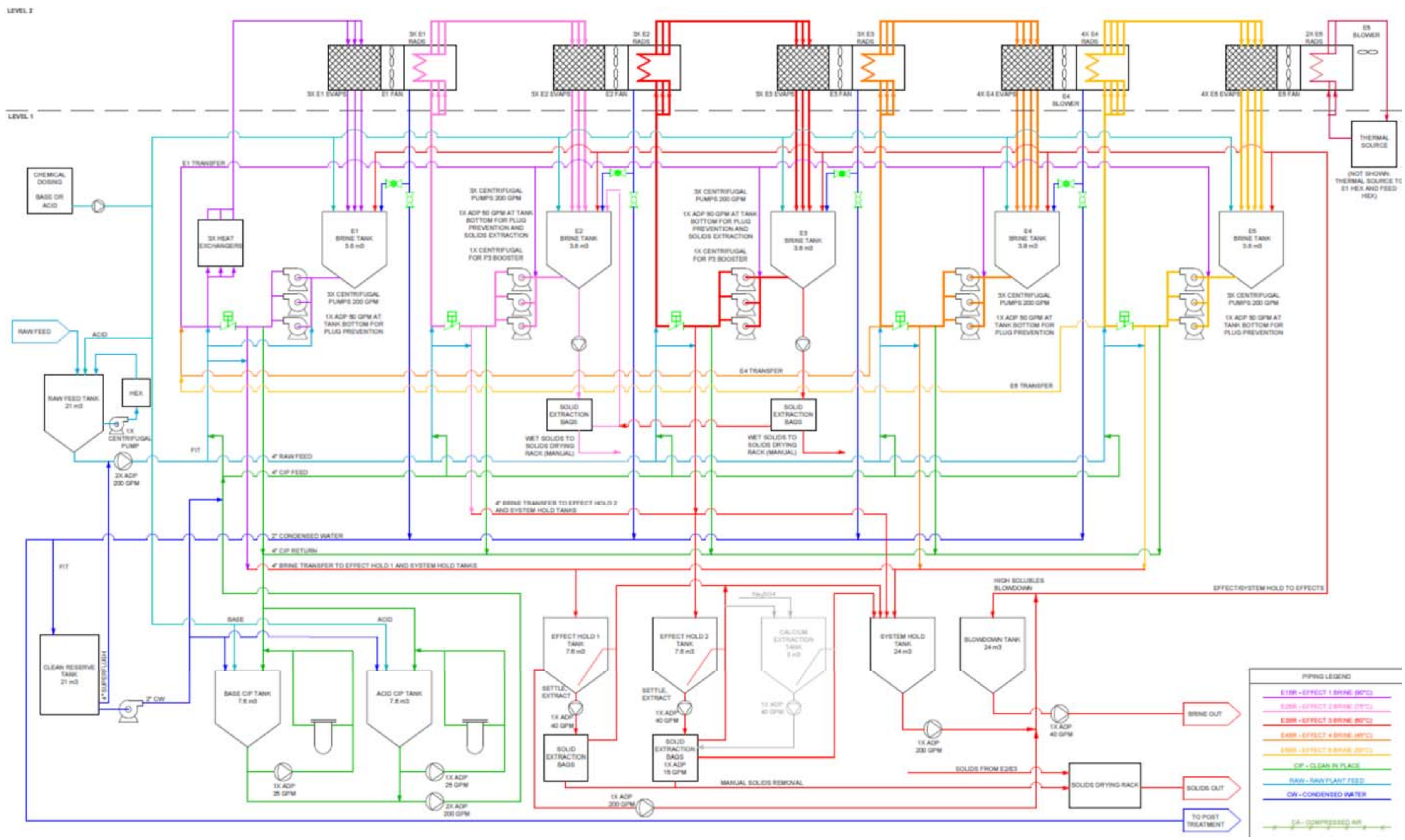

Figure 6 : Saltmaker Process Flow Diagram

3.4 POST-TREATMENT

Distilled water from the SaltMaker unit needs to be treated mainly for volatiles such as ammonia and nitrite (resulting from ammonia oxidation). The proposed chain is a chemical oxidation of nitrite with sulfamic acid followed by a reverse osmosis filtration step.

3.4.1 Nitrite Removal

The overall reaction between nitrite and sulfamic acid is presented below:

$NaNO_2 + H_3NSO_3 \rightarrow N_2 + NaHSO_4 + H_2O$

This reaction leads to the formation of nitrogen as the final product of nitrite removal.

Distilled water from the two SaltMaker units is stored in two 21 m^3 tanks. Sulfamic acid is then added in batch mode to remove nitrite (one reactor is treated while the second one stores distilled water). Acid dosage is controlled by a pH sensor. An optimum pH of 2-3 needs to be reached for effective nitrite removal. The reaction time is about 1-2 minutes in the reactor. The pH of the water from the nitrite removal tank is then adjusted to 4.5 using caustic soda prior to the reverse osmosis process.

3.4.2 Ammonia Removal by Reverse Osmosis

Reverse osmosis (RO) is a water purification technology that uses a semi-permeable membrane to remove ions and molecules. In RO, an applied pressure is used to overcome osmotic pressure. Normally, water to be treated with RO has to be pretreated for suspended solids, bacteria, and scaling compound. In the present case, as the water comes from an evaporation process, no specific pre-treatment would be required. A recovery of 96% is expected.

The RO system operates at variable recovery based on the conductivity (salt and ammonia content) of permeate. If the permeate conductivity is too high, the RO will lower recovery by opening the concentrate valve, allowing more water to flow to the concentrate stream and less water to be directed to the product stream.

Filtration is done at low pH (approximately 5.5) to promote the ammonium form which is best retained by the RO step.

The flowsheet for the RO process is presented in Figure 7.

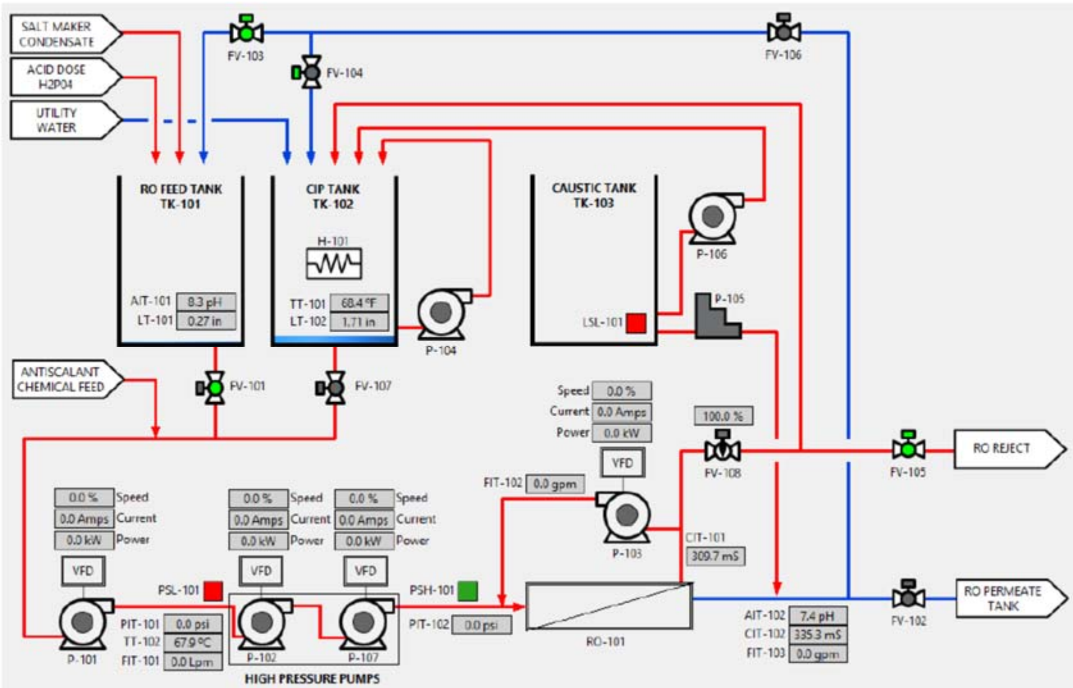

Figure 7 : RO Treatment

3.5 REVERSE OSMOSIS BRINE TREATMENT

Brine from the RO process contains a high concentration of ammonia. In order to prevent a build-up of ammonia in the process, this compound is oxidized with calcium hypochlorite in a 7.6 m^3 tank (this reaction is also commonly called 'breakpoint chlorination'). Two tanks are available for brine storage (one in ammonia destruction mode; the second in brine storage mode). The treatment is done manually in batch mode by the operator. The pH is adjusted to alkaline values. The required quantity of calcium hypochlorite is determined by the operator on the basis of the ammonia analysis obtained with a colorimetric test kit. Calcium hypochlorite is added directly in solid form. The retention time is also determined by the operator and is typically around 10 minutes.

The overall reaction leading to the release of nitrogen and nitrate as a final product is presented below:

$NH_4^+ + 1.5\ HOCl \rightarrow 0.5\ N_2 + 1.5\ H_2O + 2.5\ H^+ + 1.5\ Cl^-$
$NH_4^+ + 4\ HOCl \rightarrow NO_3^- + H_2O + 6\ H^+ + 4\ Cl^-$

Treated water is recirculated back to the SaltMaker units.

3.6 SALT BAGGING SYSTEM

Salt slurry is discharged into a big bag rack. Loading of each big bag is controlled by load cells. An automatic valve discharges the slurry into a big bag until it is full. Once the bag is full, another big bag is positioned to be filled. The big bag is left to drain of free water until it only contains solid salts. Free water (high salinity leachate) is recycled to the SaltMaker unit for further treatment. Figures 8 and 9 present the concept for the salt bagging system. The expected dryness is between 80 and 90 %.

Solid salt produced will be placed in double bags which will be stored into seacans to prevent dissolution of the salt. When required, the salt will be reused for underground mining activities. The exceeding bags of solid salt will be sent south on the barges for final disposal in accordance with regulations.

