TECHNICAL MEMORANDUM

DATE 13 December 2019 **Project No.** 19127573-439-TM-Rev1

TO Michel Groleau
Agnico Eagle Mines Limited

CC Jen Range

FROM Adwoa Cobbina; Julien Lacrampe **EMAIL julien_lacrampe@golder.com**

TECHNICAL COMMENT KIVIA-WL-TC#9: ASSESSMENT OF LAKE D5 AND LAKE D1 TO EXPEDITE THE REFILLING DURATION OF WHALE TAIL LAKE (NORTH BASIN) AT CLOSURE

1.0 INTRODUCTION

1.1 Background

Closure of the Agnico Eagle Mines Limited (Agnico Eagle) Whale Tail Pit Expansion Project (the Project) is described in the Project's Final Environmental Impact Statement (FEIS) Addendum (Golder 2018). It includes the refilling of Whale Tail Lake (North Basin) with 65 Mm^3 of water, primarily based on gravity drainage of the surrounding catchments, estimated to be completed within approximately 17 years based on the Project's mean annual water balance. Refilling of the IVR Pit is expected in 2027, and refilling of the remainder of Whale Tail Lake (North Basin) is expected in 2042.

1.2 Scope of Document

This technical memorandum provides a conceptual plan to expedite the refilling duration in response to Comment KivIA-WL-TC#9 from the Kivalliq Inuit Association (KivIA), dated 16 September 2019:

"We further request Agnico Eagle provide documentation to support an increased fill rate, and what the greatest potential rate may be, for the pits intended to prevent ongoing oxidation of the pit walls".

The conceptual plan considered an assessment of Lake D5 and Lake D1 as potential supplemental water sources, as specifically discussed between KivIA and Agnico Eagle during the technical review meeting held on 20 September 2019. Lake C38 (Nemo Lake) may be used as a source of freshwater at closure and was therefore not considered as part of this assessment.

2.0 METHODS

This assessment relied on the baseline characterization of Lake D5 and Lake D1 previously completed in response to Commitment 32 made to Fisheries and Oceans Canada, provided in Appendix A.

The conceptual plan was developed based on the methods below:

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- The reliability of Lake D5 and Lake D1 as potential water sources to expedite the Project's refilling duration was assessed at a high level based on a comparison of their baseline mean annual water yields (i.e., the quantity of water discharged from the lakes on a mean annual year) to the Project's refilling volume.
- A conservative diversion rate was determined to minimize the potential effects of diversion on the surface water quantity of the adequate source.

3.0 RESULTS

3.1 Reliability Assessment

A comparison of the baseline mean annual water yield of Lake D5 and Lake D1 to the Project's refilling volume is provided in Table 1. The following was concluded:

- The mean annual water yield of Lake D5 represents less than 2% of the Project's refilling volume. The diverted quantity would be expected to be less than the total annual water yield to minimize the potential for adverse effects on baseline water levels (see Section 3.2 for further discussion) and would not be sufficient to expedite the refilling duration significantly. Lake D5 was therefore not considered to be a reliable water source to expedite the refilling duration.
- The mean annual water yield of Lake D1 represents 26% of the Project's refilling volume. The diverted quantity would be expected to be less than the total annual water yield to minimize the potential for adverse effects on baseline water levels (see Section 3.2 for further discussion); however, this quantity would be sufficient to expedite the refilling duration significantly. Lake D1 was therefore considered to be a suitable water source to expedite the refilling duration.

Table 1: Comparison of Mean Annual Water Yield to the Project's Refilling Volume

Potential Source	Drainage Area (km^2)	Mean Annual Water Yield (m^3/year)	Proportion of Refilling Volume
Lake D5	5.9	828,000	1.3%
Lake D1	110	17,100,000	26%

3.2 Diversion Rate and Reduced Refilling Duration

Figure 1 provides the refilling duration based on the proportion of the Lake D1 mean annual water yield diverted to Whale Tail Lake (North Basin) at closure.

