Hutchinson
Environmental Sciences Ltd.

Agnew Lake Niobium Transportation Risk Assessment – Technical Review

Prepared for: The Township of Nairn and Hyman
Job #: 240184

June 20, 2025

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June 20, 2025 Project No. 240184

Belinda Ketchabaw
Township of Nairn and Hyman
64 McIntyre St.
Nairn Centre, ON
P0M 2L0

Dear Ms. Ketchabaw,

Re: Agnew Lake Niobium Transportation Risk Assessment – Technical Review Summary

Hutchinson Environmental Sciences Ltd. (HESL) conducted a technical review of potential environmental risks associated with the Niobium Relocation Project, which involves transporting niobium tailings (originating from the Beaucage Mine site in North Bay, Ontario), from the MTO gravel pit in North Bay, to the Agnew Lake Tailings Management Area (TMA). Comments and information requests from the technical review are summarized in this letter and presented in detail in the attached report.

Due to past concerns with TMA annual reporting (HESL, 2024a) and conceptual flow pathways to the Township of Nairn and Hyman's drinking water sources from the facility, further evaluation of potential risks of the project was necessary. HESL reviewed the Human Health and Ecological Risk Assessments (HHERA) for the Niobium Relocation Project (Ecometrix, 2024) and source location (MTO gravel pit) (Ecometrix, 2012 and 2015), and additional communication documents from the Ministry of Mines, including an Agnew Lake Water Quality Memorandum and the Ministry's responses to the September 11, 2024 Nairn Townhall Public Questions.

Key Findings

The overall risk from the Project appears to be low and may even have a net risk reduction due to upgrades to the existing TMA. However, the review identified the following key uncertainties, that should be clarified to make a determination on risk from the Project:

- The Project HHERA concluded there will be negligible risk to receptors during the construction and post-construction phases of the Relocation Project (through a detailed, conservative evaluation of source terms and exposure pathways), but uncertainties remain, including details on baseline and effects monitoring during the construction/post-construction phases, timelines for the follow-up work recommended in the HHERA, and long-term closure planning.
- Cumulative risks from the proposed niobium and existing uranium tailings in the TMA were not assessed.
- Timelines for tailings relocation, TMA upgrade and new closure plan are unclear.

HESL prepared information requests for Ministry of Mines and the MTO, requesting information to address these uncertainties in Section 4.

Information Requests

Technical review findings and recommended information requests to address uncertainties/unclear information, are provided in the table below.

Review Finding	Information Request/Recommendation
Ecometrix (2024) recommended that a Cumulative Effects Risk Assessment be conducted for the Agnew Lake TMA (see Section 4.1).	• The Ministry of Mines should provide a timeline for completing the cumulative effects risk assessment. • The assessment should be completed before the transport and placement of niobium tailings, so that the combined risk of niobium and uranium tailings can be fully understood and planned for/mitigated.
Ecometrix (2024) provided recommendations for additional work to confirm the assumptions and data used for the 2024 HHERA, including estimating leaching potential of niobium tailings (to replace the existing TCLP data from the MTO gravel pit, used to estimate leachability), and confirming the drainage pathways around the TMA. Changes to understanding in drainage pathways at the TMA could change the predicted exposure scenarios in the HHERA (see Section 4.2)	• The Ministry of Mines should conduct the recommended work to clarify uncertainties in the 2024 HHERA, including leach testing and confirming drainage directions at/around the TMA. The Ministry of Mines committed to conducting this work, but it was unclear when the information would be available, and if it would be incorporated into a Cumulative Effects Risk Assessment. • This information should be provided to the Township when available, and any changes to the results of the risk assessment should be disclosed to the Township.
Radon gas exposure for burrowing mammals was identified as a potential exposure pathway for burrows/tunnels, in the 2015 HHERA for the MTO gravel pit. Radon gas exposure risks from the niobium tailings as radionuclides decay may also be a potential exposure risk at the TMA. This pathway was not discussed/evaluated in the 2024 HHERA (see Section 4.2).	• The Ministry of Mines should clarify why the radon gas exposure pathway to burrowing mammals was not included in the 2024 HHERA, or if this pathway would be further investigated in the Cumulative Effects Risk Assessment.
The placement of niobium tailings near the East Barrier Dyke location was generally well-described, but, exact (mapped) locations, timelines, and mitigation measures to prevent direct exposure to	• The Ministry of Mines should provide construction workplans for the Project, to clarify the locations where niobium tailings will be placed, and confirm timelines, methods,

wildlife were not clear. Information was not provided on transportation protocols, temporary storage locations and methods, drainage/runoff management, and erosion controls during construction. Monitoring during construction appears to be unchanged from routine semi-annual monitoring and may not be sufficient for detecting short-term impacts (see Section 4.3). Dust management, health and safety plans, and radiation protection strategies were noted to be included in separate reports, which have not been provided.	erosion and sediment control measures, and niobium transportation safety risks. • A construction monitoring plan for effects detection (including fish tissue, aquatic vegetation, and benthic macroinvertebrate sampling), should be prepared and provided for Township review well in advance of the transport of niobium tailings. • The Soils Management Plan (referenced in the September 2024 Townhall meeting) should be provided for Township review. • The Health and Safety Plan and radiation protection plan for the Project should be provided to the Township. • The MTO Dust Management Plan should also provided to the Township/public in advance of niobium transport, to ensure the public will be sufficiently protected.
The 2024 HHERA recommended baseline data be collected for surface water, groundwater, sediment, and soil additional locations around the TMA (upstream and downstream of drainage pathways) in advance of niobium tailings placement. It was unclear if the Ministry of Mines had collected sufficient baseline data as recommended by Ecometrix (besides the semi-annual monitoring conducted around the TMA), and if any additional baseline monitoring locations had been proposed (especially given the previously-identified deficiencies in the TMA groundwater monitoring network, including unknown well details and monitored lithologies and a lack of deep groundwater monitoring, as described in HESL (2024a)) (see Section 4.4).	• The Ministry of Mines should provide the plans for collecting baseline data for surface water, groundwater, sediment, and soils at the TMA (including the West Dam and Middle Dam) before niobium placement, including the locations, frequency, and duration of sampling, as recommended by Ecometrix (2024), to characterize baseline conditions and verify data used in the 2024 HHERA. • The following sampling should occur for baseline characterization, as recommended by Ecometrix (2024): collection of fish tissue samples, benthic macroinvertebrate community information, and aquatic vegetation in receivers (John Creek and Ministic Creek). All COCs should be analyzed for baseline characterization (per Ecometrix, 2024). Related sampling plans should be described/provided in advance of the niobium relocation. • To establish baseline for Township valued components in far-field locations, monitoring should be routinely conducted downstream of Ministic Creek (Spanish River) and Agnew Lake.