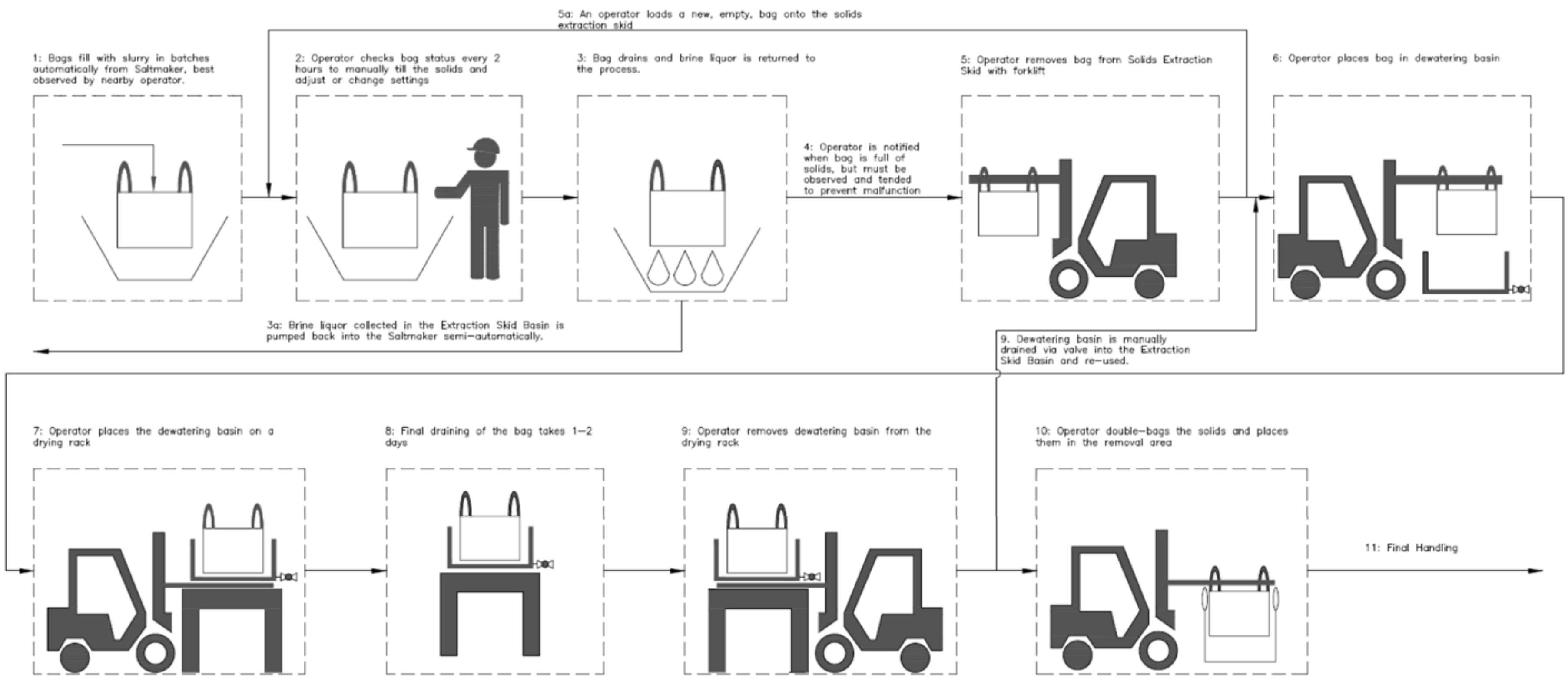

Figure 8 : Salt Bagging Concept

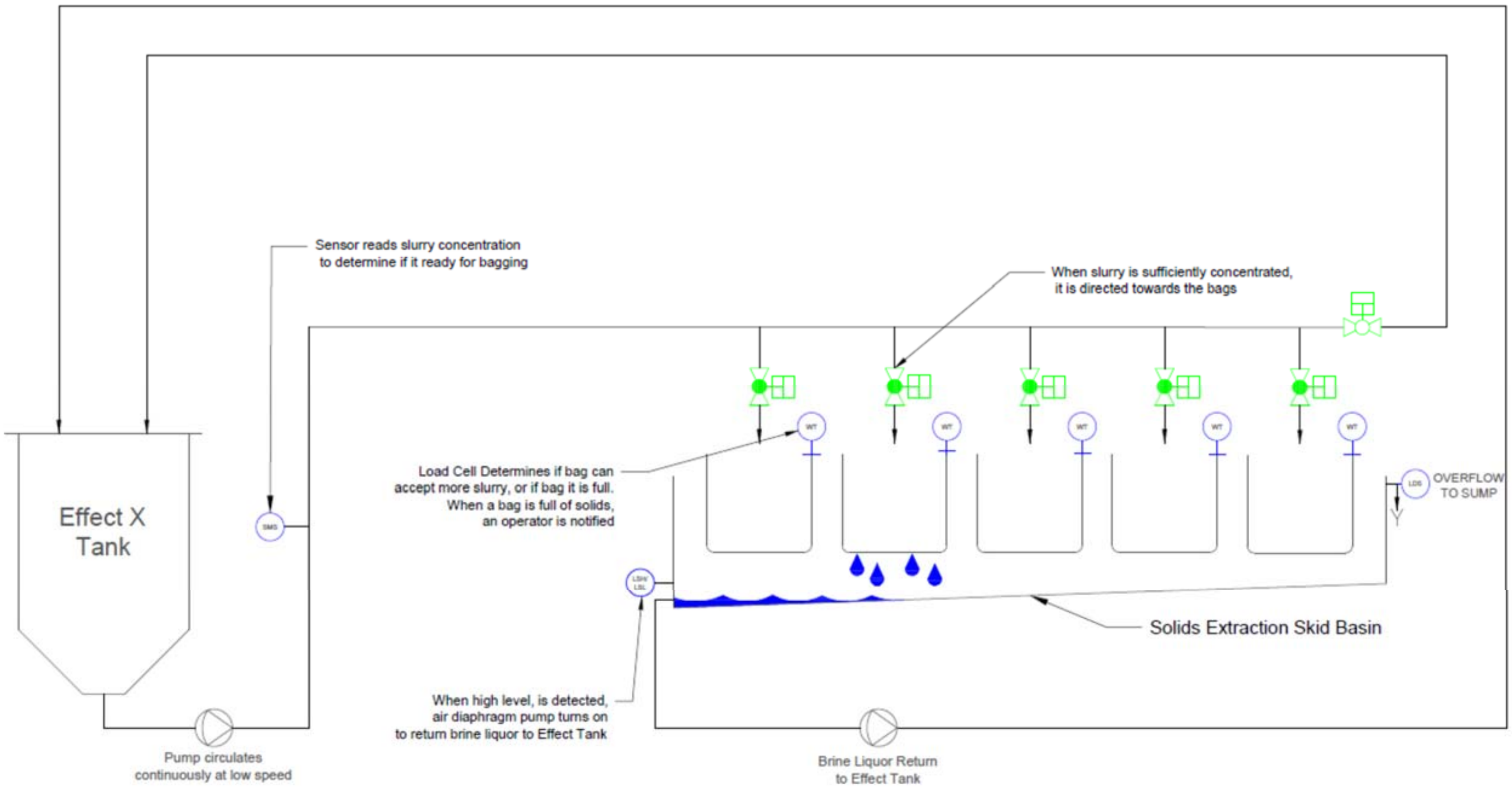

Figure 9 : Salt Bagging Flow Diagram

3.7 BLOWDOWN MANAGEMENT

The salt is mainly composed of Ca, Na and Cl. Underground water also contains a non-negligible amount of nitrate which does not precipitate during the salt production step. Therefore, the nitrate is recirculated in the SaltMaker where it accumulates. Overly high concentrations of nitrate leads to an increase in the viscosity of the water to be treated, causing the efficiency of the Saltmaker to decrease significantly. To prevent a nitrate build-up, approximately 1% of the feed flow should be removed. This corresponds to a volume of approximately 1.2 m^3 per day. During the operation, a volume of 10 m^3 is periodically removed and stored in a blowdown tank.

The blowdown solution is stored in tote tanks within sea cans. Once a year, the sea cans are sent back south whereby the totes are dealt with by a subcontractor who disposes of the solution according to regulations.

3.8 WATER HEATER

Three water heaters are required to heat water to approximately 80°C (first effect of the SaltMaker unit). Heat plate exchangers are used to transfer heat between the water to be treated and the thermal source. The thermal units are diesel driven.

3.9 SERVICE WATER SYSTEM

The service water system is mainly based on reusing distilled water produced within the plant. A 21 m^3 clean water reserve tank is being used for storage.

3.10 CONTROLS

The SWTP Pump is equipped with a variable frequency drive (VFD) that allows the flow to be modulated.

The SaltMaker system and post-treatment use a variety of sensors and automation hardware to achieve reliable plant operations. Sensors include temperature, pressure, flow, level, conductivity, and pH.

The electrical and control system for the post-treatment consists of a main control panel with multiple alternating current (AC) drives, switch gear, terminal blocks as well as the Programmable Logic Control (PLC) and modules. AC drives allow variable speed on the feed pump, high pressure pumps, and RO recirculation pump. The drives allow the control system to make flow and pressure adjustments to maximize RO recovery and efficiency. The panel houses the Human Machine Interface (HMI), conductivity and pH transmitters for operators. All instrumentation and automation functions are carried out by the PLC based on signals from sensors.

Saltworks is standardized on 4-20 mA analogue sensor outputs to minimize signal loss issues. 4-20 mA signals are read by input/output (I/O) modules on the PLC or Remote I/O units.

The SaltMaker and post-treatment use the following types of instruments:

Pressure:

These sensors are used to measure pump discharge pressure on main water lines on each effect. Trends in pressure readings can help the operator identify pipe scaling issues. They can also be used to identify pump problems. These pressure sensors use piezoresistive measuring cells (similar to a strain gauge) to measure pressure being applied on the sensor connector. A built-in transmitter amplifies this signal and converts it into 4-20 mA to communicate with the PLC modules.

For the post-treatment, these sensors are used to measure the pump inlet/discharge pressures. Trends in pressure readings can help the operator identify filter clogging or membrane fouling issues. They can also be used to identify pump problems.

Level:

These sensors are used to measure the level on SaltMaker tanks and post-treatment. Different types of sensors are used depending on the fluid and process conditions.

> ***Pressure:*** These sensors use piezoresistive measure cells that are calibrated at high resolution to measure level changes in tanks. They are mounted near the bottom of the tank. Because they measure hydrostatic pressure, they are affected by density changes of the fluid.
>
> ***Ultrasonic:*** These sensors send ultrasonic sound pulses and measure the time it takes for the pulses to reflect and bounce back from the process medium below and return to the sensor. This is translated into a level measurement. These sensors are mounted on top of the tank and do not come into direct contact with process fluids.
>
> ***Radar:*** These sensors send radar pulses and measure the time it takes for the pulses to reflect and bounce back from the process medium below and return to the sensor. This is translated into a level measurement. These sensors are mounted on top of the tank and do not come into direct contact with process fluids. In general, radar has performance and reliability advantages over ultrasonic. Suitability of radar versus ultrasonic sensors depends on actual tank conditions and is outside the scope of this manual.

Level sensor feedback allows for automated level control by filling and transfer of water in process tanks. The system is vital to continuous operation of the SaltMaker. Proper SaltMaker operations produce a unique saw-tooth pattern on main effect tanks, with a slow decrease in tank level due to evaporation and a fast increase in levels due to the transfer of process fluids into the tank. Automated level warnings help operators locate issues before they become serious enough to interrupt operations.

For the post-treatment, level sensor feedback allows for automated level control by filling and transfer of water in process tanks. The system is vital to continuous operation of the Post-Treatment RO. Automated level warnings help operators locate issues before they become serious enough to interrupt operations.

Conductivity:

These sensors are used to measure the conductivity of water, which is proportional to the ionic or salt concentration of the water. The SaltMaker deploys two different types of conductivity sensors:

> ***Contacting Conductivity Sensors:*** These sensors employ a potentiometric method. Two or four electrodes are submersed in the sample fluid. The sample fluid completes the electrical

circuit. A potential is proportional to the conductivity of the fluid. Saltworks uses this type of sensor to measure a conductivity range from 0-5 mS.

Inductive Conductivity Sensors: Two coils are wound inside the ring-shaped sensor. One coil drives a magnetic field with a known voltage and induces a current on the second coil. This current is proportional to the conductivity of the measured fluid. This type of sensor is suitable for measuring conductivity in the 5-1000 mS range.