The diversion of Lake D1 to Whale Tail Lake (North Basin) is expected to reduce discharges and water levels, with a magnitude proportional to the diverted quantities.

The diversion rate must therefore be limited to minimize the potential for adverse effects on discharges and water levels at Lake D1 and its outlet. While a detailed baseline program is planned for 2020, the baseline information currently available for Lake D1, presented in Appendix A, is insufficient to determine the potential effects of diversion with high confidence at this time. The following diversion limitations are therefore recommended for the purpose of water management planning in the absence of additional baseline data:

- Limit the annual diversion volume to 10% of the annual water yield to minimize the potential for adverse effects on water levels.
- Limit the diversion to the open water season to minimize the potential for adverse effects on overwintering fish and fish habitat.

This scenario was assessed using the Project's hydrological model developed for the FEIS updated with available information for the D watershed (Appendix A) and is expected to result in negligible effects on water levels, with an estimated reduction of less than 2 cm from the baseline levels under an average year. The diversion of Lake D1 equivalent to 10% of its mean annual water yield (approximately 1.7 Mm^3) is expected to reduce the refilling duration by approximately five years (i.e., from approximately 17 years down to approximately 12 years).

Additional baseline studies of Lake D1 are expected in 2020. These studies may be used to confirm the above, and refine the diversion concept (e.g., increase the annual diversion volume to expedite the refilling duration if adverse effects are expected to be minimal).

