

August 26th, 2010

Mr. Dennis Gourde, P.Eng.  
General Manager  
Agnico – Eagle Meadowbank Division  
Baker Lake Office

Email: [denis.gourde@agnico-eagle.com](mailto:denis.gourde@agnico-eagle.com)

Dear Mr. Gourde,

**Report No 7  
Meadowbank Mine Dike Review Board  
Meeting July 26-29, 2010**

## 1.0 INTRODUCTION

The meeting of the Dike Review Board was held on site as planned from July 26<sup>th</sup> to 29<sup>th</sup>. All three members of the Board were in attendance, though the first day's activities were missed by Dr. Robertson due to travel delays.

The objectives were to review the status of the performance of the East Dike, and the design and construction of the Bay-Goose and TSF dikes.

The activities covered those outlined in the agenda which is included as Attachment A, with the addition of some discussion on the planning for the Central Dike. The list of attendees at the meeting is given in Attachment B.

Documents were submitted by Golder and Associates (GAL) before and during the meeting for which a list is included in Attachment C. Data on grain size analyses of crushed stone filter is included in Appendix D. A selection of photographs taken during the visits is to be found in Appendix E.

In the report which follows, the Board's recommendations are underlined.

## 2.0 UPDATE ON MINE STATUS

Agnico Eagle Mines (AEM) provided an update on the mine status. The Process Plant achieved a successful start-up with the first pour of gold on February 27<sup>th</sup>. The ore is being extracted from the Northern and Southern portions of the Portage Pit. The planned winter phase of the Bay-Goose Dike construction was successfully completed with a causeway tracing the full outline of this structure.

The Board observes that the project is in midst of the transformation from construction phase to operations and the activities for some staff may be limited to one or the other. It is important to note that, ultimately, the Operations will have significant geotechnical responsibilities related to Operation, Maintenance and Surveillance of the various dams. This will entail the

preparation and updating of manuals, participation in the periodic raising of the structures, dealing with compliance issues, and undertaking tailings management. The staffing for Operations should be beginning at the present time in order that the personnel may gain experience during the construction phase and have the opportunity to profit from the presence of persons who have had involvement from the outset. Consequently, the Board recommends that GAL and Gaston Blanchette advise the project management of what the obligations are going to be in order to permit the Project to evaluate its staffing in this regard.

### 3.0 RESPONSE TO REPORT NO 6

GAL has prepared a comprehensive letter response to the MDRB report No 6. The Board is pleased that the responses are positive on all critical issues. No substantive matters have been left unattended.

### 4.0 EAST DYKE

#### 4.1 Field Inspection

The participants visited the crest of the East dike in the vicinity of the 2009 leak and sinkhole at approximately Stn. 60+490 to discuss additional planned instrumentation, and observe the subsidence (minor) noted after the 2009-2010 winter period.

An inspection was made of the entire dike toe to observe the ground conditions and the areas of visible seepage (photos #1 to 6). AEM advised that two weirs are to be installed to monitor leakage more accurately. These will be located in the North and South Channels and will be of a "V"-notch geometry. The existing rectangular weir in the North Channel may give an indication of major change in flow but lacks the precision for more subtle changes. The flow in the South channel is monitored by visual observation. Some turbidity was noted at the time of the visit but this was caused by drainage from an active dump site adjacent to the spring. (Photos # 6). It is understood that the observed seepage situation is stable and the order of magnitude of the flows is similar to those noted in late 2009.

The Board was advised that the initial survey of settlement monuments has not yet been carried out for reasons related to line of sight obstructions but also because of survey staff limitations. In the view of the Board, this is not diligent practice.

#### 4.2 Performance and design

##### 4.2.1 Instrumentation

A presentation was made of monitoring data including piezometer results for three sections, inclinometer profiles, and thermistor readings from various chains installed along the dike. Piezometric data indicates that equilibrium conditions have been attained over the time since the last meeting. The piezometric levels beneath the dike are essentially at downstream toe ground elevation with no artesian pressures. However, the Board notes that a greater head loss exists in the rock upstream of the cut-off at Stn. 60+490 than elsewhere. An influence of the lake bed sediments and till overburden may be suspected. However, as the pervious rockfill transmits pressure at full lake level to the base of the cut-off on the upstream side, a significant downward gradient is indicated in the rock at this point. The head loss between the piezometers upstream and downstream of the cut-off is comparatively less. This may indicate

anisotropic conductivity in the rock. The Board recommends that detailed evaluation of the three instrumented sections be undertaken to determine by what mechanism these patterns of pressure distribution can be explained. A flow net seepage analysis by finite element modelling may be required.

