SD 05

Water Management Plan
Version 1.0

Water Management Plan - Proposed Plan Updates (July 2021)

REPORT SECTION	UPDATE	RATIONALE
1.0 Introduction	Minor update to reference updates to integrated documents listed.	Introduction lists integrated documents and approvals, many of which are being updated.
1.1 Roles and Responsibilities	Minor updates to regulatory agencies names.	Name changes to regulatory agencies.
1.2 Objectives of the Water Management Plan	Objectives to be updated to reflect changes in site water management due to the proposed modifications to the Approved Project.	
2.0 Project Overview	Update to reflect current status of the Project, including proposed modifications.	Current revision (v. 1.0, 2017) was issued prior to construction.
2.1 Mine Phases of Development	Update to reflect current status of the Project, including proposed modifications.	Current revision (v. 1.0, 2017) was issued prior to construction.
2.2 Surface Water Quality Criteria	Update to current status of Project (including proposed modifications) and MDMER requirements.	Current revision (v. 1.0, 2017) was issued prior to construction and references Metal Mining Effluent Regulation which has been updated to MDMER.
2.3 Mine Contact Water Characterization	Update based on current water quality monitoring results.	Table 2.3 presents preliminary water quality estimates based on modelling. Update based on actual monitoring data.
2.4 Groundwater Criteria	Update as applicable based on changes made in the Groundwater Contingency Plan.	Update as applicable based on changes made in the Groundwater Contingency Plan..
2.5 Runoff Water Management Criteria	Update based on changes to surface water management features and updated water balance modelling.	Site water balance modelling has been updated for the Project and surface water management features have been added to reflect site modifications.
3.0 Water Use	N/A	No need for updates due to proposed modifications to the Approved Project.
3.1 Fire Suppression	N/A	No need for updates due to proposed modifications to the Approved Project.
3.2 Dust Suppression	Update to reflect current practice of dust suppression.	Current revision (v. 1.0, 2017) was issued prior to mining operations and included predicted water use for dust suppression measures. Able to update based on current operations.
3.3 Process Water Use	N/A	No need for updates due to proposed modifications to the Approved Project.
4.0 Site Water Management During Construction	Update to address construction of Project.	Current revision (v. 1.0, 2017) was issued prior to construction of the Approved Project. Update text to reflect construction of proposed modifications.

Water Management Plan - Proposed Plan Updates (July 2021)

REPORT SECTION	UPDATE	RATIONALE
5.0 Site Water Management During Operation	Update as required based on the Integrated Water and Tailings Management Plan.	
6.0 Water Treatment	Update to reflect changes in water quality treatment for in-pit tailings disposal and input to Watercourse #4.	
6.1 Predicted Surface Water Quality	N/A	No need for updates due to proposed modifications to the Approved Project.
6.2 Predicted Groundwater Quality	N/A	No need for updates due to proposed modifications to the Approved Project.
7.0 Surface Water and Groundwater Monitoring	General text is sufficient as is, with exception of updating regulatory agency name.	Requires update of reference to Nova Scotia Environment and Climate Change.
7.1 Surface Water Quality Monitoring	Update to address any changes in the water quality monitoring stations, and requirements of current or anticipated IA. Consider update to include sampling requirements under the EEM program.	
7.2 Groundwater Monitoring	Update changes to monitoring locations due to Project modifications, including updates to Dwg 7.2 and Table 7.2.	Updates required to be consistent with Groundwater Contingency Plan.
7.3 Water Quality Assurance and Control	N/A	No need for updates due to proposed modifications to the Approved Project.
7.4 Water Quality Monitoring	N/A	No need for updates due to proposed modifications to the Approved Project.
8.0 References and Supporting Documents	Update as applicable to incorporate new references.	

Water Management Plan
Version 1.0

Touquoy Gold Mine Facility

Prepared for:
Atlantic Mining NS Corp.
Suite 3083, Three Bentall Centre
595 Burrard Street
Vancouver, BC
V7X 1L3

Prepared by:
Stantec Consulting Ltd.
845 Prospect Street
Fredericton, NB
E3B 2T7

Project No. 121619250
February 9, 2017

This Water Management Plan is a "working" document that will be continually updated as required throughout the life of the project, at minimum at completion of construction. As such, version updates will be recorded in the table below, documenting any significant changes to water management throughout the construction and operation of the mine, and presented as shown in the table below. It is recognized that changes to water management may result from regulatory changes, variation of performance from design, operational, maintenance, surveillance and reporting procedures. This plan will be reviewed on an annual basis.

Report Version Update Summary

Version	Author	Date	Format
0	Stantec Consulting Ltd.	November 25, 2016	Surface Water Management Plan document
1.0	Stantec Consulting Ltd.	February 9, 2017	Surface Water Management Plan document , incorporating NSE review comments

Sign-off Sheet

This document entitled Water Management Plan was prepared by Stantec Consulting Ltd.Stantec Consulting Ltd. ("Stantec") for the account of Atlantic Mining NS Corp. (the "Client"). Any reliance on this document by any third party is strictly prohibited. The material in it reflects Stantec's professional judgment in light of the scope, schedule and other limitations stated in the document and in the contract between Stantec and the Client. The opinions in the document are based on conditions and information existing at the time the document was published and do not take into account any subsequent changes. In preparing the document, Stantec did not verify information supplied to it by others. Any use which a third party makes of this document is the responsibility of such third party. Such third party agrees that Stantec shall not be responsible for costs or damages of any kind, if any, suffered by it or any other third party as a result of decisions made or actions taken based on this document.

This report was prepared by Rachel Jones, Water Resources Engineer, Justin Chase, Biologist – Environmental Services, and Eric Arseneau, Environmental Coordinator. This report was revised by Water Resources Engineer, Jon Keizer, and Sheldon Smith, Senior Hydrologist

Prepared by _____
(signature)

Rachel Jones

Reviewed by _____
(signature)

Sheldon Smith

Stantec

Table of Contents

LIST OF TABLES

LIST OF FIGURES

LIST OF DRAWINGS

Acronyms & Abbreviations

AMNS	Atlantic Mining NS Corp.
BMPs	Best Management Practices
CCME	Canadian Council of Ministers of the Environment
CDA	Canadian Dam Association
CN	Cyanide
EDF	Environmental Design Flood
ESC	Erosion and Sediment Control
ESCP	Erosion and Sediment Control Plan
FDP	Final Discharge Point
GCDWQ	Guideline for Canadian Drinking Water Quality
IA	Industrial Approval (IA) for the Construction, Operation and Reclamation of an Open Pit (Surface) Gold Mine and Mineral Processing Facility, and associated works, issued by the Province of Nova Scotia (NSE 2014)
IDF	Inflow Design Flood
LOWL	Low Operating Water Level
MAC	Maximum Allowable Concentrations
MMER	Metal Mining Effluent Regulations
NOWL	Normal Operating Water Level
OMS	Operations, Maintenance, and Surveillance Manual
PMF	Probable Maximum Flood
PMP	Probable Maximum Precipitation
ROM	Run-of-Mine
TMF	Tailings Management Facility
WMP	Water Management Plan

1.0 INTRODUCTION

This live "working" Surface Water Management Plan (WMP) has been prepared by Stantec Consulting Ltd. (Stantec) for Atlantic Mining NS Corp (AMNS) for the Touquoy Gold Project ("the Project") mine facility in Halifax County, Nova Scotia. This plan will serve as the primary guidance document for surface water monitoring and management at the Touquoy mine site, and is complementary to the *Operations, Maintenance, and Surveillance Manual* (Stantec 2016a and the *Erosion and Sediment Control Plan* (2010a). This plan has been developed according to conditions outlined in the *Industrial Approval (IA) for the Construction, Operation and Reclamation of an Open Pit (Surface) Gold Mine and Mineral Processing Facility, and associated works,* issued by the Province of Nova Scotia (NSE 2014). Design details of surface water management components are detailed in the *Water Balance Report* (Stantec 2016c), *Hydraulic Design Report* (2016d), *Touquoy Mine Tailings Management Facility Construction Drawings Package* (2016f) and associated specifications (2016e). Several other reports and studies, not mentioned above supported the preparation of the WMP and can be found in the references section of this document. Closely integrated documents are summarized below:

- Atlantic Gold Tailings Management Facility Water Balance Report issued by Stantec on July 21, 2016.
- Touquoy Mine Tailings Management Facility Hydraulic Design issued by Stantec on April 5, 2016.
- Operations, Maintenance, and Surveillance Manual issued by Stantec on April 5, 2016
- Touquoy Mine Tailings Management Facility Technical Specifications issued by Stantec on October 7, 2016.
- Touquoy Mine Tailings Management Facility Construction Drawings Package issued by Stantec on October 13, 2016
- Erosion and Sediment Control Plan for the Development of the Touquoy Gold Project issued *by* Stantec on March, 2010.
- Environmental Assessment Approval (EAA). Touquoy Gold Project issued by Nova Scotia Environment & Labour (NSEL) on February 2008.
- Industrial Approval (IA) for the construction, operation, and reclamation of the Touquoy Gold Project issued as Approval No. 2012-084244 by Nova Scotia Environment (NSE) on March 24, 2014.

1.1 ROLES AND RESPONSIBILITIES

Surface water management at the Touquoy Gold Mine facility is the responsibility of the management team at AMNS and the Engineer of Record. This team is made up of individuals from Atlantic Mining NS Corp (AMNS) and Stantec Consulting Ltd (Stantec).

Atlantic Mining NS Corp is the principal coordinator of the Surface Water Management Plan and is ultimately responsible to ensure all aspects of the plan are followed and implemented. Stantec acts as a geotechnical/hydrotechnical consultant for AMNS, an independent environmental consultant that provides on-site environmental compliance monitoring and reporting services.

Table 1.1 presents the regulatory agencies that pertain to water management at the Touquoy Gold Mine Facility.

Table 1.1 Regulatory Agencies that pertain to Water Management Plan

Regulatory Agency	Address	Telephone	Fax
Environment and Climate Change Canada	45 Alderney Drive, Dartmouth, Nova Scotia, B2Y 2N6	1-800-668-6767 **OR** (902) 426-6030 (env. emergencies)	(902) 426-6348
Nova Scotia Environment	30 Damascus Road, Suite 115 Bedford, NS B4A 0C1	(902) 424-7773	(902) 424-0597
Nova Scotia Department of Natural Resources, Geoscience & Mines Branch	1701 Hollis Street, Founders Square, P.O. Box 698, Halifax, Nova Scotia, B3J 2T9	(902) 424-2035	(902) 424-7735

1.2 OBJECTIVES OF THE WATER MANAGEMENT PLAN

The goal of this Water Management Plan (WMP) is to support and guide the construction and operation of the Touquoy Gold Project. The primary objectives of water management at the site are to reduce operational risks and environmental impacts. The specific objectives of the TMF water management plan include the following:

- Mitigate water quality impacts on receiving waters;
- Reduce the consumptive use of freshwater by reusing mine contact water to avoid additional water takings from natural waterbodies, and reducing effluent treatment and discharge requirements;
- Reduce the water inventory at the site through off site drainage of non-mine contact water
- Reduce water management costs during construction and operations through the enhancement of natural drainage features, where possible;
- Enhance open pit dewatering to provide additional storage capacity to attenuate peak flows;
- Incorporate system flexibility to manage water under variable climatic conditions;
- Provide a reliable supply of process water through a portion of pond capacity assigned to inactive storage;
- Reduce water quality monitoring requirements through the establishment of a single effluent discharge point;
- Provide an effective adaptive monitoring program to manage mine water quantity and quality, and maintain the Project in compliance with regulatory requirements and approval conditions.

The WMP provides an overview of the water supply source, water use, water management, and water treatment associated to the Project.

2.0 PROJECT OVERVIEW

Atlantic Mining NS Corp. is the project operator and manager of the Touquoy Gold Project associated with mineral lease ML11-1. The Touquoy Gold mine site is located approximately 60 km northeast of Halifax, in the Moose River Gold Mines district of Halifax County, Nova Scotia (Drawing 2.1). As shown in Drawing 2.2, the mine site comprises approximately 176 ha in area; of that area the proposed Tailings Management Facility (TMF) comprises approximately 94 ha. Discharge from the TMF is proposed to drain to a polishing pond, then to a constructed wetland before being discharged to an unnamed tributary to Scraggy Lake, part of the Moose River drainage system.

AMNS is proceeding with design and construction of a new open pit mine, a tailings management facility (TMF) including a tailings pond, and a final polishing pond to the east of the open pit. The tailings pond will act as a sedimentation basin, reclaim water reservoir, and cyanide (CN) degradation pond. A process water treatment facility will provide additional CN destruction and arsenic removal. The polishing pond, downstream of the tailings pond and the process water treatment facility, will provide additional treatment prior to discharge to the constructed wetland and finally to the unnamed tributary to Scraggy Lake. The TMF dam will be constructed in five stages (raises) over a six year period.

2.1 MINE PHASES OF DEVELOPMENT

2.1.1 Construction

As described in the Erosion and Sediment Control Plan (ESCP, Stantec 2010a), construction is broken into five phases of site development construction activities that will continue over a one year period. The exception is the construction of the tailings impoundment that will continue through the construction stages, into commissioning and the operational life of the mine. The major activities involved prior to commissioning are discussed below:

- Initial site development construction activities commence, as in subsequent phases with the installation of ESC measures followed with the clearing and grubbing of land associated with the open pit mine, mill site and mill site access roads.
- Phase 2 involves additional earthwork activities at the open pit, mill (processing plant) site, the clearing and grubbing of the TMF, creation of organics/topsoil stockpiles, and refurbishment of an existing museum and construction of a new park area.
- Phase 3 site development construction activities include the advancement of Open pit, plant site, and TMF, and the construction of the Ore haul, Waste Haul, Mill site and bypass roads, relocation of a section of public highway, and installation of a live-bottom culvert on the unnamed tributary to Scraggy Lake.
- Phase 4 site development construction activities include the commencement of activities at the constructed wetland, overburden and rock will continue to be removed from the open

pit, site development including the erection of infrastructure at the Mill site, and construction of the Polishing pond and starter TMF perimeter dams.
- Final site development construction activities (Phase 5) will complete the installation of the plant site and TMF infrastructure, including the administrative complex and perimeter seepage collection ditches.

