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Memorandum

To: Christie Kearney and Kevin Pylka (Poly Met Mining, Inc.)
From: Melisa Pollak and Cory Anderson (Barr)
Subject: Effect of Spring Mine Lake Restoration Project on Stream Augmentation for Unnamed (Mud Lake) Creek
Date: 11/07/16
Project: 23690862.12 200 001
c: Tina Pint, Keith Hanson, Jere Mohr (Barr)

As part of NorthMet Project (Project), Poly Met Mining, Inc. (PolyMet) will construct the Flotation Tailings Basin (FTB) Seepage Containment System, which will capture seepage that currently flows to the headwater area of Unnamed (Mud Lake) Creek. To offset the flow reduction, and therefore avoid potential biologic and hydrologic impacts, PolyMet will construct a drainage swale that will route background watershed runoff to the headwater area of Unnamed (Mud Lake) Creek. The drainage swale, which will extend from the toe of the FTB East Dam to the Unnamed (Mud Lake) Creek headwater wetland area (Figure 1), will reroute watershed runoff that currently drains into Cell 1E of the existing tailings basin. The Final Environmental Impact Statement (FEIS) for the NorthMet Project (Project) estimated that the drainage swale could supply an annual average of approximately 310 gpm (Table 1).

Flow from Spring Mine Lake and its surrounding watershed make up a portion of the estimated 310 gpm that would be captured by the drainage swale. Spring Mine Lake is a flooded natural ore pit that was mined out by approximately 1920. Prior to mining in Area 5 (1970s-1980s), flow from Spring Mine Lake formed the headwaters of both Spring Mine Creek and Unnamed Creek. Subsequent land disturbance has redirected flow from Spring Mine Lake into tailings basin Cell 1E.

As part of the Consent Decree, Cliffs Erie (Cliffs) and PolyMet are evaluating the feasibility of diverting water from Spring Mine Lake to Cliffs' surface discharge station SD033 (near Area 5). Evaluations completed to date indicate that re-routing water from Spring Mine Lake to SD033 via a piped siphon system is a relatively low-cost and effective strategy for realizing near-term water quality improvement at SD033, and restoring historical flow from Spring Mine Lake toward Spring Mine Creek. Because the Spring Mine Lake subwatershed is part of the area that currently drains to Cell 1E, the Spring Mine Lake restoration project may decrease the amount of runoff to the drainage swale.

