AGNICO EAGLE

MELIADINE GOLD MINE

Groundwater Management Plan

JANUARY 2021
VERSION 6

EXECUTIVE SUMMARY

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.

The Groundwater Management Strategy is composed of short-, medium- and long-term management strategies. Presently, most of the short-term and medium-term management strategies have been implemented on site, including storage of saline water on site and discharge to sea via trucking at a flow rate up to 1,600 m^3/day. Furthermore, preventative grouting is being applied as a mitigation to reduce groundwater inflow volumes. The next step will be to evaluate the construction of the waterline from the site to the Melvin Bay in order to increase the discharge rate, recover storage capacity on site, and improve the robustness of the groundwater water management.

Agnico Eagle Mines Limited (Agnico Eagle) is operating 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 15.4 million tonnes (Mt) of ore, 31.4 Mt of waste rock, 7.0 Mt of overburden waste, and 15.4 Mt of tailings. There are four phases to the development of the Mine; just over 3.5 years of construction (2015 to 2019), 8.5 years of Mine operation (Q2 of 2019 to 2027) , 3 years of closure (2028 to 2030), and post-closure (2030 and 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.

Saline water generated from the Underground Mine is currently stored in surface saline ponds, as well as underground in sumps and a water stope storage unit. Saline groundwater stored on site is treated at the Saline Effluent Treatment Plant (SETP) for discharge to sea at Melvin Bay as per the Nunavut Impact Review Board (NIRB) Project Certification 006 Amendment 001, issued in February 2019. Following an internal review of the overall performance of the Saline Water Treatment Plant (SWTP), the operation of the plant was suspended in March 2020.

ᓇᐃᓈᖅᓯᒪᔪᖅ

ᑖᓐᓇ ᑎᑎᖅᑲᖅ ᐱᔾᔪᑎᖃᖅᑐᖅ ᓄᓇᒥᑦ ᐃᒪᕐᒥᒃ ᐊᐅᓚᑦᑎᓂᕐᒧᑦ ᐸᕐᓇᐅᑎᒥᒃ ᑲᑎᖅᓱᐃᓂᕐᒧᑦ, ᐱᓕᕆᐊᕆᓗᒍ, ᑐᖅᑯᕐᓗᒍ ᐊᒻᒪᓗ ᑯᕕᑎᓪᓗᒍ ᑕᕆᐅᓕᒃ ᓄᓇᒥᑦ ᐃᒪᖅ ᒪᓕᒡᓗᒋᑦ ᐊᓐᓂᑯᒃᑯᑦ Type A ᐃᒪᕐᒧᑦ ᓚᐃᓴᓐᓯᖓᑦ 2AM-MEL1631, ᐊᕙᒃᓯᒪᓂᖓ E, ᑎᑎᕋᖅᓯᒪᔪᖅ 14.

ᓄᓇᒥᑦ ᐃᒪᕐᒥᒃ ᐊᐅᓚᑦᑎᓂᕐᒧᑦ ᖃᓄᖅᑑᕆᓂᖅ ᓇᐃᑦᑑᔫᒃᑯᑦ, ᕿᑎᐊᔫᖓᔫᒃᑯᑦ ᐊᒻᒪᓗ ᐊᑯᓂᐅᔪᒥᑦ ᐊᐅᓚᑦᑎᓂᕐᓄᑦ ᖃᓄᖅᑑᕈᑎᐅᔪᑦ. ᓖᓐᓇᐅᔪᖅ, ᑕᒪᒃᑖᖅᑲᔭᖅ ᓇᐃᑦᑑᔪᒥᑦ ᐊᒻᒪᓗ ᕿᑎᐊᓃᖓᔪᒥᑦ ᐊᐅᓚᑦᑎᓂᕐᒧᑦ ᖃᓄᖅᑑᕈᑏᑦ ᐊᑐᓕᖅᑎᓯᒪᓕᖅᑐᑦ ᐅᔭᕋᒃᑕᓇᕐᒥᑦ, ᐃᓚᐅᔪᑦ ᐅᔭᕋᒃᑕᓇᕐᒥᑦ ᑐᖅᑯᖅᓯᒪᕚᒃ ᑕᓇᐅᓕᒃ ᐃᒪᕐᒥᑦ ᐊᒻᒪᓗ ᑯᕕᑎᑕᐅᑉᓗᓂ ᑕᓇᐅᕐᒧᑦ ᓄᓇᒃᑰᕈᑎᒃᑯᑦ ᐊᔭᖅᑕᐅᖃᑦᑕᖅᓗᓂ ᑯᕕᓯᕗᒃᓗᑎᒃ 1,600 m^3/ᐅᐸᓗᑕᓖᒃᑯᑦ. ᐊᒻᒪᓗ, ᐱᑕᖃᖅᑕᐃᓕᑎᑦᑎᓂᖅ ᐃᓗᑐᔪᓂᒃ ᐊᑐᖅᑕᐅᔪᖅ ᒥᒃᓵᕆᐊᖅᑎᓪᓗᒍ ᓄᓇᒥᑦ ᐃᒪᐅᑉ ᐊᕐᕿᑎᕆᓂᖓ ᑯᕙᔪᑦ ᐃᓗᐊᓄᑦ. ᐱᓕᕆᐊᖑᕆᐊᕐᓂᐊᖅᑐᑦ ᕿᒥᕐᕈᔭᐅᓗᓂ ᐃᒪᕐᒧᑦ ᓱᐸᓗᓕᓕᐅᖅᐸᓪᓕᐊᓂᖅ ᐅᔭᕋᒃᑕᓇᕐᒥᙵᖅᑐᖅ ᐃᑎᕙᐊᓄᑦ ᐊᕐᕿᓂᖅᓴᒥᒃ ᑯᕕᑦᑎᓂᐊᕐᓗᓂ, ᑐᖅᑯᖅᓯᓯᒪᔪᓐᓇᖅᓯᑎᒃᑲᓂᕐᓗᒍ ᐅᔭᕋᒃᑕᓇᕐᒥᑦ, ᐊᒻᒪᓗ ᐱᐅᓯᕆᐊᕐᓗᕆᑦ ᐱᓪᓗᓇᓐᓂᖓ ᓄᓇᒥᑦ ᐃᒪᕐᒥᑦ ᐊᐅᓚᑦᑎᓂᐅᔪᖅ.

ᐊᓐᓂᑯ ᐋᒍ ᐅᔭᕋᒃᑕᓇᐊᓕᓇᕐᒃᑯᑦ (ᐊᓐᓂᑯᒃᑯᑦ) ᐊᐅᓹᖅᑎᑦᑎᔪᖅ ᑕᓯᕐᔪᐊᕐᒥᑦ ᒎᓗᒧᑦ ᐅᔭᕋᒃᑕᓇᕐᒥᑦ (ᐅᔭᕋᒃᑕᓇᐊᖅ), 25 ᑭᓛᒥᑕᓪᓗᐊᓂᒃ ᐅᖓᓯᒃᑎᒋᔪᖅ ᐅᐊᓐᓇᖓᓂᑦ ᑲᖏᖅᖠᓂᐅᑉ, ᐊᒻᒪᓗ 80 ᑭᓛᒥᑕᓪᓗᐊᓂᒃ ᐅᖓᓯᒃᑎᒋᔪᖅ ᓂᒋᖅᐸᓯᐊᓂᑦ/ᐱᖓᓐᓇᖅᐸᓯᐊᓂᑦ ᐃᒡᓗᓕᖠᕐᔪᖕᒥᑦ ᑭᕙᓪᓕᕐᒥᑦ ᓄᓇᕗᒻᒥᑦ.