The Ministry of Mines indicated that post-construction monitoring would last at least 5 years, though the scope of long-term/closure monitoring was unclear. Storage of long-lived radionuclides underscores the need for monitoring beyond the 5-year period, as well as TMA cover monitoring as part of closure planning (see Section 4.5).	• The Ministry of Mines should provide a closure plan (or interim closure plan, if prepared) for the post-construction period, to clarify post-construction monitoring plans, cover maintenance activities and monitoring, and consider the long-term impacts of tailings storage. • Closure plans should include long-term monitoring of Township valued components in downstream Ministic Creek/Spanish River, and Agnew Lake.

Closing

We hope this review will provide constructive feedback to the Ministry of Mines and MTO, and will result in clarification and commitments/timelines for outstanding project details, to support public confidence in the project.

Sincerely,
per. Hutchinson Environmental Sciences Ltd.

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1. Introduction

Hutchinson Environmental Sciences Ltd. (HESL) was retained by the Township of Nairn and Hyman (the Township) to conduct a technical review of documents pertaining to the transport of niobium tailings from the Beaucage Mine site on the Manitou Islands in Lake Nipissing, to the receiving Agnew Lake Tailings Management Area (TMA). This technical review follows up on HESL's previous technical review of Agnew Lake TMA background information (HESL, 2024a), which highlighted environmental concerns with the TMA itself, including concerns with ongoing care and maintenance of the TMA cover, potential runoff and infiltration concerns that could pose a risk to surface water and groundwater, and insufficiencies in the TMA groundwater monitoring program and reporting. A complete conceptual flow path was identified between the TMA and sources of drinking water for the Township, indicating a possible concern for the Township (HESL, 2024b).

HESL requested additional information from the regulator (CNSC) and licensee (Ontario Ministry of Mines and Transportation) regarding environmental uncertainties and shortcomings, as well as additional information on previous risk assessments and closure planning conducted for the site, and the composition and radioactivity of the Beaucage Mines niobium tailings. The Township of Nairn and Hyman met with the Ministry of Mines and Transportation on April 15, 2025, and additional information for the Agnew Lake TMA and Beaucage Mine Site was provided.

The Niobium Rock Tailings Relocation Project (the Project) involves the transport of niobium rock tailings from the Beaucage Mine site for disposal at the Agnew Lake TMA. The niobium rock tailings are approximately 18,600 m^3, and will be deposited in layers at a designated area of the TMA, above existing uranium tailings, with material of highest radioactivity placed at greater depths. Priority 1 waste (>1 Bq/g radioactivity), followed by Priority 2 (<1 Bq/g) and Priority 3 (<detection limit) niobium waste will be placed in the TMA. Once the niobium tailings placement is complete, remediation and restoration of the tailings surface to natural conditions will occur, including the placement of 15 cm of topsoil (and subgrade material) and seeding. The tailings relocation was initially anticipated to start in July 2024, but was put on hold; the current timeline is unclear, but tailings placement may occur as early as summer 2025 (Ministry of Mines, 2024b). The construction phase is anticipated to last 4 months (Ecometrix, 2024).

The Township is particularly concerned about protecting its drinking water sources from the potential impacts of the Project, as well as existing risks from the Agnew Lake TMA. Drinking water for the Township of Nairn and Hyman is primarily provided by the Nairn Water Treatment Plant in the town of Nairn Centre, which sources surface water for drinking from the Spanish River (downstream of Ministic Creek and the TMA). Drinking water is also drawn from Agnew Lake for properties in Sand Bay Village, on the south shore of Agnew Lake (B. Ketchabaw, personal communication, November 26, 2024). Several domestic water-taking wells are located within Nairn Centre, as well as within the Spanish River watershed and at three properties along the south shore of Agnew Lake (https://www.ontario.ca/page/map-well-records, last accessed June 5, 2025).

2. Objectives and Scope of Review

HESL completed a technical review of the following documents related to the niobium tailings relocation and TMA:

- Ministry of Mines Transmittal Letters for the Township of Baldwin and the Township of Nairn and Hyman (April 15, 2025);
- Ecometrix (2024). Human Health and Ecological Risk Assessment and Conceptual Site Model Update for Agnew Lake Mine – Niobium Waste.
- Ministry of Mines (2024). Agnew Lake Water Quality Memorandum.
- Ministry of Energy and Mines (2025). Responses to September 11, 2024, Townhall Public Questions.
- Ecometrix (2015). Risk Assessment for Former Niobium Mill Waste Site, North Bay, Ontario.
- Ecometrix (2012). Risk Assessment for MTO Gravel Pit, Nipissing, ON – Problem Formulation Update.

Several additional documents related to the Ministry of Transportation's (MTO) North Bay gravel pit were included in the Ministry of Mines and MTO review packages, but were not reviewed in detail, as summaries of pertinent information from these documents were provided in the Ecometrix documents.

The technical was informed by the previous information requests, including identifying Beaucage Mines tailings composition and radioactivity (and associated risks), evaluating additional information on groundwater monitoring and TMA conditions, evaluating human health and ecological risks of the TMA site and Beaucage Mine materials (and niobium transport risks, if applicable), and any additional information on TMA closure planning. At this stage, the technical review was primarily conducted to evaluate the following questions:

- Have source terms for the Project been adequately defined for risk assessment?
- What human health or ecological risks have been identified from the placement of niobium tailings in the Agnew Lake TMA?
- Are risk management activities/recommended mitigation measures sufficient and appropriate for the site to protect human and ecological receptors, and components of value to the Township (e.g., drinking water, recreational resources)?
- How can the proposed future work for risk assessment and/or next steps for the TMA be modified to monitor and address Township concerns?

3. Review Findings

3.1 Transmittal Letters for the Township of Baldwin and the Township of Nairn and Hyman (April 15, 2025)

These letters from the Ministry of Mines provided brief summaries of the Ecometrix Human Health and Ecological Risk Assessment Report (HHERA) (2024), Annual Reports to CNSC (2021, 2022 and 2023), and the Surface Water Memo, which were included in an information package for the Township. The

Ministry of Mines emphasized that the HHERA found that there was negligible risk to humans and ecological receptors in the immediate radius of the TMA during the construction phase of the Project, and that expected radiation doses would be well below public dosing limits. Additional leachate tests were being conducted on the niobium waste tailings (in accordance with recommendations from the HHERA), and the Ministry committed to confirming drainage patterns around the TMA (although no timelines were provided for this work).