The graphs of displacement versus depth in the inclinometers are plotted to a large exaggerated horizontal scale but, in fact, show no movements of significance.

The thermistor data has been accumulated for more than a year on the East Dike. The overall portrait and particularly the deviations from the anticipated annual cycle are very valuable to define leakage zones (see TH485). A study of time lags for the temperature cycles has been initiated. The Project proposes to measure temperatures with additional thermistor strings adjacent to section 60+490  $\pm 15$ m to determine the extent of the leakage zone. The Board supports this initiative, especially as the installations will be made by drilling in existing grout casings and thus no extra intrusion is implied. The results should be overlain on the CPT longitudinal section and potential remediation schemes developed including risk analyses for each scheme. The Board wishes to be consulted after this study prior to undertaking any further action.

Flow measurement data from the weir in 2010 is limited but consistent with past readings. The existing rectangular installation is to be modified to a "V" shaped weir to improve accuracy. Other weirs are also planned in areas of significant seepage.

#### 4.2.2 Contingency Planning

The Contingency planning that is necessary is related to deterioration in the dike and its foundation with attendant increase in seepage.

The existing EPP (prepared for initial dewatering) needs to be updated for the current status, which is operational and would form part of site wide EPP. The daily inspection needs to be formalized for operational status, as would be expected from the OMS manual. A register of inspections, documentation of observations, an itemized list of leaks, and a photo record, would be expected.

#### 4.2.3 Segregation Potential

The Project has evaluated the Segregation Potential (SP) using soil index properties following the method developed by J-M Konrad and has shown that observed heave and ground ice accumulation is less than the one dimensional forecast; no additional work is required in this regard other than the ongoing monitoring of overall dike performance.

### 5.0 BAY GOOSE DYKE

#### 5.1 Field Inspection

Observations made during the site visit included the Soil-Bentonite (SB) fill preparation (photo # 7); embankment widening, functioning of turbidity barriers, water pumping to assist containment; central trench excavation, fine filter material stockpiles for the Bay Goose Dike. The Board was pleased to see how effective the turbidity barriers, together with the causeway, have been in controlling suspended sediment migration. The stockpile of fine filter material was examined and the Board remarked on the apparent high fines content (photo # 8). This non-PAG material is produced from relatively friable volcanic rock and the crushing and handling may generate

excessive fines. However, the grain size analyses, transmitted subsequent to the Board meeting and shown in Appendix C, indicate the material to be well graded and within the specified envelope except for a small fraction of oversize particles. As the materials were dry when observed it is possible that some segregation on the outer slopes of the piles may have contributed to the perception of a less well graded product. Nevertheless, it is evident that care is required in the exploitation of the stockpiles, particularly when dry, in order to minimize the segregation.

## 5.2 IFC Drawings & Specifications

A presentation was made to remind the Board of the status of the design and construction. There are no major design aspects pending but field decisions will likely be required with respect to the limits of application of the typical sections and the grouting details. It was noted that additional investigations (percussion holes) are still planned to verify the bedrock profile in more critical areas. There are no additional comments.

## 5.3 Grouting

The Contractor has completed the northern section ahead of schedule, which is a significant achievement. The Board is pleased with the attention paid to the execution and evaluation of the grouting program and is confident that rock grouting was adequate and consistent with the design concept. There were no particular surprises.

Drilling operations revealed the presence of accumulated soft sediments at the base of the wall in the North Channel. Despite the fact that preparations had been made to refine the “special washing” technique it was not applied. The Board agrees with the interpretation that the material could not be amended by conventional grouting or even by TAM and that jet grouting is required in the zones as proposed.

Elsewhere, the bedrock contact zone was grouted in a ‘live front’ grouting strategy, rather than primary and secondary holes, with the rationale that travel over thawed SB cut-off material needed to be minimized. The grouting criteria used was aimed to get closure by pressure. The Board is not convinced that this was the correct approach as higher volumes of grout were consumed as compared to the East Dike and suggests that a more traditional approach of limiting volume, allowing set, and achieving incremental closure, be re-evaluated for stages 3 and 4. There may be financial savings and grout may be better confined to the width of the cut-off. It is suspected that some of the grout injected may have ended up in the fine filter zones with consequent increase in heterogeneity and the possibility of creating areas of higher hydraulic gradients.