ᐅᔭᕋᒃᑕᓇᐊᕐᒧᑦ ᐸᕐᓇᐅᑎ ᐅᔭᕋᒃᑕᓇᐊᓕᓇᓂᕐᒧᑦ ᐊᑐᖅᑕᐅᔾᒪᔪᓂᒃ ᐱᑕᖃᖅᑐᖅ ᐱᕙᓪᓕᐊᔭᐅᓂᖓᓄᑦ ᑎᓇᒐᓂᐊᖅ ᒎᓗᑕᓕᒃ, ᒪᕐᕉᖕᓂᒃ ᓄᓇᒥᑦ ᐅᒃᑯᐃᖓᔪᖃᖅᓗᓂ (ᑎᓇᒐᓂᐊᖅ ᓄᓇᒥᑦ ᐃᓗᑦᑐᖅᓯᒪᔪᖅ 1 ᐊᒻᒪᓗ ᑎᓇᒐᓂᐊᖅ ᓄᓇᒥᑦ ᐃᓗᑦᑐᖅᓯᒪᔪᖅ 2) ᐊᒻᒪᓗ ᐊᑕᐅᓯᖅ ᓄᓇᒥᑦ ᐃᓗᑦᑐᖅᓯᒪᔪᖅ ᐅᔭᕋᒃᑕᓇᐊᖅ. ᐊᑐᖅᓯᒋᑦ ᓖᓐᓇᐅᔪᖅ ᐅᔭᕋᒃᑕᓇᐊᕐᒧᑦ ᐸᕐᓇᐅᑎ, ᐅᔭᕋᒃᑕᓇᐊᖅ 15.4 ᒥᓕᔭᓐ ᑕᓐᓗᐊᓂᒃ (Mt) ᐅᔭᕋᒃᑕᖅᑕᐅᓂᐊᖅᑐᖅ, 31.4 Mt-ᓂᒃ ᐊᒃᑕᑰᖅᑕᐅᔪᓂᒃ ᐅᔭᖅᑲᓂᒃ, 7.0 Mt-ᓂᒃ ᐅᖓᑕᐅᑦᑎᔪᑦ ᐊᒃᑕᑯᓂᒃ, ᐊᒻᒪᓗ 15.4 Mt-ᓂᒃ ᕿᒪᒃᑎᑦᑐᓂᑦ. ᓯᑕᒪᐅᓕᖓᔪᖅ ᐱᕙᓪᓕᐊᔭᐅᓂᖓ ᐅᔭᕋᒃᑕᓇᐊᖅ; ᐅᖓᑎᐊᕐᔪᐊᓄᑦ 3.5 ᐅᑭᐅᓄᑦ ᓴᓇᔭᐅᓗᓂ (2015-ᒥᑦ 2019-ᒧᑦ), 8.5 ᐅᑭᐅᓂᑦ ᐅᔭᕋᒃᑕᓇᐊᖅ ᐊᐅᓐᑮᕐᓗᓂ (Q2 2019-ᒥᑦ ᐊᒻᒪᓗ 2020-ᒧᑦ), ᐱᖓᓱᓄᑦ ᐅᑭᐅᓂᑦ ᐅᒃᑯᐊᖅᐸᓪᓕᐊᓗᓂ (2028-ᒥᑦ 2030-ᒧᑦ), ᐊᒻᒪᓗ ᐅᒃᑯᐊᖅᓯᒪᓕᖅᑎᓪᓗᒍ (2030-ᒥᑦ ᑕᐅᕗᖓ ᐅᖓᑖᓄᑦ).

ᑎᓇᒐᓂᐊᖅ ᓄᓇᐅᑉ ᐃᓗᐊᓂᑦ ᐅᔭᕋᑦᑕᕐᓂᖅ ᐊᑦᑎᒃᓯᕆᐊᖅᑕᐅᒃᑲᓐᓂᕐᓂᐅᔭᖅᑐᖅ 625 ᒦᑕᓂᒃ ᓄᓇᐅᑉ ᖀᖓᑕ ᐊᑖᓄᑦ; ᑕᐃᒪᓐᓇᒎᑦ, ᐃᓚᖓ ᓄᓇᐅᑉ ᐃᓗᐊᓂᑦ ᐅᔭᕋᒃᑕᓇᐊᖅ ᐊᐅᔾᕐᓂᐊᖅᑐᖅ ᑭᒡᓕᕆᔭᐅᔪᖅ ᖁᐊᖑᐃᓐᓇᐅᔭᖅᑑᑉ ᐊᑖᓂᑦ. ᓄᓇᐃᔭᐃᓂᖅ ᓄᓇᐅᑉ ᐃᓗᐊᓂᑦ ᐃᒻᒥᖅᑐᕐᓂᐊᖅᑐᖅ ᑯᕙᔪᒥᒃ ᐃᒪᕐᒥᒃ ᐊᐅᓹᖅᑎᑦᑎᓂᐅᑎᓪᓗᒍ, ᐃᒪᖅ ᑯᕕᑕᐅᓗᓂ ᐅᔭᕋᕐᒧᑦ ᓄᓇᐅᑉ ᐃᓗᐊᓂᑦ ᐅᔭᕋᒃᑕᓇᐊᕐᒥᑦ ᐱᓕᕆᕝᕕᐅᔪᒥᑦ ᖁᐊᖑᐃᓐᓇᐅᔭᖅᑑᑉ ᐊᑖᓄᑦ ᐅᔭᕋᒃᑕᓇᐊᖅ ᓯᕗᒻᒧᒃᓯᒪᓕᖅᑎᓪᓗᒍ.

ᑕᕆᐅᓕᒃ ᐃᒪᙱᖅᑲᑦᑕᖅᑐᖅ ᓄᓇᐅᑉ ᐃᓗᐊᓂᑦ ᐅᔭᕋᒃᑕᓇᐊᕐᒥᑦ ᑐᖅᑯᖅᑕᐅᓯᒪᖃᑦᑕᖅᑐᑦ ᓄᓇᐅᑉ ᖀᖓᓂᑦ ᑕᕆᐅᓕᒃ ᑕᓯᕋᔭᖓᒥᑦ, ᐊᒻᒪᓗ ᓄᓇᐅᑉ ᐃᓗᐊᓂᑦ ᑯᕙᖅᑕᐃᕝᕙᖕᓂᑦ ᐊᒻᒪᓗ ᐃᒪᕐᒥᑦ ᓴᓂᕋᕐᒥᑦ ᐱᔪᓂᒃ ᑐᖅᑯᖅᓯᒪᕝᕙᖕᓂᑦ. ᑕᕆᐅᓕᒃ ᓄᓇᒥᑦ ᐃᒪᕐᒥᑦ ᐱᔪᓄᑦ ᑐᖅᑯᖅᓯᒪᔪᖅ ᐅᔭᕋᒃᑕᓇᐊᕐᒥᑦ ᐱᓕᕆᐊᖑᖃᑦᑕᖅᑐᖅ ᑕᕆᐅᓕᖕᒥᑦ ᑯᕙᔪᓂᒃ ᐃᒪᓕᕆᕝᕙᖕᒥᑦ ᑯᕕᑎᑕᐅᓂᐊᕐᓗᓂ ᑕᕆᐅᕐᒧᑦ ᐃᑎᕙᐊᓂᑦ ᒪᓕᒃᓗᒍ ᐊᕝᕆᑎᓕᓇᕐᒃᑯᑦ

ᐱᓕᕆᐊᕐᒧᑦ ᓇᓗᓇᐃᒃᑯᑕᖓᑦ 006 ᐋᖅᑭᒋᐊᖅᓯᒪᔪᖅ 001, ᑐᓂᔭᐅᓚᐅᖅᑐᖅ ᐊᕗᓐᓂᕕᒃ (ᕕᕗᐊᓚ) 2019-ᒥᑦ. ᐃᓗᐊᓂᑦ ᖃᒥᕐᕈᔭᐅᖅᑳᖅᑎᓪᓗᒍ ᑕᒪᐃᓐᓄᑦ ᖃᓄᐃᓐᓂᖓᓄᑦ ᑕᕆᐅᓕᒃ ᐃᒪᓕᕆᕝᕕᒃ, ᐊᐅᓛᖅᑎᑦᑎᓂᖅ ᐃᒪᓕᕆᕝᕕᖕᒥᑦ ᓄᖅᑲᖅᑎᑕᐅᓚᐅᖅᑐᖅ ᓇᑦᑎᐊᑦ (ᒫᑦᓯ) 2020-ᒥᑦ.

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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	
5.	March 2020	All		In compliance with Agnico Eagle's amended No. 006 Project Certificate, Condition No. 25	Agnico Eagle Mines Ltd.

