Memo

To: Nunavut Impact Review Board
From: Agnico Eagle Mines Limited
Date: May 23, 2023
Subject: Additional Information – In-pit Deposition - Meliadine Extension Proposal

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In response to the Nunavut Impact Review Board's (NIRB) request in the Pre-hearing Conference Decision on the Meliadine Extension Proposal (Decision Report[1]), Agnico Eagle Mines Limited (Agnico Eagle) was requested to provide additional information to the NIRB by May 23, 2023 to allow the NIRB and parties to meaningfully conduct the assessment of the Meliadine Extension Proposal. The following additional information is provided specific to the request made by the NIRB regarding in-pit deposition:

> *Summary of discussions between Agnico Eagle and parties, key studies, required updated modelling, and any information needed to understand potential impacts regarding the alternative for in-pit waste rock and tailings deposition*

1 INTRODUCTION

Agnico Eagle has made significant progress to advance the understanding of in-pit deposition and has provided multiple supplemental analyses to parties since the Technical Meeting in November 2022. Government of Canada (i.e., CIRNAC, Environment and Climate Change Canada [ECCC], and Natural Resources Canada [NRCan]) has acknowledged support of the conclusions presented that deposition of tailings and waste rock in mined-out pits is unlikely to result in significant adverse impacts, if appropriate analyses are completed prior to deposition and appropriate controls are implemented. The KivIA will defer to CIRNAC's recommendation on in-pit deposition. The responsible departments and technical experts have made the following statements and conclusions:

- CIRNAC has considered in-pit deposition technical comments resolved for purposes of an environmental assessment, providing terms and conditions are developed and included in the Project Certificate and/or Water Licence;
- NRCan has considered all in-pit deposition technical comments resolved;
- ECCC has considered all in-pit deposition technical comments resolved; and
- KivIA will defer to CIRNAC's recommendation/resolution to the unresolved technical comments related to in-pit deposition.

Based on these conclusions, Agnico Eagle maintains its position that sufficient information has been provided as evidence for purposes of NIRB 's review.

[1] Nunavut Impact Review Board. NIRB File No. 11MN034 – Update to the Nunavut Impact Review Board's Pre-Hearing Conference Decision Agnico Eagle Mines Limited's "Meliadine Extension" Project Proposal. Dated April 3, 2023.

2 BACKGROUND

In response to technical comments received from intervenors on the in-pit deposition alternative, Agnico Eagle submitted a technical document (Commitment 42) summarizing the effects assessment of this alternative. Agnico Eagle provided Commitment 42 to the interveners and the NIRB on December 16, 2022. Agnico Eagle submitted as part of the Commitment 42 package the following documents:

- Meliadine Extension FEIS Addendum – Environmental Assessment of In-pit Deposition Alternative (Agnico Eagle 2022)
- Meliadine Extension In-pit tailings Thermal and Groundwater Analysis report (Lorax 2022a)
- Meliadine Extension Water Balance and Water Quality Model report (Lorax 2022b)

On January 16, 2023, CIRNAC issued a letter to Agnico Eagle outlining topics of interest resulting from their review of Commitment 42 plus the request for an in-person workshop. The objective of the workshop was to discuss topics of interest that were documented in the "2023-01-16_IANU_CIRNAC Memo to Agnico Eagle – Meliadine Extension Commitment #42". An in-person workshop was proposed by Agnico Eagle on January 18, 2023 and held on February 6, 2023, with CIRNAC, ECCC, NRCan, KivIA, and the NWB. Following this workshop, Agnico Eagle provided the following documents:

- Final meeting notes from the February 6, 2023 meeting which includes the status and resolution of CIRNAC's topic of interest (Appendix G-1 of this memorandum; Agnico Eagle 2023a)
- The WBWQM backfill sensitivity (Appendix G-2 of this memorandum; Lorax 2023)
- The comparison of Meliadine and Meadowbank slurry tailings properties memo (Appendix G-3 of this memorandum; Agnico Eagle 2023b)

On March 1, 2023 the NIRB sent to Agnico Eagle comments by CIRNAC, ECCC, NRCan, and KivIA on the Commitments Lists and supplemental information provided by Agnico Eagle related to the in-pit deposition alternative. The comments received are summarized below:

- CIRNAC acknowledged that the information provided by Agnico Eagle during the February 6, 2023, workshop and the additional documents have provided more clarity on the in-pit deposition alternative but needed to continue their review of the amendment.
- ECCC considered all TRCs related to in-pit deposition resolved based on the information provided by Agnico Eagle during the February 6, 2023 meeting and the additional documents provided following this meeting.
- NRCan provided a review of the information provided by Agnico Eagle and made some additional recommendations.
- KivIA provided comments and recommendations that were either already provided through the Meliadine Extension application and/or addressed by the December 16, 2022 package.

Following these comments, Agnico Eagle reached out to each party to clarify the remaining comments and worked together towards a resolution. The following sub-sections explain the meetings and the outcome.

2.1 CIRNAC

On March 3, 2023, Agnico Eagle organized a meeting with CIRNAC to review their comments on the NIRB Commitments list. Following this meeting, CIRNAC provided by e-mail the resolution status of several TRCs including the one related to in-pit deposition. CIRNAC then provided the NIRB a letter on March 15, 2023 with an update of the status of all TRCs. In this letter CIRNAC stated that they considered the TRC related to the in-pit deposition alternative to be moving towards resolution, provided that appropriate terms and conditions are developed. This letter was sent to Agnico Eagle by the NIRB on April 12, 2023.

Based on productive discussions between Agnico Eagle and CIRNAC, an appropriate term and condition has been agreed on between the two parties, and was provided for the NIRB's consideration under a separate cover as part of Agnico Eagle's May 23 package of Additional Information Requested by the NIRB.

2.2 NRCAN

On March 9, 2023, Agnico Eagle organized a meeting with NRCan to review their comments on the NIRB Commitments list. During this meeting, it was agreed to update the in-pit deposition model using the current 3D Hydrogeology model (presented for the base case). This model would respond to several concerns raised by NRCan.

On March 31, 2023, Agnico Eagle provided NRCan the 3D Hydrogeological model for the in-pit deposition alternative (Appendix G-4 of this memorandum; WSP 2023). On April 14, NRCan requested additional information which was provided by Agnico Eagle on April 24. NRCan stated that they were satisfied with the provided information and that the technical memorandum provided the groundwater flow information (groundwater seepage flows and flow pathways) that was discussed in the meeting between NRCan and Agnico Eagle.

On May 8, 2023, Agnico Eagle acknowledged NRCan comments and recommendations and provided the final 3D Hydrogeological model for the in-pit deposition alternative to NRCan which included the information provided on April 24, 2023.

Agnico Eagle considers all comments and recommendations from NRCan resolved.

2.3 KIVIA

On March 9, 2023, Agnico Eagle organized a virtual meeting with the KivIA to discuss their comments on the in-pit deposition alternative. The discussion was related to the in-pit deposition of tailings and waste rock. Agnico Eagle proposed to host another in-person meeting to discuss further.

On April 6, 2023, Agnico Eagle organized a meeting with the KivIA in Ottawa to discuss their comments on the in-pit deposition alternative. KivIA requested additional time to review the documents provided by Agnico Eagle.

On May 2, 2023, the KivIA communicated to Agnico Eagle that they will defer to CIRNAC's recommendations on the Meliadine Extension file for the in-pit deposition alternative. Therefore, Agnico Eagle considers all comments and recommendations from KivIA related to in-pit deposition resolved.

3 CONCLUSION

Agnico Eagle has made significant progress to advance the understanding of in-pit deposition alternative and has provided multiple supplemental analyses to parties since the Technical Meeting. Overall, the pertaining parties have acknowledged support of the conclusions presented that deposition of tailings and waste rock in mined-out pits is unlikely to result in significant adverse impacts, if appropriate analyses are completed and appropriate controls are implemented prior to deposition. The responsible departments and technical experts have made the following statements and conclusions:

- CIRNAC has considered in-pit deposition technical comments resolved for purposes of an environmental assessment, providing terms and conditions are developed and included in the Project Certificate and/or Water Licence;
- NRCan has considered all in-pit deposition technical comments resolved;
- ECCC has considered all in-pit deposition technical comments resolved; and
- KivIA will defer to CIRNAC's recommendation/resolution to the unresolved technical comments related to in-pit deposition.

Based on these conclusions, Agnico Eagle maintains its position that sufficient information has been provided as evidence for the purposes of NIRB's review.

4 REFERENCES

Agnico Eagle (Agnico Eagle Mines Limited). 2022. Meliadine Mine – Meliadine Extension FEIS Addendum – Environmental Assessment of In-pit Deposition Alternative. December 16, 2022.

Agnico Eagle. 2023a. In-pit Workshop meeting notes. February 22, 2023.

Agnico Eagle. 2023b. Comparison of Meliadine and Meadowbank slurry tailings properties memo. February 27, 2023.

Lorax (Lorax Environmental Services Ltd.). 2022a. In-pit Tailings Disposal Study for the Meliadine Extension (thermal and groundwater model). December 16, 2022.

Lorax. 2022b. Meliadine Extension In-pit Deposition Alternative WBWQM. December 16, 2022.

Lorax. 2023. Meliadine Extension In-pit Deposition Alternative – WBWQM Backfill sensitivity. February 22, 2023.

WSP (WSP Canada Inc.). 2023. Hydrogeological Analysis in Support of In-pit Deposition Alternatives for the Meliadine Extension. May 5, 2023. Ref No. 22524250-972-TM-Rev1-6000.

APPENDIX G-1: FEBRUARY 6, 2023 MEETING NOTES – IN-PIT DEPOSITION AND OTHER TECHNICAL COMMENTS

Meeting Notes

Participants:
Agnico Eagle Mines Limited (Agnico Eagle): Jamie Quesnel, Colleen Prather, Angie Arbaiza, Jenyfer Mosquera
Crown–Indigenous Relations and Northern Affairs Canada (CIRNAC): Amal Roy, Aminul Haque, Felexce Ngwa, Tony Brown, Gerd Wiatzka, Tony Brown, Andrew Kein (remote)
Environment and Climate Change Canada (ECCC): Victoria Shore, Anne Wilson (remote)
Natural Resources Canada (NRCan): Vikash Narine, Richard Goulet
Kivalliq Inuit Association (KivIA): Alan Sexton, Matt McDougal (remote)
Nunavut Water Board: Karen Kharatyan (remote), Ali Mohammad (remote)

Date: February 6, 2023, Ottawa
Subject: In-pit Deposition and other Technical Comments – Meliadine Extension Proposal

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The Meliadine Extension application currently in review with the Nunavut Impact Review Board (NIRB) included the alternative for in-pit deposition of tailings and waste rock in mined out pits. In response to technical comments received from intervenors on this alternative, Agnico Eagle submitted to the NIRB (December 16, 2022) a technical document (Commitment #42) summarizing the effects assessment of this alternative. On January 16, 2023, CIRNAC issued a letter to Agnico Eagle outlining topics of interest resulting from their review of Commitment #42 plus the request for an in-person workshop. The objective of the workshop was to discuss the 8 topics of interest that were documented in the "2023-01-16_IANU_CIRNAC Memo to Agnico Eagle – Meliadine Extension Commitment #42". The presentation "CIRNAC – In pit deposition workshop Ottawa" was presented by Agnico Eagle during the workshop and was sent to all participants at the end of the meeting.

The following provides a summary of the in-person workshop held on February 6, 2023, for Agnico Eagle's Meliadine Extension Proposal on the in-pit deposition alternative.

Topic 1: Pit Filing Concept

- Agnico Eagle clarified that the thermal model was performed using a water cover as well as a dry cover. The results show that: 1) the talik would open at the same time for both covers when warm tailings are placed; and 2) the talik would not form if cold tailings are placed with a dry cover. CIRNAC recommends considering this information when making final decisions regarding the design of the pit filling/closure strategy.
- Agnico Eagle clarified that the pit filling concept is based on partially filling the pits with tailings/waste rock to ensure that the overlying water quality meets applicable standards. The maximum level of tailings/waste rock that can be placed in each pit is presented in Table 3-2 of the updated WBWQM submitted in support of the pit filling alternative (Lorax, 2022)). These maximum levels are based on information available at this time. This reference applies throughout the entire document.

- Agnico Eagle clarified that in the case Operations decides to carry-out in-pit deposition, the decision process would involve an evaluation of multiple items, such as connectivity of the mined pits with respect to the underground mine, water quality in the pits, volume required of tailings or waste to dispose, and economics. In the 2022 FEIS Addendum submitted to NIRB, the base case is still the surface WRSFs and the dry stack TSF. The in-pit deposition is an alternative that will be evaluated through the NWB when Operations decide in-pit deposition is required, which could be still in a few years, later in mine life, or not at all. The regulatory approvals would be obtained on a "pit by pit" basis, taking into consideration the specific design constraints/requirements associated with each pit and the material to be deposited in the pit. Opposite to the Meadowbank site, the in-pit deposition at Portage and Goose were the base case for the application through NIRB and therefore the studies were submitted to NIRB. Furthermore, the approach for Meliadine (i.e., the alternative of in-pit deposition) is similar to what was done for D1/D5 at Whale Tail, where the alternative to discharge to D1/D5 was presented as an alternative to the NWB and the NIRB, and conditions were added to the Project Certificate (i.e., T&C 67) and Water Licence (i.e., Part E Item 7) should Agnico Eagle choose to implement the alternative.
- Agnico Eagle refers KivIA to the 2023 Water Licence application submitted to the NWB for the updated site layout with all instrumentation that has been installed to this date at Meliadine.
- Agnico Eagle is seeking to follow the Meadowbank process where Agnico Eagle committed to provide additional studies to the NWB. AEM assumes that the package of information for Meliadine would be similar to what was submitted to NWB and with a similar timeline (e.g., 6 months to 1 year prior to starting the activity). However, the final decision regarding the regulatory timelines and scope of requirements rests with the NWB.
- Agnico Eagle clarifies that opposite to Meadowbank, the pits proposed for Meliadine Extension have not been constructed yet therefore the pit shell will probably be modified and the timing for each pit to be available to receive tailings or waste may change. At Meadowbank, the pits were already mined out and already had in-pit waste rock.
- Agnico Eagle states that the main advantage for in-pit is to make use of an already disturbed area.
- CIRNAC mentions that a comparison side by side of in-pit disposal versus surface waste (dry stack and WRSFs) would help better understand which scenario yields better results for the environment. Agnico Eagle responds that the water quality predictions have been done for both scenarios (base case and alternative) and that both are acceptable to the environment.

