Atlantic Gold

Appendix F.5

Hydrogeologic Modelling Report - April 2021
Completed for the Updated 2021 Beaver Dam Mine EIS

Hydrogeologic Modelling Report

Beaver Dam Mine Project
Marinette, Nova Scotia Additional Text

Atlantic Mining NS Inc.

GHD | 455 Phillip Street Unit #100A Waterloo Ontario N2L 3X2 Canada | 088664 | Report No13 | April 15 2021

Table of Contents

Figure Index

Figure Index

Figure Index

Figure Index

Table Index

Appendix Index

1. Introduction

1.1 Background

Atlantic Mining NS Inc. (AMNS), formerly Atlantic Gold Corporation (AGC) is proposing the construction, operation, decommissioning, and reclamation of an open pit gold mine in Marinette, Nova Scotia (Beaver Dam Mine Site). The Beaver Dam Mine Project (Project) would have a maximum ore production rate of approximately 5,500 tonnes per day, over a five-year period. Ore from the Project would be crushed and transported approximately 31 km by road to the Moose River (Touquoy) mine for processing. Components of the Project include an open pit, a materials storage facilities (i.e., waste rock, topsoil and organic materials), mine haul roads, mine infrastructure for crushing, water management, hauling, truck maintenance, administration, and road upgrades.

GHD Limited (GHD) was retained by AMNS to develop a three-dimensional (3D) groundwater flow model for the Beaver Dam Mine Site. This Hydrogeologic Modelling Report (Report) presents the development, calibration, and application of the model to evaluate potential impacts of mining operations on the surrounding groundwater and surface water flow regimes. The Beaver Dam Mine Site is located approximately 7 kilometres (km) northeast of Highway 224. Figure 1.1 illustrates the Beaver Dam Mine Site location. The Beaver Dam Mine Site is remote, and the closest residences are located approximately 5 km away. The nearest regional centres are the small rural communities of Sheet Harbour, Mooseland, and Middle Musquodoboit located approximately 23 km, 32 km and 40 km away from the Beaver Dam Mine Site, respectively.

Following the discovery of gold at the Beaver Dam Mine Site in 1868, there have been several attempts to develop and mine the area. Initial development was focused on the Austen Shaft, followed by the Mill Shaft area located 1.2 km west of the Austen Shaft. The small Papke Pit approximately 400 metres (m) west of the Austen Shaft was excavated in 1926. Most of the development focused on a belt of quartz veins in greywacke and slates that are approximately 23 m wide and are intersected by the Austen Shaft. A total of 967 ounces of gold production is recorded for the Beaver Dam gold district between 1889 and 1941.

The next major period of work began in 1975 when MEX Explorations acquired claims to the Beaver Dam Mine Site. From 1978 until 1988 a number of different companies drilled a combined total of 251 diamond holes for geologic exploration as well as undertaking geophysical and geochemical surveys.

Between 1986 and 1989, Seabright Resources Ltd. (Seabright) explored from underground via a decline that reached a maximum depth of 100 m below ground surface (bgs). A total of 34 drillholes were drilled from underground by Seabright. In 1986, Seabright also excavated a small open pit in the Papke and Austen zones, removing 10,822 tonnes of material. In total, 2,445 ounces of gold were recovered from bulk samples during this period.

In 2002, Tempus Corporation, a predecessor company to Acadian Gold Corporation and now known as Acadian Mining Corporation (Acadian), acquired the Beaver Dam Mine Site. Acadian retained Mercator Geological Services (Mercator) to manage its exploration activities until 2008, and from that date until 2013, Acadian managed all exploration activities within the Beaver Dam Mine Site.

Between 2005 and 2009, Mercator and then Acadian managed several diamond drill programs with a total of 153 holes drilled.

AGC secured the Beaver Dam Mine Site in 2014 through the acquisition of Acadian. AGC undertook a drilling program from October 2014 to January 2015 and drilled 41 diamond holes and an additional 8 geotechnical holes. The October 2014 to January 2015 drillhole results were incorporated into the gold resource estimate for the Beaver Dam Mine Site (FSSI, 2015), which facilitated completing a feasibility study for developing an open pit gold mine at the Beaver Dam Mine Site (Ausenco Engineering Canada Inc., 2015). To obtain regulatory approval for an open pit mine development at the Beaver Dam Mine Site, an Environmental Impact Statement (EIS) was prepared (AGC, 2017) and submitted to the Canadian Environmental Assessment Agency (CEAA) and Nova Scotia Environment (NSE). CEAA and NSE Information Requests (IRs) stemming from their review of the EIS called for a groundwater flow modelling analysis to evaluate potential impacts to the groundwater and surface water flow regimes caused by mining operations. A Revised EIS incorporating groundwater flow modelling analyses was submitted to CEAA and NES by AGC (2019). CEAA and NSE provided a second round of IRs (Round 2 IRs) pertaining to the Revised 2019 EIS. This Report presents the 3D groundwater flow modelling conducted to support development of the Updated 2021 EIS and to address the Round 2 IRs (CEAA-2-14, CEAA-2-35, CEAA-2-41, CEA-2-42, NSE 2-35, NSE-2-145, NSE-2-149, NSE-2-150, NSE-2-159, NSE-2-160, NSE-2-161, NSE-2-162, NSE-2-163, NSE-2-164, NSE-2-166, NSE-2-167, and NSE-2-190) pertaining to the 3D groundwater flow modelling presented in the Updated 2021 EIS (AMNS 2021).

This Report describes the details of developing and applying a numerical 3D groundwater flow model for the Beaver Dam Mine Site. GHD applied the model as a predictive tool to evaluate impacts to groundwater quality and quantity with respect to groundwater flow and groundwater interactions with surface water at the Beaver Dam Mine Site. Groundwater quality and quantity are examined at end of mine life (EOM[1]) and post-closure (PC[2]). Specifically, the 3D groundwater flow model was developed to assess:

1. Groundwater inflow rates to the open pit mine at EOM
2. Groundwater drawdown at EOM and PC
3. Pit infilling rates following EOM
4. Change in groundwater discharge to/from surface water features (baseflow) at EOM and PC
5. Transport of constituents of concern (COCs) from mine features into the surrounding environment at EOM and PC

1.2 Purpose

This Report documents GHD's development of the numerical 3D groundwater flow model to represent the complex hydrogeologic conditions observed at the Beaver Dam Mine Site and surrounding area. The groundwater flow model was developed to provide a reasonable representation of hydrologic, geologic, and hydrogeologic conditions observed at the Beaver Dam

---

1 EOM is defined as the condition immediately following the cessation of mining, with the pit excavated to the maximum proposed depth and completely dewatered.

2 PC is defined as the long-term post-reclamation condition, once the pit has filled forming the pit lake.

Mine Site. The groundwater flow model was calibrated to match measured groundwater elevations and groundwater flow directions as well as estimated baseflow. GHD used the calibrated model to evaluate potential impacts of mine development on groundwater quality and quantity as well as groundwater interactions with surface water.

The objectives for developing the groundwater flow model include:

- To enhance the understanding of groundwater flow conditions at and surrounding the Beaver Dam Mine Site to facilitate developing a Hydrogeologic Conceptual Site Model (CSM) to use as the basis for developing the numerical groundwater flow model
- To construct and calibrate the numerical groundwater flow model consistent with the CSM to represent observed Beaver Dam Mine Site conditions
- To apply the calibrated groundwater flow model to evaluate potential changes in groundwater quality and quantity with respect to groundwater flow and groundwater interactions with surface water at the Beaver Dam Mine Site under EOM and PC conditions

1.3 Scope of Work

GHD developed the groundwater flow model based on site-specific and available regional data including surface water features, topography, water well records, and geologic information.

The scope of work completed by GHD to develop the groundwater flow model and apply the model to evaluate potential impacts to groundwater and surface water flow regimes included the following:

- Compiled, reviewed, and interpreted the geologic, groundwater flow, and surface water flow data available for the Beaver Dam Mine Site and surrounding area
- Developed a 3D geologic model of the Beaver Dam Mine Site and surrounding area
- Developed a CSM for the Beaver Dam Mine Site and surrounding area based on available regional and site-specific data
- Developed a 3D groundwater flow model based on the CSM to represent the existing conditions that incorporates the 3D geologic model
- Calibrated the groundwater flow model under steady-state conditions to match measured groundwater elevations and groundwater flow directions, as well as estimated baseflow
- Evaluated the sensitivity of the model calibration to model input parameters
- Applied the calibrated groundwater flow model to evaluate potential changes in groundwater quality and quantity with respect to groundwater flow and groundwater interactions with surface water at the Beaver Dam Mine Site under EOM and PC conditions
- Evaluated the sensitivity of selected model predictions to model input parameters
- Evaluated the effectiveness of potential mitigation measures
- Documented the groundwater flow model development and its application in this Report

1.4 Report Organization

This Report is organized as follows:

- **Section 1 – Introduction:** Presents the introduction, purpose, and scope of work of the hydrogeologic modelling conducted for the Beaver Dam Mine Site
- **Section 2 – Summary of Hydrologic, Geologic, and Hydrogeologic Conditions:** Presents a summary of observed regional and site-specific hydrologic, geologic, and hydrogeologic conditions at the Beaver Dam Mine Site
- **Section 3 –Hydrogeologic Conceptual Site Model:** Presents the CSM developed for the Beaver Dam Mine Site that forms the basis for the construction of the numerical groundwater flow model
- **Section 4 – Simulation Program Selection:** Presents a description of the simulation programs selected to conduct the hydrogeologic modelling
- **Section 5 – Base-Case Groundwater Flow Model Construction:** Presents details regarding construction of the numerical groundwater flow model to represent the key components of the CSM
- **Section 6 – Base-Case Groundwater Flow Model Calibration:** Presents the calibration of the numerical groundwater flow model to observed groundwater flow conditions at the Beaver Dam Mine Site and the sensitivity analysis of model calibration to variations in model input parameters
- **Section 7 – Groundwater Flow Model Application:** Presents the application of the calibrated groundwater flow model to evaluate potential impacts to the groundwater and surface water flow regimes at the Beaver Dam Mine Site at EOM and PC, and the accompanying sensitivity analysis, as well as the evaluation of potential mitigation measures
- **Section 8 – Summary and Conclusions:** Presents a summary of the hydrogeologic modelling conducted for the Beaver Dam Mine Site and the conclusions obtained
- **Section 9 – References:** Lists the references cited in this Report

2. Summary of Hydrologic, Geologic, and Hydrogeologic Conditions

A review of the regional and site-specific hydrologic, geologic, and hydrogeologic conditions at the Beaver Dam Mine Site was conducted to develop the CSM, followed by developing the 3D groundwater flow model. The details of the regional and site-specific hydrologic, geologic, hydrogeologic conditions are summarized below.

2.1 Hydrologic Conditions

The hydrologic conditions at the Beaver Dam Mine Site are affected by regional physiography, topography, and surface water features. The following sections provide brief overviews of the regional physiography, topography, and surface water features.

2.1.1 Physiography

The Beaver Dam Mine Site is located in the Atlantic Uplands division of the Appalachian physiographic province of Canada (Williams et al., 1972). The Atlantic Upland spans approximately 450 km from Cape Canso, past Halifax to Cape Sable and then continue northward approximately 100 km from Port Yarmouth to St. Mary Bay (Goldthwait, 1924). The Atlantic Upland appears in low islands and capes along the Atlantic coast, rising inland at a rate of approximately 3 m per kilometer reaching an altitude of approximately 180 to 220 m above mean sea level (AMSL) in the centre of the Nova Scotia peninsula. The Atlantic Upland is characterized by rolling hills, drumlin fields, and smooth ridges with intervening lakes, streams and muskegs.

Physiographic sections often can be subdivided into hydrologic units (basins) of common drainage areas. The Beaver Dam Mine Site is located within East/West Sheet Harbour basin, which occupies approximately 865 square kilometers in central Nova Scotia. The East/West Sheet Harbour basin is drained by the East Branch Sheet Harbour River and the West Branch Sheet Harbour River, both of which converge on Sheet Harbour and discharge to the Atlantic Ocean. The Beaver Dam Mine Site is located in a low-lying area, adjacent to Cameron Flowage. Cameron Flowage is a stillwater area on the Killag River (Jacques, Whitford & Associates Ltd. [JWA], 1986a), and is the dominant physiographic feature in the vicinity of the Beaver Dam Mine Site.

2.1.2 Topography

Regionally, the topography surrounding the Beaver Dam Mine Site slopes gently from a maximum level of approximately 210 m AMSL in the central Nova Scotia peninsula northwest of the Beaver Dam Mine Site towards sea level near Sheet Harbor to the southwest of the Beaver Dam Mine Site. Locally, the Beaver Dam Mine Site is situated in an area of low topographic relief at approximately 140 m AMSL with scattered drumlins reaching 165 to 175 m AMSL and Cameron Flowage channeling through a topographic low of approximately 130 m AMSL. Figure 2.1 presents the Beaver Dam Mine Site topography under current conditions (i.e., pre-mining).

Throughout mining operations, the local topography will be altered by the construction of major mine features including the open pit, till stockpiles, and waste stockpile. The Beaver Dam Mine Site is expected to be operated for approximately 4 years. In the final year of operation, the open pit is expected to be mined to an elevation of approximately -45 m AMSL while the waste stockpile is expected to reach an elevation of approximately 210 m AMSL.

2.1.3 Surface Water Features

Figure 2.2 presents the surface water features surrounding the Beaver Dam Mine Site, including mapped surface water features and predicted flow accumulation channels[3]. Regional surface water drainage is predominantly to the southeast along several poorly drained stream channels and shallow lakes, and there are several low-lying boggy areas across the Beaver Dam Mine Site (Peter Clifton & Associates [PCA], 2015). Most major streams in the region, including the Killag and West Branch Sheet Harbour River, follow the northwest-southeast strike of the major fault lineaments (JWA, 1986a). The most significant surface water body in the Beaver Dam Mine Site area is

3 Flow accumulation channels correspond to the location of potential unmapped streams or below ground flow. All predicted flow accumulation channels connect to a mapped surface water body (Nova Scotia Department of Natural Resources [NSDNR], 2012).

Cameron Flowage, which is located approximately 70 m northwest of the proposed open pit mine. Cameron Flowage receives the majority of surface water drainage from the Beaver Dam Mine Site with the exception of a small portion of the Beaver Dam Mine Site that drains towards Tent Lake. Cameron Flowage likely is a location of groundwater discharge.

In addition to Cameron Flowage, the other significant surface water features near the Beaver Dam Mine Site include Mud Lake, Crusher Lake, Tait Lake, and West Lake. These lakes are interconnected by a series of streams that drain into Cameron Flowage, which in turn drains into the Killag River.

2.2 Geologic Conditions

The geology at the Beaver Dam Mine Site generally consists of a silty sand glacial till (overburden), overlaying argillite and greywacke bedrock of the Moose River Member. The Moose River member is part of the larger greywacke dominated Goldenville Formation. The overburden deposits range in grain size from clays to boulders up to 1 m in diameter. Sections 2.2.1 and 2.2.2 provide descriptions of the overburden and bedrock geology, respectively.

The information presented below focuses on geologic conditions pertinent to the development of a 3D geologic model for the Beaver Dam Mine Site. The 3D geologic model formed the basis for the site-specific geology (i.e., hydraulic conductivity distribution) represented in the 3D groundwater flow model. Regional geologic conditions were inferred from monitoring well installation borehole records, exploratory geologic drillhole records, regional well records, and regional geology reports.

2.2.1 Overburden Geology

The overburden at the Beaver Dam Mine Site consists of glacial till deposits of varying thickness and occasional shallow peat bogs. Stea and Fowler (1979) describe the overburden as a blue-greenish-grey, loose, cobbly silt-sand till that will grade into a sandier, coarser till, sometimes with red clay inclusions. A typical composition of the glacial till matrix is 80 percent sand, 15 percent silt and 5 percent clay. Site-specific grain size analysis indicates that the till averages approximately 60 percent gravel, 25 percent sand, 15 percent silt, and 1 percent clay. In the upland regions, such as at the Beaver Dam Mine Site, the glacial till material is generally a coarse sandy matrix with numerous quartz cobbles and boulders, exhibiting relatively good permeability and internal drainage (JWA, 1986a). Compact silt-clay till drumlins located in the vicinity of the Beaver Dam Mine Site are expected to be less permeable due to their soil type and composition. Drumlins located in the vicinity of the Beaver Dam Mine Site are shown on Figure 2.3.

Regionally, the till deposit has an average thickness of approximately 3 m and can be up to 20 m thick in some locations such as drumlin deposits (PCA, 2015). At the Beaver Dam Mine Site, the glacial till deposits are on average approximately 3.5 to 4.5 m thick and range from 0.5 to over 22 m thick in a bedrock depression associated with the Mud Lake Fault (JWA, 1986b). Figure 2.4 shows the location of the Mud Lake Fault interpreted based on the findings of JWA (1986a) combined with the overburden thickness interpolated based on observations in exploratory drillhole records, monitoring well installation records, and regional well records.

2.2.2 Bedrock Geology

Regional Geology

Nova Scotia is divided into two distinct geologic parts: the Avalon Terrane to the north; and the Meguma Terrane to the south. The two terranes are separated by the Minus Geofracture (commonly referred to as the Cobequid-Chedabucto Fault System) (Sangster and Smith, 2007). The oldest known rocks of the Meguma Terrane are the greywackes and argillites of the Cambrian to Ordovician aged Meguma Group, which were intruded by granitic plutons during the Devonian Acadian Orogeny (Duncan, 1987; and FSS International Consultants (Australia) Pty Ltd. [FSSI], 2015).

The Paleozoic turbiditic metasedimentary sequence of the Meguma Group consists of two major stratigraphic units: the basal greywacke dominated Goldenville Formation; and the overlying, finer grained, argillite dominated Halifax Formation. The Goldenville Formation is at least 5,600 m thick, while the overlaying Halifax Formation averages approximately 4,400 m in thickness (FSSI, 2015).

The sediments of the Goldenville and Halifax Formations were deformed, uplifted, metamorphosed and intruded by granitic plutons during the Acadian Orogeny, approximately 50 to 375 million years ago. The main feature of the deformation is a series of tightly folded subparallel northeast trending upright to slightly reclined asymmetric folds (Duncan, 1987; and PCA, 2015). A group of northwest trending sinistral faults have truncated and offset the asymmetric folds by up to 6 km. Regional geologic conditions depicting the approximate locations of the Goldenville Formation, Halifax Formation, and granite intrusions are presented on Figure 2.5.

Local Geology

The Beaver Dam Mine Site is located within the Goldenville Formation of the Meguma Group. The series of tightly folded subparallel northeast trending anticlines and synclines have exposed the different stratigraphic members of the Goldenville Formation. After the classification proposed by Horne and Pelley (2007), the Meguma Group can be broken down into three members, consisting of the lowermost Moose River Member that is overlain by the Tangier Member, which in turn is overlain by the Taylors Head Member. Both the Beaver Dam Mine Site and the Touquoy Mine Site (located 19 km to the southwest of the Beaver Dam Mine Site) are located within the Moose River Member (FSSI, 2015).

The Moose River Member is at its widest in the Beaver Dam Mine Site vicinity and is folded into three sub-parallel anticlines. The Beaver Dam Mine Site is located on the southern limb of the overturned central anticline (commonly referred to as the Moose River-Beaver Dam Anticline), with both limbs dipping to the north.

The Beaver Dam Mine Site is centered on Moose River-Beaver Dam Anticline with gold mineralization occurring within the overturned southern limb of the anticline, which dips north at between 75 and 90 degrees. The Moose River-Beaver Dam Anticline is sinisterly offset into segments by two northwest trending faults: the Mud Lake Fault; and the Cameron Flowage Fault (shown on Figure 2.4). The Mud Lake Fault has been described as a 2 to 3 m wide zone of gouge within a 10 to 20 m wide brecciated zone (PCA, 2015). Duncan (1987) stated an average thickness of 12 m, ranging from 5 to 26 m, for the Mud Lake Fault and that the Mud Lake Fault usually can be sub-divided into three zones consisting of:

1. Hanging Wall Breccia (2 to 10 m) consisting of greywacke and minor argillite orthobreccia and minor parabreccia

2. Gouge Zone (2 to 10 m) consisting of graphitic argillite gouge and minor greywacke

3. Footwall Breccia (1 to 5 m) consisting of greywacke and argillite ortho-and parabreccia

The stratigraphy of the southern limb of the Moose River-Beaver Dam Anticline largely has been defined through exploratory drilling and consists of alternating interbedded argillite and greywacke units. Early efforts placed emphasis on determining the nature and extent of gold mineralization that occurs in argillite dominated units surrounded by greywacke dominated units (Duncan, 1987). The initial distinction between units was made in the late 1800s and early 1900s based on the gold bearing properties of the units, rather than their hydraulic properties. Gold bearing units at the Beaver Dam Mine Site typically are argillite dominated units surrounded by greywacke dominate units, including the Crusher Lake Greywacke as shown on Figure 2.6 (Sangster and Smith, 2007) and the Mud Lake Greywacke defined by Duncan (1987). Three argillite dominated units have been defined relative to the Beaver Dam Mine Site, consisting of the Austen, Crouse, and Papke units. The argillite and greywacke dominated units defined for the Beaver Dam Mine Site consist of:

- Austen Argillite – approximately 45 to 70 m thick, composed of dark grey argillite and 20 to 30 percent greywacke.
- Crouse Argillite – approximately 7 to 22 m thick, marking the transition from overlying greywacke dominated units to lower units dominated by argillite. Composed of dark grey, moderately graphitic argillite with greywacke intercalations forming up to 40 percent of the unit.
- Papke Argillite – approximately 15 to 30 m thick, comprised of black, graphitic argillite with less than 20 percent greywacke.
- Hanging Wall Greywacke – approximately 6 to 18 m thick, composed of light grey, fine grained greywacke and up to 40 to 50 percent dark grey to black argillite.
- Millet Seed Greywacke – approximately 8 to 25 m thick, composed of light grey fine to medium grain greywacke and 20 to 30 percent argillite.

Boreholes advanced throughout the Beaver Dam Mine Site during gold exploration identified geologic units consistent with those shown on Figure 2.6. Further boreholes advanced by GHD during monitoring well installation at the Beaver Dam Mine Site largely encountered greywacke, consistent with the Beaver Dam Mine Site being surrounding by greywacke dominated bedrock (Crusher Lake Greywacke and Mud Lake Greywacke). One GHD monitoring well borehole location, MW-02B, contacted granite bedrock, which is consistent with surficial geologic maps showing a large body of granitoids southwest of the Beaver Dam Mine Site, as presented on Figure 2.5. The borehole logs for the recent monitoring wells installed by GHD are included in GHD (2018).

The lithological dataset based on previous drillhole observations provided by AMNS was combined with the lithological data from the GHD monitoring well borehole logs to develop a 3D geologic model that was used to define geologic conditions at the Beaver Dam Mine Site. The development of the 3D geologic model is described in Section 2.3.2.

2.3 Hydrogeologic Conditions

Groundwater flow systems in Nova Scotia are relatively shallow, with the majority of groundwater flow occurring in the upper 150 m. Large-scale groundwater flow between watersheds has not been observed, likely due to the geology present throughout the Province (i.e., low permeability faulted/folded bedrock) that does not lend itself to the development of large regional aquifer systems (Kennedy et al., 2010).

At the Beaver Dam Mine Site, the groundwater table is close to ground surface (typically within 2 to 5 m bgs) and has been observed to respond rapidly to precipitation events. Seasonal variations in groundwater levels in Nova Scotia aquifers are usually less than approximately 3 m, which is consistent with seasonal groundwater level variations of approximately 1 to 2 m observed at monitoring wells throughout the Beaver Dam Mine Site. Surface water monitoring locations show a lesser average seasonal variation of approximately 30 centimetres (cm) in shallow streams and lakes. Hydrographs showing observed groundwater and surface water elevations relative to precipitation at the Beaver Dam Mine Site are presented in Appendices A and B, respectively.

The bedrock sequence forms a fractured rock aquifer system, which is overlain by a thin intermittent water bearing unit in the overburden (PCA, 2015). The degree of hydraulic connection amongst the smaller bedrock fracture systems is probably poor to moderate (PCA, 2015).

Local groundwater flow in the till overburden is a function of topographic relief with recharge occurring in areas of high elevation and discharge occurring to low lying streams, rivers, and bogs. Groundwater elevation contours corresponding to overburden/shallow bedrock groundwater elevations from the July 18, 2018 monitoring event conducted at the Beaver Dam Mine Site are presented on Figure 2.7. The interpreted groundwater elevation contours support that overburden groundwater flow mimics topographic relief and locally discharges to low-lying surface water features. Cameron Flowage likely is the most significant surface water body receiving groundwater discharge at the Beaver Dam Mine Site.

Regional groundwater flow in the fractured crystalline bedrock is controlled by secondary permeability and fracturing. Bedrock groundwater flow is expected to be predominantly southeastward along the dominant fault trends, with a lesser component of groundwater flow occurring in the northeast and east directions (JWA, 1986a). Regionally, bedrock groundwater flow is from northwest to southeast, along dominant fault trends and consistent with regional topographic relief from a topographic high of over 200 m AMSL in central Nova Scotia to sea level at the southeast shore of Nova Scotia.

2.3.1 Aquifers and Hydraulic Properties

For the purposes of the hydrogeologic modelling, three major aquifer units are defined at the Beaver Dam Mine Site consisting of the overburden, shallow weathered fractured bedrock (shallow bedrock), and deeper competent less fractured bedrock (deep bedrock). The shallow and deep bedrock units are further divided into five subunits each based on rock type/structure, consisting greywacke, argillite, granite, the Cameron Flowage Fault Zone, and the Mud Lake Fault Zone. The hydraulic properties (i.e., hydraulic conductivity) of each of the three major aquifer units are summarized below. The hydraulic conductivity values are based on a pumping test conducted by JWA (1986b), packer tests conducted by JWA and Stantec and summarized in PCA (2015), packer tests conducted by GHD in three deep boreholes surrounding the proposed open pit location (MW-05C, MW-07C, and MW-09C), and slug tests conducted by GHD in newly installed monitoring wells.

Overburden

The glacial till overburden deposits consist of silty sand and gravel containing cobbles and boulders up to 1 m in diameter. The median thickness of the overburden unit identified by AGC exploratory drillholes in the proposed pit area is 5.5 m, and the median thickness identified in GHD boreholes, which cover an area in and surrounding the Beaver Dam Mine Site, is 2.1 m. The hydraulic conductivity of the overburden was estimated as 2×10^{-7} metres per second (m/s) from a pumping test conducted by JWA (1986b).

GHD conducted slug testing in monitoring wells installed in the till overburden. The overburden slug test results are summarized in Table 2.1. Hydraulic conductivity values calculated from the slug tests range from 6.1×10^{-7} m/s to 3.8×10^{-4} m/s, with a geometric mean of 1.0×10^{-5} m/s. Lower conductivity values were observed in areas of increased overburden thickness (>10 m), such as in the vicinity of MW-12A and MW-14A. MW-12A is installed in a silt-clay drumlin and is expected to have a lower hydraulic conductivity value than that observed in the surrounding overburden.

Shallow Bedrock

In general, bedrock hydraulic conductivity at the Beaver Dam Mine Site has been observed to decrease with depth consistent with weathered and fractured bedrock at shallow depths grading into less fractured and more competent bedrock at depth. Consistent with JWA (1986b), shallow bedrock is defined as bedrock located from the top of bedrock to 22 m below the top of bedrock (and deep bedrock lies below this).

Table 2.2 summarizes the hydraulic conductivity results obtained for shallow bedrock from the GHD slug tests and packer tests, as well as the packer tests summarized by PCA (2015). The shallow bedrock hydraulic conductivity values range from 1.7×10^{-9} m/s to 1.6×10^{-4} m/s, with a geometric mean of 5.6×10^{-7} m/s.

Deep Bedrock

Consistent with JWA (1986b), deep bedrock is defined as bedrock located 22 m or more below the top of bedrock. Table 2.3 summarizes the hydraulic conductivity results obtained for deep bedrock from the GHD slug tests and packer tests, as well as the packer tests summarized by PCA (2015). The deep bedrock hydraulic conductivity values range from 1.0×10^{-10} m/s to 5.4×10^{-6} m/s, with a geometric mean of 2.9×10^{-8} m/s. The geometric mean hydraulic conductivity for the deep bedrock is approximately 20 times lower than that of the shallow bedrock, which is consistent with the less fractured and more competent nature of the deep bedrock.

2.3.1.1 Major Aquifer Rock Types

The most abundant rock types located at the Beaver Dam Mine Site are the greywacke and argillite of the Goldenville Formation. As shown on Figure 2.5, granitoids are located to the west and southwest of the Beaver Dam Mine Site, and on a regional scale, bands of the Halifax Formation are located to the north and south of the Beaver Dam Mine Site. Table 2.4 presents the hydraulic conductivity values determined from the GHD and PCA (2015) packer tests sorted by lithology and structure. The geometric mean hydraulic conductivity values from packer tests completed in argillite and greywacke are 2.7×10^{-8} m/s and 3.4×10^{-8} m/s, respectively. The similar geometric mean hydraulic conductivity values for both argillite and greywacke indicate that these two bedrock types have similar hydraulic properties at the Beaver Dam Mine Site.

2.3.1.2 Fault Zones

Two major faults are located in the vicinity of the proposed Beaver Dam Mine Site. The Cameron Flowage Fault runs below Cameron Flowage and the Mud Lake Fault location passes through the proposed pit (see Figure 2.4). Hydraulic conductivity values determined from packer tests summarized by PCA (2015) for drillhole sections that intersected the Mud Lake Fault range from 1.2×10^{-9} m/s to 1.9×10^{-6} m/s, with a geometric mean of 1.4×10^{-8} m/s (see Table 2.4). The packer test results indicate that the Mud Lake Fault has a hydraulic conductivity value similar to the surrounding bedrock. Observations by JWA (1986b) that the Mud Lake Fault is filled with a clay-like gouge support the low hydraulic conductivity results obtained for the Mud Lake Fault.

2.3.2 3D Geologic Model Development

The near vertical orientation of the interbedded greywacke and argillite units, coupled with faulting, at the Beaver Dam Mine Site does not easily lend itself to developing regionally continuous layered lithological units. To overcome this, GHD developed a 3D geologic model for the Beaver Dam Mine Site to facilitate a rigorous representation of the spatial variability and orientation observed in the lithology. GHD converted the 3D geologic model into a hydraulic conductivity zone distribution to apply in the 3D groundwater flow model.

GHD developed a 3D geologic model for the Beaver Dam Mine Site using the geologic indicator kriging (GIK) approach implemented in the software package Mining Visualization System (MVS) developed C Tech Development Corporation (C Tech) (C Tech, 2015). GIK is particularly well suited to interpolating systems that have complex heterogeneous geology, which do not readily lend themselves to a layered representation. GHD conducted a detailed review of the stratigraphic logs for all drillholes/monitoring well locations provided by AGC and those locations installed by GHD. Geologic units were categorized based on common lithological types. The 3D spatial distribution for each lithological unit then was interpolated throughout the Beaver Dam Mine Site using GIK.

Based on the observations documented in the Beaver Dam Mine Site stratigraphic logs, GHD categorized the main lithological units as follows:

- Overburden
- Argillite
- Greywacke

An interpolation domain was established for the 3D geologic model that consisted of rectangular grid blocks over the horizontal and vertical extent of the available geologic data at the Beaver Dam Mine Site. GHD applied a horizontal grid block size of 10 m by 10 m and a vertical grid block size of 10 m. GIK was used to compute the probably for each lithological type to occur in every grid block based on the observed geology at each boring. The lithological type having the highest probability (for an individual grid block) is assigned to the grid block. GIK applies an anisotropy ratio that represents the degree to which a lithological type will be interpolated horizontally in favour of vertically. For example, an anisotropy ratio of 1 represents interpolation with no direction favour, and an anisotropy ratio of 10 represents interpolation in the horizontal direction 10 times more in favour than interpolation in the vertical direction. GIK also can apply a heading (i.e., the planar direction of the formation) and a dip angle. Since the lithology at the Beaver Dam Mine Site is primarily vertical, GHD applied an anisotropy ratio of 3, a dip angle of 73 degrees, consistent with the observed 70 to 90 degree dip of the interbedded argillite and greywacke units, and a heading of 105 degrees consistent with the horizontal east/west orientation of the interbedded argillite and greywacke units.

A visualization of the 3D geologic model is included electronically in Appendix C along with the visualization viewer installation, viewing, and interaction instructions.

Screen captures from the 3D geologic model are presented on Figures 2.8 and 2.9, which show the following key features:

- Lithological types identified in drillhole/borehole records;
- Proposed open pit shell;
- Historical Mine Features; and
- Approximate Mud Lake Fault Location (on Figure 2.9) based on AGC's interpretation of geologic drillholes.

The conversion of the 3D geologic model into the hydraulic conductivity distribution specified in the 3D groundwater flow model is described in Section 5.3.

2.3.3 Groundwater Sinks

A groundwater sink is any feature that that removes groundwater from the groundwater flow system. Within the Beaver Dam Mine Site area, the primary groundwater sinks correspond to groundwater discharge to surface water features. Groundwater discharge to surface water features is discussed in more detail in the following section.

2.3.3.1 Discharge to Surface Water Features

Locally, groundwater flow typically follows the topographic relief, moving towards surface water features in low lying areas. The proposed open pit at the Beaver Dam Mine Site is located adjacent to Cameron Flowage, a stillwater area on the Killag River. Cameron Flowage is approximately 1.2 km long and up to 120 m wide. All surface water generated within the drainage catchment that includes the proposed open pit area flows into Cameron Flowage. Cameron Flowage also is a likely area of groundwater discharge (PCA, 2015).

Prior to the collection of site-specific data, the average annual groundwater discharge (baseflow) to Cameron Flowage was estimated using the four nearest hydrometric stations and scaling the watersheds that contain those stations to the size of the Cameron Flowage watershed. The nearest four hydrometric stations are Pembroke River at Glenbervie, Musquodoboit River Near Upper Musquodoboit, Musquodoboit River Near Middle Musquodoboit, and Musquodoboit River at Crawford Falls, which have drainage areas of 7,330 hectares (ha), 14,100 ha, 33,400 ha, and

65,000 ha, respectively. A baseflow value was estimated for each drainage area by applying a recursive digital filter (Eckhardt, 2005) as implemented in WHAT: Web-based Hydrograph Analysis Tool (Lim et al., 2005) to daily discharge data recorded at each of the four hydrometric stations. The estimated baseflow for each drainage area was scaled to the total drainage area of approximately 3,871 ha for Cameron Flowage, providing an estimated total average annual baseflow of approximately 23,426 meters per day (m^3/d) for Cameron Flowage with a total annual flow of 103,881 m^3/d. Based on these estimates, baseflow to Cameron Flowage would represent approximately 23 percent of the total flow. The estimated average annual baseflow for Cameron Flowage provides a calibration target against which simulated baseflow can be compared as discussed in Section 6.

Following model calibration, preliminary stage-discharge relationships were developed for six gauging locations using available flow monitoring measurement events and corresponding surface water elevations measured at the gauging locations. The preliminary stage-discharge relationships will be further refined as additional flow monitoring measurement events are conducted. The preliminary stage-discharge relationships were applied to estimate stream discharge (flow) at each of the six gauging locations. Two gauging locations, SW2A and SW1A, are located immediately upstream and downstream of Cameron Flowage, respectively, and were selected to verify the total flow and baseflow estimates calculated using the nearest four hydrometric stations. Consistent with the method applied for the nearest four hydrometric stations, a recursive digital filter (Eckhardt, 2005) as implemented in WHAT: Web-based Hydrograph Analysis Tool (Lim et al., 2005) was applied to the average daily discharge data for SW2A and SW1A to estimate baseflow at those gauge locations. The average annual baseflow estimated for SW2A and SW1A is 24,686 cubic m^3/d, with an average annual total flow of 112,420 m^3/d. Based on these values, the average annual baseflow to at SW2A and SW1A represents approximately 22 percent of the total average annual flow at those gauge locations. The estimated average annual baseflow at SW2A and SW1A is within approximately 5 percent of the estimated average annual baseflow estimated from the nearest four hydrometric station for Cameron Flowage. This comparison verifies that the estimated average annual baseflow from the nearest four hydrometric stations is reasonable and provides an appropriate model calibration target.

GHD also evaluated available streamflow data collected at SW2A and SW1A to identify seasonal lows in streamflow and baseflow as surface water features are typically most vulnerable to changes in baseflow under low-flow conditions. This occurs because under periods of low flow, baseflow is typically the dominant physical process contributing to total stream flow, whereas under periods of high flow surface water runoff is typically the dominant physical process contributing to total stream flow. The lowest two-week average flow in Cameron Flowage recorded at SW-1A and SW2A corresponds to August 16 through August 29, 2019, and is selected being representative of low-flow conditions in Cameron Flowage. From August 16 through August 29, 2019, the average total flow estimated at SW-2A and SW-1A is 3,009 m^3/d and 3,364 m^3/d, respectively. The estimated baseflow contribution to Cameron Flowage between SW-2A and SW-1A is 335 m^3/d which provides a basis for comparison for predicted baseflow changes at EOM and PC.

2.3.4 Groundwater Sources

A groundwater source is any feature that contributes water to the groundwater flow system. At the Beaver Dam Mine Site, the primary groundwater source is from groundwater recharge through precipitation infiltration. In some areas it is expected that groundwater will receive recharge from surface water features; however, surface water features overall are expected to receive net discharge from the groundwater flow system.

2.3.4.1 Recharge Through Precipitation Infiltration

Groundwater at and surrounding the Beaver Dam Mine Site receives precipitation at a reported average annual rate of approximately 1,357.7 millimetres per year (mm/yr) (climate normal for the 30-year period [1981 to 2010] at Middle Musquodoboit Climate Station). The amount of precipitation reaching the groundwater table is typically considered to range from approximately 10 to 40 percent of the average annual precipitation (Arnold et al., 2000; and Rushton and Ward, 1979).

Baseflow often is used to estimate recharge rates, with the caveats that: 1) baseflow probably represents some amount less than that which recharges the aquifer; and 2) baseflow is best applied to provide a reasonable estimate of recharge occurring over long time periods (1 year or more) (Risser et al., 2005). To estimate recharge from baseflow, the total baseflow is divided by the area of the watershed. For the Cameron Flowage watershed, the average annual estimated baseflow of 23,426 m^3/d divided by the area of the Cameron Flowage watershed of 3,871 ha gives an estimated average annual recharge rate of 221 mm/yr (approximately 16 percent of the average annual precipitation). Applying the same method to an average dry month (typically September) and an average wet month (typically April) provides an estimated range in recharge from 77 to 377 mm/yr (approximately 6 to 28 percent of the average annual precipitation). Although applying baseflow to estimate recharge has some limitations, it is suitable for the purpose of establishing a potential range of average recharge conditions at the Beaver Dam Mine Site.

The recharge estimates developed through baseflow analysis correspond well to those developed by the Nova Scotia Department of Natural Resources (NSDNR). Using a similar method, the NSDNR estimated recharge for primary watersheds across Nova Scotia (Kennedy et al., 2010). The average annual recharge rate calculated for the primary watershed within which the Beaver Dam Mine Site is located ranged from 220 to 260 mm/yr. The average annual recharge rate of 221 mm/yr estimated for the Beaver Dam Mine Site through the baseflow analysis is consistent with the range of 220 to 260 mm/yr estimated by Kennedy et al. (2010).

2.3.4.2 Recharge from Surface Water Features

While surface water features are expected to be a net groundwater sink, there will be losing reaches (i.e., sections where surface water recharges groundwater) along some surface water features. Surface water features will recharge groundwater in areas where groundwater levels fall below adjacent surface water elevations.

3. Hydrogeologic Conceptual Site Model (CSM)

The CSM forms the working basis for understanding the hydrogeologic conditions at the Beaver Dam Mine Site, including the extent, geometry, and composition of the hydrostratigraphic units, groundwater flow characters of each hydrostratigraphic unit, groundwater flow interactions between the units, and groundwater/surface water interaction. The CSM facilitates selecting model domain limits for the numerical groundwater flow model, as well as hydrostratigraphic unit representation and boundary conditions taking into consideration the observed site-specific and regional hydrogeologic conditions. The CSM then forms the basis for constructing the numerical groundwater flow model.

3.1 General Hydrogeologic Characteristics

Understanding the general hydrogeologic characteristics of the groundwater flow system for the Beaver Dam Mine Site is fundamental to developing a representative CSM and guides the development of the numerical groundwater flow model. Based on the available regional and site-specific information, the hydrogeologic characteristics are summarized as follows:

- The available monitoring well installation logs, regional well records, and exploratory drillhole records, and the 3D geologic model developed from these logs/records, the geologic conditions at the Beaver Dam Mine Site consist of steeply dipping interbedded argillite and greywacke overlain by a thin till overburden layer. The overburden consists of a silty sand and gravel containing cobbles and boulders up to 1 m in diameter. The interbedded argillite and greywacke bedrock sequence at the Beaver Dam Mine Site is truncated by the Mud Lake Fault towards the east end of the proposed open pit location.
- Groundwater flow at the Beaver Dam Mine Site occurs primarily in the till overburden layer and the shallow weathered fractured bedrock zone. Bedrock permeability decreases with depth indicating that groundwater flow rates also are expected to decrease with depth.
- Groundwater flow directions in the till overburden typically follow topographic relief, and the groundwater table is expected to mimic ground surface, with recharge occurring in upland areas, and discharge occurring to surface water features in low lying areas within the Killag River watershed.
- Groundwater flow in the bedrock is controlled by secondary permeability and fracturing, and more so in the weathered shallow bedrock than in the more competent deep bedrock. Locally, bedrock groundwater flow largely is expected to occur predominantly towards the southeast along dominant fault trends, with smaller flow components to the northeast and east. It is assumed that the secondary permeability and fracturing is well enough connected at the scale of interest that the fractured bedrock system can be treated as an equivalent porous media.
- The surface water features surrounding the Beaver Dam Mine Site receive net groundwater discharge; however, there may be some localized areas where surface water bodies recharge groundwater when the surface water elevations lie above the immediately surrounding groundwater elevations.
- At depth within the deep bedrock, the permeability becomes sufficiently low such that vertical groundwater flow is negligible.

3.2 Groundwater Flow Model Domain Limits

A groundwater flow model domain should extend to where reasonably defensible boundary conditions can be established. Model domain limits, and the associated boundary conditions, should be based on regional-scale natural hydrogeologic features where possible. The model domain limits and the associated boundary conditions should also be selected to minimize the potential to cause an incorrect bias[4] in model predictions over the area of interest within the interior of the model domain.

GHD selected a model domain and associated boundary conditions that are representative of observed conditions at the Beaver Dam Mine Site and reasonably expected conditions regionally. The selected model domain and boundary conditions assigned at the model domain limits are illustrated on Figure 3.1, and are described in general terms as follows:

- Northeast: The northeastern model domain limit is aligned with expected groundwater flow divide located between topographic highs and the surface water elevations along the centre of Como Lake and Seven Mile Stream. The northeastern boundary condition was extended beyond the secondary watershed divide shown on Figure 3.1, to provide additional physical separation between the Beaver Dam Mine Site and northeastern boundary condition such that the northeastern boundary condition would not provide a potentially incorrect bias within the area of interest at the Beaver Dam Mine Site. A river boundary condition is specified along the location of Como Lake and Seven Mile Stream in the upper-most model layers where these surface water features are present, and a no-flow boundary condition is specified to depth beneath the surface water features. A no-flow boundary condition is specified to depth between topographic highs where a lake or stream/river is not present.
- Southeast: The southeastern model domain boundary was selected as corresponding to anticipated flow divides between topographic highs southeast of Cameron Flowage. Regional groundwater flow from northwest to southeast is expected to exit the model domain along the southeastern boundary to the south of Cameron Flowage, following the general topographic relief towards the southeast. Shallow groundwater discharge is expected to the surface water features located in the southeast portion of the model and abutting the southeastern model domain boundary (which are represented in the groundwater flow model, as shown on Figure 3.1 and described in Section 5.2). A general head boundary was tested along the southeastern boundary south of Cameron flowage; however, due to the low permeability of the bedrock, flow at depth was found to be negligible with respect to groundwater flow conditions at the Beaver Dam Mine Site. Therefore, a no-flow boundary was assigned to depth (except where shallow surface water bodies are present) along the entire southeastern model domain limit.
- Southwest: The southwestern model domain limit corresponds to the tertiary water shed boundary along the centre of River Lake and the West Sheet Harbour River, as shown on Figure 3.1. A river boundary condition is specified along the southwestern model domain limit consistent the location of River Lake and the West Sheet Harbour River in the upper-most model

4 For example, unless there is a regional-scale natural hydrologic feature to warrant doing so (i.e., a substantial lake), a constant head boundary condition should not be assigned in close proximity to the area of interest since this may artificially maintain groundwater elevations should a future groundwater sink condition (i.e., a pumping well or an open pit mine) be represented within the area of interest.

layers where these surface water features are present, and a no-flow boundary condition is specified to depth beneath the surface water features.

- Northwest: The northwestern boundary condition corresponds to surface water features along West Sheet Harbour River, Kent Lake, Cope Flowage, West Lake, and West Brook. Between West Brook to north of McNeil Brook, the northwestern boundary corresponds to an inferred flow divide between topographic highs. River boundary conditions are specified in the upper-most model layers where the surface water features are present, and a no-flow boundary condition is specified to depth beneath the surface water features. A no-flow boundary condition is specified to depth where a flow divide is inferred between topographic highs.

As presented on Figure 3.1, the model domain extends approximately 8.5 km in the north-south direction and 9 km in the east-west direction. Details on implementing the boundary conditions described above at the model domain limits are provided in Section 5.2. Additional river and drain boundary conditions on the interior of the model domain corresponding to surface water features are shown on Figure 3.1. Section 5.2 describes the basis for these interior boundary conditions.

Vertically, the model domain extends from ground surface, where a recharge boundary condition is applied, to approximately 250 m bgs where a vertical no-flow boundary is inferred. At depth, the permeability the deep bedrock becomes sufficiently low such that active groundwater flow, and vertical groundwater flow in particular, is considered negligible. Ground surface is at approximately 130 m AMSL on average in the vicinity of the Beaver Dam Mine Site making the bottom of the model domain correspond to -120 m AMSL. The bottom of the proposed open pit is to extend to an elevation of -45 m AMSL, 75 m above the bottom of the model domain.

3.3 Hydrostratigraphic Unit Representation

The steeply dipping and interbedded nature of the argillite and greywacke units at the Beaver Dam Mine Site, combined with the truncation of these units caused by the Mud Lake Fault, precludes using horizontal model layers specific to each hydrostratigraphic unit. The 3D geologic model that GHD developed for the Beaver Dam Mine Site using MVS accounted for the dip angle and heading of the steeply dipping interbedded argillite and greywacke units, as well as the Mud Lake Fault. GHD imported the 3D geologic model into the numerical groundwater flow model as a 3D hydraulic conductivity distribution that specifically honoured the location of argillite and greywacke.

The Cameron Flowage Fault is located beyond the area investigated by the exploratory drillholes, and thus its location and orientation are not represented in the 3D geologic model. The Cameron Flowage Fault is assumed to have a vertical orientation, and its location is assigned based on the interpreted regional orientation presented in JWA (1986a).

Within the model domain, the Halifax Formation and location of granitoids are incorporated based on the regional extents presented on Figure 2.5.

For each bedrock and fault zone, it is assumed there is a shallow more permeable zone, caused by weathering and fracturing, and a deeper less permeable zone where weathered and fracturing are diminished.

The specific hydrostratigraphic units considered in the CSM for the Beaver Dam Mine Site are as follows:

- Overburden
- Shallow Greywacke
- Deep Greywacke
- Shallow Granite
- Deep Granite
- Shallow Argillite
- Deep Argillite
- Shallow Mud Lake Fault Zone
- Deep Mud Lake Fault Zone
- Shallow Cameron Flowage Fault Zone
- Deep Cameron Flowage Fault Zone

The shallow units listed are considered more permeable due to weathering and fracturing, while the deep units are considered less permeable due to reduced weathering and fracturing. As described in Section 2.3.1, the shallow bedrock units are defined as extending to 22 m below the top of bedrock, and the deep units lie below this.

4. Simulation Program Selection

The simulation program selection to develop the numerical groundwater flow model for the Beaver Dam Mine Site was based on the following considerations:

- The ability of the program to represent the key components of the CSM
- The demonstrated verification that the program correctly represents the hydrogeologic processes being considered
- The proven acceptance of the program by regulatory agencies and the scientific/engineering community
- The ability of the program to represent the proposed mine design
- The ability of the program to provide a reasonable numerical solution in consideration of the complexity of the hydrogeologic conditions at the Beaver Dam Mine Site

4.1 Groundwater Flow Model

MODFLOW-NWT (Niswonger et al., 2011), developed by the United States Geological Survey (USGS), is capable of simulating steady-state or transient groundwater flow in two or three dimensions. MODFLOW-NWT uses the finite-difference method to numerically approximate a solution to complex groundwater flow problems. A rectangular grid is superimposed over the study area to horizontally subdivide the region of interest into a number of rectangular cells, and then the study area is subdivided vertically using layers. Hydraulic properties are assigned to the resulting model cells per layer consistent with the hydrogeologic unit that falls within each cell. Groundwater flow is formulated as a differential water balance for every model cell and hydraulic head is solved at the center of every model cell. MODFLOW-NWT allows for the specification of flows associated with wells, areal groundwater recharge, rivers, drains, streams, and other groundwater sources/sinks.

MODFLOW-NWT was selected to simulated groundwater flow for this modelling study due to its ability to efficiently solve complex groundwater flow simulations characterized by drying and rewetting of model cells such as that encountered in the simulation of dewatering scenarios. MODFLOW-NWT is a standalone version of MODFLOW-2005 (Harbaugh, 2005), which is an update to the original MODFLOW (McDonald and Harbaugh, 1988) and MODFLOW-2000 (Harbaugh et al., 2000). MODFLOW has been extensively verified and is readily accepted by many regulatory agencies throughout North America and Europe. MODFLOW-NWT can represent the hydrogeologic components of the CSM for the Beaver Dam Mine Site. The Newton Solver (NWT) and the Upstream Weighting (UPW) package included in MODFLOW-NWT was employed to solve the groundwater flow equation. For convergence, the solution technique required the satisfaction of both hydraulic head and flow residual criteria providing a rigorous and reliable simulated water balance throughout the model domain.

4.2 Parameter Estimation

The calibration of the groundwater flow model was aided through the use of the parameter estimation program PEST, which is an acronym for Parameter Estimation (Watermark Numerical Computing, 2016). PEST is a model-independent parameter estimator that has become a groundwater industry standard for groundwater flow model calibration. It has a powerful inversion engine, which provides the ability to set bounds on model input parameters such as hydraulic conductivity and groundwater recharge. PEST was used in conjunction with pilot points (Doherty et al., 2010). Pilot points are a spatial parameterization device that can be used to estimate an initial hydraulic conductivity distribution. PEST conveys to MODFLOW-NWT input parameter values that vary within their specified bounds with the objective of establishing optimal input parameter values that minimize the error between observed and simulated calibration targets. For each run of input parameters, PEST calculates objective function values (OFVs) at each model calibration target location. OFVs represent the error between calculated versus measured values at each calibration target location. PEST automatically makes changes to the input parameter values (within their specified bounds) to reduce OFVs, selecting the run that exhibits the lowest overall OFVs as the optimal solution.

4.3 Contaminant Transport Model

Contaminant (metals) transport was simulated using MT3D-USGS (Bedekar et al., 2016). MT3D-USGS, an update to MT3DMS (Zheng and Wang, 1999), includes new transport modelling capabilities to accommodate flow terms calculated by MODFLOW packages that previously were unsupported by MT3DMS and to provide greater flexibility in the simulation of solute transport and reactive solute transport. MT3D-USGS also includes the capability to route a solute through dry model cells that may be simulated in MODFLOW-NWT. MT3D-USGS is a reactive transport model that, when integrated with MODFLOW-NWT, can simulate multispecies transport in one, two, or three dimensions, and is able to simulate transport processes that are applicable to the Beaver Dam

Mine Site, including advection, biodegradation (or decay), adsorption, and dispersion in groundwater flow systems. MT3D-USGS is commonly used by the industry and accepted by regulatory agencies throughout North America and Internationally.

4.4 Particle Tracking

Particle tracking provides a means to evaluate advective groundwater flow pathways within a simulated groundwater flow field. The program MODPATH Version 7 (Pollock, 2016), also developed by the USGS, is a 3D particle tracking program that is integrated with MODFLOW-NWT and was selected to evaluate the degree of hydraulic containment that could potentially be achieved by mitigation measures. MODPATH is commonly used by the industry and accepted by regulatory agencies throughout North America and Europe.

4.5 Graphical User Interface

The graphical user interface (GUI) Groundwater Vistas (Rumbaugh, 2017) was used as the interface between the assembled hydrogeologic data and the required MODFLOW-NWT and MT3D-USGS input files. The GUI facilitates pre- and post-processing of MODFLOW-NWT and MT3D-USGS input/output files.

5. Base-Case Groundwater Flow Model Construction

Groundwater flow model construction is the process of developing the horizontal and vertical discretization of the selected model domain, specifying hydraulic properties consistent with the hydrostratigraphic units, and implementing boundary conditions consistent with the CSM. The groundwater flow model construction relative to these aspects is presented in the following sections.

5.1 Groundwater Flow Model Spatial Domain and Discretization

Horizontally, the model domain is discretized into rows and columns using a rectangular finite-difference grid. The finite-difference grid is extended over the model domain described in Section 3.2. The finite-difference grid is presented on Figure 5.1. A minimum finite-difference grid spacing of 10 m was applied over the area of interest as defined by the preliminary mine layout. Beyond the area of interest, the grid spacing progressively increases to a maximum of 100 m at the edge of the model domain. The model domain is discretized horizontally into 272 rows and 290 columns.

Vertically, the model domain extends from ground surface to approximately 250 m bgs where a vertical no-flow boundary is inferred, as described in Section 3.2. The vertical discretization of the model domain consists of 13 model layers to capture major changes in lithology as represented by the 3D geologic model. With the exception of model layer 1, the model layers have a uniform thickness. For model layer 1, a variable layer thickness is assigned, consistent with the estimated overburden thickness presented on Figure 2.4. Ground surface elevations over the model domain were generated using a combination of Digital Elevation Model (DEM) data for the Beaver Dam Mine Site, LiDAR imagery data for the Beaver Dam Mine Site, and surveyed ground surface elevations at monitoring well, drillhole, and surface water gauge locations. Model layer 2 has a uniform thickness of 22 m, corresponding the depth of the shallow bedrock zone. Model layers 3 through 13 have a uniform thickness of 20 m.

5.2 Flow Model Boundary Conditions

As described in Section 3.2 and shown on Figure 3.1, the boundary conditions for the groundwater flow model consist of:

- River boundary conditions to represent surface water features that potentially could receive groundwater discharge or potentially could recharge groundwater (e.g., Cameron Flowage, Como Lake, Crusher Lake, Mud Lake, etc.)
- Drain boundary conditions to represent flow accumulation channels, which primarily receive groundwater discharge
- No-flow boundary conditions to represented anticipated flow divides located between topographic highs along the model domain limits
- Recharge over the top of the model domain due to precipitation infiltration
- Vertical no-flow boundary condition at depth corresponding to the inferred base of the active groundwater flow system within deep bedrock

With respect to applying the calibrated model for predictive simulations of the open pit mine, pit filling, and proposed surface water management ditches, the following additional boundary condition types are used:

- A drain boundary condition is specified to represent surface water features that are considered to represent a point of groundwater discharge only. This includes surface water management ditches, which are assumed to rapidly convey groundwater discharge to Cameron Flowage, and the seepage face of the open pit mine above the specified pike lake elevation.
- A general head boundary condition is applied to represent groundwater in-flow/out-flow. A general head boundary is specified to simulate pit lake elevations at PC, and to estimate groundwater inflow into the open pit at specific pit lake stage elevations occurring as the pit fills.

The implementation of these boundary conditions in the model is described in further detail below.

5.2.1 River Boundary Condition

A river boundary can simulate the interaction between surface water and groundwater. It can represent both groundwater discharge to surface water (i.e., a gaining stream) and groundwater recharge from surface water (i.e., a losing stream). If a specified river stage elevation is lower than the simulated groundwater elevation, the river boundary receives discharge from groundwater. If the specified river stage elevation is higher than the simulated groundwater elevation, the river boundary serves as a recharge to groundwater. The quantity of surface and groundwater exchange is equal to the difference between the simulated groundwater elevation within the river cell and the specified head within the river cell multiplied by a conductance term. The conductance term reflects the relative ease of groundwater flow through sediments or bedding material that form the base of the surface water body.

As shown on Figure 3.1, river boundary conditions were assigned to represent natural surface water features located within the active model domain. The river cell stage elevations were assigned based on ground surface elevations minus the depth to water interpolated between surface water gauge locations. The conductance term for the river cells was estimated using:

$$C_{River} = \frac{KA}{M}$$

Where:

C_{River}	=	river cell conductance (square metres per day [m^2/d])
K	=	hydraulic conductivity of streambed sediments (m/d)
A	=	area of the river cell (square metres [m^2])
M	=	thickness of the river bed material (m)

For larger surface water features (i.e., lakes and wider water features like Cameron Flowage) that encompass multiple model cells, the river cell area was calculated as the model cell area or the portion of the surface water body contained by the river cell. For narrow surface water features (i.e., streams), the river cell area was calculated as the length of the stream within the river cell multiplied by stream width estimated from satellite imagery. The streambed sediment thickness was assumed to be 0.1 m. The hydraulic conductivity of the streambed sediments was adjusted during model calibration.

5.2.2 No-Flow Boundary Condition

No-flow boundary conditions were applied where negligible groundwater flow across a model boundary reasonably can be expected. No-flow boundary conditions are specified between adjacent topographic highs where groundwater is expected to flow downslope creating a groundwater flow divide with negligible groundwater flow across the divide (the divide is assumed to correspond to a line drawn between the two adjacent topographic highs). At the bottom of the model domain (at approximately 250 m bgs), it is assumed that the permeability of the deep bedrock becomes sufficiently low such that active groundwater flow, and vertical groundwater flow in particular, is considered negligible. As a result, a no-flow boundary condition is specified across the bottom of the model domain. A no-flow boundary condition also is applied along the southeastern model domain boundary where, due to the low permeability of the bedrock, flow across this boundary is negligible with respect to groundwater flow conditions at the Beaver Dam Mine Site.

5.2.3 Recharge

Recharge from precipitation infiltration was applied as the top model domain boundary condition. Based on the 30-year annual average normal precipitation values from 1981 to 2010 for Middle Musquodoboit, Nova Scotia (Stantec, 2018), the average annual precipitation is 1,357.7 mm/yr. The total precipitation in June 2018 (one month prior to the July 18, 2018 monitoring event selected as the base case calibration target dataset, as described in Section 6.1) was 178.1 mm, which is the equivalent of a total annualized precipitation of 2,137.2 mm (about 1.6 times high than the 30-year average annual precipitation). The average monthly precipitation for June (from 1981 to 2010 for

Middle Musquodoboit) is 99.8 mm, and the total precipitation for June 2018 is approximately 1.8 times this average.

The amount of precipitation reaching the groundwater table as recharge depends on topography, shallow soil types, ground cover and land use (vegetation or building/pavement coverage), season, weather conditions, etc. Through the baseflow analysis described in Section 2.3.4.1, recharge for the Beaver Dam Mine Site was estimated to range from 77 to 377 mm/yr. Recharge was adjusted within this range during model calibration as described in Section 6.

The ground cover and land use is consistent throughout the Beaver Dam Mine Site; therefore, a single uniform recharge rate was applied over the entire model domain.

5.2.4 Drain Boundary Condition

A drain boundary condition simulates groundwater/surface water interaction in terms of groundwater discharge only. Unlike a river boundary condition, a drain boundary condition cannot represent a losing stream condition where surface water recharges groundwater. The drain boundary condition is active if the specified drain stage elevation is lower than the simulated groundwater elevation, and inactive when the specified drain stage elevation is higher than the simulation groundwater elevation. Similar to river cells, the quantity of groundwater discharge to the drain boundary is equal to the difference between the simulated groundwater elevation within the drain cell and the specified drain stage elevation multiplied by a conductance term.

A drain boundary condition was applied along flow accumulation channels. Flow accumulation channels connect to and potentially convey water to mapped surface water features. Therefore, flow accumulation channels are expected to function as groundwater discharge locations. The hydraulic conductivity value assigned to the to drain cells representing flow accumulation channels is the same as that used for the river cell streambed sediments as determined through model calibration.

A drain boundary condition was applied along the open pit wall to simulate the open pit above specified pit lake stage elevations. The drain stage elevation above the specified pit lake stage was set based on the elevation of the proposed pit walls. The drain conductance was set to a high value of 1,000 m^2/d to ensure that any groundwater entering a drain cell along the open pit wall would discharge to the open pit without resistance (when the groundwater elevation is above the drain stage elevation).

A drain boundary condition was also applied to simulate the surface water management ditches planned throughout the Beaver Dam Mine Site and interceptor trenches considered as potential mitigation measures. The ditches and trenches are designed to efficiently convey collected water to discharge locations and are expected to function as a groundwater discharge location as well. The conductance term for drain cells assigned to represent the surface water management ditches and potential interceptor trenches were calculated using the same approach as applied for the river cells. The area of the drain cell was calculated based on the length of the surface water management ditch, or interceptor trench, specified within the drain cell multiplied by the designed width of the surface water management ditch, or interceptor trench. The hydraulic conductivity used to calculate the conductance term is the same as that used for the river cell streambed sediments since the surface water management ditches, or potential interceptor trenches, are designed to be naturally lined.

5.2.5 General Head Boundary Condition

A general head boundary (GHB) condition was assigned to represent the open pit below the simulated pit lake stage elevation. The GHB condition requires specifying a hydraulic head value and a conductance term for each model cell where the boundary is applied. The hydraulic head values were set equal to the simulated pit lake stage elevation, and the conductance term was set to a high value of 1,000 m^2/d to ensure that any groundwater entering a GHB cell along the open pit wall would discharge to the open pit without resistance (when the groundwater elevation is above the hydraulic head value).

5.3 Hydraulic Conductivity Distribution

The hydraulic conductivity zones were assigned in the model to represent each of the major hydrogeologic units identified in the CSM and represented in the 3D geologic model. A single hydraulic conductivity zone was assigned in model layer 1 to represent the overburden. Within the overburden hydraulic conductivity zone, a continuously variable hydraulic conductivity distribution was assigned to represent the multiple soil types which make up the overburden unit ranging from less permeable silty-clay to more permeable cobbled silty-sand. A single hydraulic conductivity zone was assigned to each of the shallow and deep bedrock and fault units which consist of the shallow and deep greywacke, shallow and deep granite, shallow and deep argillite, shallow and deep Mud Lake Fault Zone, and shallow and deep Cameron Flowage Fault Zone. A uniform hydraulic conductivity value is assigned within each of the shallow and deep bedrock and fault zones. The hydraulic conductivity zones specified in model layers 1 to 13 are presented on Figures 5.2 through 5.14. Specifying hydraulic zones per hydrogeologic unit permits parameter estimation for each unit implemented through PEST using pilot points. The hydraulic conductivity value for each unit was adjusted during model calibration within reasonable bounds based on the results of the hydraulic conductivity testing conducted within each hydrogeologic unit (see Tables 2.1, 2.2, and 2.3), as well as values available in published literature consistent with the geological materials that make up each unit.

6. Base-Case Groundwater Flow Model Calibration

Groundwater flow model calibration is the process of adjusting model input parameter and boundary conditions such that simulated results provide a reasonable representation of observed groundwater flow conditions at the Beaver Dam Mine Site. The object is to determine a unique combination of input parameters to produce a numerical solution that best matches the observed groundwater elevations, observed groundwater flow directions, and estimated baseflow at the Beaver Dam Mine Site.

6.1 Calibration Targets

Selection of steady-state model calibration target datasets normally considers whether the available groundwater elevation monitoring captures the following:

- Represents the range in groundwater flow conditions (i.e., seasonal variations) observed at the Beaver Dam Mine Site, typically consisting of a base case (i.e., average) condition, and wet and dry conditions
- Groundwater stresses/boundary conditions represent the range of conditions affecting groundwater elevations and flow directions
- Provides spatial coverage of the model domain with measurements at the majority of the available monitoring well locations
- Includes the key area of interest within the model domain

The Site monitoring network includes monitoring well/surface water gauge locations both within and surrounding the area of interest where mining operations are proposed. Groundwater/surface water elevations have been measured at the monitoring well/surface water gauge network at the Beaver Dam Mine Site since the network was installed in May 2018. Groundwater/surface water monitoring consists of both manual water elevation measurements and automated water elevation measurements. To automatically record water elevations, transducers were installed in groundwater monitoring wells and at staff gauge locations. Manual water elevation measurements were taken periodically to verify the transducer readings. Transducer readings and manual measurements at groundwater and surface water monitoring locations are included in Appendices A and B, respectively. Gaps in manual water elevation measurements occur in winter when Site conditions precluded the collection of manual water elevations. Gaps in transducer elevation readings occur when the transducer was dry or had been removed from the well for maintenance or well sampling. Transducers were removed from surface water monitoring locations during the winter to avoid damage to the instruments due to the formation of ice on surface water features.

Dry conditions at Beaver Dam Mine Site are observed in August through September and wetter conditions are observed from November through April. The highest groundwater elevations were observed in November, corresponding to the onset of fall/winter precipitation events, and again in April corresponding to the spring freshet. The observed groundwater elevations show that seasonal variations in groundwater elevations observed at the Beaver Dam Mine Site are consistent with the seasonal variations in groundwater elevations observed at the Touquoy Mine Site, where dry conditions are also typically observed in August through September and the highest groundwater elevations are observed in November/December and in April. Similar seasonal variations in groundwater elevations are expected at the Beaver Dam and Touquoy Mine Sites since the two Site are located within 19 km of each other, within the same geologic formation, and in very similar hydrogeologic settings.

To represent the range in seasonal variations observed at the Beaver Dam Mine Site, three groundwater elevation target datasets were developed for model calibration, corresponding to average annual (base case) conditions, and then dry and wet conditions. Transducer elevation data were applied to develop the calibration target datasets. Where there was a gap in transducer elevation readings, manual measurements were applied to supplement the transducer data where available. The base case calibration target dataset corresponds to the average observed groundwater elevations from June 12, 2018 through June 12, 2019, representing a complete year of groundwater elevation data collection. The dry condition calibration target dataset corresponds to the average of the groundwater elevations observed during the two week period from September 13, 2018 through September 26, 2018 when the lowest groundwater elevations occurred (i.e., dry conditions). Two periods of consistently high groundwater elevations (i.e., wet conditions) were observed: one period in early November; and another in late April. The wet condition calibration target dataset was selected as the average of the groundwater elevations observed during the two week period in early November (from November 1, 2018 through November 14, 2018), since average observed groundwater elevations were similar for both early November and late April, and corresponding surface water elevations were available for November but not for April.

In addition to the base case, dry, and wet condition average groundwater elevation calibration target datasets, the model calibration also was evaluated against estimated baseflow throughout the model domain. Estimated baseflow rates for Cameron Flowage described in Section 2.3.3.1 were scaled up to the model domain size of 7,816 ha. The total estimated baseflow for the entire model domain is 47,299 m^3/d.

The model calibration to the base case, dry, and wet condition average groundwater elevation calibration target datasets, as well as estimated baseflow, is presented in Section 6.3. The model calibration methodology is described in Section 6.2.

6.2 Calibration Methodology

The groundwater flow field throughout the model domain was simulated under steady-state conditions for each calibration target dataset. The solution to the groundwater flow equation was obtained using a numerical solver with specified convergence criteria. As described in Section 4.1, the NWT solver and the UPW package implemented in MODFLOW-NWT was used. The convergence criteria between successive solver iterations was specified as 0.001 m for the maximum hydraulic head change, and 100 m^3/d for the maximum flow residual throughout the model domain.

Model calibration was performed in an iterative manner by adjusting the hydraulic conductivity values per geologic unit, recharge rate, and the hydraulic conductivity of the streambed sediments for river cell boundary conditions. PEST was applied to aid the model calibration process as an automated means to optimize model input parameter values within reasonable or expected ranges.

Hydraulic conductivity values were held consistent between the model calibration to each of the base case, dry, and wet conditions. Recharge was independently reduced from the base case condition for the calibration to dry conditions and was independently increased from the base case condition the calibration to wet conditions. The river and drain boundary conditions within the model domain were varied to correspond with observed average surface water elevations during the base case, dry, and wet conditions. The recharge rate was decreased for the model calibration to dry conditions to reflect the lower volume of groundwater recharge occurring during dry conditions relative to the average annual base case condition. The recharge rate was increased for the model calibration to wet conditions to reflect the increase in groundwater recharge occurring during wet conditions relative to the average annual base case condition. Dry condition groundwater elevations were approximately 0.95 m lower than the base case groundwater elevations, which supports reduced recharge for the dry condition relative to the base case condition. Wet condition groundwater elevations were 0.49 m higher than the base case groundwater elevations, which supports increased recharge for the wet condition relative to the base case condition.

The model calibration was evaluated both qualitatively and quantitatively. Qualitative evaluations included visually comparing the simulated versus observed groundwater elevations and groundwater flow directions, as well as the spatial distribution of calibration residuals, or error in matching the calibration targets. Calibration residuals are calculated as the observed groundwater elevation minus the simulated groundwater elevation at each calibration target location. A negative residual value indicates that the observed groundwater elevation is over-predicted, and a positive residual value indicates that the observed groundwater elevation is under-predicted. Focused areas of largely over- or under-predicted groundwater elevations would indicate spatial bias in the calibration results, and adjustments to model input parameters are made to minimize this bias.

The quantitative assessment of the calibration was conducted by examining the calibration residual statistics. Statistics such as the mean residual, absolute mean residual, sum of the residual values squared (referred to as the 'residual sum of squares'), and residual standard deviation, were calculated to quantify an overall measure of the discrepancy between observed and simulated groundwater elevations provided by the calibrated model. The objective of the model calibration is to minimize these residual statistics.

Another quantitative assessment of the calibration was conducted by comparing the difference between observed and simulated total baseflow for the model domain, with the goal of minimizing this difference.

A further quantitative measure of the calibration was provided by the simulated volumetric water budget reported by MODFLOW-NWT, indicating the quantities of flow into and out of the model domain via the groundwater flow components specified in the model. The volumetric budget was reviewed to ensure that the total inflows and outflows were consistent with the CSM, and to ensure that the discrepancy between simulated inflows and outflows is less than 1 percent, indicating that a satisfactory numerical convergence was obtained for the solution of the groundwater flow equation.

6.3 Groundwater Flow Model Calibration Results

The locations of all calibration targets are presented on Figure 2.4. The base case, dry, and wet condition calibration targets are listed in Tables 6.1, 6.2, and 6.3, respectively. Figures 6.1, 6.2, and 6.3 present simulated versus observed groundwater elevation contours in the overburden/shallow bedrock for the base case, dry, and wet conditions, respectively. Figures 6.1, 6.2, and 6.3 provide a qualitative evaluation of the model calibration and demonstrate that there is reasonably good agreement between the simulated and observed groundwater elevations and groundwater flow directions in the overburden.

Tables 6.1, 6.2, and 6.3 present the calibration residual at each target location for the base case, dry, and wet conditions, respectively. Scatter plots of observed versus simulated groundwater elevations are presented on Figures 6.4, 6.5, and 6.6 for the base case, dry, and wet conditions, respectively. Figures 6.4, 6.5, and 6.6 all show there is a reasonable distribution of plotted points above and below the line of exact match. This indicates that there is limited spatial bias in areas of over- and under-predicted groundwater elevations throughout the monitoring well network for all three calibration cases. The residual values at each target location are presented on Figures 6.1, 6.2, and 6.3 and demonstrate that the over- and under-predictions of observed groundwater elevations have a reasonably random distribution throughout the Beaver Dam Mine Site and surrounding area. This further supports that there is limited spatial bias in areas of over- or under-predicted groundwater elevations, and particularly so when considering that the range in observed groundwater elevations varies between 33.99 m to 35.16 m across all three calibration conditions.

The residual statistics for the base case calibrated model are summarized on Figure 6.4. The calibrated model provides a residual mean of -0.13 m, an absolute residual mean of 0.78 m, a residual sum of squares of 83.42 m^2, and residual standard deviation of 1.30 m. These residual statistics were minimized during the model calibration process while maintaining a reasonable representation of observed groundwater flow directions. The residual statistics for the base case calibrated model are considered reasonably small. There are a limited number of target locations that are distant from the primary area of interest surrounding the proposed open pit mine that have relatively larger residual values (i.e., MW-21B and MW-21C). MW-21B and MW-21C are far removed from the area of interest, are located in an area of more coarse model cell discretization, and exhibit significant downward gradients relative to other monitoring locations likely because they are located in an area of steep topographic relief. Improving the match to MW-21B and MW-21C is not possible without deteriorating the overall match to observed groundwater elevations. Since these locations are distant from the primary area of interest (i.e., the proposed open pit mine), improving the match to observed groundwater elevations at these locations is not warranted.

The residual standard deviation for the base case calibrated model is only 3.7 percent of the range in the base case condition calibration target dataset, as indicated on Figure 6.4. Spitz and Moreno (1996) suggest that the residual standard deviation should be less than about 10 percent of the range in measured groundwater elevations used as calibration targets. The residual standard deviation for the calibrated model lies well below this metric. This result, combined with the residual mean and the absolute mean being less than 1.0 m, indicates that the base case calibrated model provides a reasonably good match to the measured groundwater elevations.

The residual statistics for the model calibration to dry and wet conditions are summarized on Figures 6.5 and 6.6, respectively. In general, the dry and wet condition residual statistics are similar to the base case calibration, which demonstrates that a good calibration was obtained to both the dry and wet condition calibration datasets.

The simulated baseflow for the base case condition is 49,226 m^3/d which is within approximately 4 percent of the estimated baseflow of 47,299 m^3/d for the model domain. This indicates that a good match was obtained to the estimated baseflow, which further supports that a reasonable model calibration was obtained.

The volumetric water budget for the calibrated model was examined for the model calibration to the base case, dry and wet conditions. A discrepancy of close to zero occurs in the water budget between the simulated inflow and outflows for all three cases, which demonstrates that good numerical convergence was achieved throughout the model domain for all three calibration datasets.

Table 6.4 presents the calibrated parameter values and the corresponding bounds applied during model calibration. In general, the bounds for hydraulic conductivity values were determined from the hydraulic conductivity values obtained from the slug tests and packer tests conducted at the Beaver Dam Mine Site (see Tables 2.1, 2.2, and 2.3). The recharge bounds were set based on the baseflow analysis presented in Section 2.3.4.1.

The overburden hydraulic conductivity assigned to the calibrated model in the vicinity of MW-12A is approximately one order of magnitude below the minimum observed overburden hydraulic conductivity of 6.1×10^{-7} m/s. The measured overburden hydraulic conductivity at MW-12A of 8.8×10^{-7} m/s is near the minimum measured overburden hydraulic conductivity, and is located in a silt-clay drumlin that is expected to have a lower hydraulic conductivity value relative to the surrounding quartzite till overburden. The reduced overburden hydraulic conductivity in the vicinity of MW-12A better reflects the groundwater mounding in the overburden observed at MW-12A. As shown in Table 6.4, the calibrated variable hydraulic conductivity distribution assigned to the overburden has an average value of 1.4×10^{-4} m/s, which is within the range of measured overburden hydraulic conductivity values.

As shown in Table 6.4, the calibrated hydraulic conductivity for the shallow bedrock ranges from 3.7×10^{-7} to 4.3×10^{-7} m/s across the different shallow bedrock hydraulic conductivity zones (i.e., argillite, greywacke, granite, Cameron Flowage Fault, and Mud Lake Fault). The calibrated hydraulic conductivity for all zones in the deep bedrock is 3.3×10^{-9} m/s (i.e., deep argillite, greywacke, granite, Cameron Flowage Fault, and Mud Lake Fault).

A horizontal to vertical hydraulic conductivity anisotropy ratio of 5:1 was applied in the overburden to represent horizontal stratification of the different soil types (clay, silty, sand and gravel/cobbles) that make up the overburden. A horizontal to vertical hydraulic conductivity anisotropy ratio of 1:1 was applied in bedrock to represent the relatively uniform vertical to horizontal hydraulic characteristics of the folded and fractured bedrock.

The calibrated hydraulic conductivity values are generally consistent with the measured hydraulic conductivity values obtained from slug tests and packer tests conducted at the Beaver Dam Mine Site. The calibrated hydraulic conductivity for the shallow bedrock tended towards a higher value (3.7×10^{-7} to 4.3×10^{-7} m/s), while the calibrated hydraulic conductivity for the deep bedrock tended towards a lower value (3.3×10^{-9} m/s), which is consistent with the CSM of reduced permeability with depth in the bedrock, as presented in Section 3. The calibrated hydraulic conductivity values in the shallow and deep bedrock do not vary significantly with rock type, which is consistent with packer test results that showed similar hydraulic conductivity values in argillite and greywacke, as well as within the Mud Lake Fault Zone.

For the base case, dry, and wet conditions, the calibrated recharge rates are 197, 230, and 255 mm/yr, respectively. The range in calibrated recharge rates for the base case, dry, and wet conditions is within the range of 77 to 377 mm/yr identified through the baseflow analysis presented in Section 2.3.4.1. The range in calibrated recharge rates also is consistent with regional recharge estimates of 220 to 260 mm/yr for the primary watershed containing the Beaver Dam Mine Site (Kennedy et al., 2010).

6.4 Calibrated Model Sensitivity Analysis

GHD conducted a sensitivity analysis of the calibrated model to evaluate the potential impact of parameter changes on the calibrated model results and to address uncertainties associated with the model input parameters. A total of 15 model input parameters were considered in the sensitivity analysis, including all of the model input parameters (i.e., boundary conditions and hydraulic properties) that were adjusted during model calibration.

A series of sensitivity simulations for base case, dry, and wet condition model calibration target sets were conducted for each model input parameter. Each input parameter value was adjusted while holding all other input parameter values the same as those specified in the calibrated model. The value of each parameter was adjusted by three gradations above and below the value specified in the calibrated model. In general, the input parameter values were adjusted based upon the range of parameter values specified for the PEST calibration simulations. For the overburden, the variable hydraulic conductivity distribution was adjusted uniformly by a specified hydraulic conductivity value such that the average overburden hydraulic conductivity value varied within the specified range in observed overburden hydraulic conductivity values.

A total of 90 sensitivity simulations were conducted; six for each of the 15 model input parameters. For each sensitivity simulation, the residual sum of squares (RSS) between the observed and simulated groundwater elevations was determined for the base case, dry, and wet conditions. The percent difference between the residual sum of squares for each sensitivity simulation and that of the calibrated model was calculated. Table 6.5 presents the adjustments that were made to each input parameter value in the sensitivity simulations. The resulting change in the residual sum of squares also is shown in Table 6.5. Of the 90 sensitivity simulations, only five provided an improvement in the residual sum of squares of greater than 1 percent across the base case, dry, and wet condition calibration target datasets. Two of these corresponded to a decrease in hydraulic conductivity for the deep greywacke unit, two corresponded to an increase in the deep granite hydraulic conductivity, and one corresponded to a decrease in the deep Mud Lake Fault hydraulic conductivity.

The sensitivity analysis changes to the deep greywacke and deep Mud Lake Fault hydraulic conductivity values were not incorporated into the calibrated model since a decrease in the hydraulic conductivity for those units would approach the lower bound of the observed range for those parameter values and doing so would not be conservative with respect to conducting predictive simulations for the development of the Beaver Dam Mine Site (i.e., reducing the hydraulic conductivity of the deep greywacke unit would reduce the lateral extent of groundwater drawdown, reduce changes in baseflow, and reduce COC mobility under mine development conditions).

The sensitivity analysis changes to the hydraulic conductivity of the deep granite unit also were not incorporated into the model since the net improvement in the RSS achieved by these changes would only result in improving the match to observed groundwater elevations at MW-21C, which as discussed in Section 6.3, is far removed from the area of interest. When MW-21C is excluded from the calibration target datasets, increasing the hydraulic conductivity of the deep granite unit increases the RSS for the each of base case, dry, and wet conditions by more than 5 percent. This result represents a less optimal calibration to the remaining calibration targets that more closely correspond to the area of interest for the Beaver Dam Mine Site.

The sensitivity analysis results demonstrate that the input parameter values applied in the calibrated model are at or near optimal to match all three calibration target datasets and/or provide a conservative bias with respect to conducting the predictive simulations for the development of the Beaver Dam Mine Site.

To further examine parameter sensitivity, GHD also applied PEST to calculate the composite sensitivity of each model input parameter with respect to all calibration targets. A higher sensitivity value indicates that a parameter is well defined by the model calibration targets while a lower sensitivity value indicates that a parameter is less well defined by the model calibration targets. Those parameters that are less well defined by model calibration targets require further evaluation were they have the potential to significantly impact predictive simulations for the development of the Beaver Dam Mine Site. Figure 6.7 presents the calculated composite sensitivity values for each input parameter adjusted during model calibration. Figure 6.7 illustrates that the recharge rates, the overburden hydraulic conductivity and the shallow greywacke hydraulic conductivity have the highest composite sensitivity values and are most well defined by model calibration targets. This is expected as the recharge rates control the amount of water available throughout the model domain and the majority of calibration targets are located within the overburden and shallow greywacke units. The input parameters with lower composite sensitivity values, most specifically the hydraulic conductivity values for the Mud Lake and Cameron Flowage Fault Zones, may have some potential to impact predictive simulations for the development of the Beaver Dam Mine Site. This is evaluated through conducting additional sensitivity analysis of the predictive simulations that incorporate variations in these parameter values from that applied in the calibrated model, as discussed in Section 7.5.

7. Groundwater Flow Model Application

As described in Section 1.1, the primary objectives of this modelling effort include simulating the predictive scenarios to estimate the following:

1. Groundwater inflow rates into the open pit mine at EOM
2. Groundwater drawdown at EOM and PC
3. Pit infilling rates following EOM
4. Change in groundwater discharge to/from surface water features at EOM and PC
5. Transport of COCs from mine features into the surrounding environment at EOM and PC

GHD implemented the EOM and PC scenarios in the calibrated model to simulate potential impacts of the Beaver Dam Mine Site development. Where appropriate, predictive simulation results are compared against spatial boundaries and regulatory guidelines to assess the extent and significance of potential impacts. The implementation of the EOM and PC scenarios in the calibrated groundwater flow model is described in Section 7.1. Sections 7.2 and 7.3 present the definition of spatial boundaries and applied regulatory criteria, respectively, to assess the potential impacts of the EOM and PC scenarios. The predictive simulation results are summarized in Section 7.4.

7.1 Scenario Implementation

7.1.1 Estimation of Groundwater Inflow Rates at EOM

EOM was simulated through the incorporation of the proposed open pit mine and surface water management ditches into the calibrated models for the base case, dry, and wet conditions. The surface water management ditches were incorporated by specifying drain boundary conditions corresponding to the proposed ditch locations and dimensions, as discussed in Section 5.2.4. The open pit mine was represented by specifying drain cells along the perimeter of the proposed open pit mine. Internal model cells within the proposed open pit mine are set to no-flow boundaries. The stage elevation of the drain cells was set based on the proposed pit floor elevations provided by AMNS. As discussed in Section 5.2.4, a high conductance value of 1,000 m^2/d was assigned to the drain cells such that water entering a drain cell would discharge to the open pit without resistance (when the groundwater elevation is above the drain stage elevation). The simulated volumetric flow of water entering the pit drain cells was summed over the entire pit to estimate the total groundwater inflow rate into the pit at EOM under the base case, dry, and wet conditions.

7.1.2 Estimation of Drawdown at EOM and PC

Simulated drawdown was estimated through comparing simulated groundwater elevation contours under the calibrated base case, dry, and wet conditions against those simulated under each condition at EOM and PC. To estimate drawdown for each condition, simulated groundwater elevation contours at EOM or PC were subtracted from simulated groundwater elevation contours for the calibrated model (i.e., to estimate drawdown under dry conditions, EOM groundwater elevation contours under dry conditions were subtracted from groundwater elevation contours for the dry condition calibrated model). The extent of drawdown was compared against the project area (PA), local assessment area (LAA), and regional assessment area (RAA) boundaries shown on Figure 1.1, and also against the Property Boundary shown on Figure 7.1a.

7.1.3 Pit Infilling Rate

The pit infilling rate was developed by calculating the groundwater inflow rate at specific stage elevations as the proposed open pit mine fills with water following EOM and fills towards the PC pit lake level. The groundwater inflow rate was calculated in a 10 m increment from an initial stage elevation of -30 m AMSL (approximately 15 m above the proposed open pit mine floor) to a final pit lake elevation of 127 m AMSL (GHD, 2021a). As pit infilling progressed, drain cells with stage elevations below the specified pit lake stage elevation were converted to GHB cells to allow either groundwater discharge to the pit or groundwater recharge from the pit. Drain cells located above the specified pit lake stage elevation remained unchanged from the EOM condition so that simulation of only groundwater discharge to the pit would continue at these drain cells. The stage elevation of the GHB cells was set to the specified pit lake stage elevation. As discussed in Section 5.2.5, the conductance of the GHB cells was set to a high value of 1,000 m^2/d to ensure that any groundwater entering the GHB cells would interact freely (i.e., without resistance) with the pit lake.

Calculated groundwater inflow rates were incorporated into the Beaver Dam Mine Site water balance analysis (GHD, 2021b) to predict the pit infilling time.

7.1.4 Simulated Change in Baseflow

GHD applied the numerical groundwater flow model to evaluate potential changes in baseflow that may occur at the Beaver Dam Mine Site under EOM and PC conditions. The simulated baseflow was calculated through a mass balance of river and drain boundary conditions within the model domain (i.e., baseflow is equal to the simulated groundwater recharge from surface water features minus groundwater discharge to surface water features). The simulated baseflow at EOM is subtracted from the simulated baseflow for the calibrated model to estimate the potential change in baseflow. The potential change in baseflow is also estimated at PC. The change in baseflow is calculated under base case, dry, and wet conditions to estimate a potential range in baseflow changes moving from the current conditions (i.e., the calibrated model), to EOM conditions, and then to PC conditions. The potential change in baseflow is compared to the estimated total flow and estimated baseflow in Cameron Flowage.

7.1.5 COC Transport

The development of the Beaver Dam Mine Site has the potential to degrade groundwater and surface water quality within and surrounding the PA. Water that may have associated COC concentrations and could migrate into the surrounding environment includes:

- Water released from the open pit lake
- Water that migrates through the topsoil stockpiles, till stockpiles, and low-grade ore (LGO) stockpile
- Water that migrates through the non-acid generating (NAG) and potentially acid generating (PAG) waste rock stockpiles

Figure 7.1a shows the location of the open pit lake and the stockpiles. GHD developed a contaminant transport model to simulate the potential migration of COCs from these locations at EOM and PC.

A geosynthetic cover is proposed for the PAG waste rock stockpile to reduce precipitation infiltration into the PAG waste rock stockpile during PC. The geosynthetic cover will reduce the volume of seepage from the PAG waste rock stockpile that could recharge groundwater thereby reducing the potential COC mass loading to groundwater. The geosynthetic cover will be designed to reduce infiltration into the stockpile to under 3% of average annual precipitation. Therefore, the PAG waste rock stockpile cover is represented in the PC scenarios through specifying a recharge rate over the stockpile equal to 3% of average annual precipitation.

Three naturally occurring transport mechanism zones were specified, including the overburden, shallow bedrock, and deep bedrock. The transport mechanism zones reflect the difference in transport processes that occur within each zone, such as different effective porosities within each zone. Effective porosity values of 0.15, 0.1, and 0.02 were assigned to the overburden, shallow bedrock, and deep bedrock, respectively.

The COCs are treated as a conservative tracer using a constant unit concentration specified within each source zone. Sorption/retardation and reactions along the groundwater flow path, which may reduce COC concentrations, are assumed to be negligible and therefore were not simulated. This is conservative with respect to simulating potential COC migration. The COC transport mechanisms implemented in each zone include advection and dispersion only, which are discussed in Sections 7.1.5.1 and 7.1.5.2, respectively.

COC migration was simulated using MT3DMS-USGS. For each potential source zone that may have a unique source concentration (i.e., full pit lake, topsoil stockpiles, till stockpiles, LGO stockpile, and NAG and PAG waste rock stockpiles), an independent transport simulation was conducted. The source concentrations for each source zone were obtained from Lorax Environmental (2021) for EOM and PC conditions and are presented in Table 7.1. The total simulation duration for each scenario was selected based on the duration that potential source will be present, and to provide a conservative bias with respect to the simulated concentration at receptor locations. The duration for which each potential source is simulated to be active is described below:

- The LGO stockpile, and the till and topsoil stockpile source terms are simulated to be active for 10 years. The LGO stockpile will be removed from the Site after approximately 4 years, once the mining operation is complete. The topsoil and till stockpiles will be used in reclamation and also will be removed after approximately 4 years, once the mining operation is complete. Assuming a 10-year source duration provides a conservative bias with respect to simulating potential COC migration from the LGO stockpile, and the topsoil and till stockpiles.
- The transition from EOM to the onset of slightly acidic drainage and corresponding PC source terms will take at least 20 years (Lorax Environmental, 2018). Therefore, sources that are not removed at the end of the mine operation (i.e., the NAG and PAG stockpiles) are simulated for 50 years to provide a conservative bias with respect to the extent of the simulated COC concentration distribution and COC concentrations simulated at potential receptors (i.e., the nearby surface water features).
- The PC sources are simulated for 500-years to approximate steady-state conditions and provide a conservative estimate of potential long-term impacts relative to the maximum extent of the simulated COC concentration distributions and maximum COC concentrations simulated at potential receptors.

The concentration at each model cell simulated to migrate from the unit concentration specified at the source locations was multiplied by the source concentration associated with each potential source. Then, using the principle of superposition[5], the concentrations were summed across the transport simulations for all sources (i.e., full pit lake, topsoil stockpiles, till stockpiles, LGO stockpile, and NAG and PAG waste rock stockpiles) to estimate the total predicted COC concentrations throughout the model domain. The COC mass loading to each surface water feature was determined by multiplying the predicted COC concentrations in each model cell representing the surface water features by the groundwater discharge simulated to those model cells.

[5] The principle of superposition states that for a linear problem (i.e., the 3D contaminant transport equation), the net response cause by two or more stimuli (e.g., contaminant sources) is the sum of the responses that are caused by each stimuli individually. Therefore, each source zone can be simulated independently and summed together to estimate the total combined impact of all sources at a given receptor.

7.1.5.1 Advection

Advection, the bulk movement of a fluid through a geologic medium, is the primary transport mechanism at the Beaver Dam Mine Site. The advection mechanism is governed by Darcy's Law, which determines the groundwater flow velocity, accounting for the hydrogeologic characteristics (hydraulic gradients, hydraulic conductivity, and porosity), of the aquifer. Groundwater flow conditions simulated by MODFLOW-NWT represent advection throughout the entire model domain. MT3DMS-USGS uses the groundwater flow field simulated by MODFLOW-NWT as input for solving the advection-dispersion transport equation.

7.1.5.2 Dispersion

Dispersion is a transport mechanism by which a solute spreads along the groundwater flow path. Dispersion results from two basic processes: molecular diffusion; and mechanical mixing. Molecular diffusion is a process where solutes move from zones of higher concentrations to zones of lower concentrations. The driving force of this movement is kinetic activity at the molecular level. Mechanical dispersion occurs due to the variability (i.e., heterogeneity) in pore-space groundwater velocities that act to spread or mix a solute in an aquifer. The primary aquifer characteristics that cause this mixing are variable frictional forces in pore channels, variations in pore channel geometry, and pore channel branching.

Dispersion/spreading of solutes during groundwater flow results in dilution of solute pulses and attenuation of concentration peaks. This dilution/attention affect is accounted for in the transport equation by applying longitudinal, transverse, and vertical dispersivity coefficients in a 3D domain.

Obtaining field measurements of the dispersivity is impracticable. However, simple estimate techniques, based on the length of plume or distance to the measured point ("scale"), are available by compiling field data. It is noted that researchers indicate dispersivity values can range over two to three orders of magnitude for a given value of plume length or distance to a measurement point (Gelhar et al., 1992). Empirical relationships of dispersivity versus plume length (L_P) are provided by Al-Suwaiyan (1996) and Xu and Eckstein (1995), as follows:

$$\alpha_L = 0.82(\log_{10}(L_P))^{2.446}$$

Where:

α_L = is the longitudinal dispersivity in m

L_P = is the estimated plume length (m)

The plume length or scale is assumed to be 900 m, roughly corresponding to the maximum distance from a potential source zone (i.e., the waste rock piles) to a potential groundwater receptor (i.e., Mud Lake). Using an assumed plume length of 900 m, an estimated longitudinal dispersivity value of 11.6 m was calculated. The horizontal transverse dispersivity was specified to be 1/10 of the longitudinal dispersivity and the vertical transverse dispersivity was assumed to be 1/100 of the longitudinal dispersivity, as suggested by Gelhar et al. (1992) and Spitz and Moreno (1996).

7.1.6 Particle Tracking

GHD applied particle tracking methods as a means to evaluate the effectiveness of potential mitigation measures at providing hydraulic containment of COCs. Particle tracking is a conservative means to delineate hydraulic containment and potential migration in groundwater because it reflects only advective migration processes. Particle tracking does not account for attenuation mechanisms, such as degradation, adsorption/precipitation, and dispersion that serve to slow and reduce COC concentrations as migration occurs in groundwater. Particle tracking using MODPATH is significantly more computationally efficient than contaminant transport using MT3D-USGS for the specific purpose of evaluating hydraulic containment and was therefore selected to evaluate potential mitigation measures.

7.2 Spatial Boundaries

The spatial boundaries considered in the evaluation of potential groundwater impacts resulting from the Beaver Dam Mine Site development are the PA, LAA, RAA, and Property Boundary. The Property Boundary is the compliance point with respect to potential groundwater impacts. The PA, LAA, and RAA boundaries are presented on Figure 1.1, and the Property Boundary is presented on Figure 7.1a. The PA encompasses the proposed Beaver Dam Mine Site features including the open pit, LGO stockpile, NAG/PAG waste rock stockpiles, and Haul Road. The LAA encompasses an 800 m buffer from the PA, as required by the Province of Nova Scotia with respect to blasting for mining and construction projects. The RAA aims to account for the maximum extent of potential groundwater quality and quantity impacts and roughly corresponds to the extent of the groundwater flow model domain.

7.3 Regulatory Guidelines

Potential groundwater quality impacts should be compared against appropriate groundwater quality guidelines. While there are no potable groundwater uses at the Beaver Dam Mine Site, a portion of the Beaver Dam Mine Site is located on Crown land and potentially could be considered potable in the future. Therefore, simulated COC concentrations are compared against the Nova Scotia Environment (NSE) Tier 1 Environmental Quality Standards (EQS) for potable course grained soil for agricultural/residential use and maximum acceptable concentrations (MAC) specified under the Guidelines for Canadian Drinking Water Quality (GCDWQ). It is recognized that some COCs, including arsenic and manganese, are naturally present in groundwater at concentrations that exceed NSE Tier 1 EQS or MACs specified under the GCDWQ.

The impact to surface water quality that potentially could result from developing the open pit mine is assessed through the an evaluation of predicted groundwater COC concentrations relative to Tier 2 Pathway Specific Standard for groundwater discharge to surface water (Tier 2 PSS) and through the Predictive Water Quality Assessment for the Beaver Dam Mine Site (GHD, 2021a). The evaluation of predicted groundwater COC concentrations relative to Tier 2 PSS provides an indication of areas where groundwater COC concentrations may impact surface water bodies while the Predicted Water Quality Assessment (GHD, 2021a) evaluates the potential significance of that impact at compliance points. Simulated loadings of COCs from groundwater to surface water are combined with predicted surface water runoff from the Site to estimate surface water COC concentrations at compliance points as discussed in GHD (2021a). Predicted surface water quality is compared against Metal and

Diamond Mining Effluent Regulations (MDMER), Canadian Council of Ministers of the Environment (CCME) Guidelines for the Protection of Aquatic Life, and Site-Specific Water Quality Guidelines.

7.4 Scenario Simulation Results

7.4.1 Simulated Groundwater Inflow Rates at EOM

Steady-state groundwater inflow rates into the open pit were simulated under base case, dry, and wet conditions at EOM. The simulated volumetric flow from the pit drain cells was summed over the entire open pit to estimate the range of potential groundwater inflow rates into the open pit (presented in Table 7.2). The steady-state simulated pit groundwater inflow rates range from 531 m^3/d under dry conditions to 655 m^3/d under wet conditions. The simulated pit groundwater inflow range is consistent with the range of estimated groundwater inflow rates from 550 to 1,450 m^3/d presented in PCA (2015).

7.4.2 Simulated Drawdown

Figures 7.1a/b, 7.2a/b, and 7.3a/b show plan view simulated drawdown for EOM/PC under base case, dry, and wet conditions, respectively. Figures 7.4a/b, 7.5a/b, and 7.6a/b show simulated drawdown through a cross-section of the proposed open pit for EOM/PC under base case, dry, and wet conditions, respectively. As shown on Figure 7.3a, the greatest extent of drawdown is simulated under wet conditions at EOM. A maximum drawdown of approximately 0.5 m is simulated adjacent to Cameron Flowage within the PA, as shown on Figure 7.2a. Maximum simulated drawdown at EOM is generally less than 10 cm outside of the PA, with the exception of the area between the till stockpiles and Cameron Flowage where the maximum drawdown reaches approximately 1 m. Simulated drawdown is negligible beyond the LAA. Figures 7.1b, 7.2b, 7.3b, 7.4b, 7.5b, and 7.6b show that simulated drawdown decreases at PC relative to EOM for all conditions.

7.4.3 Estimated Pit Infilling Rate

Based on the simulation results, the estimated groundwater inflow rate into the open pit at each stage is presented in Table 7.3. GHD (2021b) combines the estimated groundwater inflow rates into the open pit with precipitation/evaporation, pit wall runoff, and surface water ditch inflow to estimate the pit infilling time based on all inflows to the pit. The estimated pit infilling time considering all inflows is 13 years, as presented in GHD (2021b).

7.4.4 Simulated Change in Baseflow

GHD applied the calibrated groundwater flow model to simulate potential changes in baseflow that may occur at the Beaver Dam Mine Site under EOM and PC conditions. The simulated within the overall groundwater flow model domain and to simulated watercourses is presented in Table 7.4. The simulated baseflow reduction over the entire groundwater flow model domain ranges from 677 to 754 m^3/d at EOM and from 446 to 620 m^3/d at PC, representing 2 to 3 percent of the total baseflow contribution to the Cameron Flowage watershed, and less than 1 percent of the total estimated average annual flow in Cameron Flowage as presented in Section 2.3.3.1.

The calibrated groundwater flow model was also used to simulate changes in baseflow within the field delineated watercourses under EOM and PC conditions. For average conditions, baseflow contribution to Cameron Flowage, adjacent to the proposed open pit, is simulated to decrease by an average of 41 percent relative to baseline conditions at EOM and 22 percent at PC. Baseflow within the Killag River downstream of Cameron Flowage is simulated to decrease by an average of 2 percent relative to baseline conditions at both EOM and PC. Baseflow within the Crusher Lake area is simulated to increase slightly by 1 and 2 percent relative to baseline conditions at EOM and PC, respectively. Baseflow in Mud Lake is simulated to decrease by 45 percent relative to baseline at EOM and by 39 percent at PC. Base contribution to WC2 is predicted to decrease by 8 and 28 percent under EOM and PC, respectively. Baseflow in WC3 is simulated to decrease by 16 percent relative to baseline conditions at EOM and by 19 percent at PC. Baseflow contribution to WC5 is simulated to decrease by 5 percent relative to baseline conditions at EOM and by 2 percent at PC. Baseflow in WC19 and WC27 are simulated to change by less than 2 percent relative to baseline conditions at both EOM and PC.

Under low-flow conditions, corresponding to August 16 through 29, 2019, the estimated baseflow contribution to Cameron Flowage is 335 m^3/d. Through applying the simulated reduction in baseflow of 42 percent and 24 percent, corresponding to EOM and PC, respectively, the potential change in total flow can be estimated. By reducing the baseflow contribution to Cameron Flowage by 42 percent and 24 percent, it is estimated that the total flow within Cameron Flowage during low-flow conditions will decrease by approximately 4 percent and 2 percent under EOM and PC conditions, respectively.

To mitigate potential impacts to flow within Cameron Flowage, during mine operations, all groundwater discharge to the open pit mine and to the surface water management ditches will be managed and ultimately discharged to back into Cameron Flowage. Once the pit lake has reached 127 m AMSL the pit will naturally discharge to Cameron Flowage. Therefore, no reduction in total flow is expected during mine operation or once the pit has filled.

Of the total simulated baseflow reduction, approximately 50 to 60 percent of the total baseflow reduction is simulated to occur within the Property Boundary and the remaining 40 to 50 percent of total baseflow reduction is simulated to occur between the Property Boundary and the LAA indicating that mine operations will not impact the baseflow beyond LAA. Within the LAA approximately 40 to 75 percent of the baseflow reduction is simulated to occur within Cameron Flowage.

7.4.5 Simulated COC Transport

GHD conducted COC transport simulations to estimate the extent and significance of potential COC impacts to groundwater and surface water. The potential COC impacts to groundwater are assessed through comparing predicted COC concentrations in groundwater against the lower of the Tier 1 EQS for potable groundwater or GCDWQ, hereafter referred to as the ′Potable Criteria′. Predicted COC concentration distributions are presented for COCs that are simulated to exceed the Potable Criteria. For these COCs, the extent of the simulated exceedance is compared to the spatial boundaries described in Section 7.2.

The potential COC impacts to surface water are assessed through comparing predicted COC concentrations in groundwater against Tier 2 PSS and through developing simulated groundwater COC mass loadings to surface water for all COCs. The simulated groundwater COC mass loadings to surface water are provided as inputs into the Predictive Water Quality Assessment (GHD, 2021a).

Within GHD (2021a), the groundwater COC mass loadings are combined with COC mass loadings from surface water runoff to assess the combined potential impact of surface water and groundwater discharge from the Beaver Dan Mine Site on Killag River surface water quality.

Figures 7.7 through 7.13 present the simulated COC exceedances of the Potable Criteria for the base case and upper case source terms under base case conditions for EOM, as follows:

- Arsenic (Figures 7.7 and 7.8) is predicted to exceed its Potable Criteria in the vicinity of the NAG and PAG waste rock stockpiles for both the base case and upper case source terms, and in the vicinity of the topsoil stockpiles for the upper case source term. The simulated arsenic Potable Criteria exceedances occur within the Property Boundary, except small isolated areas north of the NAG waste rock stockpile and the topsoil stockpile south of Mud Lake. As discussed in Lorax Environmental (2021), the simulated arsenic exceedance is expected to be temporary since arsenic concentrations will decrease as EOM source terms transition to the PC source terms. It should be noted that arsenic is naturally occurring in groundwater at the Beaver Dam Mine Site and is found at concentrations above the Potable Criteria under baseline conditions. Therefore, the potential release of arsenic at concentrations above its Potable Criteria does not represent a significant reduction in the beneficial use of groundwater at the Beaver Dam Mine Site, since groundwater requires treatment for arsenic to meet its Potable Criteria under baseline conditions.
- Manganese (Figure 7.9) is predicted to exceed its Potable Criteria at the till stockpiles for the upper case source term. The simulated manganese Potable Criteria exceedance is located within the Property Boundary and the exceedance is expected to be temporary since the till stockpiles are to be removed during reclamation of the Beaver Dam Mine Site.
- Nitrate (Figures 7.10 and 7.11) is predicted to exceed its Potable Criteria in the vicinity of the NAG waste rock stockpile for both the base case and upper case source terms. The simulated nitrate Potable Criteria exceedance is located within the Property Boundary. Furthermore, nitrate concentrations will decrease as nitrate is leeched from and depleted within NAG waste rock stockpile. Nitrate concentrations are predicted to decrease from the maximum simulated concentrations shown on Figures 7.10 and 7.11 to below the Potable Criteria within approximately 10 years and 25 years for base case and upper case source terms, respectively.
- Uranium (Figures 7.12 and 7.13) is predicted to exceed its Potable Criteria in the vicinity of the NAG waste rock stockpile for both the base case and upper case source terms, and in vicinity of the PAG waste rock stockpile for the upper case source term. The simulated uranium Potable Criteria exceedance is located within the Property Boundary. As discussed in Lorax Environmental (2021), the simulated uranium exceedance is expected to be temporary since uranium concentrations will decrease as EOM source terms transition to the PC source terms.

Figures 7.14 through 7.28 present the simulated COC exceedances of the Potable Criteria for base case and upper case source terms under base case conditions for PC, as follows:

- Arsenic (Figure 7.14), cadmium (Figure 7.16), cobalt (Figure 7.18), manganese (Figure 7.20), nickel (Figure 7.22), lead (Figure 7.24), and uranium (Figure 7.26) are predicted to exceed the Potable Criteria in the vicinity of the PAG waste rock stockpile for the base case source term. The predicted exceedances of the Potable Criteria all occur within the Property Boundary.

- Arsenic (Figure 7.15), cadmium (Figure 7.17), cobalt (Figure 7.19), manganese (Figure 7.21), nickel (Figure 7.23), lead (Figure 7.25), uranium (Figure 7.27), and zinc (Figure 7.28) are predicted to exceed the Potable Criteria in the vicinity of the PAG waste rock stockpile for the upper case source term. In all cases the pit lake contains the majority of COCs migrating from the PAG waste rock stockpile, and no predicted exceedances of the Potable Criteria occur beyond the Property Boundary.

Simulated COC exceedances of the Potable Criteria for the base case and upper case source terms for EOM and PC under dry conditions are presented on Figures D.1 to D.22 of Appendix D. Simulated COC exceedances of the Potable Criteria for the base case and upper case source terms for EOM and PC under wet conditions are presented on Figures E.1 to E.22 of Appendix E. The Appendix D and E figures show that simulated COC exceedances of the Potable Criteria in groundwater do not change significantly from that predicted under base case conditions.

Figures 7.29 through 7.32 present the simulated COC exceedances of the Tier 2 PSS for the base case and upper case source terms under base case conditions for EOM, as follows:

- Aluminum (Figure 7.29 and Figure 7.30) is predicted to exceed its Tier 2 PSS in the vicinity of the topsoil stockpiles for both the base case and upper case source terms. The predicted exceedance is within the Property Boundary for the base case source terms (Figure 7.29) and extends slightly beyond the Property Boundary for the upper case source terms (Figure 7.30).
- Arsenic (Figure 7.31) and Cadmium (Figure 7.32) are predicted to exceed the Tier 2 PSS in the vicinity of the topsoil stockpiles for the upper case source term. The predicted exceedance is within the Property Boundary for both Arsenic and Cadmium.

Figures 7.33 through 7.47 present simulated COC exceedances of the Tier 2 PSS for base case and upper case source terms under base case conditions for PC, as follows:

- Aluminum (Figure 7.33), cobalt (Figure 7.37), iron (Figure 7.40), nickel (Figure 7.42), lead (Figure 7.44), and zinc (Figure 7.46) are predicted to exceed the Tier 2 PSS in the vicinity of the PAG waste rock stockpile for the base case source terms. The predicted exceedances do not reach nearby surface water features and are within the Property Boundary.
- Cadmium (Figure 7.35) is predicted to exceed the Tier 2 PSS in the vicinity of the PAG waste rock stockpile for the base case source terms. The simulated exceedances encroach on the Property Boundary and/or reach surface water features (either Cameron Flowage to the northwest of the PAG waste rock stockpile or mapped streams to the west of the PAG waste rock stockpile).
- Aluminum (Figure 7.34), cobalt (Figure 7.38), copper (Figure 7.39), iron (Figure 7.41), and zinc (Figure 7.47) are predicted to exceed the Tier 2 PSS in the vicinity of the PAG waste rock stockpile for the upper case source terms. The predicted exceedances do not reach the nearby surface water features and are within the Property Boundary.
- Cadmium (Figure 7.36), nickel (Figure 7.43), and lead (Figure 7.45) are predicted to exceed the Tier 2 PSS in the vicinity of the PAG waste rock stockpile for the upper case source terms. The simulated exceedances encroach on the Property Boundary and/or reach surface water features (either Cameron Flowage to the northwest of the PAG waste rock stockpile or mapped streams to the west of the PAG waste rock stockpile).

Simulated COC exceedances of Tier 2 PSS for the base case and upper case source terms for EOM and PC under dry conditions are presented on Figures F.1 to F.19 of Appendix F. Simulated COC exceedances of Tier 2 PSS for the base case and upper case source terms for EOM and PC under wet conditions are presented on Figures G.1 to G.19 of Appendix G. The Appendix F and G figures show that simulated COC exceedances of the Tier 2 PSS in groundwater do not change significantly from that predicted under base case conditions.

To further evaluate the potential risk to surface water features as a result of predicted Tier 2 PSS exceedances, GHD incorporated the simulated COC mass loading to surface water features into the Predictive Water Quality Assessment (GHD, 2021a) to predict COC concentrations in surface water features. The total simulated mass loading for each COC from groundwater discharge to surface water within the Killag River watershed is presented in Table 7.5 for EOM and PC for both the base case and upper case source terms. The predicted COC concentrations in surface water are compared to CCME Guidelines for the Protection of Aquatic Life at the near-field and far-field locations within the Killag River/Cameron Flowage. The Predictive Water Quality Assessment (GHD, 2021a) addresses any potential need for treatment of the effluent water prior to discharge into the Killag River such that the combined groundwater and surface water discharge into the Killag River will meet CCME Guidelines for the Protection of Aquatic Life. However, potential localized impacts to surface water features located to the west of the PAG waste rock stockpile may not be addressed. Therefore, GHD evaluated the effectiveness of potential mitigation measures that could be applied to address the potential migration of COCs to the west of the PAG waste rock stockpile should groundwater quality monitoring indicate that there may be potential exceedances of Tier 2 PSS. The evaluation of potential mitigation measures for groundwater migration west of the PAG waste rock stockpile is presented in Section 7.6.

It is also recognized that potential uncertainty in the quality or quantity of PAG waste rock deposited in the PAG waste rock stockpile could impact potential COC concentrations. Therefore, monitoring of the PAG waste rock material deposited in the PAG waste rock pile will be addressed through the Geochemical Characterization Management Plan. A contingency of in-pit disposal will be maintained throughout operation should the Geochemical Characterization Management Plan identify that the quality or quantity of PAG may exceed prediction.

7.5 Scenario Simulation Sensitivity Analysis

7.5.1 Pit Inflow Rate Sensitivity Analysis

GHD conducted a sensitivity analysis on simulated pit inflow rates under wet conditions to assess the sensitivity of the simulated pit inflow rates from changes to the input parameter values applied in the calibrated groundwater flow model. The sensitivity analysis included changes to the following parameters:

- Pit Conductance
- Mud Lake Fault Hydraulic Conductivity
- Cameron Flowage Fault Hydraulic Conductivity
- Deep Argillite Hydraulic Conductivity
- Deep Greywacke Hydraulic Conductivity

- Shallow Argillite Hydraulic Conductivity
- Shallow Greywacke Hydraulic Conductivity

The predicted pit inflow for sensitivity analysis simulation is presented in Table 7.6. As shown in Table 7.6, the simulated pit inflow rates for the sensitivity analysis range from 655 to 1,835 m^3/d. However, the maximum inflow rate of 1,835 m^3/d corresponds to a 661 percent increase in the RSS for the calibrated groundwater flow model under wet conditions, and therefore, is not supported by observed groundwater elevations. Thus, excluding the inflow rate of 1,835 m^3/d, the expected range in simulated pit inflow rates obtained through the sensitivity analysis is from 655 to 829 m^3/d, which compares well with the estimated range in pit inflow rates of 550 to 1,450 m^3/d presented in PCA (2015).

7.5.2 COC Transport Sensitivity Analysis

A sensitivity analysis of the simulated COC concentrations was conducted in accordance with British Columbia Ministry of the Environment Guidelines (Wels et al., 2012). As described by Wels et al. (2012), there are four types of uncertainty/sensitivity:

- Type 1: Modification of this parameter within a reasonable bound has an insignificant impact on both model calibration residuals and predictive simulation results
- Type 2: Modification of this parameter within a reasonable bound has a significant impact on model calibration residuals, but has an insignificant impact on predictive simulations results
- Type 3: Modification of this parameter within a reasonable bound has a significant impact on model calibration residuals and predictive simulation results
- Type 4: Modification of this parameter within a reasonable bound has an insignificant impact on model calibration residuals, but a significant impact on predictive simulations results

Type 1 and 2 sensitivities are not of concern for predictive simulations as their impact on the predictive simulation results are insignificant. Type 3 is only of concern for an uncalibrated model and while important has been addressed through model calibration and model calibration sensitivity analysis. Type 4 is of potential cause for concern because a non-uniqueness in a model input might allow a range of valid calibrations which could have significant impact on model predictions. A non-unique model calibration can occur when model calibration residuals are insensitive to changes in a given parameter value. Therefore, in addition to testing an increase in hydraulic conductivity values for the Mud Lake Fault Zone and Cameron Flowage Fault Zone, where the model calibration sensitivity analysis identified parameters which did not significantly impact model calibration residuals, changes to those parameters were further evaluated through COC transport sensitivity analysis.

The parameter changes considered in the COC transport sensitivity analysis of COC loadings to the Killag watershed are:

- Sens 1 – Shallow Cameron Flowage Fault Zone conductivity increase by 1 order of magnitude
- Sens 2 – Shallow Cameron Flowage Fault Zone conductivity increase by 2 orders of magnitude
- Sens 3 – Deep Cameron Flowage Fault Zone conductivity increase by 1 order of magnitude

- Sens 4 – Deep Cameron Flowage Fault Zone conductivity increase by 2 orders of magnitude
- Sens 5 – Shallow Mud Lake Fault Zone conductivity increase by 1 order of magnitude
- Sens 6 – Shallow Mud Lake Fault Zone conductivity increase by 2 orders of magnitude
- Sens 7 – Deep Mud Lake Fault Zone conductivity increase by 1 order of magnitude
- Sens 8 – Deep Mud Lake Fault Zone conductivity increase by 2 orders of magnitude
- Sens 9 – Deep greywacke unit conductivity set to 0.0001016 m/d
- Sens 10 – Deep greywacke unit conductivity set to 0.0000086 m/d
- Sens 11 – Deep granite unit conductivity set to 0.1095 m/d
- Sens 12 – Deep granite unit conductivity set to 0.0549 m/d
- Sens 13 – Deep Mud Lake Fault Zone conductivity set to 0.0000086 m/d

Tables 7.7 and 7.8 present the percent change in simulated COC loadings to surface water from groundwater for EOM and PC, respectively. As shown in Tables 7.7 and 7.8, the change in simulated COC mass loading identified through the sensitivity analysis ranged from a 1% increase to a 32% decrease for EOM, and from an 11% increase to a 17% decrease for PC. To determine the impact of the potential change in loading on predicted concentrations within the Killag River, the scenarios that resulted in the maximum increase in loading were carried through to the Predictive Water Quality Assessment (GHD, 2021a). The Predictive Water Quality Assessment showed that the potential changes in COC loading identified through the transport sensitivity analysis would result in a 0 to 2% change in the predicted COC concentrations within the Killag River and no additional exceedances of CCME surface water quality guidelines beyond that already identified for PC upper case source terms (GHD, 2021a). Therefore, the sensitivity analysis of the simulated COC loadings to surface water does not identify any additional significant impacts to the Killag River.

Since the sensitivity analysis was complete, minor modifications were proposed to the topsoil stockpile layout, and the extent of the till stockpiles. While these modifications were incorporated into the predictive simulation results as they can impact the potential extent of simulated COC impacts it is not necessary to revise the sensitivity analysis since the sensitivity analysis is not significantly impacted by minor modifications to the proposed infrastructure layout. Rather, the results of the sensitivity analysis are drive by the parameter changes considered, which are independent of the infrastructure layout considered.

7.6 Simulation of Potential Mitigation Measures

GHD conducted a particle tracking analysis to evaluate the effectiveness of potential mitigation measures to provide hydraulic containment of COCs predicted to migrate west from the PAG waste rock pile towards surface water features. Figures 7.48, 7.49 and 7.50 present simulated particle pathways for COC migration from the PAG waste rock stockpile under base case, dry, and wet conditions, respectively. Figures 7.51 through 7.53 show that COCs are predicted to migrate towards surface water features west of the PAG waste rock stockpile. Therefore, a potential mitigation measure is evaluated to mitigate simulated COC migration west of the PAG waste rock stockpile.

Due to the low permeability overburden and bedrock at the Beaver Dam Mine Site, groundwater extraction wells are not feasible for providing hydraulic containment of COC migration westward from PAG waste rock stockpile. Therefore, an interceptor trench was selected as a potential mitigation measure to intercept COCs that are predicted to migrate west from the PAG waste rock stockpile towards surface water features. Figures 7.51, 7.52, and 7.53 present the potential interceptor trench location west of the PAG waste rock stockpile and the simulated particle pathways for the base case, dry, and wet conditions, respectively, with the interceptor trench in place. The depth of the interceptor trench was adjusted to achieve hydraulic containment of the COCs predicted to migrate west from the PAG waste rock stockpile. The average depth of the interceptor trench is approximately 3 m below the interpolated top of weather bedrock, as necessary to maintain simulated hydraulic containment and also to achieve gravity drainage towards the pit. Figure 7.51 through 7.53 demonstrate that hydraulic containment of COC migration west from the PAG waste rock stockpile can be achieved through implementing an interceptor trench in this area should groundwater monitoring indicate that COC concentrations are approaching Tier 2 PSS guidelines. Should monitoring indicate that an interceptor trench is necessary, additional data collected throughout development of the Beaver Dam Mine Site can be applied to refine the design of this potential mitigation measure.

8. Summary and Conclusions

GHD developed a 3D numerical groundwater flow model to represent the geologic and hydrogeologic conditions within the overburden and bedrock observed at the Beaver Dam Mine Site and surrounding area. The 3D groundwater flow model is based on a 3D geologic model that GHD developed for the Beaver Dam Mine Site to facilitate a rigorous representation of the observed geology. GHD directly converted the 3D geologic model into a hydraulic conductivity zone distribution to apply in the 3D groundwater flow model. The groundwater flow model was developed using the USGS's MODFLOW-NWT groundwater flow computer program. GHD calibrated the groundwater flow model to provide a reasonable representation of the groundwater elevations and groundwater flow directions demonstrated in the base case (average annual), dry (September 13, 2018 through September 26, 2018) and wet (November 1, 2018 through November 14, 2018) calibration target datasets. Model calibration was compared against and provides a reasonable match to estimated baseflow conditions within the model domain. The model input parameters (e.g., hydraulic conductivity and recharge) applied in the calibrated model are consistent with observed Beaver Dam Mine Site conditions.

GHD conducted a sensitivity analysis of the calibrated model which demonstrated that model parameter input values were at or near their optimal values or were selected to provide a conservative bias with respect to predictive simulations. As a result, the calibrated model input parameters are considered reasonable and appropriate for providing a calibrated groundwater flow model suitable for use as a predictive tool to evaluate potential impacts of the Beaver Dam Mine Site development.

Using the calibrated model, GHD estimated that pit inflow rates could range from 531 to 829 m^3/d. It is further estimated that it will take approximately 13 years for the open pit to naturally fill to a pit lake elevation of 127 m AMSL following EOM.

GHD applied the calibrated model to estimate potential groundwater quantity impacts at EOM and PC. A maximum drawdown of 0.5 m was simulated adjacent to Cameron Flowage and simulated drawdown was generally less than 0.1 m outside of the PA, and negligible beyond the LAA. The simulated reduction in baseflow for the Cameron Flowage watershed represents approximately 4 to 5 percent of the total baseflow, and under 1 percent of the total estimated average annual flow in Cameron Flowage. Approximately 90 percent of the simulated baseflow reduction occurs within the PA, with the remaining 10 percent occurring within the LAA, supporting that Beaver Dam Mine Site development will not impact groundwater quantity beyond the LAA. Furthermore, all groundwater discharge to mine features will be managed and discharged to Cameron Flowage following treatment. Therefore, the total flow average annual flow in Cameron Flowage should not be impacted by the Beaver Dam Mine Site development during operation and once the pit lake has been filled and discharges naturally to Cameron Flowage.

GHD also applied the calibrated groundwater model to simulate potential COC impacts to groundwater and surface water at and surrounding the Beaver Dam Mine Site. The simulation of potential COC impacts incorporates a geosynthetic cover installed over the PAG waste rock stockpile as a baseline mitigation measure to reduce the potential COC mass loading to the receiving environment. It was identified that there is potential for arsenic and uranium to exceed the Potable Criteria in the vicinity of the NAG waste rock stockpile; however, the impact is expected to be temporary as arsenic and uranium concentrations within the NAG waste rock stockpile are predicted to decrease as the source terms transition from EOM to PC conditions. Furthermore, the predicted exceedance of Potable Criteria for uranium does not extend beyond the Property Boundary, and arsenic is naturally occurring in groundwater at the Beaver Dam Mine Site at concentrations above Potable Criteria. Therefore, at EOM, no significant impact to the reasonable use of groundwater is predicted beyond the Property Boundary. At PC, using the Base Case (i.e., median) source terms, predicted exceedances of the Potable Criteria for arsenic, cadmium, cobalt, manganese, nickel, lead, and uranium occur in the vicinity of the PAG waste rock stockpile. Using the Upper Case (i.e., 90th percentile) source concentrations, zinc is also predicted to exceed the Potable Criteria in the vicinity of the PAG waste rock stockpile. All predicted long-term PC impacts are contained within the PA boundary.

Potential impacts of COC mass loadings to surface water from groundwater were assessed through a comparison of predicted COC concentrations in groundwater to Tier 2 PSS and the calculation of COC mass loadings from groundwater to surface water for incorporation into the Predictive Water Quality Assessment GHD (2021a). For EOM, the comparison against Tier 2 PSS indicated that COC concentrations are predicted to exceed Tier 2 PSS for aluminum for both the base case and upper case source terms and for arsenic and cadmium for the upper case source terms. The predicted exceedances at EOM are related to the topsoil stockpiles. For PC, exceedances of Tier 2 PSS were predicted in association with the PAG waste rock stockpile for aluminum, cadmium, cobalt, copper, iron, nickel, lead, and zinc. The predicted exceedances occur either towards Cameron Flowage or towards surface water features west of the PAG waste rock stockpile. To address predicted exceedances of Tier 2 PSS in the vicinity of Cameron Flowage, simulated COC mass loadings to the Killag River watershed were provided as inputs to the Predictive Water Quality Assessment that combined impacts from groundwater discharge and surface water runoff to assess the cumulative impact on the Killag River watershed, as presented in GHD (2020a). To address predicted exceedances of the Tier 2 PSS west of the PAG waste rock stockpile, an interceptor trench was evaluated as a potential mitigation measure. Implementing an interceptor trench is effective for achieving hydraulic containment of potential COC migration west from the PAG waste rock stockpile in the event that groundwater quality monitoring indicates COC concentrations are approaching the Tier 2 PSS in this area.

Model development and predictive scenario analysis is based on data available at the time of model development. As additional data is collected during the development of the Beaver Dam Mine Site, it is recommended that the calibrated model and predictive scenario results be updated, as warranted.

All of Which is Respectfully Submitted,

GHD

Author:

<Original signed by>

Philip Sheffield, M.A.Sc., P.Eng.

Reviewed by:

<Original signed by>

Steven M. Harris, M.A.Sc., P.Eng.

Project Manager:

<Original signed by>

Peter Oram, P.Geo.

9. References

AGC (Atlantic Gold Corporation). 2017. Beaver Dam Mine Project Environmental Impact Statement. Submitted to: Canadian Environmental Assessment Agency and Nova Scotia Environment. June 12, 2017. Marinette, NS.

AGC, 2019. Beaver Dam Mine Project. Revised Environmental Impact Statement. Submitted to: Canadian Environmental Assessment Agency and Nova Scotia Environment. February 28, 2019. Marinette, NS.

Al-Suwaiyan, M., 1996. "Discussion of 'Use of Weighted Least-Squares Method in Evaluation of the Relationship Between Dispersivity and Field Scale' by M.Xu and Y. Eckstein", *Groundwater* 34 (4): 578.

AMNS (Atlantic Mining NS Inc.) 2021a, In Progress. Beaver Dam Mine Project Updated Environmental Impact Statement. Submitted to: Impact Assessment Agency of Canada and Nova Scotia Environment. March 2021. Marinette, NS.

AMNS. 2021b. In Progress. Canadian Environmental Assessment Agency, Nova Scotia Environment and Eastern Shore Forest Watch Association Round 2, Information Request Responses. Submitted to the Canadian Environmental Assessment Agency and Nova Scotia Environment. 2021. Marinette, NS.

Arnold, J.G., R.S. Muttiah, R. Srinivasan, and P.M. Allan, 2000. Regional Estimation of Base Flow and Groundwater Recharge in the Upper Mississippi River Basin, Journal of Hydrology, 227, pp. 21-40.

Ausenco Engineering Canada Inc., 2015. NI 43-101 Technical Report Feasibility Study for Moose River Consolidated Project, Nova Scotia.

Bedekar, V., E.D. Morway, C.D. Langevin and M. Tonkin, 2016. MT3D-USGS Version 1: A U.S. Geological Survey Release of MT3DMS Updated with New and Expand Transport Capabilities for Use with MODFLOW: U.S. Geological Survey Techniques and Methods 6-A53, 69 p, http://dx.doi.org/10.3133/tm6A53.

C Tech, 2015. "MVS (Mining Visualization System) Version 9.94", copyright © 1994-2012 by C Tech Development Corporation. Sarasota, Florida.

Doherty, J.E., M.N. Fiennen, and R.J. Hunt, 2010. Approaches to Highly Parameterized Inversion: Pilot-Point Theory, Guidelines, and Research Directions, Scientific Investigation Report 2010-5168, U.S. Geological Survey.

Duncan, D.R., 1987. Assessment Report on 1987 Exploration Programme on Development License 0078, Halifax County, Nova Scotia, MTS 11E/2. Nova Scotia Department of Natural Resources Assessment Report AR ME 1987-117.

Eckhardt, K., 2005. How to construct recursive digital filters for baseflow separation. Hydrogeological processes, 19(2), 507-515.

FSS International Consultants (Australia) Pty Ltd. (FSSI), 2015. Technical Report of the Beaver Dam Gold Project, Nova Scotia, Mineral Resource Estimate, Beaver Dam Gold Project, Nova Scotia. March.

Gelhar, L.W., C. Welty, and K.R. Rehfeldt, 1992. A Critical Review of Data on Field-Scale Dispersion in Aquifers. Water Resources Research, 28(7), pp. 1955 - 1974.

GHD, 2018. Field Activities Report – Beaver Dam Mine Project, Marinette, Nova Scotia, November 8.

GHD, 2021a. Predictive Water Quality Assessment – Beaver Dam Gold Mine, Marinette, Nova Scotia, January.

GHD, 2021b. Water Balance Analysis – Beaver Dam Gold Mine, Marinette, Nova Scotia, January.

Goldthwait, J.W., 1924. Physiography of Nova Scotia, Department of Mines, Geological Survey of Canada. Memoir 140, No. 122, Geological Series.

Harbaugh, A.W. 2005. MODFLOW-2005, The U.S. Geological Survey Modular Ground-Water Model-the Ground-Water Flow Process, Chapter 16 of Book 6. Modeling Techniques, Section A. Ground Water. U.S. Geological Survey Techniques and Methods 6-A16.

Harbaugh, A.W., R. Banta, M. Hill, and M.G. McDonald, 2000. MODFLOW 2000, The U.S. Geological Survey Modular Ground Water Model — User Guide To Modularization Concepts And The Ground Water Flow Process, United States Geological Survey Open File Report 0092, Reston, Virginia.

Horne, R.J. and D.E. Pelley, 2007. Geological Transect of the Meguma Terrane from Centre Musquodoboit to Tangier. *In* Mineral Resources Branch, Report of Activities 2006; Nova Scotia Department of Natural Resources, Report ME 2007-1, p- 71-89.

Kennedy, G.W., K.G. Garroway and D.S. Finlayson-Bourque, 2010. Estimation of Regional Groundwater Budget in Nova Scotia, Nova Scotia Department of Natural Resource, Open File Illustration ME 2010-2.

Jacques, Whitford & Associates Ltd. (JWA), 1986a. Environmental Assessment of Gold Mining Exploration Beaver Dam, Nova Scotia.

Jacques, Whitford & Associates Ltd. (JWA), 1986b. Hydrogeological Investigation, Beaver Dam Mine Site.

Lim, K. J., Engel, B. A., Tang, Z., Choi, J., Kim, K., Muthukrishnan, S. and Tripathy, D., 2005: Fully automated web GIS-based hydrograph analysis tool, WHAT; Journal of American Water Resource Association, v. 41, p. 1407-1416.

Lorax Environmental, 2018. Beaver Dam Project – ML/ARD Assessment Report, December 20.

Lorax Environmental, 2021. Beaver Dam Project: Geochemical Source Term Update, January 20.

McDonald, M.G. and A.W. Harbaugh, 1988. A Modular Three-Dimensional Finite-Difference Ground-Water Flow Model. Techniques of Water-Resources Investigations of the United States Geological Survey, Book 6, Survey Open-File Report 83-875.

Niswonger, R.G., 2011. MODFLOW-NWT, A Newton Formulation for MODFLOW-2005, Chapter 37 of Section A, Groundwater Book 6, Modeling Techniques and Methods 6-A37.

NSDR (Nova Scotia Department of Natural Resources), 2012. Wet Areas Mapping and Flow Accumulation Channels. Retrieved from https://novascotia.ca/natr/forestry/gis/wamdownload.asp

Peter Clifton & Associates (PCA), 2015. Assessment of Potential Open Pit Groundwater Inflows, Beaver Dam Gold Project, Nova Scotia.

Pollock, D.W., 2016. User Guide for MODPATH Version 7–A Particle Tracking Model for MODFLOW, United States Geological Survey Open File Report 1086, Reston, Virginia.

Risser, D.W., Gburek, W.J., and Folmar, G.J., 2005, Comparison of methods for estimating ground-water recharge and base flow at a small watershed underlain by fractured bedrock in the eastern United States: U.S. Geological Survey Scientific Investigations Report 2005–5038, 31 p.

Rumbaugh, J.O. and D.B. Rumbaugh, 2017. Guide to Using Groundwater Vistas, Version 7, Environmental Simulations, Inc., Leesport, Pennsylvania.

Rushton, K.R. and C. Ward, 1979. The Estimation of Groundwater Recharge. Journal of Hydrology, 41, pp. 345-361.

Sangster, A.L. and P.K. Smith, 2007. Metallogenic Summary of the Meguma Gold Deposits, Nova Scotia. *In* Goodfellow, W.D., ed., Mineral Deposits of Canada: A Synthesis of Major Deposit-Types, District Metallogeny, the Evolution of Geological Provinces, and Exploration Methods: Geological Association of Canada, Mineral Deposits Division, Special Publication No. 5, p. 723-732.

Spitz, K. and J. Moreno, 1996. A Practical Guide to Groundwater And Solute Transport Modeling, John Wiley & Sons, Inc., Toronto, ON, pp. 461.

Stea, R., and T. Fowler, 1979. Minor and Trace Element Variations in Winconsinan Tills, Eastern Shore Region, Nova Scotia, NSDME Paper No. 79-4.

Stantec, 2018. Email communication with Rachel Jones on October 2, 2018.

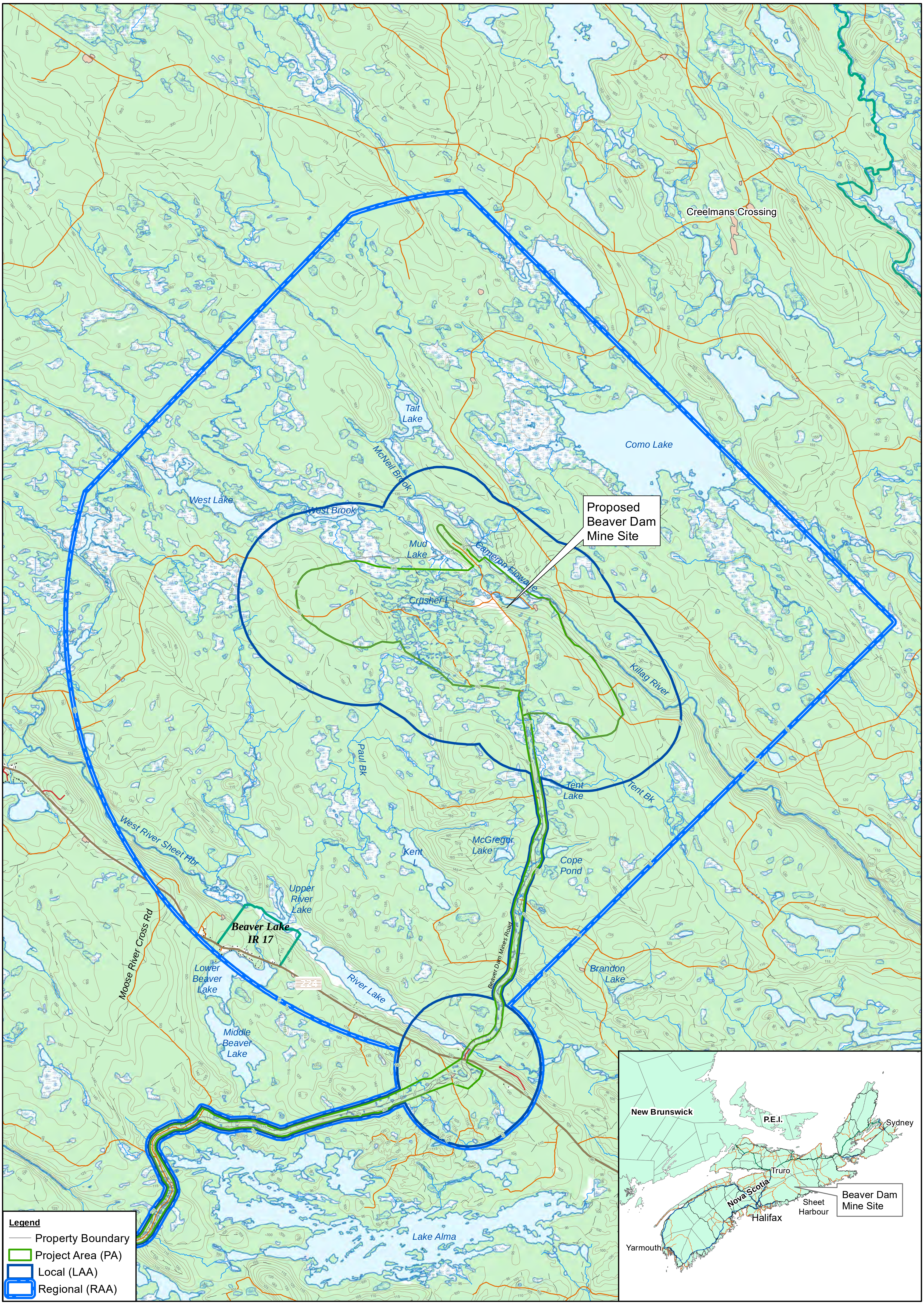
Watermark Numerical Computing, 2016. PEST, Model-Independent Parameter Estimation User Manual Part I: PEST, SENSAN and Global Optimizers, 6th Edition, Watermark Numerical Computing, Brisbane, Australia, April.

Wels, C., D.Mackie, and J.Scibek, 2012. Guidelines for Groundwater Modelling to Assess Impacts of Proposed Natural Resource Development Activities, British Columbia Ministry of the Environment, Water Protection & Sustainability Branch, April. Available at: http://www.env.gov.bc.ca/wsd/plan_protect_sustain/groundwater/groundwater_modelling_guidelines_final-2012.pdf.

Williams, H., M.J. Kennedy and E, R, W. Neale, 1972, The Appalachian Structural Province, p. 182-261. *In* Price, R.A. and R. J. W. Douglas (ed.). Variations in Tectonic Styles in Canada. Geol. Assoc. Can. Spec. Pap. 11: 181-261.

Xu, M. and Y. Eckstein, 1995. Use of Weighted Least-Squares Method in Evaluation of the Relationship Between Dispersivity and Scale, Groundwater, 33(6), pp. 905 - 908.

Zheng, C. and P.P. Wang, 1999. "MT3DMS: A Modular Three-Dimensional Multispecies Transport Model for Simulation of Advection, Dispersion, and Chemical Reactions of Contaminants in Groundwater Systems; Documentation and User's Guide", U.S. Army Corps of Engineers, Washington, DC, Contract Report SERDP-99-1, December.