The Ministry acknowledged that there were areas of the TMA with “higher-than-typical” gamma radiation levels, but stated that niobium placement at the eastern side of the TMA (previously noted as an area of erosional concern) would address concerns. Further, the Ministry stated that engineers were currently working on plans to repair the cover at the southwest corner of the TMA and that 2024 inspections found the existing cover to be “firm, stable, and in good condition” (P. 2), despite observations in previous Agnew Lake Annual Reports that portions of the cover on the east and southwest side of the TMA needed repairing. Timelines for completing the repairs were not provided. The Ministry stressed that surface water sampling in Ministic Creek and John Creek did not indicate the presence of radioactive metals exceeding background levels, and that water quality returned to background levels outside the site boundary; however, no additional information on how background levels were defined was included. Concerns with surface water sample collection (e.g., sample QA/QC, inconsistent sampling) were highlighted in HESL’s previous review, which may call into question surface water sampling data in Ministic Creek and John Creek.

This letter provided some additional context for concerns raised in HESL’s previous review, which were investigated further through a technical review of the source documents.

3.2 Ecometrix (2024). Human Health and Ecological Risk Assessment and Conceptual Site Model Update for Agnew Lake Mine – Niobium Waste.

The 2024 HHERA evaluated human health and ecological risks associated with the placement of niobium tailings in the TMA, and to update the Conceptual Site Model (CSM) for the TMA, identifying potential pathways for human and ecological exposure to contaminants of concern in the niobium tailings. The HHERA was prepared to evaluate the risks of the niobium tailings placement, and did not evaluate the risk associated with the existing TMA tailings or the TMA itself.

The HHERA provided a thorough evaluation and summary of the niobium waste source terms (aqueous and atmospheric). All relevant radionuclides (lead, thorium, radium, polonium, and uranium species) were listed as contaminants of potential concern (COPCs) in niobium waste, as well as non-radionuclides including metals. Atmospheric source terms included dust inhalation (containing radionuclides) at the fence line of the TMA. Aqueous source terms included surface water flow from the TMA to the south (either towards the polishing pond or ponding southwest of the wetland outside of the East Barrier Dyke), and possible surface water overflow from the dyke (to the east).

Ecometrix recommended that drainage direction interpretations be verified on-site, to understand post-construction conditions and confirm potential pathways. Conservative assumptions were made in generating the CSM, including assuming full loadings of contaminants to the east and west via seepage and runoff. When 100% of groundwater loadings were predicted to report to the east, exceedances of the most conservative guidelines (Provincial Water Quality Guidelines and Canadian Environmental Quality Guidelines) occurred for arsenic, cadmium, selenium, and silver (at near-field locations – east wetland and

Middle Dam) were predicted to occur. However, this was due to using the elevated detection limit from the source Toxic Characteristic Leaching Procedure (TCLP) data for the niobium tailings (from WSP, 2020) – when the detection limit was lowered, only cadmium was retained as a COPC for surface waters at the east wetland/Middle Dam, which was still expected to be conservatively defined due to the elevated detection limit in the source data.

Some uncertainties were identified in source term characterization, as concentrations of COPCs in dust were likely overestimated due to carrying forward the maximum concentrations of some constituents in niobium waste to the COPC screening (rather than the mean concentration from the dataset). Further, some detection limits for constituents (i.e., cadmium and silver) were elevated in source datasets, which were carried forward as COPC concentrations, likely overestimating concentrations of cadmium and silver in niobium waste. The aqueous source term characterization relied on TCLP analysis from the MTO gravel pit to estimate leaching potential from niobium waste, however, the acid-generating potential of the niobium waste was considered low, and therefore leachate potential of niobium waste once placed in the TMA was likely overestimated. Ecometrix relied on previous radiological investigations (AMEC, 2008), contaminant investigation (MMM Group, 2015), and a soil delineation investigation at the former Beaucage mill site (WSP, 2018) to characterize the constituents of niobium waste.

Potential exposure to human and ecological receptors during the construction phase included dust generation (due to movement of niobium waste from the laydown area to the TMA) and exposure to surface radiation. Negligible risk was estimated, as public access to the TMA will be restricted during placement, and no additional mitigation measures were recommended. Potential exposure risks during the post-construction phase (i.e., 5 years following niobium tailings placement) are summarized in Table 1.

The HHERA concluded that there was negligible risk to human and ecological receptors from niobium tailings leachate generation during the post-construction phase. An evaluation of each potential exposure pathway and risk to receptors at the TMA is included in Tables 1 and 2, below.

Table 1. Human receptor exposure pathways to COPCs in tailings during the Relocation Project, and evaluated risk/relevance to the TMA site.

Human Receptor Exposure Pathway from Niobium Tailings at the Agnew Lake TMA	Risk
Exposure to dust (containing radionuclides).	Construction: The public cannot access the TMA due to fencing (and negligible risk was estimated for individuals outside the fence line), however, workers may be exposed to radionuclides in tailings dust during deposition. Ecometrix (2024) recommended a Health and Safety Plan and Radiation Protection Plan be prepared to mitigate risks to workers during construction (i.e., through use of appropriate PPE, administrative and engineering controls), and that appropriate dust control measures be implemented, per the MTO Dust Management Plan (not reviewed). Post-construction: Dust is not expected to be generated during post-construction, as the tailings will be capped.
Consumption of fish and game from nearby watercourses. Consumption of cadmium and radionuclide-impacted surface water.	Construction: Although Ecometrix did not identify surface water risks in the construction phase, it is possible that surface water impacts (i.e., from COPC-laden runoff) could occur if construction runoff is not properly managed. Specific ESC measures to be implemented at the TMA during tailings deposition are unclear. Post-construction: Impacts to shallow groundwater due to leaching from the TMA are a possible risk, which could migrate to fish-bearing watercourses where humans hunt/fish. Ecometrix (2024) identified cadmium and radionuclides as the primary COPCs in surface waters using conservative evaluations, which were recommended to be confirmed with updated leachability testing. Ecometrix estimated that there was a low likelihood of radiological impacts to ecological receptors caused by leachate from the TMA.
Exposure to surface radiation/groundshine.	Construction: The public cannot access the TMA due to fencing, and the only human receptors at the TMA during the construction phase are construction workers. Ecometrix (2024) recommended that a Health and Safety Plan and Radiation Protection Plan be prepared to protect workers during tailings deposition. Post-construction: There is a risk of exposure to surface radiation due to recreational use of the TMA, although niobium tailings will be placed in successive layers, with highest radioactivity placed at the greatest depths, reducing radiation levels near the surface. Cover material will also reduce radiation risk; Exposure to surface radiation is dependent on condition of the cover. As closure details have not been provided, the extent of long-term cover maintenance is unclear.

