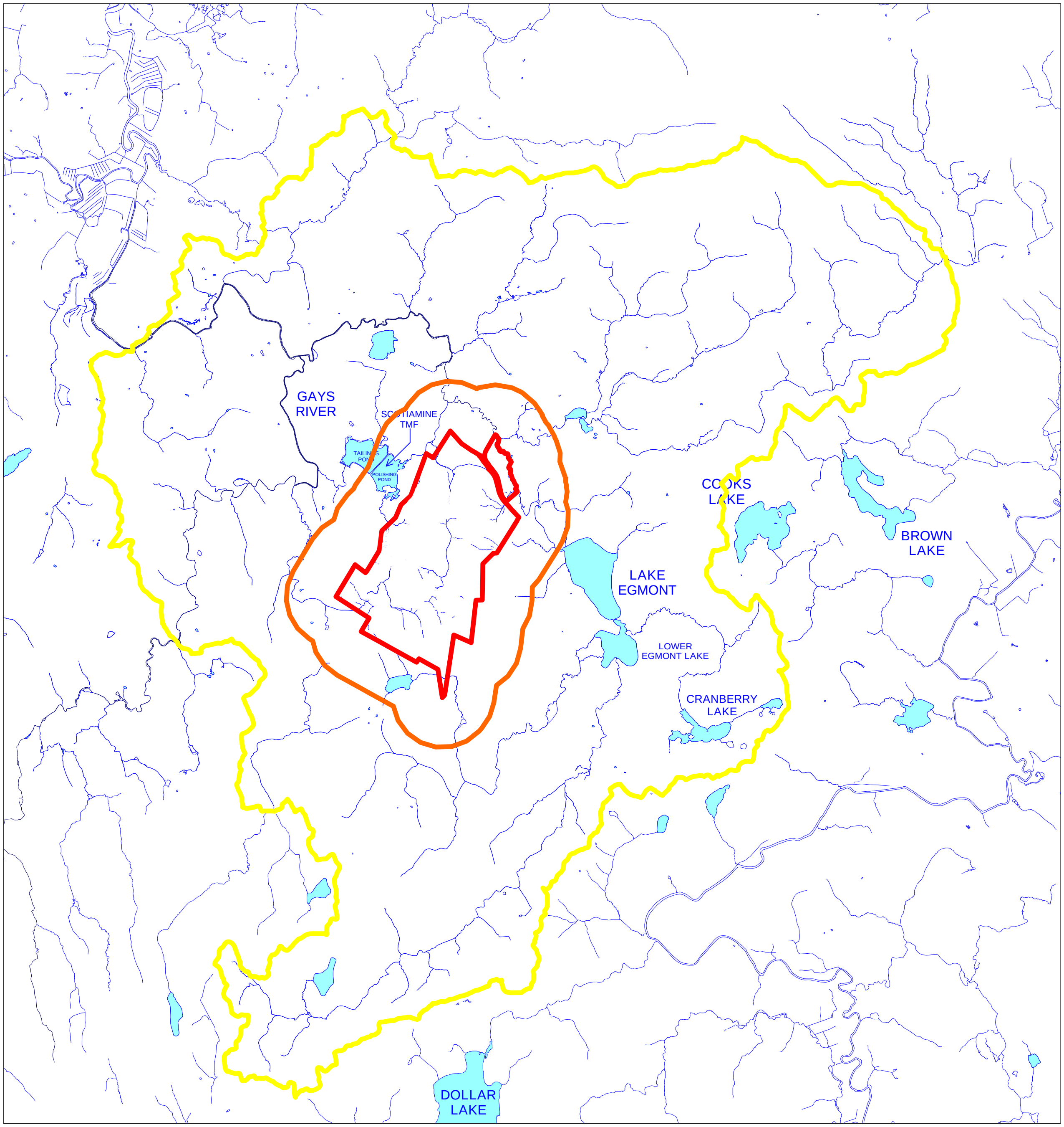

LEGEND

SURFACE WATER FEATURES
MAJOR RIVERS
SURFACE WATER BODY
REGIONAL ASSESSMENT AREA (RAA)
LOCAL ASSESSMENT AREA (LAA)
PROJECT AREA (PA)

