

From	Patrick Moran (Sr. Hydrogeologist), Rebecca Lord (Graduate Hydrogeologist)
Department	IOC Hydrogeology, Mine Technical Services
To	Angela Buchanan, Groundwater Resources Manager, NL Water Resources Management
CC	Tina Cassell, Audrianna Hewlin, Erin Higgins, Tyler Lock, Crista Lodge, Rebecca Lord, Zhanae Sutherland, Ramsey Way, Jody Wentzell, Rod Williams
Reference	Initial Hydrogeology / Hydrology Assessment (Humphrey South Extension Project)
Date	January 2024

1.0 Introduction

IOC is a leading North American producer of iron products. Mining operations are located in the province of Newfoundland and Labrador (Fig. 1). Five hydrogeologically complex orebodies are currently being mined, near to or below water table, to meet present production targets. Development of a sixth orebody, the Humphrey South Iron Ore Extension (HSE), is necessary to supply ore to meet future production targets. Initial groundwork (tree mulching, overburden removal) is tentatively scheduled to begin in Q2-Q3 2024 (pending government and business approvals) with first ore delivery occurring in 2025-2026.

An environmental assessment (EA), registration #2114, was submitted by IOC to the Government of Newfoundland and Labrador in December 2020. Conditional approval was granted on May 27, 2021 (see Appendix A). Multiple conditions must be met before any development work can proceed. Hydrogeology and hydrology specific release conditions are summarized in Table 1. The first three conditions have been met. The fourth condition, the first part of which is an initial groundwater assessment report, has not yet been met. As such, the primary purpose of this document is to provide an initial assessment of the HSE groundwater conditions.

Table 1: Hydrogeology and hydrology related HSE EA release conditions. Paraphrased, full details in Appendix A.

Condition		IOC Department	Status
1.	IOC must enter into a Memorandum of Agreement with NL Water Resources Management Division for the installation of a real-time water quality/quantity network for groundwater/surface water.	Hydrogeology	Complete
2.	A Water Resources Management Plan must be submitted to the NL Water Resources Management Division.	Environment	Complete
3.	A water quality and stage/flow monitoring plan must be developed in consultation with the NL Water Resources Management Division.	Hydrogeology/Environment	Complete
4.	A groundwater assessment, including a model of groundwater flow, must be completed for the proposed pit. An initial report with currently available data must be submitted and approved with follow up reports to be submitted annually until the groundwater assessment is complete.	Hydrogeology	In-Progress

2.0 Hydrogeologic / Hydrologic Setting

IOC has been exploring/characterizing orebodies in Labrador West since the 1950s and mining those orebodies continuously since the 1960s. Experience gained through mining, particularly regarding mine dewatering impact on surrounding groundwater tables/waterbodies, is valuable as it applies to mining future orebodies (e.g., HSE). Drilling and modelling confirm that the HSE orebody shares fundamental characteristics with adjacent, historic and currently in-production, orebodies. The HSE orebody also has its own unique combination of those characteristics as described below.

2.1 Hydrogeology

Rock comprising the deposit occurs within the 2.17 Ga aged Sokoman Iron Formation (Wardle *et al.* 2002), which is part of the larger Labrador Trough (Conliffe 2019) (Fig. 1) and has been metamorphosed, folded, and faulted during two orogenies (van Gool *et al.* 2008). A detailed description of the deposit geology/stratigraphy is provided in Appendix B. The age and tectonic evolution of the deposit gives rise to a variety of complex hydrogeologic features.

These features can be broadly divided into two hydrogeologic domains (Moran 2019). Domain One, representing most of the deposit, is comprised of unaltered crystalline metamorphic non-porous and minimally transmissive rock (Brown *et al.* 2019). Domain Two is limited in volume, but is critically important to hydrogeology, and comprised of limonitic alteration associated with shear zones (Piteau 1981) (Fig. 2). Hydraulic conductivity of the limonitically altered rock is several orders of magnitude greater than that of the unaltered parent rock (Gnansounou *et al.* 2015) (Table 2). Domain One rock commonly forms ‘no-flow’ boundaries while Domain Two rock forms high volume and transmissive aquifers within Domain One (Moran 2020).

Two large zones of limonite alteration (e.g., Domain Two), divisible into a northern and southern zone, are present within the HSE orebody (Fig. 2). They are separated by a fault and minimally transmissive Domain One metamorphic iron formation. The initial proposed pit development will intersect both limonite zones. A primary concern identified through the EA is a potential hydraulic connection between White Lake and the proposed pit with advanced dewatering activity resulting in unintended drawdown of the lake. This is primarily a potential risk with the northern zone due to its scale and that it may extend under White Lake. This issue is further addressed in Sections 4 (Discussion) and 5 (Conclusions & Future Work).

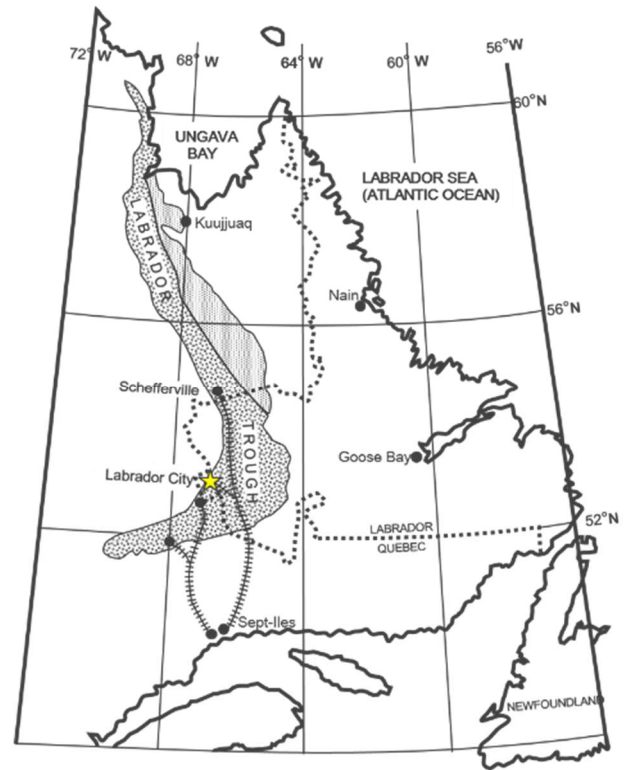


Figure 1 Geographic map of Labrador. Labrador Trough superimposed for context. Star indicates the location of the mine. Modified after Rivers *et al.* (1978).

Table 2: Hydraulic conductivities for select Domain One and Two lithologies (Gnansounou *et al.* 2015).

Lithology	Hydraulic Conductivity (m/sec)	Geometric Mean(m/sec)
D1 Quartz-Carb (n=8)	5×10^{-11} to 9×10^{-7}	4×10^{-9}
D1 Quartzite (n=6)	2×10^{-10} to 2×10^{-7}	4×10^{-9}
D1 HMO (n=5)	4×10^{-11} to 3×10^{-4}	7×10^{-9}
D2 Limonite (n=4)	3×10^{-8} to 2×10^{-5}	6×10^{-7}



Figure 2: Aerial photo (2023) showing the location of the initial pit relative to White Lake, major aquifers (brown – Domain Two), active wells, and currently installed groundwater monitoring equipment. Note, assume unaltered metamorphic rock (Domain One) outside Domain Two.

2.2 Hydrology

Geographically, the Humphrey South Extension is located at a topographic high point which acts as a regional water divide (Fig. 3).

Water falling on the east side of the ridge reports to White Lake (continuing to Luce Lake and Big Wabush Lake along which NL Water Resources and IOC operate several flow/quality monitoring stations). White Lake is one of the largest waterbodies on IOC's mining lease, measuring approximately 1.7 km x 4.0 km. Maximum depth is 42 meters and lake volume is 13,365,051 m³ (SEM 2019). Most of the lake bottom is classified as fine-grained substrate with lesser amounts of medium and coarse substrate around the shoreline (Fig. 4). There is a single outlet at its north end that connects to a diversion channel flowing into the Luce Lake drainage system. There are no perennial tributaries flowing into White Lake but there is one intermittent channel flowing in from First Pond during high flow conditions. White Lake is likely predominantly fed from groundwater from the surrounding watershed.

Water falling on the west side of the ridge reports to Carol Lake outflow (aka "Unnamed Tributary Above Fraggie Rock Lake") (continuing to Walsh River and ultimately Big Wabush Lake). Carol Lake outflow forms the headwaters to the Walsh River Cabin Homeowners Area. NL Water Resources has identified the following potential hydrology risks 1) reduced surface water flow to Walsh River headwaters, and 2) mine impacted water reporting to Walsh River headwaters. Condition 1 in Table 1 directly addresses this concern. A detailed explanation of how this concern is being addressed can be found in Section 3.2 (Hydrology Monitoring).

3.0 Current Water Monitoring Network

For well over a decade, IOC Mine Technical Services and Environmental Departments have been installing equipment, across the Mine Site, to collect groundwater and surface water data and monitor trends. The first groundwater monitoring installations were constructed in HSE during 2020 and began recording data in 2021.

3.1 Hydrogeology

At present the groundwater monitoring network consists of 13 piezometer stations, constructed between 2020 and 2023, spread across the entirety of the HSE deposit (Fig. 2). Data collection is ongoing. More piezometers are scheduled for installation in the future. Seven of these stations were completed as 2" open standpipe style piezometers meaning that in addition to recording groundwater levels they can be sampled for water chemistry/quality. The remaining six piezometers are grouted multi-sensor Vibrating Wire Piezometer (VWP) installations. Multiple sensors placed in different lithologic horizons/structures help to determine groundwater relationships across the deposit profile. Unfortunately, due to their grouted nature, water samples cannot be obtained from these installations. In total, to date, nearly 2,000 meters of drilling has been completed and 21 sensors deployed. Sensors are programmed to record hourly groundwater level data. Data is currently manually downloaded several times a year and stored in IOC's NavStar/GeoExplorer telemetry (cloud based) database. A summary of installations can be found in Table 3 (Appendix 3). Full telemetry (i.e., live data) will be implemented during the initial stages of development during which electrical and communication infrastructure will be installed.

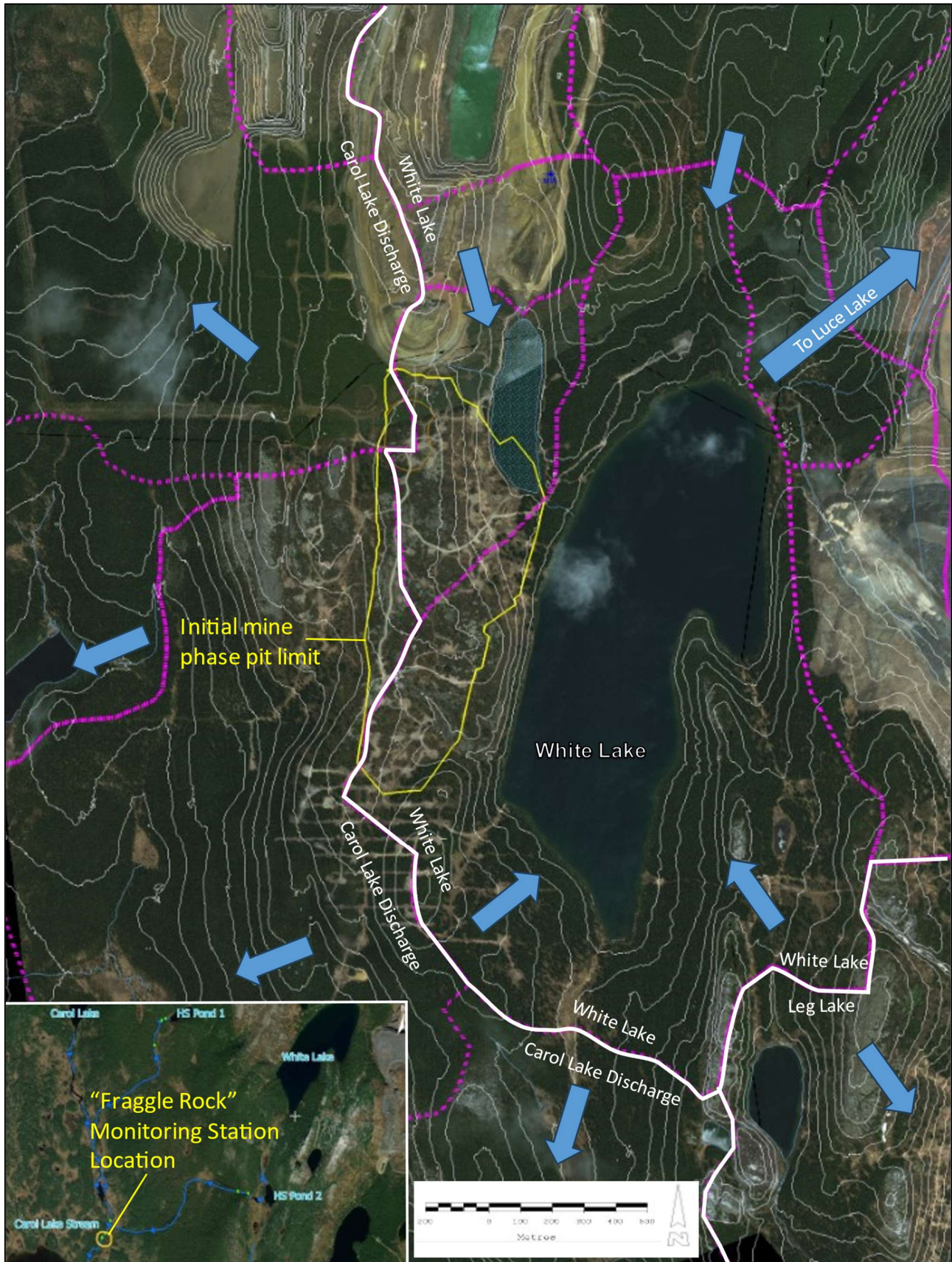


Figure 3: Aerial photo (2023) showing the location of the initial pit relative to White Lake. Topography in fine white lines. Regional water divide in bold white. Sub-catchments in dashed pink.

