# Agnico Eagle Mines Ltd. Meliadine Extension Water Licence Amendment Technical Hearing Presentation by Environment and Climate Change Canada



# Overview 'PF'P 'P

- Mandate
- Relevant acts and regulations
- Technical Comments and Recommendations

- ◄□◁σċċ ∧⁵ժ♭ċ ◁ჼL LċՐ◁ċċ
- \Cu,\d\p<</li>
   \C,\d\p





### Environment and Climate Change Canada's Mandate ব«በርቤት የልር ለታየአ»

- Preservation and enhancement of the quality of the natural environment, including water, air and soil quality;
- Coordination of the relevant policies and programs of the Government of Canada;
- Renewable resources, including migratory birds and other nondomestic flora and fauna;
- Meteorology; and
- Enforcement of regulations

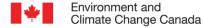
- bLՐ¬Ր° ◁Ͻ⋂ՖჼϽ° ◁ϽϤͿϪ°
   ⅆ²և¬ ለϲҧՐ⋂٬ϯϹϷϯ° ๒๓ϹϷ°
   Ⴑ≪ႾჼႻჼՐ°σ°;
- Δαρι'τής, Δαγρυμη
   Πρ<<ι>Ο' ΠλΓας αιμ αγνης
   Ο' Τας Ανμ ανγης
   Ο' Τας Ανμ ανγης
   Ο' Τας Ανμ ανγης
   Ο' Τας Ανμ ανγης
   Ο' Αργονης
- イニャークマン・マートン・
- Loton-unc Autsic





- Department of the Environment Act
- Canadian Environmental Protection Act
- Fisheries Act Pollution Prevention Provisions
- Migratory Birds Convention Act
- Species at Risk Act

- baCD
   backering
   backering
- ∩P<<br/>
  <br/>
  b) C ∩ L <br/>
  C \ A L <br/>





- Meliadine Lake water levels and water volume could be impacted by mine water withdrawals and discharges. This could have an impact on the lake's water quality and assimilation capacity.
- ECCC recommends that the Proponent confirm if Meliadine Lake levels are modelled in the Water Balance and Water Quality Model.
  - if so, explain how lake levels were modelled without incorporating the effects of water withdrawals by the mine.
  - if not, clarify where mine impacts on the lake levels have been considered.

- ECCC-d<sup>c</sup> C
   C
   C
   C
   C
   C
   C
   C
   C
   C
   C
   C
   C
   C
   C
   C
   C
   C
   C
   C
   C
   C
   C
   C
   C
   C
   C
   C
   C
   C
   C
   C
   C
   C
   C
   C
   C
   C
   C
   C
   C
   C
   C
   C
   C
   C
   C
   C
   C
   C
   C
   C
   C
   C
   C
   C
   C
   C
   C
   C
   C
   C
   C
   C
   C
   C
   C
   C
   C
   C
   C
   C
   C
   C
   C
   C
   C
   C
   C
   C
   C
   C
   C
   C
   C
   C
   C
   C
   C
   C
   C
   C
   C
   C
   C
   C
   C
   C
   C
   C
   C
   C
   C
   C
   C
   C
   C
   C
   C
   C
   C
   C
   C
   C
   C
   C
   C
   C
   C
   C
   C
   C
   C
   C
   C
   C
   C
   C
   C
   C
   C
   C
   C
  - ᢀ᠘ᢤᢞ<ᡪ,ᡆ᠋ᠣ᠘᠋᠘᠃᠖ᠳ᠖᠘ᡠ ᠘ᡃᡥ᠙ᠺ᠘ᡶᡫ᠋ᢗ᠘᠘ᠸᡊ᠙᠘᠘ᠫᢡᢉ᠘ᠾ ᠘᠑᠘ᠣᠺᢀ᠑ᠣᡕ᠘᠘ᢞᠮᡕ᠘ᡥᠲᡷᠣᡷ᠘ᡕ ᠘ᢣᢉᠲᠧ᠕᠘ᠮᡕ
  - ◇¹७▷Jơ, ⊃РፖℴℽፖՈʻጔJ ℴℴ ▷ϧϚϧϹΛϤϭ◇¹⊃Δ°ゼℂ▷ἰ° ℂՐ϶Ϳ° ΔՇՐԻԽՐՐԽՐԵՐ



