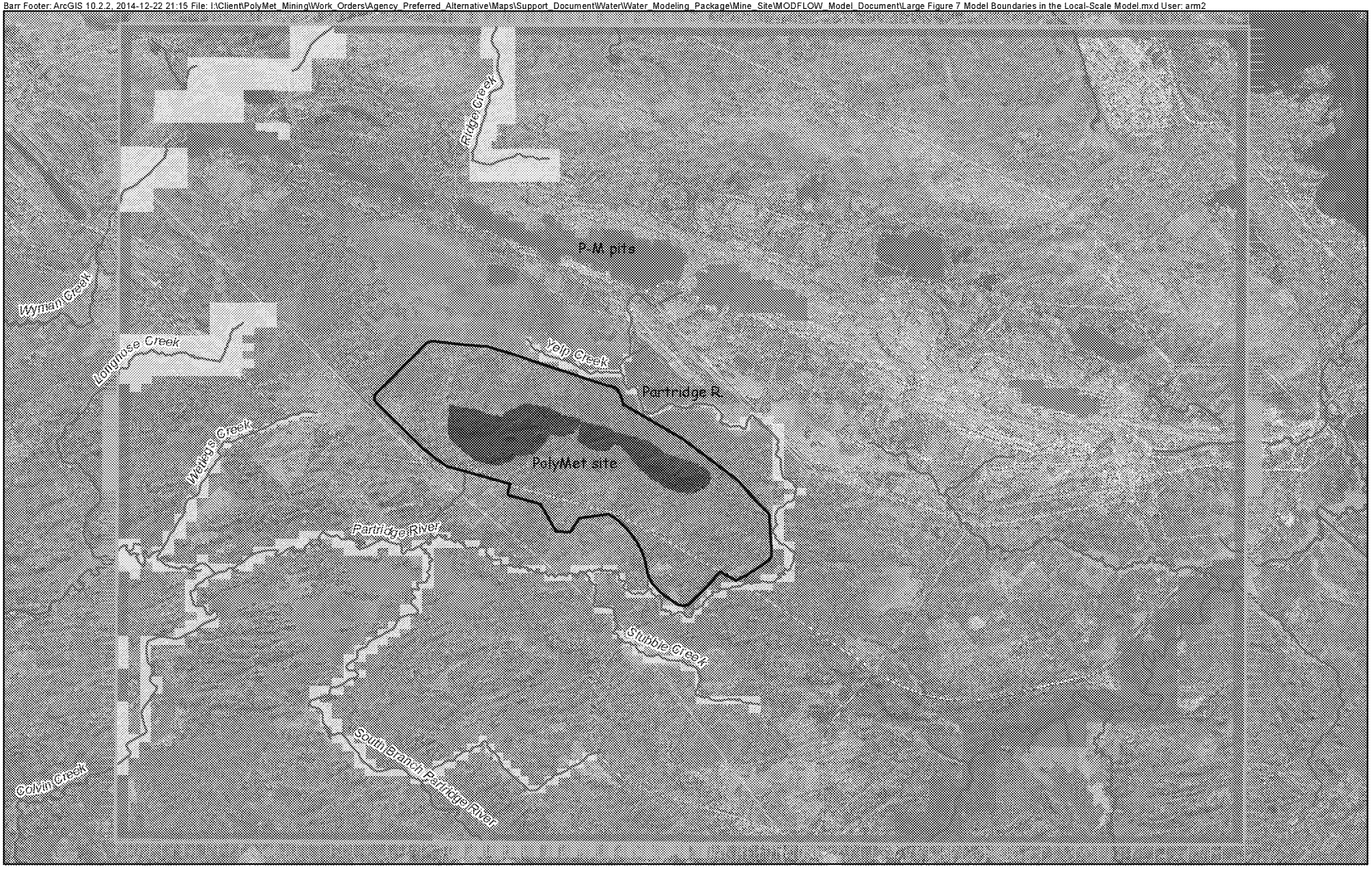
Figure 1

Barr Footer: ArcGIS 10.2.2, 2014-12-22 21:15 File: I:\Client\PolyMet_Mining\Work_Orders\Agency_Preferred_Alternative\Maps\Support_Document\Water\Water_Modeling_Package\Mine_Site\MODFLOW_Model_Document\Large Figure 7 Model Boundaries in the Local-Scale Model.mxd User: arm2



Local-Scale Model Area
Model Grid
Constant Head Cell
River Cell
Mine Site
Pits - Mine Year 11

0 0.65 1.3 2.6
Miles

Large Figure 7
MODEL BOUNDARIES IN
THE LOCAL-SCALE MODEL
NorthMet Project
Poly Met Mining, Inc.