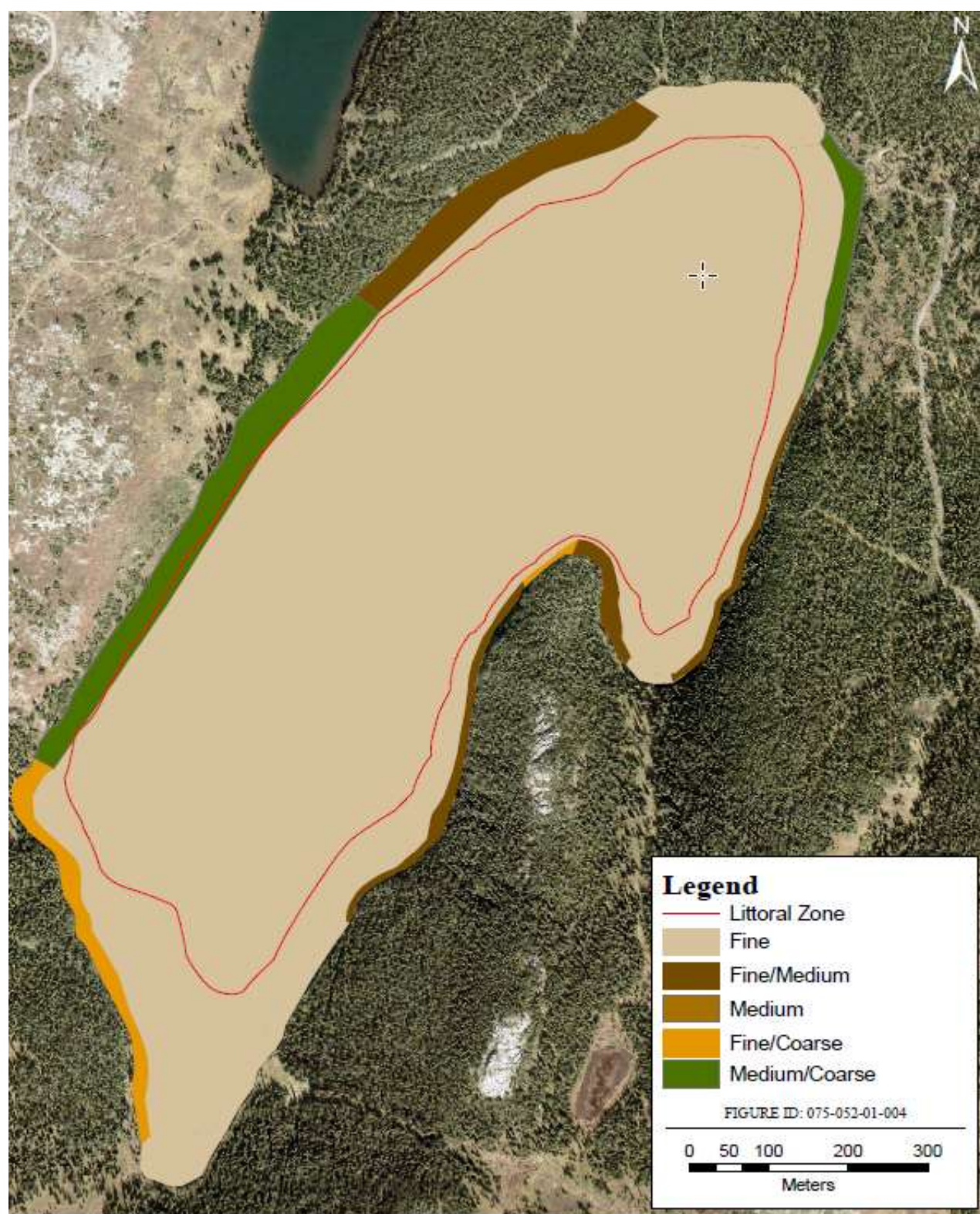


Figure 4: Modified aerial photo showing lake sediment composition of White Lake.

3.1 Hydrogeology

At present the surface water monitoring network consists of a real time streamflow and quality station located on “Unnamed Tributary Above Fraggie Rock Lake” (see Appendix D). This station became operational in November 2023. It is currently recording baseline stream water levels. Newfoundland and Labrador Water Resources will deploy water quality instruments/sensors to this station during spring 2024. The purpose of the station is to collect baseline pre-mining surface flow and quality information prior to any development/mining activity taking place in this area. The station will remain operational throughout development/mining and the data recorded will be compared to the baseline data to determine operational impacts on the surface water environment. The real time water flow data and instrumentation is managed by NL Water Resources.

4.0 Discussion

Development of the Humphrey South Ore Extension is necessary to meet future IOC ore feed requirements. Before mining can begin IOC must demonstrate an understanding of the deposit hydrogeology to Newfoundland and Labrador Water Resources. Ultimately, the goal is to identify potential risks to the surrounding groundwater and surface water environment and mitigate/offset those risks before they materialize via mining activity.

IOC has been exploring, characterizing, and mining orebodies in Labrador for 70 years. Investigations (e.g., diamond drilling, geologic modelling) of the HSE orebody have been ongoing for over a decade. Deposit geology, structural trends, alteration patterns, geotechnical characteristics, as well as general hydrogeology and hydrology trends have been defined. Recharge occurs through a combination of precipitation infiltration and via leakage from lakes, streams, and bogs in topographically higher areas. Groundwater flow is generally from areas of topographical highs towards lower lying lakes (FloSolutions, 2022). FloSolutions (2022) also noted that flow is likely to be typically north-south along the orientation of preferential pathways (faults, shear zones, weathered zones). Fractures that crosscut these features likely also results in some east-west groundwater flow (although likely smaller). These pathways also provide interconnection from higher to lower elevation water bodies.

It has been determined, through the aforementioned investigations, that the HSE orebody shares fundamental characteristics with adjacent, historic and currently in production, orebodies. By combining experience gained mining those adjacent orebodies, together with HSE specific characterisation and geologic model, the HSE deposit is conceptually understood (Fig 5). Hydrogeologically, like other deposits on IOC’s mining lease, the HSE orebody is a dual porosity system divisible into two domains - each with very different hydrogeological characteristics. Domain One, consisting of unaltered metamorphic rock, makes up most of the deposit. This rock is non-porous (e.g., fracture flow) and minimally transmissive. This rock type often acts as a “no-flow boundary”. Domain Two, consist of weathered (altered) rock associated with shear zones, and makes up a comparatively smaller portion of the deposit. This rock type often acts as a high volume, porous and transmissive, aquifer system. The HSE orebody is predominantly metamorphic crystalline Domain One rock surrounding and encompassing distinct northern and southern Domain Two limonitic aquifers (Fig 2). The northern aquifer is the larger of the two and appears to extend under the adjacent White Lake.

The initial pit will intersect both aquifers and it is expected that advanced dewatering (e.g., deep wells) will be required to support mining activity. Construction of the first dewatering well is anticipated to take place in 2025 or 2026. Partially dewatering the orebody, in advance of mining activity (a common IOC and industry wide

practice), is beneficial to the environment as it reduces the potential for large volumes of groundwater to be contaminated by surface mining activity (e.g., suspended sediment, unionized ammonia). While implementing advanced dewatering in HSE should effectively manage groundwater levels, there is potential for an associated unintended negative environmental outcome in the form of drawing down the level of water in White Lake. IOC continues working toward quantifying this risk (a list of remaining work is provided in Section 5 and Table 4). To date, thirteen groundwater piezometer stations, containing twenty-one sensors, have been installed across the deposit. The piezometers are constructed in both Domain One and Two aquifers.

Comprehensive groundwater trend analysis is currently ongoing to determine the flow regimes in the White Lake area. As monitoring location coverage is expanded and water level loggers record data for longer durations of time, in depth hydrogeological trends and analyses will be completed. At this time, regional trends can be used in conjunction with current monitoring locations to provide preliminary information about the White Lake area. Preliminary cross sections created by interpolating groundwater levels, recorded at piezometer stations in the third quarter of 2023, display consistent trends of groundwater elevation decreasing from north to south. Water levels range from 40 to 70 meters below ground surface. Multiyear piezometer data exhibits rhythmic seasonal trends, commonly seen across site outside mining areas, with water levels decreasing through winter reaching their lowest point in late April and quickly reaching their highest-level during spring freshet in May and remaining high through summer. Monitoring locations drilled into or near limonitically altered geologic units generally show the highest water levels (Fig 6). East-west cross sections also display a common trend of groundwater elevation generally increasing moving eastward with proximity to White Lake (Fig 7). Diamond drillhole VWP installations WL-23-181 and WL-23-182 were notably drilled in boggy areas. As the geologic model is updated after the 2023 geological drilling program is complete and monitoring equipment records data for longer durations of time, more comprehensive conclusions can be drawn in this area.

Hydrologically, the HSE deposit sits on a regional east-west water divide. Most of the initial phase of mining falls to the east within the White Lake watershed along which flow/quality monitoring stations exist. This watershed is contained within IOC's mining lease and does not impact a public, non-mining, area. A smaller percentage of the initial development phase falls to the west within the Carol Lake discharge watershed. This watershed forms the headwaters to the Walsh River cabin area – a public area. While most of the surface catchment impacted by mining drains away from public areas, there is a remote risk that waste dumps and overburden stockpiles placed within the Carol Lake discharge watershed may be a source of sediment. Dedicated dump surface water catchment sumps, to prevent mine impacted water from discharging to the environment, are part of HSE development strategy – in addition to the already installed monitoring station along the Carol Lake discharge (e.g., Walsh River Cabin area headwaters).

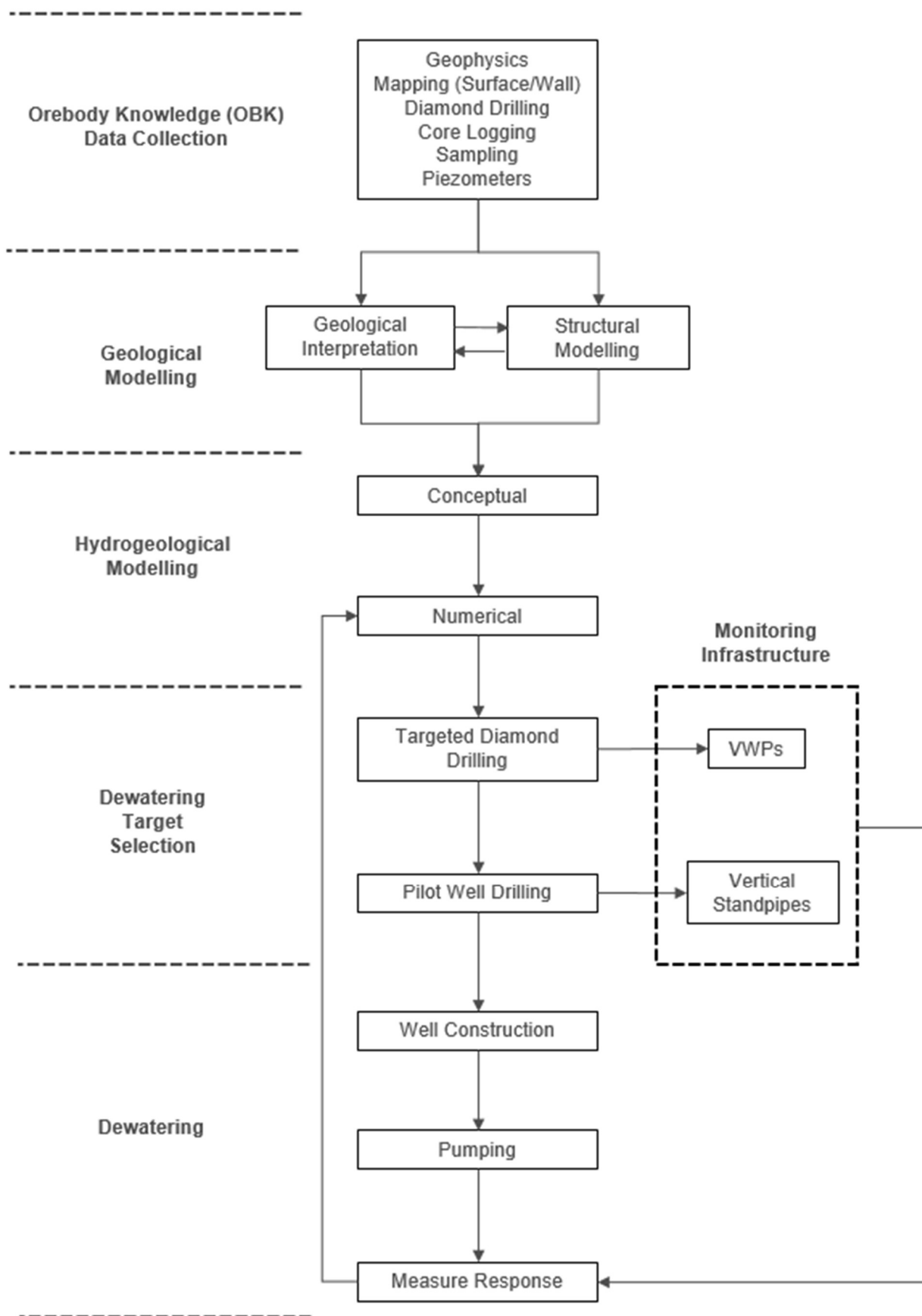


Figure 5: Advanced Dewatering workflow at IOC.