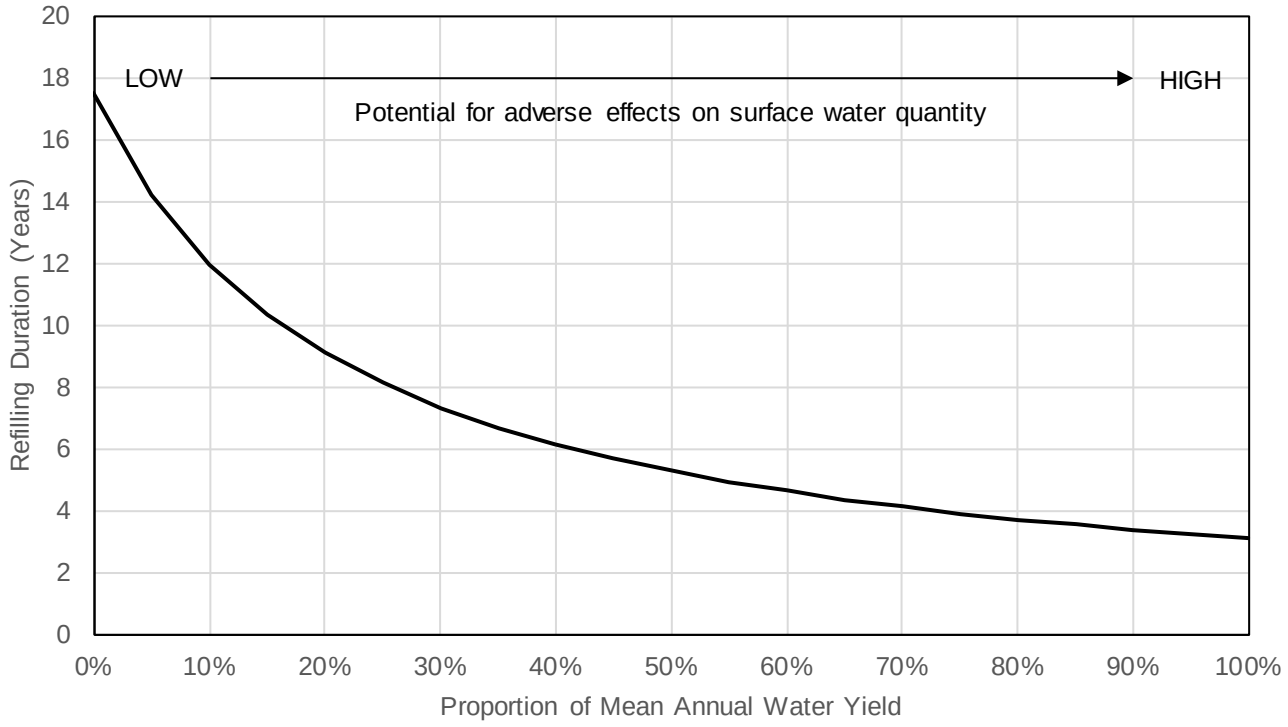

Figure 1: Estimated Refilling Duration of Whale Tail Lake (North Basin) based on Diverted Quantities from Lake D1

Closure

This technical memorandum was prepared and reviewed for Agnico Eagle by the undersigned.

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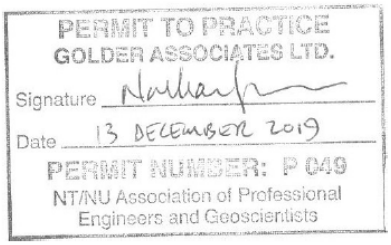
https://golderassociates.sharepoint.com/sites/113014/project files/5 technical work/stage-3_techmtg-phc/02_commitments/d1, d5 lake assessment/02_reporting/19127573-439-tm-rev1-externalrefillingsources.docx

References

Golder (Golder Associates Ltd.). 2018. Whale Tail Pit – Expansion Project. Final Environmental Impact Statement Addendum. December 2018.



APPENDIX A

Baseline Data

TECHNICAL MEMORANDUM

DATE 28 June 2019 **Project No.** 19115196-328-TM-Rev0

TO Michel Groleau
Agnico Eagle Mines Ltd.

CC John Faithful; Jen Range

FROM Julien Lacrampe **EMAIL julien_lacrampe@golder.com**

COMMITMENT 32: POTENTIAL IMPACTS OF OPERATIONAL DISCHARGES IN THE D WATERSHED ON THE DISCHARGE AND WATER LEVEL REGIMES OF LAKE D5 AND LAKE D1

1.0 INTRODUCTION

This technical memorandum is provided in response to Commitment 32 made to Fisheries and Oceans Canada during the Technical Meeting of the Agnico Eagle Mines Ltd. Whale Tail Pit Expansion Project (the Project). It provides an impact assessment of the "alternate discharge" scenario described in the Final Environmental Impact Statement (FEIS) Addendum (Golder 2018) on the discharge and water level regimes of Lake D5 and Lake D1.

2.0 METHODS

The methods of this assessment are consistent with the methods described in Section 6.3.3.1.1 of the FEIS Addendum (Golder 2018). The assessment was based on the calibrated water balance developed for the Project, updated for this assessment as follows:

- The D watershed was discretized into lake, land, and tributary areas for each sub-watershed upstream of Lake D1 (Appendix A).
- In the absence of detailed hydrological data for the D watershed, stage-discharge rating curves for each discretized lake were estimated as follows:
  - Lake D5: the rating curve was based on the rating curve available for Lake A18 (which has a similar drainage area as Lake D5), modified for consistency with estimated annual water level fluctuations of 0.2 m to 0.3 m (Appendix A). These estimated fluctuations are based on opportunistic field observations of the high water mark and of the general topography provided by Portt and Associates on 25 June 2019. A photograph of the lake outlet is provided in Appendix A.
  - Lake D1: the rating curve was based on the rating curve available for Lake A69 (i.e., the lake with the largest drainage area with an available rating curve previously derived for the Project) (Appendix A). This rating curve results in annual water level fluctuations of approximately 0.7 m over the expected range of discharges, consistent with field estimates of 0.5 m to 1.0 m provided by Portt and Associates on 25 June 2019. A photograph of the lake outlet is provided in Appendix A.

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- Other lakes: the rating curves of other discretized lakes were based on the rating curve available for Lake A18. It is noted that the rating curves of these other lakes have little effect on the discharge and water level regimes at Lake D1 given its large surface area compared to the other lakes of the D watershed. Thus, this approach was deemed to be suitable for this assessment.