		Exec Summary		General update to reflect updated Plan	
		2.4	15	Update high level mine plan, schedule, addition of SETP and RO	
		3.1	16-17	General section update, and updated groundwater inflow rates included	
		3.2	18-19	Updated saline water control structures	
		3.3	19-20	General section update/revision; moved water quality table to Appendix C	
		3.4	20-24	Section update to reflect changes to saline water management strategy	
		3.5	24	Section revision/update to include SP4, timeline details	
		3.6	-	Former Section 3.6 was updated and moved into other sections	
		4.1	25-27	General section revision/update, QAQC portion moved to Water Quality and Flow Monitoring Plan and can be found in QAQC plan	
6.	January 2021	All		In compliance with Commitment #5 from Technical Meeting held on November 30, 2020 for Amendment Application to the Water Licence No: 2AM-MEL1631	Agnico Eagle Mines Ltd.
		Exec Summary		General update to reflect updated Plan	
		3.1	17-21	Updated with further details, and relocated data reporting to the 2020 Annual Report	
		3.2	21-22	Section update focussed on saline water control structures and pond storage capacities	
		3.3	23-31	Section update to reflect current saline water management strategy and to include grouting strategy and effectiveness, and viability discussion management strategies. Addresses Commitment 5 and 6 from the Type A Water Licence Amendment	
		3.5	32	Section revision/update to reflect current schedule	
		4.1	34	Removed SWTP water quality monitoring	
		Appx B	-	Simplified Underground Water Management Flow Sheet Diagram	
		Appx C	-	Removed groundwater quality data reporting appendix. This information will be provided in the 2020 Annual Report.	
		Appx C	-	Added Grouting and Groundwater Storage information as per 2AM-MEL1631 Technical Meeting Commitment 6	

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 operating 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 Water Management Plan (WMP).

1.1 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).

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.

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 (Agnico Eagle 2014), and in a hydrogeological assessment completed for the Mine (Golder 2016). The groundwater characteristics for the Mine are briefly summarized below.

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.

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. The current mine plan applies the following approach for the development of the Tiriganiaq gold deposit:

- Tiriganiaq Underground Mine will be developed and operated from Year -5 to Year 8 (2015 to 2027);
- Tiriganiaq Pit 1 will be mined from Year 2 to Year 7 (2021 to 2026); and
- Tiriganiaq Pit 2 will be mined from Year 1 to Year 3 (2020 to 2022).

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), a Saline Water Treatment Plant (SWTP), a Reverse Osmosis Plant (RO), and a Saline Effluent Treatment Plant (SETP). Details on each treatment plant can be found in the WMP.

SECTION 3 • GROUNDWATER MANAGEMENT

3.1 Predicted Groundwater Volumes

Planning and mitigations for management of groundwater relies upon predictions of groundwater that may report to the underground workings and then require further storage and management on surface. This section provides a summary of modelling work that has been completed to predict groundwater volumes.

In the WMP of the water licence application (Agnico Eagle 2015) 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 twenty-four packer tests, two pumping tests, two injection tests, eleven 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. The numerical and conceptual hydrogeological model for Tiriganiaq Underground Mine was updated in 2016 following this extensive field campaign.

In 2019, the model was updated to reflect as-built development stages and to adjust the structures identified as potentially enhanced permeability zones (based on observed water intersections) (Golder 2020). Following the above modifications, the model was calibrated to observed groundwater inflows and to the hydraulic head responses in vibrating wire piezometers. The calibrated model was used to predict groundwater inflows to the Tiriganiaq Underground Mine over the LOM; these inflow values correspond to the values in Table 1.

Table 1 Predicted Groundwater Inflow to Underground Mine over Life of Mine (Golder, 2020)

Year	Quarter	Predicted Groundwater Inflow (m^3/day)
2019	Q1	380
2019	Q2	400
2019	Q3	430
2019	Q4	420
2020	Q1	410
2020	Q2	410
2020	Q3	420
2020	Q4	420

2021	Q1	420
2021	Q2	430
2021	Q3	440
2021	Q4	460
2022	Q1-2	480
2022	Q3-4	510
2023	-	530
2024	-	540
2025	-	580
2026	-	570
2027	-	530
2028	-	510
2029	-	490
2030	-	480
2031	-	470
2032	-	460
2033	-	450

Predicted groundwater inflow rates provided in Table 1 represent unmitigated inflow forecasts (i.e., these predictions do not account for inflow mitigations currently being conducted to reduce groundwater inflows to the underground development). The main mitigation being applied includes preventative grouting and grouting in response to water intersection. Further discussion regarding grouting is provided in Section 3.3.3.

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:

1. 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).
2. 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.
3. 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.
4. 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.

3.2 Existing Groundwater Management Control Structures

Contact water in the Underground Mine is contained within underground sumps and in the surface saline ponds. Up to 2020 this included Saline Pond 1 (SP1), Saline Pond 2 (SP2), and Saline Pond 4 (SP4). Saline Pond 3 (SP3) acts as a temporary final storage pond where the SETP effluent is stored prior to discharge to sea. As discussed in the WMP, SP2 was replaced by Saline Pond 4 (SP4) in March 2020.

A portion of the underground water is recirculated as make-up water for underground drilling. The remaining underground water is stored for treatment by the SETP for discharge to sea. From December 2018 through to March 2020, a portion of excess underground water under went desalination treatment by the SWTP. Operation of the SWTP was suspended in March 2020 due to poor performance of the treatment plant, high operating costs, and safety concerns. Further discussion on the SWTP is provided in Section 3.3.2.

In previous years (2016 – 2018) saline water was directed to and stored in the P-Area containment ponds (P1, P2, and P3) for active evaporation (Section 3.3.1). In 2019, inputs to the P-Area were limited in an effort to begin the decommissioning process of the containment structures. In 2020, no saline water inputs to the P-Area took place, with the only planned inputs resulting from precipitation runoff. Similarly, no active evaporation took place at the P-Area in 2020.

As the underground mine is now heated, calcium chloride is not currently 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.

A schematic of the underground dewatering system is provided in Appendix B. Pond capacities for storage of saline water are presented in Table 2.

Table 2 Saline Pond Storage Capacity at the Mine

Surface Pond	Capacity (m^3)	Occupied storage capacity as of January 1st 2021 (m^3)
Saline Pond 1	32,686[a]	27,200
Saline Pond 3	7,895[a]	Emptied for winter
Saline Pond 4[c]	272,122[a]	204,900
Tiriganiaq Pit 2[d]	1,563,000[c]	0

Notes:

a. As-built storage capacities
b. To be added to storage when required, based on timing of SP1 and SP4 reaching capacity.
c. Will become contingency storage when Tiriganiaq Pit 2 is made available for saline water storage
d. Forecasted storage capacity in bedrock assuming mining is stopped June 1st 2021.

3.3 Groundwater Management Strategies and Mitigations

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

- Short-term Strategy: Store saline contact water on site (Section 3.3.2)
- Medium-term Strategy: Treat saline groundwater for discharge to receiving environment in Melvin Bay via trucking (Section 3.3.3)
- Long-term Strategy: Treat saline groundwater for discharge to receiving environment in Melvin Bay via waterline (Section 3.3.4).

This section has been updated to address specifically commitment 5 from the Type A Water Licence Amendment technical meeting:

- The viability of the short-, medium- and long-term strategy for saline groundwater management (Section 3.3.1);
- Proposes a threshold (e.g. 80%) for when the available saline storage is approaching capacity and additional mitigation measures may be undertaken to ensure that, if the saline effluent pipeline is not available, Agnico Eagle has sufficient time to proceed through any applicable regulatory process, if required (Section 3.3.2).

3.3.1 Viability of Short-, Medium-, and Long-Term Management Strategies

Short-term and medium-term strategies

As described in Section 3.3.2, the short-term strategy involves storing all excess groundwater in an underground water stope and in dedicated surface saline water ponds at the Mine. Viability of the short-term strategy is mainly the relation of storage capacity available to the volume of saline water requiring storage on site. Table 3 provides comparison of annual maximums in saline water volumes requiring storage on site to the available storage capacity. The annual maximums in projected volumes to be stored are produced from a balance of the rate at which saline water accumulates on site and the rate at which it is removed from the system. As discharge to sea drives removal from the system, the currently practiced medium-term strategy of saline effluent to Melvin Bay via trucking (Section 3.3.3) is inherently related to viability of the short-term strategy and is therefore also considered in the viability assessment here. The long-term strategy (Section 3.3.4) is not considered in Table 4; only the medium-term strategy of discharge to sea via trucking is applied.