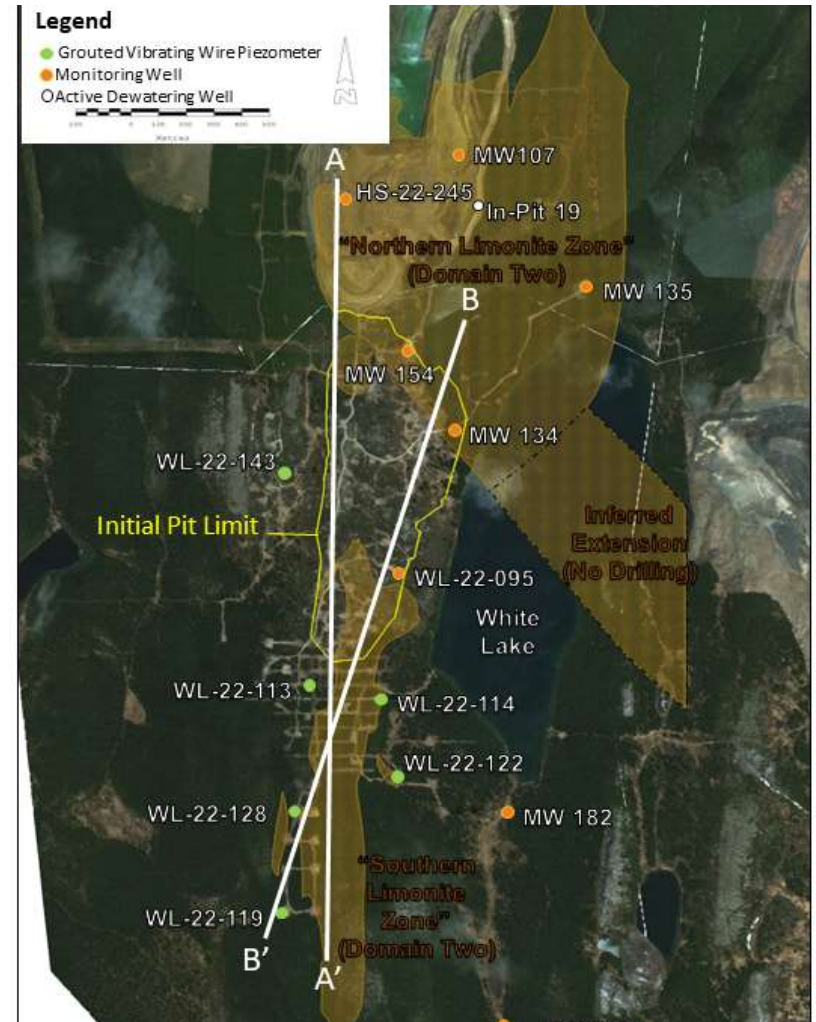
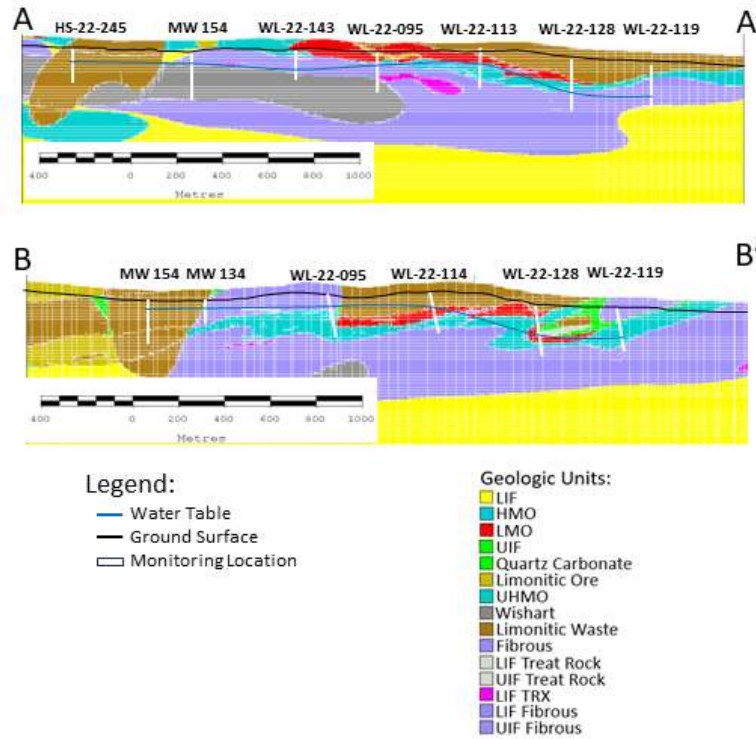


Figure 6: North-south orientation cross sections displaying the White Lake area geology and water levels recorded at monitoring locations in the third quarter of 2023.

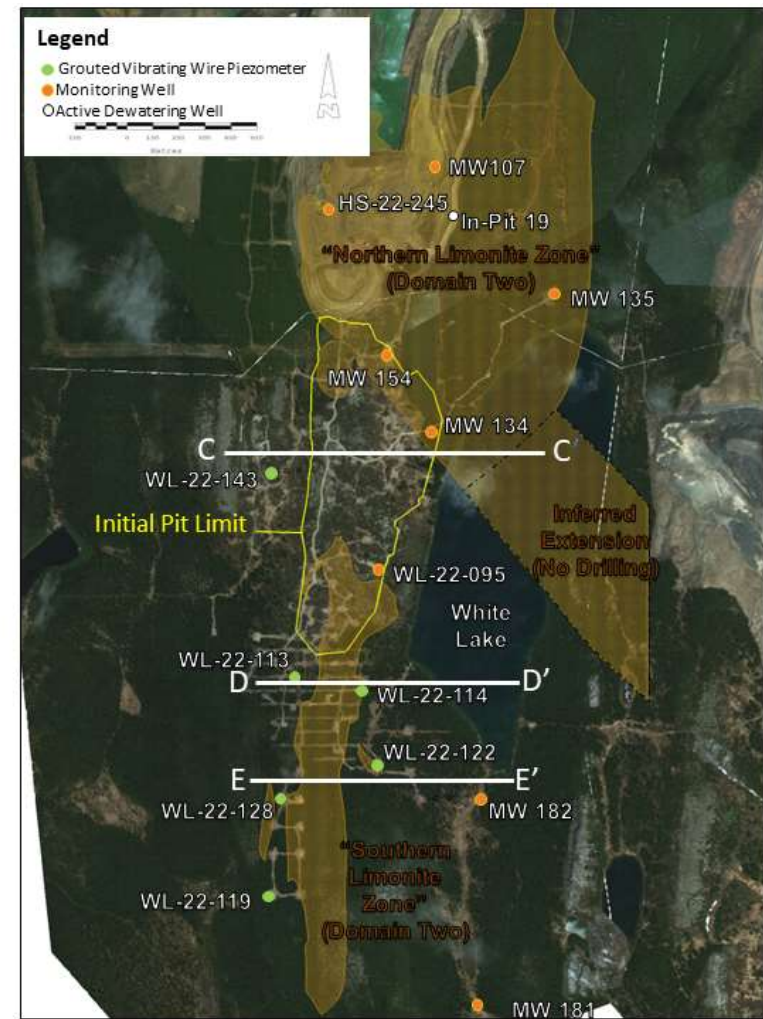
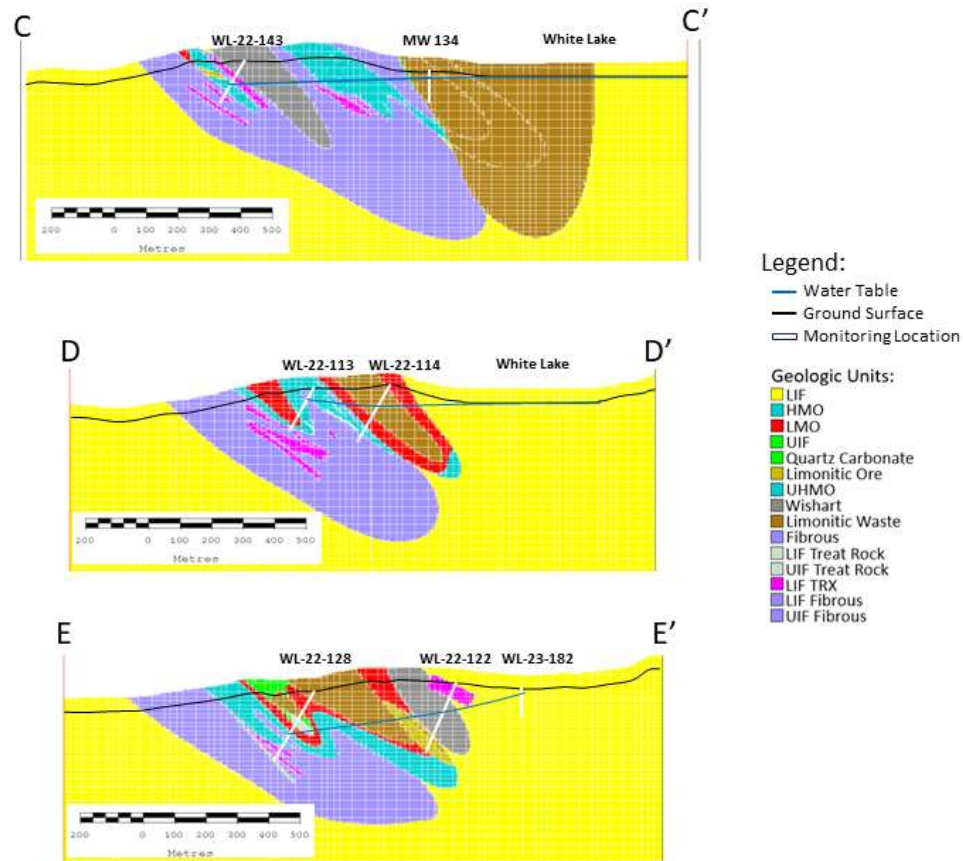


Figure 7: West-east orientation cross sections displaying the White Lake area geology and water levels recorded at monitoring locations in the third quarter of 2023.

5.0 Conclusions And Future Work

Future diamond and pilot well drilling programs will be used to expand water monitoring capacity in White Lake. VWP installations targeted at geologic contacts and structural areas of interest will be used to determine water rock interactions to better understand flow regimes. Additionally, monitoring location distribution will be expanded to achieve adequate coverage of the area to determine how White Lake interacts with the ore body. Future geological diamond drilling programs will be used to update the geologic model which will aid in the hydrogeologic interpretation of the area. Both grouted and open hole installations will be used to allow for water quality sampling. Surface water monitoring will continue to take place by NL Water Resources to provide an understanding of hydrology in the area. This information will contribute to the understanding of mining impacts on the surface water environment. This water monitoring station will help to quantify the surface water discharge in the area. Insights into topographical influences on surface water movement will also be achieved.

IOC is undertaking current work to create surface water models of the area using Leapfrog software. These water surfaces will further contribute to the understanding of the White Lake area by combining hydrogeologic, geologic, and structural models. The confidence of these models will increase with each iteration and future drilling will target areas of sparse coverage to further add confidence to the model. Consultants will be contracted in 2024 to create a hydrogeological conceptual model. These models have been developed in the past for other areas of the mine site, but without an emphasis on the White Lake area. Current monitoring locations installed in 2022 will have recorded sufficient information by the time of the model creation to give insight into seasonal trends on groundwater levels. This preliminary model will be revisited in future years as data for multiple yearly cycles is collected to add confidence to the model.

Pilot well drilling in 2024 will include three targets in White Lake (Figure 8). Rising head, falling head, and airlift tests will be conducted at these locations to determine hydraulic conductivity (k-values) further characterising the aquifers. Downhole camera surveys will also be used to examine the subsurface geology of the area. Pilot Hole 1 and 2 are targeting fractures and strongly weathered rock identified in the 2012 geologic drilling program. Testing done at these locations will contribute to a more comprehensive understanding of the hydrogeologically connected and fractured zone in this area. Pilot hole 3 will be targeting alteration identifying in MW 134. As all three of these pilot wells will be intercepting the primary aquifers within this orebody, testing will add to the hydrogeologic understanding of the area. After testing is complete, all three pilot wells will be instrumented and converted to monitoring wells.