Conductivity sensor signals help operators monitor the concentration of process water in different effects. By tracking an increase in concentration of brine over time, these sensors ensure that the SaltMaker is functioning normally.

For the post-treatment, conductivity sensor signals help operators monitor the concentration of the concentrate and permeate process streams. By tracking conductivity changes over time, these sensors ensure that the Post-Treatment RO is functioning normally.

pH:

These sensors contain a potentiometric cell made of pH-sensitive electrodes. Voltage is measured across the electrodes and the signal is amplified and processed into a 4-20 mA signal. pH sensors help monitor the condition of treated and untreated water. They are also used in optional acid and base dosing systems to monitor and control pH to adjust the solubility of the process water to different salts.

Temperature:

These sensors measure the temperature of the process streams. The SaltMaker and post-treatment use resistive RTDs (resistance temperature detectors) which are sensors that measure a change in resistance due to a change in temperature. This signal is amplified and processed into a 4-20 mA signal with a transmitter. Temperature differences between the effects provide the main driving force for the humidification-dehumidification (HDH) process. Abnormal temperature differences would indicate problems with heat transfer between one effect and the other. These sensors help operators track temperature across all the effects to confirm normal operations.

Weight:

Load cells measure the mass of the salt produced and stored in big bags. This information lets the operator know when to replace the big bag.

3.11 REAGENTS

The following reagents will be used at the SWTP:

- sulfamic acid
- calcium hypochlorite
- trisodium phosphate
- sodium meta-bisulfite
- caustic soda
- Antifoam (AF-64)
- Antisclant (CC 7430)
- Biocide (KATHON™ CF150 BIOCIDE, AQUCAR™ DB 20 Water Treatment Microbiocide)

- Cleaning chemical (BAR COR CWS-55, ROclean L211 and P303, E-Series Blends.

Most of the chemicals are supplied in liquid form (and dosed using a dosing skid pump directly into the process) except for the sulfamic acid, calcium hypochlorite, sodium meta-bisulfite and trisodium phosphate which must be prepared manually before dosing. The solutions made with these products are prepared according to the MSDS provided by the suppliers.

The application for each of these reagents is detailed in the Operation and Maintenance Manual (OMM). The MSDS are available in the OMM as well.

4 PUMPING AND PIPING

For the operation of the SWTP, pumping and piping are required to convey water:

- from underground stope to the Saline Water Pond;
- from the Saline Water Pond to the SWTP;
- treated water from SWTP to the containment pond 1 (CP1).

Appendix A: SWTP Drawings

Appendix B: Pumps selection

APPENDIX F • WATER QUALITY AND FLOW MONITORING PLAN

AGNICO EAGLE

MELIADINE GOLD MINE

Water Quality and Flow Monitoring Plan

JANUARY 2019
VERSION 1

EXECUTIVE SUMMARY

The Water Quality and Flow Monitoring Plan (the Plan) has been prepared in accordance with the requirements of the Nunavut Water Board Type A water license 2AM-MEL1631. The Plan is one component of the *Aquatic Effects Management Program* (AEMP) and is closely associated with the *Water Management Plan* and the *Metal and Diamond Mining Effluent Regulations (MDMER)*.

Section 2 of this Plan includes an overview of the monitoring programs and mine development schedule. Section 3 provides specific details (including sampling locations and parameters to be measured) for the compliance monitoring program, along with general guidance for the event monitoring program. An adaptive management program is described for regulated discharge and non-regulated discharges in Section 3. Requirements of the flow monitoring program are described in Section 4, and an overview of the reporting requirements in Section 5.

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IMPLEMENTATION SCHEDULE

As required by Water License 2AM-MEL1631, Part B, Item 10, the proposed implementation schedule for this Plan is outlined below.

This Plan will be implemented immediately (December 2018) subject to any modifications proposed by the NWB as a result of the review and approval process.

DISTRIBUTION LIST

Environmental Superintendent
Environmental Coordinators
Environmental Technicians

DOCUMENT CONTROL

Version	Date (YMD)	Section	Page	Revision
1	18/12/16	All	All	Comprehensive plan for Meliadine project. First version composed by Meliadine Environment Department.

Prepared by:

Agnico Eagle Mines Limited - Meliadine Division

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SECTION 1. INTRODUCTION

The Water Quality and Flow Monitoring Plan (the Plan) has been prepared in accordance with the requirements of the Nunavut Water Board Type A water license 2AM-MEL1631 (the License). The Plan is one component of the *Aquatic Effects Management Program* (AEMP) and is closely associated with the *Water Management Plan* and the *Metal and Diamond Mining Effluent Regulations (MDMER)*. The implementation and periodic updates to this Plan are the responsibility of the Meliadine Environment Department under the guidance of the Meliadine Environment Superintendent or designate.

The Plan summarizes the monitoring locations, sampling frequency, monitoring parameters, compliance discharge criteria and an adaptive management plan for water quality at the Meliadine Gold Project.

The purpose of this Water Quality and Flow Monitoring Plan is to establish the program that is to be implemented and followed by AEM's Meliadine environmental management team to monitor the performance of the waste and water management systems at the Meliadine Gold Project. The program includes:

- Verifying and validating the predicted water quality values with empirical measurements of the mine site water quality and flows;
- A comparison of measured water quality data to compliance requirements stipulated in the License; and
- A framework for adaptive management that allows the identification and rectification, where necessary, of unexpected trends or non-compliance in water quality and flows.

The Plan provides information on the locations of the monitoring stations at the various stages of mining. These monitoring locations are used to evaluate the performance of the mine waste and water management system.

The objectives of the monitoring program are:

1) To track the chemistry of the contact and non-contact water prior to and during discharge;

2) To assist in identifying if water treatment is required prior to discharge; and

3) To minimize the potential impacts of mining activities on the surrounding environment.

Additional locations outside the footprint of the mine (and outside the scope of this Plan) will be monitored under the *Meliadine Gold Project Aquatic Effects Management Program* (Golder 2016).

SECTION 2. OVERVIEW

2.1 OVERVIEW OF SITE WATER MANAGEMENT PLAN

Details of overall water management are discussed in the Meliadine Water Management Plan which is updated annually. A network of berms, dikes, containment ponds, channels, culverts and sumps are in place and maintained to facilitate water management (Section 3 of the *Water Management Plan*).

As specified in the *Water Management Plan*, surface contact water is intercepted, diverted and contained within various containment ponds prior to evaporation or treatment. Contact water from the Underground Mine is collected in underground sumps and recirculated for use in various underground operations. Underground contact water that is not used for operations is stored underground and any excess water that cannot be stored underground is pumped to the Saline Ponds or to the Saline Water Treatment Plant (SWTP) for treatment (See Section 3.9 of the *Water Management Plan*). Additional Saline Storage ponds will be developed on the Meliadine site (surface) in the future as groundwater inflows in the underground workings of the mine are greater than predicted. Agnico Eagle has received approval from the Nunavut Impact Review Board to discharge saline water via a diffuser to the sea in Rankin Inlet (Melvin Bay).

2.2 MONITORING PROGRAMS

This Plan has been divided into two levels of monitoring to characterize the range of impacts between the sources of contact water in the individual mine facilities and the point of discharge or release to the receiving environment. The two levels of monitoring include:

1) Compliance monitoring; and

2) Event monitoring.

2.2.1 Compliance Monitoring Program (CM)

The CM sites are those stipulated in the License; these sites vary from contact water collection ponds, structures such as ditches, culverts prior to discharge to the receiving environment and local lakes surrounding the mine site. The requirements of the License, including water quality limits, will be applied at the applicable mine discharge points identified in the CM program.

The CM program provides a mechanism to assess water quality at specified sites, and to confirm and document compliance of discharge with regulatory requirements. As part of adaptive water management, these internal monitoring stations provide protection to the receiving water environment, provide data to predict pit re-flooding water quality and ensure exceedances of predicted or regulated levels are appropriately managed or mitigated to reduce impacts.

2.2.2 Event Monitoring Program (EM)

The EM sites result from unexpected events such as spills, accidents, and malfunctions. The response programs for such events are discussed in greater detail in the following four (4) documents:

- Meliadine Spill Contingency Plan (March 2019;
- Meliadine Emergency Response Plan (May 2018);
- Meliadine Freshet Action Plan (March 2019); and
- Meliadine Water Management Plan (March 2019).

Each accidental release will require mobilization of site equipment to stabilize the release, procedures to contain, neutralize, and dispose of the discharge, and recommendations for monitoring the site following the incident.

2.3 OVERVIEW OF MINE DEVELOPMENT SCHEDULE

The Mine Plan and key mine development activities, including mine waste management are currently used concurrently with the *Water Management Plan*.

The Mine Plan proposes one underground mine (Tiriganiaq Underground Mine) and two open pits (Tiriganiaq Open Pit 1 and Tiriganiaq Open Pit 2) for the development of the Tiriganiaq gold deposit.

The Mine is estimated to produce approximately 14.9 million tonnes (Mt) of ore, 31.8 Mt of waste rock, 7.4 Mt of overburden waste, and 14.9 Mt of tailings. The following phased approach is proposed for the development of the Tiriganiaq gold deposit;

- Phase 1: 3.5 years for Mine Construction. Construction began in 2015 and is estimated to be completed in Q2 of 2019 (Q4 Year -5 to Year Q2 -1);
- Phase 2: 8.5 years for Mine Operations, beginning in 2019 (Q2 Year -1 to Year 8);
- Phase 3: 3 years Mine Closure (Year 9 to Year 11); and;
- Phase 4: Post-Closure (Year 11 forward).

Mining facilities on surface will include a plant site and accommodation buildings, three ore stockpiles, a temporary overburden stockpile, a tailings storage facility (TSF), three waste rock storage facilities (WRSFs), a water management system that includes containment ponds, water diversion channels, retention dikes/berms, and a series of water treatment plant

SECTION 3. MONITORING PROGRAM

The monitoring program is presented in three sections; requirements of the compliance monitoring program, an overview of the event monitoring program, and then details of the adaptive management program for monitoring results.

3.1 COMPLIANCE MONITORING PROGRAM

The CM program monitors the chemistry of four local lake surrounding the mine site (E3, G2, H1 and B5) as well as mine contact water collected and diverted at specified locations prior to release into the receiving water environment. The sampling is conducted in order to confirm and document compliance with regulatory requirements. The types of water and the timing of the CM program include:

- Non-contact water from local lakes;
- Mine contact water collected from drainage of different structures; and
- Monitoring points located within the containment ponds prior to release into the receiving water environment

The CM sampling program has multiple monitoring stations across the project site, with sampling at different stages of the mine life. All of the CM stations, a description of their location, parameters to be monitored and sampling frequency are listed in Table 3.1. Specific details for the monitoring parameter groups are provided in Table 3.2. In summary, Agnico Eagle follows 5 groups of parameters, as identified in Meliadine's Type A Water License Schedule I Table 1.

Figures 3.1 shows the approximate location of each of the sampling sites. The actual location of each sampling site is determined by access and safety considerations and are marked by a stake that defines the exact location of the collection point for sampling events with appropriate attached signage in English, Inuktitut and French.

GPS coordinates for all compliance monitoring stations were confirmed, as required in Part I, Item 6 of the NWB Type A water license.