Figure 2

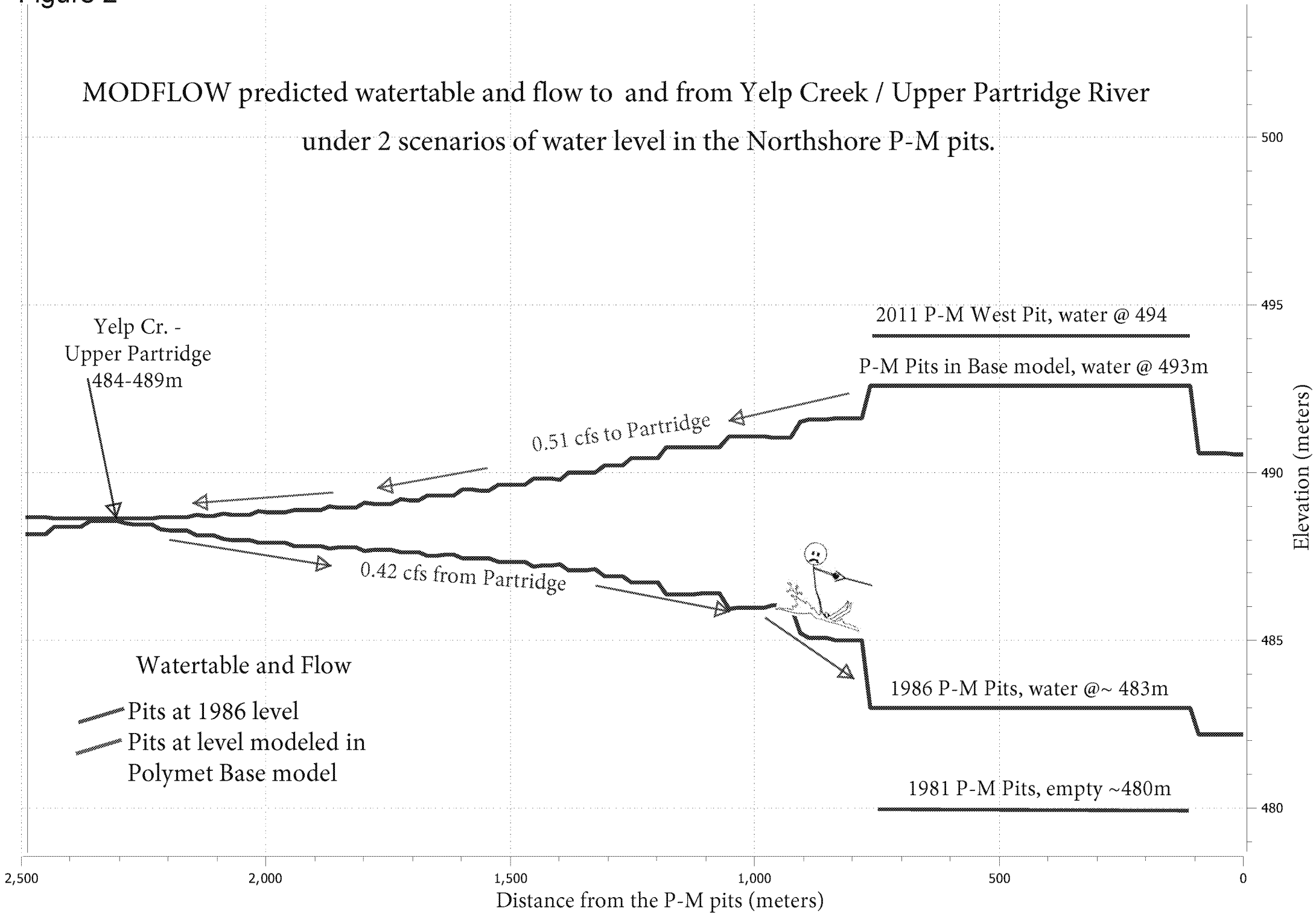