Status	Commitment/Clarification
Resolved with clarification	Agnico Eagle clarifies that the water quality model was done for a water cover which represents the worst-case scenario for the pit water quality, yielding nonetheless acceptable water quality in all the pits. Agnico Eagle would provide various studies prior to initiating the activity, and with enough time for intervenors to review. Subject to the additional direction and requirements of the NWB, at this time Agnico Eagle proposes the following studies would be submitted for review: a) Conduct an evaluation of the potential environmental effects due to in-pit deposition. The evaluation will include: • Thermal study to assess the degradation of permafrost within the pit lakes. • A hydrogeological study to assess the groundwater contaminant transport to the receiving environment. • Update the water balance and water quality forecast (WBWQM). • Update the Water Management Plan, and the Mine Waste Management Plan. At least 90 days prior to any decision to perform in-pit deposition, Agnico Eagle shall submit the requested studies to the NWB, the NIRB and relevant regulatory authorities, for approval to proceed with in-pit deposition. If the alternative in-pit deposition contingency is approved to proceed, Agnico Eagle will submit the results of its monitoring annually to the NIRB.

Topic 2: Source Terms

- Agnico Eagle clarified that slurry tailings process water chemistry was estimated, in its majority, using the 2014 FEIS whole ore tailings metallurgical testing and the 2020-2021 Tiriganiaq underground mine sump. Meadowbank process water data was only used to estimate nitrogen species (NO_3, NO_2, NH_4, T-CN and WAD-CN) which are associated with mill reagents.
- Agnico Eagle clarified that the Meliadine mill currently operates a filter press in which most process water is recirculated within the mill. On the other hand, under the in-pit deposition alternative, tailings would be deposited as a slurry. As such, current Meliadine Mine mill process water is not seen as a direct analogue for tailings pore water in the in-pit deposition study.
- CIRNAC asked Agnico Eagle if the metallurgical engineers had been consulted about this approach. Agnico Eagle confirmed that this was the best approach suggested by our experts. CIRNAC mentioned that the 2014 FEIS whole tailings metallurgical testing results are dated because Agnico Eagle has been in operation for several years now and Meadowbank data could be less or more conservative.
- CIRNAC recommends that Agnico Eagle updates the process water source term used in the in-pit deposition WBWQM with site specific data considering that this is a fundamental input to the model and to confirm level of conservatism in the model. CIRNAC recommends that once the source term is updated, that Agnico Eagle re-runs the WBWQM to confirm level of conservatism in the assumptions. CIRNAC stated that Agnico Eagle has the discretion to bring forward evidence to support their assertion that Meadowbank tailings are an appropriate and conservative surrogate for tailings that would be placed in the Meliadine pits. Until such evidence is provided, CIRNAC maintains that water quality predictions must be based on tailings generated during the operational phase of the Meliadine Mine.
- CIRNAC indicated a strong preference for Agnico Eagle to revise its water quality modeling using a Meliadine-specific tailings slurry source term during the current NIRB approvals process. However, CIRNAC clarified that such modeling may not be necessary during the NIRB process if

Agnico Eagle can demonstrate that Meadowbank tailings slurry is conservatively representative of Meliadine tailings.

- Agnico Eagle committed to assess different options to address CIRNAC's recommendations considering the timeline to provide comments to the NIRB (February 28, 2023). For example, Agnico Eagle mentioned they could start by comparing the properties of the Meadowbank and Meliadine Tailings.

Status	Commitment/Clarification
Pending resolution	Agnico Eagle clarified that slurry tailings process water source term was estimated using mostly the 2014 FEIS metallurgical testing and the 2020-2021 Tiriganiaq underground mine sump. Meadowbank process water data was used to estimate nitrogen species (NO_3, NO_2, NH_4, T-CN and WAD-CN) associated with mill reagents. Although the FEIS data may be dated, it is still representative of slurry tailings at Meliadine. Slurry tailings are not currently being produced at Meliadine and Agnico Eagle. Agnico Eagle proposes the following steps: **1. For the NIRB process** • Compare Meliadine and Meadowbank tailings properties (i.e., particle size distribution, hydraulic conductivity, porosity, etc.). • Compare Meliadine and Meadowbank mill reagents. • Submit a short technical memo with the outcome of the comparison by February 24. If the Meliadine tailings properties are similar to Meadowbank, the results of the current in pit WBWQM will continue to be considered reasonably conservative for the purposes of in-pit deposition Environmental Assessment. **2. For the NWB process** If Agnico Eagle decides to implement in pit deposition, at least 90 days prior to any decision to perform in-pit deposition, Agnico Eagle shall submit the following information as part of the updated WBWQ forecast listed under Topic of Interest #1: • If a slurry tailings sample can be produced/collected, supplemental testing will be conducted on the process water obtained from the sample. • Agnico Eagle would compare the results of this sampling event against the 2014 FEIS metallurgical testing and the source term developed for the in-pit deposition WBWQM. • Based on the outcome of the comparison, Agnico Eagle would update the slurry tailings source term in the in-pit deposition WBWQM. • Consistent with current practice at Meadowbank, if Agnico Eagle decides to implement in pit deposition at Meliadine, process water monitoring would be conducted as needed. The monitoring data will be used to update and optimize the WBWQM (i.e., in the annual reports).

Topic 3: Loadings from Terrestrial Tailings and Waste Rock

- Agnico Eagle reviewed the assumptions that were incorporated into the in-pit deposition WBWQM and clarified that this model consists of a worst-case model iteration with appropriately conservative assumptions, including loadings from the WRSFs and TSF. The site layout for in-pit deposition showed the potential net benefit of in pit deposition.
- CIRNAC mentioned that they agree with the approach taken for the model, but that Agnico Eagle could ask to utilize the already impacted footprint of the approved WRSFs and TSF in the future. CIRNAC would like to get confirmation of the potential cumulative effects of assuming 100% loadings from surface facilities (i.e., WRSF and TSF) plus loadings from in pit depositions.

- Agnico Eagle clarified that in the 2014 FEIS, larger footprints had been assessed. The 2022 FEIS Addendum presented optimized facilities and pit shells. Agnico Eagle confirmed that the intent is not to reduce the already assessed footprints of the WRFSs and TSF. Agnico Eagle mentioned that this is a discussion more suitable for the NWB process as the current in-pit WBWQM shows that water quality in the pit lakes and receiving environment is protected. Agnico Eagle committed to re-run the WBWQM assuming that the loadings of the surface WRSFs and TSF are not reduced due to in pit deposition.
- Agnico Eagle asked CIRNAC to confirm if this model iteration was required for the NIRB process or the NWB process. CIRNAC asked Agnico Eagle to confirm with the consultant the lead time to complete this model iteration and then a decision would be made.

Status	Commitment/clarification
Pending resolution	CIRNAC and Agnico Eagle agreed to find out the timing to update the in-pit deposition WBWQM with the full extent of the TSF and WRSFs (base case) plus the in-pit deposition (alternative) to evaluate the cumulative effects. Agnico Eagle would be able to provide the results of this sensitivity by February 21.

Topic 4: Modelling based on Partial Pit Flooding

- Agnico Eagle clarified that model predictions for parameters of potential concern during post-closure are below the generic guidelines in all pits and receiving lakes, indicating that water quality in the pits is achievable.
- Agnico Eagle clarified that if operations decide to implement in-pit deposition the model would be updated on a pit-by-pit case. Model assumptions will be updated using monitoring data. The volume and type of material to be backfilled in the pits would be assessed and will be based on the results of the worst-case scenario WBWQM that was completed for the in-pit deposition assessment.
- Agnico Eagle clarified that the WQ results and the 8 m cover is the minimum water cover required based on achieving pit water quality less than generic guidelines, or less than site-specific water quality objectives. If Agnico Eagle decides to modify the water cover, it would be as a minimum cover presented in the WQ report. For example, if at Discovery the 57 m water cover is required to achieve pit water quality, Agnico Eagle would not reduce this cover to 8 m.
- ECCC mentioned that the sediment quantity in the tailings and water interface hasn't been looked at as part of this assessment. The response to this comment is addressed in Topic No. 5.

Status	Commitment/Clarification
Resolved	Agnico Eagle clarifies that the water cover thicknesses presented in the Commitment #42 document is the minimum thickness required for each pit to respect water quality guidelines.

Topic 5: Full Mixing of Pit Lakes

- Agnico Eagle clarified the Meliadine Extension in-pit deposition WBWQM assumed complete mixing in the pits which is an appropriate approach for an environmental assessment of an alternative . This is the same approach that was taken for the Meadowbank In-pit deposition WBWQM submitted to NIRB in 2018 in support of the FEIS.

- ECCC and CIRNAC commented that Agnico Eagle should evaluate sediment quality for benthos and that modelling for a fully mixed lake under-represents the concentrations that would result in the quality expected for these species. The concentrations are expected to be higher in the interface of tailings/water.
- Agnico Eagle states that fish may not go to some of the pits due to their isolation and non-connectivity to the surrounding lakes. The sediment quality will be evaluated through the closure phase. If in-pit deposition occurs, it would be during the operation phase, where pits would not be connected to the receiving environment. Therefore, Agnico Eagle would have additional data and site-specific data that could be implemented through the closure phase.
- Agnico Eagle responds to ECCC that no colonization experiment for the tailings has been done at Meliadine but could do it through the regulatory phase, along with a literature review, in the case Agnico Eagle decides to go with this alternative.
- CIRNAC commented that the impact predictions show that the some of the fully mixed water bodies approach applicable water quality criteria. Given that the modeling assumes the water bodies are fully mixed, some areas of the water bodies will have concentrations that are above the criteria (e.g., at the tailings/water interface). CIRNAC states that the potential for such exceedances needs to be clearly communicated during the EA phase and that while it may be acceptable to defer final decision-making until the closure planning process, it should be clear to all parties during the EA that, based on current predictions, environmental quality may be compromised unless further mitigations are put in place.
- Agnico Eagle clarifies as well that all the studies for in-pit deposition were completed in preparation for the NWB process and not the NIRB, but due to Commitments 40 to 42 Agnico Eagle provided the studies through the NIRB process.
- Agnico Eagle clarifies that the in-pit deposition would not occur until the NWB approves the alternative. At this moment, Agnico Eagle has evaluated in-pit deposition for 17 pits (6 with tailings and 11 with waste rock). Future studies provided to the NWB would be specific to the mine plan, not a generic one which and will include information on the pit geometry, mine sequence, timing.

Status	**Commitment/Clarification**
Pending resolution	Agnico Eagle clarified that full mixing in the pits was done following the same methodology that was used for the Meadowbank in-pit WBWQM at the NIRB stage. Agnico Eagle considers that this should be a topic to address during the regulatory phase with the NWB. Agnico Eagle confirms that sediment quality and benthos would be evaluated as part of the Final Closure and Reclamation Plan similar to the Meadowbank Mine Final Closure and Reclamation Plan. Following ECCC's recommendation to provide an approach to mitigate potential effects should the sediment quality be deemed unacceptable in the pit lakes at Closure, as part of the FEIS process, Agnico Eagle proposes the following mitigation measures: • Determine pit water sampling needs and update the monitoring plans if required. • Evaluate the potential for stratification in the pits based on monitoring data. • Evaluate the potential for effects to fish or aquatic habitat, for example through an ecological risk assessment. • Evaluate the possibility of developing site specific water quality objectives. • Evaluate the need for a potential cover between the tailings and water interface.

Topic 6: Uncertainty

- CIRNAC's concern is the long-term trend of the pit water quality being too close to the guideline limit and that there is less comfort room for this particular case (Figure 5-15: WES05 and Copper predictions). Agnico Eagle states that this pit may not receive tailings. In addition, should a pit receive tailings or waste rock, Agnico Eagle can control the deposition to have more comfort in future water quality.
- ECCC states that the guideline used is an old version and that Agnico Eagle can update the guideline and/or use site specific criteria, and that mitigation measures could be implemented prior (reducing the volume of tailings or changing the waste to be implemented).

Status	Commitment/Clarification
Resolved with clarification	Agnico Eagle clarifies that the water cover can be modified (increased) to further improve the water quality in the pit and potentially address any concerns related to sediment quality.

Topic 7: Water Treatment Requirements

- Agnico Eagle clarified that the removal of reclaim water would occur during operations which was not modelled under the worst-case in-pit water quality scenario. Water management during operations was qualitatively assessed and it was assumed that reclaim water from the pits would be treated prior to discharge to Itivia Harbour via the waterline or pumped to the exhausted underground workings (if the waterline has been decommissioned).
- Agnico Eagle clarified that under Section 3.1 of the water quality report, the model does not consider the reclaim water management during operations. The EA scenario was completed assuming that all activities take place during active closure and post-closure. Agnico Eagle presented Figure 5-15 which shows that during the consolidation process, a high concentration is apparent at the start of active closure followed by a rapid flush out of the loadings, Agnico Eagle states that the models can be refined at a later stage to eliminate this spike and take into consideration the reclaim water, which will be treated (if required) and discharged to Itivia Harbour. Agnico Eagle clarified that this water would not be discharged to Meliadine Lake.
- Agnico Eagle clarified that the in-pit deposition had included provisions for a water treatment plant at closure if required. Agnico Eagle commits to evaluate the needs of treatment if required during the closure phase and through the NWB process.

Status	Commitment/clarification
Resolved with clarification	Agnico Eagle clarifies that water treatment plant would be adapted if water treatment is required.

