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Memorandum

To: Jon Ahlness, Stuart Arkley

From: Mark Jacobson; Cheryl Feigum

Subject: Wetland Impacts – Tailings Basin Mitigation Alternative, Revised June 2, 2008

Date: June 2, 2008

Project: 23/69/-862-006-001

c: John Borovsky, Jim Scott, ERM

The purpose of this memorandum is to respond to information needs identified in the Reasonable Alternatives Screening Table dated 4/21/08 for the mitigation to use LTVSMC taconite tailings for construction of the NorthMet tailings dams. The information need is to characterize the wetland impacts that will result with the implementation of the mitigation.

Figure 1 shows the evaluation area around Tailings Basin Cells 2E/1E. Two areas were evaluated for potential wetland impacts including:

1) the Buttress Area – this is a 300-ft wide area located along the length of the north side of Tailings Basin Cell 2E and would provide space to construct the buttress required to implement the mitigation; and

2) the East Basin Expansion Area – this area is located along the east and northeast side of the tailings basin and would be used to reduce the requirement for LTVSMC coarse tailings required for dam construction (natural terrain used as dam) and to provide an additional source (existing dams in this area) for LTVSMC coarse tailings required to implement the mitigation.

The wetland review was conducted using the same methodology as described in RS 14 *Wetland Delineation*, RS 14 Draft-02 *Wetland Delineation*, and RS14 Addendum 01 *Supplemental Information to the Wetland Delineation Report*. Prior to fieldwork, an off-site analysis was conducted to identify potential wetlands using historic aerial photographs, U.S. Geological Survey quadrangle maps, 2-foot topography data, National Wetland Inventory maps, and soil information.

The wetland functional assessments also used the same methodology described in RS 14, RS 14 Draft-02, and RS14 Addendum 01. As described in these documents, the methodology for the wetland functional assessments was based on the guidelines in the *Minnesota Routine Assessment Method for Evaluating Wetland Functions* (MnRAM) and used landscape and wetland characteristics.

Field reviews for wetlands were conducted within the evaluation area on March 21-22, 2007; November 12, 2007; and May 21-22, 2007. Table 1 identifies each wetland, dominant vegetation, hydrology and soil characteristics, and comments from the field review. Table 2 identifies the functional characteristics of each wetland regarding the vegetative diversity/integrity, overall wetland quality, disturbance level, disturbance type, and wetland origin. Table 3 summarizes the wetlands identified within the evaluation area during the field reviews.

There are about 36 acres of wetlands identified within the Buttress Area (Tables 2 and 3). Nearly 90 percent of the wetlands are classified as deep marsh (Circular 39 Type 4; Cowardin Type - PEMF). These wetlands are generally inundated with dead black spruce trees observed throughout the area. Other wetland types present in the area included wet meadow (Circular 39 Type 2; Cowardin Type - PEMB), shrub carr (Circular 39 Type 6; Cowardin Type - PSSB), and coniferous swamp (Circular 39 Type 7; Cowardin Type – PFO4B). The wetlands in the Buttress Area are low quality wetlands with the dominant vegetation including cattails and phragmites. This area has been historically impacted by seepage from the Tailings Basin. Black spruce is present throughout the area, however, the wetlands are generally inundated and most of the black spruce trees within the wetlands are dead.

There are about 19 acres of wetlands identified within the East Basin Expansion Area (Tables 2 and 3). Approximately 56 percent of the wetlands in this area are classified as deep marsh (Circular 39 Type 4; Cowardin Type - PEMF) and there are generally no trees present within these wetlands. Another 40 percent of the wetlands are classified as wet meadow (Circular 39 Type 2; Cowardin Type - PEMB), shallow marsh (Circular 39 Type 3; Cowardin Type - PEMC), and open water (Circular 39 Type 5; Cowardin Type - PUBF). The remaining wetlands include shrub carr (Circular 39 Type 6; Cowardin Type – PSSB) and excavated open water (Circular 39 Type 5; Cowardin Type - PUBFx). The wetlands in the East Basin Expansion Area are generally low quality wetlands with the vegetation dominated by cattails located within inundated areas.