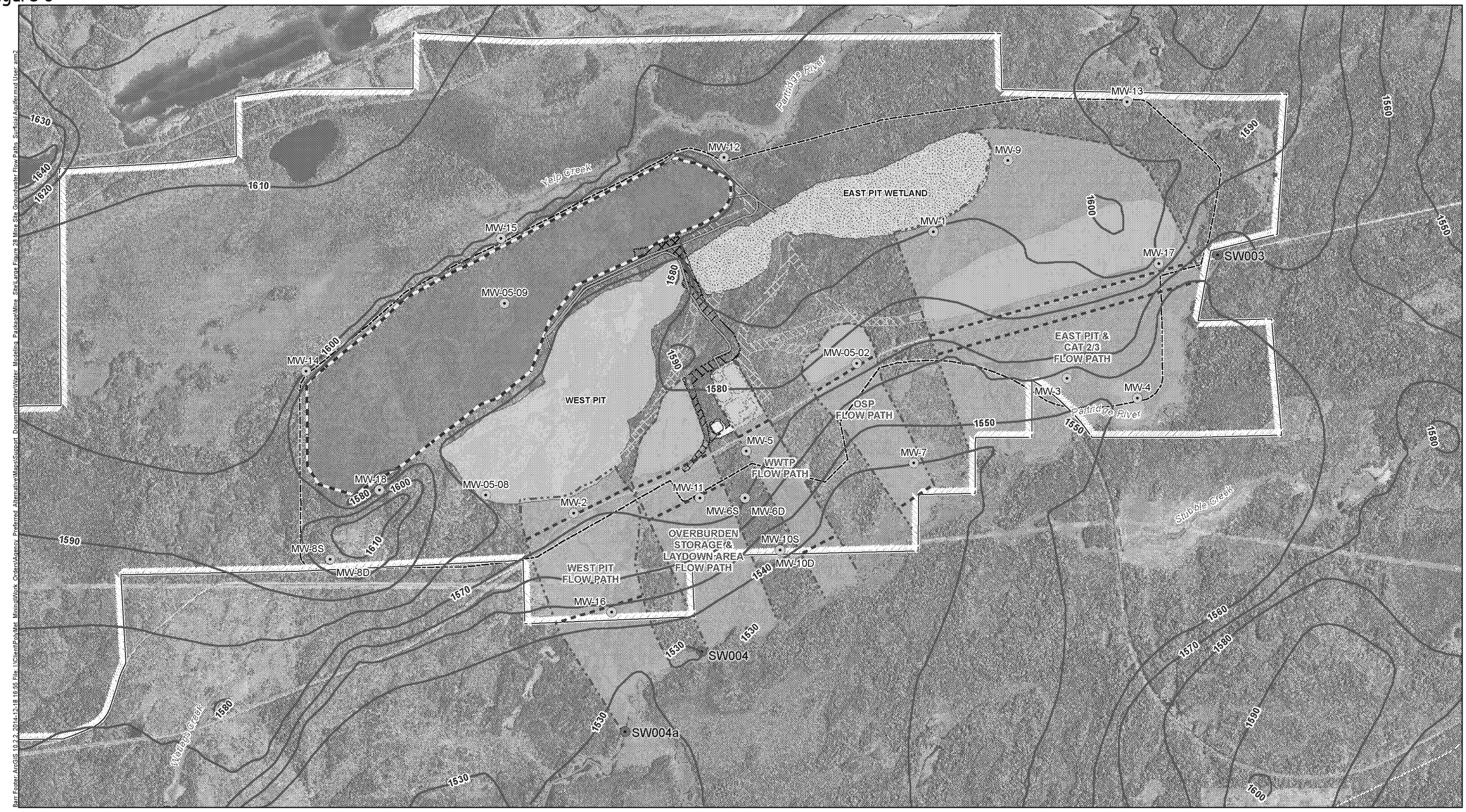