- The potential impacts of operational discharges on the discharge and water level regimes of Lake D5 and Lake D1 were assessed based on a comparison of discharges and water levels derived under two scenarios:
  - A "Baseline" scenario to estimate the natural discharge and water level regimes of Lake D5 and Lake D1.
  - A "Discharge" scenario consisting of the Baseline scenario and operational discharges provided in Table A-1 of Appendix 6-E of the FEIS Addendum (Golder 2018) applied at Lake D5 for the assessment of Lake D5, and applied at Lake D1 for the assessment of Lake D1.

3.0 RESULTS

3.1 Lake D5

The derived potential impacts of operational discharges at Lake D5 on its discharge and water level regimes are summarized in Table 1, Figure 1, and Figure 2. The derived impacts are summarized as follows:

- Discharges: mean monthly discharges are expected to increase from the baseline values during the entire open water season.

  The 2-year flood discharge is expected to increase by 90% and the 100-year flood discharge is expected to increase by 61% from the baseline values. Low discharges are expected to increase from three to eight times the baseline values. As described in the FEIS Addendum (Golder 2018), this is related to the small drainage area of Lake D5 relative to the drainage area managed by the Project. Similar impacts are expected for lakes located both downstream of Lake D5 and upstream of Lake D1, although not explicitly presented.

- Water levels: mean monthly water levels are expected to increase slightly from the baseline values during the entire water season. This is related to the configuration of the lake outlet, which, based on opportunistic observation from Portt and Associates, discharges at a high rate with small increases in water level.

  The 2-year and 100-year flood levels are both expected to increase by 0.06 m. Mean monthly levels are expected to increase by 0.05 m or less. Impacts on water levels for lakes located both downstream of Lake D5 and upstream of Lake D1 are also expected; however, these were not assessed for this commitment.

- Other: Such increases in water quantity are expected to increase the potential for erosion. Thus, erosion protection measures would be required downstream of Lake D5 under this Discharge scenario. It is also noted that the Whale Tail Haul Road crosses the Lake D5 outlet. The design of its cross-drainage structures should be reviewed and updated if required, if this Discharge scenario were to be considered.

Table 1: Changes in Discharge and Water Level at Lake D5 from Operational Discharges

Parameter	Peak Daily		Mean Monthly				
	2-Year	100-Year	June	July	August	September	October
Discharge (%)	+90%	+61%	+141%	+262%	+284%	+213%	+122%
Water Level (m)	+0.06	+0.06	+0.05	+0.05	+0.04	+0.04	+0.02