Table 3 Saline Water Volume Requiring Storage and Available Capacity in Consideration of the Short- and Medium-Term Management Strategies

Year	Saline Storage Requirement[1,5] (m^3)	Saline Pond / Open Pit Storage Capacity (m^3)			
		SP1	SP4	Tiriganiaq Pit 2[3]	Total[4]
2021	352,974	32,686	*272,122*	1,563,000	1,595,686
2022	497,991	32,686	*272,122*	1,563,000	1,595,686
2023	641,135	32,686	*272,122*	1,563,000	1,595,686
2024	782,507	32,686	*272,122*	1,563,000	1,595,686
2025	942,875	32,686		1,563,000	1,595,686
2026	1,101,245	32,686		1,563,000	1,595,686
2027	1,245,615	32,686		1,563,000	1,595,686

Notes:
1. Saline water storage requirement for given year applying predictive groundwater inflow model
2. *Italicized, gray* values are contingency storage only
3. Forecasted storage capacity in bedrock assuming mining is stopped June 1st 2021. This value differs from previous estimates provided within the NIRB Waterline Application Information Requests due to a revision of the mining forecast.
4. Excludes contingency storage
5. Storage requirements assume discharge at only 1,600 m^3/day over summer period of all years. Approval by Nunavut Planning Commission for discharge to sea at 1,600 m^3/day approved for 2021, further approval required in future years

During the application of the short- and medium-term strategies, saline water requiring storage is expected to increase year-over-year (Table 3). Saline storage capacity is not expected to be exceeded over life of mine considering the medium-term discharge to sea strategy and the groundwater inflow model. However, the without implementation of the long-term strategy, the year-over-year increase would be expected to produce an inventory of over 1.2 million cubic metres of saline water storage on site by end of mine life.

The purpose of the short- and medium-term strategies is to allow successful management of saline water until the long-term (sustainable) strategy can be applied to remove accumulated inventory and remove the requirement for year-over-year storage of saline water. Thus, in this respect and in consideration of Table 3, the short- and medium-term strategies are viewed as viable saline water management strategies. However, when viewed over the longer-term these strategies are not sustainable due to the year-over-year increase in stored water. To allow successful and sustainable management of saline water over life of mine, the long-term strategy of discharge through a waterline, and thus removal of year-over-year storage, is required.

Long-term strategy

As described in Section 3.3.4, the long-term strategy is discharge to sea through a waterline and removal of the need for permanent storage (i.e., year-over-year storage) as a management strategy. Under this strategy, the waterline would be applied to remove the inventory of saline water on site that has accumulated over winter periods.

Similar to the short-term and medium-term strategies, the long-term strategy viability relates to balance of the rate at which saline water accumulates on site and the rate at which saline water is removed from the system. The purpose of the long-term strategy, discharge through the waterline, is to empty of saline water from storage each year prior to freeze up, and thus removes the requirement for long-term storage as a management strategy. Therefore, the implementation of the long-term strategy is inherently a viable option for sustainable saline water management over life of mine, and will allow the recovery of storage capacity on site and improve the robustness of the groundwater water management. This is shown in Table 4, which provides annual maximum saline water volumes requiring storage and available storage capacity. The values within Table 4 assume the waterline begins operation by July 1st 2023.

Table 4 Saline Water Volume Requiring Storage and Available Capacity in Consideration of the Long-Term Management Strategy

Year	Saline Storage Requirement[1,5] (m^3)	Saline Pond / Open Pit Storage Capacity (m^3)			
		SP1	SP4	Tiriganiaq Pit 2[3]	Total[4]
2021	352,974	32,686	*272,122*	1,563,000	1,595,686
2022	497,991	32,686	*272,122*	1,563,000	1,595,686
2023	595,622	32,686	*272,122*	1,563,000	1,595,686
2024	305,280	32,686	*272,122*	1,563,000	1,595,686
2025	151,557	32,686		1,563,000	1,595,686
2026	159,557	32,686		1,563,000	1,595,686
2027	149,557	32,686		1,563,000	1,595,686

Notes:

1. Saline water storage requirement for given year applying predictive groundwater inflow model
2. *Italicized, gray* values are contingency storage only
3. Forecasted storage capacity in bedrock assuming mining is stopped June 1st 2021. This value differs from previous estimates provided within the NIRB Waterline Application Information Requests due to a revision of the mining forecast.
4. Excludes contingency storage
5. Storage requirements assume discharge at only 1,600 m^3/day over summer period OF 2021 and 2022, and 12,000 m^3/day in 2023+ through the waterline. Approval by Nunavut Planning Commission for discharge to sea at 1,600 m^3/day approved for 2021, further approval required in future years

As shown in Table 4, application of the waterline is expected to produce a year-over-year reduction in the volume of water stored on site until the accumulated inventory is removed. After this time, the waterline is expected to allow removal of winter accumulation of saline water on site, and thereby allow the saline ponds to be emptied each year. Therefore, as shown in Table 4, the waterline is expected to allow the recovery of storage capacity on site, improve the robustness of the groundwater water management, and produce a sustainable method for saline water management over life of mine.

Collective Viability of Short-, Medium-, and Long-Term Strategies

As exemplified in Tables 3 and 4 and the associated discussions, the currently implemented short- and medium-term strategies are viable saline water management strategies given the time frames in which these strategies are intended to support saline water management. As stated previously, implementation of the long-term strategy of discharge to Melvin Bay through a waterline is required as a sustainable saline water management strategy; to remove accumulated inventory, allow for removal of winter accumulation of saline water on site, and remove the need for year-over-year storage of saline water as a management strategy. It is expected that the long-term strategy of discharge to Melvin Bay through a waterline would be approved and operational by Q3 2023.

3.3.2 Short-Term Management Strategy - Groundwater On-site Storage

This alternative was considered as part of the Type A Water Licence Application (2015) and has been implemented on site as part of the short-term management of groundwater inflow. It involves storing all excess groundwater in an underground water stope and in dedicated surface saline water ponds at the Mine. Two saline ponds (SP1 and SP4) are currently in use for storage of saline water on Site (Table 2). It is expected that Tiriganiaq Pit 2 will be added to the saline water storage capacity in Q2 of 2021.

The ongoing mining of Tiriganiaq Pit 2 is currently generating additional storage for saline water on site. It is expected that addition of Tiriganiaq Pit 2 storage capacity will be required in the range of early-June to mid-July 2021. The sooner date in this range being in consideration of the non-mitigated forecasted groundwater inflow rates (Table 1), and the later date in the range being in consideration of the grouting effectiveness observed over Q4 2020 (Appendix C). The additional storage is required due to continued groundwater infiltration to the underground workings and finite existing surface storage capacity.

Discussion regarding thresholds for adaptive management and expected timeline to reach thresholds under the current trucking discharge to sea strategy follows in Section 3.3.2.1. More detailed discussion regarding the viability of this short-term strategy (storage on site) is provided in Section 3.3.1.

3.3.2.1 Short-Term Mitigation Measures – Increased Storage

Upon the occurrence of greater than expected groundwater inflows to the underground mine, or delay in the implementation of the long-term management strategy (waterline discharge; Section 3.3.4), Agnico Eagle will consider expanding saline pond storage capacity until inflows can be reduced or treatment/discharge is capable of managing inflows. Specifically, the mine plan as it relates to open pits can be adapted to provide additional storage. This is currently being triggered in response to the anticipation of SP4 reaching capacity mid-2021.

The mine plan as it relates to open pits will continue to be considered as an adaptive management strategy to stored volume encroaching on capacity due to the occurrence of greater than expected groundwater inflows to the underground mine, or delay in the implementation of the long-term management strategy. For instance, bedrock excavation in Tiriganiaq Pit 1 will begin in 2021 and will thus begin to accumulate potential storage capacity which can be applied to saline water storage, if required. Storage thresholds to trigger this adaptive management strategy have been set in order to allow ample time to make adjustments to the mine plan and to proceed through any applicable regulatory process, if required. The following triggers are in place regarding increasing on-site storage as adaptive management:

- Occupied storage capacity on site reaches 80% of total available storage capacity; or
- Available storage volume on site is expected to reach capacity within two (2) years given the groundwater inflow rate and discharge to sea rate occurring at that time.