3.1.1 General Sampling and Analysis Program

Samples are collected in clean laboratory-supplied containers and preserved as directed by the analytical laboratory. During all phases, samples are analyzed offsite at an accredited commercial lab (ALS in Burnaby BC, Maxxam Analytics in Ottawa, AquaTox in Puslinch, or H2Lab in Val d'Or). Samples sent to commericial laboratories may change as the site matures and additional requirements occur.

Table 3.3 summarizes the minimum sample volumes, container, preservation, and holding times for each analyte. This information is from the *USEPA Methods for Chemical Analysis of Water and Waste Water* (*EPA-600/4-79-020, 1979*).

Table 3.1: Monitoring Program

Station	Description	Phase	Monitoring Parameters	Frequency
Mine Site				
MEL-D-1	Dewatering: Water transferred from lakes to Meliadine Lake during dewatering of lakes	Construction	As defined in the Water Management Plan referred to in Part D, Item 12	Prior to discharge and Weekly during discharge
			Volume (m3)	Daily during periods of discharge
MEL-SR-1 to TBD	Surface Runoff – runoff downstream of Construction areas at Meliadine Site and Itivia Site, Seeps in contact with the roads, earthworks and any Runoff and/or discharge from borrow pits and quarries	Construction, and Operation	As defined in the Water Management Plan referred to in Part D, Item 18 and Part I, Item 11	Prior to Construction, Weekly during Construction
			Group 1	Monthly during open water or when water is present upon completion
MEL-11	Water Intake from Meliadine Lake	Construction, Operation, and Closure	Full Suite	Monthly during periods of intake
			Volume (m3)	Daily during periods of intake
MEL-12	Water treatment plant (pre-treatment) coming from CP1, off the pipe and not in the pond	Construction (prior to release), Operations, and Closure	Group 1	Monthly during periods of discharge
MEL-03-01 (and AEMP Stations)	Mixing zone in Meliadine Lake, Station 1; and MDMER exposure stations for final discharge point within mixing zone	Construction (prior to release), Operations, and Closure	Full Suite, Group 3 (MDMER)	Monthly during periods of discharge
MEL-14	Water treatment plant from CP-1 (post-treatment), end of pipe (before offsite release) in the plant before release.	Construction (upon effluent release), Operations, and Closure	Full Suite, Group 3	Prior to discharge and Weekly during discharge

			Volume (m3)	Daily during periods of discharge Once prior to discharge and Monthly thereafter
			Acute Lethality	Once prior to discharge and Monthly thereafter
MEl-15	Local lake E-3	Operations, and Closure	Group 2	Bi-annually during open water
MEL-16	Local Lake G2	Construction, Operations, and Closure	Group 2	Bi-annually during open water
MEL-17	Local Pond H1	Construction, Operations, and Closure	Group 2	Bi-annually during open water
MEL-18	Local Lake B5	Construction, Operations, and Closure	Group 2	Bi-annually during open water
MEL-19	CP-2 Collection of natural catchment drainage from the outer berm slopes of the Landfarm and industrial pad	Construction, Operations, and Closure	Group 1	Monthly during open water or when Water is present
MEL-20	CP-3 Collection of drainage from dry stacked tailings	Operations, and Closure	Group 1	Monthly during open water or when Water is present
MEL-21	CP-4 Collection of drainage from WRSF1	Operations, and Closure	Group 1	Monthly during open water or when Water is present
MEL-22	CP-5 Collection of drainage from WRSF1 and WRSF2	Construction, Operations, and Closure	Group 1	Monthly during open water or when Water is present
MEL-23	CP-6 Collection of drainage from WRSF3	Construction, Operations, and Closure	Group 1	Monthly during open water or when Water is present
MEL-24	Seepage from the Landfill between the landfill and Pond H3	Construction, Operations, and Closure	Group 1	Monthly during open water or when Water is present
MEL-25	Secondary containment area at the Itivia Site Fuel Storage and Containment Facility	Construction, Operation, Closure	Group 4, Volume (m3)	Prior to discharge or transfer of Effluent

Table 3.2: Monitoring Parameters

Group	Parameters
1	pH, turbidity, hardness, alkalinity, chloride, fluoride, sulphate, total dissolved solids (TDS), total suspended solids (TSS), total cyanide, ammonia nitrogen, nitrate, nitrite, phosphorus, orthophosphate, Total Metals (aluminum, arsenic, barium, cadmium, chromium, copper, iron, lead, manganese, mercury, molybdenum, nickel, selenium, silver, thallium, and zinc).
2	**Total and Dissolved Metals**: aluminum, antimony, arsenic, barium, beryllium, boron, cadmium, chromium, copper, iron, lead, lithium, manganese, mercury, molybdenum, nickel, selenium, silver, strontium, thallium, tin, titanium, uranium, vanadium, and zinc. **Nutrients**: ammonia-nitrogen, total Kjeldahl nitrogen, nitrate-nitrogen, nitrite-nitrogen, orthophosphate, total phosphorus, total organic carbon, dissolved organic carbon, and reactive silica. **Conventional Parameters**: bicarbonate alkalinity, chloride, carbonate alkalinity, turbidity, conductivity, hardness, calcium, potassium, magnesium, sodium, sulphate, pH, total alkalinity, TDS, TSS, total cyanide, free cyanide, and weak acid dissociable (WAD) cyanide..
3	**MDMER parameters**: total cyanide, arsenic, copper, lead, nickel, zinc, radium-226, TSS, pH, total ammonia and temperature. **MDMER additional requirements**: Effluent volumes and flow rate of discharge, Acutely Lethality tests (Rainbow Trout and Daphnia magna) and environmental effects monitoring (EEM).
4	Total arsenic, total copper, total lead, total nickel, TSS, ammonia, benzene, toluene, ethylbenzene, xylene, total petroleum hydrocarbons (TPH), and pH
Full Suite	Group 2, Total Petroleum Hydrocarbons, Turbidity. Non Acutely-lethal (Rainbow Trout and Daphnia magna) for discharge only.
Flow	Flow data-logger
Field measurements	Field pH, specific conductivity, dissolved oxygen, and temperature.

Table 3.3: Summary of Sampling Requirements for each Analyte

Parameters	Matrix Holding Time				Type of Bottle	Preservative	Volume
	Drinking Water	Waste Water	Surface Water	Ground Water (1)			
Microbiology							
Escherichia coli, total coliforms, A.A.H.B	48h	48h	48h	48h	PPS	TS, E	250ml
Enterococcus	48h	48h	48h	48h	PPS	TS, E	250ml
Thermo tolerant coliforms (fecal)	48h	48h	48h	48h	PPS	TS, E	250ml
Inorganic Chemistry							
Absorbance UV, Transmittance UV				24h	P. T. V	N	125ml
Alkalinity, Acidity, Bicarbonates, Carbonates	14d	14d	14d	14d	P, T, V	N	250ml
Ammonia nitrogen (NH_3-NH_4)	28d	28d	28d	28d	P, T, V	AS	125ml
Kjeldahl ammonia (NTK)		28d	28d	28d	P, T, V	AS	125ml
Anions (Cl, F,SO_4)	28d	28d	28d	28d	P, T, V	N	250ml
Color, Free & total Chlorine	48h	48h	48h	48h	P, T, V	N	125ml
Conductivity	28d	28d	28d	28d	P, T, V	N	250ml
Cyanides total/available, Cyanides	14d	14d	14d	14d	P, T, V	NaOH	250ml
BOD_5/Carbonated BOD_5 (2)		48h/4°	48h/4°		P, T, V	N	250ml
COD (chemical oxygen demand)		28d	28d		P, T, V	AS	125ml
Mercury (Hg)	28d	28d	28d	28d	P, T, V	AN	250ml
Total/dissolved metals (filtered on field)	180d	180d	180d	180d	P, T, V	AN	250ml
Dissolved Metals (filtered in the laboratory)	24h	24h	24h	24h	P, T, V	N	250ml
Total suspended solids & Volatile TSS		7d	7d	7d	P. T. V	N	500ml
NH_3 or NH_4		24h	24h	24h	P.T.V	N+AS	2/125ml
Nitrites (NO_2), Nitrates (NO_3), Turbidity	48h	48h	48h	48h	P, T, V	N	250ml
Nitrites-Nitrates (NO_2-NO_3)	28d	28d	28d	28d	P, T, V	AS	250ml
O-Phosphates (O-PO_4)	48h	48h	48h	48h	P, T, V	N	500ml
pH	24h	24h	24h	24h	P, T, V	N	125ml
Total Phosphorus (P-tot)	28d	28d	28d	28d	P, T, V	AS	125ml
Dissolved solids (TDS)		7d	7d	7d	P. T. V	N	250ml
Total solids		7d	7d	7d	P. T. V	N	250ml
Sulphides (H_2S) (3)	28d	28d	28d	28d	P. T. V	AcZn + NaOH	125ml
Thiosulfates	48h	48h	48h	48h	P. T. V	N	125ml
Radioactive & Organic Chemistry							
Fatty resin acids (S-T)	--	28d	28d	--	VA, VT	AS	1L
Congeners PCB (S-T)	28d	28d	28d	28d	VA, VT	N	1L
Chlorobenzene	28d	28d	28d	28d	2 Vial+1 blank	TSS	2/40ml
Total Organic Carbon (TOC)	28d	28d	28d	28d	P, T, V (B)	AC	100ml
Dissolved Organic Carbon (DOC)	48h	48h	48h	48h	P, T, V (B)	N	100ml
Total Inorganic Carbon (CIT)	48h	48h	48h	48h	P, T, V (B)	N	100ml
Phenolic compound (GC-MS)	28d	28d	28d	28d	VA, VT	AS	1L
Glyphosate (S-T)	14d	14d	14d	14d	P.T	N	500ml
PAH	28d	28d	28d	28d	VB	AS	1L
Oil & Greases (total and non-polar)	28d	28d	28d	28d	VA, VT	AS	1L
C10-C50 HP and/or Petroleum Product Identification	28d	28d	28d	28d	VA, VT	AS	1L

Phenol index	28d	28d	28d	28d	VA, VT	AS	500ml
Radium-226	180d	180d	180d	180d	P, T. V	AN	1L
VOC (MAH, CAH, THM, BTEX) (3)	28d	28d	28d	28d	2 Vial+1 blank	TSS	2/40ml

Type of bottle:
P.S.V.T.: plastic bottle, bag or glass bottle with Teflon cap
P, T: Plastic bottle or plastic bottle with Teflon cap
P.T.V.: Plastic bottle or glass bottle with plastic or Teflon cap
PPS: Sterile propyl ethylene bottle
VA: Clear or amber glass with aluminium or Teflon seal
VB: Amber glass (or clear glass covered with aluminium paper) aluminium seal of Teflon
VT: Clear or amber glass bottle with Teflon seal
Preservative:
AC: 0.1ml (100µl) of HCl per 100ml of sample
AcZn: 0.2ml zinc acetate 2N per 100ml of sample and NaOH 10N to pH >9
AN: HNO3 to pH <2
AS: H2SO4 to pH <2
E: 2.5ml EDTA 1.5% (p/v) per 100ml of sample if heavy metals are suspected
ED: 0.1ml diamine ethylene 45 mg/l per 100 ml of sample
EDTA: 1ml EDTA 0.25M per 100ml of sample
N: No preservative
NaOH: NaOH 10N to >12
TS: Sodium thiosulfate final concentration in the sample of 0.1% (p/v)

3.1.2 Compliance Monitoring Stations and Discharge Criteria

Further details of the specific CM stations and discharge criteria stipulated under the License are provided below.

