TETRA TECH EBA

TECHNICAL MEMO

ISSUED FOR USE

To:	Stephane Robert, Manager, Regulatory Affairs	**Date:**	January 7, 2016
c:	Guangwen (Gordon) Zhang, Principal Specialist	**Memo No.:**	001
From:	Nigel Goldup	**File:**	704-ENG.EARC03000-01
Subject:	Response to Information Request KIA-WL-01: Type A Water Licence Application: Meliadine Gold Project, NU		

1.0 AGNICO EAGLE COMMITMENT

In terms of the Information Request KIA-WL-01, Agnico Eagle Mines Limited (Agnico Eagle) made the following commitment:

"Moving forward Agnico Eagle is committed to revisiting their design of the main overburden waste rock storage facility to determine if a portion of the 7.4 M tonnes of overburden removed prior to mining of the Tiriganiaq open pits can be placed in a manner within the same overburden/WRSF footprint that would permit later recovery of this overburden for use in mine site reclamation purposes taking into consideration where appropriate (QA/QC, design, stability, location, usability, economics…). We will see if a practical solution can be found for closure and communicate with KIA further on the issue in advance of the hearing."

2.0 RESPONSE REGARDING REVISITING THE OVERBURDEN WITHIN THE WASTE ROCK STORAGE FACILITY

With reference to Agnico Eagle's commitment shown in bold text in Section 1.0, Tetra Tech EBA Inc. (Tetra Tech EBA) has reviewed the design of the main overburden/waste rock storage facilities (WRSFs) on behalf of Agnico Eagle and has the following comments regarding later recovery of overburden for use at the mine site.

2.1 Background Information

The overburden materials overlie the Tiriganiaq open pits and comprise frozen non-cohesive silts and sands with some coarser materials of gravels and boulders. The plan is to strip these overburden materials and place them within the footprint of the WRSFs prior to mining of the Tiriganiaq ore bodies by open pit methods. It should be noted that the overburden materials are the first materials to be excavated before mining the bedrock which contains the ore. The design of the mine site layout, which includes the WRSFs, has been optimised to keep the footprint of the mine and associated infrastructure as small and compact as possible.

Due to the non-cohesive nature of the overburden, the fact that some of this overburden could be ice rich, and once placed the overburden could be susceptible to erosion and slumping. The design considered it necessary to laterally constrain and encapsulate the majority of the overburden materials within the waste rock as shown on the attached Drawing Number 6509-616-210-202-001A to -003A. Approximately 6.5 M tonnes, 0.27 M tonnes, and 0.49 M tonnes of overburden will be stored within WRSF1, WRSF2, and WRSF3, respectively. In addition, there is a separate Temporary Overburden Stockpile comprising selected ice-poor overburden materials designated for closure and reclamation purposes. This stockpile is located east of the Tailings Storage Facility (TSF) with a storage capacity of 0.1 M tonnes as shown in Drawing Number 6500-680-210-200A.

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As presented above, the majority of the overburden will be permanently stored internally within the WRSFs. As shown in Drawing Number 6509-616-210-202-001A to -003A the overburden will be laterally supported by the waste rock. Due to the frozen blocky nature of the overburden materials, these materials cannot be compacted on placement and could be prone to thaw, settlement, water seepage from melting ice, pore water pressure buildup due to poor drainage, and possible slope stability issues if placed too steeply. Hence the design has allowed the overburden material to be buttressed by waste rock which will provide lateral support, protection, and containment. The waste rock buttress around the overburden significantly reduces the footprint of WRSFs and helps achieve the objective of a compact mine site layout.

In addition, where the waste rock covers the overburden, on the top and side slope, the waste rock will provide thermal cover for the overburden materials. This thermal cover will promote the overburden materials to stay frozen and freeze back if thawed during placement. It should be noted that the stability of the WRSFs is not reliant on these materials remaining frozen.

2.2 Options Considered for Overburden Recovery from the WRSFs

In terms of the KIA-WL-01 request and Agnico Eagle's commitment, the following options were considered and have been discussed below.