The Board notes the careful observations made regarding communication of drilling fluids during casing installation, but the explanation and significance is not yet clear.

## 5.4 Jet Grouting

The Board is pleased with the decision to proceed with jet grouting, notes that an experienced contractor has been engaged and that an acceptable schedule is being worked out. The Board confirms that the QC program is appropriate but recommends that the verification of drill hole verticality also be included. This is essential to ensure column overlap and cut-off continuity. The Contractor should be required to deliver plots with a commitment for additional

holes if overlap is inadequate. The Board wishes to see the jet grouting specifications when these become available.

#### 5.5 Instrumentation

The Board was advised of the progress in establishing the network of instruments for this structure and will comment when the final layout is available, but does not expect any concerns.

#### 5.6 Schedule

The construction schedule was presented for information and it was noted that the schedule is controlled by the limit of non-PAG rock production.

#### 5.7 Ongoing Studies

- i) The Set-back of the dyke with respect to the mine high wall is being re-evaluated. This will not affect dike design or construction.
- ii) Freeze-thaw experiments in a confined state are to be undertaken to investigate change in permeability of SB.
- iii) Seepage thermal modeling has been undertaken to guide ii) above.

### 6.0 TAILINGS STORAGE FACILITY

#### 6.1 Field visit

The Board paid a visit to the Stormwater Dyke and inspected the bedding material (photos # 9 and 10), the liner as placed and welded (photos # 11 to 13), though there was no ongoing activity, and the tailings beach (photo # 14). The susceptibility of the liner to damage by construction and operation equipment was noted. The standard of placing is variable and this is apparently due to weather conditions (wind etc) prevailing at the time of installation.

The tailings deposition was observed from the vantage point of the water reclaim jetty. The Board noted the clarity of the decant pond water and remarked that re-use as process water should thus be facilitated.

At Saddle Dam SD-1, the plans to increase the cover on the upstream tie-in of the liner and to enhance the protection were described. This will entail the construction of a groin upstream of the dike toe (photo # 16) and the direction of tailings to the enclosure to create a beach in advance of normal deposition in the area. Localised pumping was underway at the downstream toe (photo # 17) to reduce the potential for build-up of pressure under the liner until the aforementioned beach is created. There was also mention of lowering the culverts under the access road which runs downstream of the dike.

At the Saddle Dam SD-2, foundation excavation was underway on the footprint of the upstream shell where ice rich material requires removal (photo # 18).

The site of the Center dike was also visited and the liquefaction flow slides in the still saturated lake bed sediments were noted. (photos # 19 and 20).

## 6.2 2009 As-Built reports

The Board was advised of the planning for the preparation of the 2009 As-Built reports. The Board supports the structure of the report preparation team and urges that this activity be carried out as soon as reasonably possible while the staff members acquainted with the work that was carried out are still on site.

## 6.3 2010 Investigation

The objectives of the 2010 program were to enhance the knowledge of the foundation conditions at the structures for which the design is ongoing, namely the Central Dike, Saddle Dams 4, 5 and 6, and the Rockfill road No 2. The program comprised 99 air track percussion holes and 7 Sonic soundings. Conditions did not permit work in the middle part of the Central Dike due to an uneven ice sheet grounded on the lake bed. An indication of the depths to bedrock at the various locations was given for information.

## 6.4 2010 Design Update

As mentioned earlier, there are plans to enhance the liner tie-in at the Saddle Dam SD-1 with a modification at the till berm. This will require a tailings beach as soon as possible.

As far as future tie-ins are concerned, it is anticipated that all overburden will be removed to rock. The adopted configuration will allow remedial grouting if required and, being outside the general embankment profile, work on the cut-off tie-in will be decoupled from embankment construction. The bedrock will be cleaned and mapped, but the Board is not supportive of the concept to place a geotextile cover over 20 mm joint openings with a view to controlling piping. Large joints should be cleaned and plugged with mortar in a more conventional manner. The Board agrees that the option to provide a tie-in by means of a trench excavated in rock is not to be favoured, as blasting will disturb the rock and entail more extensive treatment to preclude piping.