Table 4: Summary of future HSE investigations

Future Work		IOC Department	Status
1	Confirm extent of limonite zones via diamond drilling.	Hydrogeology/Geology	Ongoing
2	Identify future dewatering well targets via pilot well drilling.	Hydrogeology/Mine Projects	Ongoing
3	Establish White Lake baseline flow/water.	Environment/Hydrogeology	Ongoing
4	Determine White Lake bottom sediment thickness profile.	Environment/Hydrogeology	Ongoing
5	Complete HSE hydrogeology models	Hydrogeology	Ongoing

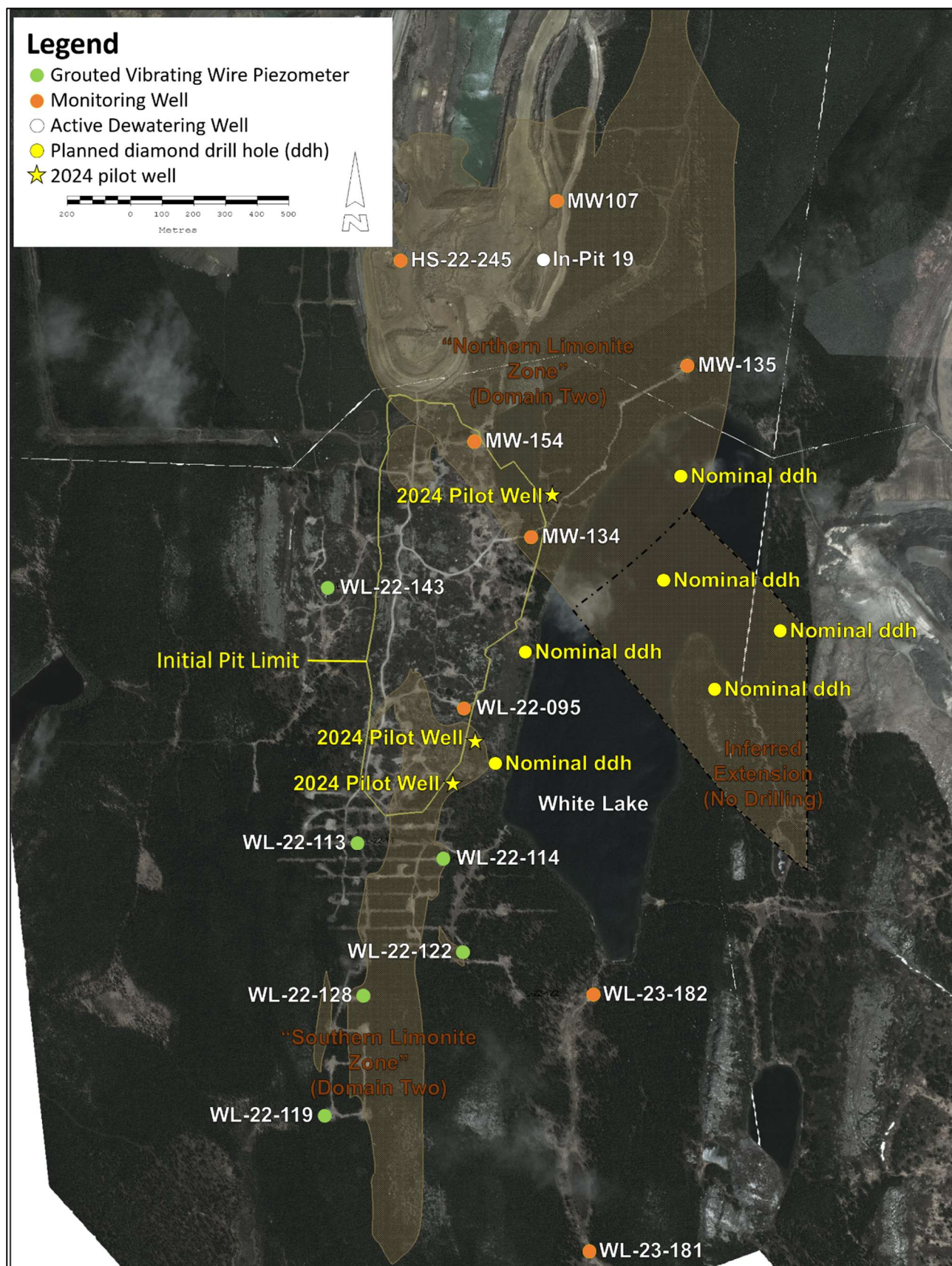


Figure 8: Aerial photo (2023) showing the location of the initial pit relative to White Lake, major aquifers (brown), active wells, and currently installed groundwater monitoring equipment. Note, assume unaltered metamorphic rock (Domain One) outside Domain Two.

References

- Brown Z, Oliver D (2019) IOC hydrogeological conceptual site model update. WSP Inc. report to IOC Mine Technical Services department, Labrador City, Newfoundland and Labrador (unpublished)
- Conliffe J (2019) Iron-ore deposits of southwestern Labrador. Newfoundland and Labrador Natural Resources and Mines occasional paper, St. John's NL, p 11-39
- FloSolutions (2022) Hydrogeologic Conceptual Model Update for Lucan and Moss Pits. Report to IOC Mine Technical Services department, Labrador, Newfoundland and Labrador (unpublished)
- Gnansounou DR, Holmes AT (2015) Wells In-Pit 8 and In-Pit 9 Assessment, Luce Pit Dewatering. Piteau Associates Inc. Report to IOC Mine Technical Services department, Labrador, Newfoundland and Labrador (unpublished)
- Moran P (2019) Groundwater occurrence at, and advanced dewatering of, a geologically complex orebody at the Iron Ore Company of Canada open pit mine in subarctic Labrador Canada. In: Proceedings of the Canadian Geotechnical Conference and IAH-CNC conference ("GeoSt. John's 2019"). St. John's, NL
- Moran P, Ross J (2020) Mine dewatering wells: reducing economic risk and increasing the probability of success through diamond drilling. In: Proceedings of the Canadian Geotechnical Conference and IAH-CNC conference ("GeoVirtual 2020"). Online
- Piteau DR, Claridge FB, Dakin RA, Stewart AF (1981) Hydrogeology assessment for seepage control in open pit mines. Piteau Associates Inc. report to IOC Mine Technical Services department, Labrador, Newfoundland and Labrador (unpublished)
- SEM (Sikumiut Environmental Management Limited) (2019) Humphrey South Extension and White Lake Pit Development Aquatic Assessment. Report to IOC Environment Department, Labrador, Newfoundland and Labrador (unpublished)
- van Gool, Rivers J, Calon T (2008) Grenville Front zone, Gagnon Terrane, southwestern Labrador: configuration of a midcrustal foreland fold-thrust belt. *Tectonics* 27: 1-13
- Wardle RJ, James DT, Scott DJ, Hall J (2002) The southeastern Churchill Province: synthesis of a Paleoproterozoic transpressional orogen: Proterozoic evolution of the northeastern Canadian Shield. *Lithoprobe eastern Canadian Shield onshore-offshore transect. Canadian Journal of Earth Sciences* 39: 639-663

Appendix A
(Registration # 2114 Environmental
Assessment Release Conditions)



Government of Newfoundland and Labrador
 Environment and Climate Change
 Office of the Minister

MAY 27 2021

COR/2021/01325

Reg. # 2114

Clayton Walker, President and CEO
 Iron Ore Company of Canada
 2 Avalon Drive
 Labrador City, NL A2V 2Y6
Patrick.Lauziere@ironore.ca

Dear Mr. Walker:

Re: Labrador City Humphrey South Iron Ore Extension

Your proposal has been reviewed by an interdepartmental environmental assessment screening committee and an opportunity to comment has been provided to the public as required by Part X of the Newfoundland and Labrador Environmental Protection Act, SNL 2002, cE-14.2. Please be advised that this undertaking is **released** from further environmental assessment subject to the following conditions:

- IOC is required to uphold all commitments made in your environmental assessment submission to mitigate the effects of the project on the environment.
- A groundwater assessment, including a model of groundwater flow, must be completed for the proposed pit. An initial report with currently available data must be submitted and approved by the Water Resources Management Division of my Department prior to commencing any work related to the project, with follow up reports to be submitted annually until the groundwater assessment is complete. For further information, please contact the Water Resources Management Division, Groundwater Section at (709) 729-2539.
- IOC must enter into a Memorandum of Agreement with the Water Resources Management Division for the installation of a real-time water quality/quantity network for groundwater/surface water as determined upon further consultation. For further information, please contact the Water Resources Management Division at (709) 729-2563, or email hkhan@gov.nl.ca.
- A Water Resources Management Plan must be submitted to the Water Resources Management Division for approval prior to commencing any work related to this



project. The Water Resources Management Plan should address the following concerns:

- if there are any brooks, rivers, ponds, streams or wetlands present in or within 30 metres of the boundaries of the project site, then please provide the type of water body and its distance from the site;
 - if any of the above-mentioned water bodies are impacted by site operations, describe how the water body will be impacted. A permit/licence from the Water Resources Management Division may be required; and,
 - if there is any potential for onsite drainage water or dewatering water to discharge into a natural water body, describe the measures that are to be deployed, such as the establishment of vegetative cover, filter strip or silt curtain to ensure the effluent or runoff meets the requirements of the Environmental Control Water and Sewage Regulations, 2003. For further information, please contact the Water Resources Management Division at (709) 729-1646, or email leahburry@gov.nl.ca.
- As contour lines show surface water in the new project area draining westward away from other monitoring stations, a water quality and stage/flow monitoring plan in this area must be developed in consultation with the Water Resources Management Division of my Department before stage 1. For further information, please contact the Water Resources Management Division at (709) 729-2563, or email hkhan@gov.nl.ca.
 - The Department of Fisheries, Forestry and Agriculture requires the following:
 - a minimum 30-metre undisturbed buffer must be maintained along all waterbodies and wetlands that appear on a 1:50,000 topographical map to protect sensitive riparian and aquatic species, and their habitat;
 - no vegetation clearing is to occur within 800 metres of a bald eagle or osprey nest during the nesting season (March 15 to July 31) and 200 metres during the remainder of the year; the 200-metre buffer also applies to all other raptor nests (e.g. Northern Goshawk, Sharp-shinned Hawk, Merlin, American Kestrel, Great-horned Owl, Boreal Owl, Northern Saw-whet Owl); and, the location of any raptor nest site must be reported to the Wildlife Division. For further information, please contact the Wildlife Division at (709) 637-2025, or Fisheries, Forestry and Agriculture at (709) 729-1140.
 - the locations of all plants surveyed (for plants of concern/interest), and,
 - confirmation of avian Species at Risk (SAR) and amphibian species (Salamander, frog) identified in the project area. For further information, please



contact the Wildlife Division at (709) 637-2025, or Fisheries, Forestry and Agriculture at (709) 729-1140.

- You are required to advise the Environmental Assessment Division when each of the conditions of release has been met, by emailing a written description, documents, and images (where applicable) to demonstrate that the conditions have been fulfilled to EAPProjectComments@gov.nl.ca.
- You are required to update the Environmental Assessment Division on the status of the project, including a copy of all permits, licences, certificates, approvals and other authorizations required for the project, within one year from the date of this release letter and to provide additional updates, if requested. Please email project updates to EAPProjectComments@gov.nl.ca.

Federal and provincial government departments and agencies that reviewed your project during the environmental assessment provide the following advice:

The Water Resources Management Division of my Department advises that you must obtain permits for any work in a body of water including wetland, to alter a body of water, work in shore water zones, or any infilling work within fifteen metres of a body of water, and for construction of a non-domestic well. You must apply for and obtain a water use licence under the Water Resources Act, for the use of water from any water source for any purpose. For further information, please contact the Water Resources Management Division at (709) 729-1646.

The Pollution Prevention Division of my Department indicates that a Certificate of Approval (COA) is required for this project. Water quality/effluent and ambient air monitoring programs will be further detailed in the Terms and Conditions of the COA. You are also reminded that all waters discharged from the proposed site during construction and operation are subject to compliance with the Environmental Control Water and Sewage Regulations, under the Water Resources Act. For further information, please contact the Pollution Prevention Division at (709) 729-5782.

The Department of Municipal and Provincial Affairs advises that a development permit is required from the Town of Labrador City. For further information, please contact the Local Governance and Land Use Planning Division at (709) 729-3090.

The Department of Industry, Energy and Technology, Mines Branch requires IOC to submit the results of the acid rock drainage study for the Humphrey South Extension area, including details of the acid-base analysis protocol to ensure that acid generating and potentially acid



generating waste is managed appropriately. For further information, please contact Paul Philpott, Mines Branch at (709) 729-2358 or email paulphilpott@gov.nl.ca.

The Department of Fisheries, Forestry and Agriculture advises that a Commercial Cutting Permit is required prior to any harvesting or timber removal, and an Operating Permit is required prior to the start of any work during the forest fire season. For further information, please contact the Department of Fisheries, Forestry and Agriculture at (709) 729-1140.

The Department of Fisheries, Forestry and Agriculture would like to review with IOC, current Best Management Practices for bank swallows to identify preferred abandoned sites on IOC grounds if needed to redirect potential breeding pairs within active sites. In addition, IOC's newly implemented bat-monitoring program must be submitted and reviewed by the Wildlife Division. For further information, please contact the Department of Fisheries, Forestry and Agriculture at (709) 729-1140.

The Department of Industry, Energy and Technology advises that IOC is required to submit a development plan, a rehabilitation and closure plan and provide financial assurance as per Section 4 of the Mining Act. For inquiries about compliance with the Mining Act, please contact the Mines Branch at (709) 729-2358, or email paulphilpott@gov.nl.ca.

The Occupational Health and Safety Division of the Department of Digital Government and Service NL advises you to ensure that the activities associated with the development are conducted in compliance with the Occupational Health and Safety Act and its regulations. This includes the responsibility for ensuring that contractors hired to perform work also comply with this legislation. The Occupational Health and Safety Division reminds you to consider procedures related to the protection of workers related to COVID-19. Procedures must follow the requirements set forth by the Chief Medical Officer of Newfoundland and Labrador (e.g. physical distancing, handwashing).

Environment and Climate Change Canada recommends that in order to avoid nest destruction and to accommodate the breeding season of migratory songbirds and waterfowl, operations should consider nesting locations between April 15th and August 15th in this region. Environment and Climate Change Canada requests you provide a GIS file of the project boundaries and study area so that the project can be mapped and the total area of wetland that will be affected. For further information, please contact the Canadian Wildlife Service at (709) 772-4221.

Environment and Climate Change Canada, Canadian Wildlife Service requests detailed information on the surveys methods and protocols that were undertaken for the bird and bat surveys, and include mitigations to reduce impacts to Bank Swallow in the Environmental



Management Plan. In addition, methods to reduce disturbance to migratory birds related to lights should be developed and submitted for review. For further information, please contact the Canadian Wildlife Service at (709) 772-4221.

Fisheries and Oceans Canada (DFO) has indicated IOC must submit a "Request for Review" to the Fish and Fish Habitat Protection Program under the Fisheries Act. This authorization request to DFO includes cases where impacts to fish and fish habitat cannot be avoided. For further information, please contact Fisheries and Oceans Canada at (709) 772-4140.

Transport Canada has indicated that infilling or dewatering of any navigable waterway would require an Exemption by Order of the Governor in Council pursuant to Section 24 of the Canadian Navigable Waters Act. IOC must submit an Application for Approval detailing the work, its effects, and the nature of the water bodies that may be involved. For further information, please contact Transport Canada at (709) 772-3088.

Although the undertaking as proposed is released from further environmental assessment, it is still subject to other legislative requirements. A summary of the comments received from government agencies during the review is attached to provide an indication of likely applicable permits, approvals and legislative requirements. You must comply with all relevant legislation and obtain all necessary permits and approvals. You are required to inform this department of any proposed significant changes to the undertaking.