# ECCC-TRC-02: Water Balance and Water Quality Model calibration

ECCC-TRC-02: ΔL>< ዻ፞ኈየ>Lσ∿し ዻ<sup>ւ</sup>L⊃ ΔL>< ℅ϼΔ·σ∿しϼ<sup>ϲ</sup> ዻ፞ኈየ>Lጚ፨ ℅>ት∖ኈC>σ∿し

ECCC's recommendations to the Proponent regarding the Water Balance and Water Quality Model:

- provide a rationale as to what might cause natural catchment runoff volume to be halved for CP3, and clarify if/how this rationale was applied to other catchments; and
- provide a statistical measure of fit between modelled and measured pond volumes, and discuss how the variance could impact mine water management.

- \\(\Omega\_1^c\tau\_1\tau\_2\tau\_2\tau\_2\tau\_2\tau\_1\tau\_2\tau

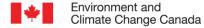




- Model indicates that that certain water quality parameters will exceed water quality guidelines for certain pits and lakes during post-closure. The proposed timeline for model updates would not allow for management actions to be implemented to avoid exceedances.
- ECCC recommends that the Proponent:
  - discuss management actions for the parameters of potential concern; and
  - propose timelines and updates to the .
     Water Balance and Water Quality Model to allow sufficient time for management actions to be put in place.

- ALD< dipple% dip ALD< babe ender the ALD< dipple and a di
- ECCC-qc ⟨¬¬¬¬с¬ч¬¬¬с¬ч¬¬¬

  - D'YS'>N' AYC'&'\'Y'-&'
     AC'"UL\A"YL\T\D \Langle ACL'\'J'
     A&\d'\L'\D \L'\A\d'\J'
     A&\d'\L'\D \L\\A\d\d'\D'
     A\D\C'\A\d'\J'
     A\D\C'\A\d\d\d\D'
     A\C\C\D\D'\.

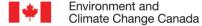




- The accuracy of the Water Balance and Water Quality Model can be evaluated using validation or sensitivity analysis.
   Neither method is present in the model, nor is there a discussion of uncertainty within the model.
- ECCC recommends that the Proponent evaluate the uncertainty of the model to provide an understanding of the range of possible results, and how this may impact the planned mine water management.

## ECCC-TRC-05: In-pit deposition modelling ECCC-TRC-05: Δンペンペープトレイト

- ECCC has three recommendations for the proponent regarding in-pit deposition modelling:
  - clarify additional water quantities required to create slurry tailings as opposed to filter tailings, specify from where this water would be sourced and confirm whether greater water withdrawals from Meliadine Lake would be required;
- ECCC-qc V~f/qc, d>c,qbpf4cq
   +cpp,qg,7d,4c,q
   +cpp,qg,7d,4c,q
   +cpp,qg,7d,4c,q
   +cpp,qq,4c,q
   +cpp,qq,q,4c,q
   +cpp,qq,q,q
   +cpp,qq,q,q,q
   +cpp,qq,q,q
   +cpp,qq,q
   +c





- explain when tailings consolidation is expected to be complete, estimate the size and extent of diffusive fluxes from in-pit tailings, and describe the contribution of consolidated tailings to the Water Balance and Water Quality Model source terms of groundwater discharge through in-pit tailings or waste rock into pit lakes; and
- describe a proposal for monitoring water quality at the interface between water and tailings or bedrock, including a proposed schedule. The monitoring plan should also discuss how the results will be used to verify model predictions and/or trigger further updates to the model.
- ▷σ⁰▷▷ፖሊጋЈ ⊃⁰ፖና▷⋂ ڻ▷▷Υѕσϭѕ⊃σ ΔĹ▷ѕ
   ⁰₽Δ°σ°∪σ⁰ ΔĹ▷ѕ «ЧĹ ⁰βΔ°°८¹∪∪σ,
   Λ⁰ԵՐ▷∩ σ° «◊°Р°С▷८ «
   °۵▷° ▷⁰▷▷ፖԵℂ◊Τ΄ Ν□°
   ⁰₽Δ⊂°∪с°σ°° «О)°С▷σσѕ°
   °α□αΔ°° γσ° «
   °α□αΔ°° γσ° «
   °α□αΔ°° γσ° «
   °α□ν «
   °α□ν «
   °α□ν «
   °α□ν «
   °α□ν «





# ECCC-TRC-06: Integration of Meliadine Extension project in Aquatic Effects Monitoring Program Design Plan ECCC-TRC-06: פרכב ארכב ארכב בייני א

- ECCC recommends that the Proponent integrate the Meliadine Extension project into the Aquatic Effects Monitoring Program, including referencing the Federal Environmental Impact Statement addendum, its findings and results.