### Construction management

With respect to the liner QC/QA:

- the bedding material is of good quality materials with satisfactory placing and compaction;
- a comparison should be made with current Diavik practice, with which GAL is familiar, in order to demonstrate the equivalence in scrutiny;
- as the work may be spread over several months with varying weather conditions there is a need for diligence particularly with respect to winter work and snow incorporation. Several wrinkles were noted during the course of the inspection. There is a need to establish whether these are excessive and to provide the inspection staff with clear criteria for acceptance;
- protocols should be established to govern equipment working on liners with mandatory use of check lists and reporting of any event that could lead to damage.

With respect to beach formation:

- GAL should declare beach requirements in light of current tailings operations; if these are not met they should evaluate alternative ice management for the coming winter season;
- The planning of the tailings deposition is based on a solids content (Cs) of 35% for the remainder year 2010 (50.8% thereafter) and reclaim water maximized to the degree possible. This necessitates a revised filling curve.

## 7.0 TAILINGS PLANNING

With the given volume available in the North Cell (Stormwater Dyke) and current production planning, the area will be able to cover deposition requirements to the end of Q4 2013.

The base case is for the Center Dyke construction to start in summer 2012, with a commitment for barging in Q1 2012. If this option is too expensive or not feasible, the possible alternative is for tailings deposition in the Portage pit of which at least part will have been worked out.

However, this scenario carries considerable regulatory risk and therefore there is a high priority to assess if the base case is still viable.

Apparently a preliminary assessment suggests that it is, given that:

- the soft silt mantle is not excessive;
- the stiff till below does not need excavation;
- the silt cover will be beneficial on closure and may be strengthened by means of wick drains to accelerate the consolidation;

However, additional site investigation is required in the middle sector and a feasibility design must be developed soon for project assessment.

## 8.0 NEXT MEETING

The dates for two meetings were tentatively set as:

Winter 2011 – Jan 27 to 28 (Vancouver) Subject to approval

Summer 2011 – July 18 to 21 (on site) subject to approval

## 9.0 ACKNOWLEDGEMENTS

The Board once again wishes to thank the personnel of AEM and GAL for their participation in the meetings, and for the excellent documentation and presentations made by AEM and GAL which contributed to the efficiency and effectiveness of the proceedings.

Signed:



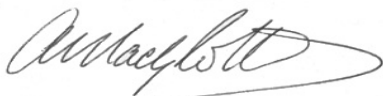
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Norbert R. Morgenstern, P.Eng



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D. Anthony Rattue, P.Eng.



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Andrew M. Robertson, P. Eng.

**ATTACHMENT A**

**AGENDA FOR BOARD MEETING NO. 7**

**July 26th-29th, 2010**



AGNICO-EAGLE MINES - MEADOWBANK DIVISION  
MEADOWBANK DIKE REVIEW BOARD

**Meeting #7 - July 26 to 29, 2010**  
**Meadowbank Mine Site, Nunavut**

AGENDA

**Monday July 26**

Mr. Morgenstern, Mr. Robertson, Mr. Bonin, Mr. Bedell, Ms. Esford and Mr. Walker arrive in Baker Lake at approximately 14:30 pm local time (TBC). AEM to provide transport from Baker Lake to site (~ 2 hrs).

Mr. Rattue, Mr. Julien, and Ms. Beaulieu arrive on site in early afternoon from Montreal on AEM Charter.

17:30      *Check-in, room assignments and site H&S orientation (AEM to provide)*

**18:30      Welcome** (AEM to confirm meeting room)

*Dinner (site cafeteria)*

**Tuesday July 27 – Morning Session (Office & Field)**

6:30      *Breakfast (site cafeteria)*

**7:30      Review of Agenda**

**7:45      Update on Status of the Mine**

**8:00      MDRB Report #6**

Review and Respond to MDRB Report #6

- Bay-Goose Dike South Portion
  - Geotechnical Investigations
  - Design
- Other Issues

**8:30      East Dike**

- Instrumentation data update
- Contingency planning update
- Segregation potential analysis

9:00      *Coffee Break*

**9:15      East Dike and Bay-Goose Field Visit**

**East Dike**

- Downstream toe inspection

**Bay-Goose Dike**

- Causeway south portion
- Turbidity barrier placement
- Rockfill placement south portion
- Initial trench excavation south portion
- Grouting north portion