Topic 8: Storage of Water in Pits

- Agnico Eagle clarifies that the first time that temporary storage of water in the pits was presented in the Water Management Plan (WMP), it was approved by the NWB without any additional studies. Nevertheless, Agnico Eagle assessed the impacts for TIR02 as provided to NIRB on January 30, 2023, as part of Commitment #19.

- Agnico Eagle clarified that the storage of water in the pits is temporary and not long-term and part of the approved Adaptive Management Plan. Agnico Eagle refers CIRNAC to the Exhibit 2 presented during the Water Licence Amendment Final Hearing (TetraTech 2021), where the curve of temporary water storage and time is presented for Tiriganiaq pit. If temporary storage is to happen in one of the pits, it may be stored in a non-exhausted pit (operations would have to stop), or in an exhausted pit; and for both cases, the water elevation would be below the overburden layer (within the bedrock only).
- Currently Agnico Eagle is working on minimizing the discharge to Meliadine lake through the NWB regulatory process by maximizing the waterline for saline water. SP6 (formerly Lake B7) would store saline water and CP8 (formerly Lake B4), in addition to CP1 would store contact water.
- In summary Agnico Eagle states that the temporary storage of water in the pits should not be assessed in this process as Agnico Eagle already has the approval through the NWB.

Status	**Commitment/Clarification**
Resolved	NA

Additional Topics of Discussion

Per CIRNAC's request (letter December 8, 2022 – Government of Canada Responses to Request for Comments on the Commitment List for Agnico Eagle Mines "Meliadine Extension Project Proposal (NIRB File No. 11MN034, Project No. 125684), three (3) unresolved technical review comments that were omitted from the Technical Meeting Commitment List were discussed during the in-pit deposition workshop:

CIRNAC-TRC-04 Minimizing Discharges to Meliadine Lake

- Agnico Eagle mentioned that the predicted discharges to Meliadine Lake presented in the 2022 FEIS Addendum are within the limits of the 2014 FEIS and represent an upper limit model iteration for the purposes of the Environmental Impact Assessment. The differences in numbers indicated by CIRNAC with respect to previous applications are due to the relative footprints of the Waterline and Meliadine Extension Project Descriptions.
- Agnico Eagle submitted an updated WBWQM to the NWB on January 13, 2023, as part of the Meliadine Extension Water Licence Amendment regulatory process. The updated WBWQM is currently under review by project intervenors.
- The main objective of the Meliadine Extension WBWQM update was to address comments received by project intervenors during the NIRB process.
- Agnico Eagle described some of the updates that had been completed in the model. For example, the updated WBWQM incorporates all the comments received by KivIA (i.e., CP3, CP4, CP5 and STP discharge changed from CP1 to SP6 for discharge to Itivia Harbour), increased storage capacity of SP6, updated of source terms with 2022 data and additional kinetic testing), and additional field and monitoring data. Agnico Eagle reiterated its commitment to comply with Term and Condition 25a of Project Certificate No.006.
- KivIA acknowledged the effort made by Agnico Eagle to incorporate their comments into the updated WBWQM submitted to the NWB. However, they would like to see additional efforts by Agnico Eagle to further reduce or eliminate discharges to Meliadine Lake (i.e., addition of a third line to the waterline).
- Agnico Eagle and KivIA confirmed that there have been ongoing discussions between the two parties on this matter (responding to CIRNAC's question). Agnico Eagle considers that further reductions to Meliadine Lake discharge could be achieved with the existing infrastructure and the Adaptive Management Plan, as needed.
- Agnico Eagle considers that this technical review comment should be considered resolved with CIRNAC under the NIRB process and further discussion with the intervenors should continue as part of the NWB regulatory process.
- CIRNAC deferred this technical comment to KivIA for resolution and could be marked as resolved for CIRNAC under the NIRB application considering that Agnico Eagle provided the information required to conduct an Environmental Assessment.
- NRCan and CIRNAC recommended that Agnico Eagle submits the updated WBWQM to NIRB highlighting the modifications to input parameters made to the model to reduce discharges to Meliadine Lake as part of the NIRB process.

- Modifications to the model inputs are outlined in the model report submitted to the NWB. A link has been provided below to direct reviewers to this document.

Status	Commitment/Clarification
Resolved for the FEIS for CIRNAC and deferred to KivIA	Agnico Eagle refers CIRNAC to Meliadine Extension updated WBWQM submitted to the NWB in support of the Water Licence Amendment on January 13, 2023. A summary of the model updates is provided in Table 2-1 of the report. Specific comparison between the 2022 FEIS WBWQM and the updated WBWQM regarding reduced discharges to Meliadine Lake are provided in Section 3.2, Figures 3.5 and 3.6. The document can be found on the NWB Public Registry located at the following: ftp://ftp.nwb-oen.ca/registry/2%20MINING%20MILLING/2A/2AM%20-%20Mining/2AM-MEL1631%20Agnico/1%20APPLICATION/2023%20Amendment/Appendix%20F%20Management%20Plans/230113%202AM-MEL1631%20MeliadineExtension-WLAmendment_AppF21_WaterMgmtPlan-v12-IMLE.pdf

CIRNAC-TRC-06 Post-Closure Arsenic Loadings from SP B7 to Tiri Pit Lake

- Agnico Eagle confirmed that the Arsenic source term had been updated as part of the WBWQM submitted to NWB using additional data from kinetic testing. The updated source term resulted in improved post-closure Arsenic concentrations in Tiri Pit Lake below the AEMP guideline.
- NRCan and CIRNAC commented that Agnico Eagle should submit an overview of the updated Arsenic Loadings from SP B7 submitted to the NWB under the NIRB process for the record.

Status	Commitment/Clarification
Resolved for FEIS purposes	Agnico Eagle refers CIRNAC to Meliadine Extension updated WBWQM submitted to the NWB in support of the Water Licence Amendment on January 13, 2023. Updated TIR01 pit lake post-closure water quality predictions are presented in Table 4-17 of the WBWQM report. The document can be found on the NWB Public Registry at the following: ftp://ftp.nwb-oen.ca/registry/2%20MINING%20MILLING/2A/2AM%20-%20Mining/2AM-MEL1631%20Agnico/1%20APPLICATION/2023%20Amendment/Appendix%20F%20Management%20Plans/230113%202AM-MEL1631%20MeliadineExtension-WLAmendment_AppF21_WaterMgmtPlan-v12-IMLE.pdf

CIRNAC-TRC-07 Post-Closure Seepage Quality from Reclaimed Areas

- Disturbed areas will be reclaimed with NPAG-NML waste rock, the TSF and Discovery WRSF will be progressively reclaimed during operations with NPAG/NML waste rock, and saline waste rock storage facilities will be backfilled to the underground mines. The predictions show that the parameters for mine facilities analyzed are below guidelines during the post-closure phase.
- Agnico Eagle clarified that Meliadine Mine site source terms of mine facilities areas, ore pads, and disturbed areas were assigned chemistry observed from monitoring data and were validated through the calibration exercise of the model.
- CIRNAC indicated it is reasonable to state that loadings from reclaimed areas are not anticipated to result in significant water quality impacts but that such loadings should not be referred to as being at "background levels". CIRNAC also indicated that the topic could/should be explored further during future modeling (e.g., modelling to support closure planning). CIRNAC agreed to consider this item resolved with the description provided.

Status	Commitment/clarification
Resolved	NA

APPENDIX G-2: WBWQM – IN-PIT DEPOSITION SENSITIVITY

TECHNICAL MEMORANDUM

To:	**Jenyfer Mosquera and Colleen Prather (Agnico Eagle Mines Ltd.)**	**Date:**	**February 21, 2023**
From:	**John Dockrey and Cheng Kuang (Lorax Environmental Services Ltd.)**	**Project:**	**A667-1**
Subject:	**Meliadine Extension WBWQM –In-pit deposition Sensitivity**		

1. Introduction

Agnico Eagle Mines Limited (Agnico Eagle) operates the Meliadine Mine, located 25 km north of Rankin Inlet in the Kivalliq region of Nunavut. The Project Certificate issued in 2015 included approval of a multi-phase approach to development, including mining of the Tiriganiaq deposit using open pit and underground mining methods and mining of the Pump, F Zone, Discovery and Wesmeg deposits using open pit methods. Meliadine Extension proposes to extend the life of the mine from 2032 to 2043 and the addition of underground mining activities at Wesmeg, Pump, F Zone, and Discovery deposits.

Lorax Environmental (Lorax) has developed a water balance and water quality model (WBWQM; Lorax, 2022a) and associated geochemical source terms (Lorax, 2022b) for the base case mine plan and water management of Meliadine Extension. The 2022 FEIS WBWQM assumed that waste rock would be stored in waste rock storage facilities (WRSFs) and processed ore would be dry stacked in a tailings storage facility (TSF) adjacent to the mill or backfilled as paste tailings in the mine underground. An in pit deposition model (Base Case) was subsequently developed to represent a waste management scenario for in-pit deposition of tailings and waste rock in all mine pits (Lorax, 2022c). The in-pit deposition base case scenario assumed that geochemical loading rates from WRSFs/TSF were reduced proportionally to the reduced mass of surficial mine waste.

This memorandum presents results of a conservative model that assumes the full TSF and WRSFs footprints and additional material is placed into mined out pits. This effectively assumes 297 Mt of waste rock and tailings will be backfilled in mine pits or stored in surface waste facilities, while only 227 Mt is planned for under the Meliadine Extension.

2. Model Update

The only update made to the Base Case model is to revert loading rates from WRSFs and TSF back to those used in the 2022 FEIS WBWQM (Lorax, 2022b) which assumed no in-pit deposition. The water balance and geochemical source terms related to tailings and waste rock in-pit deposition are consistent with those presented in the Meliadine Extension In-Pit Deposition Alternative WBWQM (Lorax, 2022c).

3. Water Quality Model Results

This section presents water quality model results for the in-pit deposition Sensitivity model. Model predictions are compared against water quality guidelines adopted in the 2020 AEMP (Agnico Eagle, 2021) as a screening tool to identify parameters of potential concern (POPCs) in the post-closure pit lakes. Results of the current in-pit deposition Sensitivity are compared to the in-pit deposition predictions (Lorax, 2022c) to examine the impact of increased loadings from WRSFs/TSF on pit water quality during closure and post-closure.

Under this cumulative in-pit deposition scenario, the maximum predictions for mine-related POPCs remain below their respective AEMP guidelines in all mine pits (Table 3-1 to Table 3-4) except for arsenic at TIRI Pit Lake. This above guideline predictions should be seen as highly conservative, as it effectively double counts geochemical loading from backfill and surface waste facilities in the upgradient catchment of Tiri Pit Lake.

Table 3-1:
Discovery and F ZONE Pit Lakes Maximum Post Closure Predictions Compared to AEMP Guidelines

Parameter	Unit	Maximum Post Closure Predictions (2051-2119)								*AEMP Guideline*
		Discovery		F ZONE01		F ZONE02		F ZONE03		
		Backfill Sensitivity	Backfill Base Case	Backfill Sensitivity	Backfill Base Case	Backfill Sensitivity	Backfill Base Case	Backfill Sensitivity	Backfill Base Case	
Total Dissolved Solids (TDS)	mg/L	101	92	178	143	101	100	115	114	*1000*
Ammonia (NH_3-N)**	mg/L	0.11	0.11	0.25	0.21	0.24	0.24	0.26	0.26	*0.58*
Chloride (Cl)	mg/L	24	22	30	27	21	21	27	27	*120*
Sulfate (SO_4)*	mg/L	31	27	70	49	21	20	27	27	*Variable*
Arsenic (As)	mg/L	0.015	0.015	0.0096	0.0080	0.0044	0.0044	0.0046	0.0046	*0.025*
Cadmium (Cd)*	mg/L	0.0000102	0.000010	0.000028	0.000025	0.000020	0.000020	0.000022	0.000021	*Variable*
Cobalt (Co)	mg/L	0.00057	0.00050	0.00102	0.00080	0.00034	0.00034	0.00032	0.00032	-
Copper (Cu)*	mg/L	0.0012	0.0012	0.0018	0.0016	0.0014	0.0014	0.0015	0.0015	*Variable*
Mercury (Hg)	mg/L	0.0000039	0.0000035	0.000014	0.000013	0.000011	0.000011	0.000011	0.000011	*2.6E-05*
Manganese (Mn)*	mg/L	0.024	0.022	0.094	0.082	0.064	0.064	0.060	0.060	*Variable*
Nickel (Ni)*	mg/L	0.0070	0.0060	0.0068	0.0051	0.0016	0.0016	0.0020	0.0020	*Variable*
Phosphorus (P)	mg/L	0.0068	0.0065	0.014	0.014	0.011	0.011	0.011	0.011	*0.01*
Lead (Pb)*	mg/L	0.00012	0.00012	0.00048	0.00047	0.00052	0.00052	0.00046	0.00046	*Variable*
Selenium (Se)	mg/L	0.00046	0.00043	0.00048	0.00048	0.00088	0.00087	0.00099	0.00098	*0.001*
Uranium (U)	mg/L	0.0027	0.0023	0.00103	0.00070	0.000086	0.000086	0.00010	0.00010	*0.015*
Zinc (Zn)*	mg/L	0.0018	0.0017	0.0023	0.0022	0.0022	0.0022	0.0021	0.0021	*Variable*

Notes: Values shaded in grey indicate parameters above the guideline. *Guideline assumes induced hardness. **The ammonia (NH_3-N) guideline was determined conservatively by assuming a pH of 8 and a temperature of 15ºC.