Past disturbances that have affected the hydrology and vegetative characteristics of the wetlands include beaver dams, culverts, road construction, parking areas, railroad embankments, diversion of flowages, and the development of the Tailings Basin Cells 2E/1E. Wetlands in the evaluation area generally have low vegetative quality and significant hydrological impacts.

T25 PSSB
T30 PSSB
T27 PFO4B
T24 PFO4B
T19 PEMF
T17 PFO4B
T29 PEMB
T26 PSSB
T23 PFO4B
T28 PFO4B
T21 PSSB
T20 PFO4B
T18 PEMF
T16 PEMF
T31 PFO4B
T15 PEMC
T14 PEMF
T12 PEMC
T13 PEMF
T11 PUBF
T10 PUBF
T9 PEMB
T7 PEMC
T8 PEMB
T6 PSSB
T4 PEMB
T5 PEMB
T3 PEMB
T1 PUBFx
T2 PUBFx

Evaluation Area
Wetland
Impacted Wetland

N

0 500 1,000 2,000 Feet

Figure 1

IMPACTED WETLANDS
Tailings Basin Area
PolyMet Mining
Hoyt Lakes, Minnesota

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Table 1
Field Review of Wetlands
Revised June 2, 2008
NorthMet Mine/PolyMet Mining

Project Area	Wetland ID	Dominant Circular 39 Type	Dominant Cowardin Type	Dominant Eggers & Reed Community Type	Dominant Vegetation	Hydrology	Soil	Field Delineated	Date(s) of Field Review	Comments
TB Mitigation Alternative - East Basin Expansion Area	T1	5	PUBFx	open water	cattails	inundated	assumed hydric[1]	Y	3/21/2007 3/22/2007 5/21/2008	cattails on edge, no vegetation in open water area
	T2	5	PUBFx	open water	cattails	inundated	assumed hydric[1]	Y	5/21/2008	Cattails and willows on edge with no vegetation in open water area. The wetland complex includes T2 and T3.
	T3	2	PEMB	wet meadow	grasses, willow	saturated to sfc	assumed hydric[1]	Y	5/21/2008	This area is ditch-like and is likely inundated during higher water periods. The wetland complex includes T2 and T3.
	T4	2	PEMB	wet meadow	grasses, sedges	inundated to saturated	assumed hydric[1] / tailings	Y	5/21/2008	Water is ponding (6-12 inches) in the depressional area at the toe of the hillslope. The south end of his area is generally dominated by cattails or willows in areas. Other areas are dominated by sedges and grasses. Inundation appears to be more than normal but area should be saturated most of the time given the topographic location. The wetland complex includes T4 and T5.
	T5	2	PEMB	wet meadow	grasses, sedges	inundated to saturated	tailings	Y	5/21/2008	This area includes the road ditch and flow across to T4. It is inundated with 1-2 inches of water or saturated. The area has some sedges but is generally devoid of vegetation. Soil is fill consisting of tailings. The wetland complex includes T4 and T5.
	T6	6	PSSB	shrub carr	birch, willows, gasses	saturated	tailings	Y	5/21/2008	Area is located in a low depressional area of the ditch between the road and the toe of the hillslope.
	T7	3	PEMC	shallow marsh	cattails	inundated to saturated	assumed hydric[1] / tailings	Y	5/21/2008	This is an open water with small trees/shrubs on the edges in the south and cattails on the edges in the north. At the far south end, where the inundation is less than 1 ft, is dominated by willows, Phragmites, grasses as transition south out of the wetland.
	T8	2	PEMB	wet meadow	sedges, grasses	saturated	assumed hydric[2] / south end of ash hill	Y	5/21/2008	This is a narrow area where surface water (< 1" deep) is flowing to T7. Some areas are only. This narrow area flows west on the backslope. The origin of the area is near the origin of T9, however, it is not connected to T9.
	T9	2	PEMB	wet meadow	cattails, sedges,grasses	saturated	assumed hydric[2] / east side of ash hill	Y	5/21/2008	The origin of this stream is at the base of a steep hill with water flowing to the north to T10. On the backslope this is a flowing stream, but as the slope flattens, the stream widens and cattails are dominant. The wetland complex includes T9, T10, T11, T12, and T13.
	T10	5	PUBF	open water	cattails, willows	inundated	assumed hydric[1]	Y	5/21/2008	T9 flows into the southeast corner of T10 in area that is inundated with 1-2 ft of water and is dominated by cattails. Willows and cattails surround the remainder of the basin that is inundated with >2 ft of water. The wetland complex includes T9, T10, T1 T12, and T13.
	T11	5	PUBF	open water	cattails	inundated	assumed hydric[1]	Y	5/21/2008	T11 is connected to T10 and has similar characteristics. However, the area is becomes narrower to the north as the water flow enters a ditch (T13) which connects to T14. The wetland complex includes T9, T10, T11, T12, and T13.
	T12	3	PEMC	shallow marsh	cattails	inundated	assumed hydric[1]	Y	5/21/2008	This is a ditch that connects T11 and T12 with cattails and some open water that is 1-3 ft deep. The wetland complex includes T9, T10, T11, T12, and T13.