Table 2. Ecological receptor exposure pathways to COPCs in tailings during the Relocation Project, and evaluated risk/relevance to the TMA site.

Ecological Receptor Exposure Pathway from Niobium Tailings at the Agnew Lake TMA	Risk
Exposure to dust (containing radionuclides). Direct contact with tailings.	Construction: Although the TMA will be fenced during construction (and negligible risk was estimated outside the fence line), ecological receptors such as birds may be exposed to disturbed material (and radionuclide-containing dust) during construction. Ecometrix stated that dust may be deposited on aboveground vegetation, but would likely be limited due to dust suppression measures (per the MTO Dust Management Plan). Short-term inhalation of dust is also possible, but will likely be short-lived due to the short construction period (4 months). Post-construction: Ecometrix stated that direct contact was not expected during post-closure due to capping of the tailings.
Exposure to surface radiation/groundshine.	Construction: Ecological receptors may be exposed to radiation from the niobium tailings if they spend sufficient time in the disturbed area (i.e., birds, terrestrial invertebrates). Given the short construction phase (4 months), risk was considered negligible. Post-construction: Exposure to radiation is not expected due to the >15 cm cap over the niobium tailings. Exposure of mammals, terrestrial plants and invertebrates, birds, and reptiles to surface radiation following closure of the TMA is dependant on the condition of the cap. Burrowing animals may be exposed to greater radiation.
Leaching of radionuclides and non-radionuclides (particularly cadmium) from niobium waste to groundwater; Migration of impacted groundwater into east wetland and west creek surface waters. Direct exposure of aquatic biota to impacted surface water. Consumption of water and food from nearby watercourses by riparian wildlife.	Construction: Leaching of COPCs from tailings to shallow groundwater (and subsequent migration to watercourses) is not expected to occur during the construction phase. Impacts to surface water due to construction runoff is a possible risk to aquatic biota if proper ESC measures are not implemented. Post-construction: Ecometrix (2024) stated that the evaluated risk of cadmium exposure to aquatic biota (aquatic invertebrates, fish, zooplankton) in surface waters to the east was elevated, as the source TCLP data had an elevated detection limit for cadmium, and was likely not a concern. Updated leachability testing of the niobium waste, that is more representative of conditions at the TMA, was recommended to confirm the conclusions of the HHERA. Risks to riparian wildlife are also overly conservative, as it was assumed during risk assessment that 100% of their food source was from the east wetland.

There were several recommendations in the HHERA that required follow-up work, to address key uncertainties with its assumptions, including:

- Niobium waste and uranium tailings sample collection for neutral leach shake-flask tests, to replace the TCLP data (WSP, 2020) that was used as a source term for leachate potential from the niobium waste into nearby surface water receivers, and to refine the conceptual model;
- Additional water and sediment sampling along John Creek and Ministic Creek (upstream and downstream of the TMA drainage paths), to characterize baseline conditions prior to niobium placement and verify the surface water quality data used in the HHERA;
- Water and sediment sampling at the West Dam and Middle Dam of the TMA, to characterize baseline conditions and verify the surface water quality data used in the HHERA; and,
- Fish tissue chemistry data, aquatic vegetation and benthic community information for the 6 water quality monitoring locations, to characterize baseline conditions prior to niobium placement.

With the exception of the leachate testing and ongoing surface water monitoring of Ministic and John Creek under the CNSC annual reporting (although additional monitoring stations are needed to address HHERA uncertainties and confirm interpretations), it was unclear if the Ministry had committed to conducting the recommended follow-up work, and what timelines were proposed for completing the work.

Recommendations also included preparing a worker health and safety plan for the construction phase of the Project, and ensuring that the MTO conducts dustfall and surface water monitoring (per MTO's dust monitoring plan) and implements required mitigation measures associated with potential ecological interactions with niobium waste materials to protect nearby receivers. Ecometrix stated that the next steps for the risk assessment were to consider cumulative risks of the existing TMA conditions, and develop an environmental monitoring program, although the timeline for this additional work was unknown (i.e., timelines/commitments from the Ministry of Mines have not been provided).

It was not clear if construction-level monitoring plans had been developed for the Project (including monitoring locations, frequency, duration, etc.), to confirm that risk remains negligible during the construction phase (i.e., metals concentrations in dustfall remain below air quality criteria at the fence line, surface water/runoff impacts are monitored and mitigated during construction activities). Construction and post-construction monitoring plans should be provided to interested third parties, to confirm that they are sufficient to detect effects, and reassure the public that the TMA is performing as expected after niobium tailings placement is complete.

An evaluation of the key objectives/questions of the review for the Township are summarized in Table 3, below.

Table 3. Evaluation of Ecometrix (2024) Human Health and Ecological Risk Assessment, in light of key technical review questions.

Evaluation Question	Review Comment
Have source terms for the niobium tailings placement in the Agnew Lake TMA been adequately defined?	The source terms for the niobium placement appeared to be thoroughly, reasonably, and conservatively defined in the Ecometrix (2024) HHERA within the limitations of the available data. Radiological and non-radiological (i.e., metals) COPCs were screened from source databases, and quantitative evaluation of each COPC for each potential exposure pathway was conducted. Conceptual pathways (atmospheric and aqueous) and human/ecological receptors were defined and substantiated for the construction and post-construction period.
What are the human health and ecological risks of the transport and placement of niobium tailings in the Agnew Lake TMA?	Construction phase human health and ecological risks include: • Exposure to dust (containing radionuclides) during tailings placement. Post-construction phase (i.e., 5 years following niobium tailings placement) human health risks include: • Exposure due to hunting and fishing in nearby watercourses (i.e., consumption of fish/game); • Consumption of cadmium and radionuclide-impacted surface water, • Exposure to surface radiation due to recreational use of the TMA. Ecological risks during the post-construction phase include: • Leaching of radionuclides and non-radionuclides (particularly cadmium) from niobium waste to groundwater (and migration into east wetland and east and west creek surface waters); • Direct exposure of aquatic biota to impacted surface water; and, • Consumption of water and food from nearby watercourses by riparian wildlife. Ecometrix reported that negligible risk to human health and ecological receptors was associated with the construction and post-construction phases, based on the data used in the HHERA. The conceptual pathways and potential human and ecological receptors for niobium tailings impacts were conservatively defined, and evaluations of risk for each pathway were thorough and relied upon the best available evidence, while explicitly stating uncertainties in model formulation (see below).
What activities have been recommended for risk management of the site?	Additional work to confirm the assumptions and source data used for evaluating risks was recommended, including leach potential testing, additional surface water sampling (upstream and downstream of TMA drainage pathways, and at the West Dam and Middle Dam), and additional aquatic monitoring (fish tissue