These phases are not linear, and surface water management control, mitigation of erosion and sediment, and monitoring have been underway as per ESCP throughout construction (pers. comm. Rod 2016). Due to integration of these phases, this WMP has been prepared by Stantec for all stages of construction and throughout the operation of the mine. Water management after operation ceases will be part of the reclamation plan.

2.1.2 Operation

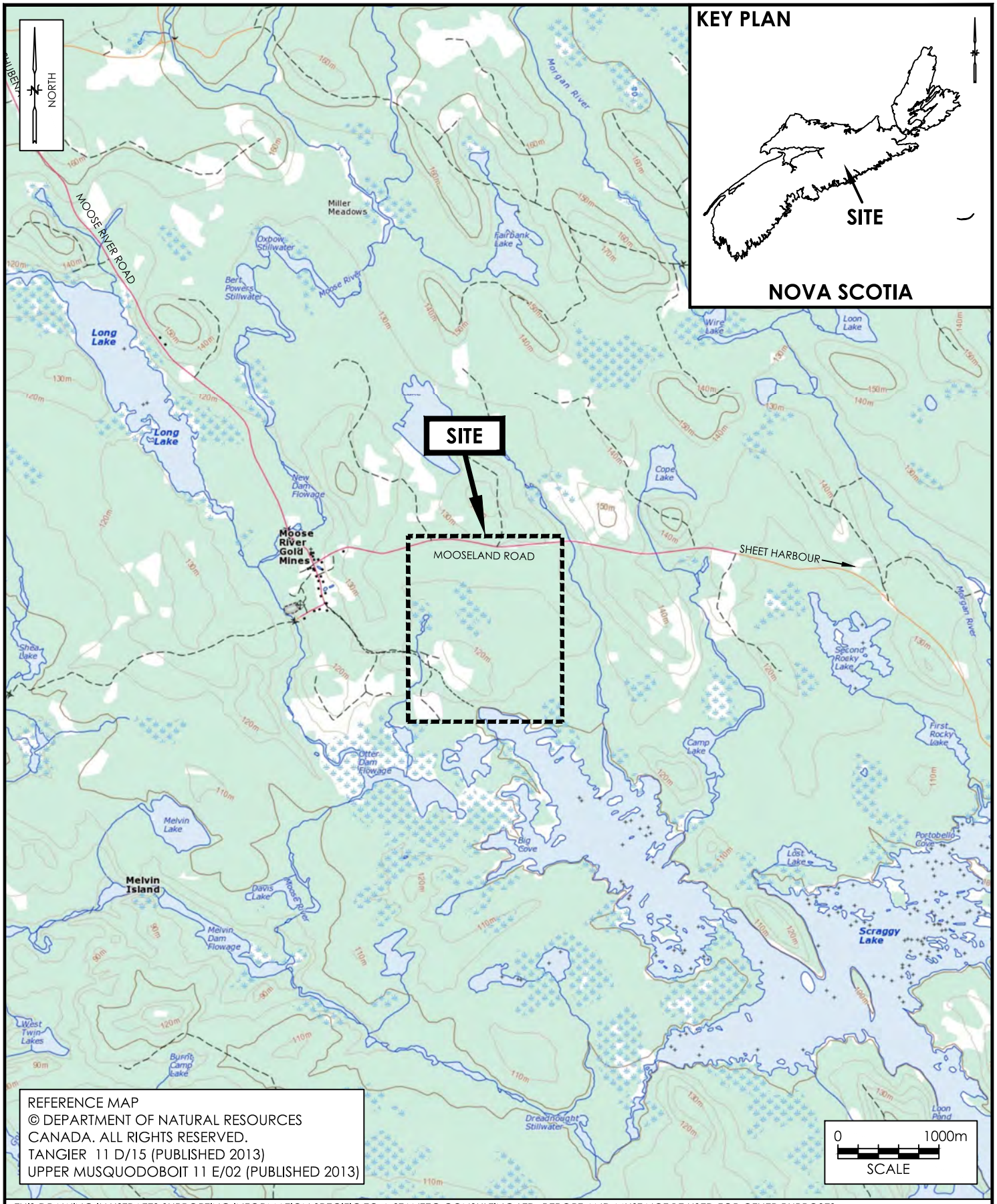
Construction of the mine site infrastructure will commence in 2016 and continue into 2017. Mining will begin during the commissioning phase proposed in August 2017 and continue through 5 stages of operation to April 2022, as summarized in Table 2.1. Stages 1 to 4 represent the Years 1 through 4 of the life of mine development, with the ultimate stage reached by Year 5. Initially, the mill production rate will be approximately100,000 tonnes per month (t/month), and full production of 166,667 t/month will be reached by Month 4, where it will remain throughout the life of the mine.

Limited pre-production mining will begin during the later stages of construction as the site is prepared for operation. Until the mill is commissioned and operations commence, ore will be stockpiled within designated areas within the run-of-mine (ROM) pad and waste rock storage area. Planned ore processing is anticipated to be approximately 100,000 t/month during commissioning, and an average of 166,667 t/month for the remaining stages of operation.

The tailings and polishing dam design consists of a rockfill dam with an upstream clay core. Surrounding the clay core on both the upstream and downstream sides is a graded filter layer. The tailings dam height varies around the site but generally ranges from 3 to 21 m at the final or ultimate stage. The height of the polishing pond dam ranges between 3 to 4 m, and borders a natural drumlin to the southwest. The tailings dam will be constructed in six downstream raises in six years while the polishing pond dam will be constructed to its ultimate height upon initial construction (Stantec 2016b).

Table 2.1 Mine production by phase

Stage	Month	Tailings Pond Crest Elevation (m)	Tailings Emergency Spillway Invert Elevation (m)	Mill Production (t/month)	Required Tailings Storage (m^3)	Available Tailings Storage (m^3)
Commissioning	0-3	116.5	---	100,000	212,014	388,138
Stage 1	3-12	121.0	119.5	166,667	1,250,884	1,812,547
Stage 2	13-24	123.5	122.0	166,667	2,604,524	3,218,148
Stage 3	25-36	126.0	124.5	166,667	3,945,578	4,528,899
Stage 4	37-48	128.0	126.5	166,667	5,306,122	5,906,087
5 - Ultimate	54+	130.0	128.5	166,667	6,262,551	6,755,099



REFERENCE MAP

TANGIER 11 D/15 (PUBLISHED 2013)
UPPER MUSQUODOBOIT 11 E/02 (PUBLISHED 2013)

THIS DRAWING ILLUSTRATES SUPPORTING INFORMATION SPECIFIC TO A STANTEC CONSULTING LTD. REPORT AND MUST NOT BE USED FOR OTHER PURPOSES.

SITE LOCATION PLAN

TOUQUOY MINE TAILINGS MANAGEMENT FACILITY
HALIFAX COUNTY, NOVA SCOTIA

Client: DDV GOLD INC.

Job No.:	121619250
Scale:	1 : 50,000
Date:	2016 11 22
Dwn. By:	JL
App'd By:	JG

Dwg. No.: 2.1

Stantec

V:\1216\active\121619250\1_geotechnical\3_drawings_logs\600_TOUQUOY\SHEET FILES\7_SWMP\19250C-SWMP-2.1.dwg

LEGEND

- CONTOUR, 1m (LIDAR 2010)
- EXISTING ROAD - PAVED
- EXISTING ROAD - DIRT
- PROPOSED MINE INFRASTRUCTURE AREA
- PROPOSED TMF INFRASTRUCTURE
- EXISTING WATERCOURSE
- EXISTING WATERBODY
- EXISTING WETLAND
- FACILITY DRAINAGE AREA
- EXISTING DRAINAGE BOUNDARIES
- FLOW DIRECTION

GRID NORTH

SQUARE LAKE

MOOSE RIVER ROAD

MOOSE RIVER

FISH RIVER

① **MILL SITE**
INFRASTRUCTURE AREA = 13.8 ha

④ **WASTE ROCK AREA**
DRAINAGE AREA = 55.1 ha
INFRASTRUCTURE AREA = 43.8 ha

CULVERT

MOOSELAND ROAD

SEEPAGE COLLECTION SEDIMENT POND

③ **OPEN PIT**
DRAINAGE AREA = 40.7 ha
INFRASTRUCTURE AREA = 37.6 ha

② **TAILINGS POND**
DRAINAGE AREA = 94.0 ha
POND AREA = 22.3 ha

SEEPAGE COLLECTION SEDIMENT POND

MOOSE RIVER

UNNAMED TRIBUTARY TO MOOSE RIVER

SEEPAGE COLLECTION SEDIMENT POND

⑤ **POLISHING POND**
DRAINAGE AREA = 16.9 ha
POND AREA = 10.5 ha

CONSTRUCTED WETLAND

SCRAGGY LAKE

0 500m
SCALE

V:\1216\active\121619250\1_geotechnical\3_drawings_logs\600_TOUQUOY\SHEET FILES\7_SWMP\19250C-SWMP-2.2.dwg

THIS DRAWING ILLUSTRATES SUPPORTING INFORMATION SPECIFIC TO A STANTEC CONSULTING LTD. REPORT AND MUST NOT BE USED FOR OTHER PURPOSES.

Reference:

1. CONESTOGA-ROVERS & ASSOCIATES; PROJECT No. 820933-E; DRAWING No. 02; DATE: AUGUST 2013.
2. GOLDER & ASSOCIATES: PROJECT No. 06-1118-041C; FIGURE No. 2; DATE: MAY, 2015.

MINE DRAINAGE BOUNDARIES

TOUQUOY MINE TAILINGS MANAGEMENT FACILITY
HALIFAX COUNTY, NOVA SCOTIA

Client: DDV GOLD LTD.

Job No.:	121619250
Scale:	1 : 12,500
Date:	2016 11 22
Dwn. By:	JL
App'd By:	RJ

Dwg. No.: 2.2

Stantec

2.2 SURFACE WATER QUALITY CRITERIA

The Touquoy Gold mine is subject to provincial and federal water quality guidelines. Provincially, the mine is subject to Approval No. 2012-084244 (the IA) issued under the Nova Scotia Environment Act, S.N.S. 1994-95, c.1 (NSE 2014). Federally, the mine will become subject to the Metal Mining Effluent Regulation (MMER, DFO 2016) when the mine exceeds an effluent discharge rate of 50 cubic metres (m^3) per day, based on effluent deposited from all final discharge point(s) (FDPs). However, based on the IA, surface water quality monitoring at all monitoring Stages designated by the MMER will be conducted during construction and one year post operation for water quality parameters specified in the MMER.

Additional surface water monitoring will be required under the Environmental Effects Monitoring (EEM) Program and consists of effluent characterization, sublethal toxicity testing, and water quality monitoring. The Touquoy Mine is not yet registered under the MMER; it has not exceeded the effluent discharge rates and therefore is not subject to MMER. Thus only the sampling requirements related to the FDP are detailed herein. In the future, when the mine is subject to the MMER, the EEM requirements will have to be evaluated and implemented within the water management plan.

Section 9 (c) (ii) of the IA dictates that the mine must comply with limits established under the MMER for all FDPs (Table 2.2). NSE may also choose to establish limits outside the scope of the MMER. Section 9 d) i) and ii) of the IA specify slightly different total suspended solids (TSS) and pH criteria than those established by the MMER. The water quality limits presented in Table 2.2 will apply for all FDPs.

Table 2.2 Effluent Criteria as set out in the MMER and Industrial Approval

MMER (Schedule 4) Effluent Criteria			
Parameter	**Maximum Authorized Monthly Mean Concentration**	**Maximum Authorized Concentration in a Composite Sample**	**Maximum Authorized Concentration in a Grab Sample**
pH[1]	≥6.0 and ≤9.5		
Arsenic (mg/L)	0.50	0.75	1.00
Copper (mg/L)	0.30	0.45	0.60
Cyanide (mg/L)	1.00	1.50	2.00
Lead (mg/L)	0.20	0.30	0.40
Nickel (mg/L)	0.50	0.75	1.00
Zinc (mg/L)	0.50	0.75	1.00
TSS (mg/L)	15.00	22.50	30.00
Radium 226 (Bq/L)	0.37	0.74	1.11

Industrial Approval 2012-084244, Section 9 Effluent Criteria (NSE 2014)		
Parameter	**TSS – Normal Background Conditions**	**TSS – Spring Freshets and Strom Events**
Total Suspended Solids (mg/L)	Max increase of 25 mg/L from background, short term (< 24 hrs) Max average increase of 5 mg/L from background, long term (24 hrs – 30 days)	Max increase of 25 mg/L from background at any time when background is >25 mg/L and<250 mg/L Shall not increase more than10% when background is >250 mg/L
pH – Grab sample	≥5.0 and ≤9.0	
pH – Arithmetic mean	≥6.0 and ≤9.0	

Note: 1 = pH is not included in Schedule 4 of MMER.

2.3 MINE CONTACT WATER CHARACTERIZATION

Mine contact water on the site includes all runoff that has been in contact with the waste rock, ore, or tailings. As summarized in the Water Balance Report (Stantec 2016c), 5,600 m^3/d of treated mine contact water will be discharged from the site daily. Mine contact water discharged from the site will be collected at the Final Discharge Point, located just downstream of the outlet of the polishing pond. Outflow from the polishing pond will flow through a constructed wetland where flow will be dispersed, overtopping the embankment and runoff as channelized flow to Scraggy Lake. Mine contact water will be treated at the Mill site and TMF treatment plants, in the tailings and polishing pond, and finally through the constructed wetland.

Water quality modeling results reported by Stantec (2016g) indicate that the treated effluent released into Scraggy Lake is expected to meet or surpass water quality standards outlined in the MMER. Total cyanide concentrations and the resulting ammonia/nitrate concentrations will be mitigated in the design of the water treatment plant to satisfy MMER requirements, if necessary.

Table 2.3 summarizes the preliminary water quality estimates at the FDP based on reported water quality concentrations by CBCL (2007) and a Assessment of Water Quality Downstream of Tailings Managmenet Faiclity (Stantec 2016g), applied to climate normal flow conditions. Water quality estimates are compared against MMER guidelines for both a grab sample and the monthly average, as well as CCME Environmental Quality Guidelines (1999 & 2007) for the protection of Freshwater Aquatic Life. CCME guidelines—though not legally binding unless adopted by provinces under a regulatory instrument—provide additional guidelines that pertain to surface water and sediment quality, including aesthetics, aquatic life, and other matters, and will be used to identify chemical parameters of concern in water quality monitoring results.