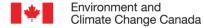


- ECCC notes that certain modifications between versions 1 and 2 of the Aquatic Effects Monitoring Program Design Plan seem to reduce clarity or provide less analysis of the data.
- ECCC recommends that the Proponent justify the simplification of analyses and text between versions 1 and 2 of the Aquatic Effects Monitoring Program Design Plan or re-integrate what was included in the previous version of the Aquatic Effects Monitoring Program Design Plan.
- ECCC-d<sup>c</sup> D<sup>c</sup>huhhh><sup>c</sup> Du<sup>c</sup>C dl<sup>c</sup>hudhCDd<sup>c</sup>
   ONGhleb Loch Dd<sup>c</sup>D<sup>c</sup>U, 1-D 2-D dd<sup>c</sup>D<sup>c</sup>C dl<sup>c</sup>C dl<sup>c</sup>D<sup>c</sup>C dl<sup>c</sup>Dhleb dl<sup>c</sup>Do<sup>c</sup> dl<sup>c</sup>C dl<sup>c</sup>



### ECCC-TRC-08: Aquatic Effects Monitoring Program reference areas

- Reference areas monitored through the Aquatic Effects Monitoring Program help identify local changes to the aquatic environment due to weather and other factors that are not related to the mine. Typically, reference areas are located in different watersheds or upstream of the near field and mid field sites.
- ECCC notes that the three reference areas used are all in Meliadine Lake. Two are downstream, located at the lake outflows. The third is in a bay that is not likely in a flow path potentially affected by discharges to Meliadine Lake.
- CY11
   CY14
   <





### ECCC-TRC-08: Aquatic Effects Monitoring Program reference areas

- ECCC recommends that the Proponent demonstrate how the selected reference sites within Meliadine Lake will remain suitable reference areas over a prolonged period with the mine Extension.
   Consideration should be given to alternate reference areas and/or modifications to the study design.
- ECCC-d<sup>c</sup> d)c<sup>c</sup>dhp<sup>c</sup> Aatho<sup>n</sup> Cdn<sup>c</sup>nor bo<sup>n</sup> of all color of the original origin



# ECCC-TRC-09: Closure of saline pond SP6 (Lake B7) ECCC-TRC-09: Lンケトゥー Cイናケ SP6 (Lake B7)

- The Extension Project proposes to use Lake B7 as a saline water storage pond for approximately 18 years. The mine plan of the Main Application document includes obtaining Metal and Diamond Mine Effluent Regulation Schedule 2 listing for Lake B7, so it can be fished out and dewatered.
- ECCC notes that sediment at the bottom
  will become enriched in salts from the
  contact with saline water over a prolonged
  period. If they are left in place uncovered at
  closure, the sediments will then become a
  source of salts and metals for the overlying
  water via diffusion. This enrichment would
  eventually reach Meliadine Lake through
  the connections with filled pits, lakes and
  streams.





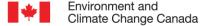
# ECCC-TRC-09: Closure of saline pond SP6 (Lake B7) ECCC-TRC-09: Lンケトゥーし Cィらケ SP6 (Lake B7)

#### ECCC recommends that:

- the proponent clarify if the Water Balance and Water Quality Model incorporates diffusion fluxes of salts and metals from saline sediment at the bottom of SP6. If it does not, the magnitude of this source should be described in relation to other fluxes so its impact can be evaluated; and
- guidelines for the protection of aquatic life are used for SP6 to assess postclosure water quality.