Are risk management activities appropriate and sufficient for protecting human and ecological receptors of importance to the Township?	chemistry, aquatic vegetation, and benthic macroinvertebrate sampling at the 6 monitoring locations, to confirm baseline conditions. Actual mitigative measures for risk management were not reported in the 2024 HHERA, as risks are reported to be negligible for human health and ecological receptors. Mitigative measures should be recommended after the cumulative HHERA for the Agnew Lake site is completed. The next steps proposed by Ecometrix are appropriate given the limitations of the dataset used to perform the risk assessment. Additional work to confirm the assumptions and datasets used for the risk assessment (as recommended by Ecometrix) should be conducted, and updated data should be incorporated in to the next iteration of the risk assessment (i.e., the cumulative risk assessment).
What recommendations have been provided for future work? How can recommendations be modified/built upon to better address and monitor Township concerns?	In addition to the recommendations Ecometrix provided (above) to confirm assumptions and refine the conceptual site model, Ecometrix stated that next steps included considering the cumulative risks of existing Agnew Lake TMA, and developing a monitoring plan to monitor cumulative effects of niobium tailings and existing uranium tailings. It is unknown when this work would be conducted – the cumulative risks of niobium and uranium tailings should be established in advance of the niobium transport project, to determine appropriate mitigative measures for the placement of niobium waste (if any), and establish future monitoring requirements. Monitoring of Township valued components (i.e., waster quality in downstream Ministic Creek/Spanish River, and Agnew Lake) should be described in the cumulative effects monitoring plan and implemented. In addition to developing a post-construction monitoring plan for cumulative effects, a construction-phase monitoring plan (i.e., Special Effects Study, or similar) should be developed in advance of the Project, to monitor impacts to surface water and groundwater (if any). The Township (and other interested third parties) should be provided with MTO's dustfall monitoring at the TMA and at the fence line, to ease public concerns with the project, and provide regular updates on the results of construction (and post-construction) monitoring to demonstrate that impacts are appropriately monitored and mitigated.

3.3 Ecometrix (2015). Risk Assessment for Former Niobium Mill Waste Site, North Bay, Ontario.

Ecometrix conducted a HHERA in 2015 for the gravel pit in North Bay, Ontario, where niobium tailings from the former niobium ore crushing mill were disposed of. Summaries of past investigations used to inform the risk assessment (Ontario Ministry of Labour, 1994; Genivar, 2011 and 2012) were provided in the report, and source material was not reviewed in detail. Although the outcomes of the 2015 HHERA are not directly comparable to the Agnew Lake site and are site-specific to the gravel pit site, the characterization of the COPCs in niobium tailings, and identified risks of the tailings to receptors serves as an analog to how the tailings may interact with the environment surrounding the TMA following deposition.

The MTO gravel pit contained approximately 11,200 tonnes of niobium tailings, which were disposed on the site from the former niobium ore crushing and treatment mill. Ecometrix conducted a primary and secondary review of COPC concentrations from previous environmental monitoring at the North Bay gravel pit site, and identified several metals and radionuclide COPCs in soil, and uranium in groundwater (human exposure risk). Ecometrix recommended several mitigation measures to prevent exposure of human and ecological receptors to COCs at the gravel pit, primarily using a soil cover to mitigate surface radiation, soil contact, and radon gas exposure, and restricting groundwater use. Human and ecological exposure pathways requiring risk management at the gravel pit site are summarized in Tables 4 and 5.

The 2015 HHERA for the MTO gravel pit was useful for evaluating how the niobium tailings have previously interacted with the environment, and what risks could exist at the Agnew Lake TMA following niobium tailings deposition. Human health and ecological risks of radiological COCs (from groundshine, soil ingestion, and radon exposure) at the gravel pit are valid risks for the Agnew Lake TMA, however, these risks will be mitigated through cover placement and fencing of the TMA. Human and ecological risks from exposure to metals in soils through direct exposure or incidental ingestion are unlikely to occur at Agnew Lake TMA (particularly during post-closure), as niobium tailings will be covered following the construction phase. Indoor radon gas exposure due to radioactive decay was identified as a potential human exposure pathway at the gravel pit; however, no buildings exist in proximity to the Agnew Lake TMA (nor will any future buildings be constructed), and is not a concern. Concerns with radon gas exposure to burrowing mammals as radionuclides decay could also be a potential concern at the Agnew Lake TMA following tailings deposition, which did not appear to be evaluated in the 2024 HHERA. The cover composition at the Agnew Lake TMA is 15 cm of subgrade material and topsoil, where burrowing animals may occur. An evaluation of each exposure pathway's relevance to the Agnew Lake TMA is provided in Tables 4 and 5, below.

Table 4. Human receptor exposure pathways identified at the MTO gravel pit (Ecometrix, 2015), and evaluation of potential risk to the Agnew Lake TMA.

Human Receptor Exposure Pathway at MTO Gravel Pit	Relevance to Agnew Lake TMA
Groundshine (radiation exposure, primarily from Ra-226) Ingestion of impacted soil, direct contact with impacted soil (radiological COCs Ra-226, Pb-210, Po-210, Ra-228, and Th-228; and vanadium)	Construction: The public cannot access the site due to fencing, although workers conducting the niobium tailings placement are a possible receptor. Ecometrix (2024) noted that a worker health and safety plan would be prepared for the construction phase, which would limit exposure of workers to radiation through engineering controls and personal protective equipment. Post-construction: Niobium tailings containing radionuclides will be placed in the TMA in successive layers, with highest radioactivity placed at the greatest depths, reducing radiation levels near the ground surface: Priority 1 niobium waste (>1 Bq/g) will be placed at the greatest depth, followed by Priority 2 waste (<1 Bq/g) and Priority 3 waste (<detection limit), followed by a 15 cm cover of subgrade material and topsoil. It is possible that recreational public use may occur at the TMA post-construction. The TMA is currently fenced; it is unlikely that any human receptor would spend a significant amount of time on the TMA. Therefore, radiation exposure or direct contact with COCs in soil following placement of the cover is unlikely, as long as the cover is properly monitored and maintained.
Ingestion of uranium in shallow groundwater	Uranium exists in groundwater at the TMA (uranium exceedances observed in Middle Dam groundwater; Ministry of Mines, 2024), and placement of niobium tailings (containing uranium) may exacerbate existing uranium concerns. Leaching constituents from the TMA tailings into shallow groundwater (and subsequent transport via drainage into watercourses) was highlighted as a potential exposure pathway in the Ecometrix (2024) HHERA – however, the observations regarding groundwater made in the 2015 MTO gravel pit HHERA are site-specific and cannot be considered comparable to the Agnew Lake TMA. Should groundwater impacts occur, impacts to surface water would be a more likely exposure pathway for human receptors (given that there are no water-taking wells in the TMA vicinity).
Inhalation of radon gas in indoor and confined spaces (e.g., excavations, tunnels).	Construction: No buildings exist on the TMA or in its immediate vicinity. Excavations or tunnels will not occur on the TMA. Human exposure risk is unlikely. Post-construction: It is unlikely that any buildings will be constructed on the Agnew Lake TMA in the future.