Please note that in accordance with Section 17 of the Environmental Assessment Regulations, the Minister's decision is valid for a period of three years from the date of this letter. If you have not commenced your project within this three-year period, you may apply to extend the three-year period for a maximum of three one-year periods, if needed. For further information, please email EAProjectComments@gov.nl.ca.

If you have any questions, please contact Joanne Sweeney, Director (A), Environmental Assessment Division, at (709) 729-0673 or joannesweeney@gov.nl.ca.

Sincerely,

A handwritten signature in blue ink, appearing to read "Bernard Davis".

BERNARD DAVIS, MHA
District of Virginia Waters – Pleasantville
Minister

Enclosures



cc: Jordan Brown, MHA
Labrador West

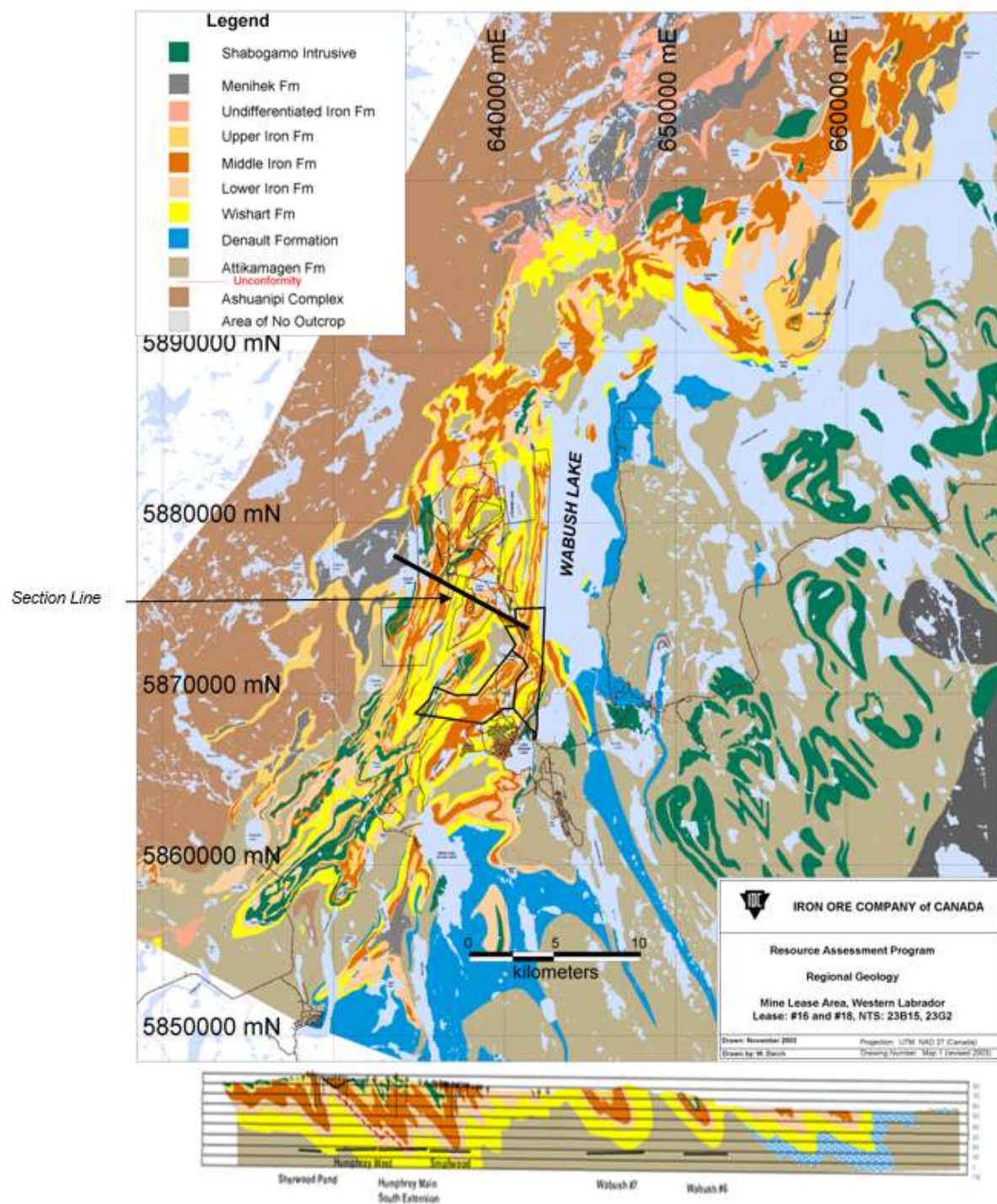
Town of Labrador City

Appendix B

(Regional And Deposit Geology)

Resource Assessment Program - Lithologic Legend

AGE	FORMATION	MEMBER	UNIT	THICKNESS RANGE	CODE - LITHOFACIES
Mid. Proterozoic (Hobbitan)	Shabogamo Intrusive				80 Gabbro 81 Metagabbro 82 Amphibolite: Hornblende-biotite +/- garnet schist
	Intrusive contact				
Lower Proterozoic (Aplonian)	Menihek Fm. (Nault Fm.)			15 - 30m	70 Quartz-graphite-feldspar-(biotite-muscovite) schist
	Soloman Fm. (Wahush Iron Fm.)	Upper IF	UIF 3	45 - 75m	44 Quartz-(actinolite-grunerite) schist 43 Quartz-grunerite schist 42 Quartz-(carbonate-grunerite) gneiss 40 Quartz-carbonate gneiss
			UIF 2		50 Quartz-carbonate-magnetite gneiss 51 Quartz-grunerite-magnetite schist 52 Quartz-magnetite-grunerite gneiss 53 Quartz-magnetite-carbonate gneiss
			UIF 1		40 Quartz-carbonate gneiss 42 Quartz-(carbonate-grunerite) schist and gneiss
		Middle IF	MIF 4	45 - 110m	61 Quartz-magnetite-specularite
			MIF 3		62 Lean quartz-specularite schist
			MIF 2		62 Quartz specularite schist 63 Quartz-specularite-anthophyllite +/- talc schist
			MIF 1		61 Quartz-(magnetite-specularite) 60 Quartz-magnetite 53 Quartz-magnetite-carbonate gneiss
		Lower IF	LIF 3	45 - 75m	40 Quartz-carbonate gneiss 42 Quartz-(carbonate-grunerite) gneiss
			LIF 2		61 Lean quartz-(specularite-magnetite) 53 Quartz-magnetite-carbonate gneiss 50 Quartz-carbonate-magnetite gneiss
			LIF 1		40 Quartz-carbonate gneiss 42 Quartz-(carbonate-grunerite) gneiss
					45 Undifferentiated
	Wishart Fm. (Carol Fm.)	Upper		60 - 90m	31 Quartzite with accessory amphibole 32 Quartzite with accessory carbonate
		Middle			30 Orthoquartzite 35 Quartzite with accessory muscovite
		Lower			34 Quartz-muscovite +/- garnet schist
					35 Undifferentiated quartzite
	Denault Fm. (Duley Fm.)			0 - 75m	20 Calcite marble +/- tremolite 21 Dolomitic marble +/- tremolite
	Attikamagen (Katsao Fm.)			0 - 305m	10 Quartz-feldspar-biotite-muscovite schist 11 Quartz-biotite +/- muscovite schist
Archean	Unconformity				
	Ashuanipi Metamorphic Complex				01 Granitic and granodioritic gneisses 02 Granite intrusive



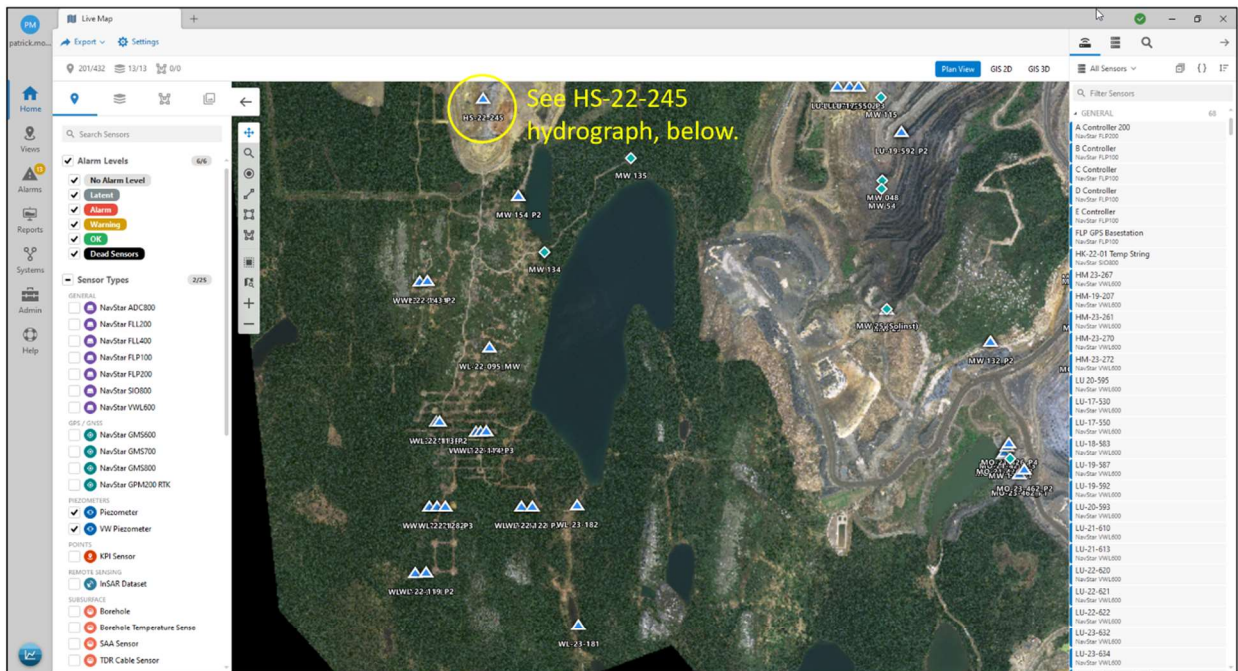
Appendix C

(Groundwater Monitoring Platform)

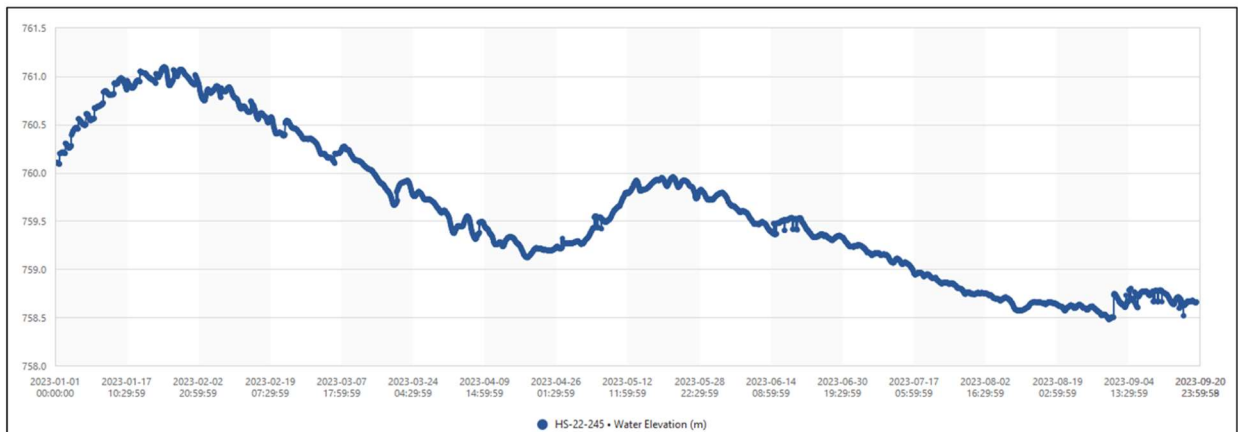
Table 3: Summary of Groundwater Monitoring Infrastructure in White Lake

Year	# of Holes	Total Meters	Total # of Sensors	Installation Type	Hole Names
2020	2	190	2	Non-Grouted Solinst Logger	MW 134, MW 135
2021	-	-	-	-	-
2022	8	1,600	17	Grouted VWP*	WL-22-095, 113, 114, 119, 122, 128, 143, MW 154
2023	2	200	2	Non-Grouted VWP	WL-23-181, 182
Total:	12	1,990	21		