2.2.1 Option 1: Placement, Storage, and Recovery of the Overburden Material in a Zone at the Outer Edge of the Facility

Option 1 reviewed the reconfiguration of the WRSFs to allow for placement, storage, and recovery of the overburden material in a zone at the outer edge of the facility. The potential of this option are presented below:

- The natural stable slope of the thawed overburden material is expected to be relatively flat (ranging between 4:1 and 6:1 [horizontal:vertical]). Therefore, storing the overburden at the outer slope would require a significantly larger WRSF footprint when compared to the current waste rock encapsulated footprint that has an outer slope of 2.2:1 to 3:1. The current design has minimised, where possible, the storage footprint by bounding the overburden with more stable waste rock, hence allowing much steeper internal overburden slopes of 1.6:1 as shown on Drawing Number 6509-616-210-202-001A.

- The outer slope of the overburden will be prone to thaw seepage, wind, freshet, and precipitation erosion. This could result in transportation of particulate matter to other areas by either wind-blown dust or suspended solids in the runoff water. With the current design, the erosion risks are largely mitigated by having the overburden encapsulated with a significant thickness of waste rock on the erodible side slopes.

- The overburden at the outer slopes will be prone to seasonal thaw and will be within the active permafrost zone. This could lead to unplanned local slumping of the overburden slopes and possible development of sinkholes as the overburden will be placed as frozen uncompacted blocks. Also, without the waste rock buttressing these slopes, the overburden material could be susceptible to larger slope failures due to the random and blocky nature of the placed overburden material. In the current design, these risks are largely mitigated by having the overburden encapsulated and buttressed by a significant thickness of waste rock.

In conclusion, the rezoning of the WRSFs to place overburden material at the outer zone of the facility for later recovery would require expanding the WRSF footprints to accommodate the less stable overburden materials. Unfortunately, with the current mine configuration there is no room to expand the WRSFs to accommodate the flatter sloped overburden materials and the associated erosion management infrastructure.

2.2.2 Option 2: Recovery of the Overburden Material from the Top of the Facility

Option 2 reviewed the existing configuration of the WRSFs for recovery of the overburden material from the top of the facility. This is considered a plausible option, but also has some risks as presented below:

- Referring to Drawing Number 6509-616-210-202-001A to -003A, only WRSF1 would be available for this option as the overburden material at WRSF2 and WRSF3 are covered by significant depths of waste rock.

- Later recovery of overburden material from the top of WRSF1 would be possible and calculations indicate that approximately 0.15 M tonnes of this overburden material could be recovered in this manner, assuming an excavated depth of 2 m. However, excavation of overburden material could create a depression in the upper surface, leading to a risk of local ponding and possible retrogressive sloughing of the rear excavation scarp. If the excavation process extends over more than one summer season, the collected water from precipitation (snow melt and rain) may need to be pumped from the excavation before proceeding with future excavations. Having a pond on the top of WRSF1 is not recommended, and could be detrimental to the safety and operation of the facility in the long-term and would need to be managed. One of the main risks is that the pond could promote thaw of the uncompacted overburden beneath the pond, eventually seeping, and cause an uncontrolled discharge of water to the downstream environment through a sinkhole or other breach of the pond containment.

In conclusion, later recovery of overburden material from the top of WRSF1 could be possible but it will require careful management of environmental, water management, operational, and safety risks. This option could yield approximately 0.15 M tonnes.

3.0 CONCLUDING REMARKS

This Technical Memo has reviewed the potential options for the later recovery of overburden materials from the WRSFs. Unfortunately, given the small footprint and compactness of the mine layout there is no available real estate to reconfigure the WRSFs to accommodate the late recovery of overburden materials. There is the potential to recover some of the overburden materials from the top of WRSF1. This would require careful management and would yield approximately 0.15 M tonnes.

4.0 LIMITATIONS OF THIS TECHNICAL MEMO

This memo and its contents are intended for the sole use of Agnico Eagle Mines Limited and their agents. Tetra Tech EBA Inc. does not accept any responsibility for the accuracy of any of the data, the analysis, or the recommendations contained or referenced in the memo when the memo is used or relied upon by any Party other than Agnico Eagle Mines Limited, or for any Project other than the proposed development at the subject site. Any such unauthorized use of this memo is at the sole risk of the user. Use of this memo is subject to the terms and conditions stated in Tetra Tech EBA's Services Agreement. Tetra Tech EBA's General Conditions are attached to this memo.

5.0 CLOSURE

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

Respectfully submitted,
Tetra Tech EBA Inc.