**11:30 Bay Goose Dike**

- IFC Drawings and Specifications

12:30 *Lunch (site cafeteria)*

**Tuesday July 27 – Afternoon Session (Office)**

**13:30 Bay Goose Dike (Cont'd)**

- Grouting
- Jet Grouting

15:30 *Coffee Break*

**15:45 Bay Goose Dike (Cont'd)**

- Instrumentation plan
- Construction plan and schedule
- Update on ongoing studies
  - Dike set back
  - Freeze/thaw testing
  - Seepage thermal modeling

18:30 *Dinner (site cafeteria)*

**Wednesday July 28 – Morning Session (Office & Field)**

6:30 *Breakfast (site cafeteria)*

**7:30 TSF Dike Field Visit**

- Stormwater Dike
- Saddle Dam 1
- Dewatering and tailings deposition progress

**10:00 TSF**

- 2009 As-Built
- 2010 Geotechnical Investigation

12:30 *Lunch (site cafeteria)*

**Wednesday July 28 – Afternoon Session (Office)**

**13:30 TSF (Cont'd)**

- 2010 Design Update
- Construction Plan and schedule

**15:00 Deliberation by the Board Members**

18:30 *Dinner (site cafeteria)*

**19:30 Preliminary report by the Board Members**

**20:30 Closure**

### **Thursday July 29 – Morning (Meadowbank/Baker Lake)**

Mr. Morgenstern, Mr. Robertson, Mr. Bonin, Mr. Bedell, Ms. Esford, Mr. Julien and Ms. Beaulieu to depart for Baker Lake no later than 8:30 am local time (TBC). AEM to provide transport from site to Baker Lake (~ 2 hrs).

Mr. Rattue depart site in early afternoon for Montreal on AEM Charter.

6:30      *Breakfast (site cafeteria)*

7:00      *Check-out (AEM to provide office space until Baker Lake transport or charter departure)*

## ATTACHMENT B

### ATTENDANCE AT JULY 2010 MEETING Held at the Meadowbank Mine site, Nunavut

Attendance		
Gaston Blanchette	AEM	Dike Superintendant
Eric Lamontagne	AEM	Mine manager
Yohan Jalbert	AEM	
Michel Julien	Golder Associates	Project Manager
Annie Beaulieu	Golder Associates	
Paul B. Bedell	Golder Associates	
Grant Bonin	Golder Associates	Grouting Specialist
Fiona Esford	Golder Associates	
Dan Walker	Golder Associates	
Lynn Wilson	Golder Associates	
Norbert Morgenstern	Self	Dike Review Board
Anthony Rattue	SNC Lavalin	Dike Review Board
Andrew Robertson	Robertson Geoconsultants	Dike Review Board

## **ATTACHMENT C**

### **LIST OF FURNISHED DOCUMENTS**

Golder Associates, 2010(a), "Bay-Goose Dike South Portion, Drawings Issued for Construction", May 2010.

Golder Associates, 2010(b), "Causeway Set Out Points and Construction Restrictions between Sta. 30+890 and Sta. 32+140, Bay-Goose Dike, Meadowbank Gold Project, Nunavut", May 2010

Golder Associates, 2010(c), "Response to report No. 6, Meadowbank Dike Review Board", July 2010.

Golder Associates, 2010(d), "East Dike CPT Investigation, Meadowbank Gold Project, Nunavut", July 2010

Golder Associates, 2010(e), "2010 Geotechnical Investigation of East Dike Soil-Bentonite Cut-off wall, Meadowbank Gold Project, Nunavut", July 2010

Golder Associates, 2010(f), "Summary of 2010 geotechnical investigation, Bay-Goose Dike, Meadowbank Gold Project, Nunavut", July 2010.

Golder Associates, 2010(g), "Foundation and backfill approval procedures during initial trench excavations (on rock and on soil) during construction of Bay-Goose Dike-South Portion, Meadowbank Gold Project, Nunavut", July 2010.

Golder Associates, 2010(h), "Segregation Potential and frost heave of S-B material, Meadowbank Gold Project, Nunavut", July 2010.