Table 3-2:
PUMP Pit Lakes Maximum Post Closure Predictions Compared to AEMP Guidelines

Parameter	Unit	Maximum Post Closure Predictions (2051-2119)								*AEMP Guideline*
		PUMP01		PUMP02		PUMP03		PUMP04		
		Backfill Sensitivity	Backfill Base Case	Backfill Sensitivity	Backfill Base Case	Backfill Sensitivity	Backfill Base Case	Backfill Sensitivity	Backfill Base Case	
Total Dissolved Solids (TDS)	mg/L	316	279	127	125	210	193	235	217	*1000*
Ammonia (NH_3-N)**	mg/L	0.24	0.20	0.23	0.23	0.29	0.29	0.21	0.20	*0.58*
Chloride (Cl)	mg/L	52	45	27	27	29	27	48	47	*120*
Sulfate (SO_4)*	mg/L	146	128	38	37	103	92	102	92	*Variable*
Arsenic (As)	mg/L	0.0053	0.0050	0.0042	0.0041	0.012	0.012	0.0038	0.0037	*0.025*
Cadmium (Cd)*	mg/L	0.000030	0.000029	0.000020	0.000020	0.000018	0.000018	0.000026	0.000026	*Variable*
Cobalt (Co)	mg/L	0.0020	0.0016	0.0003	0.00030	0.0013	0.0012	0.0012	0.0010	-
Copper (Cu)*	mg/L	0.0034	0.0030	0.0015	0.0015	0.0025	0.0023	0.0025	0.0023	*Variable*
Mercury (Hg)	mg/L	0.000016	0.000015	0.000010	0.000010	0.0000090	0.0000087	0.000013	0.000013	*2.6E-05*
Manganese (Mn)*	mg/L	0.14	0.12	0.056	0.056	0.084	0.078	0.11	0.10	*Variable*
Nickel (Ni)*	mg/L	0.025	0.020	0.0020	0.0019	0.011	0.010	0.013	0.011	*Variable*
Phosphorus (P)	mg/L	0.013	0.013	0.011	0.011	0.010	0.00999	0.012	0.012	*0.01*
Lead (Pb)*	mg/L	0.00046	0.00046	0.00044	0.00044	0.00027	0.00027	0.00047	0.00047	*Variable*
Selenium (Se)	mg/L	0.00047	0.00041	0.00090	0.00089	0.00029	0.00027	0.00061	0.00060	*0.001*
Uranium (U)	mg/L	0.00082	0.00068	0.00011	0.00011	0.00044	0.00039	0.00049	0.00043	*0.015*
Zinc (Zn)*	mg/L	0.0036	0.0032	0.0020	0.0020	0.0027	0.0025	0.0028	0.0026	*Variable*

Notes: Values shaded in grey indicate parameters above the guideline. *Guideline assumes induced hardness. **The ammonia (NH_3-N) guideline was determined conservatively by assuming a pH of 8 and a temperature of 15ºC.

Table 3-3:
WES Pit Lakes Maximum Post Closure Predictions Compared to AEMP Guidelines

Parameter	Unit	Maximum Post Closure Predictions (2051-2119)								*AEMP Guideline*
		WES01		WES02		WES03		WES04		
		Backfill Sensitivity	Backfill Base Case	Backfill Sensitivity	Backfill Base Case	Backfill Sensitivity	Backfill Base Case	Backfill Sensitivity	Backfill Base Case	
Total Dissolved Solids (TDS)	mg/L	93	93	106	105	92	92	239	239	*1000*
Ammonia (NH_3-N)**	mg/L	0.20	0.20	0.25	0.25	0.12	0.12	0.49	0.49	*0.58*
Chloride (Cl)	mg/L	31	31	30	30	18	18	114	114	*120*
Sulfate (SO_4)*	mg/L	12	12	16	15	36	36	37	37	*Variable*
Arsenic (As)	mg/L	0.0071	0.0070	0.015	0.015	0.0055	0.0055	0.021	0.021	*0.025*
Cadmium (Cd)*	mg/L	0.000017	0.000017	0.000019	0.000018	0.000022	0.000021	0.000024	0.000024	*Variable*
Cobalt (Co)	mg/L	0.00024	0.00024	0.00039	0.00036	0.00025	0.00025	0.00076	0.00076	-
Copper (Cu)*	mg/L	0.0012	0.0012	0.0013	0.0013	0.0019	0.0019	0.0019	0.0019	*Variable*
Mercury (Hg)	mg/L	0.0000079	0.0000079	0.0000097	0.0000097	0.0000088	0.0000088	0.000012	0.000012	*2.6E-05*
Manganese (Mn)*	mg/L	0.042	0.042	0.058	0.057	0.044	0.044	0.062	0.062	*Variable*
Nickel (Ni)*	mg/L	0.0019	0.0019	0.0033	0.0029	0.0051	0.0051	0.0044	0.0044	*Variable*
Phosphorus (P)	mg/L	0.0092	0.0092	0.010	0.010	0.0058	0.0058	0.0096	0.0096	*0.01*
Lead (Pb)*	mg/L	0.00032	0.00032	0.00043	0.00043	0.000098	0.000098	0.00032	0.00032	*Variable*
Selenium (Se)	mg/L	0.00076	0.00075	0.00087	0.00087	0.00031	0.00031	0.00031	0.00031	*0.001*
Uranium (U)	mg/L	0.000086	0.000086	0.00014	0.00014	0.00023	0.00023	0.00020	0.00020	*0.015*
Zinc (Zn)*	mg/L	0.0018	0.0018	0.0023	0.0022	0.0014	0.0014	0.0017	0.0017	*Variable*

Notes: Values shaded in grey indicate parameters above the guideline. *Guideline assumes induced hardness. **The ammonia (NH_3-N) guideline was determined conservatively by assuming a pH of 8 and a temperature of 15ºC.

Table 3-4:
Tiriganiaq Pit Lake, Tiri02/04 Pit Lake and Wesmeg North Pit Lake Maximum Post Closure Predictions Compared to AEMP Guidelines

Parameter	Unit	Maximum Post Closure Predictions (2051-2119)						*AEMP Guideline*
		TIRI Pit Lake		TIRI02/04		WN Pit Lake		
		Backfill Sensitivity	Backfill Base Case	Backfill Sensitivity	Backfill Base Case	Backfill Sensitivity	Backfill Base Case	
Total Dissolved Solids (TDS)	mg/L	345	246	183	148	136	123	*1000*
Ammonia (NH_3-N)**	mg/L	0.55	0.49	0.51	0.41	0.54	0.54	*0.58*
Chloride (Cl)	mg/L	53	46	60	47	31	29	*120*
Sulfate (SO_4)*	mg/L	173	112	43	33	35	30	*Variable*
Arsenic (As)	mg/L	0.027	0.022	0.0099	0.010	0.022	0.022	*0.025*
Cadmium (Cd)*	mg/L	0.000047	0.000037	0.000027	0.000025	0.000020	0.000020	*Variable*
Cobalt (Co)	mg/L	0.0021	0.0015	0.0006	0.00051	0.0013	0.0012	-
Copper (Cu)*	mg/L	0.0023	0.0019	0.0013	0.0012	0.0019	0.0018	*Variable*
Mercury (Hg)	mg/L	0.000021	0.000017	0.000013	0.000012	0.000012	0.000011	*2.6E-05*
Manganese (Mn)*	mg/L	0.14	0.10	0.058	0.055	0.076	0.070	*Variable*
Nickel (Ni)*	mg/L	0.0105	0.0075	0.0049	0.0039	0.0093	0.0072	*Variable*
Phosphorus (P)	mg/L	0.025	0.025	0.035	0.035	0.013	0.013	*0.01*
Lead (Pb)*	mg/L	0.00037	0.00037	0.00038	0.00038	0.00044	0.00045	*Variable*
Selenium (Se)	mg/L	0.00092	0.00087	0.00043	0.00041	0.00025	0.00022	*0.001*
Uranium (U)	mg/L	0.0031	0.0020	0.00070	0.00056	0.00035	0.00028	*0.015*
Zinc (Zn)*	mg/L	0.0025	0.0024	0.0023	0.0022	0.0022	0.0021	*Variable*

Notes: Values shaded in grey indicate parameters above the guideline. *Guideline assumes induced hardness. **The ammonia (NH_3-N) guideline was determined conservatively by assuming a pH of 8 and a temperature of 15ºC.

4. Closure

We trust that the information provided herein is sufficient for your present needs. Should you require anything further, please contact the undersigned.

Yours sincerely,
Lorax Environmental Services Ltd.

Prepared by:

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Feb. 21, 2023

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PERMIT TO PRACTICE
LORAX ENVIRONMENTAL SERVICES LTD.
Signature
Date Feb. 21, 2023
PERMIT NUMBER: P 1487
NT/NU Association of Professional Engineers and Geoscientists

References

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APPENDIX G-3: IN-PIT DEPOSITION COMPARISON OF MELIADINE AND MEADOWBANK SLURRY TAILINGS PROPERTIES

AGNICO EAGLE

Technical Memorandum

Date: February 27, 2023
Subject: In pit Deposition – Comparison of Meliadine and Meadowbank Slurry Tailings Properties

1. Introduction

The Meliadine Extension application currently in review with the Nunavut Impact Review Board (NIRB) included the alternative for in pit deposition of tailings and waste rock in mined out pits. In response to technical comments received from intervenors on this alternative, Agnico Eagle submitted to the NIRB (December 16, 2022) a technical document (Commitment #42) summarizing the effects assessment of this alternative.

On January 16, 2023, CIRNAC issued a letter to Agnico Eagle outlining topics of interest resulting from their review of Commitment #42 plus the request for an in-person workshop. The objective of the workshop was to discuss the 8 topics of interest that were documented in the "2023-01-16_IANU_CIRNAC Memo to Agnico Eagle – Meliadine Extension Commitment #42".

On February 6, 2023, Agnico Eagle and CIRNAC had an in-person workshop in Ottawa to discuss the 8 topics of interest. This technical memorandum addresses the commitments made under *Topic 2: Source terms,* as presented in the meeting minutes of the February 6 workshop, and more specifically, on the additional information required under the NIRB process as shown in the table below:

Status	Commitment/Clarification
Pending resolution	Agnico Eagle clarified that slurry tailings process water source term was estimated using mostly the 2014 FEIS metallurgical testing and the 2020-2021 Tiriganiaq underground mine sump. Meadowbank process water data was used to estimate nitrogen species (NO_3, NO_2, NH_4, T-CN and WAD-CN) associated with mill reagents. Although the FEIS data may be dated, it is still representative of slurry tailings at Meliadine. Slurry tailings are not currently being produced at Meliadine and Agnico Eagle. Agnico Eagle proposes the following steps: **1. For the NIRB process** • Compare Meliadine and Meadowbank tailings properties (i.e., particle size distribution, hydraulic conductivity, porosity, etc.). • Compare Meliadine and Meadowbank mill reagents. • Submit a short technical memo with the outcome of the comparison by February 24. If the Meliadine tailings properties are similar to Meadowbank, the results of the current in pit WBWQM will continue to be considered reasonably conservative for the purposes of in pit deposition Environmental Assessment. **2. For the NWB process** If Agnico Eagle decides to implement in pit deposition, at least 90 days prior to any decision to perform in pit deposition, Agnico Eagle shall submit the following information as part of the updated WBWQ forecast listed under Topic of Interest #1: • If a slurry tailings sample can be produced/collected, supplemental testing will be conducted on the process water obtained from the sample.

Status	Commitment/Clarification
	• Agnico Eagle would compare the results of this sampling event against the 2014 FEIS metallurgical testing and the source term developed for the in pit deposition WBWQM. • Based on the outcome of the comparison, Agnico Eagle would update the slurry tailings source terms in the in pit deposition WBWQM. • Consistent with current practice at Meadowbank, if Agnico Eagle decides to implement in pit deposition at Meliadine, process water monitoring would be conducted as needed. The monitoring data will be used to update and optimize the WBWQM (i.e., in the annual reports).

During the in-person meeting on February 6, 2023, CIRNAC recommended that Agnico Eagle update the process water source term used in the in pit deposition WBWQM with site specific data considering that this is a fundamental input to the model and to confirm level of conservatism in the model. CIRNAC indicated a strong preference for Agnico Eagle to revise its water quality modeling using a Meliadine-specific tailings slurry source term during the current NIRB approvals process. However, CIRNAC clarified that such modeling may not be necessary during the NIRB process if Agnico Eagle could demonstrate that Meadowbank tailings slurry is conservatively representative of Meliadine tailings.

CIRNAC stated that Agnico Eagle had the discretion to bring forward evidence to support the assertion that Meadowbank tailings are an appropriate and conservative surrogate for tailings that would be placed in the Meliadine mined out pits. Until such evidence is provided, CIRNAC maintained that water quality predictions must be based on tailings generated during the operational phase of the Meliadine Mine.

Agnico Eagle considers that the comparison of physical and geochemical properties of the Meadowbank and Meliadine Tailings presented in this technical memorandum should provide CIRNAC with sufficient evidence to complete the environmental assessment of the Meliadine Extension in pit deposition alternative under the NIRB process.

Agnico Eagle considers the assumptions and approach followed to develop in pit deposition source terms using data from the 2014 FEIS, 2022 FEIS and analogue data from Meadowbank Mine is appropriately conservative for the following reasons:

- Geochemical source terms specific to the in pit sensitivity WBWQM were developed to include source terms related to tailings and waste rock backfill, and updates to the TSF and WRSFs loadings for reduced tonnage relative to the Meliadine Extension Base Case. All other source terms applied in the in pit deposition WBWQM model were consistent with those presented the 2022 FEIS (Lorax 2022b).
- The tailings pore water chemistry source term developed for the in pit deposition WBWQM was primarily estimated from 2014 FEIS whole ore tailings metallurgical samples and process water analytical results. As presented in Section 4 this memorandum (Lorax 2022c), and the 2014 FEIS (Agnico Eagle, 2014), whole ore tailings were produced from ore samples from the multiple deposits considered for Meliadine Extension (i.e., Tiriganiaq-Wolf, Wesmeg, F Zone, Pump, and Discovery). The tailings process water chemistry source term was developed using a weighted average these 2014 FEIS metallurgical samples relative to tailings tonnages to be placed in the mined out pits.