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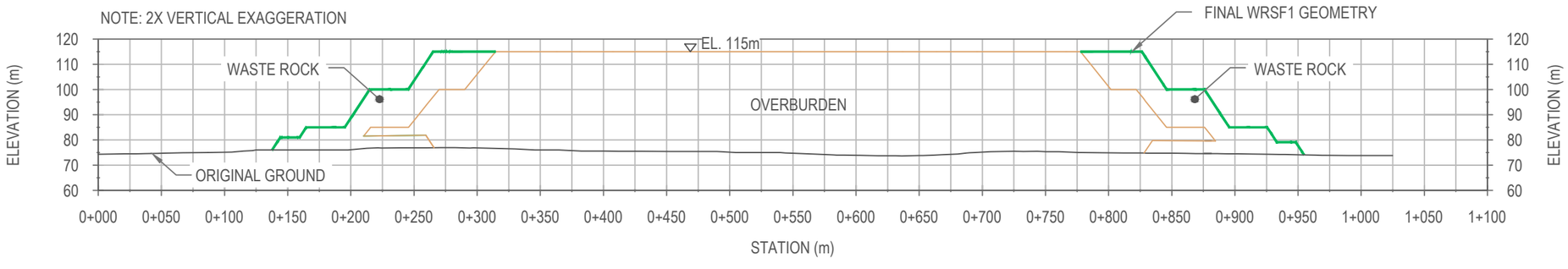
/jf

Attachments:

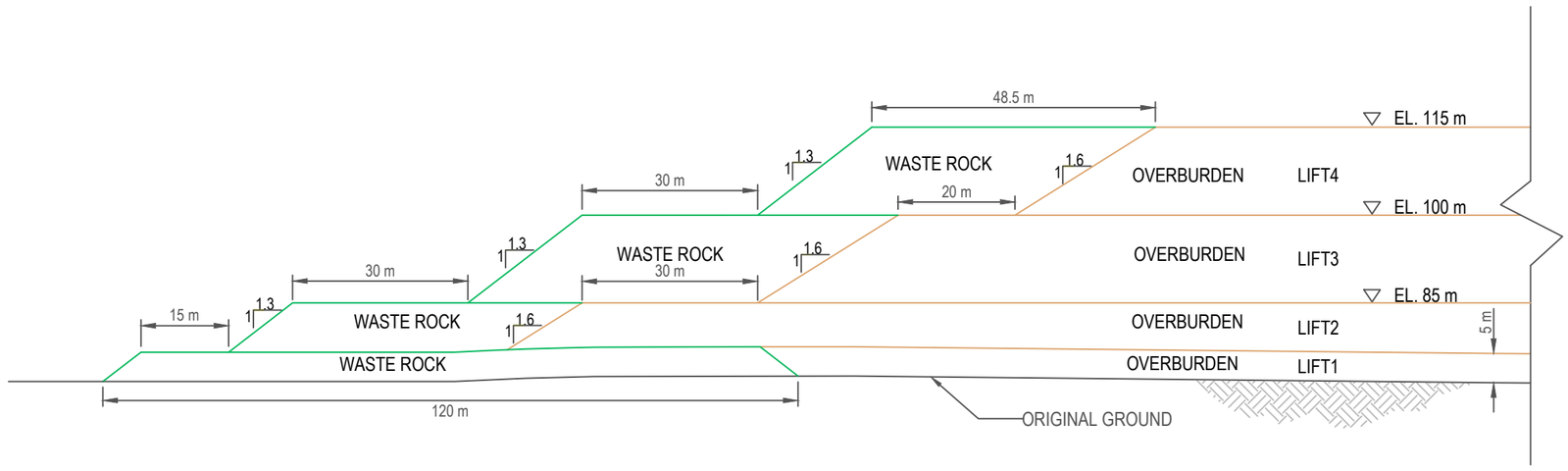
Drawing Number 6509-616-210-202-001 to -003
Drawing Number 6500-680-210-200A
Tetra Tech EBA's General Conditions

NO. DESSIN
DRAWING NO.