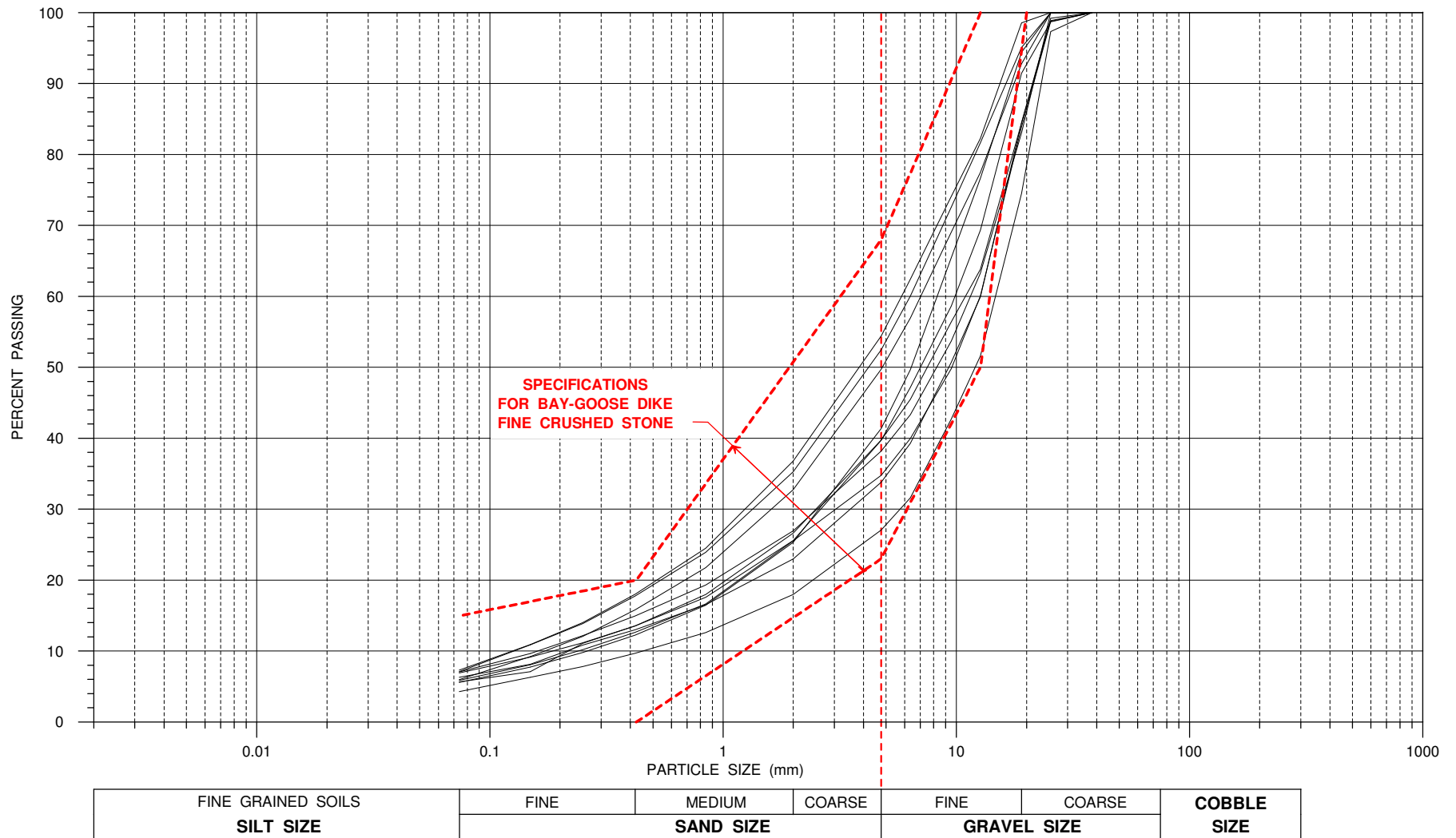
Golder Associates, 2010(i), Binder and electronic copy of PowerPoint presentations made on July 27<sup>th</sup> and 28<sup>th</sup>, 2010