0 1000 2000 3000m

N

GHD

CERTAINTEED CANADA INC
LAKE EGMONT, HALIFAX CO, NOVA SCOTIA
ANTRIM GYPSUM PROJECT

GROUNDWATER SPATIAL BOUNDARIES

Project No. **12601021**
Date **August 2024**

FIGURE 6.4-6

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Temporal Boundaries

– To provide a conservative, worst-case evaluation of the operation and closure phases three temporal boundaries were selected to evaluate groundwater quantity and quality impacts. The construction phase was not included as a temporal boundary because significant dewatering occurs once the open pit is advanced in the operation and closure phases and not during the construction phase. Temporal boundaries for the groundwater were selected as follows:
  - Phase 1b – represents partial extraction of the open pit with partial backfilling of Phase 1a.
  - End of Mine (EOM) – End of Phase 2 was used to represent EOM. This scenario represents full extraction
  - PC - Reclamation of the PA including partial pit backfill consisting of overburden, processing rejects, and waste rock, and subsequent filling of the remaining pit volume with water to form a pit lake

Administrative Boundaries

Groundwater quality with be compared against the lower of NS Tier 1 EQS for potable groundwater and CDWQ MAC, herein referred to as Potable Criteria. Groundwater quality is also compared against the NS Tier II EQS for groundwater discharging to surface water (>10 m). No administrative boundaries are identified for the effects assessment.

Technical Boundaries

No technical boundaries are identified for the effects assessment of groundwater.

6.4.4.2 Modelling of Groundwater Quantity Impacts

As described in Section 6.4.3.3, GHD developed a 3D numerical groundwater flow model that approximates groundwater flow conditions at the Project for the purpose of providing a conservative estimate of potential Project impacts to groundwater quantity. The groundwater flow model was applied to simulate potential groundwater quantity impacts (i.e., radius of influence of the pit and change in baseflow to surface water features) at Phase 1b, EOM, and PC.

Phase 1b, EOM, and PC conditions were simulated by incorporating the proposed open pit into the calibrated model. The proposed open pit was represented by specifying drain boundary cells along the perimeter of the open pit and setting internal model cells within the pit to no-flow boundaries. An additional hydraulic conductivity zone (zone 11) was added to the predictive models to represent the backfill material that will be added to the open pit. The zone representing backfill was assigned a hydraulic conductivity of 10x the till overburden based on the assumption that the backfill material will be composed partially of excavated backfill material.

For the predictive simulations representing PC conditions, constant head boundary cells were added to the perimeter of the pit to represent the pit lake. The constant head boundaries were assigned a stage of 25.1 m, consistent with the water level elevation of the proposed pit lake.

Each predictive scenario was completed assuming steady-state conditions to simulate the maximum potential changes to groundwater conditions under each scenario. Steady-state conditions are considered conservative because the actual groundwater elevation drawdown may not reach steady-state conditions during operations and subsequent filling of the pit.

6.4.4.3 Thresholds for Determination of Significance

The characterization criteria applied in the groundwater effects assessment are defined in Table and 6.4-7, below.