MODFLOW predicted watertable and flow to and from Yelp Creek / Upper Partridge River
under 2 scenarios of water level in the Northshore P-M pits.
Yelp Cr. -
Upper Partridge
484-489m
2011 P-M West Pit, water @ 494
P-M Pits in Base model, water @ 493m
0.51 cfs to Partridge
0.42 cfs from Partridge
1986 P-M Pits, water @~ 483m
1981 P-M Pits, empty ~480m
Watertable and Flow
Pits at 1986 level
Pits at level modeled in
Polymet Base model
500
495
490
485
480
Elevation (meters)
2,500
2,000
1,500
1,000
500
0
Distance from the P-M pits (meters)

Figure 2 - Profile of the water table between the upper Partridge and the P-M pits under 2 scenarios of water level in the pits.
The red stair-step line in the figure is the water table between the upper Partridge R. and the Peter-Mitchel taconite pits when the pits are at 493 meters elevation. Water is flowing from the pits to the upper Partridge R. The purple stair-step line is the water table between the upper Partridge R. and the Peter-Mitchel taconite pits when the pits are at 483 meters elevation (the elevation that they had in 1986). In the 483 meter model run, water is flowing from the upper Partridge R., to the P-M pits.

Figure 3



Mine Features
- West Pit
- East Pit Wetland
- Reclaimed Stockpile
- Removed and Reclaimed Stockpile
- Haul Roads
- Reclaimed Haul Roads

- Surface Water Monitoring Location
- Groundwater Monitoring Location
- Groundwater Containment System
- Process Water Pipe
- Groundwater Elevation Contours (Ft) at Closure[1]

[1] Inferred water table contours were developed using contours from the Mine Site MODFLOW model.

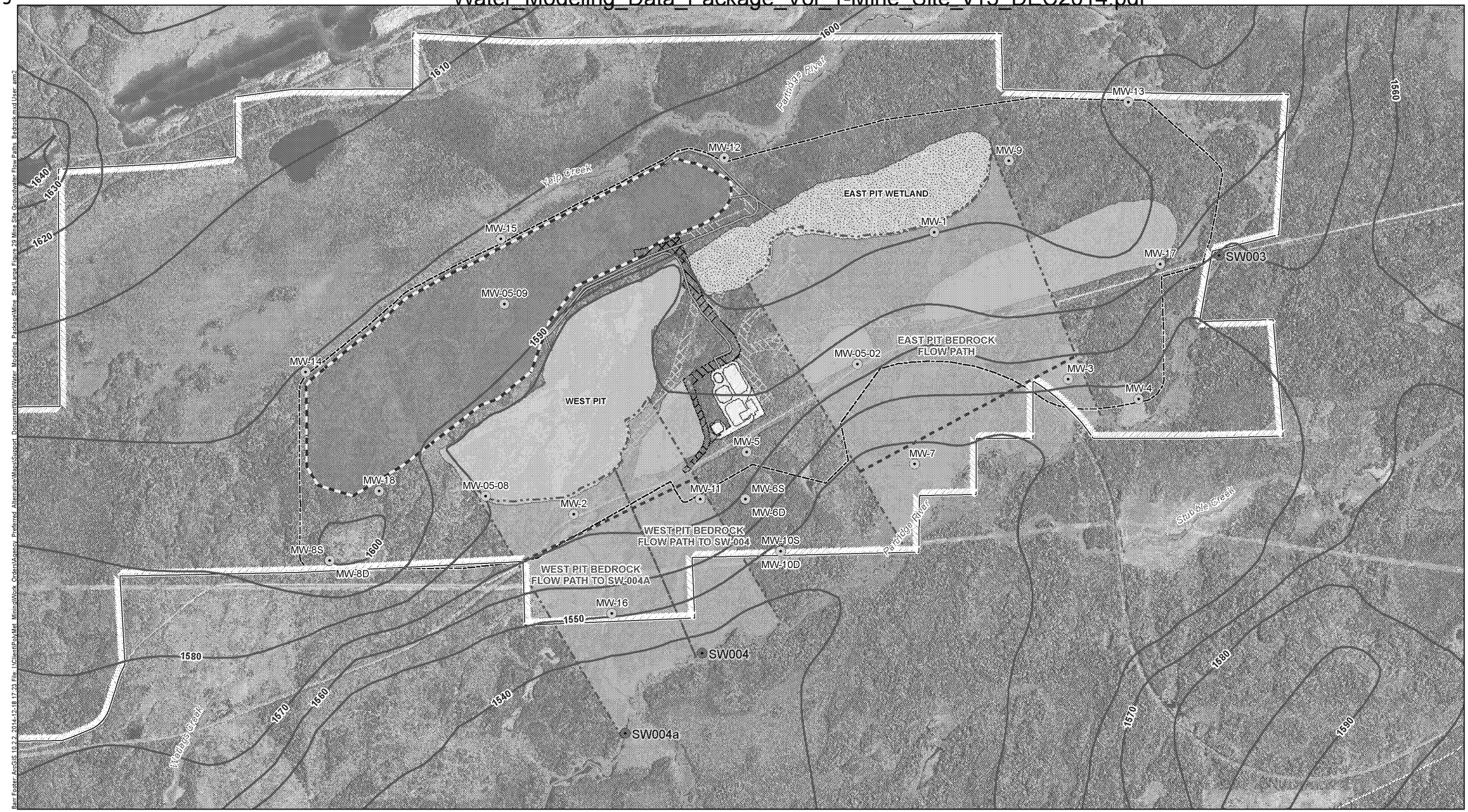
- Groundwater Evaluation Distances
- Groundwater Flow Path
- Mine Site
- Extent of Future PolyMet Lands