3.1.2.1 *Dewatering Activities*

All Waters from dewatering activities at Monitoring Program Stations MEL-D-1 through MEL-D-TBD shall be directed to Meliadine Lake and shall not exceed the quality limits presented in Table 3.4 as stipulated in Part D, Item 12 of the License.

Table 3.4: TSS and pH Criteria at CM Stations MEL-D-1 through MEL-D-TBD

Parameter	Maximum Average Concentration (mg/L)	Maximum Concentration of Any Grab Sample
TSS	15.0	30
pH	6.0 to 9.5	6.0 to 9.5

All surface runoff and/or discharge from drainage management systems, at the Monitoring Program Stations MEL-SR-1 to MEL-SR-TBD during the Construction/Operation of any facilities and infrastructure associated with this project, including laydown areas and All-weather Access Road, where flow may directly or indirectly enter a Water body, shall not exceed the Effluent quality limits presented in Table 3.5, as stipulated in Part D, Item 18 of the License.

Table 3.5: Effluent Criteria at CM Station MEL-SR-1 to MEL-SR-TBD

Parameter	Maximum Average Concentration	Maximum Concentration of Any Grab Sample
Total Suspended Solids (TSS) (mg/L)	50.0	100.0
Oil and Grease	No Visible Sheen	No Visible Sheen
pH	6.0 to 9.5	6.0 to 9.5

3.1.2.2 *Water Collection System*

A water collection system comprised of berms, dikes, containment ponds, channels, culverts and sumps was developed to control water at the Meliadine project (Section 3 of the *Water Management Plan*). Diversion berms, diversion channels and culverts will direct surface water towards containment ponds and associated dikes. Pending salinity levels, water in containment pond CP5 will be treated by a Reverse Osmosis (RO) treatment plant prior to be discharged in CP1.

Contact water from the Underground Mine is collected in underground sumps and recirculated for use in various underground operations. Underground contact water that is not used for operations is stored underground and any excess water that cannot be stored underground is pumped to the Saline Ponds. Saline water collected in the Saline Ponds is temporarily stored and then actively evaporated or pumped to the SWTP for treatment prior to being pumped to CP1.

At CP1, the water is treated for total suspended solids (TSS) at the Effluent Water Treatment Plant (EWTP) and either transferred to the process plant for use as make-up water or discharged through the diffuser located in Meliadine Lake

Effluent discharged from CP1 at CM station MEL-14 shall be directed to Meliadine Lake through the Meliadine Lake Outfall Diffuser and shall not exceed the effluent quality limits presented in Table 3.7, as stipulated in Part F, Item 3 of the License.

Table 3.6: Effluent Criteria at CM Station MEL-14

Parameter	Maximum Average Concentration	Maximum Concentration of Any Grab Sample
pH	6.0 to 9.5	6.0 to 9.5
TSS (mg/L)	15	30
TDS (mg/L)	1400	1400
Total (T)-Al (mg/L)	2.0	3.0
T-As (mg/L)	0.3	0.6
T-CN (mg/L)	0.5	1
T-Cu (mg/L)	0.2	0.4
NH_4-N (mg/L)	14	18
T-Ni (mg/L)	0.5	1
T-Pb (mg/L)	0.2	0.4
T-P (mg/L)	2.0	4.0

T-Zn (mg/L)	0.4	0.8
Total Petroleum Hydrocarbons (TPH) (mg/L)	5	5

The Discharge of Effluent from the Final Discharge Point at Monitoring Program Station MEL-14 shall be demonstrated to be non-Acutely Lethal under the following test in accordance with the Schedule I of the License:

a. Acute Lethality of Effluents to Rainbow Trout (as per Environment Canada's Environmental Protection Series Biological Test Method EPS/1/RM/13 July 1990, published by the Department of the Environment, as amended in December 2000, and as may be further amended from time to time.

Itivia Marshalling Area

Surface water runoff from the bulk fuel tank storage areas is collected within the tank's secondary containment enclosures that are equipped with an HDPE liner; these are designed to contain petroleum products released due to spill events. Water collected in the secondary containment enclosures at CM station MEL-25 is discharged to land in a controlled manner according to the Nunavut Water Board Type A water license # 2AM-MEL16331.

All effluent being discharged from the secondary containment enclosures at the itivia marshalling facility shall not exceed the effluent quality limits presented in Table 3.9, as stipulated in Part F, Item 5 of the water license.

Table 3.7: Effluent Criteria at CM Station MEL-25

Parameter	Maximum Average Concentration	Maximum Concentration of Any Grab Sample
pH	6.0 to 9.5	6.0 to 9.5
TSS (mg/L)	15.0	30.0
Benzene (ug/L)	370	370
Toluene (ug/l)	2	2
Ethylbenzene (ug/L)	90	90
Lead (mg/L)	0.1	0.1
Oil and Grease (mg/L)	5.0 and no visible sheen	5.0 and no visible sheen

3.1.2.3 *Receiving Environment*

Receiving water quality monitoring is discussed in the Aquatic Effects Management Program (AEMP) (March 2019). Within the AEMP are numerous monitoring programs: water quality, sediment quality, benthic invertebrate communities, and fish health and fish tissue chemistry. The Meliadine Lake monitoring program was designed around the key aspects of Environmental Effects Monitoring (EEM) requirements under the Metal and Diamond Mining Effluent Regulations. Water quality data are analyzed to determine if there are differences between the Near-field exposure area, the Mid-field exposure area, and the pooled reference areas of Meliadine Lake.

3.2 EVENT MONITORING

The Event Monitoring (EM) program addresses the site specific monitoring that is required following any accidental release. A "release" may be caused by:

- Spills, including unidentified seepage (Meliadine Spill Contingency Plan; March 2018); or
- Emergencies (Meliadine Emergency Response Plan; May 2017).

The EM program is designed to verify whether contamination of the surface soil and/or any nearby receiving environment and active zone has occurred as a result of an accidental release of a hazardous material or contaminated water. Verification is done through monitoring of surface runoff and nearby receiving environment during and following remedial activity. It is anticipated that due to the presence of permafrost beneath most of the mine footprint (active layer app 1.5m in depth), there will be minimal impact to groundwater from surface spills or accidental releases.

The EM plan is developed on a site specific basis subsequent to a spill or other incident, and considers the type of product spilled, the potential receptors and the potential for any remaining contamination after clean up. The plan is coordinated by the Environmental Department.

In the event of an accidental release, the water quality of any downstream receptor as well as an upstream reference (background) is sampled to determine severity of impact. Should the spill have happened over snow cover, as much contaminated snow will be removed as possible. Verification sampling would occur in the area after thaw to determine if the clean – up is complete or if further remediation is necessary. The specific parameters monitored as part of the EM program will depend on the nature of the spill, and will be determined for the specific material released.

The EM program for a particular spill will cease upon obtaining satisfactory analytical results from the potentially affected areas or as required by regulators.

3.3 ADAPTIVE MANAGEMENT PROGRAM

Results of the water quality monitoring are reviewed by the Meliadine Environment Department. Chemical trends of constituents of interest are tracked for mine site monitoring and for the AEMP program. This allows for early detection of significant changes in water quality within the mine site prior to discharge. If triggers and thresholds, such as in the AEMP program, are exceeded in the receiving environment action plans are then implemented to ensure that environmental protection objectives are met.

An adaptive management program has been designed for the Meliadine Gold Project to evaluate the monitoring data and provide a framework for action, if necessary. The program has two levels - a trigger level to compare the monitoring data against, and an action plan of mitigative measures for identified exceedances.

The adaptive management program is divided into two sections, one for parameters with regulated discharge criteria at specific monitoring locations, as specified in the License and by the Metal Diamond Mining Effluent Regulations (MDMER). The second section is for measured parameters for which no discharge limits have been identified in the License such as those in the AEMP or EEM.

Saline Water Treatment Plant Influent and Effluent

Water samples are collected weekly at both the inlet and outlet of the SWTP. Samples taken at the inlet of the SWTP represent the water quality of either Sump 75 or the Saline Pond, which will vary depending on the treatment priority for saline water storage. The results of the sample analysis are used by SWTP operators to fine-tune the treatment process and ensure its optimal performance. Samples taken at the outlet of the SWTP are analyzed to provide the quality of treated water produced by the SWTP that is transferred to CP1.

Water samples are analyzed for the following parameters: pH, conductivity, temperature, Total Suspended Solids (TSS), Total Dissolved Solids (TDS), chloride, ammonia, nitrite, nitrate, total phosphorus, total metals, total cyanide, and total mercury.

3.3.1 Adaptive Management Program for Regulated Discharge

3.3.1.1 *Action Plan*

In the case of an exceedance of a License limit or MDMER discharge limit, an action plan will be implemented. The adaptive management program requires that if one or more of the key monitored parameters exceed the respective limits, a staged sequence of responses will follow. Table 3.12 summarizes the staged adaptive action plan for the CM program for regulated discharge. Figure 3.1 is a logic diagram showing the decision path for evaluating analytical results for regulated discharges.

In addition to the mitigative measures listed above, a number of other possible alternatives are available to reduce or treat contaminants. These mitigation measures include:

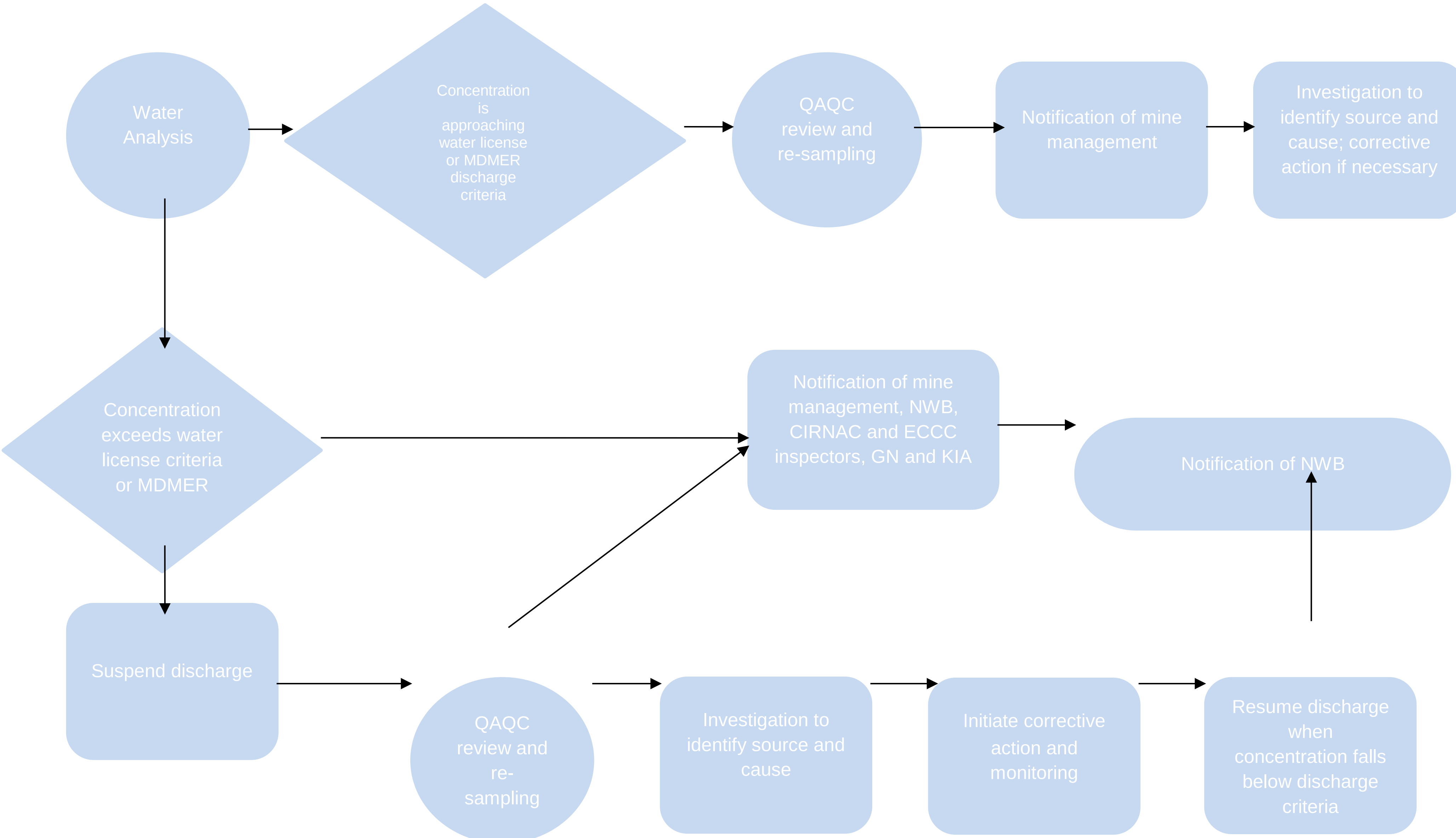
- Best management practices for sediment and erosion control would be employed to reduce TSS concentrations (i.e., flow control, sedimentation basin construction silt fencing, etc; see Sediment and Erosion Management Plan);
- Addition of a coagulant for the reduction of TSS in pond water;
- Use of geotextile or reamouring of banks to filter and reduce TSS in pond/ditch water;
- Deployment of absorbent booms and/or barriers within ponds to isolate surface petroleum hydrocarbon films for removal and/or treatment;
- Adjustments to on-site sewage treatment for the reduction of BOD and E. coli concentrations; Addition of lime to increase a low pH value or reduce metal concentrations;
- Removal of the offending source rock or the prevention of surface waters coming into contact with the offending source rock in the case of ARD; and/or
- Implementation of the *Freshet Action Plan* to proactively identify any issues around areas of concern; conduct additional monitoring, and control and contain seepage or movement of TSS on site.

Table 3.6: Action Plan for Regulated Discharge

Example	Action Plan

Exceeds water license discharge criteria or MDMER	1. Suspension of discharge activities; 2. QA/QC review and analysis, and re-sample water at the particular location if necessary; 3. Notification of mine management (General Mine Manager or designate and Environment Superintendent, or designate) and the regulators: Nunavut Water Board, CIRNAC and ECCC inspectors, GN and the Kivalliq Inuit Association; 4. Investigation to identify possible source(s) and cause(s) of the exceedance; 5. Initiation of corrective actions or water treatment, and follow up monitoring; and 6. Resumption of discharge when concentrations are below the discharge criteria

Figure 3.2: Logic Diagram for Regulated Discharge



3.3.2 Adaptive Management Program for Non-Regulated Discharge

Aside from targeted monitoring studies (i.e. "Effects Assessment Studies") such as those following construction, the AEMP is the main program aimed at measuring and assessing potential impacts of contaminants in the receiving aquatic environment that are not regulated under MDMER or NWB. This program combines with the Environmental Effects Monitoring (EEM) required under MDMER.

The program is designed to take an integrated, ecosystem-based approach that links mitigation and monitoring of physical/chemical effects to key ecological receptors in the receiving environment. It addresses key issues identified in the Meliadine EA (i.e., mining-related activities with the potential to affect water quality, fish habitat and fish populations). Monitoring results are intended to inform the "adaptive management" process", supporting the early identification of potential problems and development of mitigation options to address them by comparing results to established threshold and trigger levels.

3.3.2.1 *AEMP Action Level and Significance Threshold*

The AEMP Response Framework links monitoring results to management actions, with the purpose of maintaining the assessment endpoints within acceptable ranges. It is a systematic approach for evaluating AEMP results and responding appropriately, such that potential unexpected effects are identified and mitigation is undertaken to reduce or reverse them, thereby preventing the occurrence of a significant adverse effect. This is accomplished by continually evaluating monitoring data and implementing follow-up actions (e.g., confirmation, further study, mitigation) at pre-defined levels of change in measurement endpoints (i.e., Action Levels). For purposes of this Response Framework, the following terms are used: effect, normal range, benchmark, Action Level, and Significance Threshold.

Action Level – Action Levels (Low, Moderate, and High) are pre-defined levels of environmental change that exceeds normal ranges or benchmarks, or results of statistical tests, or a combination of these. For example, exceedance of the normal range and approach of a benchmark by a water quality parameter in the near-field exposure area may be defined as the Low Action Level. A change that falls within the normal range of variability for the study area would not trigger an Action Level.

Significance Threshold – The Significance Threshold, for the purposes of an AEMP Response Framework, is a magnitude of change that would result in significant adverse effects. It is a clear statement of environmental change that must never be reached. The AEMP Response Framework is designed to prevent reaching the significance threshold for all assessment endpoints.

3.3.2.2 *Action Levels*

The proposed Action Levels are designed to provide an early warning indication of potential adverse effects to plankton and benthos (i.e., food for fish), to fish health, and to the assurance of normal ecological function (including water quality and sediment quality). The proposed Low Action Levels (Table 8-2 and 8-3) are designed such that changes of sufficient magnitude to trigger a Low Action Level response are reported, documented, investigated, and ultimately addressed (i.e., mitigation measures or operation changes are implemented) before Significance Thresholds would ever be reached; if a Low Action Level is reached, Medium and High Action Levels (with response actions) are developed to provide further adaptive management guidance to the Mine to avoid reaching the Significance Thresholds. The type of management response taken after reaching an Action Level will depend on the type and magnitude of effect observed.

Further details on the integrated aquatic effects action plan are provided in Golder, 2018.

SECTION 4. FLOW VOLUMES

Flow volumes within the mine footprint will be measured daily during periods of discharge. Flow volume measurements will be conducted using volumetric flow meters attached to applicable pumps. For permanent pumping arrangements such as fresh water pumping systems flows will be measured using permanent in line flow meters. For periodic batch discharges, such as secondary containment sumps, portable flow meters or calculated pump time and capacity methods will be used.

Detailed pump records are maintained including date, pond/sump number, receiving location of pumped water, pump ID, duration of pumping, and total volume pumped. The average flow rates, total discharge per event and total cumulative discharge will be reported annually.

The monitoring locations for water flow volumes, in accordance with Part I, Item 9, and Table 2 of the Water License, include:

- The volume of fresh Water obtained from Meliadine Lake at Monitoring Program Station MEL-11;
- The volume of fresh Water transferred to the Meliadine Lake during lakes' dewatering activities;
- The volume of fresh Water obtained along the road and Meliadine River for dust suppression activities;
- The volume of Effluent discharged from Final Discharge Point at Monitoring Program Station MEL-14;
- The volume of reclaim Water obtained from CP1;
- The volume of Effluent discharged onto tundra at Monitoring Program Station MEL-25 or transferred to CP1 from the Itivia Site Fuel Storage and Containment Facility; and
- The volume of Effluent and Fresh Water transferred to the pits during pits' flooding.

SECTION 5. REPORTING

Reporting of water quality results is to be conducted on two levels a) monthly and annually with the results of the monitoring program and per MDMER requirements and b) in response to exceedances.

5.1 ANNUAL REPORTING

An annual report is to be submitted to the NWB, KIA, Department of Fisheries and Oceans, Crown-Indigenous Relations and Northern Affairs Canada, Nunavut Impact Review Board, Government of Nunavut, and other interested parties by March 31st of the following year. The report is to summarize the following:

- Monitoring results for each sampling station during the year and for the life of mine (construction to end of closure); activities during the year at each station; and any exceedances at stations, the action plan applied to the exceedance, and the results of the action plan;
- Annual seep water chemistry results; including location of the samples, sources of the water collected, and results of chemical analyses of the samples;
- Receiving water monitoring results;

- Spills and any accidental releases; event monitoring activities conducted following containment, remediation, and reclamation; and the results of EM program, any exceedance in EM results, and the action plan following the exceedance;
- Measured flow volumes;
- Effluent flow rates, volumes and calculated chemical loadings following the requirements of MDMER; and
- Results of QA/QC analytical data.

5.2 EXCEEDANCE REPORTING

Any measured concentration at a CM station exceeding a regulated discharge criterion stipulated in the License or MDMER will be reported to the NWB and Environment Canada and Climate Change upon receipt of the analysis. In addition, results of the action plan will be reported and, where necessary, mitigation options identified within 90 days after receipt of the analyses.

Exceedances in the concentration of a parameter in receiving water will be reported as specified in the AEMP and EEM – MDMER accordingly.

SECTION 6. REFERENCES

Golder Associates Ltd. 2016. Aquatic Effects Monitoring Program (AEMP) Design Plan. Version 1. June 2016. 6513-REP-03.

APPENDIX G • WATER MANAGEMENT STRUCTURE INSPECTION TEMPLATE

Environmental Inspection Report for Meliadine Gold Project

Water Licence 2AM-1424 Part E Item 15 – Water Management Structures – (Site Services Owner)

DATE : Inspected By :

Location :

In Compliance with	Subject	Conform	Non-conform	N/A	Comments
Water Management Plan Section 3.11.1 Culvert and Water Crossing Inspections	Ensure no damage to the inlet or outlet of culverts **on site** which may impede flow capacity.				
Water Management Plan Section 3.11.1 Culvert and Water Crossing Inspections	Ensure no damage to the inlet or outlet of culverts on the **AWAR and Bypass Road and at Itivia** which may impede flow capacity.				
Water Management Plan Section 3.11.1 Culvert and Water Crossing Inspections	Ensure no blockages within the culvert including snow, ice, and debris.				
Water Management Plan Section 3.11.1 Culvert and Water Crossing Inspections	Ensure no snow cover or snow piles, which would prevent routing of water into or out of the culvert (only applicable within 1 month prior to freshet and during freshet).				
Water Management Plan Section 3.11.1 Culvert and Water Crossing Inspections	Ensure no bed erosion upstream and downstream of watercourse crossing structures.				
Water Management Plan Section 3.11.1 Culvert and Water Crossing Inspections	Ensure no scour under bridge abutments and abutment foundations.				