- Agnico Eagle considers that including whole ore tailings metallurgical analytical results from the multiple deposits considered for Meliadine Extension (i.e., Tiriganiaq-Wolf, Wesmeg, F Zone, Pump, and Discovery) is a key input from the 2014 FEIS because all lithologies and potential geochemical constituents in tailings pore water chemistry are accounted for with this approach.
- Any tailings samples collected from the operating mine would be representative of the Tiriganiaq deposit only since it is the only deposit approved for mining under the Water Licence.
- As previously mentioned, in addition to the 2014 FEIS whole ore tailings metallurgical analytical results, and the Tiriganiaq Underground Mine sump water, Meadowbank process water data was also used in the tailings pore water chemistry source term. The Meadowbank process water data was used to estimate nitrogen species (NO_3, NO_2, NH_4, T-CN and WAD-CN) which are associated with mill reagents at concentrations specific for slurry tailings deposition. This approach was used because, as shown in Section 3 of this technical memorandum, Meadowbank and Meliadine mill use the same mill reagents (Lorax 2022c).
- The waste rock in pit deposition source terms were based exclusively from Meliadine Extension data presented in the 2022 FEIS geochemical characterization report and WBWQM, by applying scaling factors for the in pit deposition study (Lorax 2022a,b,c).
- As presented in Section 2 of this memorandum, Meadowbank slurry tailings (SNC 2018a,b), and Meliadine slurry tailings (Agnico Eagle 2014) have similar physical properties for key parameters associated to tailings consolidation processes in mined-out pits. For this reason, and although Agnico Eagle acknowledges that in-pit deposition is site-specific, Agnico Eagle considers that using the Meadowbank in pit consolidation study (SNC 2018a) to develop a tailings consolidation source term is reasonably conservative for the purposes of an environmental assessment of this alternative under the NIRB process.
- Slurry tailings are produced at Meadowbank Mine since the beginning of operations (similar to what was proposed for Meliadine in the 2014 FEIS). At Meliadine Mine tailings are placed on a surface TSF as dry stack tailings. If Agnico Eagle decides to implement in pit deposition, the process water source term would be updated as part of the NWB process.
- As presented in the in pit deposition WBWQM memorandum (Lorax 2022c), existing Meliadine-specific ARD/ML potential characterization data was accounted for in the development of waste rock and tailings source terms for the in pit deposition study. The comparison between Meadowbank and Meliadine ARD potential shows that Meadowbank tailings are PAG whereas at Meliadine, Discovery is the only deposit where tailings are considered PAG (Lorax 2022b). As presented in Section 5 of this memorandum, the comparison shows that Meadowbank and Meliadine have low ML potential. Agnico Eagle considers that the tailings pore water chemistry source term developed for the Meliadine Extension in pit deposition already captures ARD/ML potential and is reasonably conservative for the purposes of the NIRB process.
- Meliadine Extension in pit deposition assumes subaqueous in pit deposition of tailings during operations and flooding of the pit with Meliadine Lake water above the waste rock and tailings backfill and therefore eliminate or minimize the ARD/ML potential in the pit lakes.

As discussed during the in-person meeting on February 6, 2023, Agnico Eagle considers that the source terms developed for the in pit deposition study are appropriately conservative for the environmental assessment of this alternative of Meliadine Extension base case. Agnico Eagle considers that further studies on tailings properties and source terms development using operational data should be completed as part of the NWB process if Agnico Eagle decides to implement in pit deposition.

The following sections present in more detail the comparison between Meliadine Slurry Tailings and Meadowbank Slurry Tailings for the following parameters:

- Slurry Tailings Physical properties (Section 2)
- Mill reagents (Section 3)
- Tailings pore water chemistry (Section 4)
- Tailings ARD/ML comparison (Section 5)

The conclusion of the memorandum is presented in Section 6.

2. Meliadine and Meadowbank Slurry Tailings Physical Properties

The slurry tailings produced at Meadowbank and the 2014 FEIS shared similar processing at the mill. These processes include grinding, gravity separation, cyanidation, carbon absorption in a carbon-in-leach (CIL) circuit, gold recovery, cyanide destruction and addition of mill reagents. Table 2-1 summarizes the comparison of existing physical characteristics of Meadowbank Mine slurry tailings (SNC 2018a,b) and Meliadine Mine slurry tailings (EBA 2013; Tetra Tech 2014a,b).

Table 2-1: Meadowbank and Meliadine Slurry Tailings Physical Properties

Item	Slurry Tailings at Meadowbank	2014 FEIS Slurry Tailings at Meliadine
Particle Size Distribution	100% passing 150 µm;	98% passing 150 µm;
	83% passing 75 µm;	83% passing 75 µm;
	58% passing 20 µm; and	40% passing 20 µm; and
	15% passing 3 µm	5% passing 3 µm
	(SILT and some sand)	(SILT, some sand, trace clay)
Liquid limit/Plastic Limit	N/A, Non-plasticity	23, low plasticity
Specific Gravity	2.96	2.78
Sloid Content at Discharge	54%	55%
Initial Void Ratio	2.56	2.28
Dry Density of Slurry Tailings	0.84 t/m^3	0.85 t/m^3
References	SNC 2018a,b	EBA 2013; Tetra Tech 2014a,b

2.1 Tailings Consolidation Flows

Tailings consolidation flows are based on modelling completed for in pit deposition of tailings slurry at the Meadowbank Mine (SNC 2018a,b). Meadowbank consolidations results were applied for Meliadine Extension in pit deposition study as site-specific consolidation modelling has not been completed for Meliadine Mine. As shown in Table 2-1, the comparison of laboratory geotechnical properties between the Meadowbank slurry tailings and Meliadine slurry tailings from the 2014 FEIS showed similar physical behavioral characteristics. Future model refinements could incorporate site-specific considerations including tailings permeability, filling rate, pit geometry and depth, available drainage pathways, as well as local ground and rock conditions as part of the NWB process if Agnico Eagle decides to implement this alternative.

3. Mill Reagents

As previously stated, the Meliadine Extension process water source term was developed using analogue Meadowbank process water data to estimate nitrogen species (NO_3, NO_2, NH_4, T-CN and WAD-CN) which are associated with mill reagents. This approach was considered appropriate for the purposes of the environmental assessment of an alternative considering that Meliadine Mine and Meadowbank Mine utilize the same mill reagents for ore processing and tailings production. The complete list of mill reagents used at both sites is provided in Table 3-1.

Table 3-1. List of Reagents used at Meliadine and Meadowbank Mills

Chemical	Formula
Metabisulphite	$NA_2S_2O_s$
Cyanide	NaCH
Caustic	NaOH
Copper Sulfate	$CuSO_45H_20$
Quicklime	CaO
HCL Acid	HCl
Carbon	C
Lead Nitrate	$Pb(NO_3)_2$

4. In pit Deposition Source Terms

Geochemical source terms specific to the in pit sensitivity WBWQM were developed for the Meliadine Extension deposition alternative. These include source terms related waste rock and to tailings, and updates to the TSF and WRSFs for reduced tonnage relative to the NIRB Base Case. All other source terms applied in the model are consistent with those presented in Section 8.5 of the Meliadine Extension: Geochemical Characterization and Source Term Report of the 2022 FEIS (Lorax 2022b,c).

4.1 Waste Rock Source Terms

Two source terms were developed for waste rock in pit deposition: the initial-flush source term which represents rinsing of water-soluble parameters during active flooding of the mined out pits with Meliadine Lake water in the first years of Active Closure, and the long-term diffusive flux source term of constituents from waste rock pore water into the overlying pit lake (Lorax 2022c).

Waste Rock Initial Flush was developed by assuming that flooding of backfilled waste rock with Meliadine Lake water during Active Closure will result in a one-time flushing of water-soluble constituents from waste rock into the pit lake. The water-soluble geochemical load associated with waste rock was developed by scaling shake flask extraction (SFE) results and salinity rinsing tests as described below. All analytical test methods and results incorporated into this source term are originally presented in (Lorax 2022c).

Waste Rock Diffusive Flux was developed assuming that metal transport in the waste rock pore space would be dominated by diffusion created by a concentration gradient. Estimates of waste rock pore water chemistry were calculated by assuming scaled loadings from the Meliadine Extension 2022 FEIS source terms (Lorax 2022b) and were detailed in the Meliadine in pit deposition WBWQM (Lorax 2022c).

4.2 Tailings Pore Water Chemistry

As presented in the in pit deposition WBWQM technical memorandum (Lorax 2022c) the tailings pore water chemistry source term was mainly estimated from 2014 FEIS whole ore tailings metallurgical samples and process water analytical results. Table 4-6 of the Meliadine Extension WBWQM Technical Memorandum (Table 4-1 of this memorandum), and the Supporting Document SD 6-3 Appendix C.6 of 2014 FEIS (Agnico Eagle 2014), show that whole ore tailings were produced from ore samples from the multiple deposits considered for Meliadine Extension (i.e., Tiriganiaq-Wolf, Wesmeg, F Zone, Pump, and Discovery). The tailings process water chemistry was estimated using a weighted average of metallurgical supernatant samples based on the relative tonnage of each deposit for Meliadine Extension (Lorax 2022c).

One key benefit of the 2014 FEIS tailings analysis is that it contains data from all the Meliadine Extension deposits and the range of the geological lithologies expected from these different deposits. Although Agnico Eagle could collect a sample of thickened tailings from current milling processes at Meliadine before they are sent to the filter press, the tailings produced would only be representative of Tiriganiaq deposit, which is the only deposit currently approved deposit for mining Meliadine Mine.

In addition to the 2014 FEIS data, analogue data from Meadowbank Mine was used to estimate concentrations of residual mill reagents which are optimized during operations (e.g., nitrogen and cyanide species). The Meadowbank Mine operates a whole ore leach tailings slurry process, similar to what would be adopted at Meliadine Mine if tailings slurry were to be produced. Median process water concentrations reported in the Meadowbank Mine 2021 Annual Report are shown in Table 4-1. The median concentrations of NO_3, NO_2, NH_4, T-CN and WAD-CN reported for Meadowbank Mine are used to estimate tailings process water chemistry for these parameters. Similar to waste rock, it is assumed that NO_3 and NO_2 are reduced to NH_3 within the suboxic tailings pore water environment (Lorax 2022c). Median concentrations observed in Tiriganiaq underground mine sumps were also included in the development of the process water source term as shown in Table 4-1 of this memorandum (Lorax 2022c).

Slurry tailings are produced at Meadowbank Mine since the beginning of operations (similar to what was proposed for Meliadine in the 2014 FEIS). At Meliadine Mine tailings are placed on a surface TSF as dry stack tailings. Considering that tailings pore water chemistry was primarily estimated from the 2014 FEIS and Meadowbank and Meliadine mill use the same mill reagents, Agnico Eagle considers that the predicted tailings pore water chemistry used in the Meliadine Extension in pit deposition WBWQM is conservatively appropriate. If Agnico Eagle decides to implement in pit deposition, the process water source term would be updated.

Table 4-1. Water quality results for metallurgical supernatant, Tiriganiaq underground, Meadowbank process water, and predicted in pit tailings pore water source term.

Reference	Sample ID	Deposit/	TDS	Cl	F	SO_4	T-CN	WAD-CN	NH_3-N	NO_3-N	NO_2-N	Sb	As	Cd	Cr	Co	Cu	Pb	Mn	Na	Ni	P	Se	U	Zn
			mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
2014 FEIS Appendix C.6 Process Water	Met Tailings CN8	Discovery	3,260	12	0.29	1,600	15.20	0.03	-	0.1400	0.0600	0.0070	0.4240	0.0000	0.0050	0.0512	0.0590	0.0002	0.0028	762	0.0080	-	0.0200	0.01020	0.0020
	Met Tailings CN6	F Zone	2,160	12	0.07	1,100	0.01	0.01	-	0.1300	0.0600	0.0120	1.1700	0.0001	0.0050	0.1240	0.0680	0.0002	0.0533	528	0.0050	-	0.0100	0.00216	0.0020
	Met Tailings CN5	F Zone	2,680	11	0.06	1,200	17.30	0.14	-	0.1300	0.0600	0.0240	3.3300	0.0001	0.0050	0.0982	0.0880	0.0003	0.0263	574	0.0080	-	0.0100	0.00252	0.0020
	Met Tailings CN7	Pump	2,880	12	0.06	1,200	16.70	1.55	-	0.1500	0.0600	0.0160	4.2100	0.0000	0.0050	0.1950	0.1110	0.0002	0.0026	677	0.0050	-	0.0200	0.00315	0.0020
	Met Tailings CN2	Tiriganiaq	3,710	20	0.09	2,200	5.95	0.04	-	0.1300	0.0600	0.0410	9.7400	0.0000	0.0050	0.0769	0.0290	0.0006	0.0109	694	0.0120	-	0.0100	0.00316	0.0020
	Met Tailings CN1	Tiriganiaq	2,480	13	0.10	1,200	14.20	0.05	-	0.1200	0.0600	0.0320	7.6000	0.0001	0.0050	0.0832	0.0900	0.0009	0.0072	560	0.0070	-	0.0100	0.00262	0.0030
	Met Tailings CN3	Wesmeg	2,790	14	0.12	1,500	19.50	0.06	-	0.1500	0.0600	0.0070	0.2200	0.0000	0.0050	0.1130	0.0520	0.0003	0.0523	584	0.0080	-	0.0200	0.00296	0.0020
	Met Tailings CN4	Wolf	3,090	16	0.15	2,000	0.01	0.01	-	0.5000	0.6000	0.0190	0.2920	0.0000	0.0050	0.0805	0.0610	0.0008	0.0212	877	0.0120	-	0.0100	0.00446	0.0020
Median sump chemistry in Tiriganiaq underground mine (2020-2021)	Mine Sump Water	Tiriganiaq Underground	55,000	27,500	-	2,800	-	-	140.00	-	-	-	-	-	-	-	-	-	-	14,100	-	-	-	-	-
Median from 2020 Mill Monitoring Data (Agnico Eagle, 2022) 54% solids, 46% water	Meadowbank Process Water	Goose and Portage Pits	3,180	370	0.28	1,550	0.76	0.05	75.00	9.00	0.30	0.026	1.02	0.0003	0.0032	-	2.60	-	0.069	378	1.31	0.175	0.147	0.01	0.0015
In pit deposition WBWQM (Lorax)	In pit Tailings Pore Water Source Term (all pits)		**3,488**	**300**	**0.12**	**1,649**	**0.76**	**0.05**	**85.5**	**-**	**-**	**0.021**	**3.58**	**0.00004**	**0.005**	**0.096**	**0.062**	**0.001**	**0.025**	**811**	**0.009**	**0.175**	**0.014**	0.00363	**0.0022**

Source: Table 4-6 Meliadine Extension in pit Deposition WBWQM (Lorax 2022c).