0 1,000 2,000 4,000
Feet

Large Figure 28
MINE SITE GROUNDWATER
FLOW PATHS - SURFICIAL AQUIFER
NorthMet Project
Poly Met Mining Inc.
Hoyt Lakes, MN

Figure 4

Water_Modeling_Data_Package_Vol_1-Mine_Site_v13_DEC2014.pdf



Mine Features
- West Pit
- East Pit Wetland
- Reclaimed Stockpile
- Removed and Reclaimed Stockpile
- Haul Roads
- Reclaimed Haul Roads

- Surface Water Monitoring Location
- Groundwater Monitoring Location
- Groundwater Containment System
- Process Water Pipe
- Groundwater Elevation Contours (Ft) at Closure[1]

[1] Inferred water table contours were developed using contours from the Mine Site MODFLOW model.

- Groundwater Evaluation Distances
- Groundwater Flow Path
- Mine Site
- Extent of Future PolyMet Lands

0 1,000 2,000 4,000
Feet

Large Figure 29
MINE SITE GROUNDWATER FLOW PATHS - BEDROCK
NorthMet Project
Poly Met Mining Inc.
Hoyt Lakes, MN

Figure 5

Water Levels in Peter-Mitchel Area003-east pit

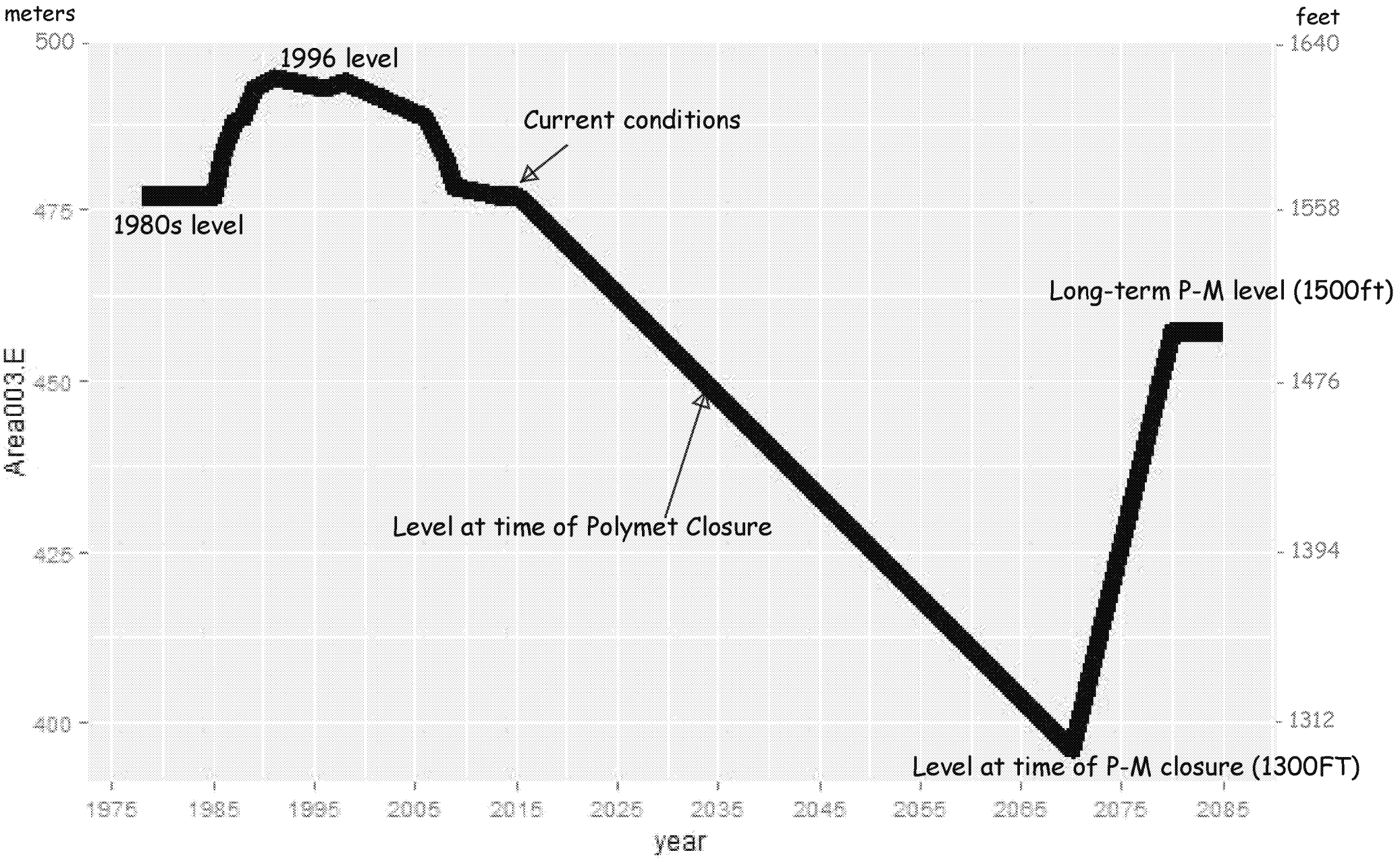
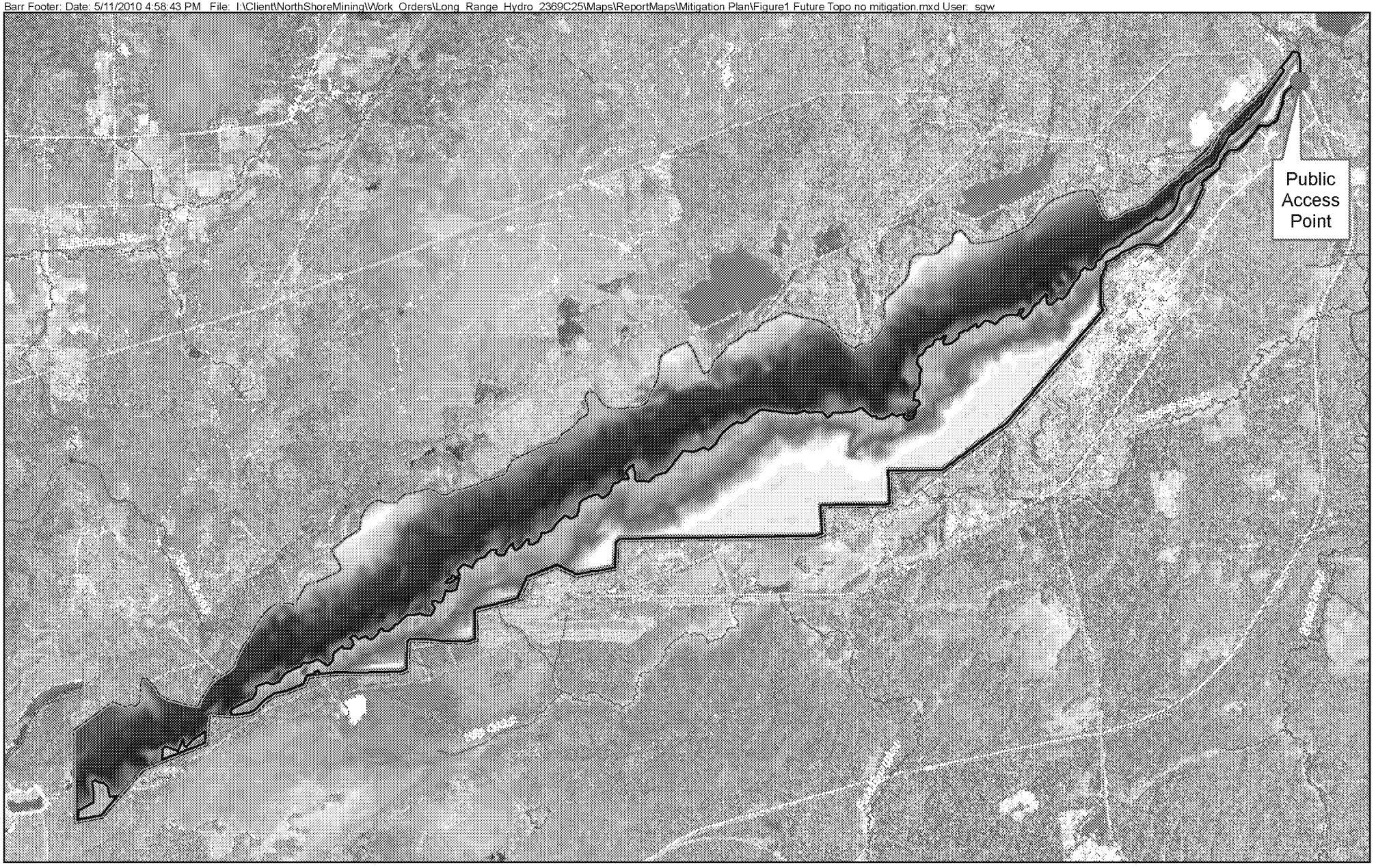