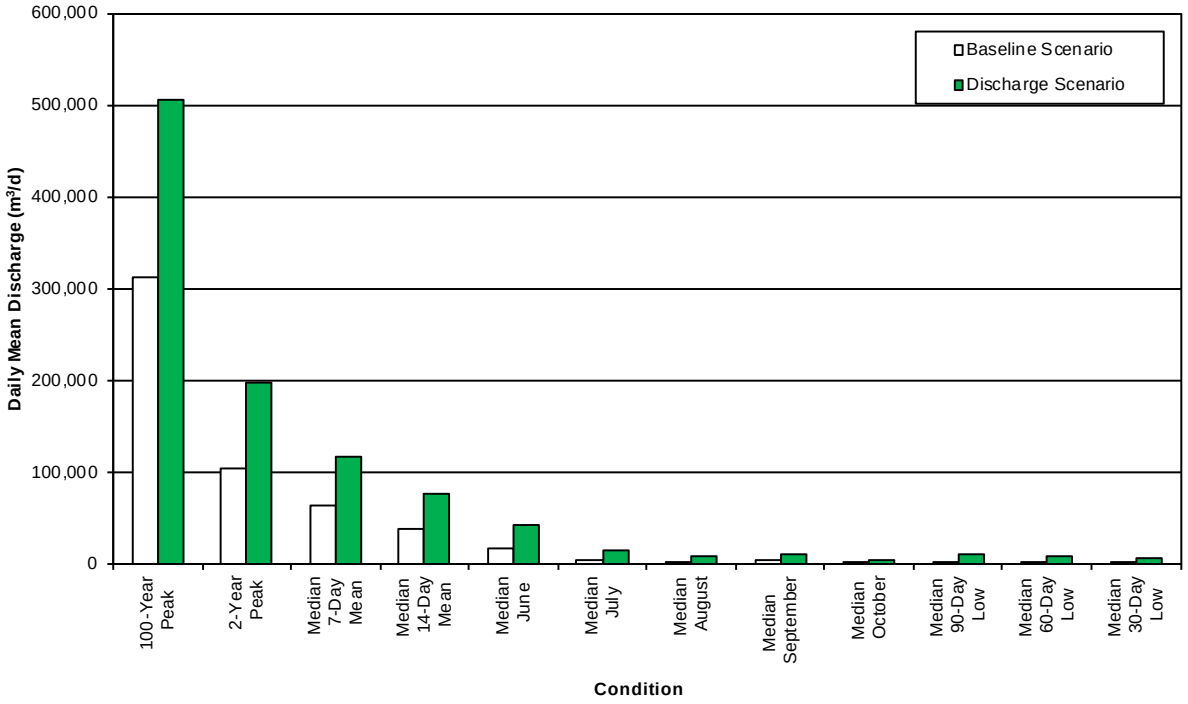

Figure 1: Derived Discharge Regimes at Lake D5 during the Baseline and Discharge Scenarios