Source: Service Nova Scotia, Atlantic Mining NS, GHD, McCallum Environmental

0 500 1,000 1,500
Meters
Coordinate System:
NAD 1983 CSRS UTM Zone 20N

N

GHD

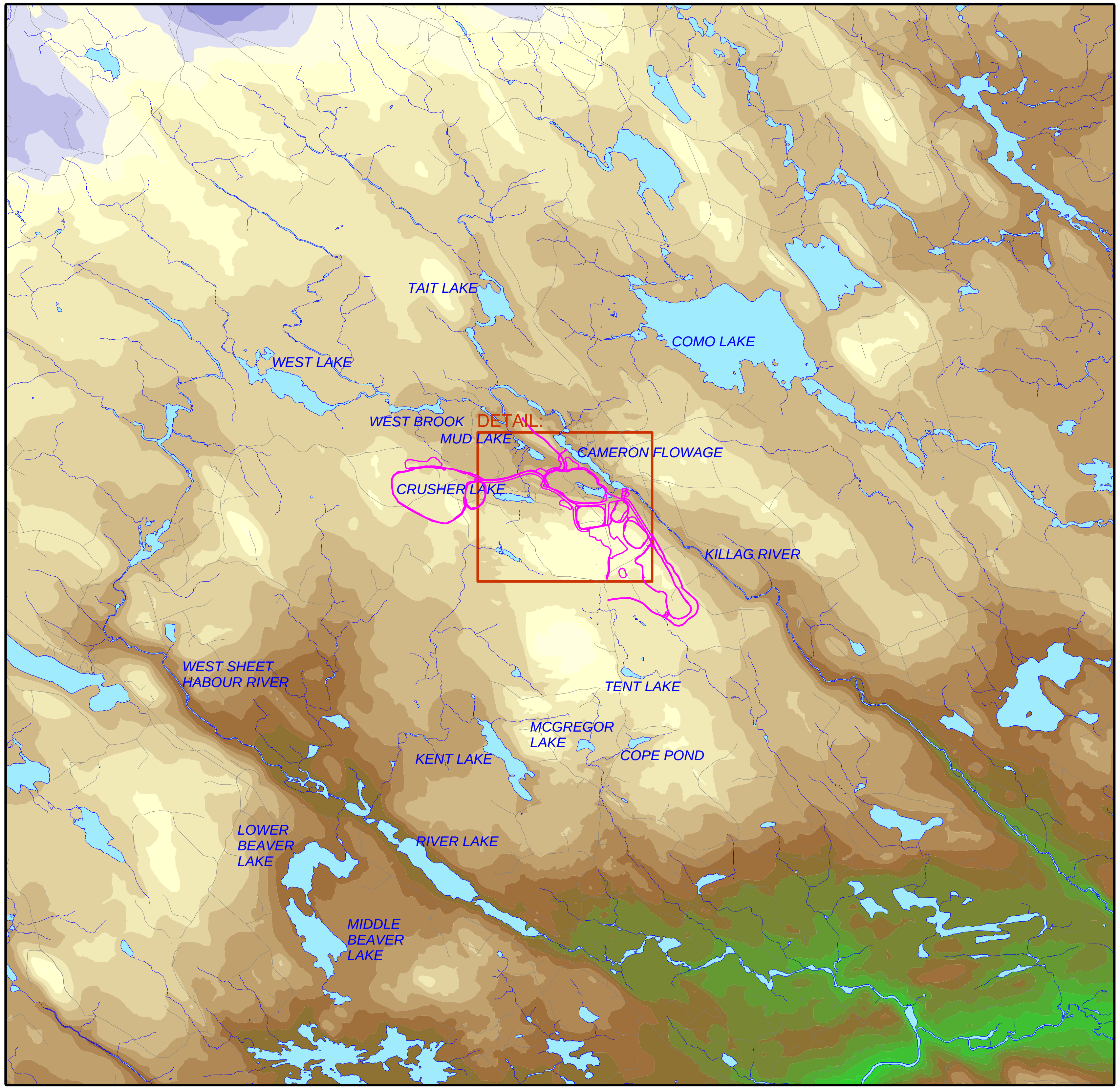
ATLANTIC GOLD CORPORATION
MARINETTE, NOVA SCOTIA
BEAVER DAM MINE

088664 (013)
Mar 10, 2021

BEAVER DAM MINE SITE LOCATION

FIGURE 1.1

GIS File: I:\GIS_DATA\Projects\6-chars\08----\088---\088664 Atlantic BD\088664(013)\088664(013)_GIS-HX001.mxd



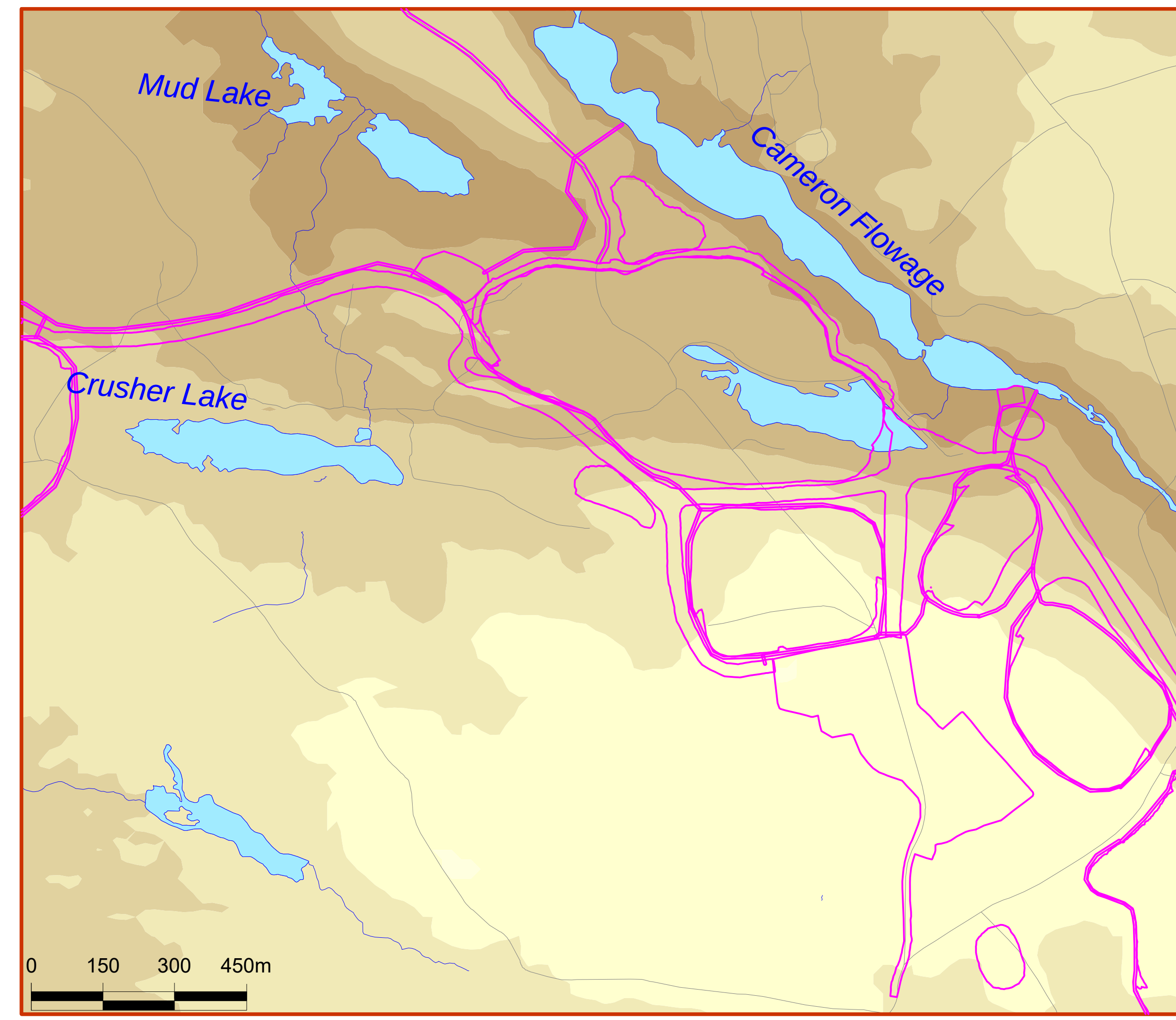
LEGEND

- SURFACE WATER BODY
- MINE FEATURES
- ROAD

GROUND SURFACE ELEVATION (m AMSL)

0 20 40 60 80 100 120 140 160 180 200

DETAIL:



0 700 1,400 2,100m

ATLANTIC GOLD CORPORATION
MARINETTE, NOVA SCOTIA
BEAVER DAM MINE

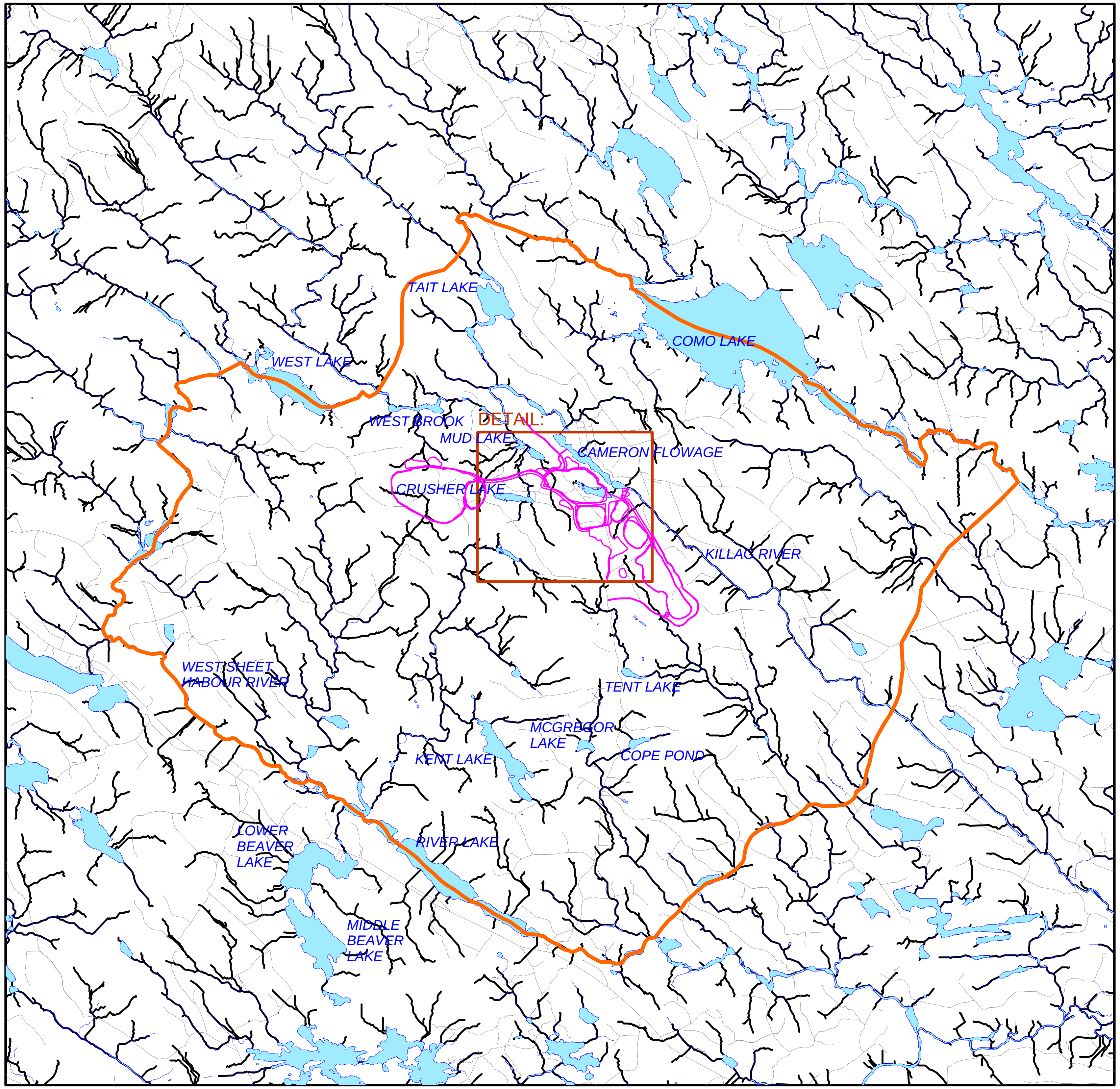
PRE-MINING TOPOGRAPHY

088664-031

January 19, 2021

FIGURE 2.1

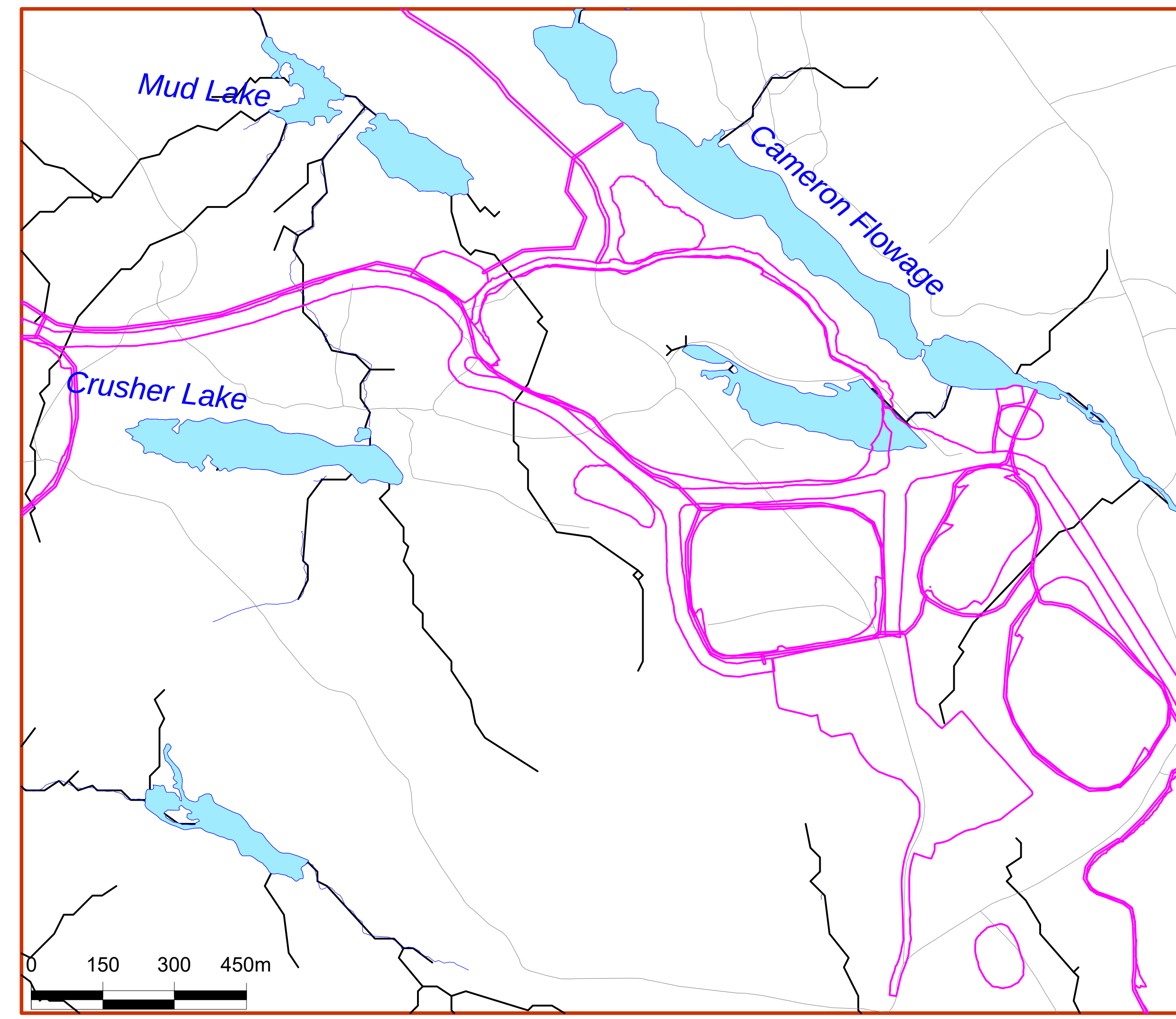
HEG file: Z:\HEG\088664\DOCUMENTATION\RPT\088664-RPT-13\FIGURES\Figure 2.1 - Pre-Mining Topography.srf



LEGEND

- SURFACE WATER BODY
- MINE FEATURES
- ROAD
- FLOW ACCUMULATION CHANNEL
- ACTIVE MODEL DOMAIN

DETAIL:



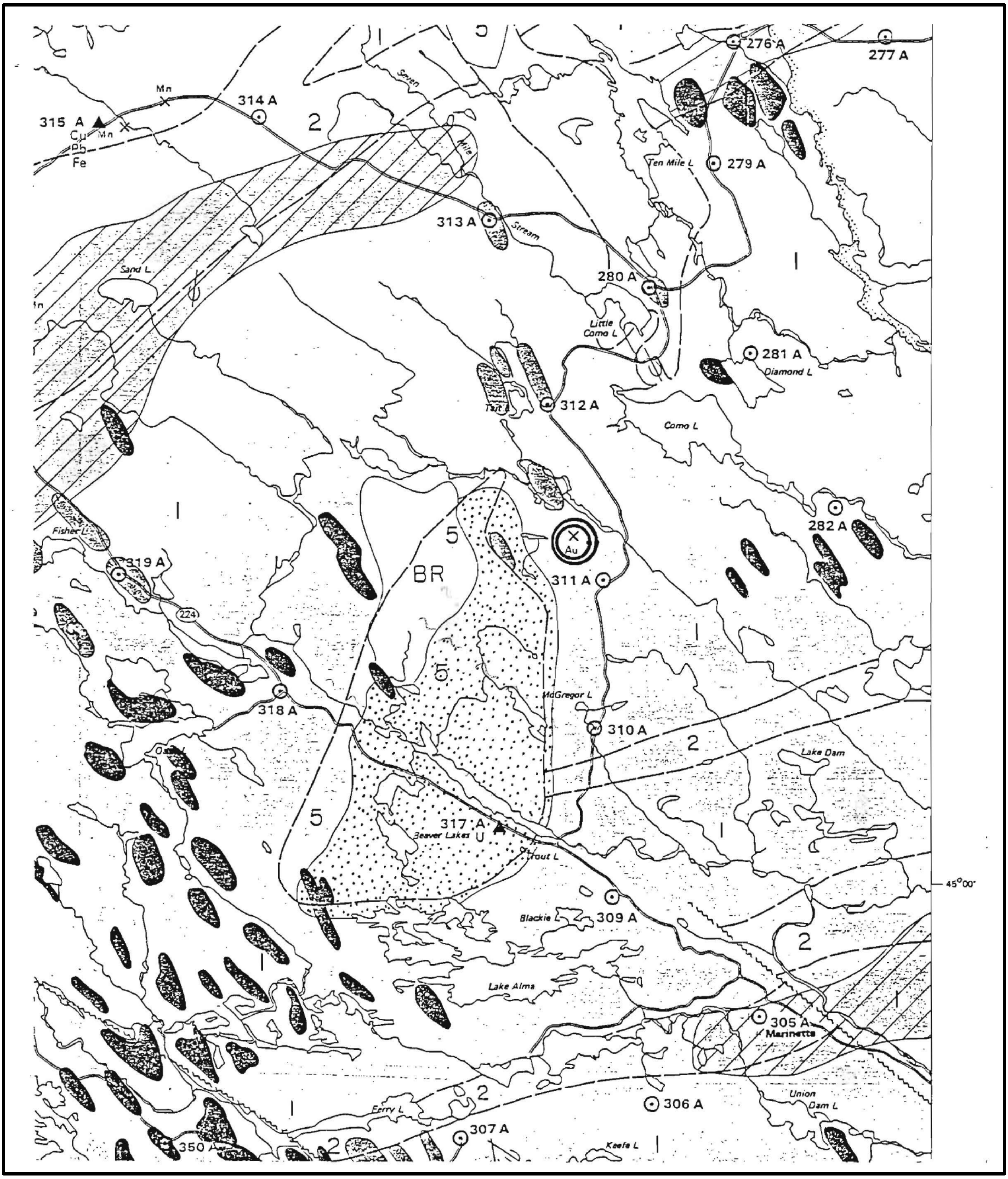
ATLANTIC GOLD CORPORATION
MARINETTE, NOVA SCOTIA
BEAVER DAM MINE

088664-031
January 19, 2021

SURFACE WATER FEATURES

FIGURE 2.2

HEG file: Z:\HEG\088664\DOCUMENTATION\RPT\088664-RPT-13\FIGURES\Figure 2.2- Surface Water Features.srf



SOURCE:
NOVA SCOTIA DEPARTMENT OF MINES & ENERGY ON ENVIRONMENTAL ASSESSMENT OF GOLD MINING EXPLORATION, BEAVER DAM, NOVA SCOTIA. REPORT 86-005, 1965.
PRODUCED BY JACQUES, WHIRFORD AND ACCOCIATES LIMITED AND P. LANE AND ASSOCIATES LLIMITED. (1986)

LEGEND

- SLATE TILL
- QUARTZITE TILL
- GRANITE TILL
- SILT-CLAY TILL DRUMLIN
- LOCATION OF BEAVERDAM MINE

Bedrock Geology

- 12 Basalt, sandstone, shale
- 11 Sedimentary rocks
- 10 Marginal basin sedimentary rocks
- 9 Marginal basin sedimentary rocks
- 8 Continential and marginal basin sedimentary rocks
- 7 Undifferentiated sedimentary and volcanic rocks
- 6 Mixed sedimentary and volcanic rocks
- 5 Granite: mainly granite
- 4 Torbrook formation
- 3 White rock
- 2 Halifax formation
- 1 Goldenville formation

0 70 140 210km

N

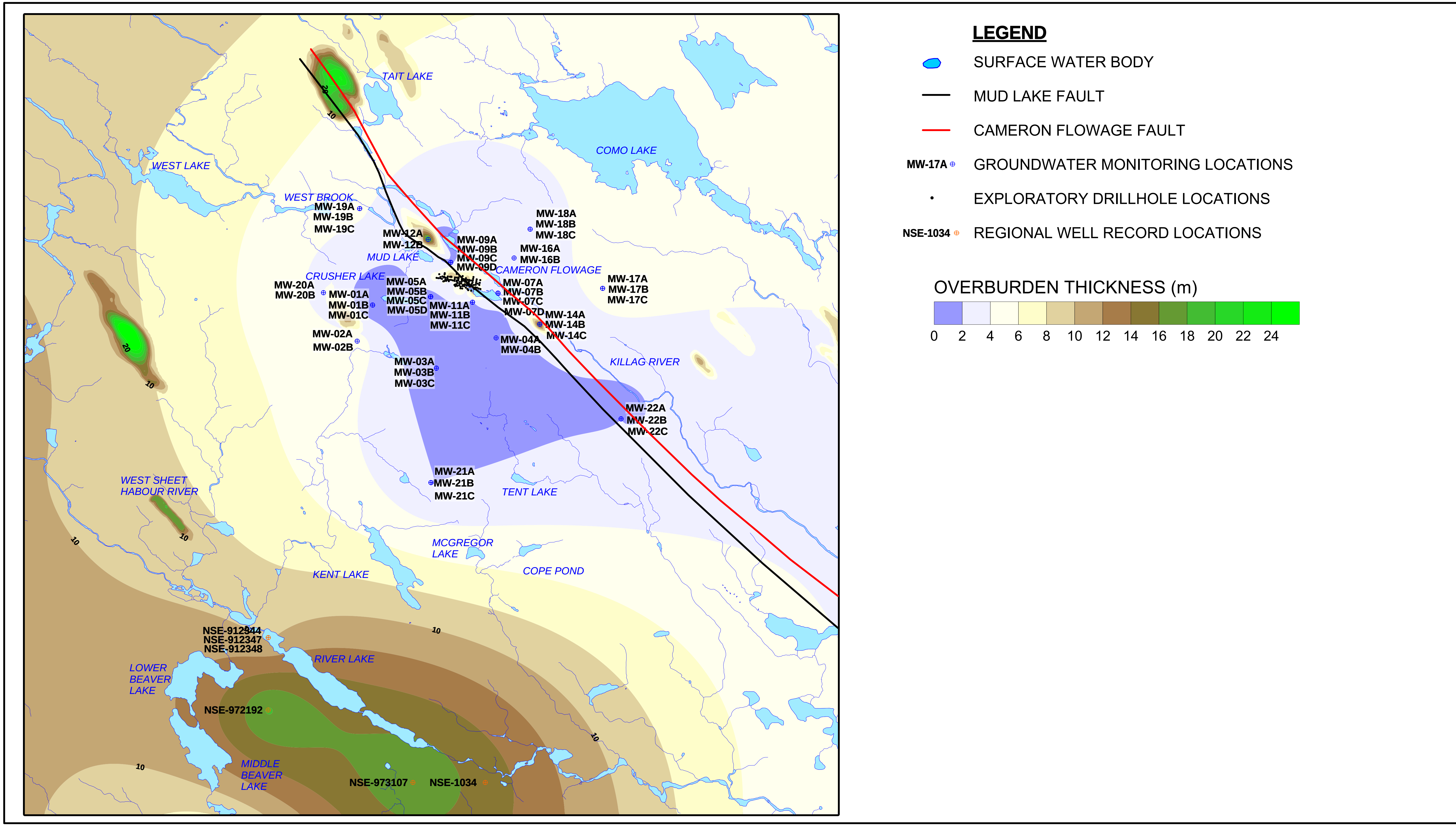
ATLANTIC GOLD CORPORATION
MARINETTE, NOVA SCOTIA
BEAVER DAM MINE

088664-031
Oct 22, 2019

LOCATION OF DRUMLINS

FIGURE 2.3

Z:\HEG\088664\DOCUMENTATION\RPT\088664-RPT-13\FIGURES\Figure 2.3 - Location of Drumlins.srf



0 700 1,400 2,100m

ATLANTIC GOLD CORPORATION
MARINETTE, NOVA SCOTIA
BEAVER DAM MINE

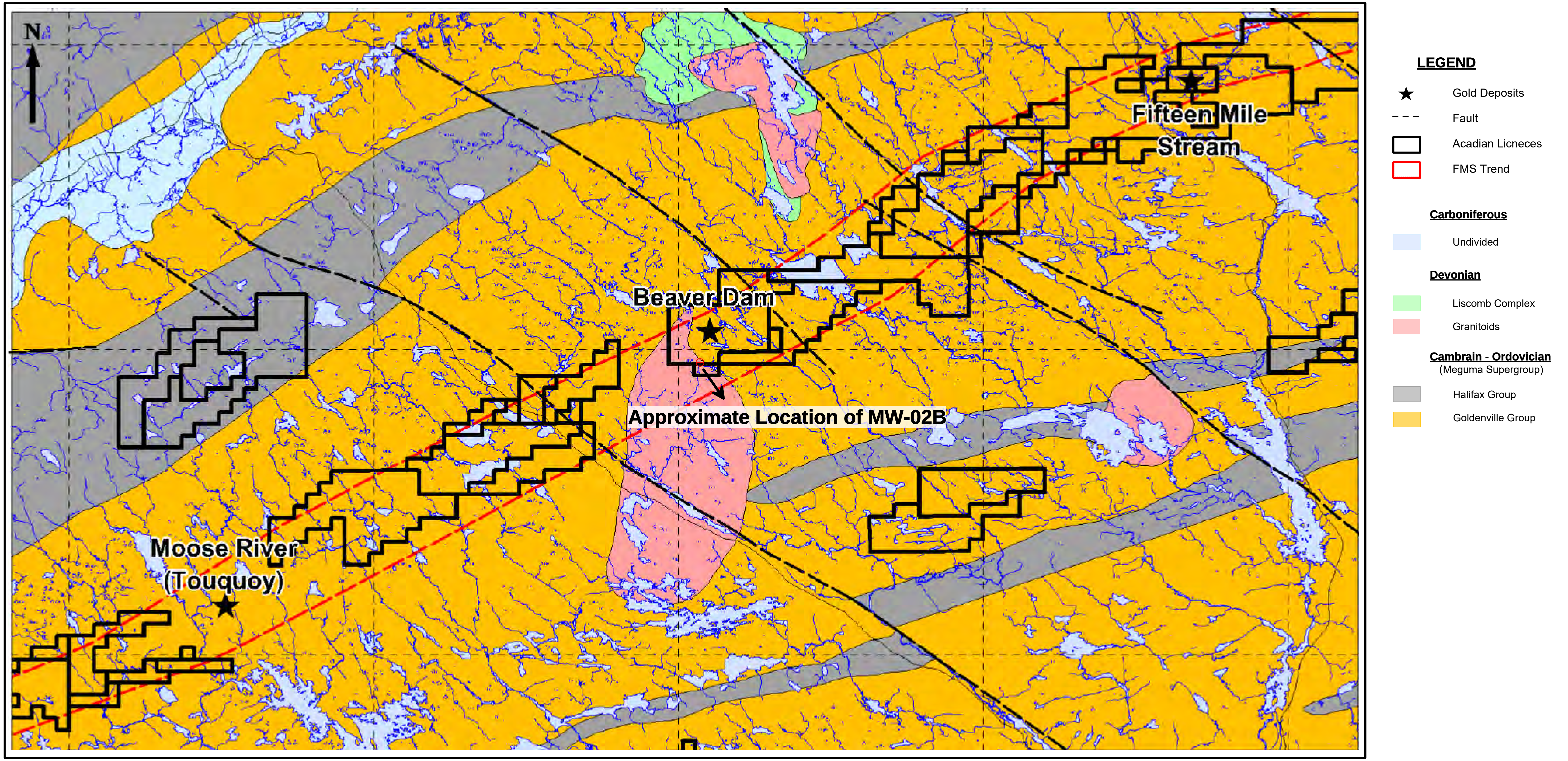
088664-031

October 23, 2019

ESTIMATED OVERBURDEN THICKNESS

FIGURE 2.4

Z:\HEG\088664\DOCUMENTATION\RPT\088664-RPT-13\FIGURES\Figure 2.4 - Estimated Overburden Thickness.srf



SOURCE:
ANNUAL QUALIFIED PERSONS REPORT FOR BEAVER DAM GOLD PROJECT, HALIFAX, NOVA SCOTIA - YEAR ENDED 31 MARCH 2014 - LIONGOLD CORPORATION LIMITED, SINGAPORE PREPARED IN ACCORDANCE WITH THE REQUIREMENTS OF SINGAPORE EXCHANGE PRACTICE NOTE 6.3. PRODUCED BY DR SIMON DOMINY AND MR RICHARD HORNE

0 1,300 2,600 3,900m

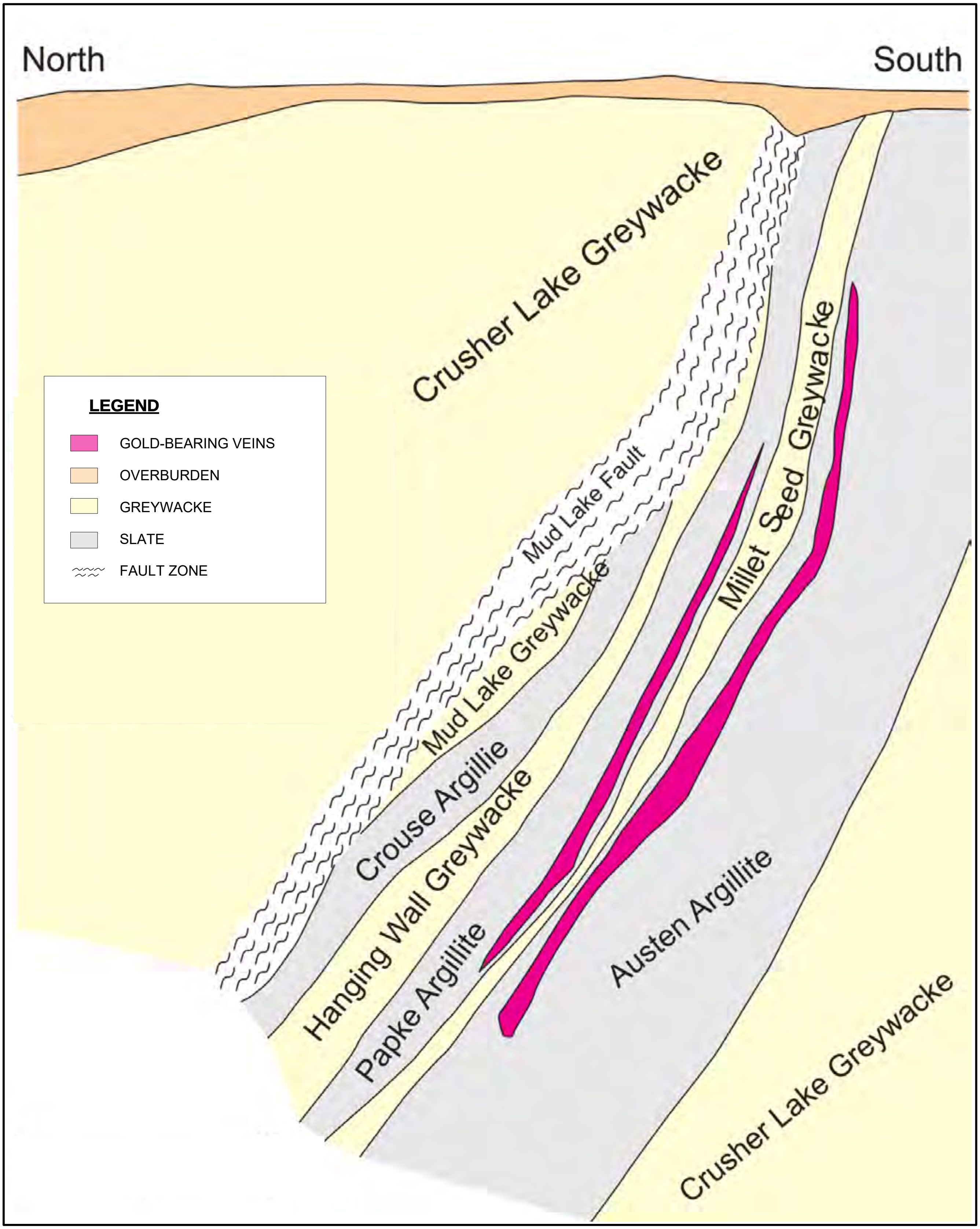
ATLANTIC GOLD CORPORATION
MARINETTE, NOVA SCOTIA
BEAVER DAM MINE

REGIONAL GEOLOGY

088664-031
October 22, 2019

FIGURE 2.5

Z:\HEG\088664\DOCUMENTATION\RPT\088664-RPT-13\FIGURES\Figure 2.5 - Regional Geology.srf



SOURCE: SANGSTER, A.L.,AND SMITH, P.K., 2007, METALLOGENIC SUMMARY OF THE MEGUMA GOLD DEPOSITS, NOVA SCOTIA, IN GOODFELLOW, W.D., ED., MINERAL DEPOSITS OF CANADA: A SYNTHESIS OF MAJOR DEPOSIT-TYPES, DISTRICT METALLOGENY, THE EVOLUTION OF GEOLOGICAL PROVINCES

0 23 46 69m

ATLANTIC GOLD CORPORATION
MARINETTE, NOVA SCOTIA
BEAVER DAM MINE

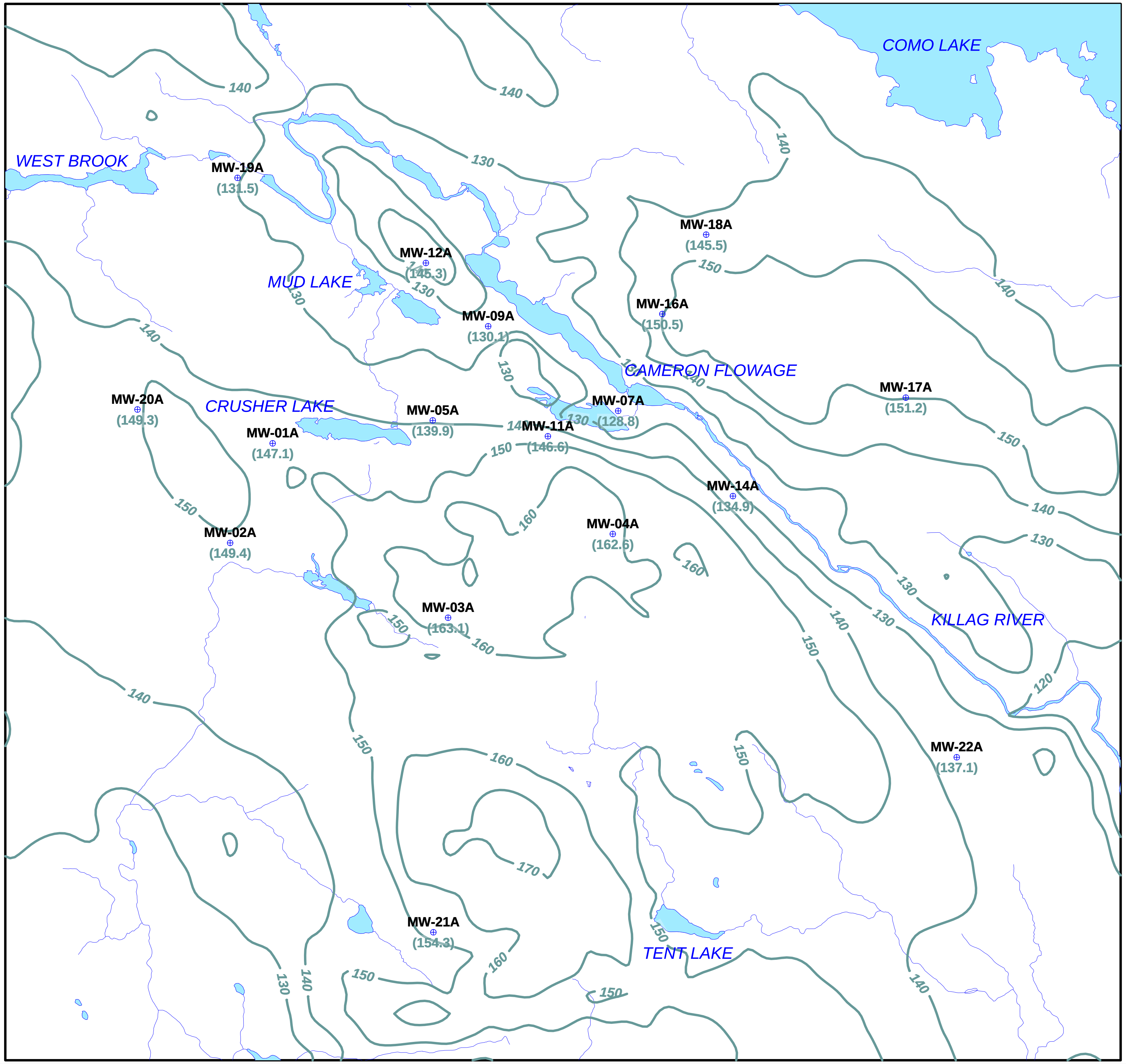
SECTION THROUGH BEAVER DAM DEPOSIT

088664-031

October 22, 2019

FIGURE 2.6

Z:\HEG\088664\DOCUMENTATION\RPT\088664-RPT-13\FIGURES\Figure 2.6 - Section through Beaver Dam Deposit.srf



LEGEND

- SURFACE WATER BODY
- MW-17A ⊕ WATER LEVEL MONITORING LOCATION
- (154.5) OVERBURDEN GROUNDWATER ELEVATION MEASURED ON JULY 18, 2018 (m AMSL)
- — 140 — OBSERVED OVERBURDEN GROUNDWATER ELEVATION CONTOURS - JULY 18, 2018 (m AMSL)

0 200 400 600m

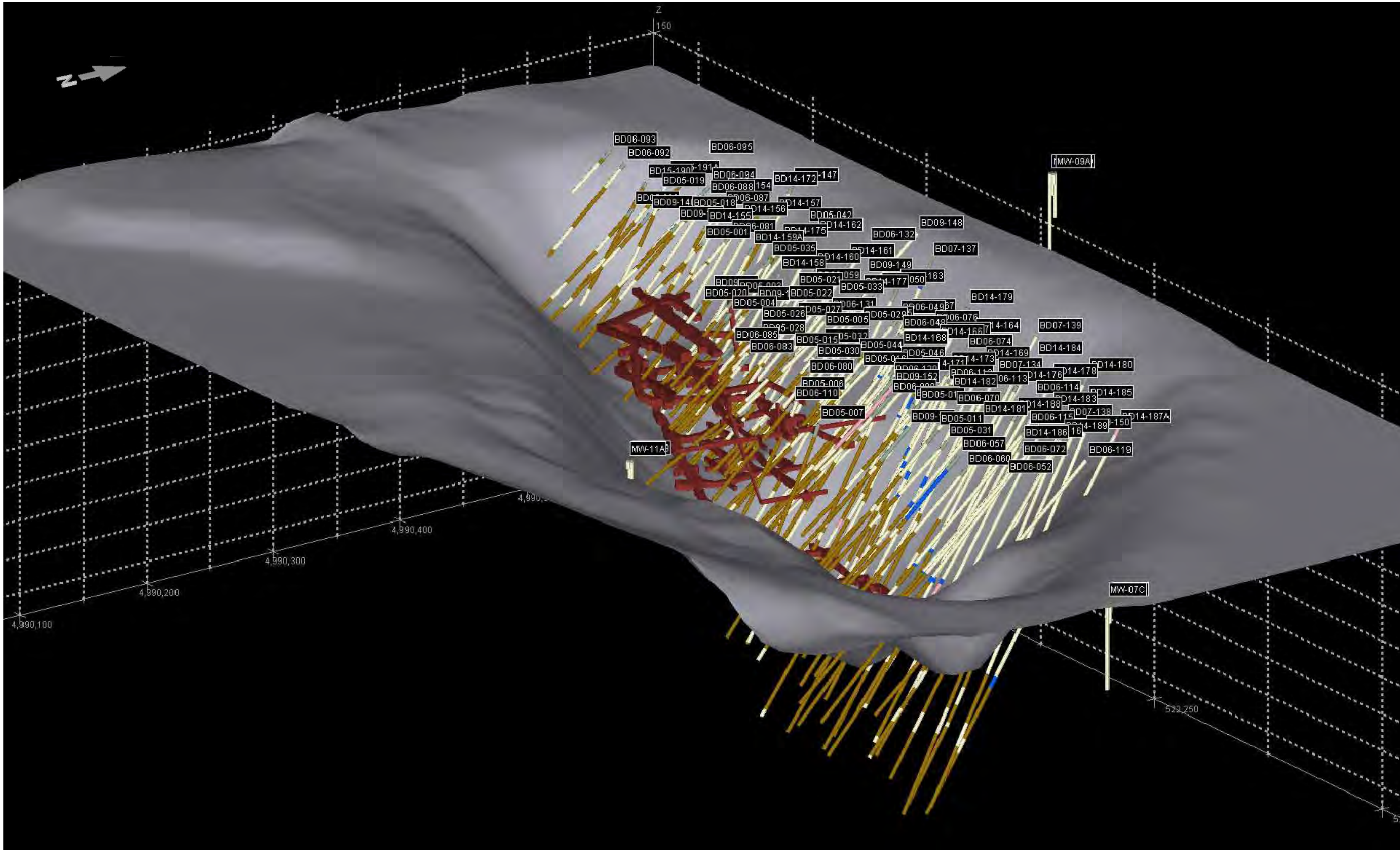
ATLANTIC GOLD CORPORATION
MARINETTE, NOVA SCOTIA
BEAVER DAM MINE

OBSERVED OVERBURDEN GROUNDWATER ELEVATION CONTOURS - JULY 18, 2018

088664-031
March 18, 2021

FIGURE 2.7

HEG file: Z:\HEG\088664\DOCUMENTATION\RPT\088664-RPT-13\FIGURES\RPTFigures\Figure 2.7 - Observed Overburden Groundwater Elevation Contours - July 18, 2018.srf



LEGEND

HISTORICAL MINE WORKINGS
PROPOSED MINE EXCAVATION

OVERBURDEN
ARGILLITE
GREYWACKE
MUD LAKE FAULT
UNDEFINED

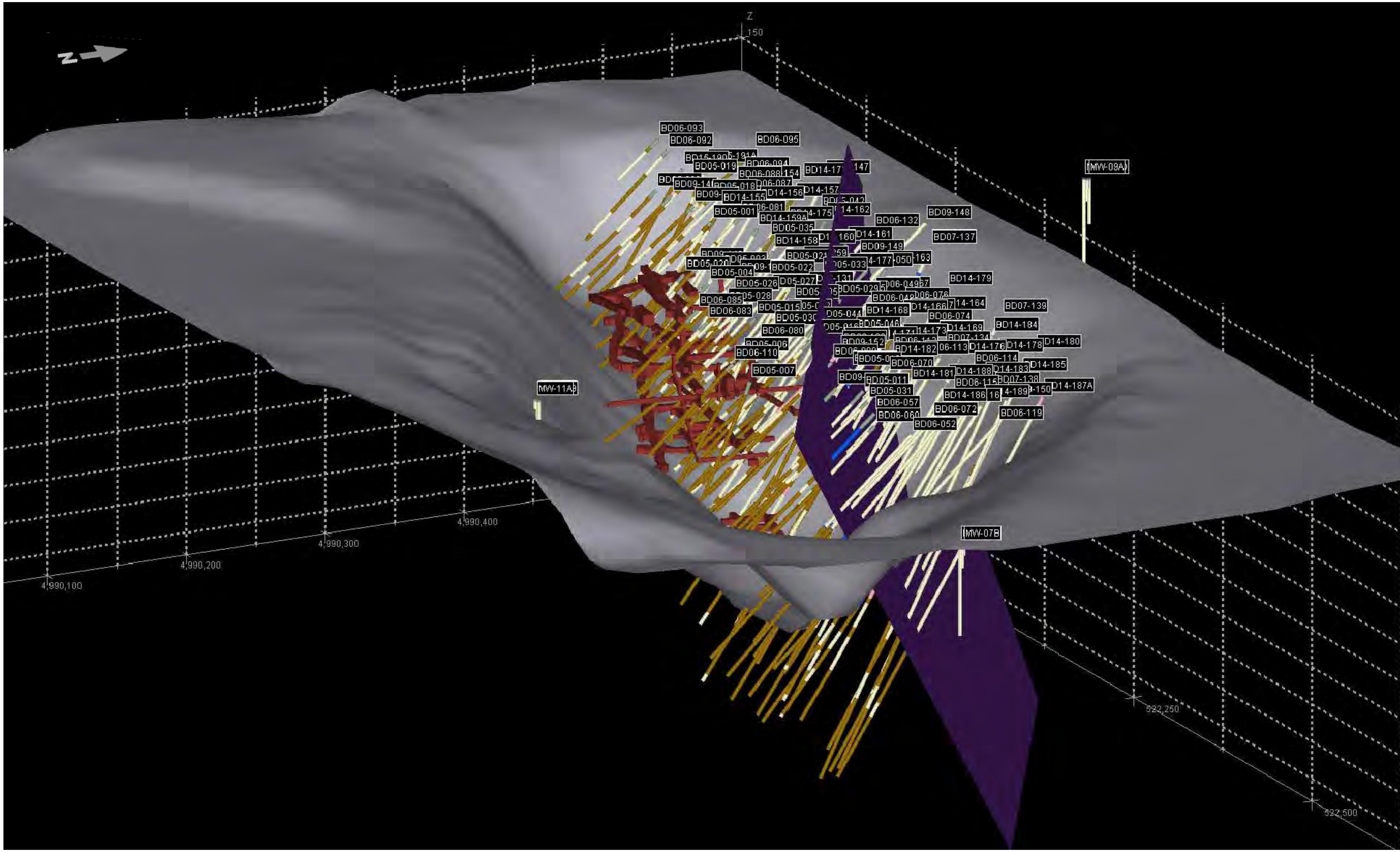
ATLANTIC GOLD CORPORATION
MARINETTE, NOVA SCOTIA
BEAVER DAM MINE

HISTORIC MINE WORKINGS

88664-031
Oct 22, 2019

FIGURE 2.8

CAD File: P:\drawings\88000s\88664\88664-reports\88664-00(009)\88664-00(009)GN\88664-00(009)GN-WA001.dwg



LEGEND

- HISTORICAL MINE WORKINGS
- PROPOSED MINE EXCAVATION
- APPROXIMATE MUD LAKE FAULT LOCATION

- OVERBURDEN
- ARGILLITE
- GREYWACKE
- MUD LAKE FAULT
- UNDEFINED

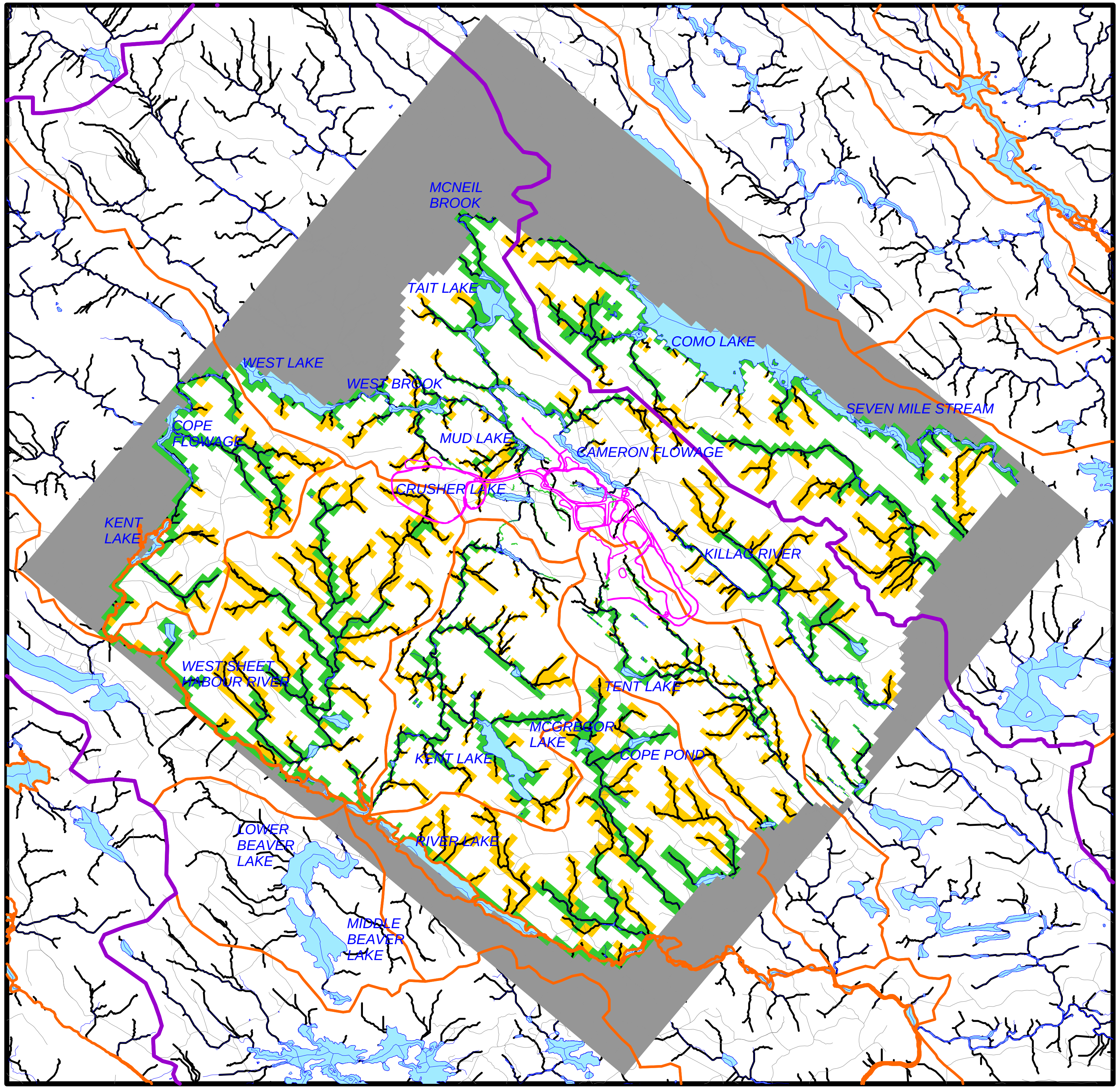
ATLANTIC GOLD CORPORATION
MARINETTE, NOVA SCOTIA
BEAVER DAM MINE

88664-031
Oct 22, 2019

APPROXIMATE MUD LAKE FAULT LOCATION

FIGURE 2.9

CAD File: P:\drawings\88000s\88664\88664-reports\88664-00(009)\88664-00(009)GN\88664-00(009)GN-WA001.dwg



LEGEND

- SURFACE WATER BODY
- MINE FEATURES
- ROAD
- FLOW ACCUMULATION CHANNEL
- SECONDARY WATERSHED DIVIDE
- TERTIARY WATERSHED DIVIDE
- RIVER BOUNDARY CONDITION
- NO-FLOW BOUNDARY CONDITION
- DRAIN BOUNDARY CONDITION

0 700 1,400 2,100m

N

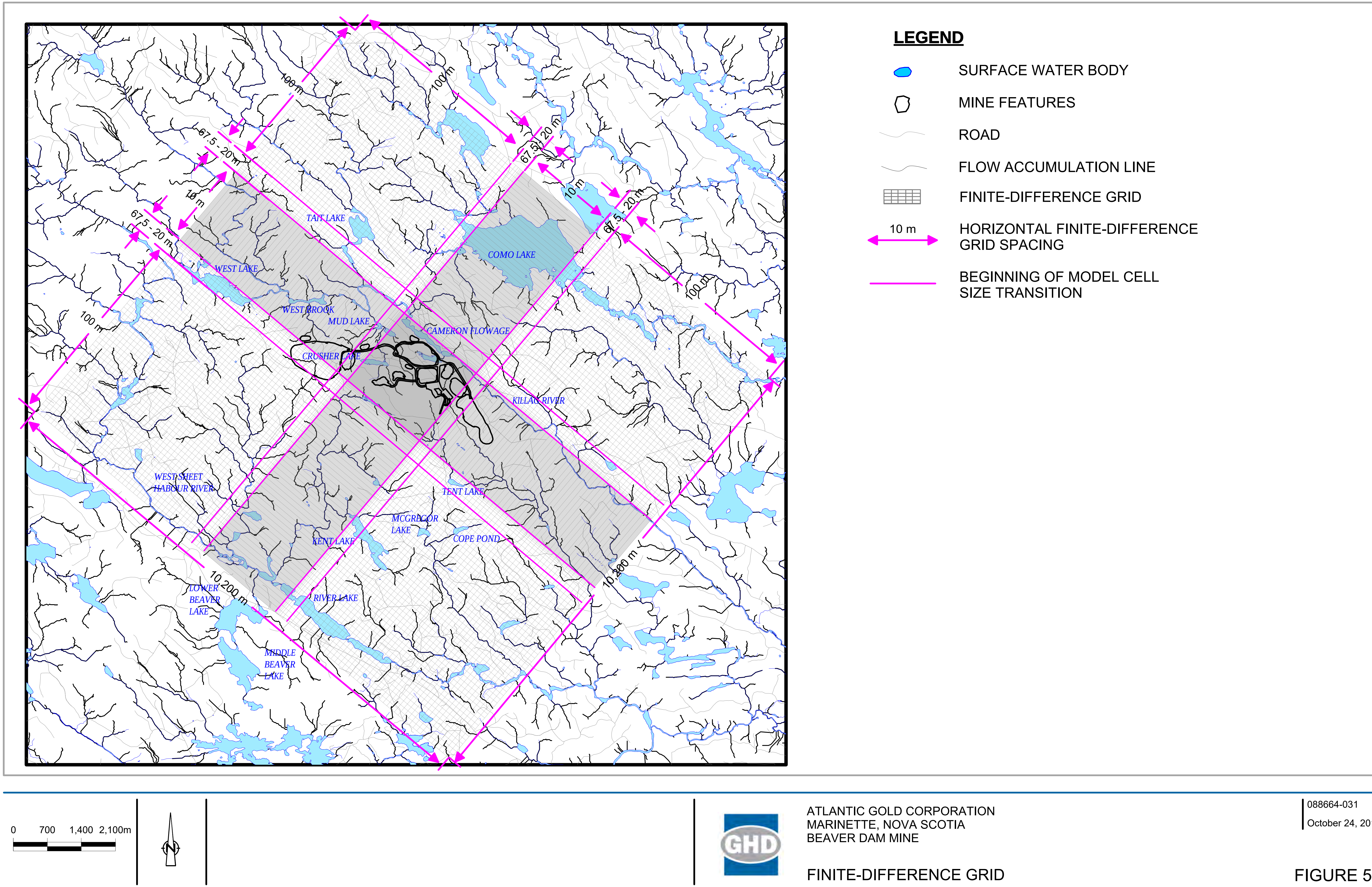
ATLANTIC GOLD CORPORATION
MARINETTE, NOVA SCOTIA
BEAVER DAM MINE

088664-031
January 19, 2021

GROUNDWATER FLOW MODEL DOMAIN

FIGURE 3.1

HEG file: Z:\HEG\088664\DOCUMENTATION\RPT\088664-RPT-13\FIGURES\Figure 3.1 - Groundwater Flow Model Domain.srf



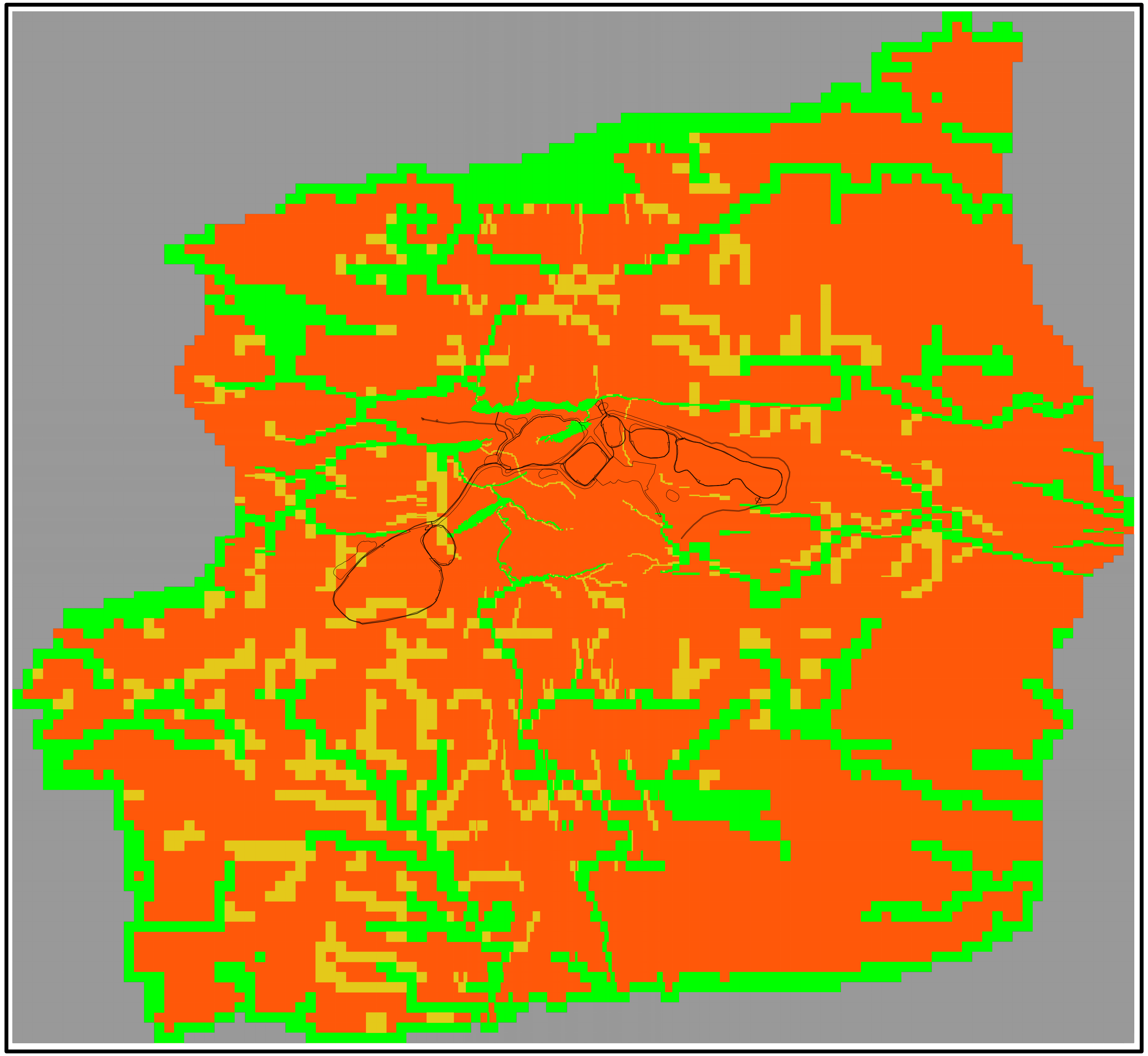
ATLANTIC GOLD CORPORATION
MARINETTE, NOVA SCOTIA
BEAVER DAM MINE

088664-031
October 24, 2019

FINITE-DIFFERENCE GRID

FIGURE 5.1

HEG file: Z:\HEG\088664\DOCUMENTATION\RPT\088664-RPT-13\FIGURES\Figure 5.1 - Finite-Difference Grid.srf



LEGEND

MINE FEATURES

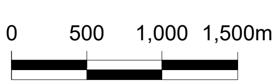
RIVER BOUNDARY CONDITION

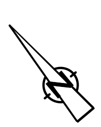
NO-FLOW BOUNDARY CONDITION

DRAIN BOUNDARY CONDITION

HYDRAULIC CONDUCTIVITY ZONES

OVERBURDEN





ATLANTIC GOLD CORPORATION
MARINETTE, NOVA SCOTIA
BEAVER DAM MINE

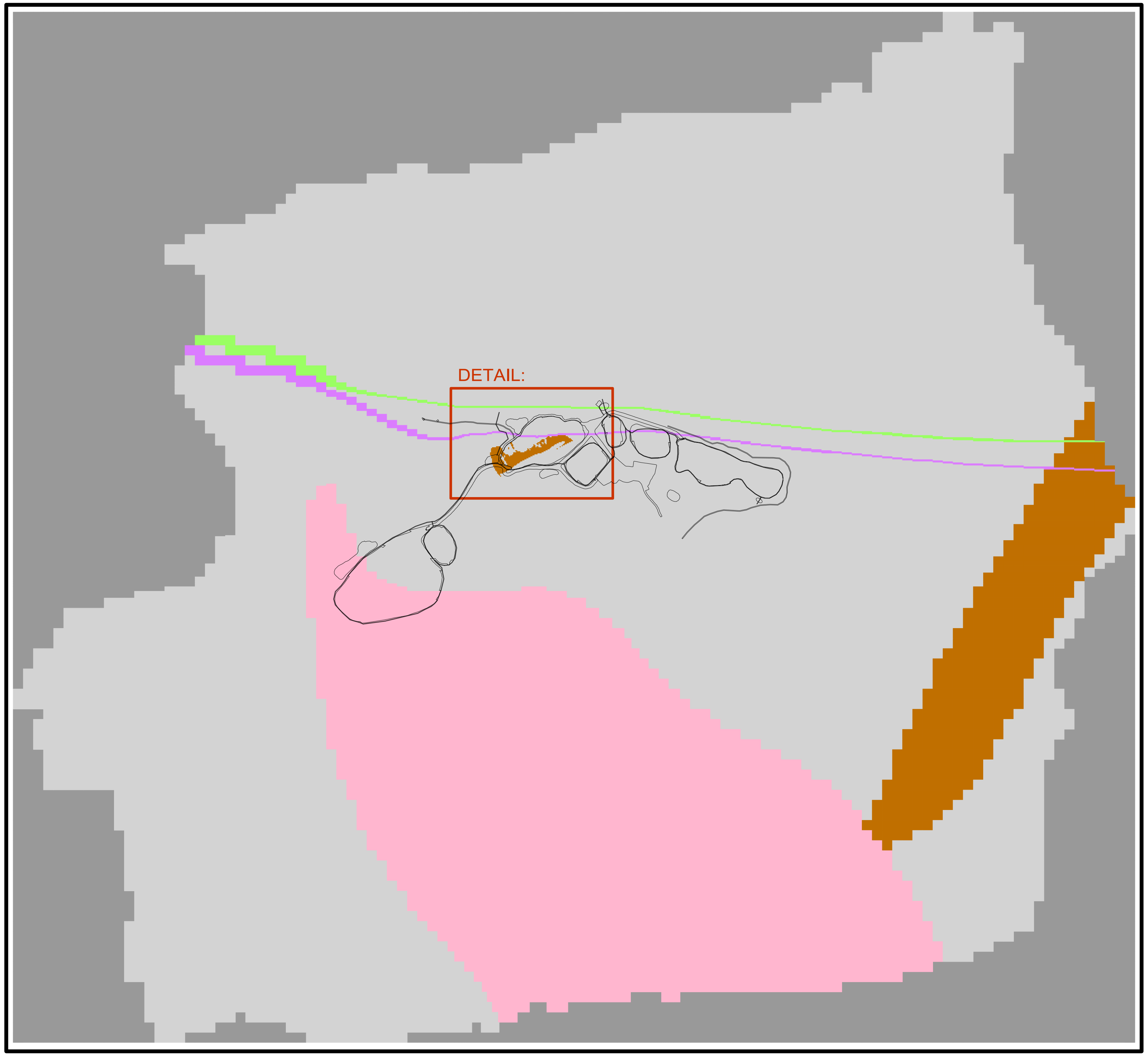
HYDRAULIC CONDUCTIVITY DISTRIBUTION IN OVERBURDEN (LAYER 1)

088664-031

January 19, 2021

FIGURE 5.2

HEG file: Z:\HEG\088664\DOCUMENTATION\RPT\088664-RPT-13\FIGURES\Figure 5.2 - Hydraulic Conductivity Distribution in Overburden (Layer 1).srf



LEGEND

MINE FEATURES

NO-FLOW BOUNDARY CONDITION

HYDRAULIC CONDUCTIVITY ZONES

SHALLOW BEDROCK GREYWACKE FORMATION

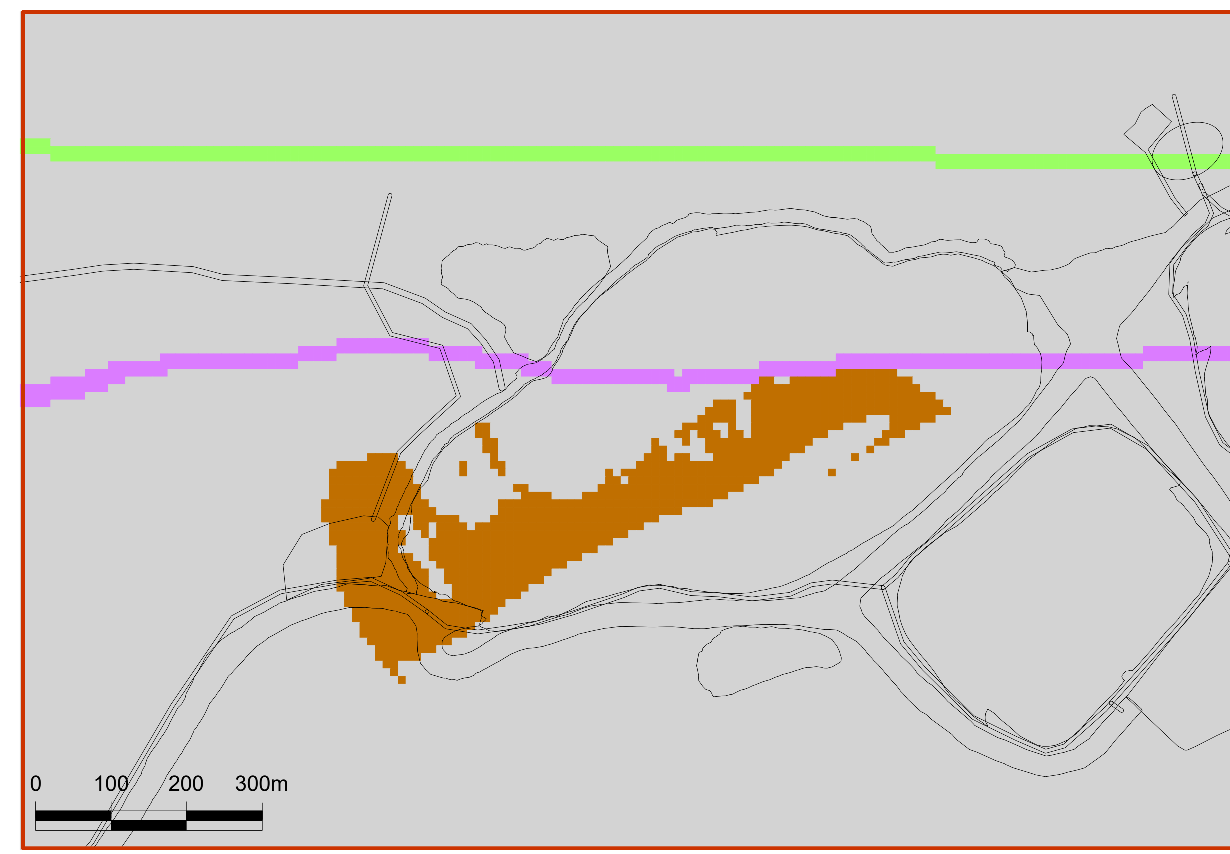
SHALLOW BEDROCK GRANITE FORMATION

SHALLOW BEDROCK ARGILLITE FORMATION

SHALLOW MUD LAKE FAULT

SHALLOW CAMERON FLOWAGE FAULT

DETAIL:



0 500 1,000 1,500m

ATLANTIC GOLD CORPORATION
MARINETTE, NOVA SCOTIA
BEAVER DAM MINE

HYDRAULIC CONDUCTIVITY DISTRIBUTION IN SHALLOW BEDROCK (LAYER 2)

088664-031

January 19, 2021

FIGURE 5.3

HEG file: Z:\HEG\088664\DOCUMENTATION\RPT\088664-RPT-13\FIGURES\Figure 5.3 - Hydraulic Conductivity Distribution in Shallow Bedrock (Layer 2).srf

LEGEND

MINE FEATURES

NO-FLOW BOUNDARY CONDITION

HYDRAULIC CONDUCTIVITY ZONES

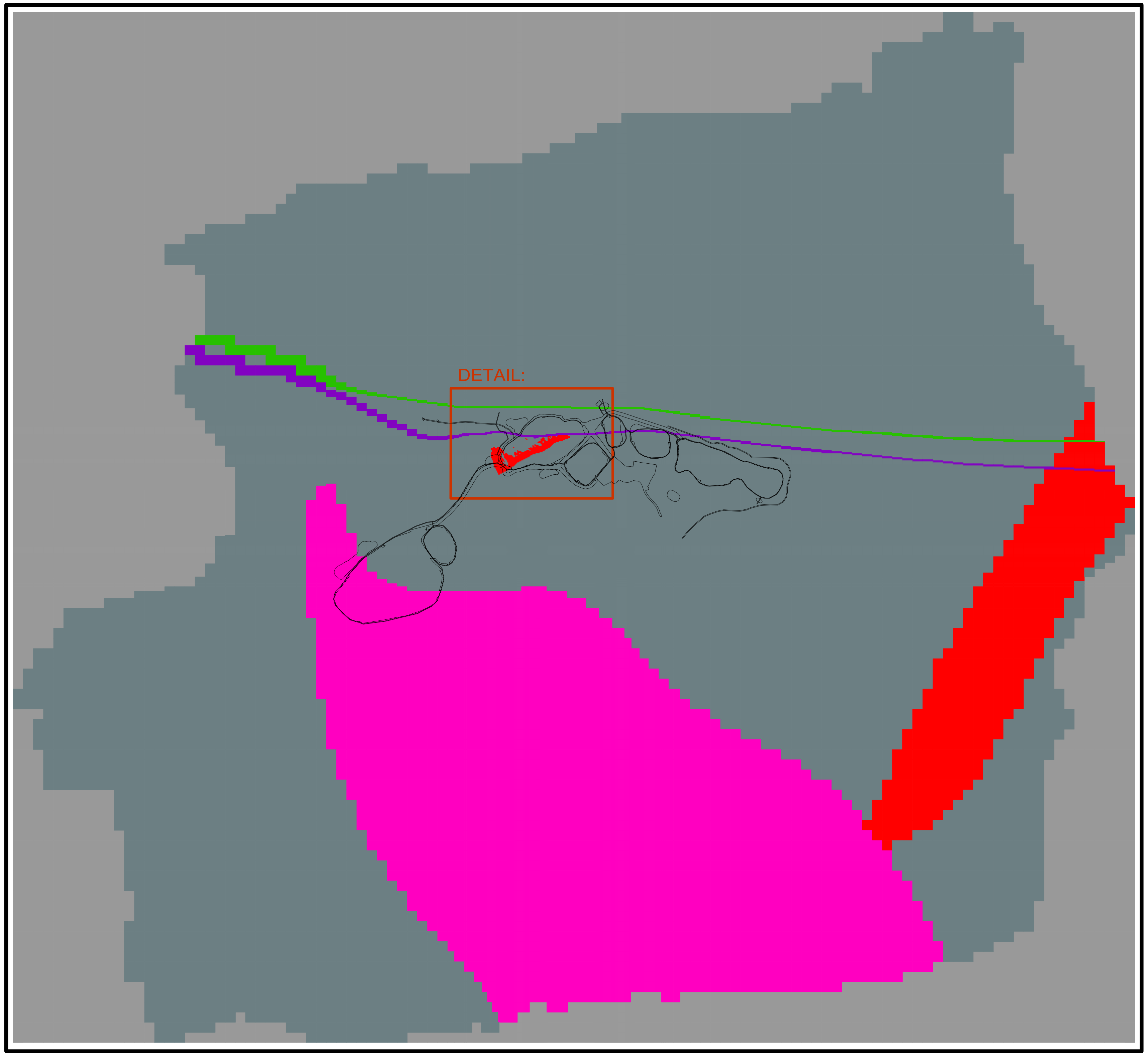
DEEP BEDROCK GREYWACKE FORMATION

DEEP BEDROCK GRANITE FORMATION

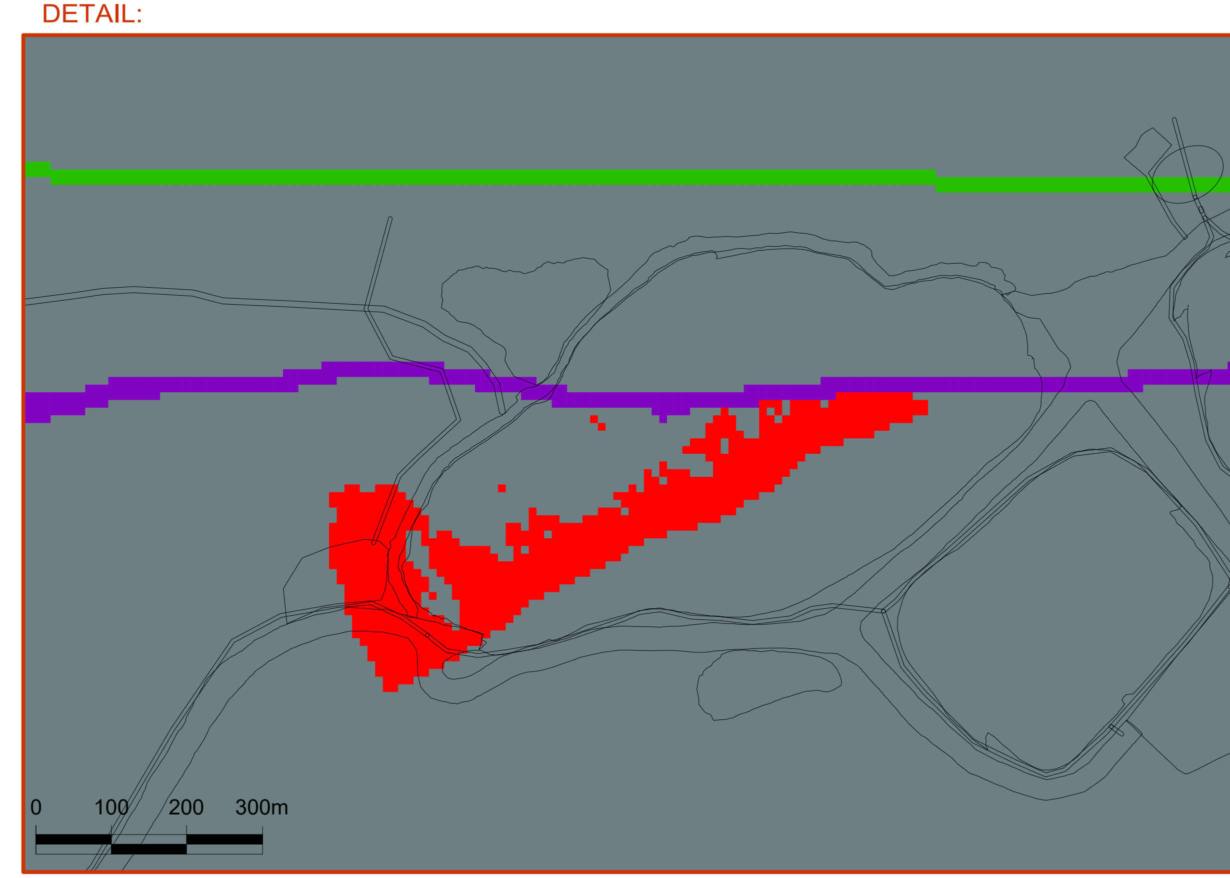
DEEP BEDROCK ARGILLITE FORMATION

DEEP MUD LAKE FAULT

DEEP CAMERON FLOWAGE FAULT



DETAIL:



0 500 1,000 1,500m

ATLANTIC GOLD CORPORATION
MARINETTE, NOVA SCOTIA
BEAVER DAM MINE

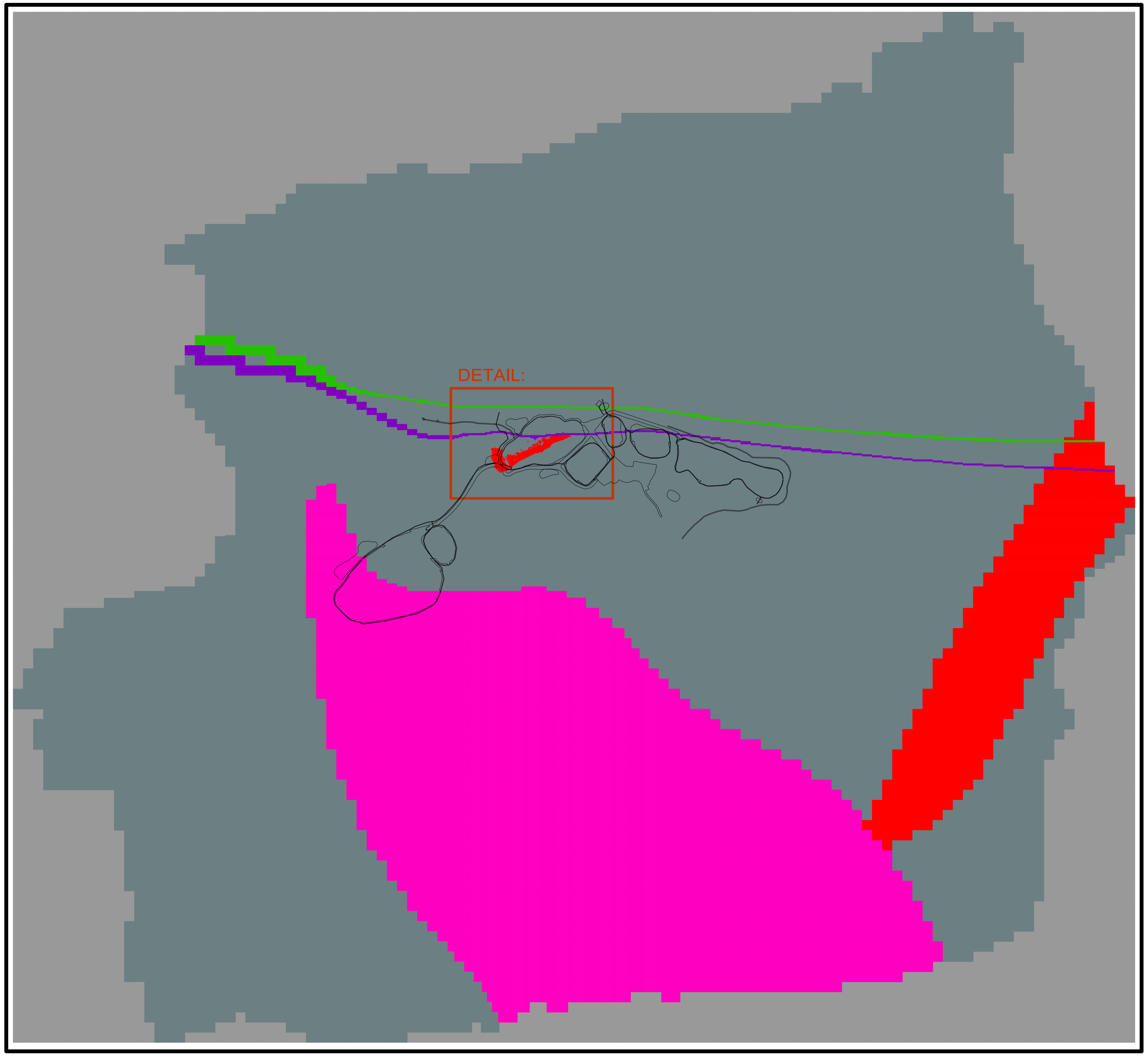
HYDRAULIC CONDUCTIVITY DISTRIBUTION IN DEEP BEDROCK (LAYER 3)

088664-031

January 19, 2021

FIGURE 5.4

HEG file: Z:\HEG\088664\DOCUMENTATION\RPT\088664-RPT-13\FIGURES\Figure 5.4 - Hydraulic Conductivity Distribution in Deep Bedrock (Layer 3).srf



LEGEND

MINE FEATURES

NO-FLOW BOUNDARY CONDITION

HYDRAULIC CONDUCTIVITY ZONES

DEEP BEDROCK GREYWACKE FORMATION

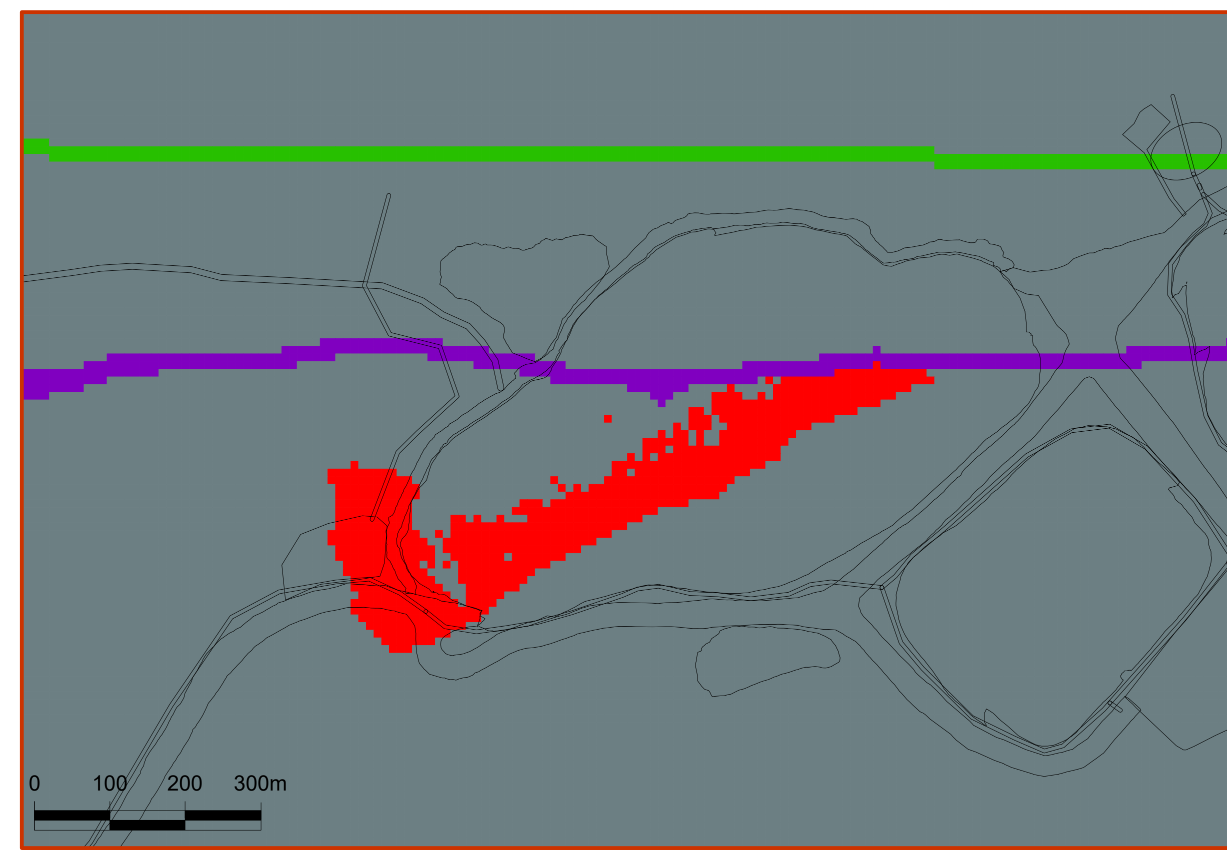
DEEP BEDROCK GRANITE FORMATION

DEEP BEDROCK ARGILLITE FORMATION

DEEP MUD LAKE FAULT

DEEP CAMERON FLOWAGE FAULT

DETAIL:



0 500 1,000 1,500m

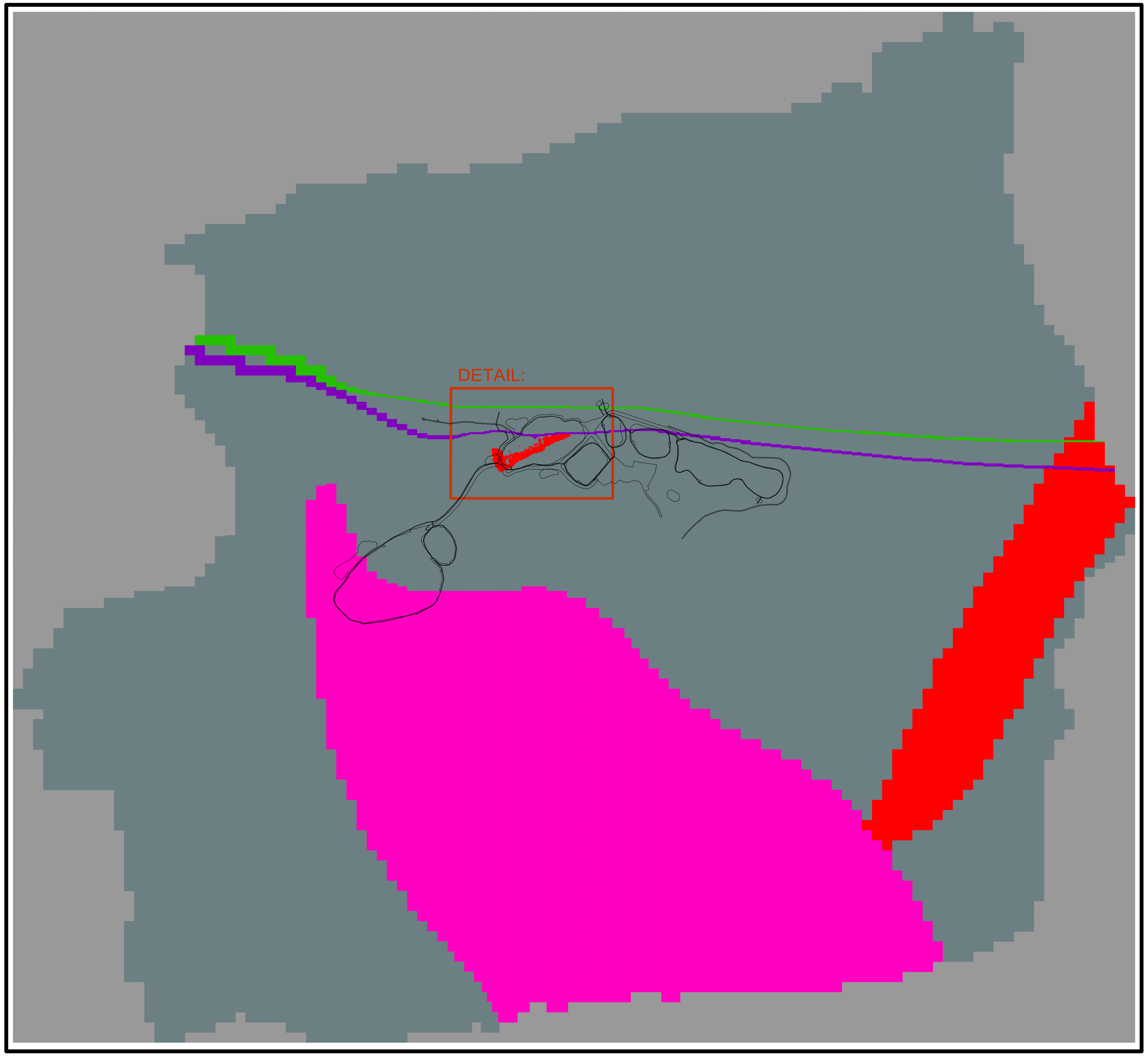
ATLANTIC GOLD CORPORATION
MARINETTE, NOVA SCOTIA
BEAVER DAM MINE

HYDRAULIC CONDUCTIVITY DISTRIBUTION IN DEEP BEDROCK (LAYER 4)

088664-031

January 19, 2021

FIGURE 5.5



LEGEND

MINE FEATURES

NO-FLOW BOUNDARY CONDITION

HYDRAULIC CONDUCTIVITY ZONES

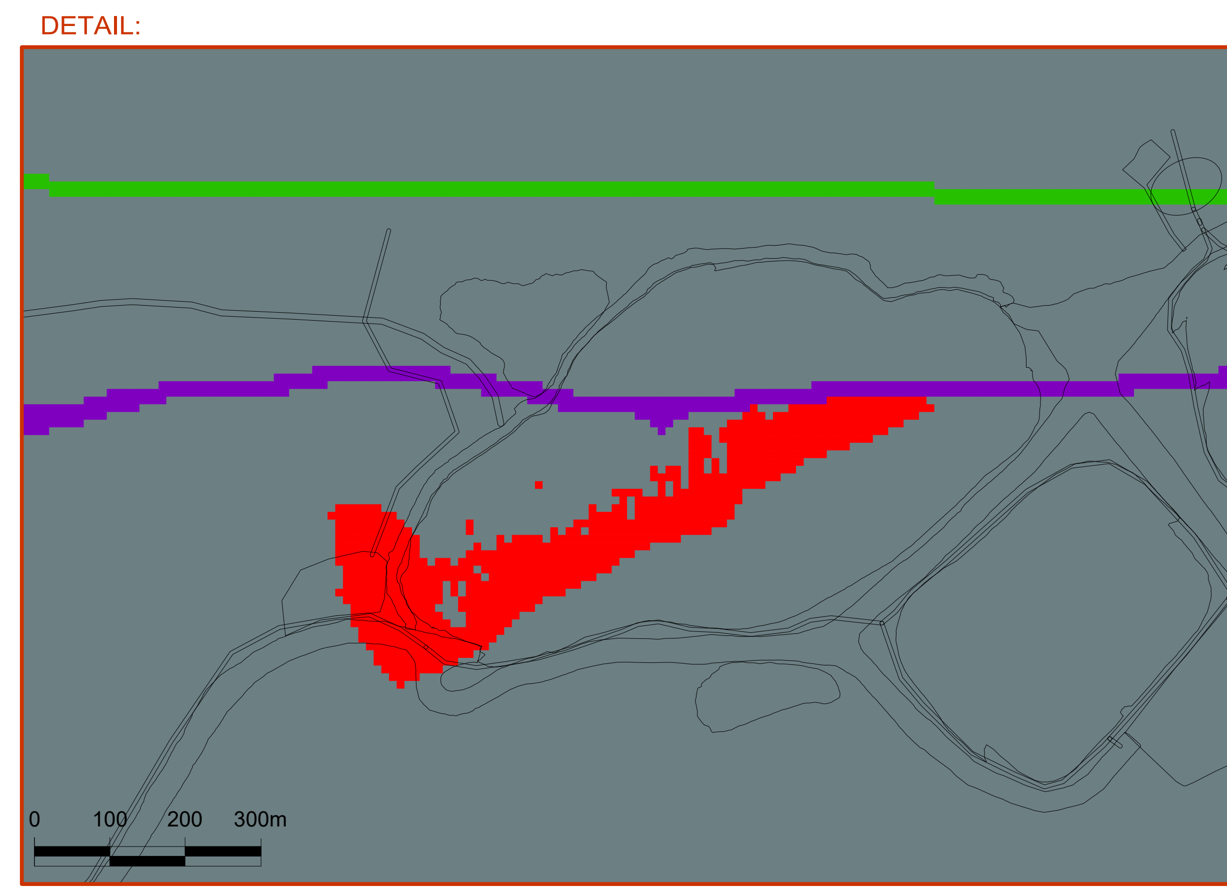
DEEP BEDROCK GREYWACKE FORMATION

DEEP BEDROCK GRANITE FORMATION

DEEP BEDROCK ARGILLITE FORMATION

DEEP MUD LAKE FAULT

DEEP CAMERON FLOWAGE FAULT



0 500 1,000 1,500m

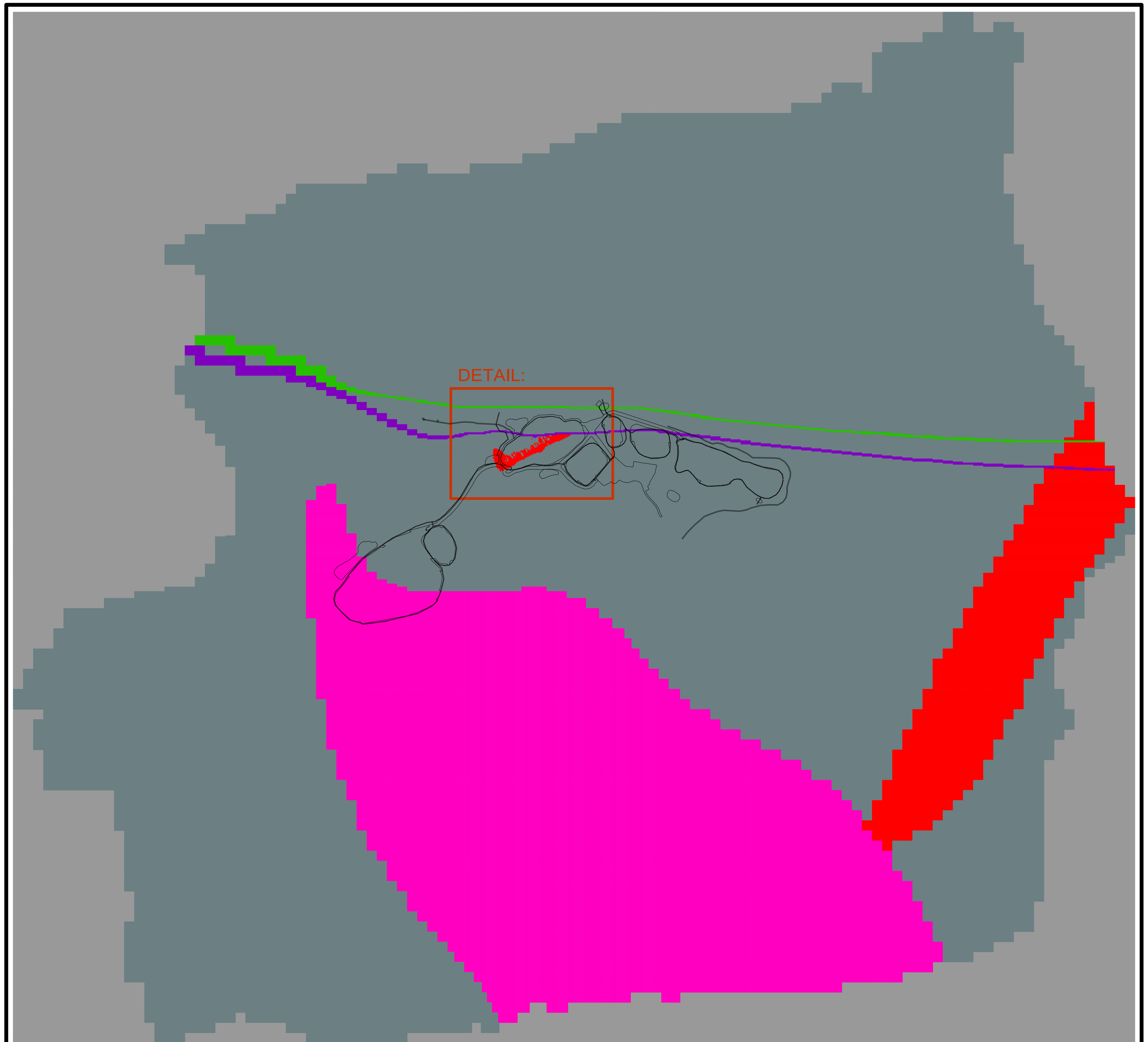
ATLANTIC GOLD CORPORATION
MARINETTE, NOVA SCOTIA
BEAVER DAM MINE

HYDRAULIC CONDUCTIVITY DISTRIBUTION IN DEEP BEDROCK (LAYER 5)

088664-031

January 19, 2021

FIGURE 5.6



LEGEND

MINE FEATURES

NO-FLOW BOUNDARY CONDITION

HYDRAULIC CONDUCTIVITY ZONES

DEEP BEDROCK GREYWACKE FORMATION

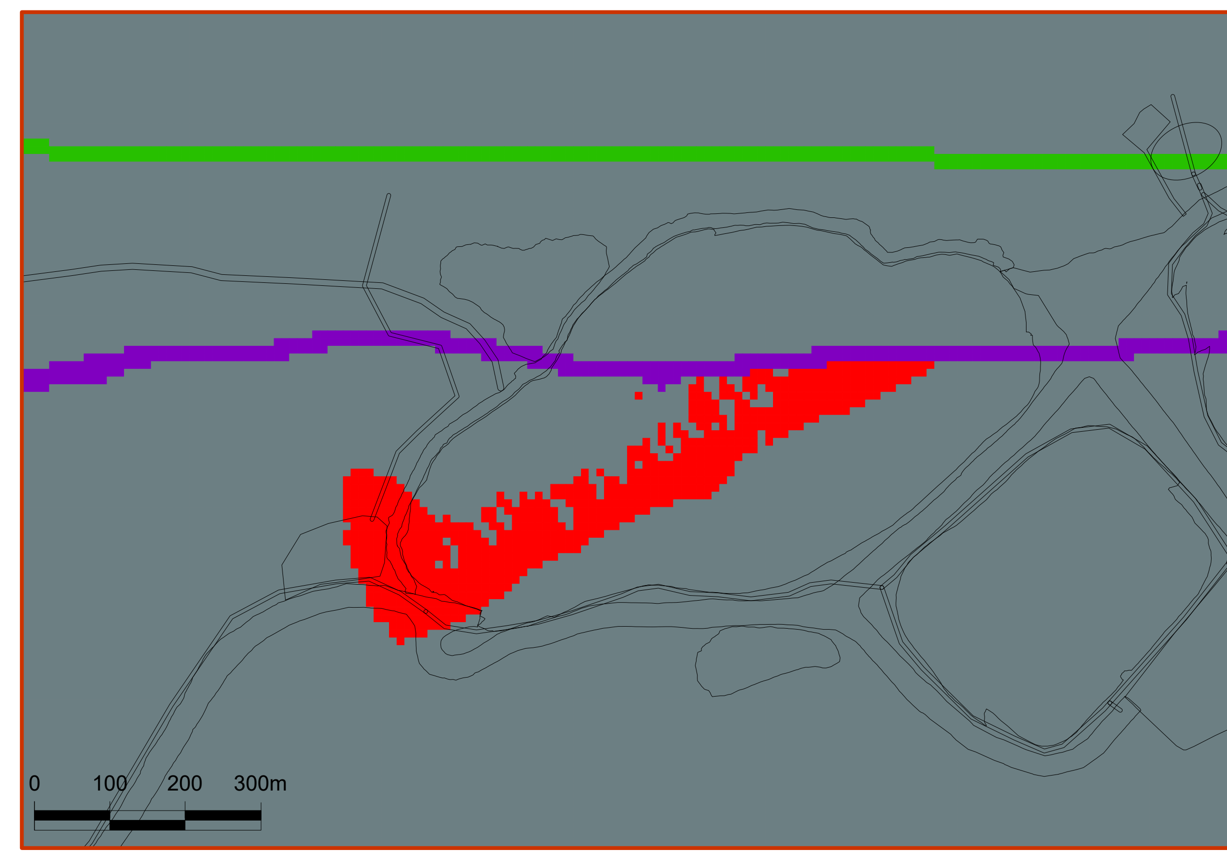
DEEP BEDROCK GRANITE FORMATION

DEEP BEDROCK ARGILLITE FORMATION

DEEP MUD LAKE FAULT

DEEP CAMERON FLOWAGE FAULT

DETAIL:



0 500 1,000 1,500m

ATLANTIC GOLD CORPORATION
MARINETTE, NOVA SCOTIA
BEAVER DAM MINE

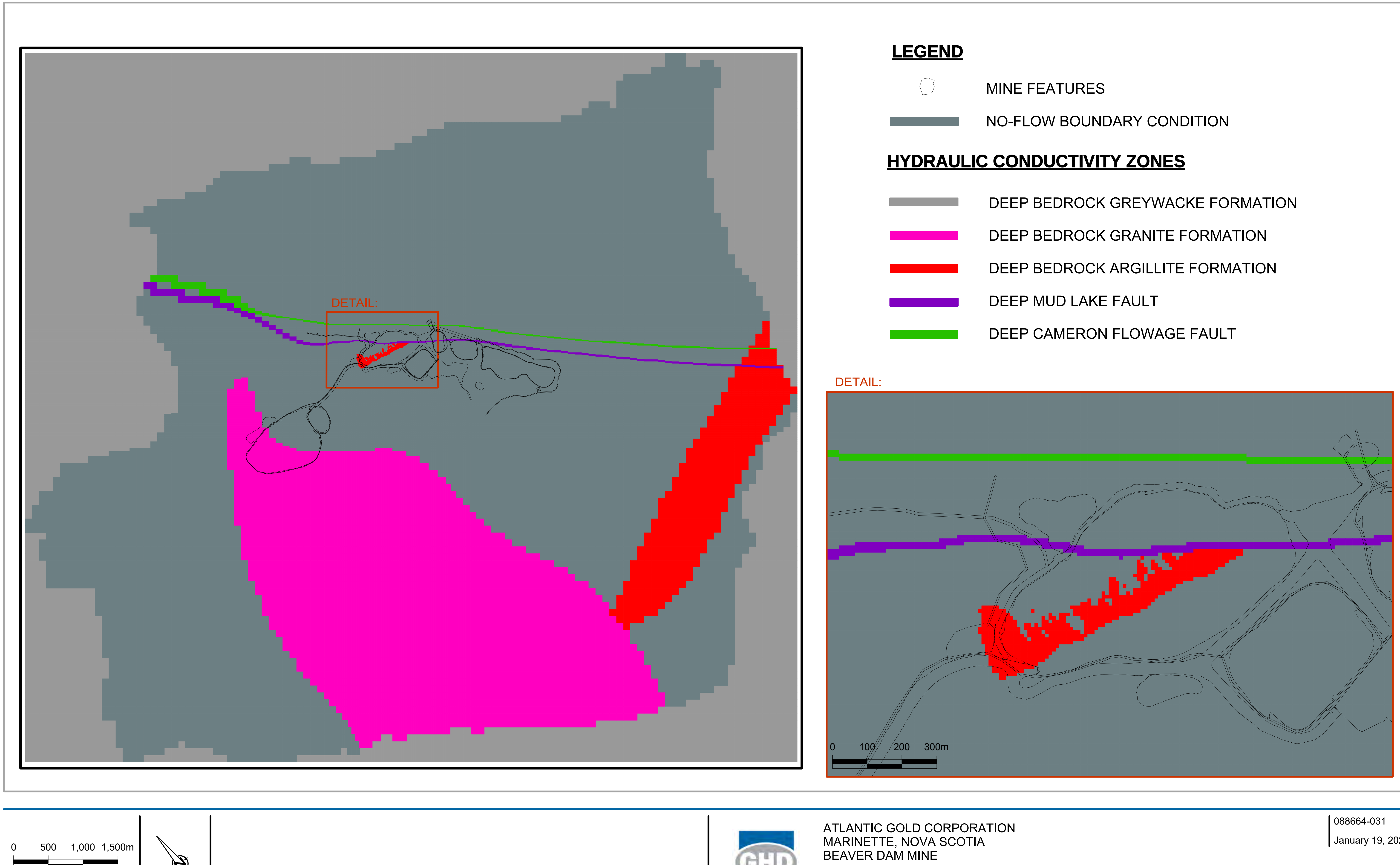
HYDRAULIC CONDUCTIVITY DISTRIBUTION IN DEEP BEDROCK (LAYER 6)

088664-031

January 19, 2021

FIGURE 5.7

HEG file: Z:\HEG\088664\DOCUMENTATION\RPT\088664-RPT-13\FIGURES\Figure 5.7 - Hydraulic Conductivity Distribution in Deep Bedrock (Layer 6).srf



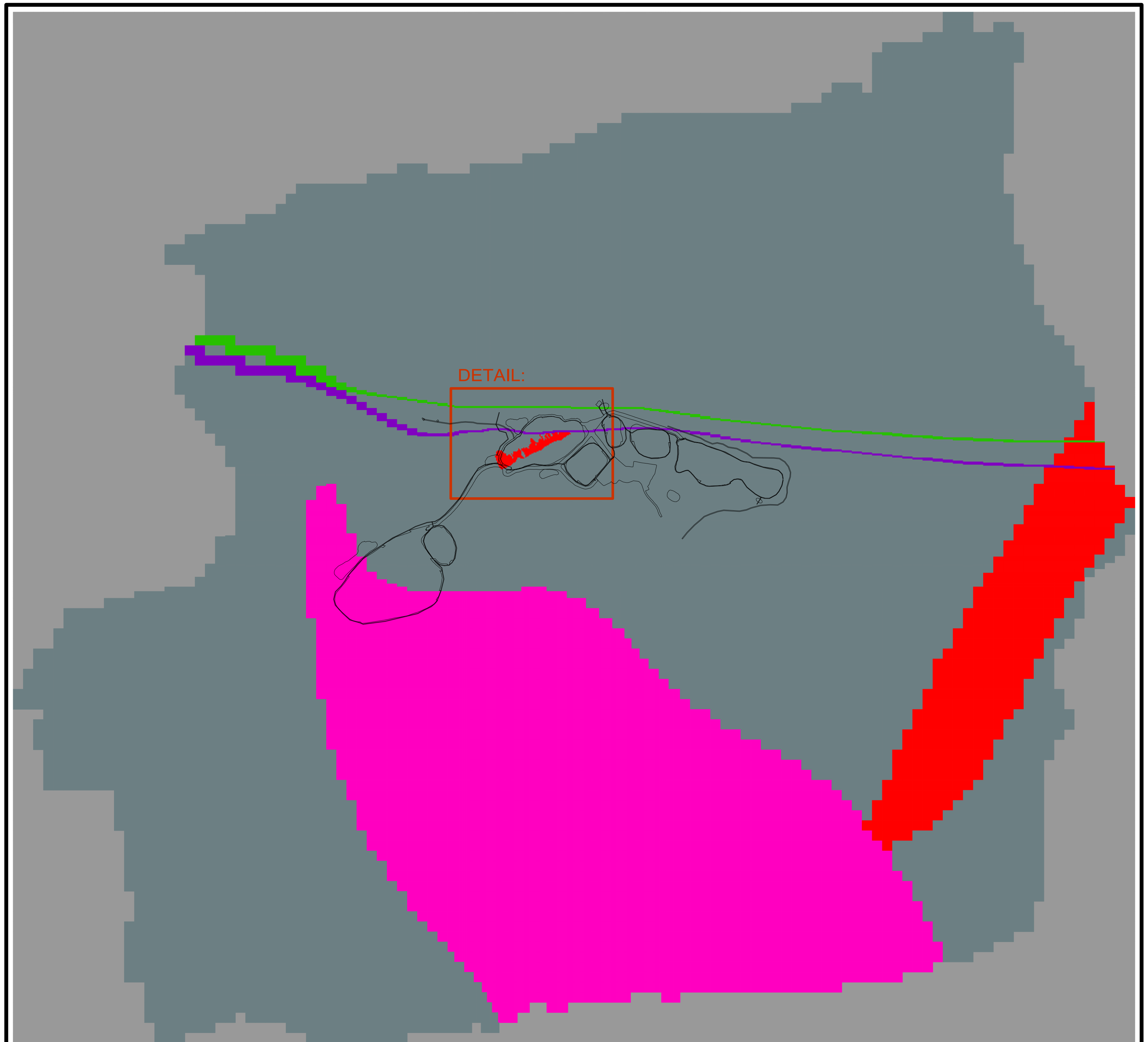
ATLANTIC GOLD CORPORATION
MARINETTE, NOVA SCOTIA
BEAVER DAM MINE

HYDRAULIC CONDUCTIVITY DISTRIBUTION IN DEEP BEDROCK (LAYER 7)

088664-031
January 19, 2021

FIGURE 5.8

HEG file: Z:\HEG\088664\DOCUMENTATION\RPT\088664-RPT-13\FIGURES\Figure 5.8 - Hydraulic Conductivity Distribution in Deep Bedrock (Layer 7).srf



LEGEND

MINE FEATURES

NO-FLOW BOUNDARY CONDITION

HYDRAULIC CONDUCTIVITY ZONES

DEEP BEDROCK GREYWACKE FORMATION

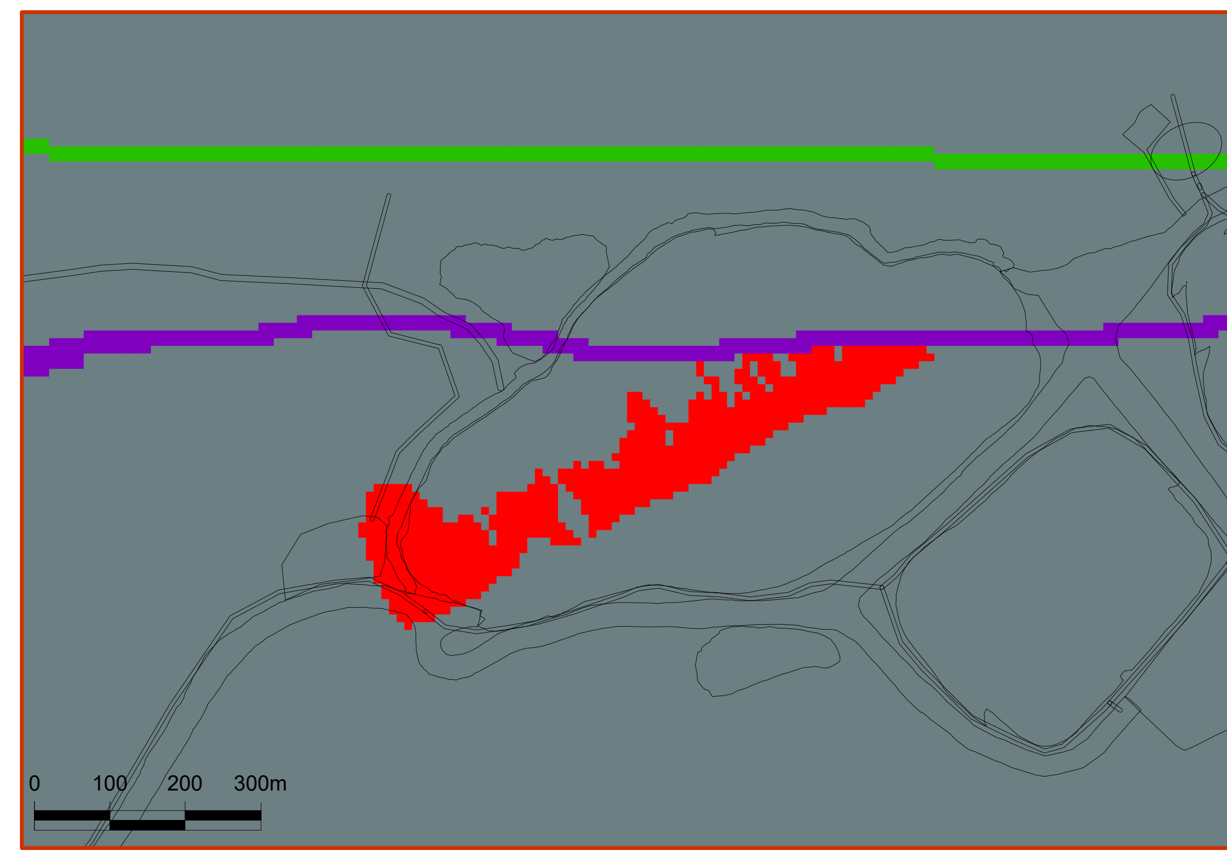
DEEP BEDROCK GRANITE FORMATION

DEEP BEDROCK ARGILLITE FORMATION

DEEP MUD LAKE FAULT

DEEP CAMERON FLOWAGE FAULT

DETAIL:



0 500 1,000 1,500m

ATLANTIC GOLD CORPORATION
MARINETTE, NOVA SCOTIA
BEAVER DAM MINE

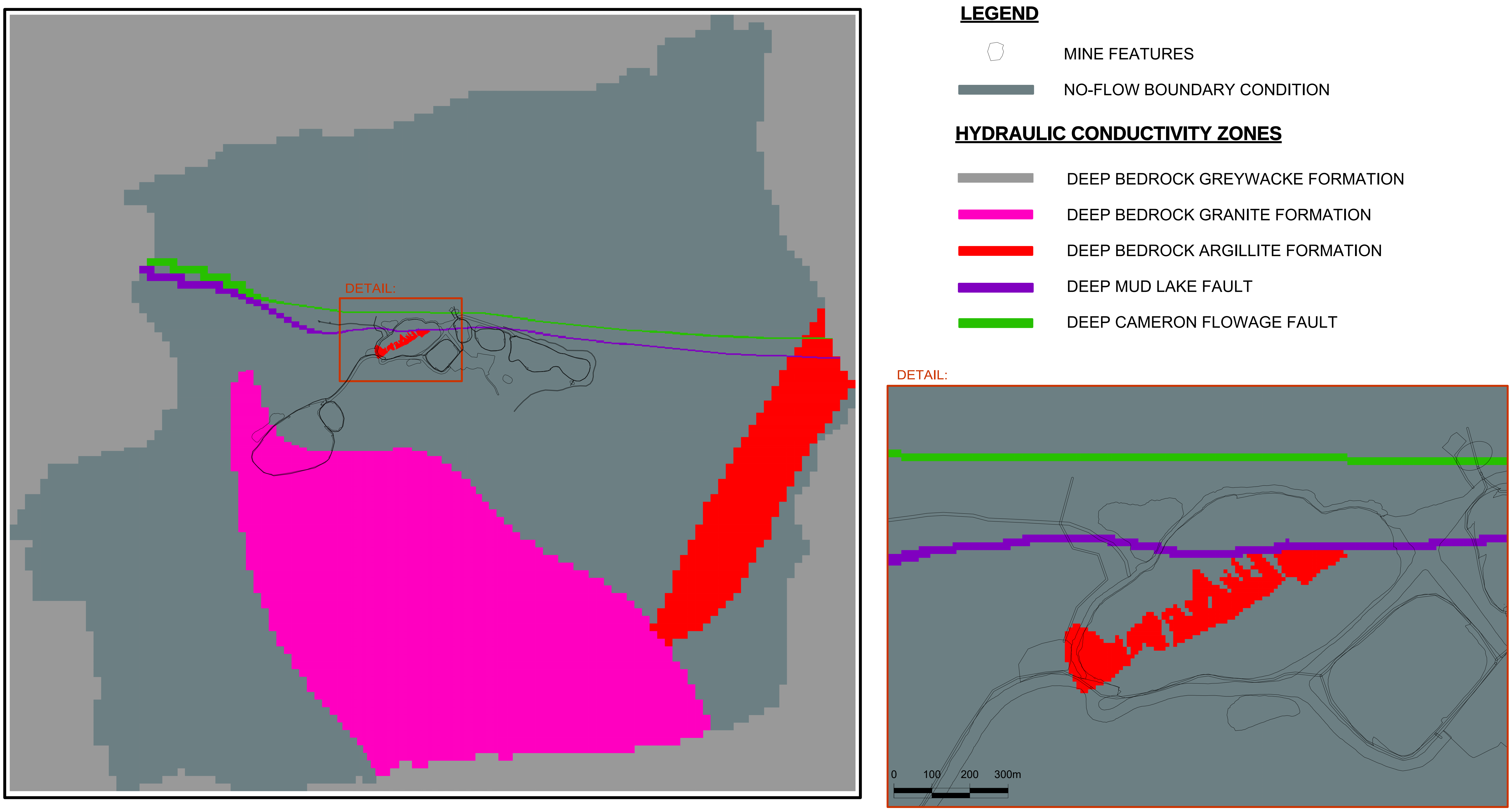
HYDRAULIC CONDUCTIVITY DISTRIBUTION IN DEEP BEDROCK (LAYER 8)

088664-031

January 19, 2021

FIGURE 5.9

HEG file: Z:\HEG\088664\DOCUMENTATION\RPT\088664-RPT-13\FIGURES\Figure 5.9 - Hydraulic Conductivity Distribution in Deep Bedrock (Layer 8).srf



0 500 1,000 1,500m

ATLANTIC GOLD CORPORATION
MARINETTE, NOVA SCOTIA
BEAVER DAM MINE

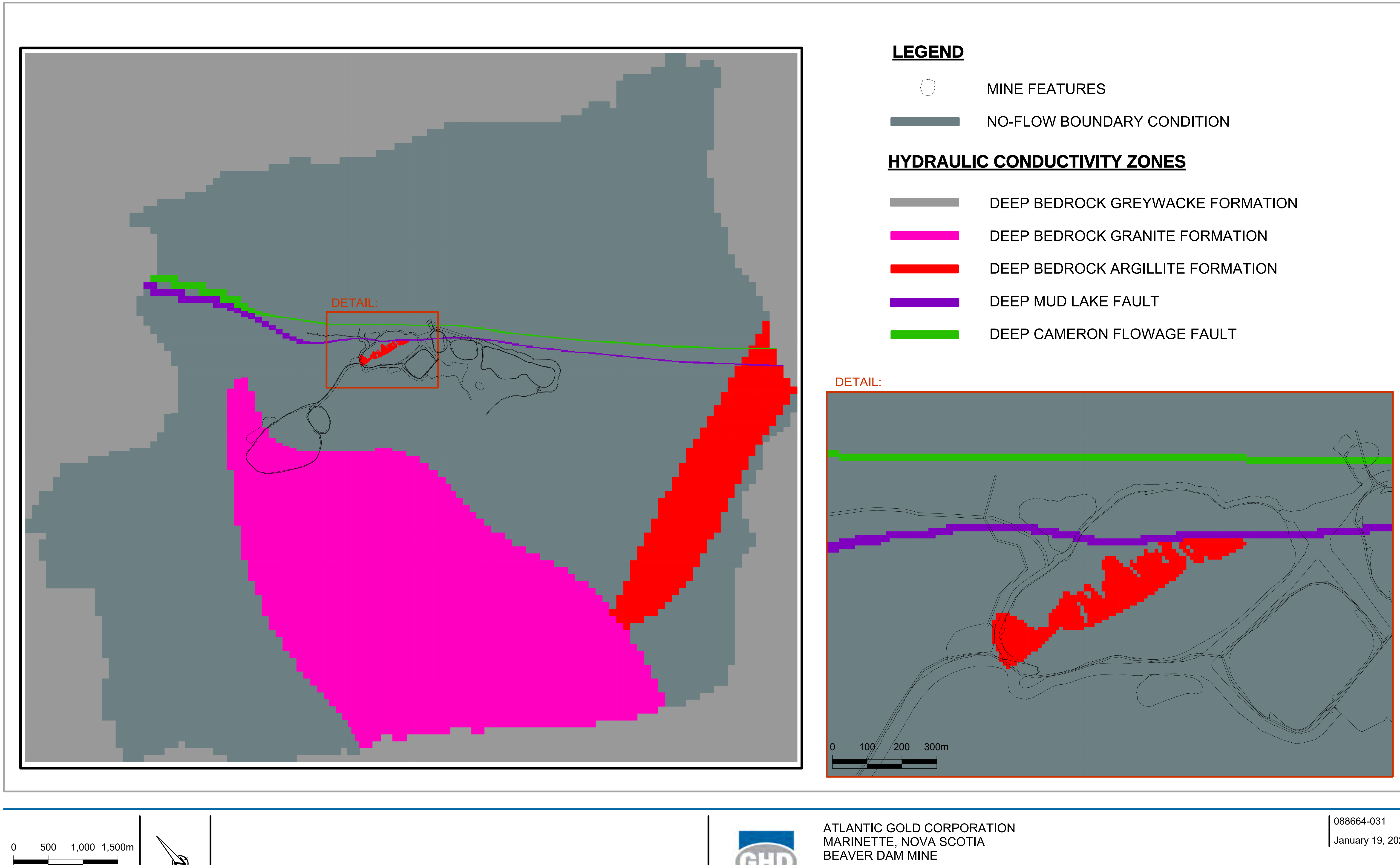
HYDRAULIC CONDUCTIVITY DISTRIBUTION IN DEEP BEDROCK (LAYER 9)

088664-031

January 19, 2021

FIGURE 5.10

HEG file: Z:\HEG\088664\DOCUMENTATION\RPT\088664-RPT-13\FIGURES\Figure 5.10 - Hydraulic Conductivity Distribution in Deep Bedrock (Layer 9).srf



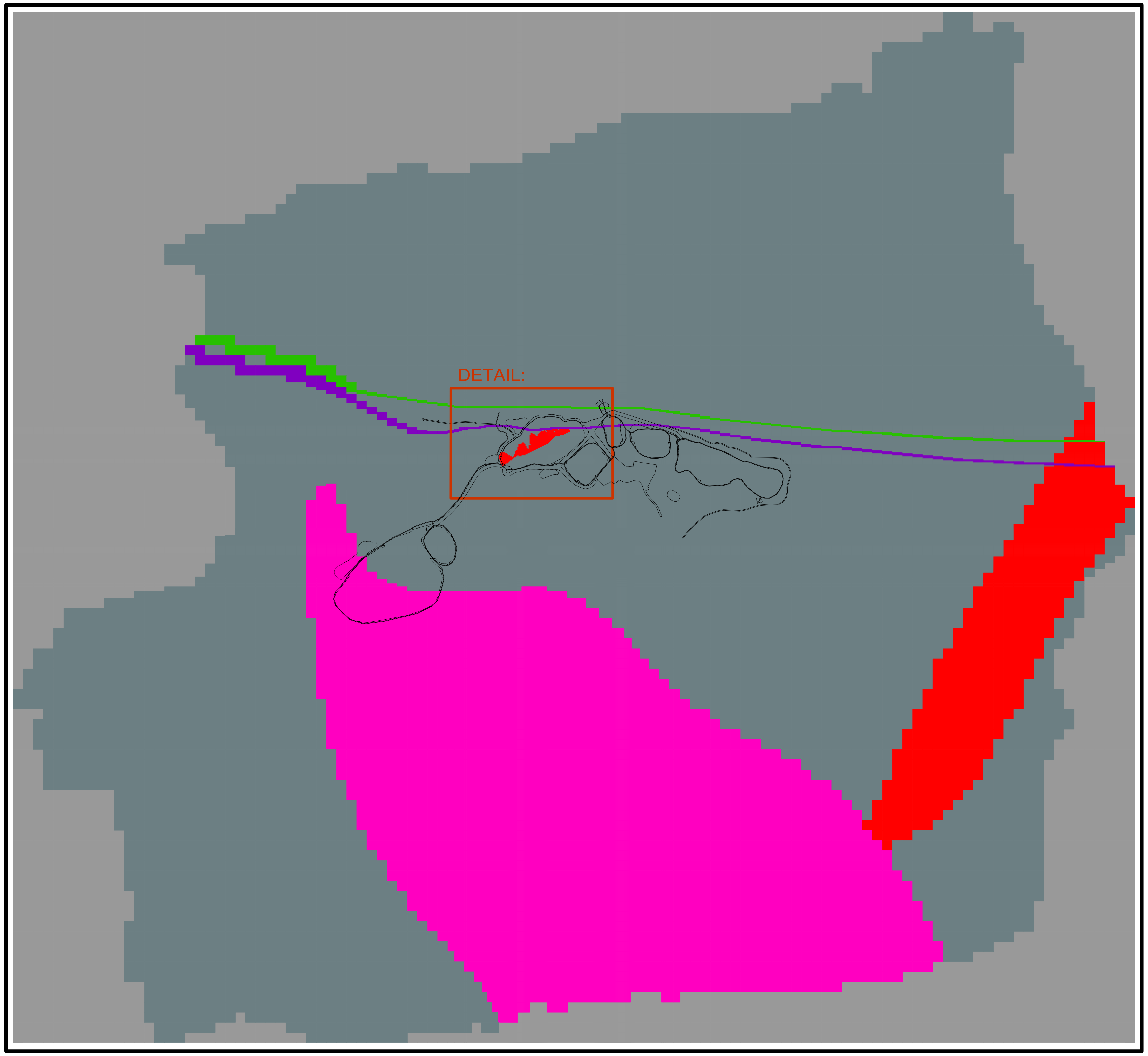
ATLANTIC GOLD CORPORATION
MARINETTE, NOVA SCOTIA
BEAVER DAM MINE

HYDRAULIC CONDUCTIVITY DISTRIBUTION IN DEEP BEDROCK (LAYER 10)

088664-031
January 19, 2021

FIGURE 5.11

HEG file: Z:\HEG\088664\DOCUMENTATION\RPT\088664-RPT-13\FIGURES\Figure 5.11 - Hydraulic Conductivity Distribution in Deep Bedrock (Layer 10).srf



LEGEND

MINE FEATURES

NO-FLOW BOUNDARY CONDITION

HYDRAULIC CONDUCTIVITY ZONES

DEEP BEDROCK GREYWACKE FORMATION

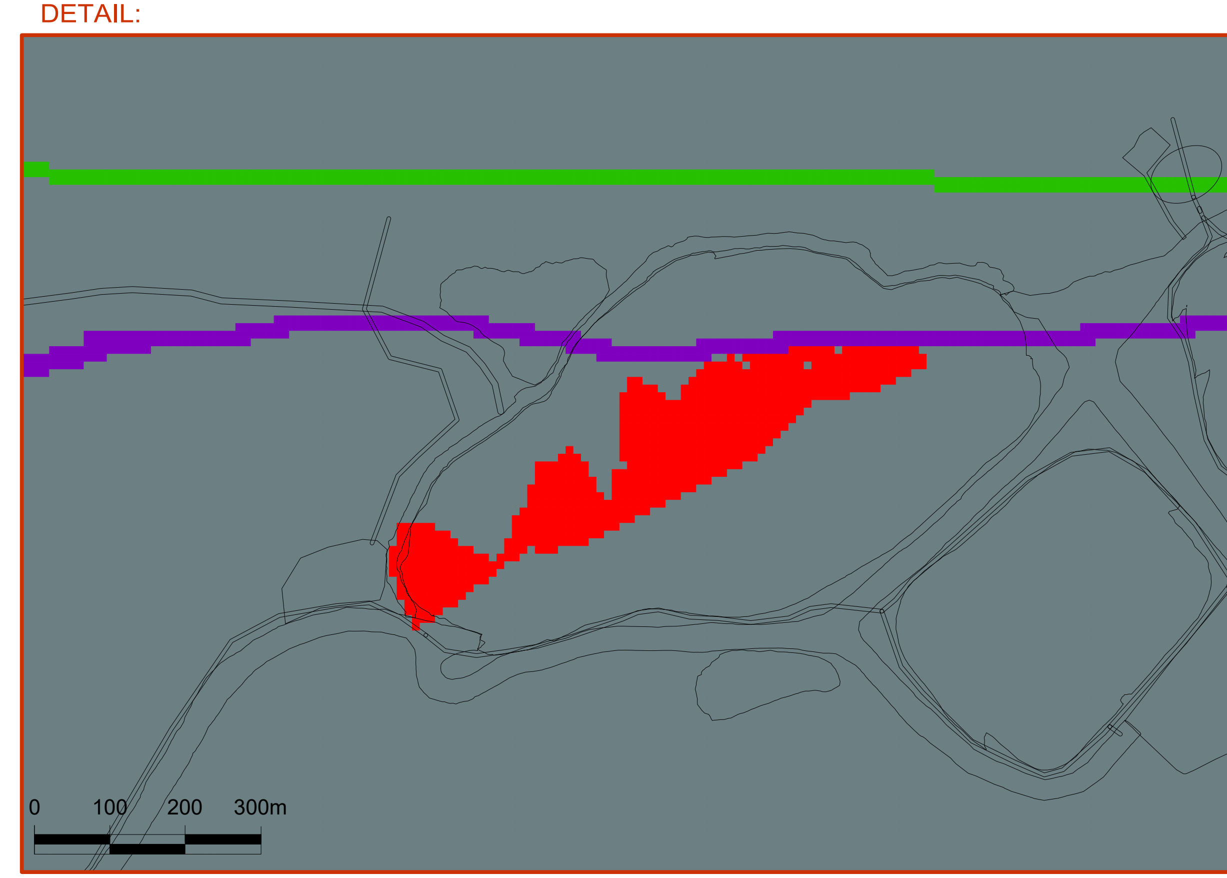
DEEP BEDROCK GRANITE FORMATION

DEEP BEDROCK ARGILLITE FORMATION

DEEP MUD LAKE FAULT

DEEP CAMERON FLOWAGE FAULT

DETAIL:



0 500 1,000 1,500m

ATLANTIC GOLD CORPORATION
MARINETTE, NOVA SCOTIA
BEAVER DAM MINE

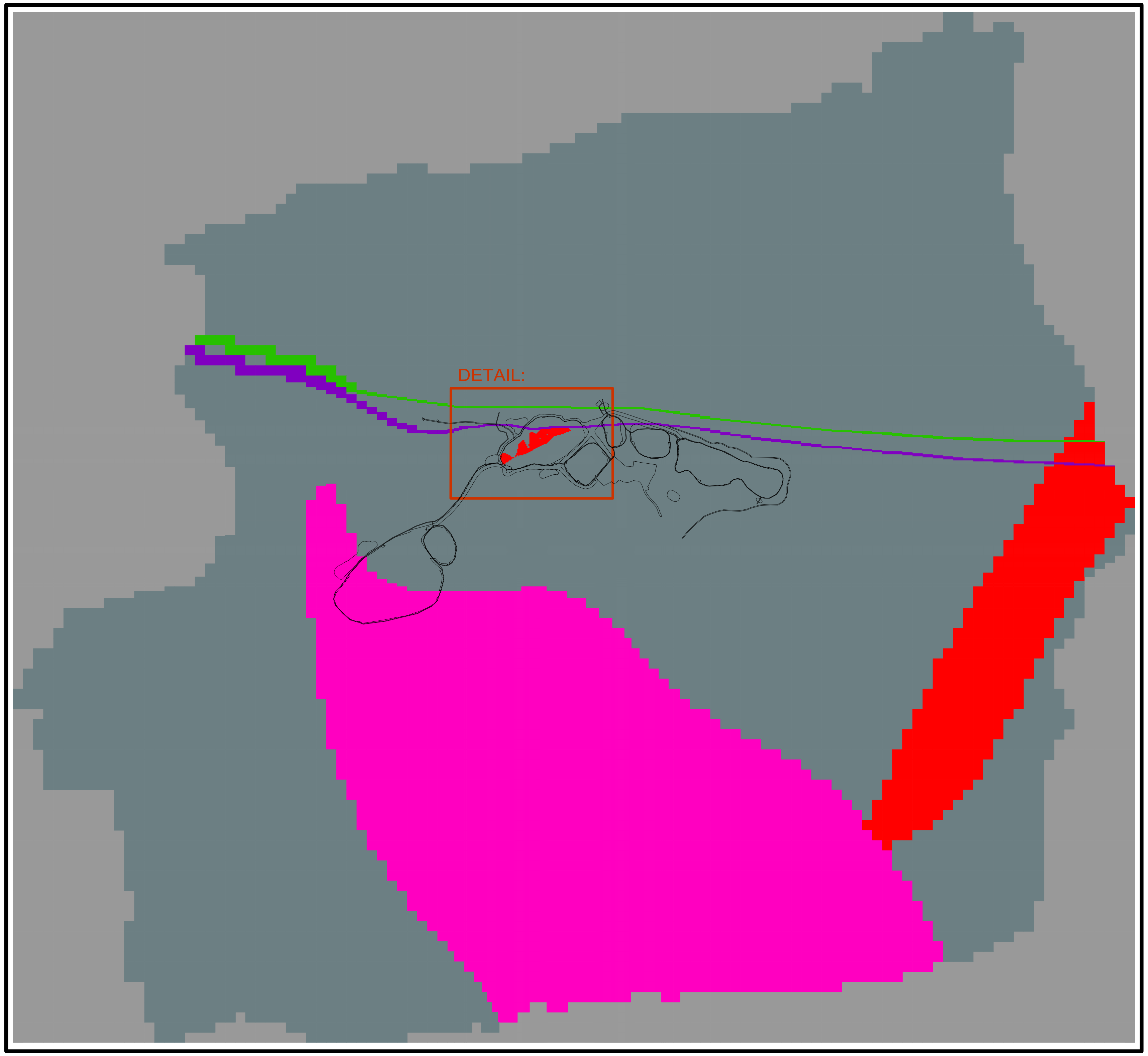
HYDRAULIC CONDUCTIVITY DISTRIBUTION IN DEEP BEDROCK (LAYER 11)

088664-031

January 19, 2021

FIGURE 5.12

HEG file: Z:\HEG\088664\DOCUMENTATION\RPT\088664-RPT-13\FIGURES\Figure 5.12 - Hydraulic Conductivity Distribution in Deep Bedrock (Layer 11).srf



LEGEND

MINE FEATURES

NO-FLOW BOUNDARY CONDITION

HYDRAULIC CONDUCTIVITY ZONES

DEEP BEDROCK GREYWACKE FORMATION

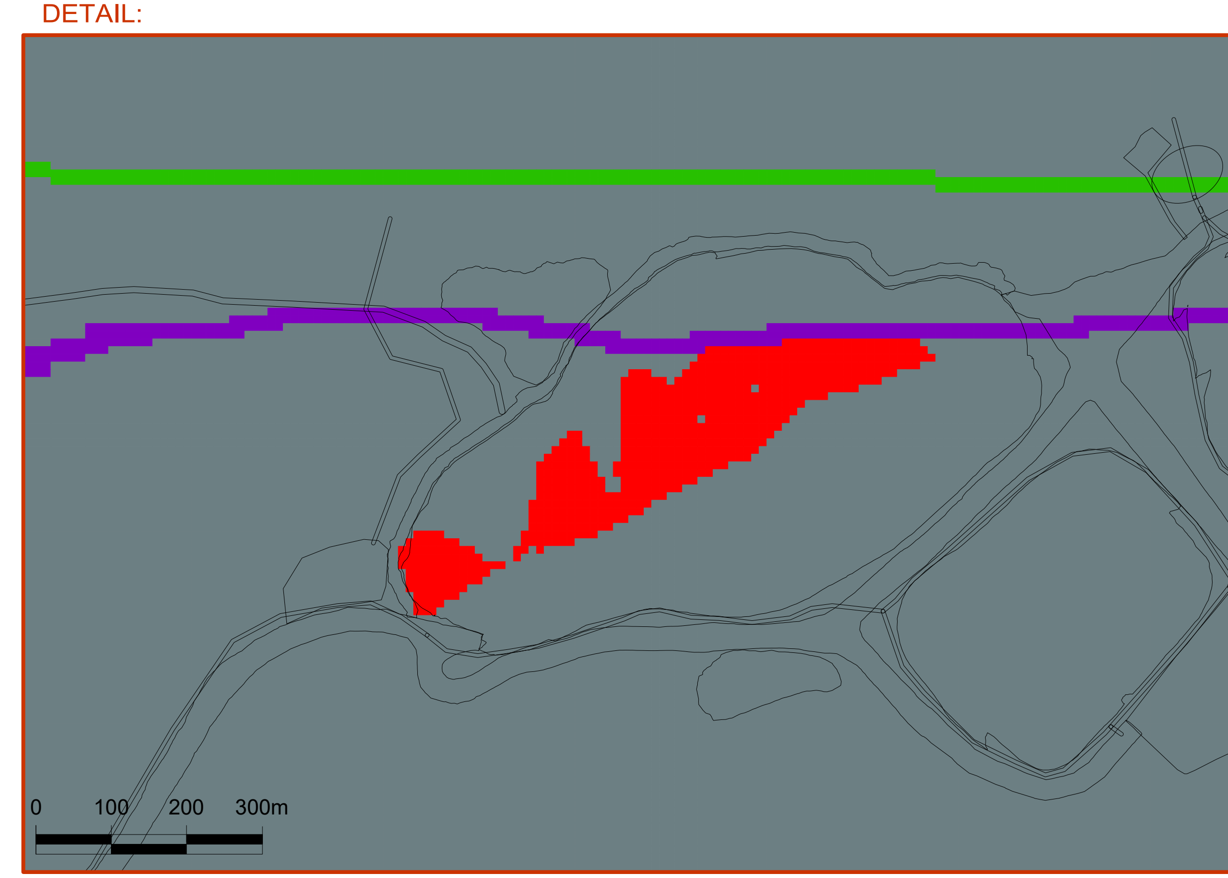
DEEP BEDROCK GRANITE FORMATION

DEEP BEDROCK ARGILLITE FORMATION

DEEP MUD LAKE FAULT

DEEP CAMERON FLOWAGE FAULT

DETAIL:



0 500 1,000 1,500m

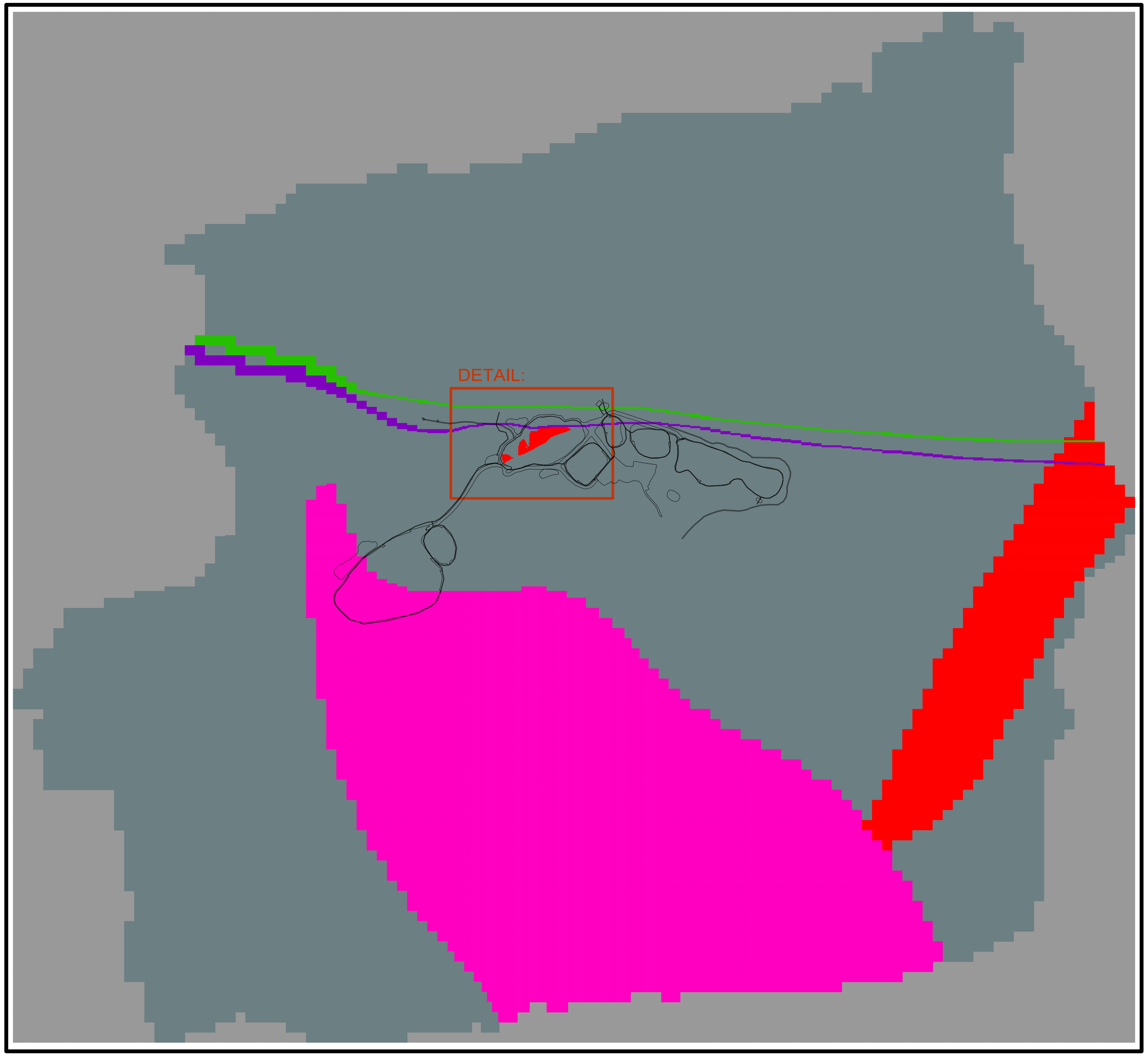
ATLANTIC GOLD CORPORATION
MARINETTE, NOVA SCOTIA
BEAVER DAM MINE

HYDRAULIC CONDUCTIVITY DISTRIBUTION IN DEEP BEDROCK (LAYER 12)

088664-031

January 19, 2021

FIGURE 5.13



LEGEND

MINE FEATURES

NO-FLOW BOUNDARY CONDITION

HYDRAULIC CONDUCTIVITY ZONES

DEEP BEDROCK GREYWACKE FORMATION

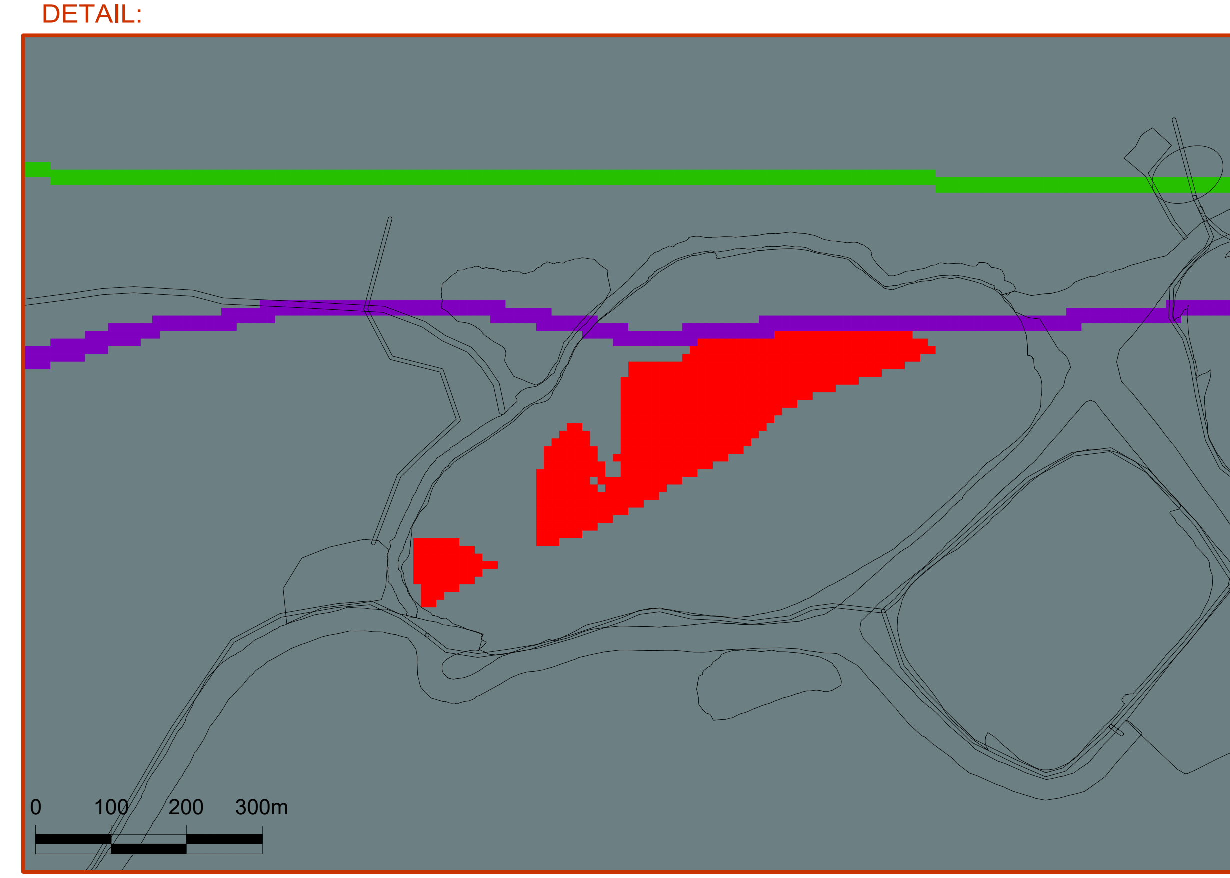
DEEP BEDROCK GRANITE FORMATION

DEEP BEDROCK ARGILLITE FORMATION

DEEP MUD LAKE FAULT

DEEP CAMERON FLOWAGE FAULT

DETAIL:



0 500 1,000 1,500m

ATLANTIC GOLD CORPORATION
MARINETTE, NOVA SCOTIA
BEAVER DAM MINE

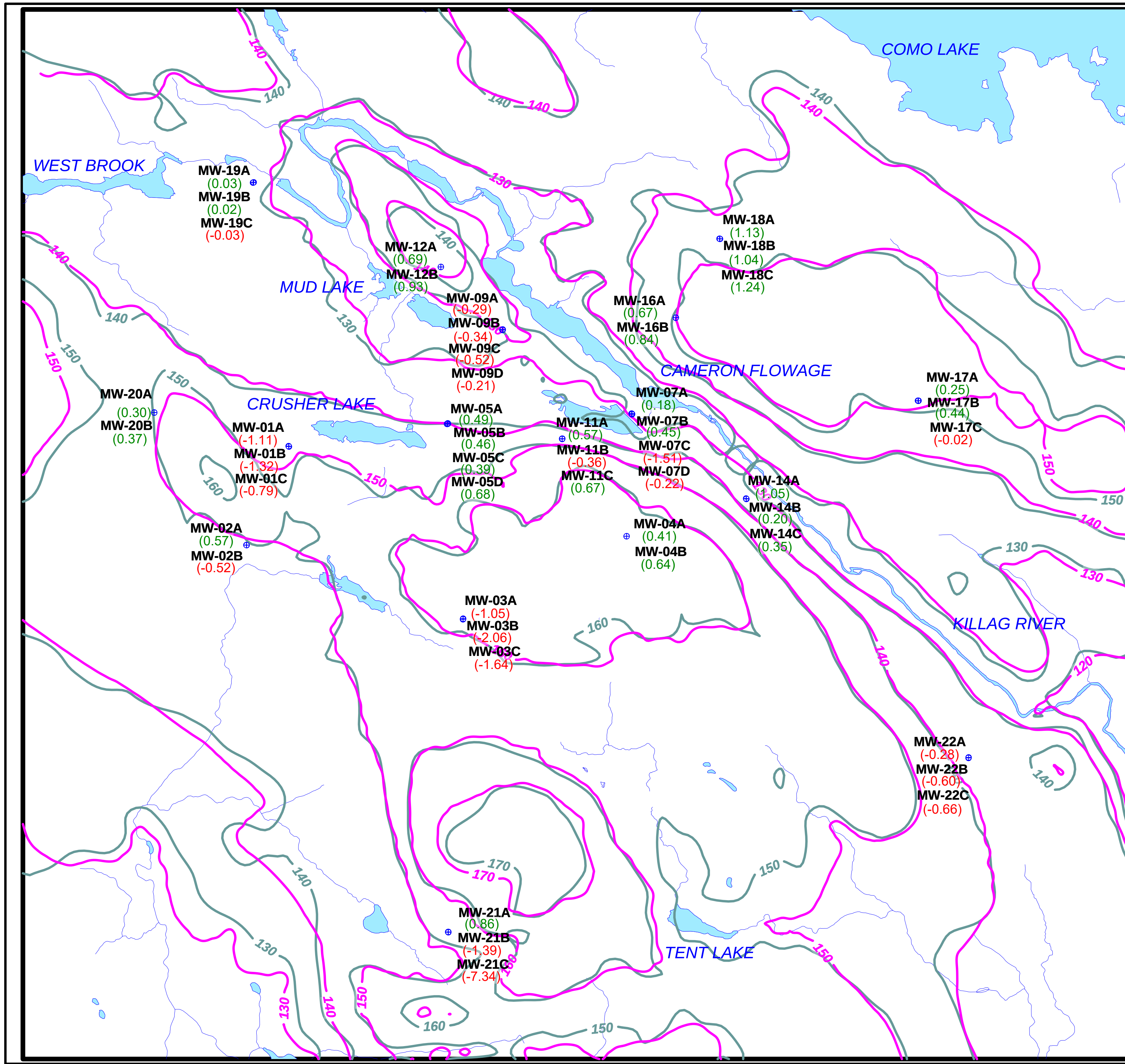
HYDRAULIC CONDUCTIVITY DISTRIBUTION IN DEEP BEDROCK (LAYER 13)

088664-031

January 19, 2021

FIGURE 5.14

HEG file: Z:\HEG\088664\DOCUMENTATION\RPT\088664-RPT-13\FIGURES\Figure 5.14 - Hydraulic Conductivity Distribution in Deep Bedrock (Layer 13).srf



LEGEND

SURFACE WATER BODY

MW-17A ⊕ WATER LEVEL MONITORING LOCATION

(0.03) UNDER-PREDICTION OF OBSERVED GROUNDWATER ELEVATION (m)

(-0.21) OVER-PREDICTION OF OBSERVED GROUNDWATER ELEVATION (m)

— 140 — OBSERVED GROUNDWATER ELEVATION CONTOURS - JULY 18, 2018 (m AMSL)

— 140 — SIMULATED GROUNDWATER ELEVATION CONTOURS - JULY 18, 2018 (m AMSL)