Table 2.3 Preliminary Water Quality Estimates at the Final Discharge Point

Parameter (Symbol & Name)		Concentration (mg/L)			
		Concentration based on 2007 Sample	MMER Discharge Limits (Oct. 2016)		CCME Guideline for the Protection of Freshwater Aquatic Life
			Grab	Monthly average	
Ag	Silver	0.000207	-	-	0.00025[b]
Al	Aluminum	0.316	-	-	0.0005-0.1[c]
As	Arsenic	0.0297	1.00	0.500	0.005
Ca	Calcium	167	-	-	-
Cd	Cadmium	0.00000321	-	-	0.11-7.7[c]
Cl	Chloride	24	-	-	120
Co	Cobalt	0.178	-	-	-
Cr	Chromium	0.000597	-	-	-
Cu	Copper	0.0521	0.600	0.300	0.002 – 0.004
Fe	Iron	0.988	-	-	0.3
K	Potassium	55.5	-	-	-
Mg	Magnesium	6.58	-	-	-
Mn	Manganese	0.0784	-	-	-
Na	Sodium	460	-	-	-
NH_4+NH_3	Ammonia + Ammonium	7.92	-	-	-
Ni	Nickel	0.0036	1.00	0.500	0.025-0150
NO_3	Nitrate	0.0556			0.550[d], 0.130[b]
Pb	Lead	0.00353	0.400	0.200	0.100 – 0.700[c]
P	Phosphorus	0.0833	-	-	-
Sb	Antimony	0.0102	-	-	-
Se	Selenium	0.00142	-	-	0.001
SO_4	Sulfate	998	-	-	100
U	Uranium	0.00388	-	-	-
Zn	Zinc	0.0315	1.00	0.500	0.03
CN	Total Cyanide*	0.426	2.00	1.00	--

Notes

- = Assumes no CN destruction of the treated discharge into the polishing pond plus untreated seepage.

2.4 GROUNDWATER CRITERIA

Although groundwater resources in Canada are generally managed by provincial regulatory bodies as described above, the Guidelines for Canadian Drinking Water Quality (GCDWQ) published by Health Canada are also applicable to groundwater across Canada, and have been adopted by the government of Nova Scotia for regulated public drinking water supplies. As the project site is not near a current domestic water source, these regulations are not legally binding and will be compared to water quality results to help identify elevated parameter concentrations. The GCDWQ are "*established based on current published scientific research related to health effects, aesthetic effects and operational considerations*" (Health Canada 2014).

Table 2.4 presents the groundwater monitoring guidelines (GCDWQ, Health Canada 2014) of water quality parameters to be monitored for the Project.

Table 2.4 Groundwater Monitoring Criteria

Parameter	Units	Guideline for Canadian Drinking Water Quality (GCDWQ) (MAC unless otherwise noted)
Total Alkalinity	mg/L	-
Aluminum	mg/L	-
Ammonia		-
Antimony	mg/L	6000
Arsenic	mg/L	10,000
Barium	mg/L	1
Beryllium	mg/L	-
Bismuth		-
Boron	mg/L	5
Conductivity	µSIE/cm	-
Calcium	mg/L	-
Cadmium	mg/L	0.005
Chloride	mg/L	≤250[AO]
Chromium	mg/L	0.05
Cobalt		-
Colour		≤ 1.5
Copper	mg/L	≤1[AO]
Cyanate		-
Cyanide		-
Fluoride	mg/L	1.5

Parameter	Units	Guideline for Canadian Drinking Water Quality (GCDWQ) (MAC unless otherwise noted)
Ion Balance		-
Iron	mg/L	≤0.3[AO]
Hardness	mg/L	-
Hydrocarbons		-
Lead	mg/L	0.010
Potassium	mg/L	-
Magnesium	mg/L	-
Manganese	mg/L	≤0.05[AO]
Nickel		-
Nitrite (as N)	mg/L	3
Nitrate (as N)	mg/L	45
Nitrate + Nitrite (as N)	mg/L	10
Orthophosphate		-
pH	unitless	6.5-8.5
Reactive Silica		-
Silver		-
Sodium	mg/L	<200[AO]
Reactive Silica		-
Sulphate	mg/L	<250[AO]
Selenium	mg/L	0.05
Stronium		-
Total Dissolved Solids (Calculated)	mg/L	<500[AO]
Total Organic Carbon		-
Total Petroleum		-
Total Petroleum Hydrocarbons & BTEX		-
Total Suspended Solids		-
Turbidity	NTU	1
Thallium		-
Thallium		-
Thiocyanate		-
Tin		-
Titanium	µg/L	-

Parameter	Units	Guideline for Canadian Drinking Water Quality (GCDWQ) (MAC unless otherwise noted)
Uranium	mg/L	20,000
Vanadium		-
Zinc	mg/L	<5,000,000[AO]

Notes
MAC = Maximum allowable concentration (Health Canada 2014).
MPN = Most probable number.
AO = Aesthetic Objectives
"-" = Not applicable.

2.5 RUNOFF WATER MANAGEMENT CRITERIA

The water management features have been designed to withstand flooding events using criteria based on level of consequence of the stormwater management infrastructure.

The proposed TMF includes a tailings dam and polishing pond dam that incorporates current regulatory requirements into the design, including the Canadian Dam Association (CDA 2014) design standards. Design of the tailings dam crest and invert elevation of associated spillways are determined by considering the Inflow Design Flood (IDF), the Environmental Design Flood (EDF), the Normal Operating Water Level (NOWL), the Low Operating Water Level (LOWL), and freeboard. The storage requirements of water retention structures are summarized in Table 2.5, and detailed in subsequent sections.

Table 2.5 Storage Requirements of Major Water Retention Structures

Dam	Selected IDF a	Selected EDF	Selected NOWL	Selected LOWL
Tailings Pond Dam	1/3 between 1:1000 Storm Event (277 mm) and the PMF (generated from 493 mm PMP)[a] = 349 mm [d] in 24 hours	1:25 year Storm = 171.6 mm [c]	Climate Normal Conditions Dewatering Surplus	Inactive Storage Condition
Polishing Pond Dam	1:100 year (217.2 mm) Storm in 24 hours	Not Applicable	Climate Normal Conditions Discharge Surplus	Inactive Storage Condition

Source: a= CDA (2014), b = Golder (2007a) Feasibility Study, c = Applied to all contributing areas. d = The IDF is the flow derived from a precipitation event of 349 mm magnitude.

The IDF is the most severe inflow flood (peak, volume, shape, duration, timing) for which a dam and its associated facilities are designed (CDA 2014). The TMF dams were assessed as having a High Consequence classification (Golder, 2007). As per the CDA requirement for a high

consequence classification, the IDF should be 1/3 between the 1:1000 year flood event and the probable maximum flood (PMF). The PMF is a flood that results from a precipitation event known as the probable maximum precipitation (PMP). The PMP is defined as the most extreme precipitation event physically possible in the area. The PMP was selected in a supporting Dam Break Flooding Study and a preliminary design of the tailings management area both completed by Golder (2007). Golder reported that the PMF event was approximately 493 mm in 24 hours, the IDF was set at 349 mm in 24 hours associated to the 1/3 between the 1:1000 year flood and the PMF.

The EDF is the most severe flood that is to be managed without release of untreated water to the environment (CDA 2014). Retention of water during the EDF requires storage capacity above the NOWL (CDA 2014). An emergency spillway will enhance the safe operation of the TMF by increasing the range of inflows that can be managed in extreme circumstances. The EDF can be defined by the required dilution of water quality parameters of concern, such as total suspended solids, arsenic, and cyanide predicted to be in the tailings pond water (Atlantic Gold 2007).

For components that are temporary in nature, or are only expected to service the operational period of the Project, the 1:25 year storm is used as the design criteria. These features include the seepage collection ditch around the tailings pond and associated pumping capacity, mill site pond, ROM Pad ditch, waste rock storage pond, waste rock ditch, and open pit dewatering pumping capacity. However, the allotted freeboard height of most of this infrastructure would accommodate flows of a higher storm event. Design of the decant structure pumping capacity and pore spacing was based on the required capacity of the maximum Waste Water Treatment Plant (WWTP) of 10,800 m³/d and the average reclaim flows to the mill for process use.

2.5.1 Mean Annual Flow

The volume of runoff generated on site was estimated in the associated water balance report (Stantec 2016c). The water balance was based on the normal climatic conditions for the nearest Environment Canada climate station (Station ID 8203535), which amounted to approximately 1357.7 mm, annually. Touquoy Gold Project site climate normal conditions are summarized in Table 2.6.

Table 2.6 Representative Climate Values for the Mine Site

Climate Normal for the 30-year period (1981-2010) at Middle Musquodoboit Climate Station													
Parameter	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Year**
Temperature (°C)	-6.2	-5.2	-1.3	4.4	9.9	14.8	18.5	18.4	14.2	8.5	3.5	-2.4	6.4
Rainfall (mm)	80.4	62.1	92.8	99.5	104.9	99.8	103.8	91.9	110.7	116.7	128.6	97.2	1188.4
Snowfall (cm)	49.4	41.3	31.4	9.5	0.5	0.0	0.0	0.0	0.0	0.0	8.2	31.9	172.2
Precipitation (mm)	129.8	100.5	124.2	109.0	105.4	99.8	103.8	91.9	110.7	116.7	136.8	129.1	1357.7
Snow Depth (cm)	40	67	64	22	6	1	0	0	0	0	25	28	21.1
Monthly Lake Evaporation at Truro Climate Station for 30 year period (1981-2010)													
Lake Evaporation (mm/day)	0.0	0.0	0.0	0.0	89.9	102.0	117.8	96.1	69.0	40.3	0.0	0.0	515.1

3.0 WATER USE

Water use for the Project includes potable water for use in the processing plant area buildings, water for fire suppression and dust suppression, and water for mine operation. Potable water will be supplied by a water delivery supplier. Water supply for use in the mill will include fresh water pumped from Scraggy Lake, water recovered from open pit dewatering, precipitation runoff, and reclaim from the tailings pond (GHD 2016).

3.1 FIRE SUPPESSION

Requirements for fire suppression water supply or withdrawal are not specified in the existing IA or EAA (NSE 2014 and NSEL 2008, respectively). Fire suppression water will initially be supplied through a buried pipeline to a raw water/fire water storage tank (Ausenco 2015). When sufficient quantities of tailings water are available, tailings reclaim can also be used for fire suppression. Any additional water required will be withdrawn from the polishing pond.

3.2 DUST SUPPRESSION

Water will be used for all dust suppression for the Project. As per the Industrial Approval (NSE 2014), dust must be suppressed such that ambient particulate emissions levels outside the site boundaries do not exceed 70 µg/m^3 annually (geometric mean), and 120 µg/m^3 daily (24 hr. average). Treated mine contact water stored in the polishing pond will be used for all dust suppression throughout operation. Initially, water for dust suppression will be withdrawn from Scraggy Lake until water storage in the polishing pond reaches approximately normal operating water level. Based on climate normal conditions, this is anticipated to occur during the commissioning phase of the mine operating life (Stantec 2016c). It is anticipated that water will

be required for dust suppression from May through October, and quantities used will range from approximately 310 to 3100 m^3/month. Under climate normal conditions (i.e., 1981-2010), water used for dust suppression is estimated to total 3,020 m^3/year. In dry years, water use for dust suppression is estimated to increase to approximately 6,553 m^3/year. For details on specific dust control mechanisms that will be employed in each mine facility component, refer to the Fugitive Dust Control Plan (CRA 2008).

3.3 PROCESS WATER USE

Process water refers to water used for ore processing within the mill, as well as initial water pumped to the tailings pond for commencement of processing if sufficient water is not yet accumulated (GHD 2016). Mill water demands include mill process water and freshwater. Mill process water demand is supplied from reclaim water from the TMF, which includes runoff from the waste rock area, open pit dewatering, and seepage. Freshwater will be drawn from Scaggy Lake. According to CRA (2007), dewatering of the open pit could supply enough process water for the first month of operation, prior to any water withdraw from Scraggy Lake. When adequate tailings water has accumulated (by year two of operation), approximately 6,845 m^3/day of reclaim water will be available for use, and will supply 95-100% of process water demand. Reclaim water will be drawn from the southern region of the tailings pond.

An integrated water balance has been developed for the Project to evaluate the water quantity from various mine components and to promote the reuse of water and reduce discharge requirements. The water balance model considered climate normal conditions and 100 year wet and dry scenarios. As presented in the Water Balance (Stantec 2016c), the average demand for process water will be approximately 5,446 m^3/day. The quantity of ore processed will be relatively consistent from month to month. Table 3.1 and Drawing 3.1, summarizes the process water use. Water will be withdrawn through an intake structure in Scraggy lake, which will require a fish screen, following the *DFO Freshwater Intake End-of-Pipe Fish Screen Guideline* (1995).