5. Acid Rock Drainage (ARD) / Metal Leaching (ML) Potential

This section provides an overview of the ARD/ML potential of Meliadine Extension and Meadowbank Mine, based on existing static and kinetic characterization completed at both sites as part of past and ongoing regulatory processes or presented to regulators through the Annual Reports.

5.1 Meliadine Extension Tailings ARD/ML Potential

Meliadine mill tailings have been extensively characterized through the 2014 FEIS (Agnico Eagle 2014), the 2022 FEIS (Lorax 2022a,b) Table 5-14 of that report shows that Discovery is the only deposit where the majority of tailings are considered PAG. Only 18% of tailings from all other deposits at Meliadine are classified as PAG or Uncertain (Lorax 2022b).

As presented in Appendix C of the NWB WBWQM update (Lorax 2023), saturated column test work was completed in 2022 to characterize the metal leaching potential of tailings under saturated conditions at Meliadine. Overall, saturated column results show that metal release will be dominated by rinsing of filter press water and water-soluble oxides and evaporites. Saturated column results show limited evidence for reductive dissolution reactions. Meliadine tailings metal leaching potential was accounted for in the tailings consolidation flows source term. If in pit deposition is implemented, monitoring data will be used to update assumptions during operations and tailings will be placed under a water cover of at least 8 m depth.

5.2 Meadowbank Tailings and ARD/ML Potential

In the 2017 Meadowbank Mine Annual Report, Agnico Eagle presented geochemical characterization of tailings associated with tailings solids, tailings supernatant, cyanide leach residue, and bleed from the cyanide destruction process. Refer to Table 5-2 of the 2017 Meadowbank Annual Report which presents the results of that sampling. The results indicate that at Meadowbank are classified as PAG but with low metal leaching potential. The results of the 2017 sampling were integrated into the Water Quality Forecast, the design of the TSF cover for closure.

As presented in the in pit deposition WBWQM memorandum (Lorax 2022c), existing Meliadine-specific ARD/ML potential characterization data was accounted for in the development of waste rock and tailings source terms for the in pit deposition study and is considered reasonably conservative for the purposes of the NIRB process. In addition, Meliadine Extension in pit deposition assumes subaqueous in pit deposition of tailings during operations and flooding of the pit with Meliadine Lake water above the waste rock and tailings backfill and therefore eliminate or minimize the ARD/ML potential in the pit lakes.

6 Conclusion

Agnico Eagle considers that the comparison of physical and geochemical properties of the Meadowbank and Meliadine Tailings presented in this technical memorandum provide sufficient evidence to complete the environmental assessment of the Meliadine Extension alternative under the NIRB process. The information presented in this memorandum demonstrated that the assumptions and approach followed to develop in pit deposition source terms using data from the 2014 FEIS, 2022 FEIS, and analogue data from Meadowbank Mine is appropriately conservative for the following seven reasons:

1. The majority of geochemical source terms developed for the in pit deposition study are already based on Meliadine specific data. Analogue Meadowbank data was used in instances where mill process or in pit deposition specific information is not currently available at Meliadine mine (i.e., dry stack tailings production vs slurry tailings production).

2. Evidence was provided to show that the tailings pore water chemistry source term developed for the in pit deposition WBWQM was primarily estimated from 2014 FEIS whole ore tailings metallurgical samples and process water analytical results. As presented in in the supporting documents provided in support of the in pit deposition WBWQM (Lorax 2022c), whole ore tailings were produced from ore samples from the multiple deposits considered for Meliadine Extension (i.e., Tiriganiaq-Wolf, Wesmeg, F Zone, Pump, and Discovery). The tailings process water chemistry was estimated using a weighted average of metallurgical supernatant samples relative to the tailings tonnage of each deposit. Agnico Eagle considers that this is a key input from the 2014 FEIS which has been incorporated into the in pit deposition WBWQM.
3. Any tailings samples collected from the operating mine would be representative of the Tiriganiaq deposit only since it is the only deposit approved for mining under the Water Licence.
4. Considering that Meadowbank and Meliadine use the same mill reagents, Agnico Eagle was able to justify the use of Meadowbank slurry tailings process water in combination with 2014 FEIS process water quality data is conservatively appropriate.
5. Agnico Eagle presented existing characterization results for Meadowbank slurry tailings and 2014 FEIS Meliadine slurry tailings. The results show that the slurry tailings have similar physical properties for key parameters associated to tailings consolidation, and as such, using analogue data from the Meadowbank study for the in pit deposition study at Meadowbank is considered reasonably conservative for the purposes of an environmental assessment of this alternative for Meliadine under the NIRB process.
6. Tailings ARD/ML potential was considered for the Meliadine in pit deposition source terms, using Meliadine Extension geochemical characterization data In the in-pit deposition WBWQM it was assumed that a pathway for ARD potential in the pits would be mitigated by subaqueous deposition of tailings during operations and the placement of water cover of at least 8m above the tailings (and waste rock) at closure and post-closure.
7. As discussed during the February 6 meeting in Ottawa, if Agnico Eagle decides to implement in pit deposition, Agnico Eagle will monitor water quality in the pits and use operational monitoring data to assess and optimize in pit deposition. It is important to note, that under current appropriately conservatively assumptions used to develop the Meliadine Extension in pit deposition WBWQM, predicted water quality in the pit lakes would be protective of aquatic life and the environment.

Agnico Eagle considers that further studies on tailings properties and source terms development using operational data should be updated as part of the NWB process if Agnico Eagle decides to implement in pit deposition.

7 References

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APPENDIX G-4: HYDROGEOLOGICAL ANALYSIS IN SUPPORT OF IN-PIT DEPOSITION

TECHNICAL MEMORANDUM

DATE 5 May 2023 **Reference No.** 22524250-972-TM-Rev1-6000

TO Angie Arbaiza
Agnico Eagle Mines Limited

FROM Jennifer Levenick, P.Eng. and Don Chorley, P.Geo. **EMAIL Jennifer.Levenick@wsp.com; Don.Chorley@wsp.com**

HYDROGEOLOGICAL ANALYSIS IN SUPPORT OF IN-PIT DEPOSITION ALTERNATIVES FOR THE MELIADINE EXTENSION

1.0 INTRODUCTION

Agnico Eagle Mines Limited (Agnico Eagle) is proposing to expand the development at the Meliadine Gold Project (herein referred to as the Meliadine Extension or the Project), located approximately 25 km north from Rankin Inlet and 80 km southwest from Chesterfield Inlet in the Kivalliq Region of Nunavut. The Project includes open-pits and the Tiriganiaq underground development that was assessed through the 2014 FEIS (Agnico Eagle 2014a) plus additional new underground developments.

In 2021, Golder Associates Ltd. (now WSP) documented a summary of hydrogeology existing conditions for the Project and subsequently completed a hydrogeological assessment of groundwater conditions that are expected to develop in the Project area during mining in support of the Environmental Impact Statement (EIS) (Golder 2021). Since completion of the EIS, supplemental hydrogeological data was collected to enhance the understanding of hydrogeological conditions. These data formed the framework for an updated summary of hydrogeology existing conditions (WSP Golder 2022a) and updated 3D groundwater modelling predictions to reflect the enhanced hydrogeological characterization (WSP Golder 2022b; WSP Golder 2002c). These updates were submitted to the NWB under the 2023 Water License amendment. The updated groundwater model was calibrated to observed inflows and hydraulic heads near the existing Tiriganiaq underground and used to predict groundwater inflow (quantity and TDS quality) for the mine developments located below the permafrost or in open taliks during operations and closure. Closure predictions presented in WSP Golder (2022c) assumed no backfill would be placed in the open pits.

As part of the Project, Agnico Eagle is considering the alternative of in-pit deposition of tailings in six of the open pits (WES01, WES04, WES05, WN-01, PUMP01 and PUMP03) and waste rock deposition in the Discovery open pit. Lorax (2022b) completed analytical modelling for each of the proposed pits to be backfilled, and for one pit (WES05) they completed simplified 2D numerical modelling. This technical memorandum presents an updated hydrogeological assessment for the in-pit deposition of tailings/waste rock using the updated 3D calibrated model presented in WSP Golder (2022b). Relative to the analytical assessment, this approach will more effectively consider the influence of the underground developments present near the open pits and the three-dimensional groundwater flow field in the study area. The objective of the modelling was to provide updated pre-feasibility level predictions of seepage quantities and seepage migration pathways from each of the open pits to be considered for in-pit tailings or waste rock deposition.

2.0 SIMULATION OF POST-CLOSURE CONDITIONS WITH IN-PIT DESPOSITION

Post-closure groundwater flow conditions resulting from in-pit disposal were simulated by making the changes outlined below in the calibrated groundwater model (documented in WSP Golder 2022b) and then running the model in steady state. Particle tracking was used to predict the seepage migration pathways from the backfilled pits, and simplified transport analysis was used to predict the quantity of contact water that would discharge to down-gradient surface water receptors. The model simulates advective flow processes (advection and dispersion) only. Density dependent flow, or geochemical processes (sorption, desorption, precipitation, dissolution, and degradation) were not considered.

- Pit Lake levels in post-closure were assigned based on predicted levels in the water balance and water quality model for the Project (Lorax 2022a), along with final lake elevations at Lakes A6, A8 and B5 which intersect open pits. These values supersede the pit lake elevations adopted in the Lorax (2022b) in-pit disposal study. For all other lakes, the water levels were assumed to be unchanged from pre-mining conditions. Water levels assigned to the model for existing conditions and post-closure conditions are summarized in Table 1.
- The formation of pit lakes at closure will result in the degradation of permafrost below the pit lake. For post closure predictions, it was conservatively assumed that the permafrost would be fully degraded such that each pit lake would be connected to the regional groundwater flow system. Thermal modelling completed by Lorax (2022b) suggest that tailings deposition scenarios that promote heat loss from the tailings during operations will prolong formation of open taliks below the pits and the placement of dry covers could potentially prevent full permafrost degradation (formation of open talik) below the pits.
- The underground developments in the model were represented as linear discrete feature elements in the model, with an assigned hydraulic conductivity of one metre per second. This hydraulic conductivity was sufficiently high to allow for the equalization of hydraulic heads across the underground access ramps and drifts and the simulation of potential preferential flow through the developed workings. Of the proposed pits considered for in-pit tailings or waste rock disposition, five have underlying underground developments (WES01, WN01, PUM01, PUM03 and Disc).
- The top layer of the model was sub-divided into two layers to allow adequate simulation of flow through the tailings or waste rock. The elevation of nodes on slice 3 (top of model layer three) was set to match the final extents of the excavated open pit. The top of slice 1 (top of model layer one) was set to match the backfill elevation of the tailings or waste rock. The top of slice 2 (top of model layer two) was set equidistant from between slice 1 and slice 3 nodal elevations.
- Consistent with the previous assessment of in-pit disposal (Lorax 2022b), a hydraulic conductivity of 1×10^{-7} m/s was assumed for the tailings backfill and a hydraulic conductivity of 1×10^{-3} m/s was assumed for the waste rock backfill. Lorax (2022b) reported that the tailings hydraulic conductivity is based on laboratory measurements on tailings samples from Agnico Eagle's Meadowbank mine that were presented in Golder (2017).

- Two types of boundary conditions were used to simulate transport of contact water from the tailings or waste rock: specified concentration boundaries and zero flux boundaries.
  - The simulated pit lake above the deposited tailings or waste rock backfill was applied a source concentration/specified concentration boundary of 100 milligrams per litre (mg/L). All other pit lakes and surface water lakes were assigned a specified concentration of 0 mg/L. This approach allows for easy estimation of the proportion (percentage) of the seepage from the tailings or waste rock to a receiving environment (e.g., the concentration predicted by the model in the discharge to a receptor is equal to the proportion of the discharge that is contact water from the up-gradient pit lake).
  - Zero flux boundaries were assigned to the perimeter of the model. Overall, the boundaries of the model are set sufficiently far from the open pit and underground developments to not influence model predictions associated with the in-pit deposition of tailings and waste rock.
- No changes were made to the calibrated hydraulic conductivity values of the hydrostratigraphic units within the model domain. The assigned porosity (0.001), longitudinal dispersivity (5 m) and transverse dispersivity (0.5 m) were also unchanged from the calibrated model used previously for the simulation of total dissolved solids in the inflow to the underground developments.

Table 1: Predicted Post-closure Pit Lake and Surface Water Elevations

Lake	Post-closure Water Level (masl)	Pit Lake	Post-closure Water Level (masl)
A6	59.6	Disc	67
A8 East	62.2	FZO01	59.6
A8 West	62.2	FZO02	59.6
B4	56.5	FZO03	59.6
B5	58.3	PUM01	58.7
B6	61.9	PUM02	60.3
B7	62.7	PUM03	60.3
CH1	53.5	PUM04	62.2
CH5	58.8	TIRI01, TIRI-03 and WES01	62.5
CH6	63.5	TIRI02-04	65
Control	54.6	WES02	62.2
D4	55.5	WES03	62.2
D7	57.0	WES04	63
Meliadine	51.8	WES05	63.6
UN01	51.0	WN01	58.3
UN02	57.0		
UN03	58.0		

Table 1: Predicted Post-closure Pit Lake and Surface Water Elevations

Lake	Post-closure Water Level (masl)	Pit Lake	Post-closure Water Level (masl)
UN04	56.5		
UN06	60.0		
UN07	61.0		
UN09	64.0		
UN10	69.0		
UN11	79.0		

3.0 MODELLING RESULTS

Table 2 presents a summary of the modelling results for each open pit being considered as part of the pre-feasibility assessment of in-pit deposition of tailings or waste rock. As presented in Table 2, two of the open pits (WN01 and PUM03) are not predicted to be a source of contact water seepage and instead groundwater is predicted to discharge to the pit lakes formed in these pits (93.7 m^3/day at WN01 and 2 m^3/day at Pum03). The higher flow at WN01 is the result of the pit being adjacent to TIR03, which has a higher post closure pit lake elevation (62.5 m versus 58.3 m). The remaining five pits considered for in-pit deposition (WES01, WES04, WES05, PUM01 and DISC) are predicted to be a source of contact water discharge. For the pits with a predicted seepage loss, the contact water seepage from the in-filled pits ranged from 0.02 m^3/day at PUM01 to 4.1 m^3/day at WES05. These contact water discharges are small compared to the annual baseline runoff (less than 0.02%) estimated for lakes B5 (770,000 m^3), B4 (3,150,000 m^3), CH1 (2,170,000 m^3) and CH5 (1,490,000 m^3) as part of the FEIS (Agnico Eagle 2014). For Meliadine Lake (84,700,000 m^3), the contact water discharge compared to the annual baseline runoff is even smaller (less than 0.002%).