0 600 1,200 1,800m

N

ATLANTIC GOLD CORPORATION
MARINETTE, NOVA SCOTIA
BEAVER DAM MINE

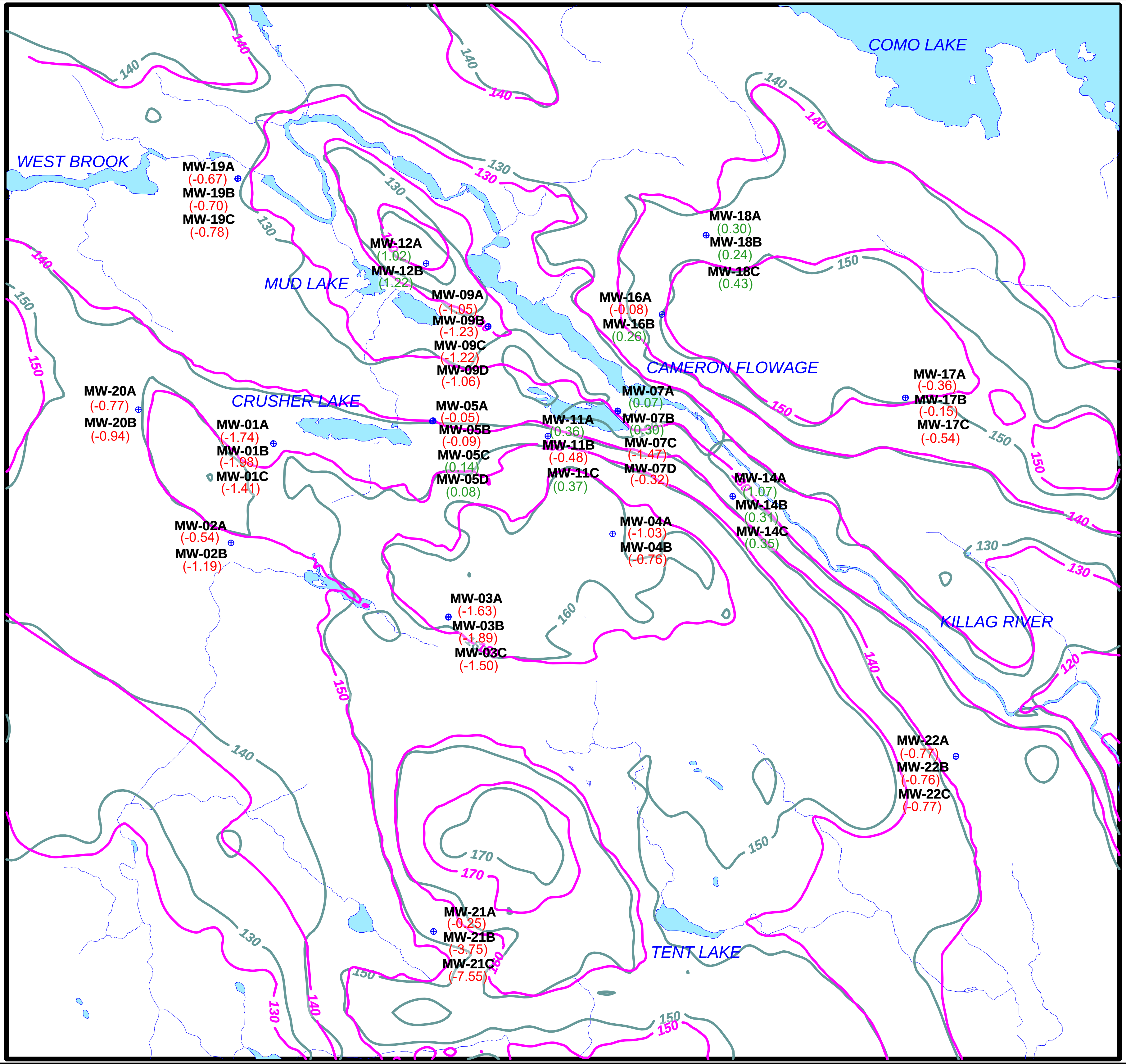
SIMULATE VERSUS OBSERVED GROUNDWATER ELEVATION CONTOURS - BASE CASE CONDITION

088664-031

November 13, 2019

FIGURE 6.1

HEG file: Z:\HEG\088664\DOCUMENTATION\RPT\088664-RPT-13\FIGURES\Figure 6.1 - Simulate versus Observed Groundwater Elevation Contours - Base Case Condition.srf



LEGEND

- SURFACE WATER BODY
- MW-17A ⊕ WATER LEVEL MONITORING LOCATION
- (0.11) UNDER-PREDICTION OF OBSERVED GROUNDWATER ELEVATION (m)
- (-0.54) OVER-PREDICTION OF OBSERVED GROUNDWATER ELEVATION (m)
- 140 OBSERVED GROUNDWATER ELEVATION CONTOURS - SEPTEMBER 5, 2018 (m AMSL)
- 140 SIMULATED GROUNDWATER ELEVATION CONTOURS - SEPTEMBER 5, 2018 (m AMSL)

0 600 1,200 1,800m

N

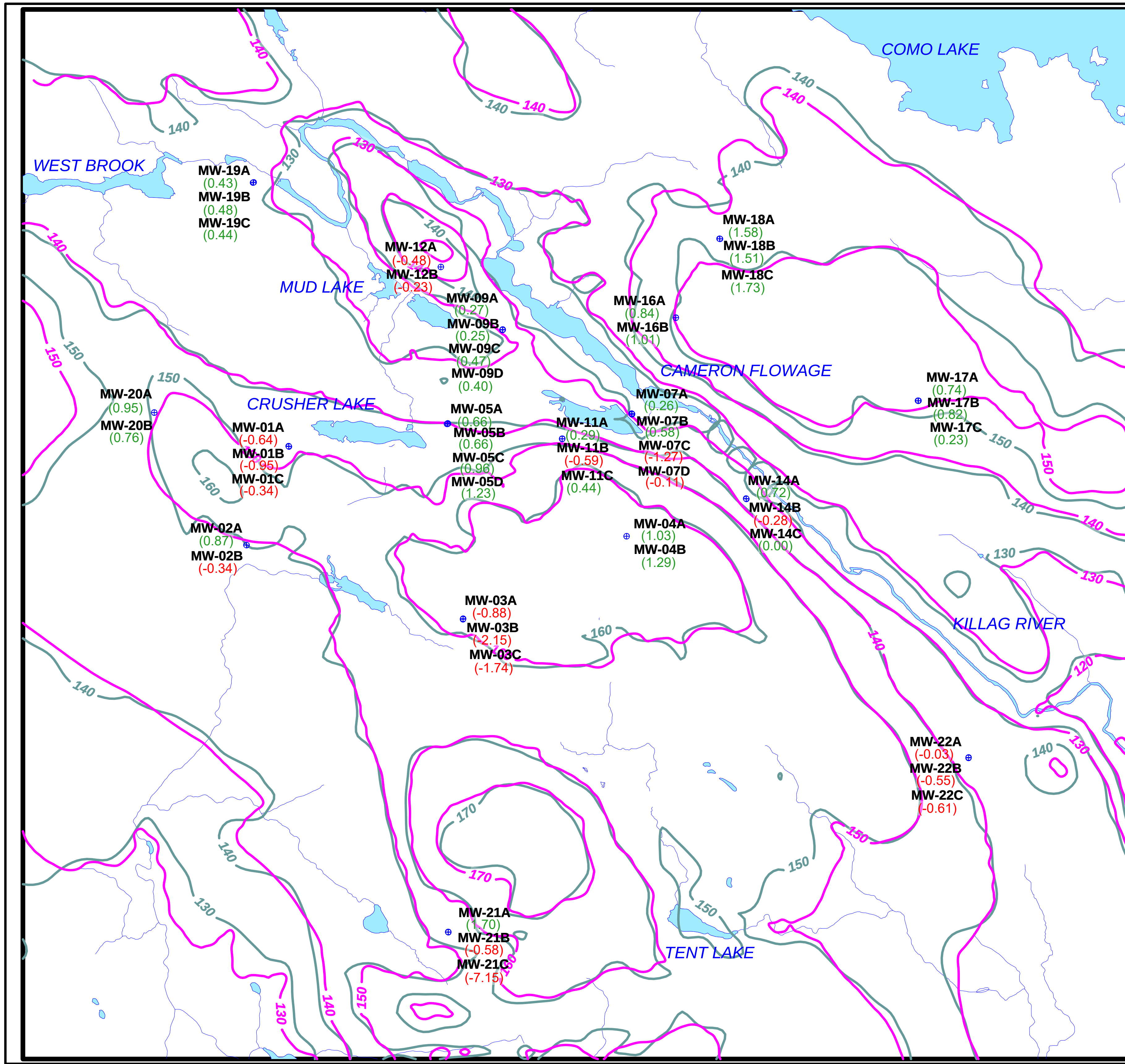
ATLANTIC GOLD CORPORATION
MARINETTE, NOVA SCOTIA
BEAVER DAM MINE

SIMULATE VERSUS OBSERVED GROUNDWATER ELEVATION CONTOURS - DRY CONDITION

088664-031
November 13, 2019

FIGURE 6.2

HEG file: Z:\HEG\088664\DOCUMENTATION\RPT\088664-RPT-13\FIGURES\Figure 6.2 - Simulate versus Observed Groundwater Elevation Contours - Dry Condition.srf



LEGEND

SURFACE WATER BODY

MW-17A — WATER LEVEL MONITORING LOCATION

(0.74) — UNDER-PREDICTION OF OBSERVED GROUNDWATER ELEVATION (m)

(-0.33) — OVER-PREDICTION OF OBSERVED GROUNDWATER ELEVATION (m)

140 — OBSERVED GROUNDWATER ELEVATION CONTOURS - JULY 18, 2018 (m AMSL)

140 — SIMULATED GROUNDWATER ELEVATION CONTOURS - JULY 18, 2018 (m AMSL)

0 600 1,200 1,800m

N

GHD

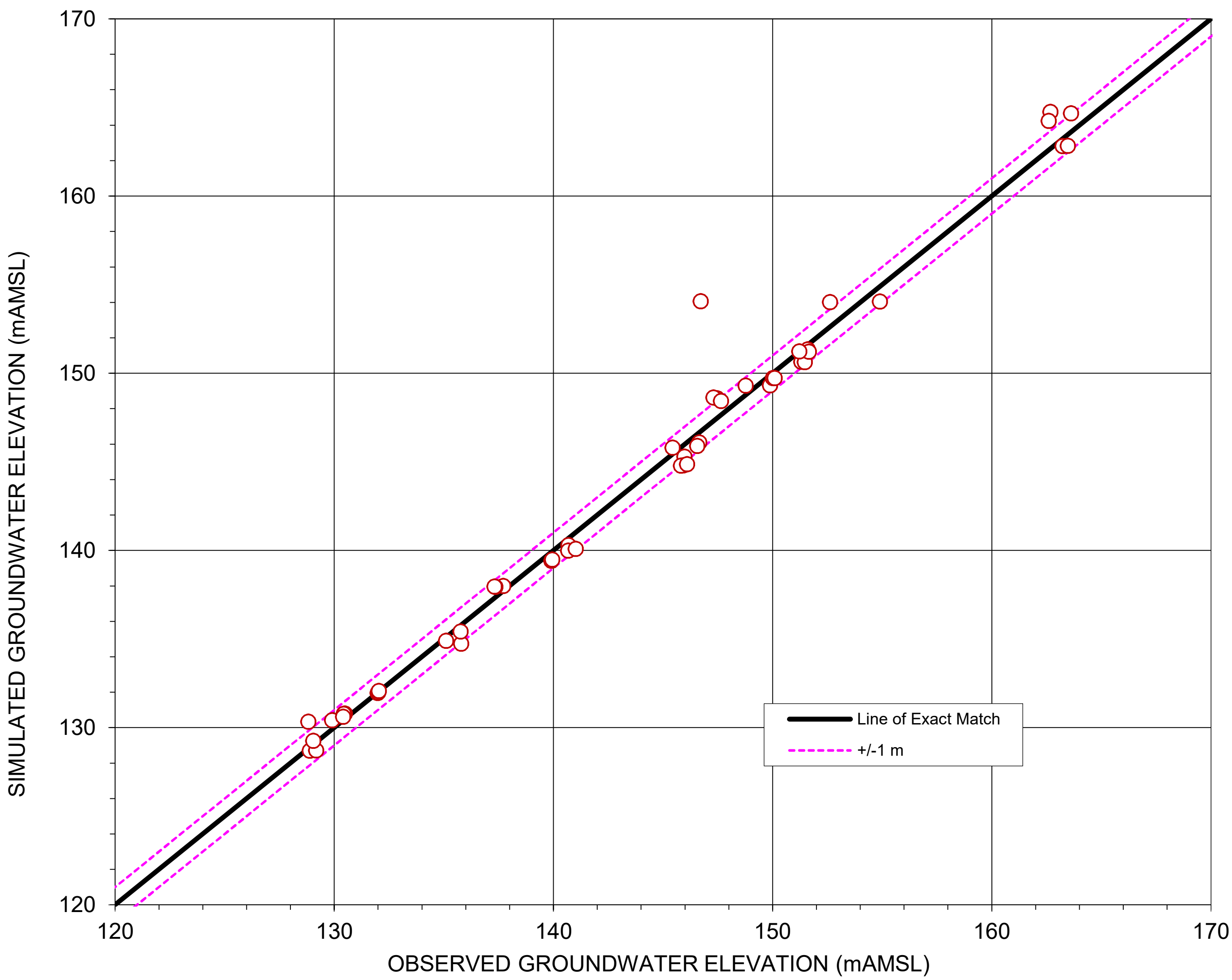
ATLANTIC GOLD CORPORATION
MARINETTE, NOVA SCOTIA
BEAVER DAM MINE

SIMULATE VERSUS OBSERVED GROUNDWATER ELEVATION CONTOURS - WET CONDITION

088664-031
November 13, 2019

FIGURE 6.3

HEG file: Z:\HEG\088664\DOCUMENTATION\RPT\088664-RPT-13\FIGURES\Figure 6.3 - Simulate versus Observed Groundwater Elevation Contours - Wet Condition.srf

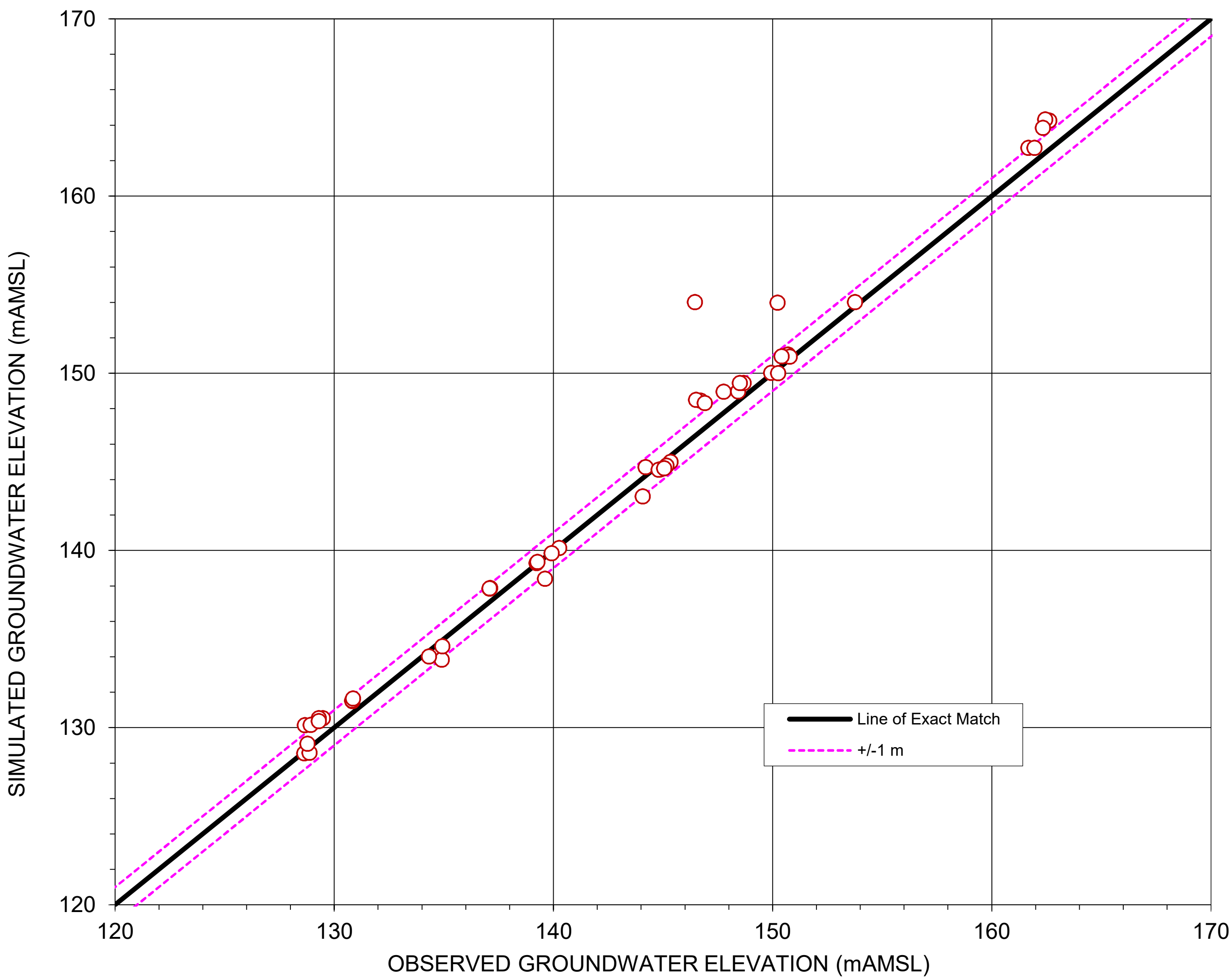


CALIBRATION STATISTICS

NUMBER OF OBSERVATIONS =	49
RESIDUAL MEAN (m) =	-0.13
ABSOLUTE RESIDUAL MEAN (m) =	0.78
RESIDUAL STANDARD DEVIATION (m) =	1.30
RESIDUAL SUM OF SQUARES (m^2) =	83.42
MINIMUM RESIDUAL (m) =	-7.34
MAXIMUM RESIDUAL (m) =	1.24
OBSERVED HEAD RANGE (m) =	34.80
STANDARD DEVIATION/HEAD RANGE =	0.037
SCALED RMSE (%) =	3.7%

figure 6.4

SCATTER PLOT OF SIMULATED VS. OBSERVED
GROUNDWATER ELEVATIONS - BASE CASE CONDITION
ATLANTIC GOLD CORPORATION
MARINETTE, NOVA SCOTIA
Beaver Dam Mine

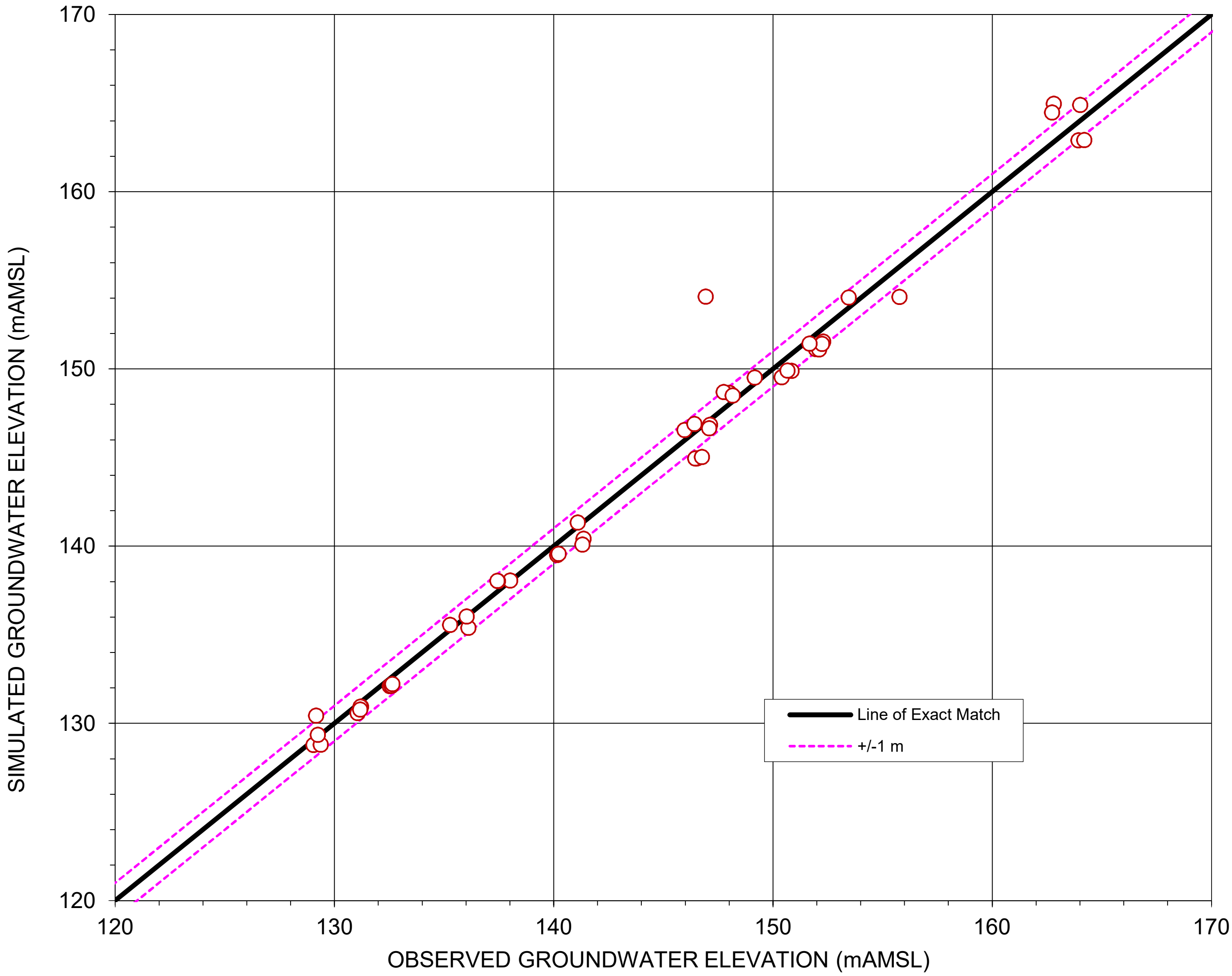


CALIBRATION STATISTICS

NUMBER OF OBSERVATIONS =	49
RESIDUAL MEAN (m) =	-0.67
ABSOLUTE RESIDUAL MEAN (m) =	0.94
RESIDUAL STANDARD DEVIATION (m) =	1.34
RESIDUAL SUM OF SQUARES (m^2) =	109.57
MINIMUM RESIDUAL (m) =	-7.55
MAXIMUM RESIDUAL (m) =	1.22
OBSERVED HEAD RANGE (m) =	33.99
STANDARD DEVIATION/HEAD RANGE =	0.039
SCALED RMSE (%) =	4.4%

figure 6.5

SCATTER PLOT OF SIMULATED VS. OBSERVED
GROUNDWATER ELEVATIONS - DRY CONDITION
ATLANTIC GOLD CORPORATION
MARINETTE, NOVA SCOTIA
Beaver Dam Mine

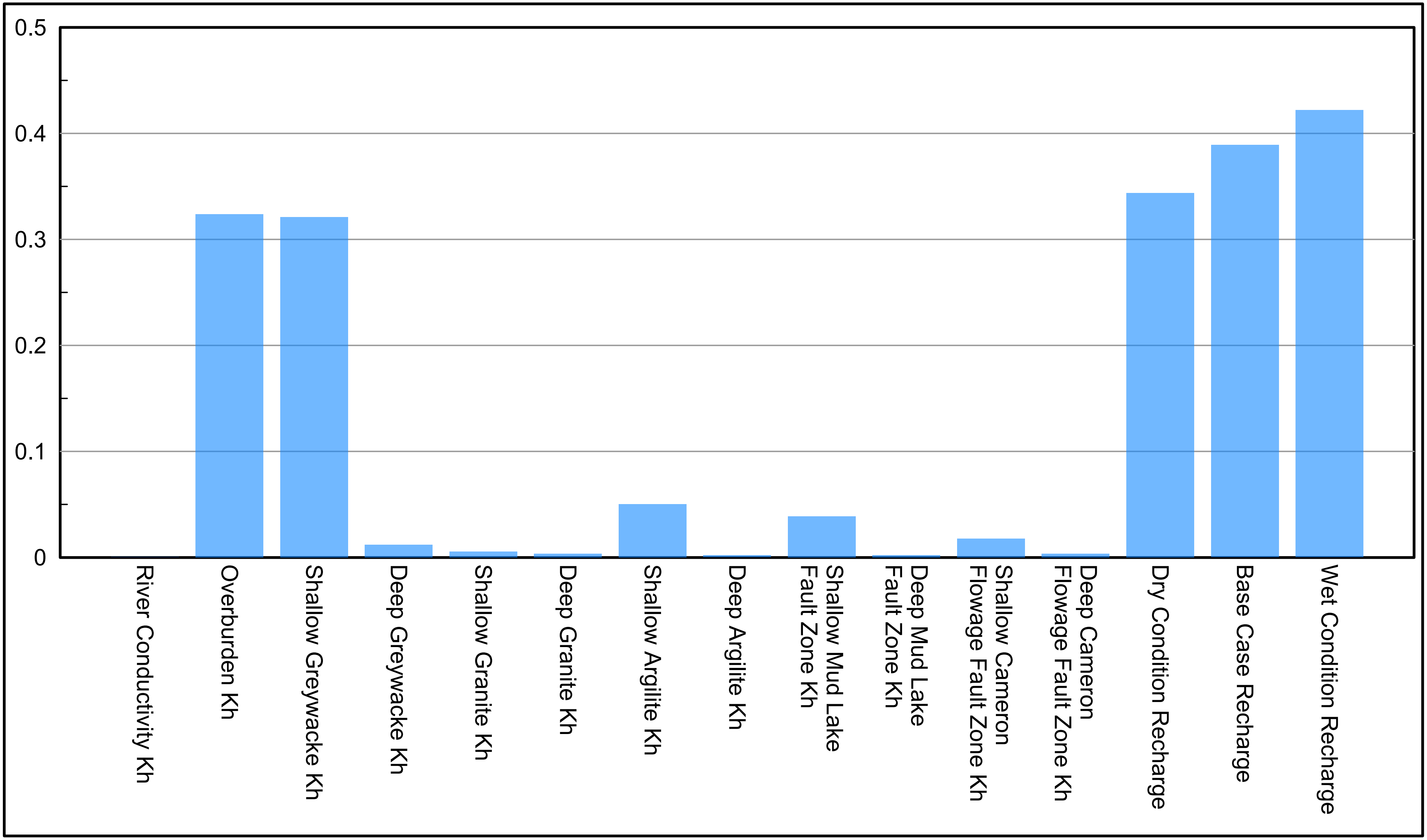


CALIBRATION STATISTICS

NUMBER OF OBSERVATIONS =	49
RESIDUAL MEAN (m) =	0.10
ABSOLUTE RESIDUAL MEAN (m) =	0.87
RESIDUAL STANDARD DEVIATION (m) =	1.34
RESIDUAL SUM OF SQUARES (m^2) =	88.66
MINIMUM RESIDUAL (m) =	-7.15
MAXIMUM RESIDUAL (m) =	1.73
OBSERVED HEAD RANGE (m) =	35.16
STANDARD DEVIATION/HEAD RANGE =	0.038
SCALED RMSE (%) =	3.8%

figure 6.6

SCATTER PLOT OF SIMULATED VS. OBSERVED
GROUNDWATER ELEVATIONS - WET CONDITION
ATLANTIC GOLD CORPORATION
MARINETTE, NOVA SCOTIA
Beaver Dam Mine



ATLANTIC GOLD CORPORATION
MARINETTE, NOVA SCOTIA
BEAVER DAM MINE

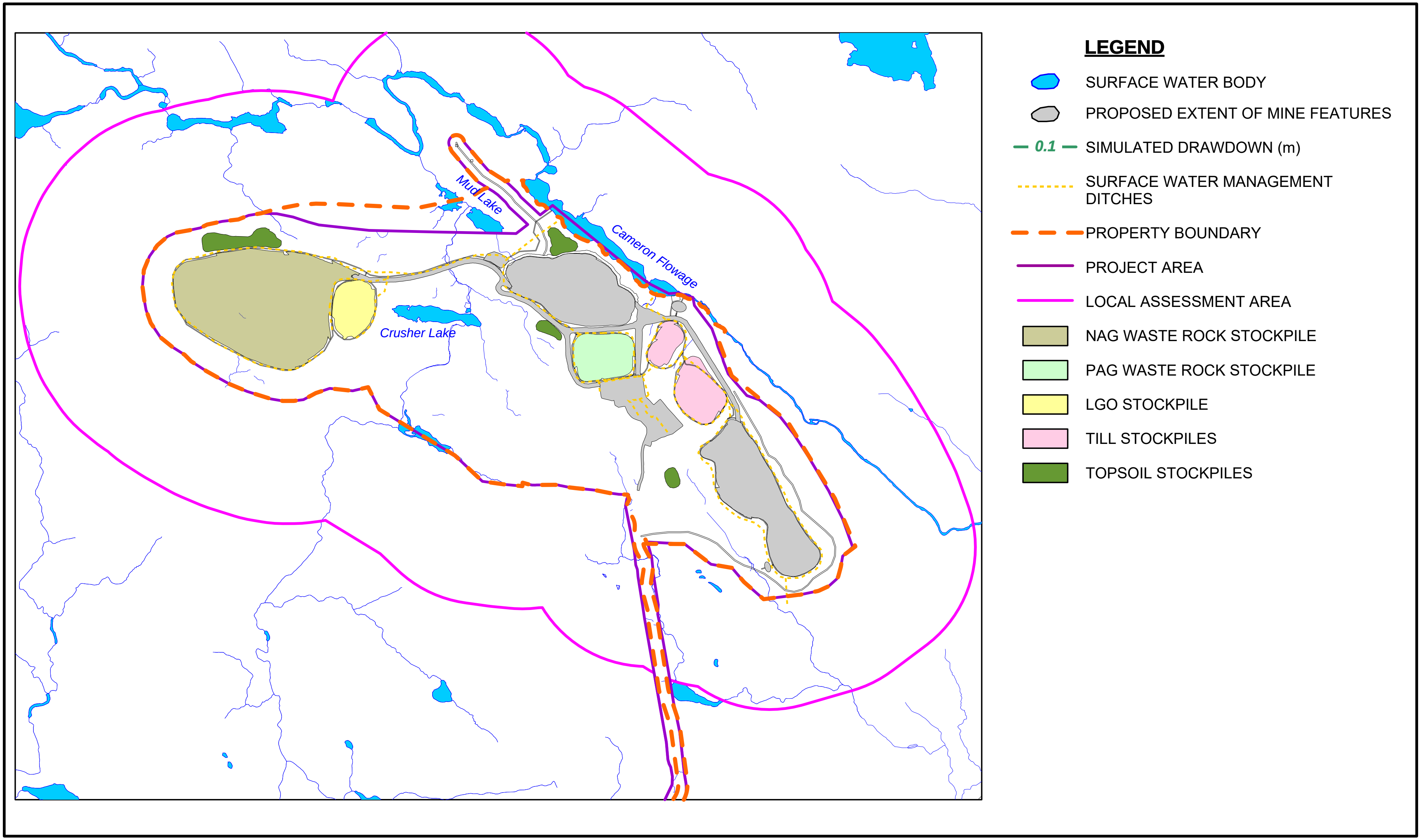
CALIBRATED MODEL PARAMETER
COMPOSITE SENSITIVITIES

088664-031

November 11, 2019

FIGURE 6.7

HEG file: Z:\HEG\088664\DOCUMENTATION\RPT\088664-RPT-13\FIGURES\Figure 6.7 - Composite Sensitivities.grf



ATLANTIC GOLD CORPORATION
MARINETTE, NOVA SCOTIA
BEAVER DAM MINE

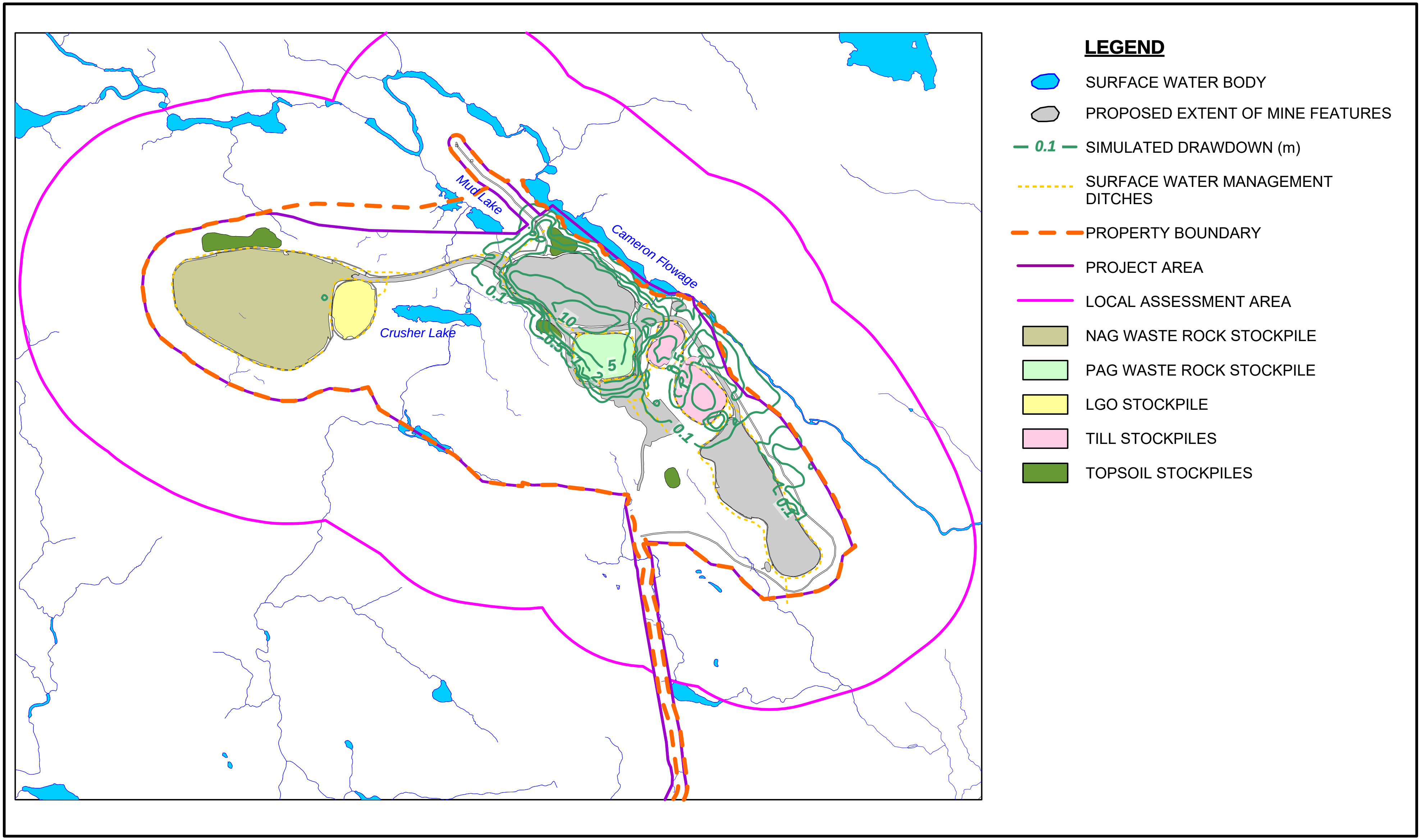
SIMULATED DRAWDOWN EOM - BASE CASE CONDITION

088664-031

March 11, 2021

FIGURE 7.1a

HEG file: Z:\HEG\088664\DOCUMENTATION\RPT\088664-RPT-13\FIGURES\Figure 7.1a - Simulated Drawdown Base Case Condition - EOM.srf



0 300 600 900m

N

ATLANTIC GOLD CORPORATION
MARINETTE, NOVA SCOTIA
BEAVER DAM MINE

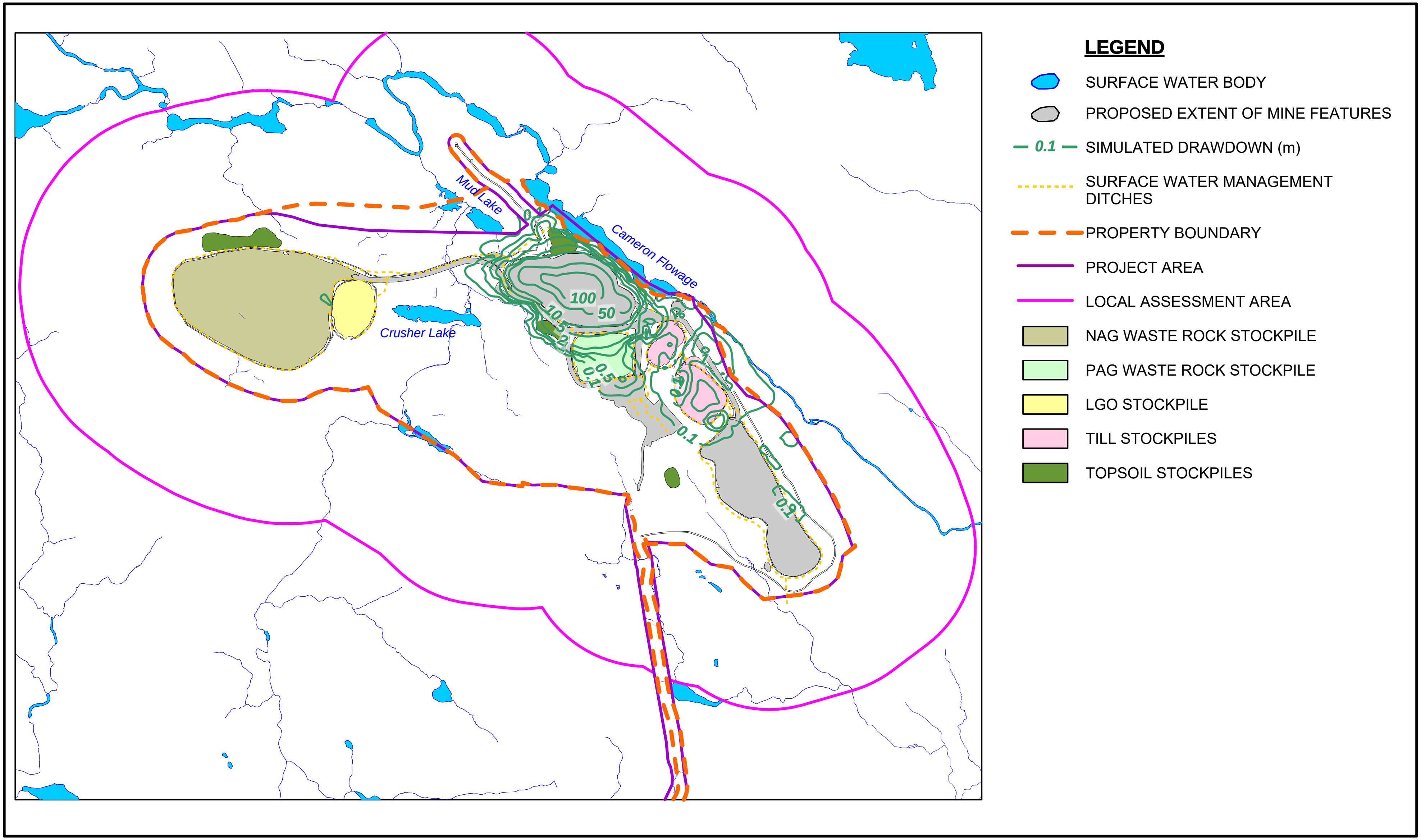
SIMULATED DRAWDOWN PC - BASE CASE CONDITION

088664-031

March 11, 2021

FIGURE 7.1b

HEG file: Z:\\HEG\088664\DOCUMENTATION\RPT\088664-RPT-13\FIGURES\Figure 7.1b - Simulated Drawdown Base Case Condition - PC.srf



ATLANTIC GOLD CORPORATION
MARINETTE, NOVA SCOTIA
BEAVER DAM MINE

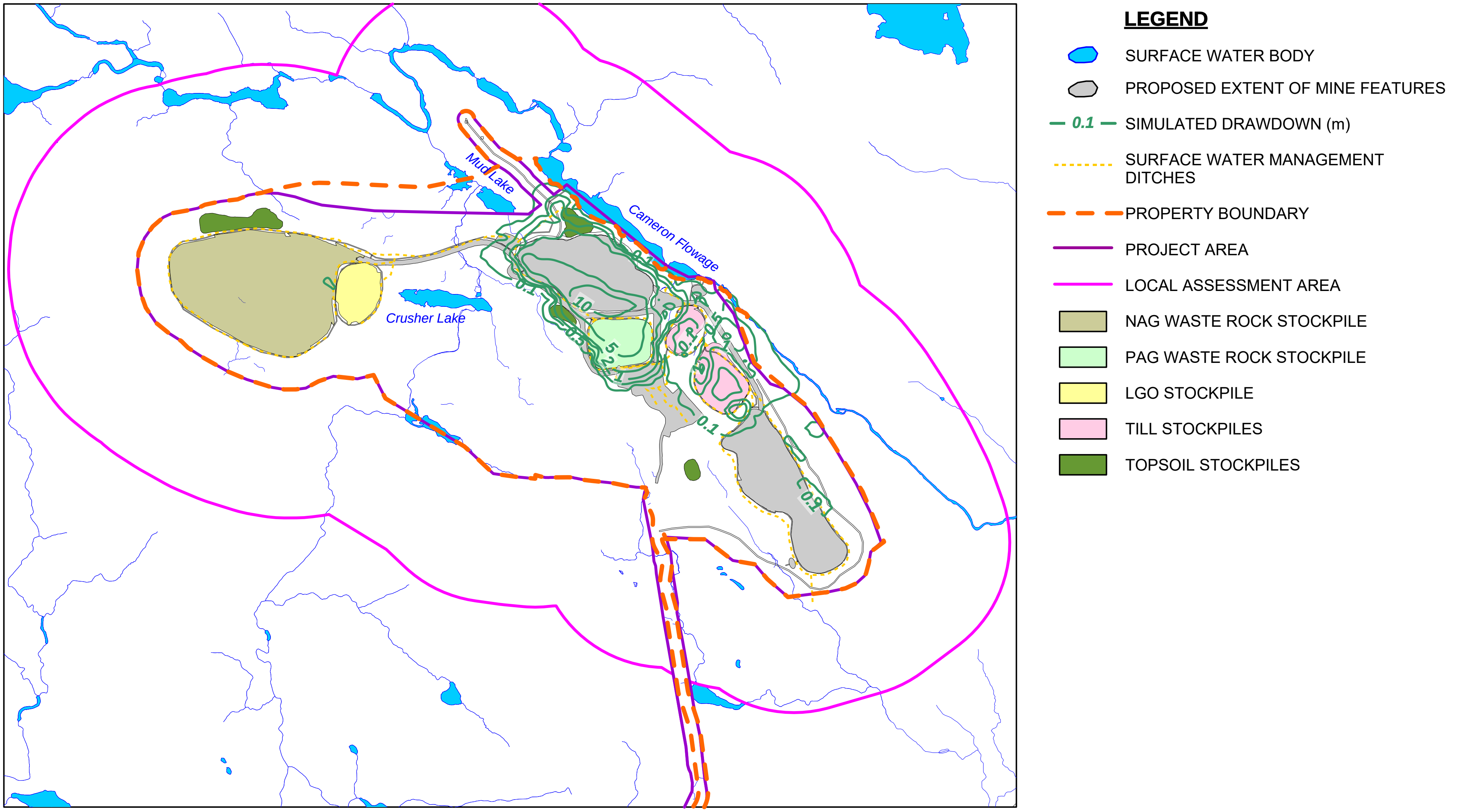
SIMULATED DRAWDOWN EOM - DRY CONDITION

088664-031

March 11, 2021

FIGURE 7.2a

HEG file: Z:\HEG\088664\DOCUMENTATION\RPT\088664-RPT-13\FIGURES\Figure 7.2a - Simulated Drawdown Dry Condition - EOM.srf



0 300 600 900m

ATLANTIC GOLD CORPORATION
MARINETTE, NOVA SCOTIA
BEAVER DAM MINE

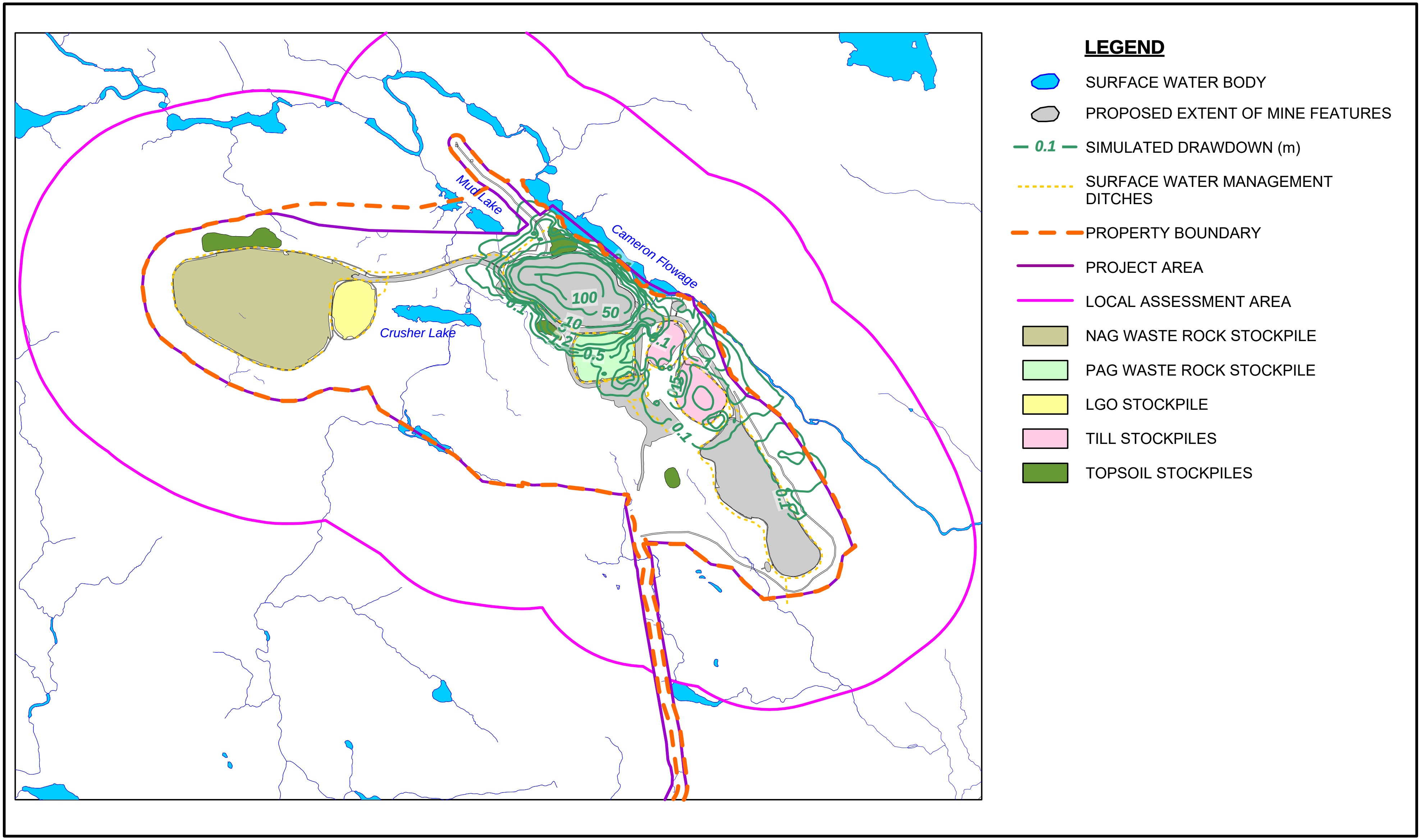
SIMULATED DRAWDOWN PC - DRY CONDITION

088664-031

March 11, 2021

FIGURE 7.2b

HEG file: Z:\HEG\088664\DOCUMENTATION\RPT\088664-RPT-13\FIGURES\Figure 7.2b - Simulated Drawdown Dry Condition - PC.srf



0 300 600 900m

ATLANTIC GOLD CORPORATION
MARINETTE, NOVA SCOTIA
BEAVER DAM MINE

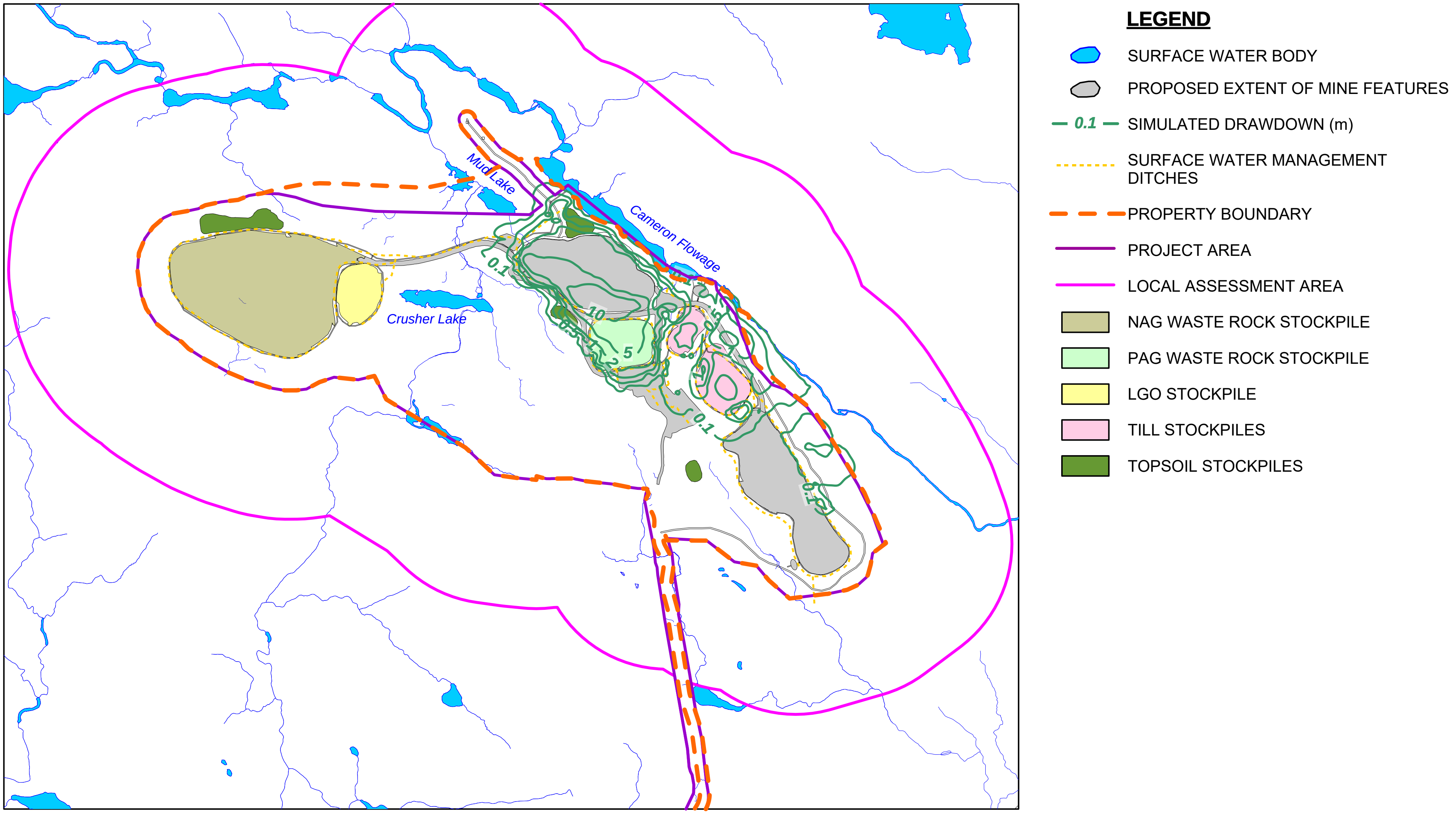
SIMULATED DRAWDOWN EOM - WET CONDITION

088664-031

March 11, 2021

FIGURE 7.3a

HEG file: Z:\HEG\088664\DOCUMENTATION\RPT\088664-RPT-13\FIGURES\Figure 7.3a - Simulated Drawdown Wet Condition - EOM.srf



0 300 600 900m

ATLANTIC GOLD CORPORATION
MARINETTE, NOVA SCOTIA
BEAVER DAM MINE

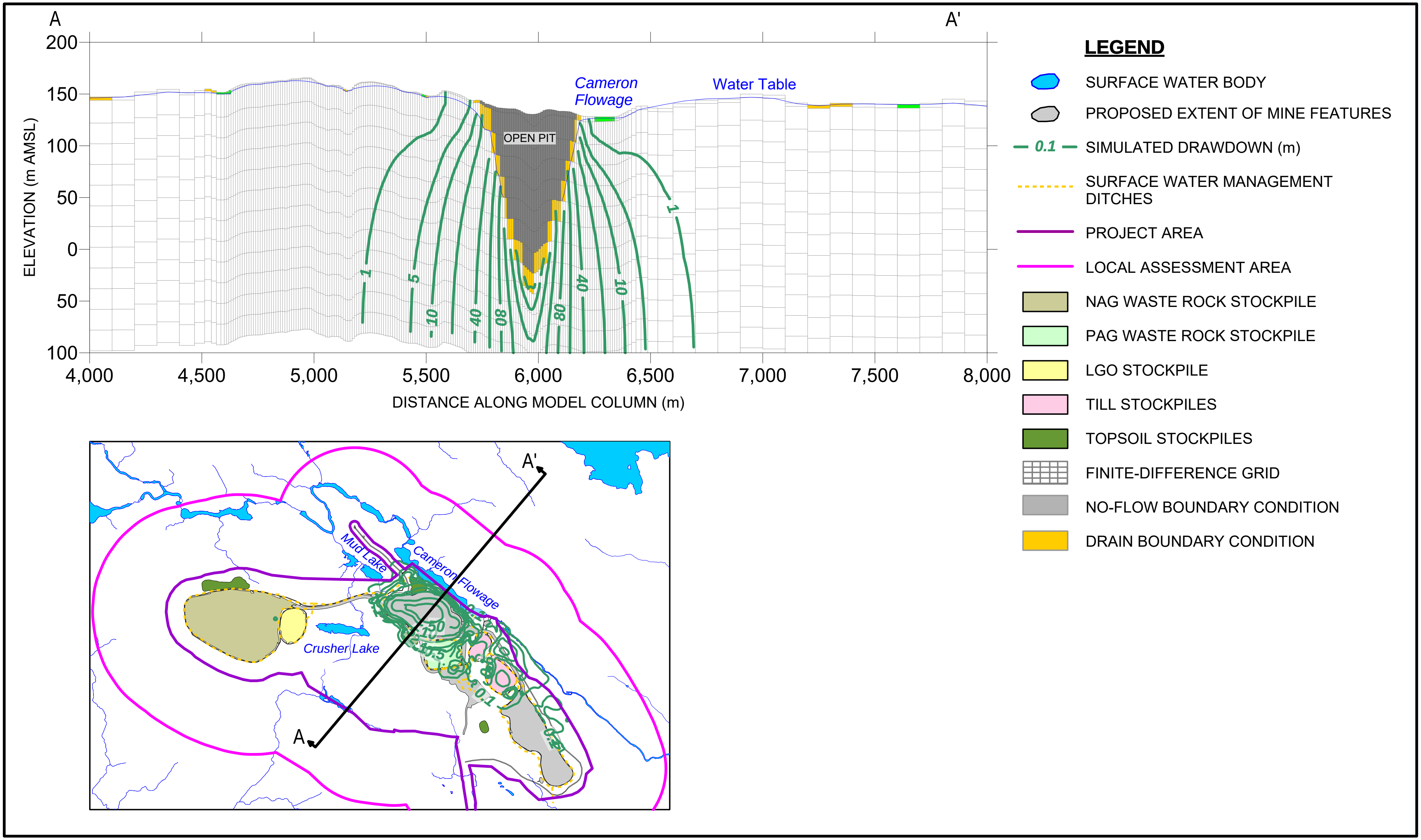
SIMULATED DRAWDOWN PC - WET CONDITION

088664-031

March 11, 2021

FIGURE 7.3b

HEG file: Z:\HEG\088664\DOCUMENTATION\RPT\088664-RPT-13\FIGURES\Figure 7.3b - Simulated Drawdown Wet Condition - PC.srf



0 500 1000 1500m

ATLANTIC GOLD CORPORATION
MARINETTE, NOVA SCOTIA
BEAVER DAM MINE

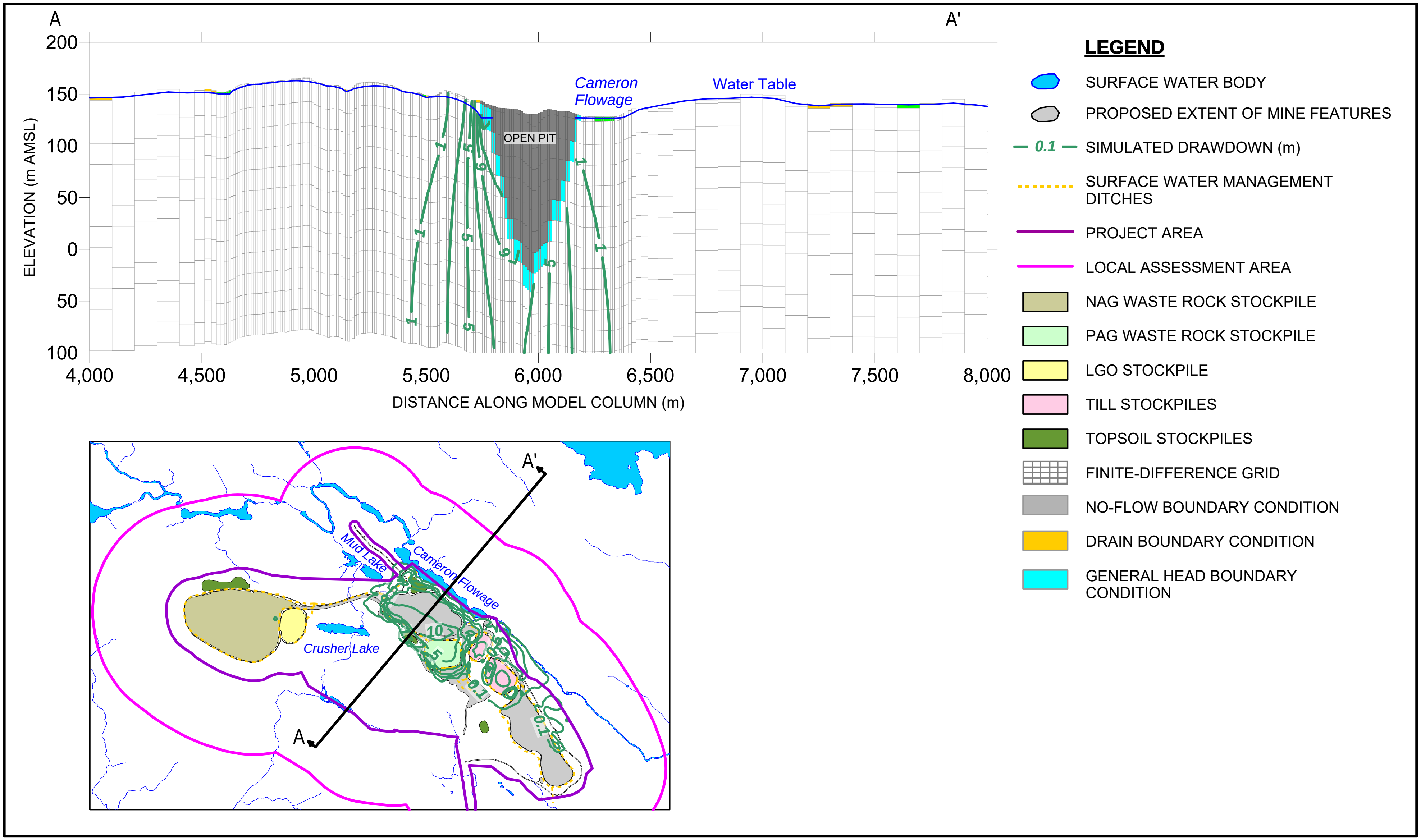
088664-031

March 11, 2021

SIMULATED DRAWDOWN THROUGH OPEN PIT (EOM - BASE CASE CONDITION)

FIGURE 7.4a

HEG file: Z:\HEG\088664\DOCUMENTATION\RPT\088664-RPT-13\FIGURES\Figure 7.4a - Simulated Drawdown Base Case Condition - EOM.srf



0 500 1000 1500m

ATLANTIC GOLD CORPORATION
MARINETTE, NOVA SCOTIA
BEAVER DAM MINE

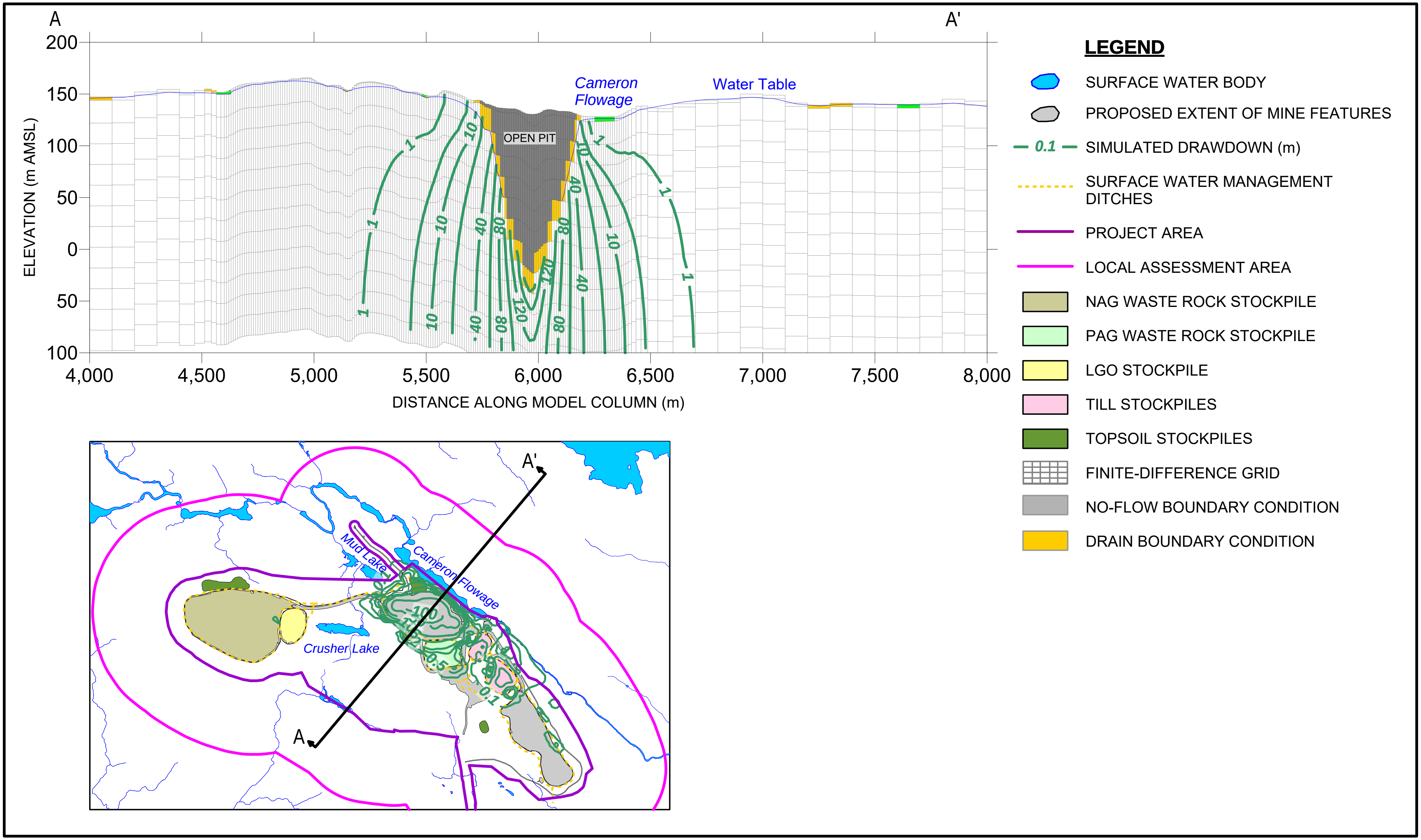
088664-031

March 11, 2021

SIMULATED DRAWDOWN THROUGH OPEN PIT (PC - BASE CASE CONDITION)

FIGURE 7.4b

HEG file: Z:\HEG\088664\DOCUMENTATION\RPT\088664-RPT-13\FIGURES\Figure 7.4b - Simulated Drawdown Base Case Condition - PC.srf



0 500 1000 1500m

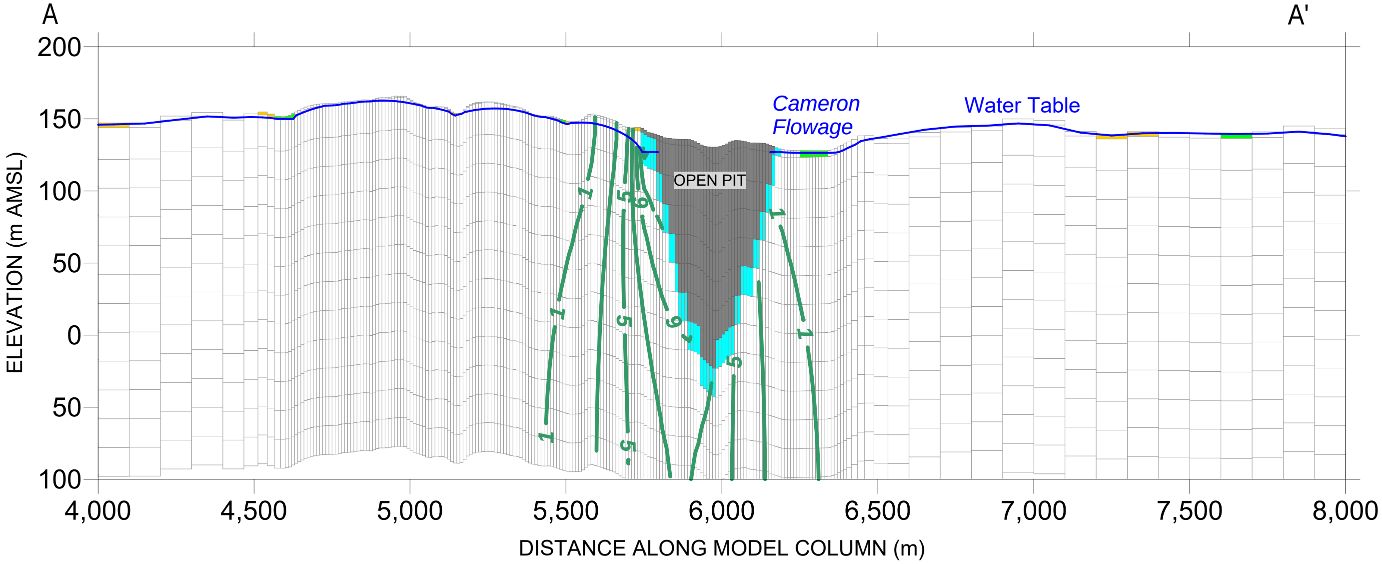
ATLANTIC GOLD CORPORATION
MARINETTE, NOVA SCOTIA
BEAVER DAM MINE

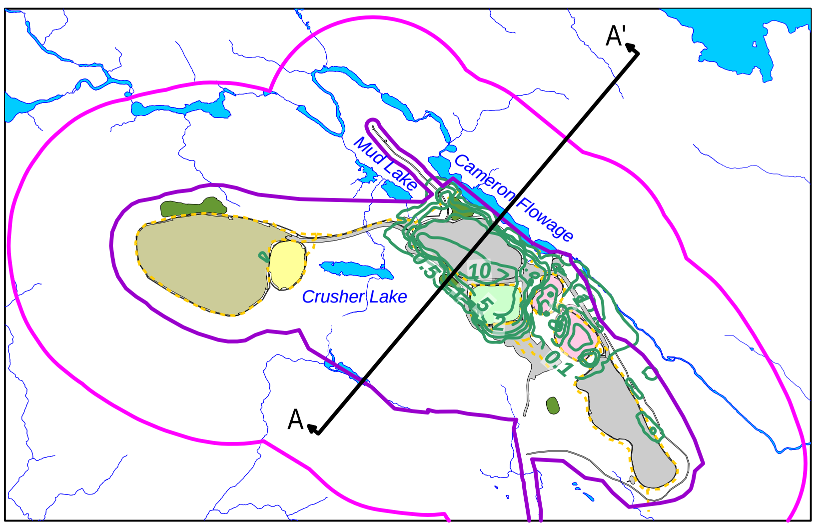
088664-031
March 11, 2021

SIMULATED DRAWDOWN THROUGH OPEN PIT (EOM - DRY CONDITION)

FIGURE 7.5a

HEG file: Z:\HEG\088664\DOCUMENTATION\RPT\088664-RPT-13\FIGURES\Figure 7.5a - Simulated Drawdown Dry Condition - EOM.srf





LEGEND

- SURFACE WATER BODY
- PROPOSED EXTENT OF MINE FEATURES
- 0.1 SIMULATED DRAWDOWN (m)
- SURFACE WATER MANAGEMENT DITCHES
- PROJECT AREA
- LOCAL ASSESSMENT AREA
- NAG WASTE ROCK STOCKPILE
- PAG WASTE ROCK STOCKPILE
- LGO STOCKPILE
- TILL STOCKPILES
- TOPSOIL STOCKPILES
- FINITE-DIFFERENCE GRID
- NO-FLOW BOUNDARY CONDITION
- DRAIN BOUNDARY CONDITION
- GENERAL HEAD BOUNDARY CONDITION

0 500 1000 1500m

N

GHD

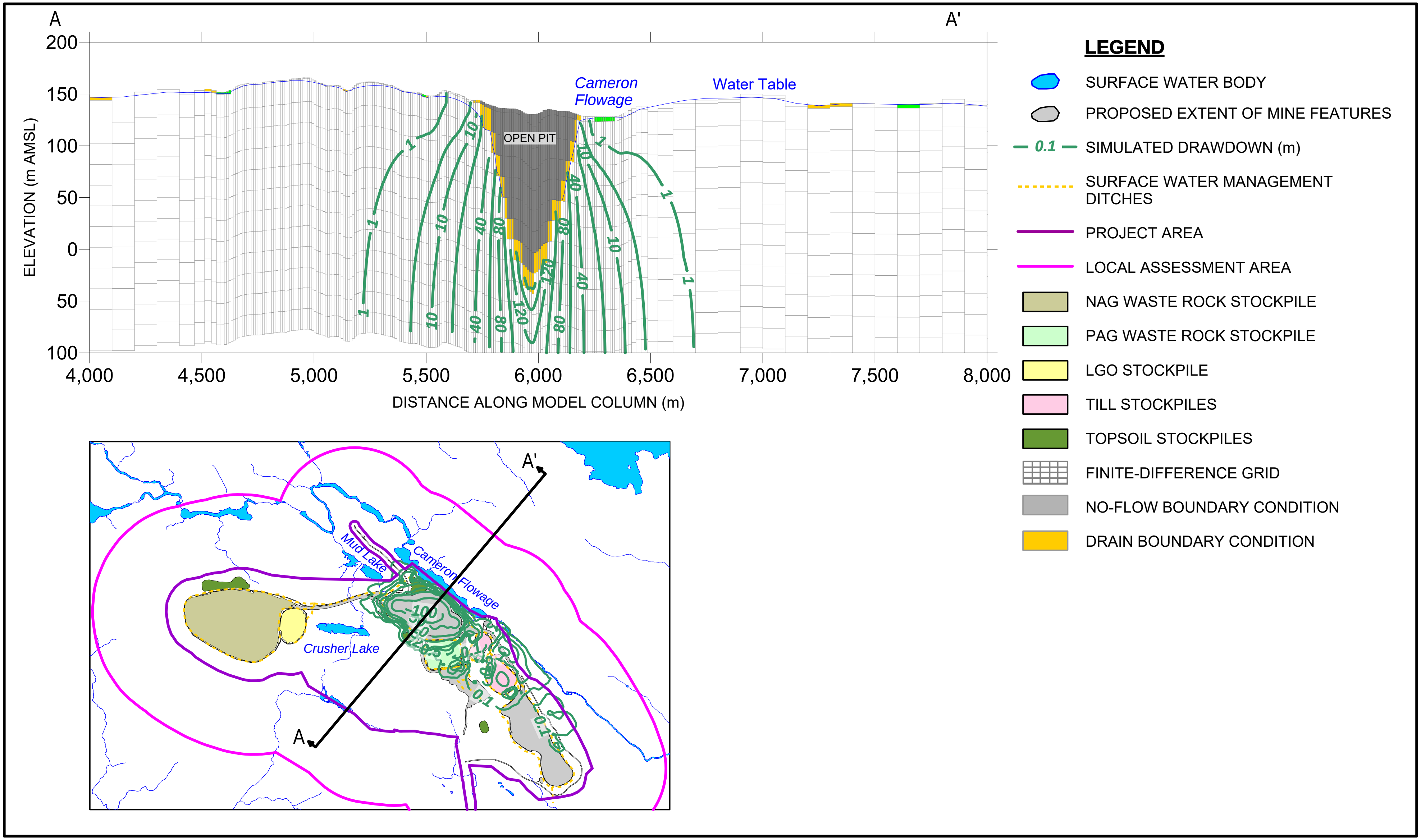
ATLANTIC GOLD CORPORATION
MARINETTE, NOVA SCOTIA
BEAVER DAM MINE

088664-031
March 11, 2021

SIMULATED DRAWDOWN THROUGH OPEN PIT (PC - DRY CONDITION)

FIGURE 7.5b

HEG file: Z:\HEG\088664\DOCUMENTATION\RPT\088664-RPT-13\FIGURES\Figure 7.5b - Simulated Drawdown Dry Condition - PC.srf



0 500 1000 1500m

ATLANTIC GOLD CORPORATION
MARINETTE, NOVA SCOTIA
BEAVER DAM MINE

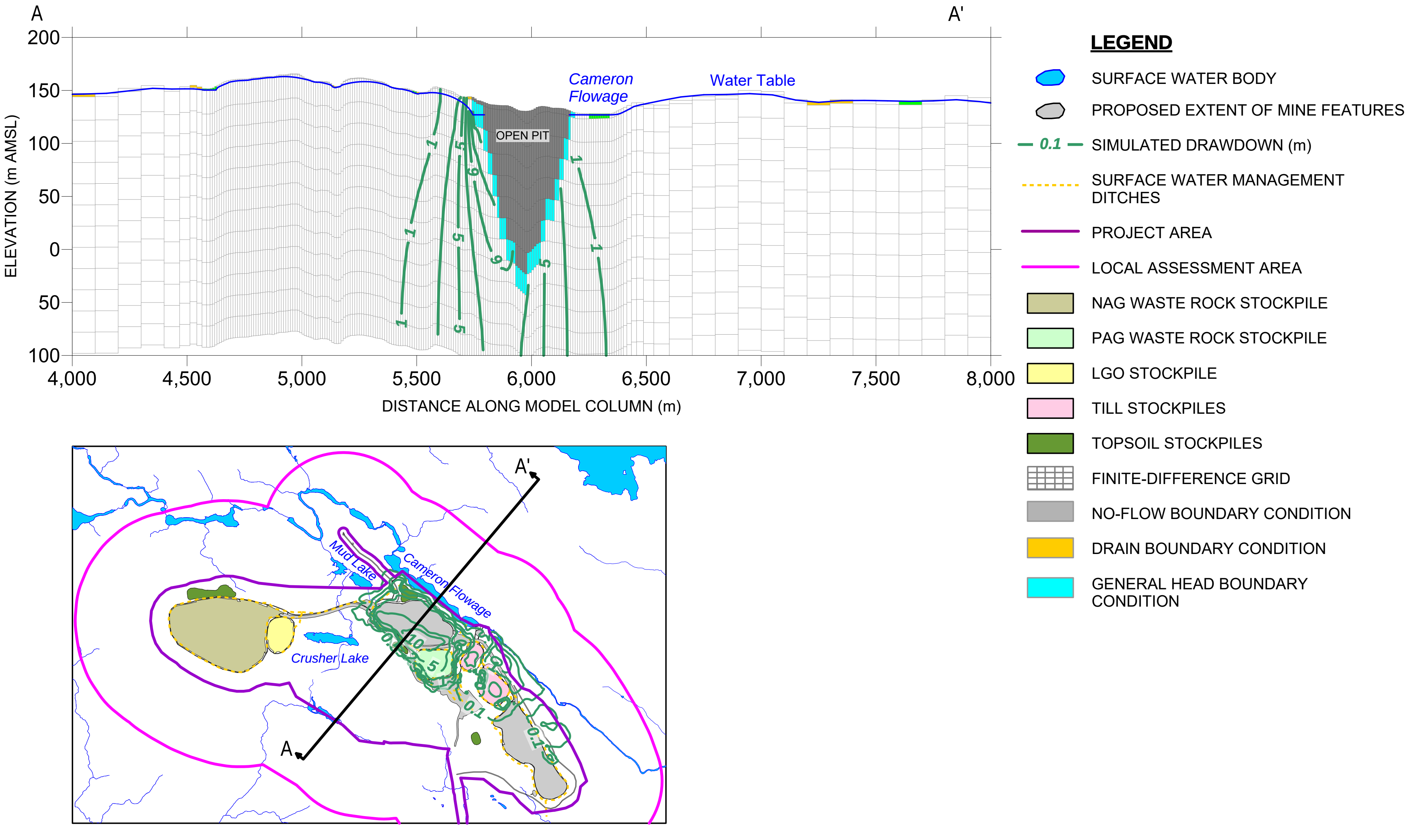
088664-031

March 11, 2021

SIMULATED DRAWDOWN THROUGH OPEN PIT (EOM - WET CONDITION)

FIGURE 7.6a

HEG file: Z:\HEG\088664\DOCUMENTATION\RPT\088664-RPT-13\FIGURES\Figure 7.6a - Simulated Drawdown Wet Condition - EOM.srf



0 500 1000 1500m

ATLANTIC GOLD CORPORATION
MARINETTE, NOVA SCOTIA
BEAVER DAM MINE

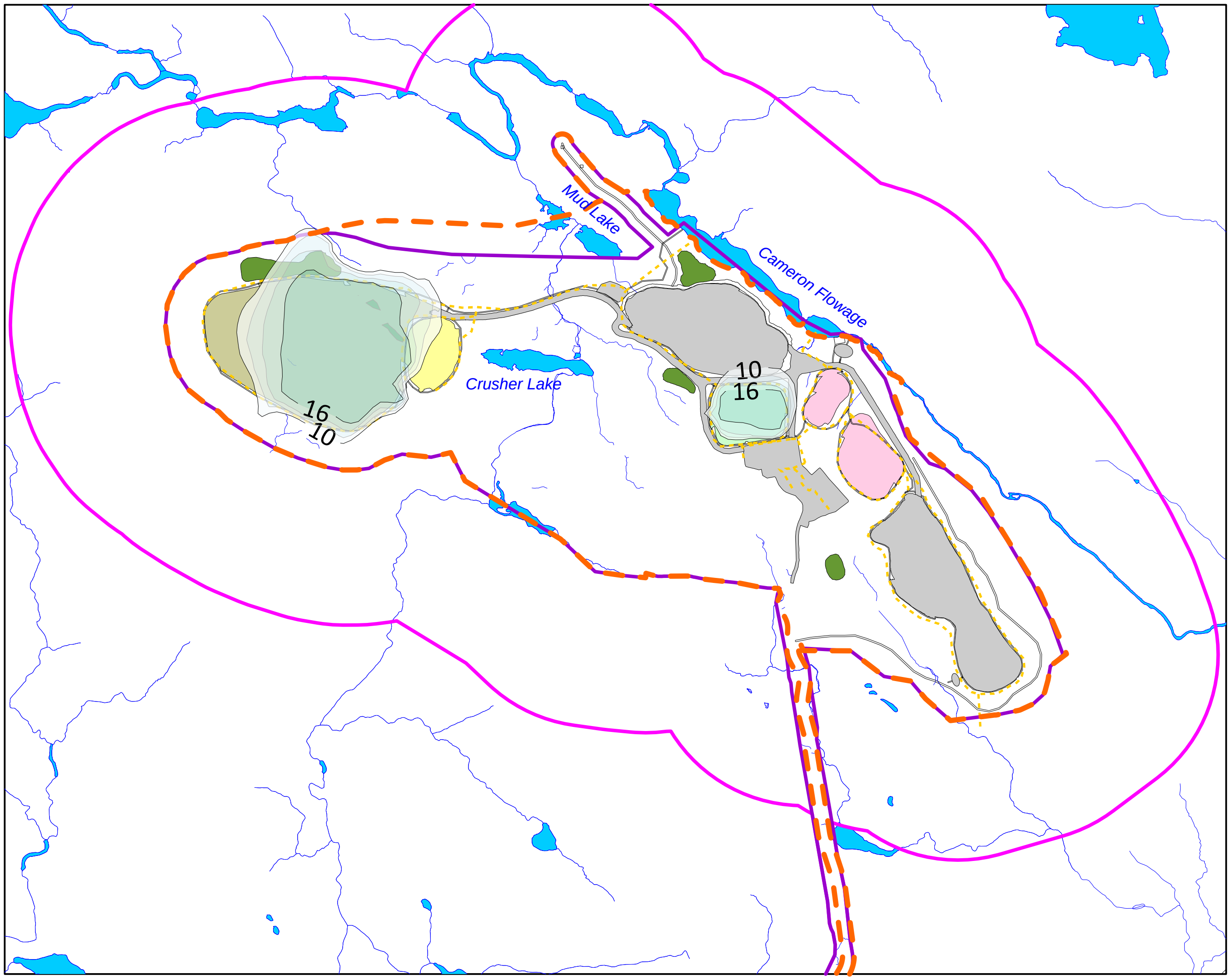
088664-031

March 11, 2021

SIMULATED DRAWDOWN THROUGH OPEN PIT (PC - WET CONDITION)

FIGURE 7.6b

HEG file: Z:\HEG\088664\DOCUMENTATION\RPT\088664-RPT-13\FIGURES\Figure 7.6b - Simulated Drawdown Wet Condition - PC.srf



LEGEND

- SURFACE WATER BODY
- PROPOSED EXTENT OF MINE FEATURES
- 0.1 SIMULATED ARSENIC CONCENTRATION (ug/L)
- SURFACE WATER MANAGEMENT DITCHES
- PROPERTY BOUNDARY
- PROJECT AREA
- LOCAL ASSESSMENT AREA
- NAG WASTE ROCK STOCKPILE
- PAG WASTE ROCK STOCKPILE
- LGO STOCKPILE
- TILL STOCKPILES
- TOPSOIL STOCKPILES

Note: The arsenic Tier 1 EQS for potable groundwater is 10 ug/L.

0 300 600 900m

ATLANTIC GOLD CORPORATION
MARINETTE, NOVA SCOTIA
BEAVER DAM MINE

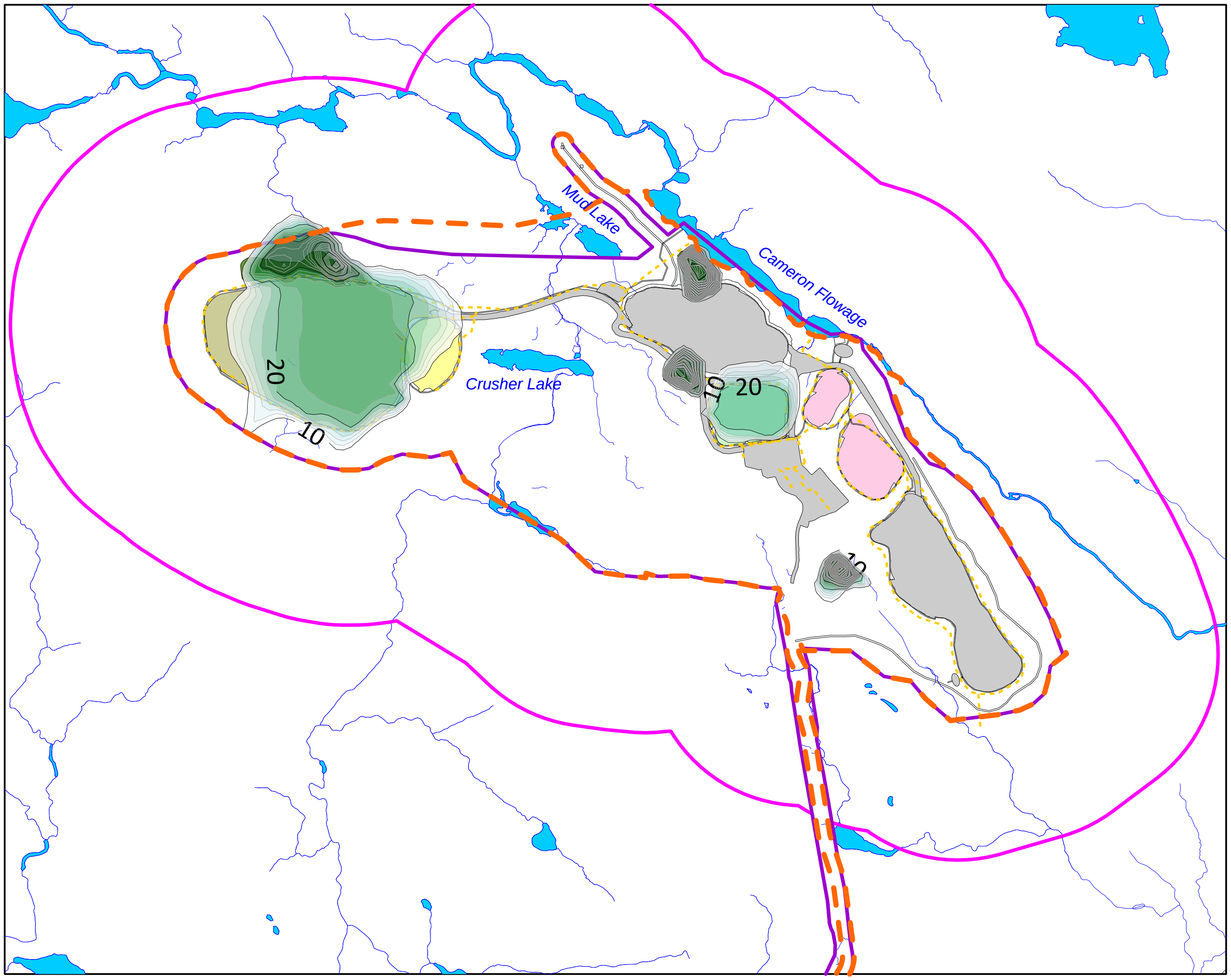
SIMULATED ARSENIC CONCENTRATION VERSUS POTABLE CRITERIA
EOM - BASE CASE SOURCE TERMS - BASE CASE CONDITION

088664-031

March 11, 2021

FIGURE 7.7

HEG file: Z:\HEG\088664\DOCUMENTATION\RPT\088664-RPT-13\FIGURES\Figure 7.7 - Simulated Arsenic Concentration Versus Potable Criteria - EOM- BC - AVG.srf



LEGEND

- SURFACE WATER BODY
- PROPOSED EXTENT OF MINE FEATURES
- 0.1 — SIMULATED ARSENIC CONCENTRATION (ug/L)
- SURFACE WATER MANAGEMENT DITCHES
- PROPERTY BOUNDARY
- PROJECT AREA
- LOCAL ASSESSMENT AREA
- NAG WASTE ROCK STOCKPILE
- PAG WASTE ROCK STOCKPILE
- LGO STOCKPILE
- TILL STOCKPILES
- TOPSOIL STOCKPILES

Note: The arsenic Tier 1 EQS for potable groundwater is 10 ug/L.

0 300 600 900m

N

GHD

ATLANTIC GOLD CORPORATION
MARINETTE, NOVA SCOTIA
BEAVER DAM MINE

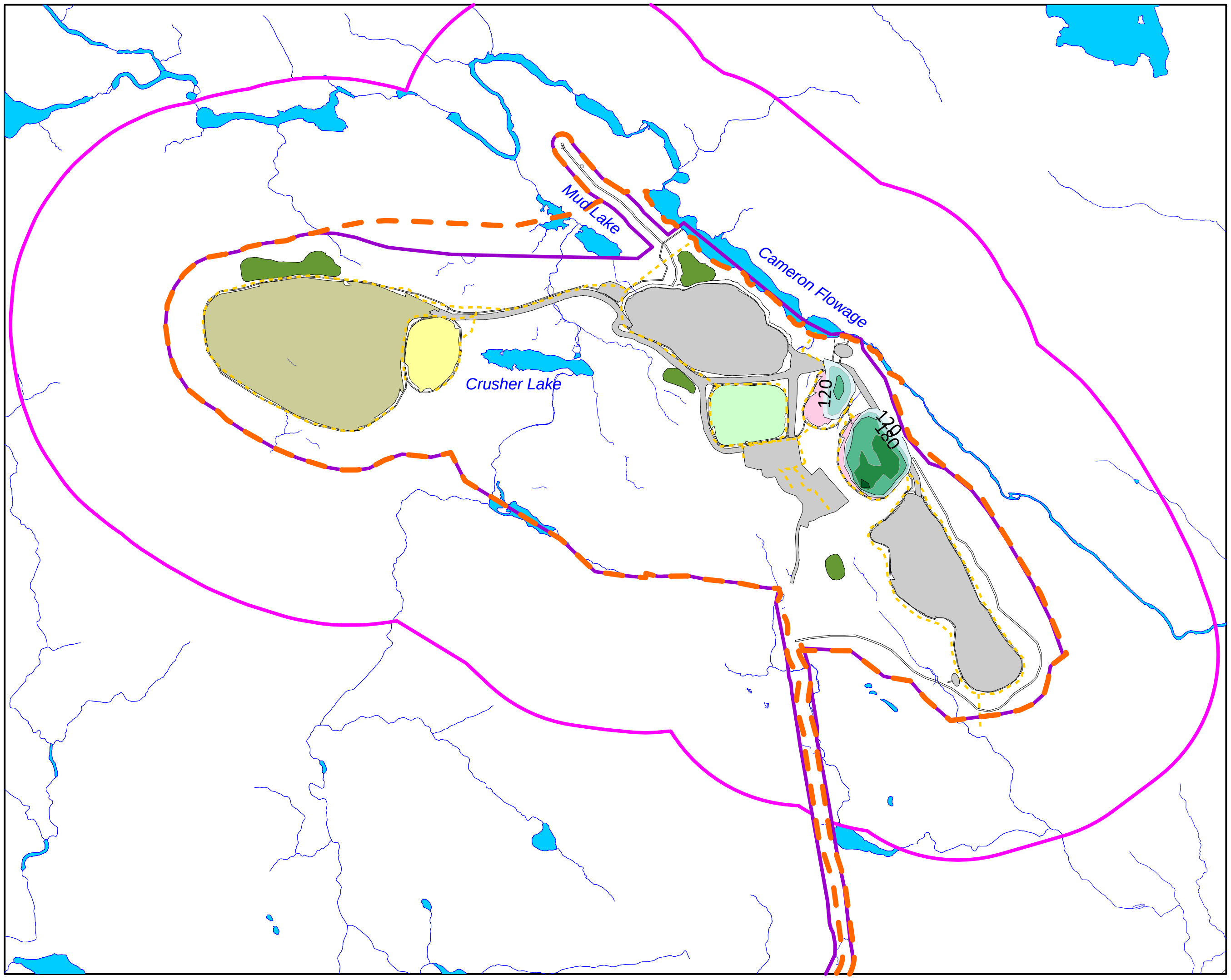
SIMULATED ARSENIC CONCENTRATION VERSUS POTABLE CRITERIA
EOM - UPPER CASE SOURCE TERMS - BASE CASE CONDITION

088664-031

March 11, 2021

FIGURE 7.8

HEG file: Z:\HEG\088664\DOCUMENTATION\RPT\088664-RPT-13\FIGURES\Figure 7.8 - Simulated Arsenic Concentration Versus Potable Criteria - EOM - UC - AVG.srf



LEGEND

SURFACE WATER BODY
PROPOSED EXTENT OF MINE FEATURES
0.1 — SIMULATED MANGANESE CONCENTRATION (ug/L)
SURFACE WATER MANAGEMENT DITCHES
PROPERTY BOUNDARY
PROJECT AREA
LOCAL ASSESSMENT AREA
NAG WASTE ROCK STOCKPILE
PAG WASTE ROCK STOCKPILE
LGO STOCKPILE
TILL STOCKPILES
TOPSOIL STOCKPILES

Note: The manganese Tier 1 EQS for potable groundwater is 120 ug/L.

0 300 600 900m

ATLANTIC GOLD CORPORATION
MARINETTE, NOVA SCOTIA
BEAVER DAM MINE

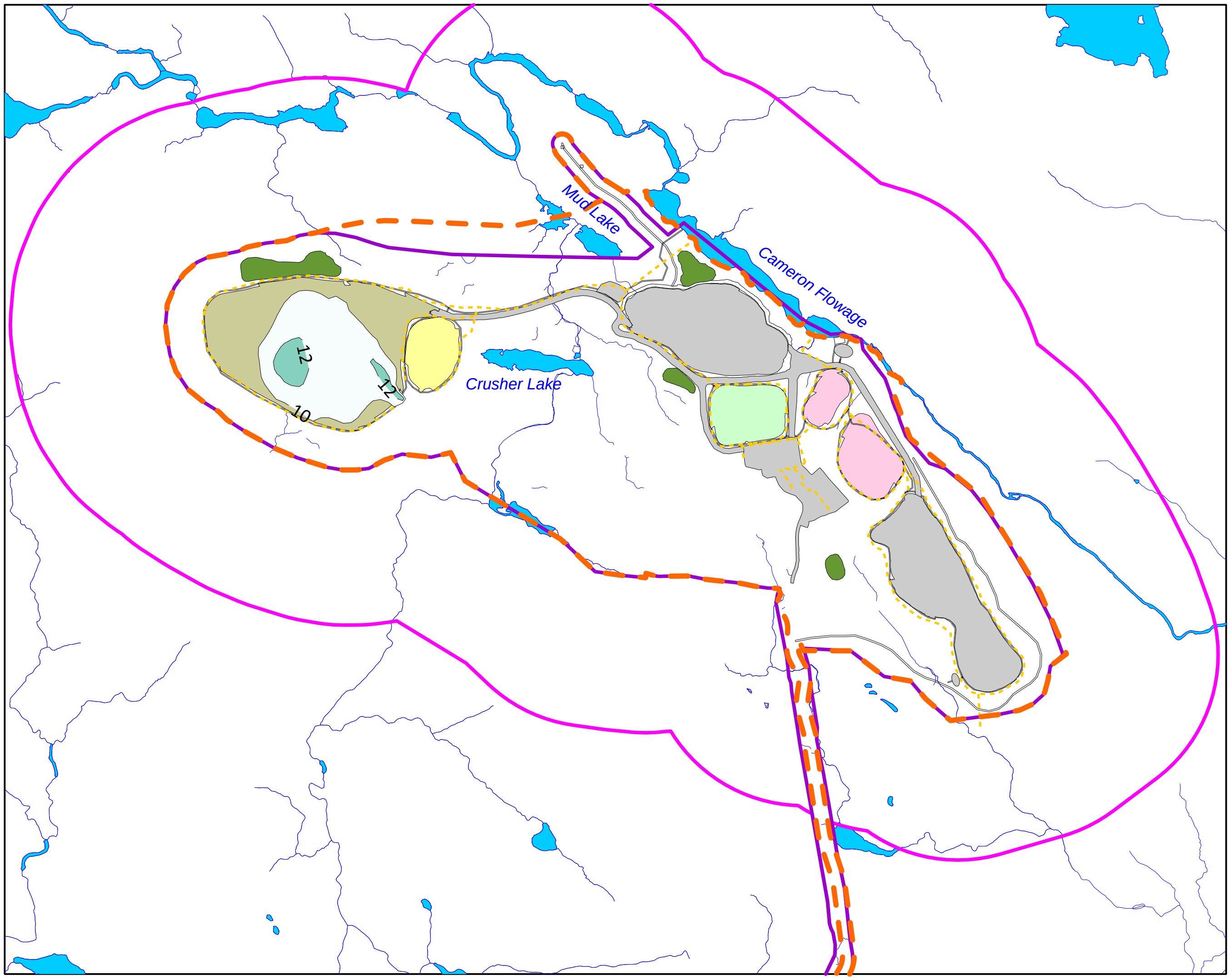
SIMULATED MANGANESE CONCENTRATION VERSUS POTABLE CRITERIA
EOM - UPPER CASE SOURCE TERMS - BASE CASE CONDITION

088664-031

March 11, 2021

FIGURE 7.9

HEG file: Z:\HEG\088664\DOCUMENTATION\RPT\088664-RPT-13\FIGURES\Figure 7.9 - Simulated Manganese Concentration Versus Potable Criteria - EOM - UC - AVG.srf



LEGEND

- SURFACE WATER BODY
- PROPOSED EXTENT OF MINE FEATURES
- 0.1 — SIMULATED NITRATE CONCENTRATION (mg/L)
- SURFACE WATER MANAGEMENT DITCHES
- PROPERTY BOUNDARY
- PROJECT AREA
- LOCAL ASSESSMENT AREA
- NAG WASTE ROCK STOCKPILE
- PAG WASTE ROCK STOCKPILE
- LGO STOCKPILE
- TILL STOCKPILES
- TOPSOIL STOCKPILES

Note: The nitrate GCDWQ for potable groundwater is 10 mg/L.

0 300 600 900m

ATLANTIC GOLD CORPORATION
MARINETTE, NOVA SCOTIA
BEAVER DAM MINE

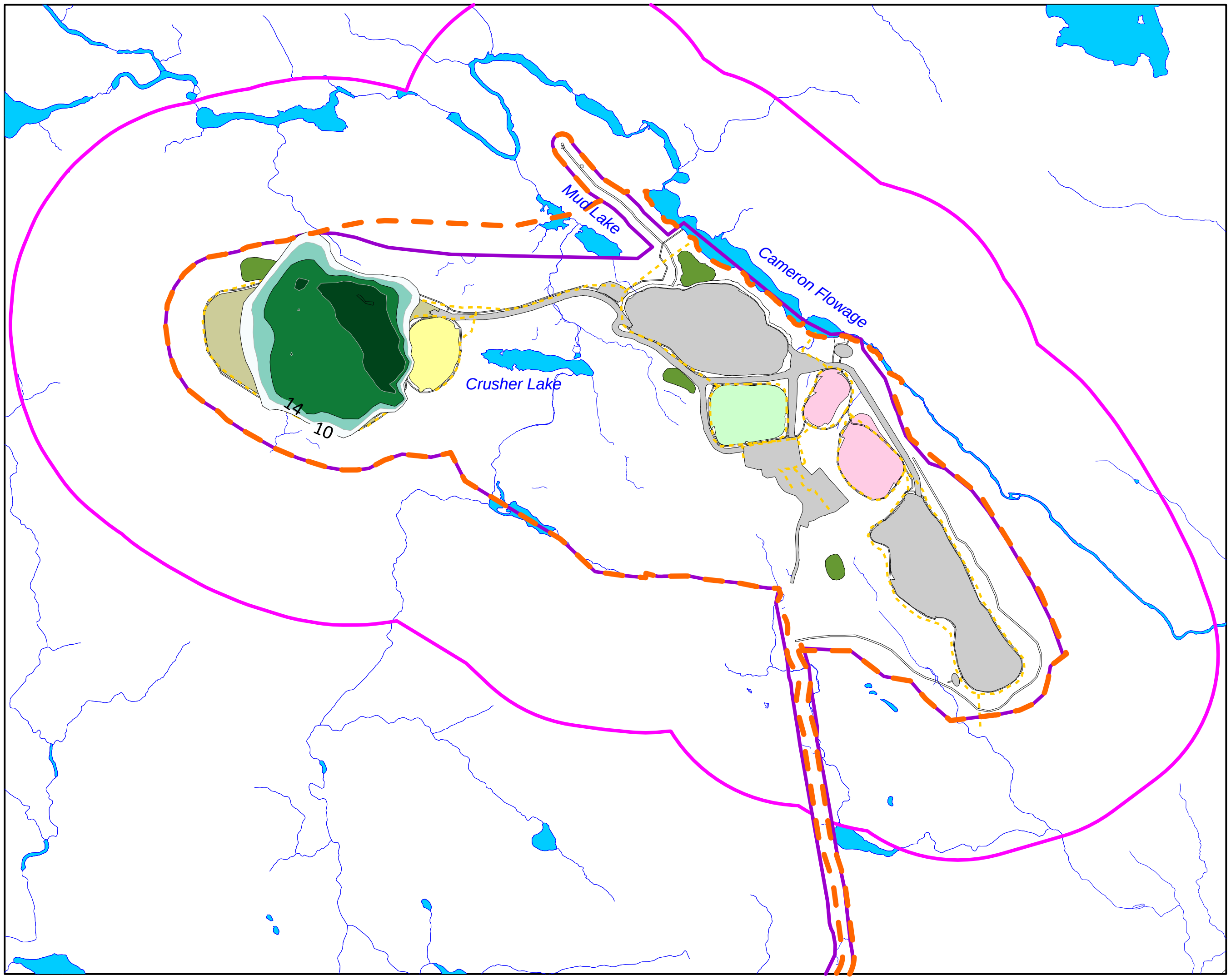
SIMULATED NITRATE CONCENTRATION VERSUS POTABLE CRITERIA
EOM - BASE CASE SOURCE TERMS - BASE CASE CONDITION

088664-031

March 11, 2021

FIGURE 7.10

HEG file: Z:\HEG\088664\DOCUMENTATION\RPT\088664-RPT-13\FIGURES\Figure 7.9 - Simulated Manganese Concentration Versus Potable Criteria - EOM - UC - AVG.srf



LEGEND

SURFACE WATER BODY

PROPOSED EXTENT OF MINE FEATURES

0.1 — SIMULATED NITRATE CONCENTRATION (mg/L)

SURFACE WATER MANAGEMENT DITCHES

PROPERTY BOUNDARY

PROJECT AREA

LOCAL ASSESSMENT AREA

NAG WASTE ROCK STOCKPILE

PAG WASTE ROCK STOCKPILE

LGO STOCKPILE

TILL STOCKPILES

TOPSOIL STOCKPILES

Note: The nitrate GCDWQ for potable groundwater is 10 mg/L.

0 300 600 900m

ATLANTIC GOLD CORPORATION
MARINETTE, NOVA SCOTIA
BEAVER DAM MINE

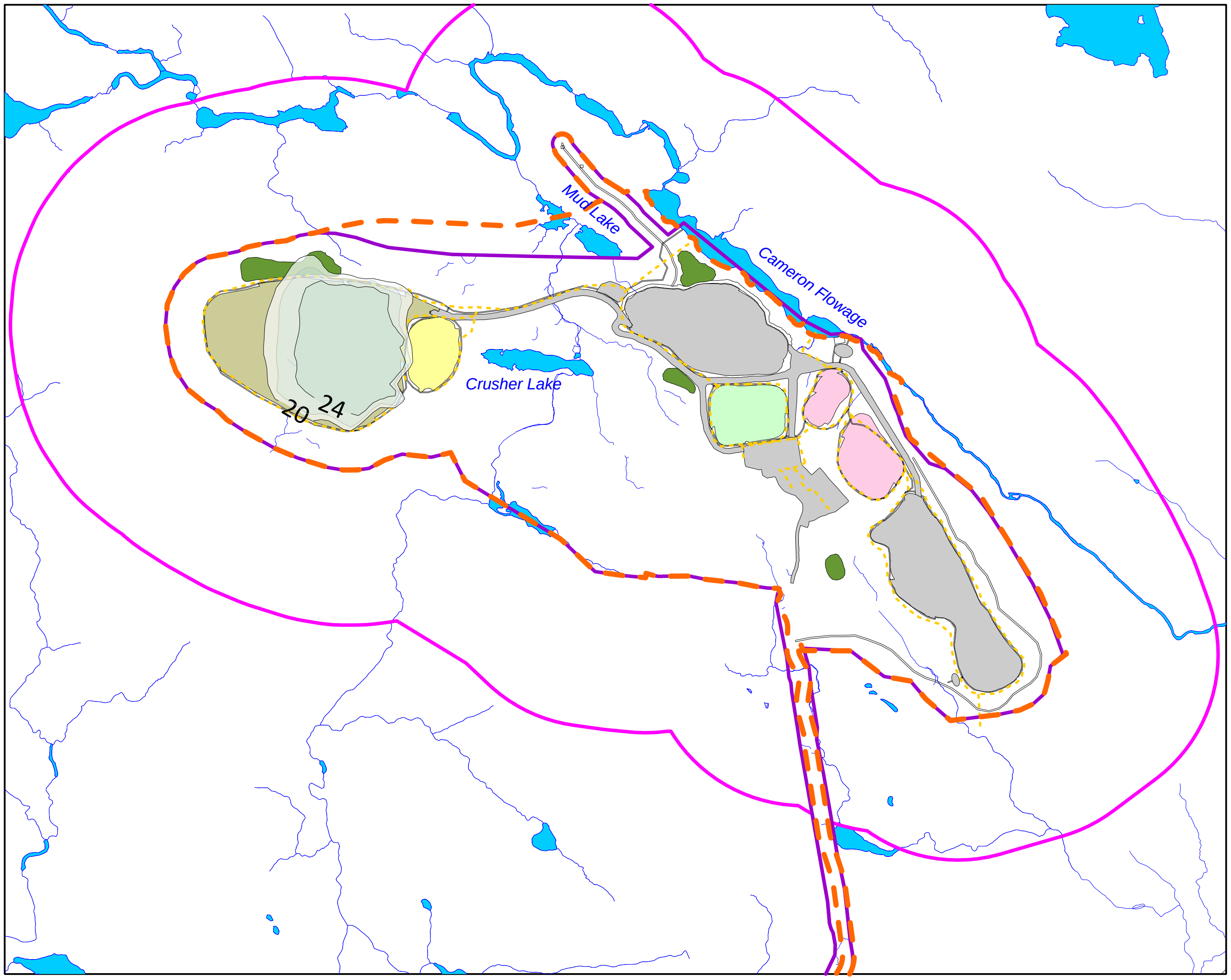
SIMULATED NITRATE CONCENTRATION VERSUS POTABLE CRITERIA
EOM - UPPER CASE SOURCE TERMS - BASE CASE CONDITION

088664-031

March 11, 2021

FIGURE 7.11

HEG file: Z:\HEG\088664\DOCUMENTATION\RPT\088664-RPT-13\FIGURES\Figure 7.9 - Simulated Manganese Concentration Versus Potable Criteria - EOM - UC - AVG.srf



LEGEND

- SURFACE WATER BODY
- PROPOSED EXTENT OF MINE FEATURES
- 0.1 — SIMULATED URANIUM CONCENTRATION (ug/L)
- SURFACE WATER MANAGEMENT DITCHES
- PROPERTY BOUNDARY
- PROJECT AREA
- LOCAL ASSESSMENT AREA
- NAG WASTE ROCK STOCKPILE
- PAG WASTE ROCK STOCKPILE
- LGO STOCKPILE
- TILL STOCKPILES
- TOPSOIL STOCKPILES

Note: The uranium Tier 1 EQS for potable groundwater is 20 ug/L.

0 300 600 900m

N

GHD

ATLANTIC GOLD CORPORATION
MARINETTE, NOVA SCOTIA
BEAVER DAM MINE

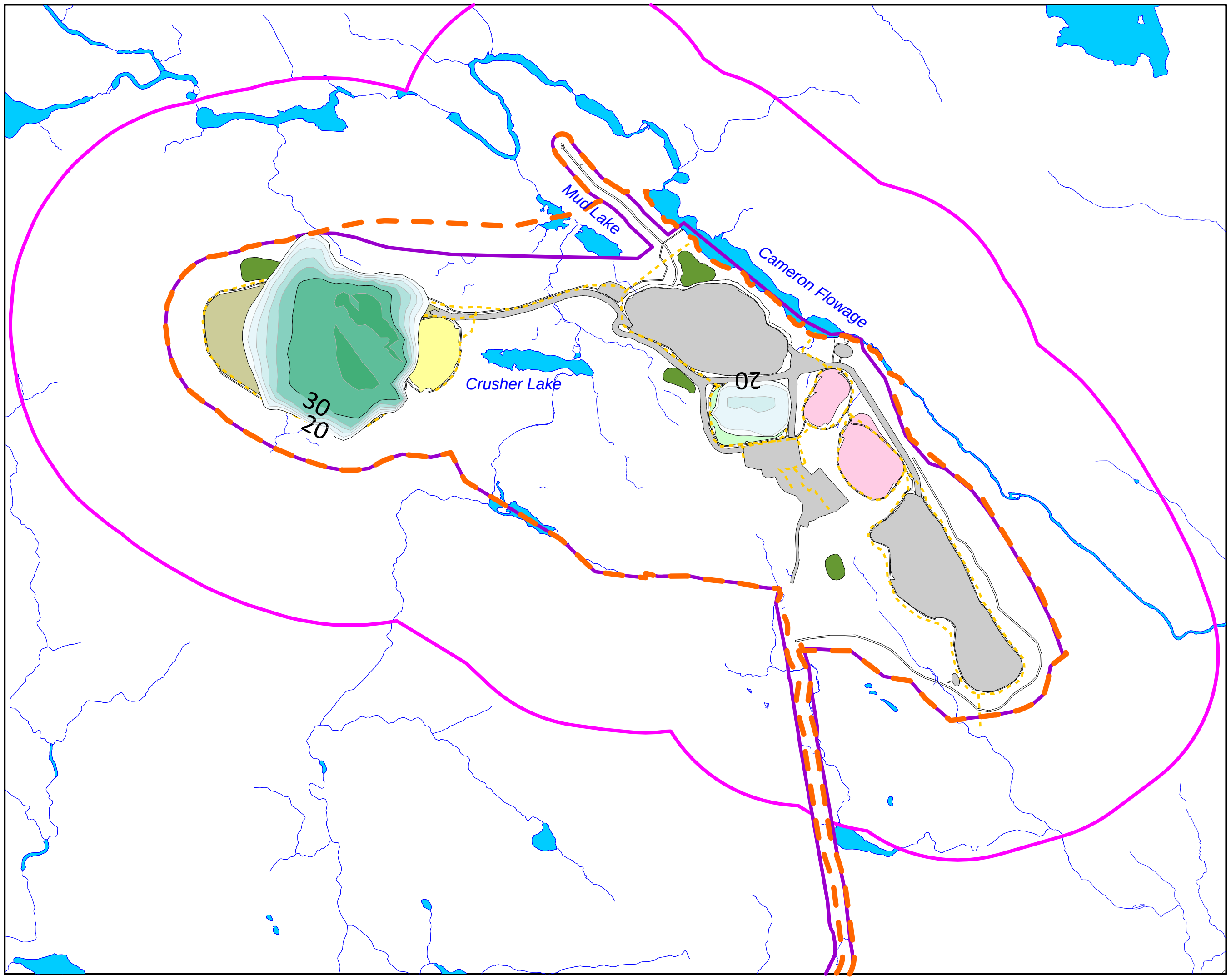
SIMULATED URANIUM CONCENTRATION VERSUS POTABLE CRITERIA
EOM - BASE CASE SOURCE TERMS - BASE CASE CONDITION

088664-031

March 11, 2021

FIGURE 7.12

HEG file: Z:\HEG\088664\DOCUMENTATION\RPT\088664-RPT-13\FIGURES\Figure 7.10 - Simulated Uranium Concentration Versus Potable Criteria - EOM - BC - AVG.srf



LEGEND

- SURFACE WATER BODY
- PROPOSED EXTENT OF MINE FEATURES
- 0.1 — SIMULATED URANIUM CONCENTRATION (ug/L)
- SURFACE WATER MANAGEMENT DITCHES
- PROPERTY BOUNDARY
- PROJECT AREA
- LOCAL ASSESSMENT AREA
- NAG WASTE ROCK STOCKPILE
- PAG WASTE ROCK STOCKPILE
- LGO STOCKPILE
- TILL STOCKPILES
- TOPSOIL STOCKPILES

Note: The uranium Tier 1 EQS for potable groundwater is 20 ug/L.

0 300 600 900m

ATLANTIC GOLD CORPORATION
MARINETTE, NOVA SCOTIA
BEAVER DAM MINE

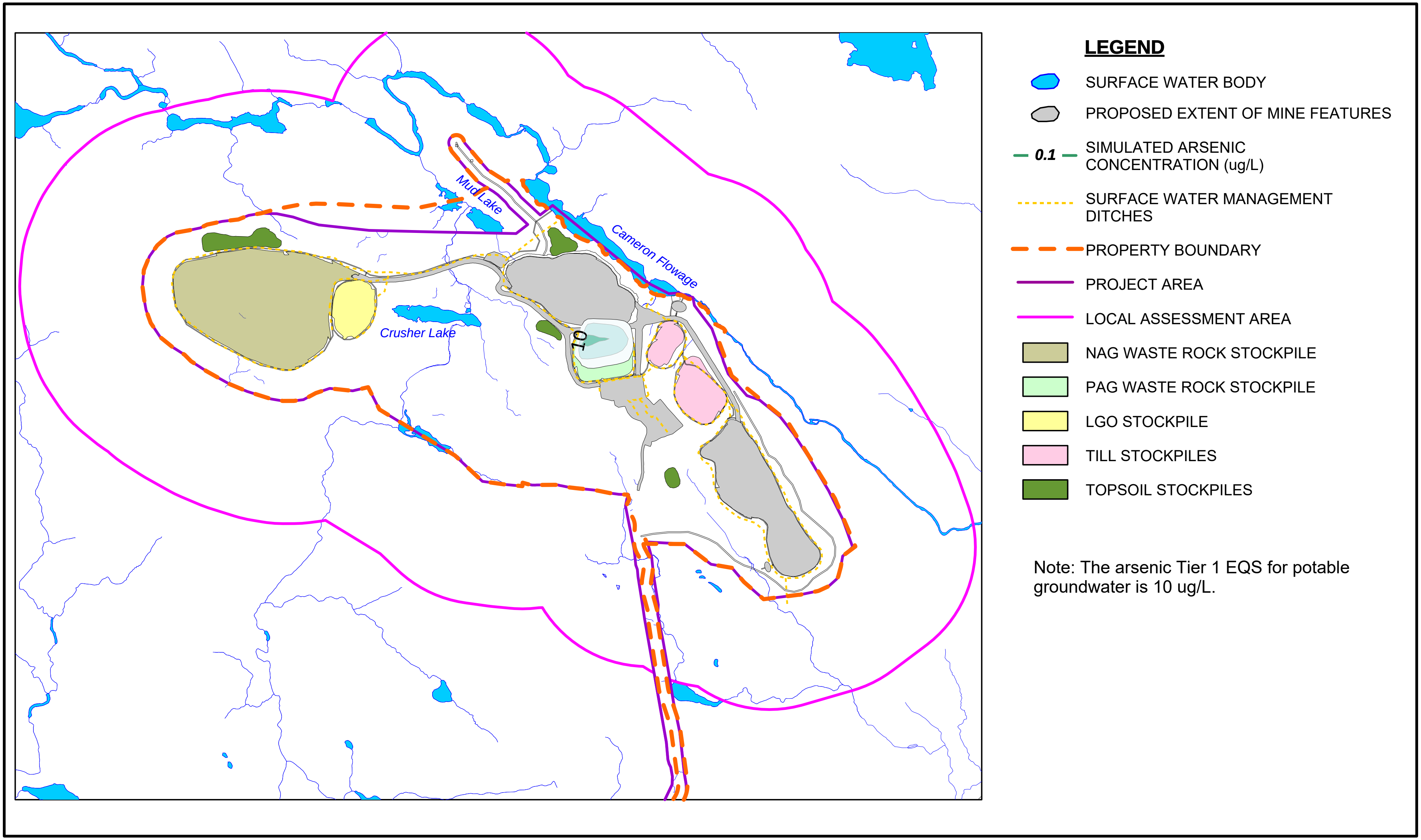
SIMULATED URANIUM CONCENTRATION VERSUS POTABLE CRITERIA
EOM - UPPER CASE SOURCE TERMS - BASE CASE CONDITION

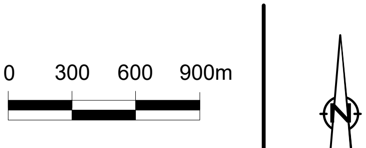
088664-031

March 11, 2021

FIGURE 7.13

HEG file: Z:\HEG\088664\DOCUMENTATION\RPT\088664-RPT-13\FIGURES\Figure 7.11 - Simulated Uranium Concentration Versus Potable Criteria - EOM - UC - AVG.srf





ATLANTIC GOLD CORPORATION
MARINETTE, NOVA SCOTIA
BEAVER DAM MINE

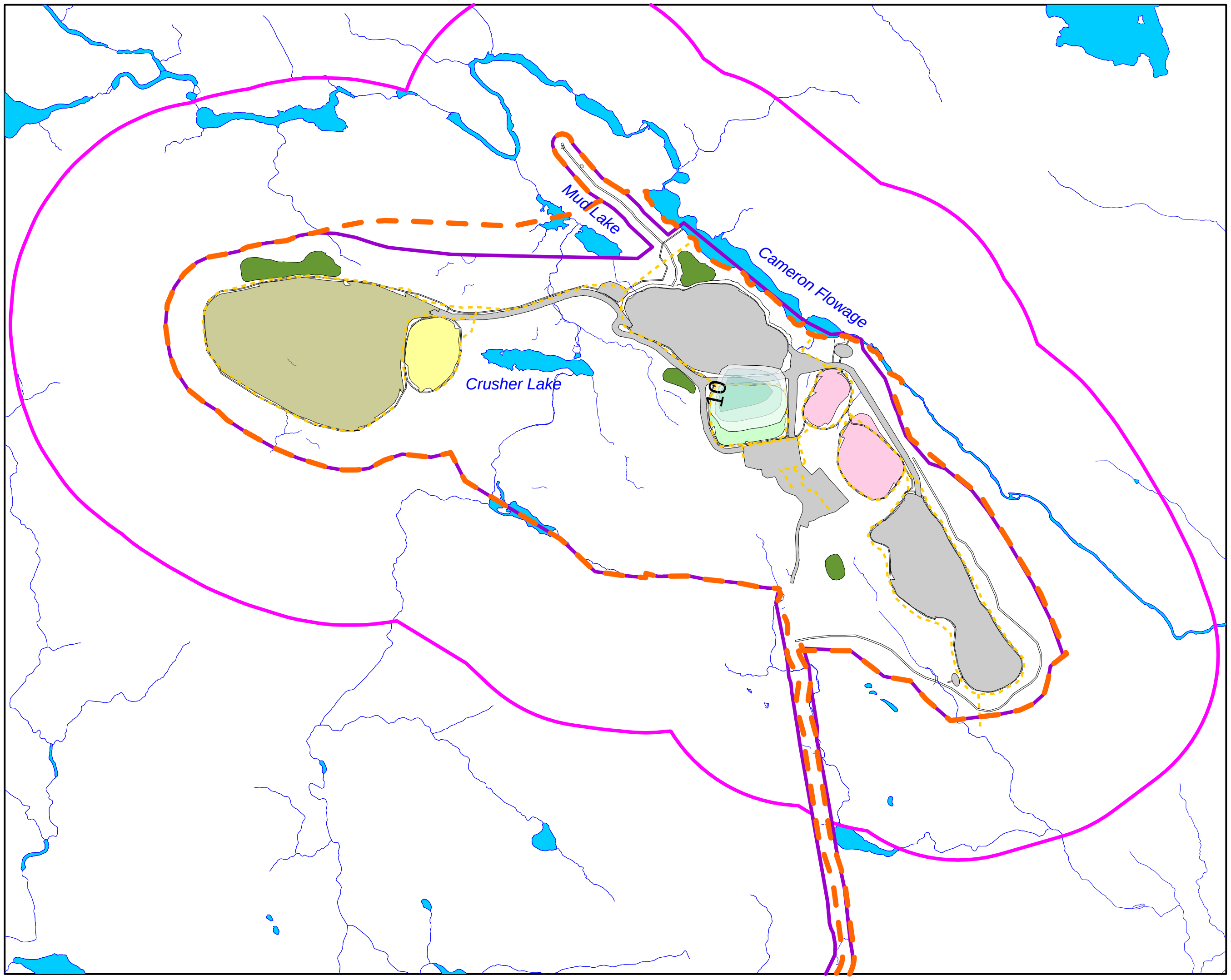
SIMULATED ARSENIC CONCENTRATION VERSUS POTABLE CRITERIA
PC - BASE CASE SOURCE TERMS - BASE CASE CONDITION

088664-031

March 11, 2021

FIGURE 7.14

HEG file: Z:\HEG\088664\DOCUMENTATION\RPT\088664-RPT-13\FIGURES\Figure 7.12 - Simulated Arsenic Concentration Versus Potable Criteria - PC - BC - AVG.srf



LEGEND

- SURFACE WATER BODY
- PROPOSED EXTENT OF MINE FEATURES
- 0.1 SIMULATED ARSENIC CONCENTRATION (ug/L)
- SURFACE WATER MANAGEMENT DITCHES
- PROPERTY BOUNDARY
- PROJECT AREA
- LOCAL ASSESSMENT AREA
- NAG WASTE ROCK STOCKPILE
- PAG WASTE ROCK STOCKPILE
- LGO STOCKPILE
- TILL STOCKPILES
- TOPSOIL STOCKPILES

Note: The arsenic Tier 1 EQS for potable groundwater is 10 ug/L.

0 300 600 900m

ATLANTIC GOLD CORPORATION
MARINETTE, NOVA SCOTIA
BEAVER DAM MINE

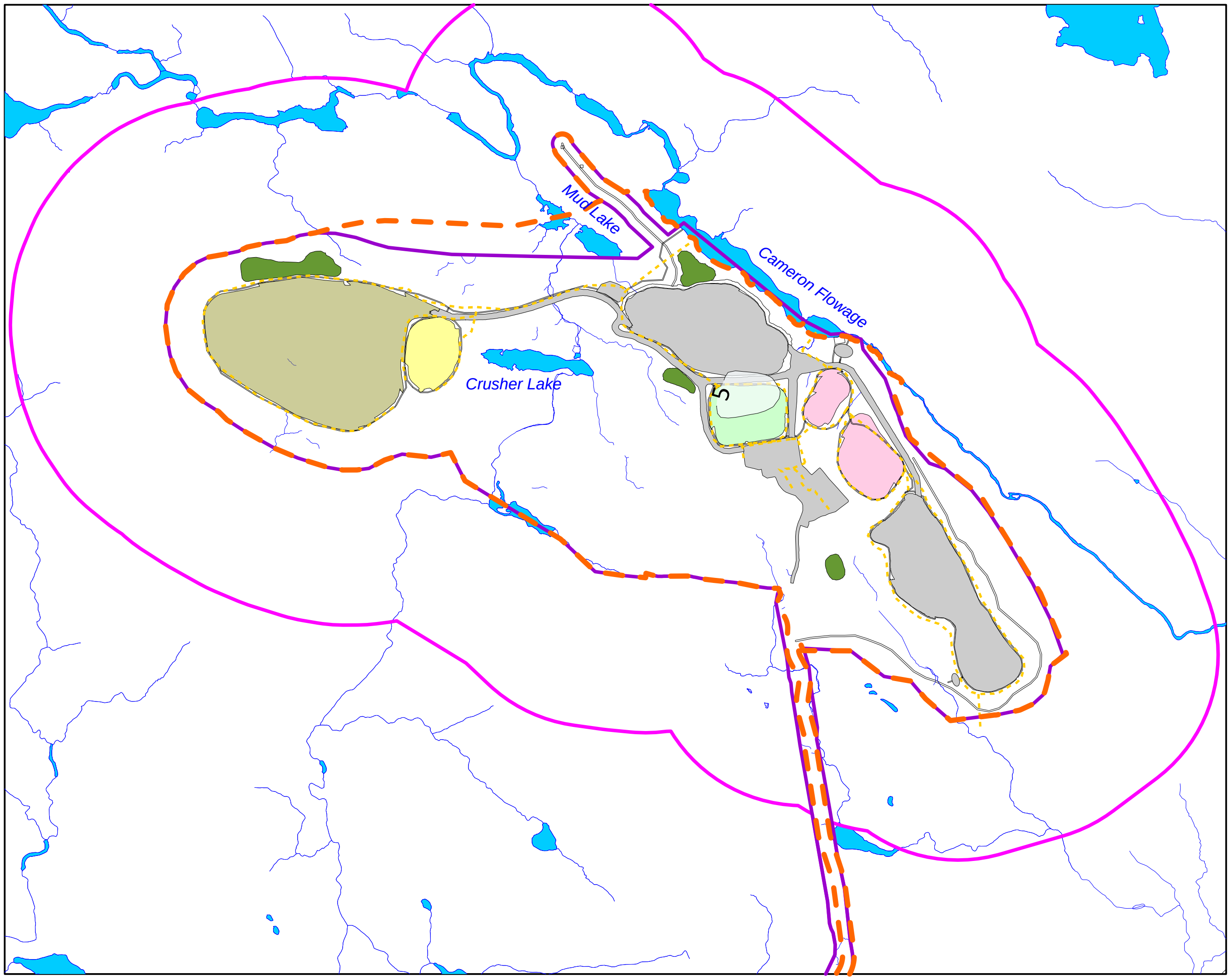
SIMULATED ARSENIC CONCENTRATION VERSUS POTABLE CRITERIA
PC - UPPER CASE SOURCE TERMS - BASE CASE CONDITION

088664-031

March 11, 2021

FIGURE 7.15

HEG file: Z:\HEG\088664\DOCUMENTATION\RPT\088664-RPT-13\Figure 7.13 - Simulated Arsenic Concentration Versus Potable Criteria - PC - UC - AVG.srf



LEGEND

- SURFACE WATER BODY
- PROPOSED EXTENT OF MINE FEATURES
- 0.1 — SIMULATED CADMIUM CONCENTRATION (ug/L)
- SURFACE WATER MANAGEMENT DITCHES
- PROPERTY BOUNDARY
- PROJECT AREA
- LOCAL ASSESSMENT AREA
- NAG WASTE ROCK STOCKPILE
- PAG WASTE ROCK STOCKPILE
- LGO STOCKPILE
- TILL STOCKPILES
- TOPSOIL STOCKPILES

Note: The cadmium Tier 1 EQS for potable groundwater is 5 ug/L.

0 300 600 900m

ATLANTIC GOLD CORPORATION
MARINETTE, NOVA SCOTIA
BEAVER DAM MINE

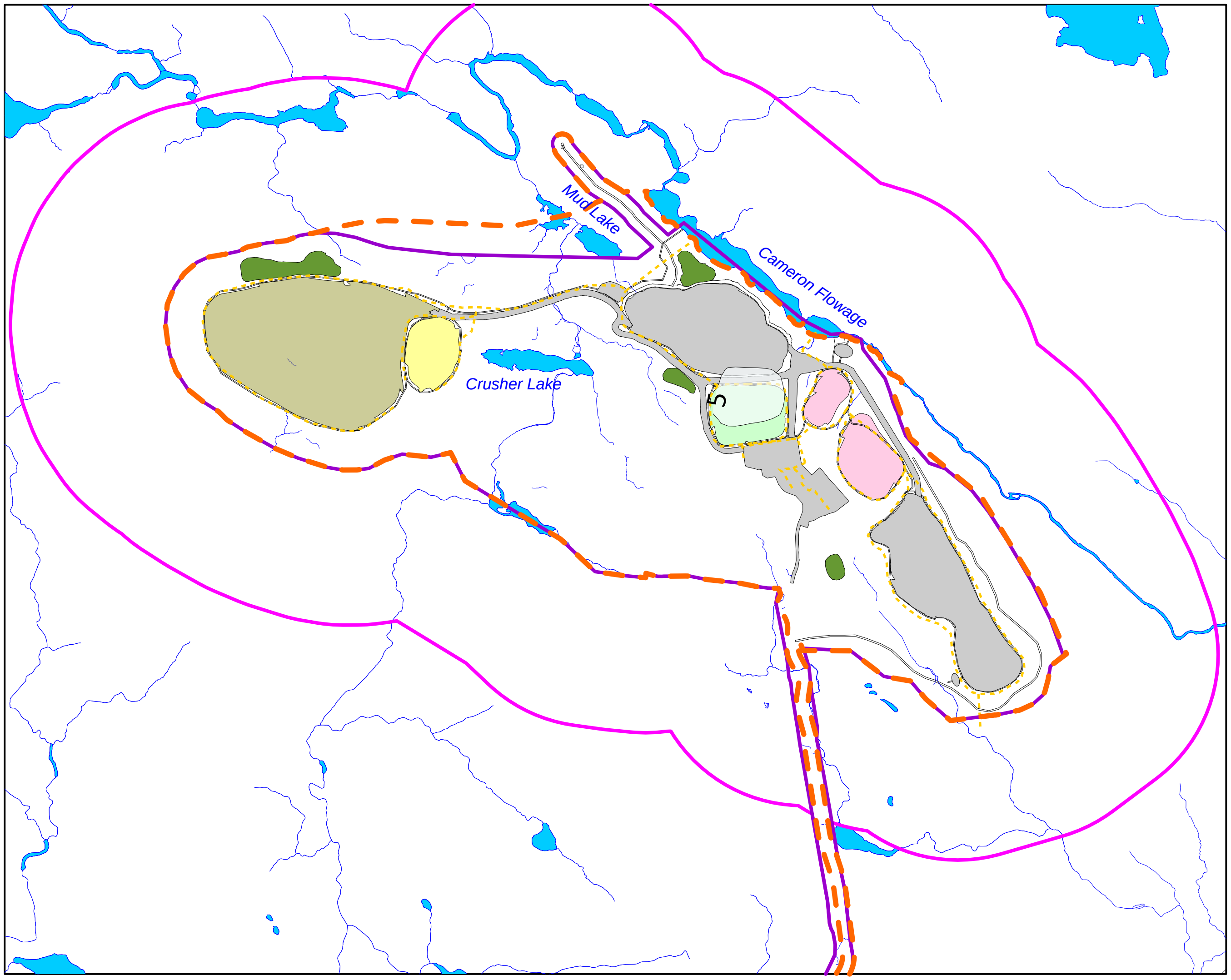
SIMULATED CADMIUM CONCENTRATION VERSUS POTABLE CRITERIA
PC - BASE CASE SOURCE TERMS - BASE CASE CONDITION

088664-031

March 11, 2021

FIGURE 7.16

HEG file: Z:\HEG\088664\DOCUMENTATION\RPT\088664-RPT-13\FIGURES\Figure 7.14 - Simulated Cadmium Concentration Versus Potable Criteria - PC - BC - AVG.srf



LEGEND

- SURFACE WATER BODY
- PROPOSED EXTENT OF MINE FEATURES
- 0.1 — SIMULATED CADMIUM CONCENTRATION (ug/L)
- SURFACE WATER MANAGEMENT DITCHES
- PROPERTY BOUNDARY
- PROJECT AREA
- LOCAL ASSESSMENT AREA
- NAG WASTE ROCK STOCKPILE
- PAG WASTE ROCK STOCKPILE
- LGO STOCKPILE
- TILL STOCKPILES
- TOPSOIL STOCKPILES

Note: The cadmium Tier 1 EQS for potable groundwater is 5 ug/L.

0 300 600 900m

ATLANTIC GOLD CORPORATION
MARINETTE, NOVA SCOTIA
BEAVER DAM MINE

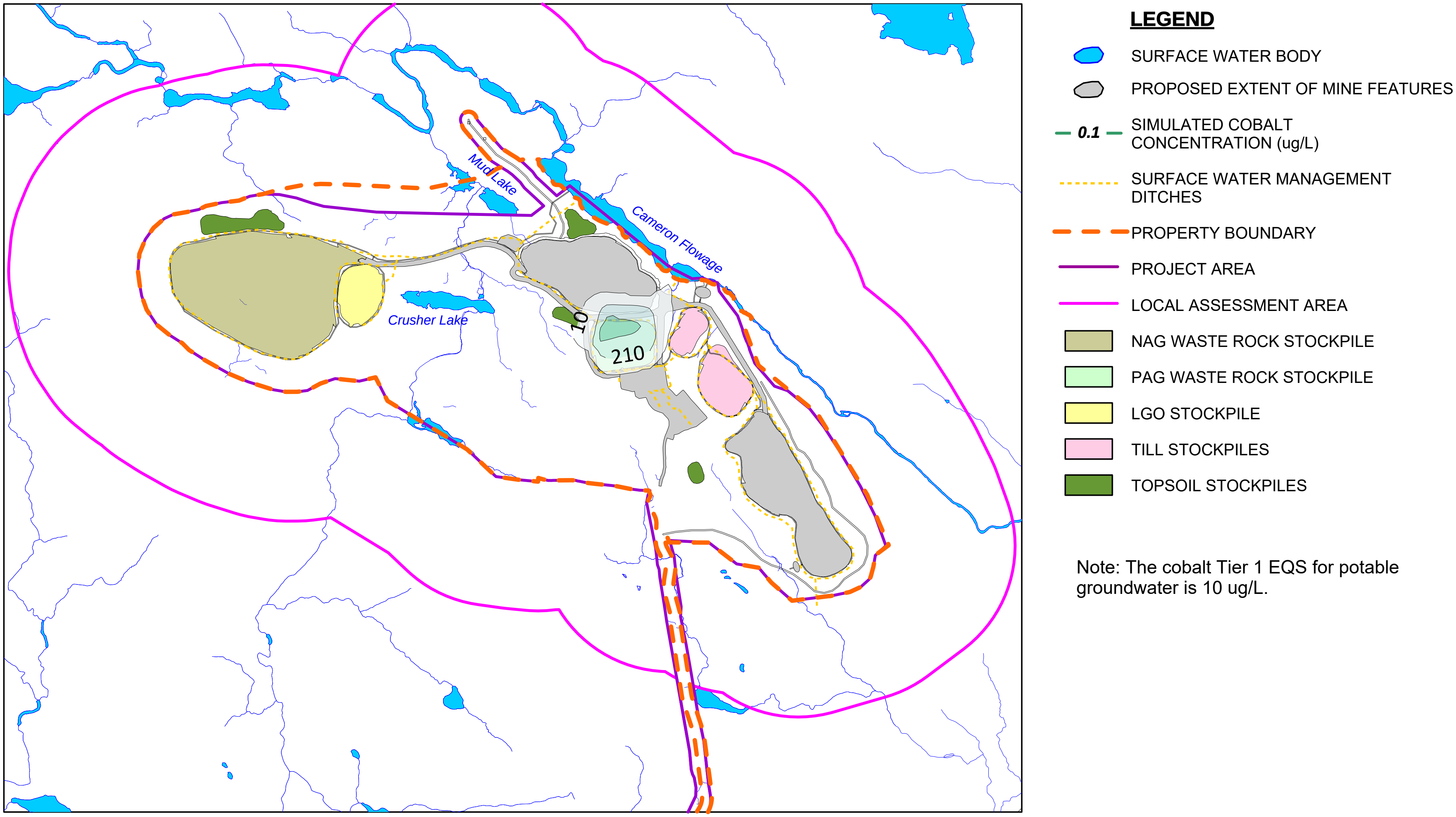
SIMULATED CADMIUM CONCENTRATION VERSUS POTABLE CRITERIA
PC - UPPER CASE SOURCE TERMS - BASE CASE CONDITION

088664-031

March 11, 2021

FIGURE 7.17

HEG file: Z:\HEG\088664\DOCUMENTATION\RPT\088664-RPT-13\FIGURES\Figure 7.15 - Simulated Cadmium Concentration Versus Potable Criteria - PC - UC - AVG.srf



Note: The cobalt Tier 1 EQS for potable groundwater is 10 ug/L.

0 300 600 900m

ATLANTIC GOLD CORPORATION
MARINETTE, NOVA SCOTIA
BEAVER DAM MINE

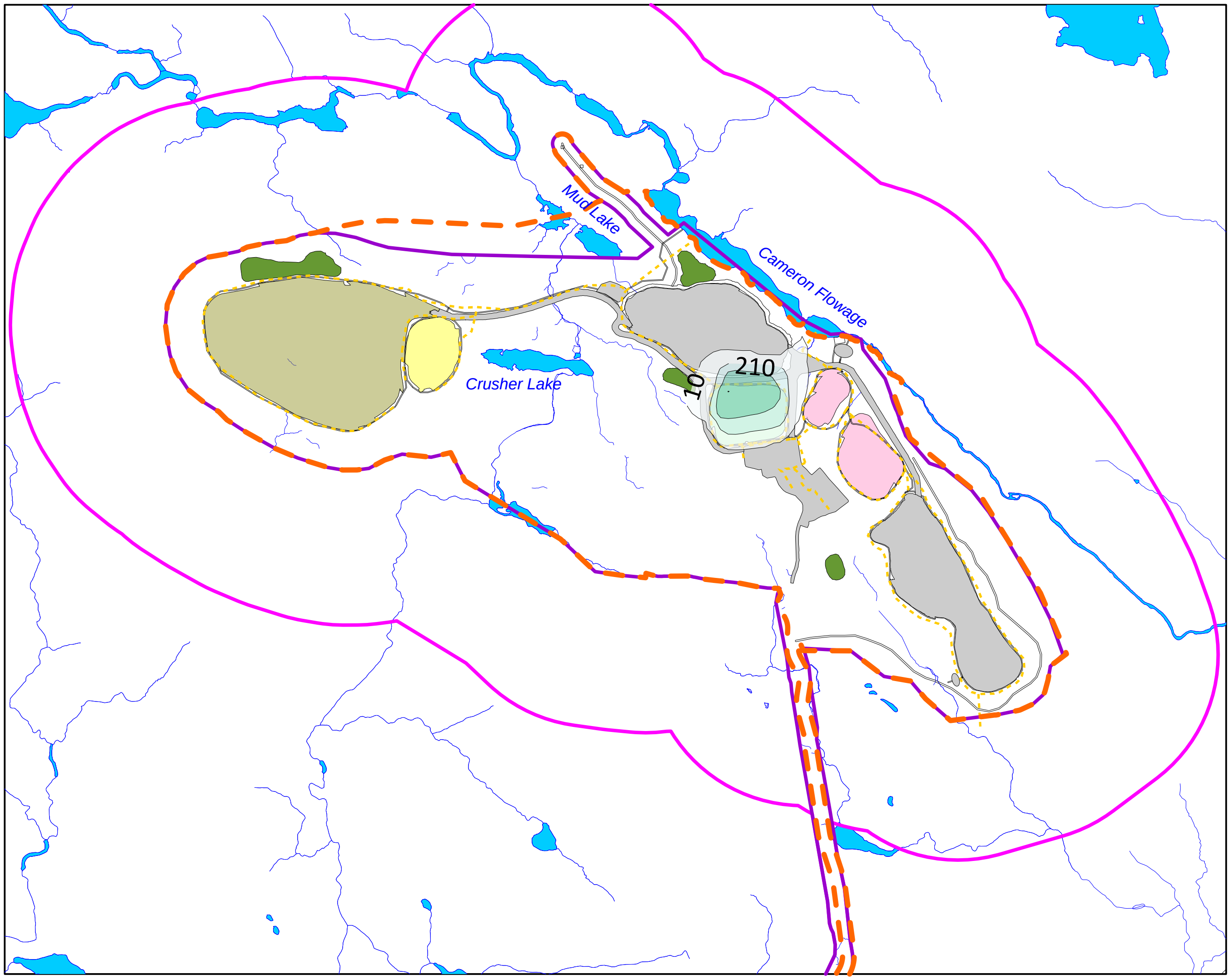
SIMULATED COBALT CONCENTRATION VERSUS POTABLE CRITERIA
PC - BASE CASE SOURCE TERMS - BASE CASE CONDITION

088664-031

March 11, 2021

FIGURE 7.18

HEG file: Z:\HEG\088664\DOCUMENTATION\RPT\088664-RPT-13\FIGURES\Figure 7.16 - Simulated Cobalt Concentration Versus Potable Criteria - PC - BC - AVG.srf



LEGEND

- SURFACE WATER BODY
- PROPOSED EXTENT OF MINE FEATURES
- 0.1 SIMULATED COBALT CONCENTRATION (ug/L)
- SURFACE WATER MANAGEMENT DITCHES
- PROPERTY BOUNDARY
- PROJECT AREA
- LOCAL ASSESSMENT AREA
- NAG WASTE ROCK STOCKPILE
- PAG WASTE ROCK STOCKPILE
- LGO STOCKPILE
- TILL STOCKPILES
- TOPSOIL STOCKPILES

Note: The cobalt Tier 1 EQS for potable groundwater is 10 ug/L.

ATLANTIC GOLD CORPORATION
MARINETTE, NOVA SCOTIA
BEAVER DAM MINE

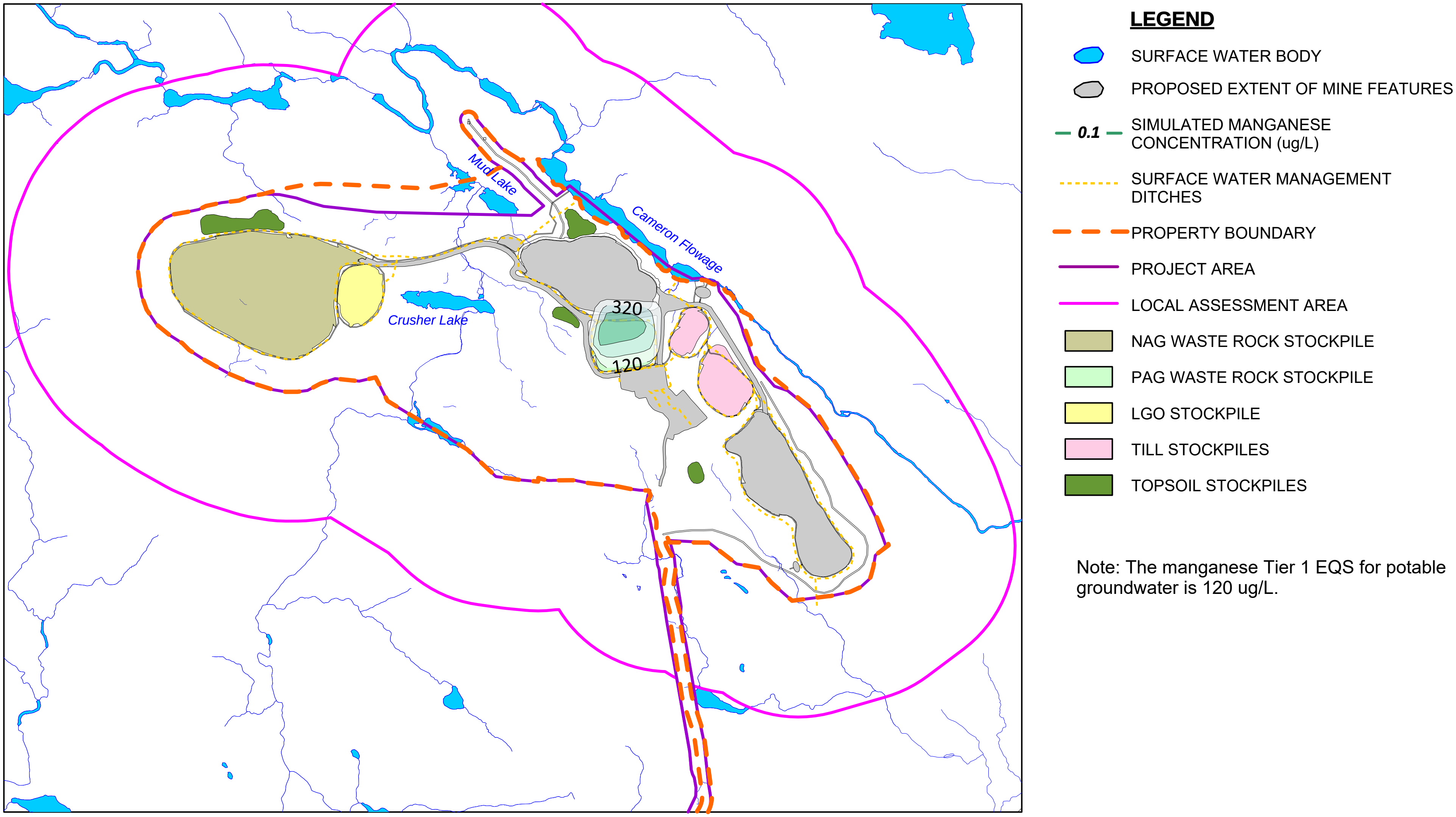
SIMULATED COBALT CONCENTRATION VERSUS POTABLE CRITERIA
PC - UPPER CASE SOURCE TERMS - BASE CASE CONDITION

088664-031

March 11, 2021

FIGURE 7.19

HEG file: Z:\HEG\088664\DOCUMENTATION\RPT\088664-RPT-13\FIGURES\Figure 7.17 - Simulated Cobalt Concentration Versus Potable Criteria - PC - UC - AVG.srf



Note: The manganese Tier 1 EQS for potable groundwater is 120 ug/L.