	T13	4	PEMF	deep marsh	cattails	inundated	assumed hydric[1]	Y	5/21/2008	This is a large open water wetland with cattails, some willow and grasses, on the west edge within the evaluation area. The wetland complex includes T9, T10, T11, T12, and T13.
	T14	4	PEMF	deep marsh	cattails	inundated	assumed hydric[1] / tailings	Y	5/21/2008 5/22/2008	This is a large wetland complex dominated by cattails. There were no dead black spruce trees observed. The area was inundated but depth unknown in center of wetland.
	T15	3	PEMC	shallow marsh	cattails	inundated	assumed hydric[1]	Y	5/21/2008	This area was dominated by Phragmites on parts of the south edge with cattails throughout the basin. It is located in a depressional area that appears to be at least partially created. There is an upland area on the east side of T15 that separates T15 from T14.
	T31	7	PFO4B	coniferous swamp	cattails	saturated[3]	assumed hydric[1]	Y	5/21/2008	This area is on the north side of T14 and this area appeared to be somewhat forested compared to T14.
TB Mitigation Alternative - Buttress Area	T16	4	PEMF	deep marsh	cattails	inundated	assumed hydric[1]	Y	11/12/2007 5/22/2008	This area is inundated (>1-2 ft). Vegetation is dominated by cattails, dead black spruce trees with willows and birch on the south edge. Within the evaluation area, the wetland complex includes T17, T16, and T29.
	T17	7	PFO4B	coniferous swamp	cattails	saturated[3]	assumed hydric[1]	Y	11/12/2007 5/22/2008	This area is appears to be saturated since live black spruce is observed in the area. Within the evaluation area, the wetland complex includes T17, T16, and T29.
	T18	4	PEMF	deep marsh	cattails	inundated	assumed hydric[1]	Y	11/12/2007 5/22/2008	This area is inundated (>1-2 ft). Vegetation is dominated by cattails with dead black spruce trees present. On the south edge is Phragmites with some willows. The east and west edges have some live black spruce trees.
	T19	4	PEMF	deep marsh	cattails	inundated	assumed hydric[1]	Y	11/12/2007 5/22/2008	This area is inundated (>1-2 ft). Vegetation is dominated by cattails with dead black spruce trees present. Within the evaluation area, the wetland complex includes T19 through T28 and T30.
	T20	7	PFO4B	coniferous swamp	cedar	inundated	assumed hydric[1]	Y	11/12/2007 5/22/2008	This area is on the south edge of T19. It is inundated with less than 1 ft of water. Cedar is present in this area. Within the evaluation area, the wetland complex includes T19 through T28 and T30.
	T21	6	PSSB	shrub carr	willow	inundated	assumed hydric[1]	Y	11/12/2007 5/22/2008	This is an area of willows and other shrubby vegetation located on the south side of T19. Within the evaluation area, the wetland complex includes T19 through T28 and T30.
	T23	7	PFO4B	coniferous swamp	black spruce	inundated	assumed hydric[2]	Y	11/12/2007 5/22/2008	There is a small area of black spruce present on the south side of T19. Within the evaluation area, the wetland complex includes T19 through T28 and T30.
	T24	7	PFO4B	coniferous swamp	black spruce	inundated	assumed hydric[3]	Y	11/12/2007 5/22/2008	There is a small area of black spruce present on the south side of T19. Within the evaluation area, the wetland complex includes T19 through T28 and T30.
	T25	6	PSSB	shrub carr	willows, birch	inundated	assumed hydric[3]	Y	11/12/2007 5/22/2008	An area of willows and small birch are present along the ditch with some black spruce. Within the evaluation area, the wetland complex includes T19 through T28 and T30.
	T26	6	PSSB	shrub carr	willows, birch	inundated	assumed hydric[3]	Y	11/12/2007 5/22/2008	This area is inundated. Dominant vegetation includes willows and birch with some black spruce. Within the evaluation area, the wetland complex includes T19 through T28 and T30.
	T27	7	PFO4B	coniferous swamp	black spruce	inundated	assumed hydric[3]	Y	11/12/2007 5/22/2008	There is a small area of black spruce present with some black spruce. Within the evaluation area, the wetland complex includes T19 through T28 and T30.
	T28	7	PFO4B	coniferous swamp	black spruce	inundated	assumed hydric[4]	Y	11/12/2007 5/22/2008	There is a small area of black spruce present on the south side of T19. Within the evaluation area, the wetland complex includes T19 through T28 and T30.
	T29	2	PEMB	wet meadow	cattails	saturated	assumed hydric[1]	Y	11/12/2007 5/22/2008	This area is saturated. Vegetation is dominated by cattails with willows and birch also present. Within the evaluation area, the wetland complex includes T17, T16, and T29.
	T30	6	PSSB	shrub carr	cattails	inundated	assumed hydric[2]	Y	11/12/2007 5/22/2008	This area is inundated. Dominant vegetation includes willows and birch with some black spruce. Within the evaluation area, the wetland complex includes T19 through T28 and T30.