FORMAT ANSI B-11x17



SECTION A–A WRSF1



TYPICAL DESIGN SECTION FOR WRSF1

ISSUED FOR PERMITTING
AGNICO EAGLE
DATE : 06-01-2016

NOTES:

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No. PROJET / PROJECT NO.	6509	
DATE		

TITRE / TITLE

AGNICO EAGLE - MELIADINE GOLD PROJECT
616-WASTE STOCK PILE
210-GENERAL ARRANGEMENT
TYPICAL SECTIONS FOR
WASTE ROCK STORAGE FACILITIES-WRSF1

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6509–616–210–202–001A		0	1 / 3

AE-CART-ANSI B

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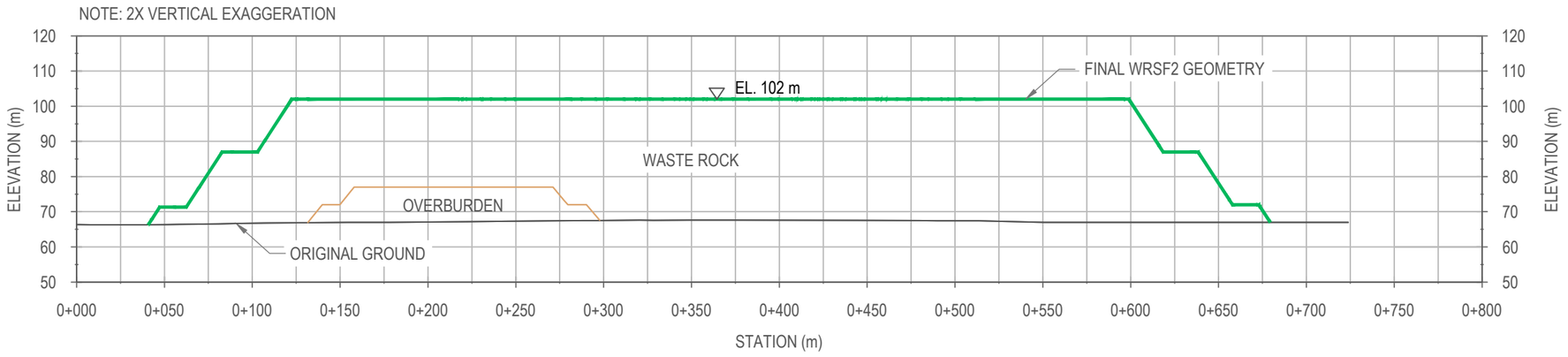

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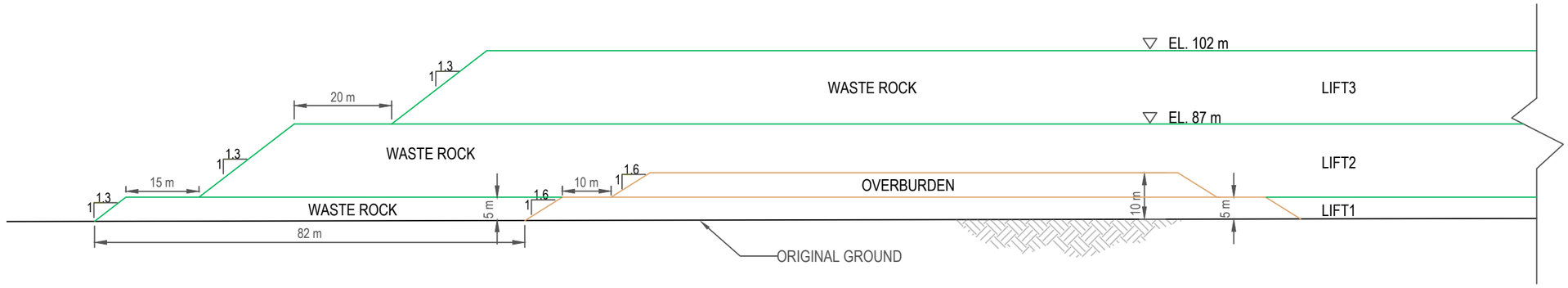

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AGNICO EAGLE – MELIADINE GOLD PROJECT
616–WASTE STOCK PILE
210–GENERAL ARRANGEMENT
TYPICAL SECTIONS FOR
WASTE ROCK STORAGE FACILITIES–WRSF2