0 300 600 900m

ATLANTIC GOLD CORPORATION
MARINETTE, NOVA SCOTIA
BEAVER DAM MINE

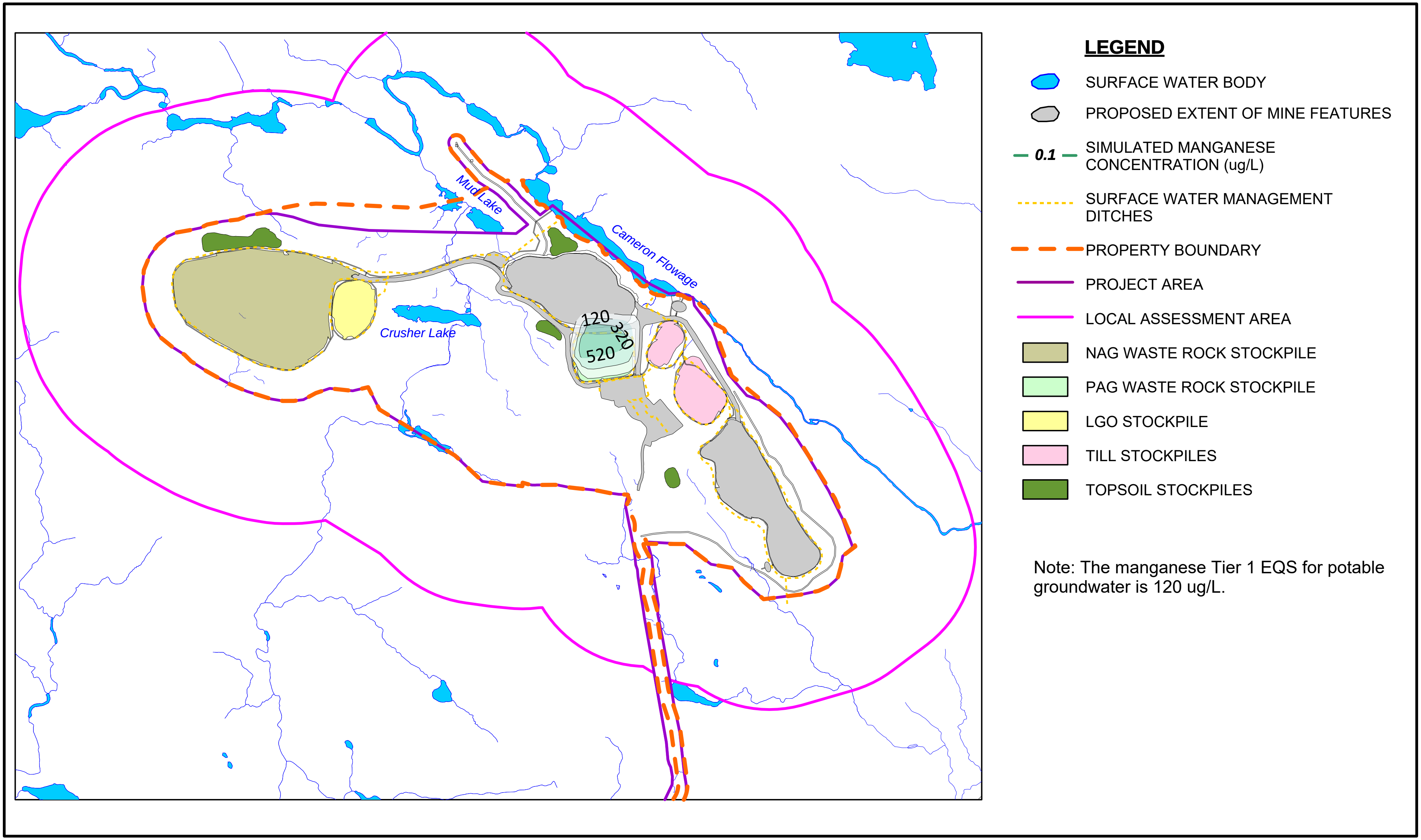
SIMULATED MANGANESE CONCENTRATION VERSUS POTABLE CRITERIA
PC - BASE CASE SOURCE TERMS - BASE CASE CONDITION

088664-031

March 11, 2021

FIGURE 7.20

HEG file: Z:\HEG\088664\DOCUMENTATION\RPT\088664-RPT-13\FIGURES\Figure 7.18 - Simulated Manganese Concentration Versus Potable Criteria - PC - BC - AVG.srf



ATLANTIC GOLD CORPORATION
MARINETTE, NOVA SCOTIA
BEAVER DAM MINE

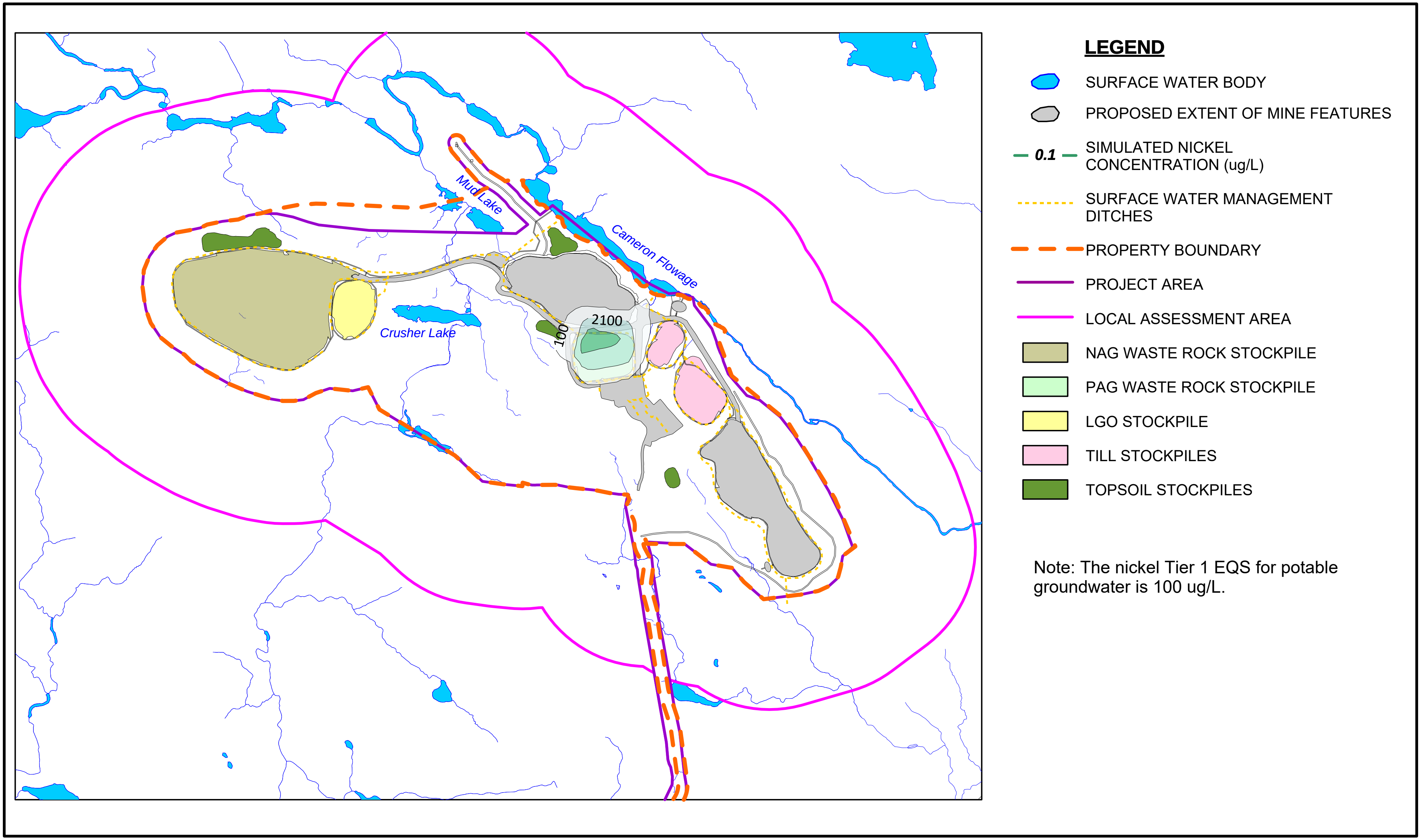
SIMULATED MANGANESE CONCENTRATION VERSUS POTABLE CRITERIA
PC - UPPER CASE SOURCE TERMS - BASE CASE CONDITION

088664-031

March 11, 2021

FIGURE 7.21

HEG file: Z:\HEG\088664\DOCUMENTATION\RPT\088664-RPT-13\FIGURES\Figure 7.19 - Simulated Manganese Concentration Versus Potable Criteria - PC - UC - AVG.srf



0 300 600 900m

ATLANTIC GOLD CORPORATION
MARINETTE, NOVA SCOTIA
BEAVER DAM MINE

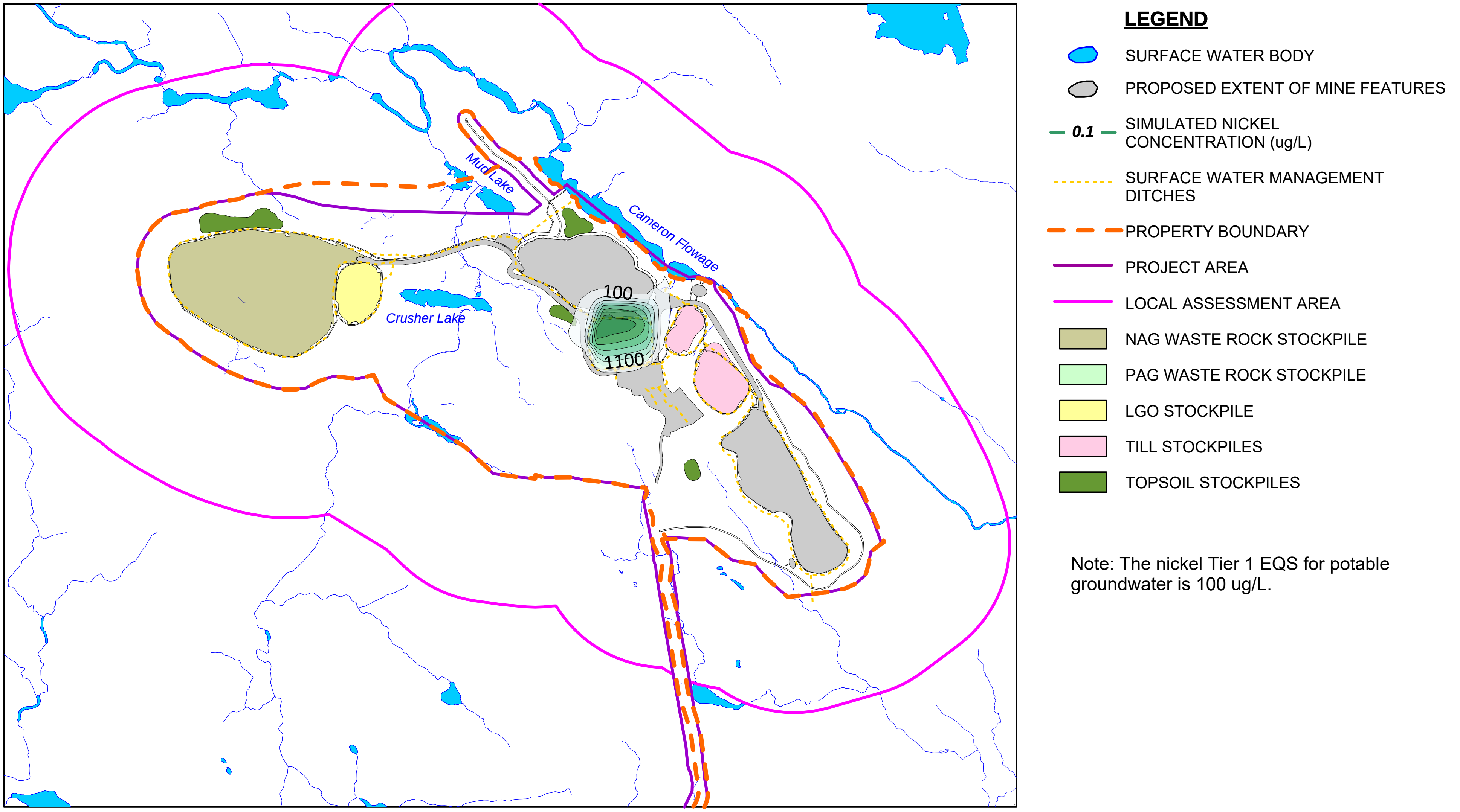
SIMULATED NICKEL CONCENTRATION VERSUS POTABLE CRITERIA
PC - BASE CASE SOURCE TERMS - BASE CASE CONDITION

088664-031

March 11, 2021

FIGURE 7.22

HEG file: Z:\HEG\088664\DOCUMENTATION\RPT\088664-RPT-13\FIGURES\Figure 7.20 - Simulated Nickel Concentration Versus Potable Criteria - PC - BC - AVG.srf



ATLANTIC GOLD CORPORATION
MARINETTE, NOVA SCOTIA
BEAVER DAM MINE

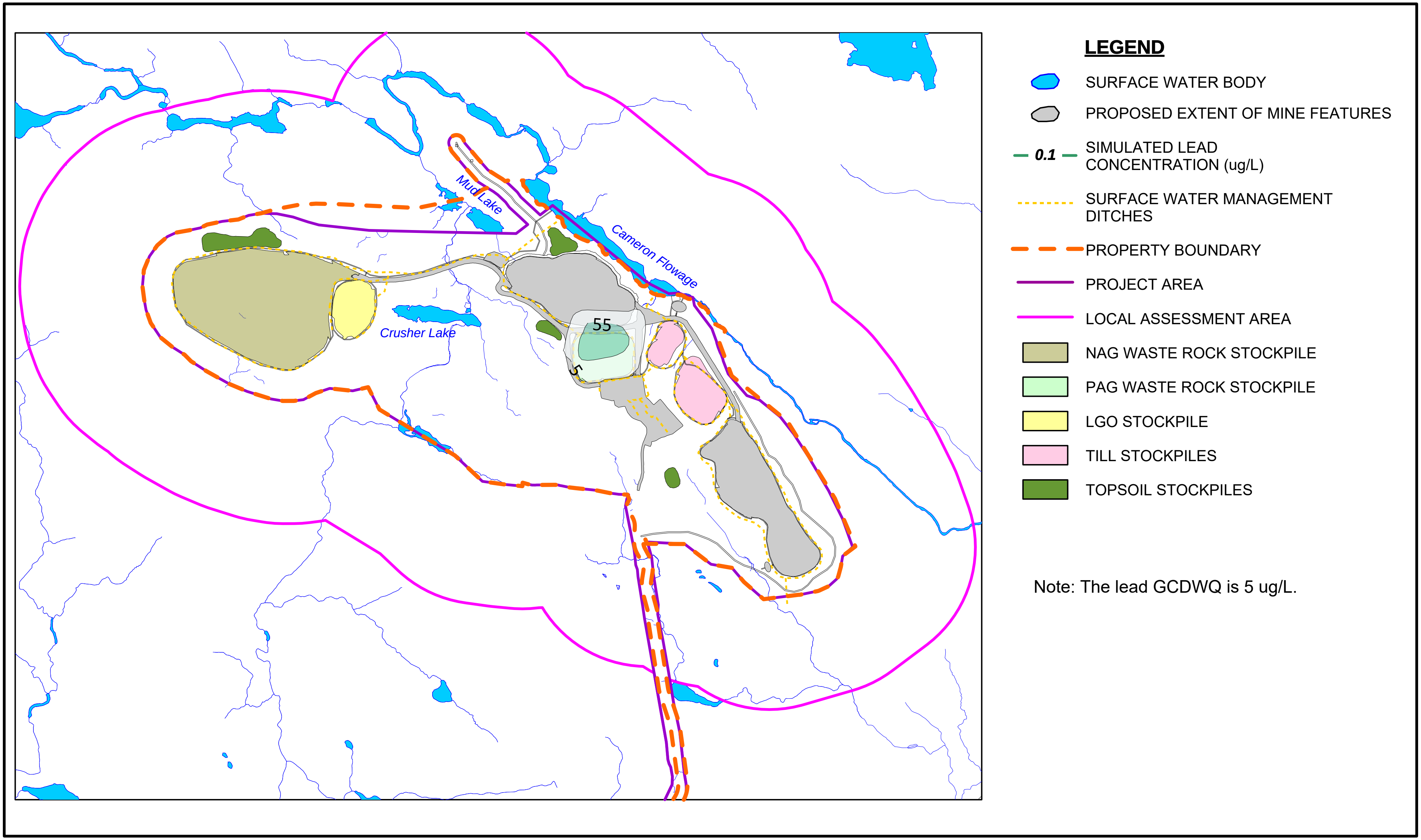
SIMULATED NICKEL CONCENTRATION VERSUS POTABLE CRITERIA
PC - UPPER CASE SOURCE TERMS - BASE CASE CONDITION

088664-031

March 11, 2021

FIGURE 7.23

HEG file: Z:\HEG\088664\DOCUMENTATION\RPT\088664-RPT-13\FIGURES\Figure 7.21 - Simulated Nickel Concentration Versus Potable Criteria - PC - UC - AVG.srf



ATLANTIC GOLD CORPORATION
MARINETTE, NOVA SCOTIA
BEAVER DAM MINE

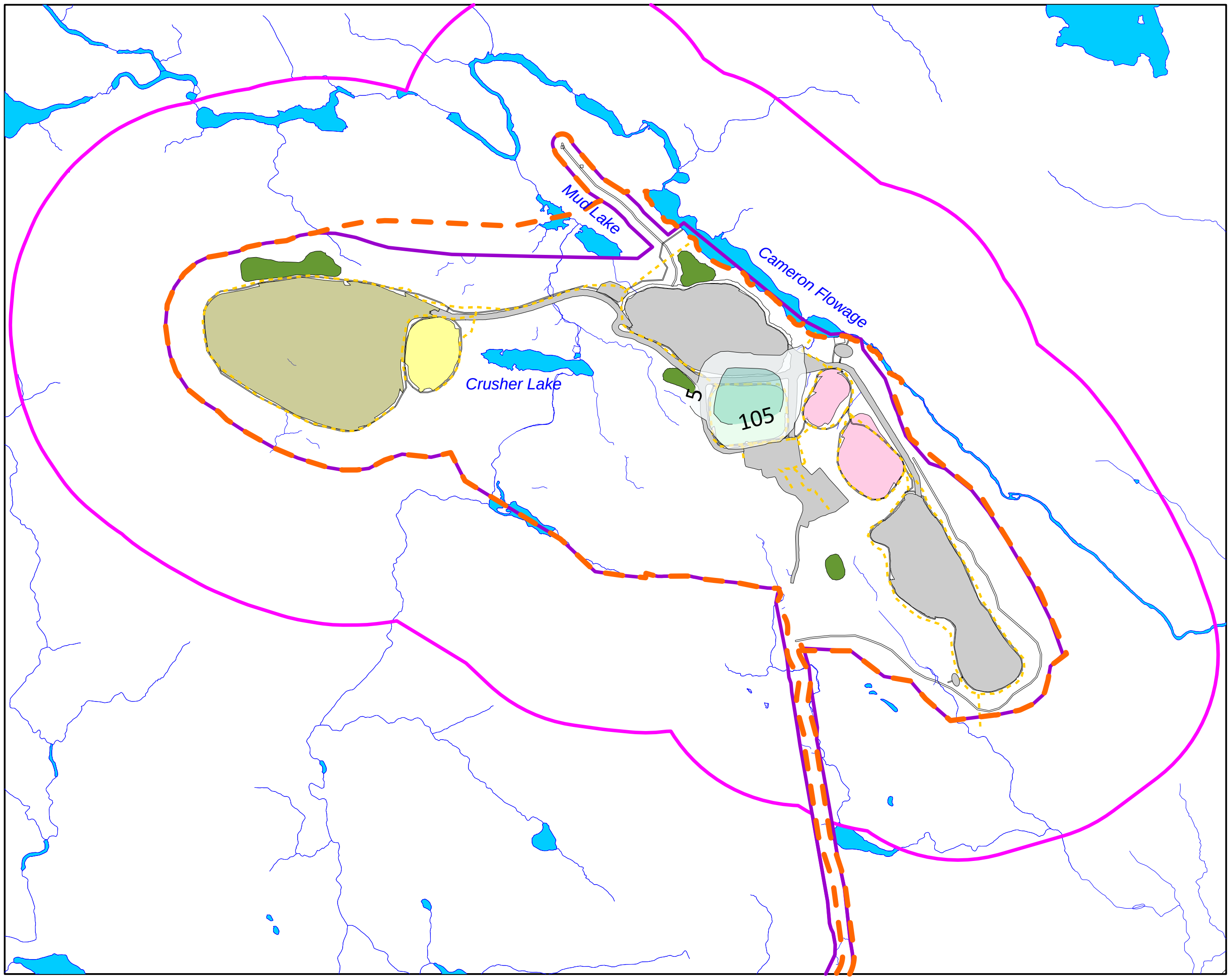
SIMULATED LEAD CONCENTRATION VERSUS POTABLE CRITERIA
PC - BASE CASE SOURCE TERMS - BASE CASE CONDITION

088664-031

March 11, 2021

FIGURE 7.24

HEG file: Z:\HEG\088664\DOCUMENTATION\RPT\088664-RPT-13\FIGURES\Figure 7.22 - Simulated Lead Concentration Versus Potable Criteria - PC - BC - AVG.srf



LEGEND

- SURFACE WATER BODY
- PROPOSED EXTENT OF MINE FEATURES
- 0.1 — SIMULATED LEAD CONCENTRATION (ug/L)
- SURFACE WATER MANAGEMENT DITCHES
- PROPERTY BOUNDARY
- PROJECT AREA
- LOCAL ASSESSMENT AREA
- NAG WASTE ROCK STOCKPILE
- PAG WASTE ROCK STOCKPILE
- LGO STOCKPILE
- TILL STOCKPILES
- TOPSOIL STOCKPILES

Note: The lead GCDWQ is 5 ug/L.

0 300 600 900m

ATLANTIC GOLD CORPORATION
MARINETTE, NOVA SCOTIA
BEAVER DAM MINE

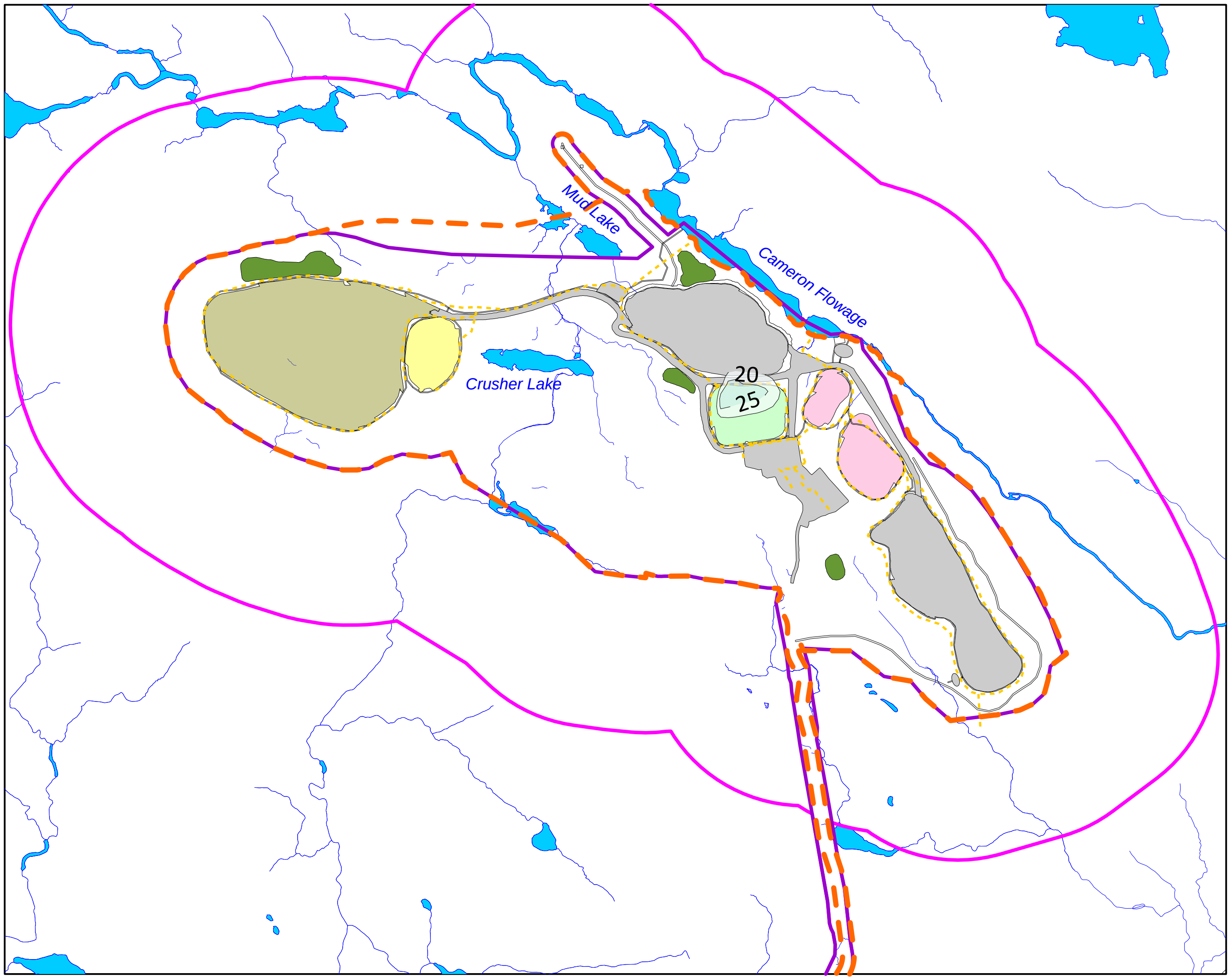
SIMULATED LEAD CONCENTRATION VERSUS POTABLE CRITERIA
PC - UPPER CASE SOURCE TERMS - BASE CASE CONDITION

088664-031

March 11, 2021

FIGURE 7.25

HEG file: Z:\HEG\088664\DOCUMENTATION\RPT\088664-RPT-13\FIGURES\Figure 7.23 - Simulated Lead Concentration Versus Potable Criteria - PC - UC - AVG.srf



LEGEND

- SURFACE WATER BODY
- PROPOSED EXTENT OF MINE FEATURES
- 0.1 SIMULATED URANIUM CONCENTRATION (ug/L)
- SURFACE WATER MANAGEMENT DITCHES
- PROPERTY BOUNDARY
- PROJECT AREA
- LOCAL ASSESSMENT AREA
- NAG WASTE ROCK STOCKPILE
- PAG WASTE ROCK STOCKPILE
- LGO STOCKPILE
- TILL STOCKPILES
- TOPSOIL STOCKPILES

Note: The uranium Tier 1 EQS for potable groundwater is 20 ug/L.

0 300 600 900m

ATLANTIC GOLD CORPORATION
MARINETTE, NOVA SCOTIA
BEAVER DAM MINE

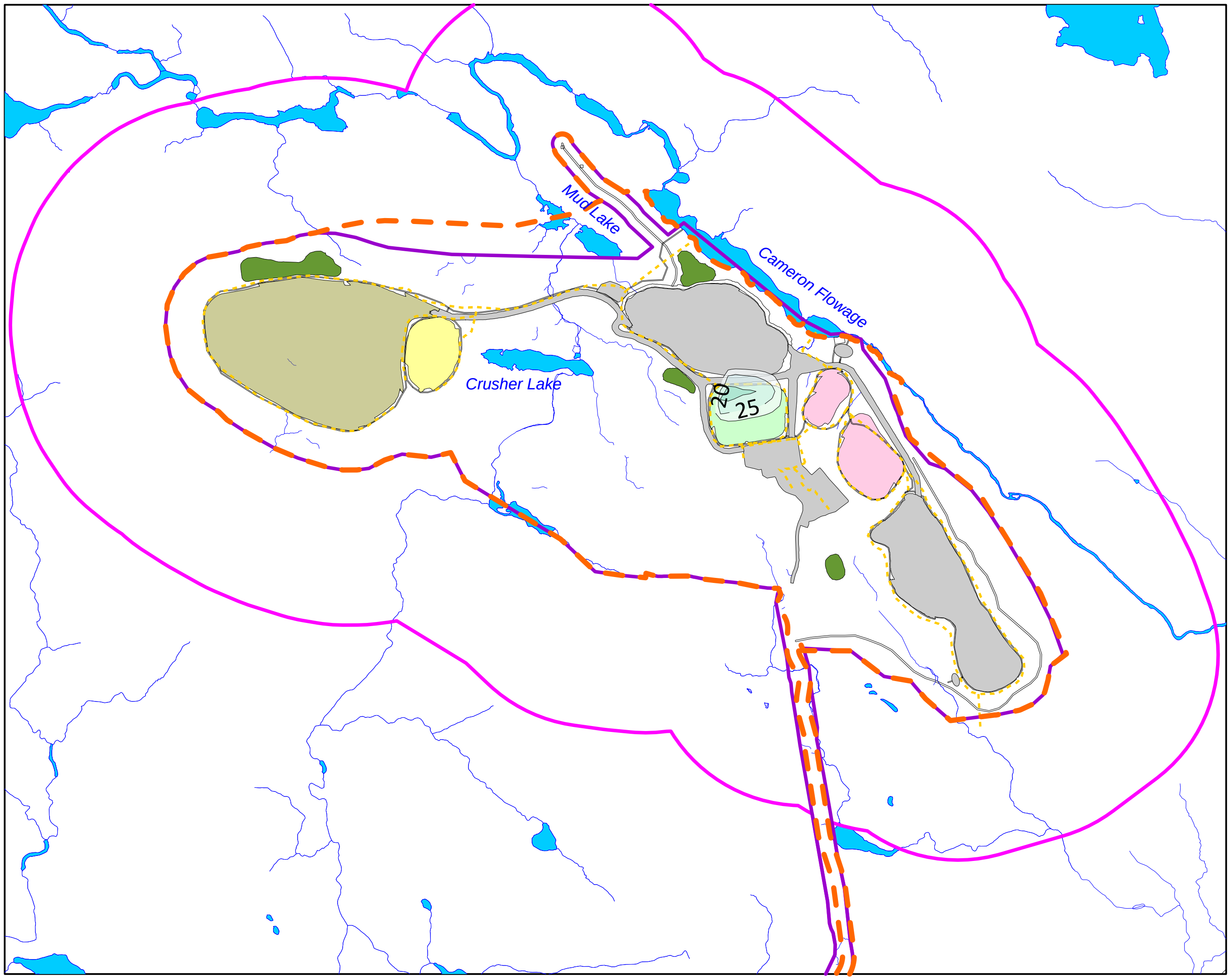
SIMULATED URANIUM CONCENTRATION VERSUS POTABLE CRITERIA
PC - BASE CASE SOURCE TERMS - BASE CASE CONDITION

088664-031

March 11, 2021

FIGURE 7.26

HEG file: Z:\HEG\088664\DOCUMENTATION\RPT\088664-RPT-13\FIGURES\Figure 7.25 - Simulated Uranium Concentration Versus Potable Criteria - PC - BC - AVG.srf



Note: The uranium Tier 1 EQS for potable groundwater is 20 ug/L.

0 300 600 900m

ATLANTIC GOLD CORPORATION
MARINETTE, NOVA SCOTIA
BEAVER DAM MINE

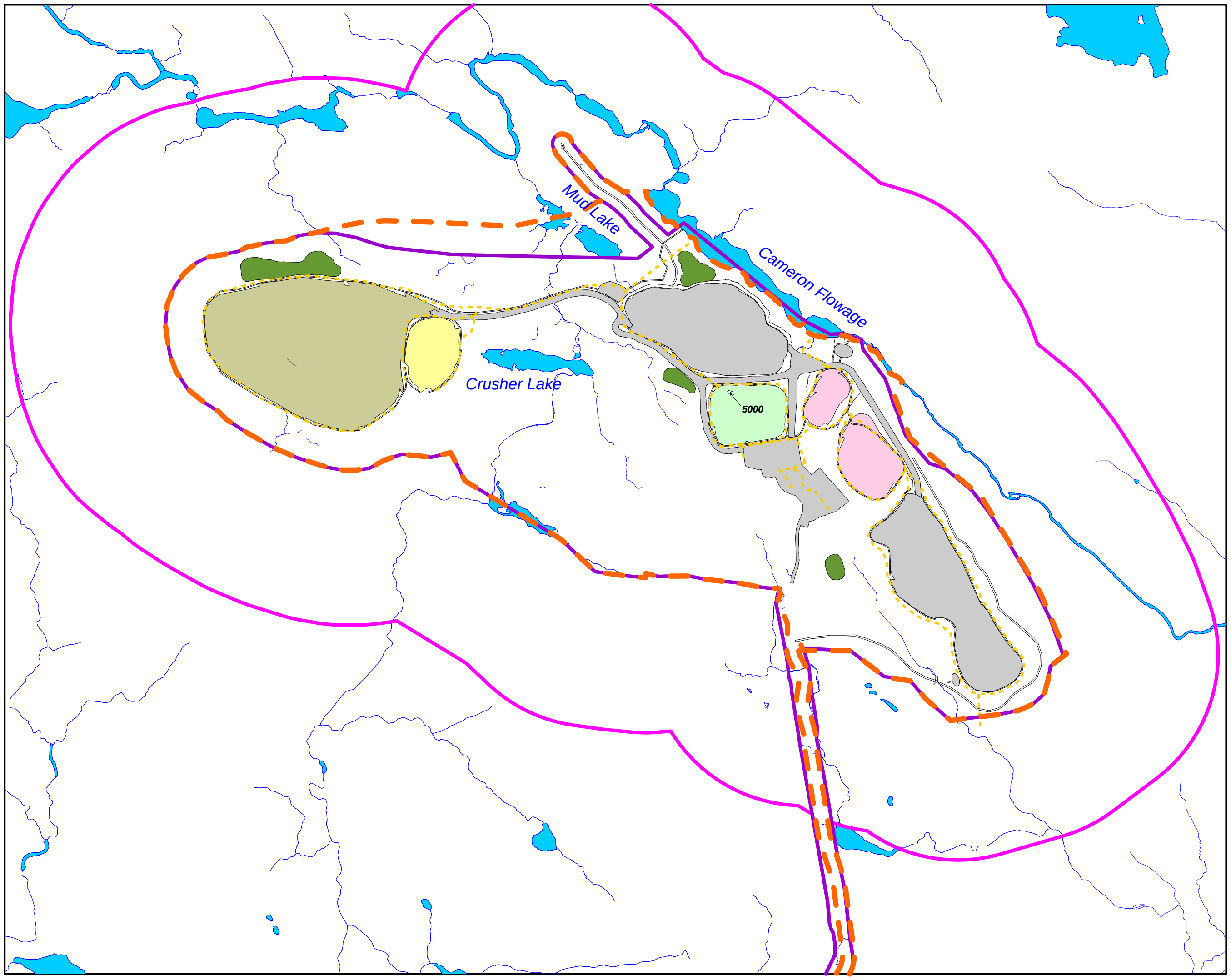
SIMULATED URANIUM CONCENTRATION VERSUS POTABLE CRITERIA
PC - UPPER CASE SOURCE TERMS - BASE CASE CONDITION

088664-031

March 11, 2021

FIGURE 7.27

HEG file: Z:\HEG\088664\DOCUMENTATION\RPT\088664-RPT-13\FIGURES\Figure 7.26 - Simulated Uranium Concentration Versus Potable Criteria - PC - UC - AVG.srf



LEGEND

- SURFACE WATER BODY
- PROPOSED EXTENT OF MINE FEATURES
- 0.1 SIMULATED ZINC CONCENTRATION (ug/L)
- SURFACE WATER MANAGEMENT DITCHES
- PROPERTY BOUNDARY
- PROJECT AREA
- LOCAL ASSESSMENT AREA
- NAG WASTE ROCK STOCKPILE
- PAG WASTE ROCK STOCKPILE
- LGO STOCKPILE
- TILL STOCKPILES
- TOPSOIL STOCKPILES

Note: The zinc Tier 1 EQS for potable groundwater is 5000 ug/L.

0 300 600 900m

ATLANTIC GOLD CORPORATION
MARINETTE, NOVA SCOTIA
BEAVER DAM MINE

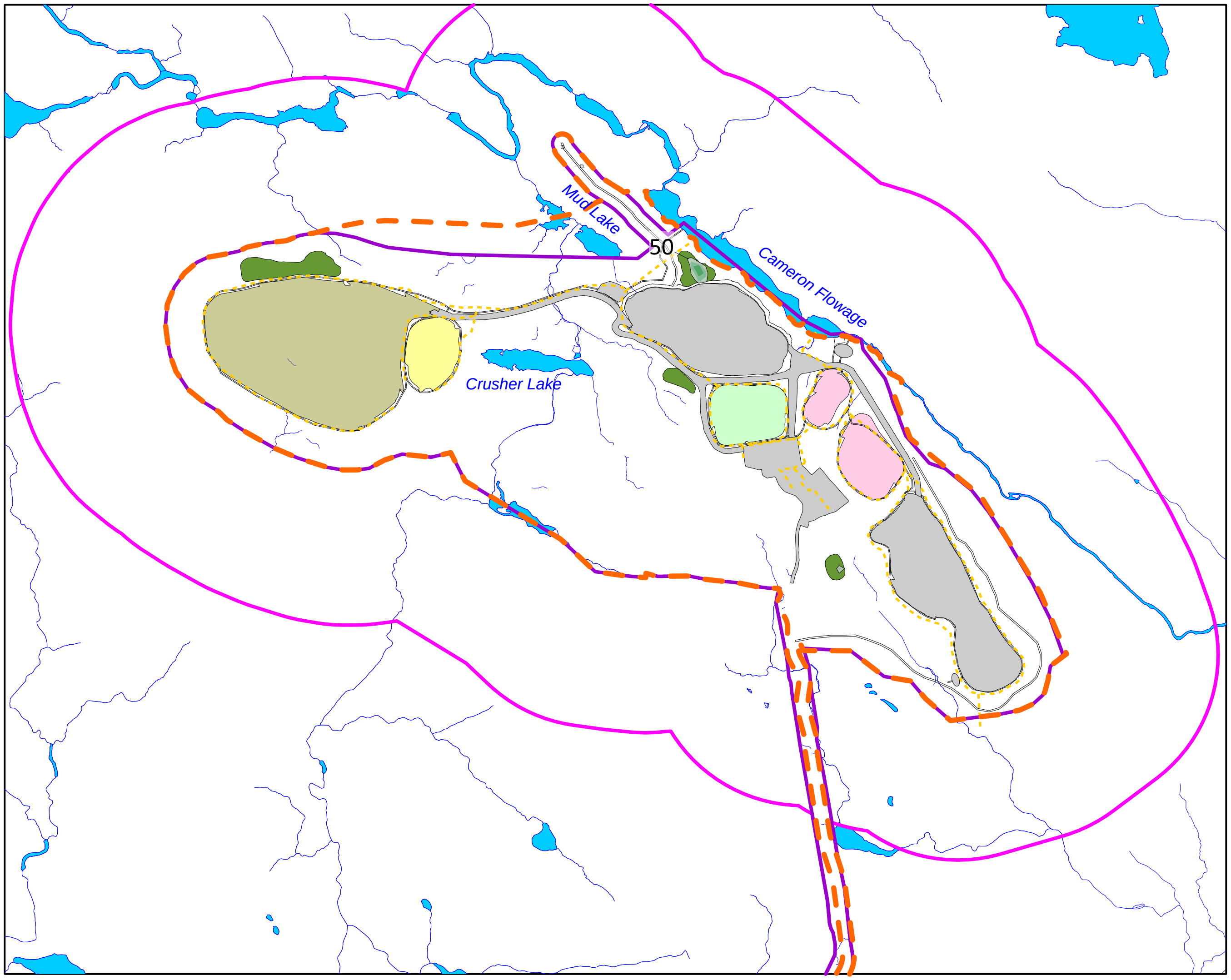
SIMULATED ZINC CONCENTRATION VERSUS POTABLE CRITERIA
PC - UPPER CASE SOURCE TERMS - BASE CASE CONDITION

088664-031

March 11, 2021

FIGURE 7.28

HEG file: Z:\HEG\088664\DOCUMENTATION\RPT\088664-RPT-13\FIGURES\Figure 7.28 - Simulated Zinc Concentration Versus Potable Criteria - PC - UC - AVG.srf



LEGEND

- SURFACE WATER BODY
- PROPOSED EXTENT OF MINE FEATURES
- 0.1 — SIMULATED ALUMINUM CONCENTRATION (ug/L)
- SURFACE WATER MANAGEMENT DITCHES
- PROPERTY BOUNDARY
- PROJECT AREA
- LOCAL ASSESSMENT AREA
- NAG WASTE ROCK STOCKPILE
- PAG WASTE ROCK STOCKPILE
- LGO STOCKPILE
- TILL STOCKPILES
- TOPSOIL STOCKPILES

Note: The aluminum Tier 2 PSS for groundwater discharge to surface water (>10 m) is 50 ug/L.

0 300 600 900m

ATLANTIC GOLD CORPORATION
MARINETTE, NOVA SCOTIA
BEAVER DAM MINE

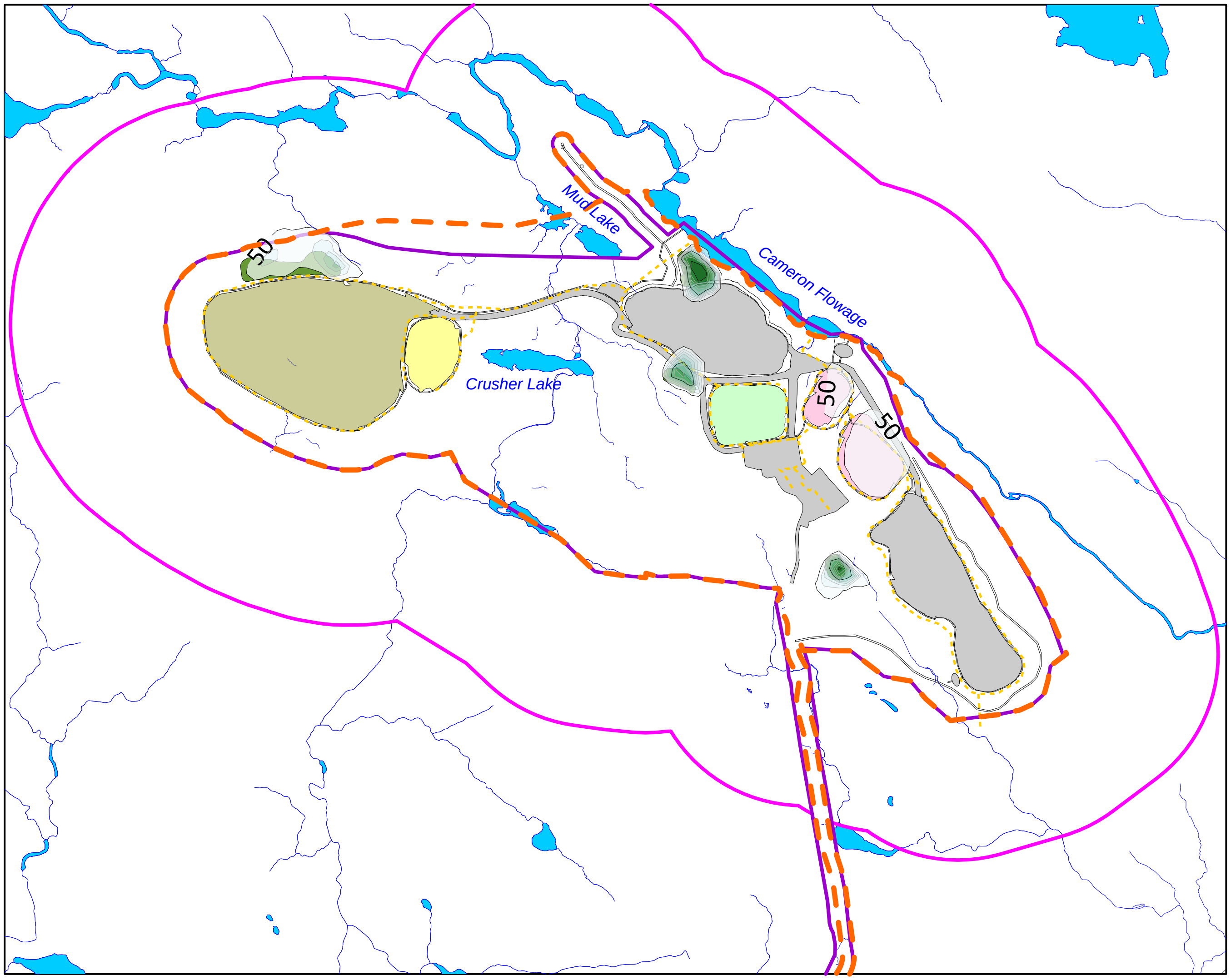
SIMULATED ALUMINUM CONCENTRATION VERSUS TIER 2 PSS
EOM - BASE CASE SOURCE TERMS - BASE CASE CONDITION

088664-031

March 11, 2021

FIGURE 7.29

HEG file: Z:\HEG\088664\DOCUMENTATION\RPT\088664-RPT-13\FIGURES\Figure 7.29 - Sim_Aluminum_PSS - EOM - BC - AVG.srf



LEGEND

- SURFACE WATER BODY
- PROPOSED EXTENT OF MINE FEATURES
- 0.1 SIMULATED ALUMINUM CONCENTRATION (ug/L)
- SURFACE WATER MANAGEMENT DITCHES
- PROPERTY BOUNDARY
- PROJECT AREA
- LOCAL ASSESSMENT AREA
- NAG WASTE ROCK STOCKPILE
- PAG WASTE ROCK STOCKPILE
- LGO STOCKPILE
- TILL STOCKPILES
- TOPSOIL STOCKPILES

Note: The aluminum Tier 2 PSS for groundwater discharge to surface water (>10 m) is 50 ug/L.

0 300 600 900m

ATLANTIC GOLD CORPORATION
MARINETTE, NOVA SCOTIA
BEAVER DAM MINE

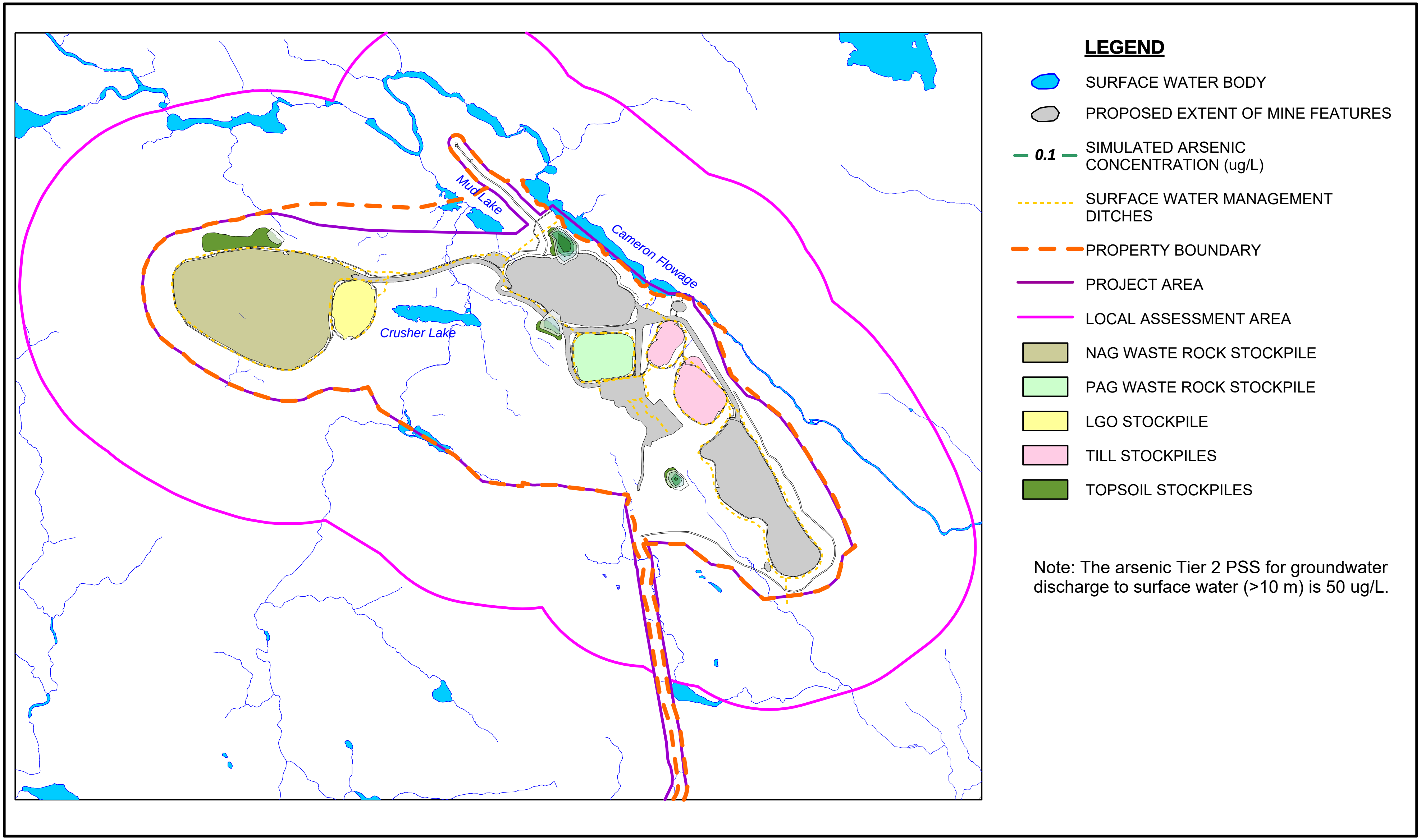
SIMULATED ALUMINUM CONCENTRATION VERSUS TIER 2 PSS
EOM - UPPER CASE SOURCE TERMS - BASE CASE CONDITION

088664-031

March 11, 2021

FIGURE 7.30

HEG file: Z:\HEG\088664\DOCUMENTATION\RPT\088664-RPT-13\FIGURES\Figure 7.30 - Sim_Aluminum_PSS - EOM - UC - AVG.srf



ATLANTIC GOLD CORPORATION
MARINETTE, NOVA SCOTIA
BEAVER DAM MINE

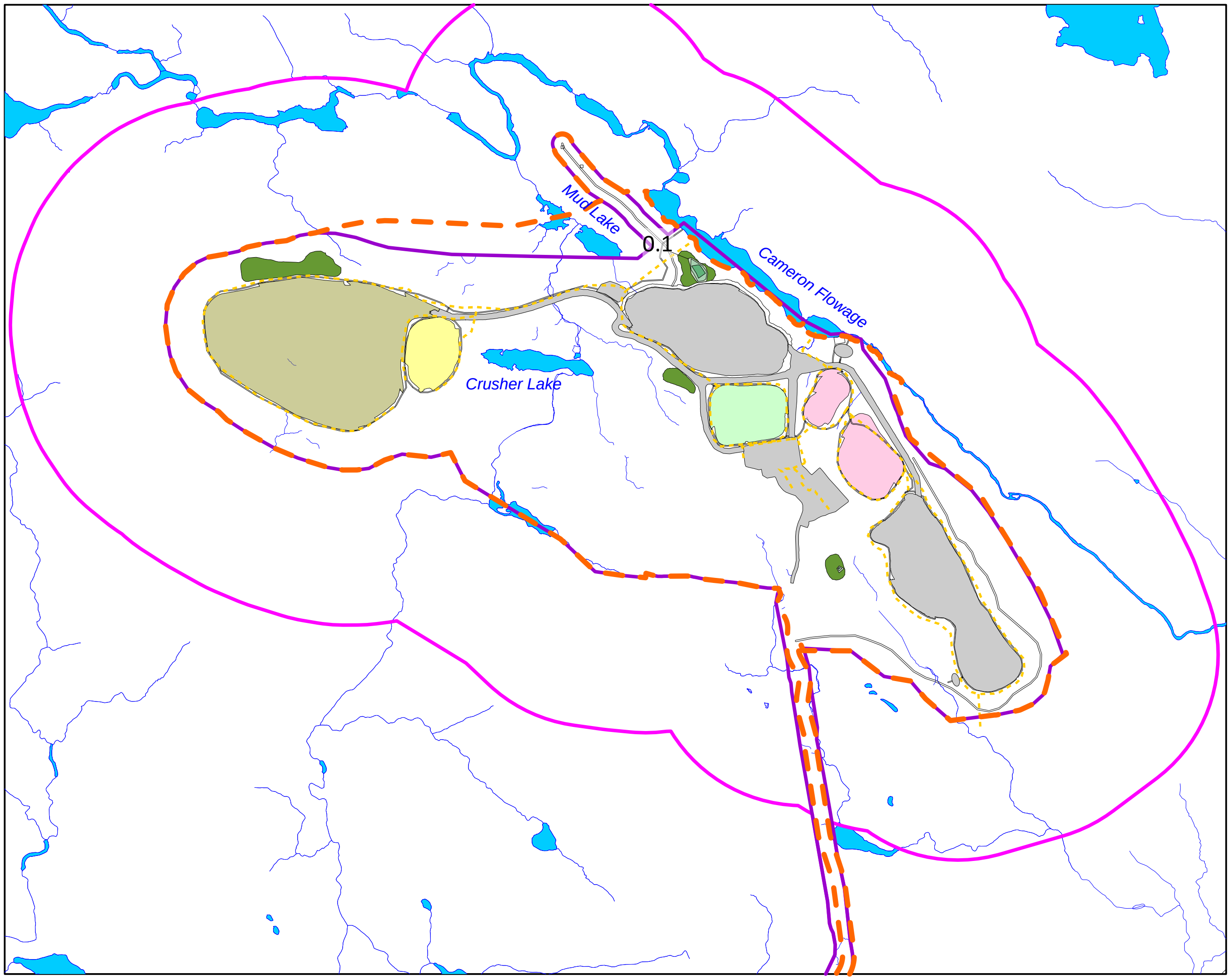
SIMULATED ARSENIC CONCENTRATION VERSUS TIER 2 PSS
EOM - UPPER CASE SOURCE TERMS - BASE CASE CONDITION

088664-031

March 11, 2021

FIGURE 7.31

HEG file: Z:\HEG\088664\DOCUMENTATION\RPT\088664-RPT-13\FIGURES\Figure 7.31 - Sim_Arsenic_PSS - EOM - UC - AVG.srf



LEGEND

- SURFACE WATER BODY
- PROPOSED EXTENT OF MINE FEATURES
- 0.1 SIMULATED CADMIUM CONCENTRATION (ug/L)
- SURFACE WATER MANAGEMENT DITCHES
- PROPERTY BOUNDARY
- PROJECT AREA
- LOCAL ASSESSMENT AREA
- NAG WASTE ROCK STOCKPILE
- PAG WASTE ROCK STOCKPILE
- LGO STOCKPILE
- TILL STOCKPILES
- TOPSOIL STOCKPILES

Note: The cadmium Tier 2 PSS for groundwater discharge to surface water (>10 m) is 0.1 ug/L.

0 300 600 900m

ATLANTIC GOLD CORPORATION
MARINETTE, NOVA SCOTIA
BEAVER DAM MINE

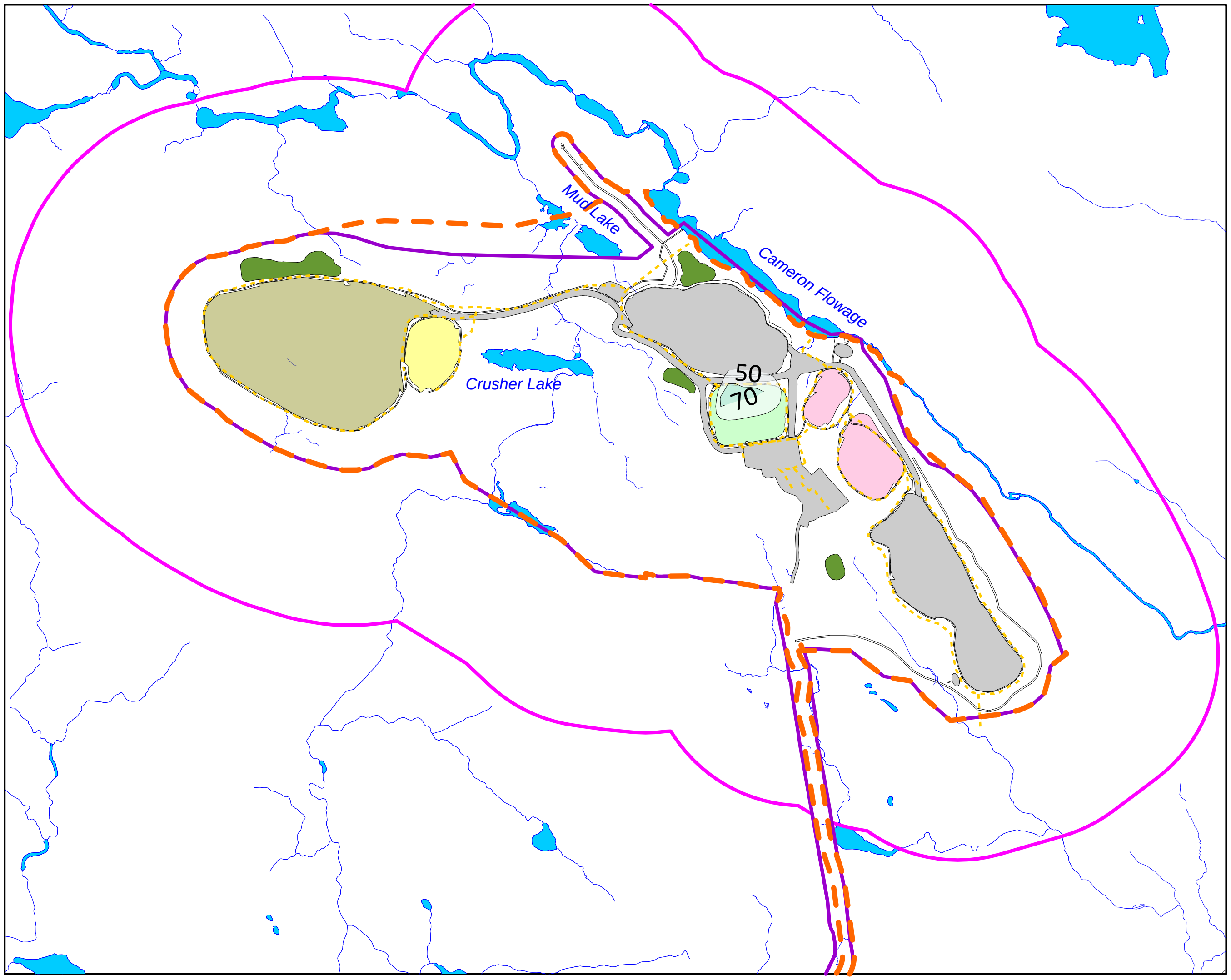
SIMULATED CADMIUM CONCENTRATION VERSUS TIER 2 PSS
EOM - UPPER CASE SOURCE TERMS - BASE CASE CONDITION

088664-031

March 11, 2021

FIGURE 7.32

HEG file: Z:\HEG\088664\DOCUMENTATION\RPT\088664-RPT-13\FIGURES\Figure 7.32 - Sim_Cadmium_PSS-EOM-UC-AVG.srf



LEGEND

- SURFACE WATER BODY
- PROPOSED EXTENT OF MINE FEATURES
- 0.1 — SIMULATED ALUMINUM CONCENTRATION (ug/L)
- SURFACE WATER MANAGEMENT DITCHES
- PROPERTY BOUNDARY
- PROJECT AREA
- LOCAL ASSESSMENT AREA
- NAG WASTE ROCK STOCKPILE
- PAG WASTE ROCK STOCKPILE
- LGO STOCKPILE
- TILL STOCKPILES
- TOPSOIL STOCKPILES

Note: The aluminum Tier 2 PSS for groundwater discharge to surface water (>10 m) is 50 ug/L.

0 300 600 900m

ATLANTIC GOLD CORPORATION
MARINETTE, NOVA SCOTIA
BEAVER DAM MINE

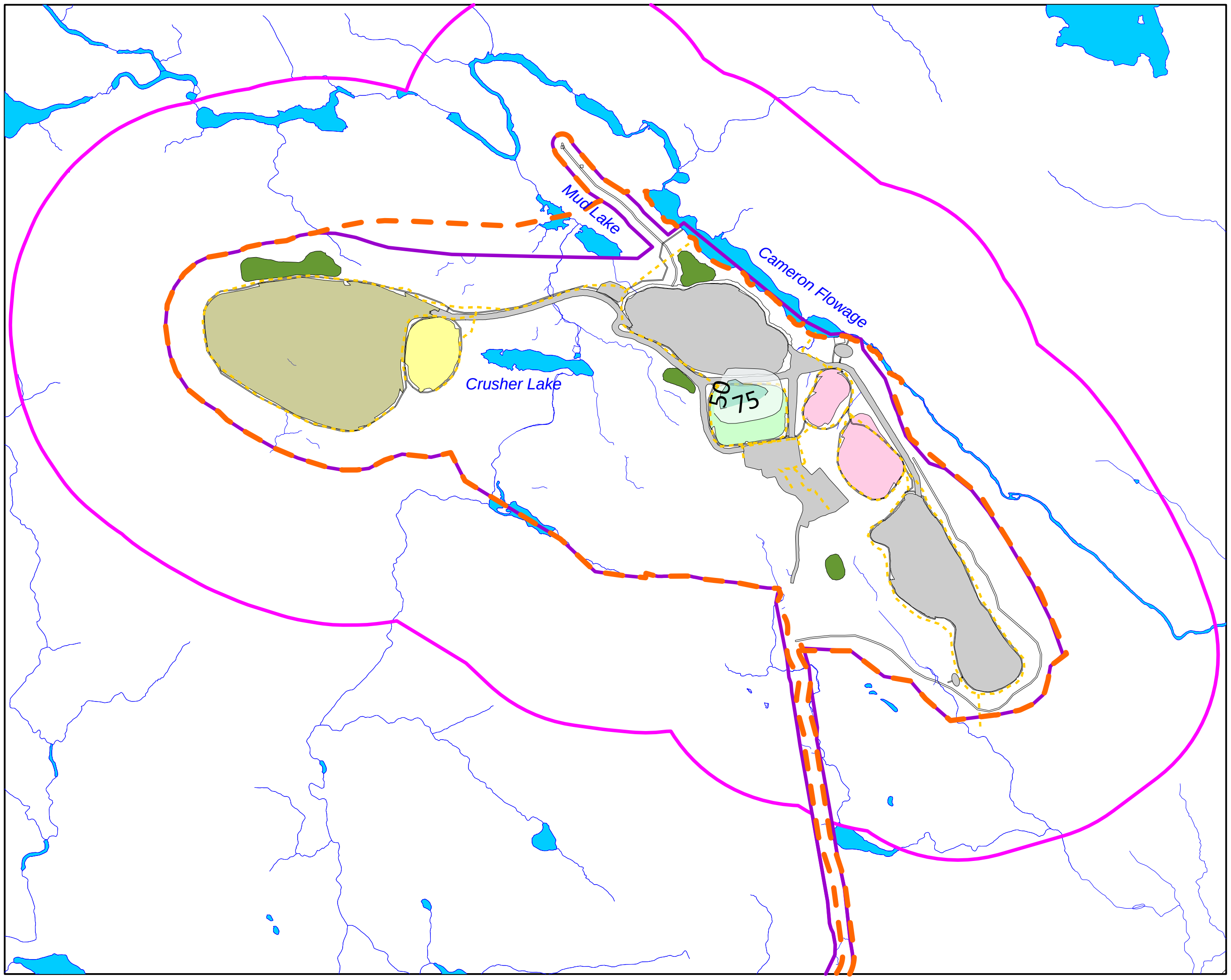
SIMULATED ALUMINUM CONCENTRATION VERSUS TIER 2 PSS
PC - BASE CASE SOURCE TERMS - BASE CASE CONDITION

088664-031

March 11, 2021

FIGURE 7.33

HEG file: Z:\HEG\088664\DOCUMENTATION\RPT\088664-RPT-13\FIGURES\Figure 7.33 - Sim_Aluminum_PSS-PC-BC-AVG.srf



LEGEND

- SURFACE WATER BODY
- PROPOSED EXTENT OF MINE FEATURES
- 0.1 — SIMULATED ALUMINUM CONCENTRATION (ug/L)
- SURFACE WATER MANAGEMENT DITCHES
- PROPERTY BOUNDARY
- PROJECT AREA
- LOCAL ASSESSMENT AREA
- NAG WASTE ROCK STOCKPILE
- PAG WASTE ROCK STOCKPILE
- LGO STOCKPILE
- TILL STOCKPILES
- TOPSOIL STOCKPILES

Note: The aluminum Tier 2 PSS for groundwater discharge to surface water (>10 m) is 50 ug/L.

0 300 600 900m

ATLANTIC GOLD CORPORATION
MARINETTE, NOVA SCOTIA
BEAVER DAM MINE

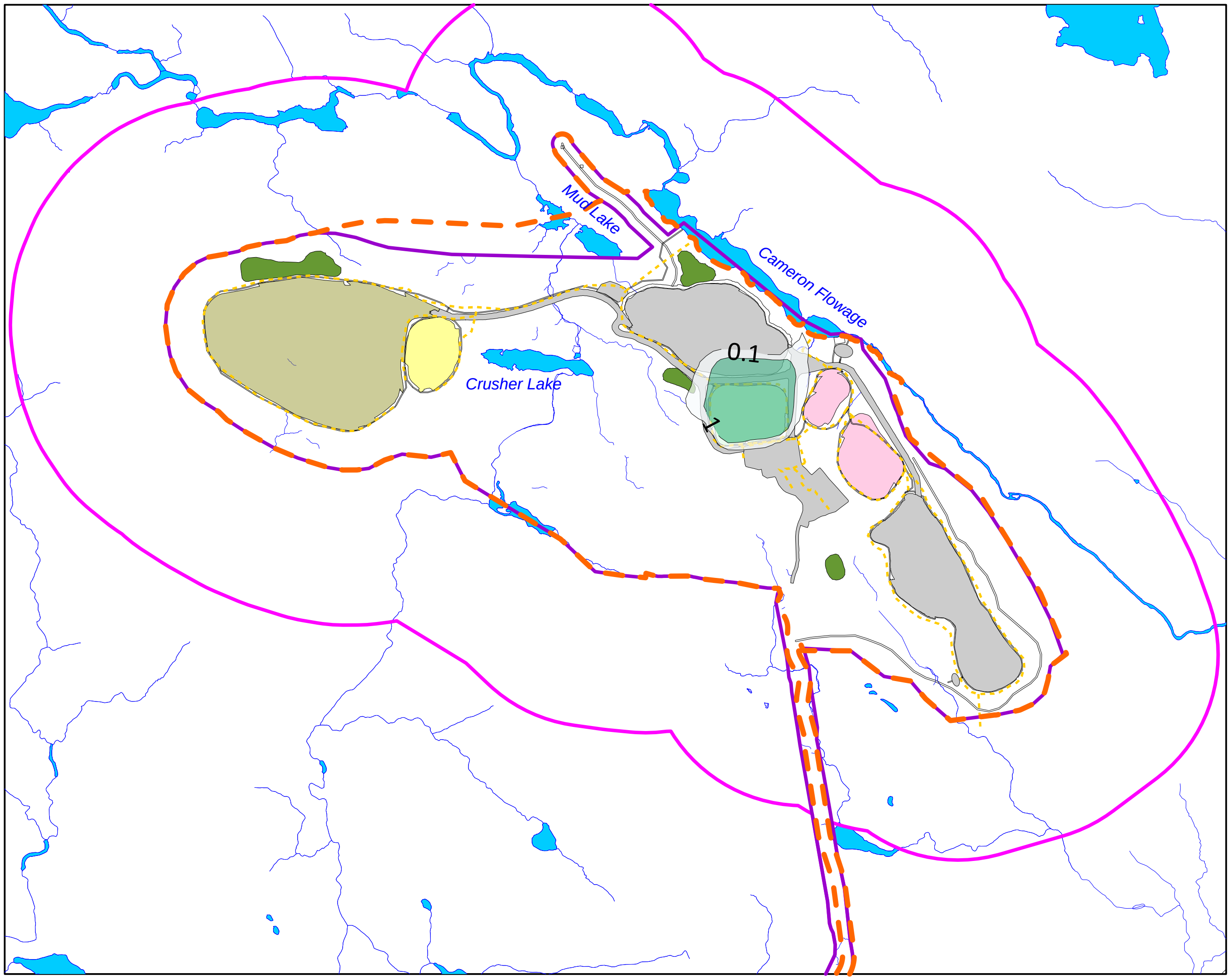
SIMULATED ALUMINUM CONCENTRATION VERSUS TIER 2 PSS
PC - UPPER CASE SOURCE TERMS - BASE CASE CONDITION

088664-031

March 11, 2021

FIGURE 7.34

HEG file: Z:\HEG\088664\DOCUMENTATION\RPT\088664-RPT-13\FIGURES\Figure 7.34 - Sim_Aluminum_PSS-PC-UC-AVG.srf



LEGEND

- SURFACE WATER BODY
- PROPOSED EXTENT OF MINE FEATURES
- 0.1 SIMULATED CADMIUM CONCENTRATION (ug/L)
- SURFACE WATER MANAGEMENT DITCHES
- PROPERTY BOUNDARY
- PROJECT AREA
- LOCAL ASSESSMENT AREA
- NAG WASTE ROCK STOCKPILE
- PAG WASTE ROCK STOCKPILE
- LGO STOCKPILE
- TILL STOCKPILES
- TOPSOIL STOCKPILES

Note: The cadmium Tier 2 PSS for groundwater discharge to surface water (>10 m) is 0.1 ug/L.

0 300 600 900m

ATLANTIC GOLD CORPORATION
MARINETTE, NOVA SCOTIA
BEAVER DAM MINE

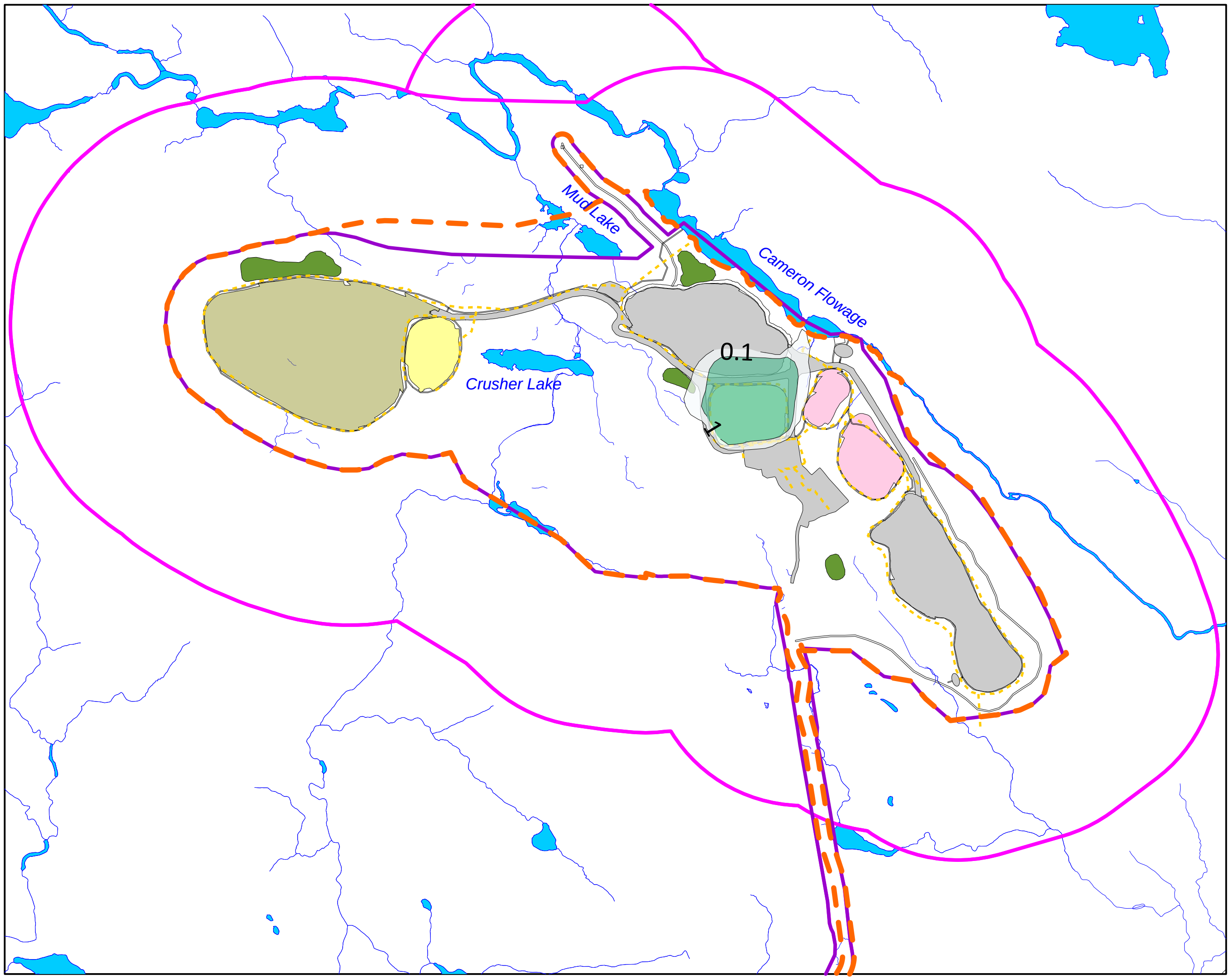
SIMULATED CADMIUM CONCENTRATION VERSUS TIER 2 PSS
PC - BASE CASE SOURCE TERMS - BASE CASE CONDITION

088664-031

March 11, 2021

FIGURE 7.35

HEG file: Z:\HEG\088664\DOCUMENTATION\RPT\088664-RPT-13\FIGURES\Figure 7.35 - Sim_Cadmium_PSS-PC-BC-AVG.srf



LEGEND

- SURFACE WATER BODY
- PROPOSED EXTENT OF MINE FEATURES
- 0.1 — SIMULATED CADMIUM CONCENTRATION (ug/L)
- SURFACE WATER MANAGEMENT DITCHES
- PROPERTY BOUNDARY
- PROJECT AREA
- LOCAL ASSESSMENT AREA
- NAG WASTE ROCK STOCKPILE
- PAG WASTE ROCK STOCKPILE
- LGO STOCKPILE
- TILL STOCKPILES
- TOPSOIL STOCKPILES

Note: The cadmium Tier 2 PSS for groundwater discharge to surface water (>10 m) is 0.1 ug/L.

0 300 600 900m

ATLANTIC GOLD CORPORATION
MARINETTE, NOVA SCOTIA
BEAVER DAM MINE

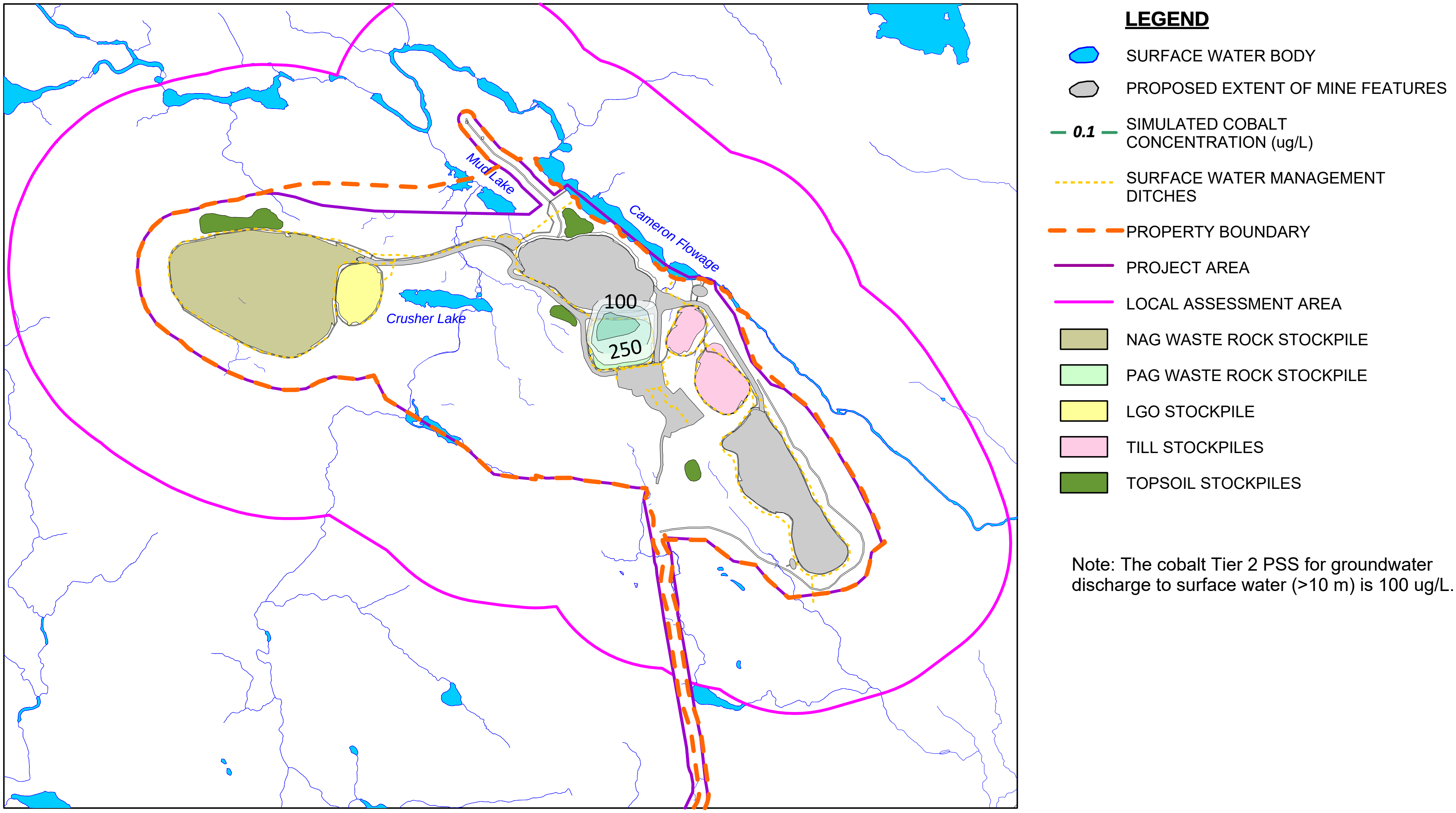
SIMULATED CADMIUM CONCENTRATION VERSUS TIER 2 PSS
PC - UPPER CASE SOURCE TERMS - BASE CASE CONDITION

088664-031

March 11, 2021

FIGURE 7.36

HEG file: Z:\HEG\088664\DOCUMENTATION\RPT\088664-RPT-13\FIGURES\Figure 7.36 - Sim_Cadmium_PSS-PC-UC-AVG.srf



Note: The cobalt Tier 2 PSS for groundwater discharge to surface water (>10 m) is 100 ug/L.

0 300 600 900m

ATLANTIC GOLD CORPORATION
MARINETTE, NOVA SCOTIA
BEAVER DAM MINE

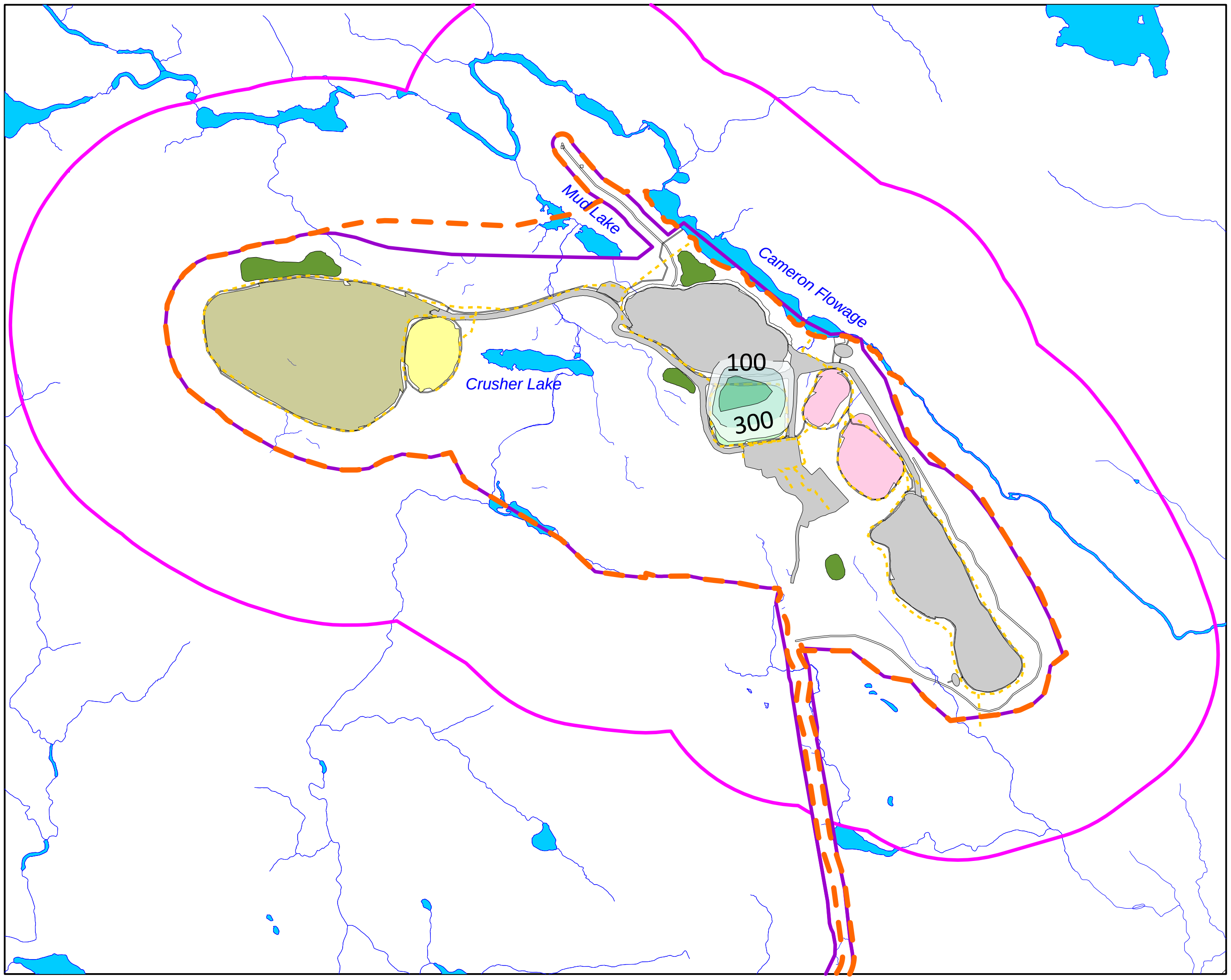
SIMULATED COBALT CONCENTRATION VERSUS TIER 2 PSS
PC - BASE CASE SOURCE TERMS - BASE CASE CONDITION

088664-031

March 11, 2021

FIGURE 7.37

HEG file: Z:\HEG\088664\DOCUMENTATION\RPT\088664-RPT-13\FIGURES\Figure 7.37 - Sim_Cobalt_PSS-PC-BC-AVG.srf



LEGEND

- SURFACE WATER BODY
- PROPOSED EXTENT OF MINE FEATURES
- 0.1 — SIMULATED COBALT CONCENTRATION (ug/L)
- SURFACE WATER MANAGEMENT DITCHES
- PROPERTY BOUNDARY
- PROJECT AREA
- LOCAL ASSESSMENT AREA
- NAG WASTE ROCK STOCKPILE
- PAG WASTE ROCK STOCKPILE
- LGO STOCKPILE
- TILL STOCKPILES
- TOPSOIL STOCKPILES

Note: The cobalt Tier 2 PSS for groundwater discharge to surface water (>10 m) is 100 ug/L.

0 300 600 900m

N

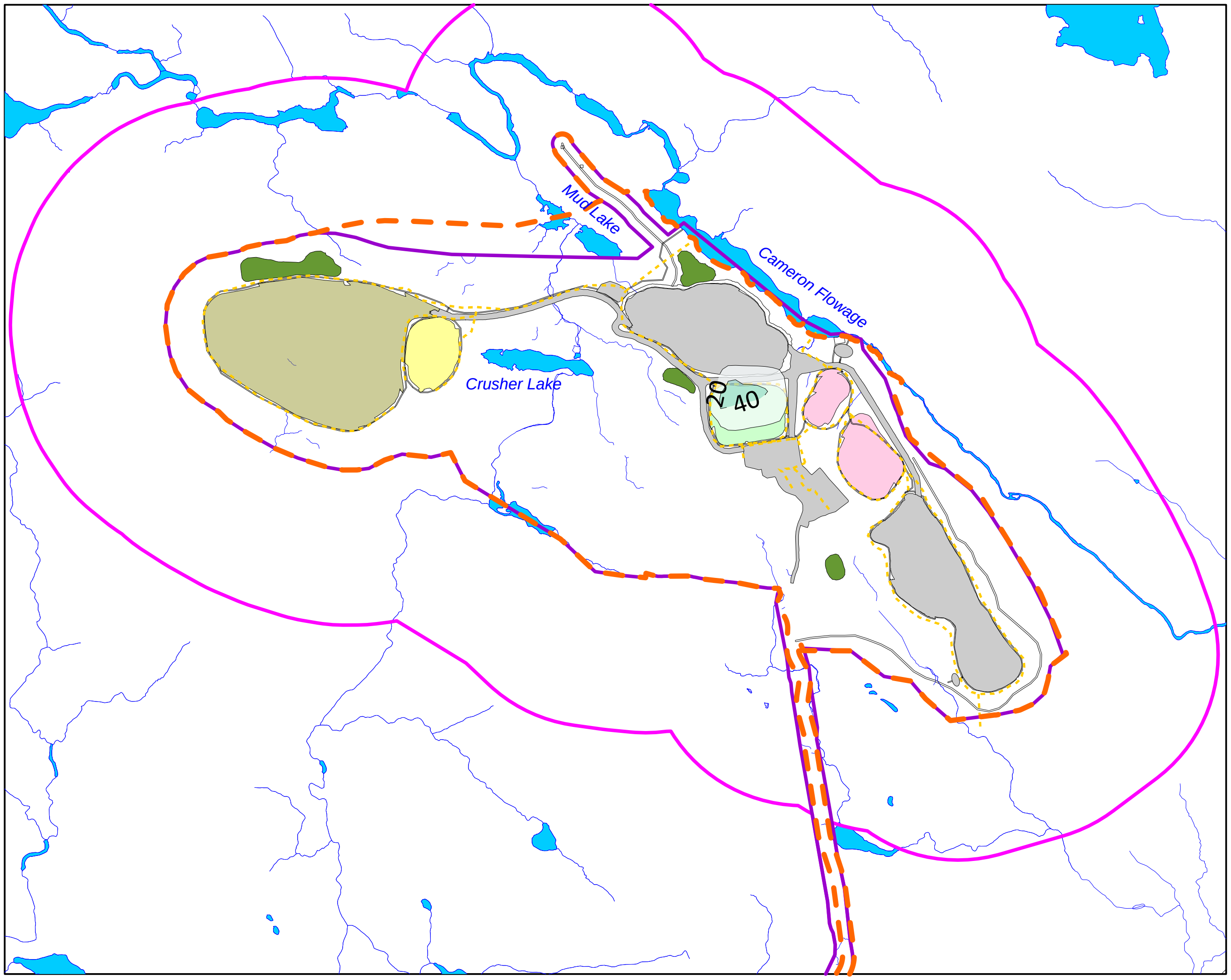
ATLANTIC GOLD CORPORATION
MARINETTE, NOVA SCOTIA
BEAVER DAM MINE

SIMULATED COBALT CONCENTRATION VERSUS TIER 2 PSS
PC - UPPER CASE SOURCE TERMS - BASE CASE CONDITION

088664-031
March 11, 2021

FIGURE 7.38

HEG file: Z:\HEG\088664\DOCUMENTATION\RPT\088664-RPT-13\FIGURES\Figure 7.38 - Sim_Cobalt_PSS-PC-UC-AVG.srf



LEGEND

- SURFACE WATER BODY
- PROPOSED EXTENT OF MINE FEATURES
- 0.1 — SIMULATED COPPER CONCENTRATION (ug/L)
- SURFACE WATER MANAGEMENT DITCHES
- PROPERTY BOUNDARY
- PROJECT AREA
- LOCAL ASSESSMENT AREA
- NAG WASTE ROCK STOCKPILE
- PAG WASTE ROCK STOCKPILE
- LGO STOCKPILE
- TILL STOCKPILES
- TOPSOIL STOCKPILES

Note: The copper Tier 2 PSS for groundwater discharge to surface water (>10 m) is 20 ug/L.

0 300 600 900m

ATLANTIC GOLD CORPORATION
MARINETTE, NOVA SCOTIA
BEAVER DAM MINE

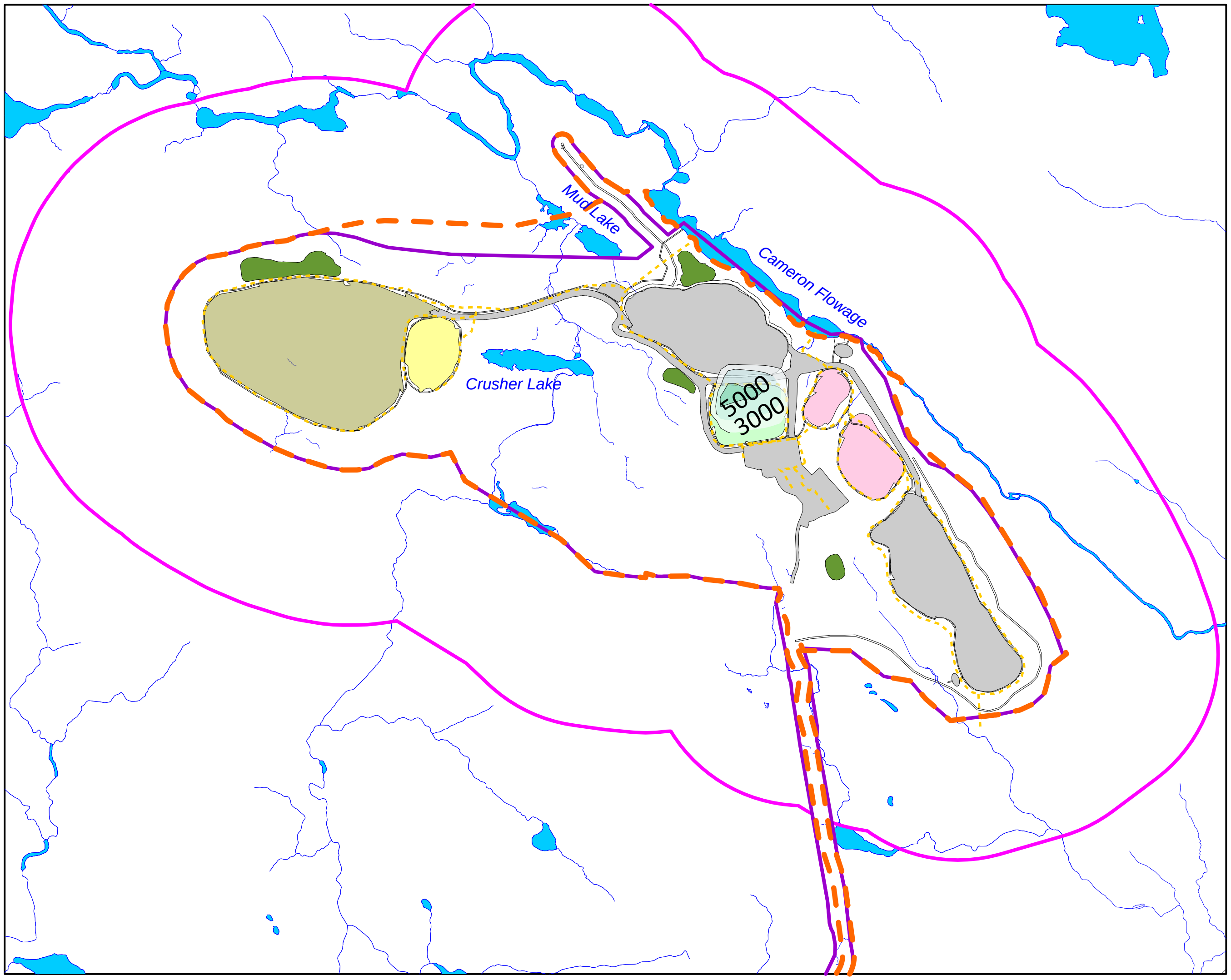
SIMULATED COPPER CONCENTRATION VERSUS TIER 2 PSS
PC - UPPER CASE SOURCE TERMS - BASE CASE CONDITION

088664-031

March 11, 2021

FIGURE 7.39

HEG file: Z:\HEG\088664\DOCUMENTATION\RPT\088664-RPT-13\FIGURES\Figure 7.40 - Sim_Copper_PSS-PC-UC-AVG.srf



LEGEND

- SURFACE WATER BODY
- PROPOSED EXTENT OF MINE FEATURES
- 0.1 — SIMULATED IRON CONCENTRATION (ug/L)
- SURFACE WATER MANAGEMENT DITCHES
- PROPERTY BOUNDARY
- PROJECT AREA
- LOCAL ASSESSMENT AREA
- NAG WASTE ROCK STOCKPILE
- PAG WASTE ROCK STOCKPILE
- LGO STOCKPILE
- TILL STOCKPILES
- TOPSOIL STOCKPILES

Note: The iron Tier 2 PSS for groundwater discharge to surface water (>10 m) is 3,000 ug/L.

0 300 600 900m

ATLANTIC GOLD CORPORATION
MARINETTE, NOVA SCOTIA
BEAVER DAM MINE

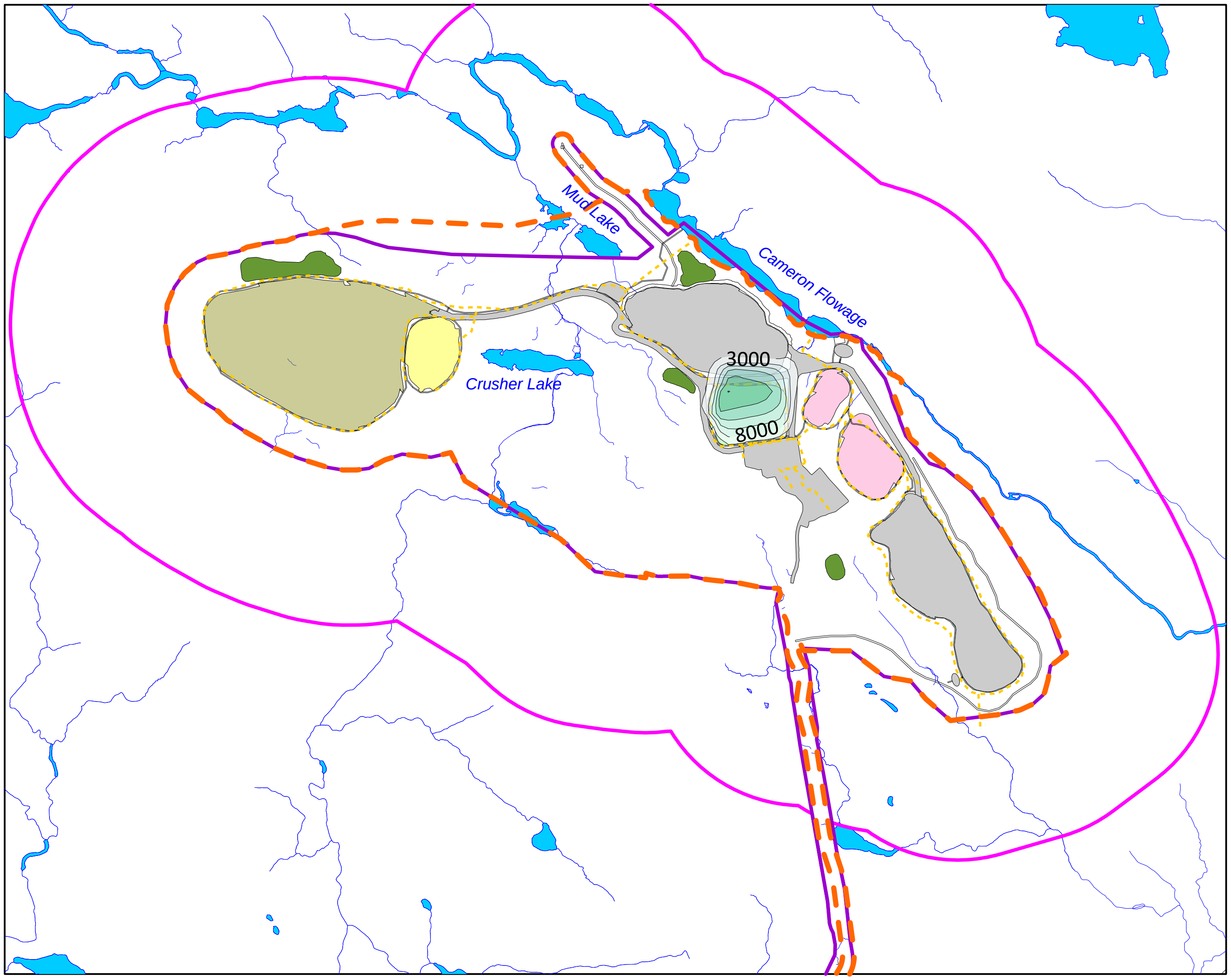
SIMULATED IRON CONCENTRATION VERSUS TIER 2 PSS
PC - BASE CASE SOURCE TERMS - BASE CASE CONDITION

088664-031

March 11, 2021

FIGURE 7.40

HEG file: Z:\HEG\088664\DOCUMENTATION\RPT\088664-RPT-13\FIGURES\Figure 7.41 - Sim_Iron_PSS-PC-BC-AVG.srf



LEGEND

- SURFACE WATER BODY
- PROPOSED EXTENT OF MINE FEATURES
- 0.1 — SIMULATED IRON CONCENTRATION (ug/L)
- SURFACE WATER MANAGEMENT DITCHES
- PROPERTY BOUNDARY
- PROJECT AREA
- LOCAL ASSESSMENT AREA
- NAG WASTE ROCK STOCKPILE
- PAG WASTE ROCK STOCKPILE
- LGO STOCKPILE
- TILL STOCKPILES
- TOPSOIL STOCKPILES

Note: The iron Tier 2 PSS for groundwater discharge to surface water (>10 m) is 3,000 ug/L.

0 300 600 900m

N

GHD

ATLANTIC GOLD CORPORATION
MARINETTE, NOVA SCOTIA
BEAVER DAM MINE

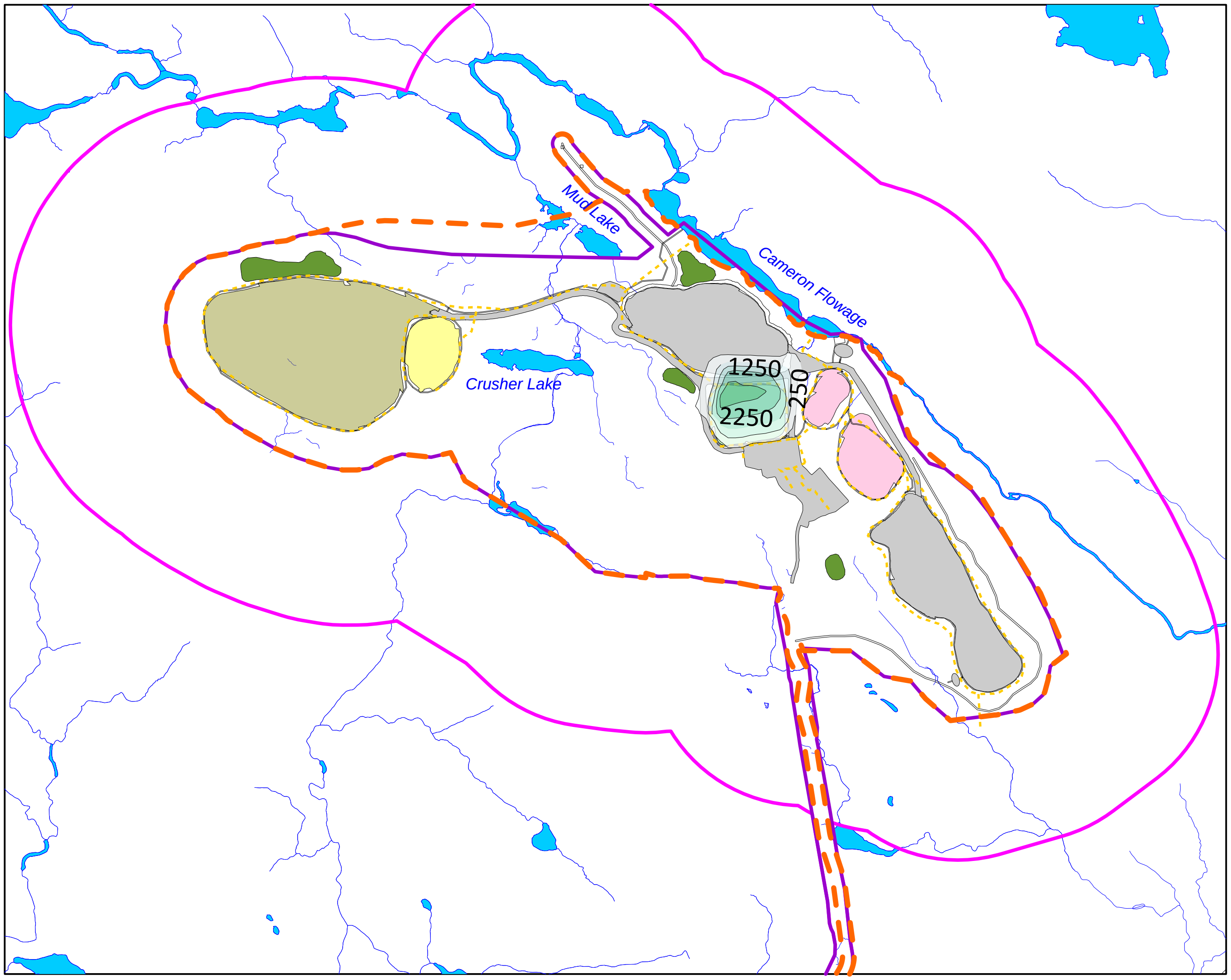
SIMULATED IRON CONCENTRATION VERSUS TIER 2 PSS
PC - UPPER CASE SOURCE TERMS - BASE CASE CONDITION

088664-031

March 11, 2021

FIGURE 7.41

HEG file: Z:\HEG\088664\DOCUMENTATION\RPT\088664-RPT-13\FIGURES\Figure 7.42 - Sim_Iron_PSS-PC-UC-AVG.srf



LEGEND

- SURFACE WATER BODY
- PROPOSED EXTENT OF MINE FEATURES
- 0.1 — SIMULATED NICKEL CONCENTRATION (ug/L)
- SURFACE WATER MANAGEMENT DITCHES
- PROPERTY BOUNDARY
- PROJECT AREA
- LOCAL ASSESSMENT AREA
- NAG WASTE ROCK STOCKPILE
- PAG WASTE ROCK STOCKPILE
- LGO STOCKPILE
- TILL STOCKPILES
- TOPSOIL STOCKPILES

Note: The nickel Tier 2 PSS for groundwater discharge to surface water (>10 m) is 250 ug/L.

0 300 600 900m

ATLANTIC GOLD CORPORATION
MARINETTE, NOVA SCOTIA
BEAVER DAM MINE

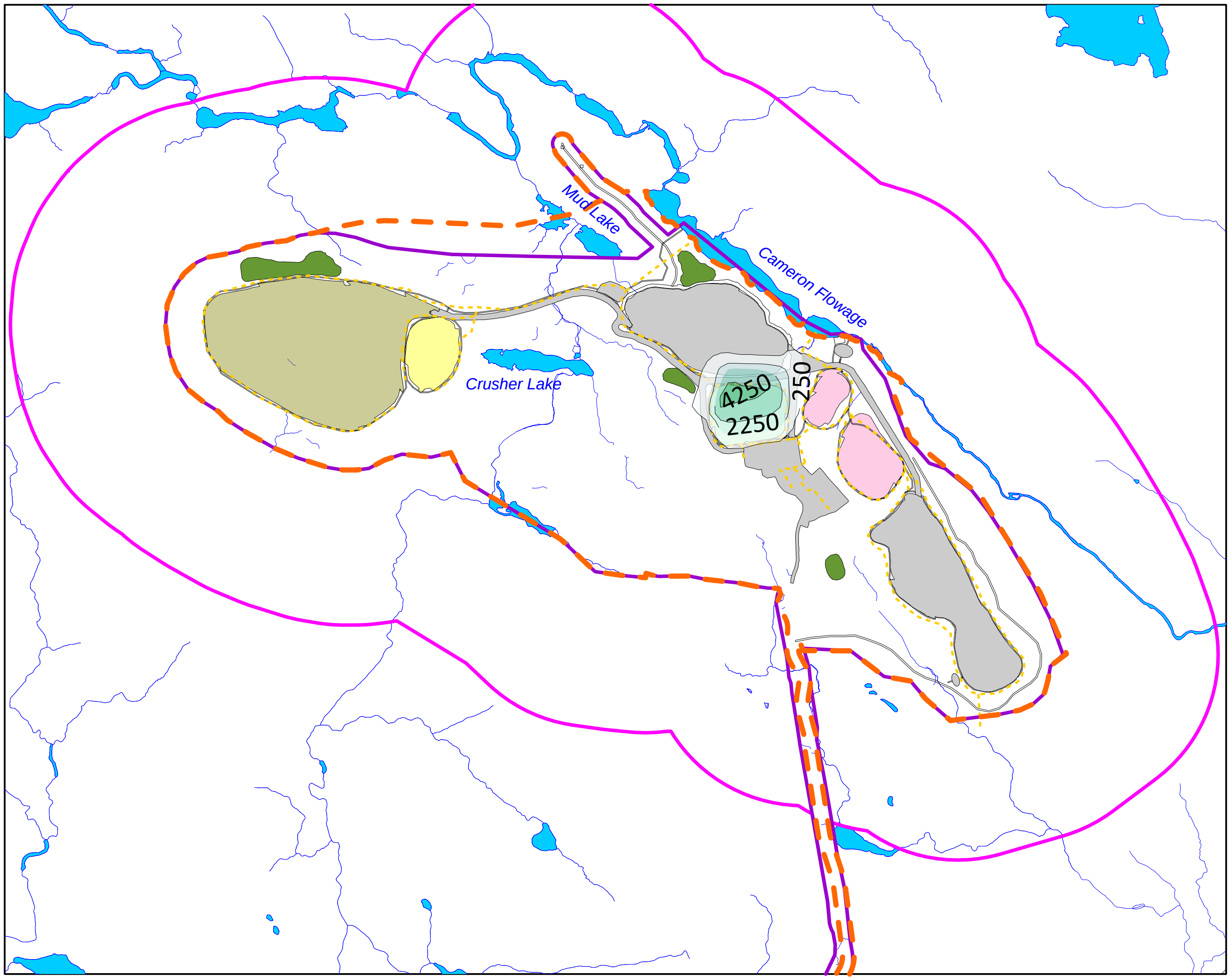
SIMULATED NICKEL CONCENTRATION VERSUS TIER 2 PSS
PC - BASE CASE SOURCE TERMS - BASE CASE CONDITION

088664-031

March 11, 2021

FIGURE 7.42

HEG file: Z:\HEG\088664\DOCUMENTATION\RPT\088664-RPT-13\FIGURES\Figure 7.43 - Sim_Nickel_PSS-PC-BC-AVG.srf



LEGEND

SURFACE WATER BODY
PROPOSED EXTENT OF MINE FEATURES
0.1 SIMULATED NICKEL CONCENTRATION (ug/L)
SURFACE WATER MANAGEMENT DITCHES
PROPERTY BOUNDARY
PROJECT AREA
LOCAL ASSESSMENT AREA
NAG WASTE ROCK STOCKPILE
PAG WASTE ROCK STOCKPILE
LGO STOCKPILE
TILL STOCKPILES
TOPSOIL STOCKPILES

Note: The nickel Tier 2 PSS for groundwater discharge to surface water (>10 m) is 250 ug/L.

0 300 600 900m

ATLANTIC GOLD CORPORATION
MARINETTE, NOVA SCOTIA
BEAVER DAM MINE

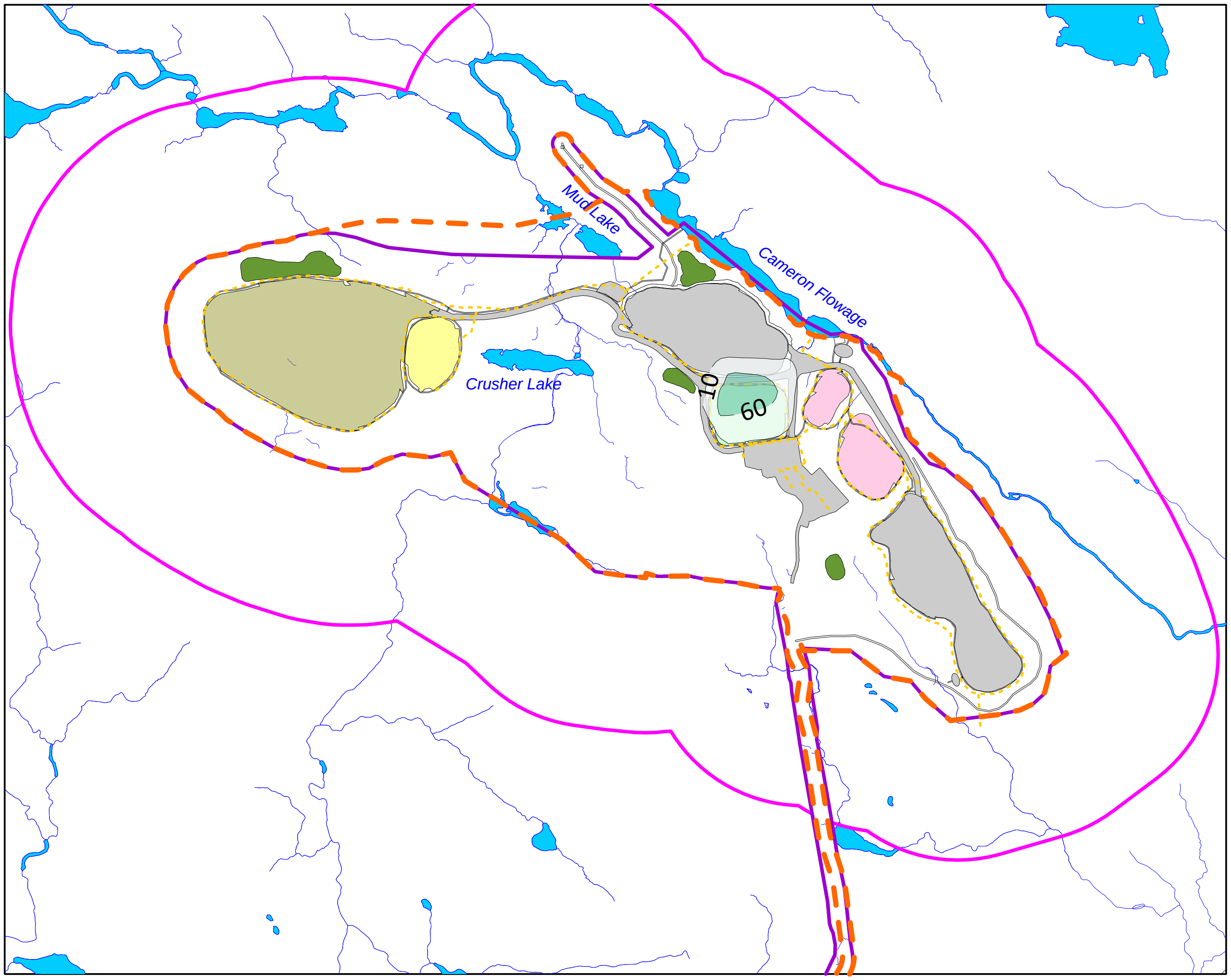
SIMULATED NICKEL CONCENTRATION VERSUS TIER 2 PSS
PC - UPPER CASE SOURCE TERMS - BASE CASE CONDITION

088664-031

March 11, 2021

FIGURE 7.43

HEG file: Z:\HEG\088664\DOCUMENTATION\RPT\088664-RPT-13\FIGURES\Figure 7.44 - Sim_Nickel_PSS-PC-UC-AVG.srf



LEGEND

- SURFACE WATER BODY
- PROPOSED EXTENT OF MINE FEATURES
- 0.1 — SIMULATED LEAD CONCENTRATION (ug/L)
- SURFACE WATER MANAGEMENT DITCHES
- PROPERTY BOUNDARY
- PROJECT AREA
- LOCAL ASSESSMENT AREA
- NAG WASTE ROCK STOCKPILE
- PAG WASTE ROCK STOCKPILE
- LGO STOCKPILE
- TILL STOCKPILES
- TOPSOIL STOCKPILES

Note: The lead Tier 2 PSS for groundwater discharge to surface water (>10 m) is 10 ug/L.

0 300 600 900m

ATLANTIC GOLD CORPORATION
MARINETTE, NOVA SCOTIA
BEAVER DAM MINE

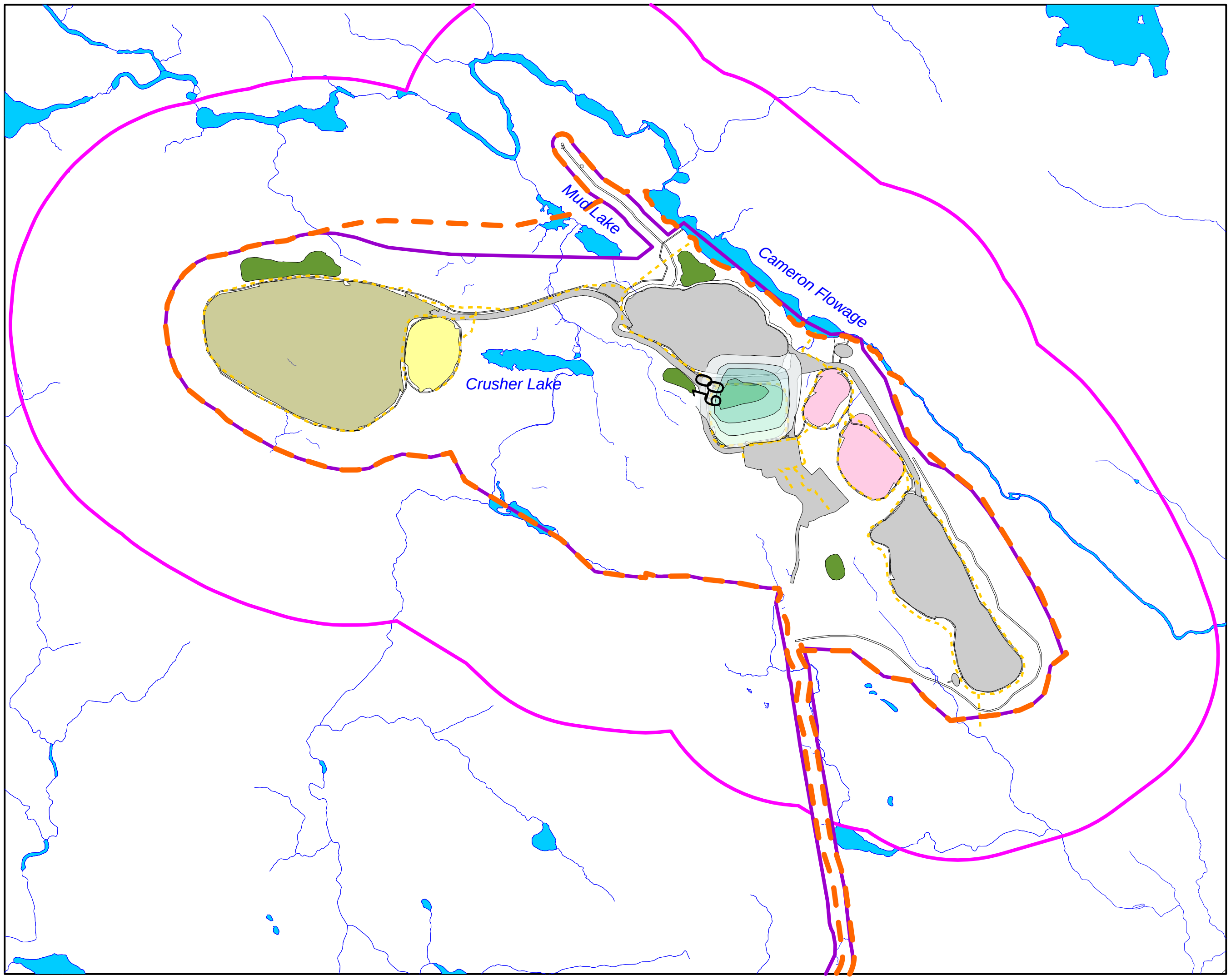
SIMULATED LEAD CONCENTRATION VERSUS TIER 2 PSS
PC - BASE CASE SOURCE TERMS - BASE CASE CONDITION

088664-031

March 11, 2021

FIGURE 7.44

HEG file: Z:\HEG\088664\DOCUMENTATION\RPT\088664-RPT-13\FIGURES\Figure 7.45 - Sim_Lead_PSS-PC-BC-AVG.srf



LEGEND

- SURFACE WATER BODY
- PROPOSED EXTENT OF MINE FEATURES
- 0.1 SIMULATED LEAD CONCENTRATION (ug/L)
- SURFACE WATER MANAGEMENT DITCHES
- PROPERTY BOUNDARY
- PROJECT AREA
- LOCAL ASSESSMENT AREA
- NAG WASTE ROCK STOCKPILE
- PAG WASTE ROCK STOCKPILE
- LGO STOCKPILE
- TILL STOCKPILES
- TOPSOIL STOCKPILES

Note: The lead Tier 2 PSS for groundwater discharge to surface water (>10 m) is 10 ug/L.

0 300 600 900m

ATLANTIC GOLD CORPORATION
MARINETTE, NOVA SCOTIA
BEAVER DAM MINE

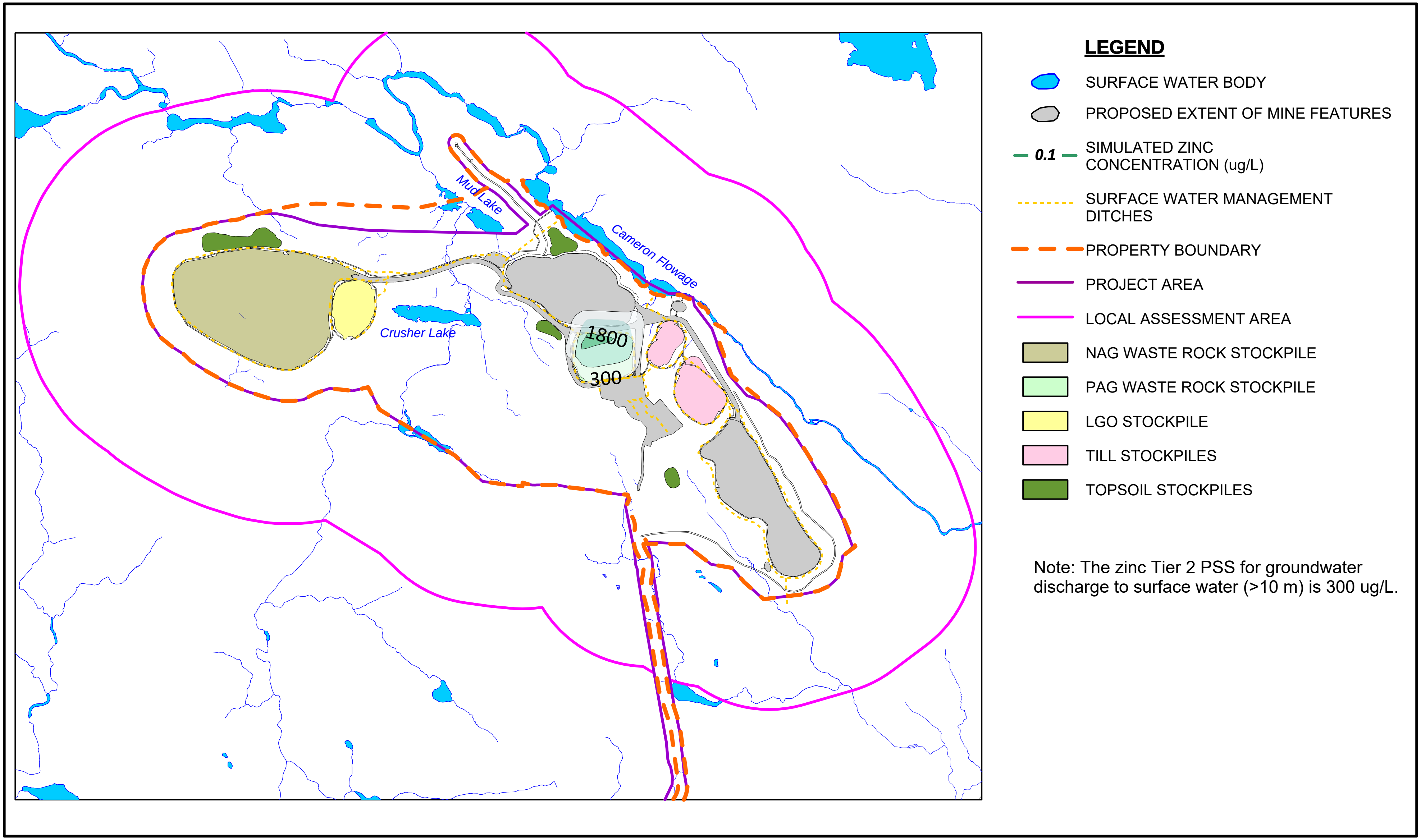
SIMULATED LEAD CONCENTRATION VERSUS TIER 2 PSS
PC - UPPER CASE SOURCE TERMS - BASE CASE CONDITION

088664-031

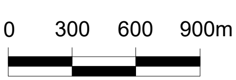
March 11, 2021

FIGURE 7.45

HEG file: Z:\HEG\088664\DOCUMENTATION\RPT\088664-RPT-13\FIGURES\Figure 7.45 - Sim_Lead_PSS-PC-BC-AVG.srf



Note: The zinc Tier 2 PSS for groundwater discharge to surface water (>10 m) is 300 ug/L.



ATLANTIC GOLD CORPORATION
MARINETTE, NOVA SCOTIA
BEAVER DAM MINE

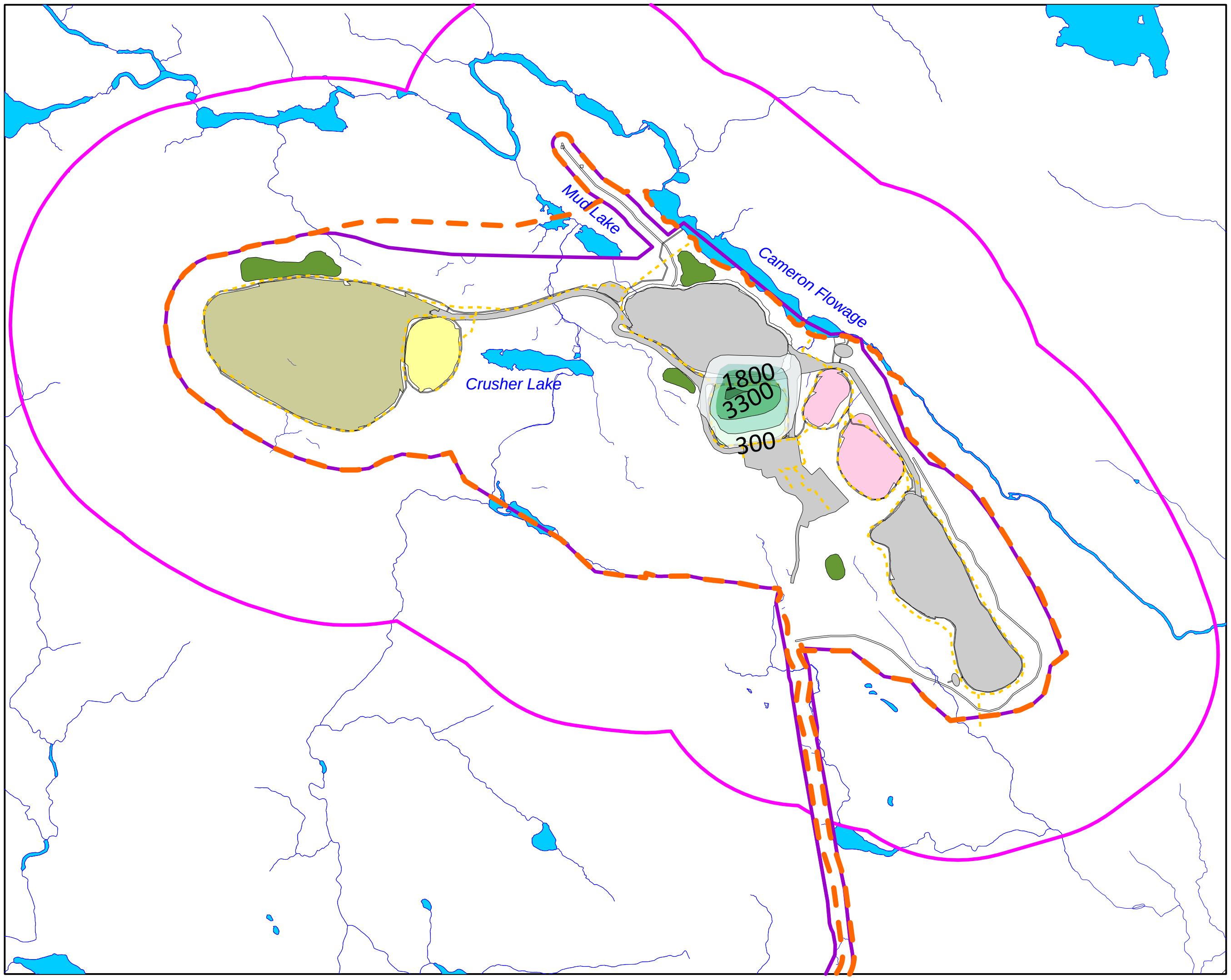
SIMULATED ZINC CONCENTRATION VERSUS TIER 2 PSS
PC - BASE CASE SOURCE TERMS - BASE CASE CONDITION

088664-031

March 11, 2021

FIGURE 7.46

HEG file: Z:\HEG\088664\DOCUMENTATION\RPT\088664-RPT-13\FIGURES\Figure 7.48 - Sim_Zinc_PSS-PC-BC-AVG.srf



LEGEND

- SURFACE WATER BODY
- PROPOSED EXTENT OF MINE FEATURES
- 0.1 — SIMULATED ZINC CONCENTRATION (ug/L)
- SURFACE WATER MANAGEMENT DITCHES
- PROPERTY BOUNDARY
- PROJECT AREA
- LOCAL ASSESSMENT AREA
- NAG WASTE ROCK STOCKPILE
- PAG WASTE ROCK STOCKPILE
- LGO STOCKPILE
- TILL STOCKPILES
- TOPSOIL STOCKPILES

Note: The zinc Tier 2 PSS for groundwater discharge to surface water (>10 m) is 300 ug/L.

0 300 600 900m

ATLANTIC GOLD CORPORATION
MARINETTE, NOVA SCOTIA
BEAVER DAM MINE

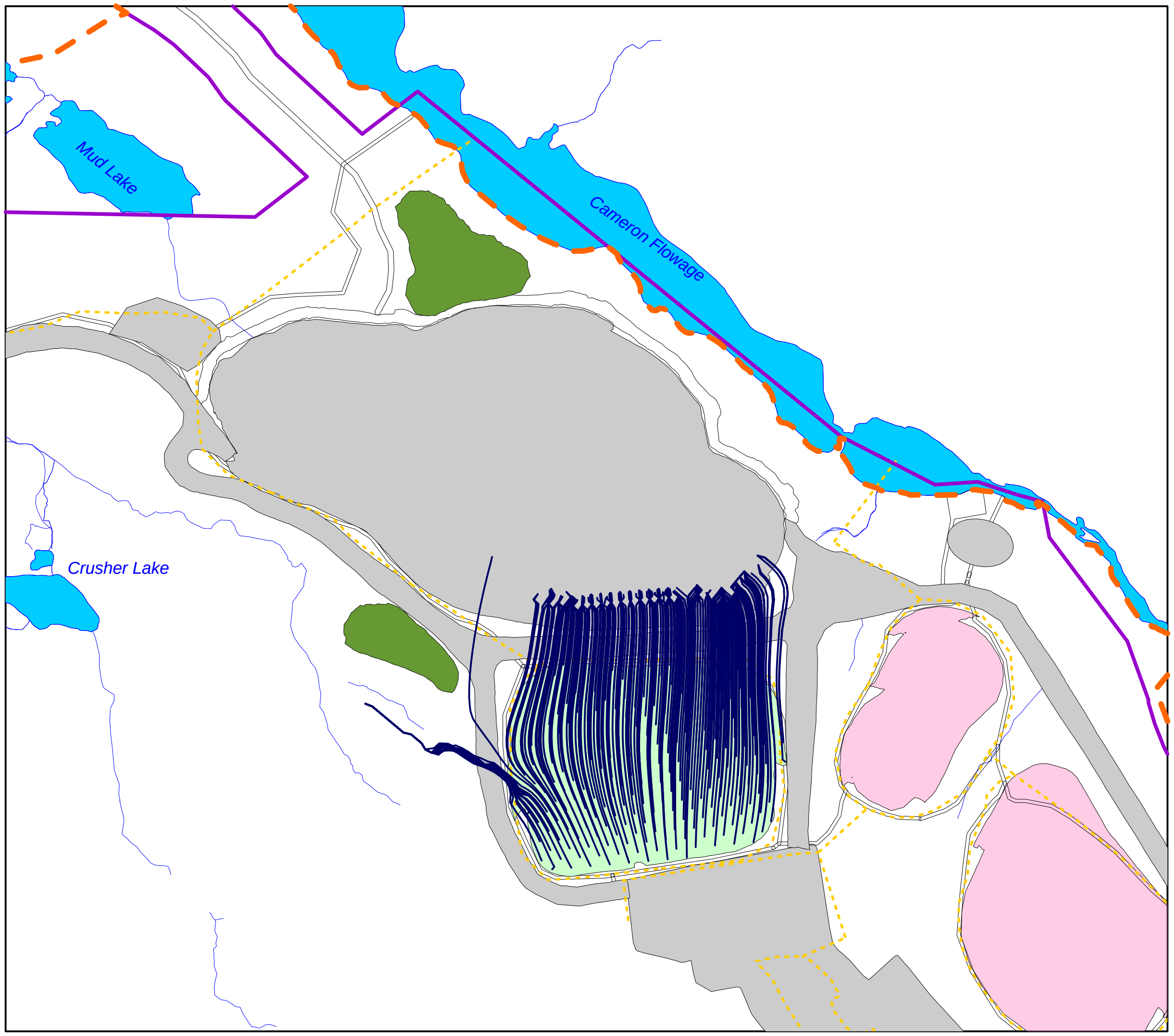
SIMULATED ZINC CONCENTRATION VERSUS TIER 2 PSS
PC - UPPER CASE SOURCE TERMS - BASE CASE CONDITION

088664-031

March 11, 2021

FIGURE 7.47

HEG file: Z:\HEG\088664\DOCUMENTATION\RPT\088664-RPT-13\FIGURES\Figure 7.49 - Sim_Zinc_PSS-PC-UC-AVG.srf



LEGEND

- SURFACE WATER BODY
- PROPOSED EXTENT OF MINE FEATURES
- PARTICLE PATHWAY
- SURFACE WATER MANAGEMENT DITCHES
- PROPERTY BOUNDARY
- PROJECT AREA
- PAG WASTE ROCK STOCKPILE
- TILL STOCKPILES
- TOPSOIL STOCKPILES

0 90 180 270m

ATLANTIC GOLD CORPORATION
MARINETTE, NOVA SCOTIA
BEAVER DAM MINE

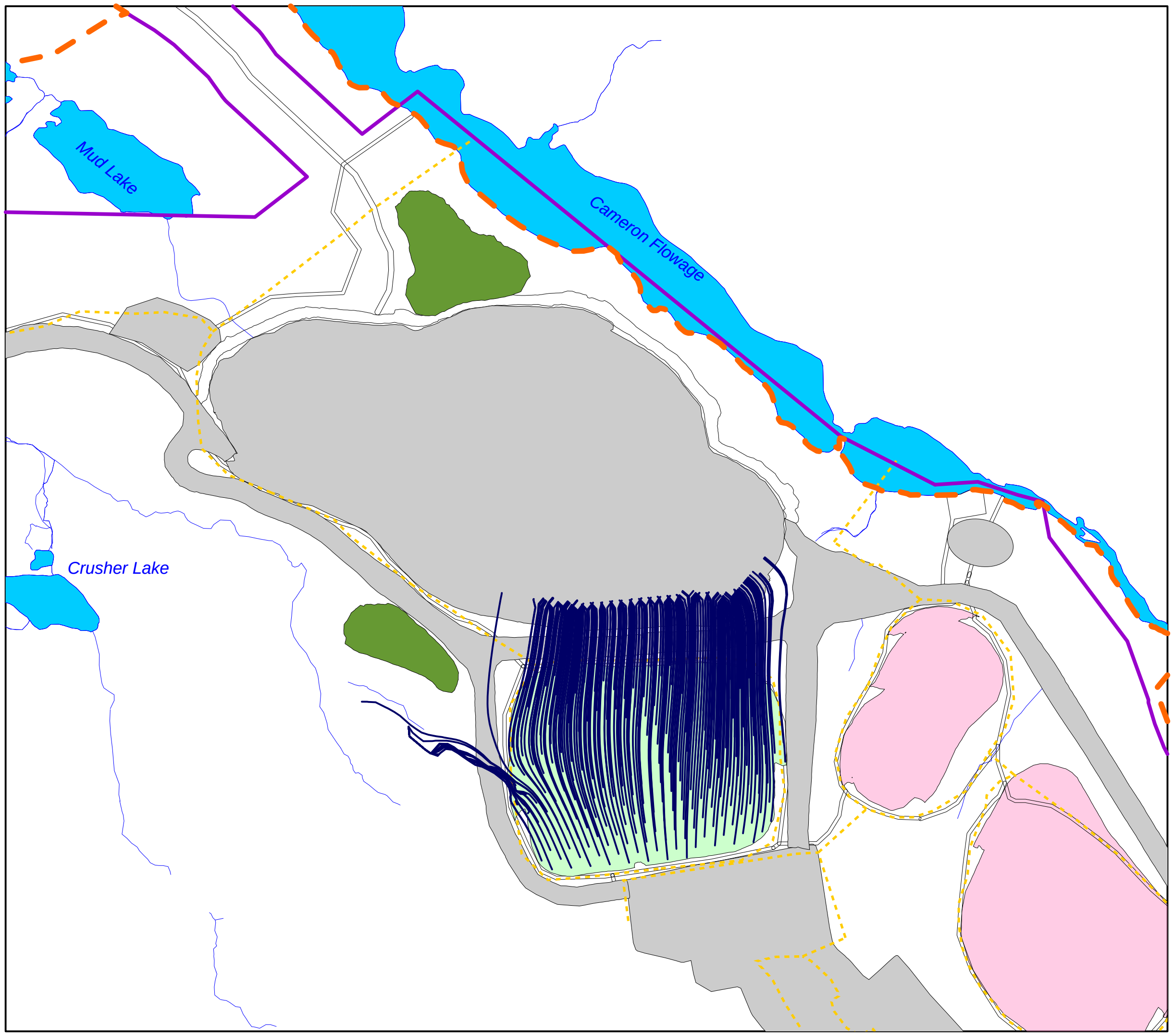
SIMULATED PARTICLE PATHWAYS WITHOUT MITIGATION
PC - BASE CASE CONDITION

088664-031

March 11, 2021

FIGURE 7.48

HEG file: Z:\HEG\088664\DOCUMENTATION\RPT\088664-RPT-13\FIGURES\Figure 7.50 - pathways-PC-AVG.srf



LEGEND

SURFACE WATER BODY
PROPOSED EXTENT OF MINE FEATURES
PARTICLE PATHWAY
SURFACE WATER MANAGEMENT DITCHES
PROPERTY BOUNDARY
PROJECT AREA
PAG WASTE ROCK STOCKPILE
TILL STOCKPILES
TOPSOIL STOCKPILES

0 90 180 270m

ATLANTIC GOLD CORPORATION
MARINETTE, NOVA SCOTIA
BEAVER DAM MINE

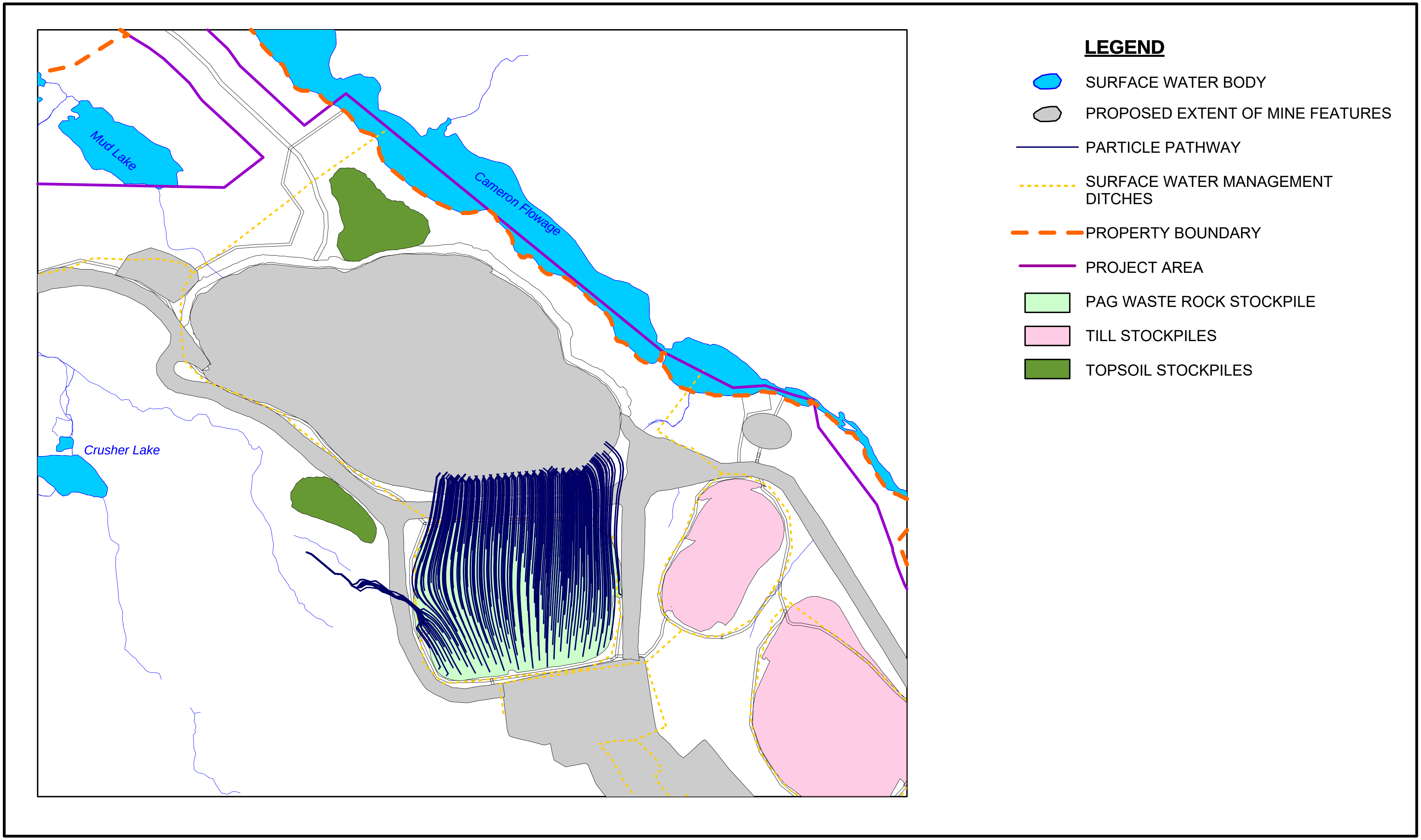
SIMULATED PARTICLE PATHWAYS WITHOUT MITIGATION
PC - DRY CASE CONDITION

088664-031

March 11, 2021

FIGURE 7.49

HEG file: Z:\HEG\088664\DOCUMENTATION\RPT\088664-RPT-13\FIGURES\Figure 7.51 - Pathways-PC-DRY.srf



ATLANTIC GOLD CORPORATION
MARINETTE, NOVA SCOTIA
BEAVER DAM MINE

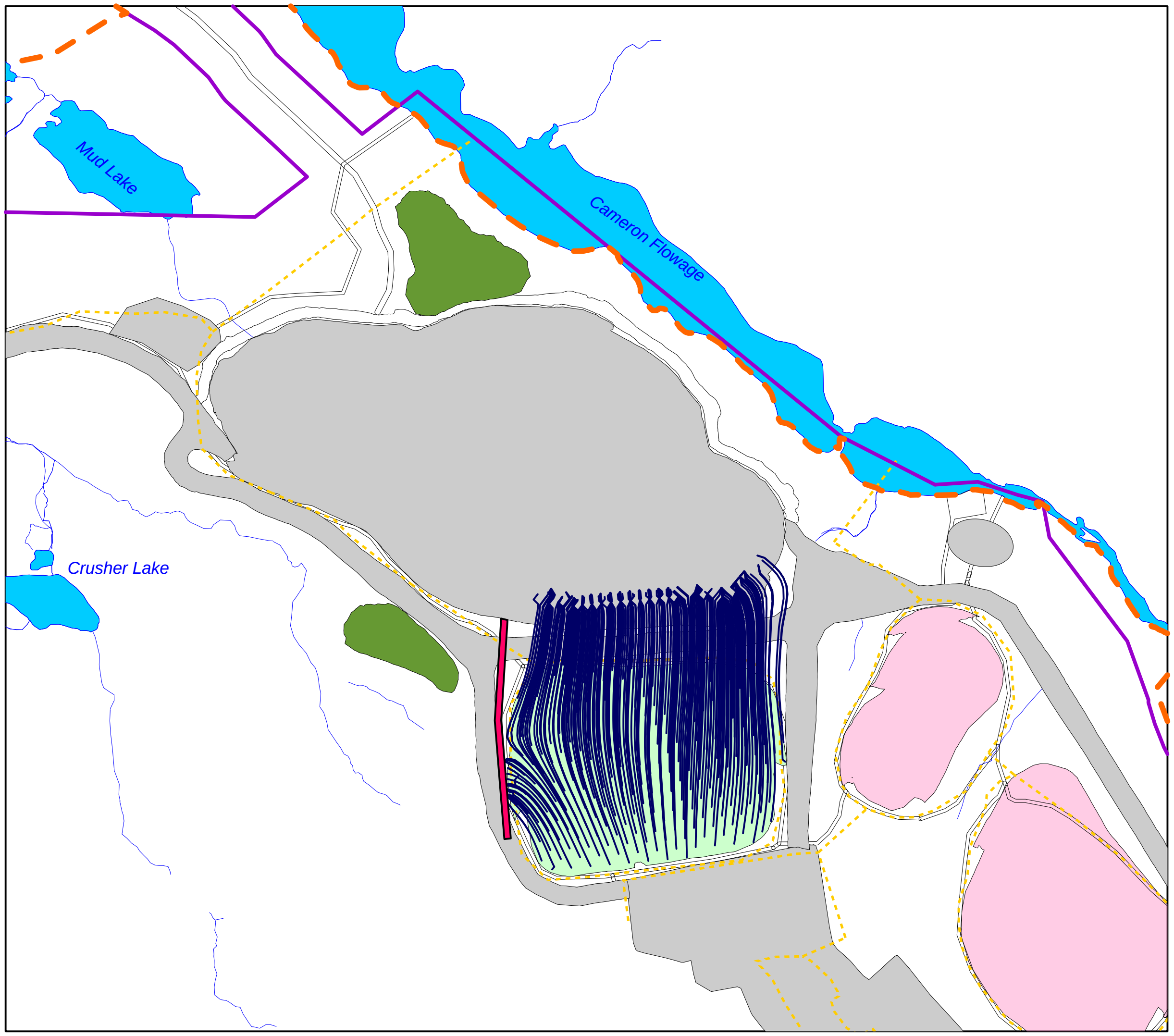
SIMULATED PARTICLE PATHWAYS WITHOUT MITIGATION
PC - WET CASE CONDITION

088664-031

March 11, 2021

FIGURE 7.50

HEG file: Z:\HEG\088664\DOCUMENTATION\RPT\088664-RPT-13\FIGURES\Figure 7.52 - Pathways-PC-WET.srf



LEGEND

- SURFACE WATER BODY
- PROPOSED EXTENT OF MINE FEATURES
- PARTICLE PATHWAY
- SURFACE WATER MANAGEMENT DITCHES
- PROPERTY BOUNDARY
- PROJECT AREA
- PAG WASTE ROCK STOCKPILE
- TILL STOCKPILES
- TOPSOIL STOCKPILES
- POTENTIAL INTERCEPTOR TRENCH LOCATION

0 90 180 270m

ATLANTIC GOLD CORPORATION
MARINETTE, NOVA SCOTIA
BEAVER DAM MINE

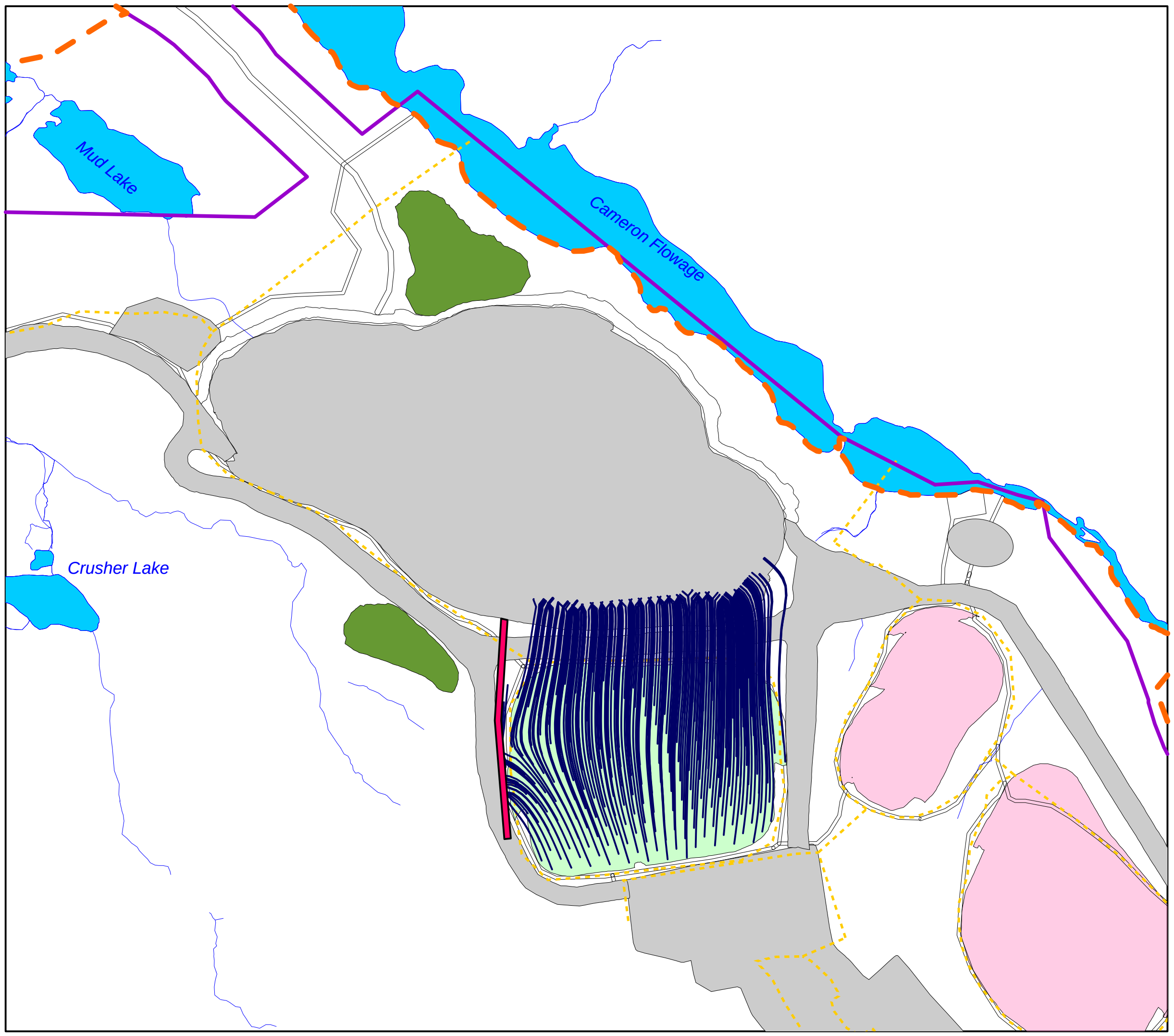
SIMULATED PARTICLE PATHWAYS WITH MITIGATION
PC - BASE CASE CONDITION

088664-031

March 11, 2021

FIGURE 7.51

HEG file: Z:\HEG\088664\DOCUMENTATION\RPT\088664-RPT-13\FIGURES\Figure 7.53 - Pathways-PC-AVG-mitigation.srf



LEGEND

- SURFACE WATER BODY
- PROPOSED EXTENT OF MINE FEATURES
- PARTICLE PATHWAY
- SURFACE WATER MANAGEMENT DITCHES
- PROPERTY BOUNDARY
- PROJECT AREA
- PAG WASTE ROCK STOCKPILE
- TILL STOCKPILES
- TOPSOIL STOCKPILES
- POTENTIAL INTERCEPTOR TRENCH LOCATION

0 90 180 270m

ATLANTIC GOLD CORPORATION
MARINETTE, NOVA SCOTIA
BEAVER DAM MINE

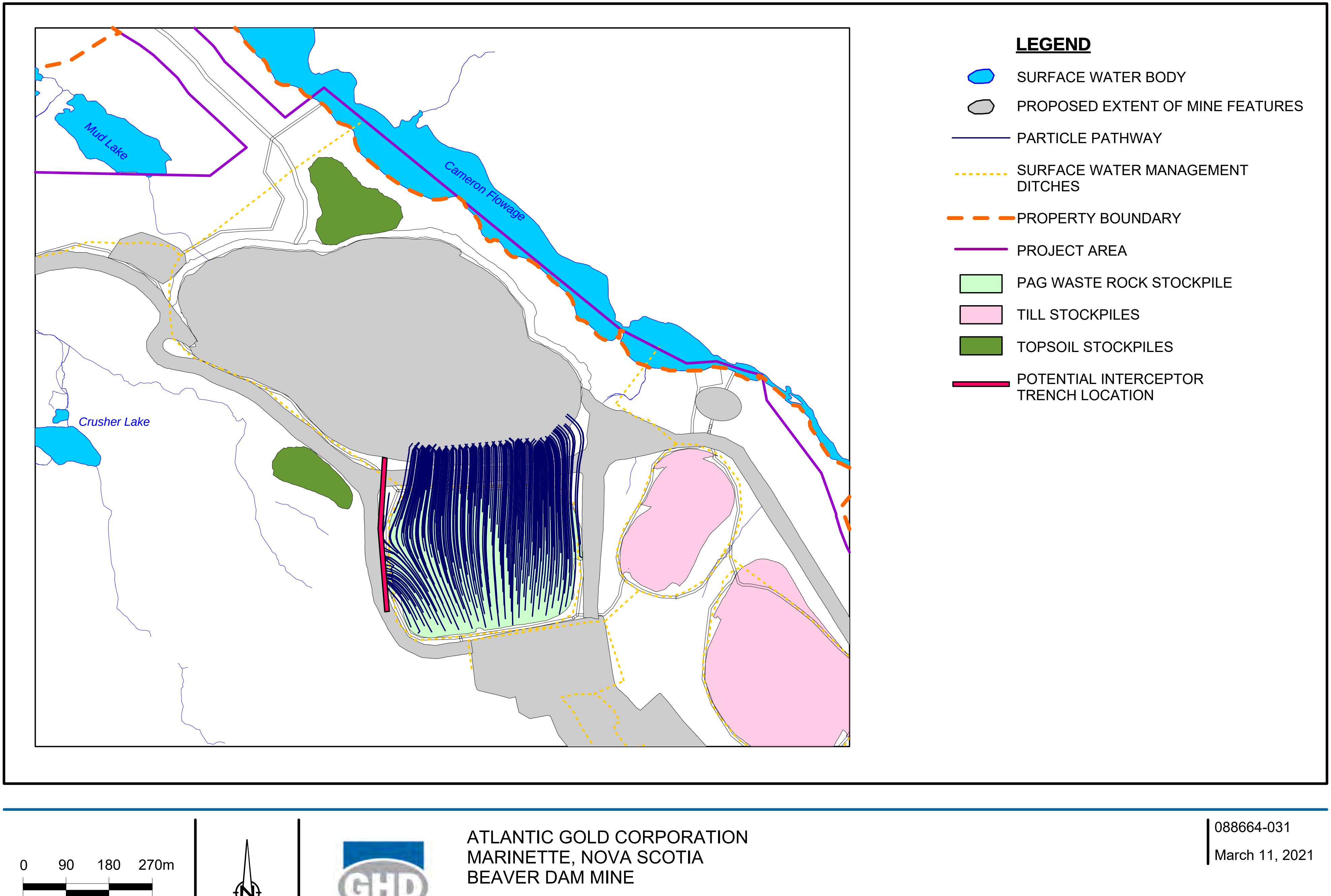
SIMULATED PARTICLE PATHWAYS WITH MITIGATION
PC - DRY CASE CONDITION

088664-031

March 11, 2021

FIGURE 7.52

HEG file: Z:\HEG\088664\DOCUMENTATION\RPT\088664-RPT-13\FIGURES\Figure 7.54 - Pathways-PC-DRY-mitigation.srf



ATLANTIC GOLD CORPORATION
MARINETTE, NOVA SCOTIA
BEAVER DAM MINE

SIMULATED PARTICLE PATHWAYS WITH MITIGATION
PC - WET CASE CONDITION

088664-031

March 11, 2021

FIGURE 7.53

HEG file: Z:\HEG\088664\DOCUMENTATION\RPT\088664-RPT-13\FIGURES\Figure 7.55 - Pathways-PC-WET-mitigation.srf

Table 2.1

Overburden Slug Test Hydraulic Conductivity Results
Atlantic Gold Corporation
Marinette, Nova Scotia

Monitoring Well ID	Lithology / Structure	Hydraulic Test Method/Type	Hydraulic Conductivity (m/s)	Overburden Thickness[(1)] (m)	Monitoring Well Screened (m BGS)
MW-02A	overburden	Bouwer-Rice/Falling Head	1.8E-05	5.10	3.20
MW-02A	overburden	Bouwer-Rice/Rising Head	1.7E-05	5.10	3.20
MW-12A	overburden	Bouwer-Rice/Rising Head	8.8E-07	20.78	3.51
MW-12A	overburden	Dagan/Rising Head	8.9E-07	20.78	3.51
MW-14A	overburden	Bouwer-Rice/Falling Head	9.7E-07	18.10	3.80
MW-14A	overburden	Bouwer-Rice/Rising Head	6.1E-07	18.10	3.80
MW-14A	overburden	Bouwer-Rice/Falling Head	1.2E-06	18.10	3.80
MW-14A	overburden	Bouwer-Rice/Rising Head	9.4E-07	18.10	3.80
MW-17A	overburden	Bouwer-Rice/Falling Head	6.7E-06	4.67	2.67
MW-17A	overburden	Bouwer-Rice/Rising Head	2.1E-06	4.67	2.67
MW-19A	overburden	Bouwer-Rice/Rising Head	8.5E-05	4.72	2.67
MW-19A	overburden	Springer-Gelhar/Rising Head	1.7E-04	4.72	2.67
MW-19A	overburden	Dagan/Rising Head	7.7E-05	4.72	2.67
MW-19A	overburden	Bouwer-Rice/Rising Head	1.1E-04	4.72	2.67
MW-19A	overburden	Springer-Gelhar/Rising Head	3.8E-04	4.72	2.67
MW-19A	overburden	Dagan/Rising Head	9.3E-05	4.72	2.67
		Geometric Mean	1.0E-05		
		Minimum Value	6.1E-07		
		Maximum Value	3.8E-04		

Notes:

m/s Metres per second
m BGS Metres below ground surface
(1) Where the tested well did not contact bedrock, the overburden thickness is taken as the average of the overburden thickness encountered at each well within a given well nest that contacted bedrock.