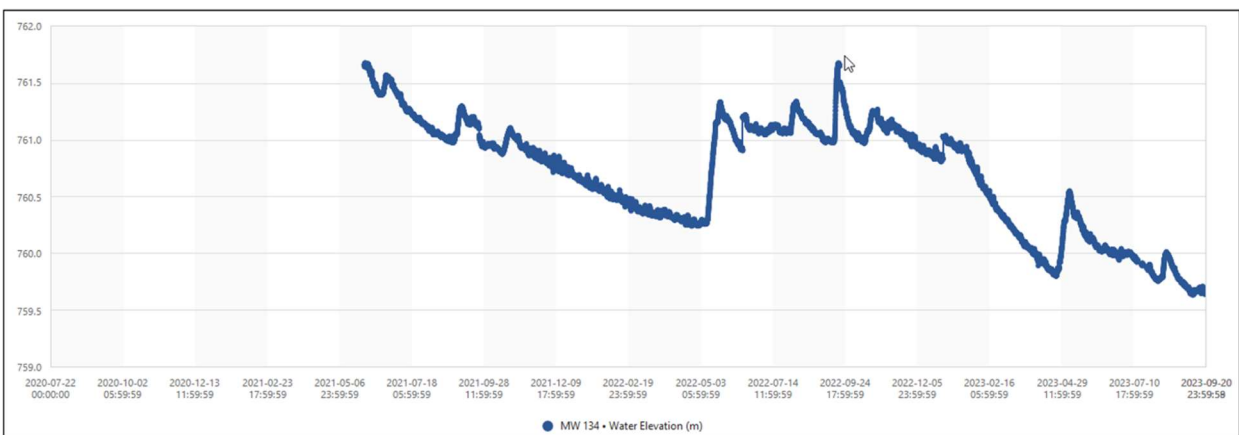
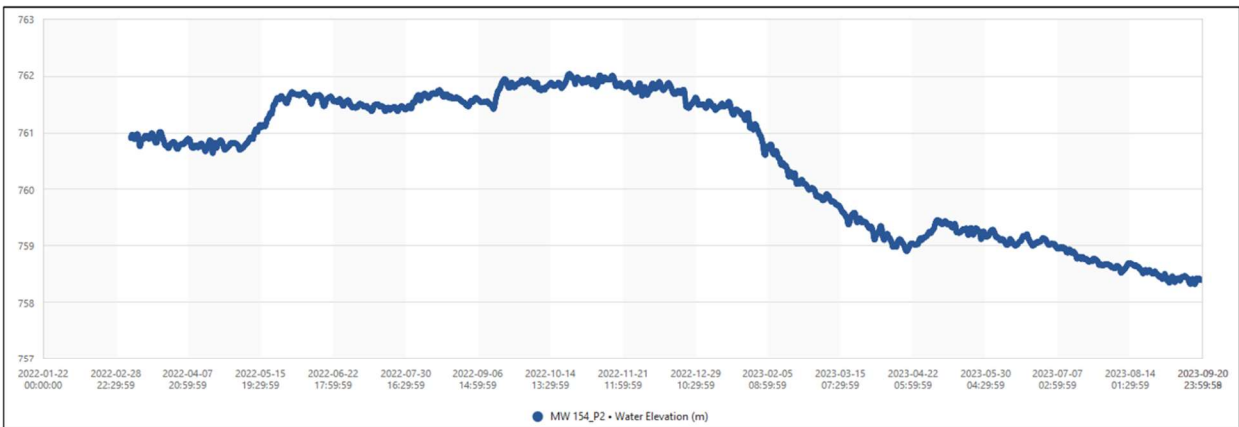
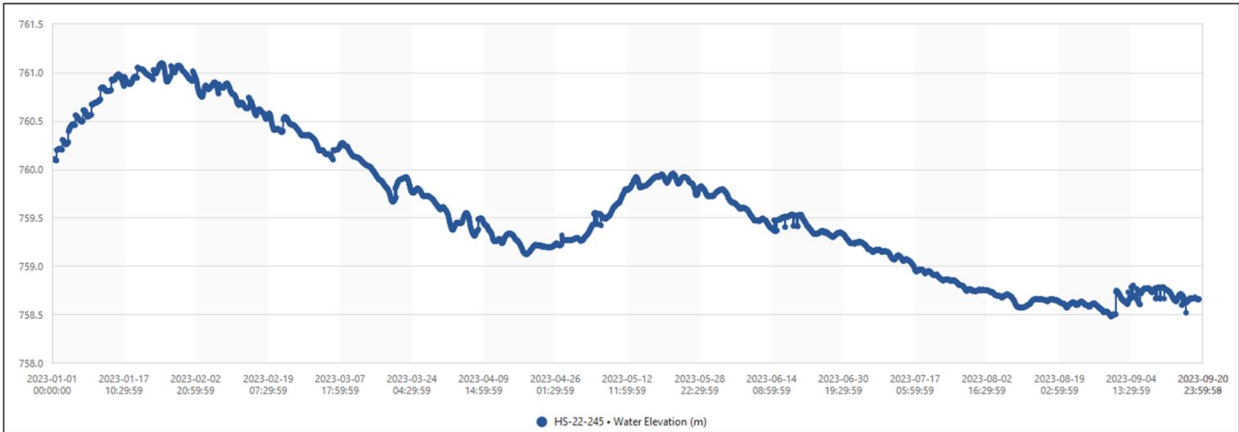
*WL-22-095 is a non-grouted VWP installation.

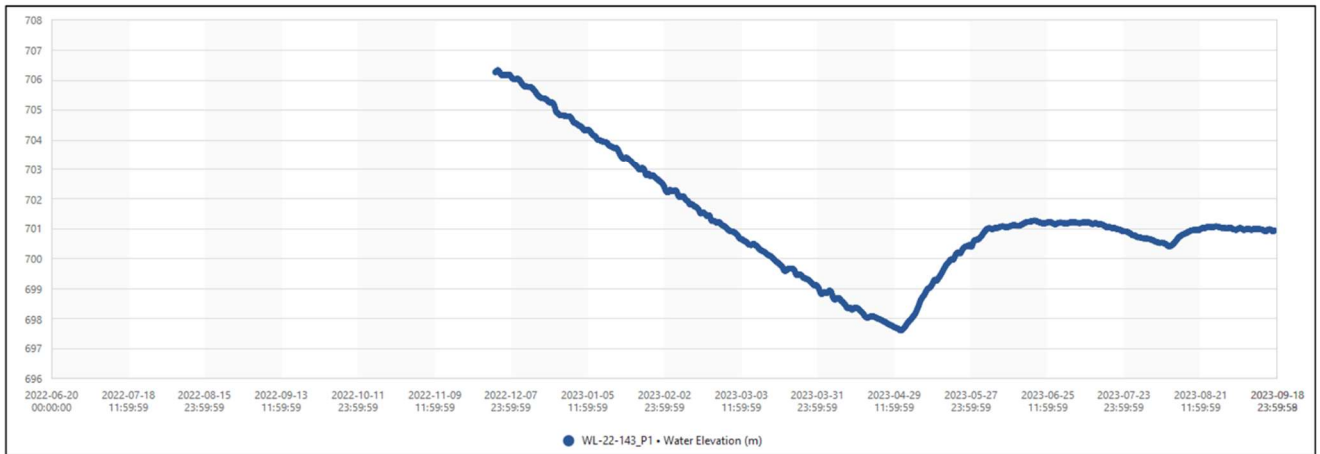
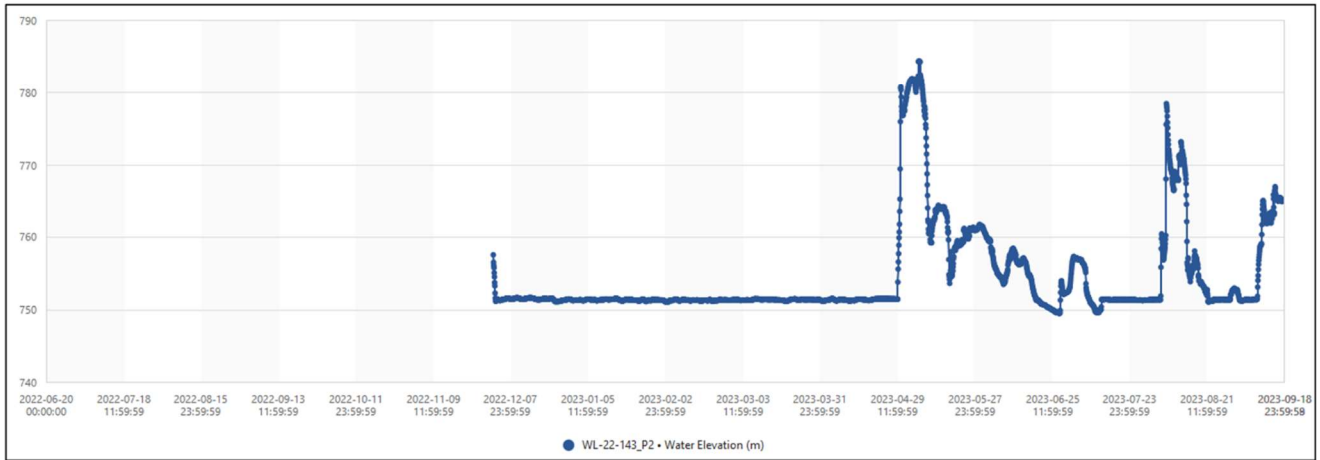
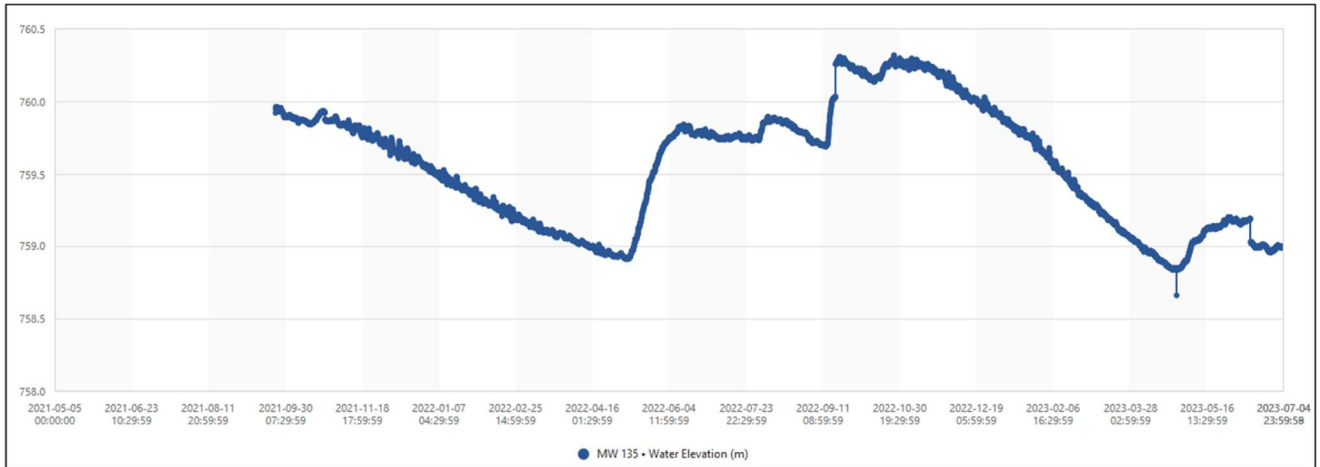


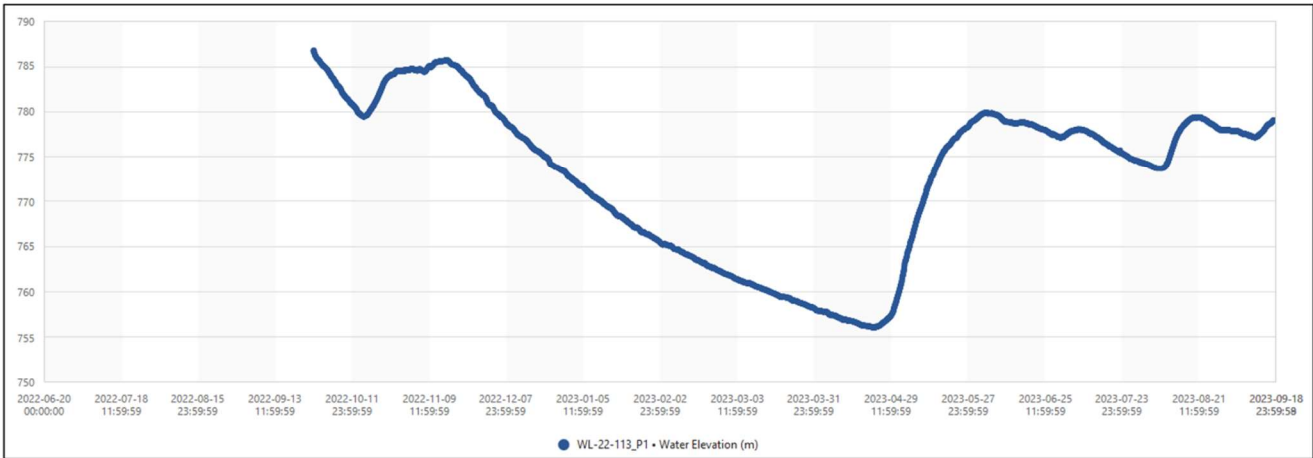
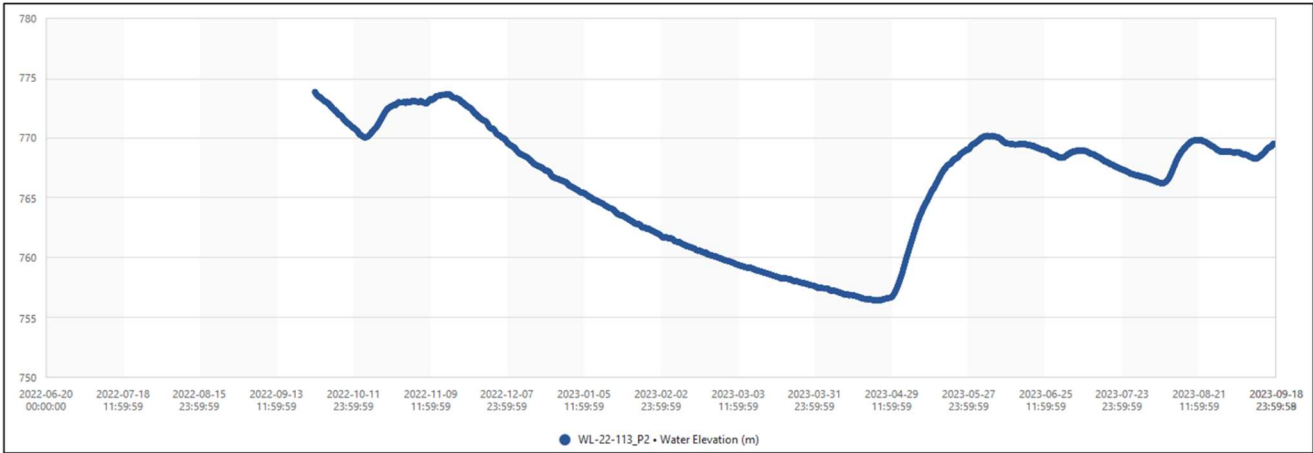
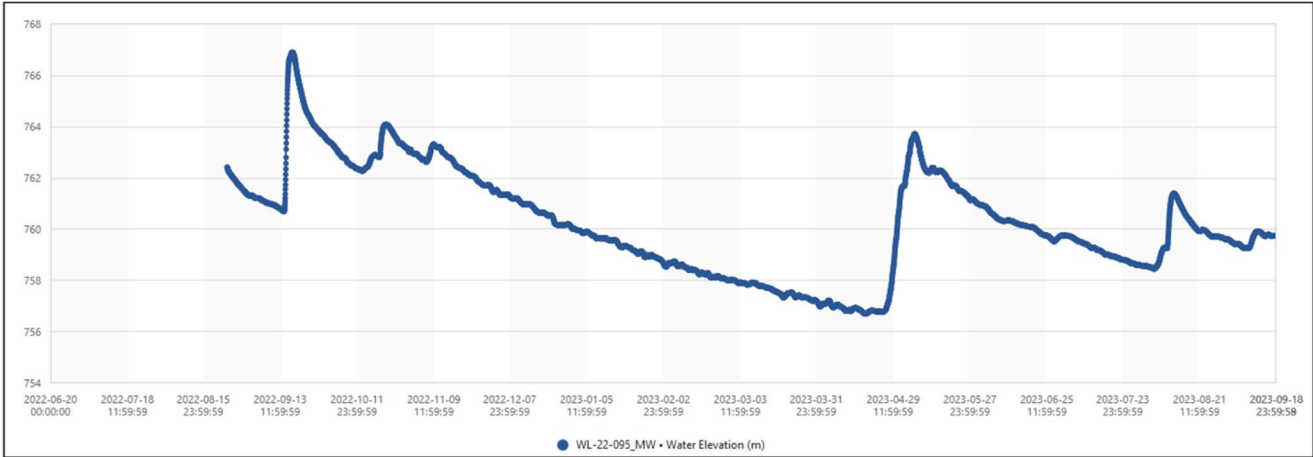
Appendix 3, Figure 1: GeoExplorer (NavStar) interface. Note location of HSE, White Lake, and current piezometric monitoring stations.