- ECCC-d<sup>c</sup> ΔL<sup>e</sup>Φ><sup>c</sup>d>><sup>c</sup>:

  - LCΓ
     CD
     CD
     CD
     CD
     CD
     CD
     CD
     CD
     CD
     DD
     AD
     DD
     DD
     DD





## ECCC-TRC-10: Saline water disposal during closure ECCC-TRC-10: ΔΓ<sup>™</sup>C<sup>™</sup>σ<sup>™</sup> L⊃/L∩<sup>™</sup>J

- At closure, saline water stored on surface will have to be disposed of.
- Although it is indicated that there is sufficient underground void space for this saline water at closure, the Water Balance and Water Quality Model provides and alternative for saline water disposal.
- ECCC recommends that the Proponent confirm if they are still considering disposing saline water in pits.
  - if so, a description of what modelling would be done, data necessary for the modelling and proposed timelines should be provided.

- LDYLN-J, AL® D®d®CDYLゼ® Ġ~U&CD®
   ACCD>n
- - \[
     \Delta \cdots \cdo



### ECCC-TRC-11: Uncertainty in thermal modelling for Discovery WRSFs ECCC-TRC-11: בבבר アンペンペントン・トゥッコン・ロール Discovery WRSFsーム・

- Most of the waste rock at the Meliadine mine is classified as non-potentially acid generating and non-metal leaching.
- Waste rock associated with the
  Discovery Pit is different in that the
  majority has been classified as
  potentially acid generating or metal
  leaching, or uncertain with respect to
  acid generation and metal leaching.
  Discovery Pit waste rock must therefore
  be stored in a manner to prevent
  development of acid drainage or metal
  leaching which would negatively impact
  water quality.



### ECCC-TRC-11: Uncertainty in thermal modelling for Discovery WRSFs ECCC-TRC-11: בבבンペンルンドンマム・コンタム・ィー Discovery WRSFsーュー

- A thermal cover made of non-potentially acid generating and non-metal leaching waste rock is proposed for the Discovery waste rock storage facilities. Uncertainty in the thermal model of the waste rock storage facilities is not discussed.
- ECCC recommends that the Proponent:
  - discuss uncertainty in the Thermal
    Modelling of Meliadine Discovery
    waste rock storage facilities through a
    sensitivity analysis or comparison to
    measured data at other waste rock
    storage facilities; and
  - consider including a safety factor in the design of the thermal cover thickness.

- ECCC-qc △⊃ Cdb>c √ Cdb \Lambda Ldc:

  - Δ
     Δ
     L
     L
     L
     L
     L
     L
     L
     L
     L
     L
     L
     L
     L
     L
     L
     L
     L
     L
     L
     L
     D
     E
     E
     E
     E
     E
     E
     E
     E
     E
     E
     E
     E
     E
     E
     E
     E
     E
     E
     E
     E
     E
     E
     E
     E
     E
     E
     E
     E
     E
     E
     E
     E
     E
     E
     E
     E
     E
     E
     E
     E
     E
     E
     E
     E
     E
     E
     E
     E
     E
     E
     E
     E
     E
     E
     E
     E
     E
     E
     E
     E
     E
     E
     E
     E
     E
     E
     E
     E
     E
     E
     E
     E
     E
     E
     E
     E
     E
     E
     E
     E
     E
     E
     E
     E
     E
     E
     E
     E
     E
     E
     E
     E
     E
     E
     E
     E
     E
     E
     E
     E
     E
     E
     E
     E
     E
     E
     E
     E
     E
     E
     E
     E
     E





### Thank You Ladit







## Annex I: Environment and Climate Change Canada's Technical Review Comments

ECCC-TRC-01	Meliadine Lake water balance
ECCC-TRC-02	Water Balance and Water Quality Model calibration
ECCC-TRC-03	Water Balance and Water Quality Model results
ECCC-TRC-04	Water Balance and Water Quality Model uncertainty
ECCC-TRC-05	In-pit deposition modelling
ECCC-TRC-06	Integration of Meliadine Extension project in Aquatic Effects
	Monitoring Program Design Plan
ECCC-TRC-07	Changes to analysis methods and descriptions in Aquatic Effects
	Monitoring Program Design Plan
ECCC-TRC-08	Aquatic Effects Monitoring Program reference areas
ECCC-TRC-09	Closure of saline pond SP6 (Lake B7)
ECCC-TRC-10	Saline water disposal during closure
ECCC-TRC-11	Uncertainty in thermal modelling for Discovery WRSFs