Water Management Plan Section 3.11.1 Culvert and Water Crossing Inspections	Ensure no erosion along cutslopes and fillslopes of embankments (rill and gully erosion)				
Water Management Plan Section 3.11.2 Containment Pond Inspections	Ensure no unplanned inputs to containment ponds via surface runoff which are not part of the water management system				
Water Management Plan Section 3.11.2 Containment Pond Inspections	Ensure water level elevations in containment ponds are not above the operating manual maximum (OMM)				
Water Management Plan Section 3.11.3 Dike Inspections	Monitoring and documentation of **changes** in previously observed movement and /or deterioration of dikes. Weekly during flow and monthly thereafter.				
Water Management Plan Section 3.11.3 Dike Inspections	Monitoring and documentation of **newly** observed movement and /or deterioration dikes. Weekly during flow and monthly thereafter.				
Water Management Plan Section 3.11.3 Dike Inspections	Monitoring and documentation of seepage through the downstream dike slope. Weekly during flow and monthly thereafter.				
Water Management Plan Section 3.11.3 Dike Inspections	Monitoring and documentation of water presence in channel/sump downstream of dike. Weekly during flow and monthly thereafter.				
Water Management Plan Section 3.11.3 Dike Inspections	Monitoring and documentation of areas of deterioration or movement of dike channel/sump. Weekly during flow and monthly thereafter.				

Water Management Plan Section 3.11.3 Dike Inspections	Issues observed as part of dike inspections will be addressed by Agnico Eagle geotechnical engineer				
Water Management Plan Section 3.11.4 Diversion Channel and Berm Inspections	Ensure no obstructions to flow (i.e., ice, debris) within channels on site which would impede maximum flow capacity				
Water Management Plan Section 3.11.4 Diversion Channel and Berm Inspections	Ensure no inflows to channels on site which are not part of the water management system				
Water Management Plan Section 3.11.4 Diversion Channel and Berm Inspections	Ensure no slumping or failure of banks of channels on site which could impede flow or introduce TSS				
Water Management Plan Section 3.11.4 Diversion Channel and Berm Inspections	No seepage through water diversion berms resulting in water movement to areas not planned within the water management system				
Water Management Plan Section 3.11.4 Diversion Channel and Berm Inspections	No erosion of diversion berms (i.e., undercutting, slope failure)				

Comments / Recommendations

Environmental Personnel Name :

Signature :

Actions Corrected:
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____
____
____

Supervisor Name: ____________________________________

Signature: ____________________________________

Picture 1:

Picture 2:

Picture 3:

APPENDIX H • 2019 WATER BALANCE AND QUALITY FORECAST RESULTS

Containment Pond 1											
	Volume	**TDS**	**Inflows**								
Result:	Volume (end of month)	Monthly Average TDS	South of Esker	H15 Watershed	CP1 East Watershed	CP1 West Watershed	Ore Stockpiles	CP1 West Shore Watershed	Industrial Pad Runoff	Portal 2 Catchment	Crusher Pad Runoff
Unit:	m3	mg/L	m3	m3	m3	m3	m3	m3	m3	m3	m3
2019 Jan	112247.2	1969.523	0	0	0	0	0	0	0	0	0
2019 Feb	119396.3	1879.312	0	0	0	0	0	0	0	0	0
2019 Mar	126733.5	1797.157	0	0	0	0	0	0	0	0	0
2019 Apr	131650.3	1745.63	0	0	0	0	0	0	0	0	0
2019 May	136730.4	1709.831	0	0	0	0	0	0	0	0	0
2019 Jun	235123.7	1804.616	9371.438	17273.25	11579.31	22168.33	1932.813	11475.49	24239.98	3237.486	1029.42
2019 Jul	262239.8	2329.541	1625.417	2995.935	2125.795	3981.168	521.462	1381.294	6038.066	876.312	278.64
2019 Aug	314478.2	2786.252	2357.999	4346.216	3000.123	5678.327	799.5072	1715.708	7451.265	1046.706	332.82
2019 Sep	365789.9	3026.668	1927.459	3552.654	2414.665	4597.84	484.9281	1156.391	5502.455	754.602	239.94
2019 Oct	390387	3174.841	595.223	1097.103	731.3918	1403.299	66.20123	313.6647	1476.144	194.736	61.92
2019 Nov	398063.8	3222.95	0	0	0	0	0	0	0	0	0
2019 Dec	405744.6	3171.37	0	0	0	0	0	0	0	0	0

Containment Pond 1											
	Inflows										
Result:	Landfill Runoff	H13 Catchment Runoff	WRSF2 Catchment	Direct Precipitation	Runoff from TSF	WRSF1 Runoff	Recirculated from EWTP	Pumped from CP3	Pumped from CP4	Pumped from CP5	SWTP Permeate
Unit:	m3	m3	m3	m3	m3	m3	m3	m3	m3	m3	m3
2019 Jan	0	0	0	0	0	0	0	0	0	0	3303.72
2019 Feb	0	0	0	0	0	0	0	0	0	0	3696
2019 Mar	0	0	0	0	0	0	0	0	0	0	3493
2019 Apr	0	0	0	0	0	0	0	0	0	0	1200
2019 May	0	0	0	0	0	0	0	0	0	0	1240
2019 Jun	931.266	24362.21	18771.24	15324.5	7095.284	2972.649	0	24074.28	0	0	1551.942
2019 Jul	252.072	4225.471	3554.507	0	1920.528	750.6201	0	10481.84	0	0	4119.5
2019 Aug	301.086	6129.909	4943.415	0	2293.964	908.4846	0	13856.72	0	0	4092
2019 Sep	217.062	5010.668	3944.967	2233.305	1653.788	617.0021	0	10719.85	0	0	3965.5
2019 Oct	56.016	1547.356	1181.911	4082.843	426.784	119.1622	0	3080.324	0	0	4092
2019 Nov	0	0	0	0	0	0	0	0	0	0	3960
2019 Dec	0	0	0	0	0	0	0	0	0	0	3960

Containment Pond 1										
	Inflows			Outflows						
Result:	Truck Wash	STP	RO Permeate	Steady Rate Treatment	Overflow	Discharge to Sea	Evaporation	To CP5	Seepage through DCP1	EWTP
Unit:	m3	m3	m3	m3	m3	m3	m3	m3	m3	m3
2019 Jan	16	3798.21	0	0	0	0	0	0	0	0
2019 Feb	16	3437.13	0	0	0	0	0	0	0	0
2019 Mar	20	3824.16	0	0	0	0	0	0	0	0
2019 Apr	16	3700.8	0	0	0	0	0	0	0	0
2019 May	16	3824.16	0	0	0	0	0	0	0	0
2019 Jun	20	3700.8	0	0	0	0	0	0	0	106353.2
2019 Jul	16	3824.16	0	0	0	0	18444.97	0	0	4038.207
2019 Aug	16	3824.16	0	0	0	0	7409.704	0	0	4360.83
2019 Sep	20	3700.8	0	0	0	0	0	0	0	2149.706
2019 Oct	16	3824.16	0	0	0	0	0	0	0	0
2019 Nov	16	3700.8	0	0	0	0	0	0	0	0
2019 Dec	20	3700.8	0	0	0	0	0	0	0	0

Containment Pond 3								
	Volume	**TDS**	**Inflows**				**Outflows**	
Result:	Volume (end of month)	Monthly Average TDS	Direct Precipitation	Natural Runoff	Disturbed Runoff	TSF Runoff	To Environment	To CP1
Unit:	m3	mg/l	m3	m3	m3	m3	m3	m3
2019 Jan	0	0	0	0	0	0	0	0
2019 Feb	0	0	0	0	0	0	0	0
2019 Mar	0	0	0	0	0	0	0	0
2019 Apr	0	0	0	0	0	0	0	0
2019 May	0	0	0	0	0	0	0	0
2019 Jun	25454	4872.601	0	30075.3	5054	14398.98	0	24074.28
2019 Jul	25454	5158.659	0	5216.37	1368	3897.468	0	10481.84
2019 Aug	25454	5441.455	0	7567.41	1634	4655.309	0	13856.72
2019 Sep	25454	5460.194	0	6185.7	1178	3356.153	0	10719.85
2019 Oct	25454	5387.477	0	1910.22	304	866.104	0	3080.324
2019 Nov	25454	5349.831	0	0	0	0	0	0
2019 Dec	25454	5349.831	0	0	0	0	0	0

Containment Pond 5											
	Volume	TDS	Inflows							Outflows	
Result:	Volume (end of month)	Monthly Average TDS	CP5 Catchment	WRSF 1 Catchment	Direct Precipitation	WRSF1 Runoff	Pumped from DCP5	Pumped from P3	Pumped from CP1	Overflow to CP1	Overflow to P1
Unit:	m3	mg/L	m3	m3	m3	m3	m3	m3	m3	m3	m3
2019 Jan	21482.37	12200	0	0	0	0	0	0	0	0	0
2019 Feb	21482.37	12200	0	0	0	0	0	0	0	0	0
2019 Mar	21482.37	12200	0	0	0	0	0	0	0	0	0
2019 Apr	21482.37	12200	0	0	0	0	0	0	0	0	0
2019 May	21482.37	12200	0	0	0	0	0	0	0	0	0
2019 Jun	10000	5592.921	22712.53	18195.42	2956.112	3973.06	0	0	0	0	0
2019 Jul	10000	4334.254	4361.398	3340.417	0	1002.185	0	0	0	0	0
2019 Aug	10000	5705.95	6155.219	4714.314	0	1213.01	0	0	0	0	0
2019 Sep	13591.38	5630.497	4923.284	3794.34	287.2397	824.9692	0	0	0	0	0
2019 Oct	16964.68	6914.495	1431.923	1149.29	633.2043	158.8829	0	0	0	0	0
2019 Nov	16964.68	7950.064	0	0	0	0	0	0	0	0	0
2019 Dec	16964.68	7950.064	0	0	0	0	0	0	0	0	0

Containment Pond 5							
	Outflows						
Result:	Overflow to P2	Overflow to P3	Pumped to CP1	Seepage to DCP5	Evaporation	RO Unit - Brine	RO Unit - Permeate
Unit:	m3	m3	m3	m3	m3	m3	m3
2019 Jan	0	0	0	0	0	0	0
2019 Feb	0	0	0	0	0	0	0
2019 Mar	0	0	0	0	0	0	0
2019 Apr	0	0	0	0	0	0	0
2019 May	0	0	0	0	0	0	0
2019 Jun	0	0	0	0	0	10084.31	49235.18
2019 Jul	0	0	0	0	2460.033	2497.587	3746.38
2019 Aug	0	0	0	0	953.5013	4451.617	6677.425
2019 Sep	0	0	0	0	0	2495.382	3743.073
2019 Oct	0	0	0	0	0	0	0
2019 Nov	0	0	0	0	0	0	0
2019 Dec	0	0	0	0	0	0	0