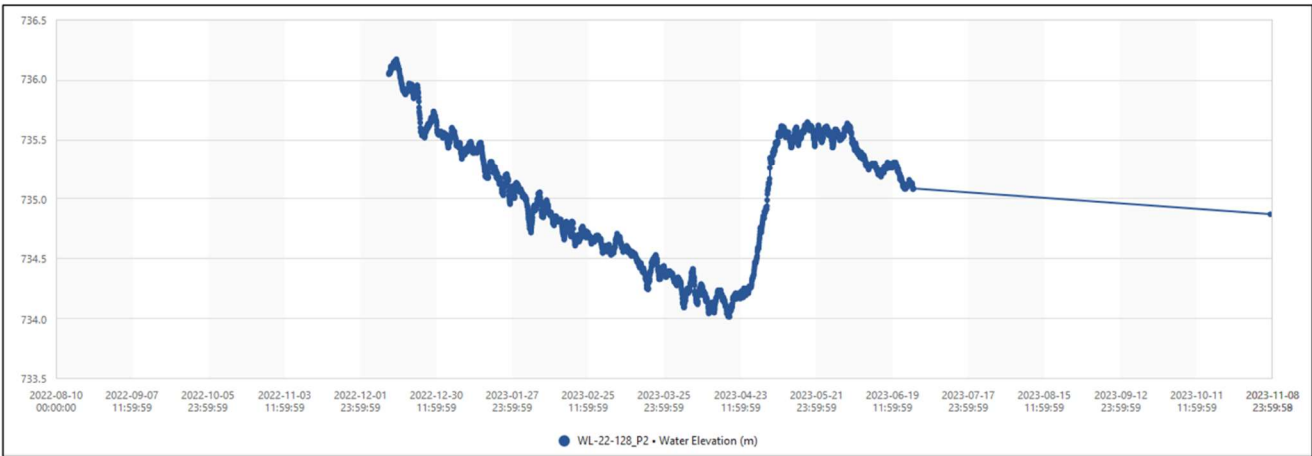
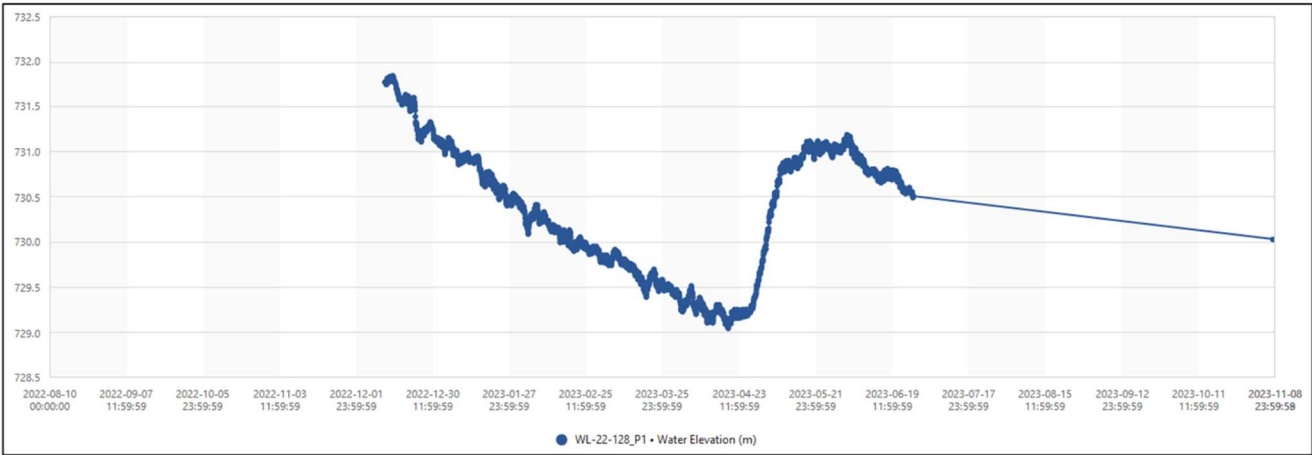
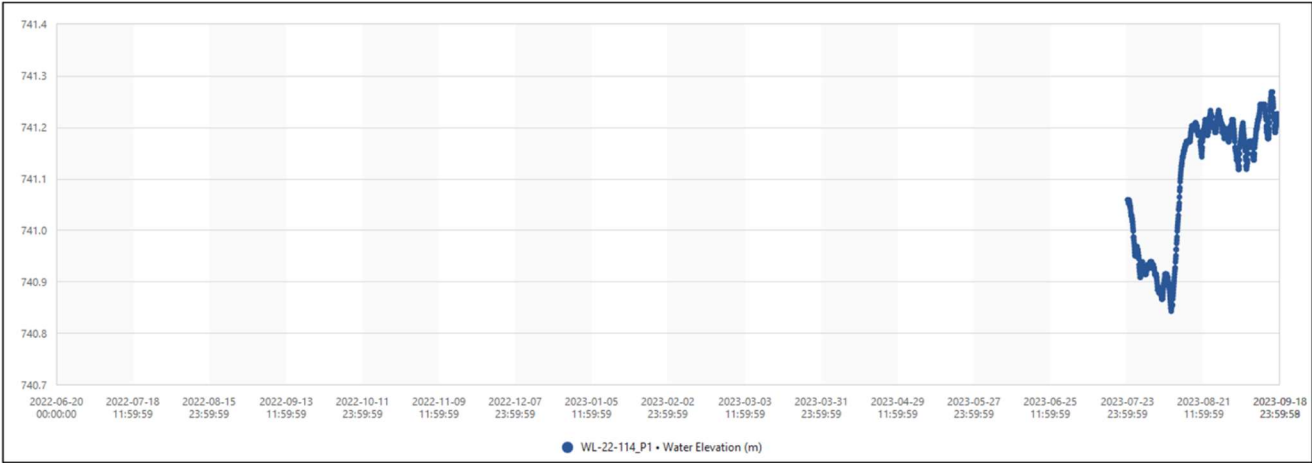


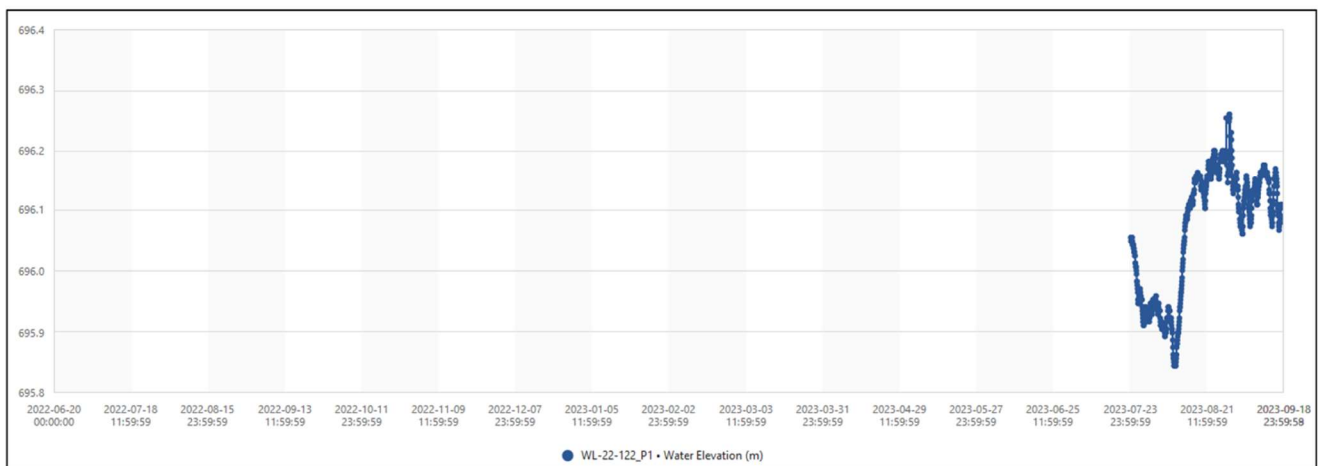
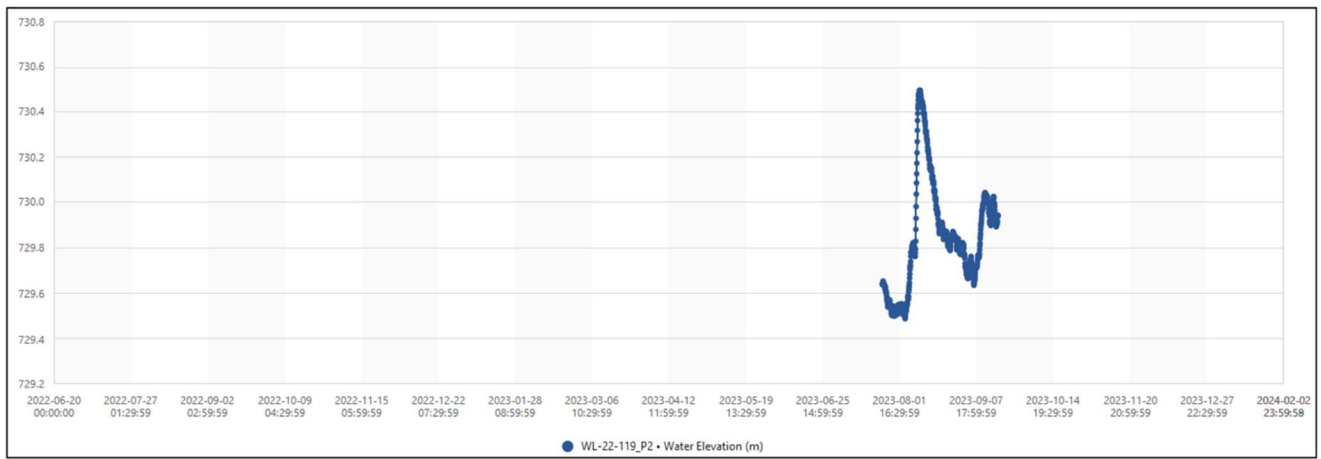
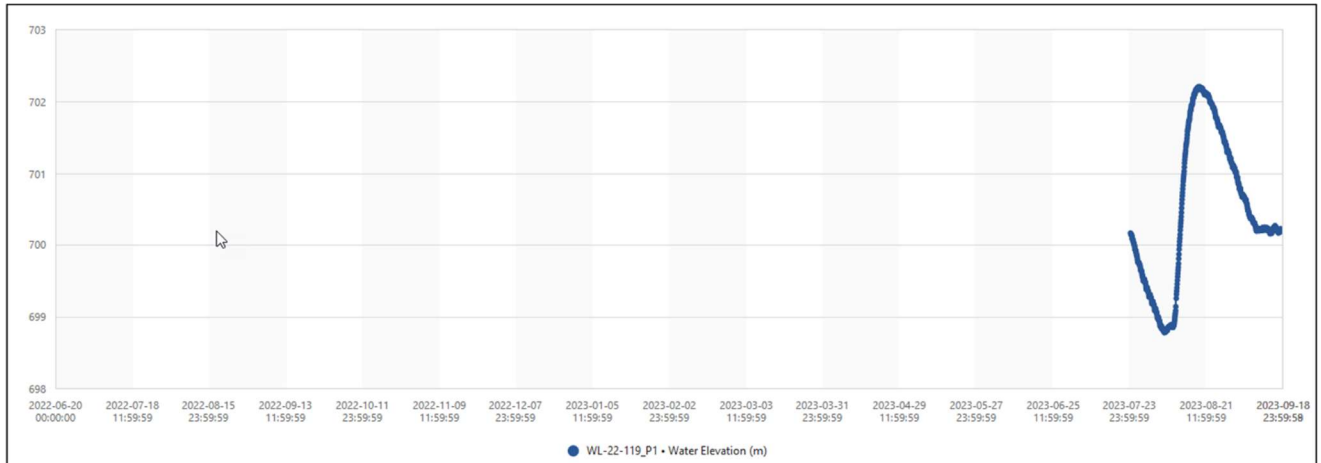
Appendix 3, Figure 2: GeoExplorer (NavStar) interface. HS-22-245 groundwater data (hydrograph).