[1] The soil was assumed to be hydric because: 1) the vegetation and hydrology met the criteria for a wetland, and 2) the area was depressional and generally located at the toe of the slope.
[2] The soil was assumed to be hydric because: 1) the vegetation and hydrology met the criteria for a wetland, and 2) the area was on the backslope and water was flowing through a defined channel.
[3] This area was reviewed from the road so hydrology is assumed to be saturated since there were no dead black spruce trees observed.

Table 2
Projected Wetland Impact Detail
June 2, 2008
NorthMet Mine/PolyMet Mining

Project Area	Wetland ID	Dominant Circular 39 Type	Total Wetland Area (acres)	Projected Total Wetland Impacts (acres)	Projected Indirect Wetland Impacts (acres)	Dominant Eggers & Reed Community Type	Vegetative Diversity/ Integrity	Overall Wetland Quality	Disturbance Level	Disturbance Type	Wetland Origin	Field Delineated	Impact Type (Direct/Indirect)
TB Mitigation Alternative - East Basin Expansion Area	T1	5		0.17	0.00	open water	Low	Low	High	Impounded	Natural	Y	Direct
TB Mitigation Alternative - East Basin Expansion Area	T2	5		0.90	0.00	open water	Low	Low	High	Impounded	Natural	Y	Direct
TB Mitigation Alternative - East Basin Expansion Area	T3	2		0.09	0.00	wet meadow	Low	Low	High	Ditch	Created	Y	Direct
TB Mitigation Alternative - East Basin Expansion Area	T4	2		1.02	0.00	wet meadow	Low	Low	High	Road Fill	Created	Y	Direct
TB Mitigation Alternative - East Basin Expansion Area	T5	2		0.24	0.00	wet meadow	Low	Low	High	Road Fill	Created	Y	Direct
TB Mitigation Alternative - East Basin Expansion Area	T6	6		0.07	0.00	shrub carr	Low	Low	High	Road Fill	Created	Y	Direct
TB Mitigation Alternative - East Basin Expansion Area	T7	3		0.92	0.00	shallow marsh	Low	Low	High	Impounded	Created	Y	Direct
TB Mitigation Alternative - East Basin Expansion Area	T8	2		0.04	0.00	wet meadow	Low	Low	High	Seepage	Created	Y	Direct
TB Mitigation Alternative - East Basin Expansion Area	T9	2		0.38	0.00	wet meadow	Low	Low	High	Seepage	Created	Y	Direct
TB Mitigation Alternative - East Basin Expansion Area	T10	5		1.48	0.00	open water	Low	Low	High	Impounded	Natural	Y	Direct
TB Mitigation Alternative - East Basin Expansion Area	T11	5		0.96	0.00	open water	Low	Low	High	Impounded	Natural	Y	Direct
TB Mitigation Alternative - East Basin Expansion Area	T12	3		0.39	0.00	shallow marsh	Low	Low	High	Impounded	Created	Y	Direct
TB Mitigation Alternative - East Basin Expansion Area	T13	4		0.60	0.00	deep marsh	Low	Low	High	Impounded	Natural	Y	Direct