Table 3.1 Process Water Use

Process Water Use	Rate
Mill Availability	91.3 %
Moisture content of ore entering the mill	164 m^3/d (3 %)
Evaporation and spillage losses at the mill	145 m^3/d (2%)
Concentrate from ore	negligible
Water in tailings discharged to the TMF, assuming 57% slurry density	7263 m^3/d
Process water discharged to the TMF	71 m^3/d
Freshwater make-up required for the mill	399 m^3/d (5.5%)
Reclaim water to the mill from the TMF	3845 m^3/d

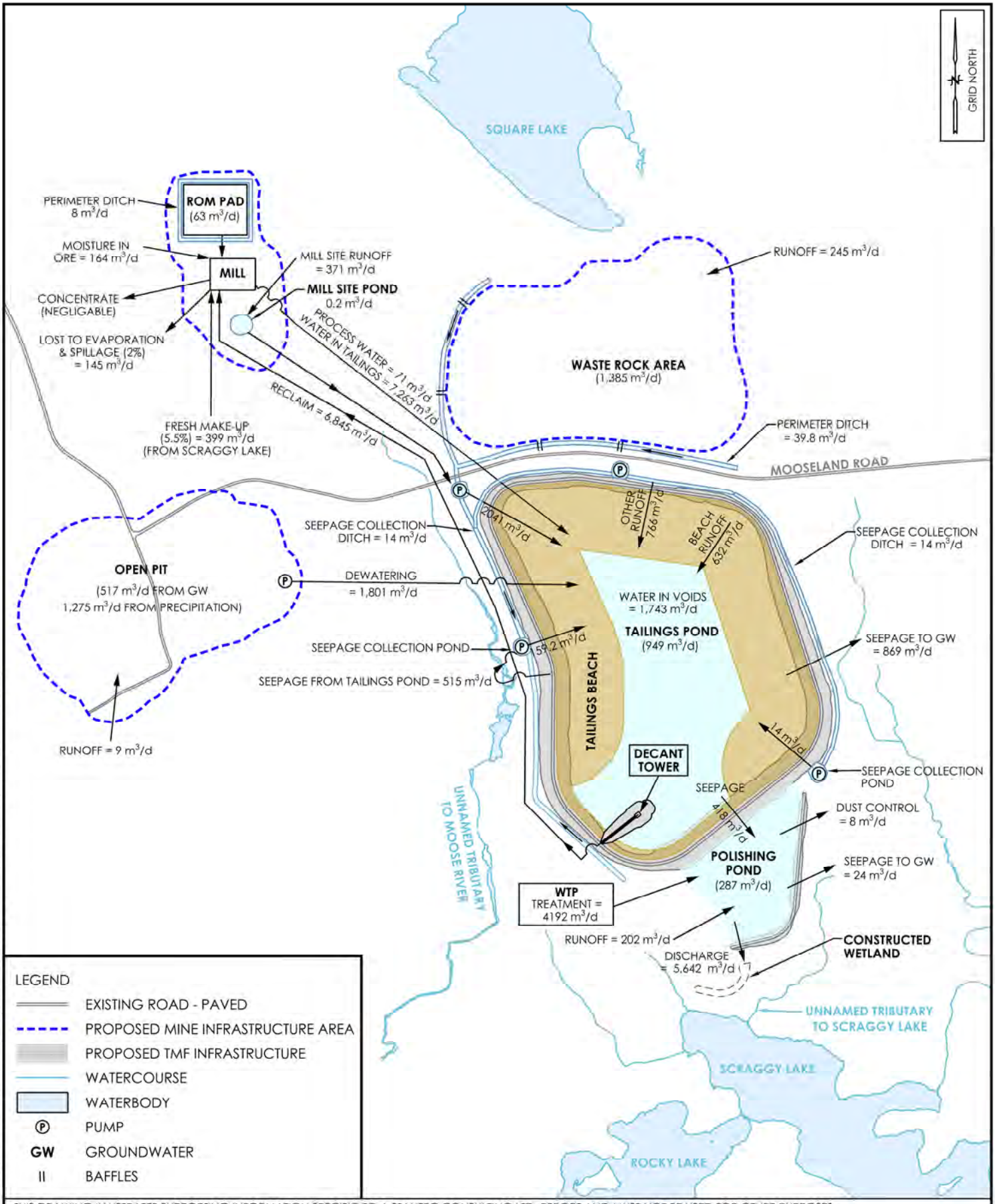
As stipulated in the IANSE 2014, an application for water withdrawal will be prepared for water withdrawal from Scraggy Lake for process and service water use during both construction and operation no later than ninety (90) days prior to commencing construction. The application shall specify the full anticipated daily maximum and average withdrawal volume, expected duration for start-up, and make-up water requirements for water withdrawal from Scraggy Lake. The application shall be written to follow the submission requirements of the NSE "*Guide to Surface Water Withdrawal Approvals 2015*" because water withdrawal exceeds 23,000 L/d for a period greater than two weeks.

As per the IA and the EAA, all waste process water (mill effluent) shall be directed to the Tailings Management Facility for treatment before release from the final discharge point. Discharge through the emergency spillways is permitted when design flow of the tailings impoundment and wetland treatment spillway is exceeded. Refer to Section 7 of this report for wastewater treatment requirements and liquid effluent limits. Refer to the IA for requirements for erosion and sedimentation control, and watercourse protection.

Water used in ore processing, dust suppression, and fire suppression will initially be supplied from Scraggy Lake through a buried pipeline to a raw water/fire water storage tank (Ausenco 2015) until the TMF contains sufficient water to be reclaimed for these uses. Runoff water accumulated within the open pit can also be used for initial processing and other purposes. The estimated water reclaim demand to the mill is 1,960,393 m^3/year (Stantec 2016d). The estimated taillings water reclaim rate is 6,845 m^3/day on average (Stantec 2016c). Annual tailings pond surplus (i.e., available for operational use) under climate normal, wet, and dry year conditions are 1,511,251 m^3, 2,293,270 m^3, and 866,620 m^3, respectively. It is anticipated that the tailings pond will have accumulated adequate water reserves to supply mill processing demands and other operational requirements by the eighth month of operation (Stantec 2016d, CRA 2007).

4.0 SITE WATER MANAGEMENT DURING CONSTRUCTION

As described in the Erosion and Sediment Control Plan (ESCP, Stantec 2010a), the primary water management activity during construction will be erosion and sediment control (ESC) measures and mine underground dewatering. ESC measures will be required for various construction phase activities outlined in Section 2.1 and in the ESCP (2010), and include clearing and grubbing of vegetation, stripping and stockpiling of topsoil, excavation and stockpiling of overburden, and excavation for building foundations, ditch construction, road construction, borrow area development and operation, and preparation of surfaces for major Project components.



THIS DRAWING ILLUSTRATES SUPPORTING INFORMATION SPECIFIC TO A STANTEC CONSULTING LTD. REPORT AND MUST NOT BE USED FOR OTHER PURPOSES.

MINE PROCESS FLOW DIAGRAM

TOUQUOY MINE TAILINGS MANAGEMENT FACILITY

HALIFAX COUNTY, NOVA SCOTIA

Job No.:	121619250	Dwg. No.: 3.1	Rev. No.: 2.0
Scale:	N.T.S.		
Date:	2016 11 22		
Dwn. By:	JL		
App'd By:	RJ		
Client:	DDV GOLD LTD.		

Stantec

V:\1216\active\121619250\1_geotechnical\3_drawings_logs\600_TOUQUOY\SHEET FILES\7_SWMP\19250C-SWMP-3.1.dwg

The objective of the ESCP was to reduce environmental impacts involving earthwork activities during the development of the Touquoy Mine Project. The four basic principles adopted in development of the ESCP are to:

- Direct runoff away from active work areas before construction commences, reducing the volume of sediment-laden water to manage;
- Limit the amount and timing of exposed soil left open at any one time to reduce the potential for erosion;
- Control sediment-laden runoff leaving the site, following ESC measures put in place for the construction of the Project; and,
- Protect sensitive receptors from sediment-laden runoff by directing untreated runoff away from these areas.

Sensitive receptors on and adjacent to the site will require protection from sediment-laden runoff generated during site development. The most sensitive receptors, based on their proximity to active work areas where land disturbance will be encountered, include Moose River and its Unnamed Tributary and associated wetlands, Scraggy Lake and unnamed tributaries, and Square Lake.

The primary water management activities during construction are expected to include collection, treatment, and discharge of surface runoff from the construction area and surface runoff and groundwater inflow to foundation excavations. Standard sediment control features will be used during construction, including installation of silt fencing and construction of diversion ditches to collect surface water runoff. During construction, water from the construction area will be directed to a sediment pond to be located in the southern portion of the site where primary sedimentation will be provided. The ponds have been sized for the 1:25 year storm event.

During construction, primary runoff constituents of concern are expected to be TSS and potentially elevated metals concentrations resulting from the storage of overburden, waste rock, and ore. No blasting is required during construction or in TMF operations; only blasting in the open pit is expected (pers. comm. Rod, 2016).

Recommended water management best practices to manage surface runoff and reduce the erosion potential of the site have been included in the ESCP (Stantec 2010a), and generally include:

- Construction of perimeter (or ring) ditches around the footprint of Project component areas prior to clearing and grubbing on the site. The ditches will be constructed to collect and treat sediment-laden runoff inside the work area and divert runoff outside the work area offsite.
- Placement of flow checks consisting of clear stone in ditches to reduce the velocity of flow and deposit sediment load.
- Construct in the dry, dewatering areas prior to construction or installing temporary flow diversion measures to reduce the amount of sediment.

- Divert sediment-laden runoff to collection ponds or sedimentation ponds for treatment prior to discharge. Removal of excess sediment from the collection ponds may be required to reinstate the design storage capacity.

Examples of water management features in project component area are included below, and described in more detail in the ESCP (Stantec 2010a):

- A perimeter ditch to divert surface runoff away from potential areas of exposed soil during grubbing operations along two sections of the Mill (plant) site access road, at the intersection where the Mill site access road meets the Plant Site and an area immediately north of the Mooseland Road.
- Additional cross culverts under the mill site access road may be installed as localized drainage dictates.
- Diversion ditch up-gradient of the Mill pond to direct surface water away from the land disturbance associated with its construction.
- During clearing and grubbing activities associated with the open pit, surface water runoff and seepage will be collected in excavation sumps and pumped to either temporary sedimentation ponds (and discharged to the environment if discharge criteria are met) or further treated using additional ponds and/or filter bags prior to discharge.
- Prior to development of the Waste Rock Storage area, perimeter ditches and water collection ponds will be constructed to collect and store surface runoff. The drainage ditches will be construed to drain by gravity to the collection ponds, where possible. In low areas where gravity flow to the collection ponds is not practical, sumps will be constructed to collect water and pump it to the collection ponds. Water in the collection ponds will be monitored, treated via sedimentation as necessary, and discharged to the environment once water quality meets the conditions stipulated in the IA.
- Temporarily divert flow in the unnamed tributary to Moose River, to construct a live bottom culvert in the dry for the construction of the waste haul and Bypass road. Water will be discharged to a vegetated area through a perforated PVC pipe, located more than 60 m from any watercourse, or alternatively into a filter bag.
- Topsoil, overburden, and bedrock removed for construction will be stored for rehabilitation and closure purposes in designated areas next to the tailings pond, mill site, or the open pit, as shown in ESCP (Stantec 2010a). The construction of a diversion ditch to divert surface water away from a planned organics/topsoil stockpile is to be constructed northeast of the Mill site. This may also necessitate the installation of a cross culvert under the Mill site access road, or a diversion ditch will be constructed to direct surface runoff away from organics/topsoil stockpliles.
- Installation of a ring ditch along the western perimeter of the bypass road just south of the unnamed tributary to Moose river to divert surface runoff from the grubbing operation away from the unnamed tributary to Moose River.

Implementation and maintenance of the ESCP will be monitored on a daily basis and in more detail prior to and immediately following a precipitation event of 25 mm or more. ESC measures will be put in place to ensure that liquid effluent limits are met in the receiving watercourse, as set out in Section 2, and in Section 9)d) of the IA . Maintenance and monitoring of the ESC measures are the responsibility of the contractor. This is outlined in the Operations Maintenance and Surveillance manual (Stantec 2016a), and therefore is not discussed in the monitoring section to follow.

5.0 SITE WATER MANAGEMENT DURING OPERATION

The Project site, including the mill site, TMF, open pit, waste rock area, and polishing pond, are contained within a 221.22 ha area of controlled drainage. Surface water at the site is managed so that runoff from all project component areas—including the Mill site, Waste Rock Area, and Open pit—is collected in the tailings pond, as required under the IA (NSE 2014). Surface water that has not been in contact with areas disturbed by the Project will be diverted away from the mine site. The exception is two overburden stockpiles situated between the tailings impoundment and the open pit, to the south and west of the tailings reclaim pond. A minimum 30 m undeveloped buffer was maintained in design of the mine site components, including the adjacent unnamed tributary to Moose River , and the Unnamed tributary to Scraggy Lake and associated wetland.

Refer to the Touquoy Mine Tailings Management Facility Technical Specifications (Stantec 2016e), the TMF Hydraulic Design (Stantec 2016d), and the TMF Construction Drawings Package (Stantec 2016f) (hereafter referred to as Construction Drawings) for details on project components including construction specifications. The following is an overview of the TMF as it pertains to surface water quality and quantity. Surface water management by Project component is summarized in the paragraphs to follow.

This mill site will comprise approximately 13.8 ha , and includes the mill and administrative complex. As described in Merit Engineers (2006) and required under the IA (NSE 2014), storm runoff from the mill site will be collected in the stormwater pond for transfer to the tailings pond. Exposed erodible soils at the mill site will be vegetated or covered with an approved granular blanket to minimize erosion. A ROM pad will be located south of the Mill, and will include a surrounding perimeter ditch to collect runoff, drained via a pipe connected to site the mill site stormwater pond.

The waste rock area will be approximately 55.1 ha, and will be used for waste rock storage and as an overflow stockpile for ore. Perimeter ditches constructed around the waste rock area will flow into three sedimentation ponds. Outflow from the ponds is conveyed in ditches and pumped into the tailings pond to provide further treatment (Stantec 2016c) and dilution.

The open pit will be approximately 40.7 ha in area. Mine water from dewatering the open pit will be collected in sumps and pumped to the tailings pond (Stantec 2016c).

The tailings pond will be approximately 94 ha in area. The primary purpose of the TMF is to provide storage of process tailings which minimizes environmental impact and enables effective site water management at minimal cost to the environment and AMNS (Stantec 2016a). The tailings are spigotted or end discharged into the Tailings Pond from the north, east, and west sides of the facility to maintain a tailings beach against the east and west dam sections, and to facilitate water flow (effluent and runoff) to create a pond at the south end of the tailings basin. This will assist in limiting seepage. The perimeter dam of the tailings area will be raised in stages

over the life of the mine ensuring sufficient storage capacity is maintained while making use of suitable material generated by mining as it becomes available. The perimeter dam will be constructed with a low permeability core as discussed, and tailings will be placed against the upstream face to minimize the seepage rate. In addition, seepage collection ditches will collect and direct seepage back to a storage pond where it will be pumped back into the tailings basin.