Table 6.4-7 Characterization Criteria for Residual Effects on Groundwater Quantity

Characterization	Quantitative Measure or Definition of Qualitative Categories
Magnitude	**N** – Simulated drawdown is less than 0.5 m **L** – Simulated drawdown greater than 0.5 but less than 1 m

Characterization	Quantitative Measure or Definition of Qualitative Categories
	M – Simulated drawdown greater than 1 but less than 5 m **H** – Simulated drawdown greater than 5 m
Geographic Extent	**PA** – direct and indirect effects from Project activities are restricted to the PA **LAA** – direct and indirect effects from Project activities are restricted to the LAA **RAA** – direct and indirect effects from Project activities are restricted to the RAA
Timing	**N/A** — seasonal aspects are unlikely to affect VCs **A** — seasonal aspects may affect VCs
Duration	**ST** – effects are limited to the construction phase or operations phase **MT** – effects occur in the construction phase and operations phase **LT** – effects occur in the construction phase and operations phase and persist in closure **P** – valued component unlikely to recover to baseline conditions
Frequency	**O** – effects occur once **S** – effects occur at irregular intervals throughout the Project **R** – effects occur at regular intervals throughout the Project **C** – effects occur continuously throughout the Project
Reversibility	**RE** – groundwater quantity will recover to baseline conditions before or after Project activities have been completed. **PR -** mitigation cannot guarantee a return to baseline conditions **IR** – effects to VCs are permanent and will not recover to baseline conditions

A significant adverse effect to groundwater quantity from the Project is defined as:

– A Project-related effect with a low magnitude, which occurs beyond the LAA, occurs sporadically or more frequently and is only partially reversible to irreversible.

Table 6.4-8 Characterization Criteria for Residual Effects on Groundwater Quality

Characterization	Quantitative Measure or Definition of Qualitative Categories
Magnitude	**N** – Concentration of groundwater parameters within the range of background concentrations at the PA boundary. **L** – Concentration of groundwater parameters above background levels but lower than the applicable guidelines. **M** – Concentrations of groundwater water parameters above both background and applicable guidelines at the PA boundary but resulting in no changes to potable well location. **H** – Concentrations of groundwater parameters exceed baseline and applicable guidelines at a potable well location.
Geographic Extent	**PA** – direct and indirect effects from Project activities are restricted to the PA **LAA** – direct and indirect effects from Project activities are restricted to the LAA **RAA** – direct and indirect effects from Project activities are restricted to the RAA
Timing	**N/A** — seasonal aspects are unlikely to affect VCs **A** — seasonal aspects may affect VCs
Duration	**ST** – effects are limited to the construction phase or operations phase **MT** – effects occur in the construction phase and operations phase **LT** – effects occur in the construction phase and operations phase and persist in closure **P** – valued component unlikely to recover to baseline conditions
Frequency	**O** – effects occur once **S** – effects occur at irregular intervals throughout the Project **R** – effects occur at regular intervals throughout the Project

Characterization	Quantitative Measure or Definition of Qualitative Categories
	C – effects occur continuously throughout the Project
Reversibility	**RE** – groundwater quality will recover to baseline conditions before or after Project activities have been completed. **PR -** mitigation cannot guarantee a return to baseline conditions **IR** – effects to VCs are permanent and will not recover to baseline conditions

A significant adverse effect to groundwater quality from the Project is defined as:

– A Project-related effect with a high magnitude, are of potential regional geographic extent and of medium to long term duration, occur at any frequency and are only partially reversible to irreversible.

6.4.5 Project Interactions and Potential Effects

Potential Project interactions with noise are presented in Table 6.4-9, below.

Table 6.4-9 Project Activities and Groundwater Interactions

Project Phase	Relevant Project Activity
Construction	Clearing, grubbing, and grading Topsoil, overburden, and waste rock management Surface infrastructure installation and construction Haul road construction Collection ditch and settling pond construction General waste management
Operation	Gypsum management (extraction, loading, hauling, screening) Topsoil, overburden, and waste rock management Water management Haul road construction and maintenance Petroleum products management Maintenance and repairs General waste management
Closure	Earthworks Water management General waste management

These interactions have the potential to change groundwater quantity and quality from baseline conditions as outlined below.