## **ATTACHMENT D**

### **GRAIN SIZE CURVES FOR 0-20mm CRUSHED STONE**

#### **FILTER AND BEDDING MATERIALS**

## GRAIN SIZE DISTRIBUTION



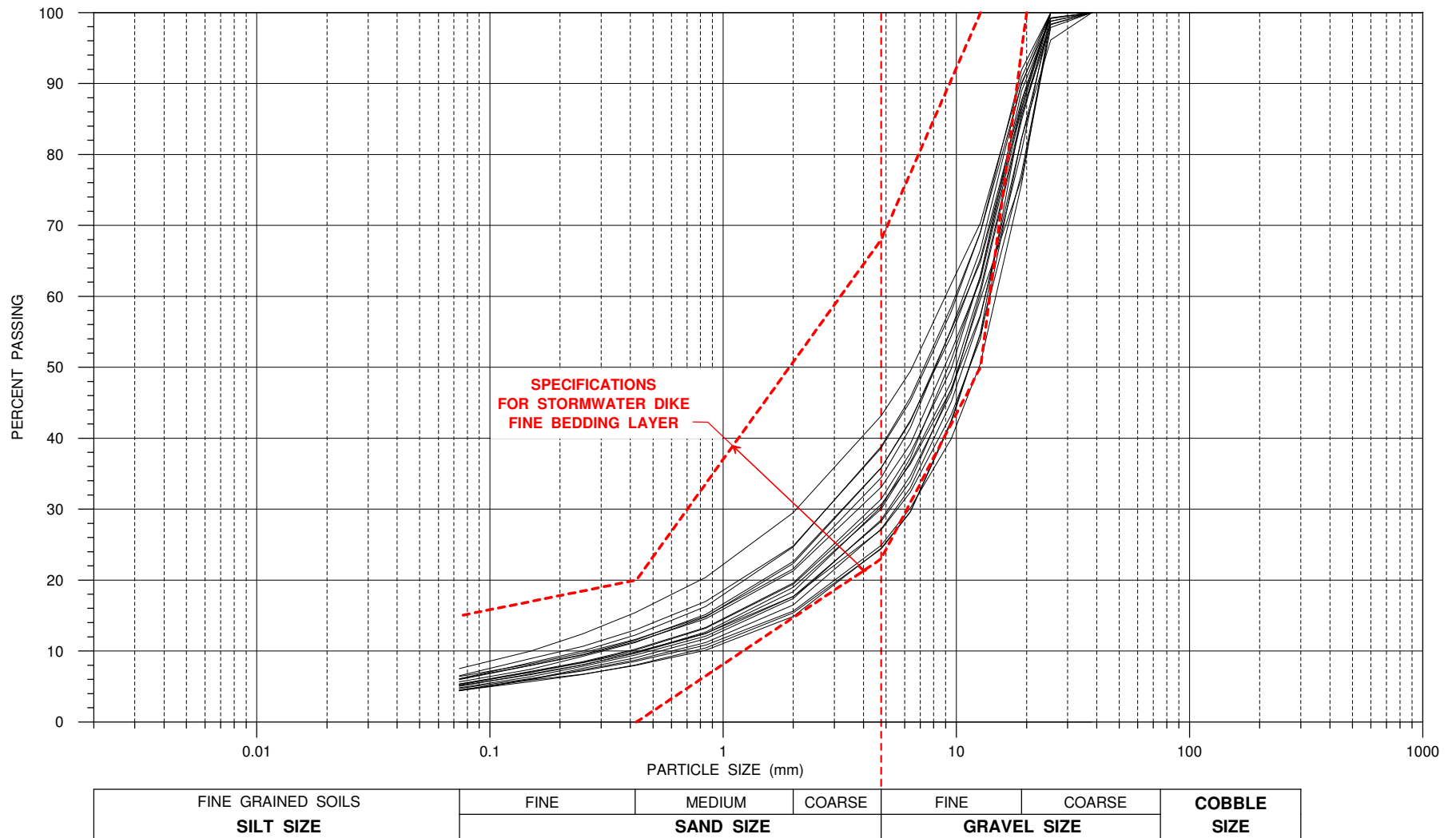
**NOTES:**

- 1) FINE CRUSHED STONE SAMPLED FROM STOCKPILE  
FOR BAY-GOOSE DIKE BETWEEN JULY 29th AND AUGUST 10th  
(10 SAMPLES)
- 2) MADE OF NPAG MATERIAL
- 3) SAMPLING AND TESTING BY AEM

**AGNICO-EAGLE MINES LIMITED - MEADOWBANK DIVISION**

**MEADOWBANK GOLD PROJECT - BAY-GOOSE DIKE**  
**SAMPLES FROM STOCKPILE OF FINE CRUSHED STONE**  
**GRAIN SIZE CURVES**

## GRAIN SIZE DISTRIBUTION



**NOTES:**

- 1) AS-PLACED FINE BEDDING LAYER SAMPLED BETWEEN JULY 19th AND AUGUST 06th (19 SAMPLES)
- 2) MADE OF PAG MATERIAL
- 3) SAMPLED AND TESTED BY AEM