It will be the goal of Agnico Eagle to reduce the amount of saline water stored in the saline ponds as much as possible during the open water season through discharge to sea in order to maximize storage potential. Under the current medium-term strategy of trucking discharge to sea (i.e., without consideration of a waterline), it is expected that available storage (Table 2) will not reach 80% capacity during LOM based on the modelled groundwater inflows (Table 1). This projection is shown in Table 3.

3.3.3 Medium-Term Management Strategy

3.3.3.1 Saltwater Treatment Plant (SWTP) - Desalination

In 2018, Agnico Eagle constructed and commissioned a Salt Water Treatment Plant (SWTP) consisting of two evaporator crystallizers (SaltMakers) to treat groundwater. The SWTP removes excessive total suspended solids (TSS), calcium chloride ($CaCl_2$), sodium chloride (NaCl), metals, phosphorous (P), and nitrogen compounds from the influent saline water. Further specifications of the SWTP can be found within the SWTP Design Report (Agnico Eagle 2018) and the SWTP As-Built Report (Agnico Eagle 2019a).

In March 2020, operation of the plant was suspended due to poor performance coupled with high energy consumption and plant safety concerns. The SWTP is not currently a component of the groundwater management strategy.

3.3.3.2 Saline Effluent Treatment, Storage and Haulage

In August 2019, Agnico Eagle began discharge of treated effluent from the Saline Effluent Treatment Plant (SETP) to sea at Melvin Bay as per the Nunavut Impact Review Board (NIRB) Project Certification 006 Amendment 001, issued in February 2019. In September 2020, the daily rate of discharge to Melvin Bay was elevated from 800 m^3/day to 1600 m^3/day. This increase was included in the Roads Management Plan (Agnico Eagle, 2019b) and the updated SETP Design Report (Agnico Eagle, 2020a).

Saline water in the underground mine is first treated for total suspended solids (TSS) underground through a Mudwizard system including decanting basins. The saline water is then transferred to the surface saline ponds (Table 2). From there, the saline water as well as other contact water will be pumped to the SETP (raw water source) for treatment of ammonia and TSS. Water treated by the SETP and discharged to the environment will meet MDMER end-of-pipe discharge criteria and be non-acutely and non-chronically toxic as per regulated toxicity testing per the MDMER.

Initial treatment includes TSS removal. Next, breakpoint chlorination treatment is applied to remove elevated ammonia levels, which are inferred to be the result of the use of explosives. Excess chlorine is then removed with activated carbon filters. Following the activated carbon filters, treated saline water is pumped to Saline Pond 3 (SP3) for final settling and storage. The SETP is designed to treat 1,600 m^3/day of saline water for TSS and ammonia. More details are available in Agnico Eagle (2020a).

Treated saline water stored in SP3 is hauled by tanker trucks to Itivia. Truck loads are up to 36 m^3 per truck and are unloaded using a flexible 4" HDPE suction pipe. The truck discharge pump transfers the treated effluent into the 6'' discharge HDPE pipeline and through the diffuser. The truck discharge pump is also used to transfer effluent into the storage tank until the next day before it is pumped into sea, when necessary. Further information on trucking can be found in the Roads Management Plan (Agnico Eagle 2019b).

3.3.3.3 Pumping and Diffusion Plan

The flow rate to be discharged to Melvin Bay will not exceed 1,600 m^3/day with a TDS concentration of 39,600 mg/L. The discharge facility includes 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. Pumping will occur during the summer season (June to October) until the long-term strategy is approved and constructed. The saline effluent will be discharged in a controlled manner through the diffuser to allow for maximum diffusion and minimum environmental impact to the marine environment. Environmental monitoring is discussed in the Ocean Discharge Monitoring Plan (Agnico Eagle, 2020).

The effluent discharge system will consist of a discharge pump, a 50,000 L storage tank, as well as suction and discharge pipelines. The 50,000 L storage tank will only be used to contain the treated effluent until the next day, if the 1,600 m^3/day discharge limit is attained upon a truck's arrival. The storage tank is installed on a containment area, built on a geomembrane with underlying and overlying granular materials and surrounded by berms.

3.3.3.4 Medium-Term Mitigation Measures – Groundwater Monitoring and Grouting

Hydraulic Monitoring

As a strategy to support groundwater inflow modelling and monitor groundwater responses to mining, eighteen (18) 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, and as calibration data for the groundwater inflow model (Section 3.1).

Groundwater Quantity and Quality Monitoring

The groundwater monitoring program (Section 4) allows ongoing comparison of modelled water quantity/quality to realized trends. Details pertaining to the groundwater monitoring program are found in Section 4.

Non-contact groundwater samples as part of the groundwater monitoring program are used to identify trends and improve predictions regarding groundwater inflow chemistry. If non-contact groundwater samples collected indicate that TDS concentrations are more than 20% higher than the estimated 64,000 mg/L (Section 3.4), then water quality predictions for underground will be reviewed and updated, if required.

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

*Fractured Bedrock Grouting*A refined grouting approach began in 2019 based on the premise of preventative grouting (cementing) having greater effectiveness over reactionary grouting, which in previous years would be triggered by intersecting water bearing fractures when carrying out drilling (production and exploratory) and blasting activities.

In developing underground workings, exploratory DDHs in areas of planned development are cemented prior to the advancement of the development. Furthermore, "Jumbo" holes (holes drilled by a Jumbo Drill) are drilled ahead of development and cemented specifically for the purpose of pre-development grouting. Combined, these grouting efforts act to reduce the potential for intersecting inflows with the increased surface area of the excavated heading. Where possible, residual inflows are then plugged on an as-needed basis in these areas. Inflows in blasted stopes and diffuse seeps are generally not able to be grouted and thus remain as active inflows to the underground workings.

The potential for intersecting water-bearing fractures is increased in production long holes (stopes), due to the increased surface area of the excavation and the proximity of the excavation to known water bearing structures. As such, during the drilling phase of stope production, a “grout curtain” is set in and around the stope to minimize the potential for inflows after blasting.

Observed grouting effectiveness over 2020 is provided in Appendix C. It is important to note that as mining advances, inflow rates are susceptible to rapid and sustained increase if water bearing structures are intersected within stopes, and where grouting is not possible. The long-term groundwater management strategy (Section 3.3.4) aims to provide capacity to manage non-mitigated inflows over the life of mine.

3.3.4 Long-Term Management Strategy - Treated Groundwater Discharge to Melvin Bay at Itivia Harbour via a Waterline

Based on the current inventory of saline water stored on site (Table 2), plus current and forecasted groundwater inflows (Section 3.1), the proposed long-term strategy of discharging to Melvin Bay via a waterline will be required to ensure we meet all obligations. Specifically, the objective of the long-term strategy is to remove the need for permanent storage of water on site as a management strategy by providing discharge capacity to empty the saline ponds each year. Storage under the long-term strategy would only be required on a temporary basis to store winter accumulation of groundwater inflows to the Underground Mine. The long term strategy was submitted to the appropriate authorities in 2020.

3.4 Groundwater Quality

Historically, 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 samples have been collected from 2017 through 2020 from DDHs intersecting water bearing structures (Section 4). Results from the 191 samples collected from 2017 to 2020 indicate stable and consistent concentrations for several parameters and indicate that TDS concentrations are less than predicted at a mean concentration of 56,000 mg/L. The detailed 2020 groundwater quality dataset will be provided in the 2020 Annual Report.

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).

3.5 Discharge Schedule

The following Table summarizes the discharge schedule under the short-term and medium-term strategy (i.e., before the long-term strategy of discharge via the waterline is available).

Table 5 High Level Mine Water Management Schedule

Activity	Timeline	Notes
On-site water storage	Ongoing	Tiriganiaq Pit 2 being added to storage capacity in June – July 2021
Discharge saline water to the sea (Melvin Bay, Rankin Inlet)	Annually June through October	Typically open water initiates discharge to Melvin Bay
Active Discharge to Meliadine lake	Annually May through October;	—
Operation of Salt Water Treatment Plant	24 hr. a day / 7 days a week, year round	Operation suspended
Inactive Discharge	Annually November through May	Water will be stored underground and in surface containment ponds during the winter

SECTION 4 • GROUNDWATER MONITORING PROGRAM

4.1 Water Quality and Quantity Monitoring

Water quantity and quality monitoring is an important part of the groundwater management strategy to verify the predicted water quantity and quality trends and conduct adaptive management should differing trends be observed.