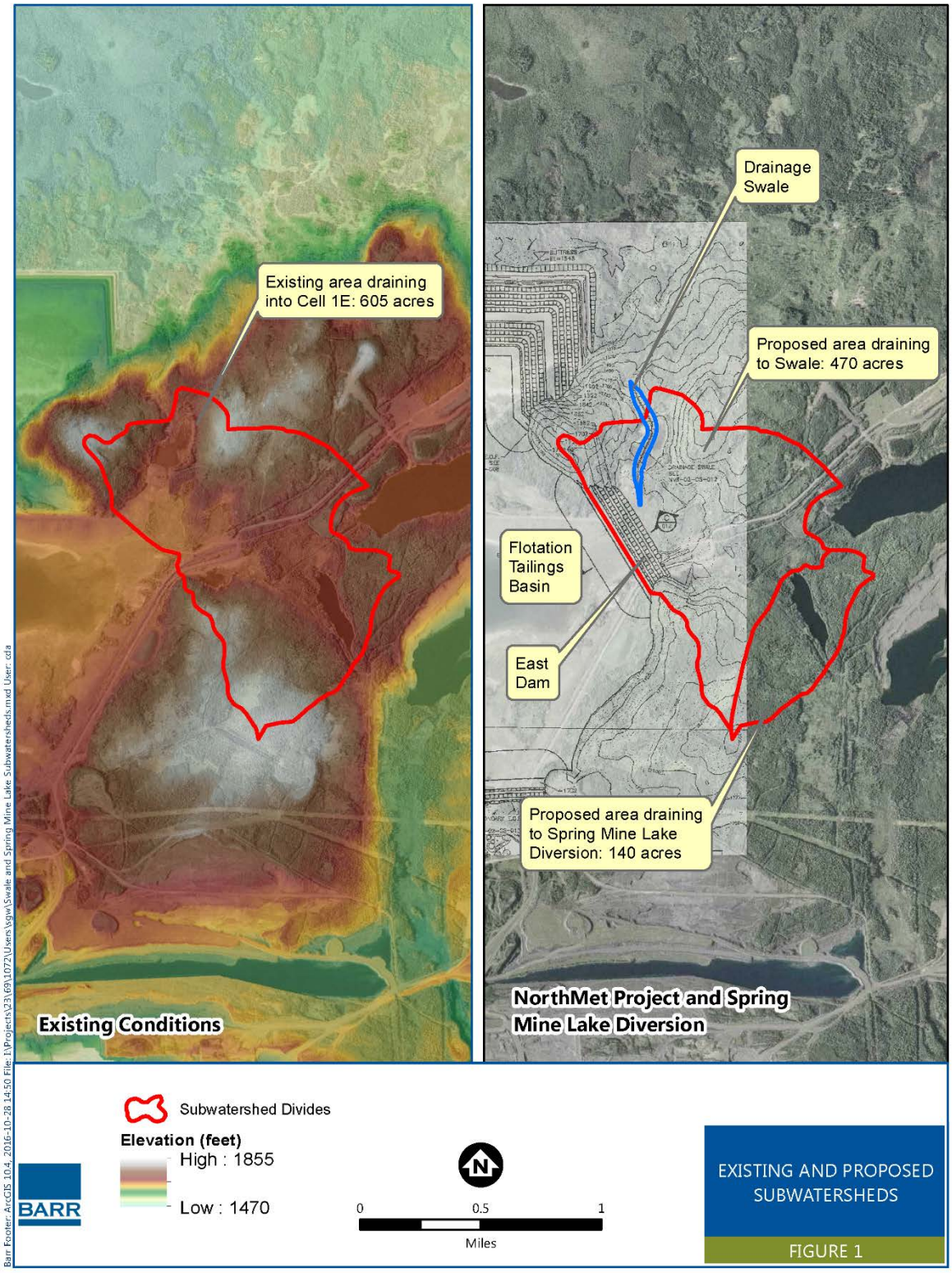
The question addressed by this memo is how construction of the Spring Mine Lake restoration project could affect PolyMet's ability to meet stream augmentation objectives for Unnamed (Mud Lake) Creek. To answer this question, Barr subtracted the subwatershed that drains to Spring Mine Lake from the total watershed area estimated in the FEIS to drain to the swale (Figure 1). Based on the change in watershed area, the Spring Mine Lake restoration project is estimated to reduce flow through the drainage swale by approximately 70 gpm (Table 1), an approximately 20% reduction from the average flow through the swale estimated for the FEIS.

During environmental review, stream augmentation was discussed in terms of stream flow rates, *i.e.,* maintaining ±20% of existing conditions flow. For the FEIS, the existing annual average stream flow at MLC-3 on Mud Lake Creek was estimated at approximately 830 gpm. Table 1 shows that after construction of the Spring Mine Lake restoration project, the drainage swale is expected to deliver adequate water to maintain flow at MLC-3 at 80% of existing conditions flow.

- Estimated flow at MLC-3 with NorthMet Project as evaluated for FEIS – 730 gpm (88% of existing)
- Estimated flow at MLC-3 with NorthMet Project plus the Spring Mine Lake restoration project – 660 gpm (80% of existing)

Table 1 Estimated Effect of Spring Mine Lake Restoration Project on Average Flow at MLC-3

Watershed Area Contributing to MLC-3	FEIS NorthMet Project		NorthMet Project plus Spring Mine Lake Restoration Project	
	Flow (gpm)	Area (acres)	Flow (gpm)	Area (acres)
Watershed downstream of swale	420	825	420	825
Watershed upstream of swale				
Spring Mine Lake subwatershed	70	140	0	0
Other watershed tributary to swale	240	470	240	470
Total future watershed contribution to MLC-3	730	1435	660	1295


Existing area draining into Cell 1E: 605 acres
Existing Conditions
Drainage Swale
Proposed area draining to Swale: 470 acres
Flotation Tailings Basin
East Dam
Proposed area draining to Spring Mine Lake Diversion: 140 acres
NorthMet Project and Spring Mine Lake Diversion
Subwatershed Divides
Elevation (feet)
High : 1855
Low : 1470
0
0.5
1
Miles
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EXISTING AND PROPOSED SUBWATERSHEDS
FIGURE 1
Barr Footer: ArcGIS 10.4, 2016-10-28 14:50 File: I:\Projects\23\69\1072\Users\vgw\Swale and Spring Mine Lake Subwatersheds.mxd User: cda