TB Mitigation Alternative - East Basin Expansion Area	T14	4		10.06	0.00	deep marsh	Low	Low	High	Impounded	Natural	Y	Direct
TB Mitigation Alternative - East Basin Expansion Area	T15	3		1.70	0.00	shallow marsh	Low	Low	High	Impounded	Created	Y	Direct
TB Mitigation Alternative - East Basin Expansion Area	T31	7		0.03	0.00	coniferous swamp	Low	Low	High	Impounded	Natural	Y	Direct
TB Mitigation Alternative - East Basin Expansion Area				**19.05**	**0.0**								
TB Mitigation Alternative - Buttress Area	T16	4		9.03	0.00	deep marsh	Low	Low	High	Ditch	Created	Y	Direct
TB Mitigation Alternative - Buttress Area	T17	7		1.18	0.00	coniferous swamp	Low	Low	High	Impounded	Natural	Y	Direct
TB Mitigation Alternative - Buttress Area	T18	4		4.07	0.00	deep marsh	Low	Low	High	Impounded	Natural	Y	Direct
TB Mitigation Alternative - Buttress Area	T19	4		18.91	0.00	deep marsh	Low	Low	High	Ditch / Impounded	Natural	Y	Direct
TB Mitigation Alternative - Buttress Area	T20	7		0.45	0.00	coniferous swamp	Low	Low	High	Impounded	Natural	Y	Direct
TB Mitigation Alternative - Buttress Area	T21	6		0.48	0.00	shrub carr	Low	Low	High	Impounded	Natural	Y	Direct
TB Mitigation Alternative - Buttress Area	T23	7		0.22	0.00	coniferous swamp	Low	Low	High	Impounded	Natural	Y	Direct
TB Mitigation Alternative - Buttress Area	T24	7		0.33	0.00	coniferous swamp	Low	Low	High	Impounded	Natural	Y	Direct
TB Mitigation Alternative - Buttress Area	T25	6		0.01	0.00	shrub carr	Low	Low	High	Impounded	Natural	Y	Direct
TB Mitigation Alternative - Buttress Area	T26	6		1.38	0.00	shrub carr	Low	Low	High	Impounded	Natural	Y	Direct
TB Mitigation Alternative - Buttress Area	T27	7		0.03	0.00	coniferous swamp	Low	Low	High	Impounded	Natural	Y	Direct
TB Mitigation Alternative - Buttress Area	T28	6		0.05	0.00	shrub carr	Low	Low	High	Impounded	Natural	Y	Direct
TB Mitigation Alternative - Buttress Area	T29	2		0.00	0.00	wet meadow	Low	Low	High	Ditch	Created	Y	Direct
TB Mitigation Alternative - Buttress Area	T30	6		0.02	0.00	shrub carr	Low	Low	High	Impounded	Natural	Y	Direct
TB Mitigation Alternative - Buttress Area				**36.16**	**0.0**								

Table 3
Summary of Wetlands
Revised June 2, 2008
NorthMet Mine/PolyMet Mining

Wetland Type		Evaluation Area	
Circular 39	**Cowardin**	**Buttress Area (acres)**	**East Basin Expansion Area (acres)**
Type 2	PEMB	0.003	1.77
Type 3	PEMC	---	3.01
Type 4	PEMF	32.01	10.66
Type 5	PUBF, PUBFx	---	3.51
Type 6	PSSB	1.94	0.07
Type 7	PFO4B	2.21	0.03
TOTAL		**36.16**	**19.05**