The groundwater monitoring plan, summarized in Table 5, will be further defined as the Mine advances and will be conducted in agreement with the WMP for the Mine (Agnico Eagle 2019c).

4.1.1 Water Quantity

Combined (mine-wide) groundwater inflow rates to the Underground Mine are currently estimated by manually measuring and summating all visible inflows across the mine. Recorded measurements are logged in a database from which daily estimated inflow rates can be produced. The database is updated accordingly as flow rates at existing inflow locations change (i.e., inflows are grouted) and as new inflows are observed. Thus, the database is maintained to represent the current state of mine-wide groundwater infiltration. These measured and estimated inflows are periodically verified by applying flow meters paired with global water storage surveys to calculate change in storage expected to originate from groundwater inflows. Groundwater inflow rates reported via the aforementioned database are compared to modelled rates (Table 1) on a quarterly basis. Groundwater inflow rate data as described here will be provided in the Annual Report.

Excess underground water volumes transferred from the Underground Mine to storage ponds on surface are recorded at a flow meter located after the main pumping station from underground to surface. Furthermore, water volumes in storage ponds are tracked via water elevation surveys applied to volume-elevation curves. Further details pertaining to the underground water management system can be found in Appendix B.

4.1.2 Water Quality

Underground Contact Water

Underground contact water is sampled on a monthly basis at the locations identified in Table 5. All underground contact water sampling locations are analyzed for the following parameters: conventional parameters (specific conductivity, TDS, TSS, pH, hardness, alkalinity, total and dissolved organic carbon, turbidity), oil and grease, major ions, total and free cyanide, radium 226, dissolved and total metals (including mercury), nutrients (nitrate and nitrite, ammonia, Kjeldahl nitrogen, total phosphorus, orthophosphate) and volatile organic compounds (i.e., benzene, xylene, ethylene toluene, F2-F4 petroleum hydrocarbons). The Sump 125 sampling location (sampled 2016 – 2019) was replaced by the Level 300 sampling location in 2020 due to reconfiguration of the underground water management system (Appendix B). Underground contact water monitoring 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.

Non-contact Groundwater

Non-contact groundwater quality is monitored at mine seeps and/or DDH water intersects to verify the quality of formation water flowing into the mine prior to contact. 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 (Agnico Eagle, 2019d). 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. DDH intersect water samples are analyzed for the following parameters: conventional parameters (specific conductivity, TDS, TSS, pH, hardness, alkalinity, total and dissolved organic carbon, turbidity), major ions, nutrients (nitrate and nitrite, ammonia, Kjeldahl nitrogen, total phosphorus, orthophosphate), radium 226, dissolved and total metals (including mercury). Non-contact groundwater quality data collected over 2020 will be provided in the Annual Report.

Table 6 presents a summary of the groundwater monitoring plan presented in Section 4.1.

Table 6 Groundwater Monitoring Plan

Monitoring Type	Monitoring Location	Purpose	Frequency
Verification	Underground Seeps	Quantity - Seepage survey to verify underground inflow rates	Updated daily
Verification	SP1 and SP4	Quality – Monitor quality of surface saline storage ponds	Monthly
Verification	Level 300 pre-clarification	Quality – Monitor quality of collective saline contact water underground prior to clarification	Monthly
Verification	Underground seeps/DDHs	Quality – Verify quality of groundwater flowing into underground mine	Quarterly

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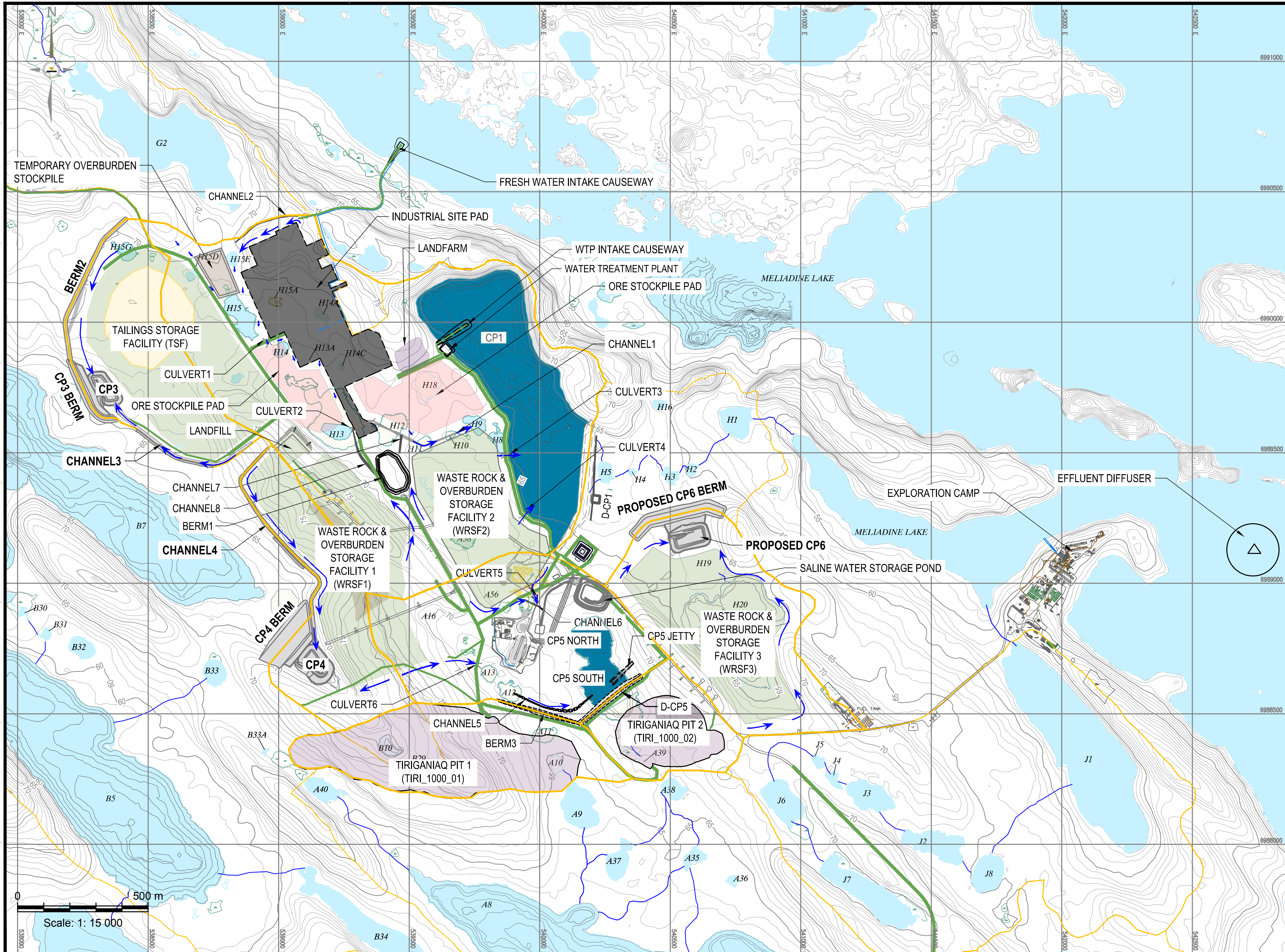
APPENDIX A • SITE LOCATION AND MINE SITE LAYOUT

NO. DESSIN
DRAWING NO.