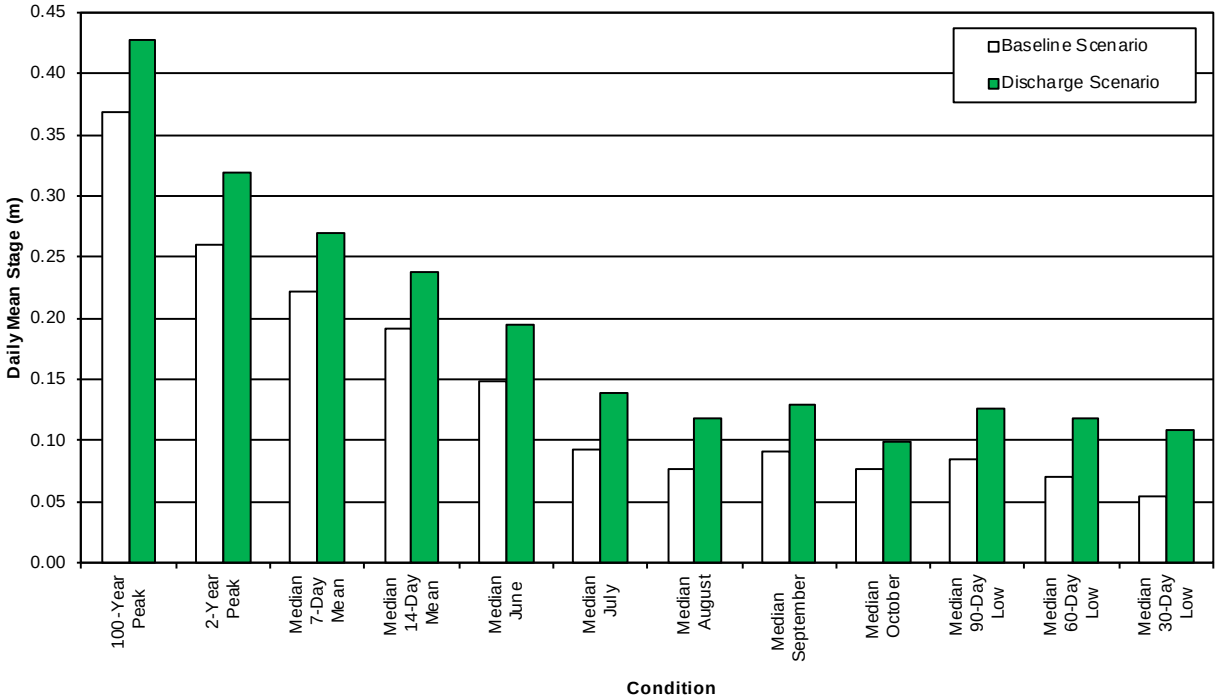

Figure 2: Derived Water Level Regimes at Lake D5 during the Baseline and Discharge Scenarios

3.2 Lake D1

The derived potential impacts of operational discharges at Lake D1 on its discharge and water level regimes are summarized in Table 2, Figure 3, and Figure 4. The derived impacts are summarized as follows:

- Discharges: mean monthly discharges are expected to increase from the baseline values during the entire open water season.

  The 2-year flood discharge is expected to increase by 5% and the 100-year flood discharge is expected to increase by 3% from the baseline values. Low discharges are expected to increase by 11% to 14% from the baseline values. As described in the FEIS Addendum (Golder 2018), these increases are related to the large drainage area of Lake D1 relative to the drainage area managed by the Project.

- Water levels: mean monthly water levels are expected to increase slightly from the baseline values during the entire water season.

  The 2-year and 100-year flood levels are both expected to increase by 0.01 m. Mean monthly levels are expected to increase by 0.01. These theoretical increases are not expected to be measurable.

Table 2: Changes in Discharge and Water Level at Lake D1 from Operational Discharges

Parameter	Peak Daily		Mean Monthly				
	2-Year	100-Year	June	July	August	September	October
Discharge (%)	+5%	+3%	+7%	+12%	+11%	+10%	+7%
Water Level (m)	+0.01	+0.01	+0.01	+0.01	+0.01	+0.01	+0.01

