

**DATE** July 20, 2009**PROJECT No.** 08-1428-0029/6000  
Doc. No. 917 Ver. 0**TO** Dr. Eric Lamontagne  
Agnico-Eagle Mines Limited Meadowbank Division**FROM** Paul M. Bedell; Michel Julien; Dan Walker**EMAIL** paul\_bedell@golder.com;  
mjulien@golder.com;  
drwalker@golder.com**STORMWATER DIKE AND SADDLE DAM 1 GEOMEMBRANES, TAILINGS STORAGE FACILITY,  
MEADOWBANK GOLD PROJECT**

The detailed designs of the Stormwater Dike and Saddle Dam 1 of the Tailings Storage Facility (TSF) at the Meadowbank Gold Project are being revised in preparation for their construction during 2009. The results of the geotechnical drilling investigation completed in May 2009 are inputs to the design revisions as these results determined the thicknesses and indicated expected ice contents of the foundation soils for these structures.

The geomembranes of the structures were reviewed following the completion of the geotechnical drilling program. The original design for both structures included a Coletanche ES3 (4.8 mm thick) bituminous geomembrane to act as the water retaining element. This technical memorandum discusses the geomembranes for the revised designs of the Stormwater Dike and Saddle Dam 1; namely, a Coletanche ES3 (4.8 mm thick) bituminous geomembrane and a 1.5 mm thick linear low density polyethylene (LLDPE) geomembrane, respectively.

## **1.0 STORMWATER DIKE**

The results of the geotechnical drilling program indicate that the foundation soils along the alignment of the Stormwater Dike are ice-rich in the areas of the abutments and thawed to the bedrock surface in the central portion. The ice-rich soils in the areas of the abutments are limited in extent and depth; these soils will be removed as part of the foundation preparation activities. The remainder of the foundation soils are thawed and have a maximum thickness of about 11 m; these will be inspected such that all softened and deleterious materials are removed prior to fill placement. The structure will be founded on a stable foundation comprising bedrock or non-ice-rich (*i.e.*, thawed or ice-poor) soils.

The Stormwater Dike is an internal structure to the TSF and has a service lifetime of about three years until tailings are deposited on the south side to encapsulate it. Settlement of the structure over its service lifetime is not expected to compromise the Coletanche ES3 bituminous geomembrane included in the original design as the ice-rich foundation soils at the abutment will be removed and the remainder of the structure will be founded on a non-ice-rich (*i.e.*, thawed to ice-poor) and prepared foundation soils.



A Coletanche ES3 bituminous geomembrane will be installed on the upstream face of the structure as shown on Figure 1. The geomembrane will be keyed into the upstream foundation to either bedrock or to a depth of 4 m into soil. The key-in detail, shown on Figure 1, is configured such that should frozen foundation conditions be present beneath the structure, they will be maintained to further enhance control of seepage beneath the structure. The bottom edge of the geomembrane will be encapsulated in a zone of low permeability backfill, till and/or processed fill mixed with bentonite, in the key trench. The geomembrane will be covered with fill for protection from exposure to ultraviolet (UV), wind and ice damage.

## 2.0 SADDLE DAM 1

The results from the geotechnical drilling program indicate that the soils along the alignment of Saddle Dam 1 have a maximum thickness of about 10 m. The soils are frozen to bedrock; the upper 4 m to 5 m of the soils are inferred to be ice-rich.

Saddle Dam 1 is a perimeter structure of the TSF that is to function during operations through to the post-closure period. To provide for the long-term performance of this structure, the design cross-section has been revised to that shown on Figure 2. The geomembrane will be tied-in to the bedrock surface at the upstream toe of the structure. The key-in detail, shown on Figure 2, is configured such that the frozen foundation conditions are maintained to further enhance control of seepage beneath the structure.

The ice-rich soils beneath the projection of the geomembrane will be removed to limit settlement of the structure and to reduce the potential for damage to the geomembrane should the foundation soils thaw. The downstream shell of the dam may be readily repaired should the limited quantity of ice-rich soils to be left in place thaw and settle.

The geomembrane of Saddle Dam 1, as shown on Figure 2, is a 1.5 mm thick LLDPE geomembrane with texturing on both sides. This geomembrane is able to more readily withstand movement (*e.g.*, from differential settlement) without compromising performance than a bituminous geomembrane.

A layer of 500 g/m<sup>2</sup> geotextile will be installed on each side of the geomembrane to protect it during installation.

The bottom edge of the geomembrane will be encapsulated in a low permeability backfill material in the key trench, as shown on Figure 2, similar to that of the Stormwater Dike. The zone of low permeability backfill material has been extended upstream to facilitate a tie-in to bedrock grouting should it be deemed warranted in the future.

Following the installation of the upper layer of geotextile, a cover of fill will be placed, similar to that of the Stormwater Dike, to protect it from UV, wind and ice damage.

### 3.0 DOCUMENT CLOSURE

We trust that the information provided in this technical memorandum meets your current requirements. It is recommended that this completed and signed document be provided to the Meadowbank Dike Review Board for the July 2009 meeting.