Total contact water seepage from the in-filled pits predicted by Lorax (2022b) using analytical modelling ranged from 0.009 m^3/day (WES04) to 1.24 m^3/day (WES05), which is overall slightly lower than predictions by the groundwater model. For the two pits that are not predicted by the groundwater model to be sources of contact water seepage, the seepage loss predicted from the analytical model was estimated to be 0.06 m^3/day (WN01) and 0.027 m^3/day (PUM03) respectively to Meliadine Lake. Although the analytical estimates are generally lower than those of the groundwater model (WN01 and PUM03 excluded), the analytical modelling results from Lorax (2022b) support that seepage loss from each of the in-filled pits is expected to be low.

Contact water from the WES04 and WES05 is predicted to discharge to Meliadine Lake (0.2 m^3/day and 4.1 m^3/day respectively), whereas PUM01 is predicted to discharge to Lake B4 (0.02 m^3/day). WES01 is primarily predicted to discharge contact water to nearby pit lake WN01 (0.7 m^3/day), with smaller discharges to Lake B4 (0.1 m^3/day and Lake B5 (0.2 m^3/day). DISC is predicted to discharge five down-gradient lakes. These lakes in order of decreasing discharge quantity are CH1 (1 m^3/day), Lake UN1 (0.8 m^3/day), Meliadine Lake (0.6 m^3/day), CH5 (0.41 m^3/day) and UN3[1] (0.031 m^3/day). Nearby Lake CH6 is predicted to be a recharge zone and therefore no contact water is predicted to discharge to this lake from DISC. Seepage from DISC pit is influenced by the three northwest trending faults present near the open pit, which contributes to the discharge migrating to lakes further away (Meliadine Lake and CH1).

Travel times predicted by the model range from 70 years (WES01) to over 1000 years at WES04, and do not include the time for permafrost to degradation and the development of open talik below the pits. In general the travel times may be faster than predicted by the model due to the method of fault simulation. Faults within the Project area generally range from 2 to 6 m thick, which is less than the element size near the undergrounds and open pits (10 to 25 m). An exception is the Pyke Fault and KMS corridor that have larger interpreted widths (15 to 100 m). Faults are simulated in the model by assigning an effective hydraulic conductivity representative of the combined transmissivity of the fault and competent bedrock to elements parallel to the fault alignment, with the fault set to be approximately two elements wide. The faults have been conservatively assumed to extend several kilometres away from the underground development and to extend to a depth of approximately one kilometre (-1025 m elevation). This approach is effective for capturing total flux to and from the pits and undergrounds but may result in slower travel times. Considering that the faults may be approximately a factor of ten wider in the model, actual travel times may be a tenth of those predicted by the groundwater model.

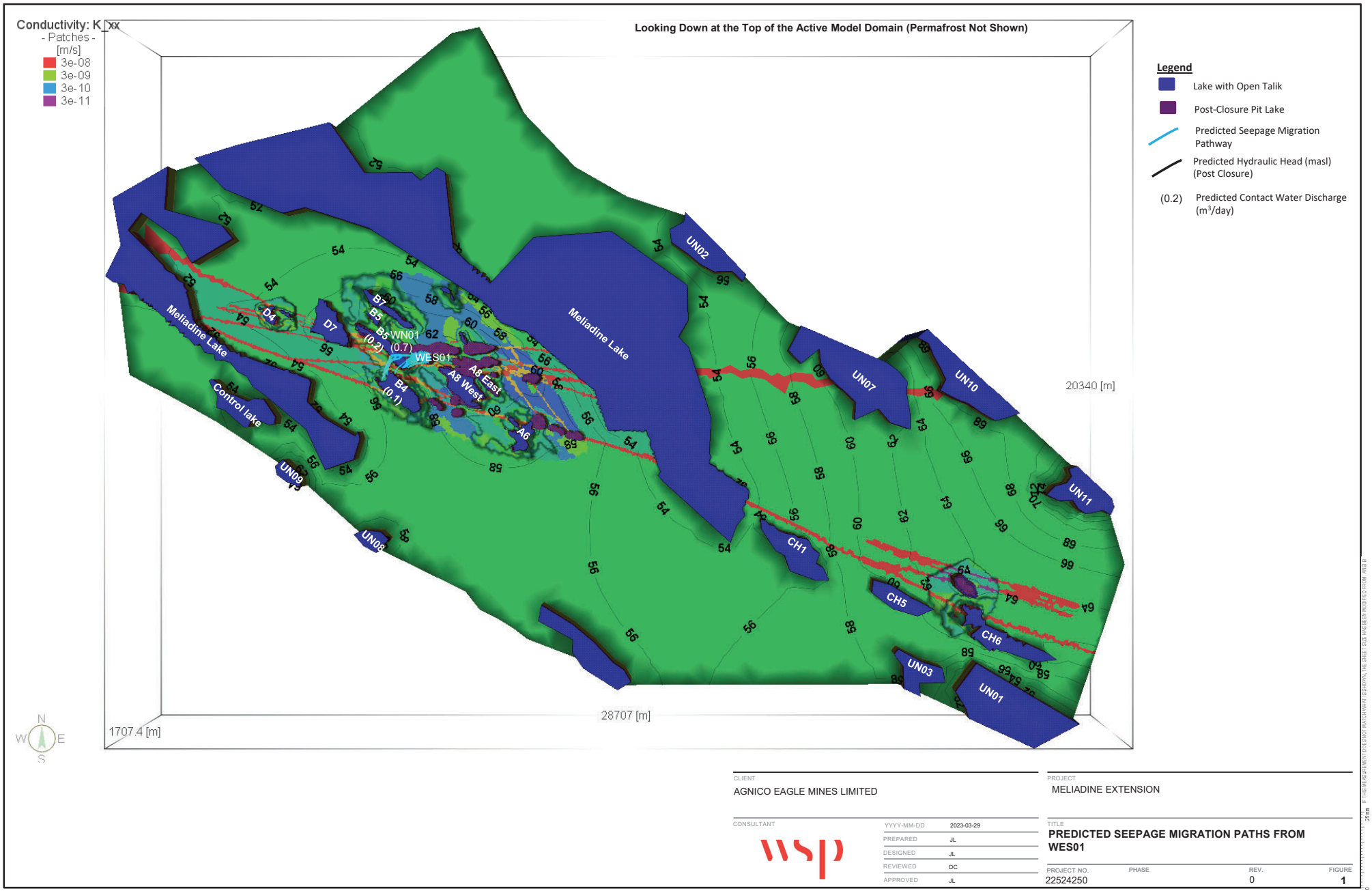
[1] Although contact water discharge to UN03 is predicted to the northwest edge of the lake, the lake is overall predicted to be a net source of groundwater recharge.

Table 2: Predict Contact Seepage Discharge from In-filled Pits to Downgradient Surface Water Lakes and Pit Lakes

Value	Unit	WES01	WES04	WES05	WN01	PUM01	PUM03	DISC
Pit Bottom Elevation	m asl	-10	30	-45	-65	25	-5	-75
Backfill Material[(a)]	-	Tailings	Tailings	Tailings	Tailings	Tailings	Tailings	Waste Rock
Backfill Elevation[(a)]	m asl	50	54	47	44	47	49	16
Underlying Underground	-	present	not present	not present	present	present	present	present
Post-closure Pit Lake Elevation[(b)]	m asl	62.5	63	63.6	58.3	58.7	60.3	67
Receptor and Predicted Contact Water Flux using Numerical Groundwater Model	m^3/day	Lake B4 – 0.1 Pit Lake WN01 – 0.7 Lake B5 – 0.2 (total contact water seepage – 1)	Meliadine Lake – 0.2	Meliadine Lake – 4.1	No Pit Lake Discharge. Groundwater discharges to Pit Lake. Total Discharge to Pit Lake – 93.7.	Lake B4 – 0.02	No Pit Lake Discharge. Groundwater discharges to Pit Lake. Total Discharge to Pit Lake – 2.0.	Meliadine Lake – 0.6 Lake UN1 – 0.8 Lake CH1 – 1.0 Lake CH5 – 0.4 Lake UN3 – 0.03 (total contact water seepage 2.8)
Travel Time (first arrival of contact water seepage) Using Numerical Groundwater Model[(b)]	Years	Lake B4 – 450 Lake WN01 – 70 Lake B5 – 70	Meliadine Lake – >1000	Meliadine Lake – 275	not applicable	Lake B4 – 650	not applicable	Meliadine Lake – >1000 Lake UN1 – >1000 Lake CH1 – >1000 Lake CH5 – >1000 Lake UN3 – >1000

(a) From Lorax 2022.

(b) Travel times do not include time to develop open talik conditions below the pits. Actual travels times may be faster than predicted as a result of how the faults are incorporated in the model (see Section 3.0).



CLIENT
AGNICO EAGLE MINES LIMITED

PROJECT
MELIADINE EXTENSION

CONSULTANT
wsp

YYYY-MM-DD	2023-03-29
PREPARED	JL
DESIGNED	JL
REVIEWED	DC
APPROVED	JL

TITLE
PREDICTED SEEPAGE MIGRATION PATHS FROM WES01

PROJECT NO.	PHASE	REV.	FIGURE
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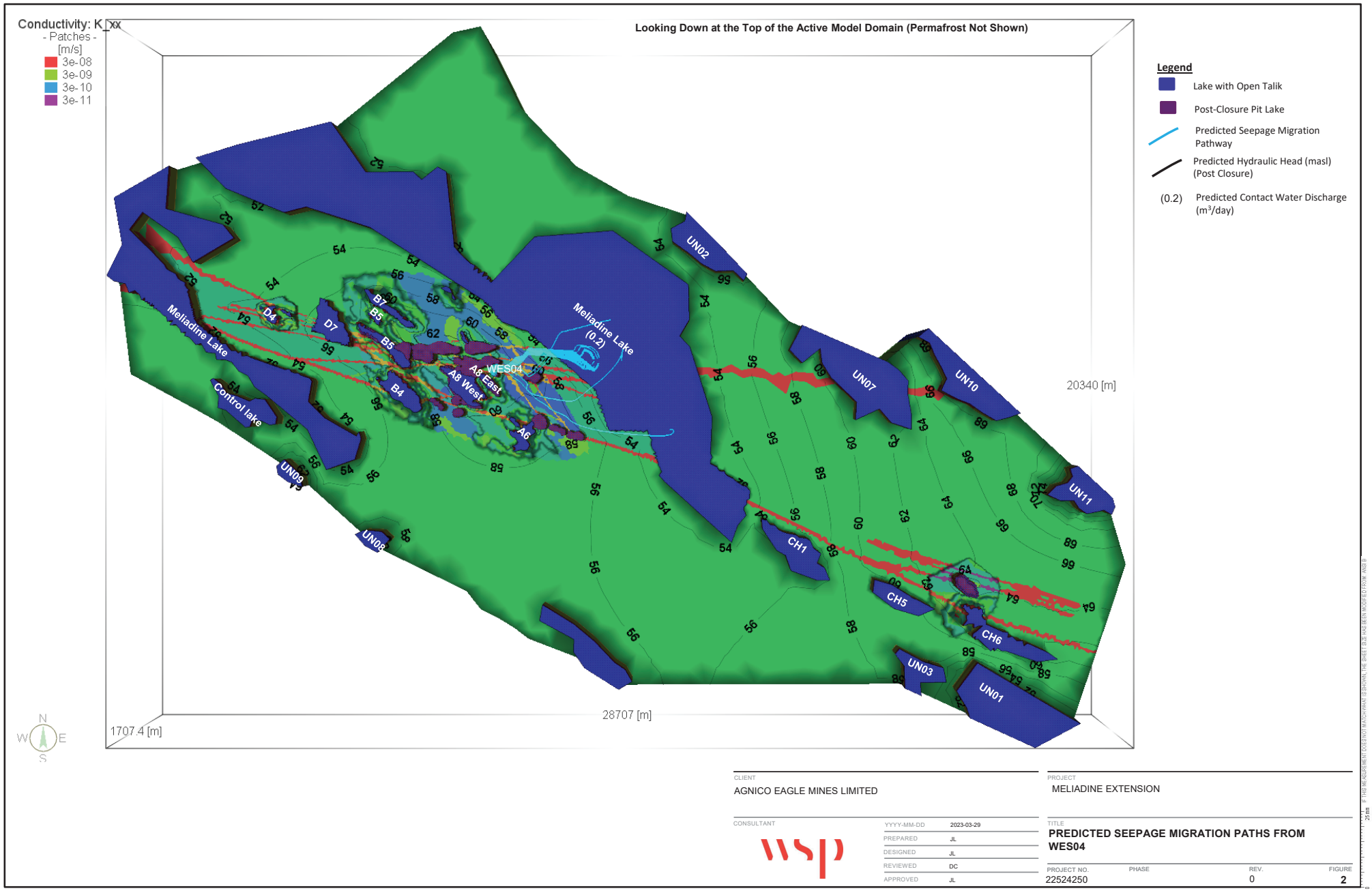