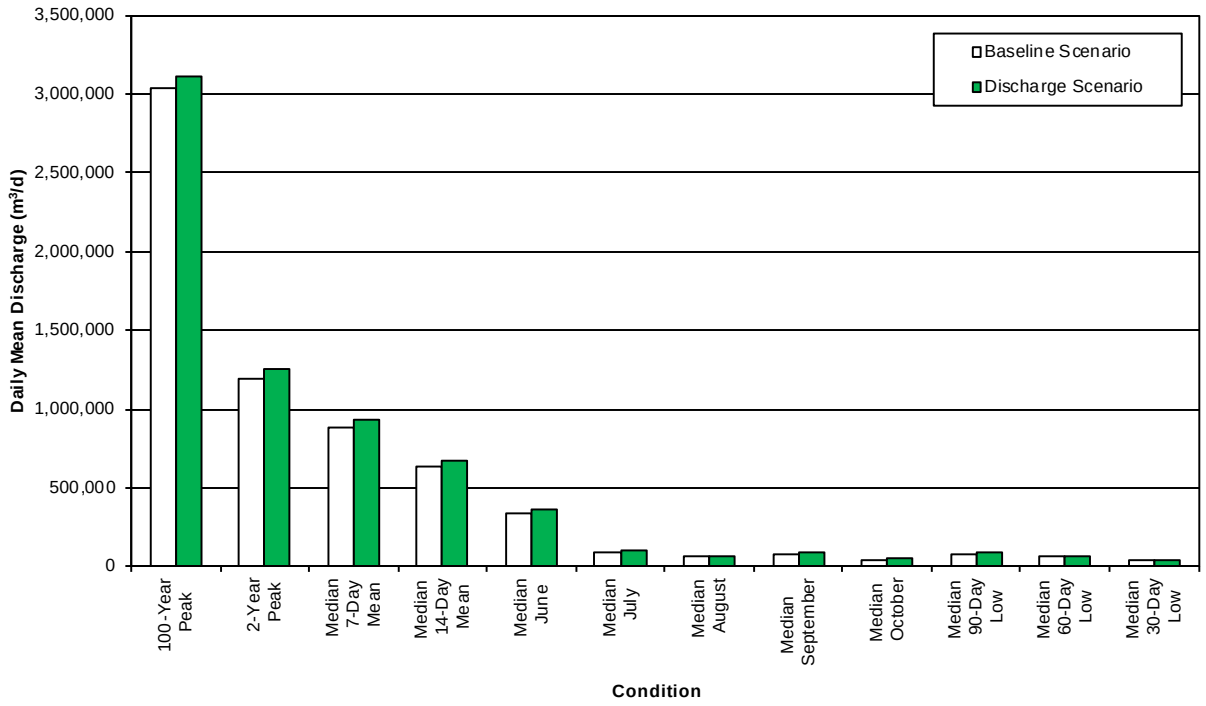

Figure 3: Derived Discharge Regimes at Lake D1 during the Baseline and Discharge Scenarios

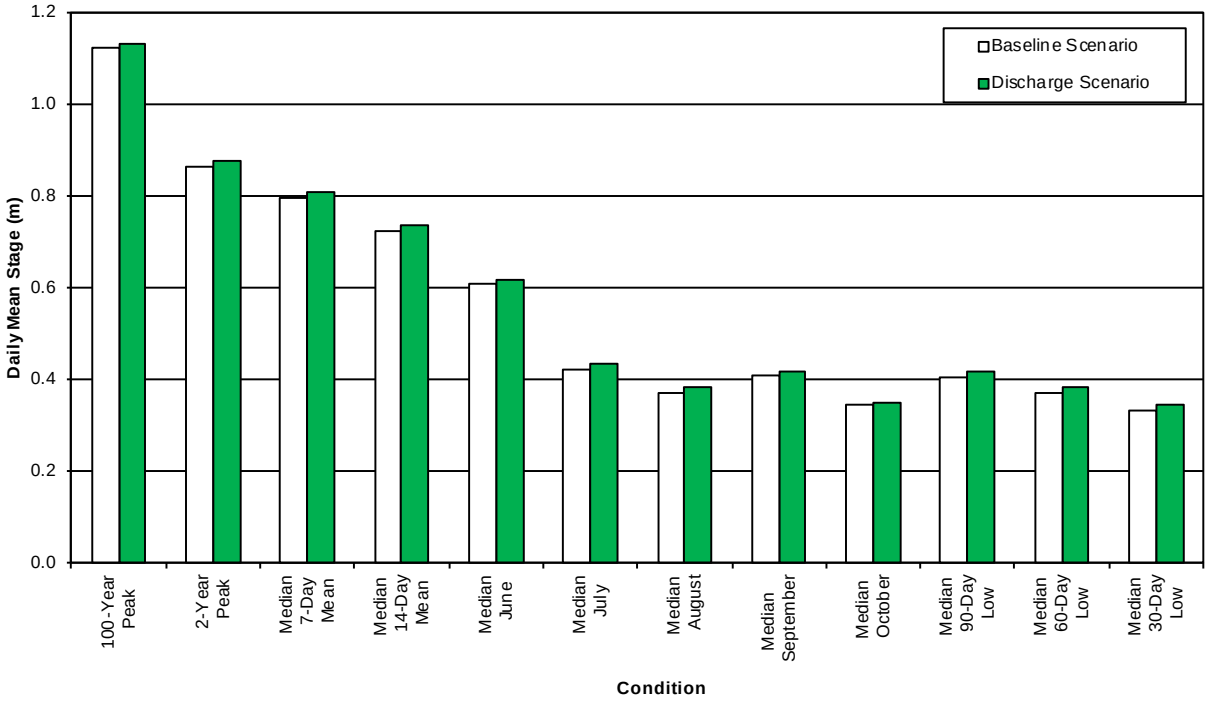

Figure 4: Derived Water Level Regimes at Lake D1 during the Baseline and Discharge Scenarios

Closure

This impact assessment was based on limited baseline data. Its results should be confirmed or refined if this Discharge scenario is considered, to allow the development of adequate mitigation measures.