Table 2.2

Shallow Bedrock Hydraulic Conductivity Testing Results
Atlantic Gold Corporation
Marinette, Nova Scotia

Monitoring Well ID	Lithology / Structure	Hydraulic Test Method/Type	Hydraulic Conductivity (m/s)	Depth Below Top of Bedrock to Midpoint of Test Interval (m)
MW-05C	Greywacke	Packer Test	5.0E-07	1.4
MW-16A	Overburden/Weathered Bedrock/Bedrock - Greywacke	Bouwer-Rice/Falling Head	7.2E-06	2.0
MW-16A	Overburden/Weathered Bedrock/Bedrock - Greywacke	Bouwer-Rice/Rising Head	4.9E-06	2.0
MW-04A	Bedrock - Greywacke	Bouwer-Rice/Falling Head	1.0E-04	2.6
MW-04A	Bedrock - Greywacke	Springer-Gelhar/Rising Head	1.6E-04	2.6
MW-07A	Bedrock - Greywacke	Bouwer-Rice/Falling Head	5.7E-07	2.8
MW-07A	Bedrock - Greywacke	Bouwer-Rice/Rising Head	3.0E-05	2.8
MW-21A	Bedrock - Greywacke	Bouwer-Rice/Falling Head	3.4E-06	2.8
MW-21A	Bedrock - Greywacke	Bouwer-Rice/Rising Head	3.9E-06	2.8
MW-20A	Weathered Bedrock/Bedrock - Greywacke	Bouwer-Rice/Falling Head	3.7E-05	2.8
MW-20A	Weathered Bedrock/Bedrock - Greywacke	Bouwer-Rice/Rising Head	4.4E-05	2.8
MW-05A	Weathered Bedrock/Bedrock - Greywacke	Bouwer-Rice/Rising Head	2.6E-06	2.9
MW-05A	Weathered Bedrock/Bedrock - Greywacke	Dagan/Rising Head	1.7E-06	2.9
MW-05A	Weathered Bedrock/Bedrock - Greywacke	Bouwer-Rice/Rising Head	3.8E-06	2.9
MW-05A	Weathered Bedrock/Bedrock - Greywacke	Dagan/Rising Head	4.4E-06	2.9
MW-18A	Bedrock - Greywacke	Bouwer-Rice/Falling Head	4.7E-05	2.9
MW-18A	Bedrock - Greywacke	Bouwer-Rice/Rising Head	3.6E-05	2.9
MW-17B	Weathered Upper Bedrock - Greywacke	Bouwer-Rice/Falling Head	5.0E-05	3.0
MW-17B	Weathered Upper Bedrock - Greywacke	Bouwer-Rice/Rising Head	3.5E-05	3.0
MW-17B	Weathered Upper Bedrock - Greywacke	Bouwer-Rice/Falling Head	2.6E-05	3.0
MW-17B	Weathered Upper Bedrock - Greywacke	Bouwer-Rice/Rising Head	2.8E-05	3.0
MW-11A	Bedrock - Greywacke	Bouwer-Rice/Falling Head	2.8E-06	3.3
MW-11A	Bedrock - Greywacke	Bouwer-Rice/Rising Head	4.6E-05	3.3
MW-07C	Greywacke	Packer Test	2.1E-06	3.4
MW-12B	Bedrock - Greywacke	Bouwer-Rice/Falling Head	8.2E-07	3.5
MW-12B	Bedrock - Greywacke	Bouwer-Rice/Rising Head	9.4E-07	3.5
MW-05C	Greywacke	Packer Test	8.3E-08	4.4
MW-09A	Weathered Bedrock/Bedrock - Greywacke	Bouwer-Rice/Falling Head	9.8E-07	4.5
MW-09A	Weathered Bedrock/Bedrock - Greywacke	Bouwer-Rice/Rising Head	8.3E-07	4.5
MW-07C	Greywacke	Packer Test	1.3E-06	6.4
MW-14B	Bedrock - Greywacke	Bouwer-Rice/Falling Head	7.7E-08	6.5
MW-14B	Bedrock - Greywacke	Bouwer-Rice/Rising Head	4.5E-08	6.5
MW-05C	Greywacke	Packer Test	4.3E-07	7.5
MW-09C	Greywacke	Packer Test	1.3E-07	7.7
BD85-016	Greywacke, Quartzite	Packer Test	8.0E-07	8.2
MW-17C	Bedrock - Greywacke	Bouwer-Rice/Falling Head	6.4E-06	8.7
MW-17C	Bedrock - Greywacke	Bouwer-Rice/Rising Head	4.6E-06	8.7
MW-02B	Bedrock - Granite	Bouwer-Rice/Falling Head	5.0E-07	8.9
MW-02B	Bedrock - Granite	Bouwer-Rice/Rising Head	4.2E-07	8.9
MW-05C	Greywacke	Packer Test	3.8E-07	10.5
MW-07C	Greywacke	Packer Test	4.6E-07	10.7
MW-09C	Greywacke	Packer Test	2.7E-07	10.8
MW-18B	Bedrock - Greywacke	Bouwer-Rice/Falling Head	7.0E-07	11.1
MW-18B	Bedrock - Greywacke	Bouwer-Rice/Rising Head	3.7E-07	11.1
MW-07B	Bedrock - Greywacke	Bouwer-Rice/Falling Head	1.3E-07	11.2
MW-07B	Bedrock - Greywacke	Bouwer-Rice/Rising Head	1.2E-07	11.2
BD14-188	Greywacke Hanging wall	Packer Test	1.0E-08	11.3
MW-16B	Bedrock - Greywacke	Bouwer-Rice/Falling Head	5.1E-07	11.4
MW-16B	Bedrock - Greywacke	Bouwer-Rice/Rising Head	4.1E-07	11.4
BD85-029	Argillite	Packer Test	4.7E-07	11.5
MW-21B	Bedrock - Greywacke	Bouwer-Rice/Falling Head	9.3E-07	11.8
MW-21B	Bedrock - Greywacke	Bouwer-Rice/Rising Head	4.5E-07	11.8
MW-11B	Bedrock - Greywacke	Bouwer-Rice/Falling Head	3.2E-07	11.8
MW-11B	Bedrock - Greywacke	Bouwer-Rice/Rising Head	2.4E-07	11.8
BD85-005	Argillite	Packer Test	5.2E-07	12.0
BD85-016	Quartzite	Packer Test	1.6E-06	12.2

Table 2.2

Shallow Bedrock Hydraulic Conductivity Testing Results
Atlantic Gold Corporation
Marinette, Nova Scotia

Monitoring Well ID	Lithology / Structure	Hydraulic Test Method/Type	Hydraulic Conductivity (m/s)	Depth Below Top of Bedrock to Midpoint of Test Interval (m)
MW-04B	Bedrock - Greywacke	Bouwer-Rice/Falling Head	2.0E-05	12.3
MW-04B	Bedrock - Greywacke	Bouwer-Rice/Rising Head	1.4E-05	12.3
BD85-090	Quartzite	Packer Test	3.1E-08	12.5
MW-22B	Bedrock - Greywacke	Bouwer-Rice/Falling Head	1.8E-06	12.8
MW-22B	Bedrock - Greywacke	Bouwer-Rice/Rising Head	1.3E-06	12.8
MW-05B	Bedrock - Greywacke	Bouwer-Rice/Falling Head	9.6E-06	12.9
MW-05B	Bedrock - Greywacke	Bouwer-Rice/Rising Head	8.2E-06	12.9
MW-09B	Bedrock - Greywacke	Bouwer-Rice/Falling Head	3.0E-08	13.0
MW-09B	Bedrock - Greywacke	Bouwer-Rice/Rising Head	2.3E-08	13.0
MW-01B	Bedrock - Greywacke	Bouwer-Rice/Falling Head	2.3E-07	13.1
MW-01B	Bedrock - Greywacke	Bouwer-Rice/Rising Head	2.5E-07	13.1
BD85-013	Greywacke	Packer Test	2.0E-08	13.3
BD85-082	Greywacke	Packer Test	3.6E-08	13.5
MW-05C	Greywacke	Packer Test	8.2E-07	13.6
BD85-007	Argillite	Packer Test	4.7E-08	13.6
MW-07C	Greywacke	Packer Test	3.3E-09	13.7
MW-09C	Greywacke	Packer Test	5.5E-09	13.9
MW-18C	Overburden/Weathered Bedrock - Greywacke	Bouwer-Rice/Falling Head	1.5E-08	15.1
MW-18C	Overburden/Weathered Bedrock - Greywacke	Bouwer-Rice/Rising Head	1.1E-08	15.1
BD85-016	Quartzite	Packer Test	4.9E-08	16.2
BD85-005	Argillite	Packer Test	9.0E-08	16.2
MW-05C	Greywacke	Packer Test	1.6E-07	16.6
BD85-090	Greywacke	Packer Test	3.0E-08	16.7
MW-07C	Greywacke	Packer Test	7.4E-08	16.8
MW-09C	Greywacke	Packer Test	1.7E-09	16.9
BD85-013	Greywacke, Quartzite	Packer Test	2.4E-08	17.0
BD85-043	Quartzite	Packer Test	8.3E-09	17.4
BD85-082	Greywacke	Packer Test	1.1E-06	17.7
BD85-007	Argillite, Quartzite	Packer Test	1.1E-08	17.8
MW-09C	Greywacke	Packer Test	1.1E-08	20.0
BD85-005	Argillite	Packer Test	1.8E-07	20.4
BD85-090	Greywacke, Quartzite	Packer Test	2.4E-08	20.8
BD85-029	Greywacke	Packer Test	9.9E-08	21.1
MW-14C	Bedrock - Greywacke	Bouwer-Rice/Falling Head	2.7E-07	21.5
MW-14C	Bedrock - Greywacke	Bouwer-Rice/Rising Head	1.6E-07	21.5
MW-14C	Bedrock - Greywacke	Bouwer-Rice/Falling Head	5.0E-06	21.5
MW-14C	Bedrock - Greywacke	Bouwer-Rice/Rising Head	2.3E-07	21.5
BD85-043	Greywacke, Argillite	Packer Test	2.6E-08	21.7
BD85-082	Quartzite / Fault	Packer Test	1.9E-06	21.8
BD85-007	Quartzite	Packer Test	8.4E-07	22.0
		Geometric Mean	5.6E-07	
		Minimum Value	1.7E-09	
		Maximum Value	1.6E-04	

Notes:

m	Metres
m/s	Metres per second
1.0E-08	Hydraulic conductivity test result did not provide an exact hydraulic conductivity value, but indicated that the hydraulic conductivity is less than the specified value.

Table 2.3

Deep Bedrock Hydraulic Conductivity Testing Results
Atlantic Gold Corporation
Marinette, Nova Scotia

Monitoring Well ID	Lithology / Structure	Hydraulic Test Method/Type	Hydraulic Conductivity (m/s)	Depth Below Top of Bedrock to Midpoint of Test Interval (m)
MW-07C	Greywacke	Packer Test	4.3E-08	22.9
MW-11C	Greywacke	Slug Test	1.0E-10	23.3
MW-19C	Bedrock - Greywacke	Bouwer-Rice/Falling Head	3.7E-06	24.2
MW-19C	Bedrock - Greywacke	Bouwer-Rice/Rising Head	3.3E-06	24.2
BD85-090	Greywacke, Quartzite	Packer Test	8.1E-08	24.9
MW-09C	Greywacke	Packer Test	3.5E-09	26.0
MW-07D	Greywacke	Bouwer-Rice/Falling Head	3.0E-07	26.4
MW-07D	Greywacke	Bouwer-Rice/Rising Head	2.9E-07	26.4
MW-22C	Bedrock - Greywacke	Bouwer-Rice/Falling Head	5.0E-07	26.4
MW-22C	Bedrock - Greywacke	Bouwer-Rice/Rising Head	4.2E-07	26.4
BD85-082	Greywacke	Packer Test	8.0E-07	27.3
MW-05D	Bedrock - Greywacke	Bouwer-Rice/Rising Head	1.2E-07	28.0
MW-05D	Bedrock - Greywacke	Bouwer-Rice/Rising Head	1.0E-07	28.0
MW-09D	Bedrock - Greywacke	Bouwer-Rice/Falling Head	3.0E-08	28.1
MW-09D	Bedrock - Greywacke	Bouwer-Rice/Rising Head	2.4E-08	28.1
MW-03C	Bedrock - Greywacke	Bouwer-Rice/Falling Head	5.4E-06	28.1
MW-03C	Bedrock - Greywacke	Bouwer-Rice/Rising Head	3.6E-06	28.1
MW-07C	Greywacke	Packer Test	4.4E-09	29.0
BD85-029	Greywacke	Packer Test	9.4E-07	29.7
BD14-188	Greywacke Hanging wall	Packer Test	5.0E-09	32.0
MW-09C	Greywacke	Packer Test	4.5E-09	32.1
BD85-083	Greywacke / Fault	Packer Test	1.5E-08	34.3
BD85-029	Greywacke	Packer Test	9.0E-08	35.3
BD85-082	Quartzite	Packer Test	6.1E-07	36.8
MW-05C	Greywacke	Packer Test	6.8E-09	37.9
BD85-082	Quartzite	Packer Test	4.6E-07	40.9
MW-07C	Greywacke	Packer Test	2.2E-08	41.2
MW-09C	Greywacke	Packer Test	7.2E-10	41.3
BD85-083	Greywacke / Fault	Packer Test	1.0E-08	43.2
BD85-043	Greywacke	Packer Test	1.0E-06	43.2
BD85-005	Greywacke	Packer Test	1.4E-06	43.8
MW-05C	Greywacke	Packer Test	2.3E-09	44.0
MW-07C	Greywacke	Packer Test	2.8E-08	44.2
MW-05C	Greywacke	Packer Test	7.9E-10	47.1
BD85-043	Greywacke	Packer Test	2.3E-07	47.5
MW-09C	Greywacke	Packer Test	1.2E-08	50.4
BD85-007	Greywacke / Fault	Packer Test	2.0E-09	51.2
BD85-083	Greywacke / Fault	Packer Test	1.2E-09	52.1

Table 2.3

Deep Bedrock Hydraulic Conductivity Testing Results
Atlantic Gold Corporation
Marinette, Nova Scotia

Monitoring Well ID	**Lithology / Structure**	**Hydraulic Test Method/Type**	**Hydraulic Conductivity (m/s)**	**Depth Below Top of Bedrock to Midpoint of Test Interval (m)**
MW-07C	Greywacke	Packer Test	2.0E-07	53.4
MW-05C	Greywacke	Packer Test	1.0E-08	56.2
BD85-043	Greywacke	Packer Test	2.7E-09	57.6
MW-05C	Bedrock - Greywacke	Bouwer-Rice/Rising Head	3.4E-08	57.8
BD85-007	Greywacke	Packer Test	5.4E-07	59.5
MW-09C	Greywacke	Packer Test	4.2E-09	59.6
BD85-043	Greywacke	Packer Test	3.4E-09	61.9
BD85-016	Greywacke, Argillite	Packer Test	2.5E-07	65.3
BD85-013	Greywacke, Argillite	Packer Test	5.8E-08	65.4
BD85-083	Argillite	Packer Test	7.1E-09	65.4
BD85-013	Argillite	Packer Test	4.1E-08	69.1
BD85-016	Greywacke, Argillite	Packer Test	3.0E-07	69.2
BD85-013	Argillite	Packer Test	2.8E-08	72.7
BD85-016	-	Packer Test	3.9E-07	73.2
BD85-083	Greywacke, Argillite	Packer Test	2.7E-08	74.3
BD85-013	Argillite	Packer Test	2.5E-08	76.4
BD85-013	Argillite	Packer Test	4.3E-08	80.2
BD85-007	Argillite	Packer Test	3.0E-08	80.5
BD85-029	Greywacke, Argillite	Packer Test	4.9E-08	92.9
BD85-029	Greywacke	Packer Test	1.6E-08	97.1
BD14-188	Fault	Packer Test	1.0E-08	100.5
BD85-043	Greywacke	Packer Test	1.0E-09	109.3
BD85-043	Greywacke	Packer Test	7.6E-10	113.6
BD85-043	Greywacke	Packer Test	2.6E-09	118.0
BD85-043	Greywacke, Argillite	Packer Test	1.6E-09	122.3
BD85-043	Argillite	Packer Test	5.5E-10	126.5
BD14-188	Foot wall	Packer Test	2.0E-09	128.5
BD85-043	Argillite	Packer Test	3.7E-10	130.9
BD14-188	Foot wall	Packer Test	4.0E-10	150.0
		Geometric Mean	2.9E-08	
		Minimum Value	1.0E-10	
		Maximum Value	5.4E-06	

Notes:

m	Metres
m/s	Metres per second
2.0E-09	Hydraulic conductivity test result did not provide an exact hydraulic conductivity value, but indicated that the hydraulic conductivity is less than the specified value

Table 2.4

Bedrock Packer Test Hydraulic Conductivity Results by Lithology and Structure
Atlantic Gold Corporation
Marinette, Nova Scotia

Monitoring Well ID	Lithology / Structure	Hydraulic Test Method/Type	Hydraulic Conductivity (m/s)	Depth Below Top of Bedrock to Midpoint of Test Interval (m)
Greywacke				
MW-05C	Greywacke	Packer Test	5.0E-07	1.4
MW-07C	Greywacke	Packer Test	2.1E-06	3.4
MW-05C	Greywacke	Packer Test	8.3E-08	4.4
MW-07C	Greywacke	Packer Test	1.3E-06	6.4
MW-05C	Greywacke	Packer Test	4.3E-07	7.5
MW-09C	Greywacke	Packer Test	1.3E-07	7.7
MW-05C	Greywacke	Packer Test	3.8E-07	10.5
MW-07C	Greywacke	Packer Test	4.6E-07	10.7
MW-09C	Greywacke	Packer Test	2.7E-07	10.8
BD85-013	Greywacke	Packer Test	2.0E-08	13.3
BD85-082	Greywacke	Packer Test	3.6E-08	13.5
MW-05C	Greywacke	Packer Test	8.2E-07	13.6
MW-07C	Greywacke	Packer Test	3.3E-09	13.7
MW-09C	Greywacke	Packer Test	5.5E-09	13.9
MW-05C	Greywacke	Packer Test	1.6E-07	16.6
BD85-090	Greywacke	Packer Test	3.0E-08	16.7
MW-07C	Greywacke	Packer Test	7.4E-08	16.8
MW-09C	Greywacke	Packer Test	1.7E-09	16.9
BD85-082	Greywacke	Packer Test	1.1E-06	17.7
MW-09C	Greywacke	Packer Test	1.1E-08	20.0
BD85-029	Greywacke	Packer Test	9.9E-08	21.1
MW-07C	Greywacke	Packer Test	4.3E-08	22.9
MW-11C	Greywacke	Packer Test	1.0E-10	23.3
MW-09C	Greywacke	Packer Test	3.5E-09	26.0
BD85-082	Greywacke	Packer Test	8.0E-07	27.3
MW-07C	Greywacke	Packer Test	4.4E-09	29.0
BD85-029	Greywacke	Packer Test	9.4E-07	29.7
MW-09C	Greywacke	Packer Test	4.5E-09	32.1
BD85-029	Greywacke	Packer Test	9.0E-08	35.3
MW-05C	Greywacke	Packer Test	6.8E-09	37.9
MW-07C	Greywacke	Packer Test	2.2E-08	41.2
MW-09C	Greywacke	Packer Test	7.2E-10	41.3
BD85-043	Greywacke	Packer Test	1.0E-06	43.2
BD85-005	Greywacke	Packer Test	1.4E-06	43.8
MW-05C	Greywacke	Packer Test	2.3E-09	44.0
MW-07C	Greywacke	Packer Test	2.8E-08	44.2
MW-05C	Greywacke	Packer Test	7.9E-10	47.1
BD85-043	Greywacke	Packer Test	2.3E-07	47.5
MW-09C	Greywacke	Packer Test	1.2E-08	50.4
MW-07C	Greywacke	Packer Test	2.0E-07	53.4
MW-05C	Greywacke	Packer Test	1.0E-08	56.2
BD85-043	Greywacke	Packer Test	2.7E-09	57.6
BD85-007	Greywacke	Packer Test	5.4E-07	59.5
MW-09C	Greywacke	Packer Test	4.2E-09	59.6
BD85-043	Greywacke	Packer Test	3.4E-09	61.9
BD85-029	Greywacke	Packer Test	1.6E-08	97.1
BD85-043	Greywacke	Packer Test	1.0E-09	109.3
BD85-043	Greywacke	Packer Test	7.6E-10	113.6
BD85-043	Greywacke	Packer Test	2.6E-09	118.0
BD14-188	Greywacke Hanging wall	Packer Test	1.0E-08	11.3
BD14-188	Greywacke Hanging wall	Packer Test	5.0E-09	32.0
BD85-016	Greywacke, Quartzite	Packer Test	8.0E-07	8.2
BD85-013	Greywacke, Quartzite	Packer Test	2.4E-08	17.0
BD85-090	Greywacke, Quartzite	Packer Test	2.4E-08	20.8
BD85-090	Greywacke, Quartzite	Packer Test	8.1E-08	24.9
		Greywacke Geometric Mean	3.4E-08	
		Greywacke Minimum Value	1.0E-10	
		Greywacke Maximum Value	2.1E-06	

Table 2.4

Bedrock Packer Test Hydraulic Conductivity Results by Lithology and Structure
Atlantic Gold Corporation
Marinette, Nova Scotia

Monitoring Well ID	Lithology / Structure	Hydraulic Test Method/Type	Hydraulic Conductivity (m/s)	Depth Below Top of Bedrock to Midpoint of Test Interval (m)
Argillite				
BD85-029	Argillite	Packer Test	4.7E-07	11.5
BD85-005	Argillite	Packer Test	5.2E-07	12.0
BD85-007	Argillite	Packer Test	4.7E-08	13.6
BD85-005	Argillite	Packer Test	9.0E-08	16.2
BD85-005	Argillite	Packer Test	1.8E-07	20.4
BD85-083	Argillite	Packer Test	7.1E-09	65.4
BD85-013	Argillite	Packer Test	4.1E-08	69.1
BD85-013	Argillite	Packer Test	2.8E-08	72.7
BD85-013	Argillite	Packer Test	2.5E-08	76.4
BD85-013	Argillite	Packer Test	4.3E-08	80.2
BD85-007	Argillite	Packer Test	3.0E-08	80.5
BD85-043	Argillite	Packer Test	5.5E-10	126.5
BD85-043	Argillite	Packer Test	3.7E-10	130.9
BD85-007	Argillite, Quartzite	Packer Test	1.1E-08	17.8
		Argillite Geometric Mean	2.7E-08	
		Argillite Minimum Value	3.7E-10	
		Argillite Maximum Value	5.2E-07	
Mud Lake Fault Zone				
BD14-188	Fault	Packer Test	1.0E-08	100.5
BD85-082	Quartzite / Fault	Packer Test	1.9E-06	21.8
BD85-083	Greywacke / Fault	Packer Test	1.5E-08	34.3
BD85-083	Greywacke / Fault	Packer Test	1.0E-08	43.2
BD85-007	Greywacke / Fault	Packer Test	2.0E-09	51.2
BD85-083	Greywacke / Fault	Packer Test	1.2E-09	52.1
		Mud Lake Fault Geometric Mean	1.4E-08	
		Mud Lake Fault Minimum Value	1.2E-09	
		Mud Lake Fault Maximum Value	1.9E-06	
Uncategorized Lithologies				
BD85-016	-	Packer Test	3.9E-07	73.2
BD85-016	Quartzite	Packer Test	1.6E-06	12.2
BD85-090	Quartzite	Packer Test	3.1E-08	12.5
BD85-016	Quartzite	Packer Test	4.9E-08	16.2
BD85-043	Quartzite	Packer Test	8.3E-09	17.4
BD85-007	Quartzite	Packer Test	8.4E-07	22.0
BD85-082	Quartzite	Packer Test	6.1E-07	36.8
BD85-082	Quartzite	Packer Test	4.6E-07	40.9
BD14-188	Foot wall	Packer Test	2.0E-09	128.5
BD14-188	Foot wall	Packer Test	4.0E-10	150.0
Greywacke and Argillite				
BD85-043	Greywacke, Argillite	Packer Test	2.6E-08	21.7
BD85-016	Greywacke, Argillite	Packer Test	2.5E-07	65.3
BD85-013	Greywacke, Argillite	Packer Test	5.8E-08	65.4
BD85-016	Greywacke, Argillite	Packer Test	3.0E-07	69.2
BD85-083	Greywacke, Argillite	Packer Test	2.7E-08	74.3
BD85-029	Greywacke, Argillite	Packer Test	4.9E-08	92.9
BD85-043	Greywacke, Argillite	Packer Test	1.6E-09	122.3

Notes:

m	Metres
m/s	Metres per second
2.0E-09	Hydraulic conductivity test result did not provide an exact hydraulic conductivity value, but indicated that the hydraulic conductivity is less than the specified value

Table 6.1

Model Calibration Targets and Residuals - Base Case Condition
Atlantic Gold Corporation
Marinette, Nova Scotia

Monitoring Well ID	Model Layer	Observed Groundwater Elevation(1) (m AMSL)	Simulated Groundwater Elevation (m AMSL)	Residual(2) (m)
MW-01A	2	147.47	148.59	-1.11
MW-01B	2	147.30	148.63	-1.32
MW-01C	3	147.65	148.43	-0.79
MW-02A	1	149.88	149.31	0.57
MW-02B	2	148.78	149.30	-0.52
MW-03A	2	163.62	164.67	-1.05
MW-03B	2	162.68	164.74	-2.06
MW-03C	3	162.60	164.24	-1.64
MW-04A	2	163.23	162.82	0.41
MW-04B	2	163.47	162.83	0.64
MW-05A	2	139.90	139.42	0.49
MW-05B	2	139.94	139.48	0.46
MW-05C	4	140.69	140.30	0.39
MW-05D	3	140.68	139.99	0.68
MW-07A	2	128.88	128.70	0.18
MW-07B	2	129.17	128.72	0.45
MW-07C	4	128.82	130.33	-1.51
MW-07D	3	129.04	129.26	-0.22
MW-09A	2	130.49	130.78	-0.29
MW-09B	2	130.44	130.78	-0.34
MW-09C	4	129.90	130.42	-0.52
MW-09D	3	130.41	130.62	-0.21
MW-11A	2	146.66	146.09	0.57
MW-11B	2	145.44	145.79	-0.36
MW-11C	2	146.57	145.89	0.67
MW-12A	1	145.98	145.29	0.69
MW-12B	2	141.01	140.09	0.93
MW-14A	1	135.79	134.73	1.05
MW-14B	2	135.10	134.91	0.20
MW-14C	3	135.77	135.42	0.35
MW-16A	2	151.31	150.64	0.67
MW-16B	2	151.47	150.62	0.84
MW-17A	1	151.60	151.35	0.25
MW-17B	2	151.66	151.22	0.44
MW-17C	2	151.22	151.24	-0.02
MW-18A	2	145.92	144.79	1.13
MW-18B	2	145.82	144.79	1.04
MW-18C	2	146.11	144.87	1.24
MW-19A	1	131.98	131.96	0.03
MW-19B	2	132.00	131.98	0.02
MW-19C	3	132.04	132.07	-0.03

Table 6.1

Model Calibration Targets and Residuals - Base Case Condition
Atlantic Gold Corporation
Marinette, Nova Scotia

Monitoring Well ID	Model Layer	Observed Groundwater Elevation[1] (m AMSL)	Simulated Groundwater Elevation (m AMSL)	Residual[2] (m)
MW-20A	2	150.02	149.72	0.30
MW-20B	2	150.10	149.72	0.37
MW-21A	2	154.90	154.05	0.86
MW-21B	2	152.62	154.01	-1.39
MW-21C	3	146.72	154.05	-7.34
MW-22A	2	137.71	137.98	-0.28
MW-22B	2	137.35	137.95	-0.60
MW-22C	3	137.31	137.97	-0.66

Notes:

m	Metres
m AMSL	Metres above mean sea level
0.58	Positive groundwater elevation residual - over prediction of observed groundwater elevation
-1.58	Negative groundwater elevation residual - under prediction of observed groundwater elevation
(1)	Average observed groundwater elevation for June 12, 2018 to June 12, 2019.
(2)	Residual is calculated as observed groundwater elevation minus the simulated groundwater elevation.

Table 6.2

Model Calibration Targets and Residuals - Dry Case Condition
Atlantic Gold Corporation
Marinette, Nova Scotia

Monitoring Well ID	Model Layer	Observed Groundwater Elevation(1) (m AMSL)	Simulated Groundwater Elevation (m AMSL)	Residual(2) (m)
MW-01A	2	146.72	148.46	-1.74
MW-01B	2	146.51	148.50	-1.98
MW-01C	3	146.90	148.31	-1.41
MW-02A	1	148.43	148.97	-0.54
MW-02B	2	147.77	148.96	-1.19
MW-03A	2	162.62	164.26	-1.63
MW-03B	2	162.44	164.33	-1.89
MW-03C	3	162.34	163.84	-1.50
MW-04A	2	161.68	162.71	-1.03
MW-04B	2	161.95	162.72	-0.76
MW-05A	2	139.23	139.28	-0.05
MW-05B	2	139.27	139.35	-0.09
MW-05C	4	140.27	140.13	0.14
MW-05D	3	139.92	139.84	0.08
MW-07A	2	128.63	128.55	0.07
MW-07B	2	128.87	128.57	0.30
MW-07C	4	128.66	130.13	-1.47
MW-07D	3	128.77	129.10	-0.32
MW-09A	2	129.48	130.53	-1.05
MW-09B	2	129.29	130.52	-1.23
MW-09C	4	128.93	130.15	-1.22
MW-09D	3	129.30	130.36	-1.06
MW-11A	2	145.35	144.99	0.36
MW-11B	2	144.21	144.69	-0.48
MW-11C	2	145.16	144.79	0.37
MW-12A	1	144.07	143.05	1.02
MW-12B	2	139.62	138.40	1.22
MW-14A	1	134.91	133.83	1.07
MW-14B	2	134.32	134.02	0.31
MW-14C	3	134.93	134.59	0.35
MW-16A	2	149.93	150.02	-0.08
MW-16B	2	150.25	150.00	0.26
MW-17A	1	150.70	151.06	-0.36
MW-17B	2	150.79	150.94	-0.15
MW-17C	2	150.41	150.95	-0.54
MW-18A	2	144.86	144.56	0.30
MW-18B	2	144.80	144.56	0.24
MW-18C	2	145.06	144.63	0.43
MW-19A	1	130.83	131.50	-0.67
MW-19B	2	130.82	131.52	-0.70
MW-19C	3	130.86	131.64	-0.78

Table 6.2

Model Calibration Targets and Residuals - Dry Case Condition
Atlantic Gold Corporation
Marinette, Nova Scotia

Monitoring Well ID	Model Layer	Observed Groundwater Elevation(1) (m AMSL)	Simulated Groundwater Elevation (m AMSL)	Residual(2) (m)
MW-20A	2	148.68	149.45	-0.77
MW-20B	2	148.51	149.45	-0.94
MW-21A	2	153.77	154.01	-0.25
MW-21B	2	150.22	153.97	-3.75
MW-21C	3	146.46	154.01	-7.55
MW-22A	2	137.11	137.88	-0.77
MW-22B	2	137.09	137.85	-0.76
MW-22C	3	137.09	137.86	-0.77

Notes:

m	Metres
m AMSL	Metres above mean sea level
0.52	Positive groundwater elevation residual - over prediction of observed groundwater elevation
-1.74	Negative groundwater elevation residual - under prediction of observed groundwater elevation
(1)	Average observed groundwater elevation during dry period from September 13, 2018 through September 26, 2018.
(2)	Residual is calculated as observed groundwater elevation minus the simulated groundwater elevation.

Table 6.3

Model Calibration Targets and Residuals - Wet Case Condition
Atlantic Gold Corporation
Marinette, Nova Scotia

Monitoring Well ID	Model Layer	Observed Groundwater Elevation[1] (m AMSL)	Simulated Groundwater Elevation (m AMSL)	Residual[2] (m)
MW-01A	2	148.01	148.65	-0.64
MW-01B	2	147.75	148.69	-0.95
MW-01C	3	148.16	148.50	-0.34
MW-02A	1	150.39	149.52	0.87
MW-02B	2	149.16	149.51	-0.34
MW-03A	2	164.02	164.89	-0.88
MW-03B	2	162.81	164.96	-2.15
MW-03C	3	162.73	164.47	-1.74
MW-04A	2	163.93	162.90	1.03
MW-04B	2	164.20	162.91	1.29
MW-05A	2	140.16	139.50	0.66
MW-05B	2	140.23	139.57	0.66
MW-05C	4	141.37	140.41	0.96
MW-05D	3	141.31	140.09	1.23
MW-07A	2	129.04	128.78	0.26
MW-07B	2	129.38	128.80	0.58
MW-07C	4	129.16	130.44	-1.27
MW-07D	3	129.25	129.35	-0.11
MW-09A	2	131.22	130.95	0.27
MW-09B	2	131.19	130.94	0.25
MW-09C	4	131.05	130.59	0.47
MW-09D	3	131.18	130.78	0.40
MW-11A	2	147.13	146.84	0.29
MW-11B	2	145.96	146.55	-0.59
MW-11C	2	147.09	146.65	0.44
MW-12A	1	146.42	146.90	-0.48
MW-12B	2	141.10	141.33	-0.23
MW-14A	1	136.11	135.39	0.72
MW-14B	2	135.28	135.56	-0.28
MW-14C	3	136.03	136.02	0.00
MW-16A	2	151.97	151.12	0.84
MW-16B	2	152.11	151.10	1.01
MW-17A	1	152.29	151.55	0.74
MW-17B	2	152.23	151.42	0.82
MW-17C	2	151.66	151.43	0.23
MW-18A	2	146.53	144.95	1.58
MW-18B	2	146.46	144.94	1.51
MW-18C	2	146.75	145.02	1.73
MW-19A	1	132.52	132.10	0.43
MW-19B	2	132.60	132.12	0.48
MW-19C	3	132.64	132.21	0.44

Table 6.3

Model Calibration Targets and Residuals - Wet Case Condition
Atlantic Gold Corporation
Marinette, Nova Scotia

Monitoring Well ID	Model Layer	Observed Groundwater Elevation(1) (m AMSL)	Simulated Groundwater Elevation (m AMSL)	Residual(2) (m)
MW-20A	2	150.85	149.89	0.95
MW-20B	2	150.66	149.90	0.76
MW-21A	2	155.77	154.07	1.70
MW-21B	2	153.45	154.03	-0.58
MW-21C	3	146.94	154.08	-7.15
MW-22A	2	138.02	138.05	-0.03
MW-22B	2	137.47	138.02	-0.55
MW-22C	3	137.43	138.04	-0.61

Notes:

m	Metres
m AMSL	Metres above mean sea level
1.21	Positive groundwater elevation residual - over prediction of observed groundwater elevation
-0.84	Negative groundwater elevation residual - under prediction of observed groundwater elevation
(1)	Average observed groundwater elevation during wet period from November 1, 2018 through November 14, 2018.
(2)	Residual is calculated as observed groundwater elevation minus the simulated groundwater elevation.

Table 6.4

Calibrated Parameter Values
Atlantic Gold Corporation
Marinette, Nova Scotia

Parameter	Parameter Value		Observed Parameter Range: Maximum		Observed Parameter Range: Minimum	
	(m/s)	(m/d)	(m/s)	(m/d)	(m/s)	(m/d)
Average Overburden K_H (1)	1.40E-04	1.21E+01	3.82E-04	3.30E+01	6.08E-07	5.25E-02
Shallow Greywacke K_H (1)	4.25E-07	3.67E-02	1.57E-04	1.35E+01	1.67E-09	1.44E-04
Deep Greywacke K_H (1)	3.33E-09	2.87E-04	5.44E-06	4.70E-01	1.00E-10	8.64E-06
Shallow Granite K_H (1)	3.71E-07	3.20E-02	1.57E-04	1.35E+01	1.67E-09	1.44E-04
Deep Granite K_H (1)	3.34E-09	2.88E-04	5.44E-06	4.70E-01	1.00E-10	8.64E-06
Shallow Argillite K_H (1)	3.70E-07	3.20E-02	1.57E-04	1.35E+01	1.67E-09	1.44E-04
Deep Argillite K_H (1)	3.32E-09	2.87E-04	5.44E-06	4.70E-01	1.00E-10	8.64E-06
Shallow Mud Lake Fault Zone K_H (1)	3.69E-07	3.19E-02	1.57E-04	1.35E+01	1.67E-09	1.44E-04
Deep Mud Lake Fault Zone K_H (1)	3.32E-09	2.87E-04	5.44E-06	4.70E-01	1.00E-10	8.64E-06
Shallow Cameron Flowage Fault Zone K_H (1)	4.25E-07	3.67E-02	1.57E-04	1.35E+01	1.67E-09	1.44E-04
Deep Cameron Flowage Fault Zone K_H (1)	3.33E-09	2.87E-04	5.44E-06	4.70E-01	1.00E-10	8.64E-06
River Conductivity K_H (1)	2.44E-04	2.10E+01	3.82E-04	3.30E+01	6.08E-07	5.25E-02
	(mm/yr)		(mm/yr)		(mm/yr)	
Dry Condition Recharge	197		77		377	
Base Case Condition Recharge	230		77		377	
Wet Condition Recharge	255		77		377	

Notes:

m/s Metres per second
m/d Meters per day
mm/yr Millimetres per year
(1) K_H is horizontal hydraulic conductivity.

Table 6.5

Model Calibration Sensitivity Analysis
Atlantic Gold Corporation
Marinette, Nova Scotia

Sensitivity Analysis Simulation No.	Parameter	Units	Parameter Value For Sensitivity Simulation	Dry Condition		Base Case Condition		Wet Condition	
				Sensitivity Simulation RSS_{SENS} (ft^2)	Percent Change in RSS From Calibrated Model ΔRSS_{SENS}[(1)] (%)	Sensitivity Simulation RSS_{SENS} (ft^2)	Percent Change in RSS From Calibrated Model ΔRSS_{SENS}[(1)] (%)	Sensitivity Simulation RSS_{SENS} (ft^2)	Percent Change in RSS From Calibrated Model ΔRSS_{SENS}[(1)] (%)
1.1	Average Overburden K_H	m/d	33.0048	179.69	63.99%	198.53	137.99%	210.41	137.34%
1.2	Average Overburden K_H	m/d	26.04396513	156.48	42.81%	164.08	96.69%	172.58	94.67%
1.3	Average Overburden K_H	m/d	19.08313027	129.96	18.61%	122.35	46.67%	127.54	43.86%
-	Average Overburden K_H	m/d	12.1222954	109.57	-	83.42	-	88.66	-
1.4	Average Overburden K_H	m/d	8.0990436	125.78	14.80%	95.56	14.55%	115.95	30.79%
1.5	Average Overburden K_H	m/d	4.0757918	319.61	191.69%	324.57	289.08%	415.05	368.17%
1.6	Average Overburden K_H	m/d	0.05254	1100597.71	1004348.19%	1505229.96	1804308.72%	1850112.60	2086763.13%
2.1	Shallow Greywacke KH	m/d	4.323456	1939.50	1670.06%	2237.40	2582.10%	2373.30	2577.00%
2.2	Shallow Greywacke KH	m/d	2.89453457	1794.70	1537.91%	2061.90	2371.72%	2176.30	2354.79%
2.3	Shallow Greywacke KH	m/d	1.46561314	1485.10	1255.36%	1689.20	1924.94%	1763.80	1889.51%
-	Shallow Greywacke KH	m/d	0.03669171	109.57	-	83.42	-	88.66	-
2.4	Shallow Greywacke KH	m/d	0.02447266	131.64	20.14%	99.55	19.34%	120.73	36.18%
2.5	Shallow Greywacke KH	m/d	0.01225361	262.70	139.75%	269.37	222.91%	362.77	309.19%
2.6	Shallow Greywacke KH	m/d	0.00003456	79163.00	72147.23%	6166.40	7292.03%	5842.80	6490.48%
3.1	Deep Greywacke KH	m/d	0.16416	1528.20	1294.69%	1622.60	1845.11%	1638.10	1747.72%
3.2	Deep Greywacke KH	m/d	0.109535818	1226.90	1019.72%	1289.40	1445.68%	1289.50	1354.51%
3.3	Deep Greywacke KH	m/d	0.054911636	735.72	571.45%	745.96	794.23%	723.39	715.96%
-	Deep Greywacke KH	m/d	0.000287454	109.57	-	83.42	-	88.66	-
3.4	Deep Greywacke KH	m/d	0.000194516	108.72	-0.78%	82.42	-1.20%	88.08	-0.64%
3.5	Deep Greywacke KH	m/d	0.000101578	107.34	-2.04%	80.95	-2.96%	87.16	-1.68%
3.6	Deep Greywacke KH	m/d	0.00000864	104.35	-4.77%	78.05	-6.43%	85.22	-3.87%
4.1	Shallow Granite KH	m/d	4.323456	103.41	-5.62%	94.90	13.76%	107.34	21.08%
4.2	Shallow Granite KH	m/d	2.892978207	102.72	-6.25%	92.40	10.76%	103.88	17.17%
4.3	Shallow Granite KH	m/d	1.462500413	101.93	-6.97%	87.90	5.37%	97.70	10.20%
-	Shallow Granite KH	m/d	0.03202262	109.57	-	83.42	-	88.66	-
4.4	Shallow Granite KH	m/d	0.021359933	110.04	0.43%	83.60	0.21%	88.73	0.09%
4.5	Shallow Granite KH	m/d	0.010697247	110.57	0.91%	83.83	0.49%	88.86	0.23%
4.6	Shallow Granite KH	m/d	0.00003456	112.15	2.35%	84.89	1.77%	89.74	1.23%
5.1	Deep Granite KH	m/d	0.16416	96.40	-12.02%	80.76	-3.19%	89.83	1.33%
5.2	Deep Granite KH	m/d	0.109536141	97.49	-11.03%	79.52	-4.67%	87.69	-1.09%
5.3	Deep Granite KH	m/d	0.054912281	100.01	-8.73%	78.72	-5.63%	85.67	-3.37%
-	Deep Granite KH	m/d	0.000288422	109.57	-	83.42	-	88.66	-
5.4	Deep Granite KH	m/d	0.000195161	110.36	0.72%	84.17	0.89%	89.37	0.81%
5.5	Deep Granite KH	m/d	0.000101901	111.52	1.78%	85.27	2.22%	90.44	2.01%
5.6	Deep Granite KH	m/d	0.00000864	113.44	3.53%	87.10	4.41%	92.21	4.01%
6.1	Shallow Argillite KH	m/d	4.323456	126.88	15.80%	105.54	26.52%	108.88	22.81%
6.2	Shallow Argillite KH	m/d	2.892967007	126.33	15.29%	104.99	25.86%	108.41	22.28%
6.3	Shallow Argillite KH	m/d	1.462478013	124.59	13.71%	103.08	23.57%	106.68	20.33%
-	Shallow Argillite KH	m/d	0.03198902	109.57	-	83.42	-	88.66	-
6.4	Shallow Argillite KH	m/d	0.021337533	109.82	0.23%	83.28	-0.17%	89.33	0.76%
6.5	Shallow Argillite KH	m/d	0.010686047	112.51	2.68%	86.30	3.45%	93.81	5.81%
6.6	Shallow Argillite KH	m/d	0.00003456	134.12	22.40%	107.32	28.65%	117.96	33.05%
7.1	Deep Argillite K_H	m/d	0.16416	109.58	0.01%	84.08	0.79%	89.38	0.81%
7.2	Deep Argillite K_H	m/d	0.109535688	109.55	-0.02%	83.99	0.68%	89.27	0.69%
7.3	Deep Argillite K_H	m/d	0.054911376	109.48	-0.08%	83.80	0.45%	89.07	0.47%
-	Deep Argillite K_H	m/d	0.000287065	109.57	-	83.42	-	88.66	-
7.4	Deep Argillite KH	m/d	0.000194256	109.55	-0.02%	83.38	-0.04%	88.61	-0.05%
7.5	Deep Argillite KH	m/d	0.000101448	109.50	-0.07%	83.31	-0.13%	88.54	-0.13%
7.6	Deep Argillite KH	m/d	0.00000864	109.30	-0.25%	83.10	-0.39%	88.37	-0.32%

Table 6.5

Model Calibration Sensitivity Analysis
Atlantic Gold Corporation
Marinette, Nova Scotia

				Dry Condition		Base Case Condition		Wet Condition	
Sensitivity Analysis Simulation No.	Parameter	Units	Parameter Value For Sensitivity Simulation	Sensitivity Simulation RSS_{SENS} (ft^2)	Percent Change in RSS From Calibrated Model ΔRSS_{SENS}(1) (%)	Sensitivity Simulation RSS_{SENS} (ft^2)	Percent Change in RSS From Calibrated Model ΔRSS_{SENS}(1) (%)	Sensitivity Simulation RSS_{SENS} (ft^2)	Percent Change in RSS From Calibrated Model ΔRSS_{SENS}(1) (%)
8.1	Shallow Mud Lake Fault Zone K_H	m/d	4.323456	125.40	14.44%	105.18	26.09%	102.92	16.09%
8.2	Shallow Mud Lake Fault Zone K_H	m/d	2.892938383	122.95	12.21%	101.72	21.94%	99.97	12.76%
8.3	Shallow Mud Lake Fault Zone K_H	m/d	1.462420767	119.45	9.01%	96.99	16.26%	96.40	8.74%
-	Shallow Mud Lake Fault Zone K_H	m/d	0.03190315	109.57	-	83.42	-	88.66	-
8.4	Shallow Mud Lake Fault Zone K_H	m/d	0.021280287	108.99	-0.53%	82.66	-0.91%	89.65	1.12%
8.5	Shallow Mud Lake Fault Zone K_H	m/d	0.010657423	109.77	0.18%	83.58	0.19%	95.44	7.65%
8.6	Shallow Mud Lake Fault Zone K_H	m/d	0.00003456	136.82	24.87%	125.33	50.24%	168.04	89.54%
9.1	Deep Mud Lake Fault Zone K_H	m/d	0.16416	116.15	6.00%	89.99	7.88%	90.29	1.85%
9.2	Deep Mud Lake Fault Zone K_H	m/d	0.109535599	114.29	4.31%	88.10	5.61%	89.53	0.99%
9.3	Deep Mud Lake Fault Zone K_H	m/d	0.054911199	112.06	2.27%	85.95	3.03%	88.90	0.27%
-	Deep Mud Lake Fault Zone K_H	m/d	0.000286798	109.57	-	83.42	-	88.66	-
9.4	Deep Mud Lake Fault Zone K_H	m/d	0.000194079	109.53	-0.04%	83.34	-0.09%	88.57	-0.09%
9.5	Deep Mud Lake Fault Zone K_H	m/d	0.000101359	109.39	-0.17%	83.14	-0.34%	88.37	-0.32%
9.6	Deep Mud Lake Fault Zone K_H	m/d	0.00000864	108.15	-1.30%	81.82	-1.92%	87.37	-1.45%
10.1	Shallow Cameron Flowage Fault Zone K_H	m/d	4.323456	124.72	13.82%	99.73	19.55%	96.87	9.26%
10.2	Shallow Cameron Flowage Fault Zone K_H	m/d	2.89453457	123.18	12.42%	97.84	17.29%	95.42	7.63%
10.3	Shallow Cameron Flowage Fault Zone K_H	m/d	1.46561314	120.38	9.86%	94.58	13.38%	93.18	5.10%
-	Shallow Cameron Flowage Fault Zone K_H	m/d	0.03669171	102.93	-	83.42	-	88.66	-
10.4	Shallow Cameron Flowage Fault Zone K_H	m/d	0.02447266	108.74	-0.76%	82.68	-0.89%	88.87	0.24%
10.5	Shallow Cameron Flowage Fault Zone K_H	m/d	0.01225361	107.48	-1.91%	81.71	-2.05%	89.88	1.38%
10.6	Shallow Cameron Flowage Fault Zone K_H	m/d	0.00003456	106.85	-2.48%	83.90	0.57%	101.98	15.03%
11.1	Deep Cameron Flowage Fault Zone K_H	m/d	0.16416	111.95	2.17%	85.96	3.05%	88.29	-0.41%
11.2	Deep Cameron Flowage Fault Zone K_H	m/d	0.109535818	111.13	1.42%	85.11	2.03%	88.03	-0.71%
11.3	Deep Cameron Flowage Fault Zone K_H	m/d	0.054911636	110.03	0.42%	84.01	0.71%	87.80	-0.96%
-	Deep Cameron Flowage Fault Zone K_H	m/d	0.000287454	102.93	-	83.42	-	88.66	-
11.4	Deep Cameron Flowage Fault Zone K_H	m/d	0.000194516	109.59	0.02%	83.43	0.01%	88.70	0.05%
11.5	Deep Cameron Flowage Fault Zone K_H	m/d	0.000101578	109.58	0.01%	83.41	-0.01%	88.76	0.12%
11.6	Deep Cameron Flowage Fault Zone K_H	m/d	0.00000864	109.59	0.02%	83.39	-0.04%	89.14	0.55%

Table 6.5

Model Calibration Sensitivity Analysis
Atlantic Gold Corporation
Marinette, Nova Scotia

Sensitivity Analysis Simulation No.	Parameter	Units	Parameter Value For Sensitivity Simulation	Dry Condition: Sensitivity Simulation RSS_{SENS} (ft^2)	Dry Condition: Percent Change in RSS From Calibrated Model ΔRSS_{SENS} (1) (%)	Base Case Condition: Sensitivity Simulation RSS_{SENS} (ft^2)	Base Case Condition: Percent Change in RSS From Calibrated Model ΔRSS_{SENS} (1) (%)	Wet Condition: Sensitivity Simulation RSS_{SENS} (ft^2)	Wet Condition: Percent Change in RSS From Calibrated Model ΔRSS_{SENS} (1) (%)
12.1	River Conductivity K_H	m/d	33.0048	109.56	-0.01%	83.42	0.00%	88.67	0.01%
12.2	River Conductivity K_H	m/d	29.01956667	109.56	-0.01%	83.42	0.00%	88.66	0.01%
12.3	River Conductivity K_H	m/d	25.03433333	109.57	0.00%	83.42	0.00%	88.66	0.01%
-	River Conductivity K_H	m/d	21.0491	109.57	-	83.42	-	88.66	-
12.4	River Conductivity K_H	m/d	14.05024661	109.58	0.01%	83.41	-0.01%	88.64	-0.01%
12.5	River Conductivity K_H	m/d	7.051393227	109.60	0.03%	83.40	-0.02%	88.62	-0.04%
12.6	River Conductivity K_H	m/d	0.05253984	110.09	0.47%	82.82	-0.72%	86.62	-2.29%
13.1	Dry Condition Recharge	mm/yr	376.7510574	434.20	296.27%	83.42	0.00%	88.66	0.00%
13.2	Dry Condition Recharge	mm/yr	316.7393637	256.29	133.90%	83.42	0.00%	88.66	0.00%
13.3	Dry Condition Recharge	mm/yr	256.7276699	146.70	33.88%	83.42	0.00%	88.66	0.00%
-	Dry Condition Recharge	mm/yr	196.7159762	109.57	-	83.42	-	88.66	-
13.4	Dry Condition Recharge	mm/yr	156.655428	131.18	19.72%	83.42	0.00%	88.66	0.00%
13.5	Dry Condition Recharge	mm/yr	116.5948797	200.84	83.29%	83.42	0.00%	88.66	0.00%
13.6	Dry Condition Recharge	mm/yr	76.53433147	349.55	219.01%	83.42	0.00%	88.66	0.00%
14.1	Base Case Recharge	mm/yr	376.7510574	109.57	0.00%	269.98	223.64%	88.66	0.00%
14.2	Base Case Recharge	mm/yr	327.7971749	109.57	0.00%	159.76	91.51%	88.66	0.00%
14.3	Base Case Recharge	mm/yr	278.8432925	109.57	0.00%	96.40	15.55%	88.66	0.00%
-	Base Case Recharge	mm/yr	229.88941	109.57	-	83.42	-	88.66	-
14.4	Base Case Recharge	mm/yr	178.7710505	109.57	0.00%	128.18	53.66%	88.66	0.00%
14.5	Base Case Recharge	mm/yr	127.652691	109.57	0.00%	251.02	200.91%	88.66	0.00%
14.6	Base Case Recharge	mm/yr	76.53433147	109.57	0.00%	500.86	500.41%	88.66	0.00%
15.1	Wet Condition Recharge	mm/yr	376.7510574	109.57	0.00%	83.42	0.00%	242.13	173.11%
15.2	Wet Condition Recharge	mm/yr	336.0207198	109.57	0.00%	83.42	0.00%	157.55	77.71%
15.3	Wet Condition Recharge	mm/yr	295.2903823	109.57	0.00%	83.42	0.00%	105.54	19.05%
-	Wet Condition Recharge	mm/yr	254.5600447	109.57	-	83.42	-	88.66	-
15.4	Wet Condition Recharge	mm/yr	195.2181403	109.57	0.00%	83.42	0.00%	132.69	49.67%
15.5	Wet Condition Recharge	mm/yr	135.8762359	109.57	0.00%	83.42	0.00%	275.53	210.79%
15.6	Wet Condition Recharge	mm/yr	76.53433147	109.57	0.00%	83.42	0.00%	584.16	558.91%

Notes:

ft^2 Square feet
m/d Metres per day
mm/yr Millimetres per year
RSS Residual Sum of Squares
(light blue shading) Results for calibrated model
(green shading) The RSS for a given model improves by over 1% relative to the calibrated model
(1) Change in RSS from calibrated model is calculated as RSS_{SENS} minus RSS_{CALIB}. A negative change represents a reduction in the RSS from that of the calibrated model.

Table 7.1

Source Concentrations
Atlantic Gold Corporation
Marinette, Nova Scotia

		BD Pit walls				**NAG WRSF**			
		Base Case	Upper Case	Base Case	Upper Case	Base Case	Upper Case	Base Case	Upper Case
		EOM		PC		EOM		PC	
Sulphate	**mg/L**	433	541	333	344	631	873	414	445
Al	**mg/L**	0.0058	0.0058	0.0058	0.0058	0.0058	0.0059	0.0058	0.0058
Ag	**mg/L**	0.000070	0.000080	0.000070	0.000070	0.000050	0.00010	0.000050	0.00010
As	**mg/L**	0.018	0.023	0.0074	0.0089	0.018	0.023	0.0071	0.0083
Ca	**mg/L**	83	74	96	94	70	61	86	82
Cd	**mg/L**	0.000010	0.000020	0.000090	0.00012	0.000030	0.000050	0.000040	0.000060
B	**mg/L**	0.15	0.22	0.086	0.11	0.025	0.050	0.025	0.050
Co	**mg/L**	0.0024	0.0034	0.0096	0.015	0.0026	0.0037	0.0029	0.0038
Cr	**mg/L**	0.00050	0.0010	0.00050	0.0010	0.00050	0.0010	0.00050	0.0010
Cu	**mg/L**	0.0010	0.0020	0.0010	0.0020	0.0010	0.0020	0.0010	0.0020
Fe	**mg/L**	0.0040	0.0041	0.0040	0.0040	0.0041	0.0042	0.0040	0.0040
Hg	**mg/L**	0.000010	0.000010	0.000010	0.000010	0.000010	0.000010	0.000010	0.000010
K	**mg/L**	41	57	20	21	45	63	25	27
Mg	**mg/L**	26	32	12	12	59	73	29	30
Mn	**mg/L**	0.035	0.042	0.043	0.046	0.085	0.10	0.11	0.12
Mo	**mg/L**	0.048	0.11	0.21	0.23	0.015	0.033	0.059	0.064
Na	**mg/L**	56	97	31	37	101	190	48	64
Ni	**mg/L**	0.039	0.050	0.17	0.44	0.035	0.046	0.024	0.040
Pb	**mg/L**	0.00045	0.0011	0.0016	0.0096	0.00025	0.00050	0.00025	0.00050
Sb	**mg/L**	0.00024	0.00052	0.00013	0.00024	0.00023	0.00049	0.00013	0.00027
Se	**mg/L**	0.00094	0.0016	0.00045	0.0017	0.0015	0.0027	0.00071	0.0021
Tl	**mg/L**	0.000050	0.00010	0.000050	0.000080	0.000050	0.00010	0.000050	0.00010
U	**mg/L**	0.049	0.063	0.016	0.018	0.026	0.033	0.0068	0.0075
Zn	**mg/L**	0.0044	0.0051	0.096	0.25	0.0077	0.0086	0.0076	0.013
Nitrate[(1)]	**mg/L**	5.5	18	N/A	N/A	22.2	40.3	N/A	N/A
Nitrite[(1)]	**mg/L**	0.17	0.54	N/A	N/A	0.51	0.93	N/A	N/A
Ammonia[(1)]	**mg/L**	1	6.9	N/A	N/A	2.8	5.1	N/A	N/A

		PAG WRSF				**Low-Grade Ore**			
		Base Case	Upper Case	Base Case	Upper Case	Base Case	Upper Case	Base Case	Upper Case
		EOM		PC		EOM		PC	
Sulphate	**mg/L**	638	872	701	856	582	758	565	564
Al	**mg/L**	0.0058	0.0059	0.13	0.14	0.0058	0.0058	0.027	0.051
Ag	**mg/L**	0.000050	0.00010	0.00012	0.00012	0.000050	0.00010	0.00014	0.00014
As	**mg/L**	0.017	0.022	0.035	0.041	0.016	0.027	0.0084	0.012
Ca	**mg/L**	70	61	67	62	73	65	74	73
Cd	**mg/L**	0.000030	0.000060	0.012	0.016	0.000040	0.000071	0.0039	0.0045
B	**mg/L**	0.025	0.050	0.30	0.42	0.025	0.050	0.31	0.47
Co	**mg/L**	0.0029	0.0041	0.80	1.0	0.0019	0.0026	0.25	0.24
Cr	**mg/L**	0.00050	0.0010	0.0015	0.0034	0.00050	0.0010	0.0015	0.0025
Cu	**mg/L**	0.0010	0.0020	0.032	0.077	0.0010	0.0020	0.0082	0.011
Fe	**mg/L**	0.0041	0.0042	13	46	0.0041	0.0041	0.13	0.40
Hg	**mg/L**	0.000010	0.000010	0.000010	0.000010	0.000010	0.000010	0.000020	0.000020
K	**mg/L**	48	67	27	28	53	82	40	44
Mg	**mg/L**	62	76	79	84	60	76	62	50
Mn	**mg/L**	0.088	0.11	1.1	1.2	0.11	0.13	0.56	0.64
Mo	**mg/L**	0.014	0.032	0.0028	0.0032	0.011	0.025	0.0090	0.0070
Na	**mg/L**	97	181	72	113	67	115	42	62
Ni	**mg/L**	0.039	0.052	8.0	12	0.028	0.032	2.7	2.5
Pb	**mg/L**	0.00025	0.00050	0.14	0.31	0.00025	0.00050	0.032	0.044
Sb	**mg/L**	0.00020	0.00044	0.00012	0.00028	0.00034	0.00081	0.00014	0.00033
Se	**mg/L**	0.0015	0.0027	0.0055	0.012	0.0018	0.0025	0.0020	0.0026
Tl	**mg/L**	0.000050	0.00010	0.00088	0.0011	0.000050	0.00010	0.00047	0.00038
U	**mg/L**	0.019	0.024	0.048	0.053	0.015	0.017	0.017	0.019
Zn	**mg/L**	0.0076	0.0082	6.0	8.4	0.0070	0.014	1.2	2.1
Nitrate[(1)]	**mg/L**	6.7	13.1	N/A	N/A	10.5	21.5	N/A	N/A
Nitrite[(1)]	**mg/L**	0.15	0.3	N/A	N/A	0.24	0.49	N/A	N/A
Ammonia[(1)]	**mg/L**	0.8	1.7	N/A	N/A	1.3	2.7	N/A	N/A

		Topsoil Stockpile		**Till Stockpile**	
		Base Case	Upper Case	Base Case	Upper Case
		EOM/PC		EOM/PC	
Sulphate	**mg/L**	9.0	33	65	127
Al	**mg/L**	0.081	0.83	0.0078	0.11
Ag	**mg/L**	0.000030	0.000030	0.000030	0.000030
As	**mg/L**	0.0038	0.19	0.0021	0.0076
Ca	**mg/L**	1.0	5.7	22	41
Cd	**mg/L**	0.000030	0.00016	0.000030	0.000040
B	**mg/L**	0.0050	0.011	0.0050	0.011
Co	**mg/L**	0.00084	0.0050	0.00019	0.00097
Cr	**mg/L**	0.00088	0.0012	0.00025	0.00098
Cu	**mg/L**	0.0014	0.0064	0.0020	0.0034
Fe	**mg/L**	0.26	0.46	0.023	0.16
Hg	**mg/L**	0.000030	0.000030	0.000030	0.000030
K	**mg/L**	0.79	2.4	0.81	1.3
Mg	**mg/L**	0.47	1.1	2.3	5.5
Mn	**mg/L**	0.11	0.12	0.11	0.30
Mo	**mg/L**	0.000050	0.00016	0.0027	0.012
Na	**mg/L**	1.6	3.3	3.6	2.4
Ni	**mg/L**	0.0015	0.022	0.00046	0.0015
Pb	**mg/L**	0.00013	0.0011	0.00010	0.00019
Sb	**mg/L**	0.000050	0.00011	0.00020	0.00051
Se	**mg/L**	0.00079	0.00095	0.00058	0.0014
Tl	**mg/L**	0.000050	0.000050	0.000050	0.000050
U	**mg/L**	0.000090	0.00010	0.000090	0.00099
Zn	**mg/L**	0.0050	0.032	0.0050	0.0050
Nitrate[(1)]	**mg/L**	N/A	N/A	N/A	N/A
Nitrite[(1)]	**mg/L**	N/A	N/A	N/A	N/A
Ammonia[(1)]	**mg/L**	N/A	N/A	N/A	N/A

Note:

mg/L Milligrams per liter
(1) Nitrate, Nitrite, and Ammonia are assigned a post-closure annual decay rate of 24%, 38%, 38% and 80% for the NAG WRSF, PAG WRSF, Low-Grade Ore Stockpile and Pit Walls, respectively.

Table 7.2

Predicted Pit Inflow Rates by Hydrostratigraphic Unit
Atlantic Gold Corporation
Marinette, Nova Scotia

Hydrostratigraphic Unit	Model Layer	Layer Thickness (m)	Dry Condition Pit Inflow (m^3/d)	Base Case Condition Pit Inflow (m^3/d)	Wet Condition Pit Inflow (m^3/d)
Overburden	1	Variable	-23	-47	-62
Shallow Bedrock	2	22	-359	-391	-414
Deep Bedrock	3 to 9	160	-150	-167	-179
		Total	**-531**	**-605**	**-655**

Notes:

m Metres
m^3/d Cubic metres per day

Table 7.3

Estimated Groundwater Inflow Rate into Open Pit
Atlantic Gold Corporation
Marinette, Nova Scotia

Top of Stage Elevation (masl)	Groundwater Inflow Rate into Open Pit (m^3/d)
127	385
120	541
110	584
100	592
90	594
80	597
70	599
60	600
50	601
40	602
30	603
20	604
10	604
0	604
-10	605
-20	605
-30	605

Notes:

masl Metres above sea level
m^3/d Cubic metres per day

Table 7.4

Simulated Change in Baseflow
Atlantic Gold Corporation
Marinette, Nova Scotia

	Simulated Baseflow Baseline Condition (m^3/d)	Simulated Baseflow EOM (m^3/d)	Simulated Baseflow Difference Baseline and EOM (m^3/d)	Percent Change EOM[(1)] (%)	Simulted BaseFlow PC (Stage 127m) (m^3/d)	Simulated Baseflow Difference Baseline and PC (m^3/d)	Percent Change PC[(1)] (%)
Base Case Condition							
Total Model Domain	-49,227	-48,498	-729	-1%	-48,679	-548	-1%
Cameron Flowage	-749	-446	-304	-41%	-582	-168	-22%
Killag River[(2)]	-4,058	-3,992	-67	-2%	-3,992	-66	-2%
Crusher Lake Area	-57	-58	1	1%	-58	1	2%
Mud Lake	-442	-242	-200	-45%	-272	-170	-39%
WC2	-53	-49	-4	-8%	-38	-15	-28%
WC3	-101	-85	-16	-16%	-82	-19	-19%
WC5	-415	-396	-19	-5%	-406	-10	-2%
WC19	-431	-425	-6	-1%	-425	-6	-1%
WC27	-78	-78	0	0%	-78	0	0%
Dry Condition							
Total Model Domain	-42,124	-41,446	-677	-2%	-41,678	-446	-1%
Cameron Flowage	-719	-445	-274	-38%	-579	-140	-20%
Killag River[(2)]	-3,446	-3,393	-53	-2%	-3,393	-53	-2%
Crusher Lake Area	-45	-46	1	2%	-47	1	3%
Mud Lake	-380	-214	-166	-44%	-243	-136	-36%
WC2	-44	-39	-5	-11%	-30	-14	-32%
WC3	-83	-70	-14	-16%	-69	-15	-17%
WC5	-355	-336	-19	-5%	-346	-9	-3%
WC19	-372	-367	-5	-1%	-367	-5	-1%
WC27	-64	-64	0	0%	-64	0	0%
Wet Condition							
Total Model Domain	-54,509	-53,756	-754	-1%	-53,890	-620	-1%
Cameron Flowage	-774	-452	-322	-42%	-590	-184	-24%
Killag River[(2)]	-4,322	-4,246	-76	-2%	-4,246	-76	-2%
Crusher Lake Area	-67	-67	0	0%	-67	0	0%
Mud Lake	-485	-262	-223	-46%	-292	-193	-40%
WC2	-60	-56	-4	-7%	-44	-16	-27%
WC3	-114	-96	-17	-15%	-91	-23	-20%
WC5	-458	-437	-20	-4%	-446	-11	-2%
WC19	-474	-467	-7	-1%	-467	-7	-1%
WC27	-86	-86	0	0%	-86	0	0%

Note:
m^3/d Cubic metres per day
(1) A negative (-) percentage indicates a predicted reduction in baseflow and a positive (+) percent indicates an increase in baseflow
(2) Killag River refers to the section of the Killag River downstream of Cameron Flowage and within the groundwater model flow domain

Table 7.5

Simulated COC Loading to Surface Water from Groundwater
Atlantic Gold Corporation
Marinette, Nova Scotia

COC	Simulated EOM Loading - Base Case Source Term (kg/d)	Simulated EOM Loading - Upper Case Source Term (kg/d)	Simulated PC Loading - Base Case Source Term (kg/d)	Simulated PC Loading - Upper Case Source Term (kg/d)
Sulphate	8.71E+01	1.20E+02	1.09E+02	1.17E+02
Al	3.35E-03	2.72E-02	1.66E-03	1.68E-03
Ag	8.23E-06	1.52E-05	1.33E-05	2.65E-05
As	2.59E-03	9.24E-03	1.90E-03	2.23E-03
Ca	1.01E+01	9.17E+00	2.25E+01	2.15E+01
Cd	5.72E-06	1.29E-05	2.41E-05	3.37E-05
B	3.69E-03	7.44E-03	6.87E-03	1.36E-02
Co	3.69E-04	6.48E-04	1.66E-03	2.13E-03
Cr	9.92E-05	1.88E-04	1.33E-04	2.66E-04
Cu	2.06E-04	5.14E-04	2.99E-04	6.13E-04
Fe	8.77E-03	1.66E-02	1.55E-02	5.31E-02
Hg	2.66E-06	2.67E-06	2.65E-06	2.65E-06
K	6.53E+00	9.39E+00	6.70E+00	7.11E+00
Mg	8.27E+00	1.03E+01	7.54E+00	7.82E+00
Mn	1.72E-02	2.23E-02	3.01E-02	3.22E-02
Mo	1.95E-03	4.54E-03	1.54E-02	1.67E-02
Na	1.31E+01	2.44E+01	1.26E+01	1.69E+01
Ni	4.78E-03	6.73E-03	1.53E-02	2.37E-02
Pb	3.99E-05	1.06E-04	2.18E-04	4.80E-04
Sb	3.88E-05	8.61E-05	3.44E-05	7.15E-05
Se	2.51E-04	4.13E-04	1.93E-04	5.59E-04
Tl	9.08E-06	1.61E-05	1.42E-05	2.75E-05
U	3.23E-03	4.08E-03	1.84E-03	2.04E-03
Zn	1.26E-03	2.36E-03	8.72E-03	1.27E-02
Nitrate	2.87E+00	5.15E+00	5.82E+00	1.06E+01
Nitrite	2.46E-02	4.47E-02	1.34E-01	2.44E-01
Ammonia	4.58E-02	8.17E-02	7.34E-01	1.34E+00

Notes:
kg/d Kilograms per day

Table 7.6

Sensitivity Analysis of Simulated Pit Inflow Rate Relative to Calibrated Wet Condition
Atlantic Gold Corporation
Marinette, Nova Scotia

Sensitivity Analysis Scenario Under Wet Conditions	Pit Inflow (m^3/d)	Percent Increase in Pit Inflow	Increase in RSS[(1)]	Description of Sensitivity Analysis Scenario
Pit Conductance	-655	0%	N/A[(2)]	Pit conductance increased from 1000 to 2000
MLF-1	-678	3%	4%	Hydraulic conductivity of Mud Lake Fault increased by an order of magnitude
MLF-2	-815	24%	14%	Hydraulic conductivity of Mud Lake Fault increased by two orders of magnitude
CFF-2	-656	0%	8%	Hydraulic conductivity of Cameron Flowage Fault increased by two orders of magnitude
Deep Argillite	-667	2%	0%	Hydraulic conductivity of deep argillite unit increased by an order of magnitude
Deep Greywacke	-829	26%	9%	Hydraulic conductivity of deep greywacke unit increased by an order of magnitude
Shallow Argillite	-699	7%	11%	Hydraulic conductivity of shallow argillite unit increased by an order of magnitude
Shallow Greywacke[(3)]	-1,835	180%	661%	Hydraulic conductivity of shallow greywacke unit increased by an order of magnitude

Notes:

m^3/d Cubic metres per day
(1) Percent increase in Residual Sum of Square Errors (RSS) relative to the calibrated wet condition model.
(2) The wet calibrated model targets correspond to pre-development conditions, therefore it is not applicable to compare a post-development condition with pre-development calibration targets.
(3) Calibration statistics deteriorate significantly indicating that increasing the conductivity of the weathered fractured greywacke unit by an order of magnitude is not supported by observed groundwater elevation.

Table 7.7

Percent Change in Simulated COC Loadings to Surface Water from Groundwater - EOM
Atlantic Gold Corporation
Marinette, Nova Scotia

COC	Sens 1	Sens 2	Sens 3	Sens 4	Sens 5	Sens 6	Sens 7	Sens 8	Sens 9	Sens 10	Sens 11	Sens 12	Sens 13
Sulphate	0.00%	-0.02%	-0.01%	0.01%	-0.03%	-0.10%	-0.26%	-0.63%	0.55%	0.85%	-28.25%	-17.67%	0.01%
Al	0.00%	-0.06%	0.00%	0.05%	-0.15%	-0.54%	-1.31%	-3.11%	0.34%	0.54%	-18.36%	-9.79%	0.10%
Ag	-0.01%	-0.09%	-0.03%	0.07%	-0.11%	-0.41%	-1.13%	-3.40%	0.54%	0.83%	-25.77%	-15.90%	0.03%
As	0.00%	-0.02%	0.00%	0.01%	-0.04%	-0.12%	-0.30%	-0.74%	0.51%	0.79%	-28.06%	-17.46%	0.02%
Ca	0.00%	-0.05%	-0.02%	0.04%	-0.07%	-0.23%	-0.64%	-1.89%	0.55%	0.84%	-27.16%	-16.98%	0.01%
Cd	-0.01%	-0.13%	-0.04%	0.10%	-0.15%	-0.59%	-1.61%	-4.96%	0.52%	0.80%	-23.32%	-14.27%	0.04%
B	0.00%	-0.03%	-0.01%	0.02%	-0.05%	-0.17%	-0.45%	-1.22%	0.53%	0.83%	-27.25%	-16.96%	0.02%
Co	0.00%	-0.01%	0.00%	0.01%	-0.04%	-0.10%	-0.25%	-0.49%	0.58%	0.89%	-28.53%	-17.71%	0.02%
Cr	0.00%	-0.06%	-0.01%	0.05%	-0.10%	-0.36%	-0.94%	-2.58%	0.48%	0.75%	-24.34%	-14.67%	0.04%
Cu	-0.02%	-0.24%	-0.08%	0.18%	-0.26%	-1.06%	-2.92%	-9.29%	0.56%	0.88%	-22.70%	-13.77%	0.05%
Fe	0.01%	-0.08%	0.00%	0.06%	-0.18%	-0.66%	-1.60%	-3.77%	0.28%	0.46%	-15.62%	-7.59%	0.13%
Hg	-0.02%	-0.28%	-0.09%	0.22%	-0.32%	-1.30%	-3.55%	-11.20%	0.54%	0.85%	-20.49%	-12.09%	0.07%
K	0.00%	0.00%	0.00%	0.00%	-0.02%	-0.04%	-0.10%	-0.08%	0.54%	0.83%	-27.01%	-16.89%	0.01%
Mg	0.00%	-0.01%	0.00%	0.01%	-0.02%	-0.06%	-0.14%	-0.22%	0.55%	0.85%	-27.82%	-17.40%	0.01%
Mn	-0.01%	-0.16%	-0.05%	0.12%	-0.19%	-0.74%	-2.03%	-6.35%	0.53%	0.83%	-22.53%	-13.71%	0.04%
Mo	0.00%	-0.03%	-0.01%	0.02%	-0.05%	-0.16%	-0.43%	-1.19%	0.54%	0.84%	-29.32%	-18.34%	0.01%
Na	0.00%	-0.01%	0.00%	0.01%	-0.02%	-0.05%	-0.14%	-0.22%	0.55%	0.85%	-30.03%	-18.78%	0.01%
Ni	0.00%	0.00%	0.00%	0.00%	-0.02%	-0.04%	-0.10%	-0.06%	0.58%	0.90%	-28.96%	-18.09%	0.01%
Pb	0.00%	-0.06%	-0.02%	0.05%	-0.08%	-0.30%	-0.80%	-2.33%	0.53%	0.82%	-26.27%	-16.23%	0.03%
Sb	-0.01%	-0.12%	-0.04%	0.09%	-0.13%	-0.53%	-1.46%	-4.66%	0.50%	0.78%	-24.00%	-14.94%	0.02%
Se	0.00%	-0.05%	-0.02%	0.04%	-0.08%	-0.28%	-0.75%	-2.15%	0.51%	0.79%	-25.41%	-15.70%	0.02%
Tl	-0.01%	-0.13%	-0.04%	0.10%	-0.16%	-0.62%	-1.69%	-5.22%	0.54%	0.83%	-24.54%	-15.01%	0.04%
U	0.00%	0.00%	0.00%	0.00%	-0.01%	-0.02%	-0.06%	0.00%	0.47%	0.73%	-30.92%	-19.34%	0.01%
Zn	-0.01%	-0.09%	-0.03%	0.07%	-0.12%	-0.45%	-1.22%	-3.71%	0.54%	0.83%	-26.00%	-16.02%	0.03%
Nitrate	0.00%	0.00%	0.00%	0.00%	-0.01%	-0.01%	-0.02%	0.01%	0.32%	0.49%	-32.40%	-20.27%	0.00%
Nitrite	0.00%	0.00%	0.00%	0.00%	-0.01%	-0.01%	-0.02%	0.01%	0.31%	0.48%	-32.43%	-20.29%	0.00%
Ammonia	0.00%	0.00%	0.00%	0.00%	-0.01%	-0.01%	-0.02%	0.01%	0.31%	0.48%	-32.49%	-20.32%	0.00%
Average Change	**0.00%**	**-0.06%**	**-0.02%**	**0.05%**	**-0.09%**	**-0.33%**	**-0.89%**	**-2.57%**	**0.49%**	**0.76%**	**-26.30%**	**-16.16%**	**0.03%**
Minimum Change	**0.01%**	**0.00%**	**0.00%**	**0.22%**	**-0.01%**	**-0.01%**	**-0.02%**	**0.01%**	**0.58%**	**0.90%**	**-15.62%**	**-7.59%**	**0.13%**
Maximum Change	**-0.02%**	**-0.28%**	**-0.09%**	**0.00%**	**-0.32%**	**-1.30%**	**-3.55%**	**-11.20%**	**0.28%**	**0.46%**	**-32.49%**	**-20.32%**	**0.00%**

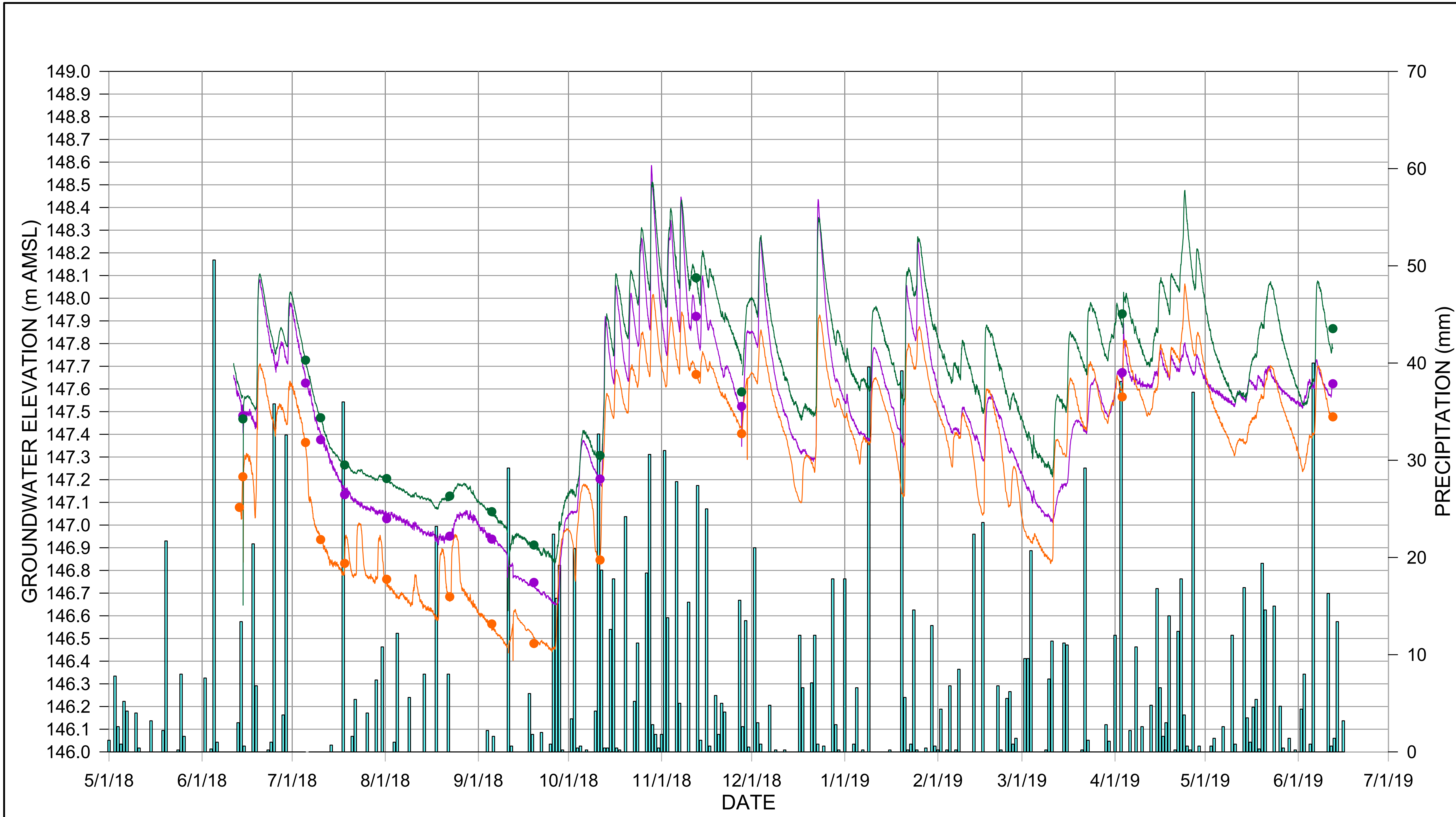
Table 7.8

Percent Change in Simulated COC Loadings to Surface Water from Groundwater - PC
Atlantic Gold Corporation
Marinette, Nova Scotia

COC	Sens 1	Sens 2	Sens 3	Sens 4	Sens 5	Sens 6	Sens 7	Sens 8	Sens 9	Sens 10	Sens 11	Sens 12	Sens 13
Sulphate	0.00%	0.00%	0.00%	0.00%	-0.08%	-0.14%	0.00%	-0.01%	0.22%	0.33%	4.35%	0.23%	0.00%
Al	0.00%	0.00%	-0.01%	-0.01%	-0.94%	-1.62%	-0.03%	-0.09%	0.79%	1.21%	3.99%	0.21%	0.08%
Ag	0.00%	0.00%	0.00%	0.00%	-0.11%	-0.19%	-0.01%	-0.01%	0.24%	0.36%	4.32%	0.22%	0.01%
As	0.00%	0.00%	0.00%	0.00%	-0.23%	-0.39%	-0.01%	-0.02%	0.32%	0.48%	4.28%	0.22%	0.02%
Ca	0.00%	0.00%	0.00%	0.00%	-0.04%	-0.07%	0.00%	-0.01%	0.19%	0.29%	4.37%	0.23%	0.00%
Cd	0.02%	0.03%	-0.04%	-0.08%	-6.10%	-10.52%	-0.21%	-0.56%	4.22%	6.50%	1.91%	0.10%	0.55%
B	0.00%	0.00%	-0.01%	-0.01%	-0.54%	-0.92%	-0.02%	-0.05%	0.52%	0.80%	4.19%	0.22%	0.05%
Co	0.02%	0.03%	-0.04%	-0.07%	-5.82%	-10.03%	-0.20%	-0.54%	4.03%	6.21%	2.02%	0.10%	0.52%
Cr	0.00%	0.00%	0.00%	0.00%	-0.14%	-0.23%	-0.01%	-0.01%	0.25%	0.39%	4.33%	0.22%	0.01%
Cu	0.00%	0.00%	-0.01%	-0.02%	-1.30%	-2.24%	-0.05%	-0.12%	1.03%	1.58%	3.84%	0.20%	0.12%
Fe	0.03%	0.05%	-0.07%	-0.13%	-10.10%	-17.41%	-0.35%	-0.93%	6.87%	10.60%	0.29%	0.01%	0.91%
Hg	0.00%	0.00%	0.00%	0.00%	-0.05%	-0.08%	0.00%	-0.01%	0.20%	0.30%	4.35%	0.23%	0.00%
K	0.00%	0.00%	0.00%	0.00%	-0.05%	-0.09%	0.00%	-0.01%	0.20%	0.30%	4.36%	0.23%	0.00%
Mg	0.00%	0.00%	0.00%	0.00%	-0.13%	-0.22%	-0.01%	-0.01%	0.25%	0.38%	4.33%	0.23%	0.01%
Mn	0.00%	0.00%	0.00%	-0.01%	-0.45%	-0.78%	-0.02%	-0.04%	0.47%	0.71%	4.19%	0.22%	0.04%
Mo	0.00%	0.00%	0.00%	0.00%	0.00%	-0.01%	0.00%	0.00%	0.17%	0.25%	4.37%	0.23%	0.00%
Na	0.00%	0.00%	0.00%	0.00%	-0.07%	-0.12%	0.00%	-0.01%	0.21%	0.32%	4.36%	0.23%	0.00%
Ni	0.02%	0.03%	-0.04%	-0.08%	-6.34%	-10.94%	-0.22%	-0.59%	4.38%	6.75%	1.81%	0.09%	0.57%
Pb	0.02%	0.04%	-0.05%	-0.10%	-7.57%	-13.05%	-0.27%	-0.70%	5.19%	8.00%	1.32%	0.07%	0.68%
Sb	0.00%	0.00%	0.00%	0.00%	-0.05%	-0.08%	0.00%	-0.01%	0.20%	0.29%	4.35%	0.23%	0.00%
Se	0.00%	0.00%	0.00%	-0.01%	-0.35%	-0.60%	-0.01%	-0.03%	0.39%	0.60%	4.23%	0.22%	0.03%
Tl	0.00%	0.00%	-0.01%	-0.01%	-0.75%	-1.30%	-0.03%	-0.07%	0.67%	1.02%	4.07%	0.21%	0.07%
U	0.00%	0.00%	0.00%	-0.01%	-0.32%	-0.55%	-0.01%	-0.03%	0.38%	0.58%	4.24%	0.22%	0.03%
Zn	0.03%	0.04%	-0.06%	-0.11%	-8.36%	-14.41%	-0.29%	-0.77%	5.71%	8.82%	1.00%	0.05%	0.75%
Nitrate	0.00%	0.00%	0.00%	0.00%	-0.02%	-0.03%	0.00%	0.00%	0.18%	0.26%	4.38%	0.23%	0.00%
Nitrite	0.00%	0.00%	0.00%	0.00%	-0.02%	-0.03%	0.00%	0.00%	0.18%	0.26%	4.38%	0.23%	0.00%
Ammonia	0.00%	0.00%	0.00%	0.00%	-0.02%	-0.03%	0.00%	0.00%	0.18%	0.26%	4.38%	0.23%	0.00%
Average Change	**0.00%**	**0.01%**	**-0.01%**	**-0.02%**	**-1.85%**	**-3.19%**	**-0.07%**	**-0.17%**	**1.39%**	**2.14%**	**3.63%**	**0.19%**	**0.16%**
Minimum Change	**0.03%**	**0.05%**	**0.00%**	**0.00%**	**0.00%**	**-0.01%**	**0.00%**	**0.00%**	**6.87%**	**10.60%**	**4.38%**	**0.23%**	**0.91%**
Maximum Change	**0.00%**	**0.00%**	**-0.07%**	**-0.13%**	**-10.10%**	**-17.41%**	**-0.35%**	**-0.93%**	**0.17%**	**0.25%**	**0.29%**	**0.01%**	**0.00%**

Appendices

Appendix A
Groundwater Elevation Hydrographs



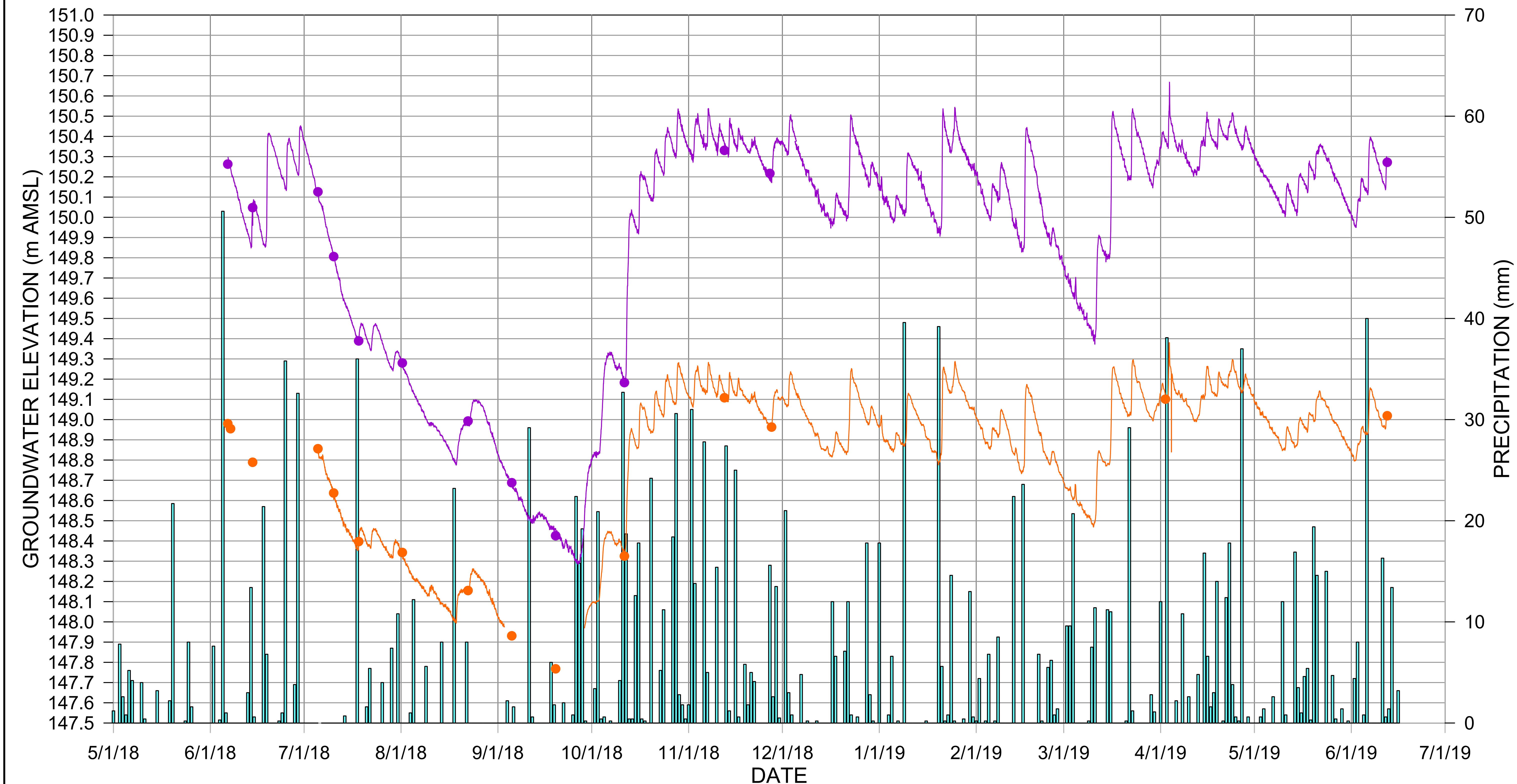
ATLANTIC GOLD CORPORATION
BEAVER DAM MINE PROJECT
MARTINETTE, NOVA SCOTIA

MW-01 WELL NEST
MEASURED GROUNDWATER ELEVATIONS

088664-031
Oct 28, 2019

FIGURE A.1

HEG file: Z:\HEG\088664\DOCUMENTATION\RPT\088664-RPT-13\FIGURES\Appendix A\Figure A.1 - MW-01 Hydrograph.grf



Legend

MW-02A PRECIPITATION (mm) MANUAL MEASUREMENTS

MW-02B

ATLANTIC GOLD CORPORATION
BEAVER DAM MINE PROJECT
MARTINETTE, NOVA SCOTIA

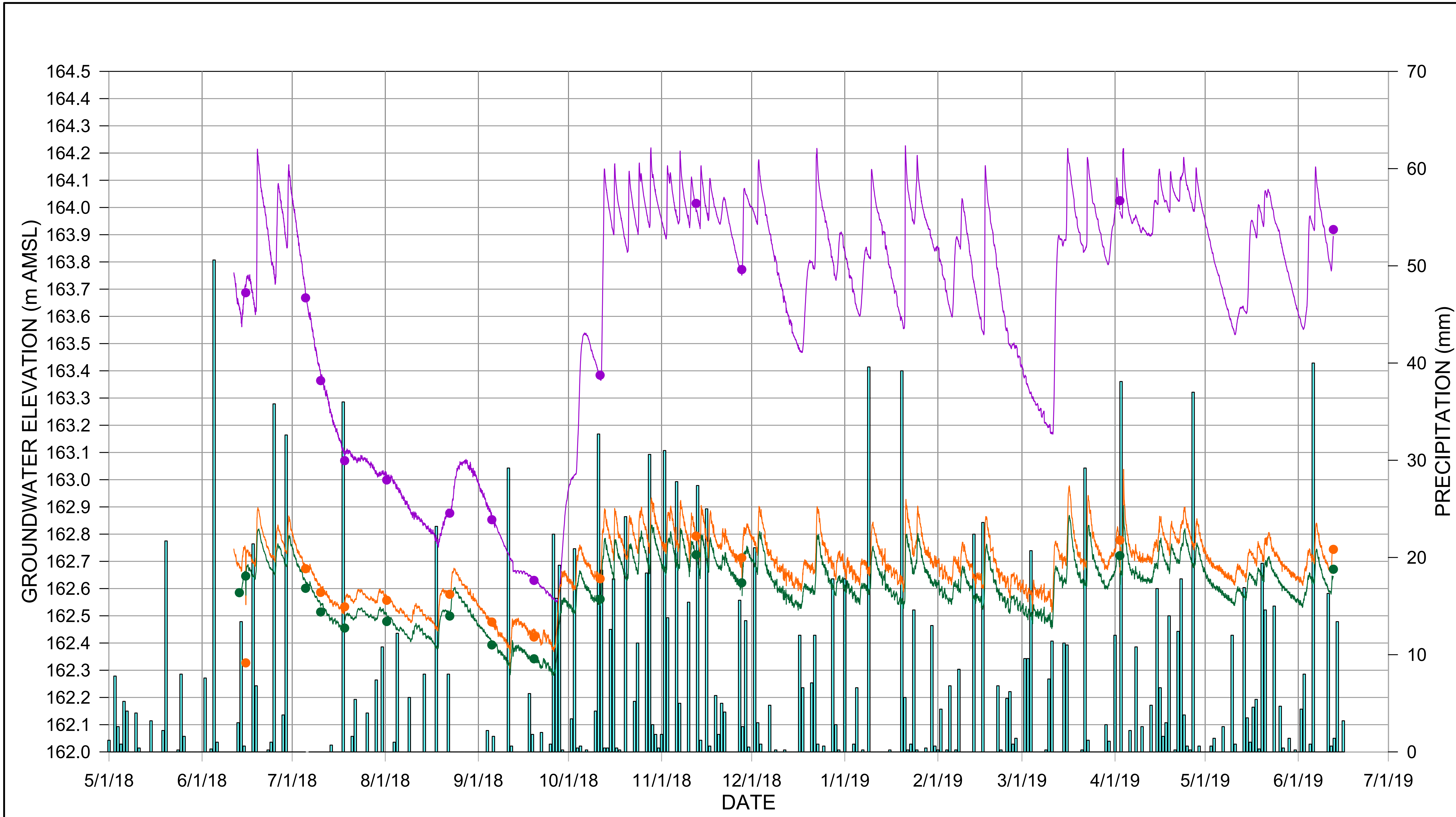
MW-02 WELL NEST
MEASURED GROUNDWATER ELEVATIONS

088664-031

Oct 28, 2019

FIGURE A.2

HEG file: Z:\HEG\088664\DOCUMENTATION\RPT\088664-RPT-13\FIGURES\APPENDIX A\Figure A.2 - MW-02 Hydrograph.grf



Legend

MW-03A MW-03C MANUAL MEASUREMENTS

MW-03B PRECIPITATION (mm)

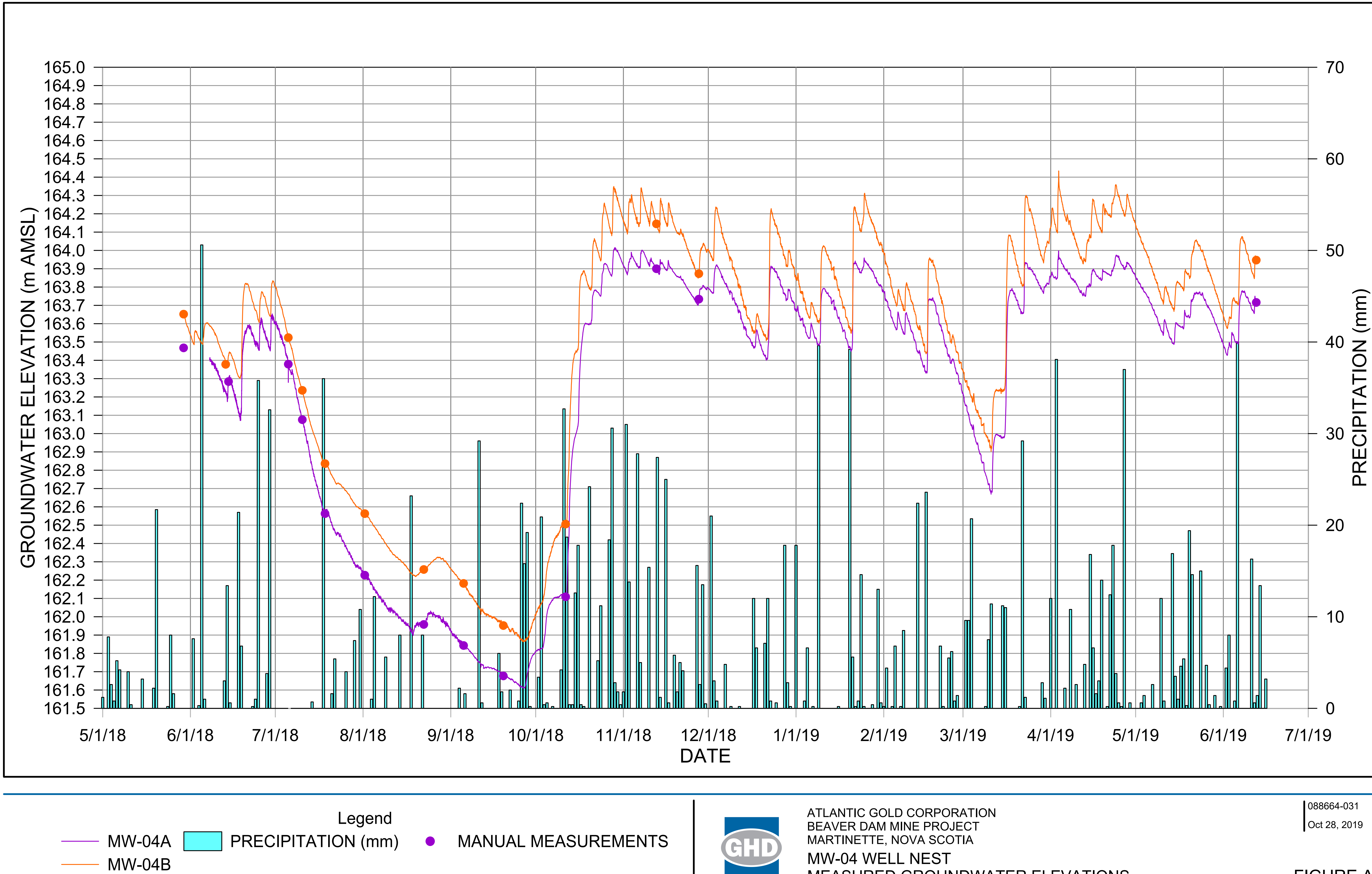
ATLANTIC GOLD CORPORATION
BEAVER DAM MINE PROJECT
MARTINETTE, NOVA SCOTIA

MW-03 WELL NEST
MEASURED GROUNDWATER ELEVATIONS

088664-031
Oct 28, 2019

FIGURE A.3

HEG file: Z:\HEG\088664\DOCUMENTATION\RPT\088664-RPT-13\FIGURES\Appendix A\Figure A.3 - MW-03 Hydrograph.grf



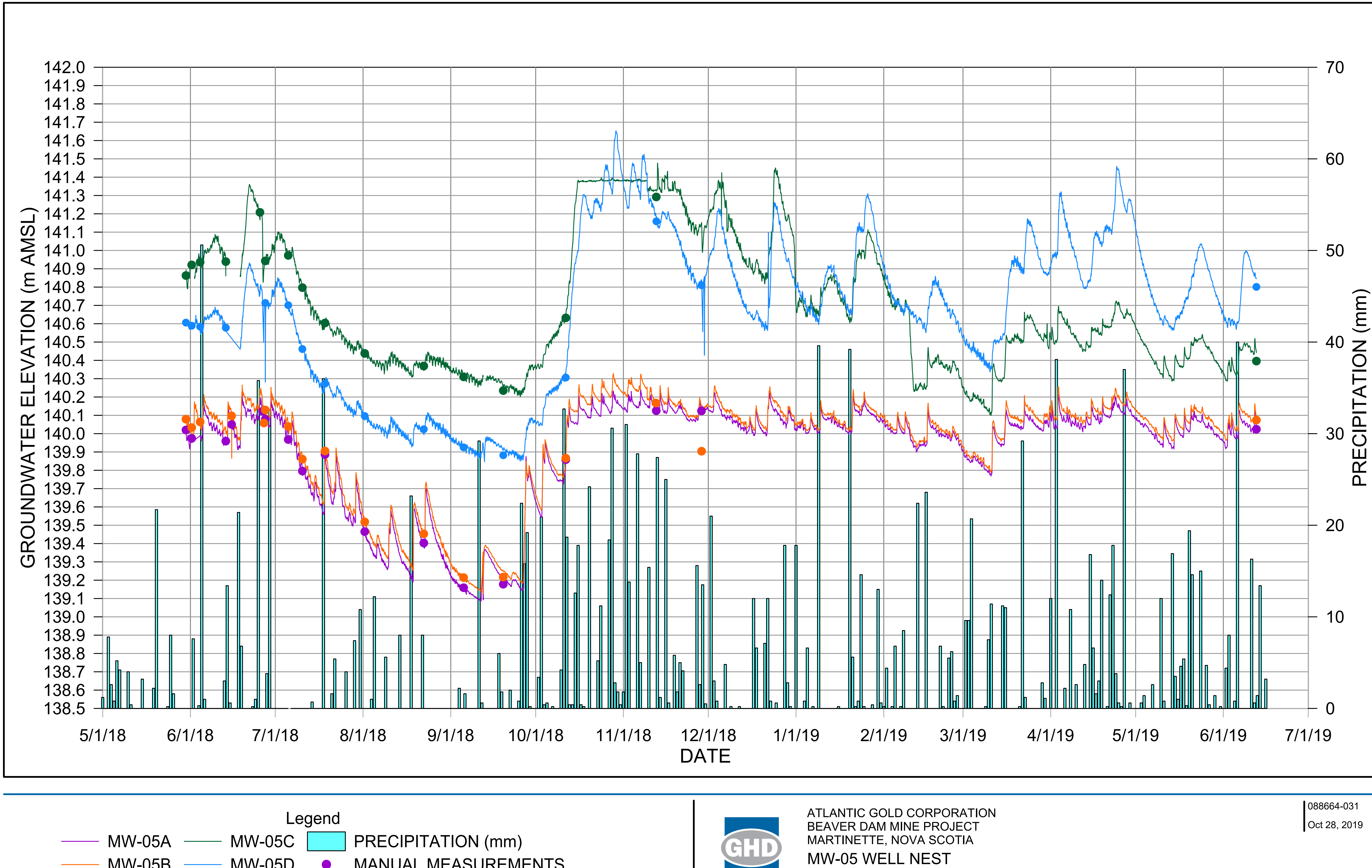
ATLANTIC GOLD CORPORATION
BEAVER DAM MINE PROJECT
MARTINETTE, NOVA SCOTIA

MW-04 WELL NEST
MEASURED GROUNDWATER ELEVATIONS

088664-031
Oct 28, 2019

FIGURE A.4

HEG file: Z:\HEG\088664\DOCUMENTATION\RPT\088664-RPT-13\FIGURES\Appendix A\Figure A.4 - MW-04 Hydrograph.grf



GHD

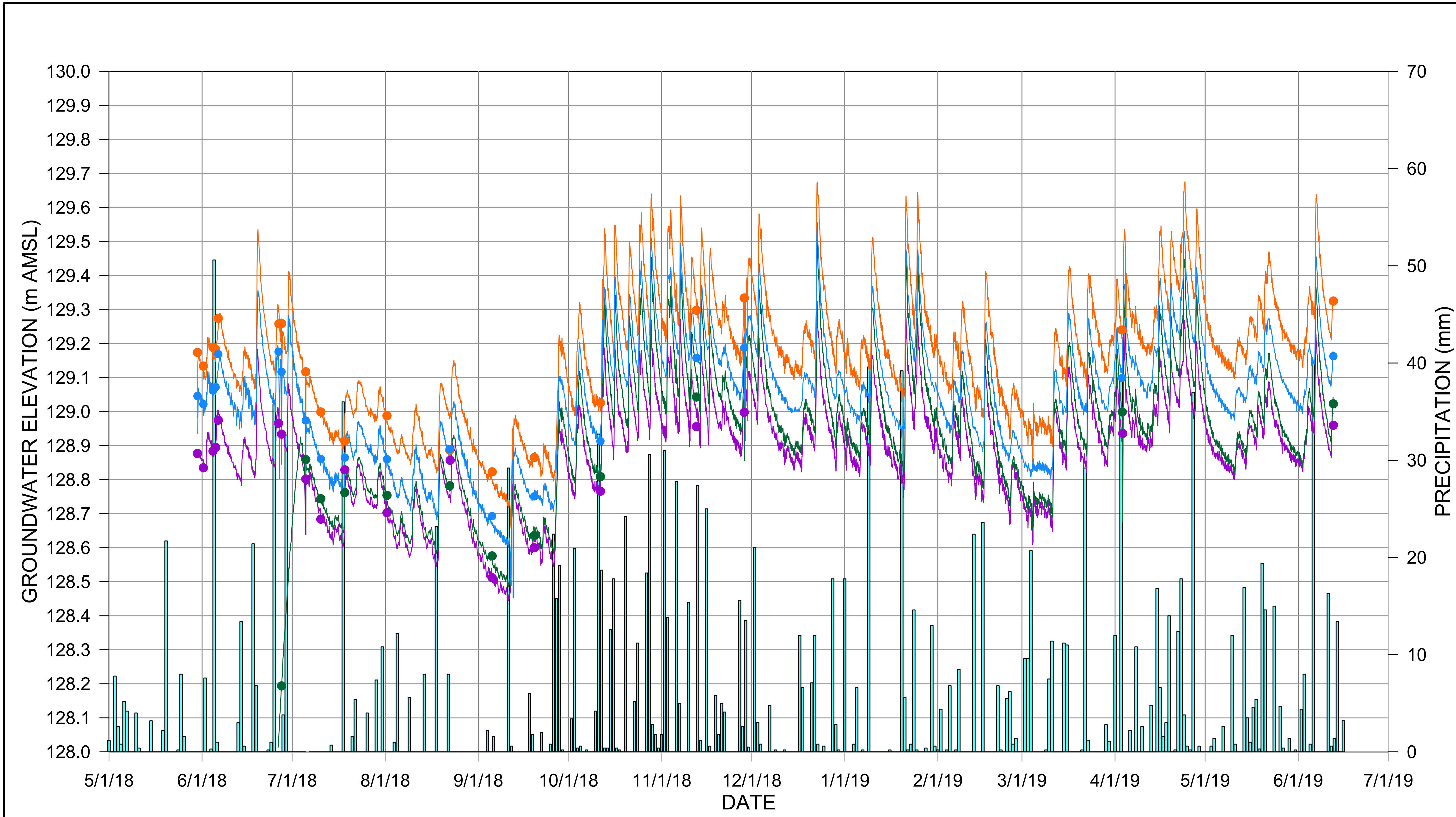
ATLANTIC GOLD CORPORATION
BEAVER DAM MINE PROJECT
MARTINETTE, NOVA SCOTIA

MW-05 WELL NEST
MEASURED GROUNDWATER ELEVATIONS

088664-031
Oct 28, 2019

FIGURE A.5

HEG file: Z:\HEG\088664\DOCUMENTATION\RPT\088664-RPT-13\FIGURES\Appendix A\Figure A.5 - MW-05 Hydrograph.grf



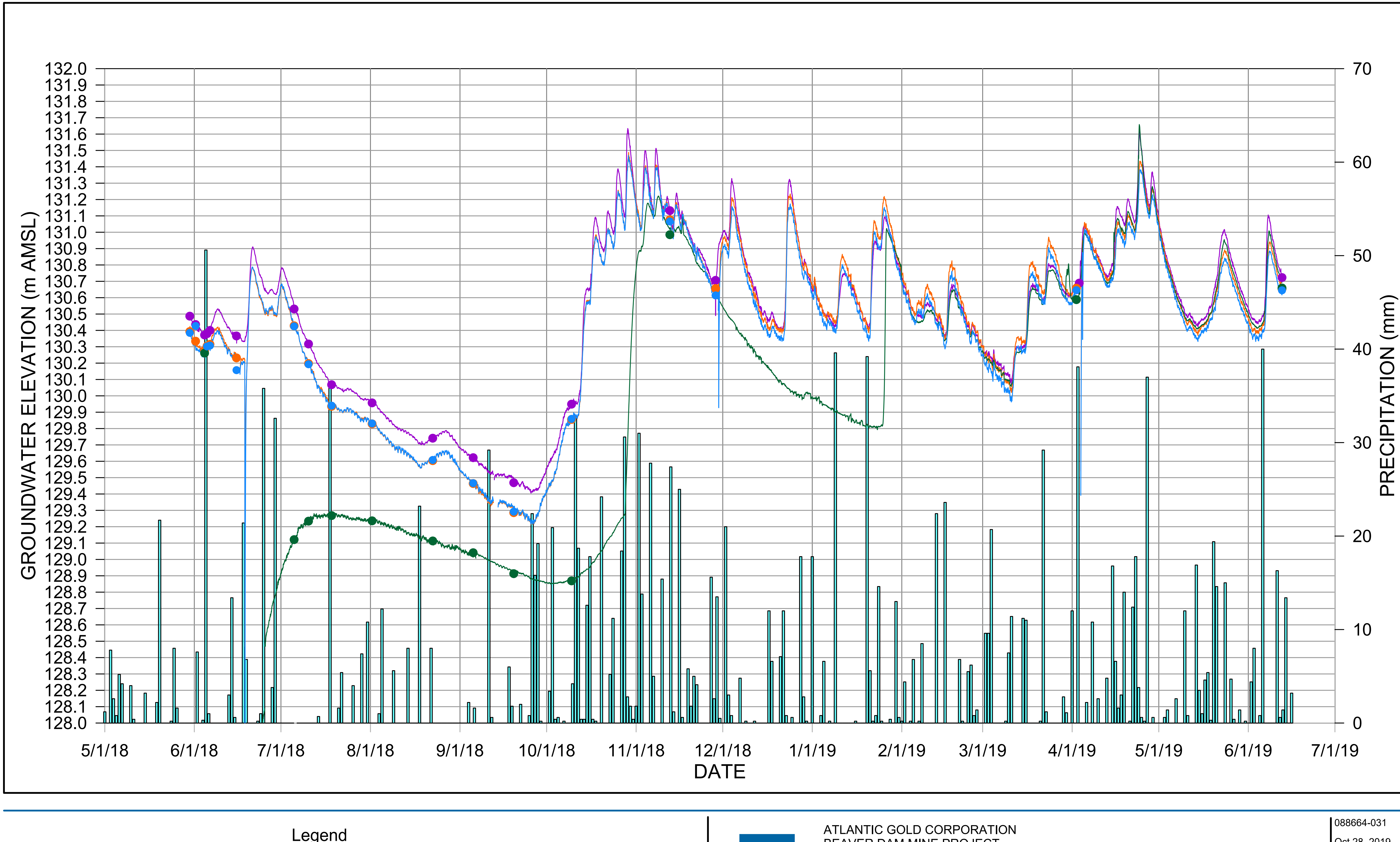
ATLANTIC GOLD CORPORATION
BEAVER DAM MINE PROJECT
MARTINETTE, NOVA SCOTIA

MW-07 WELL NEST
MEASURED GROUNDWATER ELEVATIONS

088664-031
Oct 28, 2019

FIGURE A.6

HEG file: Z:\HEG\088664\DOCUMENTATION\RPT\088664-RPT-13\FIGURES\Appendix A\Figure A.6 - MW-07 Hydrograph.grf



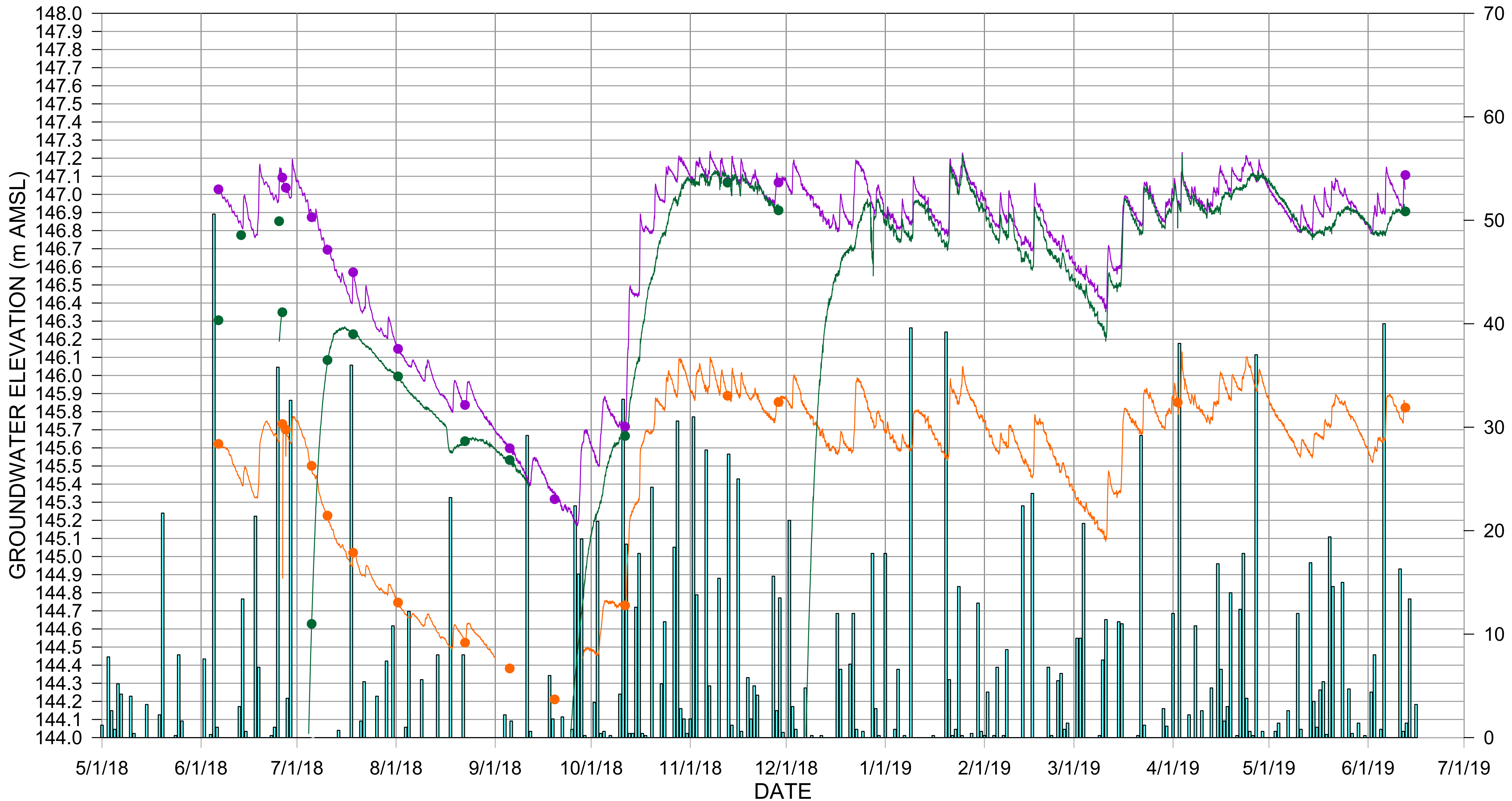
ATLANTIC GOLD CORPORATION
BEAVER DAM MINE PROJECT
MARTINETTE, NOVA SCOTIA

MW-09 WELL NEST
MEASURED GROUNDWATER ELEVATIONS

088664-031
Oct 28, 2019

FIGURE A.7

HEG file: Z:\HEG\088664\DOCUMENTATION\RPT\088664-RPT-13\FIGURES\Appendix A\Figure A.7 - MW-09 Hydrograph.grf



Legend

MW-11A
MW-11C
MANUAL MEASUREMENTS
MW-11B
PRECIPITATION (mm)

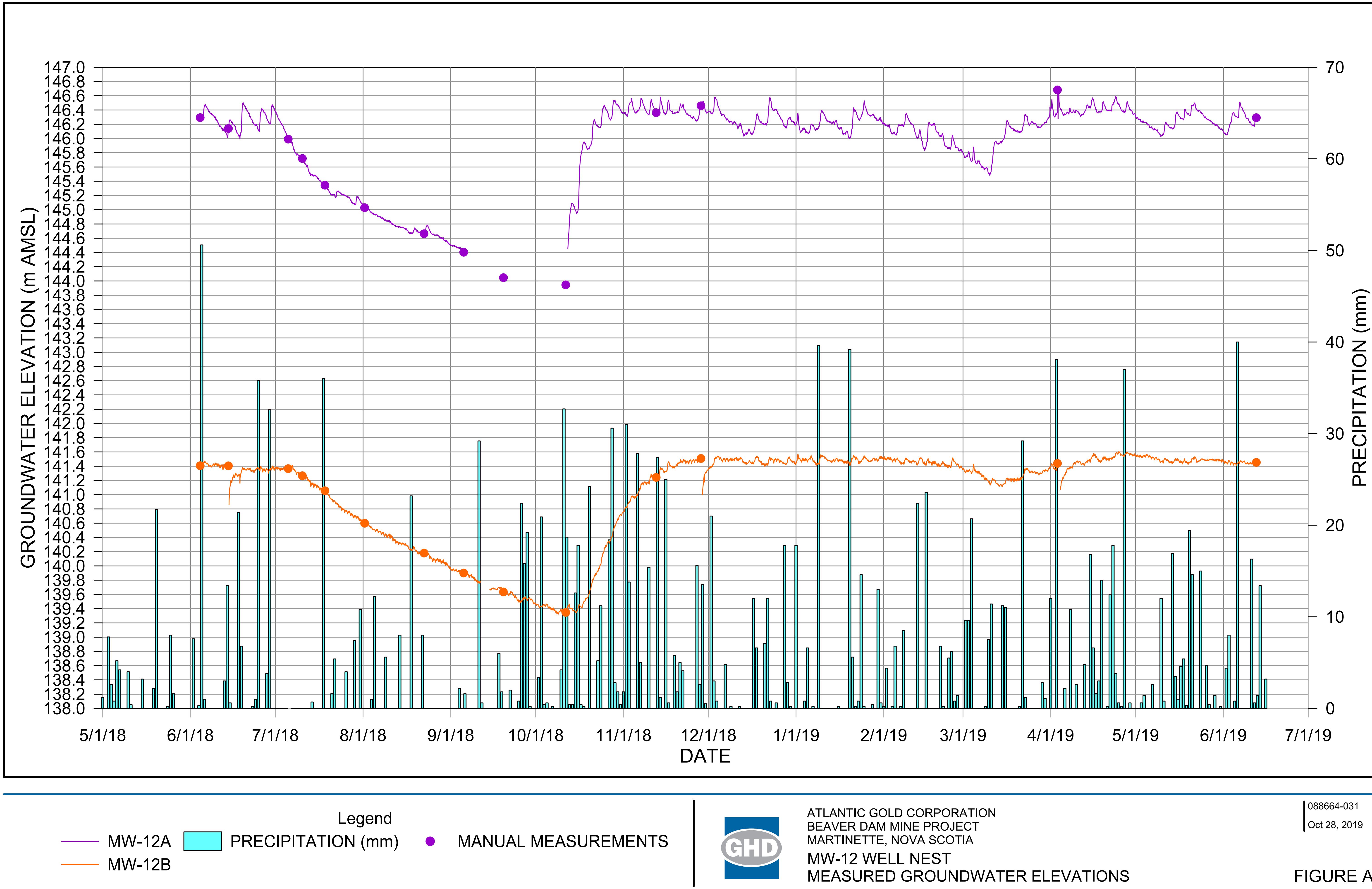
ATLANTIC GOLD CORPORATION
BEAVER DAM MINE PROJECT
MARTINETTE, NOVA SCOTIA

MW-11 WELL NEST
MEASURED GROUNDWATER ELEVATIONS

088664-031
Oct 28, 2019

FIGURE A.8

HEG file: Z:\HEG\088664\DOCUMENTATION\RPT\088664-RPT-13\FIGURES\Appendix A\Figure A.8 - MW-11 Hydrograph.grf

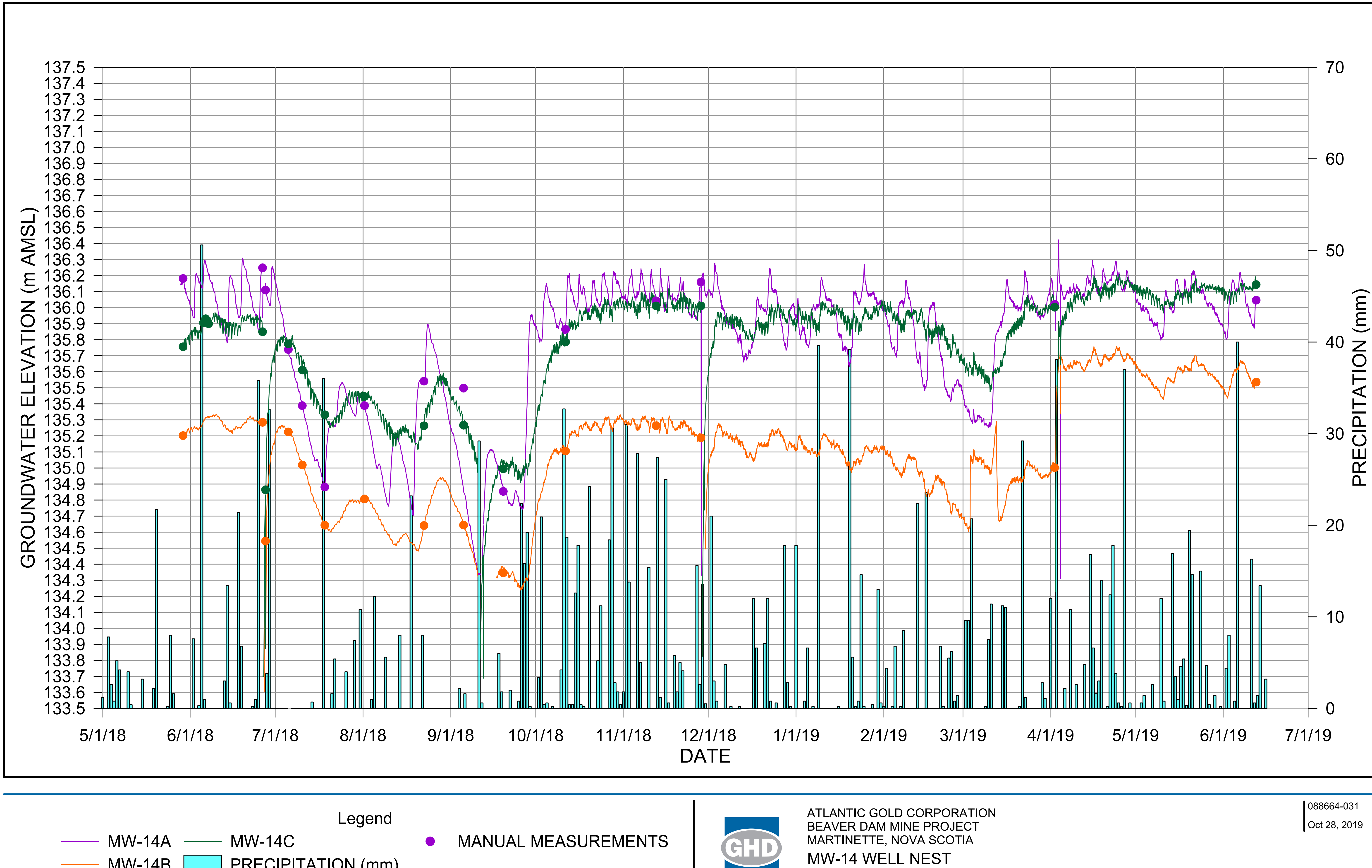


ATLANTIC GOLD CORPORATION
BEAVER DAM MINE PROJECT
MARTINETTE, NOVA SCOTIA

MW-12 WELL NEST
MEASURED GROUNDWATER ELEVATIONS

088664-031
Oct 28, 2019

FIGURE A.9



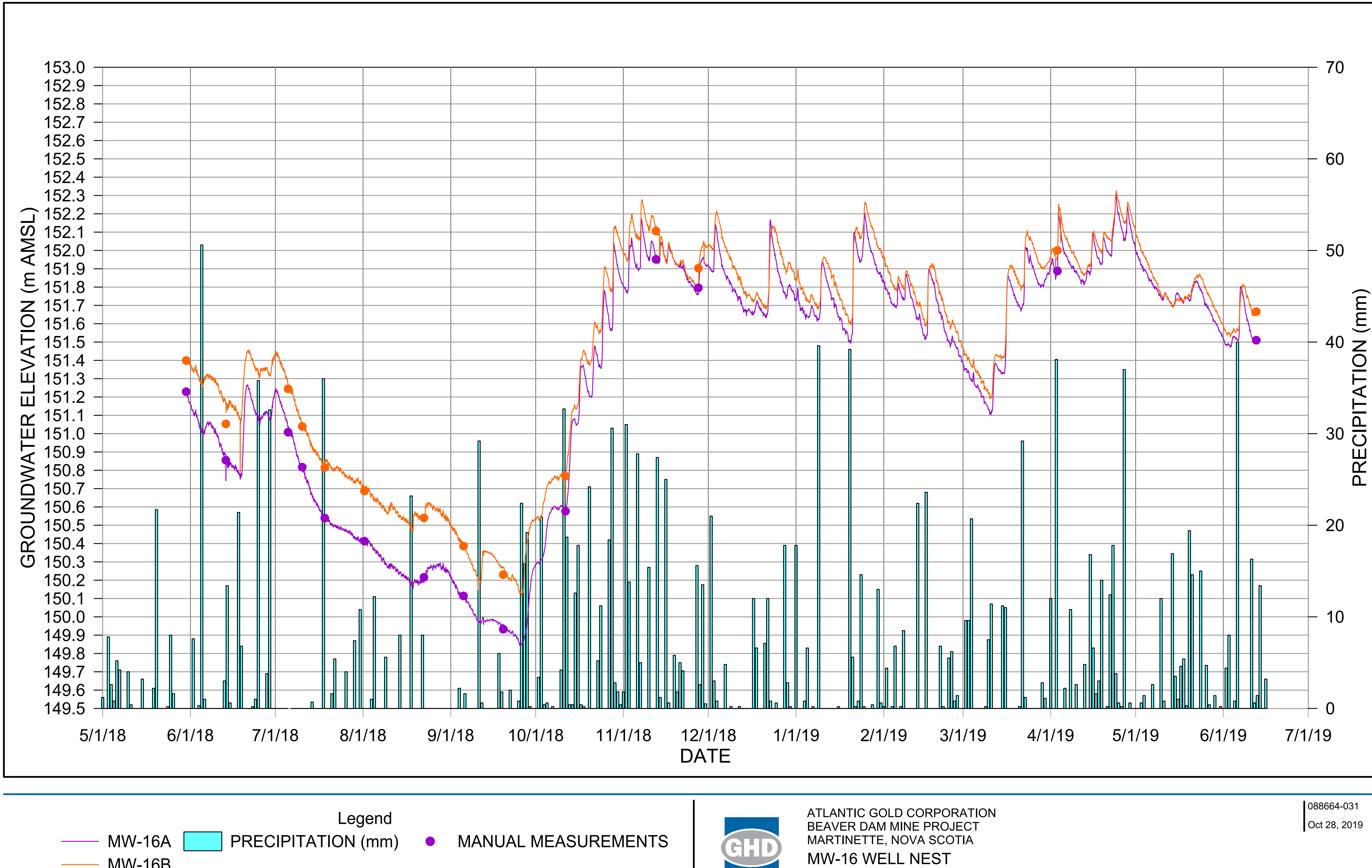
ATLANTIC GOLD CORPORATION
BEAVER DAM MINE PROJECT
MARTINETTE, NOVA SCOTIA

MW-14 WELL NEST
MEASURED GROUNDWATER ELEVATIONS

088664-031
Oct 28, 2019

FIGURE A.10

HEG file: Z:\HEG\088664\DOCUMENTATION\RPT\088664-RPT-13\FIGURES\Appendix A\Figure A.10 - MW-14 Hydrograph.grf



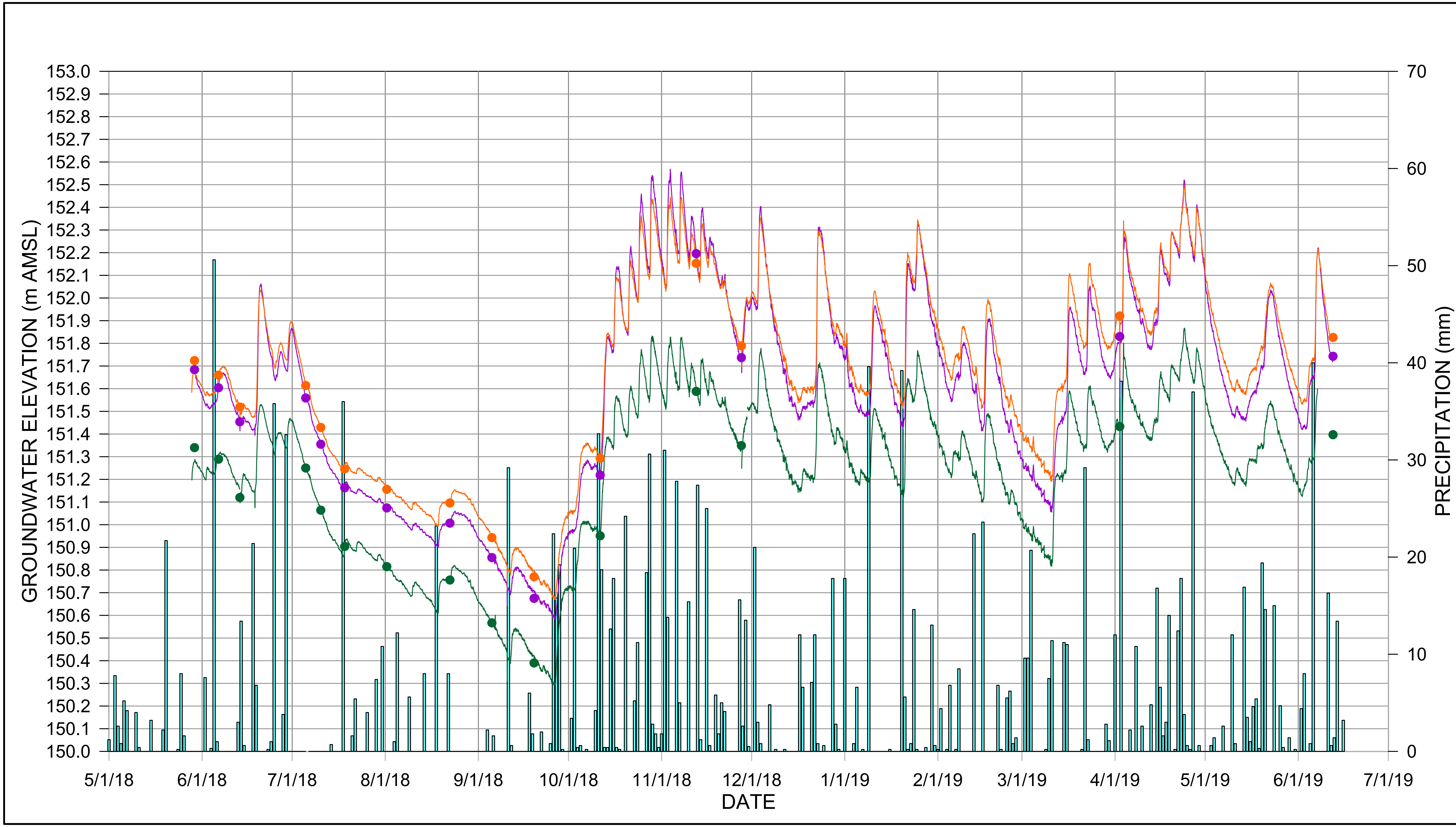
ATLANTIC GOLD CORPORATION
BEAVER DAM MINE PROJECT
MARTINETTE, NOVA SCOTIA

MW-16 WELL NEST
MEASURED GROUNDWATER ELEVATIONS

088664-031
Oct 28, 2019

FIGURE A.11

HEG file: Z:\HEG\088664\DOCUMENTATION\RPT\088664-RPT-13\FIGURES\Appendix A\Figure A.11 - MW-16 Hydrograph.grf



