TETRA TECH

TECHNICAL MEMO

ISSUED FOR USE

To:	Michel Groleau, B.A.Sc., P.Eng. Nunavut Permitting and Regulatory Affairs Agnico Eagle Mines Limited	**Date:**	March 28, 2021
c:		**Memo No.:**	001
From:	Bill Horne, M.Sc., P.Eng. Director of Arctic Engineering Tetra Tech Canada Inc.	**File:**	704-ENG.EARC03140-20

Subject: Assessment of Water Storage in Tiriganiaq II Open Pit, Meliadine Mine, Canada

1.0 INTRODUCTION

Saline water from the Meliadine Gold Mine underground operations is managed by temporarily storing it in ponds (saline ponds) and ultimately disposing it at sea. Site contact water (surface water) is managed through a series of water collection ponds (CP's) with annual disposal to Meliadine Lake provided it meets the permitted discharge limits.

The Tiriganiaq Pit 2 will be used as a saline pond for a period of time. It has been suggested to also to store a portion of the contact water in the pit. Agnico Eagle requested Tetra Tech Canada Inc. (Tetra Tech) to assess the effects on the permafrost if the Tiriganiaq Pit 2 pit was used to store both saline water and contact water.

2.0 WATER STORAGE

Projected water levels in Tiriganiaq Pit 2 water storage were evaluated for two scenarios. The primary difference between the two scenarios is that surface contact water (CP1 – CP6) runoff for June is added to Tiriganiaq Pit 2 in order to reduce the site discharge to Meliadine Lake.

Under Scenario 1, only saline water would be stored Tiriganiaq Pit 2 until the Waterline is approved, assumed 2023, and then the pit would be emptied on annual basis.

Water storage in Tiriganiaq Pit 2 under Scenario 2 considers contact water in June directed to the pit along saline water. The water level increases to near the top of the pit. The extent and depth of the water cover is much greater in Scenario 2 compared to Scenario 1. Also, the length of time before the pit is to be emptied is much greater under Scenario 2 since the amount water that can be drained is limited to a set amount.

3.0 PERMAFROST IMPACTS

Water in the pit will degrade the permafrost below the water level. In essence, a talik will start to develop and will propergate into submerged base and side slopes of the pit.

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In Scenario 1 the majority of the pit is flooded for 2 years; after this time the pit is drained, allowing the the base of the pit to be exposed to ambient tempertures during the first part of each winter. This will reduce the amount of permafrost degradation in the base of the pit.

Additional contact water directed to Tiriganiaq Pit 2 under Scenario 2 results in the pit nearly full in the first two years, and base of the pit remains flooded for approximately 6 years. The additional water and longer inpit pond duration in Scenario 2 will result in warmer permafrost, and additional permafrost degradation of the pit wall and base.

As mining within Tiriganiaq Pit 2 is expected to resume later in mine life, geotechnical integrity of the pit walls must be considered. Similarly, as mining of the Tiriganiaq Underground mine will occur underneath Tiriganiaq Pit 2, it is important to also consider the geotechnical integrity of the crown pillar together with the pond water pressure head at the pit base.

Permafrost degradation could result in the following:

- Destabilization of the pit walls; this could impact the subsequent mining of Tiriganiaq Pit 2.
- Initiate thaw degradation seepage flow from the base of the partially flooded pit into the underground mine working.
- Warmer ground tempertures in the crown pillar (i.e. the zone between base of open pit and the underground mine working) resulting in less stable underground mine working conditions.

Permafrost degradation could result in higher risk to worker safety in the open pit and underground mine. In conclusion Tetra Tech recommends to limit the depth of water and the water storage period in Tiriganiac Pit 2 to reduce permafrost dregradation and the formation of a talik below the pit flood level.

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5.0 CLOSURE

We trust this technical memo meets your present requirements. If you have any questions or comments, please contact the undersigned.

Enclosure: Limitations on Use of this Document

APPENDIX A

TETRA TECH'S LIMITATIONS ON USE OF THIS DOCUMENT

LIMITATIONS ON USE OF THIS DOCUMENT

GEOTECHNICAL

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1.4 DISCLOSURE OF INFORMATION BY CLIENT

The Client acknowledges that it has fully cooperated with TETRA TECH with respect to the provision of all available information on the past, present, and proposed conditions on the site, including historical information respecting the use of the site. The Client further acknowledges that in order for TETRA TECH to properly provide the services contracted for in the Contract, TETRA TECH has relied upon the Client with respect to both the full disclosure and accuracy of any such information.

1.5 INFORMATION PROVIDED TO TETRA TECH BY OTHERS

During the performance of the work and the preparation of this Professional Document, TETRA TECH may have relied on information provided by persons other than the Client.

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The Client, and any Authorized Party, acknowledges that the Professional Document is based on limited data and that the conclusions, opinions, and recommendations contained in the Professional Document are the result of the application of professional judgment to such limited data.