This technical memorandum was prepared and reviewed for Agnico Eagle by the undersigned.

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https://golderassociates.sharepoint.com/sites/102931/stage c_techmeeting/03_tech_mtg_commitments/commitment_32_dfo3.4/02_response/19115196-328-tm-rev0-commitment32-opsdischargewatershedd.docx

References

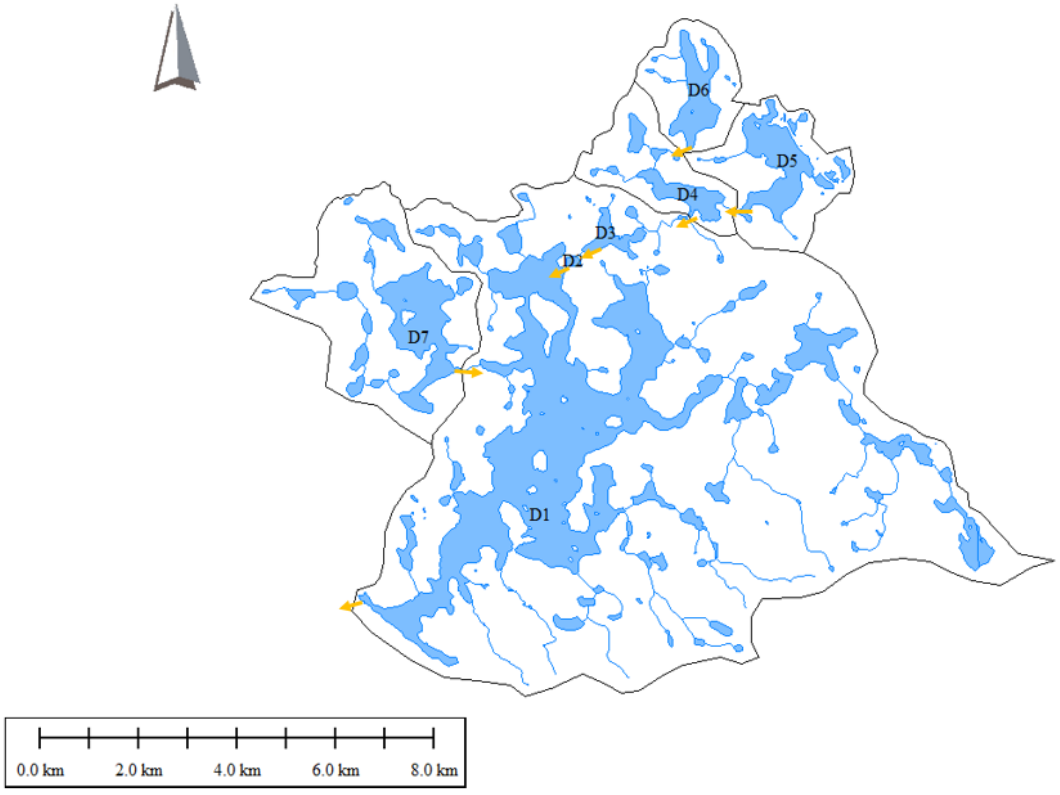
Golder (Golder Associates Ltd.). 2018. Whale Tail Pit – Expansion Project. Final Environmental Impact Statement Addendum. December 2018.

APPENDIX A

Baseline Data

Discretized D Watershed

The discretized D watershed is shown below.



Photographs

Field photographs are provided below for the lake outlet of Lake D5 and of the Lake D1, provided by Cam Portt and Associates.

Lake D5 Outlet (23 June 2019):

Lake D1 Outlet (1 June 2019):

Rating Curves

Estimated rating curves for Lake D5 (based on the derived rating for Lake A18) and for Lake D1 (based on the derived rating curve for Lake A69) are shown below.