Legend

MW-17A
MW-17B
MW-17C
PRECIPITATION (mm)
MANUAL MEASUREMENTS

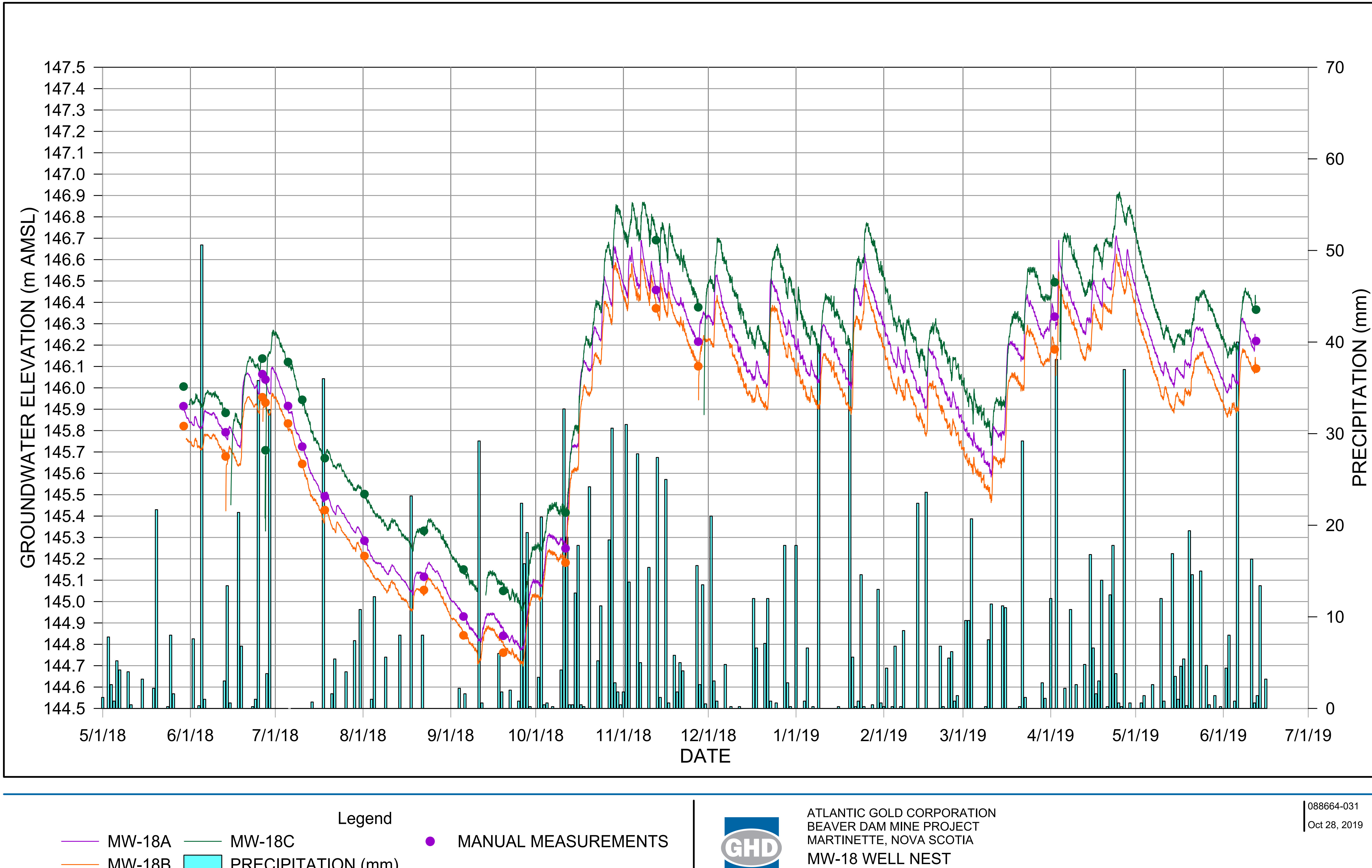
ATLANTIC GOLD CORPORATION
BEAVER DAM MINE PROJECT
MARTINETTE, NOVA SCOTIA

MW-17 WELL NEST
MEASURED GROUNDWATER ELEVATIONS

088664-031
Oct 28, 2019

FIGURE A.12

HEG file: Z:\HEG\088664\DOCUMENTATION\RPT\088664-RPT-13\FIGURES\Appendix A\Figure A.12 - MW-17 Hydrograph.grf



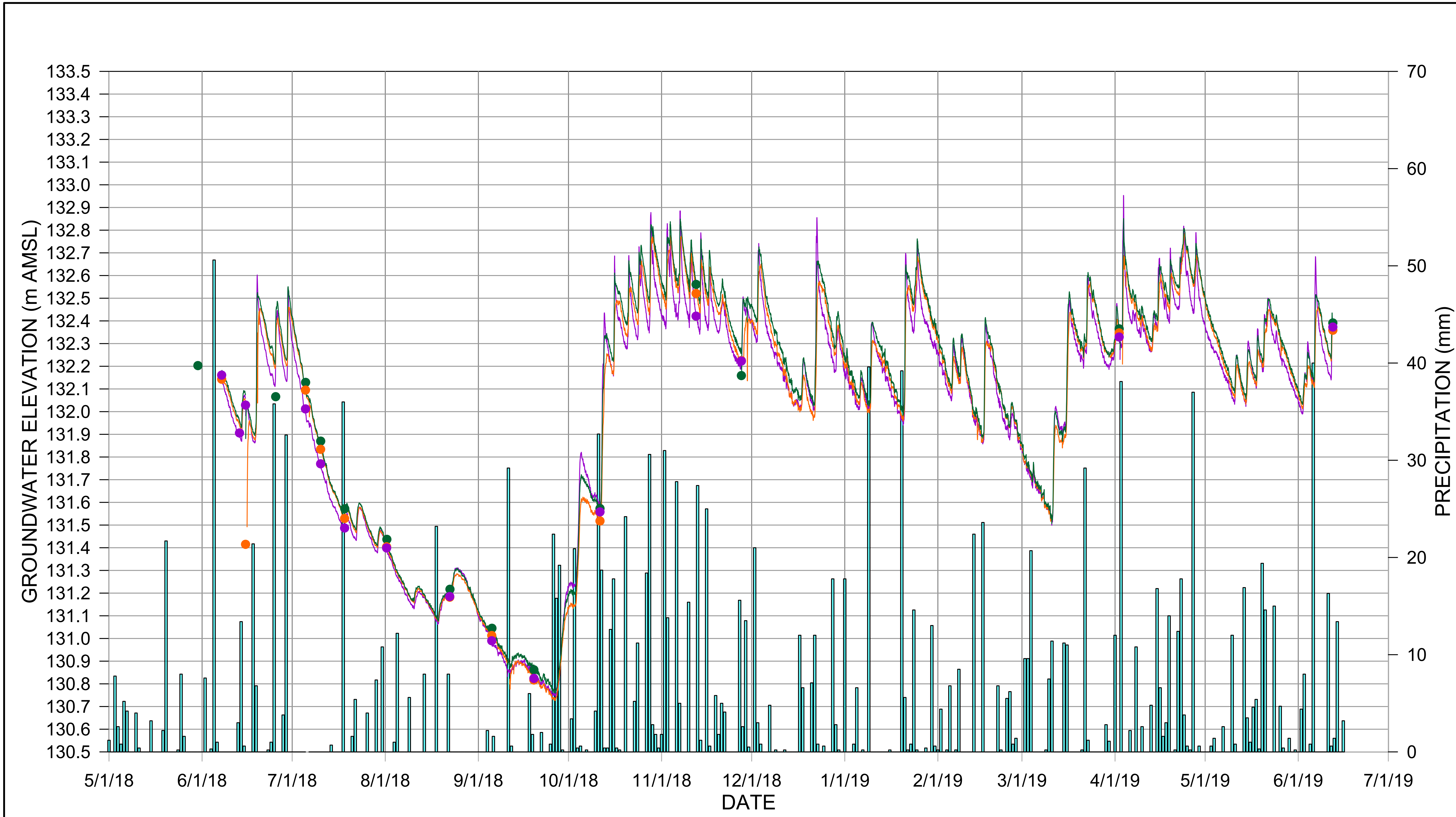
ATLANTIC GOLD CORPORATION
BEAVER DAM MINE PROJECT
MARTINETTE, NOVA SCOTIA

MW-18 WELL NEST
MEASURED GROUNDWATER ELEVATIONS

088664-031
Oct 28, 2019

FIGURE A.13

HEG file: Z:\HEG\088664\DOCUMENTATION\RPT\088664-RPT-13\FIGURES\Appendix A\Figure A.13 - MW-18 Hydrograph.grf



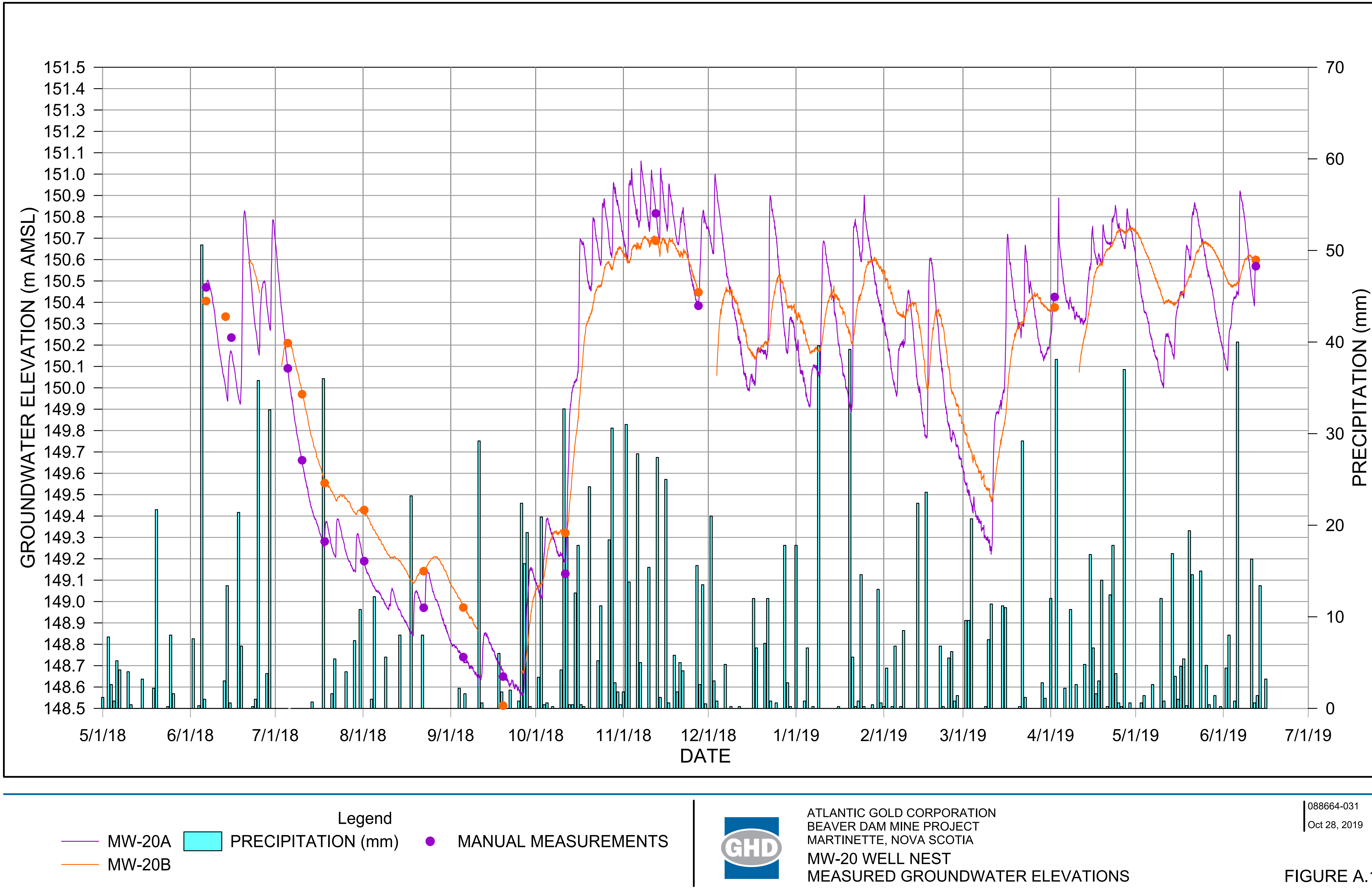
ATLANTIC GOLD CORPORATION
BEAVER DAM MINE PROJECT
MARTINETTE, NOVA SCOTIA

MW-19 WELL NEST
MEASURED GROUNDWATER ELEVATIONS

088664-031
Oct 28, 2019

FIGURE A.14

HEG file: Z:\HEG\088664\DOCUMENTATION\RPT\088664-RPT-13\FIGURES\Appendix A\Figure A.14 - MW-19 Hydrograph.grf



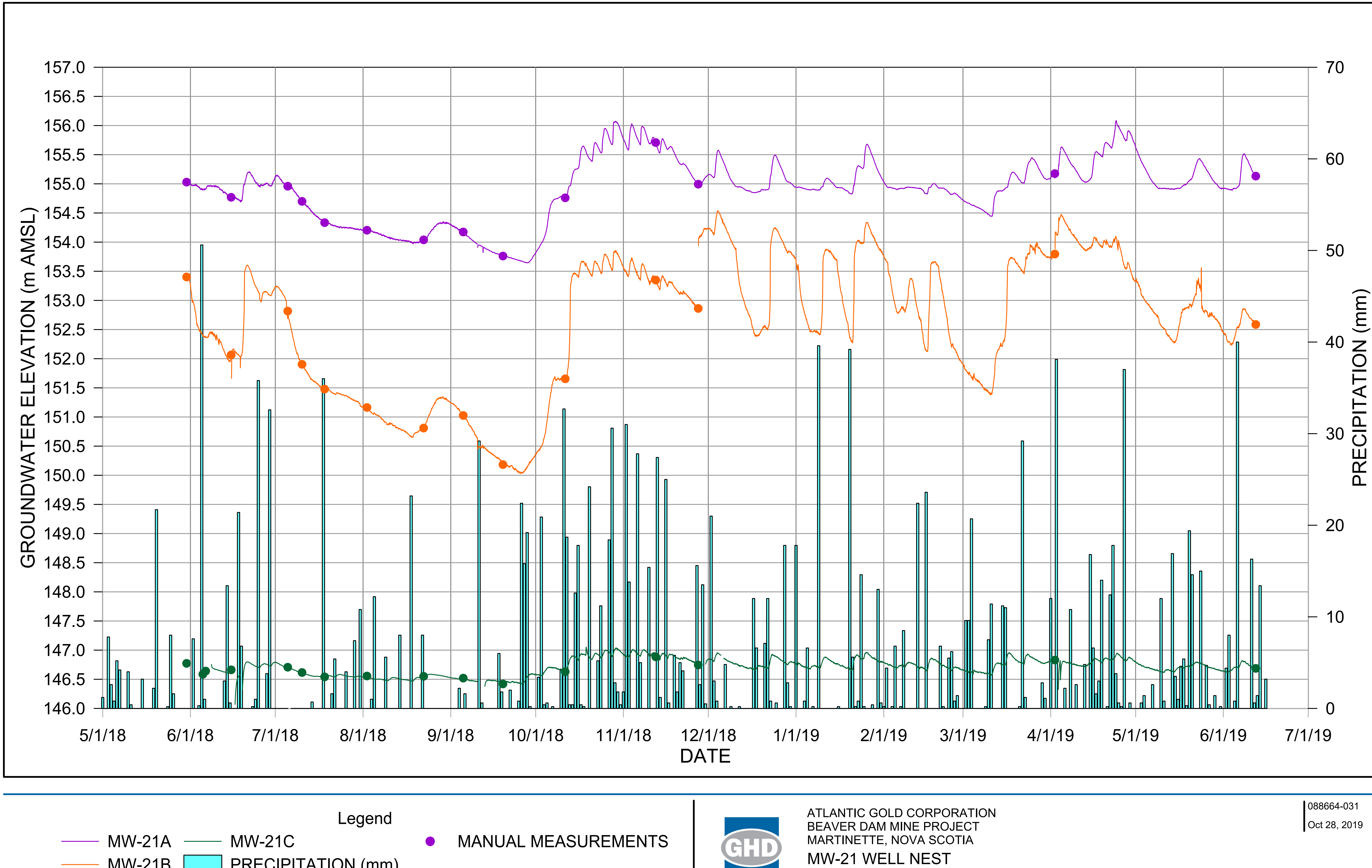
ATLANTIC GOLD CORPORATION
BEAVER DAM MINE PROJECT
MARTINETTE, NOVA SCOTIA

MW-20 WELL NEST
MEASURED GROUNDWATER ELEVATIONS

088664-031
Oct 28, 2019

FIGURE A.15

HEG file: Z:\HEG\088664\DOCUMENTATION\RPT\088664-RPT-13\FIGURES\Appendix A\Figure A.15 - MW-20 Hydrograph.grf



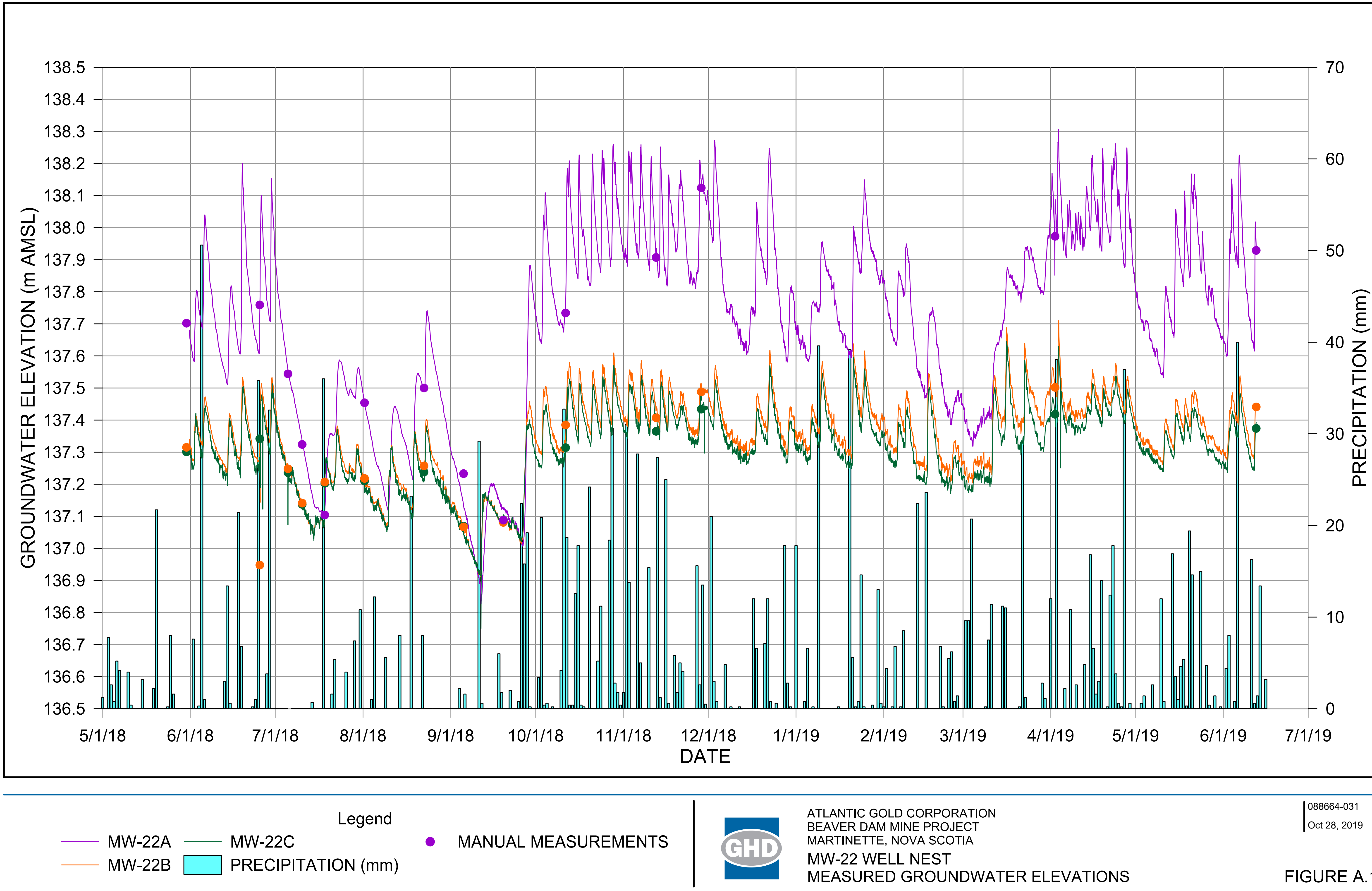
ATLANTIC GOLD CORPORATION
BEAVER DAM MINE PROJECT
MARTINETTE, NOVA SCOTIA

MW-21 WELL NEST
MEASURED GROUNDWATER ELEVATIONS

088664-031
Oct 28, 2019

FIGURE A.16

HEG file: Z:\HEG\088664\DOCUMENTATION\RPT\088664-RPT-13\FIGURES\Appendix A\Figure A.16 - MW-21 Hydrograph.grf



ATLANTIC GOLD CORPORATION
BEAVER DAM MINE PROJECT
MARTINETTE, NOVA SCOTIA

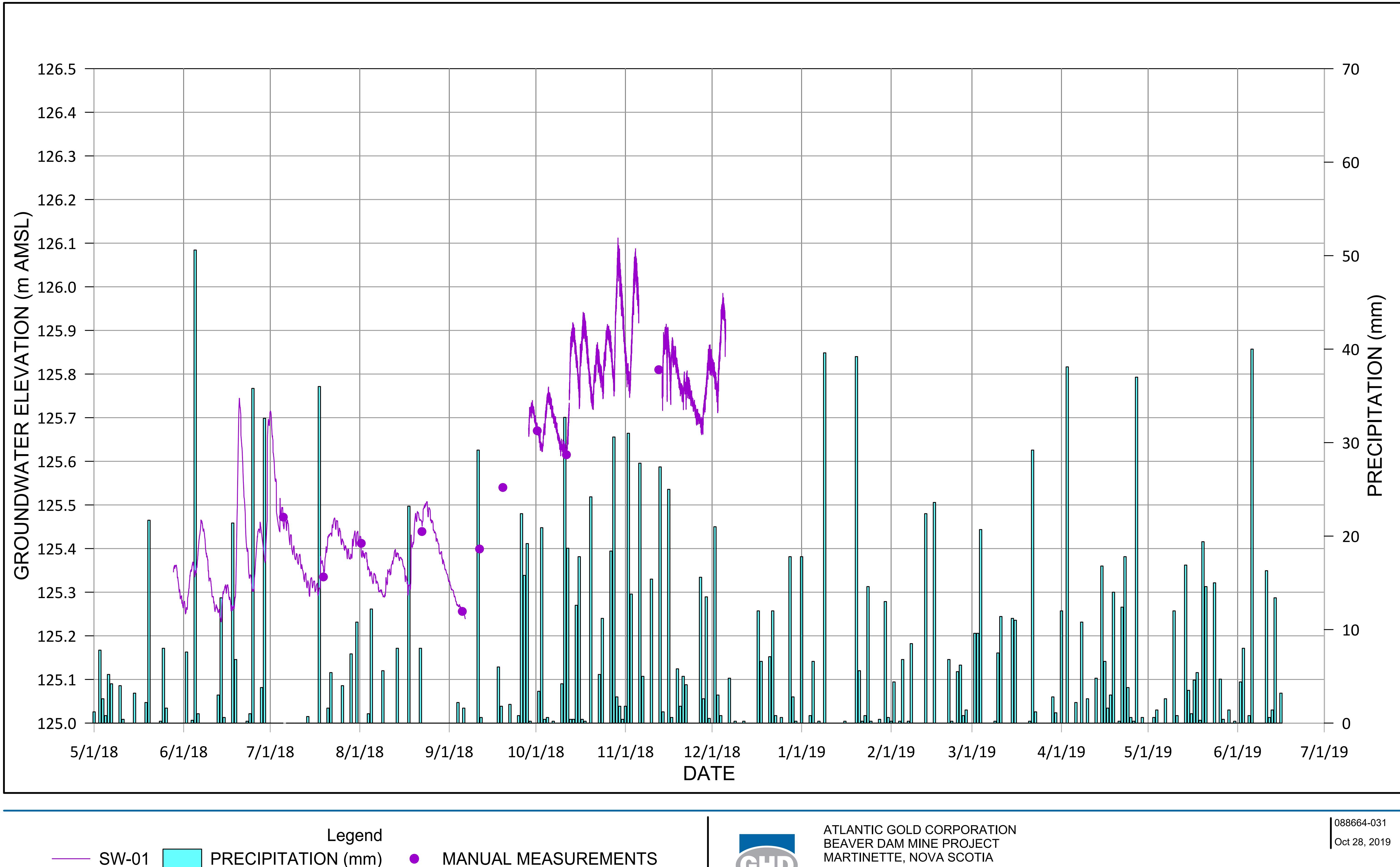
MW-22 WELL NEST
MEASURED GROUNDWATER ELEVATIONS

088664-031
Oct 28, 2019

FIGURE A.17

HEG file: Z:\HEG\088664\DOCUMENTATION\RPT\088664-RPT-13\FIGURES\Appendix A\Figure A.17 - MW-22 Hydrograph.grf

Appendix B
Surface Water Elevation Hydrographs



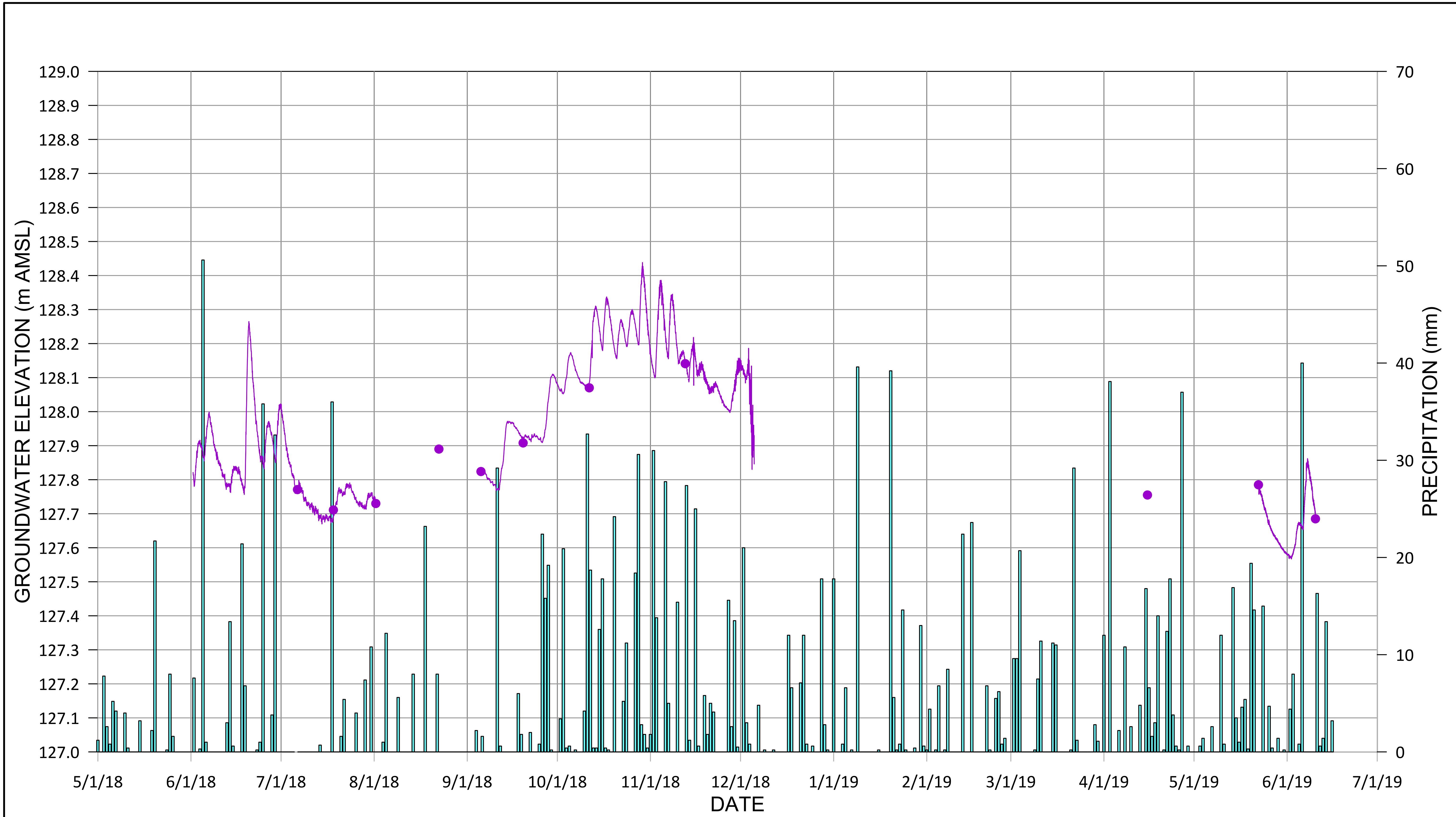
ATLANTIC GOLD CORPORATION
BEAVER DAM MINE PROJECT
MARTINETTE, NOVA SCOTIA

SW-01
MEASURED SURFACE WATER ELEVATIONS

088664-031
Oct 28, 2019

FIGURE B.1

HEG file: Z:\HEG\088664\DOCUMENTATION\RPT\088664-RPT-13\FIGURES\Appendix B\Figure B.1 - SW-01 Hydrograph.grf



Legend

SW-02 PRECIPITATION (mm) MANUAL MEASUREMENTS

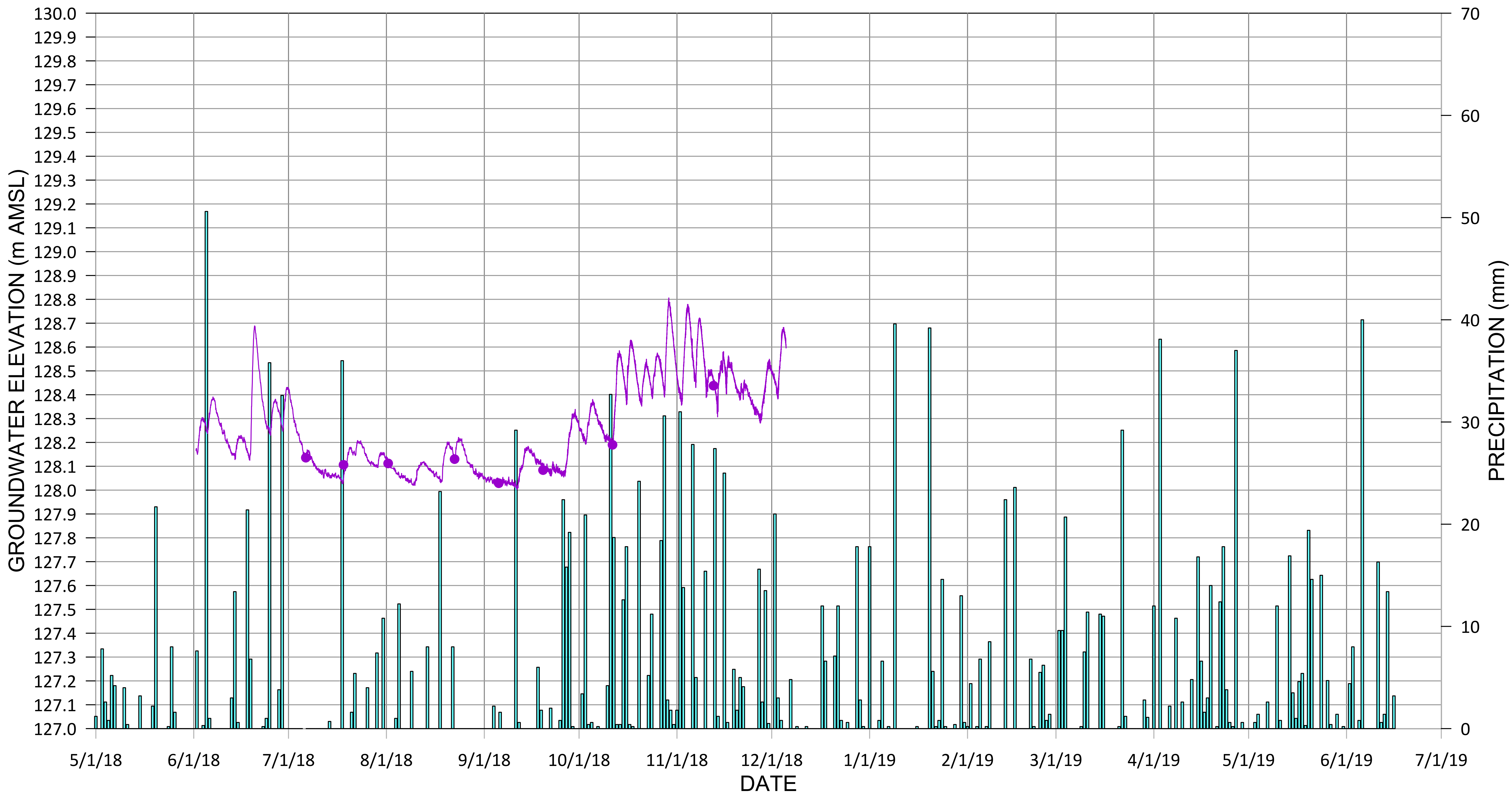
ATLANTIC GOLD CORPORATION
BEAVER DAM MINE PROJECT
MARTINETTE, NOVA SCOTIA

SW-02
MEASURED SURFACE WATER ELEVATIONS

088664-031
Oct 28, 2019

FIGURE B.2

HEG file: Z:\HEG\088664\DOCUMENTATION\RPT\088664-RPT-13\FIGURES\Appendix B\Figure B.2 - SW-02 Hydrograph.grf



Legend

SW-04A PRECIPITATION (mm) MANUAL MEASUREMENTS

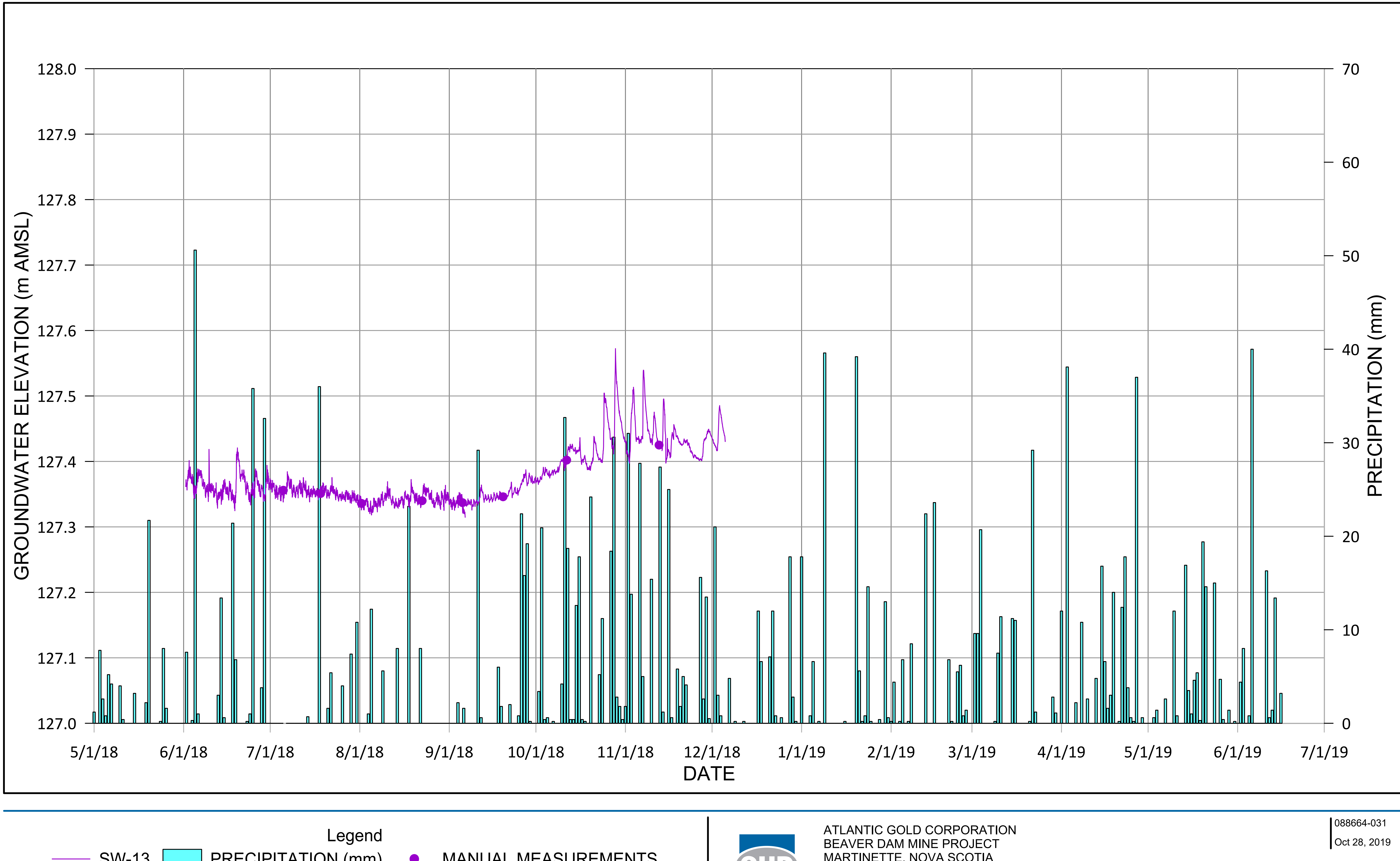
ATLANTIC GOLD CORPORATION
BEAVER DAM MINE PROJECT
MARTINETTE, NOVA SCOTIA

SW-04A
MEASURED SURFACE WATER ELEVATIONS

088664-031
Oct 28, 2019

FIGURE B.3

HEG file: Z:\HEG\088664\DOCUMENTATION\RPT\088664-RPT-13\FIGURES\Appendix B\Figure B.3 - SW-04a Hydrograph.grf



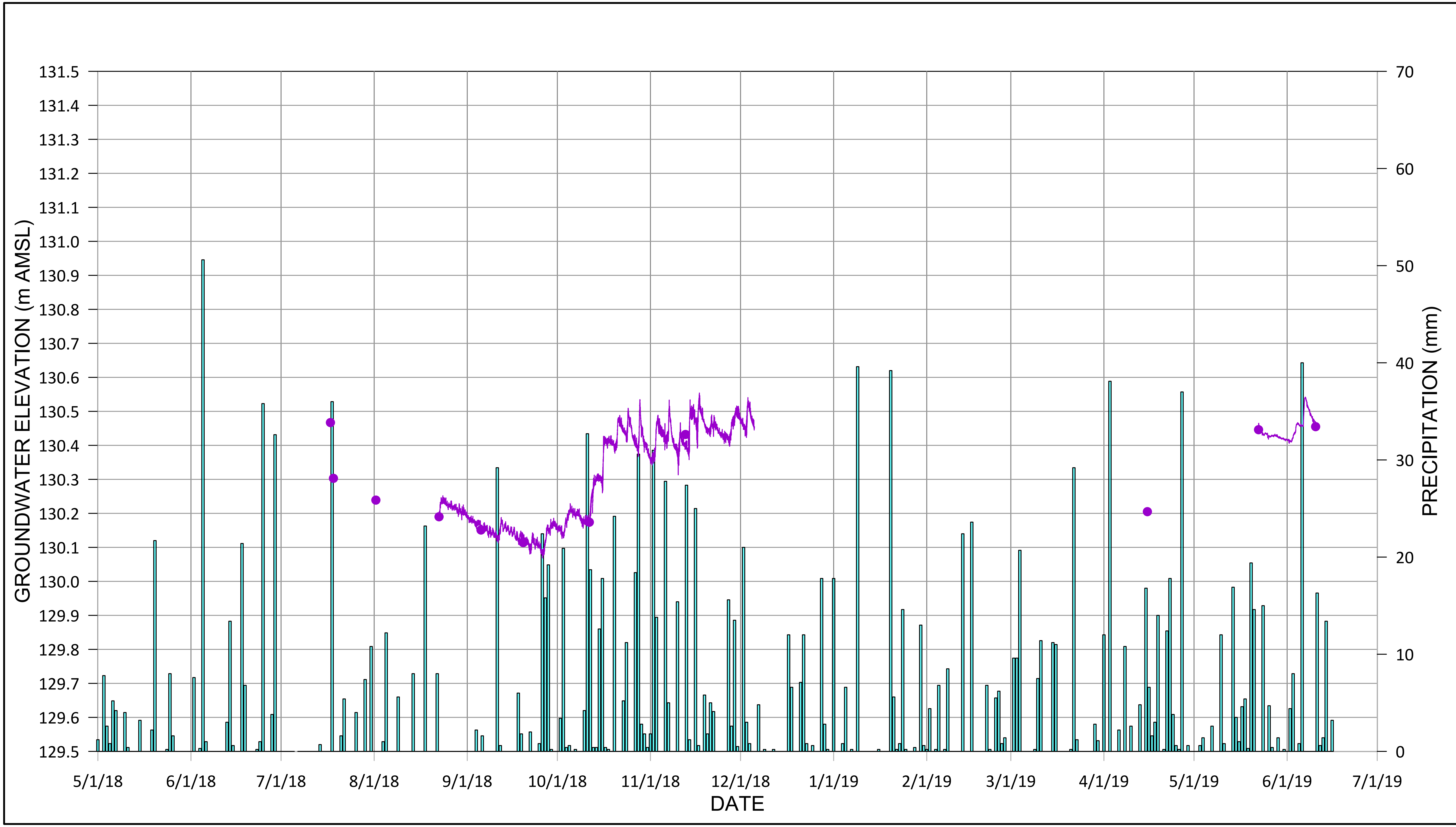
ATLANTIC GOLD CORPORATION
BEAVER DAM MINE PROJECT
MARTINETTE, NOVA SCOTIA

SW-13
MEASURED SURFACE WATER ELEVATIONS

088664-031
Oct 28, 2019

FIGURE B.4

HEG file: Z:\HEG\088664\DOCUMENTATION\RPT\088664-RPT-13\FIGURES\Appendix B\Figure B.4 - SW-13 Hydrograph.grf



Legend

SW-14 PRECIPITATION (mm) MANUAL MEASUREMENTS

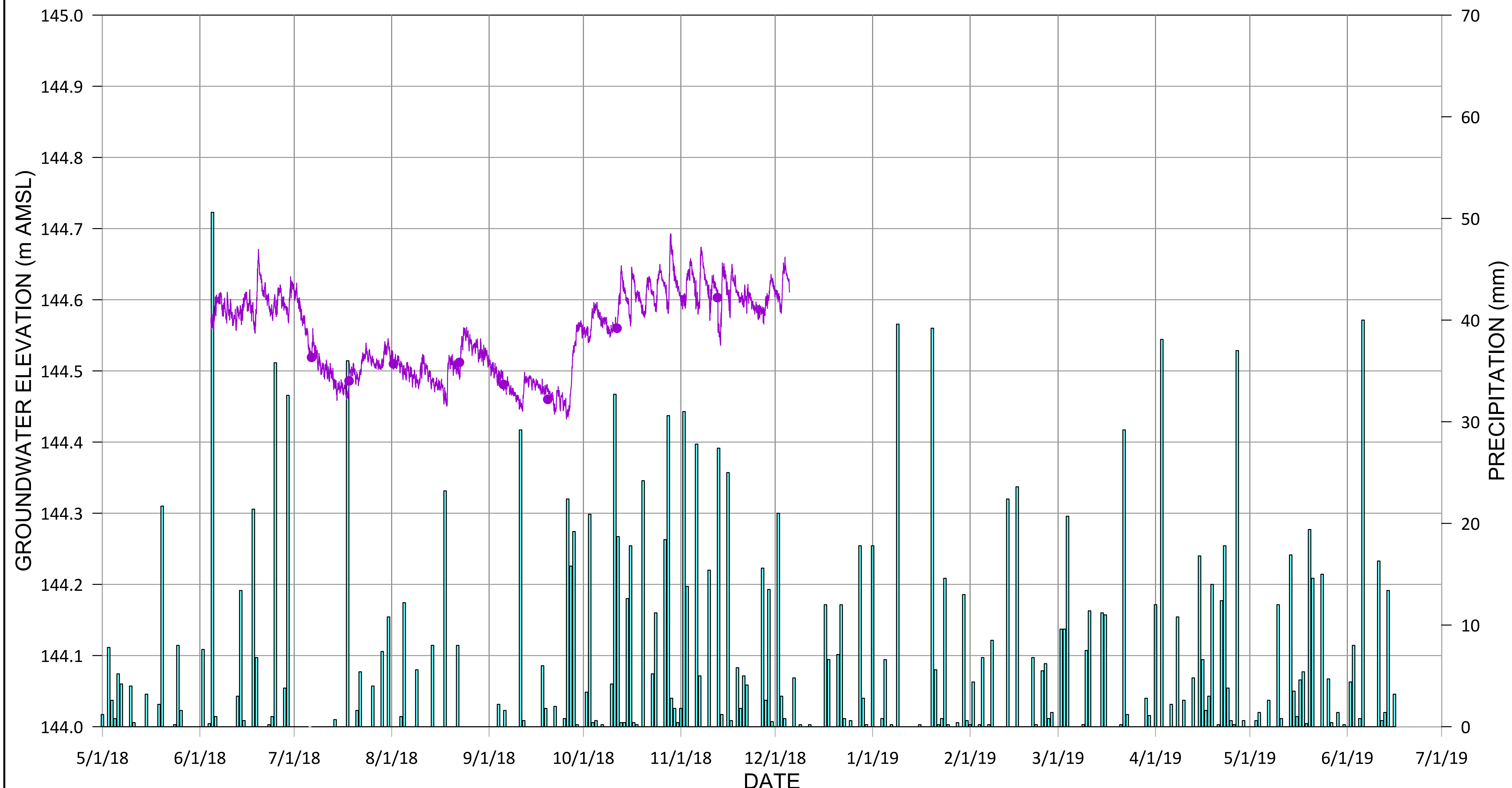
ATLANTIC GOLD CORPORATION
BEAVER DAM MINE PROJECT
MARTINETTE, NOVA SCOTIA

SW-14
MEASURED SURFACE WATER ELEVATIONS

088664-031
Oct 28, 2019

FIGURE B.5

HEG file: Z:\HEG\088664\DOCUMENTATION\RPT\088664-RPT-13\FIGURES\Appendix B\Figure B.5 - SW-14 Hydrograph.grf



Legend

SW-18 PRECIPITATION (mm) MANUAL MEASUREMENTS

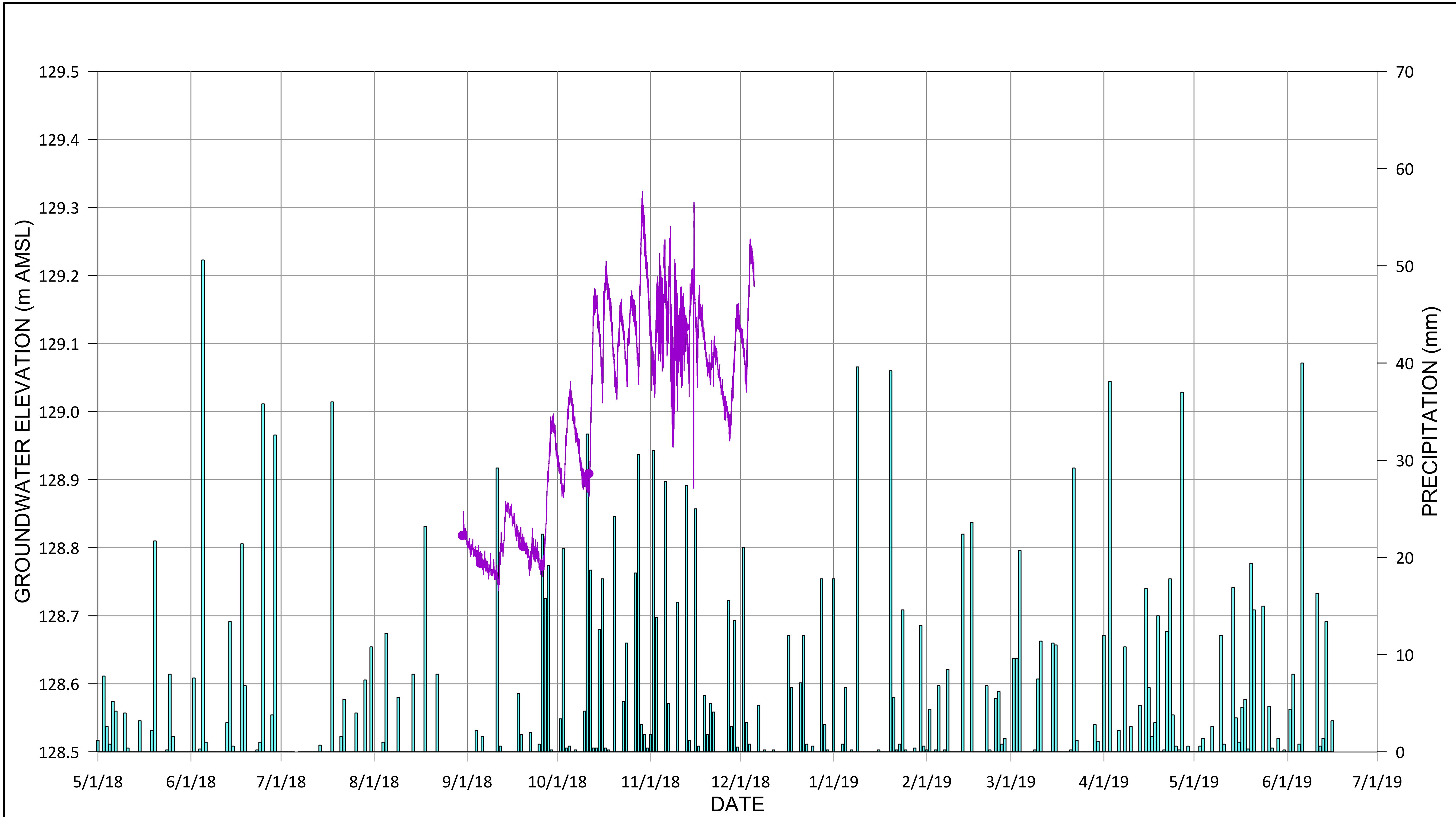
ATLANTIC GOLD CORPORATION
BEAVER DAM MINE PROJECT
MARTINETTE, NOVA SCOTIA

SW-18
MEASURED SURFACE WATER ELEVATIONS

088664-031
Oct 28, 2019

FIGURE B.6

HEG file: Z:\HEG\088664\DOCUMENTATION\RPT\088664-RPT-13\FIGURES\Appendix B\Figure B.6 - SW-18 Hydrograph.grf



Legend

SW-19 PRECIPITATION (mm) MANUAL MEASUREMENTS

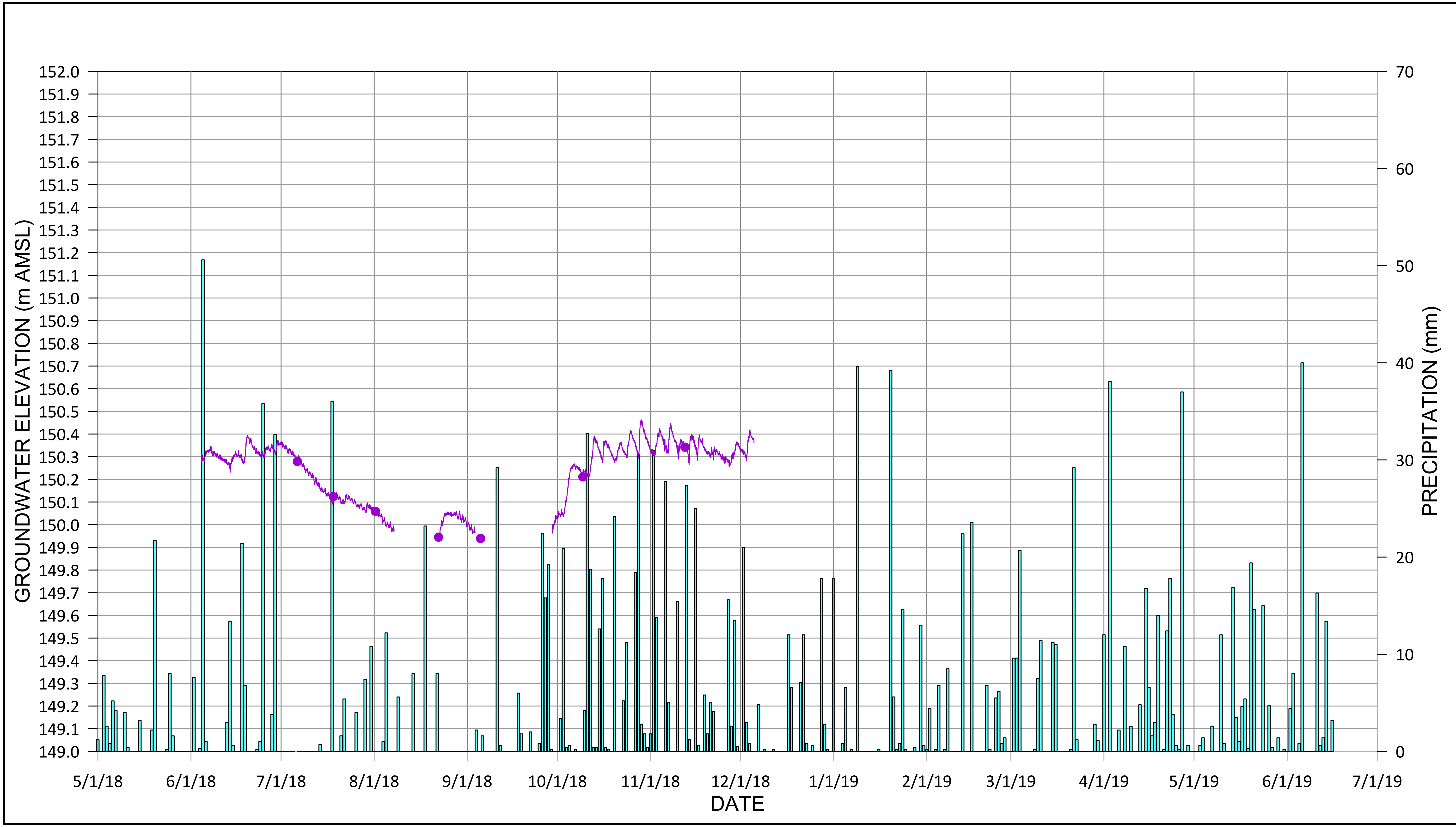
ATLANTIC GOLD CORPORATION
BEAVER DAM MINE PROJECT
MARTINETTE, NOVA SCOTIA

SW-19
MEASURED SURFACE WATER ELEVATIONS

088664-031
Oct 28, 2019

FIGURE B.7

HEG file: Z:\HEG\088664\DOCUMENTATION\RPT\088664-RPT-13\FIGURES\Appendix B\Figure B.7 - SW-19 Hydrograph.grf



GHD

ATLANTIC GOLD CORPORATION
BEAVER DAM MINE PROJECT
MARTINETTE, NOVA SCOTIA

SW-22
MEASURED SURFACE WATER ELEVATIONS

088664-031
Oct 28, 2019

FIGURE B.8

HEG file: Z:\HEG\088664\DOCUMENTATION\RPT\088664-RPT-13\FIGURES\Appendix B\Figure B.8 - SW-22 Hydrograph.grf

Appendix C
3D Geologic Model

Appendix C 3D Presentation Package

GHD developed a 3D Visualization presentation package for the Beaver Dam Mine Site located in Marinette, Halifax County, Nova Scotia (Beaver Dam Mine Site). The presentation package includes an interface menu and three 4DIM (4-Dimensional Interactive Model) the Beaver Dam Mine Site geology:

Please follow instructions below to download and view the models.

1. Click on link http://ghd.2big4email.com/en/downloadfiles.aspx?param=SU8kIVg6KdMDviEVVgxbYweQuAleQuAl
2. The 3DV presentation has been zipped together and is named "**074846-00(PRES001)3DV_WA_3DPRESENTATION_2016-12-12.zip**". Copy this zip file to your Hard Drive (C:\).
3. Extract zip file to root of hard drive (folder name should look like C:**074846-00(PRES001)3DV_WA_3DPRESENTATION_2016-12-12**). Maintain folder structure, the presentation will not work if it is altered (no folders or subfolders can have spaces in the names).
4. Double click on interface menu file "3DVISUALIZATION.EXE". This will automatically load up an interface menu window on your screen; from this interface menu you can access the desired 4DIM model by double clicking on the model title and the 4DIM will automatically launch in a separate window. Basic controls for the 4D interactive model player are provided below. Following this, an image is provided of the interface menu that should appear after launching the file "3DVISUALIZATION.EXE".

Basic 4D Interactive Model Player Controls

Select your desired 4DIM animation (*.4d) by doubled clicking on the file. This will automatically open up the associated 4DIM file in a separate window called the 4DIM Player.

To ZOOM IN or OUT, hold down SHIFT and the left mouse button while moving the mouse forwards or backwards.

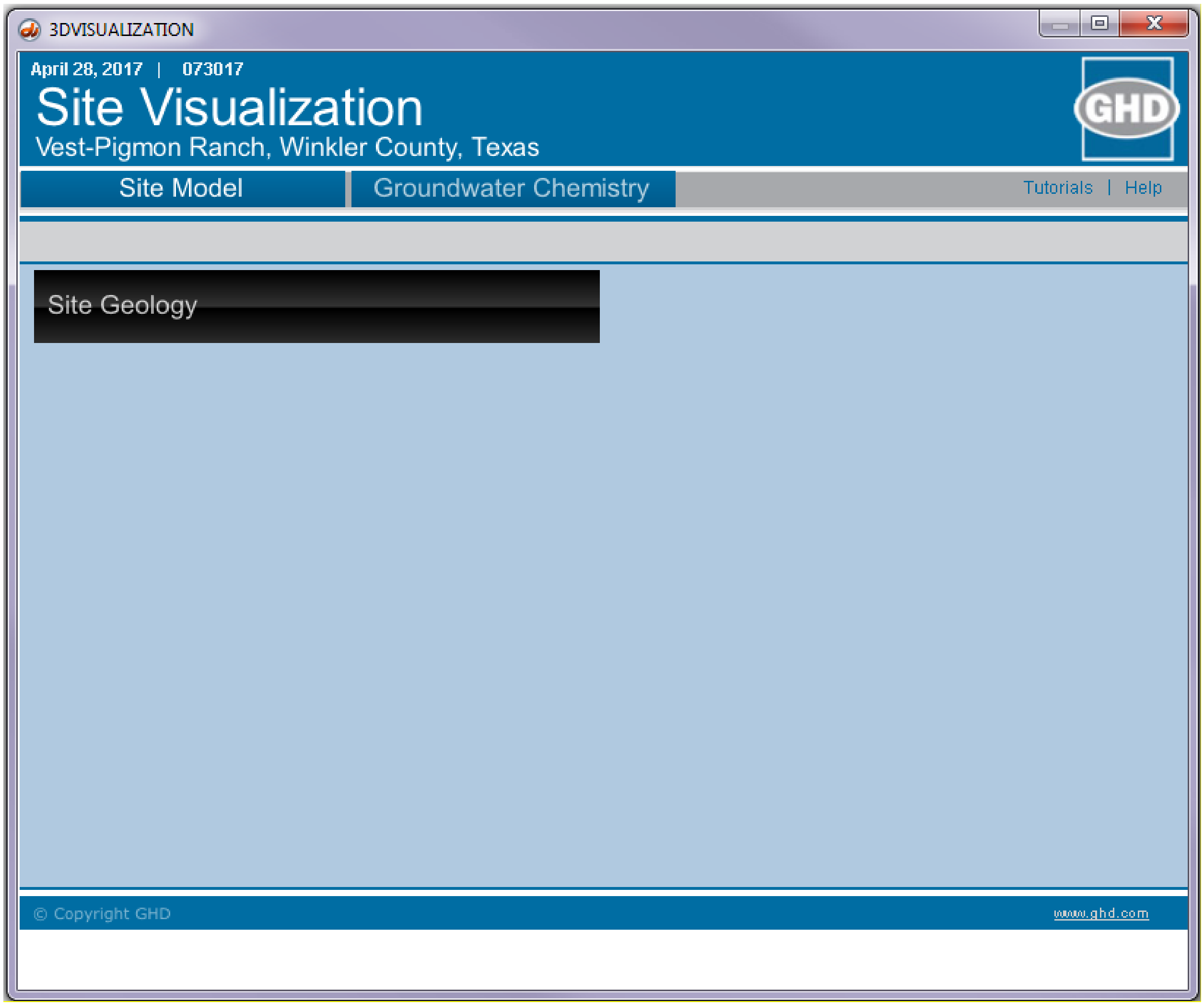
To PAN, hold down the right mouse button while moving the mouse.

To ROTATE the model, hold down the left mouse key while moving the mouse.

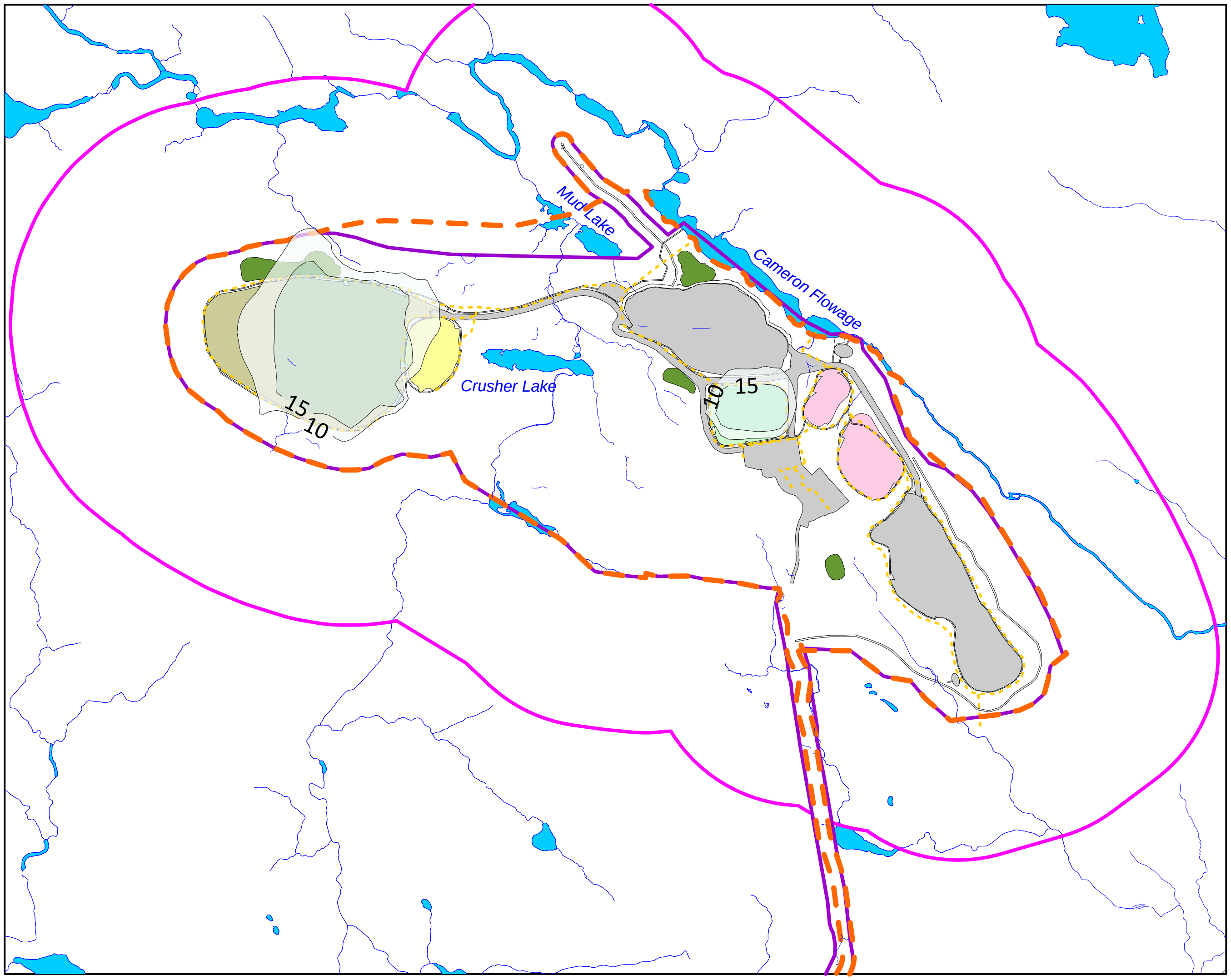
Additional player information may be accessed through the Help menu.

To CHANGE FRAMES, click on the  or  buttons located on the Current Frame slider bar (below) to move through the frames in the animation.

Interface Menu



Appendix D
Simulated COC Concentrations in Groundwater Versus Potable Criteria – Dry Conditions



LEGEND

- SURFACE WATER BODY
- PROPOSED EXTENT OF MINE FEATURES
- 0.1 SIMULATED ARSENIC CONCENTRATION (ug/L)
- SURFACE WATER MANAGEMENT DITCHES
- PROPERTY BOUNDARY
- PROJECT AREA
- LOCAL ASSESSMENT AREA
- NAG WASTE ROCK STOCKPILE
- PAG WASTE ROCK STOCKPILE
- LGO STOCKPILE
- TILL STOCKPILES
- TOPSOIL STOCKPILES

Note: The arsenic Tier 1 EQS for potable groundwater is 10 ug/L.

0 300 600 900m

ATLANTIC GOLD CORPORATION
MARINETTE, NOVA SCOTIA
BEAVER DAM MINE

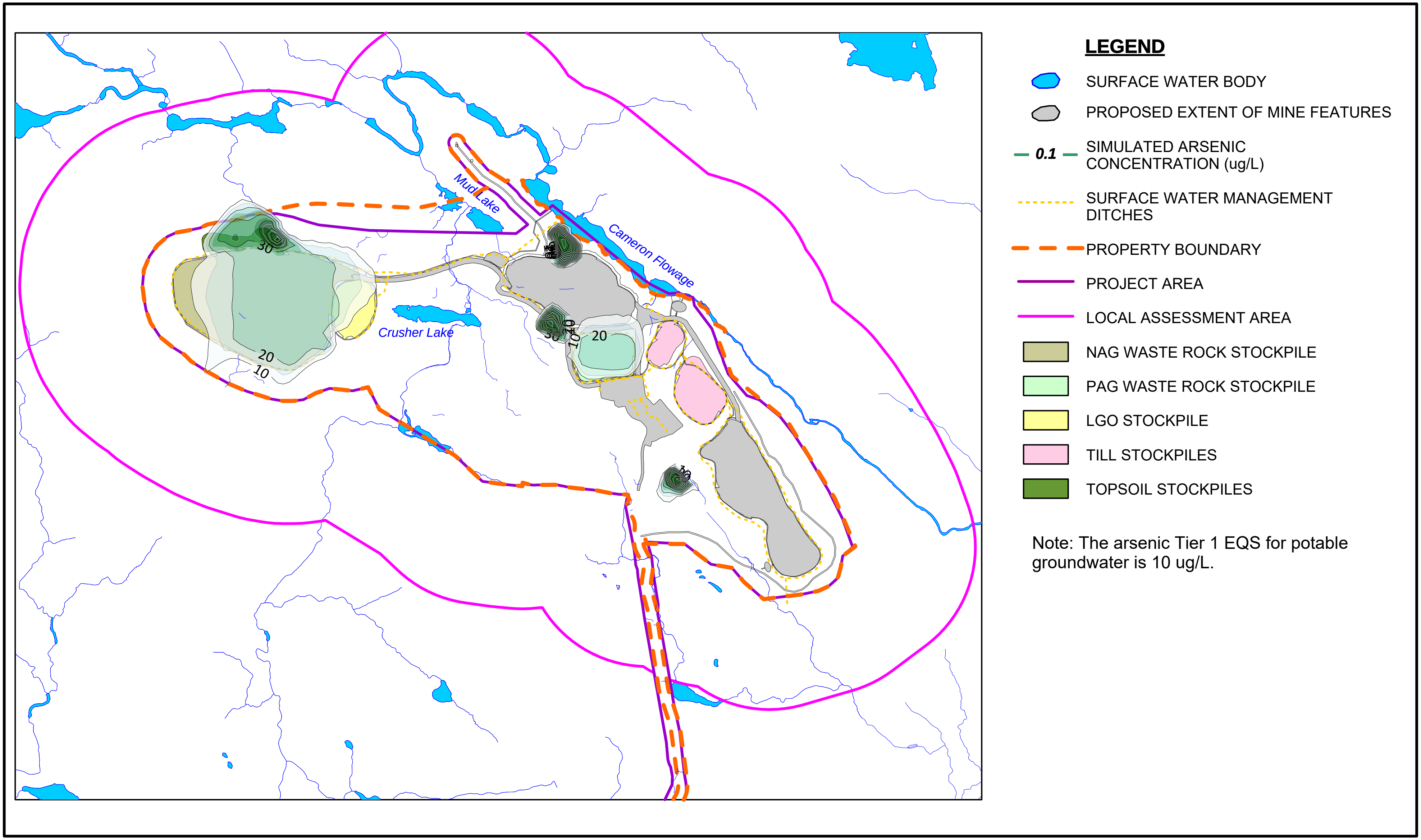
SIMULATED ARSENIC CONCENTRATION VERSUS POTABLE CRITERIA
EOM - BASE CASE SOURCE TERMS - DRY CASE CONDITION

088664-031

March 11, 2021

FIGURE D.1

HEG file: Z:\HEG\088664\DOCUMENTATION\RPT\088664-RPT-13\FIGURES\D.1 - Simulated Arsenic Concentration Versus Potable Criteria - EOM- BC - DRY.srf



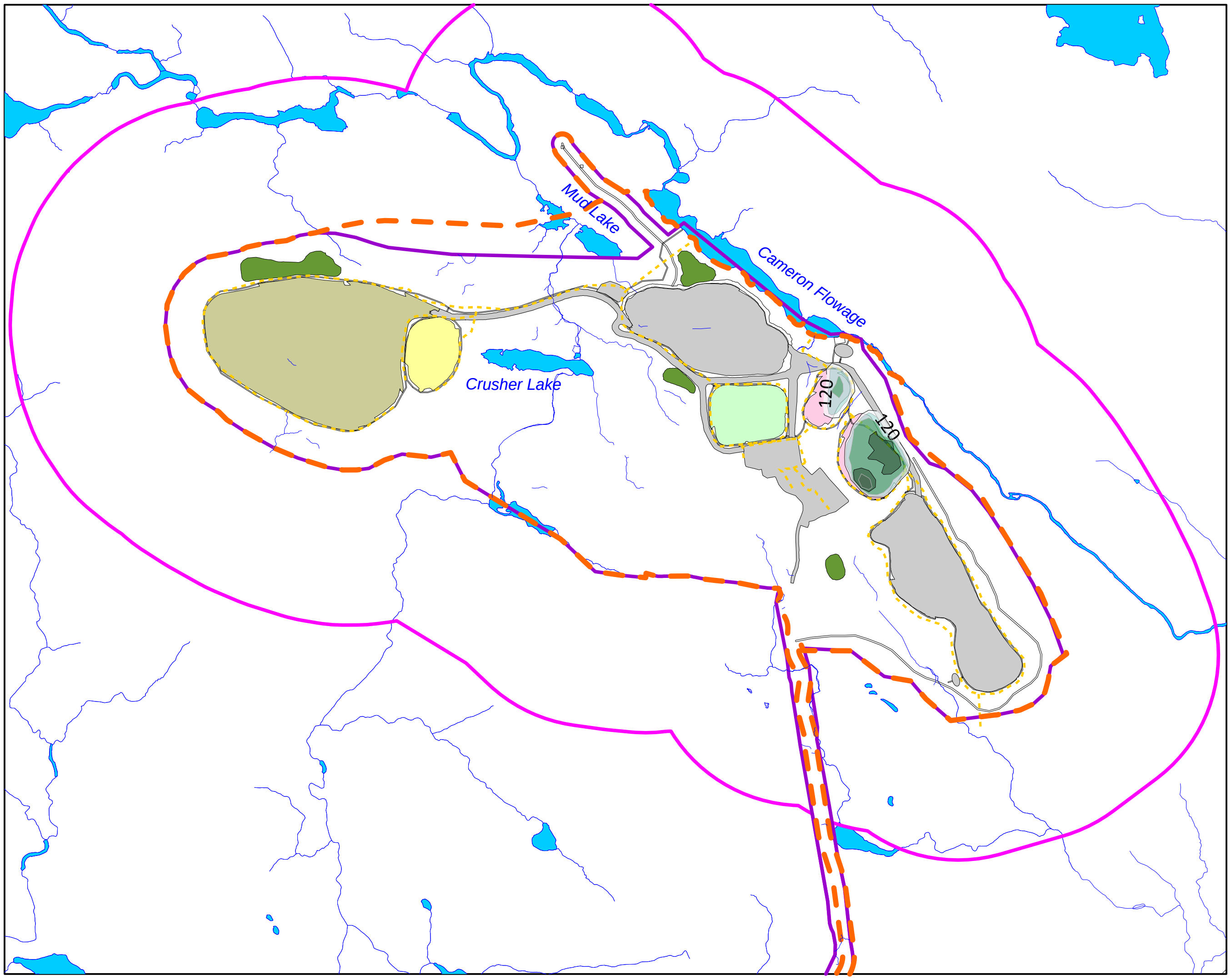
ATLANTIC GOLD CORPORATION
MARINETTE, NOVA SCOTIA
BEAVER DAM MINE

SIMULATED ARSENIC CONCENTRATION VERSUS POTABLE CRITERIA
EOM - UPPER CASE SOURCE TERMS - DRY CASE CONDITION

088664-031
March 11, 2021

FIGURE D.2

HEG file: Z:\HEG\088664\DOCUMENTATION\RPT\088664-RPT-13\FIGURES\D.2 - Simulated Arsenic Concentration Versus Potable Criteria - EOM - UC - DRY.srf



LEGEND

- SURFACE WATER BODY
- PROPOSED EXTENT OF MINE FEATURES
- 0.1 SIMULATED MANGANESE CONCENTRATION (ug/L)
- SURFACE WATER MANAGEMENT DITCHES
- PROPERTY BOUNDARY
- PROJECT AREA
- LOCAL ASSESSMENT AREA
- NAG WASTE ROCK STOCKPILE
- PAG WASTE ROCK STOCKPILE
- LGO STOCKPILE
- TILL STOCKPILES
- TOPSOIL STOCKPILES

Note: The manganese Tier 1 EQS for potable groundwater is 120 ug/L.

0 300 600 900m

GHD

ATLANTIC GOLD CORPORATION
MARINETTE, NOVA SCOTIA
BEAVER DAM MINE

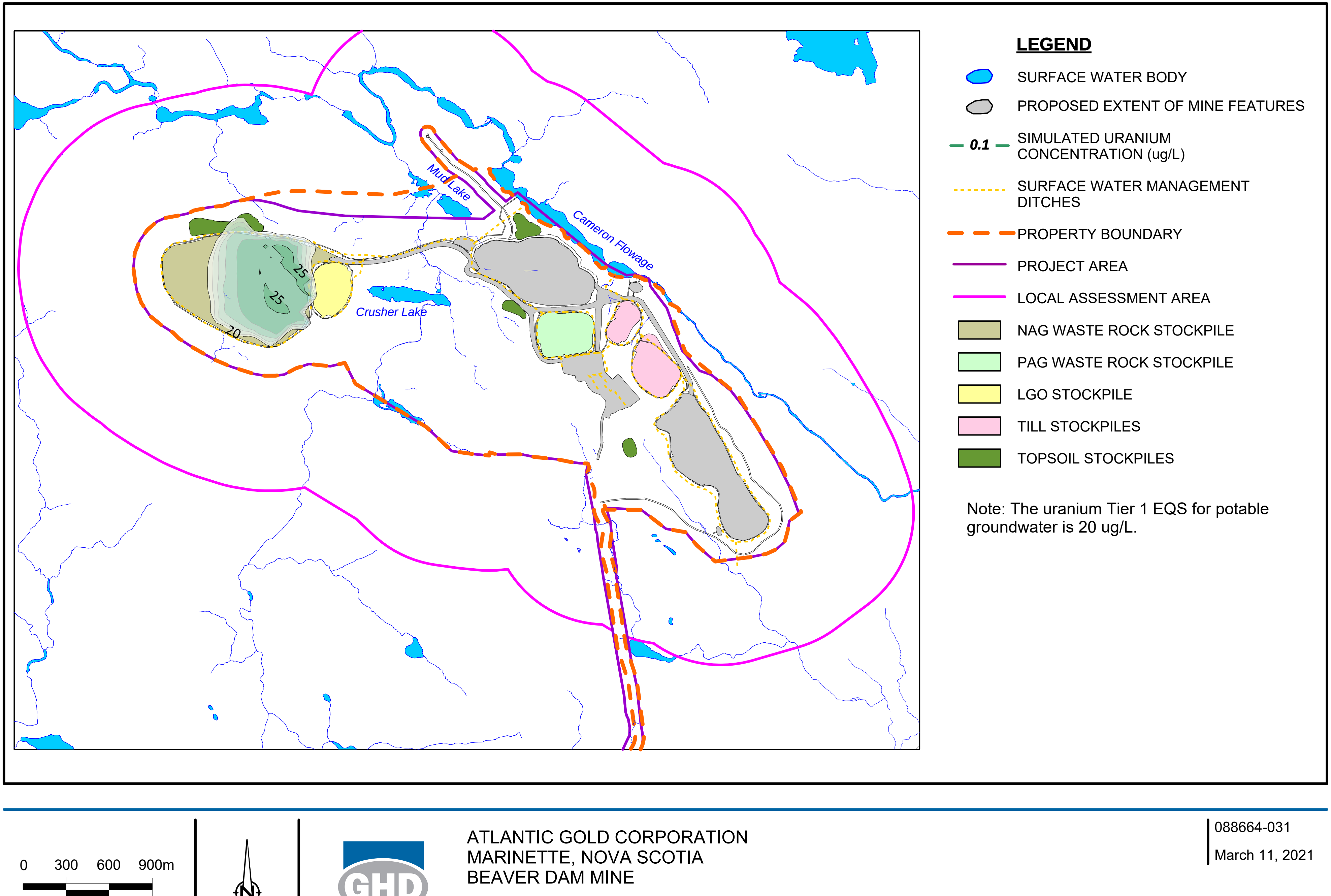
SIMULATED MANGANESE CONCENTRATION VERSUS POTABLE CRITERIA
EOM - UPPER CASE SOURCE TERMS - DRY CASE CONDITION

088664-031

March 11, 2021

FIGURE D.3

HEG file: Z:\HEG\088664\DOCUMENTATION\RPT\088664-RPT-13\FIGURES\D.3 - Simulated Manganese Concentration Versus Potable Criteria - EOM - UC - DRY.srf



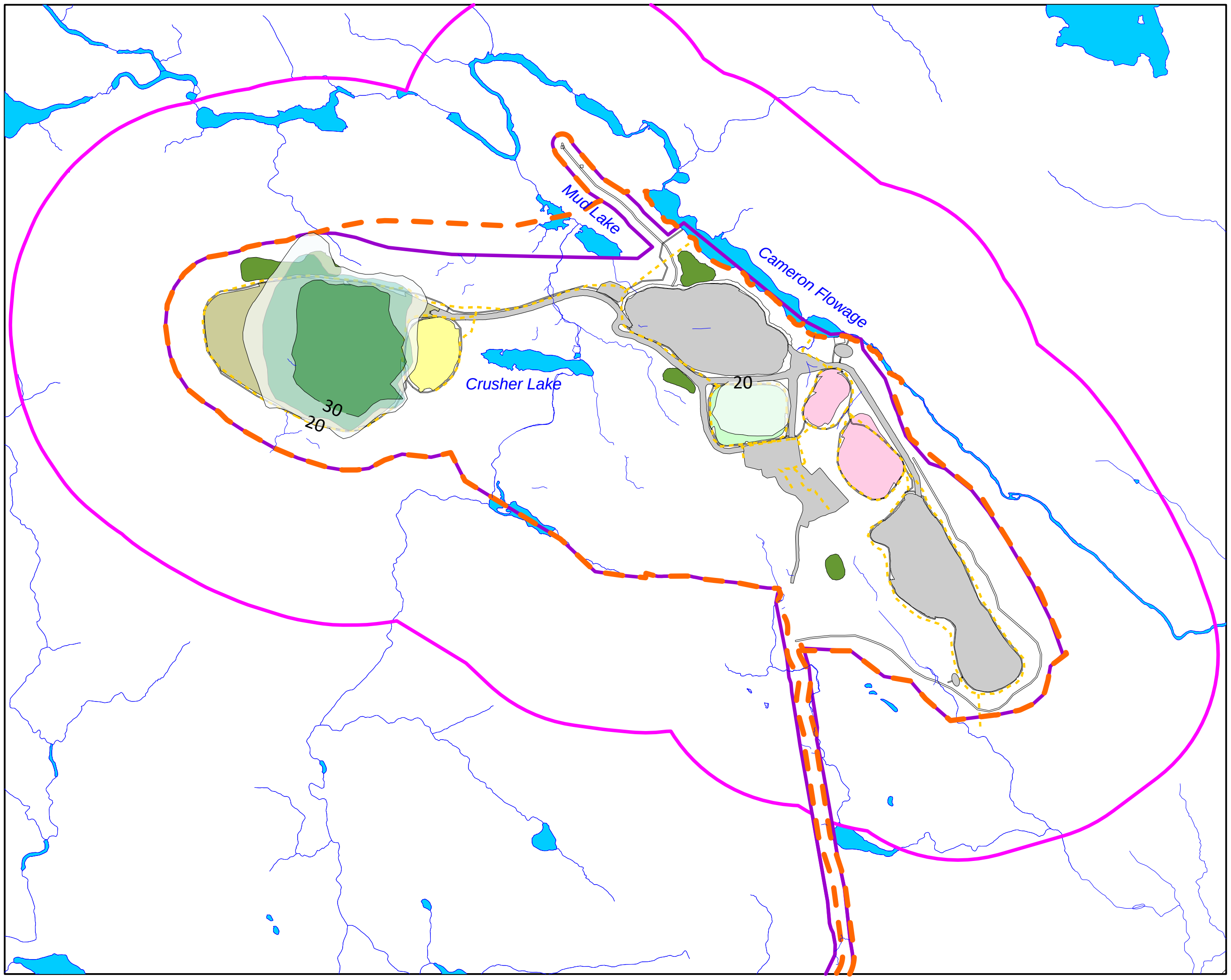
ATLANTIC GOLD CORPORATION
MARINETTE, NOVA SCOTIA
BEAVER DAM MINE

SIMULATED URANIUM CONCENTRATION VERSUS POTABLE CRITERIA
EOM - BASE CASE SOURCE TERMS - DRY CASE CONDITION

088664-031
March 11, 2021

FIGURE D.4

HEG file: Z:\HEG\088664\DOCUMENTATION\RPT\088664-RPT-13\FIGURES\D.4 - Simulated Uranium Concentration Versus Potable Criteria - EOM - BC - DRY.srf



LEGEND

- SURFACE WATER BODY
- PROPOSED EXTENT OF MINE FEATURES
- 0.1 SIMULATED URANIUM CONCENTRATION (ug/L)
- SURFACE WATER MANAGEMENT DITCHES
- PROPERTY BOUNDARY
- PROJECT AREA
- LOCAL ASSESSMENT AREA
- NAG WASTE ROCK STOCKPILE
- PAG WASTE ROCK STOCKPILE
- LGO STOCKPILE
- TILL STOCKPILES
- TOPSOIL STOCKPILES

Note: The uranium Tier 1 EQS for potable groundwater is 20 ug/L.

0 300 600 900m

N

ATLANTIC GOLD CORPORATION
MARINETTE, NOVA SCOTIA
BEAVER DAM MINE

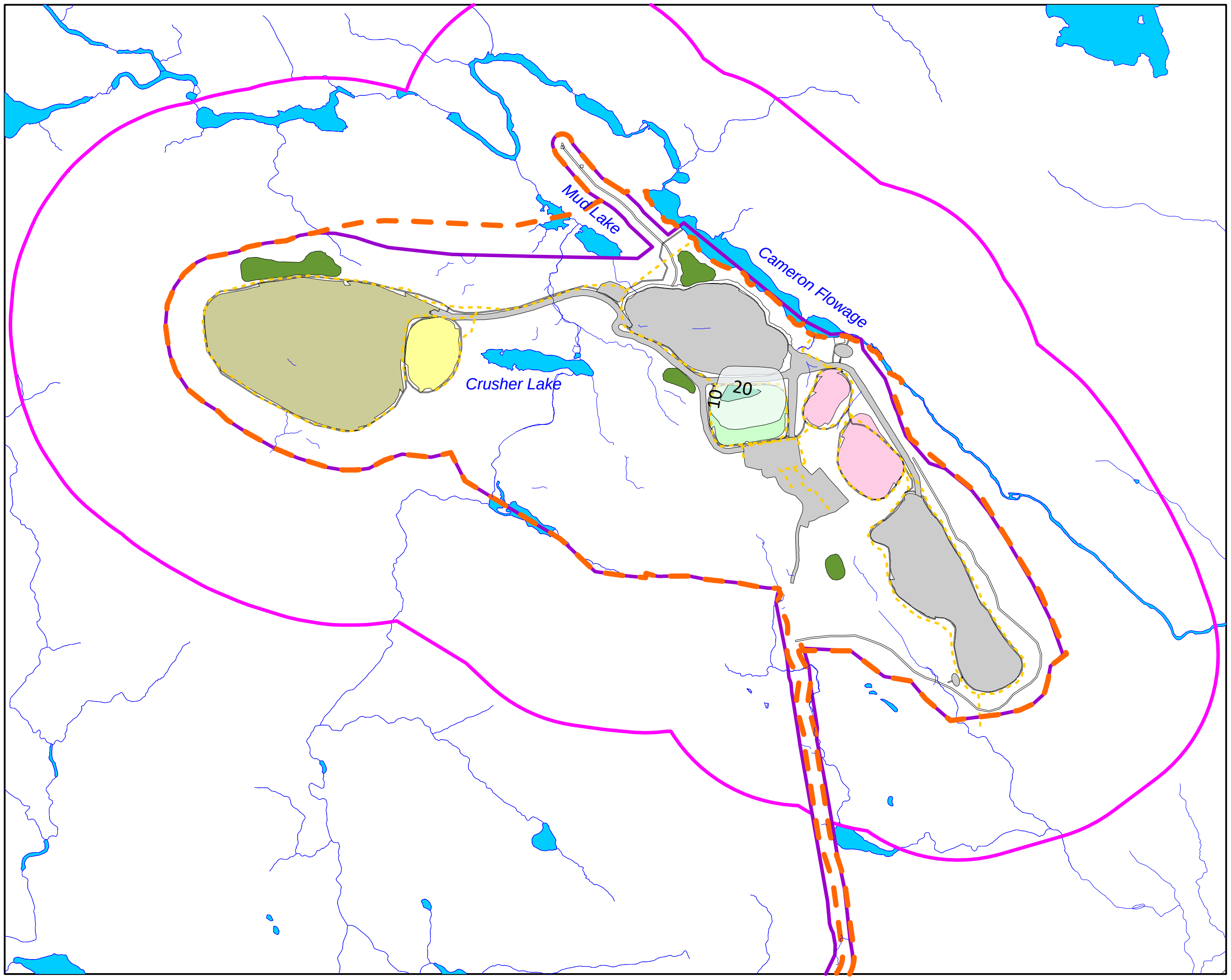
SIMULATED URANIUM CONCENTRATION VERSUS POTABLE CRITERIA
EOM - UPPER CASE SOURCE TERMS - DRY CASE CONDITION

088664-031

March 11, 2021

FIGURE D.5

HEG file: Z:\HEG\088664\DOCUMENTATION\RPT\088664-RPT-13\FIGURES\D.5 - Simulated Uranium Concentration Versus Potable Criteria - EOM - UC - DRY.srf



LEGEND

- SURFACE WATER BODY
- PROPOSED EXTENT OF MINE FEATURES
- 0.1 — SIMULATED ARSENIC CONCENTRATION (ug/L)
- SURFACE WATER MANAGEMENT DITCHES
- PROPERTY BOUNDARY
- PROJECT AREA
- LOCAL ASSESSMENT AREA
- NAG WASTE ROCK STOCKPILE
- PAG WASTE ROCK STOCKPILE
- LGO STOCKPILE
- TILL STOCKPILES
- TOPSOIL STOCKPILES

Note: The arsenic Tier 1 EQS for potable groundwater is 10 ug/L.

0 300 600 900m

ATLANTIC GOLD CORPORATION
MARINETTE, NOVA SCOTIA
BEAVER DAM MINE

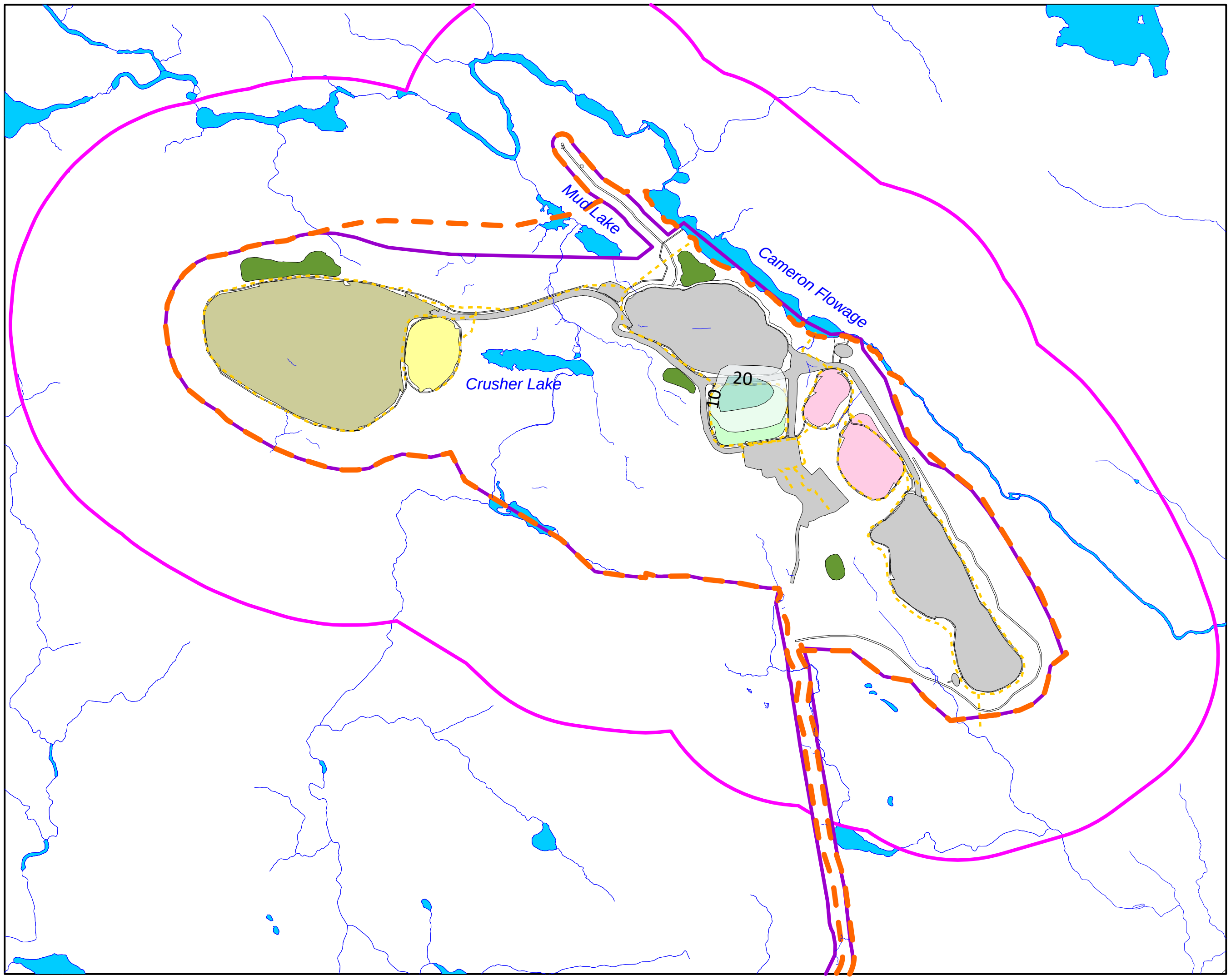
SIMULATED ARSENIC CONCENTRATION VERSUS POTABLE CRITERIA
PC - BASE CASE SOURCE TERMS - DRY CASE CONDITION

088664-031

March 11, 2021

FIGURE D.6

HEG file: Z:\HEG\088664\DOCUMENTATION\RPT\088664-RPT-13\FIGURES\D.6 - Simulated Arsenic Concentration Versus Potable Criteria - PC - BC - DRY.srf



LEGEND

SURFACE WATER BODY
PROPOSED EXTENT OF MINE FEATURES
0.1 SIMULATED ARSENIC CONCENTRATION (ug/L)
SURFACE WATER MANAGEMENT DITCHES
PROPERTY BOUNDARY
PROJECT AREA
LOCAL ASSESSMENT AREA
NAG WASTE ROCK STOCKPILE
PAG WASTE ROCK STOCKPILE
LGO STOCKPILE
TILL STOCKPILES
TOPSOIL STOCKPILES

Note: The arsenic Tier 1 EQS for potable groundwater is 10 ug/L.

0 300 600 900m

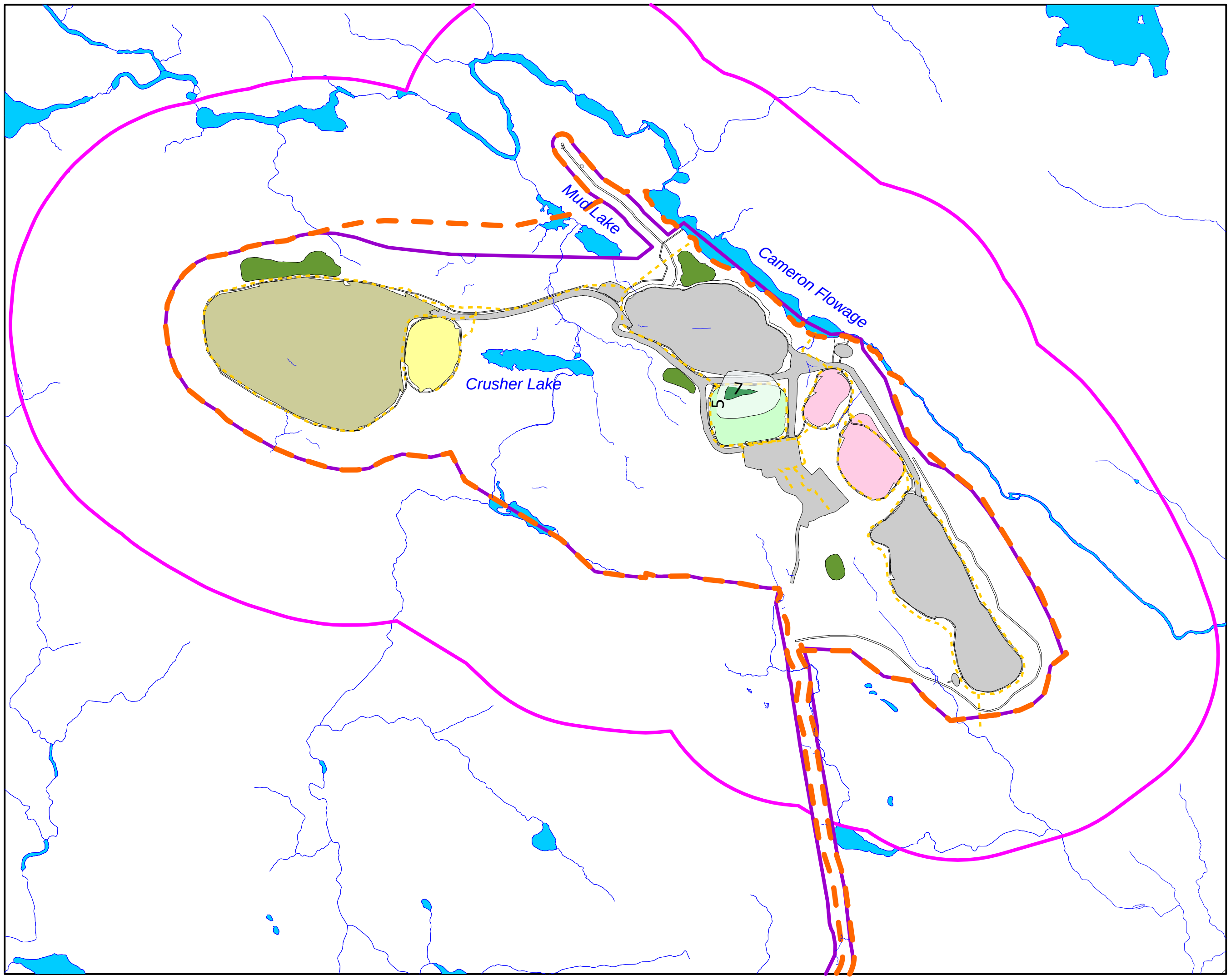
ATLANTIC GOLD CORPORATION
MARINETTE, NOVA SCOTIA
BEAVER DAM MINE

SIMULATED ARSENIC CONCENTRATION VERSUS POTABLE CRITERIA
PC - UPPER CASE SOURCE TERMS - DRY CASE CONDITION

088664-031
March 11, 2021

FIGURE D.7

HEG file: Z:\HEG\088664\DOCUMENTATION\RPT\088664-RPT-13\D.7 - Simulated Arsenic Concentration Versus Potable Criteria - PC - UC - DRY.srf



LEGEND

SURFACE WATER BODY
PROPOSED EXTENT OF MINE FEATURES
0.1 SIMULATED CADMIUM CONCENTRATION (ug/L)
SURFACE WATER MANAGEMENT DITCHES
PROPERTY BOUNDARY
PROJECT AREA
LOCAL ASSESSMENT AREA
NAG WASTE ROCK STOCKPILE
PAG WASTE ROCK STOCKPILE
LGO STOCKPILE
TILL STOCKPILES
TOPSOIL STOCKPILES

Note: The cadmium Tier 1 EQS for potable groundwater is 5 ug/L.

0 300 600 900m

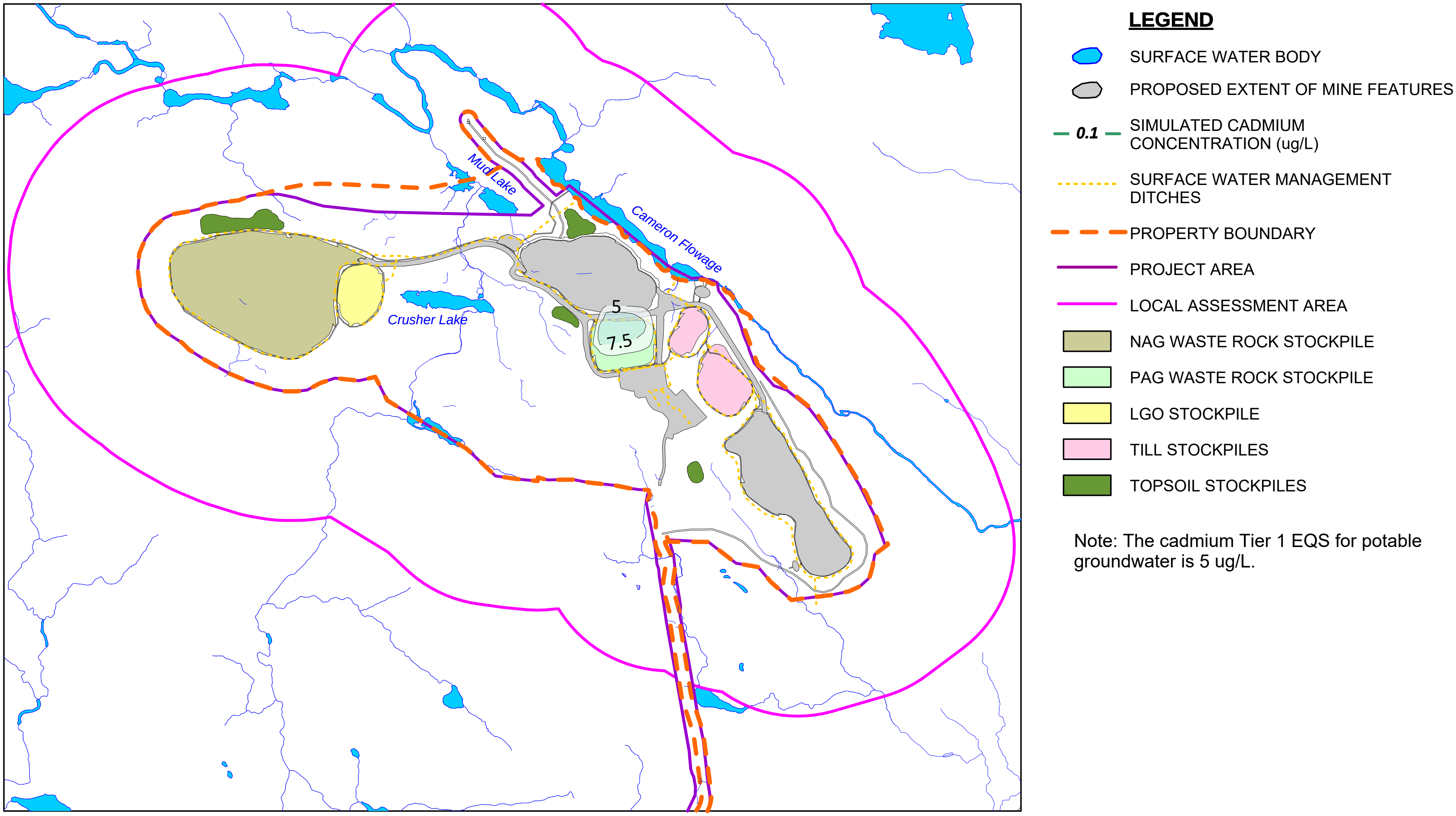
ATLANTIC GOLD CORPORATION
MARINETTE, NOVA SCOTIA
BEAVER DAM MINE

SIMULATED CADMIUM CONCENTRATION VERSUS POTABLE CRITERIA
PC - BASE CASE SOURCE TERMS - DRY CASE CONDITION

088664-031
March 11, 2021

FIGURE D.8

HEG file: Z:\HEG\088664\DOCUMENTATION\RPT\088664-RPT-13\FIGURES\D.8 - Simulated Cadmium Concentration Versus Potable Criteria - PC - BC - DRY.srf



Note: The cadmium Tier 1 EQS for potable groundwater is 5 ug/L.

0 300 600 900m

ATLANTIC GOLD CORPORATION
MARINETTE, NOVA SCOTIA
BEAVER DAM MINE

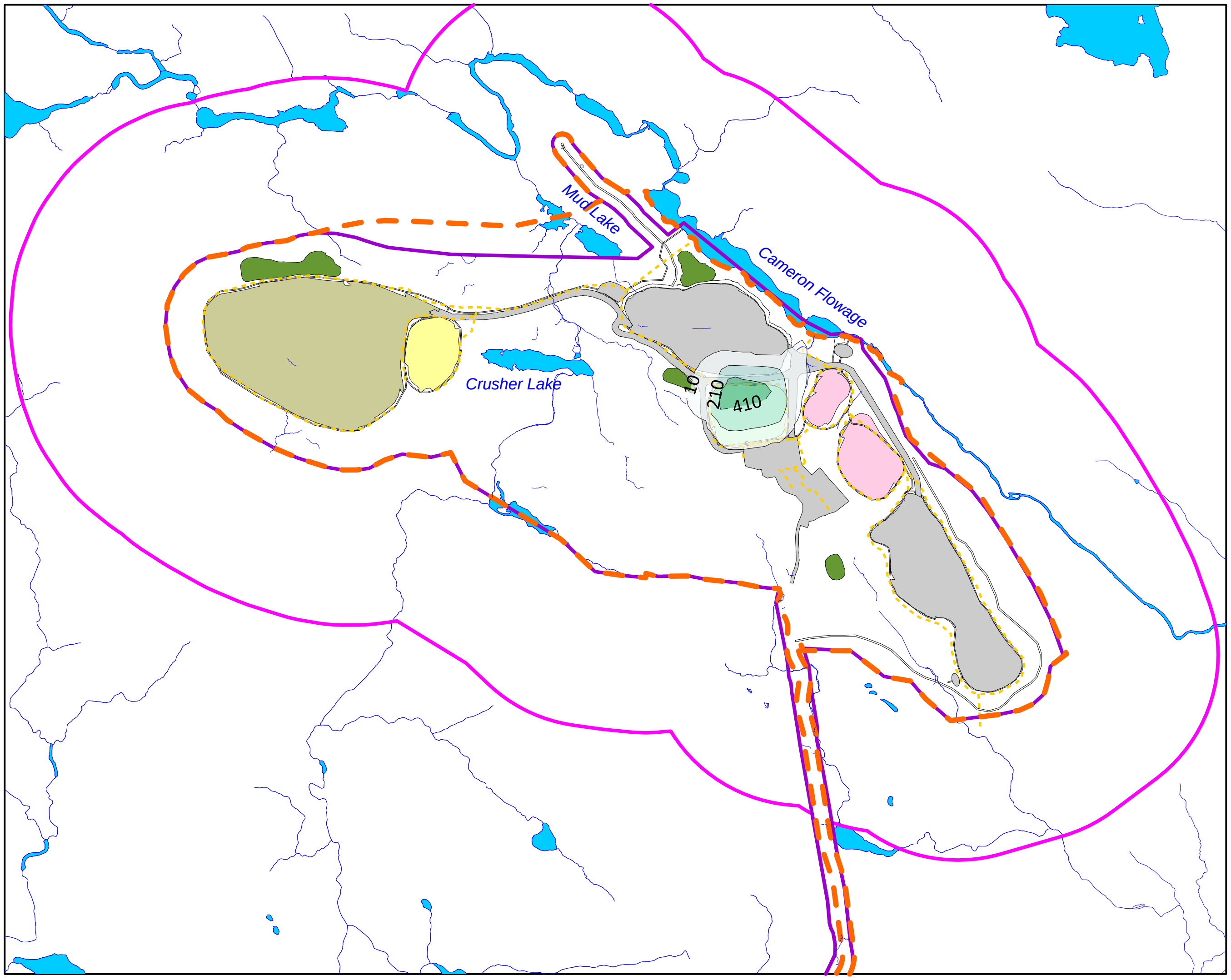
SIMULATED CADMIUM CONCENTRATION VERSUS POTABLE CRITERIA
PC - UPPER SOURCE TERMS - DRY CASE CONDITION

088664-031

March 11, 2021

FIGURE D.9

HEG file: Z:\HEG\088664\DOCUMENTATION\RPT\088664-RPT-13\FIGURES\D.9 - Simulated Cadmium Concentration Versus Potable Criteria - PC - UC - DRY.srf



LEGEND

- SURFACE WATER BODY
- PROPOSED EXTENT OF MINE FEATURES
- 0.1 SIMULATED COBALT CONCENTRATION (ug/L)
- SURFACE WATER MANAGEMENT DITCHES
- PROPERTY BOUNDARY
- PROJECT AREA
- LOCAL ASSESSMENT AREA
- NAG WASTE ROCK STOCKPILE
- PAG WASTE ROCK STOCKPILE
- LGO STOCKPILE
- TILL STOCKPILES
- TOPSOIL STOCKPILES

Note: The cobalt Tier 1 EQS for potable groundwater is 10 ug/L.

0 300 600 900m

ATLANTIC GOLD CORPORATION
MARINETTE, NOVA SCOTIA
BEAVER DAM MINE

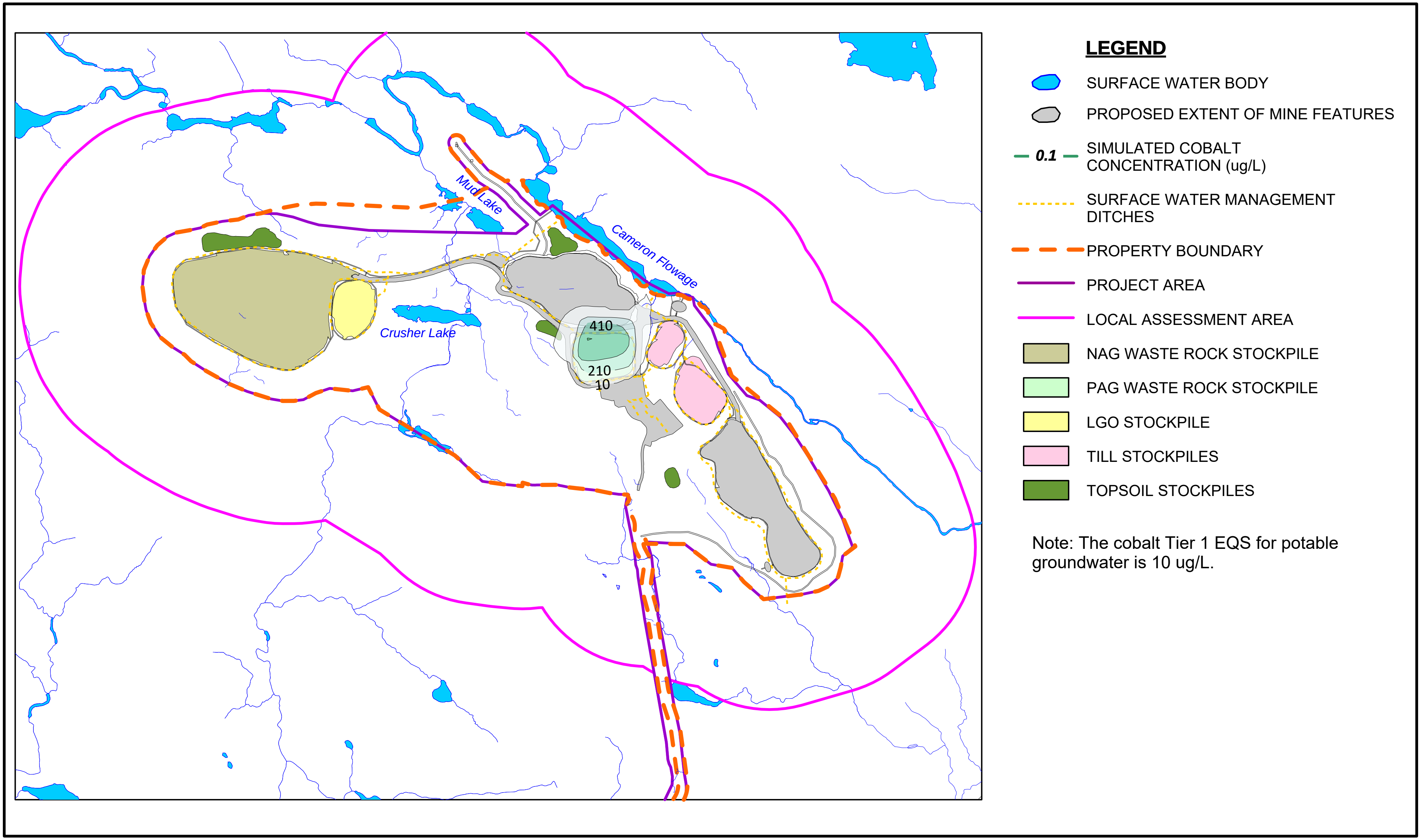
SIMULATED COBALT CONCENTRATION VERSUS POTABLE CRITERIA
PC - BASE CASE SOURCE TERMS - DRY CASE CONDITION

088664-031

March 11, 2021

FIGURE D.10

HEG file: Z:\HEG\088664\DOCUMENTATION\RPT\088664-RPT-13\FIGURES\D.10 - Simulated Cobalt Concentration Versus Potable Criteria - PC - BC - DRY.srf



0 300 600 900m

ATLANTIC GOLD CORPORATION
MARINETTE, NOVA SCOTIA
BEAVER DAM MINE

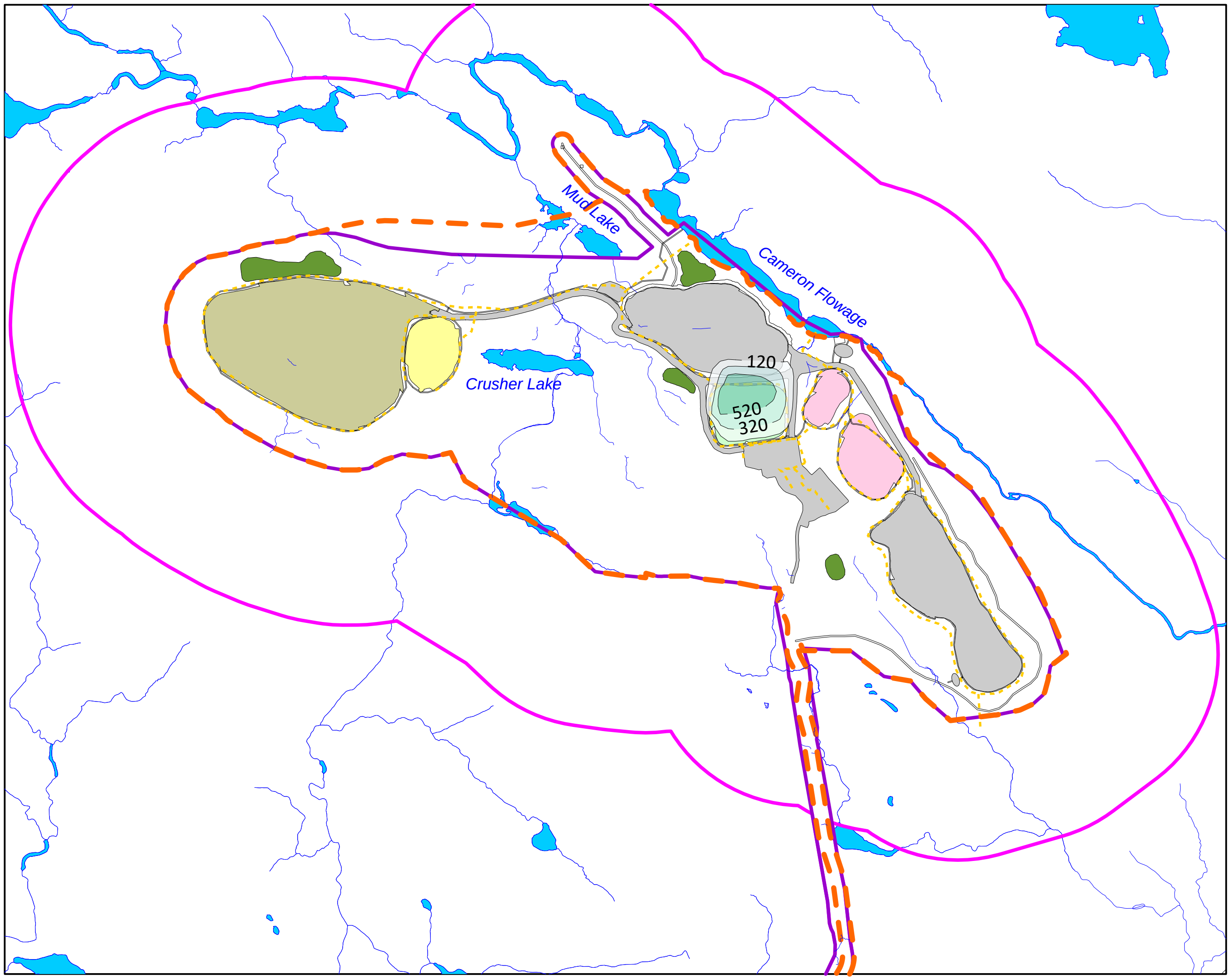
SIMULATED COBALT CONCENTRATION VERSUS POTABLE CRITERIA
PC - UPPER CASE SOURCE TERMS - DRY CASE CONDITION

088664-031

March 11, 2021

FIGURE D.11

HEG file: Z:\HEG\088664\DOCUMENTATION\RPT\088664-RPT-13\FIGURES\D.11 - Simulated Cobalt Concentration Versus Potable Criteria - PC - UC - DRY.srf



LEGEND

- SURFACE WATER BODY
- PROPOSED EXTENT OF MINE FEATURES
- 0.1 — SIMULATED MANGANESE CONCENTRATION (ug/L)
- SURFACE WATER MANAGEMENT DITCHES
- PROPERTY BOUNDARY
- PROJECT AREA
- LOCAL ASSESSMENT AREA
- NAG WASTE ROCK STOCKPILE
- PAG WASTE ROCK STOCKPILE
- LGO STOCKPILE
- TILL STOCKPILES
- TOPSOIL STOCKPILES

Note: The manganese Tier 1 EQS for potable groundwater is 120 ug/L.

0 300 600 900m

ATLANTIC GOLD CORPORATION
MARINETTE, NOVA SCOTIA
BEAVER DAM MINE

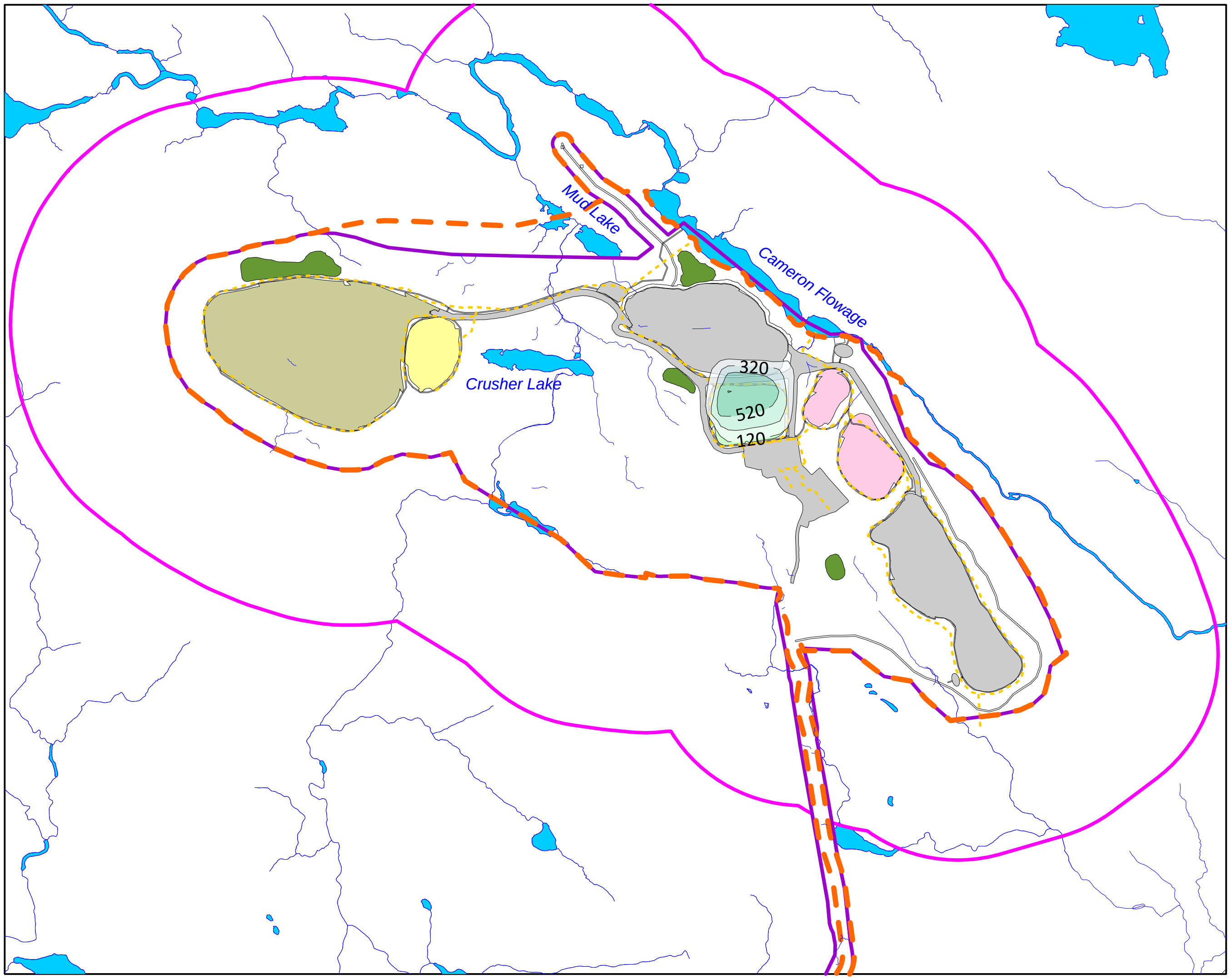
SIMULATED MANGANESE CONCENTRATION VERSUS POTABLE CRITERIA
PC - BASE CASE SOURCE TERMS - DRY CASE CONDITION

088664-031

March 11, 2021

FIGURE D.12

HEG file: Z:\HEG\088664\DOCUMENTATION\RPT\088664-RPT-13\FIGURES\D.12 - Simulated Manganese Concentration Versus Potable Criteria - PC - BC - DRY.srf



LEGEND

- SURFACE WATER BODY
- PROPOSED EXTENT OF MINE FEATURES
- 0.1 SIMULATED MANGANESE CONCENTRATION (ug/L)
- SURFACE WATER MANAGEMENT DITCHES
- PROPERTY BOUNDARY
- PROJECT AREA
- LOCAL ASSESSMENT AREA
- NAG WASTE ROCK STOCKPILE
- PAG WASTE ROCK STOCKPILE
- LGO STOCKPILE
- TILL STOCKPILES
- TOPSOIL STOCKPILES

Note: The manganese Tier 1 EQS for potable groundwater is 120 ug/L.

0 300 600 900m

ATLANTIC GOLD CORPORATION
MARINETTE, NOVA SCOTIA
BEAVER DAM MINE

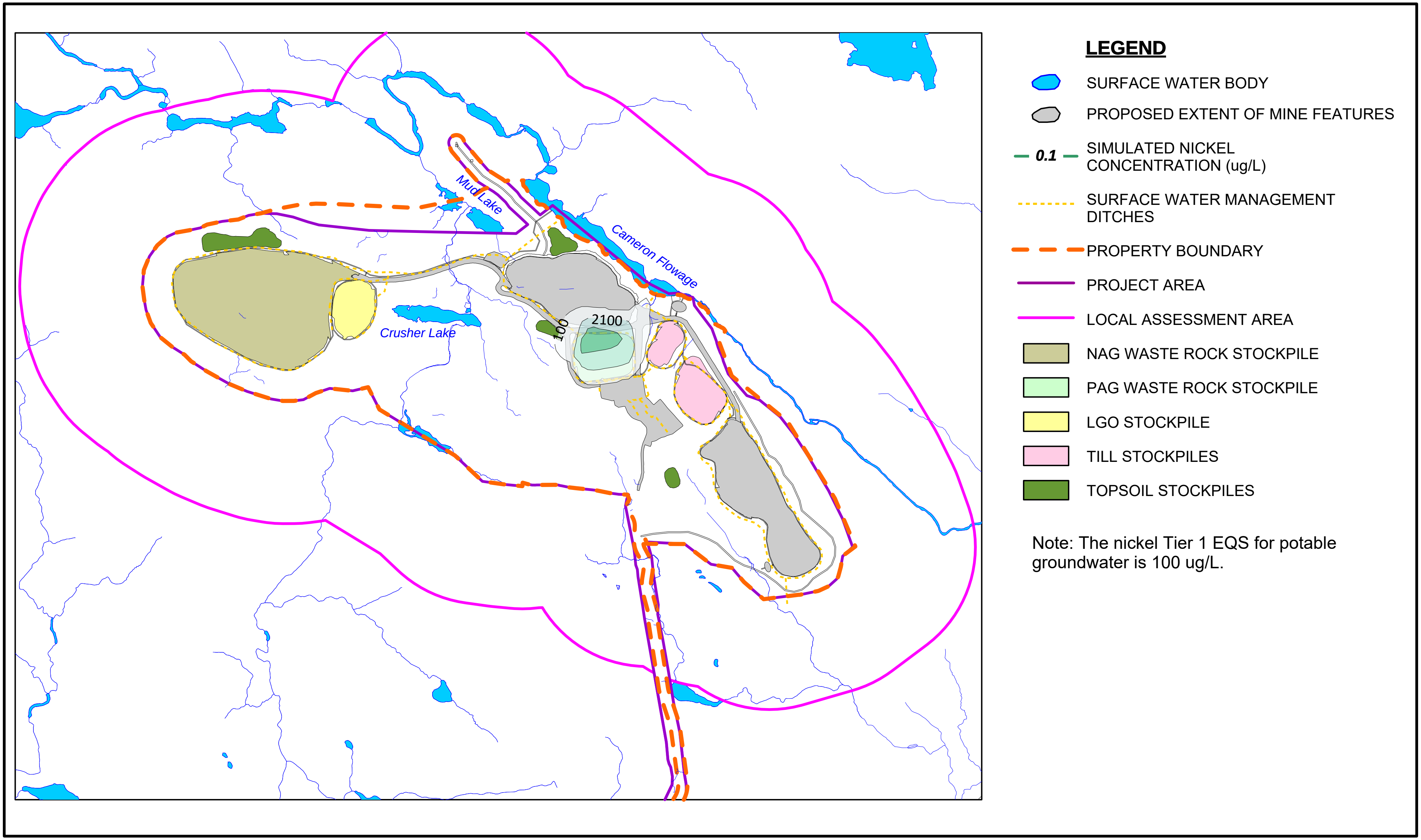
SIMULATED MANGANESE CONCENTRATION VERSUS POTABLE CRITERIA
PC - UPPER CASE SOURCE TERMS - DRY CASE CONDITION

088664-031

March 11, 2021

FIGURE D.13

HEG file: Z:\HEG\088664\DOCUMENTATION\RPT\088664-RPT-13\FIGURES\D.13 - Simulated Manganese Concentration Versus Potable Criteria - PC - UC - DRY.srf



ATLANTIC GOLD CORPORATION
MARINETTE, NOVA SCOTIA
BEAVER DAM MINE

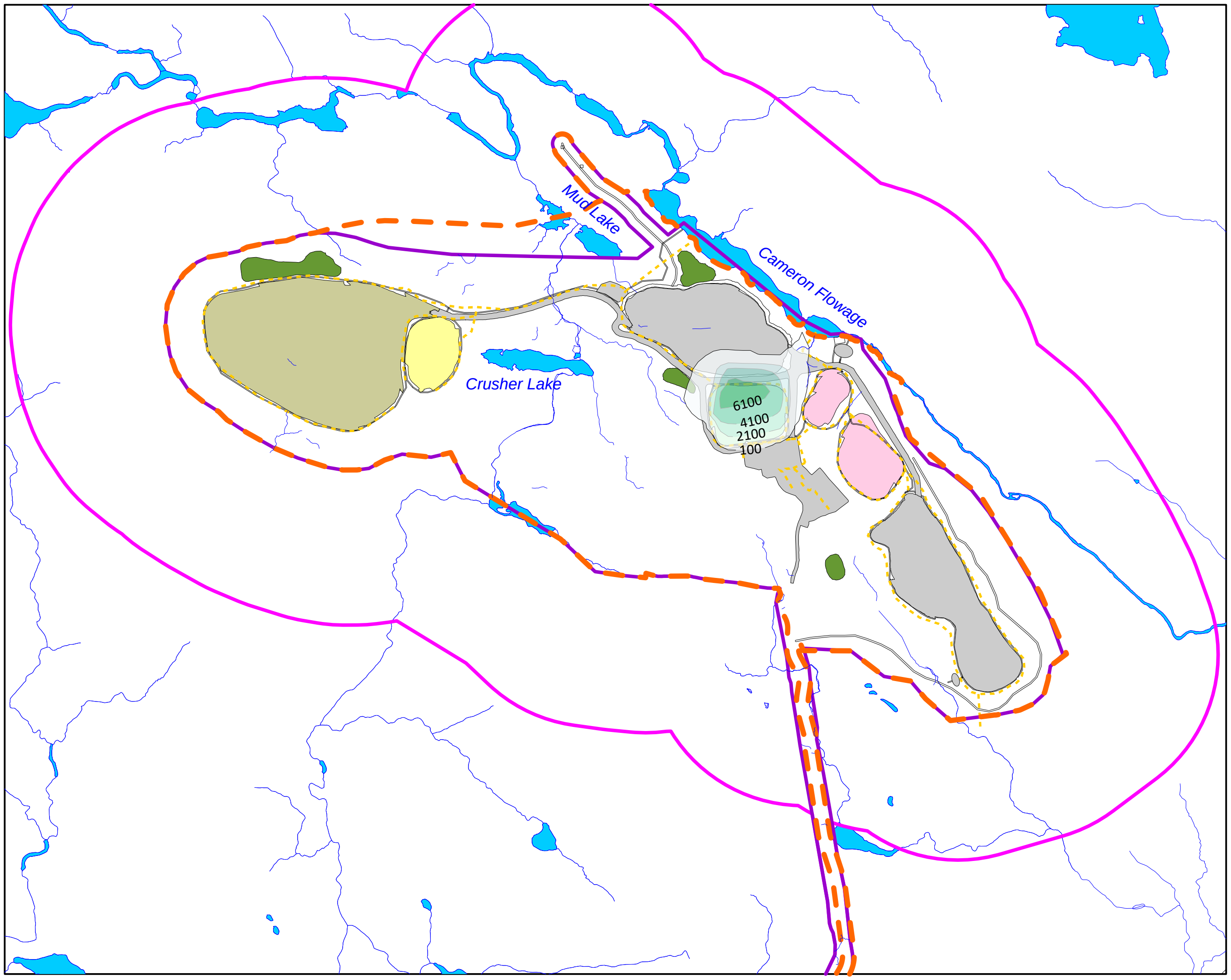
SIMULATED NICKEL CONCENTRATION VERSUS POTABLE CRITERIA
PC - BASE CASE SOURCE TERMS - DRY CASE CONDITION

088664-031

March 11, 2021

FIGURE D.14

HEG file: Z:\HEG\088664\DOCUMENTATION\RPT\088664-RPT-13\FIGURES\D.14 - Simulated Nickel Concentration Versus Potable Criteria - PC - BC - DRY.srf



LEGEND

- SURFACE WATER BODY
- PROPOSED EXTENT OF MINE FEATURES
- 0.1 SIMULATED NICKEL CONCENTRATION (ug/L)
- SURFACE WATER MANAGEMENT DITCHES
- PROPERTY BOUNDARY
- PROJECT AREA
- LOCAL ASSESSMENT AREA
- NAG WASTE ROCK STOCKPILE
- PAG WASTE ROCK STOCKPILE
- LGO STOCKPILE
- TILL STOCKPILES
- TOPSOIL STOCKPILES

Note: The nickel Tier 1 EQS for potable groundwater is 100 ug/L.

0 300 600 900m

ATLANTIC GOLD CORPORATION
MARINETTE, NOVA SCOTIA
BEAVER DAM MINE

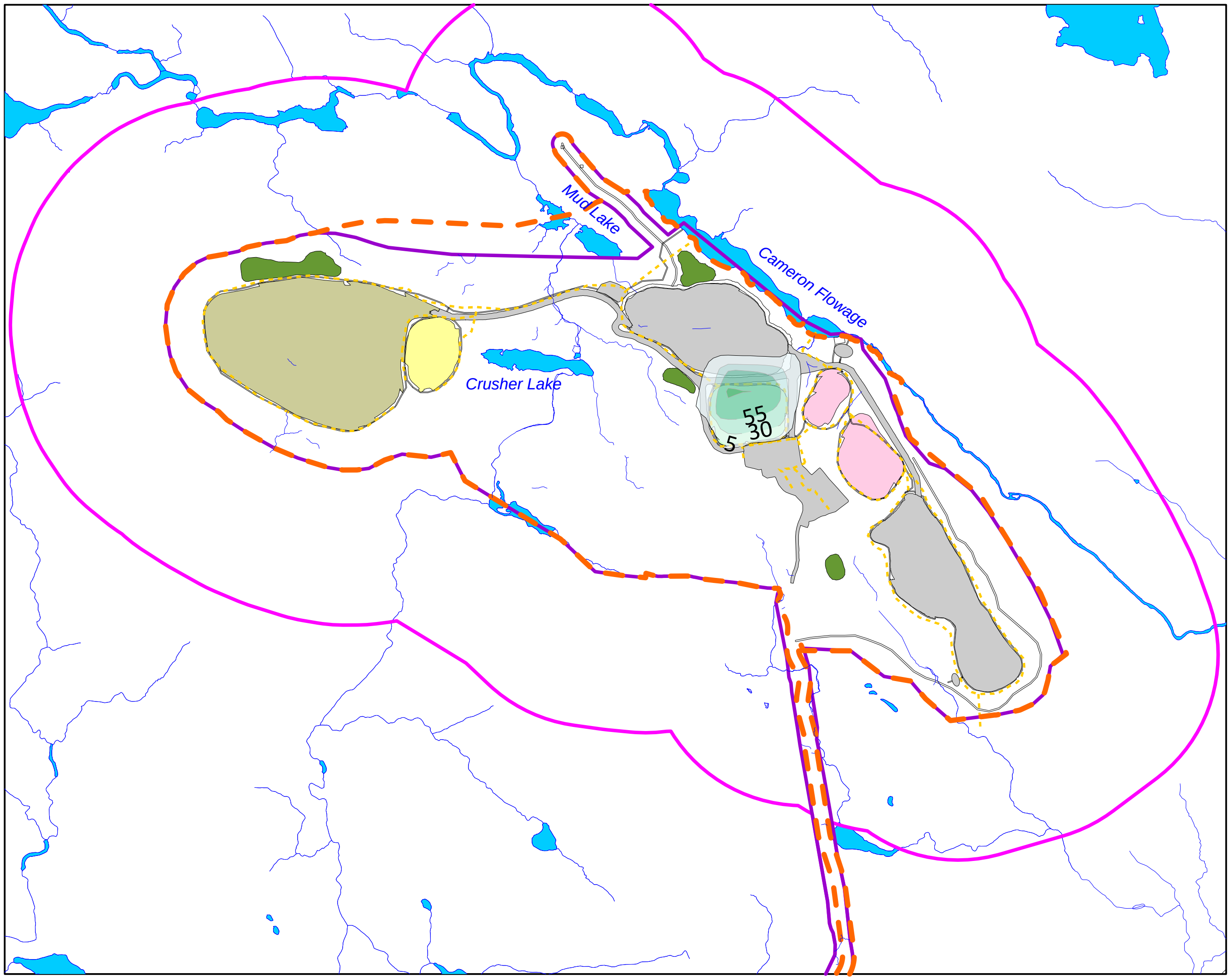
SIMULATED NICKEL CONCENTRATION VERSUS POTABLE CRITERIA
PC - UPPER CASE SOURCE TERMS - DRY CASE CONDITION

088664-031

March 11, 2021

FIGURE D.15

HEG file: Z:\HEG\088664\DOCUMENTATION\RPT\088664-RPT-13\FIGURES\D.15 - Simulated Nickel Concentration Versus Potable Criteria - PC - UC - DRY.srf



LEGEND

SURFACE WATER BODY

PROPOSED EXTENT OF MINE FEATURES

0.1 — SIMULATED LEAD CONCENTRATION (ug/L)

SURFACE WATER MANAGEMENT DITCHES

PROPERTY BOUNDARY

PROJECT AREA

LOCAL ASSESSMENT AREA

NAG WASTE ROCK STOCKPILE

PAG WASTE ROCK STOCKPILE

LGO STOCKPILE

TILL STOCKPILES

TOPSOIL STOCKPILES

Note: The lead GCDWQ is 5 ug/L.

0 300 600 900m

ATLANTIC GOLD CORPORATION
MARINETTE, NOVA SCOTIA
BEAVER DAM MINE

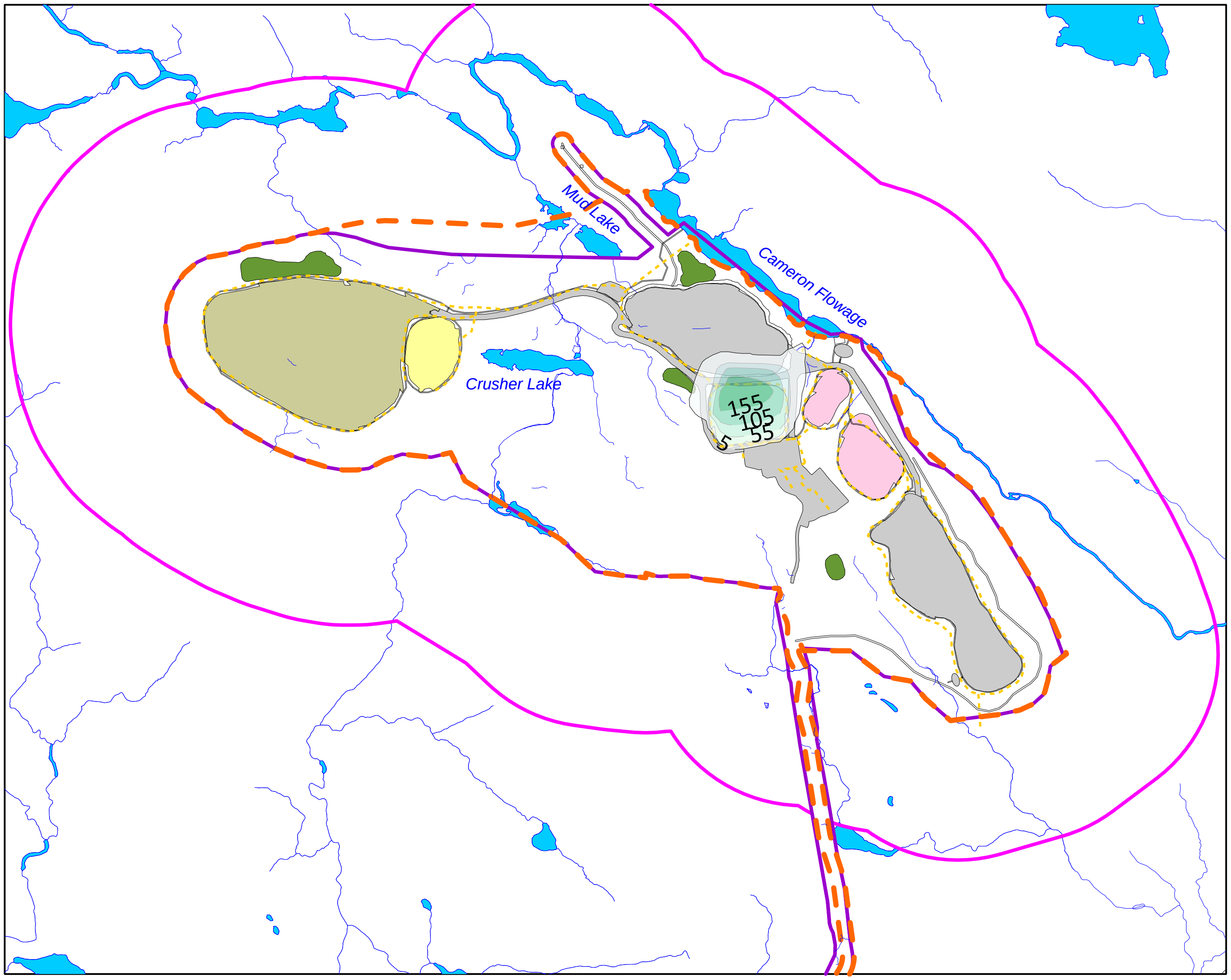
SIMULATED LEAD CONCENTRATION VERSUS POTABLE CRITERIA
PC - BASE CASE SOURCE TERMS - DRY CASE CONDITION

088664-031

March 11, 2021

FIGURE D.16

HEG file: Z:\HEG\088664\DOCUMENTATION\RPT\088664-RPT-13\FIGURES\D.16 - Simulated Lead Concentration Versus Potable Criteria - PC - BC - DRY.srf



LEGEND

- SURFACE WATER BODY
- PROPOSED EXTENT OF MINE FEATURES
- 0.1 SIMULATED LEAD CONCENTRATION (ug/L)
- SURFACE WATER MANAGEMENT DITCHES
- PROPERTY BOUNDARY
- PROJECT AREA
- LOCAL ASSESSMENT AREA
- NAG WASTE ROCK STOCKPILE
- PAG WASTE ROCK STOCKPILE
- LGO STOCKPILE
- TILL STOCKPILES
- TOPSOIL STOCKPILES

Note: The lead GCDWQ is 5 ug/L.