Seepage collection ditches will accommodate the 1:25 year design storm. The ditches will collect seepage at the toe of the tailings dam and shallow flow though overburden, flow into the seepage collection ponds, and be pumped and returned to the tailings pond. The average pumping rates for the seepage collection ditches are: 0.13 m^3/s north ditch, 0.40 m^3/s west ditch, 0.15 m^3/s east ditch (Stantec 2016d).

Details on the storage capacity, proposed dewatering, and associated water management infrastructure of the tailings pond is included in sections below.

5.1.1 Hydraulic Capacity of the Tailings Pond

The tailings pond is designed to increase storage capacity on a yearly basis for five consecutive years, with the ability to contain all tailings waste and sufficient reclaim water for the mill processes. The stage storage details of the tailings pond are outlined in Figure 5.1.

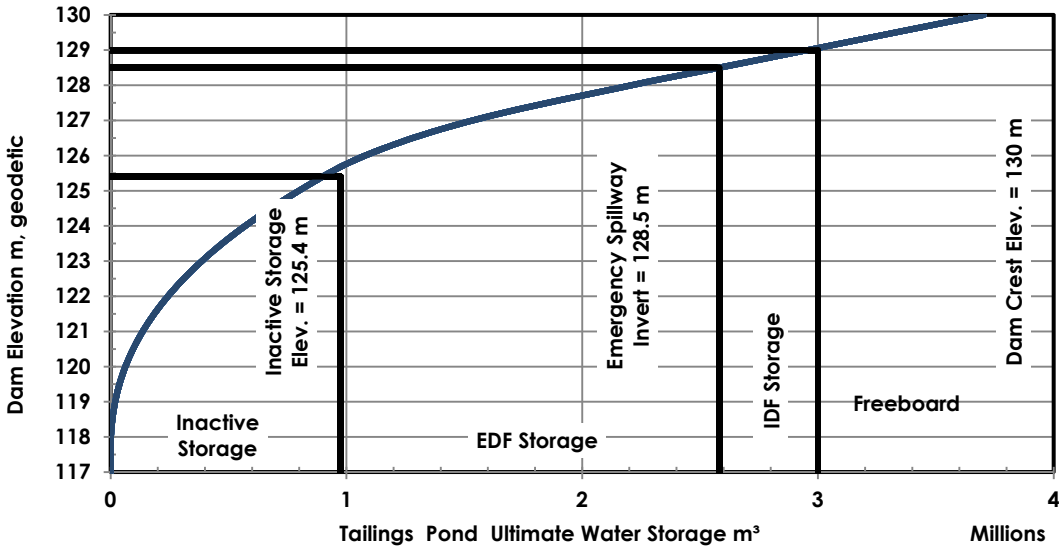


Figure 5.1 Tailings Pond Stage Storage Curve

The tailings pond will be operated to manage water in the facility such that the tailings facility has adequate capacity at all times to store, route, or otherwise handle runoff from extreme precipitation events such as the EDF and IDF (Stantec 2016c). Water enters the tailings pond as process water in the tailings slurry, direct precipitation, and runoff from surrounding un-diverted catchments. The capacity of the tailings pond will be reviewed on a semi-annual basis by a professional engineer to check that there is the available capacity in the tailings impoundment to retain the projected accumulation of mine tailings and runoff.

Freeboard is the difference in elevation between the high water level and the crest of the dam. The storage volume that can accommodate the IDF plus required freeboard represents the minimum dam crest elevation at each stage. The tailings spillway invert elevation was set to store the EDF scenario (Stantec 2016c) in the pond without use of the emergency spillway. A freeboard of approximately 1.5 m, varying by stage, satisfies the one meter minimum freeboard requirement set out in the IA (NSE 2014).

Table 5.1 presents the number of days each month the TMF would be dewatered under climate normal conditions for Stage 4, operating within the minimum and maximum storage thresholds. Figure 5.2 illustrates how the pond could be dewatered under climate normal conditions, maintaining inactive storage and providing enough capacity to contain the EDF. The dewatering rate is constrained to the maximum water treatment plant capacity and non-frozen discharge conditions from the plant. Figure 5.3 illustrates the storage capacity of the tailings pond under climate normal conditions by stage, considering the storage of water and tailings. At ultimate stage, the maximum water surface elevation as a result of the tailings dam spillway design discharge is 128.7 m.

Table 5.1 Dewatering Days of TMF under Climate Normal Conditions in Stage 4

	Stage 4											
Month	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**
Dewatering Days	0	31	29	0	0	0	16	31	30	31	23	0

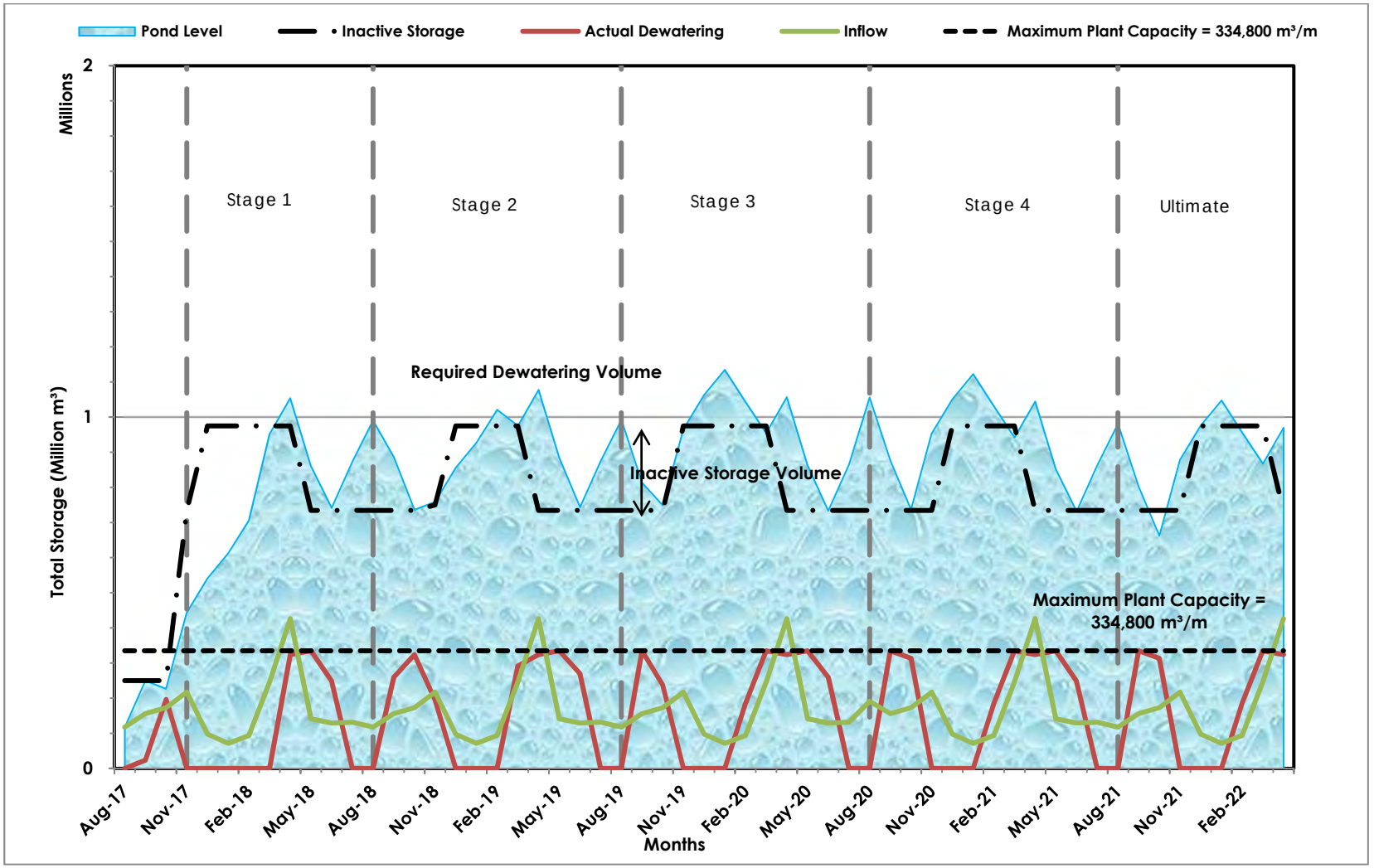


Figure 5.2 Tailings Pond Water Management

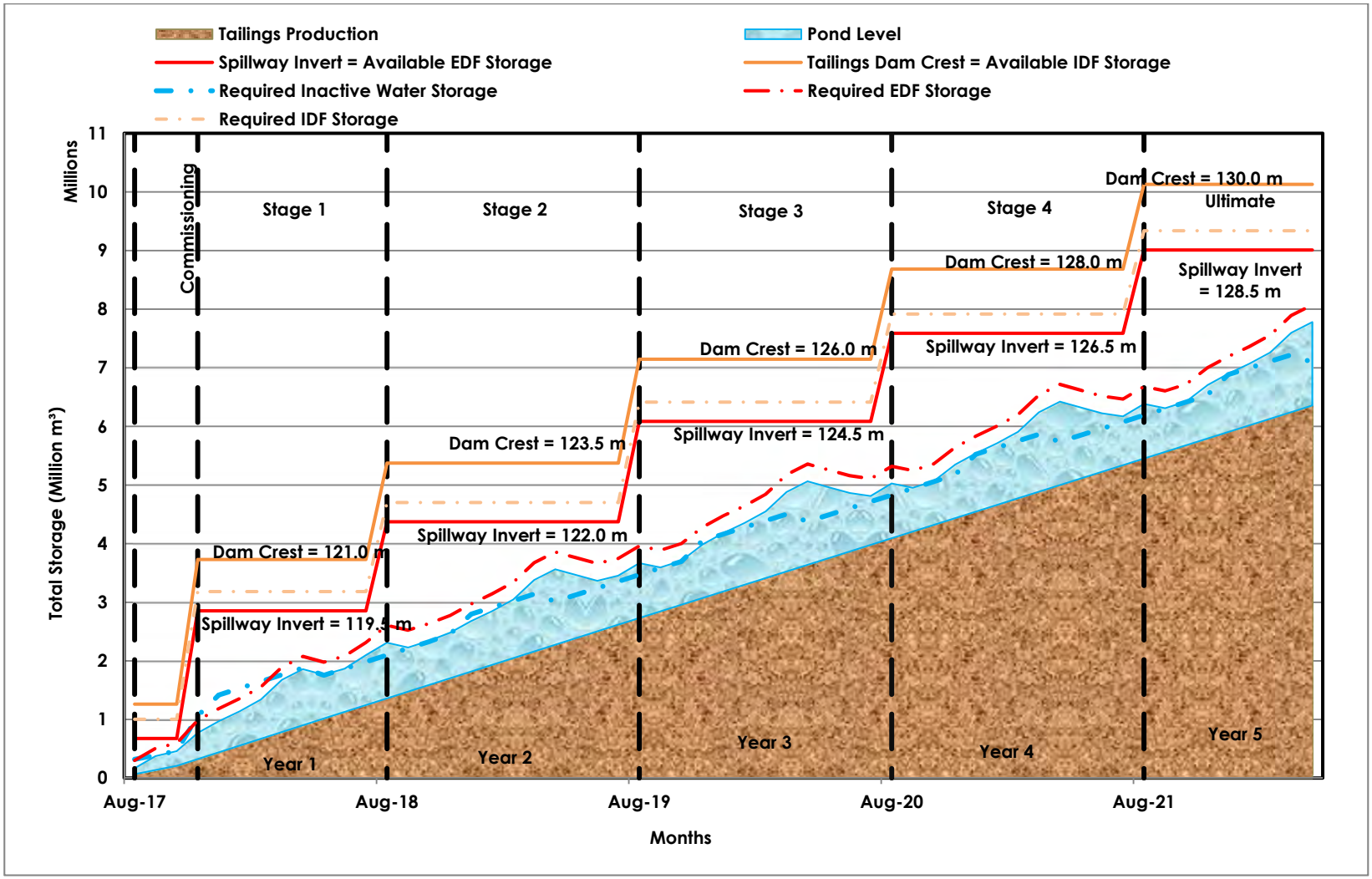


Figure 5.3 Tailings Pond Water and Tailings Storage

5.1.2 Decant Structure

The decant system will incorporate two pumps located in a standalone seepage decant tower, comprised of interlocking precast concrete rings. Reclaimed water will either be pumped to the Effluent Treatment Plant (ETP) for discharge or to the Process Plant for re-use. Two decant towers will be required during the life of the mine. Decant Tower 1 is designed to operate from Commissioning to Stage 2. Decant Tower 2 is designed to operate from Stage 2 until the end of operations. Access to the decant system is via a 6 m wide access road constructed of coarse waste rock. Safety bunds are to be constructed on either side of the access road to enhance operational safety.

Throughout the life of the mine, the decant towers are to be raised, in tandem with raises to the TMF embankment, by adding additional concrete rings until the tower reaches a maximum height of approximately 7 m (in Year 2). Decant Tower 2 is to be constructed using the access road of Decant Tower 1 as a foundation for construction. After the pumps have been moved to Decant Tower 2 and it becomes operational, Decant Tower 1 can be backfilled with rock and abandoned. Decant towers are shown in detail on drawing 19250W-110 and 111 of the Construction Drawings (Stantec 2016f)

Water will be decanted from the tailings pond at a rate of 450 m^3/h to the effluent treatment plant feed and 223 m^3/h to the decant reclaim pump (Stantec 2016d).

5.1.3 Flood Conveyance Channel

Spillway design flows for both the tailings pond and polishing ponds spillways will be conveyed to lower gradient receiving environments through a flood conveyance channel (Stantec 2016d). These structures will consist of rock chutes or loose rip rap lined channels, and will provide protection of underlying soil to maintain a stable slope and to dissipate a portion of the flow energy. Refer to section 7 of the Hydraulic Design (Stantec 2016d) for details on channel geometry and required freeboard.