FORMAT ANSI B–11x17



LEGEND

- CATCHMENT BOUNDARY
- SERVICE ROAD
- HAUL ROAD
- WATERBODY
- WATER COLLECTION POND
- DRAINED POND AREA
- OPEN PIT
- OVERBURDEN
- WASTE ROCK
- ORE
- TAILINGS
- INDUSTRIAL SITE PAD
- CONTACT WATER FLOW DIRECTION

AGNICO EAGLE

TETRA TECH

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TITRE / TITLE	# DWG
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DESSINS EN RÉFÉRENCE/REFERENCE DRAWINGS

REV	DESCRIPTION	DATE	PAR BY
0	ISSUED FOR USE	01–22–2020	GZ
A	ISSUED FOR REVIEW	01–17–2020	GZ

REVISIONS

DESSINÉ PAR DRAWN BY	EL	DATE 01–22–2020
VÉRIFIÉ PAR CHECKED BY	GZ	01–22–2020
APPROUVÉ PAR APPROVED BY		
No. PROJET PROJECT NO.	6526	
DATE		

TITRE / TITLE

AGNICO EAGLE – MELIADINE GOLD PROJECT

FIGURE 2 LOCATION PLAN FOR CP6 AND CP6 BERM AS SHOWN ON GENERAL SITE LAYOUT PLAN FOR PROPOSED INFRASTRUCTURE DURING MINE OPERATION (YEAR 7)

ÉCHELLE/ SCALE	1:15000	FICHIER FILE	.DWG

No. DESSIN/ DRAWING NO.	REVISION	FEUILLE/SHT
	0	1 / 1

AE–CART–ANSI B

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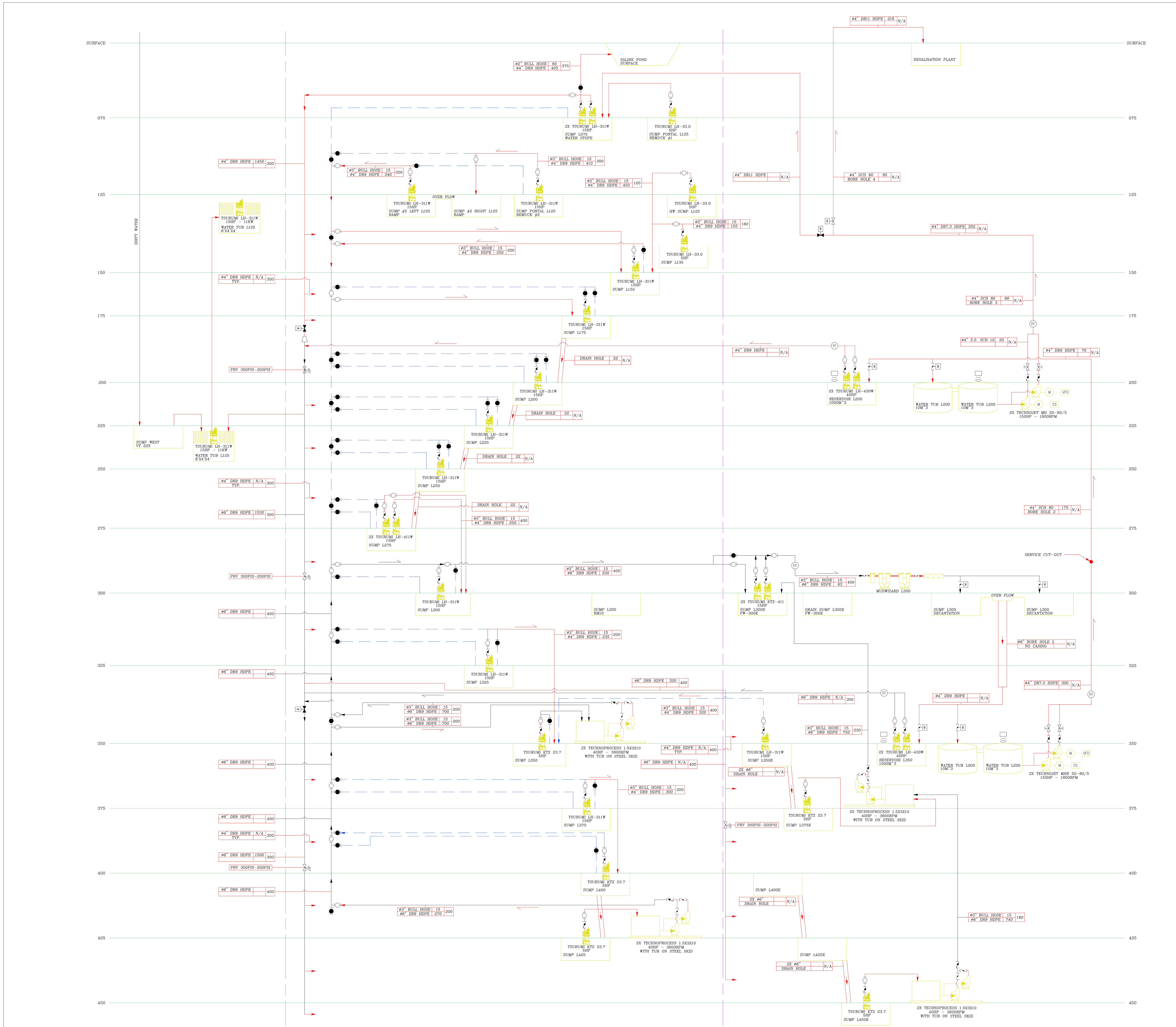
APPENDIX B • UNDERGROUND WATER MANAGEMENT FLOW SHEET DIAGRAM



PIPE UNDER PRESSURE	
PIPE UNDER PRESSURE 6"	
PIPE WITHOUT PRESSURE	
EQUIPMENT	
LEVEL	
SECTOR	
FIRST PIPE | LENGHT (M) / SECOND PIPE | LENGHT (M)	ø3" BULL HOSE 15 / ø4" DR9 HDPE 410 — 200 FLOW (USGPM)
BALL VALVE NC	
BALL VALVE NO	
GATE VALVE NC	
GATE VALVE NO	
CHECK VALVE	
PRESSURE REDUCING VALVE	
BUTTERFLY VALVE	
MOTORISED BUTTERFLY VALVE	M
LEVEL SENSOR	
FLOW METER	FIT
CONCENTRIC REDUCER	

TOTAL HP INSTALLED: 1045 HP

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

FICHIER/FILE: ...AGNICO-EAGLE MELIADINE - AUDIT DE GESTION DES EAUX DU SITE\3 - DESSINS\EN PROGRÈS\MISE EN PLAN\P1806201-0002 (P&ID NOV 2018)
ÉCHELLE DE TRACÉ/PLOT SCALE: 0.037902

APPENDIX C • 2AM-MEL1631 TECHNICAL MEETING COMMITMENT 6

KIA Information Request Follow-Up (KIA-IR-09)

At the technical meeting (November 30, 2020) for amendment to Meliadine Type A Water Licence (2AM-MEL1631), Kivalliq Inuit Association (KivIA) requested additional information on reductions in groundwater flows. This request formed Commitment 6:

- Agnico Eagle to provide an explanation of how the groundwater inflows have been reduced, information on the effectiveness of grouting and an evaluation of the available saline groundwater storage including a discussion regarding estimated time to reaching capacity.

Agnico Eagle has structured the response as follows:

- Grouting Strategy
- Grouting Effectiveness
- Evaluation of Available Storage

This document provides the additional requested information and completes this commitment.

Grouting Strategy

A refined grouting approach began in 2019 based on the premise of preventative grouting (cementing) having greater effectiveness over reactionary grouting, which in previous years would be triggered by intersecting water bearing fractures when carrying out drilling (production and exploratory) and blasting activities.

In developing underground workings, exploratory Diamond Drill Holes (DDHs) in areas of planned development are cemented prior to the advancement of the development. Furthermore, “Jumbo” holes (holes drilled by a Jumbo Drill) are drilled ahead of development and cemented specifically for the purpose of pre-development grouting. Combined, these grouting efforts act to reduce the potential for intersecting inflows with the increased surface area of the excavated heading. Where possible, residual inflows are then plugged on an as-needed basis in these areas. Inflows in stopes and diffuse seeps are generally not able to be grouted and thus remain as active inflows to the underground workings.

The potential for intersecting water-bearing fractures is increased in production long holes (stopes), due to the increased surface area of the excavation and the proximity of the excavation to known water bearing structures. As such, during the drilling phase of stope production, a “grout curtain” is set in and around the stope to minimize the potential for inflows after blasting.