The Professional Document is not applicable to any other sites, nor should it be relied upon for types of development other than those to which it refers. Any variation from the site conditions present, or variation in assumed conditions which might form the basis of design or recommendations as outlined in this report, at or on the development proposed as of the date of the Professional Document requires a supplementary investigation and assessment.

TETRA TECH is neither qualified to, nor is it making, any recommendations with respect to the purchase, sale, investment or development of the property, the decisions on which are the sole responsibility of the Client.

1.7 ENVIRONMENTAL AND REGULATORY ISSUES

Unless stipulated in the report, TETRA TECH has not been retained to investigate, address or consider and has not investigated, addressed or considered any environmental or regulatory issues associated with development on the subject site.

1.8 NATURE AND EXACTNESS OF SOIL AND ROCK DESCRIPTIONS

Classification and identification of soils and rocks are based upon commonly accepted systems and methods employed in professional geotechnical practice. This report contains descriptions of the systems and methods used. Where deviations from the system or method prevail, they are specifically mentioned.

Classification and identification of geological units are judgmental in nature as to both type and condition. TETRA TECH does not warrant conditions represented herein as exact, but infers accuracy only to the extent that is common in practice.

Where subsurface conditions encountered during development are different from those described in this report, qualified geotechnical personnel should revisit the site and review recommendations in light of the actual conditions encountered.

1.9 LOGS OF TESTHOLES

The testhole logs are a compilation of conditions and classification of soils and rocks as obtained from field observations and laboratory testing of selected samples. Soil and rock zones have been interpreted. Change from one geological zone to the other, indicated on the logs as a distinct line, can be, in fact, transitional. The extent of transition is interpretive. Any circumstance which requires precise definition of soil or rock zone transition elevations may require further investigation and review.

1.10 STRATIGRAPHIC AND GEOLOGICAL INFORMATION

The stratigraphic and geological information indicated on drawings contained in this report are inferred from logs of test holes and/or soil/rock exposures. Stratigraphy is known only at the locations of the test hole or exposure. Actual geology and stratigraphy between test holes and/or exposures may vary from that shown on these drawings. Natural variations in geological conditions are inherent and are a function of the historic environment. TETRA TECH does not represent the conditions illustrated as exact but recognizes that variations will exist. Where knowledge of more precise locations of geological units is necessary, additional investigation and review may be necessary.

1.11 PROTECTION OF EXPOSED GROUND

Excavation and construction operations expose geological materials to climatic elements (freeze/thaw, wet/dry) and/or mechanical disturbance which can cause severe deterioration. Unless otherwise specifically indicated in this report, the walls and floors of excavations must be protected from the elements, particularly moisture, desiccation, frost action and construction traffic.

1.12 SUPPORT OF ADJACENT GROUND AND STRUCTURES

Unless otherwise specifically advised, support of ground and structures adjacent to the anticipated construction and preservation of adjacent ground and structures from the adverse impact of construction activity is required.

1.13 INFLUENCE OF CONSTRUCTION ACTIVITY

There is a direct correlation between construction activity and structural performance of adjacent buildings and other installations. The influence of all anticipated construction activities should be considered by the contractor, owner, architect and prime engineer in consultation with a geotechnical engineer when the final design and construction techniques are known.

1.14 OBSERVATIONS DURING CONSTRUCTION

Because of the nature of geological deposits, the judgmental nature of geotechnical engineering, as well as the potential of adverse circumstances arising from construction activity, observations during site preparation, excavation and construction should be carried out by a geotechnical engineer. These observations may then serve as the basis for confirmation and/or alteration of geotechnical recommendations or design guidelines presented herein.

1.15 DRAINAGE SYSTEMS

Where temporary or permanent drainage systems are installed within or around a structure, the systems which will be installed must protect the structure from loss of ground due to internal erosion and must be designed so as to assure continued performance of the drains. Specific design detail of such systems should be developed or reviewed by the geotechnical engineer. Unless otherwise specified, it is a condition of this report that effective temporary and permanent drainage systems are required and that they must be considered in relation to project purpose and function.

1.16 BEARING CAPACITY

Design bearing capacities, loads and allowable stresses quoted in this report relate to a specific soil or rock type and condition. Construction activity and environmental circumstances can materially change the condition of soil or rock. The elevation at which a soil or rock type occurs is variable. It is a requirement of this report that structural elements be founded in and/or upon geological materials of the type and in the condition assumed. Sufficient observations should be made by qualified geotechnical personnel during construction to assure that the soil and/or rock conditions assumed in this report in fact exist at the site.

1.17 SAMPLES

TETRA TECH will retain all soil and rock samples for 30 days after this report is issued. Further storage or transfer of samples can be made at the Client's expense upon written request, otherwise samples will be discarded.