Table 5. Ecological receptor exposure pathways identified at the MTO gravel pit, and evaluation of potential risk to the Agnew Lake TMA.

Ecological Receptor Exposure Pathway at MTO Gravel Pit	Relevance to Agnew Lake TMA
Groundshine (radiation exposure) Direct exposure to metals in impacted soils for plants, soil organisms, mammals, and birds	Construction: Particularly during placement of Priority 1 material (radioactivity >1 Bq/g), birds, soil organisms, and small mammals that cannot be contained by TMA fencing may be exposed to radioactivity and non-radiological COCs (metals) while niobium tailings are uncovered. Post-construction: It is unlikely that ecological receptors would be exposed to radioactivity or non-radiological COCs following cover placement, unless the TMA cover is not properly maintained.
Direct exposure to radionuclides (primarily Ra-226) in impacted soils for soil organisms	Construction: During niobium tailings placement, soil organisms may co-occur with the tailings while they are exposed; therefore, exposure of soil organisms to radioactivity during the construction phase could occur. Post-construction: After the TMA cover is placed, soil organisms such as earthworms will likely inhabit the topsoil portion of the cover. The subgrade material beneath the topsoil may provide some shielding from radioactivity of the tailings; therefore, radiological risks to soil organisms are likely limited.
Inhalation of radon for burrowing mammals.	Construction: Burrowing mammals may be exposed to radon gas (if any) while niobium tailings are uncovered; therefore, radon inhalation may present a risk during the construction phase. However, radon was not considered a source or significant pathway for burrowing mammals/plants in the 2024 HHERA, or information may have been insufficient for evaluation. Radon risks to outdoor/burrow air should be further evaluated in the cumulative risk assessment. Post-construction: After the TMA cover is placed, the subgrade material may be a suitable barrier between the tailings and burrowing mammals; therefore, radon gas exposure for burrowing mammals is likely not a concern.

3.4 Ecometrix (2012). Risk Assessment for MTO Gravel Pit, Nipissing, ON – Problem Formulation Update.

Ecometrix also prepared a Risk Assessment for the MTO gravel pit in North Bay, Ontario in 2012. In the 2024 HHERA, the 2012 (and 2015) Risk Assessment was used as a line of evidence to evaluate the leaching potential of the niobium waste, and potential risks to receptors around the gravel pit, which could serve as an analog for potential impacts to receptors at the Agnew Lake TMA. However, the 2015 HHERA was more comprehensive, covered all COCs identified in the 2012 ERA, and recommended specific mitigation measures for exposure pathways. No further review or evaluation of the 2012 ERA is necessary.

3.5 Ministry of Mines (2024). Agnew Lake Water Quality Memorandum.

The Ministry of Mines water quality memo was an internal memo providing information on the water quality surrounding the Agnew Lake mine. The Ministry provided some additional context for previously identified uncertainties in their monitoring program, including that drainage from the east and west sides of the TMA is limited, and therefore difficult to sample due to insufficient volume (explaining increased sediment content in samples, as observed in the 2023 annual report). The Ministry stated that "*while it may appear distressing that elements of concern such as uranium and radium are present and above PWQO at the west and middle dam, it is not cause for concern…wetlands are a standard rehabilitation technique to reduce flow rates, and polish outflow acting as a natural filter*", and asserts that the TMA site has no effect on Agnew Lake water chemistry, as downstream water quality is attributed to background metal concentrations.

Significant gaps are present in the monitoring program (i.e., the groundwater monitoring network) and remain unaddressed. Near-field exceedances of uranium and radium are occurring in limited volumes of drainage, additional targeted surface water monitoring downstream of near-field locations and in nearby groundwater wells should be completed to confirm that exceedances from impacted drainage are isolated to the near-field environment.

The Ministry of Mines recommended continuing the existing monitoring program (i.e., 2 monitoring events/year), for the duration of the construction work at the TMA, and at least 5 years post-construction. The existing monitoring program lacks sufficient resolution to detect effects from the 4-month construction period, and should be modified to reflect construction risks (including more targeted monitoring locations, monitored at increased frequency). As recommended in the 2024 HHERA, a more robust background water quality dataset is also needed in advance of the construction phase.

While engineered wetlands can provide attenuation of certain COPCs, specific design is required for treatment of radionuclides; natural wetlands often do not provide substantial radionuclide reduction, and should not be considered as a mitigation measure without proper evaluation and verification testing.

3.6 Ministry of Energy and Mines (2025). Responses to September 11, 2024, Townhall Public Questions.

The document provided the Ministry of Mines' answers to several questions from the public townhall meeting on September 11, 2024, which provided some new information on the Project, which has been evaluated in Table 4, below.

Table 6. Evaluation of information from the Ministry of Mines (2025) Townhall Public Questions and resulting information requests.

Townhall Public Questions - Findings	Review Comment
Ministry of Mines stated that "*any work on the cover of the TMA* [including the niobium transport project] *requires a Health and Safety Plan and Radiation Protection Plan*." It was unclear if these plans had been prepared and were available for third party/public review. Ecometrix (2024) previously stated that a Health and Safety Plan was recommended for the protection of human receptors (i.e., workers) during the construction phase of the project.	The Ministry of Mines should provide a copy of the Health and Safety Plan and radiation protection plan to the Township, for their review. The Health and Safety Plan and radiation protection plan should include information on safe practices for excavating, hauling, and placing the niobium tailings in the TMA, to ensure that proper measures have been included to protect human and ecological receptors from exposure to radiation.
The document states that "the Ministry of Mines has confirmed that surface water quality returns to acceptable conditions reflective of background conditions outside of the licence boundary. There is no evidence that the ALTMA negatively affects water chemistry and quality in Agnew Lake or the surface water in the immediate surrounding areas including John and Ministic Creek" (Question 4, P. 4). Ministry of Mines previously asserted that there was no evidence of adverse effects on surface water quality in their transmittal letters to the Townships. It is unclear how Mines defined background conditions, or what monitoring data and stations were used. In Agnew Lake annual reporting, one station is located upstream in Ministic Creek (AL-110), where discrepancies between duplicate samples were previously noted (Ministry of Mines, 2024a). It was unclear if Mines used this single reference station to define background conditions (nor whether the dataset used was sufficient for defining background), or if a regional dataset was also used.	The Ministry of Mines should provide additional information to support their claim that surface water quality in John and Ministic Creek is reflective of background conditions. The Ministry of Mines should clarify what station(s) and datasets were used to establish background conditions, and the time period covered by the data.