5.1.4 Tailings Pipeline

The tailings slurry pipeline from the mill to the north west corner of the TMF will be a 300 mm diameter HDPE pipe contained in a 450mm diameter outer safety pipe. The safety pipe will provide secondary containment and early detection of any leaking slurry from the 300 mm diameter pipe. An approximately 180 m^3 collection pond will be installed at a low point, just south of the Mooseland Road that will capture any slurry drained from the tailings line or the outer safety pipe. At the north west corner of the TMF, Atlantic Gold tailings slurry will be conveyed via a single 300 mm diameter pipe around the inside of the tailings pond embankment. The 300 mm diameter pipe will have a series of 50 mm diameter valves and hoses installed every 20 m to control the location of tailings deposition. Any leaks will be collected in the tailings pond.

6.0 WATER TREATMENT

As outlined in Section 9.0 of the IA, water quality treatment for the tailings process water effluent involves the following:

1. Cyanide destruction circuit in the mill circuit using the INCO Air/So^2 process, designed to achieve < 0.6 mg/L weak acid dissociable cyanide levels (pers. comm. Thomas 2016), prior to discharging to the TMF;
2. Sedimentation of suspended solids and supplemental natural CN degradation in the TMF, with seasonal discharge to a process water treatment facility;
3. Arsenic removal and pH adjustment in the process water treatment facility;
4. Sludge removal in "geo bags", of the effluent of the water treatment facility;
5. Effluent equalization and sedimentation in the polishing pond; and,
6. Constructed wetland downstream of the polishing pond.

The tailings pond will have sufficient storage to facilitate the sedimentation of suspended solids, precipitation of dissolved and suspended arsenic solids, and co-precipitation of cyanide-metal complexes. Water will be stored in the tailings pond during open water conditions to promote natural degradation of residual CN, when possible. The CN degradation process in the tailings pond is primarily comprised of volatilization and UV light degradation. The tailings pond is expected to receive CN concentrations in tailings water below MMER specifications (pers.comm. Thomas 2016), and will further reduce CN concentrations prior to discharge to the polishing pond. The tailings pond will generally retain water from approximately January 1 to August 1 to promote the natural degradation of CN. However, discharge may occur during this period to manage extreme rainfall events and protect the integrity of the dam. Heavy metal concentrations (copper, lead, zinc, and nickel) in the tailings pond are expected to meet *MMER* specifications and Nova Scotia environmental approval guidelines (NSE 2014) upon discharge from the TMF, with the exception of arsenic (CBCL 2007).

An effluent treatment plant will be situated between the tailings dam and the polishing pond. The treatment process will involve the addition of ferric sulphate to the effluent to precipitate arsenic, hydrated lime to adjust pH, and coagulant polymer to facilitate the removal of colloidal sized suspended matter. The plant will have a maximum designed capacity of 450 m^3/hr, operating at an average rate of 350 m^3/hr for approximately 6 months of the year (CRA 2012).

Treated effluent from the Effluentr Treatment Plant will be discharged through sludge containment cells (i.e., geobags), which use chemical polymers and flocculants for further settlement and removal of sediments (Stantec 2016a). Geobags will be installed as per the manufacturer's recommendations in the polishing pond area, as shown on the construction drawings (Stantec 2016f). Polymer addition for metals precipitation may be required in the effluent treatment process and the manufacturer's recommendations should be followed to ensure adequate sludge retention. The geobags will be placed on the geobag laydown area as specified on the construction drawings.

A polishing pond will further reduce the arsenic concentrations to well below the MMER effluent limit, via further sedimentation (CBCL 2007). Water will be retained in the polishing pond for approximately 7 days, when possible, as the available storage volume in the pond is minimal (Stantec 2010b, Golder 2007) for preparations of lime slurry, preparation of coagulate solution and to provide the additional setting of sediments.

The water quality treatment chain including the tailings pond, process water treatment facility, polishing pond, and constructed wetland is designed to provide a final effluent that meets the MMER effluent water quality criteria.

6.1 PREDICTED SURFACE WATER QUALITY

As described in Section 2.3, effluent water quality must meet the requirements set out by MMER. The prefeasibility study (Atlantic Gold 2007) outlined predicted water quality parameters of concern by project component. Mine water and surface runoff from the open pit area was predicted to contain suspended solids, explosive residuals (mainly nitrates), and potentially traces of arsenic. Waste rock area runoff water may contain suspended solids and traces of arsenic. Surface runoff from areas immediately up-gradient of the tailings disposal area may contain suspended solids from wind-blown sources (i.e., the waste rock pile, tailings pond, and ROM pad). Process tailings water from the mill will contain suspended solids, be highly alkaline, and contain free and metal-complexed cyanide (Cn). Water from these areas is directed to the tailings pond for treatment. Key water quality parameters of concern for effluent treatment are listed in Table 6.1.

As described in the Environmental Assessment (CRA 2012), acid rock drainage will not be a concern with respect to mining, milling, and reclamation stages of the development.

As explained in the Water Balance Report (Stantec 2016c), all parameters of concern are anticipated to be below *Metal Mining Effluent Regulations* MMER maximum concentrations before entering the tailings pond. The exception is the likelihood of residual total suspended sediments and total cyanide concentrations. In design of the operation of the tailings pond, dilution from the 1:25 year storm event was assumed to be sufficient to meet MMER effluent criteria (DFO 2002) at the FDP. Releases greater than the 1:25 year storm event would not be treated in the TMF and would be discharged through the emergency spillway.

Table 6.1 Key Water Quality Parameters of Concern

Parameter	Units	Mine Waste Dump	Open Pit	Plant Area Runoff	Tailings Management Facility	MMER Maximum Concentrations (Monthly Average)
Total Suspended Solids	mg/L	0 -1500	0-1500	0-1500	0-1500	15
Arsenic	mg/L	0.6	0.8	0.6	0.06*	0.5
Iron	mg/L	0.7	1.8	0.7	2.11*	---
Free Cyanide	mg/L	---	---	---	< 0.05*	1.0
Nitrate	mg/L-N	---	22.8	---	0.05	---
Ammonia	mg/L-N	---	22.8	---	29.3	---
Sulphate	mg/L	---	---	---	533	---

Note: "---" = no value
* = Base Met Labs 2016
Source: Atlantic Gold 2007

6.2 PREDICTED GROUNDWATER QUALITY

Groundwater will be monitored in and around the open pit to confirm the degree of interaction between groundwater and surface water predicted in the baseline hydrologic and hydrogeologic studies.

As stated in the EA application (CRA 2007), significant adverse Project related effects on groundwater resources from the Touquoy project are not anticipated. The groundwater table in the area is near surface, which will inhibit inflow by maintaining a low gradient for groundwater fow. At the TMF, in addition to the low gradient, the low permeability of the tailings, and the presence of an upstream clay blanket will limit seepage into the groundwater. The low-permeability clay core of the tailings dam will also limit the amount of lateral seepage from the TMF to the perimeter ditches. Seepage through the dam will be low relative to average daily discharge rates at the FDP. Permeability through the clay core of the dam will minimize the passage of tailings water though the dam wall. Tailings deposited in the tailings beach along the face of the wall will further reduce seepage. Shallow seepage from the north of the tailings pond was assumed to run into the polishing pond, and seepage along the remaining perimeter of the dam is collected in ditches and recycled back into the tailings pond (Stantec 2016c). Some groundwater is predicted to seep from the TMF and travel to Scraggy Lake and Watercourse #4. Elevated concentrations of some metals (i.e., aluminum, arsenic and iron) are predicted to exceed the CCME FAL criteria, however, these elements exceed the concentrations in the baseline conditions. In addition, unionized ammonia is also predicted to exceed the CCME FAL criteria, but it is anticipated that the mill operations can be optimized to reduce arsenic, cyanide and ammonia.

7.0 SURFACE WATER AND GROUNDWATER MONITORING

The objective of the water quality monitoring program is to confirm compliance with regulatory requirements, support predictions of effects of the Project on water quality, identify changes in drainage patterns and surface water flow, and determine if additional mitigation or emergency response measures are required. All monitoring results will be submitted to NSE within 30 days of each quarter of monitoring, and will include the laboratory certificates of analysis and in spreadsheet format. An annual report will be submitted to NSE no later than April 30 of each year based on results of the previous year, identifying relative trends in parameters and a discussion of the significance of the findings.

7.1 SURFACE WATER QUALITY MONITORING

Surface water quality will be impacted by runoff in contact with the mine. While no formal limits are set out in the Industrial Approval (NSE 2014), the parameters listed in Table 6.1 must be monitored at all of the surface water quality monitoring sites during construction, operation, and reclamation of the Project. Additionally, pursuant to the MMER (Subsections 5, 14, and 17), monthly acute toxicity and bi-annual sublethal toxicity testing must be completed for effluent from the Final Discharge Point (FDP) SW14.

Section 10(c) of the Approval (NSE 2012) identifies thirteen (13) surface water monitoring stations located within and around the Touquoy mine site. Surface water monitoring locations are described in Table 7.1 and shown on Drawing 7.1. The locations of these stations may require some adjustments in the field post-construction, where applicable. These stations can be partitioned by those identified to characterize water quality at background stations, and those selected as downstream stations (i.e., reference and exposure stations).

Additional sampling requirements apply under the EEM program and are not fully detailed in this management plan. These requirements will be fully determined once the Project site becomes subject to MMER.

Table 7.1 Surface Water Monitoring Stations and Requirements as per IA (NSE 2014)

Site	Location	Rational	Description	Water Quality Parameters	Monitoring Frequency
SW-1	504325E, 4981604N	Background	Moose River – Adjacent to Facility and Upstream of Moose River Road culvert. Upstream of the open pit.	General	Monthly
SW-2	504378E, 4980703N	Downstream	Moose River – Downstream of Facility and upstream of Bridge, just below the open pit.	General	Monthly
SW-3	505587E, 4980396N	Downstream	Unnamed Tributary to Moose River Downstream of Facility, east of the Tailings Pond.	General	Monthly
SW-11	504140E, 4982529N	Background	Moose River – Upstream at Facility Boundary. This site represents relatively un-impacted conditions upstream of the facility.	General	Monthly
SW-12	506060E, 4982420N	Background	Outlet from Square Lake. This site represents relatively un-impacted upstream conditions.	General	Monthly
SW-13	507950E, 4976355N	Downstream	Outlet from Scraggy Lake at Dam. This is a relatively far-field site, intended to characterize surface water leaving the lake.	General	Monthly
SW-14	506352E, 4979925N	*FDP	Final Facility Liquid Effluent Outfall from Tailings Impoundment/Engineered Wetland	General Acute Toxicity Sub-lethal Toxicity Flow	Weekly Monthly Bi-Annually Monthly
SW-15	506398E, 49798351N	Downstream	Unnamed Tributary to Scraggy Lake situated between the Tailings Impoundment and Engineered Wetland, just downstream of the final effluent discharge point.	General	Monthly
SW-16	506601E, 4980999N	Downstream	Seepage Collection Point East of Tailings.	General	Monthly
SW-17	505740E, 4980792N	Downstream	Seepage Collection Point West of Tailings.	General	Monthly
SW-18	501475E, 4974281N	Downstream	Fish River North of Pughole and Upstream of Bridge. This is the most far-field downstream sampling location.	General	Monthly
SW-19	505333E, 4981589N	Downstream	Unnamed Tributary to Moose River -Upstream of the Tailings Pond, adjacent to the Waste Rock Storage Area.	General	Monthly
SW-20	506931E, 4980433N	Downstream	East of the Tailings Impoundment on an unnamed Tributary to Scraggy Lake	General	Monthly

Table 7.1 Surface Water Monitoring Stations and Requirements as per IA (NSE 2014)

Site	Location	Rational	Description	Water Quality Parameters	Monitoring Frequency
SW21	506349E, 4979823N	Downstream	In Scraggy Lake, at outlet of PolishingPond Emergency Spillway	General	Monthly
Open Pit Mine	Field Identify	Open Pit Discharge	Located to the west of the TMF. Drainage water from the open pit is pumped into the TMF for subsequent treatment.	pH	Weekly
Waste Rock Storage Facility	505524E, 4981459N	WRSF Drainage	Located south of Square Lake and to the north of the TMF, at outfall of Waste Rock perimeter ditch, upstream of culvert under road.	pH	Weekly
General Water Quality - Parameters to be Monitored (NSE 2014)					
Total Alkalinity, Dissolved Chloride, Colour, Hardness, Nitrate & Nitrite, Nitrate Nitrogen, Ammonia (as N), Total Organic Carbon, Orthophosphate, pH, Reactive Silica, Dissolved Sulphate, Turbidity, Conductivity, Aluminum, Antimony, Arsenic, Barium, Beryllium, Bismuth, Boron, Cadmium, Calcium, Chromium, Cobalt, Cyanate, Cyanide (WAD), Cyanide (Free), Thiocyanate, Copper, Iron, Lead, Manganese, Molybdenum, Nickel, Selenium, Silver, Strontium, Thallium, Tin, Titanium, Uranium, Vanadium, Zinc, Total Suspended Solids, Sodium, Potassium, Magnesium, Fluoride, Ion Balance, Mercury, Sulphate, Total Petroleum				
Acute and Sub-lethal Toxicity Testing (DFO 2016)					
Rainbow Trout Acute Lethality Test (non-acutely lethal at all times) *Daphnia magna* Acute Lethality Test Sublethal Testing					

Notes: Well locations reference coordinate system is NAD83(CSRS) UTM Zone 20T

* = FDP refers to liquid effluent final discharge point.

7.1.1 Monitoring of Environmentally Sensitive Areas (Watercourses and Wetlands)

In addition to routine surface water monitoring, water quality monitoring of environmentally sensitive areas, including watercourses and wetlands, will be conducted to identify any elevated water quality parameters and impacts from the mine. These water courses have been monitored to establish a baseline of water quality conditions, and will be continually monitored throughout construction and operation. Likewise, the erosion and sediment control plan (Stantec 2010a) is designed to protect nearby sensitive areas. The effectiveness of erosion and sediment controls will be routinely assessed as per the ESCP.

Various factors are considered when determining the 'sensitivity' of an area. There are several 'highly' sensitive areas on the Moose River Gold Mines site, where these factors are considered (pers. comm. Rod 2016). For example, watercourse 4 (referred to in Table 7.1 as "unnamed tributary to Moose River) is highly sensitive for various reasons: it is a tributary that flows into Moose River, it is fish habitat, it is a low lying area that is down-gradient from the construction site, and it is crossed by several roads.