0 300 600 900m

ATLANTIC GOLD CORPORATION
MARINETTE, NOVA SCOTIA
BEAVER DAM MINE

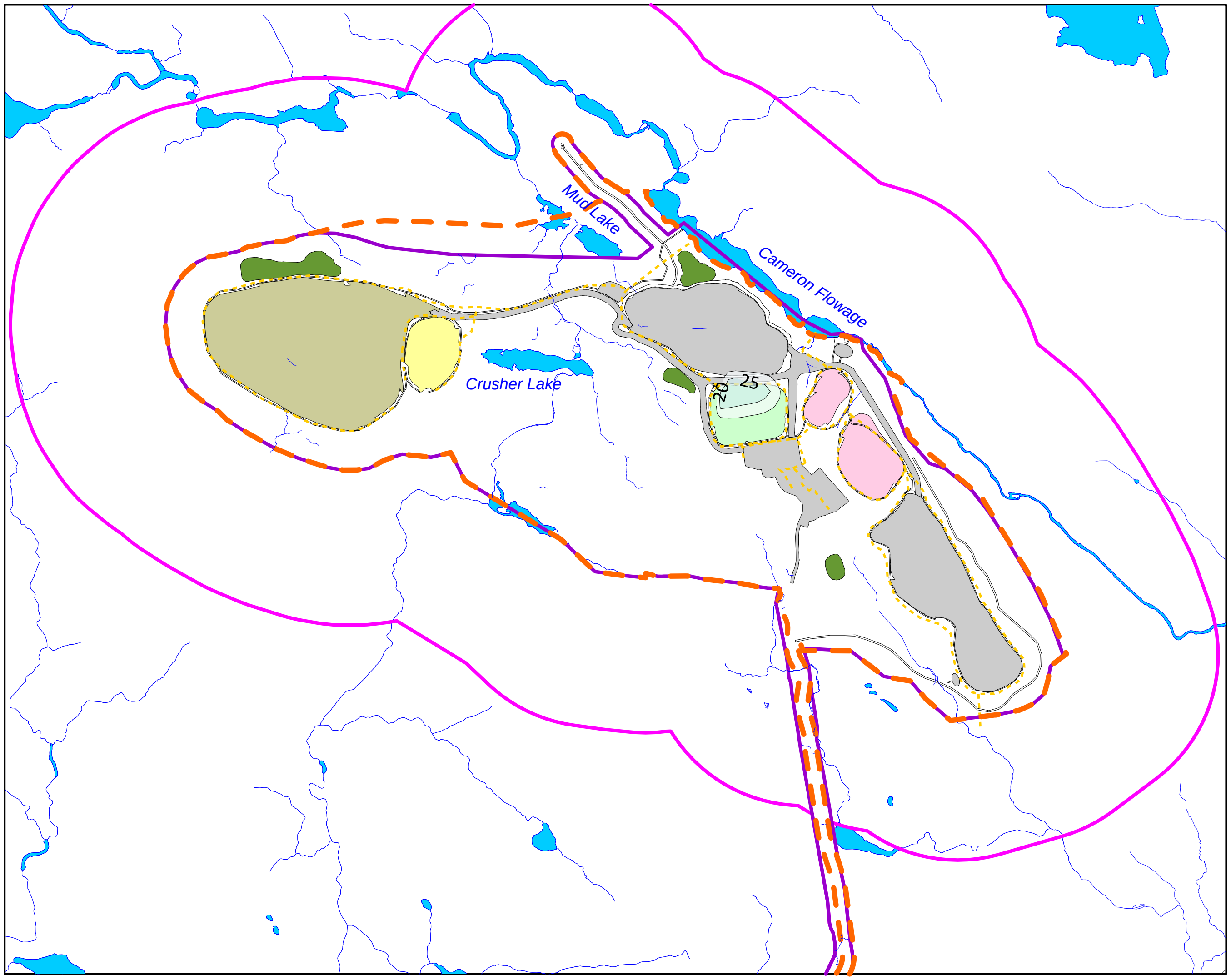
SIMULATED LEAD CONCENTRATION VERSUS POTABLE CRITERIA
PC - UPPER CASE SOURCE TERMS - DRY CASE CONDITION

088664-031

March 11, 2021

FIGURE D.17

HEG file: Z:\HEG\088664\DOCUMENTATION\RPT\088664-RPT-13\FIGURES\D.17 - Simulated Lead Concentration Versus Potable Criteria - PC - UC - DRY.srf



LEGEND

- SURFACE WATER BODY
- PROPOSED EXTENT OF MINE FEATURES
- 0.1 — SIMULATED URANIUM CONCENTRATION (ug/L)
- SURFACE WATER MANAGEMENT DITCHES
- PROPERTY BOUNDARY
- PROJECT AREA
- LOCAL ASSESSMENT AREA
- NAG WASTE ROCK STOCKPILE
- PAG WASTE ROCK STOCKPILE
- LGO STOCKPILE
- TILL STOCKPILES
- TOPSOIL STOCKPILES

Note: The uranium Tier 1 EQS for potable groundwater is 20 ug/L.

0 300 600 900m

ATLANTIC GOLD CORPORATION
MARINETTE, NOVA SCOTIA
BEAVER DAM MINE

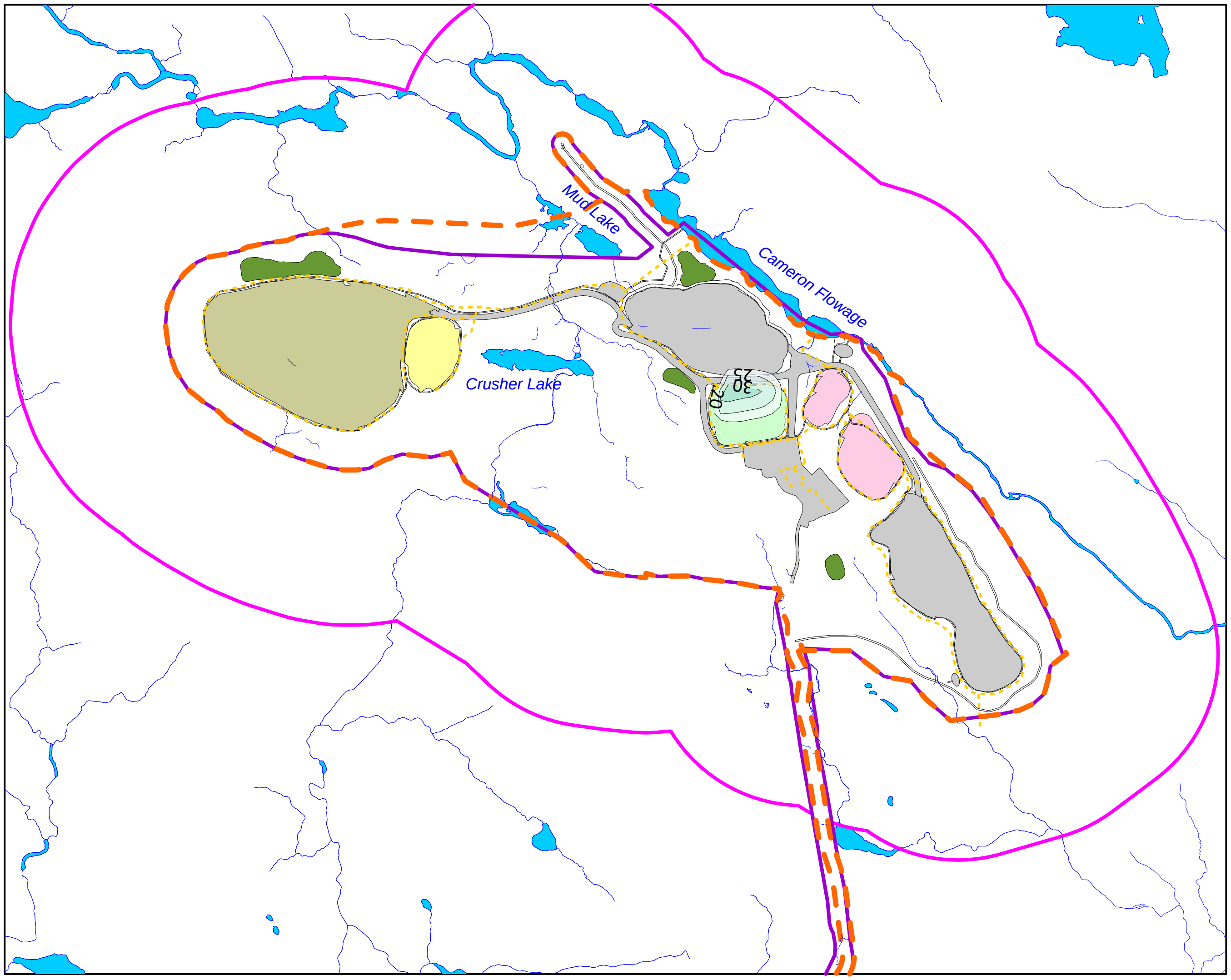
SIMULATED URANIUM CONCENTRATION VERSUS POTABLE CRITERIA
PC - BASE CASE SOURCE TERMS - DRY CASE CONDITION

088664-031

March 11, 2021

FIGURE D.18

HEG file: Z:\HEG\088664\DOCUMENTATION\RPT\088664-RPT-13\FIGURES\D.19 - Simulated Uranium Concentration Versus Potable Criteria - PC - BC - DRY.srf



LEGEND

- SURFACE WATER BODY
- PROPOSED EXTENT OF MINE FEATURES
- 0.1 — SIMULATED URANIUM CONCENTRATION (ug/L)
- SURFACE WATER MANAGEMENT DITCHES
- PROPERTY BOUNDARY
- PROJECT AREA
- LOCAL ASSESSMENT AREA
- NAG WASTE ROCK STOCKPILE
- PAG WASTE ROCK STOCKPILE
- LGO STOCKPILE
- TILL STOCKPILES
- TOPSOIL STOCKPILES

Note: The uranium Tier 1 EQS for potable groundwater is 20 ug/L.

0 300 600 900m

ATLANTIC GOLD CORPORATION
MARINETTE, NOVA SCOTIA
BEAVER DAM MINE

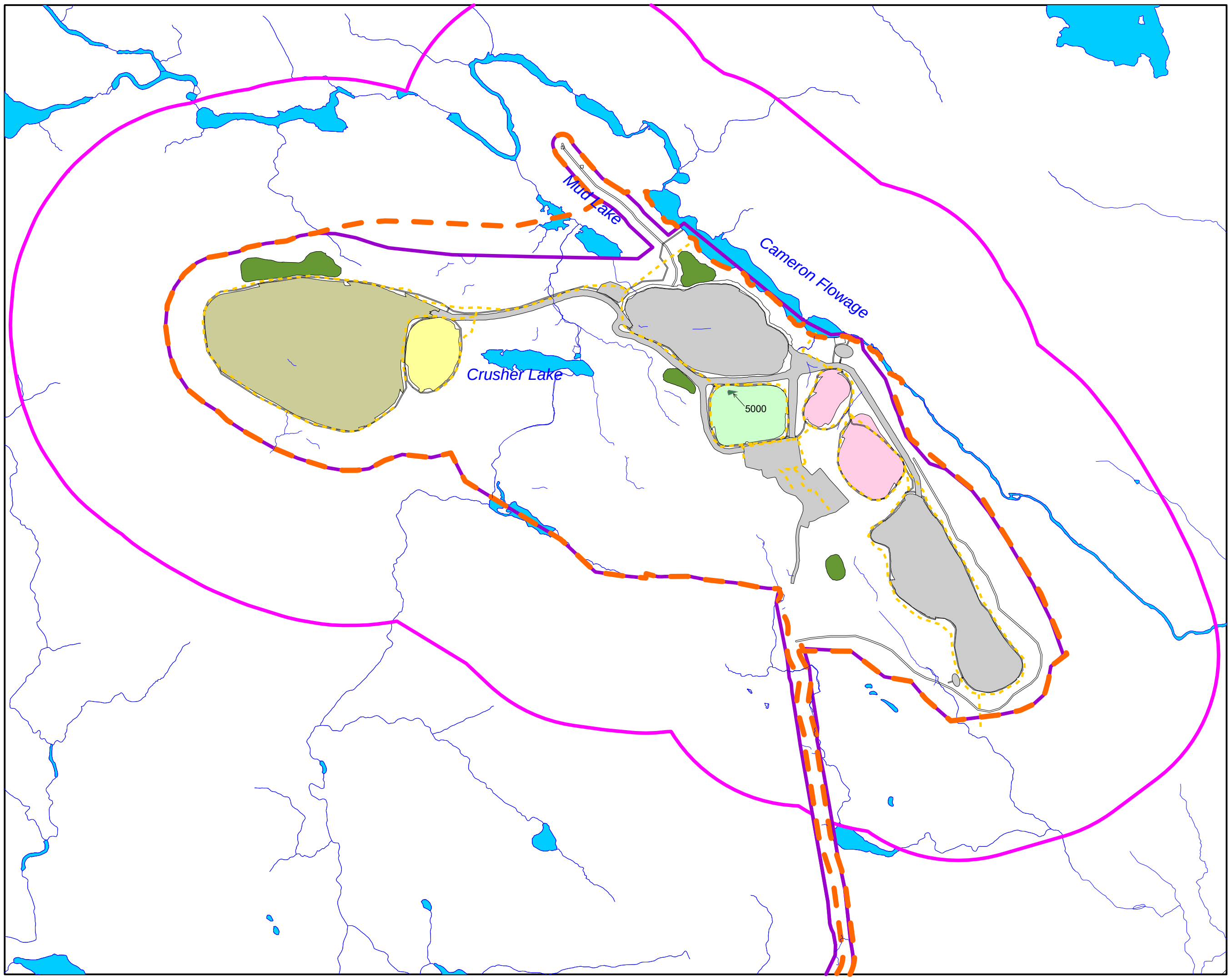
SIMULATED URANIUM CONCENTRATION VERSUS POTABLE CRITERIA
PC - UPPER CASE SOURCE TERMS - DRY CASE CONDITION

088664-031

March 11, 2021

FIGURE D.19

HEG file: Z:\HEG\088664\DOCUMENTATION\RPT\088664-RPT-13\FIGURES\D.20 - Simulated Uranium Concentration Versus Potable Criteria - PC - UC - DRY.srf



LEGEND

- SURFACE WATER BODY
- PROPOSED EXTENT OF MINE FEATURES
- 0.1 SIMULATED ZINC CONCENTRATION (ug/L)
- SURFACE WATER MANAGEMENT DITCHES
- PROPERTY BOUNDARY
- PROJECT AREA
- LOCAL ASSESSMENT AREA
- NAG WASTE ROCK STOCKPILE
- PAG WASTE ROCK STOCKPILE
- LGO STOCKPILE
- TILL STOCKPILES
- TOPSOIL STOCKPILES

Note: The zinc Tier 1 EQS for potable groundwater is 5000 ug/L.

0 300 600 900m

ATLANTIC GOLD CORPORATION
MARINETTE, NOVA SCOTIA
BEAVER DAM MINE

SIMULATED ZINC CONCENTRATION VERSUS POTABLE CRITERIA
PC - UPPER CASE SOURCE TERMS - DRY CASE CONDITION

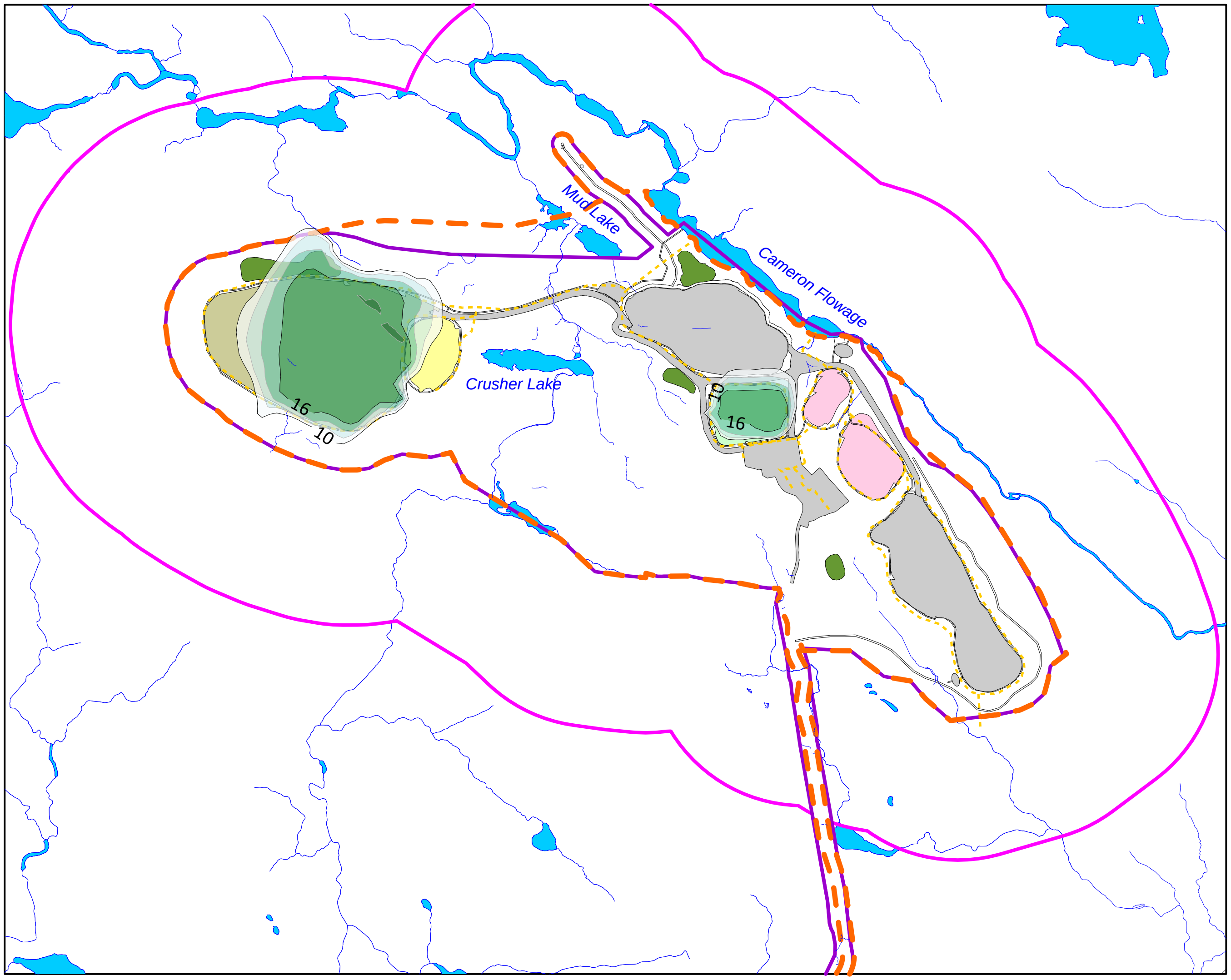
088664-031

March 11, 2021

FIGURE D.20

HEG file: Z:\HEG\088664\DOCUMENTATION\RPT\088664-RPT-13\FIGURES\D.22 - Simulated Zinc Concentration Versus Potable Criteria - PC - UC - DRY.srf

Appendix E
Simulated COC Concentrations in Groundwater Versus Potable Criteria – Wet Conditions



LEGEND

SURFACE WATER BODY
PROPOSED EXTENT OF MINE FEATURES
0.1 SIMULATED ARSENIC CONCENTRATION (ug/L)
SURFACE WATER MANAGEMENT DITCHES
PROPERTY BOUNDARY
PROJECT AREA
LOCAL ASSESSMENT AREA
NAG WASTE ROCK STOCKPILE
PAG WASTE ROCK STOCKPILE
LGO STOCKPILE
TILL STOCKPILES
TOPSOIL STOCKPILES

Note: The arsenic Tier 1 EQS for potable groundwater is 10 ug/L.

0 300 600 900m

ATLANTIC GOLD CORPORATION
MARINETTE, NOVA SCOTIA
BEAVER DAM MINE

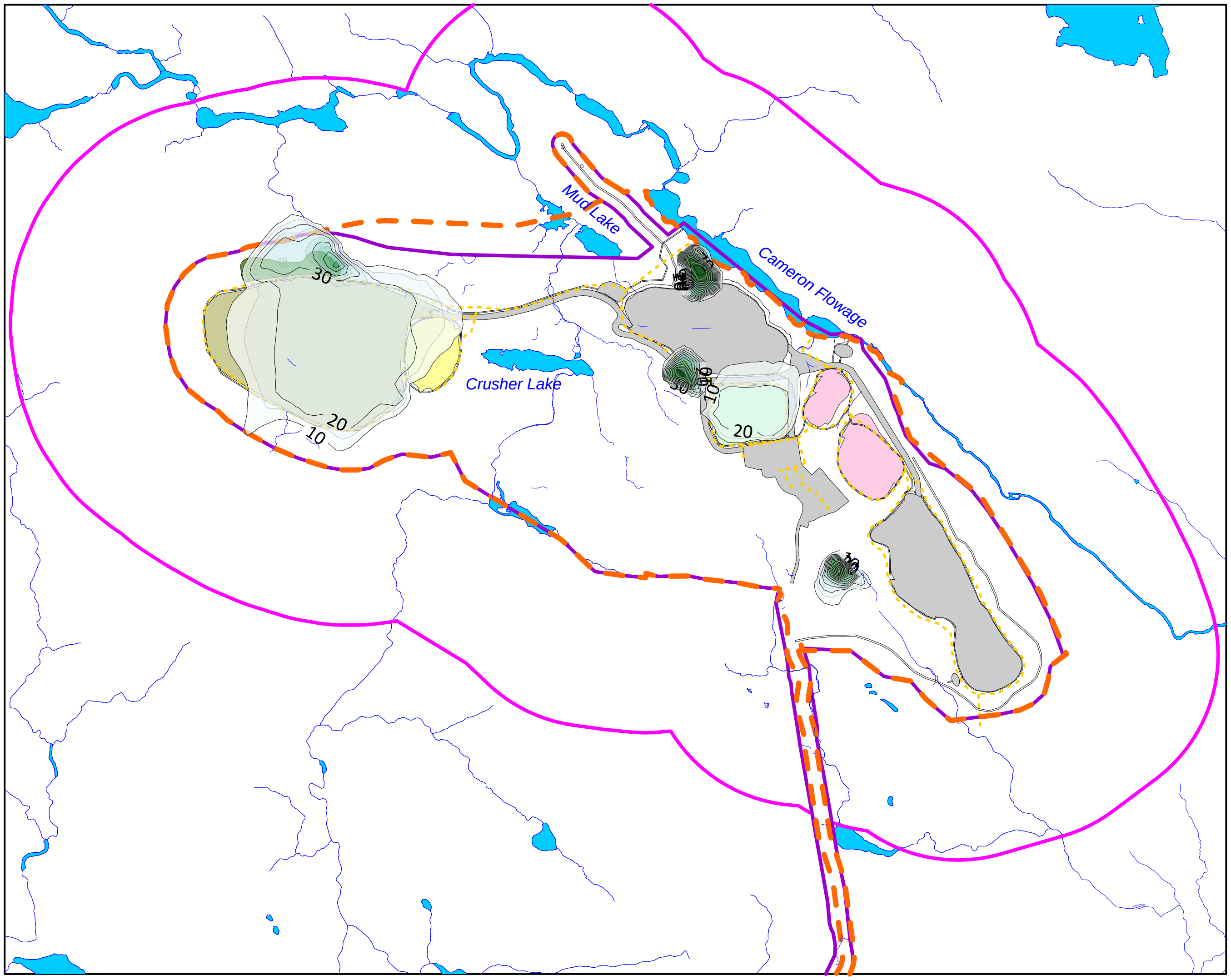
SIMULATED ARSENIC CONCENTRATION VERSUS POTABLE CRITERIA
EOM - BASE CASE SOURCE TERMS - WET CASE CONDITION

088664-031

March 11, 2021

FIGURE E.1

HEG file: Z:\HEG\088664\DOCUMENTATION\RPT\088664-RPT-13\FIGURES\E.1 - Simulated Arsenic Concentration Versus Potable Criteria - EOM- BC - WET.srf



LEGEND

- SURFACE WATER BODY
- PROPOSED EXTENT OF MINE FEATURES
- 0.1 SIMULATED ARSENIC CONCENTRATION (ug/L)
- SURFACE WATER MANAGEMENT DITCHES
- PROPERTY BOUNDARY
- PROJECT AREA
- LOCAL ASSESSMENT AREA
- NAG WASTE ROCK STOCKPILE
- PAG WASTE ROCK STOCKPILE
- LGO STOCKPILE
- TILL STOCKPILES
- TOPSOIL STOCKPILES

Note: The arsenic Tier 1 EQS for potable groundwater is 10 ug/L.

0 300 600 900m

N

ATLANTIC GOLD CORPORATION
MARINETTE, NOVA SCOTIA
BEAVER DAM MINE

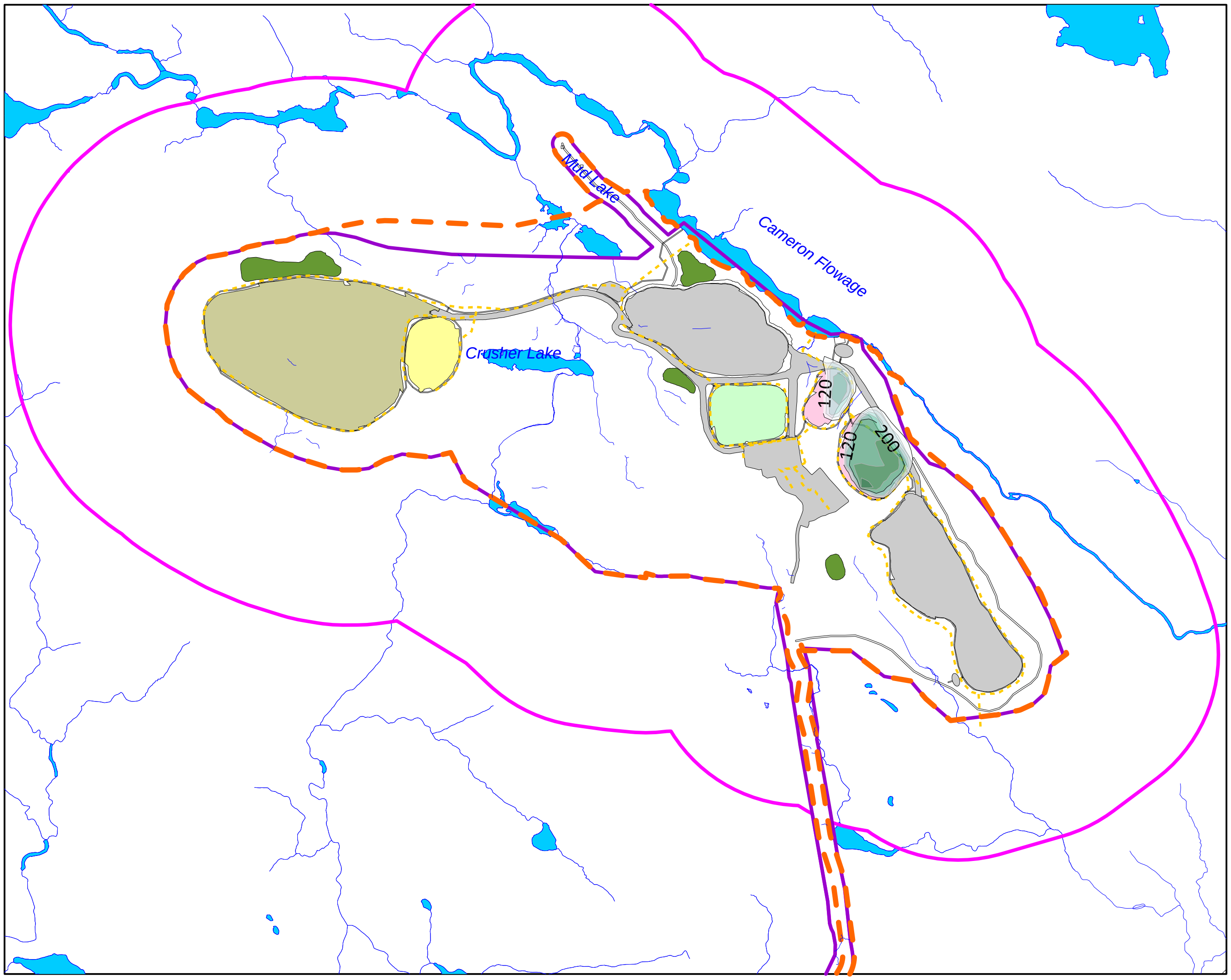
SIMULATED ARSENIC CONCENTRATION VERSUS POTABLE CRITERIA
EOM - UPPER CASE SOURCE TERMS - WET CASE CONDITION

088664-031

March 11, 2021

FIGURE E.2

HEG file: Z:\HEG\088664\DOCUMENTATION\RPT\088664-RPT-13\FIGURES\E.2 - Simulated Arsenic Concentration Versus Potable Criteria - EOM - UC - WET.srf



LEGEND

- SURFACE WATER BODY
- PROPOSED EXTENT OF MINE FEATURES
- 0.1 — SIMULATED MANGANESE CONCENTRATION (ug/L)
- SURFACE WATER MANAGEMENT DITCHES
- PROPERTY BOUNDARY
- PROJECT AREA
- LOCAL ASSESSMENT AREA
- NAG WASTE ROCK STOCKPILE
- PAG WASTE ROCK STOCKPILE
- LGO STOCKPILE
- TILL STOCKPILES
- TOPSOIL STOCKPILES

Note: The manganese Tier 1 EQS for potable groundwater is 120 ug/L.

0 300 600 900m

ATLANTIC GOLD CORPORATION
MARINETTE, NOVA SCOTIA
BEAVER DAM MINE

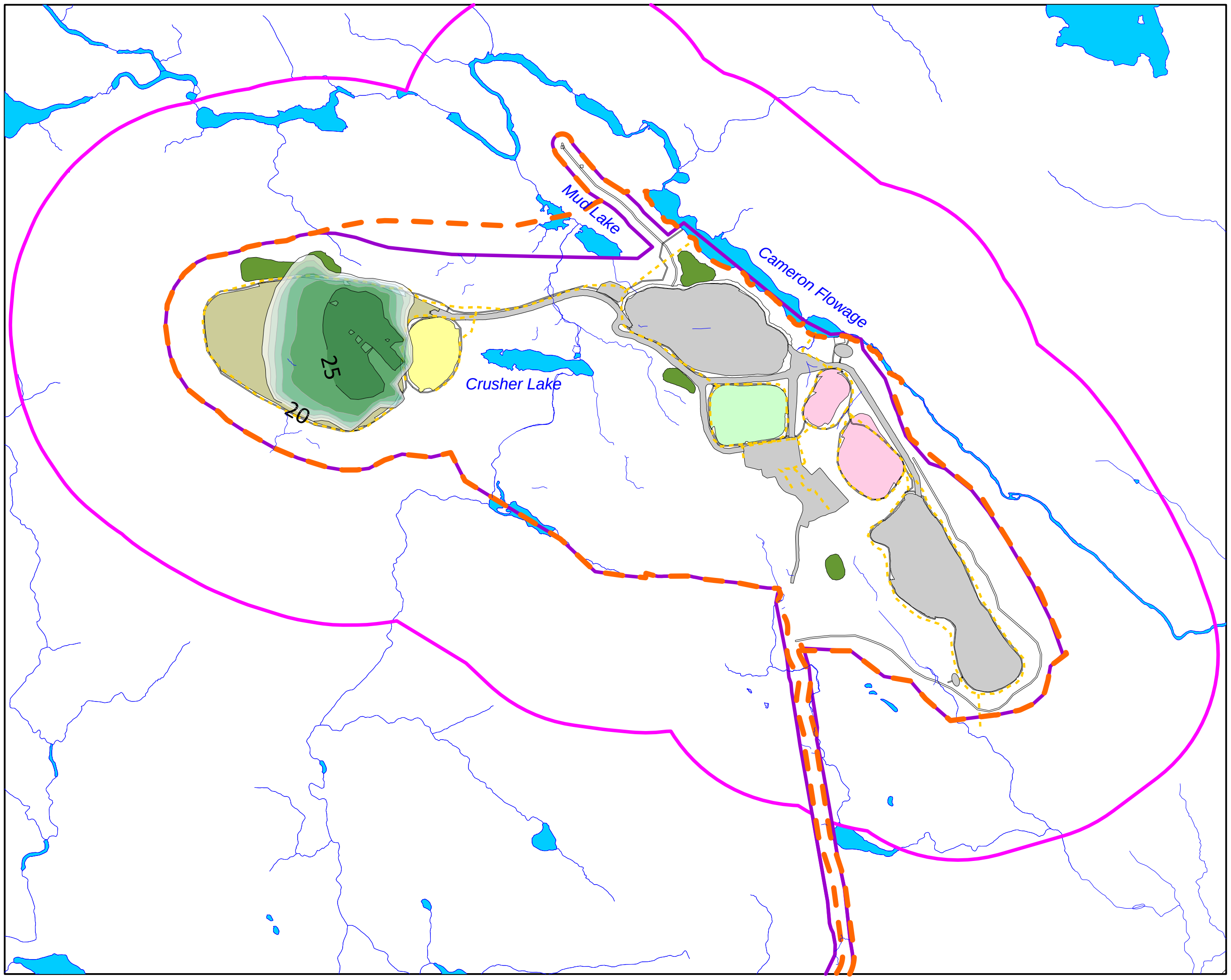
SIMULATED MANGANESE CONCENTRATION VERSUS POTABLE CRITERIA
EOM - UPPER CASE SOURCE TERMS - WET CASE CONDITION

088664-031

March 11, 2021

FIGURE E.3

HEG file: Z:\HEG\088664\DOCUMENTATION\RPT\088664-RPT-13\FIGURES\E.3 - Simulated Manganese Concentration Versus Potable Criteria - EOM - UC - WET.srf



LEGEND

- SURFACE WATER BODY
- PROPOSED EXTENT OF MINE FEATURES
- 0.1 SIMULATED URANIUM CONCENTRATION (ug/L)
- SURFACE WATER MANAGEMENT DITCHES
- PROPERTY BOUNDARY
- PROJECT AREA
- LOCAL ASSESSMENT AREA
- NAG WASTE ROCK STOCKPILE
- PAG WASTE ROCK STOCKPILE
- LGO STOCKPILE
- TILL STOCKPILES
- TOPSOIL STOCKPILES

Note: The uranium Tier 1 EQS for potable groundwater is 20 ug/L.

0 300 600 900m

ATLANTIC GOLD CORPORATION
MARINETTE, NOVA SCOTIA
BEAVER DAM MINE

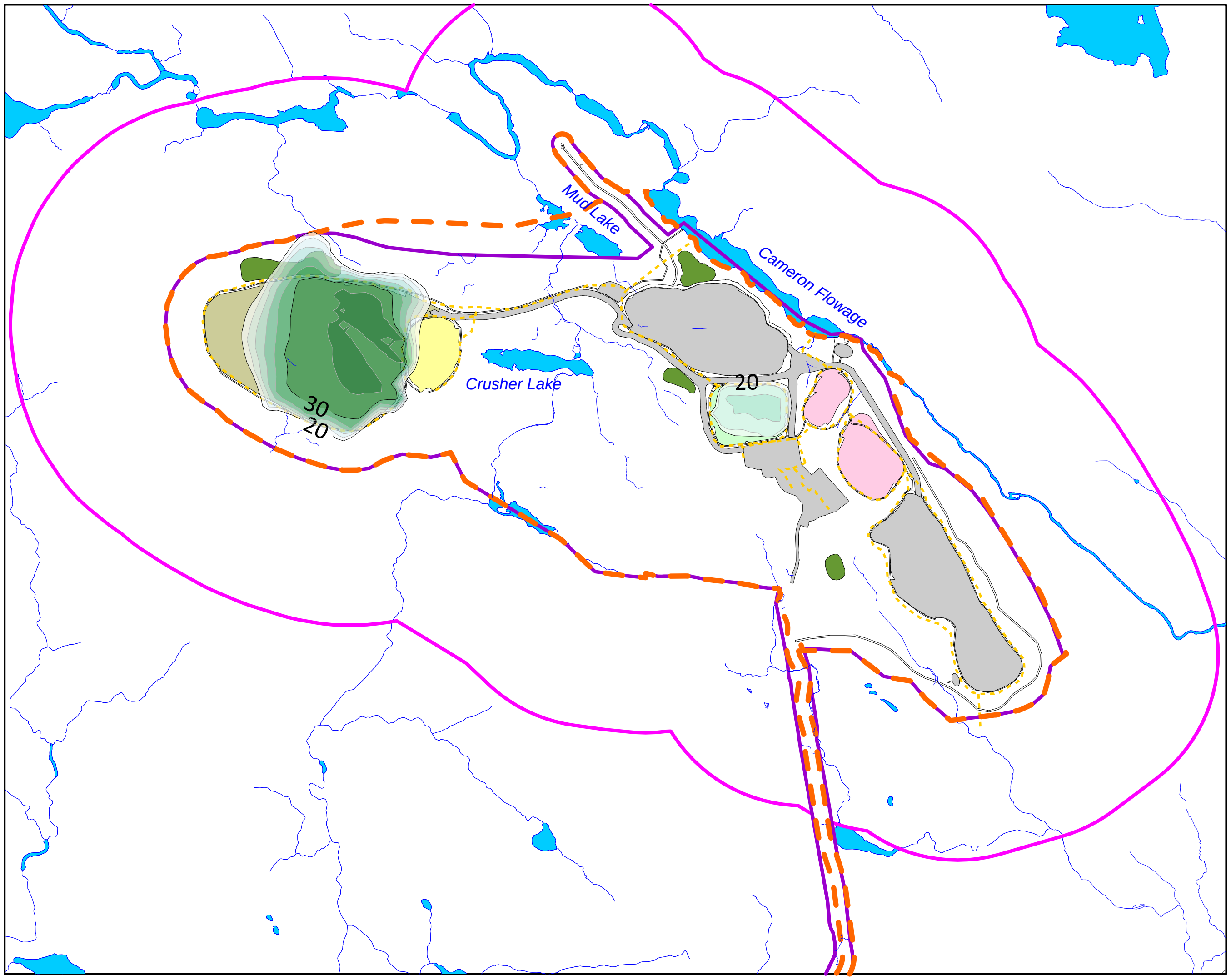
SIMULATED URANIUM CONCENTRATION VERSUS POTABLE CRITERIA
EOM - BASE CASE SOURCE TERMS - WET CASE CONDITION

088664-031

March 11, 2021

FIGURE E.4

HEG file: Z:\HEG\088664\DOCUMENTATION\RPT\088664-RPT-13\FIGURES\E.4 - Simulated Uranium Concentration Versus Potable Criteria - EOM - BC - WET.srf



LEGEND

- SURFACE WATER BODY
- PROPOSED EXTENT OF MINE FEATURES
- 0.1 — SIMULATED URANIUM CONCENTRATION (ug/L)
- SURFACE WATER MANAGEMENT DITCHES
- PROPERTY BOUNDARY
- PROJECT AREA
- LOCAL ASSESSMENT AREA
- NAG WASTE ROCK STOCKPILE
- PAG WASTE ROCK STOCKPILE
- LGO STOCKPILE
- TILL STOCKPILES
- TOPSOIL STOCKPILES

Note: The uranium Tier 1 EQS for potable groundwater is 20 ug/L.

0 300 600 900m

ATLANTIC GOLD CORPORATION
MARINETTE, NOVA SCOTIA
BEAVER DAM MINE

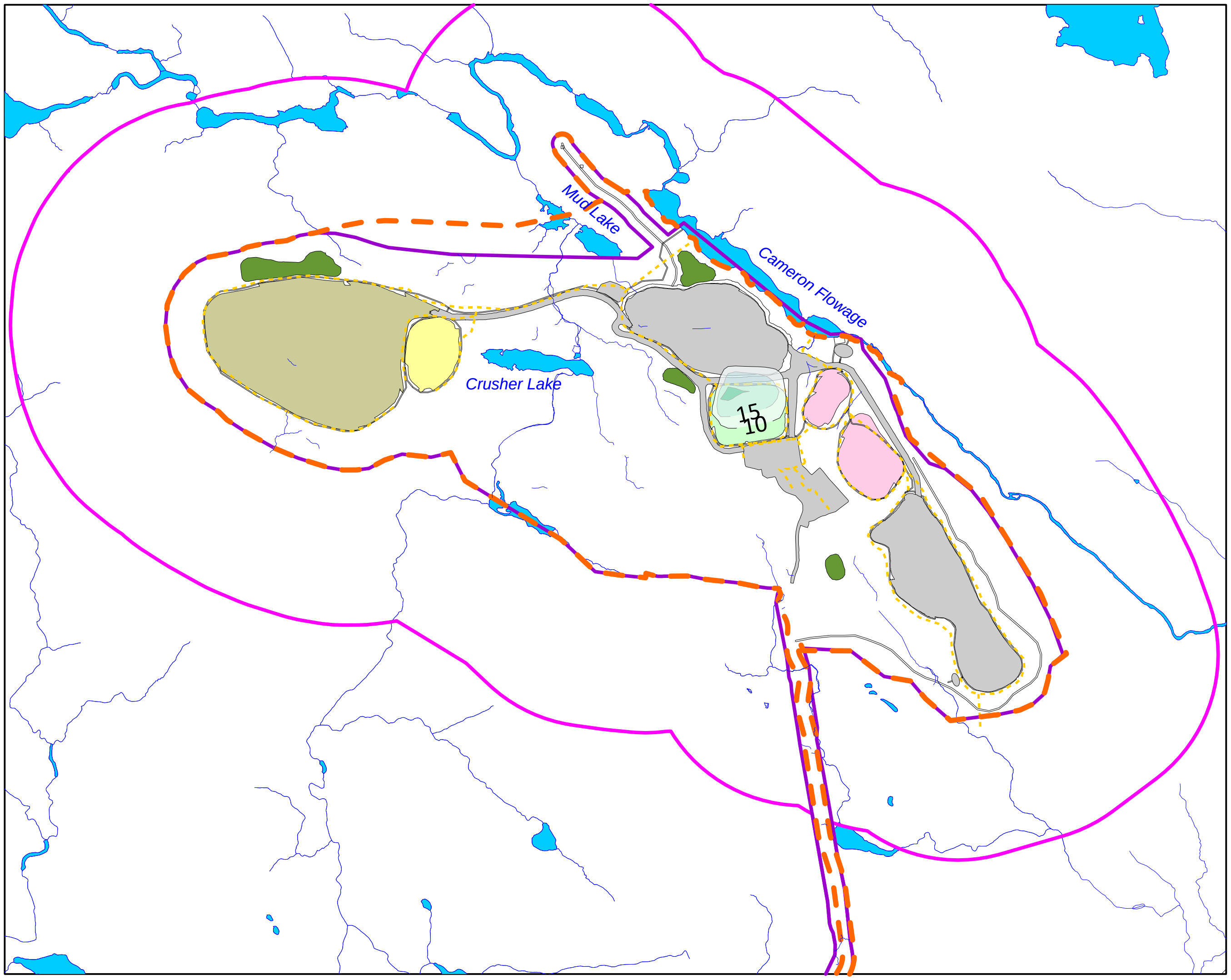
SIMULATED URANIUM CONCENTRATION VERSUS POTABLE CRITERIA
EOM - UPPER CASE SOURCE TERMS - WET CASE CONDITION

088664-031

March 11, 2021

FIGURE E.5

HEG file: Z:\HEG\088664\DOCUMENTATION\RPT\088664-RPT-13\FIGURES\E.5 - Simulated Uranium Concentration Versus Potable Criteria - EOM - UC - WET.srf



LEGEND

- SURFACE WATER BODY
- PROPOSED EXTENT OF MINE FEATURES
- 0.1 SIMULATED ARSENIC CONCENTRATION (ug/L)
- SURFACE WATER MANAGEMENT DITCHES
- PROPERTY BOUNDARY
- PROJECT AREA
- LOCAL ASSESSMENT AREA
- NAG WASTE ROCK STOCKPILE
- PAG WASTE ROCK STOCKPILE
- LGO STOCKPILE
- TILL STOCKPILES
- TOPSOIL STOCKPILES

Note: The arsenic Tier 1 EQS for potable groundwater is 10 ug/L.

0 300 600 900m

ATLANTIC GOLD CORPORATION
MARINETTE, NOVA SCOTIA
BEAVER DAM MINE

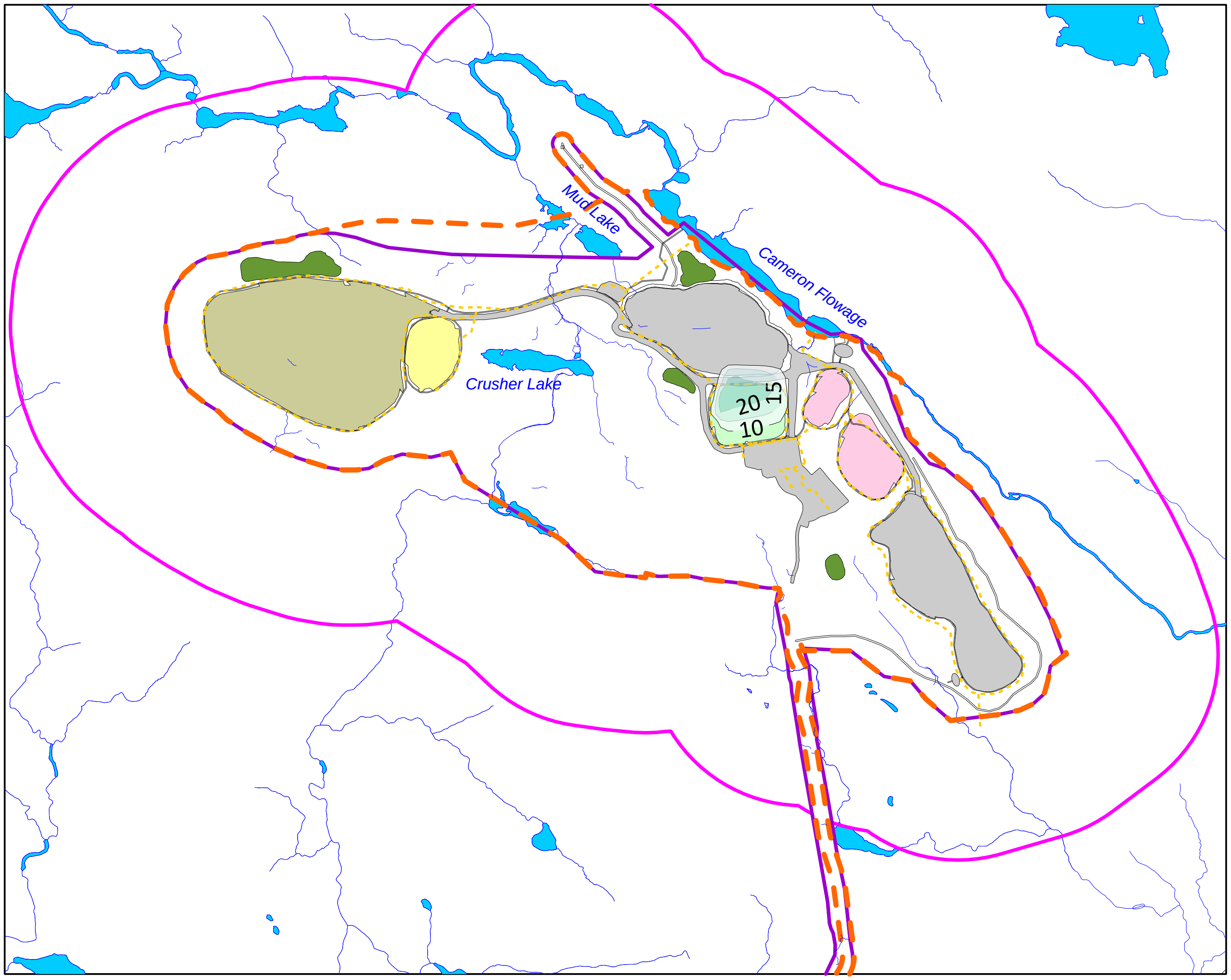
SIMULATED ARSENIC CONCENTRATION VERSUS POTABLE CRITERIA
PC - BASE CASE SOURCE TERMS - WET CASE CONDITION

088664-031

March 11, 2021

FIGURE E.6

HEG file: Z:\HEG\088664\DOCUMENTATION\RPT\088664-RPT-13\FIGURES\E.6 - Simulated Arsenic Concentration Versus Potable Criteria - PC - BC - WET.srf



LEGEND

- SURFACE WATER BODY
- PROPOSED EXTENT OF MINE FEATURES
- 0.1 — SIMULATED ARSENIC CONCENTRATION (ug/L)
- SURFACE WATER MANAGEMENT DITCHES
- PROPERTY BOUNDARY
- PROJECT AREA
- LOCAL ASSESSMENT AREA
- NAG WASTE ROCK STOCKPILE
- PAG WASTE ROCK STOCKPILE
- LGO STOCKPILE
- TILL STOCKPILES
- TOPSOIL STOCKPILES

Note: The arsenic Tier 1 EQS for potable groundwater is 10 ug/L.

0 300 600 900m

N

GHD

ATLANTIC GOLD CORPORATION
MARINETTE, NOVA SCOTIA
BEAVER DAM MINE

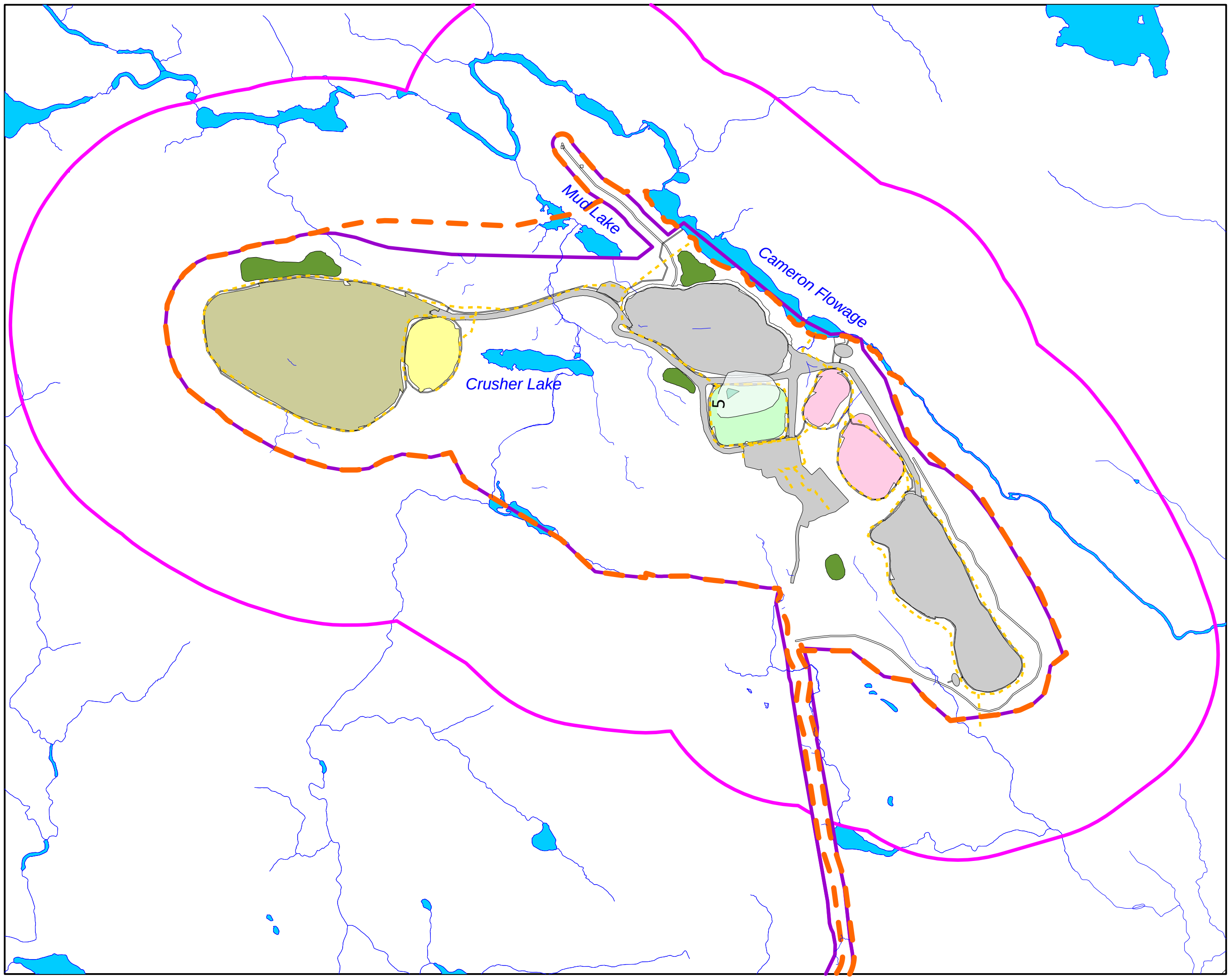
SIMULATED ARSENIC CONCENTRATION VERSUS POTABLE CRITERIA
PC - UPPER CASE SOURCE TERMS - WET CASE CONDITION

088664-031

March 11, 2021

FIGURE E.7

HEG file: Z:\HEG\088664\DOCUMENTATION\RPT\088664-RPT-13\E.7 - Simulated Arsenic Concentration Versus Potable Criteria - PC - UC - WET.srf



LEGEND

- SURFACE WATER BODY
- PROPOSED EXTENT OF MINE FEATURES
- 0.1 — SIMULATED CADMIUM CONCENTRATION (ug/L)
- SURFACE WATER MANAGEMENT DITCHES
- PROPERTY BOUNDARY
- PROJECT AREA
- LOCAL ASSESSMENT AREA
- NAG WASTE ROCK STOCKPILE
- PAG WASTE ROCK STOCKPILE
- LGO STOCKPILE
- TILL STOCKPILES
- TOPSOIL STOCKPILES

Note: The cadmium Tier 1 EQS for potable groundwater is 5 ug/L.

0 300 600 900m

N

ATLANTIC GOLD CORPORATION
MARINETTE, NOVA SCOTIA
BEAVER DAM MINE

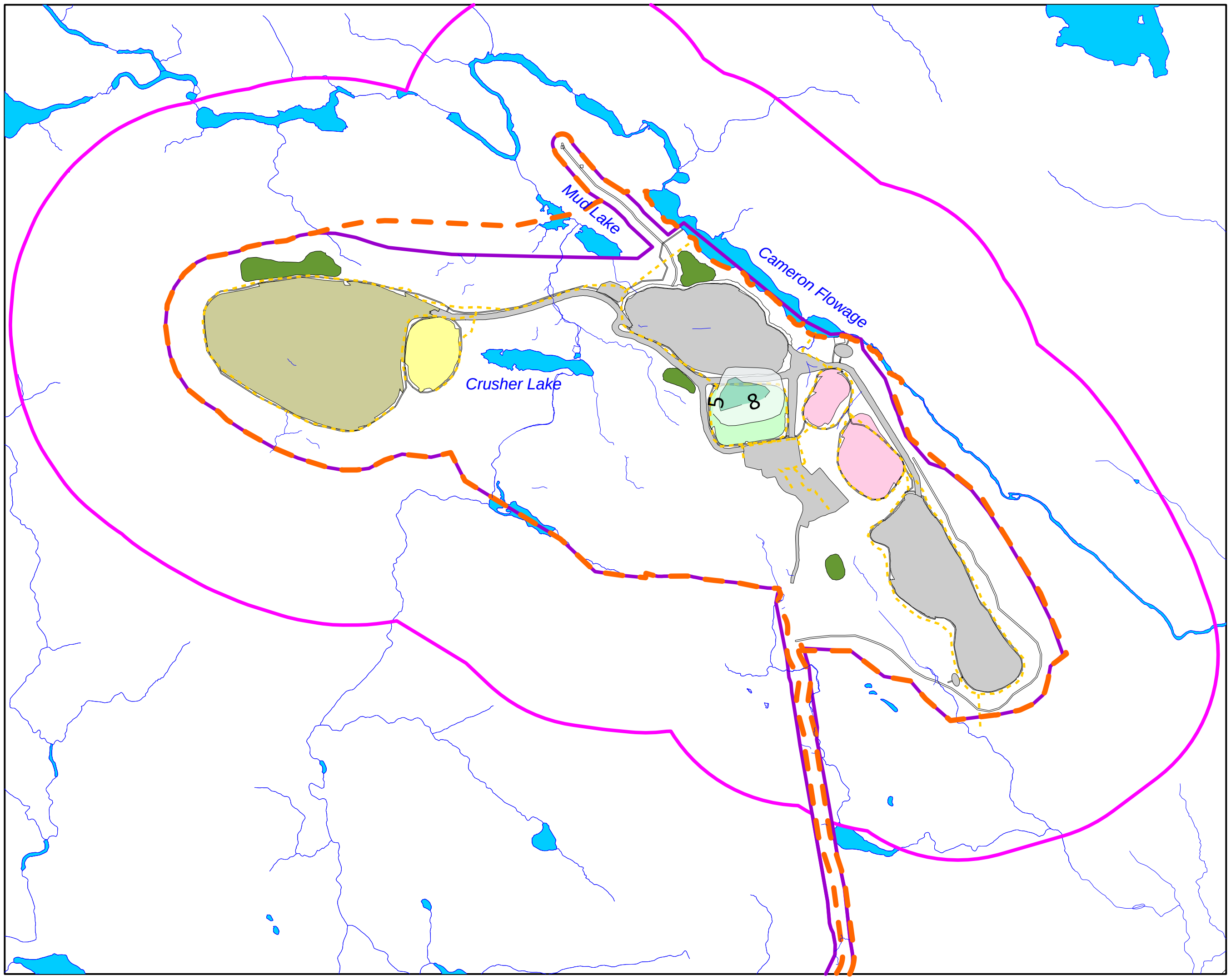
SIMULATED CADMIUM CONCENTRATION VERSUS POTABLE CRITERIA
PC - BASE CASE SOURCE TERMS - WET CASE CONDITION

088664-031

March 11, 2021

FIGURE E.8

HEG file: Z:\HEG\088664\DOCUMENTATION\RPT\088664-RPT-13\FIGURES\E.8 - Simulated Cadmium Concentration Versus Potable Criteria - PC - BC - WET.srf



LEGEND

- SURFACE WATER BODY
- PROPOSED EXTENT OF MINE FEATURES
- 0.1 — SIMULATED CADMIUM CONCENTRATION (ug/L)
- SURFACE WATER MANAGEMENT DITCHES
- PROPERTY BOUNDARY
- PROJECT AREA
- LOCAL ASSESSMENT AREA
- NAG WASTE ROCK STOCKPILE
- PAG WASTE ROCK STOCKPILE
- LGO STOCKPILE
- TILL STOCKPILES
- TOPSOIL STOCKPILES

Note: The cadmium Tier 1 EQS for potable groundwater is 5 ug/L.

0 300 600 900m

ATLANTIC GOLD CORPORATION
MARINETTE, NOVA SCOTIA
BEAVER DAM MINE

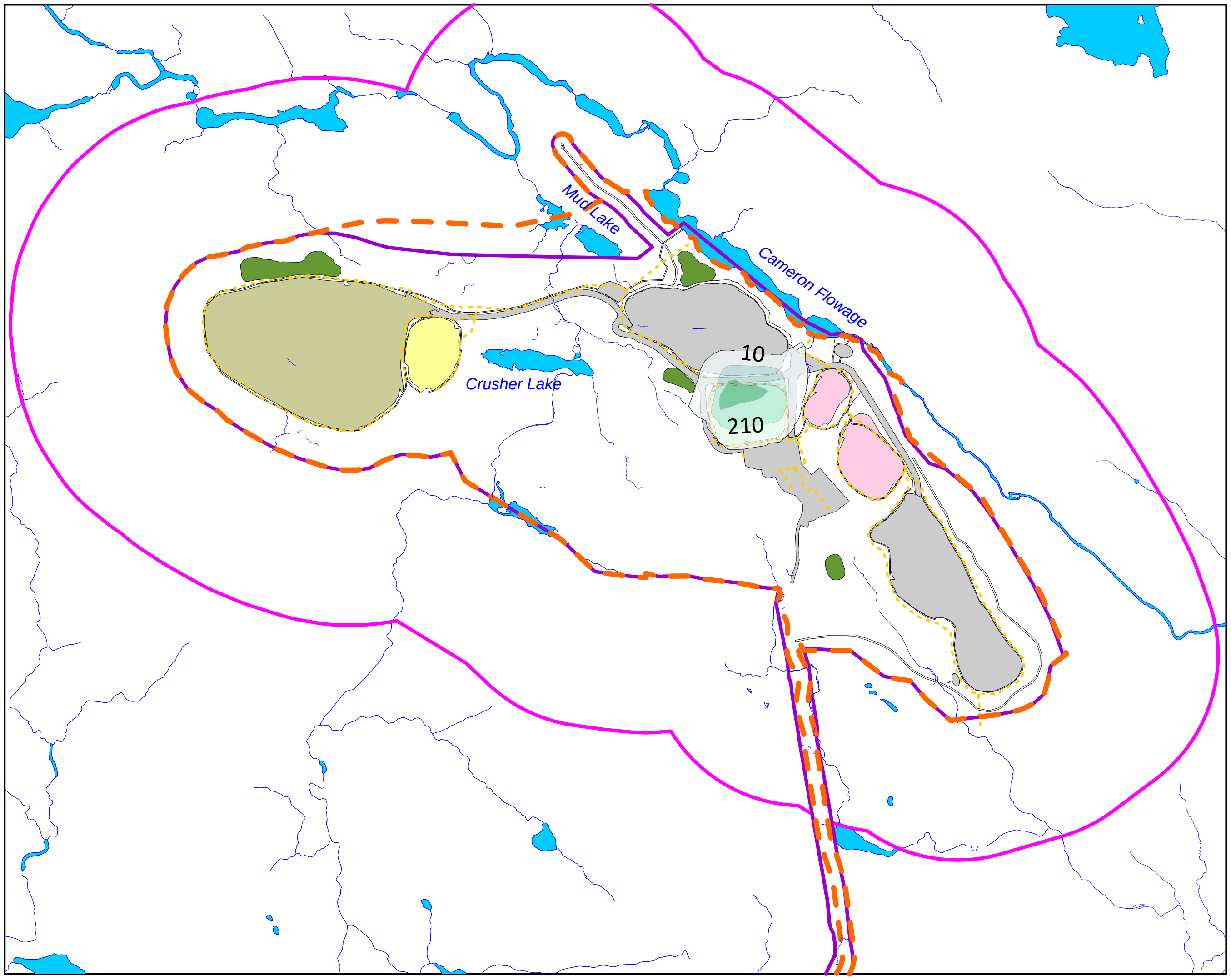
SIMULATED CADMIUM CONCENTRATION VERSUS POTABLE CRITERIA
PC - UPPER SOURCE TERMS - WET CASE CONDITION

088664-031

March 11, 2021

FIGURE E.9

HEG file: Z:\HEG\088664\DOCUMENTATION\RPT\088664-RPT-13\FIGURES\E.9 - Simulated Cadmium Concentration Versus Potable Criteria - PC - UC - WET.srf



LEGEND

SURFACE WATER BODY
PROPOSED EXTENT OF MINE FEATURES
0.1 SIMULATED COBALT CONCENTRATION (ug/L)
SURFACE WATER MANAGEMENT DITCHES
PROPERTY BOUNDARY
PROJECT AREA
LOCAL ASSESSMENT AREA
NAG WASTE ROCK STOCKPILE
PAG WASTE ROCK STOCKPILE
LGO STOCKPILE
TILL STOCKPILES
TOPSOIL STOCKPILES

Note: The cobalt Tier 1 EQS for potable groundwater is 10 ug/L.

0 300 600 900m

ATLANTIC GOLD CORPORATION
MARINETTE, NOVA SCOTIA
BEAVER DAM MINE

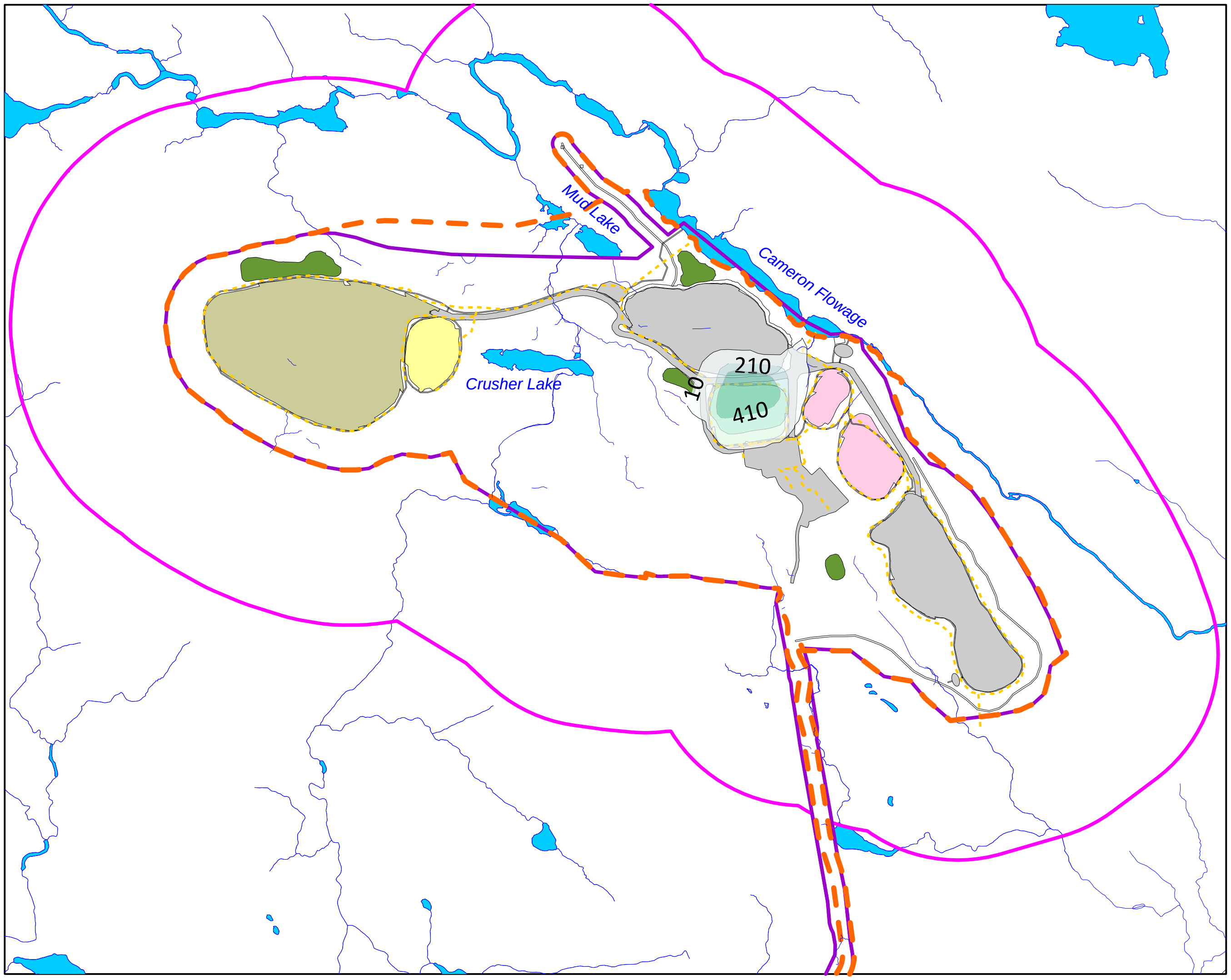
SIMULATED COBALT CONCENTRATION VERSUS POTABLE CRITERIA
PC - BASE CASE SOURCE TERMS - WET CASE CONDITION

088664-031

March 11, 2021

FIGURE E.10

HEG file: Z:\HEG\088664\DOCUMENTATION\RPT\088664-RPT-13\FIGURES\E.10 - Simulated Cobalt Concentration Versus Potable Criteria - PC - BC - WET.srf



LEGEND

SURFACE WATER BODY

PROPOSED EXTENT OF MINE FEATURES

0.1 — SIMULATED COBALT CONCENTRATION (ug/L)

SURFACE WATER MANAGEMENT DITCHES

PROPERTY BOUNDARY

PROJECT AREA

LOCAL ASSESSMENT AREA

NAG WASTE ROCK STOCKPILE

PAG WASTE ROCK STOCKPILE

LGO STOCKPILE

TILL STOCKPILES

TOPSOIL STOCKPILES

Note: The cobalt Tier 1 EQS for potable groundwater is 10 ug/L.

0 300 600 900m

N

ATLANTIC GOLD CORPORATION
MARINETTE, NOVA SCOTIA
BEAVER DAM MINE

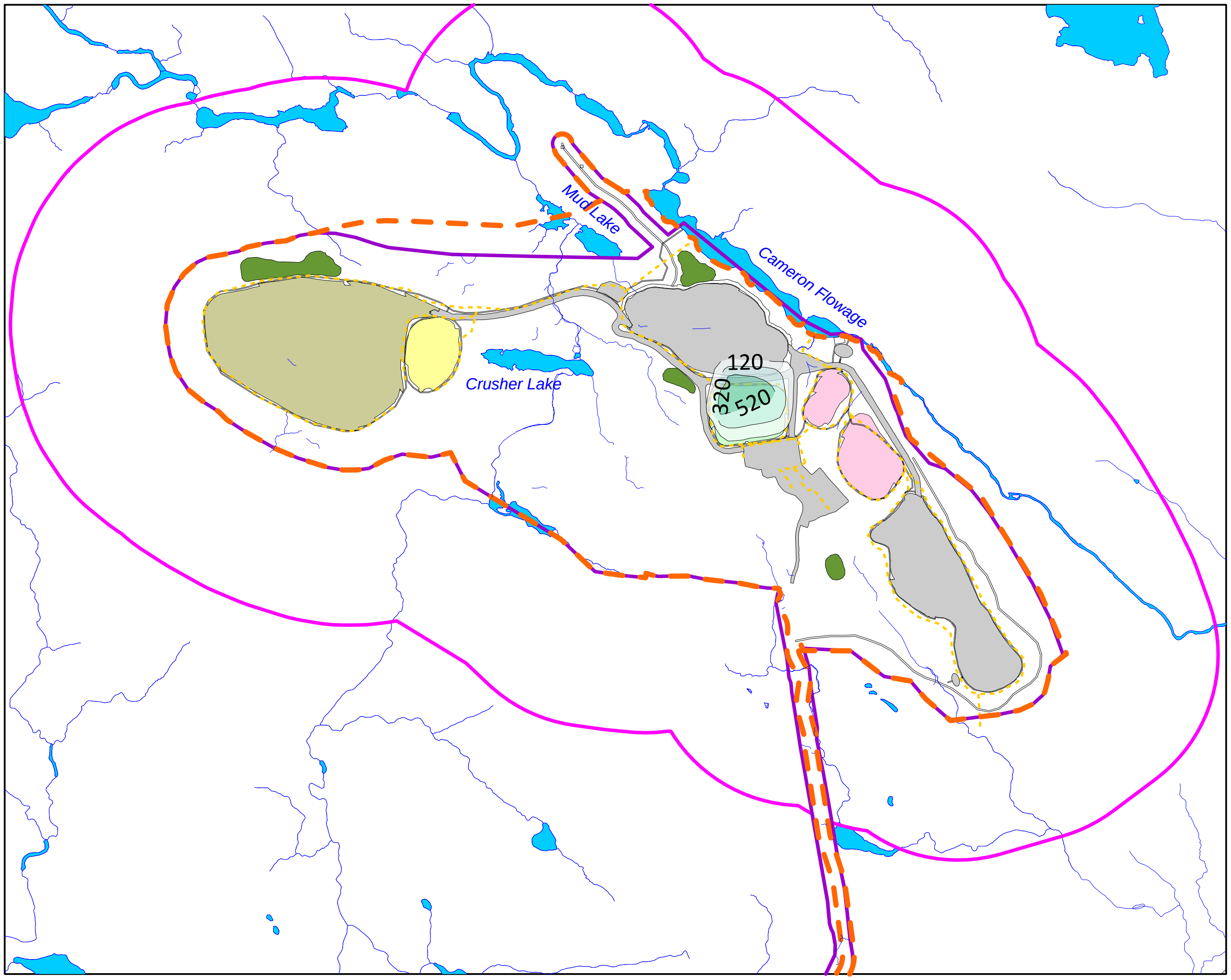
SIMULATED COBALT CONCENTRATION VERSUS POTABLE CRITERIA
PC - UPPER CASE SOURCE TERMS - WET CASE CONDITION

088664-031

March 11, 2021

FIGURE E.11

HEG file: Z:\HEG\088664\DOCUMENTATION\RPT\088664-RPT-13\FIGURES\E.11 - Simulated Cobalt Concentration Versus Potable Criteria - PC - UC - WET.srf



LEGEND

- SURFACE WATER BODY
- PROPOSED EXTENT OF MINE FEATURES
- 0.1 — SIMULATED MANGANESE CONCENTRATION (ug/L)
- SURFACE WATER MANAGEMENT DITCHES
- PROPERTY BOUNDARY
- PROJECT AREA
- LOCAL ASSESSMENT AREA
- NAG WASTE ROCK STOCKPILE
- PAG WASTE ROCK STOCKPILE
- LGO STOCKPILE
- TILL STOCKPILES
- TOPSOIL STOCKPILES

Note: The manganese Tier 1 EQS for potable groundwater is 120 ug/L.

0 300 600 900m

ATLANTIC GOLD CORPORATION
MARINETTE, NOVA SCOTIA
BEAVER DAM MINE

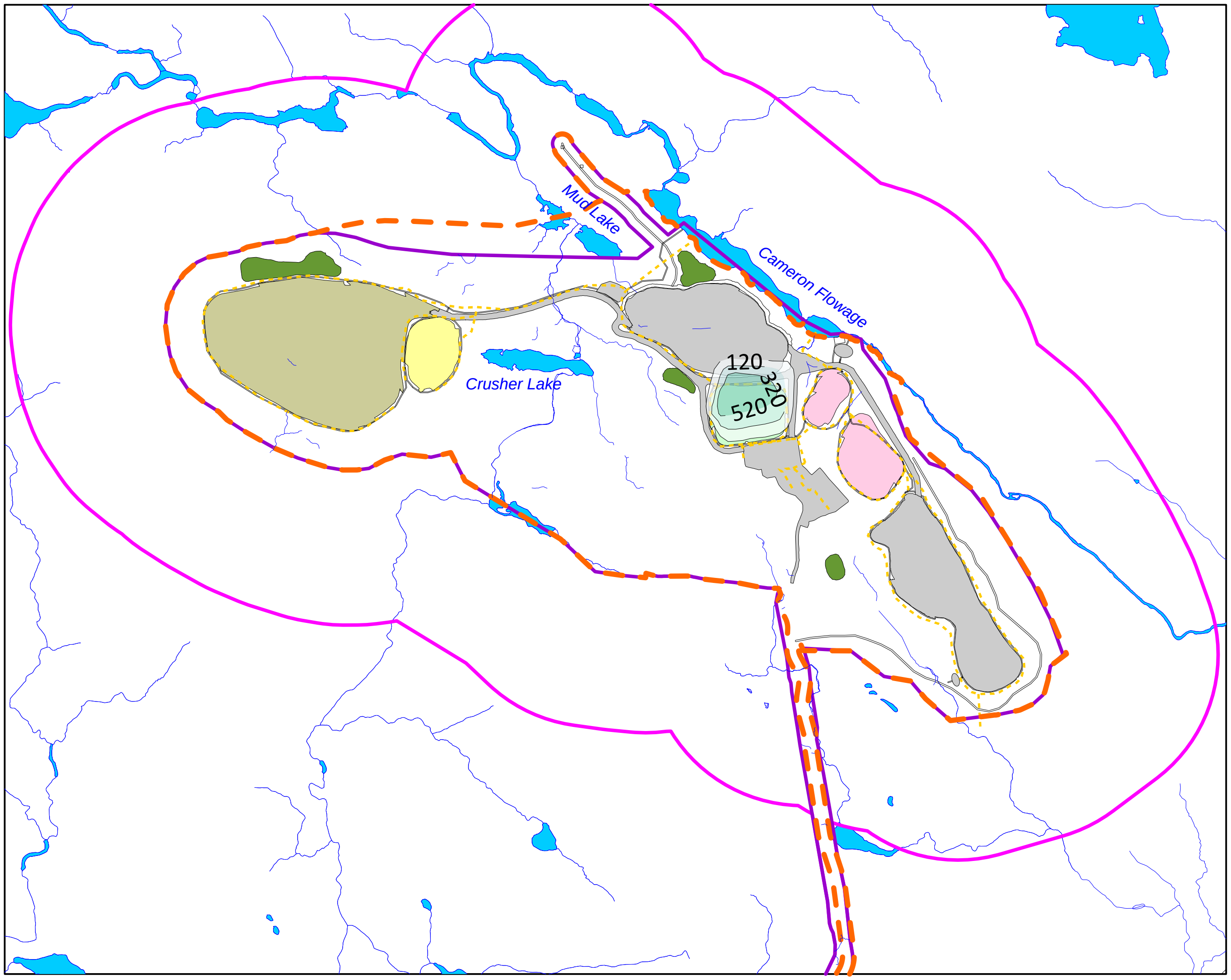
SIMULATED MANGANESE CONCENTRATION VERSUS POTABLE CRITERIA
PC - BASE CASE SOURCE TERMS - WET CASE CONDITION

088664-031

March 11, 2021

FIGURE E.12

HEG file: Z:\HEG\088664\DOCUMENTATION\RPT\088664-RPT-13\FIGURES\E.12 - Simulated Manganese Concentration Versus Potable Criteria - PC - BC - WET.srf



LEGEND

- SURFACE WATER BODY
- PROPOSED EXTENT OF MINE FEATURES
- 0.1 — SIMULATED MANGANESE CONCENTRATION (ug/L)
- SURFACE WATER MANAGEMENT DITCHES
- PROPERTY BOUNDARY
- PROJECT AREA
- LOCAL ASSESSMENT AREA
- NAG WASTE ROCK STOCKPILE
- PAG WASTE ROCK STOCKPILE
- LGO STOCKPILE
- TILL STOCKPILES
- TOPSOIL STOCKPILES

Note: The manganese Tier 1 EQS for potable groundwater is 120 ug/L.

0 300 600 900m

N

GHD

ATLANTIC GOLD CORPORATION
MARINETTE, NOVA SCOTIA
BEAVER DAM MINE

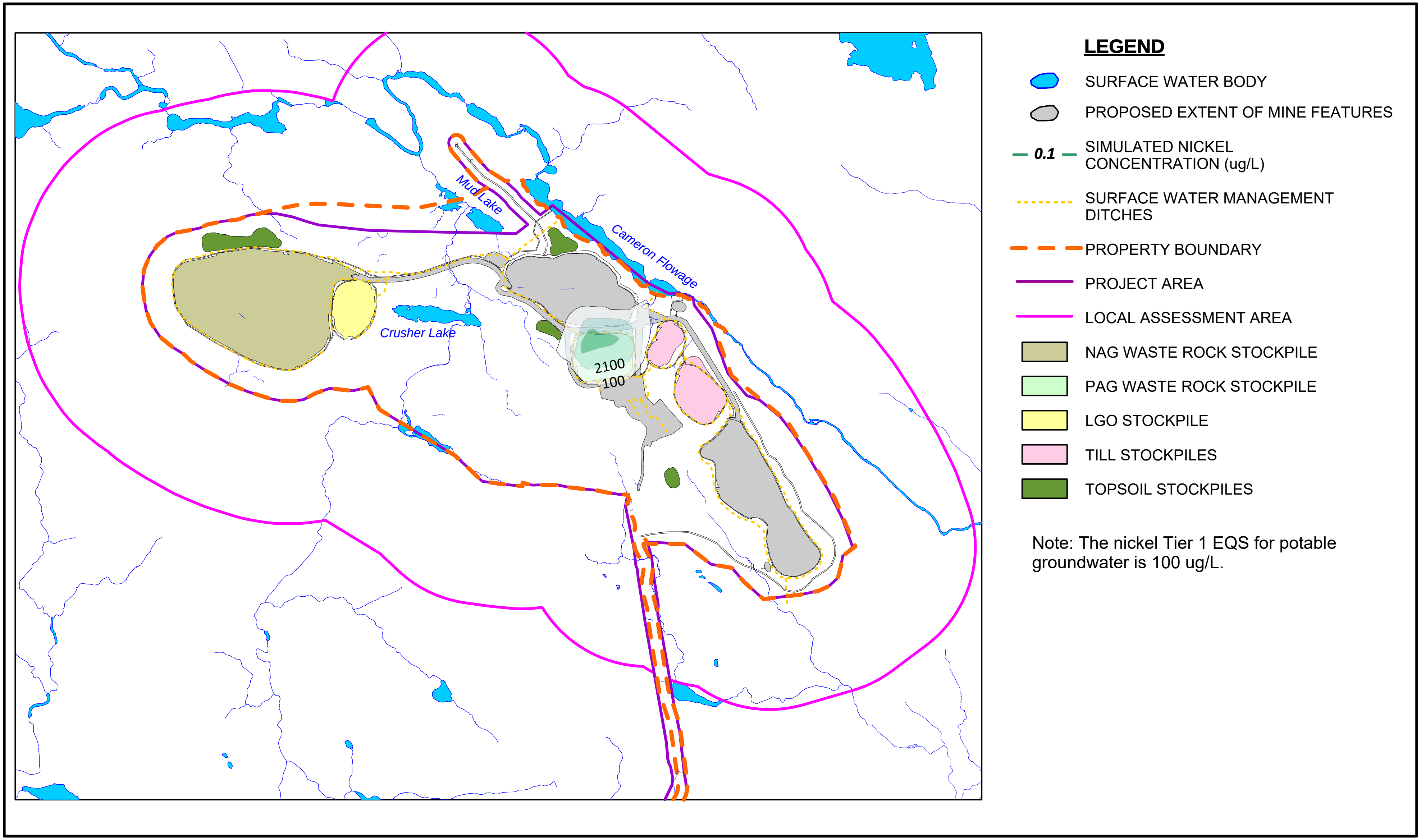
SIMULATED MANGANESE CONCENTRATION VERSUS POTABLE CRITERIA
PC - UPPER CASE SOURCE TERMS - WET CASE CONDITION

088664-031

March 11, 2021

FIGURE E.13

HEG file: Z:\HEG\088664\DOCUMENTATION\RPT\088664-RPT-13\FIGURES\E.13 - Simulated Manganese Concentration Versus Potable Criteria - PC - UC - WET.srf



0 300 600 900m

ATLANTIC GOLD CORPORATION
MARINETTE, NOVA SCOTIA
BEAVER DAM MINE

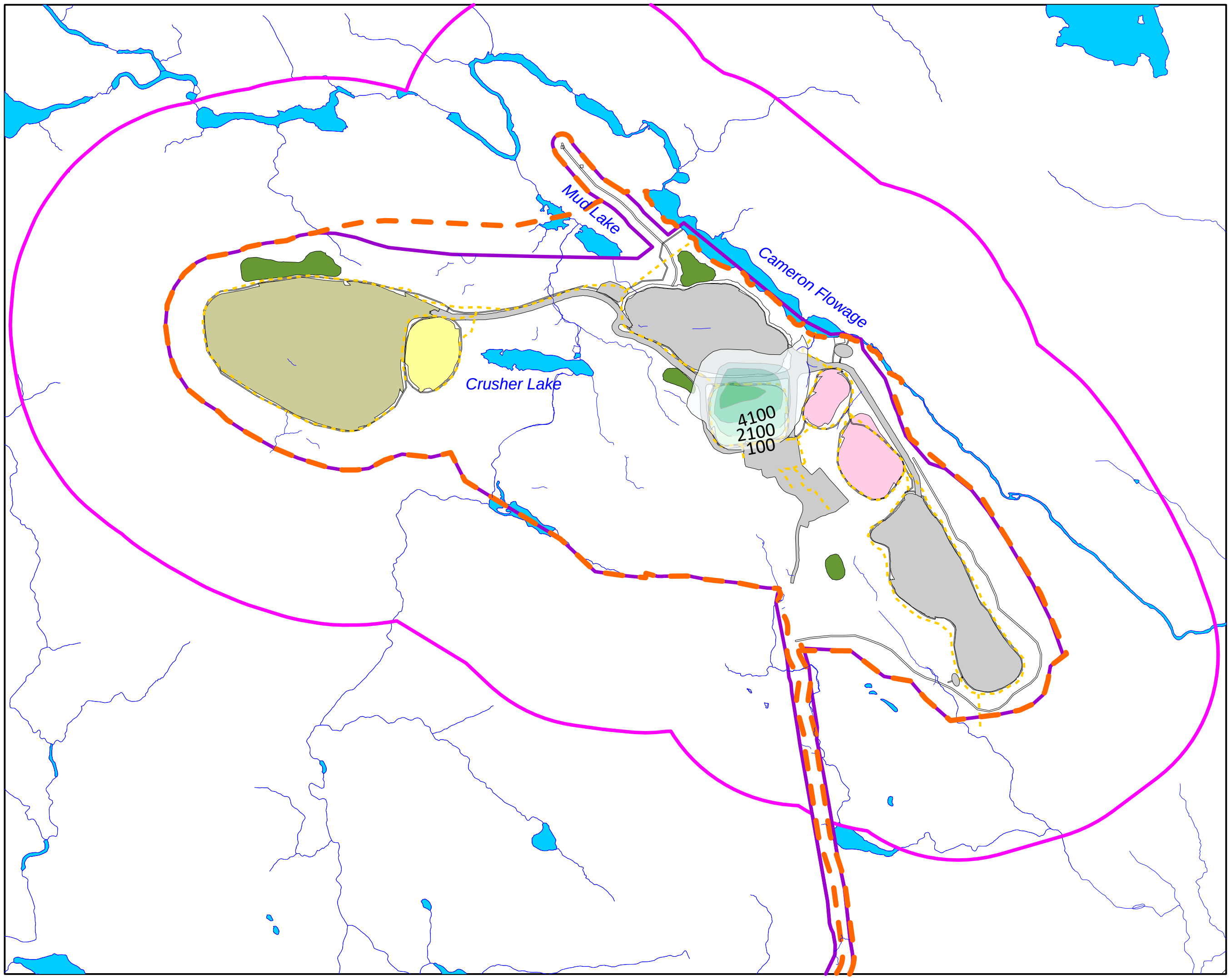
SIMULATED NICKEL CONCENTRATION VERSUS POTABLE CRITERIA
PC - BASE CASE SOURCE TERMS - WET CASE CONDITION

088664-031

March 11, 2021

FIGURE E.14

HEG file: Z:\HEG\088664\DOCUMENTATION\RPT\088664-RPT-13\FIGURES\E.14 - Simulated Nickel Concentration Versus Potable Criteria - PC - BC - WET.srf



LEGEND

- SURFACE WATER BODY
- PROPOSED EXTENT OF MINE FEATURES
- 0.1 — SIMULATED NICKEL CONCENTRATION (ug/L)
- SURFACE WATER MANAGEMENT DITCHES
- PROPERTY BOUNDARY
- PROJECT AREA
- LOCAL ASSESSMENT AREA
- NAG WASTE ROCK STOCKPILE
- PAG WASTE ROCK STOCKPILE
- LGO STOCKPILE
- TILL STOCKPILES
- TOPSOIL STOCKPILES

Note: The nickel Tier 1 EQS for potable groundwater is 100 ug/L.

0 300 600 900m

N

ATLANTIC GOLD CORPORATION
MARINETTE, NOVA SCOTIA
BEAVER DAM MINE

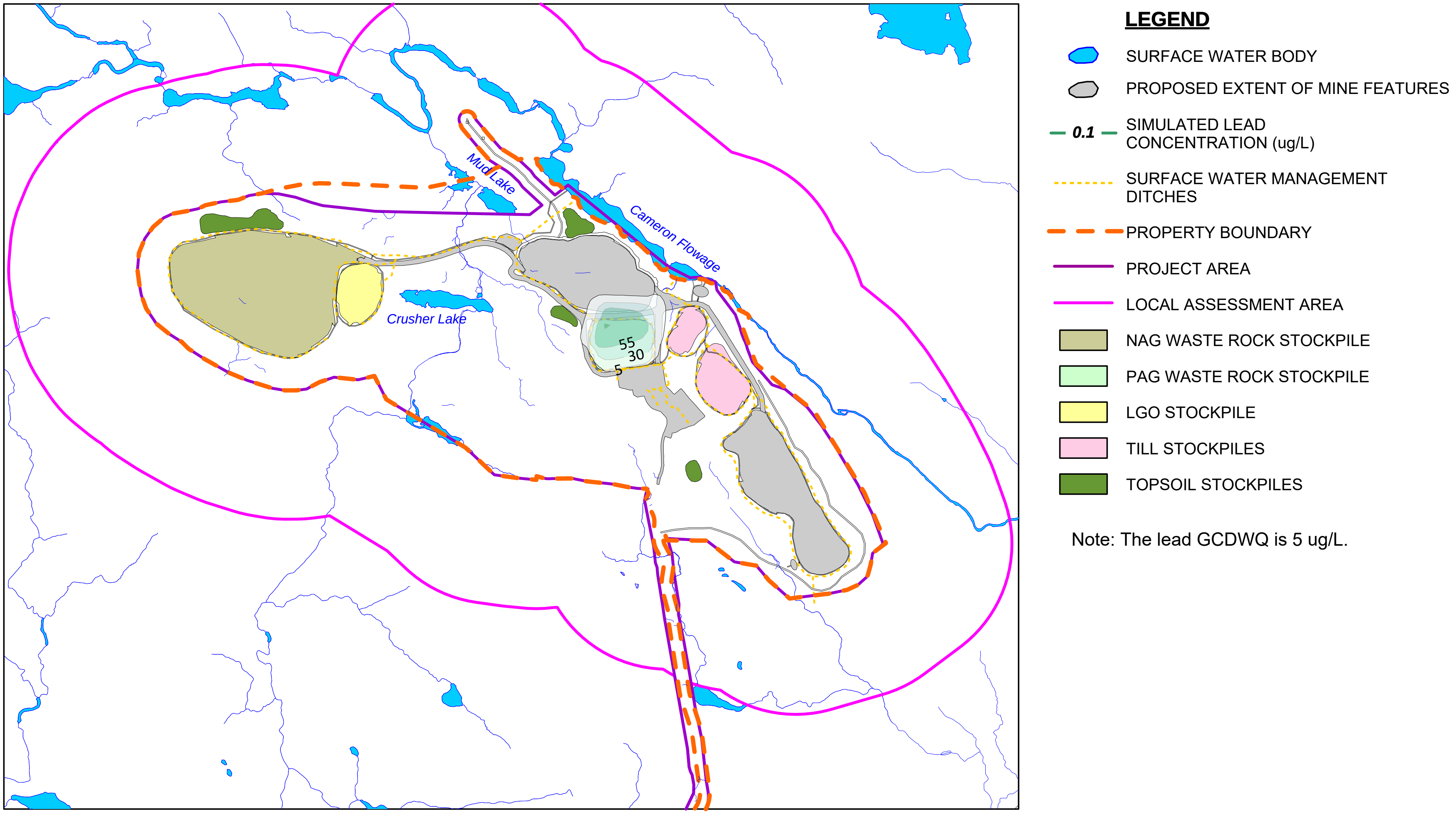
SIMULATED NICKEL CONCENTRATION VERSUS POTABLE CRITERIA
PC - UPPER CASE SOURCE TERMS - WET CASE CONDITION

088664-031

March 11, 2021

FIGURE E.15

HEG file: Z:\HEG\088664\DOCUMENTATION\RPT\088664-RPT-13\FIGURES\E.15 - Simulated Nickel Concentration Versus Potable Criteria - PC - UC - WET.srf



0 300 600 900m

ATLANTIC GOLD CORPORATION
MARINETTE, NOVA SCOTIA
BEAVER DAM MINE

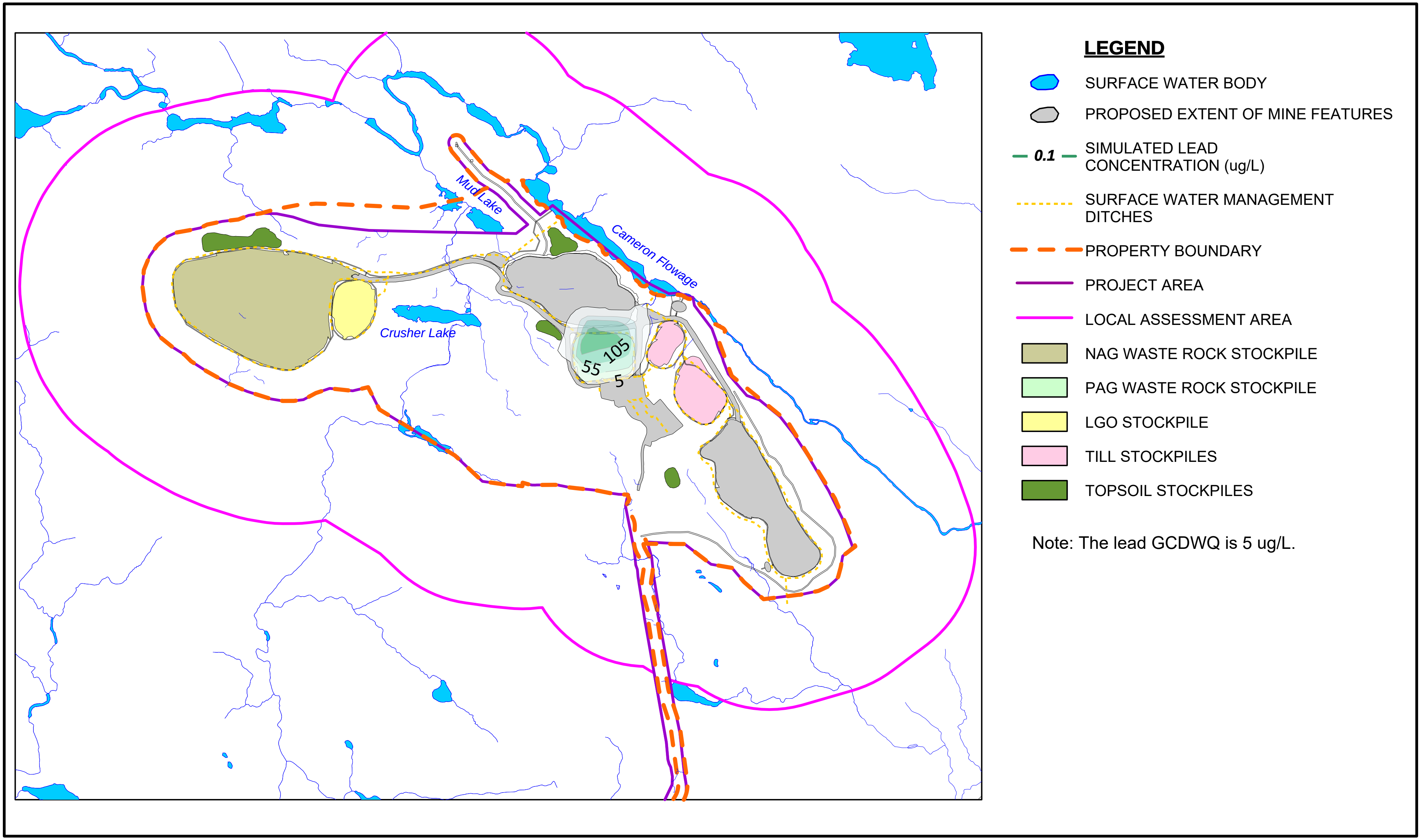
SIMULATED LEAD CONCENTRATION VERSUS POTABLE CRITERIA
PC - BASE CASE SOURCE TERMS - WET CASE CONDITION

088664-031

March 11, 2021

FIGURE E.16

HEG file: Z:\HEG\088664\DOCUMENTATION\RPT\088664-RPT-13\FIGURES\E.16 - Simulated Lead Concentration Versus Potable Criteria - PC - BC - WET.srf



0 300 600 900m

ATLANTIC GOLD CORPORATION
MARINETTE, NOVA SCOTIA
BEAVER DAM MINE

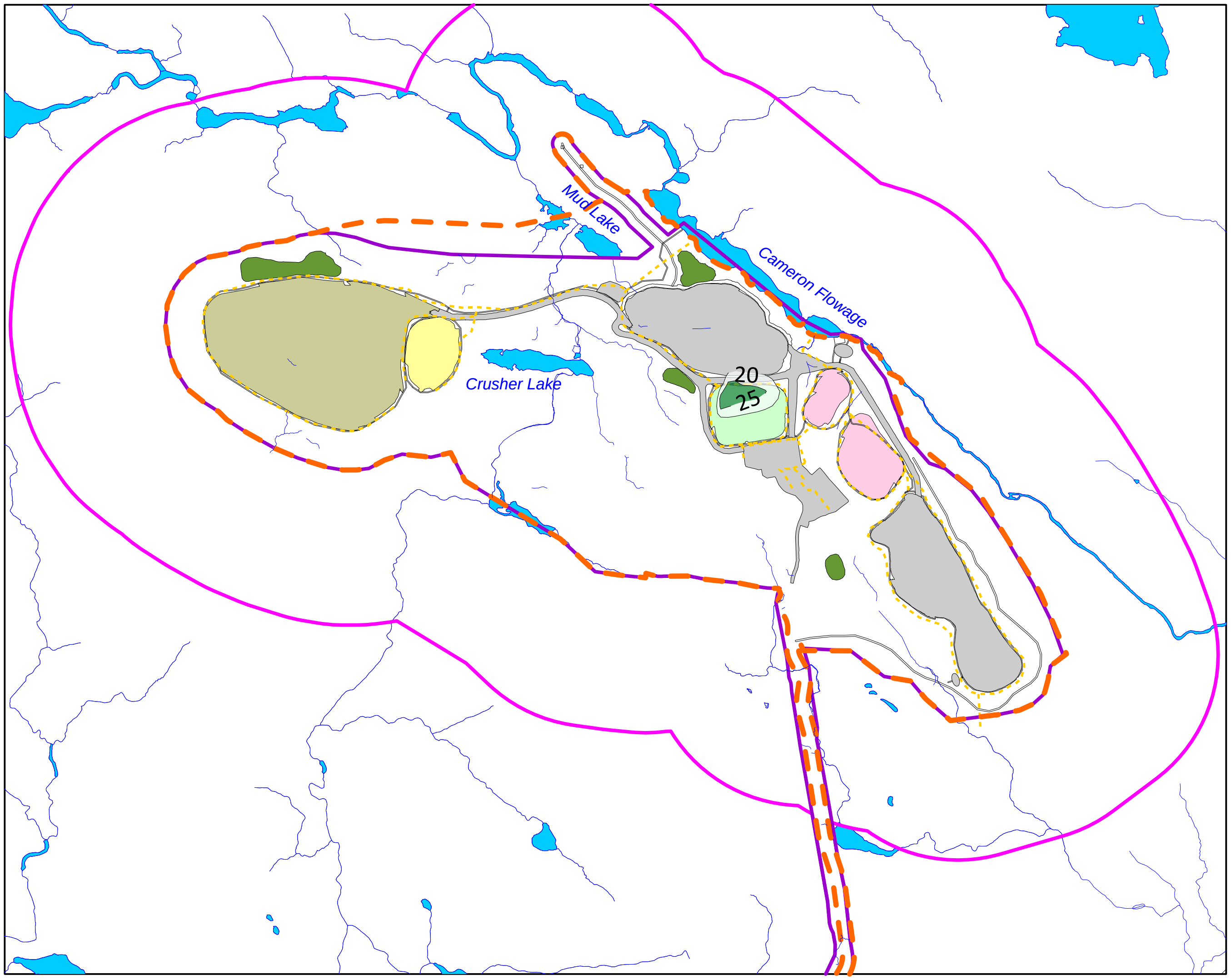
SIMULATED LEAD CONCENTRATION VERSUS POTABLE CRITERIA
PC - UPPER CASE SOURCE TERMS - WET CASE CONDITION

088664-031

March 11, 2021

FIGURE E.17

HEG file: Z:\HEG\088664\DOCUMENTATION\RPT\088664-RPT-13\FIGURES\E.17 - Simulated Lead Concentration Versus Potable Criteria - PC - UC - WET.srf



LEGEND

- SURFACE WATER BODY
- PROPOSED EXTENT OF MINE FEATURES
- 0.1 SIMULATED URANIUM CONCENTRATION (ug/L)
- SURFACE WATER MANAGEMENT DITCHES
- PROPERTY BOUNDARY
- PROJECT AREA
- LOCAL ASSESSMENT AREA
- NAG WASTE ROCK STOCKPILE
- PAG WASTE ROCK STOCKPILE
- LGO STOCKPILE
- TILL STOCKPILES
- TOPSOIL STOCKPILES

Note: The uranium Tier 1 EQS for potable groundwater is 20 ug/L.

0 300 600 900m

ATLANTIC GOLD CORPORATION
MARINETTE, NOVA SCOTIA
BEAVER DAM MINE

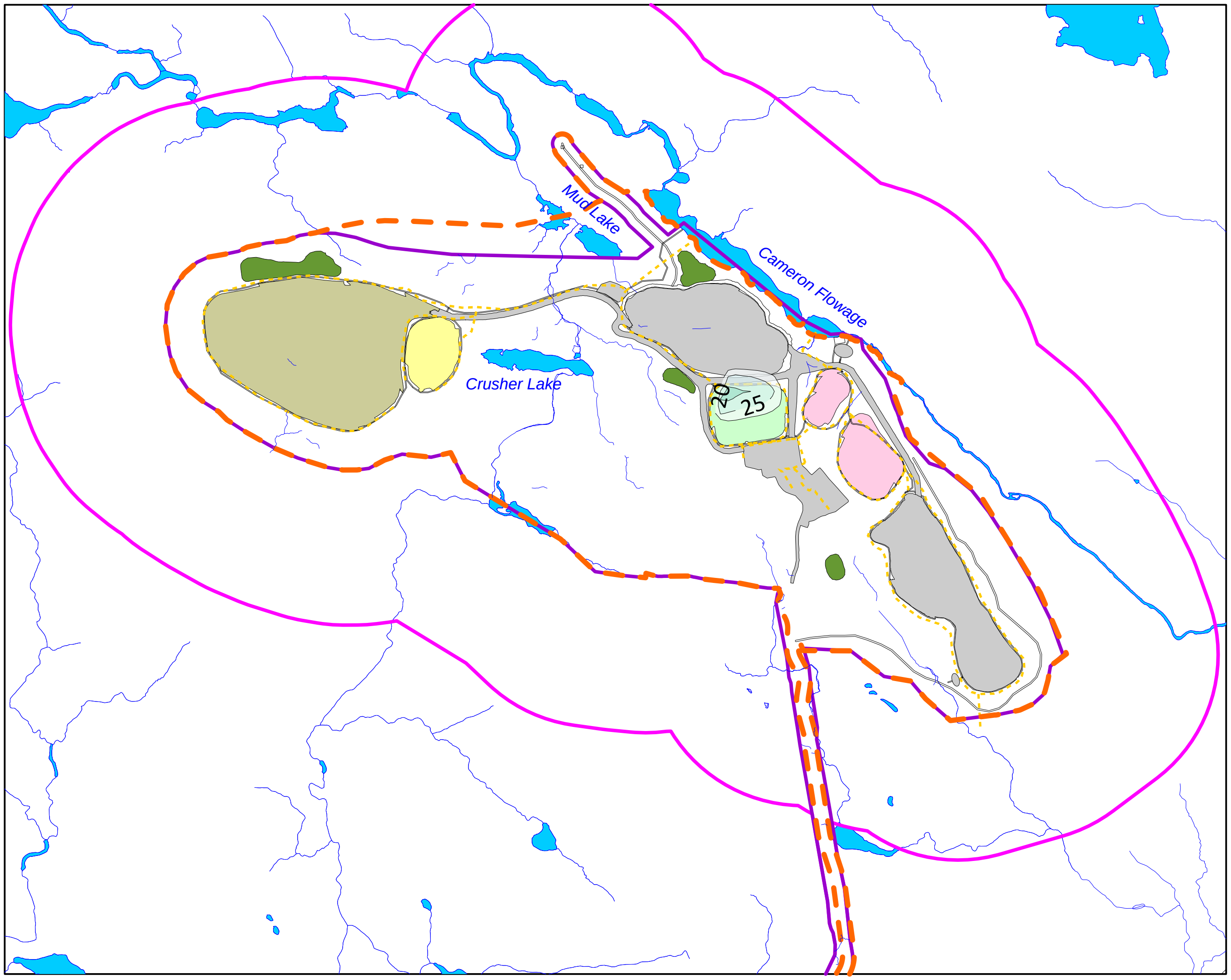
SIMULATED URANIUM CONCENTRATION VERSUS POTABLE CRITERIA
PC - BASE CASE SOURCE TERMS - WET CASE CONDITION

088664-031

March 11, 2021

FIGURE E.18

HEG file: Z:\HEG\088664\DOCUMENTATION\RPT\088664-RPT-13\FIGURES\E.19 - Simulated Uranium Concentration Versus Potable Criteria - PC - BC - WET.srf



LEGEND

- SURFACE WATER BODY
- PROPOSED EXTENT OF MINE FEATURES
- 0.1 — SIMULATED URANIUM CONCENTRATION (ug/L)
- SURFACE WATER MANAGEMENT DITCHES
- PROPERTY BOUNDARY
- PROJECT AREA
- LOCAL ASSESSMENT AREA
- NAG WASTE ROCK STOCKPILE
- PAG WASTE ROCK STOCKPILE
- LGO STOCKPILE
- TILL STOCKPILES
- TOPSOIL STOCKPILES

Note: The uranium Tier 1 EQS for potable groundwater is 20 ug/L.

0 300 600 900m

ATLANTIC GOLD CORPORATION
MARINETTE, NOVA SCOTIA
BEAVER DAM MINE

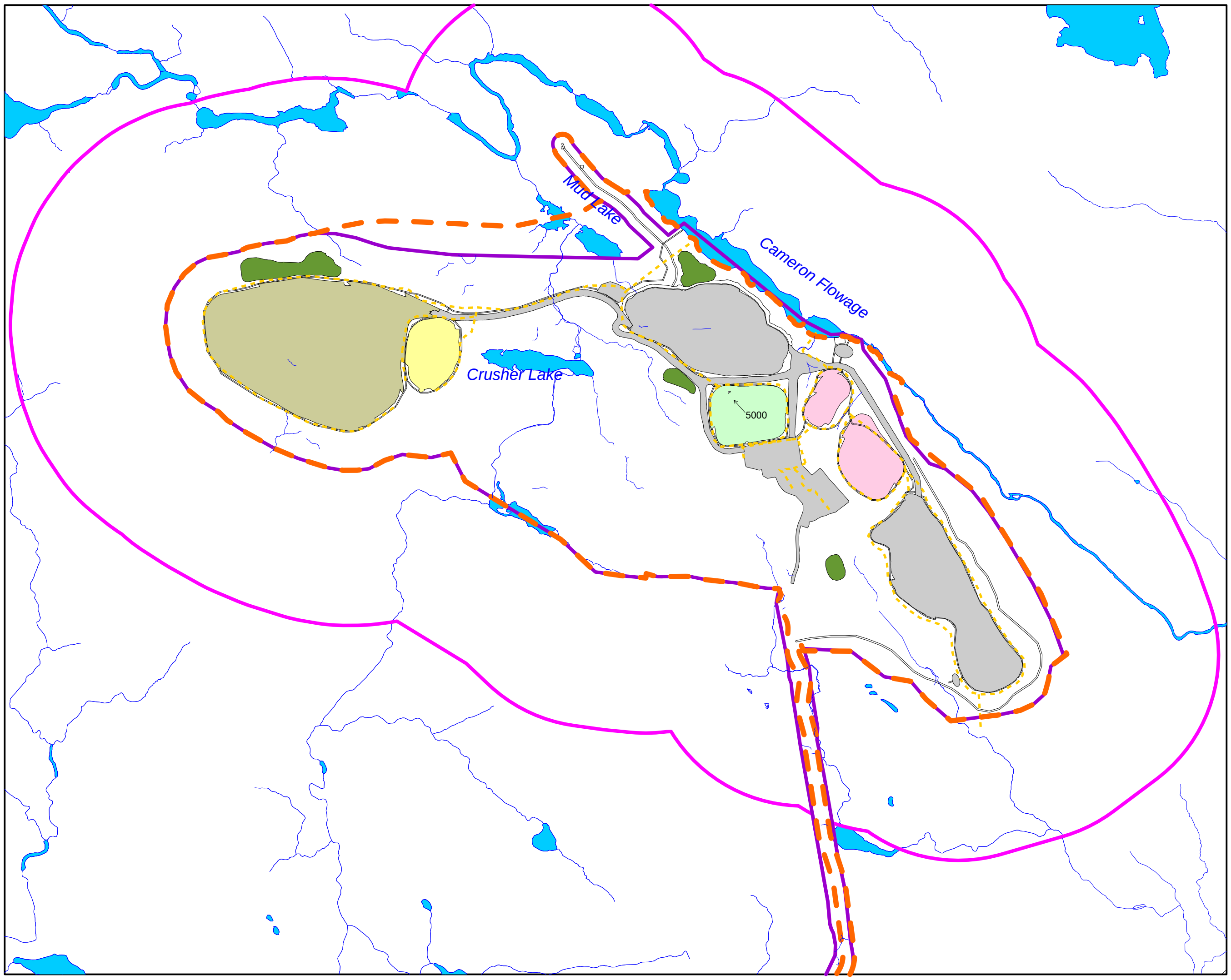
SIMULATED URANIUM CONCENTRATION VERSUS POTABLE CRITERIA
PC - UPPER CASE SOURCE TERMS - WET CASE CONDITION

088664-031

March 11, 2021

FIGURE E.19

HEG file: Z:\HEG\088664\DOCUMENTATION\RPT\088664-RPT-13\FIGURES\E.20 - Simulated Uranium Concentration Versus Potable Criteria - PC - UC - WET.srf



LEGEND

SURFACE WATER BODY

PROPOSED EXTENT OF MINE FEATURES

0.1 — SIMULATED ZINC CONCENTRATION (ug/L)

SURFACE WATER MANAGEMENT DITCHES

PROPERTY BOUNDARY

PROJECT AREA

LOCAL ASSESSMENT AREA

NAG WASTE ROCK STOCKPILE

PAG WASTE ROCK STOCKPILE

LGO STOCKPILE

TILL STOCKPILES

TOPSOIL STOCKPILES

Note: The zinc Tier 1 EQS for potable groundwater is 5000 ug/L.

0 300 600 900m

N

GHD

ATLANTIC GOLD CORPORATION
MARINETTE, NOVA SCOTIA
BEAVER DAM MINE

SIMULATED ZINC CONCENTRATION VERSUS POTABLE CRITERIA
PC - UPPER CASE SOURCE TERMS - WET CASE CONDITION

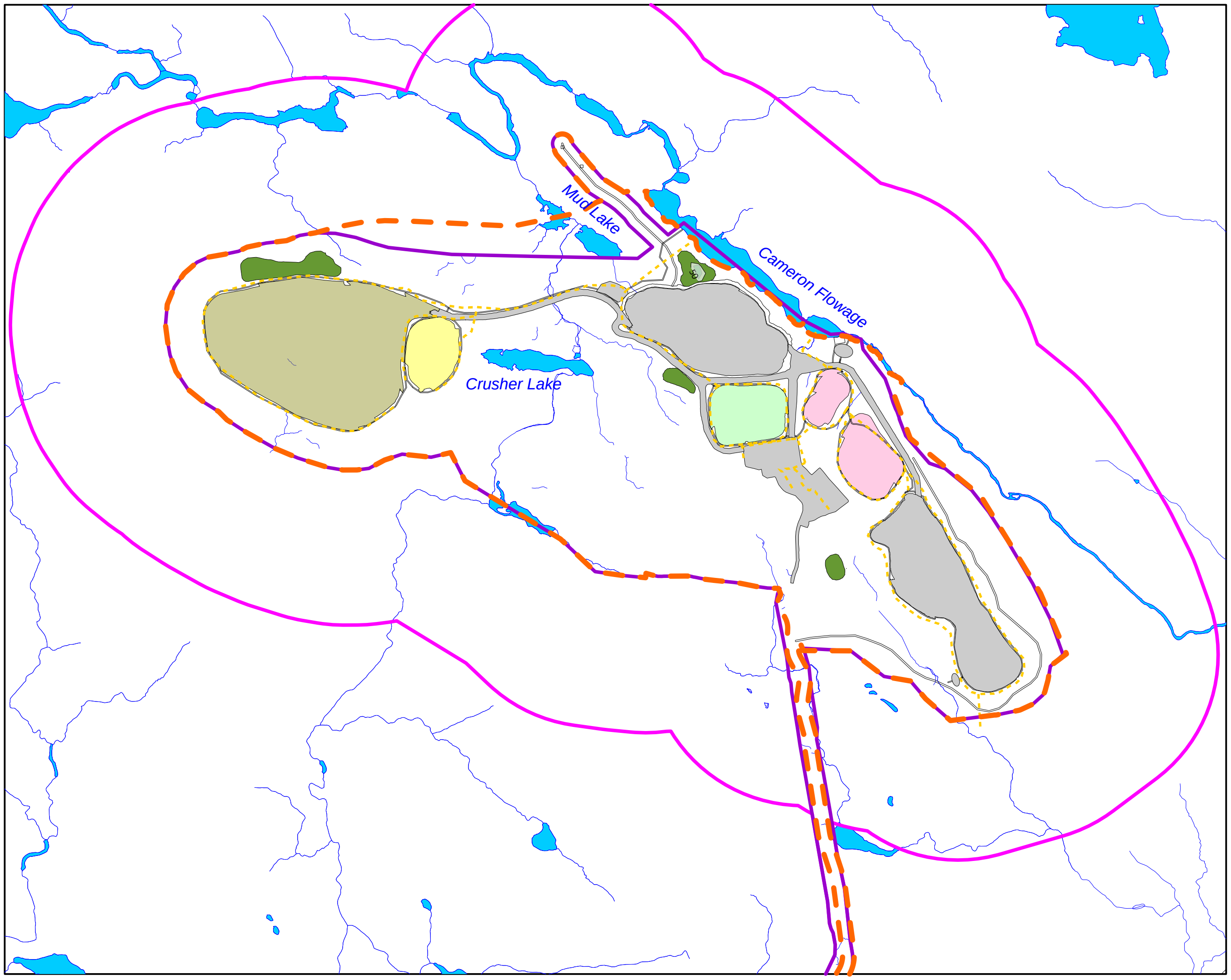
088664-031

March 11, 2021

FIGURE E.20

HEG file: Z:\HEG\088664\DOCUMENTATION\RPT\088664-RPT-13\FIGURES\E.22 - Simulated Zinc Concentration Versus Potable Criteria - PC - UC - WET.srf

Appendix F
Simulated COC Concentrations in Groundwater Versus Tier 2 PSS – Dry Conditions



LEGEND

- SURFACE WATER BODY
- PROPOSED EXTENT OF MINE FEATURES
- *0.1* SIMULATED ALUMINUM CONCENTRATION (ug/L)
- SURFACE WATER MANAGEMENT DITCHES
- PROPERTY BOUNDARY
- PROJECT AREA
- LOCAL ASSESSMENT AREA
- NAG WASTE ROCK STOCKPILE
- PAG WASTE ROCK STOCKPILE
- LGO STOCKPILE
- TILL STOCKPILES
- TOPSOIL STOCKPILES

Note: The aluminum Tier 2 PSS for groundwater discharge to surface water (>10 m) is 50 ug/L.

0 300 600 900m

N

GHD

ATLANTIC GOLD CORPORATION
MARINETTE, NOVA SCOTIA
BEAVER DAM MINE

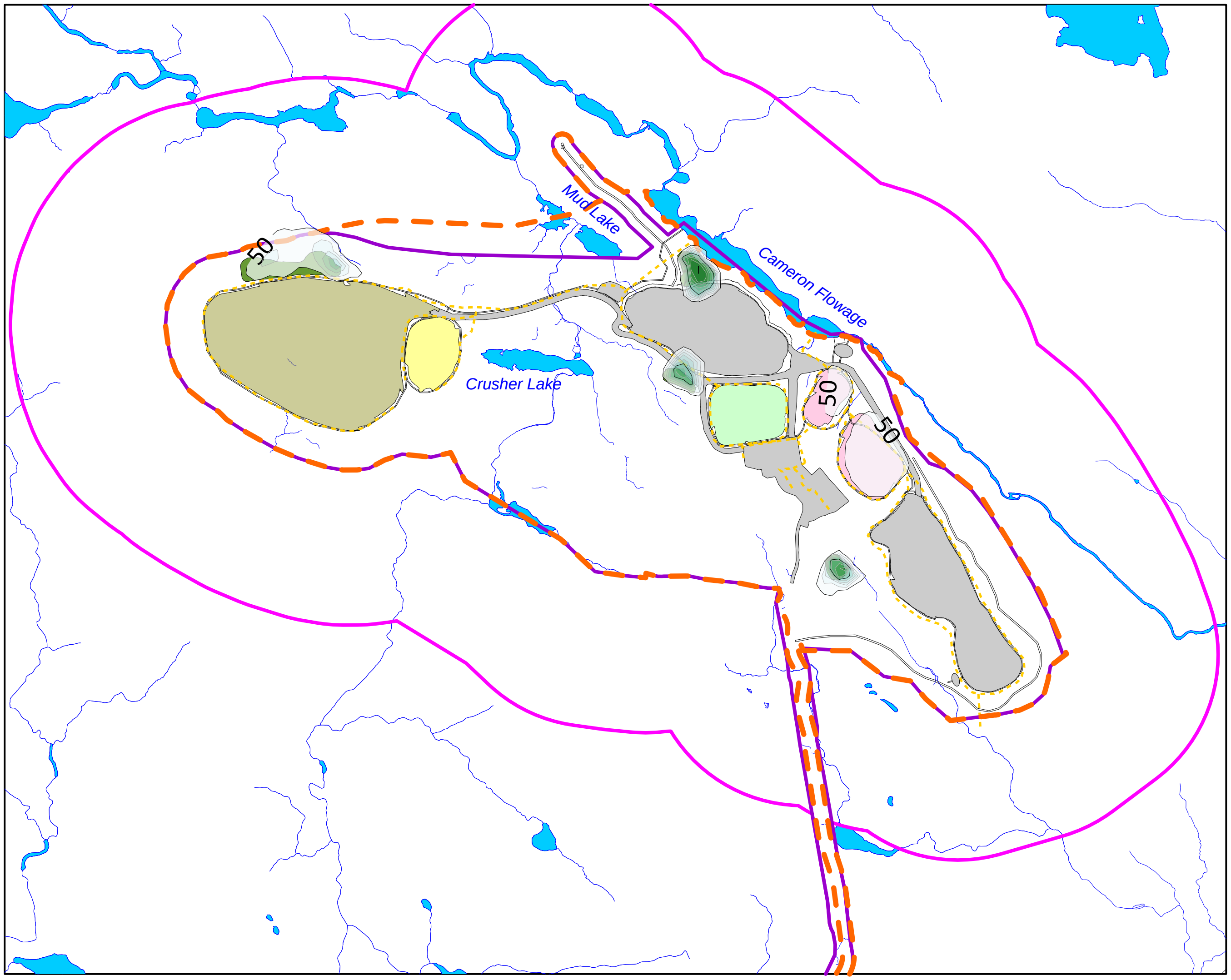
SIMULATED ALUMINUM CONCENTRATION VERSUS TIER 2 PSS
EOM - BASE CASE SOURCE TERMS - DRY CASE CONDITION

088664-031

March 11, 2021

Figure F.1

HEG file: Z:\HEG\088664\DOCUMENTATION\RPT\088664-RPT-13\FIGURES\Figure 7.29 - Sim_Aluminum_PSS - EOM - BC - AVG.srf



LEGEND

- SURFACE WATER BODY
- PROPOSED EXTENT OF MINE FEATURES
- 0.1 — SIMULATED ALUMINUM CONCENTRATION (ug/L)
- SURFACE WATER MANAGEMENT DITCHES
- PROPERTY BOUNDARY
- PROJECT AREA
- LOCAL ASSESSMENT AREA
- NAG WASTE ROCK STOCKPILE
- PAG WASTE ROCK STOCKPILE
- LGO STOCKPILE
- TILL STOCKPILES
- TOPSOIL STOCKPILES

Note: The aluminum Tier 2 PSS for groundwater discharge to surface water (>10 m) is 50 ug/L.

0 300 600 900m

ATLANTIC GOLD CORPORATION
MARINETTE, NOVA SCOTIA
BEAVER DAM MINE

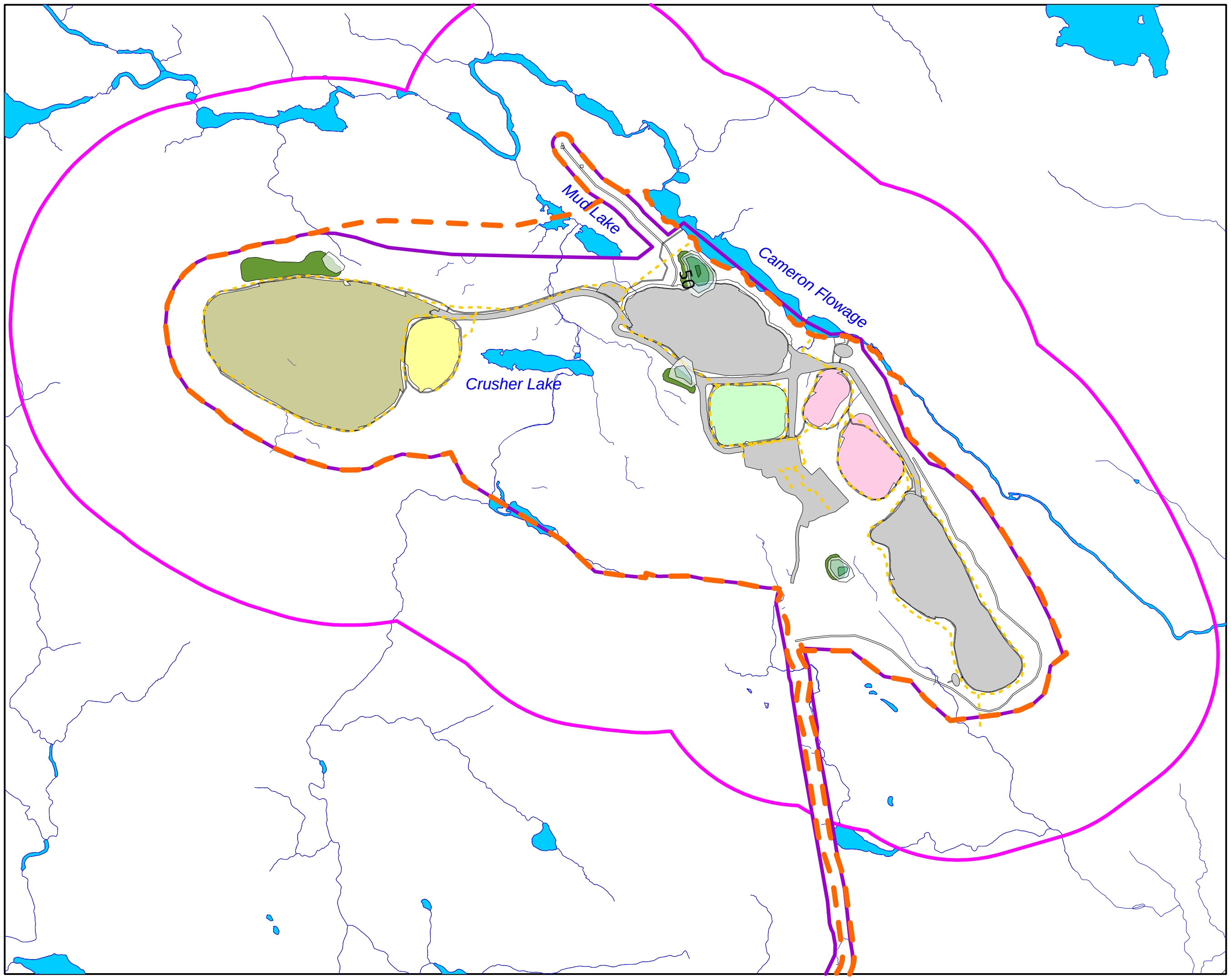
SIMULATED ALUMINUM CONCENTRATION VERSUS TIER 2 PSS
EOM - UPPER CASE SOURCE TERMS - DRY CASE CONDITION

088664-031

March 11, 2021

Figure F.2

HEG file: Z:\HEG\088664\DOCUMENTATION\RPT\088664-RPT-13\FIGURES\Figure 7.30 - Sim_Aluminum_PSS - EOM - UC - AVG.srf



LEGEND

- SURFACE WATER BODY
- PROPOSED EXTENT OF MINE FEATURES
- 0.1 — SIMULATED ARSENIC CONCENTRATION (ug/L)
- SURFACE WATER MANAGEMENT DITCHES
- PROPERTY BOUNDARY
- PROJECT AREA
- LOCAL ASSESSMENT AREA
- NAG WASTE ROCK STOCKPILE
- PAG WASTE ROCK STOCKPILE
- LGO STOCKPILE
- TILL STOCKPILES
- TOPSOIL STOCKPILES

Note: The arsenic Tier 2 PSS for groundwater discharge to surface water (>10 m) is 50 ug/L.

0 300 600 900m

ATLANTIC GOLD CORPORATION
MARINETTE, NOVA SCOTIA
BEAVER DAM MINE

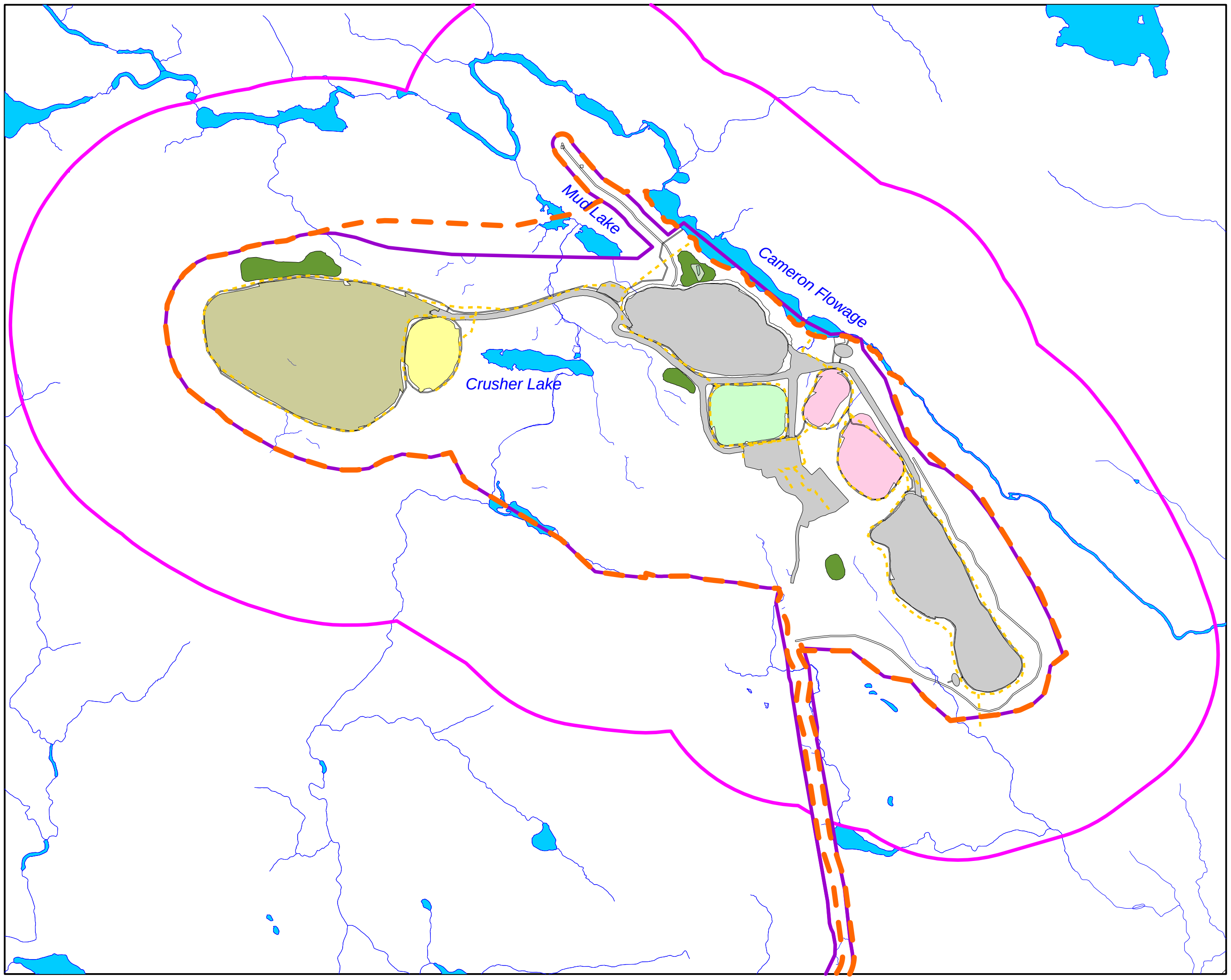
SIMULATED ARSENIC CONCENTRATION VERSUS TIER 2 PSS
EOM - UPPER CASE SOURCE TERMS - DRY CASE CONDITION

088664-031

March 11, 2021

Figure F.3

HEG file: Z:\HEG\088664\DOCUMENTATION\RPT\088664-RPT-13\FIGURES\Figure 7.31 - Sim_Arsenic_PSS - EOM - UC - AVG.srf



LEGEND

- SURFACE WATER BODY
- PROPOSED EXTENT OF MINE FEATURES
- 0.1 — SIMULATED CADMIUM CONCENTRATION (ug/L)
- SURFACE WATER MANAGEMENT DITCHES
- PROPERTY BOUNDARY
- PROJECT AREA
- LOCAL ASSESSMENT AREA
- NAG WASTE ROCK STOCKPILE
- PAG WASTE ROCK STOCKPILE
- LGO STOCKPILE
- TILL STOCKPILES
- TOPSOIL STOCKPILES

Note: The cadmium Tier 2 PSS for groundwater discharge to surface water (>10 m) is 0.1 ug/L.

0 300 600 900m

ATLANTIC GOLD CORPORATION
MARINETTE, NOVA SCOTIA
BEAVER DAM MINE

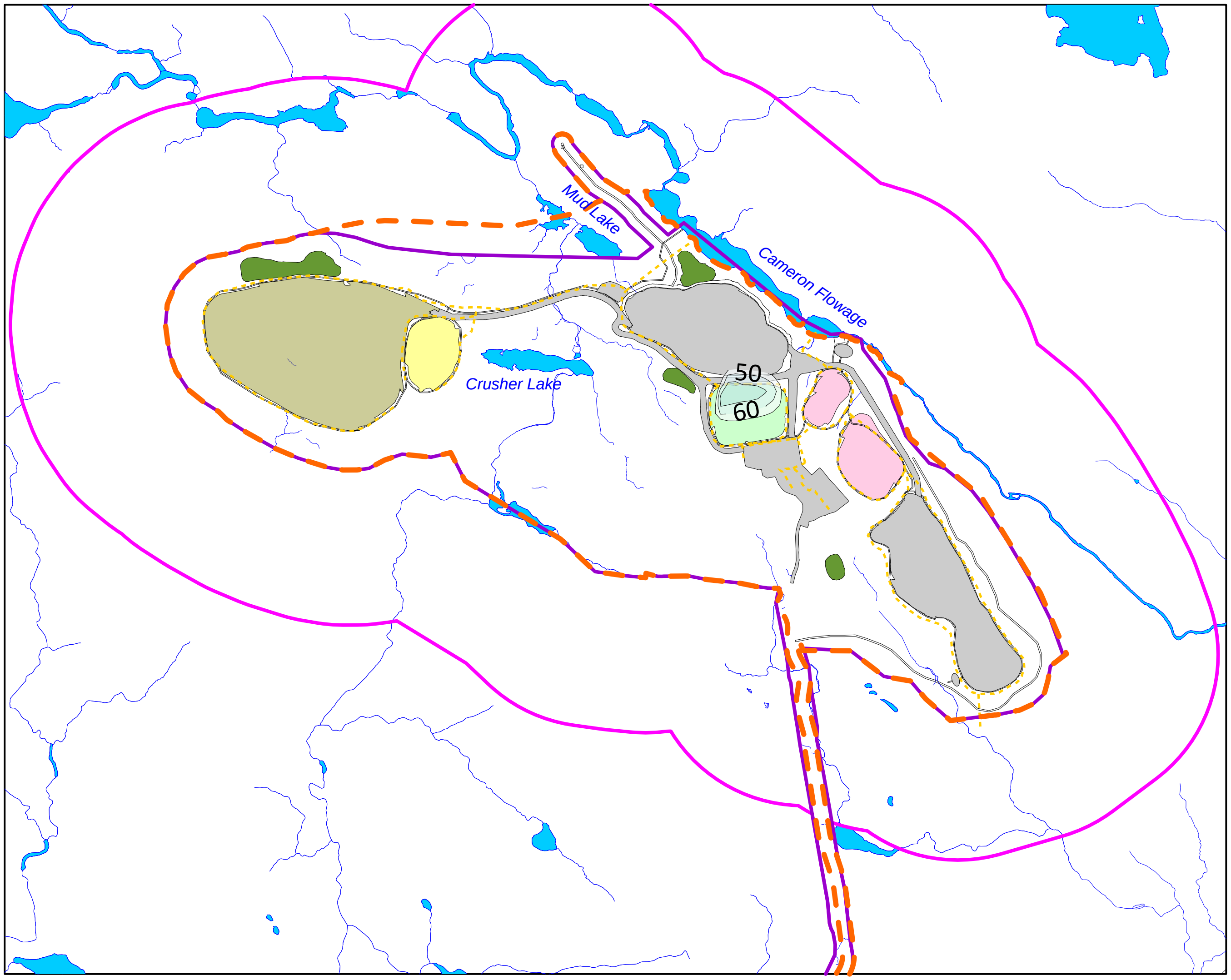
SIMULATED CADMIUM CONCENTRATION VERSUS TIER 2 PSS
EOM - UPPER CASE SOURCE TERMS - DRY CASE CONDITION

088664-031

March 11, 2021

Figure F.4

HEG file: Z:\HEG\088664\DOCUMENTATION\RPT\088664-RPT-13\FIGURES\Figure 7.32 - Sim_Cadmium_PSS-EOM-UC-AVG.srf



LEGEND

- SURFACE WATER BODY
- PROPOSED EXTENT OF MINE FEATURES
- 0.1 SIMULATED ALUMINUM CONCENTRATION (ug/L)
- SURFACE WATER MANAGEMENT DITCHES
- PROPERTY BOUNDARY
- PROJECT AREA
- LOCAL ASSESSMENT AREA
- NAG WASTE ROCK STOCKPILE
- PAG WASTE ROCK STOCKPILE
- LGO STOCKPILE
- TILL STOCKPILES
- TOPSOIL STOCKPILES

Note: The aluminum Tier 2 PSS for groundwater discharge to surface water (>10 m) is 50 ug/L.

0 300 600 900m

ATLANTIC GOLD CORPORATION
MARINETTE, NOVA SCOTIA
BEAVER DAM MINE

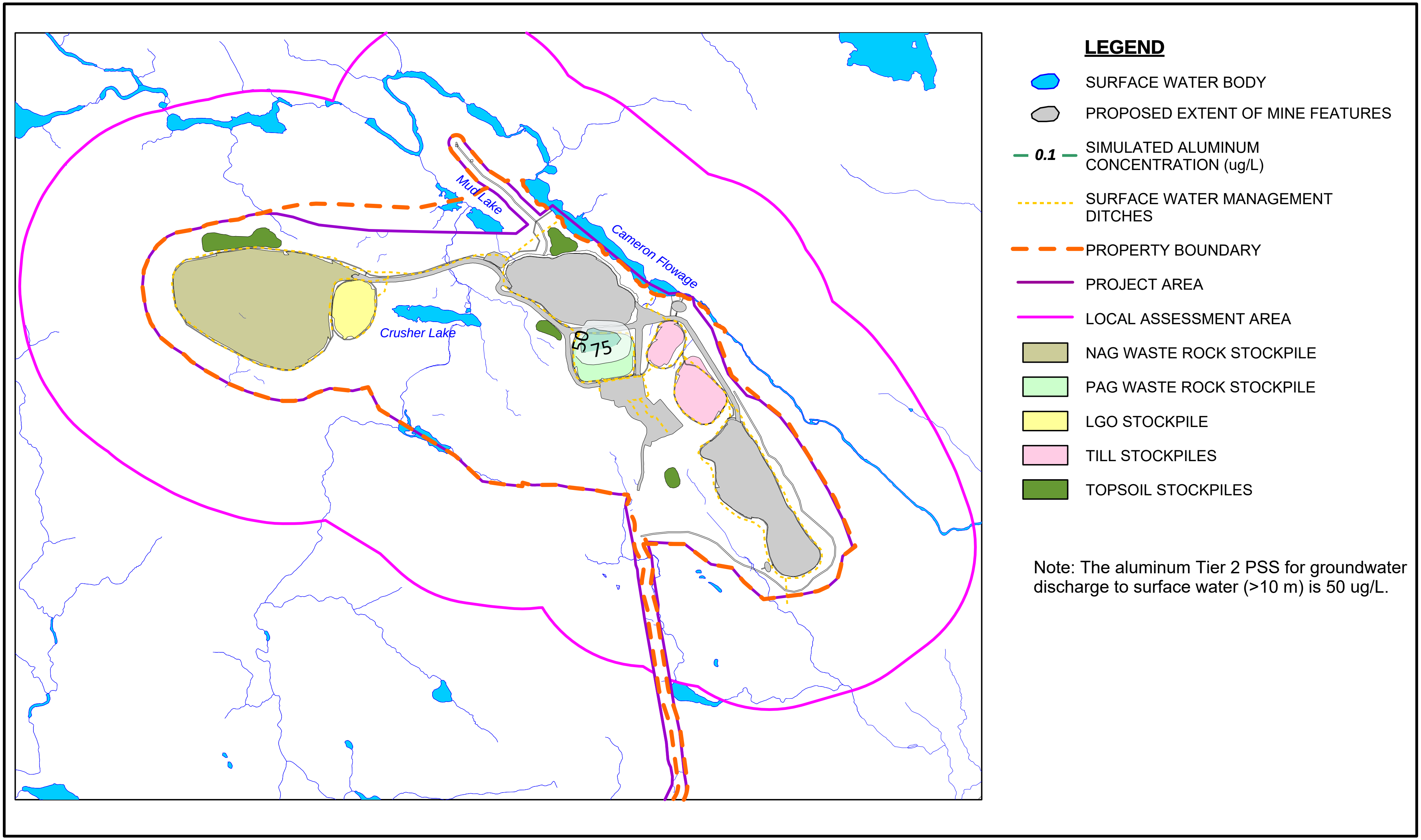
SIMULATED ALUMINUM CONCENTRATION VERSUS TIER 2 PSS
PC - BASE CASE SOURCE TERMS - DRY CASE CONDITION

088664-031

March 11, 2021

Figure F.5

HEG file: Z:\HEG\088664\DOCUMENTATION\RPT\088664-RPT-13\FIGURES\Figure 7.33 - Sim_Aluminum_PSS-PC-BC-AVG.srf



ATLANTIC GOLD CORPORATION
MARINETTE, NOVA SCOTIA
BEAVER DAM MINE

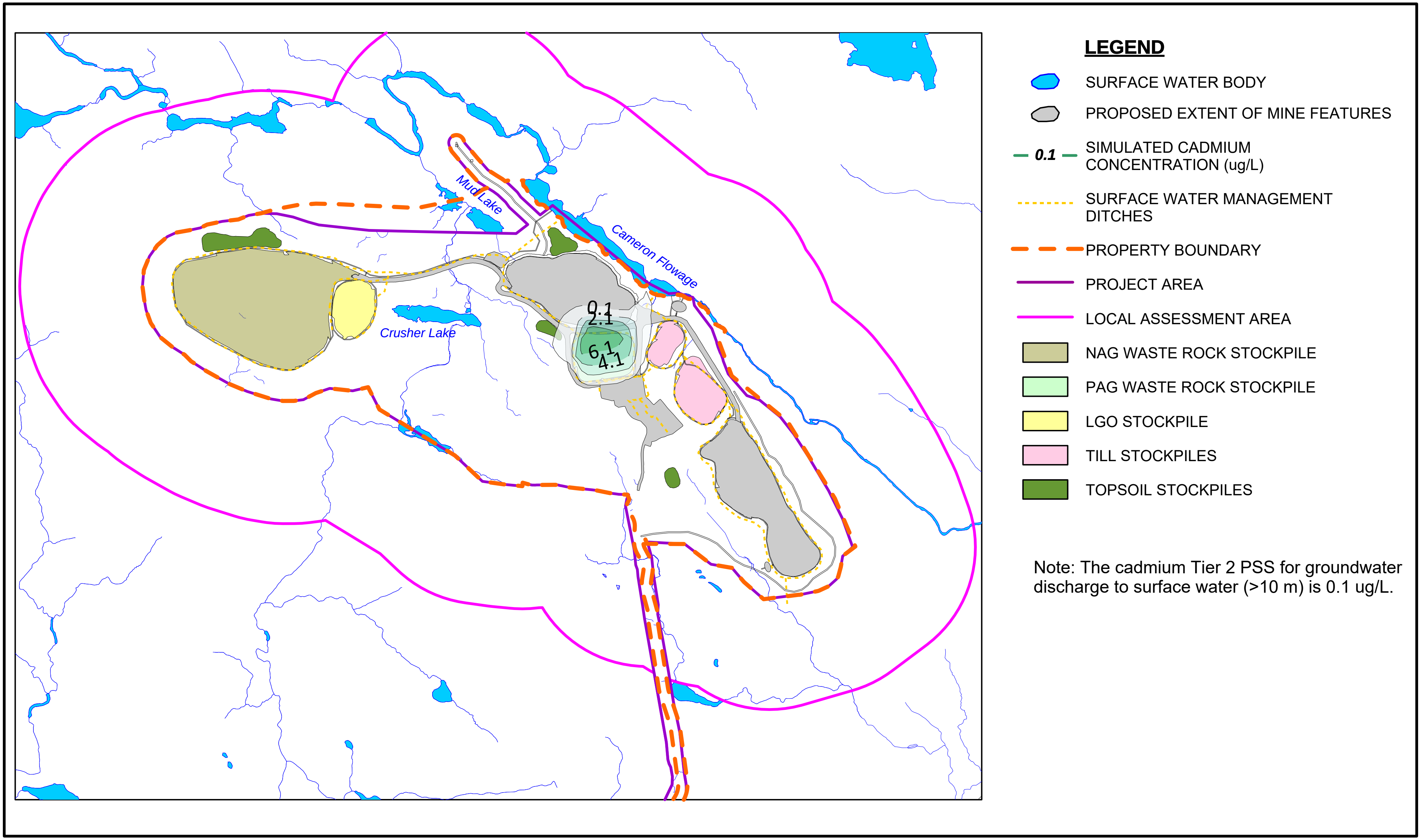
SIMULATED ALUMINUM CONCENTRATION VERSUS TIER 2 PSS
PC - UPPER CASE SOURCE TERMS - DRY CASE CONDITION

088664-031

March 11, 2021

Figure F.6

HEG file: Z:\HEG\088664\DOCUMENTATION\RPT\088664-RPT-13\FIGURES\Figure 7.34 - Sim_Aluminum_PSS-PC-UC-AVG.srf



Note: The cadmium Tier 2 PSS for groundwater discharge to surface water (>10 m) is 0.1 ug/L.

ATLANTIC GOLD CORPORATION
MARINETTE, NOVA SCOTIA
BEAVER DAM MINE

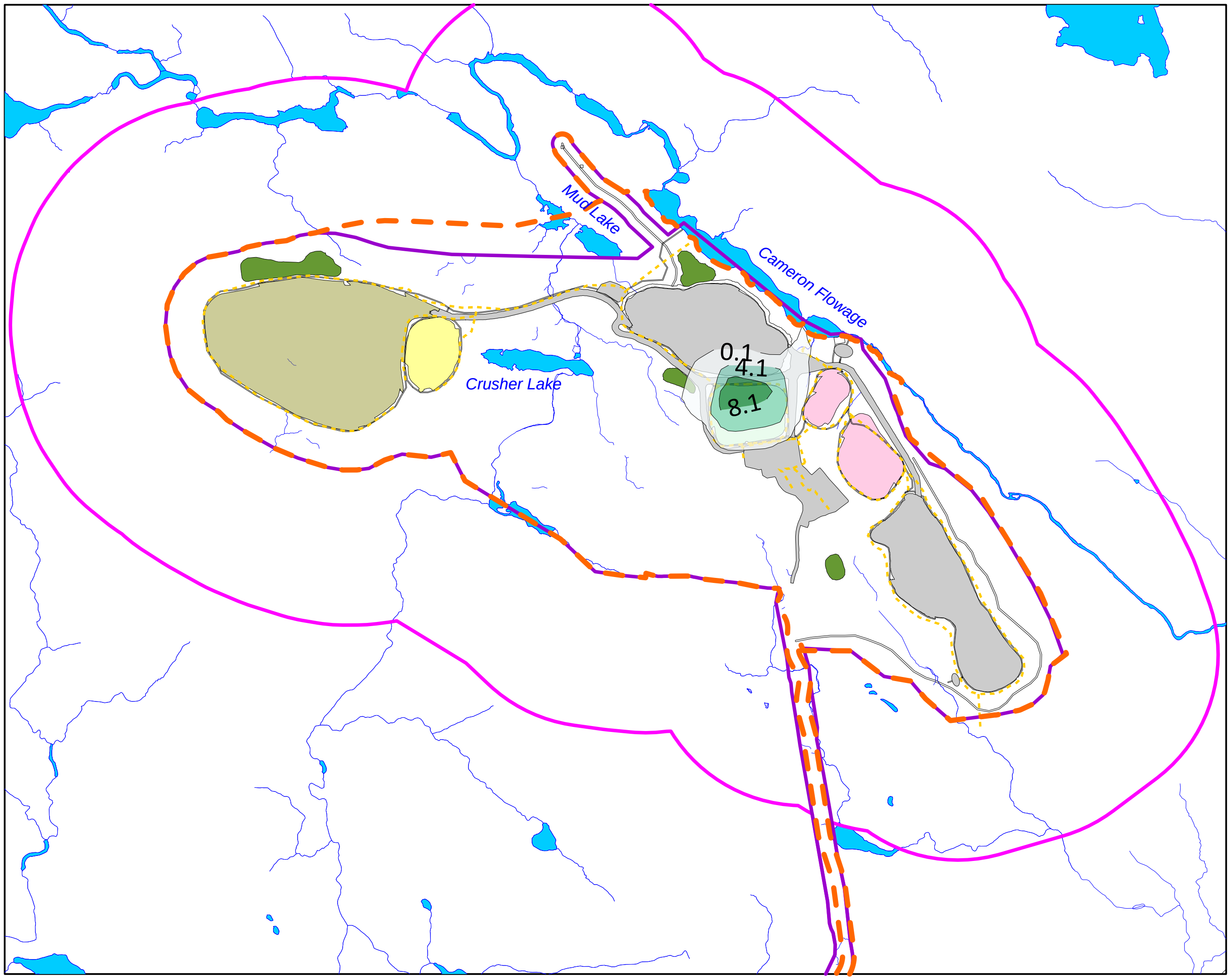
SIMULATED CADMIUM CONCENTRATION VERSUS TIER 2 PSS
PC - BASE CASE SOURCE TERMS - DRY CASE CONDITION

088664-031

March 11, 2021

Figure F.7

HEG file: Z:\HEG\088664\DOCUMENTATION\RPT\088664-RPT-13\FIGURES\Figure 7.35 - Sim_Cadmium_PSS-PC-BC-AVG.srf



LEGEND

SURFACE WATER BODY

PROPOSED EXTENT OF MINE FEATURES

0.1 — SIMULATED CADMIUM CONCENTRATION (ug/L)

SURFACE WATER MANAGEMENT DITCHES

PROPERTY BOUNDARY

PROJECT AREA

LOCAL ASSESSMENT AREA

NAG WASTE ROCK STOCKPILE

PAG WASTE ROCK STOCKPILE

LGO STOCKPILE

TILL STOCKPILES

TOPSOIL STOCKPILES

Note: The cadmium Tier 2 PSS for groundwater discharge to surface water (>10 m) is 0.1 ug/L.