The Ministry of Mines asserts that post-construction monitoring (following niobium placement) will occur for a minimum of 5 years. The extent of post-closure monitoring (beyond the existing annual reporting requirement of 2 sampling events per year) was not known, and it was unclear if a closure plan had been prepared for the Agnew Lake site. Given that radioactive decay of the radionuclides contained in the niobium tailings (and existing uranium tailings) will give rise to daughter materials (i.e., radon-222 for Ra-226), monitoring beyond the post-construction period (5 years) is pertinent. It was unclear if the Ministry of Mines would continue semi-annual monitoring beyond the post-construction period, or whether a closure monitoring plan had been developed.	The Ministry of Mines should clarify whether a closure plan has been prepared for the Agnew Lake site.
Regarding niobium tailings placement, the Ministry of Mines stated that "The maximum fill thickness will be less than 1.5 m and slope down to 0.3 m near the edge, where it will tie-in to the existing cover…Before placing material on the existing cover and tailings, a biaxial composite geogrid and layer of Granular A material will be placed," to protect the cover from any disturbance during construction (Question 18 and 19, P. 10). A Soils Management Plan is also mentioned, which "contains provisions for material containment and protection against erosion and transport by water." (P. 13). It is understood that niobium tailings placement is expected to occur near the East Barrier Dyke, where erosional concerns have been previously noted due to surface water flow over the dam, and were intended for repair during niobium placement. However, since construction-level plans have not been provided/reviewed, it is unclear if niobium tailings may be placed in other areas. Further, maintenance concerns with the TMA cover have been a persistent concern over the years – the erosion noted at the East Barrier Dyke was first observed in 2020, and although it was not observed to worsen over the years, additional erosional concerns at the southwest corner of the TMA (near the West Dam) also remained unaddressed (to be addressed as part of a separate project; details unknown). It is expected that the Soil Management Plan may contain erosion and sediment control measures to prevent erosion of the cover in the future.	The Ministry of Mines should provide construction-level plans for the niobium relocation project, to clarify the exact locations where niobium tailings will be placed, and confirm timelines, methods, and erosion and sediment control measures. The Soils Management Plan should also be provided for Township and public review, to better understand the proposed erosion and sediment control measures. Mines should also clarify how maintenance response times will be improved once the new TMA cover is placed. Maintenance plans for the new TMA cover should also be provided (i.e., in closure planning), to ensure that future cover concerns are promptly identified and repaired.

4. Summary of Key Review Findings and Information Requests

The risk assessment for the Project identified negligible risk to human and ecological receptors outside the TMA during construction, via dust and water exposure pathways. While post-construction risks were also deemed negligible, they remain uncertain due to the lack of a cumulative risk assessment from existing uranium and incoming niobium tailings. Additionally, the 2024 HHERA did not include specific mitigation measures, and the timeline for completing the cumulative HHERA for the TMA remains unclear.

Key information requests to be presented to the Ministry of Mines and Ministry of Transportation, to clarify uncertainties and next steps, are provided in the sections below.

4.1 Cumulative Effects Risk Assessment

Recommendation:

The Ministry of Mines should provide a timeline for completing the cumulative effects risk assessment. The assessment should be completed in advance of the transport and placement of niobium tailings, so that the combined (long-term) risk of niobium and uranium tailings can be fully understood and planned for/mitigated.

Rationale:

Ecometrix stated that as part of next steps for Agnew Lake TMA and Niobium Transport Project, a risk assessment for cumulative effects of niobium tailings and existing uranium tailings would be prepared. The timeline for the completion of this next phase of the HHERA was unknown. The long-term impacts of the Project cannot therefore, be evaluated or mitigated (if necessary)

Long-term, there is potential for COPCs from tailings to leach into shallow groundwater (as this is an established exposure pathway in the 2024 HHERA; conservatively evaluated to be of limited risk); therefore, cumulative risks of niobium and uranium tailings are a particular concern for groundwater (and subsequent drainage to watercourses). Uranium exceedances were previously documented in shallow groundwater near the TMA (e.g., MW103, upgradient of the Middle Dam), and groundwater monitoring was observed to be limited in the vicinity of the TMA (i.e., no deeper monitoring wells, limited understanding of hydrogeology of the site, etc.), as documented in the Agnew Lake CNSC Annual Reports (Ministry of Mines, 2024a). If the uranium exceedance in Middle Dam groundwater can be attributed to the TMA (and not background conditions), it is possible that combined impacts of niobium tailings and existing uranium tailings could pose a greater risk than estimated in the 2024 HHERA.

4.2 Confirming Assumptions in 2024 HHERA

Recommendation:

The Ministry of Mines should conduct the work recommended in the 2024 HHERA clarify uncertainties, including leach testing and confirming drainage directions at/around the TMA. Although Ministry of Mines

has committed to conducting this work, it was unclear when this information would be available, and if it would be incorporated into the Cumulative Effects Risk Assessment. The information should be provided to the Township when available, and any changes to the results of the risk assessment in light of new information should be disclosed to the Township. Further, the Ministry of Mines should clarify why the radon gas exposure pathway to burrowing mammals was not included in the 2024 HHERA, or if this pathway would be further investigated in the Cumulative Effects Risk Assessment.

Rationale:

Recommendations for additional work were provided by Ecometrix in the 2024 HHERA, to confirm assumptions and dataset limitations, including updating TCLP data (per WSP, 2020) used for estimating leaching potential of the niobium tailings into groundwater and water bodies (which Ministry of Mines is currently conducting), confirming drainage pathways at the TMA, and collecting baseline data. This information will inform the Cumulative Risk Assessment and may change the outcomes of the 2024 HHERA, although it is understood that risk was evaluated conservatively and significant differences are not expected from differences in leachability of niobium waste. However, confirming drainage pathways at the TMA may change the understanding of contaminant migration pathways and potential receptors, which could change exposure scenarios in the HHERA.