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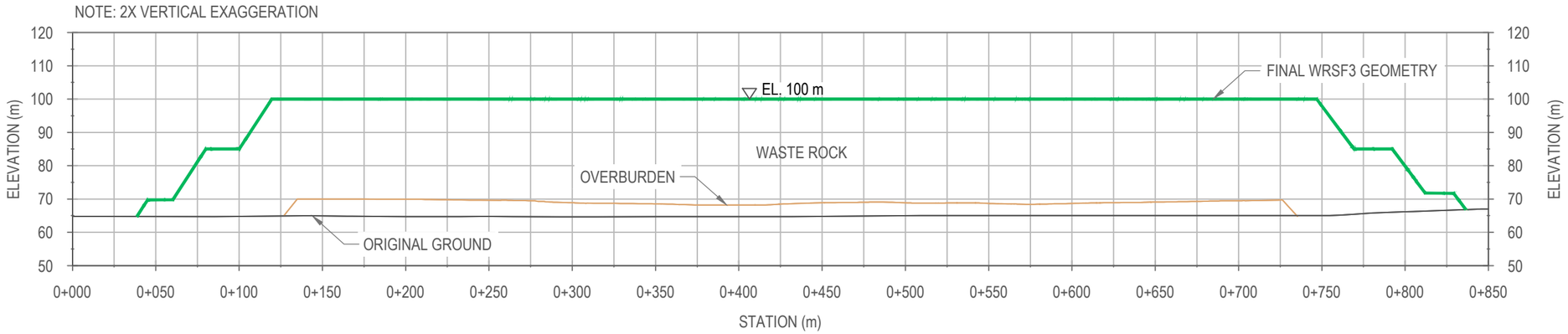
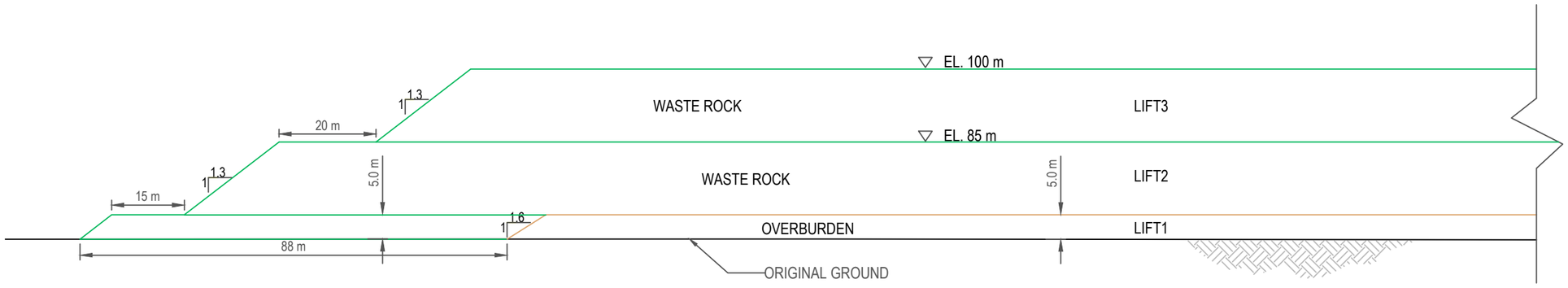


SECTION C–C WRSF3



TYPICAL DESIGN SECTION FOR WRSF3

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TITRE / TITLE

AGNICO EAGLE – MELIADINE GOLD PROJECT
616–WASTE STOCK PILE
210–GENERAL ARRANGEMENT
TYPICAL SECTIONS FOR
WASTE ROCK STORAGE FACILITIES–WRSF3

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TEMPORARY OVERBURDEN STOCKPILE
CHANNEL2
SEWAGE TREATMENT PLANT
INDUSTRIAL SITE PAD
LANDFARM
FRESH WATER INTAKE CAUSEWAY
WATER TREATMENT PLANT
WTP INTAKE CAUSEWAY
TREATED SEWAGE DISCHARGE
ORE STOCKPILE 3
ORE STOCKPILE 1
ORE STOCKPILE 2
CHANNEL1
CULVERT3
CULVERT4
CULVERT5
CHANNEL6
CP6 JETTY
CP6
CP1
CP3
CP4
CP5
CP5 JETTY
TAILINGS STORAGE FACILITY (TSF)
CULVERT1
CHANNEL3
CULVERT2
LANDFILL
BERM1
CHANNEL8
CHANNEL7
CHANNEL4
WASTE ROCK & OVERBURDEN STORAGE FACILITY 1 (WRSF1)
WASTE ROCK & OVERBURDEN STORAGE FACILITY 2 (WRSF2)
WASTE ROCK & OVERBURDEN STORAGE FACILITY 3 (WRSF3)
CULVERT6
CHANNEL5
BERM2
BERM3
TIRIGANIAQ PIT 1 (TIRI_1000_01)
TIRIGANIAQ PIT 2 (TIRI_1000_02)
EFFLUENT DIFFUSER
EXPLORATION CAMP
MELIADINE LAKE
FUEL TANK
D-CP1
D-CP3
D-CP4
D-CP5
D-CP6