Grouting Effectiveness

Generally speaking, grouting effectiveness and thereby mine-wide groundwater inflows are inversely proportional to the tonnage of cement use, up to a threshold of effectiveness when increased grouting efforts begin to produce less and less inflow reduction effect. This is mainly because the remaining inflow points are not able to be grouted. The aforementioned correlation has been observed in the analysis of piezometer data, where groundwater pressures plateau or increase during periods of increased cement usage and decrease during periods of decreased cement usage. Groundwater pressures in piezometer monitoring have also shown an overall reduced rate of decrease when compared to periods prior to the implementation of a preventative grouting strategy.

Quantifying grouting effectiveness requires the comparison of non-grouted groundwater inflow rates to grouted inflow rates. Grouting has occurred since the beginning of underground works, with increased efforts starting in 2019, and therefore non-grouted groundwater inflows are not actualized. For the purpose of producing a quantitative evaluation of grouting effectiveness, the hydrogeological model is applied as the non-grouted groundwater inflow rate. Detailed discussions on the hydrogeological model and life of mine model estimates are provided in the Groundwater Management Plan (Agnico Eagle 2021) and in Golder (2020).

Applying the assumption that non-mitigated (non-grouted) groundwater inflow rates would be equal to the hydrogeological model groundwater inflow rates (Golder 2020) allows quantification of a percent effectiveness of grouting when comparing to actual (with grouting) inflow rates. The modelled groundwater inflow rates from Golder (2020) average 415 m^3/day in 2020 and the actual groundwater inflow rates averaged 231 m^3/day over 2020. Thus, average grouting effectiveness calculated over the year of 2020 is estimated at 44% (i.e., the grouting efforts in 2020 are calculated to have reduced the expected groundwater inflow rates by 44%). Quarterly grouting effectiveness is provided in Table 1 as a means to provide insight into the variability of grouting effectiveness.

Table 1 Grouting Effectiveness

Year, Quarter	Hydrogeological Model Prediction (Golder 2020)	Measured Groundwater Inflow	Grouting Effectiveness
2020, Q1	410 m^3/day	249 m^3/day	39%
2020, Q3	410 m^3/day	195 m^3/day	52%
2020, Q3	420 m^3/day	219 m^3/day	48%
2020, Q4	420 m^3/day	260 m^3/day	38%

As previously mentioned, both the annual and quarterly calculations assume that if grouting was not carried out then the groundwater inflow rates would have indeed occurred at the modelled rate of Golder (2020).

Evaluation of Available Storage

The following sections consider modelled, non-mitigated (i.e., non-grouted) groundwater inflow rates from Golder (2020). The hydrogeological model is further discussed in the Groundwater Management Plan. Grouting effectiveness observed over 2020, as discussed in the sections above, is not applied to the storage assessments due to uncertainty associated with the application of grouting effectiveness observed in 2020 to the life of mine groundwater model. Grouting effectiveness is expected to be driven by the nature of the bedrock in proximity to the development; specifically, to the degree of fracturing and faulting in proximity to the development which dictate the degree to which the rock can be grouted. The hydrogeological model will be updated in future to incorporate a grouting scenario, and thus produce a mitigated (i.e., after grouting) groundwater inflow projection over life of mine. As this information is not currently available, the information below only considers non-mitigated (i.e., no grouting) hydrogeological model scenarios from Golder (2020).

Storage vs. Capacity – Trucking Discharge to Sea

Annual maximum saline water volumes requiring storage on site and the available storage capacity on site are compared (Table 2). The annual maximum in projected volumes to be stored are produced from a balance of the rate at which saline water accumulates on site and the rate at which it is removed from the system. Table 2 considers modelled groundwater inflow rate (Golder 2020), a trucking discharge to sea rate of 1,600 m^3/day over the open water season, and does not apply an increased rate of discharge through the waterline. The trucking discharge rate of 1,600 m^3/day has been approved by the authorities for 2021, however, requires approval by the Nunavut Planning Commission (NPC) in future years. Further information regarding the inputs of Table 2 are provided in the Groundwater Management Plan (Agnico Eagle 2021).

Table 2 Saline Water Volume Requiring Storage and Available Capacity in Consideration Trucking Discharge to Sea

Year	Saline Storage Requirement[1,5] (m^3)	Saline Pond / Open Pit Storage Capacity (m^3)			
		SP1	SP4	Tiriganiaq Pit 2[3]	Total[4]
2021	352,974	32,686	*272,122*	1,563,000	1,595,686
2022	497,991	32,686	*272,122*	1,563,000	1,595,686
2023	641,135	32,686	*272,122*	1,563,000	1,595,686
2024	782,507	32,686	*272,122*	1,563,000	1,595,686
2025	942,875	32,686		1,563,000	1,595,686
2026	1,101,245	32,686		1,563,000	1,595,686
2027	1,245,615	32,686		1,563,000	1,595,686

Notes:

1. Saline water storage requirement for given year applying predictive groundwater inflow model
2. *Italicized, gray* values are contingency storage only
3. Forecasted storage capacity in bedrock assuming mining is stopped June 1st 2021. This value differs from previous estimates provided within the NIRB Waterline Application Information Requests due to a revision of the mining forecast.
4. Excludes contingency storage
5. Storage requirements assume discharge at only 1,600 m^3/day over summer period of all years. Approval by Nunavut Planning Commission for discharge to sea at 1,600 m^3/day approved for 2021, further approval required in future years

During the application of the storage and trucking discharge strategies, saline water requiring storage is expected to increase year-over-year (Table 2). Saline storage capacity is not expected to be exceeded over life of mine considering the trucking discharge to sea strategy and the groundwater inflow model. However, the without implementation of the waterline (long-term strategy), the year-over-year increase would be expected to produce an inventory of over 1.2 million cubic metres of saline water storage on site by end of mine life.

The purpose of the storage and trucking discharge strategies (short- and medium-term strategies) is to allow successful management of saline water until the long-term (sustainable) strategy of waterline discharge can be applied to remove accumulated inventory. Thus, in this respect and considering Table 2, the short- and medium-term strategies are viewed as viable saline water management strategies. However, when viewed over the longer-term these strategies are not sustainable due to the year-over-year increase in stored water. To allow successful and sustainable management of saline water over life of mine, the long-term strategy of discharge through a waterline, and thus removal of year-over-year storage, is required.

Storage vs. Capacity – Waterline Discharge to Sea

The purpose of the long-term strategy, discharge through the waterline, is to produce a discharge (removal) rate that allows emptying of saline water from storage each year, and thus removes the requirement for long-term storage as a management strategy. This is shown in Table 3, which provides annual maximum saline water volumes requiring storage and available storage capacity. The values within Table 3 assume the waterline begins operation by July 1st 2023.

Table 3 Saline Water Volume Requiring Storage and Available Capacity in Consideration Waterline Discharge to Sea

Year	Saline Storage Requirement[1,5] (m^3)	Saline Pond / Open Pit Storage Capacity (m^3)			
		SP1	SP4	Tiriganiaq Pit 2[3]	Total[4]
2021	352,974	32,686	*272,122*	1,563,000	1,595,686
2022	497,991	32,686	*272,122*	1,563,000	1,595,686
2023	595,622	32,686	*272,122*	1,563,000	1,595,686
2024	305,280	32,686	*272,122*	1,563,000	1,595,686
2025	151,557	32,686		1,563,000	1,595,686
2026	159,557	32,686		1,563,000	1,595,686
2027	149,557	32,686		1,563,000	1,595,686

Notes:

1. Saline water storage requirement for given year applying predictive groundwater inflow model
2. *Italicized, gray* values are contingency storage only
3. Forecasted storage capacity in bedrock assuming mining is stopped June 1st 2021. This value differs from previous estimates provided within the NIRB Waterline Application Information Requests due to a revision of the mining forecast.
4. Excludes contingency storage
5. Storage requirements assume discharge at only 1,600 m^3/day over summer period OF 2021 and 2022, and 12,000 m^3/day in 2023+ through the waterline. Approval by Nunavut Planning Commission for discharge to sea at 1,600 m^3/day approved for 2021, further approval required in future years

As shown in Table 3, application of the waterline is expected to produce a year-over-year reduction in the volume of water stored on site until the accumulated inventory is removed. After this time, the waterline is expected to allow for emptying of saline water from storage each year. Therefore, as shown in Table 3, the waterline is expected to allow the recovery of storage capacity on site, improve the robustness of the groundwater water management, and produce a sustainable method for saline water management over life of mine.

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