CLIENT
AGNICO EAGLE MINES LIMITED

PROJECT
MELIADINE EXTENSION

CONSULTANT
wsp

YYYY-MM-DD	2023-03-29
PREPARED	JL
DESIGNED	JL
REVIEWED	DC
APPROVED	JL

TITLE
PREDICTED SEEPAGE MIGRATION PATHS FROM WES04

PROJECT NO.	PHASE	REV.	FIGURE
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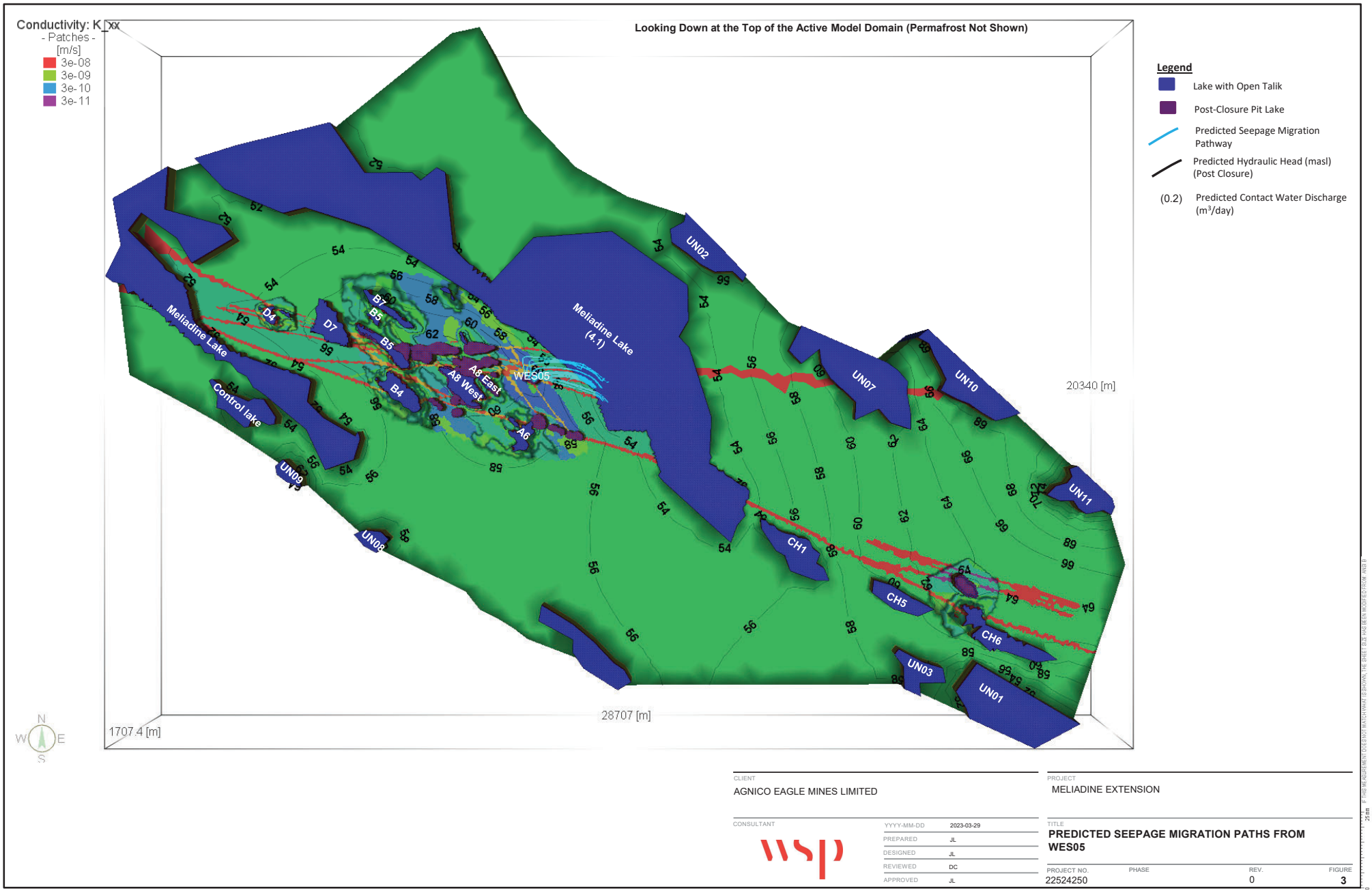

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CONSULTANT
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YYYY-MM-DD	2023-03-29
PREPARED	JL
DESIGNED	JL
REVIEWED	DC
APPROVED	JL

TITLE
PREDICTED SEEPAGE MIGRATION PATHS FROM WES05

PROJECT NO.	PHASE	REV.	FIGURE
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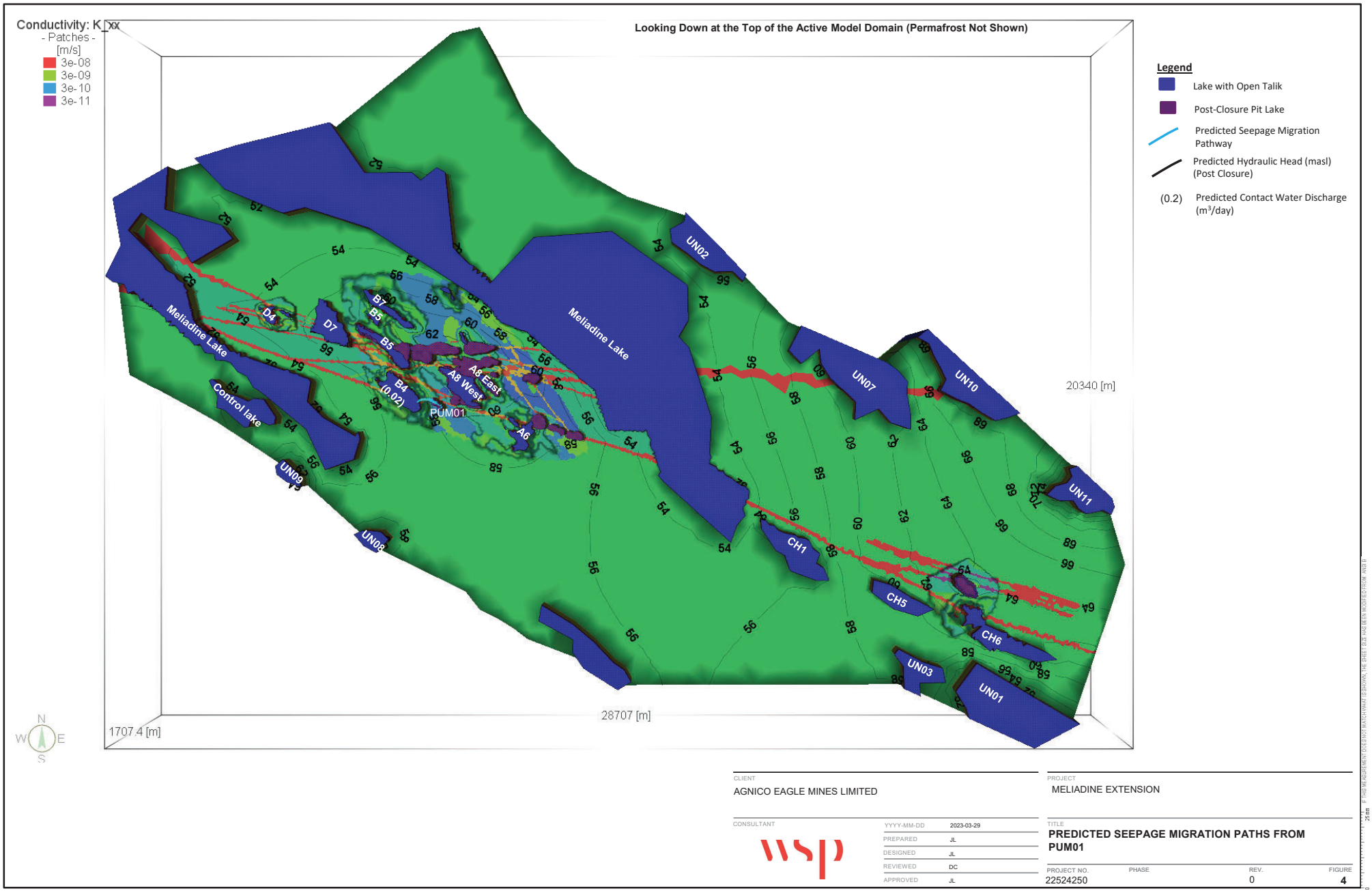

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PROJECT
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CONSULTANT
wsp

YYYY-MM-DD	2023-03-29
PREPARED	JL
DESIGNED	JL
REVIEWED	DC
APPROVED	JL

TITLE
PREDICTED SEEPAGE MIGRATION PATHS FROM PUM01

PROJECT NO.	PHASE	REV.	FIGURE
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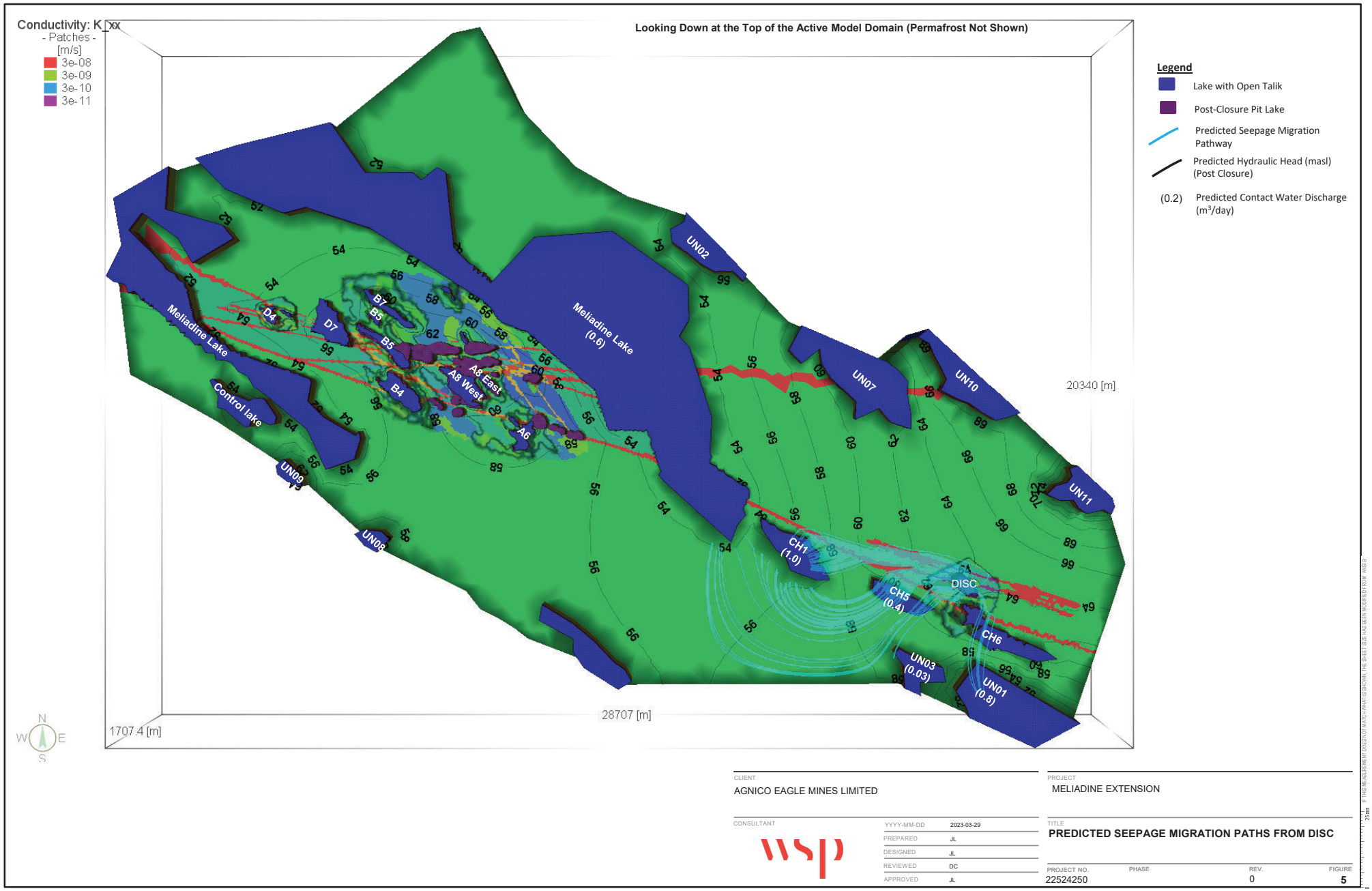

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AGNICO EAGLE MINES LIMITED

CONSULTANT
wsp

YYYY-MM-DD	2023-03-29
PREPARED	JL
DESIGNED	JL
REVIEWED	DC
APPROVED	JL

PROJECT
MELIADINE EXTENSION

TITLE
PREDICTED SEEPAGE MIGRATION PATHS FROM DISC

PROJECT NO.	PHASE	REV.	FIGURE
22524250		0	**5**

4.0 CLOSURE

We trust the above meets your present requirements. If you have any questions or require addition information, please contact the undersigned.

WSP Canada Inc.

2023-05-05

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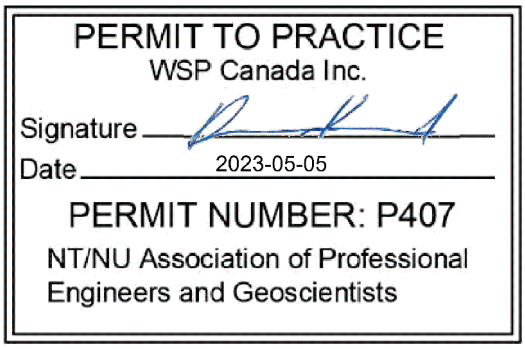
JL/DC/jc/sd

https://golderassociates.sharepoint.com/sites/162716/project files/6 deliverables/02_issued/22524250-972-tm-rev1-6000-in-pit alternatives/22524250-972-tm-rev1-6000-in pit alternatives 05may_23.docx



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