ATLANTIC GOLD CORPORATION
MARINETTE, NOVA SCOTIA
BEAVER DAM MINE

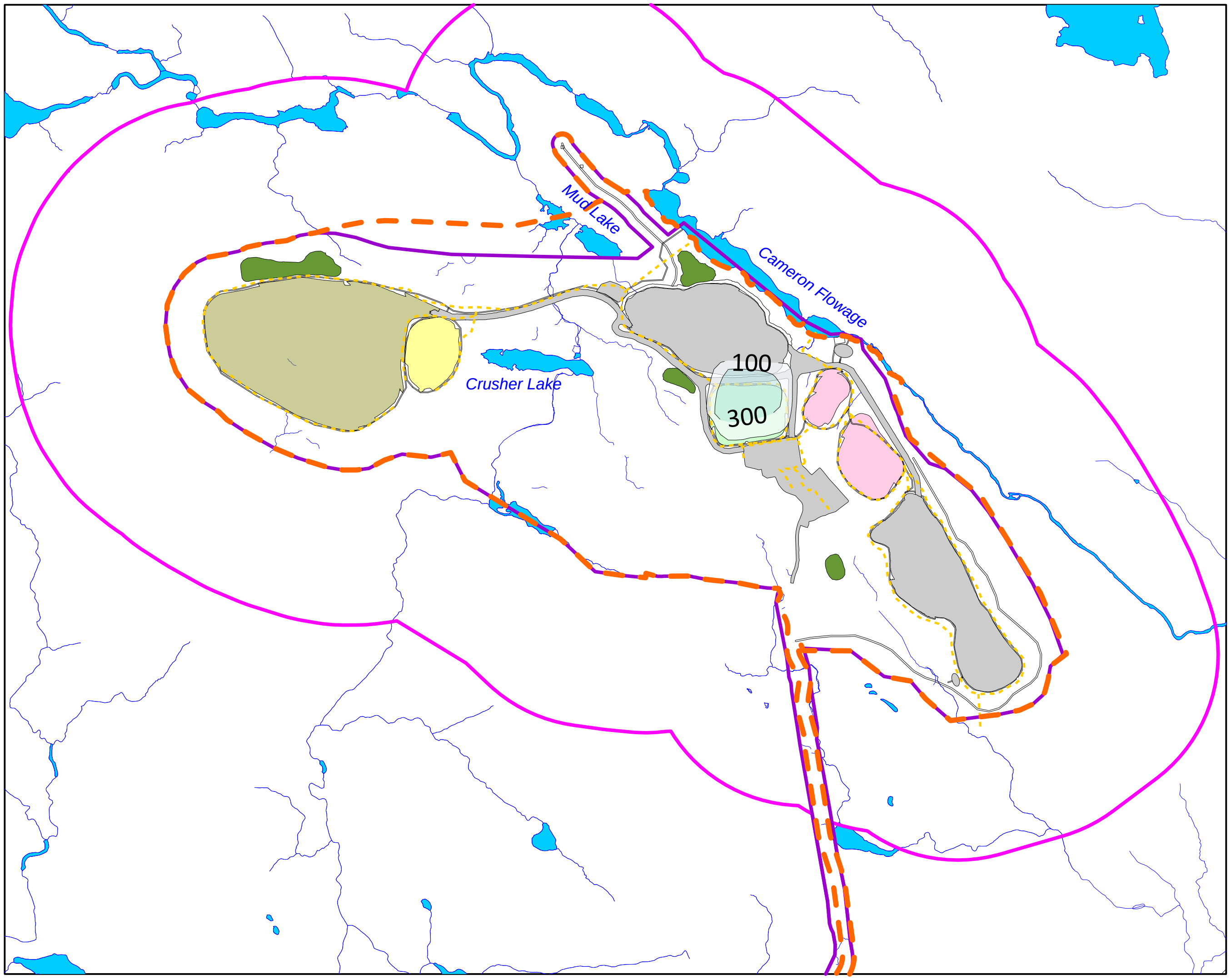
SIMULATED CADMIUM CONCENTRATION VERSUS TIER 2 PSS
PC - UPPER CASE SOURCE TERMS - DRY CASE CONDITION

088664-031

March 11, 2021

Figure F.8

HEG file: Z:\HEG\088664\DOCUMENTATION\RPT\088664-RPT-13\FIGURES\Figure 7.36 - Sim_Cadmium_PSS-PC-UC-AVG.srf



LEGEND

- SURFACE WATER BODY
- PROPOSED EXTENT OF MINE FEATURES
- 0.1 — SIMULATED COBALT CONCENTRATION (ug/L)
- SURFACE WATER MANAGEMENT DITCHES
- PROPERTY BOUNDARY
- PROJECT AREA
- LOCAL ASSESSMENT AREA
- NAG WASTE ROCK STOCKPILE
- PAG WASTE ROCK STOCKPILE
- LGO STOCKPILE
- TILL STOCKPILES
- TOPSOIL STOCKPILES

Note: The cobalt Tier 2 PSS for groundwater discharge to surface water (>10 m) is 100 ug/L.

0 300 600 900m

ATLANTIC GOLD CORPORATION
MARINETTE, NOVA SCOTIA
BEAVER DAM MINE

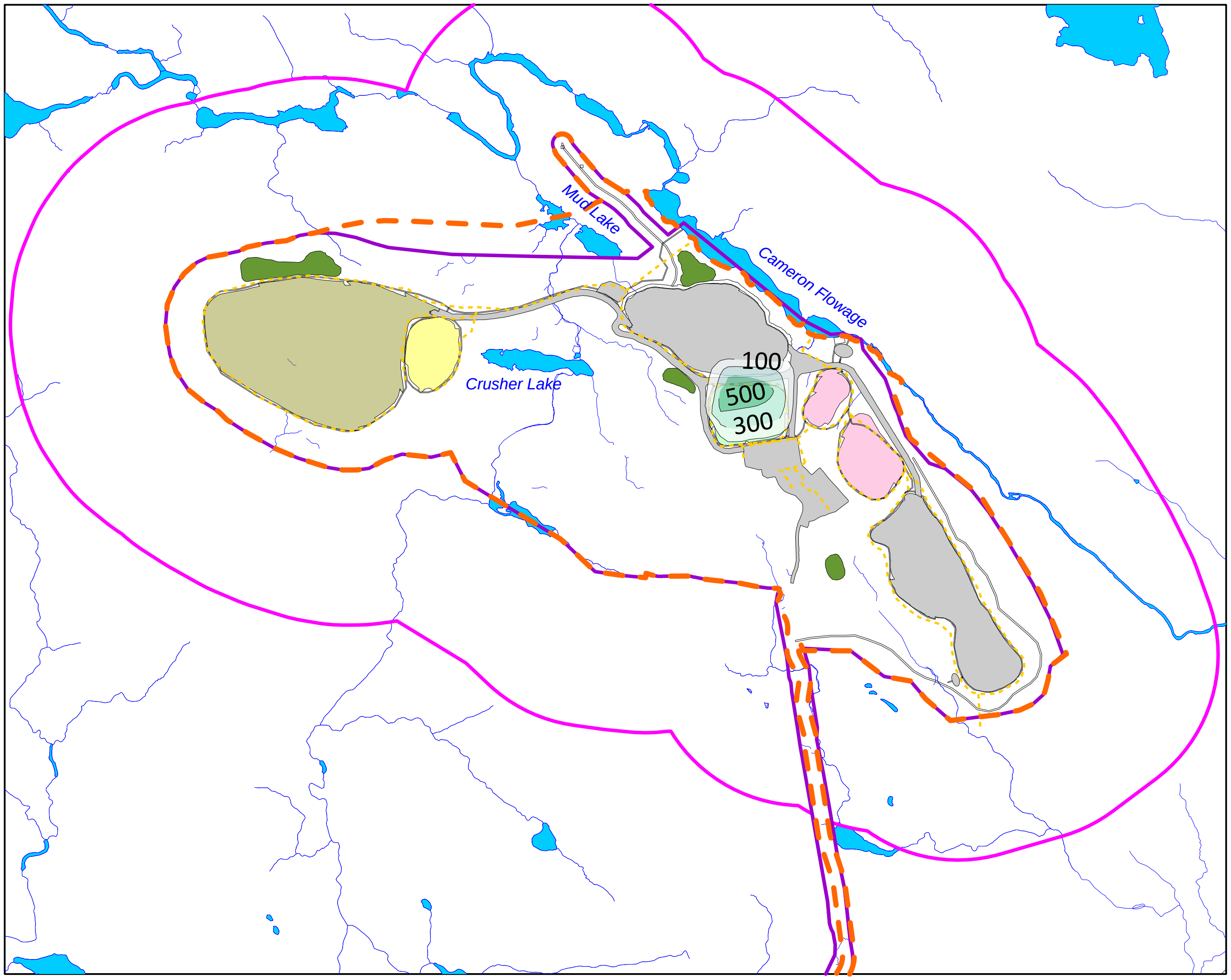
SIMULATED COBALT CONCENTRATION VERSUS TIER 2 PSS
PC - BASE CASE SOURCE TERMS - DRY CASE CONDITION

088664-031

March 11, 2021

Figure F.9

HEG file: Z:\HEG\088664\DOCUMENTATION\RPT\088664-RPT-13\FIGURES\Figure 7.37 - Sim_Cobalt_PSS-PC-BC-AVG.srf



LEGEND

SURFACE WATER BODY
PROPOSED EXTENT OF MINE FEATURES
0.1 — SIMULATED COBALT CONCENTRATION (ug/L)
SURFACE WATER MANAGEMENT DITCHES
PROPERTY BOUNDARY
PROJECT AREA
LOCAL ASSESSMENT AREA
NAG WASTE ROCK STOCKPILE
PAG WASTE ROCK STOCKPILE
LGO STOCKPILE
TILL STOCKPILES
TOPSOIL STOCKPILES

Note: The cobalt Tier 2 PSS for groundwater discharge to surface water (>10 m) is 100 ug/L.

0 300 600 900m

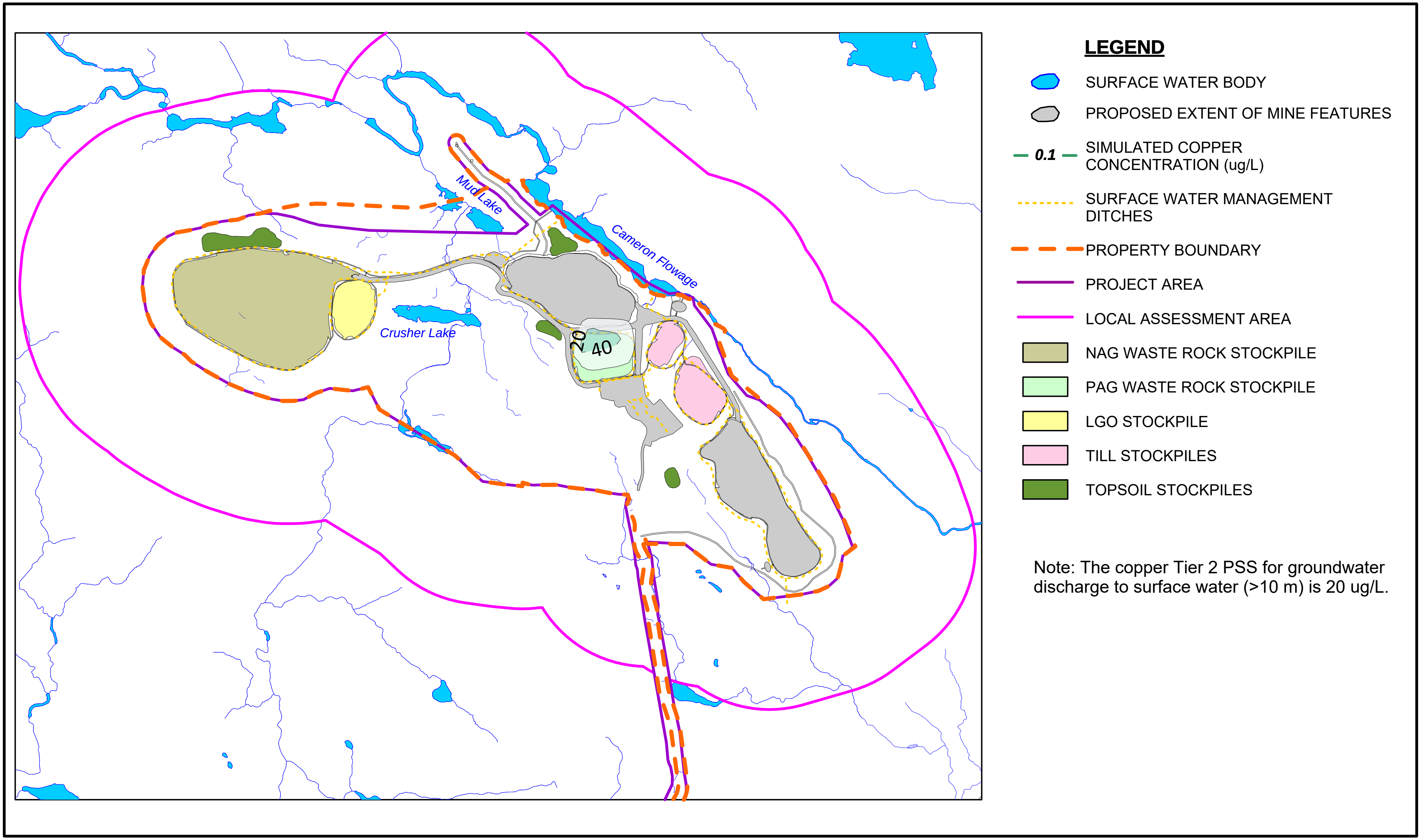
ATLANTIC GOLD CORPORATION
MARINETTE, NOVA SCOTIA
BEAVER DAM MINE

SIMULATED COBALT CONCENTRATION VERSUS TIER 2 PSS
PC - UPPER CASE SOURCE TERMS - DRY CASE CONDITION

088664-031
March 11, 2021

Figure F.10

HEG file: Z:\HEG\088664\DOCUMENTATION\RPT\088664-RPT-13\FIGURES\Figure 7.38 - Sim_Cobalt_PSS-PC-UC-AVG.srf



Note: The copper Tier 2 PSS for groundwater discharge to surface water (>10 m) is 20 ug/L.

0 300 600 900m

N

ATLANTIC GOLD CORPORATION
MARINETTE, NOVA SCOTIA
BEAVER DAM MINE

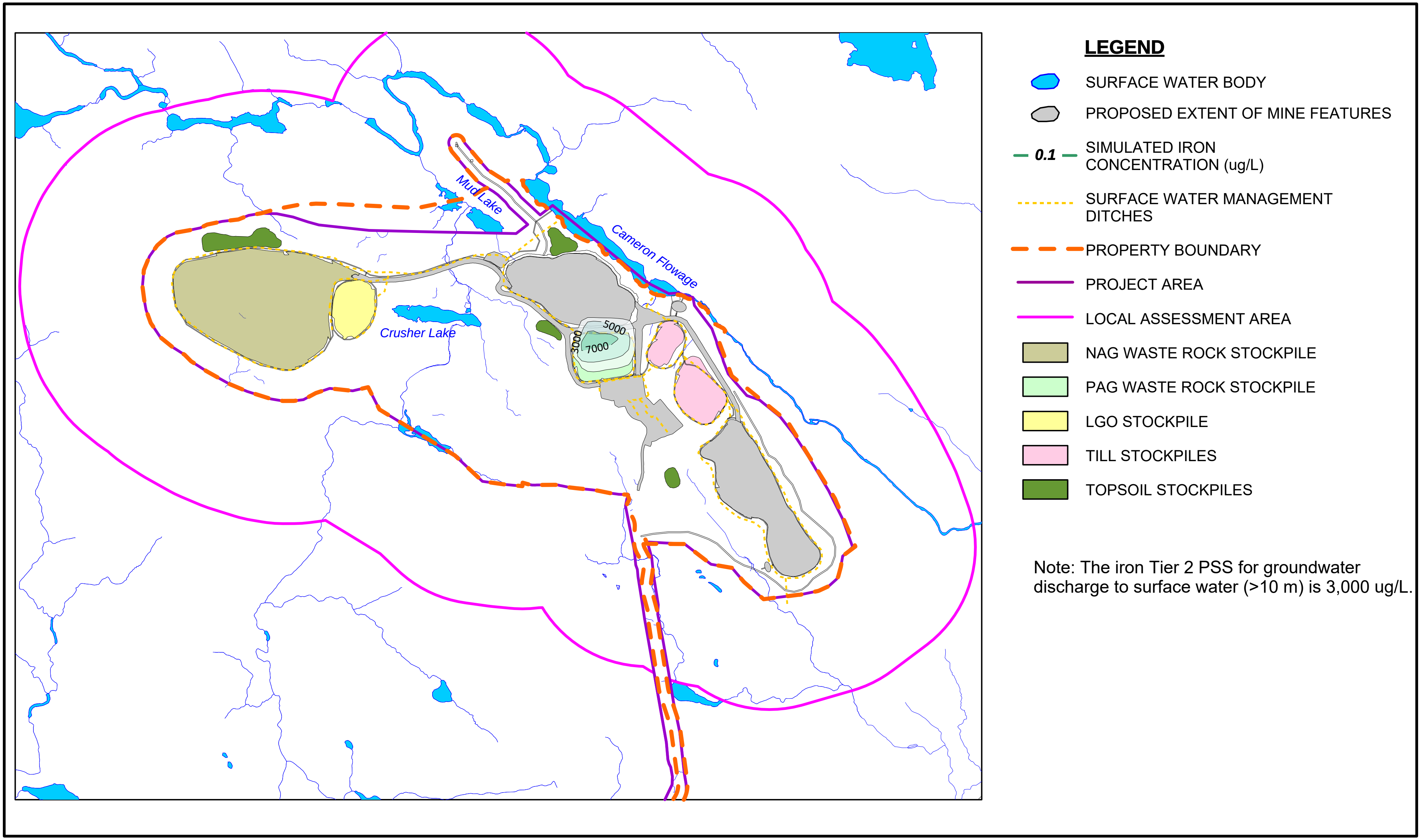
SIMULATED COPPER CONCENTRATION VERSUS TIER 2 PSS
PC - UPPER CASE SOURCE TERMS - DRY CASE CONDITION

088664-031

March 11, 2021

Figure F.11

HEG file: Z:\HEG\088664\DOCUMENTATION\RPT\088664-RPT-13\FIGURES\Figure 7.40 - Sim_Copper_PSS-PC-UC-AVG.srf



ATLANTIC GOLD CORPORATION
MARINETTE, NOVA SCOTIA
BEAVER DAM MINE

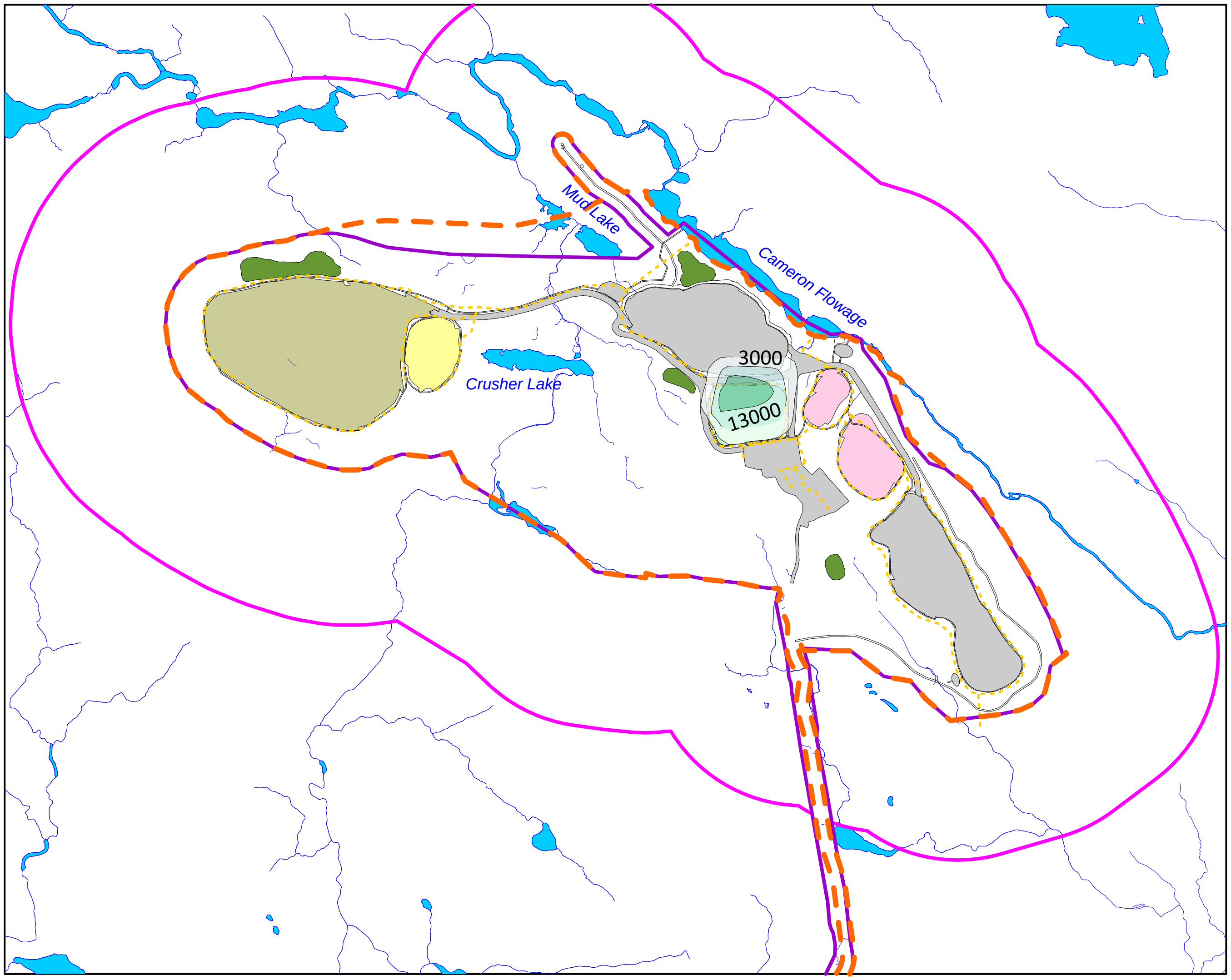
SIMULATED IRON CONCENTRATION VERSUS TIER 2 PSS
PC - BASE CASE SOURCE TERMS - DRY CASE CONDITION

088664-031

March 11, 2021

Figure F.12

HEG file: Z:\HEG\088664\DOCUMENTATION\RPT\088664-RPT-13\FIGURES\Figure 7.41 - Sim_Iron_PSS-PC-BC-AVG.srf



Note: The iron Tier 2 PSS for groundwater discharge to surface water (>10 m) is 3,000 ug/L.

0 300 600 900m

N

GHD

ATLANTIC GOLD CORPORATION
MARINETTE, NOVA SCOTIA
BEAVER DAM MINE

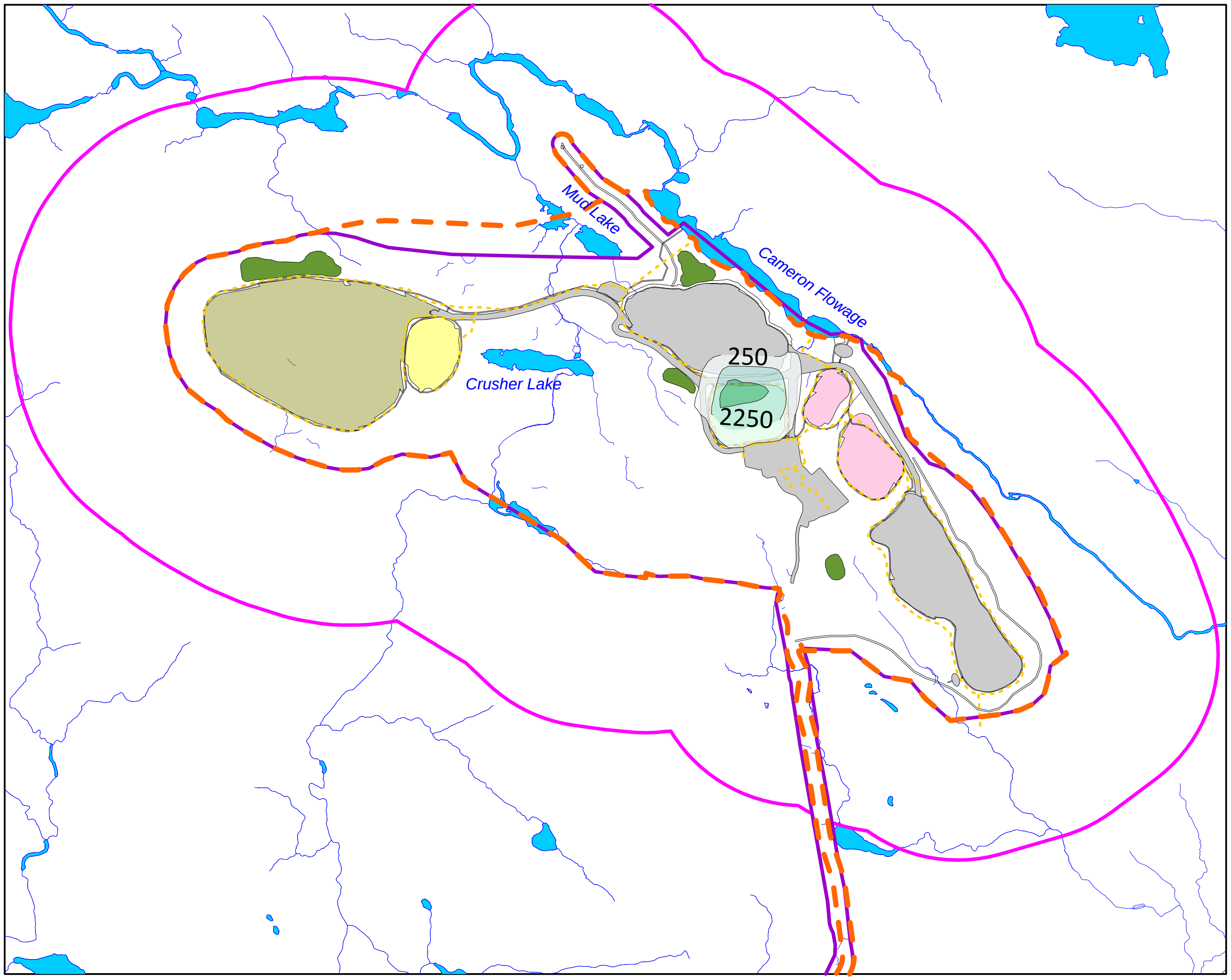
SIMULATED IRON CONCENTRATION VERSUS TIER 2 PSS
PC - UPPER CASE SOURCE TERMS - DRY CASE CONDITION

088664-031

March 11, 2021

Figure F.13

HEG file: Z:\HEG\088664\DOCUMENTATION\RPT\088664-RPT-13\FIGURES\Figure 7.42 - Sim_Iron_PSS-PC-UC-AVG.srf



LEGEND

- SURFACE WATER BODY
- PROPOSED EXTENT OF MINE FEATURES
- 0.1 — SIMULATED NICKEL CONCENTRATION (ug/L)
- SURFACE WATER MANAGEMENT DITCHES
- PROPERTY BOUNDARY
- PROJECT AREA
- LOCAL ASSESSMENT AREA
- NAG WASTE ROCK STOCKPILE
- PAG WASTE ROCK STOCKPILE
- LGO STOCKPILE
- TILL STOCKPILES
- TOPSOIL STOCKPILES

Note: The nickel Tier 2 PSS for groundwater discharge to surface water (>10 m) is 250 ug/L.

0 300 600 900m

ATLANTIC GOLD CORPORATION
MARINETTE, NOVA SCOTIA
BEAVER DAM MINE

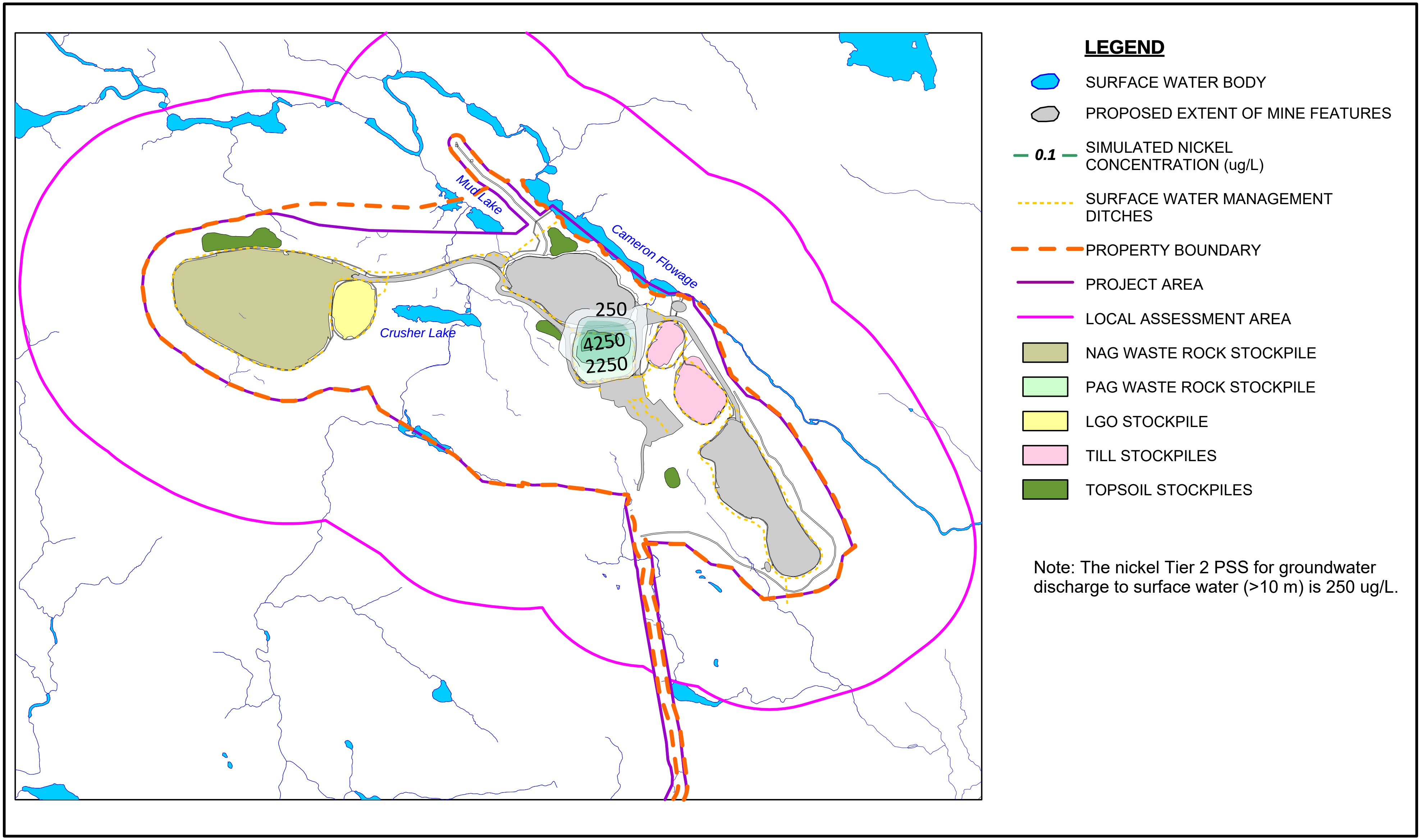
SIMULATED NICKEL CONCENTRATION VERSUS TIER 2 PSS
PC - BASE CASE SOURCE TERMS - DRY CASE CONDITION

088664-031

March 11, 2021

Figure F.14

HEG file: Z:\HEG\088664\DOCUMENTATION\RPT\088664-RPT-13\FIGURES\Figure 7.43 - Sim_Nickel_PSS-PC-BC-AVG.srf



Note: The nickel Tier 2 PSS for groundwater discharge to surface water (>10 m) is 250 ug/L.

ATLANTIC GOLD CORPORATION
MARINETTE, NOVA SCOTIA
BEAVER DAM MINE

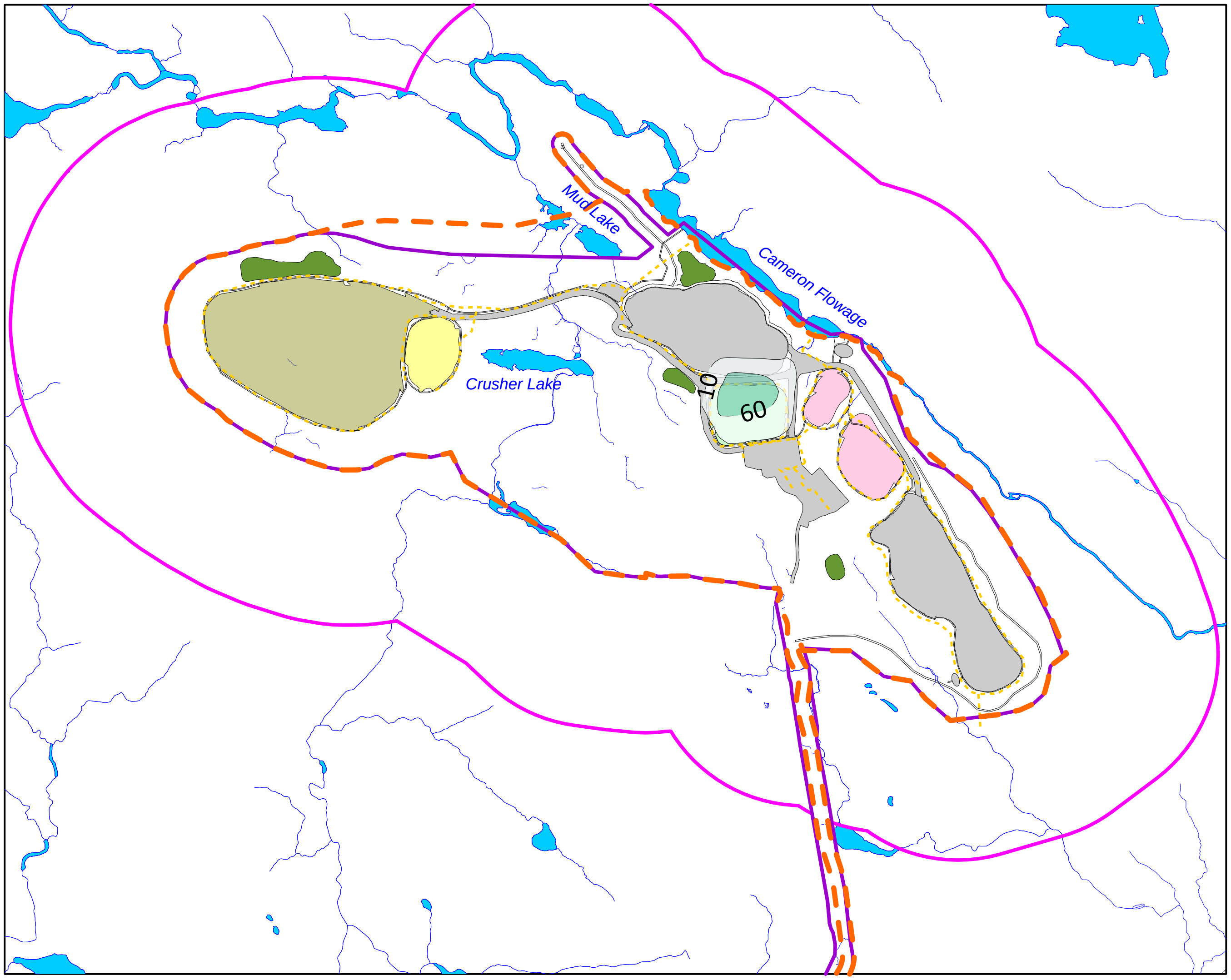
SIMULATED NICKEL CONCENTRATION VERSUS TIER 2 PSS
PC - UPPER CASE SOURCE TERMS - DRY CASE CONDITION

088664-031

March 11, 2021

Figure F.15

HEG file: Z:\HEG\088664\DOCUMENTATION\RPT\088664-RPT-13\FIGURES\Figure 7.44 - Sim_Nickel_PSS-PC-UC-AVG.srf



LEGEND

SURFACE WATER BODY
PROPOSED EXTENT OF MINE FEATURES
0.1 SIMULATED LEAD CONCENTRATION (ug/L)
SURFACE WATER MANAGEMENT DITCHES
PROPERTY BOUNDARY
PROJECT AREA
LOCAL ASSESSMENT AREA
NAG WASTE ROCK STOCKPILE
PAG WASTE ROCK STOCKPILE
LGO STOCKPILE
TILL STOCKPILES
TOPSOIL STOCKPILES

Note: The lead Tier 2 PSS for groundwater discharge to surface water (>10 m) is 10 ug/L.

0 300 600 900m

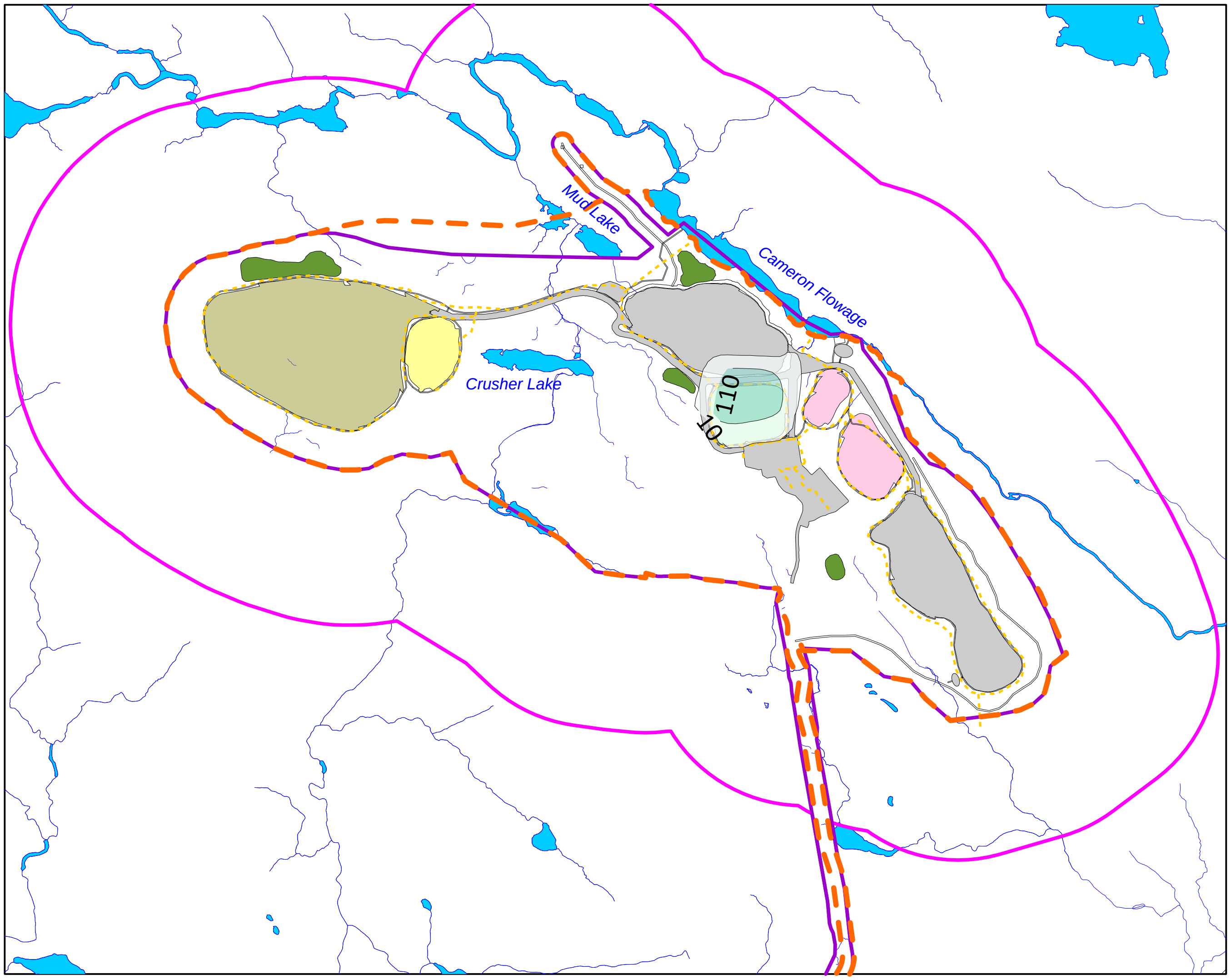
ATLANTIC GOLD CORPORATION
MARINETTE, NOVA SCOTIA
BEAVER DAM MINE

SIMULATED LEAD CONCENTRATION VERSUS TIER 2 PSS
PC - BASE CASE SOURCE TERMS - DRY CASE CONDITION

088664-031
March 11, 2021

Figure F.16

HEG file: Z:\HEG\088664\DOCUMENTATION\RPT\088664-RPT-13\FIGURES\Figure 7.45 - Sim_Lead_PSS-PC-BC-AVG.srf



LEGEND

- SURFACE WATER BODY
- PROPOSED EXTENT OF MINE FEATURES
- 0.1 SIMULATED LEAD CONCENTRATION (ug/L)
- SURFACE WATER MANAGEMENT DITCHES
- PROPERTY BOUNDARY
- PROJECT AREA
- LOCAL ASSESSMENT AREA
- NAG WASTE ROCK STOCKPILE
- PAG WASTE ROCK STOCKPILE
- LGO STOCKPILE
- TILL STOCKPILES
- TOPSOIL STOCKPILES

Note: The lead Tier 2 PSS for groundwater discharge to surface water (>10 m) is 10 ug/L.

0 300 600 900m

N

GHD

ATLANTIC GOLD CORPORATION
MARINETTE, NOVA SCOTIA
BEAVER DAM MINE

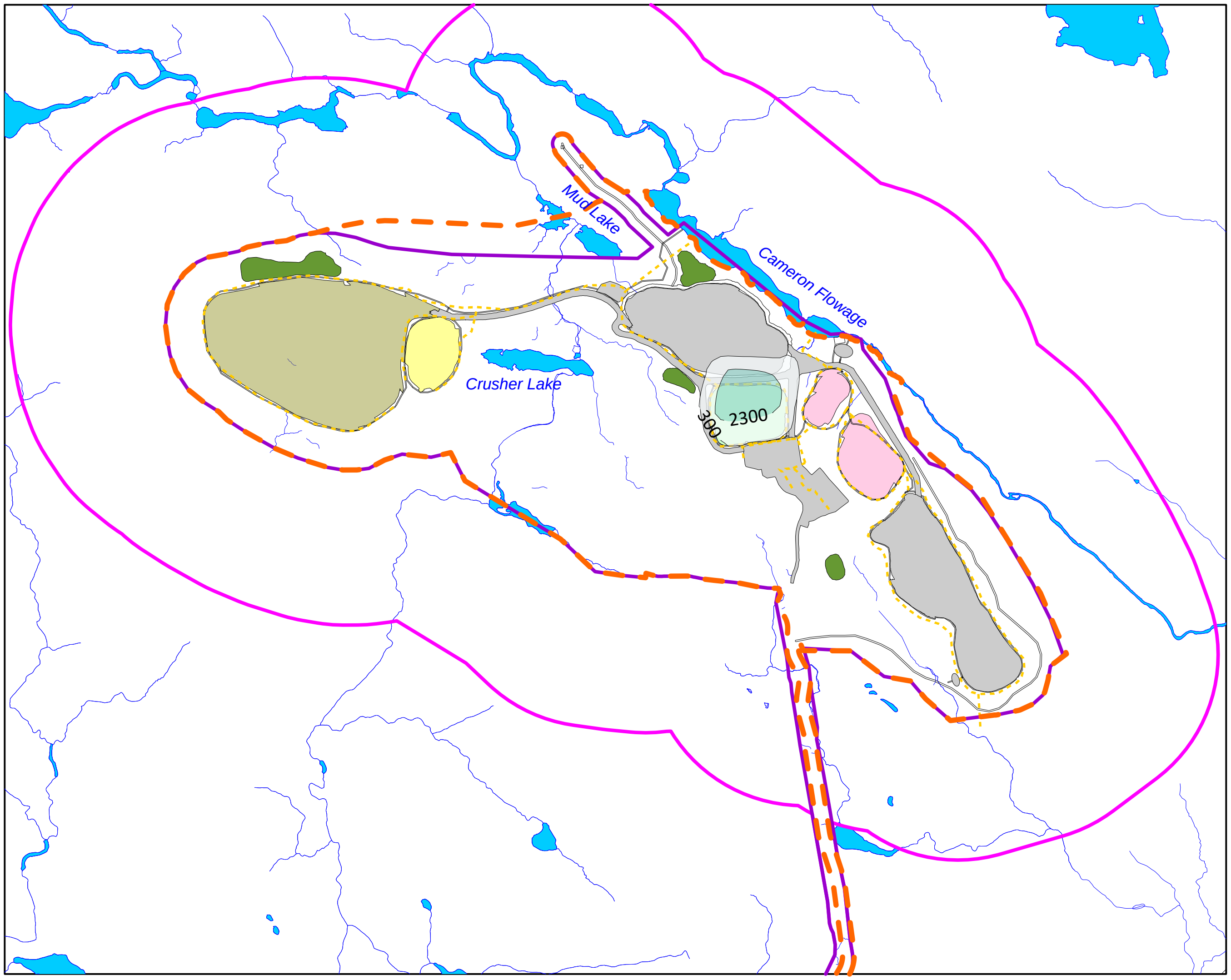
SIMULATED LEAD CONCENTRATION VERSUS TIER 2 PSS
PC - UPPER CASE SOURCE TERMS - DRY CASE CONDITION

088664-031

March 11, 2021

Figure F.17

HEG file: Z:\HEG\088664\DOCUMENTATION\RPT\088664-RPT-13\FIGURES\Figure 7.45 - Sim_Lead_PSS-PC-BC-AVG.srf



LEGEND

- SURFACE WATER BODY
- PROPOSED EXTENT OF MINE FEATURES
- 0.1 — SIMULATED ZINC CONCENTRATION (ug/L)
- SURFACE WATER MANAGEMENT DITCHES
- PROPERTY BOUNDARY
- PROJECT AREA
- LOCAL ASSESSMENT AREA
- NAG WASTE ROCK STOCKPILE
- PAG WASTE ROCK STOCKPILE
- LGO STOCKPILE
- TILL STOCKPILES
- TOPSOIL STOCKPILES

Note: The zinc Tier 2 PSS for groundwater discharge to surface water (>10 m) is 300 ug/L.

0 300 600 900m

ATLANTIC GOLD CORPORATION
MARINETTE, NOVA SCOTIA
BEAVER DAM MINE

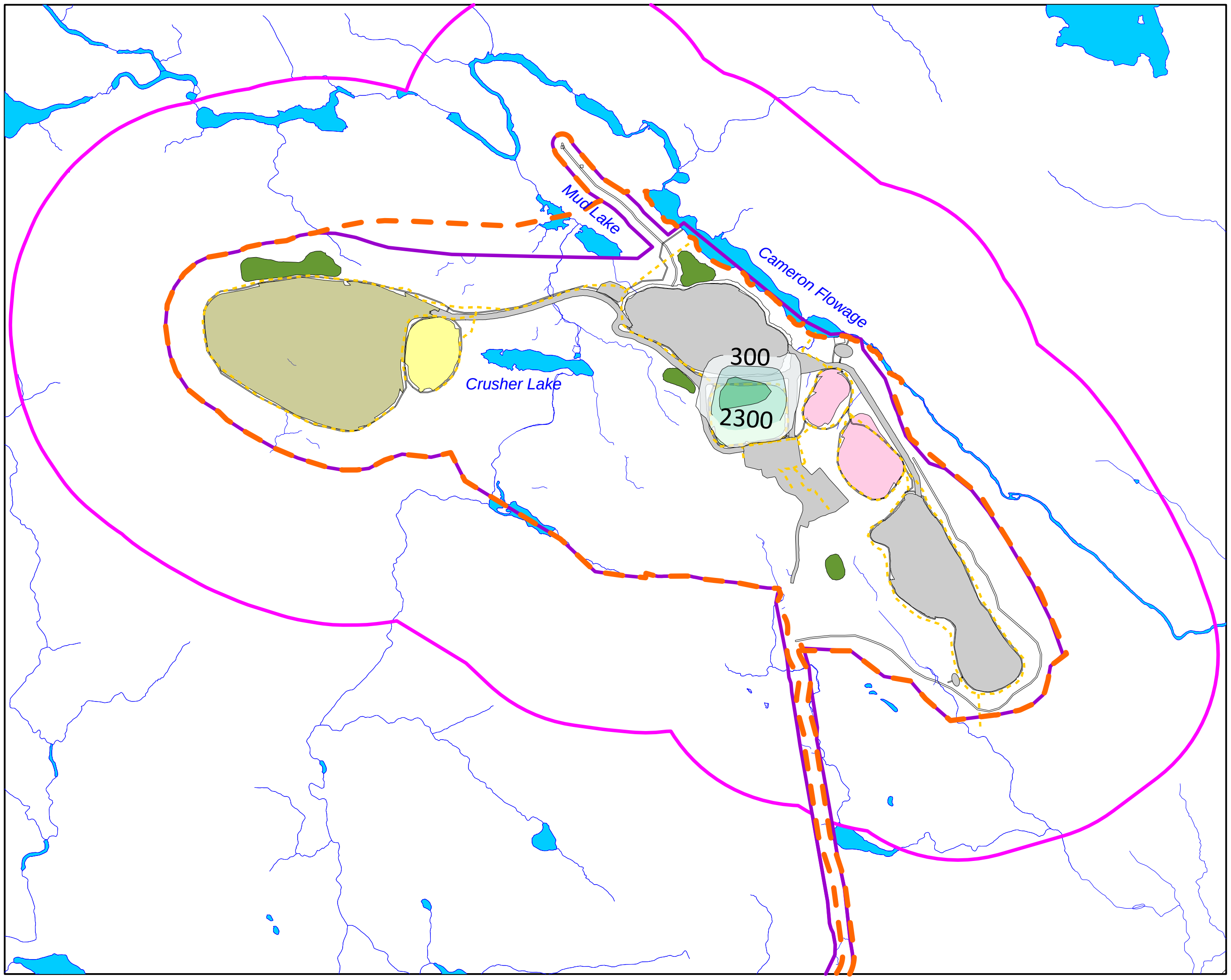
SIMULATED ZINC CONCENTRATION VERSUS TIER 2 PSS
PC - BASE CASE SOURCE TERMS - DRY CASE CONDITION

088664-031

March 11, 2021

Figure F.18

HEG file: Z:\HEG\088664\DOCUMENTATION\RPT\088664-RPT-13\FIGURES\Figure 7.48 - Sim_Zinc_PSS-PC-BC-AVG.srf



LEGEND

- SURFACE WATER BODY
- PROPOSED EXTENT OF MINE FEATURES
- 0.1 SIMULATED ZINC CONCENTRATION (ug/L)
- SURFACE WATER MANAGEMENT DITCHES
- PROPERTY BOUNDARY
- PROJECT AREA
- LOCAL ASSESSMENT AREA
- NAG WASTE ROCK STOCKPILE
- PAG WASTE ROCK STOCKPILE
- LGO STOCKPILE
- TILL STOCKPILES
- TOPSOIL STOCKPILES

Note: The zinc Tier 2 PSS for groundwater discharge to surface water (>10 m) is 300 ug/L.

0 300 600 900m

ATLANTIC GOLD CORPORATION
MARINETTE, NOVA SCOTIA
BEAVER DAM MINE

SIMULATED ZINC CONCENTRATION VERSUS TIER 2 PSS
PC - UPPER CASE SOURCE TERMS - DRY CASE CONDITION

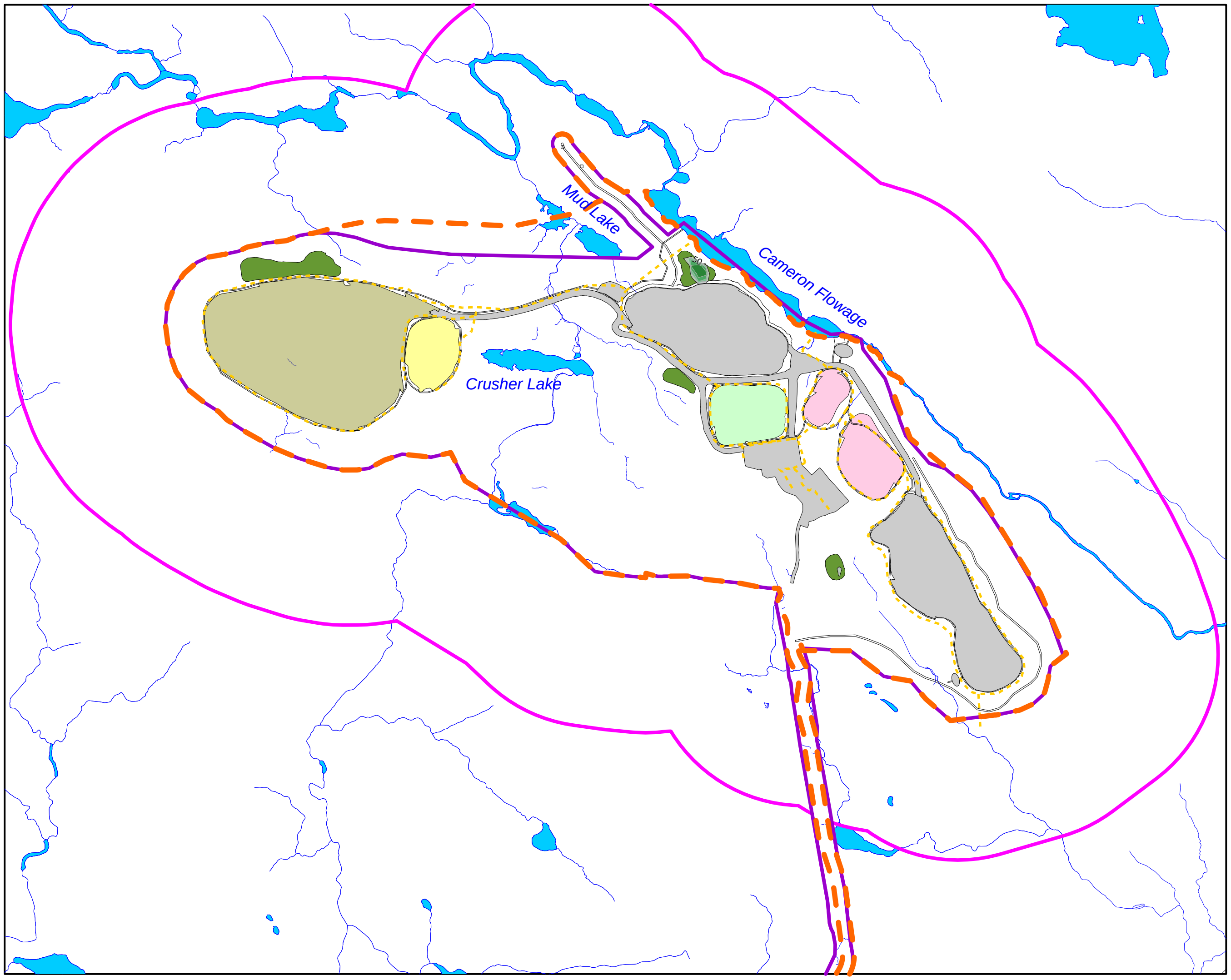
088664-031

March 11, 2021

Figure F.19

HEG file: Z:\HEG\088664\DOCUMENTATION\RPT\088664-RPT-13\FIGURES\Figure 7.49 - Sim_Zinc_PSS-PC-UC-AVG.srf

Appendix G
Simulated COC Concentrations in Groundwater Versus Tier 2 PSS – Wet Conditions



LEGEND

- SURFACE WATER BODY
- PROPOSED EXTENT OF MINE FEATURES
- 0.1 SIMULATED ALUMINUM CONCENTRATION (ug/L)
- SURFACE WATER MANAGEMENT DITCHES
- PROPERTY BOUNDARY
- PROJECT AREA
- LOCAL ASSESSMENT AREA
- NAG WASTE ROCK STOCKPILE
- PAG WASTE ROCK STOCKPILE
- LGO STOCKPILE
- TILL STOCKPILES
- TOPSOIL STOCKPILES

Note: The aluminum Tier 2 PSS for groundwater discharge to surface water (>10 m) is 50 ug/L.

0 300 600 900m

ATLANTIC GOLD CORPORATION
MARINETTE, NOVA SCOTIA
BEAVER DAM MINE

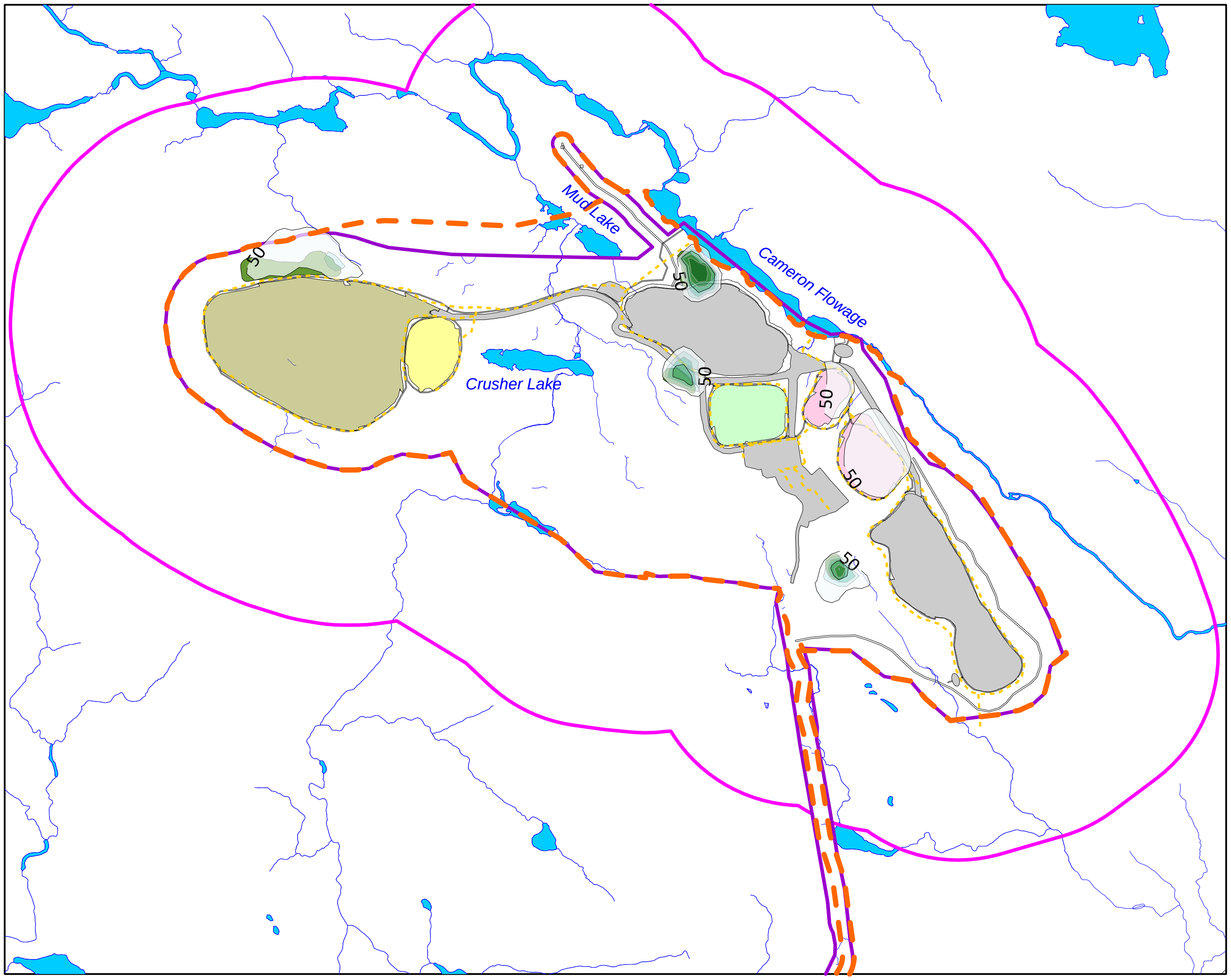
SIMULATED ALUMINUM CONCENTRATION VERSUS TIER 2 PSS
EOM - BASE CASE SOURCE TERMS - WET CASE CONDITION

088664-031

March 11, 2021

Figure G.1

HEG file: Z:\HEG\088664\DOCUMENTATION\RPT\088664-RPT-13\FIGURES\Figure 7.29 - Sim_Aluminum_PSS - EOM - BC - AVG.srf



LEGEND

- SURFACE WATER BODY
- PROPOSED EXTENT OF MINE FEATURES
- 0.1 — SIMULATED ALUMINUM CONCENTRATION (ug/L)
- SURFACE WATER MANAGEMENT DITCHES
- PROPERTY BOUNDARY
- PROJECT AREA
- LOCAL ASSESSMENT AREA
- NAG WASTE ROCK STOCKPILE
- PAG WASTE ROCK STOCKPILE
- LGO STOCKPILE
- TILL STOCKPILES
- TOPSOIL STOCKPILES

Note: The aluminum Tier 2 PSS for groundwater discharge to surface water (>10 m) is 50 ug/L.

0 300 600 900m

N

GHD

ATLANTIC GOLD CORPORATION
MARINETTE, NOVA SCOTIA
BEAVER DAM MINE

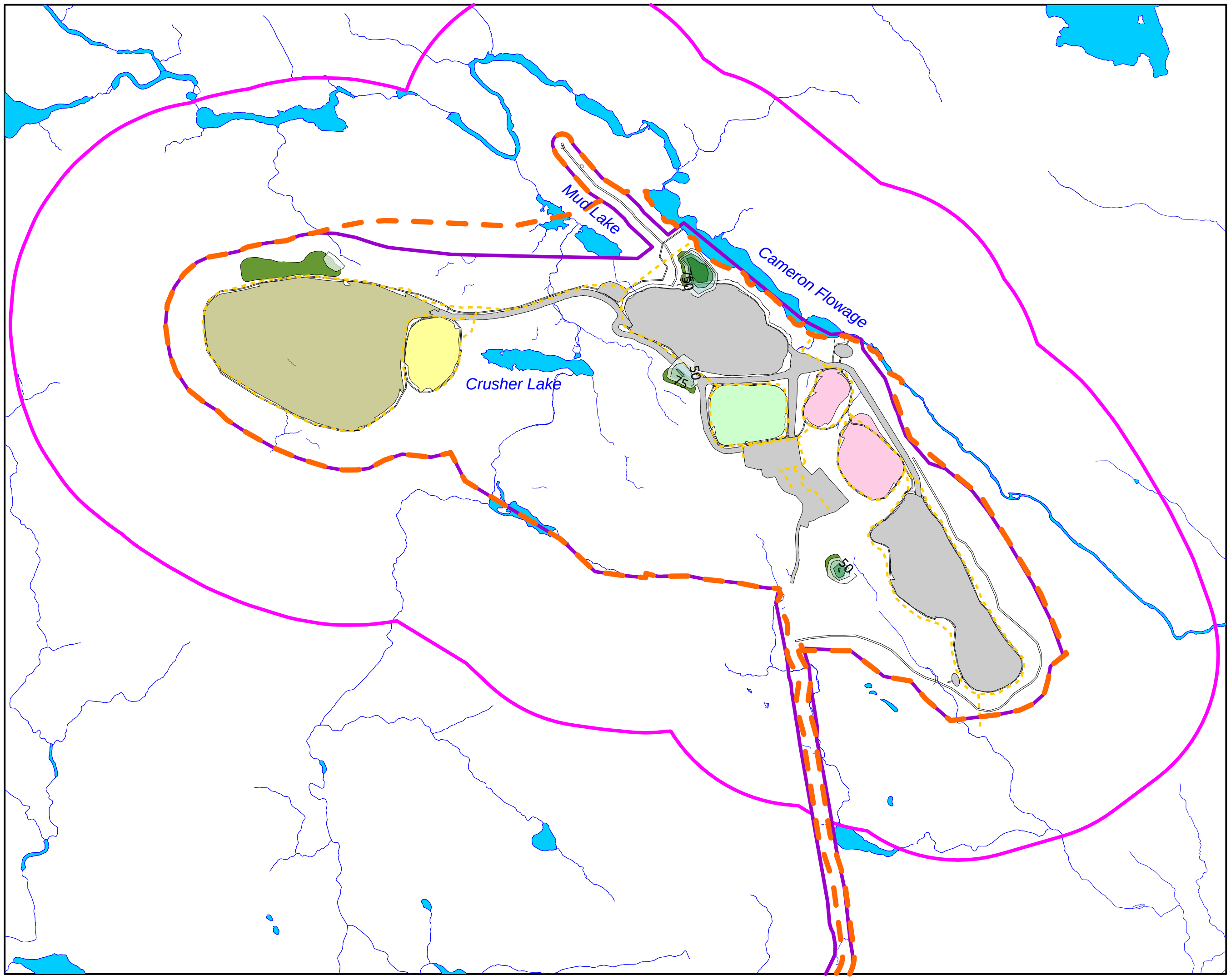
SIMULATED ALUMINUM CONCENTRATION VERSUS TIER 2 PSS
EOM - UPPER CASE SOURCE TERMS - WET CASE CONDITION

088664-031

March 11, 2021

Figure G.2

HEG file: Z:\HEG\088664\DOCUMENTATION\RPT\088664-RPT-13\FIGURES\Figure 7.30 - Sim_Aluminum_PSS - EOM - UC - AVG.srf



LEGEND

- SURFACE WATER BODY
- PROPOSED EXTENT OF MINE FEATURES
- 0.1 — SIMULATED ARSENIC CONCENTRATION (ug/L)
- SURFACE WATER MANAGEMENT DITCHES
- PROPERTY BOUNDARY
- PROJECT AREA
- LOCAL ASSESSMENT AREA
- NAG WASTE ROCK STOCKPILE
- PAG WASTE ROCK STOCKPILE
- LGO STOCKPILE
- TILL STOCKPILES
- TOPSOIL STOCKPILES

Note: The arsenic Tier 2 PSS for groundwater discharge to surface water (>10 m) is 50 ug/L.

0 300 600 900m

N

ATLANTIC GOLD CORPORATION
MARINETTE, NOVA SCOTIA
BEAVER DAM MINE

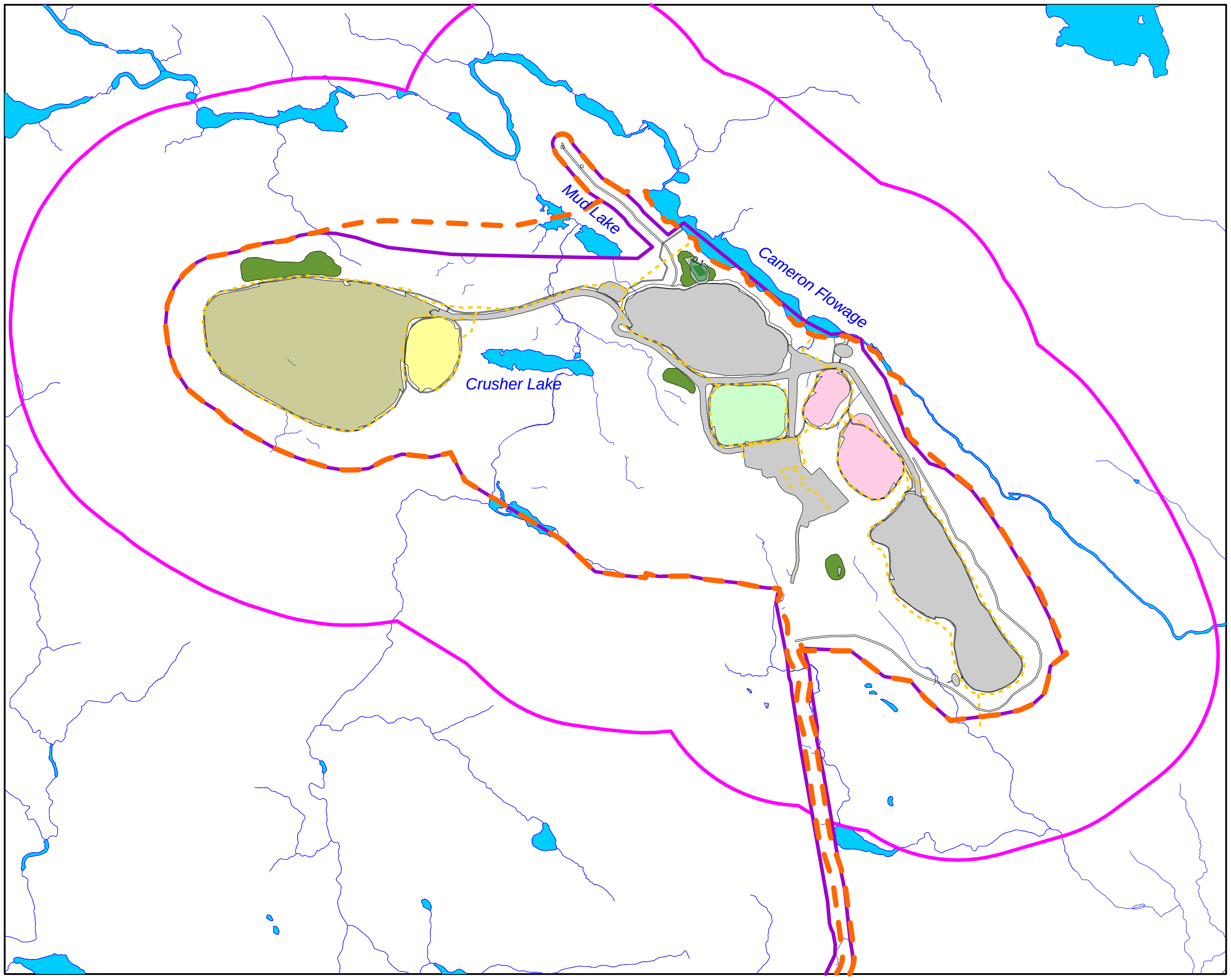
SIMULATED ARSENIC CONCENTRATION VERSUS TIER 2 PSS
EOM - UPPER CASE SOURCE TERMS - WET CASE CONDITION

088664-031

March 11, 2021

Figure G.3

HEG file: Z:\HEG\088664\DOCUMENTATION\RPT\088664-RPT-13\FIGURES\Figure 7.31 - Sim_Arsenic_PSS - EOM - UC - AVG.srf



LEGEND

- SURFACE WATER BODY
- PROPOSED EXTENT OF MINE FEATURES
- 0.1 SIMULATED CADMIUM CONCENTRATION (ug/L)
- SURFACE WATER MANAGEMENT DITCHES
- PROPERTY BOUNDARY
- PROJECT AREA
- LOCAL ASSESSMENT AREA
- NAG WASTE ROCK STOCKPILE
- PAG WASTE ROCK STOCKPILE
- LGO STOCKPILE
- TILL STOCKPILES
- TOPSOIL STOCKPILES

Note: The cadmium Tier 2 PSS for groundwater discharge to surface water (>10 m) is 0.1 ug/L.

0 300 600 900m

ATLANTIC GOLD CORPORATION
MARINETTE, NOVA SCOTIA
BEAVER DAM MINE

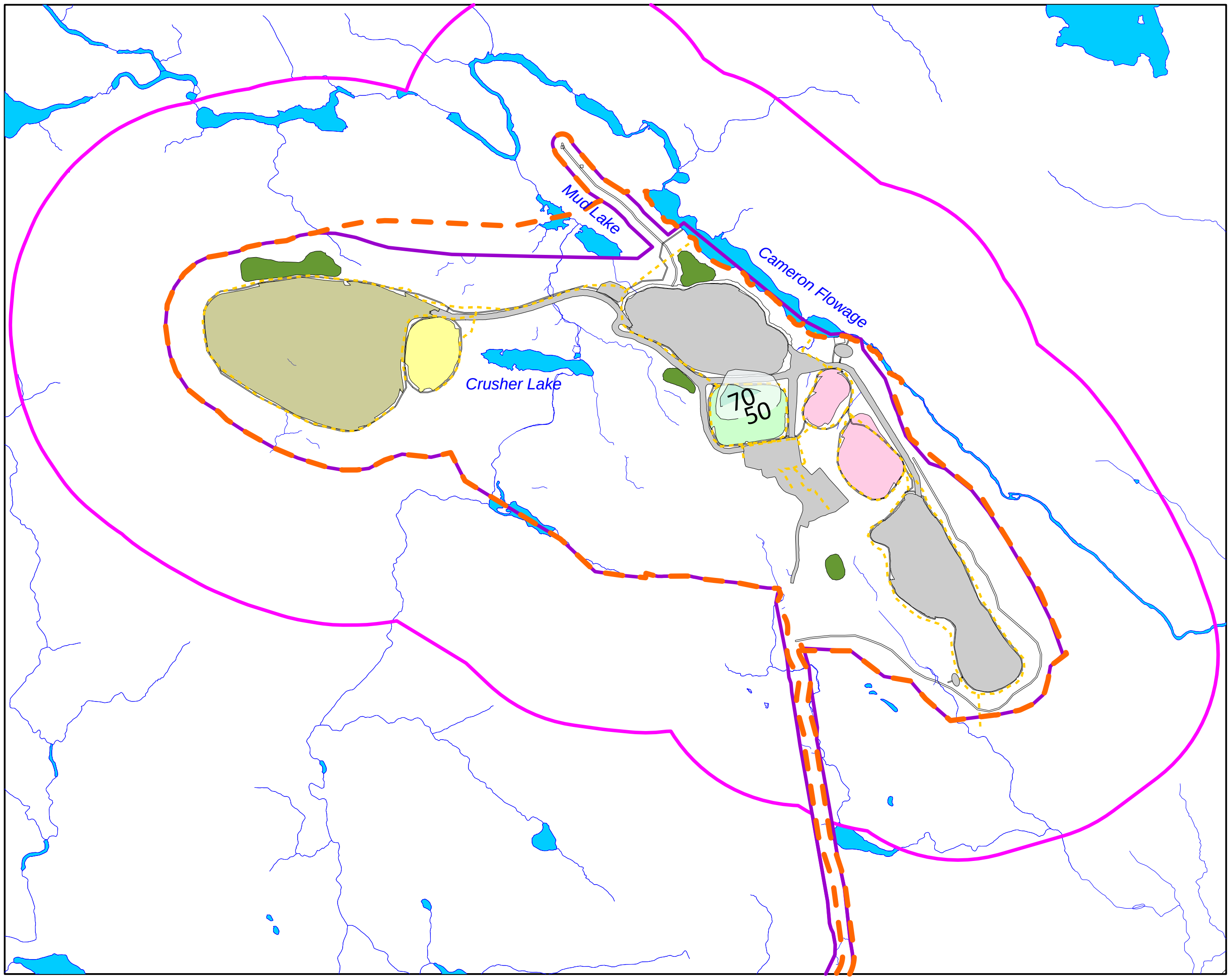
SIMULATED CADMIUM CONCENTRATION VERSUS TIER 2 PSS
EOM - UPPER CASE SOURCE TERMS - WET CASE CONDITION

088664-031

March 11, 2021

Figure G.4

HEG file: Z:\HEG\088664\DOCUMENTATION\RPT\088664-RPT-13\FIGURES\Figure 7.32 - Sim_Cadmium_PSS-EOM-UC-AVG.srf



LEGEND

SURFACE WATER BODY
PROPOSED EXTENT OF MINE FEATURES
0.1 SIMULATED ALUMINUM CONCENTRATION (ug/L)
SURFACE WATER MANAGEMENT DITCHES
PROPERTY BOUNDARY
PROJECT AREA
LOCAL ASSESSMENT AREA
NAG WASTE ROCK STOCKPILE
PAG WASTE ROCK STOCKPILE
LGO STOCKPILE
TILL STOCKPILES
TOPSOIL STOCKPILES

Note: The aluminum Tier 2 PSS for groundwater discharge to surface water (>10 m) is 50 ug/L.

0 300 600 900m

ATLANTIC GOLD CORPORATION
MARINETTE, NOVA SCOTIA
BEAVER DAM MINE

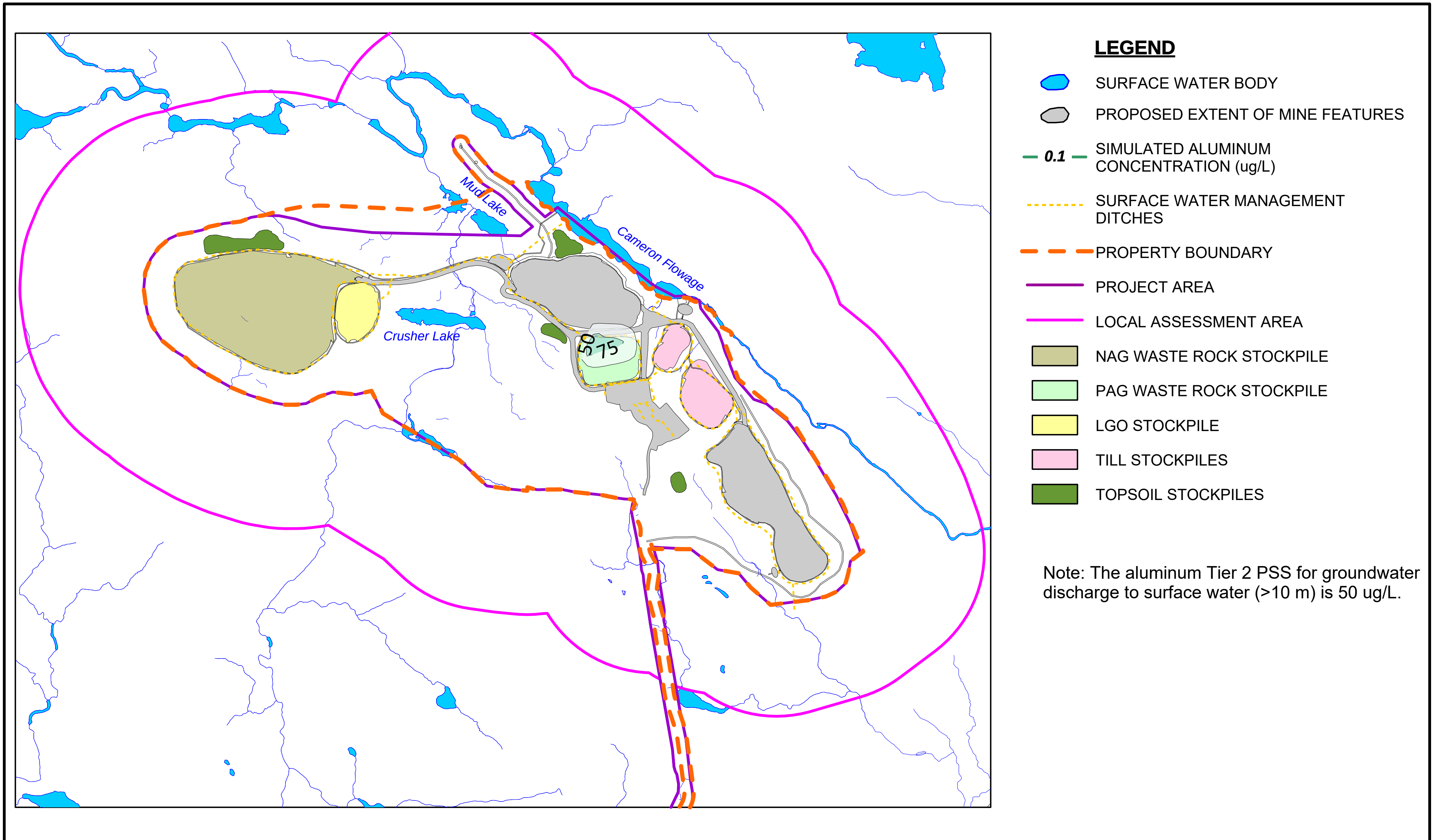
SIMULATED ALUMINUM CONCENTRATION VERSUS TIER 2 PSS
PC - BASE CASE SOURCE TERMS - WET CASE CONDITION

088664-031

March 11, 2021

Figure G.5

HEG file: Z:\HEG\088664\DOCUMENTATION\RPT\088664-RPT-13\FIGURES\Figure 7.33 - Sim_Aluminum_PSS-PC-BC-AVG.srf



ATLANTIC GOLD CORPORATION
MARINETTE, NOVA SCOTIA
BEAVER DAM MINE

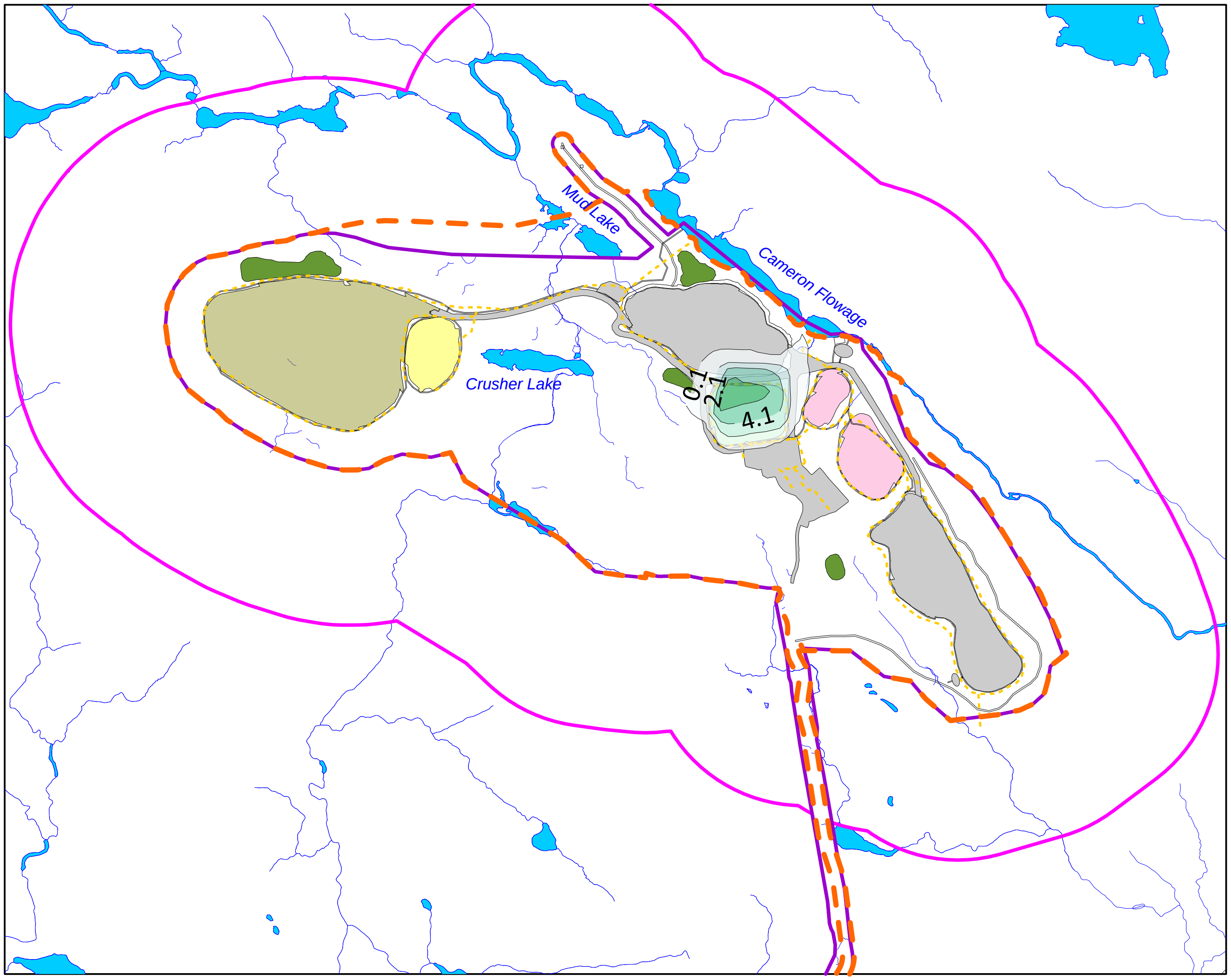
SIMULATED ALUMINUM CONCENTRATION VERSUS TIER 2 PSS
PC - UPPER CASE SOURCE TERMS - WET CASE CONDITION

088664-031

March 11, 2021

Figure G.6

HEG file: Z:\HEG\088664\DOCUMENTATION\RPT\088664-RPT-13\FIGURES\Figure 7.34 - Sim_Aluminum_PSS-PC-UC-AVG.srf



LEGEND

- SURFACE WATER BODY
- PROPOSED EXTENT OF MINE FEATURES
- 0.1 — SIMULATED CADMIUM CONCENTRATION (ug/L)
- SURFACE WATER MANAGEMENT DITCHES
- PROPERTY BOUNDARY
- PROJECT AREA
- LOCAL ASSESSMENT AREA
- NAG WASTE ROCK STOCKPILE
- PAG WASTE ROCK STOCKPILE
- LGO STOCKPILE
- TILL STOCKPILES
- TOPSOIL STOCKPILES

Note: The cadmium Tier 2 PSS for groundwater discharge to surface water (>10 m) is 0.1 ug/L.

0 300 600 900m

ATLANTIC GOLD CORPORATION
MARINETTE, NOVA SCOTIA
BEAVER DAM MINE

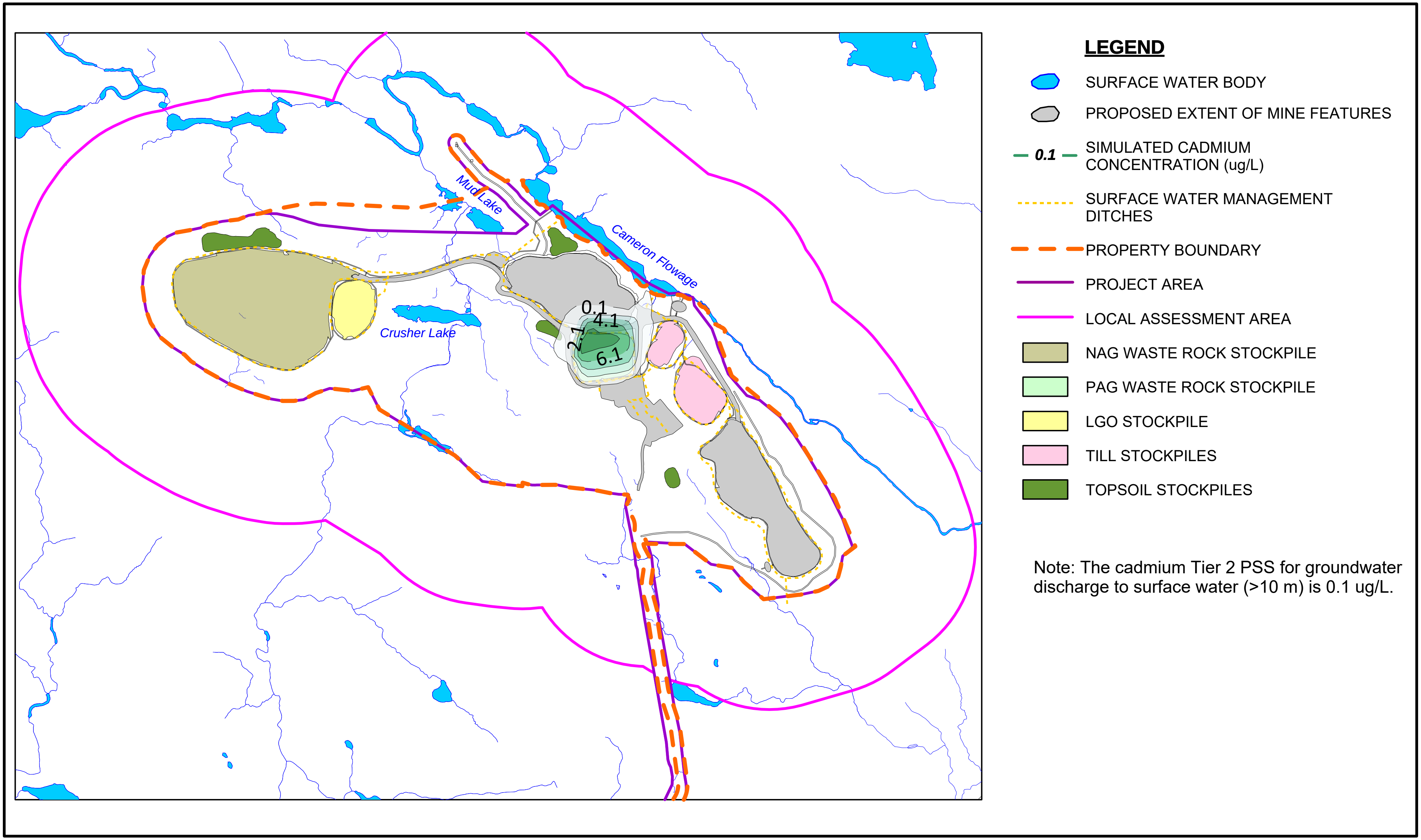
SIMULATED CADMIUM CONCENTRATION VERSUS TIER 2 PSS
PC - BASE CASE SOURCE TERMS - WET CASE CONDITION

088664-031

March 11, 2021

Figure G.7

HEG file: Z:\HEG\088664\DOCUMENTATION\RPT\088664-RPT-13\FIGURES\Figure 7.35 - Sim_Cadmium_PSS-PC-BC-AVG.srf



0 300 600 900m

ATLANTIC GOLD CORPORATION
MARINETTE, NOVA SCOTIA
BEAVER DAM MINE

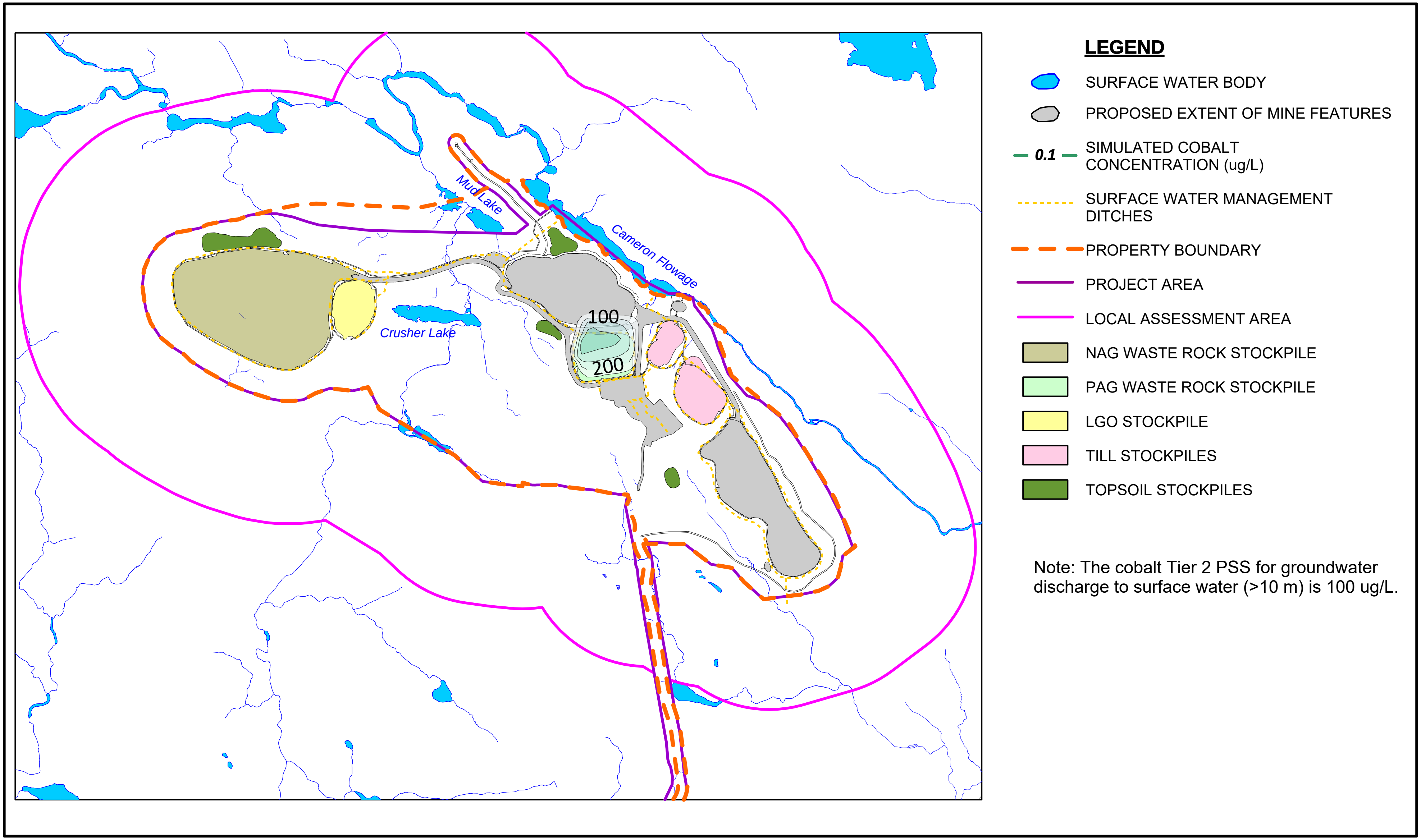
SIMULATED CADMIUM CONCENTRATION VERSUS TIER 2 PSS
PC - UPPER CASE SOURCE TERMS - WET CASE CONDITION

088664-031

March 11, 2021

Figure G.8

HEG file: Z:\HEG\088664\DOCUMENTATION\RPT\088664-RPT-13\FIGURES\Figure 7.36 - Sim_Cadmium_PSS-PC-UC-AVG.srf



Note: The cobalt Tier 2 PSS for groundwater discharge to surface water (>10 m) is 100 ug/L.

0 300 600 900m

N

ATLANTIC GOLD CORPORATION
MARINETTE, NOVA SCOTIA
BEAVER DAM MINE

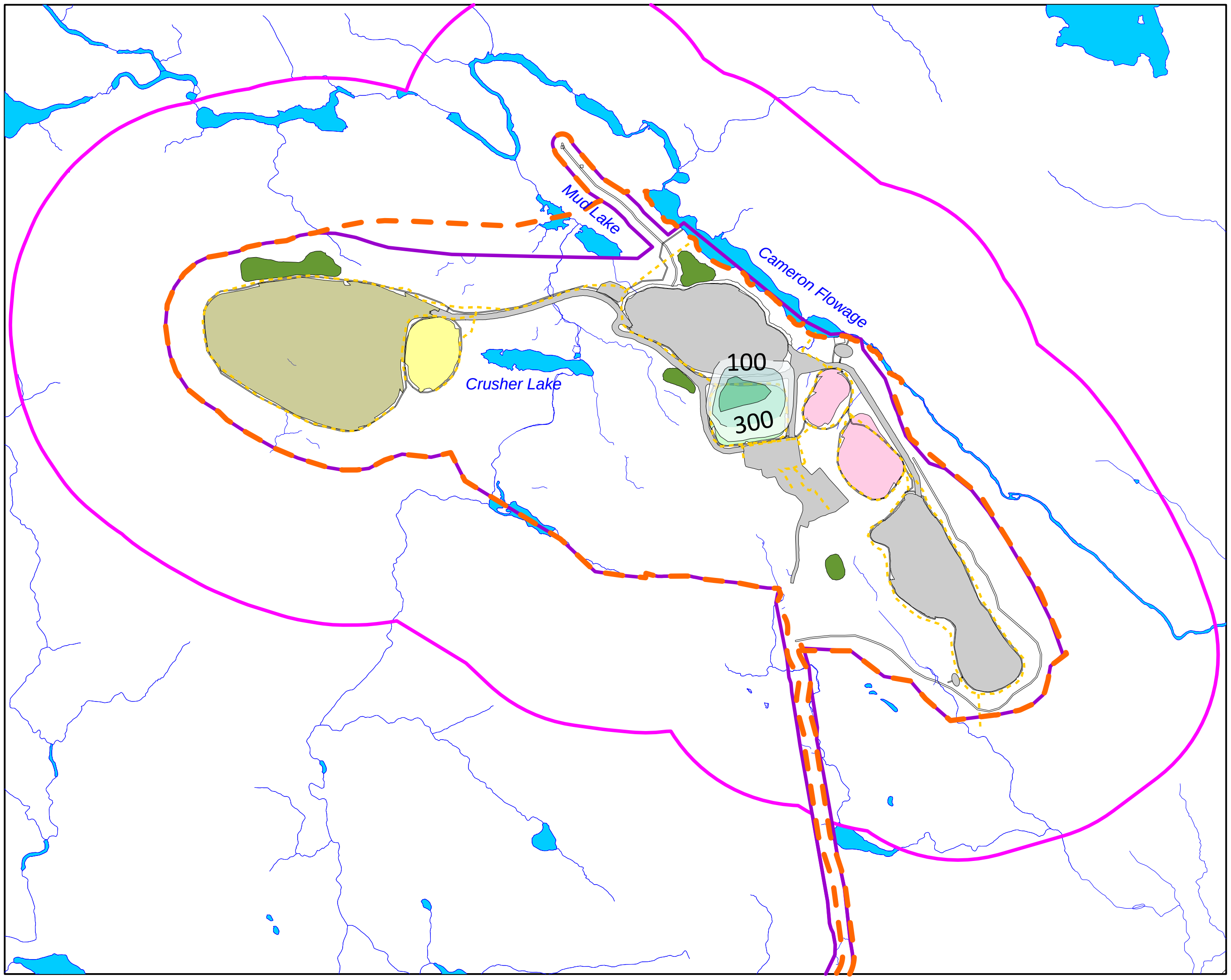
SIMULATED COBALT CONCENTRATION VERSUS TIER 2 PSS
PC - BASE CASE SOURCE TERMS - WET CASE CONDITION

088664-031

March 11, 2021

Figure G.9

HEG file: Z:\HEG\088664\DOCUMENTATION\RPT\088664-RPT-13\FIGURES\Figure 7.37 - Sim_Cobalt_PSS-PC-BC-AVG.srf



LEGEND

- SURFACE WATER BODY
- PROPOSED EXTENT OF MINE FEATURES
- 0.1 SIMULATED COBALT CONCENTRATION (ug/L)
- SURFACE WATER MANAGEMENT DITCHES
- PROPERTY BOUNDARY
- PROJECT AREA
- LOCAL ASSESSMENT AREA
- NAG WASTE ROCK STOCKPILE
- PAG WASTE ROCK STOCKPILE
- LGO STOCKPILE
- TILL STOCKPILES
- TOPSOIL STOCKPILES

Note: The cobalt Tier 2 PSS for groundwater discharge to surface water (>10 m) is 100 ug/L.

0 300 600 900m

ATLANTIC GOLD CORPORATION
MARINETTE, NOVA SCOTIA
BEAVER DAM MINE

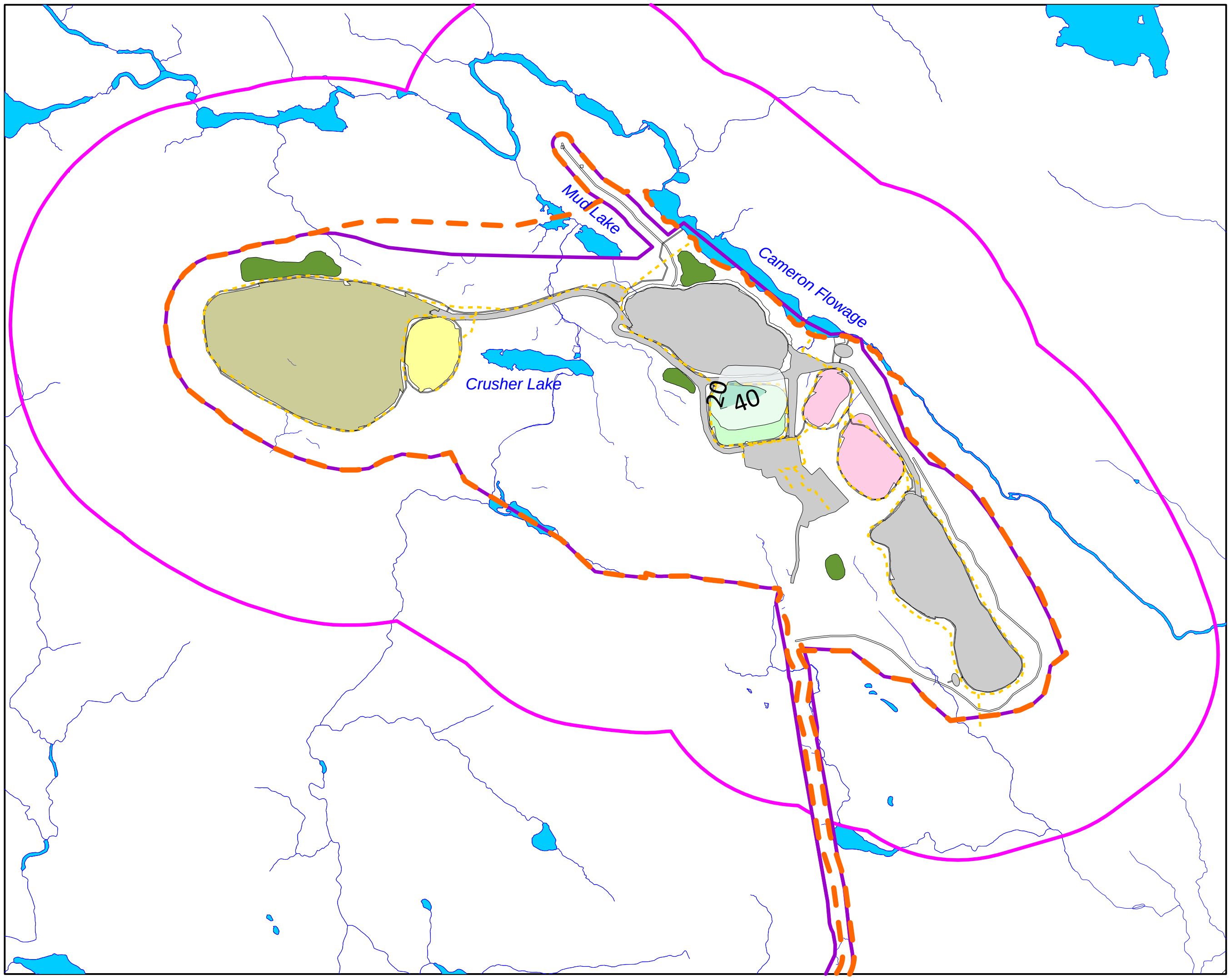
SIMULATED COBALT CONCENTRATION VERSUS TIER 2 PSS
PC - UPPER CASE SOURCE TERMS - WET CASE CONDITION

088664-031

March 11, 2021

Figure G.10

HEG file: Z:\HEG\088664\DOCUMENTATION\RPT\088664-RPT-13\FIGURES\Figure 7.38 - Sim_Cobalt_PSS-PC-UC-AVG.srf



LEGEND

- SURFACE WATER BODY
- PROPOSED EXTENT OF MINE FEATURES
- 0.1 — SIMULATED COPPER CONCENTRATION (ug/L)
- SURFACE WATER MANAGEMENT DITCHES
- PROPERTY BOUNDARY
- PROJECT AREA
- LOCAL ASSESSMENT AREA
- NAG WASTE ROCK STOCKPILE
- PAG WASTE ROCK STOCKPILE
- LGO STOCKPILE
- TILL STOCKPILES
- TOPSOIL STOCKPILES

Note: The copper Tier 2 PSS for groundwater discharge to surface water (>10 m) is 20 ug/L.

0 300 600 900m

ATLANTIC GOLD CORPORATION
MARINETTE, NOVA SCOTIA
BEAVER DAM MINE

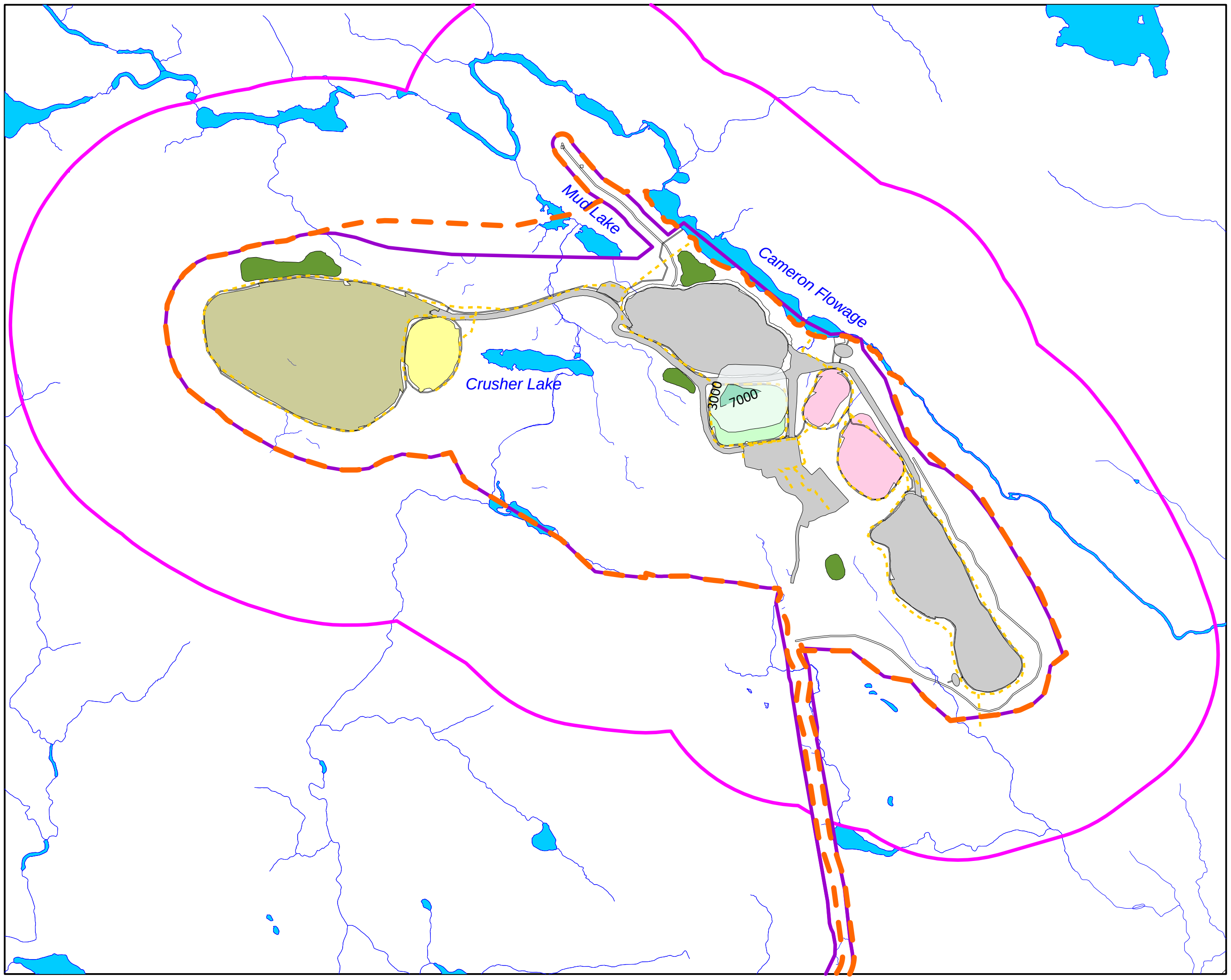
SIMULATED COPPER CONCENTRATION VERSUS TIER 2 PSS
PC - UPPER CASE SOURCE TERMS - WET CASE CONDITION

088664-031

March 11, 2021

Figure G.11

HEG file: Z:\HEG\088664\DOCUMENTATION\RPT\088664-RPT-13\FIGURES\Figure 7.40 - Sim_Copper_PSS-PC-UC-AVG.srf



LEGEND

SURFACE WATER BODY

PROPOSED EXTENT OF MINE FEATURES

0.1 SIMULATED IRON CONCENTRATION (ug/L)

SURFACE WATER MANAGEMENT DITCHES

PROPERTY BOUNDARY

PROJECT AREA

LOCAL ASSESSMENT AREA

NAG WASTE ROCK STOCKPILE

PAG WASTE ROCK STOCKPILE

LGO STOCKPILE

TILL STOCKPILES

TOPSOIL STOCKPILES

Note: The iron Tier 2 PSS for groundwater discharge to surface water (>10 m) is 3,000 ug/L.

0 300 600 900m

N

ATLANTIC GOLD CORPORATION
MARINETTE, NOVA SCOTIA
BEAVER DAM MINE

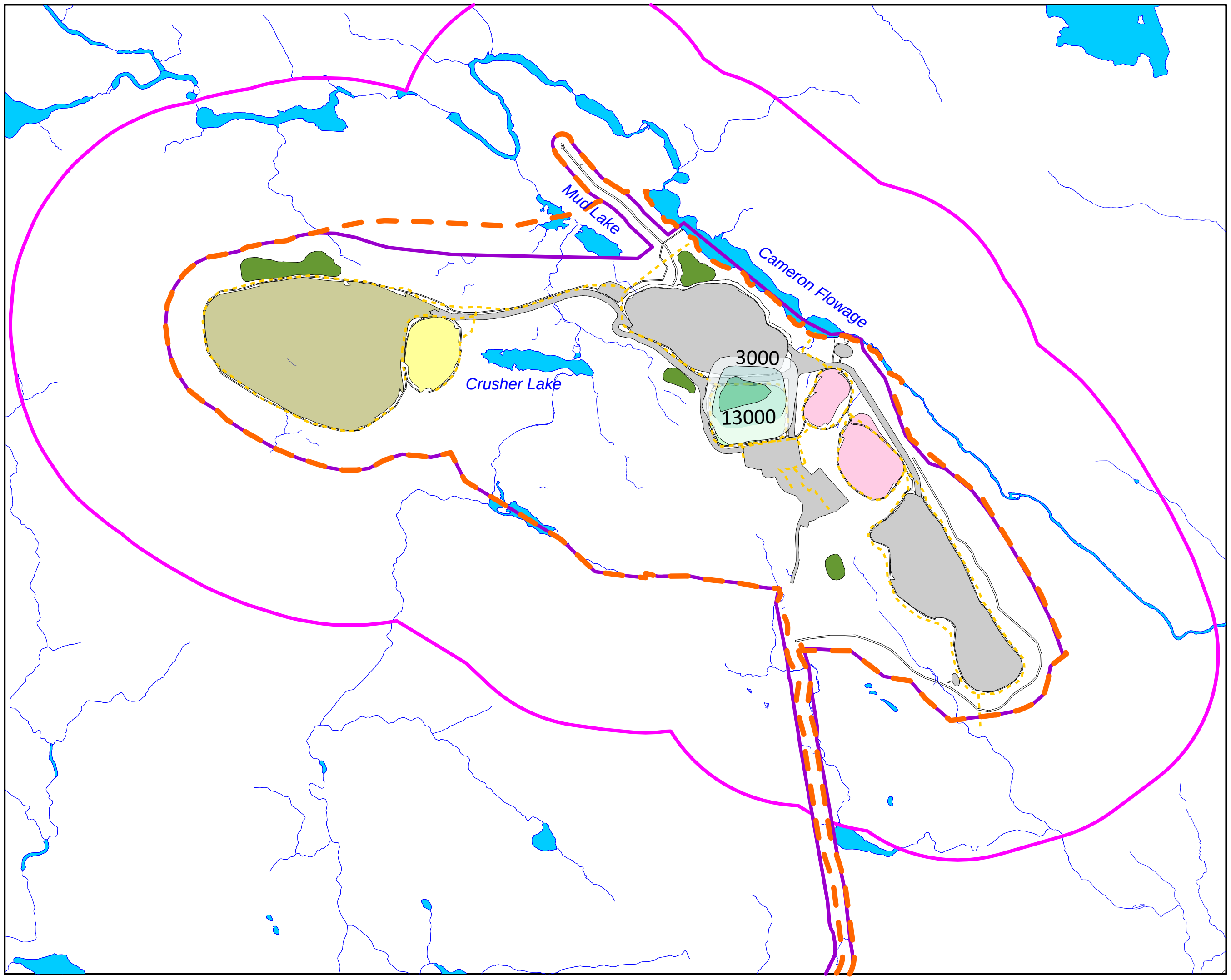
SIMULATED IRON CONCENTRATION VERSUS TIER 2 PSS
PC - BASE CASE SOURCE TERMS - WET CASE CONDITION

088664-031

March 11, 2021

Figure G.12

HEG file: Z:\HEG\088664\DOCUMENTATION\RPT\088664-RPT-13\FIGURES\Figure 7.41 - Sim_Iron_PSS-PC-BC-AVG.srf



LEGEND

- SURFACE WATER BODY
- PROPOSED EXTENT OF MINE FEATURES
- 0.1 SIMULATED IRON CONCENTRATION (ug/L)
- SURFACE WATER MANAGEMENT DITCHES
- PROPERTY BOUNDARY
- PROJECT AREA
- LOCAL ASSESSMENT AREA
- NAG WASTE ROCK STOCKPILE
- PAG WASTE ROCK STOCKPILE
- LGO STOCKPILE
- TILL STOCKPILES
- TOPSOIL STOCKPILES

Note: The iron Tier 2 PSS for groundwater discharge to surface water (>10 m) is 3,000 ug/L.

0 300 600 900m

N

ATLANTIC GOLD CORPORATION
MARINETTE, NOVA SCOTIA
BEAVER DAM MINE

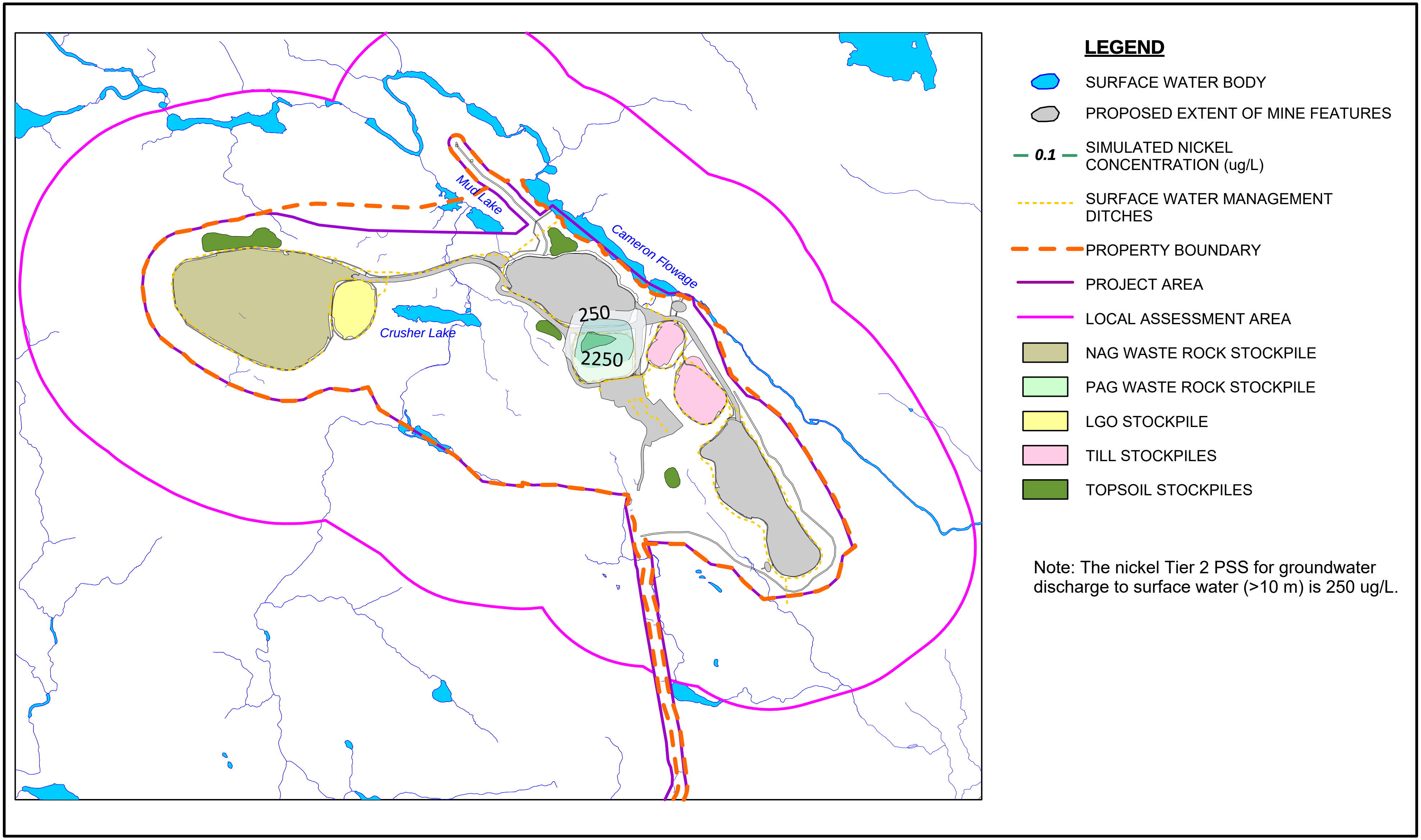
SIMULATED IRON CONCENTRATION VERSUS TIER 2 PSS
PC - UPPER CASE SOURCE TERMS - WET CASE CONDITION

088664-031

March 11, 2021

Figure G.13

HEG file: Z:\HEG\088664\DOCUMENTATION\RPT\088664-RPT-13\FIGURES\Figure 7.42 - Sim_Iron_PSS-PC-UC-AVG.srf



ATLANTIC GOLD CORPORATION
MARINETTE, NOVA SCOTIA
BEAVER DAM MINE

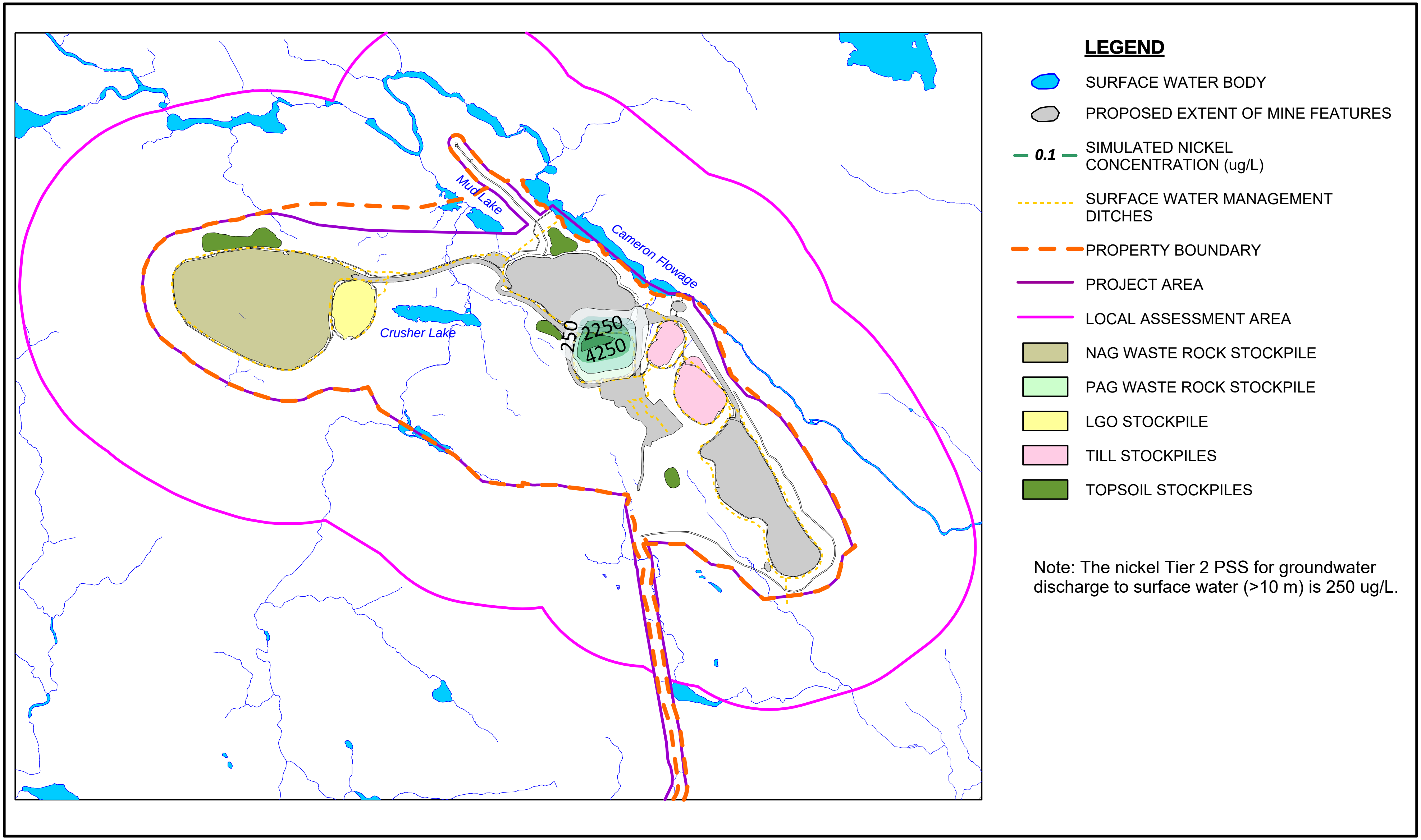
SIMULATED NICKEL CONCENTRATION VERSUS TIER 2 PSS
PC - BASE CASE SOURCE TERMS - WET CASE CONDITION

088664-031

March 11, 2021

Figure G.14

HEG file: Z:\HEG\088664\DOCUMENTATION\RPT\088664-RPT-13\FIGURES\Figure 7.43 - Sim_Nickel_PSS-PC-BC-AVG.srf



GHD

ATLANTIC GOLD CORPORATION
MARINETTE, NOVA SCOTIA
BEAVER DAM MINE

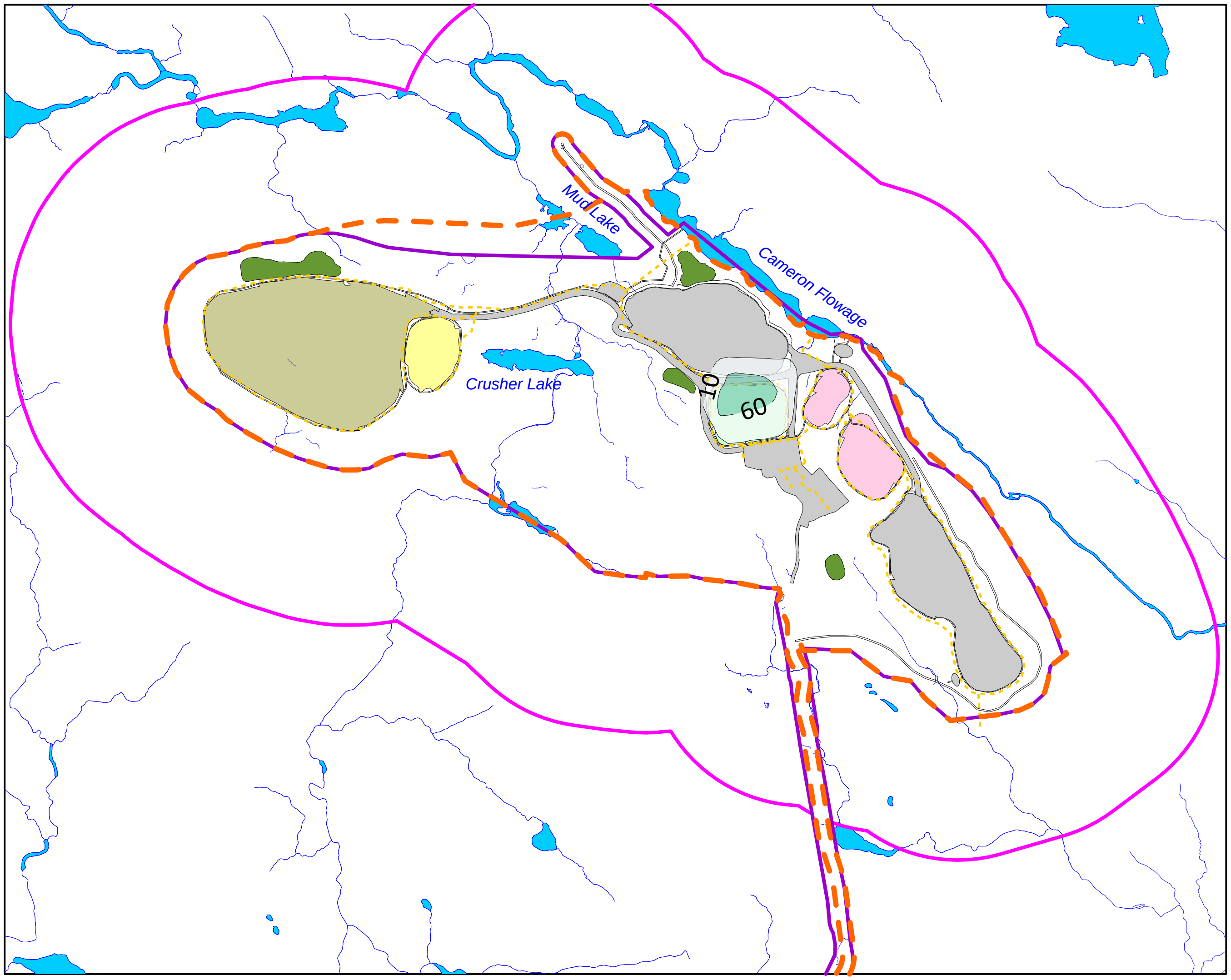
SIMULATED NICKEL CONCENTRATION VERSUS TIER 2 PSS
PC - UPPER CASE SOURCE TERMS - WET CASE CONDITION

088664-031

March 11, 2021

Figure G.15

HEG file: Z:\HEG\088664\DOCUMENTATION\RPT\088664-RPT-13\FIGURES\Figure 7.43 - Sim_Nickel_PSS-PC-BC-AVG.srf



LEGEND

- SURFACE WATER BODY
- PROPOSED EXTENT OF MINE FEATURES
- 0.1 — SIMULATED LEAD CONCENTRATION (ug/L)
- SURFACE WATER MANAGEMENT DITCHES
- PROPERTY BOUNDARY
- PROJECT AREA
- LOCAL ASSESSMENT AREA
- NAG WASTE ROCK STOCKPILE
- PAG WASTE ROCK STOCKPILE
- LGO STOCKPILE
- TILL STOCKPILES
- TOPSOIL STOCKPILES

Note: The lead Tier 2 PSS for groundwater discharge to surface water (>10 m) is 10 ug/L.

0 300 600 900m

N

ATLANTIC GOLD CORPORATION
MARINETTE, NOVA SCOTIA
BEAVER DAM MINE

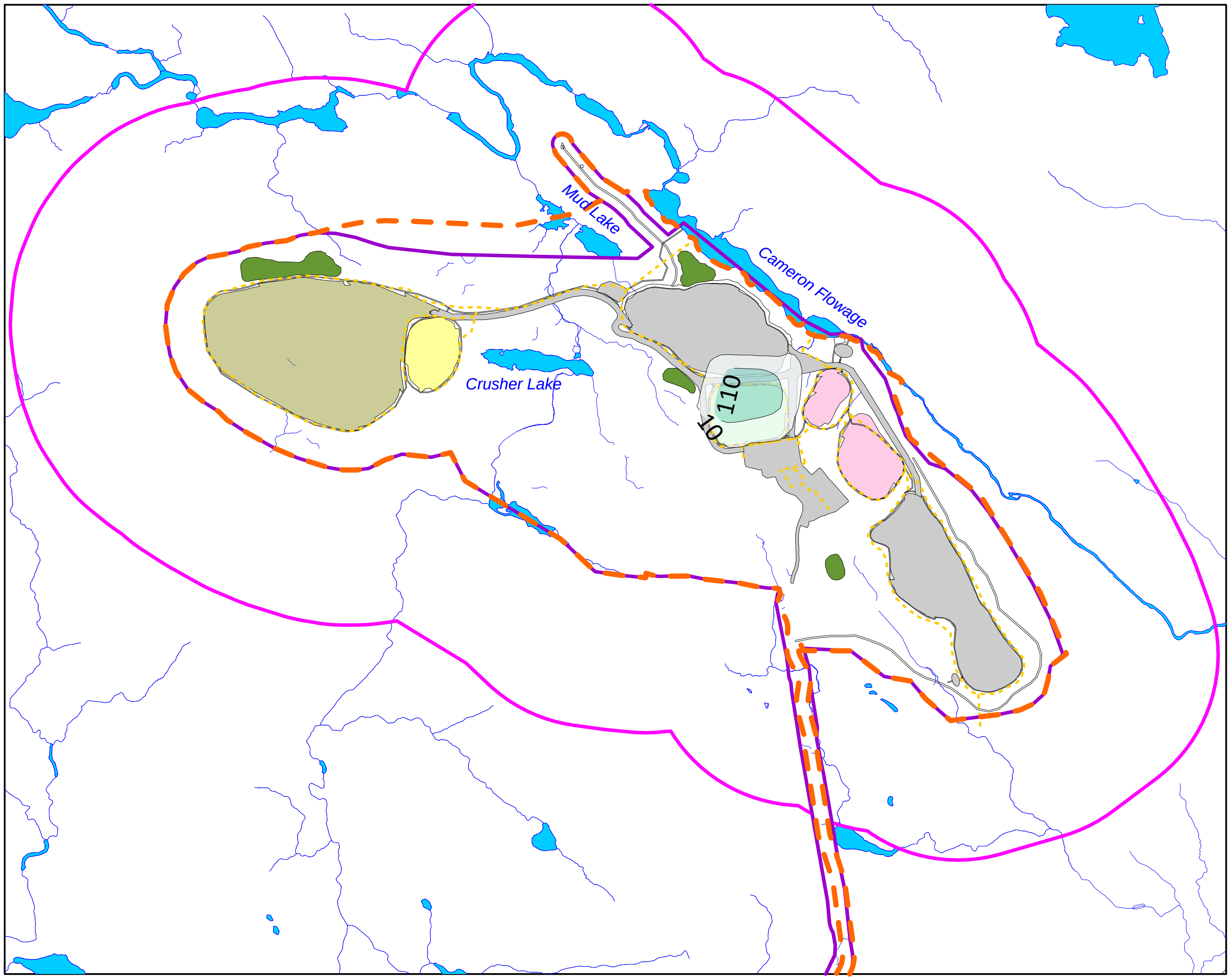
SIMULATED LEAD CONCENTRATION VERSUS TIER 2 PSS
PC - BASE CASE SOURCE TERMS - WET CASE CONDITION

088664-031

March 11, 2021

Figure G.16

HEG file: Z:\HEG\088664\DOCUMENTATION\RPT\088664-RPT-13\FIGURES\Figure 7.45 - Sim_Lead_PSS-PC-BC-AVG.srf



LEGEND

- SURFACE WATER BODY
- PROPOSED EXTENT OF MINE FEATURES
- 0.1 — SIMULATED LEAD CONCENTRATION (ug/L)
- SURFACE WATER MANAGEMENT DITCHES
- PROPERTY BOUNDARY
- PROJECT AREA
- LOCAL ASSESSMENT AREA
- NAG WASTE ROCK STOCKPILE
- PAG WASTE ROCK STOCKPILE
- LGO STOCKPILE
- TILL STOCKPILES
- TOPSOIL STOCKPILES

Note: The lead Tier 2 PSS for groundwater discharge to surface water (>10 m) is 10 ug/L.

0 300 600 900m

ATLANTIC GOLD CORPORATION
MARINETTE, NOVA SCOTIA
BEAVER DAM MINE

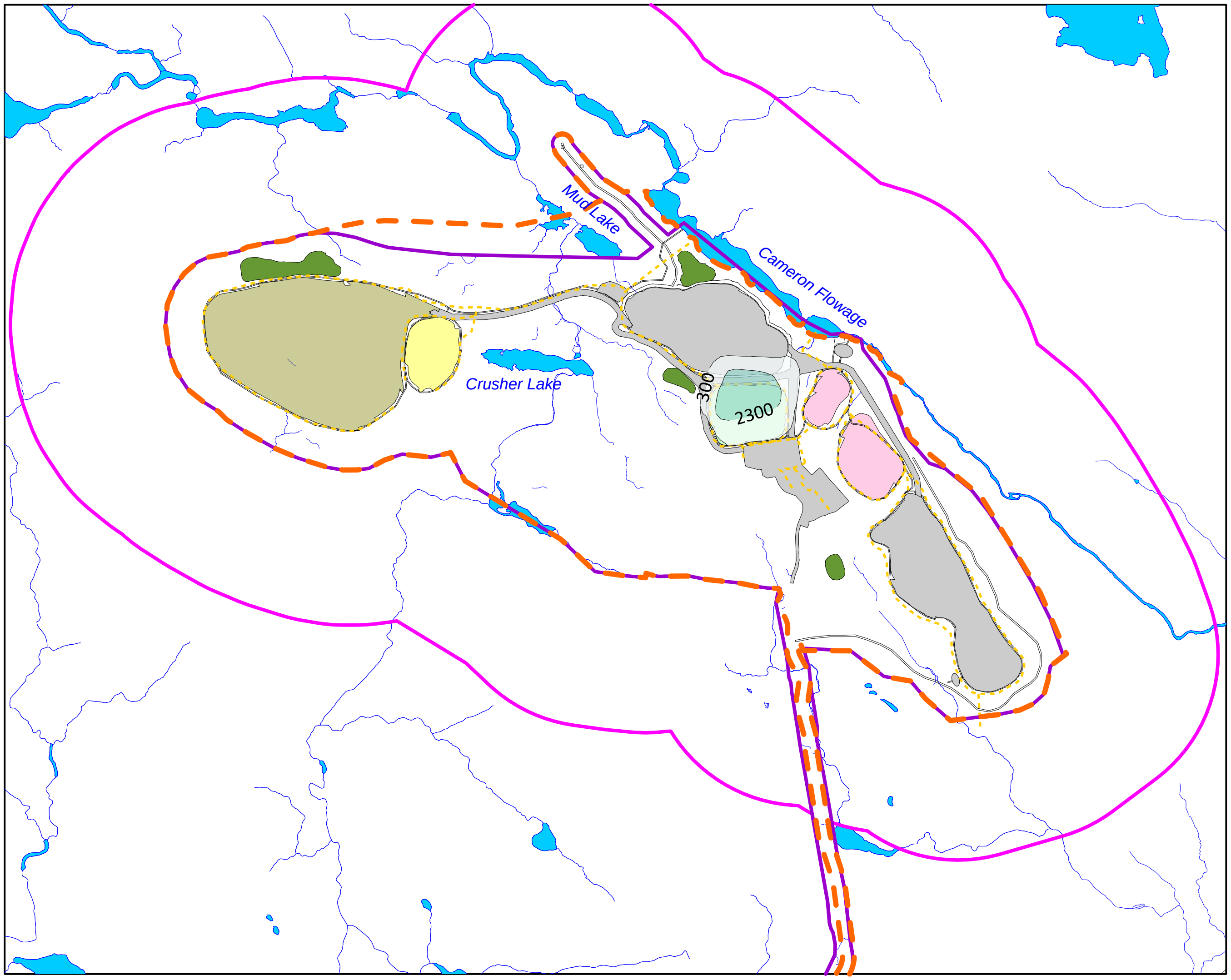
SIMULATED LEAD CONCENTRATION VERSUS TIER 2 PSS
PC - UPPER CASE SOURCE TERMS - WET CASE CONDITION

088664-031

March 11, 2021

Figure G.17

HEG file: Z:\HEG\088664\DOCUMENTATION\RPT\088664-RPT-13\FIGURES\Figure 7.45 - Sim_Lead_PSS-PC-BC-AVG.srf



LEGEND

- SURFACE WATER BODY
- PROPOSED EXTENT OF MINE FEATURES
- 0.1 — SIMULATED ZINC CONCENTRATION (ug/L)
- SURFACE WATER MANAGEMENT DITCHES
- PROPERTY BOUNDARY
- PROJECT AREA
- LOCAL ASSESSMENT AREA
- NAG WASTE ROCK STOCKPILE
- PAG WASTE ROCK STOCKPILE
- LGO STOCKPILE
- TILL STOCKPILES
- TOPSOIL STOCKPILES

Note: The zinc Tier 2 PSS for groundwater discharge to surface water (>10 m) is 300 ug/L.

0 300 600 900m

ATLANTIC GOLD CORPORATION
MARINETTE, NOVA SCOTIA
BEAVER DAM MINE

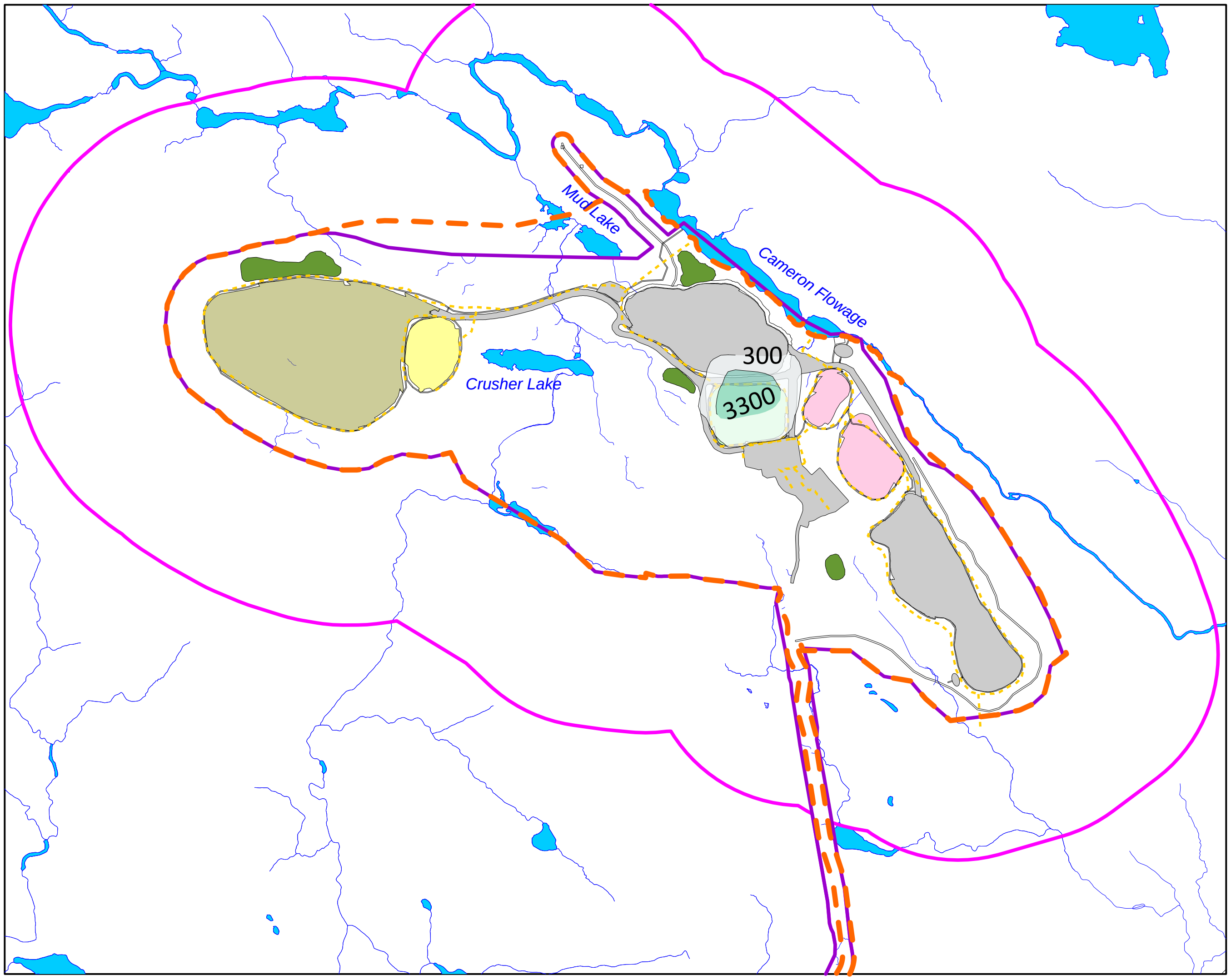
SIMULATED ZINC CONCENTRATION VERSUS TIER 2 PSS
PC - BASE CASE SOURCE TERMS - WET CASE CONDITION

088664-031

March 11, 2021

Figure G.18

HEG file: Z:\HEG\088664\DOCUMENTATION\RPT\088664-RPT-13\FIGURES\Figure 7.48 - Sim_Zinc_PSS-PC-BC-AVG.srf



LEGEND

- SURFACE WATER BODY
- PROPOSED EXTENT OF MINE FEATURES
- 0.1 — SIMULATED ZINC CONCENTRATION (ug/L)
- SURFACE WATER MANAGEMENT DITCHES
- PROPERTY BOUNDARY
- PROJECT AREA
- LOCAL ASSESSMENT AREA
- NAG WASTE ROCK STOCKPILE
- PAG WASTE ROCK STOCKPILE
- LGO STOCKPILE
- TILL STOCKPILES
- TOPSOIL STOCKPILES

Note: The zinc Tier 2 PSS for groundwater discharge to surface water (>10 m) is 300 ug/L.

0 300 600 900m

ATLANTIC GOLD CORPORATION
MARINETTE, NOVA SCOTIA
BEAVER DAM MINE

SIMULATED ZINC CONCENTRATION VERSUS TIER 2 PSS
PC - UPPER CASE SOURCE TERMS - WET CASE CONDITION

088664-031

March 11, 2021

Figure G.19

HEG file: Z:\HEG\088664\DOCUMENTATION\RPT\088664-RPT-13\FIGURES\Figure 7.49 - Sim_Zinc_PSS-PC-UC-AVG.srf

about GHD

GHD is one of the world's leading professional services companies operating in the global markets of water, energy and resources, environment, property and buildings, and transportation. We provide engineering, environmental, and construction services to private and public sector clients.

www.ghd.com