**AGNICO-EAGLE MINES LIMITED - MEADOWBANK DIVISION**

**MEADOWBANK GOLD PROJECT - STORMWATER DIKE**

**SAMPLES OF AS-PLACED FINE BEDDING LAYER**

**GRAIN SIZE CURVES**



## **ATTACHMENT E**

## **PHOTOGRAPHS**



Photo # 1      East dike, seepage areas in North Channel



Photo # 2      East dike, seepage circa Stn. 60+550



Photo # 3 East dike, location of weir circa Stn. 60+490



Photo # 4 East dike, weir circa Stn. 60+490





Photo # 5      East dike, flow from toe of dike in South Channel



Photo # 6      East dike, active dumping area adjacent to above flow





Photo # 7 Bay-Goose, preparation of dry SB mix

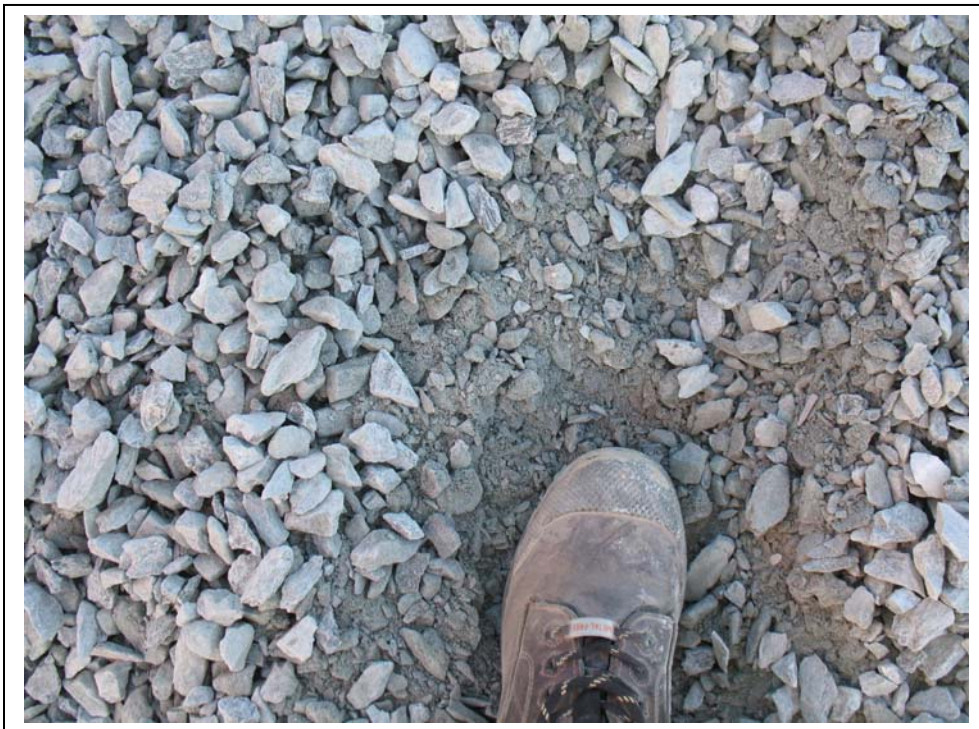


Photo # 8 Bay-Goose, material for fine filter from non PAG rock





Photo # 9 Stormwater dike, stockpile of bedding material from PAG rock



Photo # 10 Stormwater dike, placed and compacted bedding



Photo # 11 Stormwater dike, Coletanche liner minor wrinkles



Photo # 12 Stormwater dike, liner damaged by construction subsequent to installation





Photo # 13 Stormwater dike, liner weld failure at wrinkle



Photo # 14 Stormwater dike, tailings beach and decant water pond





Photo # 15 Saddle dam SD1, LLDPE liner with geotextile cover



Photo # 16 Saddle dam SD1, upstream toe



Photo # 17     Saddle dam SD1, downstream shoulder. Note pump and culverts in background



Photo # 18     Saddle dam SD2, excavation of ice rich soils





Photo # 19 Central dike axis, view from North abutment to South



Photo # 20 Central dike axis, flow slide in lakebed sediments