0 500 m
Scale: 1: 15 000

LEGEND

- CATCHMENT BOUNDARY
- SERVICE ROAD
- HAUL ROAD
- NON CONTACT WATERBODY
- CONTACT WATERBODY
- WATER COLLECTION POND
- DRAINED POND AREA
- OPEN PIT
- OVERBURDEN
- WASTE ROCK
- ORE
- TAILINGS
- INDUSTRIAL SITE PAD
- CONTACT WATER FLOW DIRECTION

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TITRE / TITLE

AGNICO EAGLE – MELIADINE GOLD PROJECT
GENERAL SITE LAYOUT PLAN

ÉCHELLE/ SCALE 1:15000	FICHIER FILE .DWG		
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GENERAL CONDITIONS

GEOTECHNICAL REPORT

This report incorporates and is subject to these “General Conditions”.

1.0 USE OF REPORT AND OWNERSHIP

This geotechnical report pertains to a specific site, a specific development and a specific scope of work. It is not applicable to any other sites nor should it be relied upon for types of development other than that to which it refers. Any variation from the site or development would necessitate a supplementary geotechnical assessment.

This report and the recommendations contained in it are intended for the sole use of Tetra Tech EBA’s Client. Tetra Tech EBA does not accept any responsibility for the accuracy of any of the data, the analyses or the recommendations contained or referenced in the report when the report is used or relied upon by any party other than Tetra Tech EBA’s Client unless otherwise authorized in writing by Tetra Tech EBA. Any unauthorized use of the report is at the sole risk of the user.

This report is subject to copyright and shall not be reproduced either wholly or in part without the prior, written permission of Tetra Tech EBA. Additional copies of the report, if required, may be obtained upon request.

2.0 ALTERNATE REPORT FORMAT

Where Tetra Tech EBA submits both electronic file and hard copy versions of reports, drawings and other project-related documents and deliverables (collectively termed Tetra Tech EBA’s instruments of professional service), only the signed and/or sealed versions shall be considered final and legally binding. The original signed and/or sealed version archived by Tetra Tech EBA shall be deemed to be the original for the Project.

Both electronic file and hard copy versions of Tetra Tech EBA’s instruments of professional service shall not, under any circumstances, no matter who owns or uses them, be altered by any party except Tetra Tech EBA. Tetra Tech EBA’s instruments of professional service will be used only and exactly as submitted by Tetra Tech EBA.

Electronic files submitted by Tetra Tech EBA have been prepared and submitted using specific software and hardware systems. Tetra Tech EBA makes no representation about the compatibility of these files with the Client’s current or future software and hardware systems.

3.0 ENVIRONMENTAL AND REGULATORY ISSUES

Unless stipulated in the report, Tetra Tech EBA 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.

4.0 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 EBA 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.

5.0 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.

6.0 STRATIGRAPHIC AND GEOLOGICAL INFORMATION

The stratigraphic and geological information indicated on drawings contained in this report are inferred from logs of testholes and/or soil/rock exposures. Stratigraphy is known only at the locations of the testhole or exposure. Actual geology and stratigraphy between testholes 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 EBA 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.

7.0 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.

8.0 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.

9.0 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.

10.0 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.

11.0 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.

12.0 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.

13.0 SAMPLES

Tetra Tech EBA 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.

14.0 INFORMATION PROVIDED TO TETRA TECH EBA BY OTHERS

During the performance of the work and the preparation of the report, Tetra Tech EBA may rely on information provided by persons other than the Client. While Tetra Tech EBA endeavours to verify the accuracy of such information when instructed to do so by the Client, Tetra Tech EBA accepts no responsibility for the accuracy or the reliability of such information which may affect the report.