Sensitivity of local ecological features is also influenced by the stability of the construction site. Whenever there is a risk of destabilization and sedimentation during a severe weather event, sensitive areas and their surroundings must be monitored to prevent potential impacts. A weather event is classified as severe when precipitation exceeds 25 mm, there are 'freeze-thaw' conditions with dramatic temperature variation, or after an intense snow melt (pers. comm. Rod 2016). These conditions create high risk of a destabilization event, and therefore potential short-term impacts to sensitive features.

7.1.2 Non-Compliance – Final Discharge Point

A non-compliance event is defined as an event that occurs outside the acceptable parameters of the Approval 2012-084244 and/or the MMER. When an exceedance occurs, measures must be taken to correct and prevent the incident from occurring in the future. Note, that in addition to exceedances detected during routine monitoring of final discharge (Table 7.1), the following procedures also apply to exceedances of TSS and pH detected at the any time (i.e., during sever weather events) from the FDP or other sampling stations.

7.1.2.1 Reporting of Non-Compliant Event(s)

The chain of command for reporting a non-compliance event at the Final Discharge Point (SW-14) is outlined the process flow diagram - Drawing 7.1. The Environmental Coordinator or designate is responsible for ensuring all reporting is completed as required, and that corrective actions are put in place. Process flow in green indicated more action is necessary where process flow in red complete the non-compliance event reporting plan.

7.1.2.2 Corrective Actions for Non-compliance Events

In the event that an exceedance of regulated limits occurs, a number of measures will be taken. The choice of corrective measures and their order of application will be determined by the Environmental Coordinator (or designate) and in consultation, if required, with consultants, and according to prevalent site conditions.

The Environmental Coordinator will liaise with the required parties, to put into effect the appropriate corrective actions. If necessary, an intensive water quality monitoring program will be initiated by the Environmental Coordinator to assess the effectiveness of the corrective actions.

During non-compliance events, the Environmental Coordinator is responsible for reporting the exceedance to the regulatory officials. In a non-emergency event the Environmental Coordinator or designate will immediately report the event to the regulatory officials verbally. In the event of an emergency, the Environmental Coordinator or designate will immediately notify the regulatory officials verbally. They will also provide written notification as requested by the Nova Scotia Environment Department, and within 30 days to Environment and Climate Change Canada (ECCC). All communications will be thoroughly recorded and/or documented.

As described in the IA, should exceedances in sulfate be identified then the Copper Sulphate Management plan should be implemented.

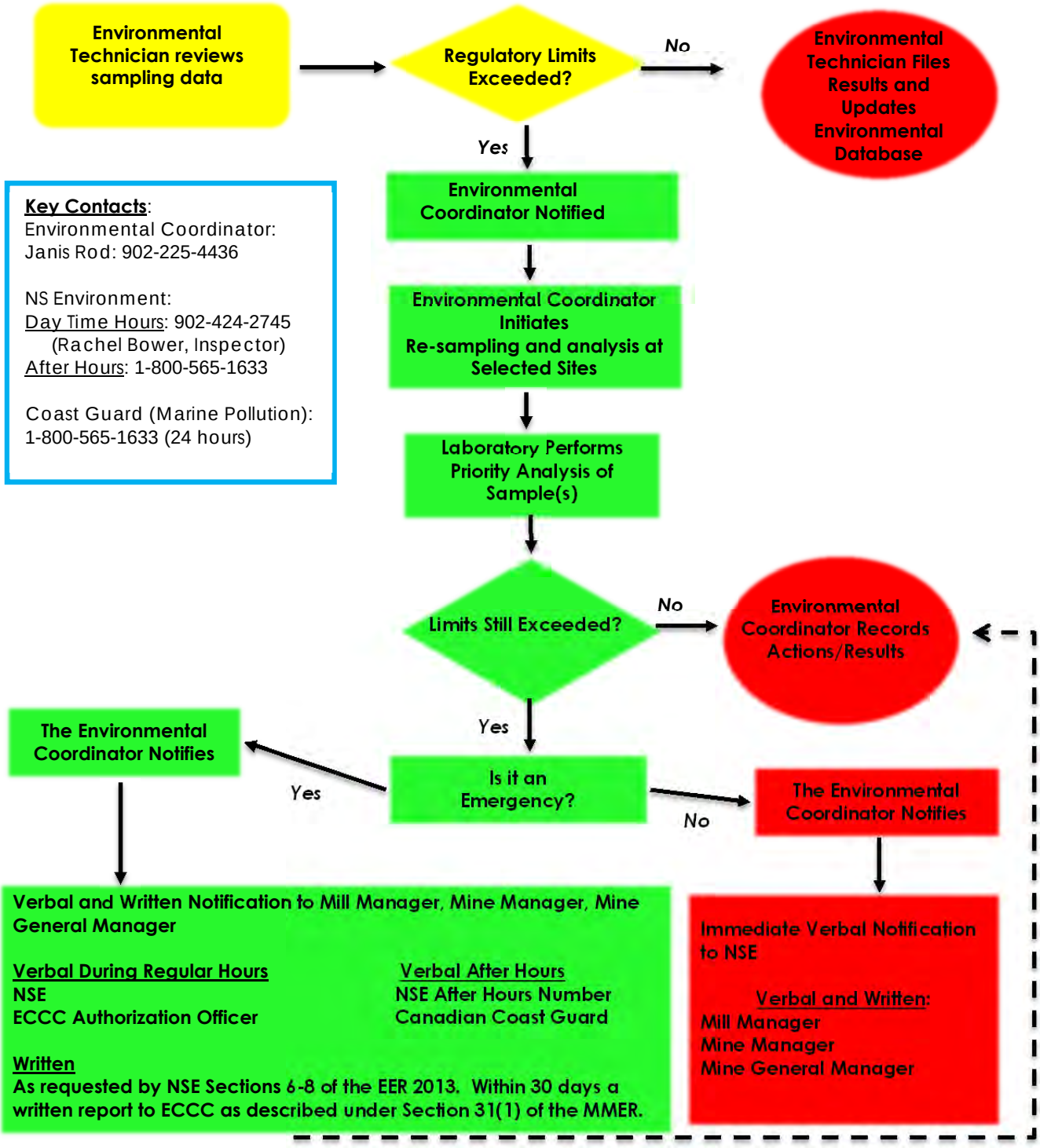
7.1.2.3 Specific Actions for TSS during Severe Weather Events

If there is any discoloration or turbidity identified in a watercourse and wetland during a severe weather event, there are several mitigative actions that must be followed:

- Immediately determine the point source of sedimentation;
- Halt all construction activities if necessary;
- Ensure that all erosion and sedimentation controls are working properly;
- Correct any issues that need attention or maintenance (it is important to have assistance on site, (i.e., laborer and operator));
- Additional controls may be needed to decrease silt escapement;
- Documentation, including photos, water levels, flow, weather, amount of precipitation received, and any issues or corrective actions;
- Notification to NS Environment and/or DFO;
- Total suspended solids (TSS) samples should be collected at areas showing signs of turbidity as well as a background location (see Drawing 7.2 for background TSS sampling locations on watercourse 4)
- Once turbidity subsides and water conditions return to ‘normal’, follow-up TSS samples should be collected again at the same locations, and documentation of the event and monitoring response should be completed; and
- Notification and follow-up documentation submitted to NS Environment once TSS results are received from lab.

Once TSS samples are received from the lab, the results will be tabulated in MS Excel. NS Environment will be informed if results exceed a maximum increase of 25 mg/L from background levels in a 24-hour period, or if there is a maximum average increase of 5 mg/L from background levels for a long-term exposure (i.e., 24-hour period to 30 days; as per section 5.c of the IA).

Drawing 7.1 Non-Compliance Event Reporting Flow Chart



7.2 GROUNDWATER MONITORING

7.2.1 Ground Water Monitoring Locations and Sampling Requirements

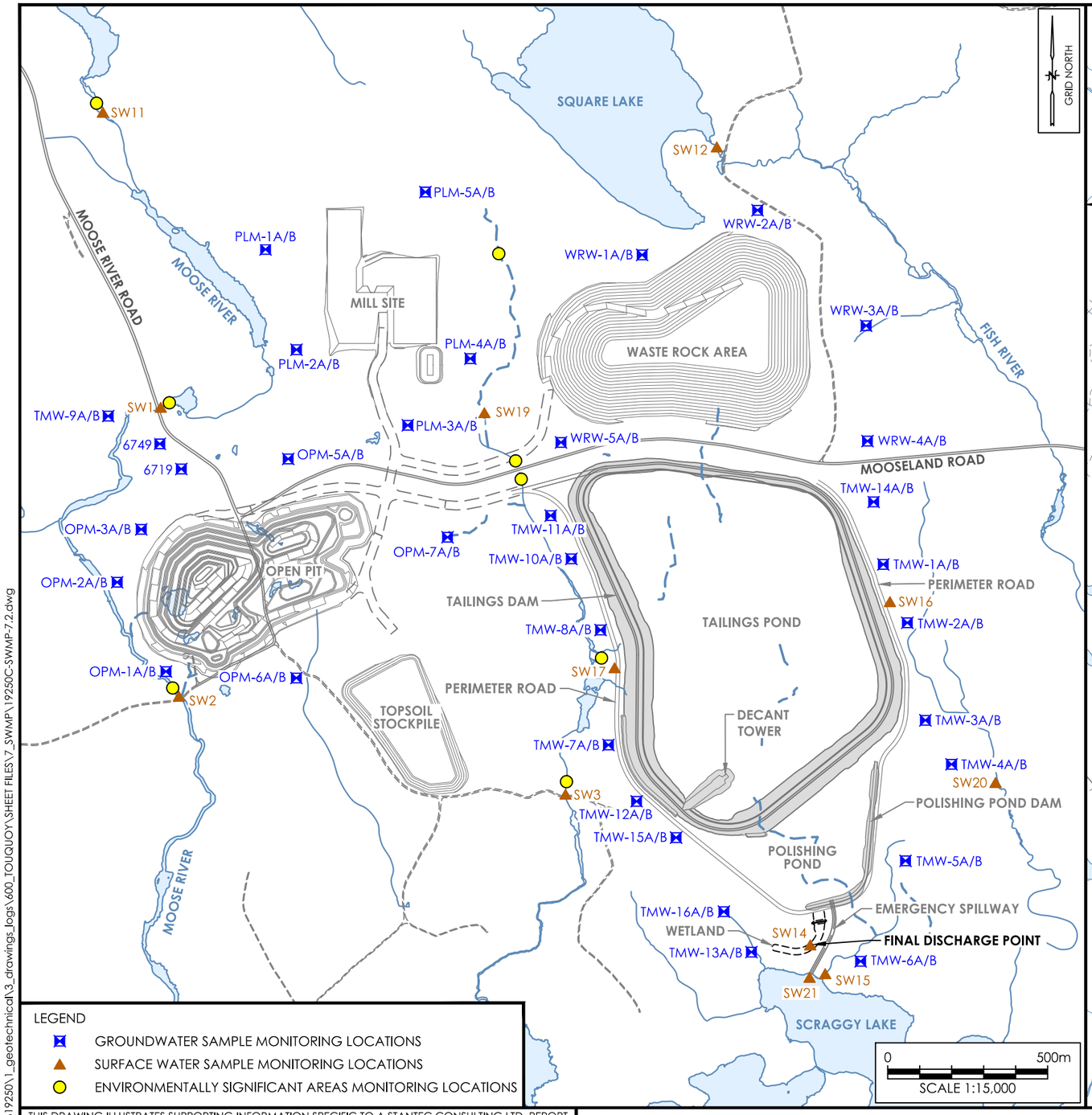
Groundwater in contact with the mine site will have changes in quality. Groundwater quality will be monitored in order to make predictions of seepage volumes and support calibration of the seepage model. Section 13 of the IA identifies 32 groundwater monitoring stations located around the perimeter of the project site, plus two (2) domestic groundwater wells located at the office, and one (1) well located at the museum. Monitoring well pairs consisting of one well installed to intercept the water table and the other installed in shallow fractured bedrock, as per condition 13. iv) of the IA. Well locations are described in Table 7.2, and shown on Drawing 7.1. While no formal limits are set out in the IA, the parameters listed in Table 7.2 will be measured at all groundwater monitoring sites during pre-construction, construction, operation, reclamation, and post-reclamation phases.