Changes in groundwater quantity may be caused by:

– Compaction of surfaces thereby reducing recharge: earth works including construction of the haul road, buildings, and stockpile management may lead to the compaction of subsurface soils. This may reduce the area in the PA that is available for groundwater recharge and cause a temporary lowering of the groundwater table relative to baseline conditions.
– Clearing and grubbing increasing recharge: clearing and grubbing will take place during construction and in operation as the open pit advances onto Crown lands. Removal of vegetation may temporarily increase recharge thereby potentially causing a small increase in local groundwater levels.
– Open pit dewatering: open pit dewatering will cause a lowering of the groundwater table and will reduce the quantity of groundwater available to surface water resources and potentially to potable well users.

- Blasting: Blasting is not anticipated to occur at a regular frequency but if used, blasting has the potential to increase fracture frequency in the bedrock near blast holes thereby increasing the permeability of the rock to groundwater flow.

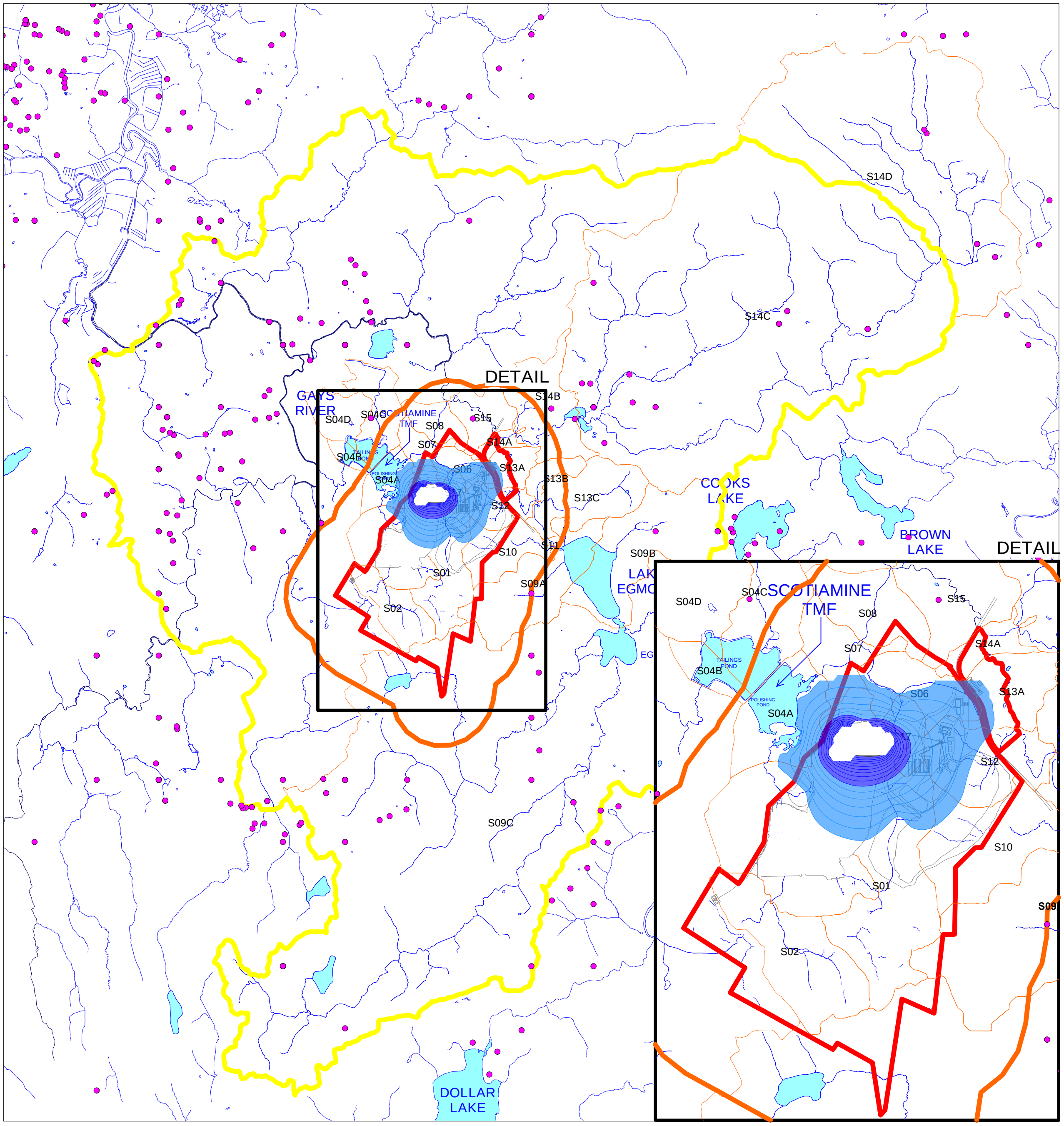
Changes in groundwater quality may be caused by:

- Topsoil, overburden and waste rock interactions with water: precipitation falling on topsoil and overburden stockpiles may leach potential constituents of concern from the stockpiles and that water may infiltrate into the subsurface and impact groundwater quality.
- Incomplete combustion of blast materials: As stated above, blasting is not anticipated to occur at a regular frequency however, the use of ammonium nitrate type explosives during operations has the potential to affect groundwater quality because the incomplete combustion of the explosive can leave nitrogen residual substances that can leach into groundwater.
- There is potential for spills of petroleum products associated with the use of machinery and handling/storage of petroleum products.

The potential impacts on groundwater quantity within the PA, LAA, and RAA as predicted by the numerical groundwater flow model are outlined below. The potential impacts on groundwater quality are discussed qualitatively. Potential impacts not directly addressed through the numerical groundwater flow modelling assessment are addressed through mitigation measures described in Section 6.4.6. The groundwater quantity and quality assessments are summarized below.

6.4.5.1 Simulated Change in Groundwater Table

GHD applied the groundwater flow model to simulate the change in the groundwater table (drawdown) that could potentially occur due to Project development. Figures 6.4-7, 6.4-8, and 6.4-9 present the simulated drawdown under Phase 1b, EOM, and PC conditions. As shown on Figures 6.4-7, 6.4-8, and 6.4-9, the greatest drawdown extent (i.e., radius of influence) is simulated under EOM conditions. This is expected as the EOM conditions correspond to the maximum extraction and dewatering. As shown on Figure 6.4-8, the maximum drawdown extent under EOM conditions extends approximately 800 m to the northeast and 700 m to the southwest of the open pit and is generally confined to within the LAA, with the exception of a small portion where simulated drawdown >0.5m is predicted to occur approximately 30 metres beyond the LAA. The maximum drawdown extent under all three conditions is contained within the RAA, and does not reach the nearest identified residential well location. As shown on Figure 6.4-9, the maximum predicted drawdown extent decreases under PC conditions compared to EOM conditions due to the partial filling of the pit with water under PC conditions.



LEGEND

- SURFACE WATER FEATURES
- MAJOR RIVERS
- CONCEPTUAL MINE LAYOUT
- S04A SURFACE WATER SUBCATCHMENT AREA
- SURFACE WATER BODY
- WATER SUPPLY WELL
- ACTIVE MODEL DOMAIN / REGIONAL ASSESSMENT AREA (RAA)
- LOCAL ASSESSMENT AREA (LAA)
- PROJECT AREA (PA)

DRAWDOWN (m)

- 0.5 - 20
- 20 - 30
- 30 - 60

0 1000 2000 3000m

N

CERTAINTEED CANADA INC
LAKE EGMONT, HALIFAX CO, NOVA SCOTIA
ANTRIM GYPSUM PROJECT

GROUNDWATER DRAWDOWN RELATIVE TO BASELINE CONDITIONS - PHASE 1b

Project No. **12601021**
Date **August 2024**

FIGURE 6.4-7

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