Saline Pond											
	Volume	TDS	Inflows						Outflows		
Result:	Volume (end of month)	Monthly Average TDS	Catchment Runoff	Direct Precipitation	Pumped P3	RO Brine	SWTP Brine	Pumped from UG	Evaporation	Pumped to SWTP Brine Mode	Pumped to SWTP Solids Mode
Unit:	m3	mg/L	m3	m3	m3	m3	m3	m3	m3	m3	m3
2019 Jan	13742.88	14808.54	0	0	0	0	1415.88	0	0	0	0
2019 Feb	13742.88	13903.09	0	0	0	0	0	0	0	0	0
2019 Mar	13742.88	13903.09	0	0	0	0	0	0	0	0	0
2019 Apr	13742.88	13903.09	0	0	0	0	0	0	0	0	0
2019 May	13742.88	13903.09	0	0	0	0	0	0	0	0	0
2019 Jun	24627.83	20260.96	1006.166	346.7753	0	10084.31	0	0	0	0	552.3078
2019 Jul	22919.93	19988.99	266.0104	0	0	2497.587	0	0	379.4909	0	4092
2019 Aug	23451.4	19071.36	318.4354	0	0	4451.617	0	0	146.5843	0	4092
2019 Sep	22715.32	18078	229.4377	42.59506	0	2495.382	0	0	0	0	3503.5
2019 Oct	22850.69	17785.79	59.33286	76.04437	0	0	0	0	0	0	0
2019 Nov	22850.69	17736.85	0	0	0	0	0	0	0	0	0
2019 Dec	22850.69	17736.85	0	0	0	0	0	0	0	0	0

Saline Pond		
	Outflows	
Result:	Pumped to P3	Overflow (tracked)
Unit:	m3	m3
2019 Jan	0	0
2019 Feb	0	0
2019 Mar	0	0
2019 Apr	0	0
2019 May	0	0
2019 Jun	0	0
2019 Jul	0	0
2019 Aug	0	0
2019 Sep	0	0
2019 Oct	0	0
2019 Nov	0	0
2019 Dec	0	0

Underground											
	Volume				TDS			Inflows		Outflows	
Result:	Sump System Volume (end of month)	Stope 75 Volume (end of month)	Stope 350 Volume (end of month)	Cumulative Underground Overflow (tracked)	Sump System Monthly Average TDS	Stope 75 Monthly Average TDS	Stope 350 Monthly Average TDS	Truck Wash	Groundwater Inflow	Lost to Rock Water Content	To SWTP Solids Mode
Unit:	m3	m3	m3	m3	mg/L	mg/L	mg/L	m3	m3	m3	m3
2019 Jan	830	4830	1100	0	55800	55794.9	55800	0	1240	0	0
2019 Feb	830	2254	1100	0	55800	55772.9	55800	0	1120	0	3696
2019 Mar	830	1	1100	0	55800	56572.61	55800	0	1240	0	3493
2019 Apr	830	1	1100	0	55800	55800	55800	0	1200	0	1200
2019 May	830	1	1100	0	55800	55800	55800	0	1240	0	1240
2019 Jun	830	168.366	1100	0	55800	55800	55800	0	1200	0	1032.634
2019 Jul	813.2645	1370.033	1100	0	55800	55800	55800	0	1240	55.06886	0
2019 Aug	830	7253.963	1100	0	55800	55800	55800	0	7440	1539.334	0
2019 Sep	830	10000	3543.666	0	55800	55800	55800	0	7200	1553.797	456.5
2019 Oct	830	10000	5169.999	0	55800	55800	55800	0	7440	1721.668	4092
2019 Nov	830	10000	6340	509.5294	55800	55800	55800	0	7200	1560.469	3960
2019 Dec	830	10000	6340	2390.044	55800	55800	55800	0	7200	1359.485	3960

Underground							
	Outflows						
Result:	To SWTP Brine Mode	Pumped to P3	Pumped to P2	Pumped to P1	Pumped to Saline Pond	Discharged to Sea	Uncontained
Unit:	m3	m3	m3	m3	m3	m3	m3
2019 Jan	5244	0	0	0	0	0	0
2019 Feb	0	0	0	0	0	0	0
2019 Mar	0	0	0	0	0	0	0
2019 Apr	0	0	0	0	0	0	0
2019 May	0	0	0	0	0	0	0
2019 Jun	0	0	0	0	0	0	0
2019 Jul	0	0	0	0	0	0	0
2019 Aug	0	0	0	0	0	0	0
2019 Sep	0	0	0	0	0	0	0
2019 Oct	0	0	0	0	0	0	0
2019 Nov	0	0	0	0	0	0	509.5294
2019 Dec	0	0	0	0	0	0	1880.515

P-Area (P1)											
	Volume	**TDS**	**Inflows**								
Result:	Volume (end of month)	Monthly Average TDS	Pumped from Portal 2	Overflow from CP5	Natural Runoff	Disturbed Runoff	Direct Precipitation	Waste Rock Runoff	From WRSF1	Batch Plant	Pumped from DP1
Unit:	m3	mg/L	m3	m3	m3	m3	m3	m3	m3	m3	m3
2019 Jan	4780.69	21869.53	0	0	0	0	0	0	0	0	0
2019 Feb	4780.69	22578.54	0	0	0	0	0	0	0	0	0
2019 Mar	4780.69	23287.54	0	0	0	0	0	0	0	0	0
2019 Apr	4780.69	24020.59	0	0	0	0	0	0	0	0	0
2019 May	4780.69	24753.63	0	0	0	0	0	0	0	0	0
2019 Jun	2519.543	71092.29	0	0	0	10797.06	1339.07	1442.724	0	0	0
2019 Jul	1000	385783.2	0	0	0	3301.09	0	390.5118	0	0	0
2019 Aug	1000	477220.1	0	0	0	3957.756	0	466.4446	0	0	0
2019 Sep	1000	553830.9	0	0	0	2853.266	61.0435	336.274	0	0	0
2019 Oct	2447.435	406213.1	0	0	0	705.5518	171.3472	86.7804	0	0	0
2019 Nov	2447.435	250700.6	0	0	0	0	0	0	0	0	0
2019 Dec	2447.435	252109	0	0	0	0	0	0	0	0	0

P-Area (P1)								
	Inflows				**Outflows**			
Result:	Cement Truck Water	Pumped from P2	Pumped from P3	Overflow from P3	Evaporators	Seepage to DP1	Evaporation	Overflow (tracked)
Unit:	m3	m3	m3	m3	m3	m3	m3	m3
2019 Jan	0	0	0	0	0	0	0	0
2019 Feb	0	0	0	0	0	0	0	0
2019 Mar	0	0	0	0	0	0	0	0
2019 Apr	0	0	0	0	0	0	0	0
2019 May	0	0	0	0	0	0	0	0
2019 Jun	0	0	0	0	15840	0	0	0
2019 Jul	0	0	0	0	4641.166	0	569.9786	0
2019 Aug	0	0	0	0	4213.94	0	210.2609	0
2019 Sep	0	0	0	0	3250.583	0	0	0
2019 Oct	0	0	0	513.8342	30.0788	0	0	0
2019 Nov	0	0	0	0	0	0	0	0
2019 Dec	0	0	0	0	0	0	0	0

P-Area (P2)											
	Volume	TDS	Inflows								Outflows
Result:	Volume (end of month)	Monthly Average Concentration	Natural Runoff	Disturbed Runoff	Direct Precipitation	Waste Rock Runoff	Pumped from P3	Pumped from Stope 75	Overflow from CP5	Waste Rock Drainage	Evaporation
Unit:	m3	mg/L	m3	m3	m3	m3	m3	m3	m3	m3	m3
2019 Jan	104.81	19600	0	0	0	0	0	0	0	0	0
2019 Feb	104.81	19600	0	0	0	0	0	0	0	0	0
2019 Mar	104.81	19600	0	0	0	0	0	0	0	0	0
2019 Apr	104.81	19600	0	0	0	0	0	0	0	0	0
2019 May	104.81	19600	0	0	0	0	0	0	0	0	0
2019 Jun	5563.494	11014.63	378.162	3440.459	463.2935	1176.769	0	0	0	0	0
2019 Jul	6226.724	10836.17	65.5898	880.3659	0	318.524	0	0	0	0	601.2498
2019 Aug	6828.18	11539.06	95.1514	1044.319	0	380.4593	0	0	0	0	238.2542
2019 Sep	6828.18	11569.89	77.778	751.9566	69.43901	274.2846	0	0	0	0	0
2019 Oct	6828.18	11355.95	24.0188	194.0533	124.373	70.78312	0	0	0	0	0
2019 Nov	6828.18	11245.97	0	0	0	0	0	0	0	0	0
2019 Dec	6828.18	11245.97	0	0	0	0	0	0	0	0	0

P-Area (P2)		
	Outflows	
Result:	Pumped to P1	Overflow (to P3)
Unit:	m3	m3
2019 Jan	0	0
2019 Feb	0	0
2019 Mar	0	0
2019 Apr	0	0
2019 May	0	0
2019 Jun	0	0
2019 Jul	0	0
2019 Aug	0	680.2193
2019 Sep	0	1173.458
2019 Oct	0	413.2282
2019 Nov	0	0
2019 Dec	0	0

P-Area (P3)											
	Volume	**TDS**	**Inflows**								
Result:	Volume (end of month)	Monthly Average TDS	Natural Runoff	Disturbed Runoff	Direct Precipitation	Waste Rock Runoff	Pumped from DP3	Pumped from Saline Pond	Pumped from Portal 1	Overflow from P2	Pumped from Stope 75
Unit:	m3	mg/L	m3	m3	m3	m3	m3	m3	m3	m3	m3
2019 Jan	7482.97	20100	0	0	0	0	0	0	0	0	0
2019 Feb	7482.97	20100	0	0	0	0	0	0	0	0	0
2019 Mar	7482.97	20100	0	0	0	0	0	0	0	0	0
2019 Apr	7482.97	20100	0	0	0	0	0	0	0	0	0
2019 May	7482.97	20100	0	0	0	0	0	0	0	0	0
2019 Jun	13783.23	16377.66	0	3433.21	1228.547	0	0	0	1638.5	0	0
2019 Jul	13747.94	14232.56	0	892.0443	0	0	0	0	450	0	0
2019 Aug	15480.77	14502.28	0	1055.891	0	0	0	0	537.5	680.2193	0
2019 Sep	17951.49	13947.89	0	749.296	160.4624	0	0	0	387.5	1173.458	0
2019 Oct	18431.67	13431.39	0	193.3503	287.4392	0	0	0	100	413.2282	0
2019 Nov	18431.67	13259.85	0	0	0	0	0	0	0	0	0
2019 Dec	18431.67	13259.85	0	0	0	0	0	0	0	0	0

P-Area (P3)								
	Inflows	**Outflows**						
Result:	Overflow from CP5	Evaporation	Pumped to P1	Pumped to P2	Pumped to CP5	Seepage to DP3	Pumped to Saline Pond	Overflow (to P1)
Unit:	m3	m3	m3	m3	m3	m3	m3	m3
2019 Jan	0	0	0	0	0	0	0	0
2019 Feb	0	0	0	0	0	0	0	0
2019 Mar	0	0	0	0	0	0	0	0
2019 Apr	0	0	0	0	0	0	0	0
2019 May	0	0	0	0	0	0	0	0
2019 Jun	0	0	0	0	0	0	0	0
2019 Jul	0	1377.335	0	0	0	0	0	0
2019 Aug	0	540.7764	0	0	0	0	0	0
2019 Sep	0	0	0	0	0	0	0	0
2019 Oct	0	0	0	0	0	0	0	513.8342
2019 Nov	0	0	0	0	0	0	0	0
2019 Dec	0	0	0	0	0	0	0	0