**GOLDER ASSOCIATES LTD.**

**ORIGINAL SIGNED**

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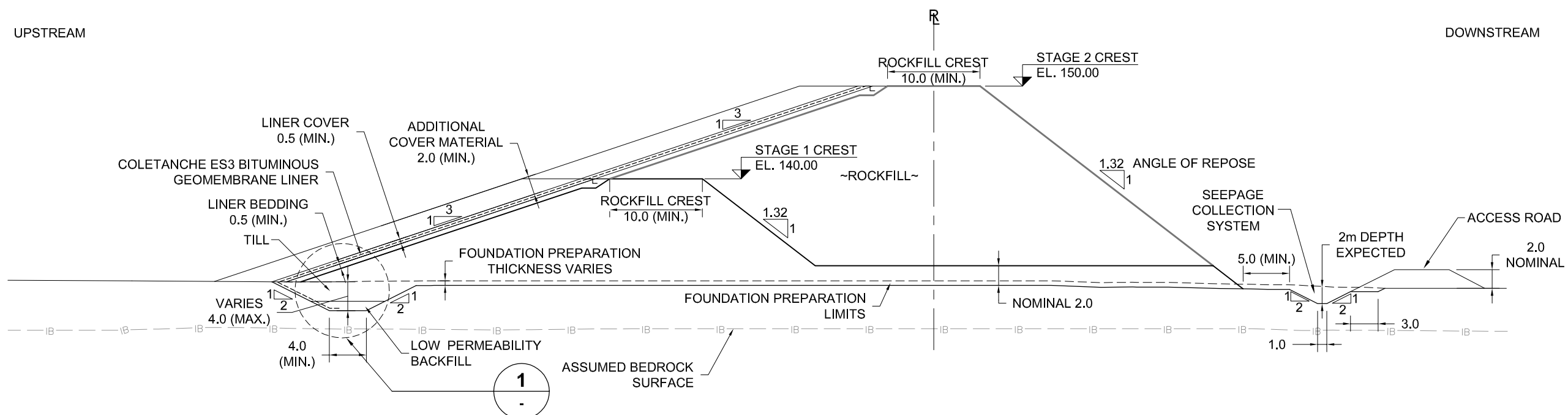
**ORIGINAL SIGNED**

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Attachments: Figures 1 and 2

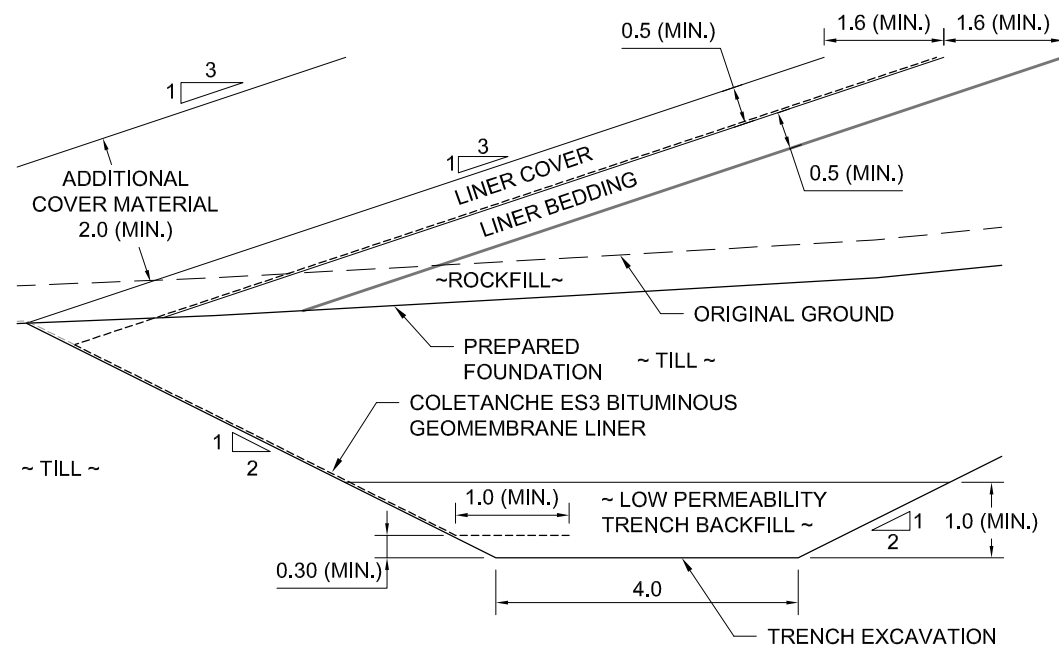
\\bur1-s-filesrv2\final\2008\1428\08-1428-0029\doc 917 0720\_09 tm-stormwater dike saddle dam 1 geomembranes tailings storage-meadowbank ver 0.doc



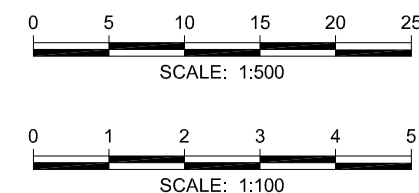
**TYPICAL CROSS-SECTION - STRIPPING AND ROCKFILL  
PLACEMENT STORMWATER DIKE**  
SCALE 1:500

### LEGEND

- STAGE 1 ROCKFILL LIMIT
- STAGE 2 ROCKFILL LIMIT
- - - COLETANCHE ES3 BITUMINOUS GEOMEMBRANE LINER
- EXISTING GROUND
- - - IB - - - INFERRED BEDROCK
- R REFERENCE LINE



**1 - DETAIL - LINER TIE IN WITH TRENCH EXCAVATION  
STORMWATER DIKE**  
SCALE 1:100



**NOT FOR CONSTRUCTION**

**AEM**

**AGNICO-EAGLE MINES LIMITED**

**MEADOWBANK GOLD PROJECT  
NUNAVUT**

**STORMWATER DIKE  
TYPICAL SECTION AND  
LINER TIE-IN DETAIL**

**FIGURE 1**