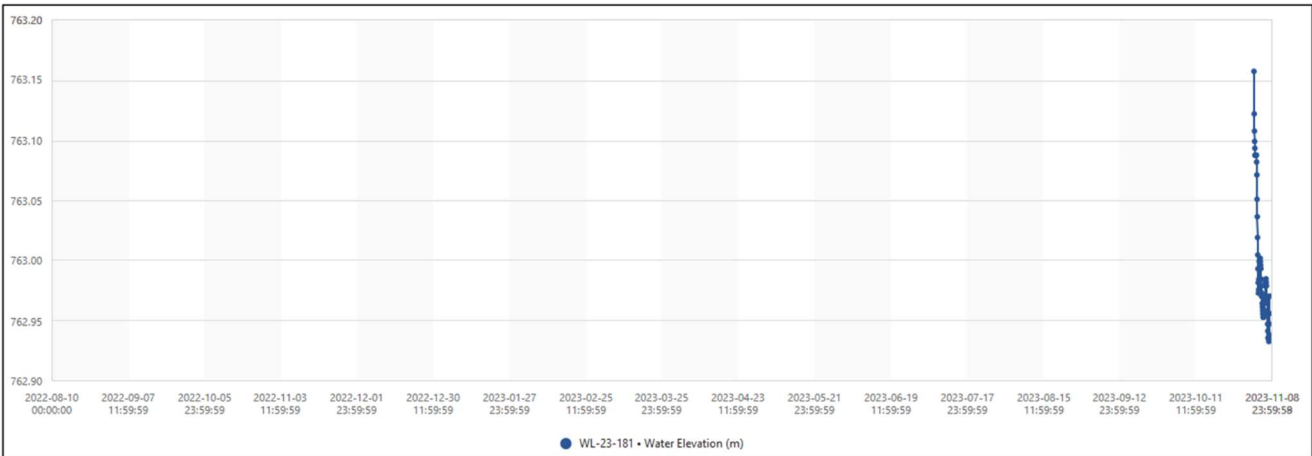
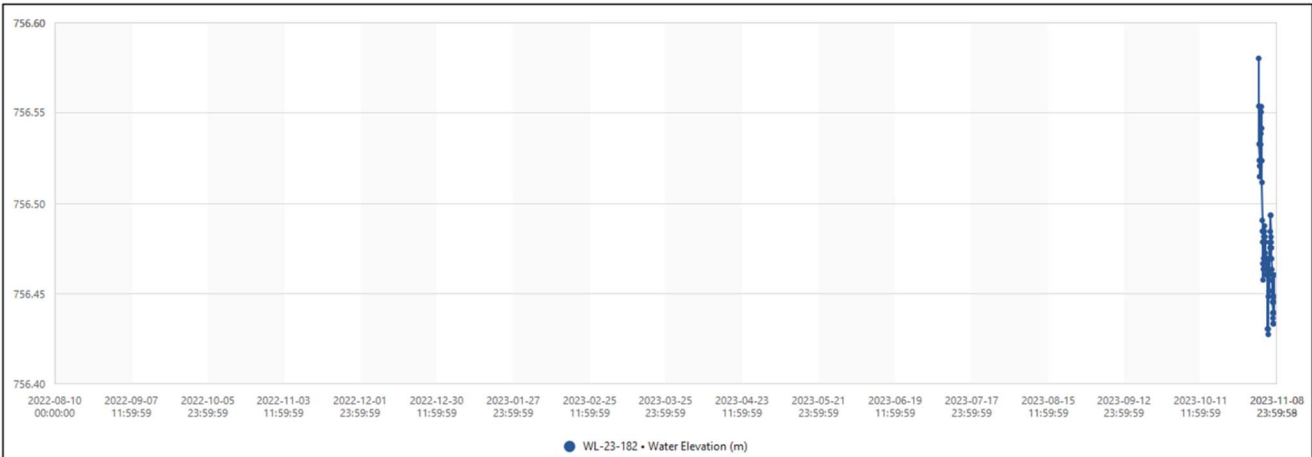
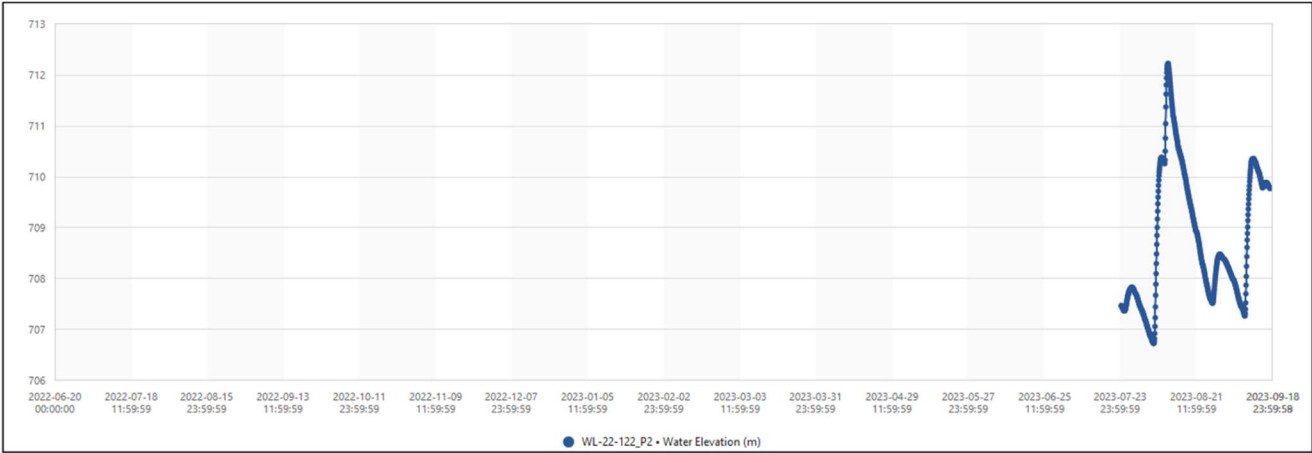












Appendix D
(Updated Surface Water Monitoring
Agreement)



Government of Newfoundland and Labrador
 Department of Environment and Climate Change
 Water Resources Management Division

AMENDMENT TO WATER USE LICENCE

Pursuant to the *Water Resources Act*, SNL 2002 cW-4.01, specifically Section(s) 18

Date: DECEMBER 19, 2023

File No: 517
 WUL No: WUL-21-11698
 Amendment No: 2

Licensee: Iron Ore Company of Canada (IOC)
 2 Avalon Drive
 P.O. Box 1000
 Labrador City, NL, A2V 2Y6

Attention: Jody Wentzell

Re: Water Withdrawal and Use from Unnamed Bodies of Water near Labrador City

The original Water Use Licence dated APRIL 06, 2021 is amended as follows:

Addition of Terms and Conditions as per Appendix A.

All other terms and conditions of the original Licence will apply and failure to comply with the terms and conditions of this amendment and the original Licence will render this Licence null and void, place the Licensee and their agent(s) in violation of the *Water Resources Act* and make the Licensee responsible for taking any remedial measures as may be prescribed by this Department.

(for) MINISTER

File No: 517
WUL No: WUL-21-11698
Amendment No: 2

- cc: Ms. Annette Tobin, P. Eng.
Water Resources Management Engineer, Water Agreements
Water Resources Management Division
Department of Municipal Affairs and Environment
P.O. Box 8700
4th Floor, West Block, Confederation Building
St. John's, NL A1B 4J6
annettetobin@gov.nl.ca
- cc: Ms. Paula Dawe, P.Eng.
Manager, Water Rights, Investigations and Modelling Section
Water Resources Management Division
Department of Environment and Climate Change
P.O. Box 8700
4th Floor, West Block, Confederation Building
St. John's, NL A1B 4J6
pauladawe@gov.nl.ca
- cc: Tara Clinton
Senior Environmental Scientist, Real-Time Water Quality Monitoring Program
Water Resources Management Division
Department of Environment & Climate Change
taraclinton@gov.nl.ca

GOVERNMENT OF NEWFOUNDLAND AND LABRADOR
Department of Environment and Climate Change

File No: 517
Licence No: WUL-21-11698
Amendment No: 2

APPENDIX A
Terms and Conditions for Amendment

Water Resources Monitoring Network

1. The establishment of a water resources monitoring network and its operation and maintenance is required pursuant to the release of the project under the *Environmental Protection Act* and requirements under Section 31 of the *Water Resources Act SNL 2002 cW-4.01*.
2. A water resources monitoring network may consist of a station(s) that collects water quality, water level, streamflow, climate, groundwater level, web camera images, or other data deemed necessary for the management of water resources.
3. Additional water monitoring stations may be added or existing stations removed from the monitoring network through an amendment to this Licence. Monitoring stations must remain active for the life of the Iron Ore Company of Canada project unless otherwise agreed to by this Department.
4. The following locations shall comprise the water resources monitoring network:

Station Name	Station Number	Latitude	Longitude	Station Type
Wabush Lake at Dolomite Road	03OA014	52.96681	-66.85922	Quality/Hydrometric
Wabush Lake at Lake Outlet (Julienne Narrows)	03OA005	53.15167	-66.78544	Quality/Hydrometric
Luce Brook below Tinto Pond	03OA012	52.98772	-66.87703	Hydrometric
Dumbell Stream above Dumbell Lake	03OA016	52.98612	-66.92010	Quality/Hydrometric
Pumphouse Stream above Drum Lake	03OA017	52.978889	-66.957944	Quality/Hydrometric
Unnamed Tributary above Fraggie Rock Lake	NF03OA0025	52.973626	-67.018828	Quality/Hydrometric

5. Terms and Conditions contained within the following section(s) of the original Licence and Amendment(s) are valid for the life of the Iron Ore Company of Canada project unless determined otherwise by this Department:
 - a. Water Resources Monitoring Network

6. All other Terms and Conditions contained within the original Licence and Amendment(s) are valid until April 6, 2026.

7. Annual operation and maintenance costs for each station to be paid for by the Licence Holder, plus applicable taxes, are as follows:

Component	Cost (\$/year)
Wabush Lake at Dolomite Road	\$42,000
Wabush Lake at Lake Outlet (Julienne Narrows)	\$42,000
Luce Brook below Tinto Pond	\$34,000
Dumbell Stream above Dumbell Lake	\$42,000
Pumphouse Stream above Drum Lake	\$42,000
Unnamed Tributary above Fraggie Rock Lake	\$42,000

8. Operation and maintenance costs will be prorated based on the date of initial station installation or station removal.

9. The annual amount payable for operation and maintenance by the Licence Holder shall remain fixed for a period of 5 years from the date of issue of the Amendment 1 containing the Section: "Water Resources Monitoring Network". The annual amount payable shall be reviewed and adjusted based on actual network operation and maintenance costs a minimum of every 5 years to reflect changes in annual costs.

10. All invoices or requests for payment shall be submitted by the Department to the Licence Holder at:

Iron Ore Company of Canada
2 Avalon Drive
Labrador City, NL A2V 2Y9
Attn: Jody Wentzell

11. All payments by the Licence Holder shall be made payable to the Exchequer of Newfoundland and Labrador within thirty days of receipt of invoice and mailed to:

Haseen Khan, P. Eng., Director
Water Resources Management Division
Department of Environment and Climate Change
PO Box 8700
St. John's, NL A1B 4J6
Email: hkhan@gov.nl.ca
Phone: (709) 729-2535
Fax: (709) 729-0320

12. The Department shall:

- a. Ensure the operation and maintenance of the station(s) according to Departmental monitoring protocols, manuals, and guidelines.
- b. Invoice the Licence Holder for annual operation and maintenance costs for each station and any relevant work undertaken outside the scope of this Licence Amendment.
- c. Follow data quality assurance/quality control protocols as outlined in Departmental protocols, manuals or guidelines to ensure data is accurate and acceptable.
- d. Perform annual performance testing and evaluation of water quality instrumentation.
- e. Monitor and analyze water quality data on a regular basis (quarterly) and report back to the Licence Holder. Prepare an Annual Report for stations monitoring water quality to be provided to the Licence Holder and made available on the Departmental website.
- f. Maintain an inventory of spare equipment, where feasible, for deployment, in the event of instrument malfunction, to minimize loss of data.
- g. Process and archive station data and maintain a webpage to report water resources monitoring station data on a near real-time basis.
- h. Ensure a satellite or other communication link is provided for each station to allow transmission of the collected data from the station to the Department's data management system.
- i. Make use of station data to create value added tools and products as necessary.
- j. Adhere to all applicable regulations, logistic and/or safety procedures, including any additional requirements specified by the Licence Holder. Should there be a conflict between any applicable standards, the most stringent requirement which does not conflict with the Department's policies, logistical and/or safety procedures will take precedence.

13. The Licence Holder shall:

- a. Be responsible for all costs, including applicable Departmental rates, for additional activities not outlined in this Licence. Such activities shall be carried out with the prior written approval of the Licence Holder.
- b. Purchase water resources monitoring instrumentation required for the station(s) that meets the technical specifications provided by the Department.
- c. Be responsible for the cost associated with the repair, replacement, and/or upgrading of any instrumentation that was originally purchased by the Licence Holder in order to meet current provincial standards for instrumentation.
- d. Be responsible for the purchase of water quality sensors of the type specified by the Department as a result of annual performance testing of instrumentation related to the station(s).
- e. Be responsible for all costs associated with the repair, replacement, relocation, or decommissioning of a station(s) or station equipment arising from any cause other than the negligence or willful misconduct of the Department or the Department's employees.

- f. Provide all the instrumentation and equipment required for Departmental staff to operate and maintain a station(s) according to Departmental monitoring protocols, manuals, and guidelines.
- g. Agree to allow the Department to use station data to create value added tools and products as necessary.