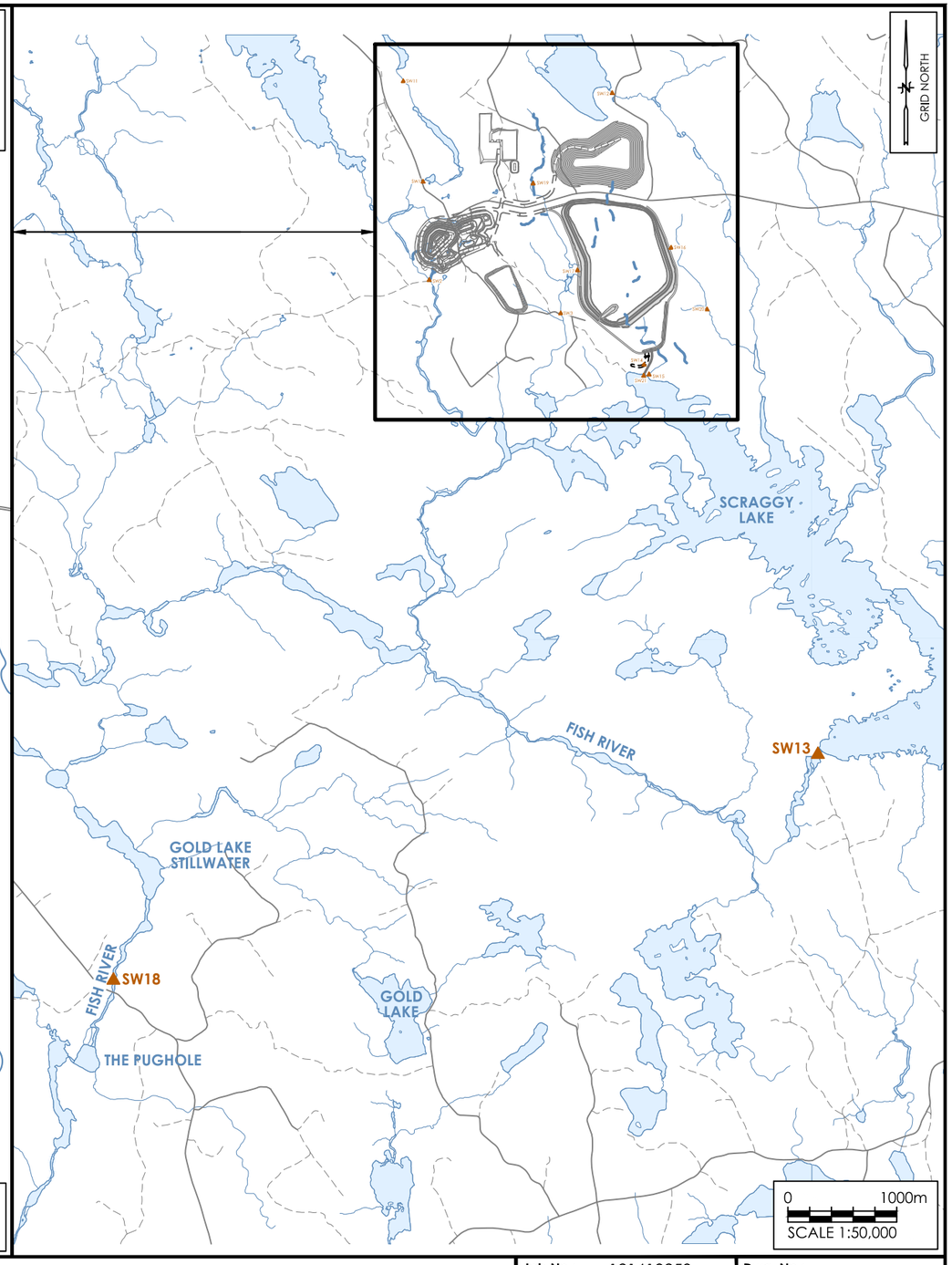
As per the IA, AMNS is required to:

- Collect four (4) baseline samples from all groundwater monitoring wells stations on a quarterly basis prior to the start of the tailings dam construction and/or mining for parameters listed in Table 7.2.
- Sample all groundwater monitoring well stations on a quarterly basis during all phases of the project for parameters listed in Table 7.2.
- Collect static water levels from all groundwater monitoring wells on a monthly basis during all phases of the project.
- The top of well casing relative has been surveyed to the NAD83 (CSRS UTM Zone 20T), the geodetic reference used on the sites tied to mine water levels.

Should groundwater monitoring identify impacts to Moose River or tributary flows, the Groundwater Contingency Plan presented in the IA (Jacques Whitford Limited 2008) will be implemented to maintain flow. Refer to the contingency plan for details on emergency response.

Groundwater and surface water monitoring locations can be found in drawing 7.2.





LEGEND

- GROUNDWATER SAMPLE MONITORING LOCATIONS
- SURFACE WATER SAMPLE MONITORING LOCATIONS
- ENVIRONMENTALLY SIGNIFICANT AREAS MONITORING LOCATIONS

Reference:

DATA SOURCE: SNSMR (REPRODUCED AND DISTRIBUTED WITH THE PERMISSION OF SERVICE NOVA SCOTIA & MUNICIPAL RELATIONS)

GROUNDWATER AND SURFACE WATER MONITORING LOCATIONS

TOUQUOY MINE TAILINGS MANAGEMENT FACILITY

HALIFAX COUNTY, NOVA SCOTIA

Client: DDV GOLD LTD.

Job No.:	121619250
Scale:	AS SHOWN
Date:	2017 02 09
Dwn. By:	JL
App'd By:	RJ

Dwg. No.: 7.2

Stantec

V:\1216\active\121619250\1_geotechnical\3_drawings_logs\600_TOUQUOY\SHEET FILES\7_SWMP\19250C-SWMP-7.2.dwg

Table 7.2 Groundwater Monitoring Stations

Area	Groundwater Monitoring Station	Monitoring Frequency
Plant	PLM-1A/B, PLM-2A/B, PLM-3A/B, PLM-4A/B, PLM-5A/B	Quarterly
Open Pit Mine	OPM-1A/B, OPM-2A/B, OPM-3A/B, OPM-5A/B, OPM-6A/B, OPM-7A/B	Quarterly
Waste Rock Area	WRW-1A/B, WRW-2A/B, WRW-3A/B, WRW-4A/B, WRW-5A/B	Quarterly
Tailings Management Facility	2 Domestic Wells, TMW-1A/B, TMW-2A/B, TMW-3A/B, TMW-4A/B, TMW-5A/B, TMW-6A/B, TMW-7A/B, TMW-8A/B, TMW-9A/B Museum, TMW-10A/B, TMW-11A/B, TMW-12A/B, TMW-13A/B, TMW-14A/B, TMW-15A/B, TMW-16A/B	Quarterly
Groundwater Sampling Parameters (NSE 2014)		
Total Alkalinity, Dissolved Chloride, Colour, Hardness, Nitrate & Nitrite, Nitrate Nitrogen, Ammonia (As N), Total Organic Carbon, Orthophosphate, pH, Reactive Silica, Dissolved Sulphate, Turbidity, Conductivity, Total Dissolved Solids, Aluminum, Antimony, Arsenic, Barium, Beryllium, Bismuth, Boron, Cadmium, Calcium, Chromium, Cobalt, Cyanate, Cyanide (WAD), Cyanide (Free), Thiocyanate, Copper, Iron, Lead, Manganese, Molybdenum, Nickel, Selenium, Silver, Strontium, Thallium, Tin, Titanium, Uranium, Vanadium Zinc, Total Suspended Solids, Sodium, Potassium, Magnesium, Fluoride, Ion Balance, Mercury, Sulphate, Total Petroleum, Hydrocarbons, TPH & BTEX, Static Water Level **In situ field measurements**: Temperature, pH, Conductivity		
Note: Well locations reference coordinate system is NAD83(CSRS) UTM Zone 20T.		

7.3 WATER QUALITY ASSURANCE AND CONTROL

Quality Assurance and Quality Control (QA/QC) are integral components of proper field and laboratory procedures. As stated in the MMER (Schedule 5, Section 7(e)), water quality monitoring is to be conducted by *implementing quality assurance and quality control measures that will ensure the accuracy of water quality monitoring data* (DFO 2002, 2016).

7.4 WATER QUANTITY MONITORING

As per condition 11.e) of the IA, effluent discharge, mine water, tailings water recycle, freshwater makeup, process water and potable water volumes will be recorded on a daily basis. Gauges will be installed in distribution lines for process reclaim water, spigoted tailings, and process water discharge to facilitate the monitoring of flows. Records will include a monthly total and average volumes. Fresh water make-up and potable water withdrawal will be gauged and recorded.

The polishing pond outlet during flow conditions representing a 1:25 year storm event or less, and emergency spillway for higher flow events are considered the final effluent discharge point. Flow monitoring is required for the polishing dam outlet structure and emergency spillway at a minimum accuracy of 15% of the total discharge, according to the flow measurement requirements outlined in the MMER guidance document (Environment Canada 2001).

As per condition 13. B) (ii)) of the IA , groundwater monitoring wells will be monitored for static water level on a monthly basis. Select groundwater monitoring wells will be monitored more frequently in order to develop a relationship of groundwater and surface water. The frequency of water level monitoring will be reviewed after a year of data has been collected and analyzed.

8.0 REFERENCES & SUPPORTING DOCUMENTS

Atlantic Gold. 2007. Prefeasibility Study Process Design Criteria – Effluent Treatment. Rev B. May 17, 2007.

Ausenco. 2015. NI 43-101 Technical Report. Feasibility Study for Moose River Consolidated Project, Nova Scotia. August 13, 2015. Vancouver, BS. Prepared for Atlantic Gold Corporation.

Base Metallurgical Laboratories Ltd. 2016. Arsenic Precipitation Evaluation of Touquoy Gold Project – BL0097. Kamloops, BC. October 2016. Prepared for Mr. John Thomas, Atlantic Gold Corp.

Canadian Dam Association (CDA). 2014. Technical Bulletin: Application of Dam Safety Guidelines to Mining Dams.

CBCL Limited Consulting Engineers (CBCL). 2007. Touquoy Gold Effluent Treatment Facilities. Preliminary Engineering Study. CBCL Final Report 070836.

Canadian Council of Ministers of the Environment (CCME). 1999. Canadian Environmental Quality Guidelines Summary Table – Water Quality Guidelines for the Protection of Aquatic Life. Available online at: http://st-ts.ccme.ca/. Last accessed on May 14, 2015.

Canadian Council of Ministers of the Environment (CCME). 2007. Canadian Water Quality Guidelines for the Protection of Freshwater and Aquatic Life: Summary table. Updated December, 2007. In Canadian environmental quality guidelines, 1999. Canadian Council of Ministers of Environment.

Conestoga-Rovers & Associates (CRA). 2007. Environmental Assessment Registration Document for the Touquoy Gold Project. Moose River Gold Mines, Nova Scotia. Dartmouth, NS. March 2007. Prepared for DDV Gold Ltd.

Conestoga-Rovers & Associates (CRA). 2008. Fugitive Dust Control Plan. Appendix 5 of Air Quality Management Plan, Appendix N of CRA (2012) Industrial Approval Application and Supporting Documentation. Touquoy Gold Project, Moose River Gold Mines, NS.

Conestoga-Rovers & Associates (CRA). 2012. Industrial Approval Application and Supporting Documentation. Touquoy Gold Project, Moose River Gold Mines, NS.

Environment Canada. 2001. Guidance Document for Flow Measurement of Metal Mining Effluents – Final Report. Minerals and Metals Division, Environmental Protection Service. Ottawa, Ontario.

Fisheries and Oceans Canada (DFO). 2016. Metal Mining Effluent Regulations. Canada Gazette Part II, Vol. 136, No. 13. SOR/2002-222. Pages 1246 to 1543. Ottawa.

Fisheries and Oceans Canada (DFO). 2002. Metal Mining Effluent Regulations. P.C. 2002-987. June 6, 2002. Canada Gazette Part II, Vol. 136, No. 13. SOR/202 202 to 226 and SI/2002-90 to 96. Pages 1246 to 1543. Ottawa.

GHD. 2016. Water Withdrawal Application Supporting Document. Touquoy Mine, Moose River Consolidated Project, Moose River Gold Mines, Halifax County, Nova Scotia. February 16, 2016. Prepared for Atlantic Gold.

Department of Fisheries and Oceans (DFO). 1995. DFO Freshwater Intake End-of-Pipe Fish Screen Guideline (1995). Ottawa. Ontario. Available at: http://www.dfo-mpo.gc.ca/Library/223669.pdf

Golder Associates Ltd (Golder). 2007. Dam Break Flooding Study. Atlantic Gold Tailings Management Area Touquoy, Nova Scotia. Ontario. September 2007. Prepared for Atlantic Gold.

Health Canada. 2010b. Guidelines for Canadian Drinking Water Quality. Summary Table. Federal-Provincial- Territorial Committee on Drinking Water of the Federal-Provincial-Territorial Committee on Health and the Environment.

Jacques Whitford Limited. 2008. Groundwater Monitoring Plan, Industrial Approval Application, Touquoy Gold Mine, Moose River Gold Mines, Nova Scotia. Prepared for DDV Gold Limited, June 9, 2008.

Merit Engineers. 2006. Section 10 - Water Management. Touquoy Gold Project Definitive Feasibility Study. Commissioned by Atlantic Gold.

Nova Scotia Department of Environment & Labour (NSEL). 2008. Environmental Assessment Approval. Touquoy Gold Project. Halifax, NS. February 2008.

Nova Scotia Department of Environment (NSE). Guide to Surface Water Withdrawal Approvals. July 2015. NS. Available at: https://novascotia.ca/nse/water/docs/guideToSurfaceWaterWithdrawalApprovals.pdf

Province of Nova Scotia (NS). 2014. Environment Act, S.N.S. 1994-95, c.1. Approval No. 2012-084244. March 24, 2014.

Stantec Consulting Ltd. (Stantec) 2010a. Erosion and Sediment Control Plan for the Development of the Touquoy Gold Project, Moose River Gold Mines, Nova Scotia. Fredericton, NB. March 2010. Prepared for Nova Scotia Environment.

Stantec Consulting Ltd. (Stantec) 2010b. Final Report Constructed Wetland Design Basis Report for Industrial Approval. Dartmouth, NS. April 2010. Prepared for DDV Gold Limited, Moose River, NS.

Stantec Consulting Ltd. (Stantec). 2016a. Operations, Maintenance, and Surveillance Manual. Touquoy Mine Tailings Management Facility – DDV Gold Limited. Fredericton, NB. April 2016. Prepared for DDV Gold Ltd.

Stantec Consulting Ltd. (Stantec). 2016b. Touquoy Mine Tailings Management Facility Dam Design – Seepage Assessment. Fredericton, NB.

Stantec Consulting Ltd. (Stantec). 2016c. Water Balance Report. Atlantic Gold Tailings Management Facility. Fredericton, NB. July 2016. Prepared for Atlantic Gold Corp.

Stantec Consulting Ltd. (Stantec). 2016d. Touquoy Mine Tailings Management Facility Hydraulic Design. Fredericton, NB. April 2016. Prepared for Atlantic Gold Corp.

Stantec Consulting Ltd. (Stantec). 2016e. Touquoy Mine Tailings Management Facility Technical Specifications. Fredericton, NB. October 2016. Prepared for DDV Gold Limited.

Stantec Consulting Ltd. (Stantec). 2016f. Construction Drawings - Touquoy Mine Tailings Management Facility. October 2016. Fredericton, NB. Prepared for DDV Gold Ltd.

Stantec Consulting Ltd. (Stantec). 2016g. Assessment of Water Quality Dwosntream of Tailings amnagamaent Facility, Touquoy Gold Project. November 2016. Fredericton, NB. Prepared for Atlantic Mining NS Corp.

8.1 PERSONAL COMMUNICATIONS

Rod, Janis. Personal Communication, November 24, 2016. Atlantic Gold Corporation. Email.

Thomas, John. Personal Communication, February 3, 2016. Atlantic Gold Corporation. Email.