The outdoor radon gas exposure pathway for burrowing mammals (i.e., in burrows and tunnels) was identified in the 2015 HHERA for the MTO gravel pit; this pathway was not discussed in the 2024 HHERA, and it was assumed that insufficient information existed to evaluate this pathway at this stage. The Ministry of Mines should clarify why radon gas exposure was not considered in the HHERA for the Agnew Lake site, and provide information on how this pathway will be evaluated in the Cumulative Risk Assessment.

4.3 Construction Monitoring

Recommendation:

The Ministry of Mines should provide construction workplans for the Niobium Relocation Project, to clarify the exact locations where niobium tailings will be placed, and confirm timelines, methods, erosion and sediment control measures, and niobium transportation safety risks. A construction monitoring plan should be provided for effects monitoring (including fish tissue, aquatic vegetation, and benthic macroinvertebrate sampling). The plan should be provided well in advance of the transport of niobium tailings.

The Ministry of Mines should provide the Township and other interested parties with the Soils Management Plan (referenced in the September 2024 Townhall meeting), as well as the Health and Safety Plan and radiation protection plan prepared for the Niobium Relocation Project to the Township. The MTO Dust Management Plan should be made available to the public in advance of niobium transport to ensure they are sufficiently protective of the public.

Rationale:

The niobium tailings placement will occur near the East Barrier Dyke, however, exact placement location(s) are unknown. Although the placement strategy for niobium tailings is understood (i.e., Priority 1 materials with higher radioactivity will be placed deepest on the TMA, followed by less radioactive materials),

methods, timelines, and mitigative measures to prevent erosion and direct exposure of tailings to receptors (i.e., human workers, birds, small mammals, etc) are unknown. Protocols for the transportation of tailings, laydown areas at the site where tailings may be temporarily stored, and management of drainage while tailings are exposed (i.e., through temporary covering) are not well known, and should be provided in a detailed construction plan, for ease of public review. This was previously recommended (HESL, 2024).

Monitoring details during the construction phase of the Niobium Relocation Project (besides the routine semi-annual monitoring) have not been proposed, and construction-phase monitoring plans/details have not been provided. The existing monitoring program conducted for the CNSC annual reporting will remain in effect during the construction phase, and it does not appear that any changes to the monitoring locations or frequency have been proposed. The existing monitoring program is not sufficient to detect potential effects during the construction phase (i.e., niobium placement activities), given that the construction phase is expected to last ~4 months. A Special Effects monitoring program should be prepared, including more frequent surface water monitoring during the construction phase, to ensure that any potential effects are detected and mitigated immediately, taking into account drainage pathways from the niobium tailings placement area. Additional erosion and sediment control measures should be implemented during the construction phase, which should be summarized in the monitoring plan (especially given that erosional concerns are an existing issue with the TMA cover). Details on erosion and sediment control measures may be included in the Soils Management Plan, which is not publicly available.

Dust generation was noted to be the main exposure pathway for receptors during tailings placement in the 2024 HHERA, which would be mitigated by restricting public access and implementing dust control measures from the MTO Dust Management Plan. The plan should be reviewed in advance of tailings placement, to ensure that it is sufficiently protective of the public. Health and Safety Plans and radiation protection plans were noted to have previously been prepared by the Ministry of Mines, and should be provided to the Township, to ensure that proposed measures are sufficiently protective of receptors, and include engineering controls and appropriate personal protective equipment to protect workers from niobium tailings, as recommended by Ecometrix (2024).

4.4 Baseline Data Collection

Recommendation:

The Ministry of Mines should provide plans for collecting baseline data for surface water, groundwater, sediment, and soil at the TMA (including the West Dam and Middle Dam) before niobium placement, including the locations, frequency, and duration of sampling, as recommended by Ecometrix (2024), to characterize baseline and verify the data used in the 2024 HHERA. Collection of fish tissue samples, benthic macroinvertebrate community information, and aquatic vegetation in receivers (John Creek and Ministic Creek) and analysis for all COPCs (radiological and non-radiological) should also occur for baseline characterization, as recommended by Ecometrix (2024), and associated sampling plans should be described/provided in advance of the niobium transport project. Any upgrades/modifications to monitoring networks (i.e., details regarding any additional groundwater monitoring wells) to facilitate the collection of baseline data should be described.

To establish baseline for Township valued components (i.e., far-field locations), monitoring should be routinely conducted downstream of Ministic Creek (Spanish River) and Agnew Lake.

Rationale:

Ecometrix (2024) recommended that baseline data be collected for surface water, groundwater, sediment, and soil additional locations around the TMA (upstream and downstream of drainage pathways) in advance of niobium tailings placement. It was unclear if the Ministry of Mines had collected sufficient baseline data (including seasonal data), and if any additional surface water/groundwater monitoring locations had been proposed for baseline data collection. Given that deficiencies have been previously identified in the groundwater monitoring network at the Agnew Lake TMA (i.e., limited details regarding existing wells, target lithologies, and lack of deep groundwater monitoring wells), it was unclear if the existing groundwater monitoring network was sufficient for establishing baseline data for shallow and deep groundwater, and any plans to install new wells were unknown.

4.5 Closure Planning

Recommendation:

The Ministry of Mines should provide a closure plan (or interim closure plan, if prepared) for the post-construction period, to clarify post-construction monitoring plans, cover maintenance activities and monitoring, and consider the long-term impacts of tailings storage. Closure plans should include long-term monitoring of Township valued components at monitoring stations in downstream Ministic Creek/Spanish River, and Agnew Lake.

Rationale:

The Ministry of Mines stated that post-construction monitoring would occur for at least 5 years following the niobium tailings placement, and it was unclear the extent of monitoring that would occur. In the post-construction phase, the main exposure pathway was leaching of COPCs from the TMA into shallow groundwater, impacting watercourses and aquatic receptors (although Ecometrix stated that this pathway was of negligible risk based on the best available information, using conservative estimates). However, the cumulative effects of niobium and uranium tailings are not yet understood, and as many radionuclides in the niobium tailings are long-lived (i.e., Ra-226, which has a half-life of 1600 years, and forms radon gas during its decay), long-term/closure monitoring is particularly pertinent to monitoring the long-term radioactivity of the site, and radionuclide concentrations in groundwater. Long-term monitoring and maintenance of the TMA cover is essential to protect the environment from radiation and direct contact of tailings with receptors – cover condition monitoring and maintenance plans should be included in closure planning.

5. Closing

Thank you for the opportunity to conduct this technical review! If you have any questions or concerns, please contact Emily Ham or David Leeder.

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