Figure 6

Barr Footer: Date: 5/11/2010 4:58:43 PM File: I:\Client\NorthShoreMining\Work_Orders\Long_Range_Hydro_2369C25\Maps\ReportMaps\Mitigation Plan\Figure1 Future Topo no mitigation.mxd User: sgw



1500 ft contour

Mine Site Boundary

Streams

Future Topography (no mitigation)

Elevation (feet)

High : 1785.95

Low : 1195.2

N

Kilometers

1 0 1 2 3

Miles

1 0 1 2

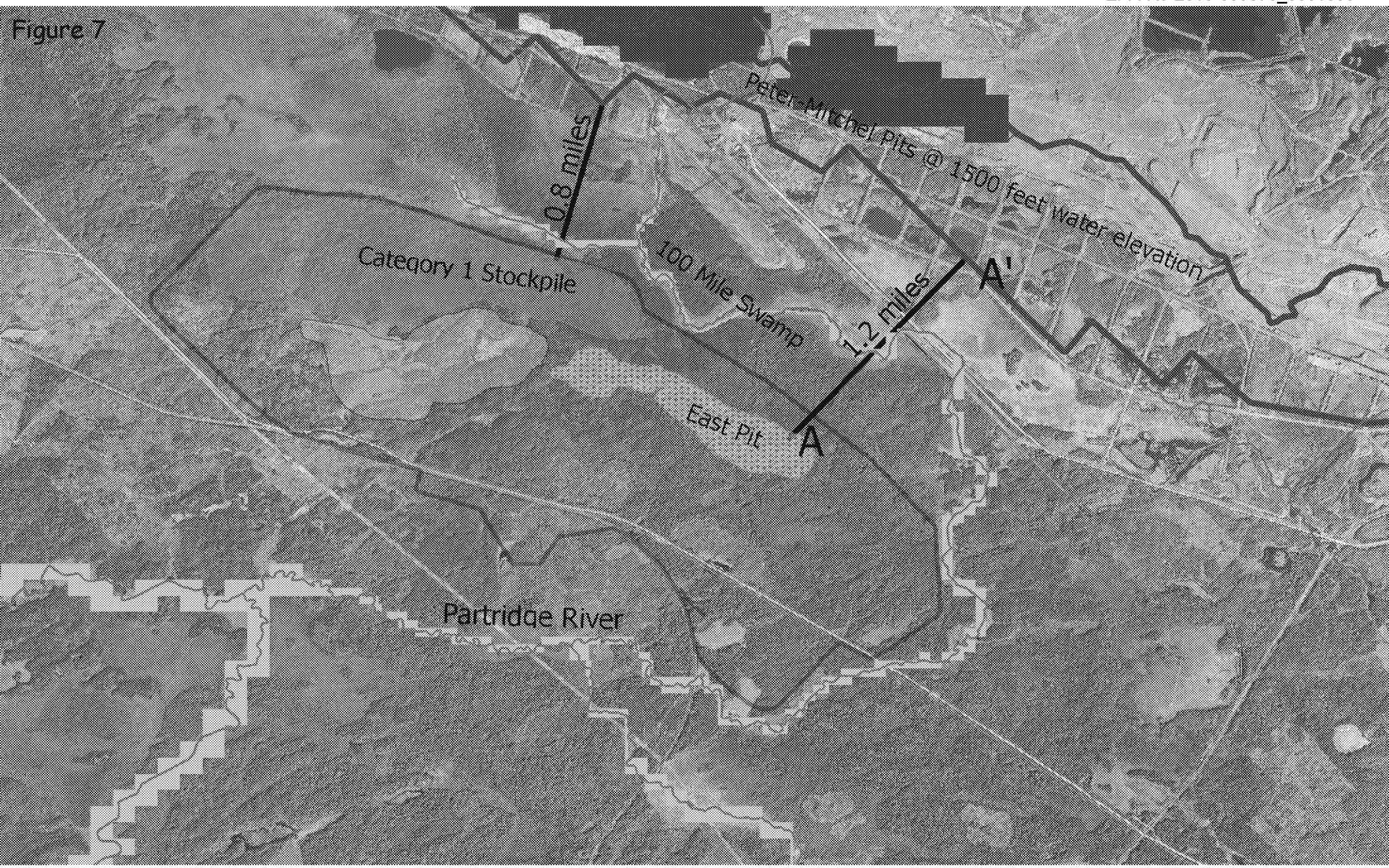
Figure 1

BARR

Ultimate Topography of the PMP
(without Mitigation)
Peter Mitchell Pit Mitigation Plan
North Shore Mining
Babbitt, Minnesota

Figure from the Northshore Watershed Mitigation Plan of 2011. - A map of the Peter-Mitchel pit final lake water elevation from the Feb. 11, 2011 report titled "Watershed Mitigation Plan" (MDNR 2011s.pdf) which contains the May 2010 BARR Engineering document titled: "Peter Mitchell Pit Concept Mitigation Plan". That plan identifies the final status of the P-M pits as being connected into a long east-west pit that will be allowed to fill to a water elevation of 1500 ft (457 meters). The recreational lake formed by this filling is scheduled to passively discharge to a tributary of the Dunka River in the north-east. While the ultimate water level in the reflooded P-M pits is expected to be 1500 feet, in the interim, the taconite pit bottoms continue to be deepened to an elevation of approximately 1300 ft (396 meters). In 2011 the bottoms of the P-M pits ranged down to an elevation of 1394 feet (425 meters).

Figure 7



Outline of Peter-Mitchel1500 ft pit lake.

Project Areas

Cat. 1 Stockpile

West Pit

East Pit

2500 0 2500 5000 ft

Polymet pits and Category 1 stockpile at closure.
Northshore Peter-Mitchel pit lake at 1500 foot level

GLIFWC, 2015-08-06

Figure 8 Flow of particles when P-M pits are at closure levels (457 meters).

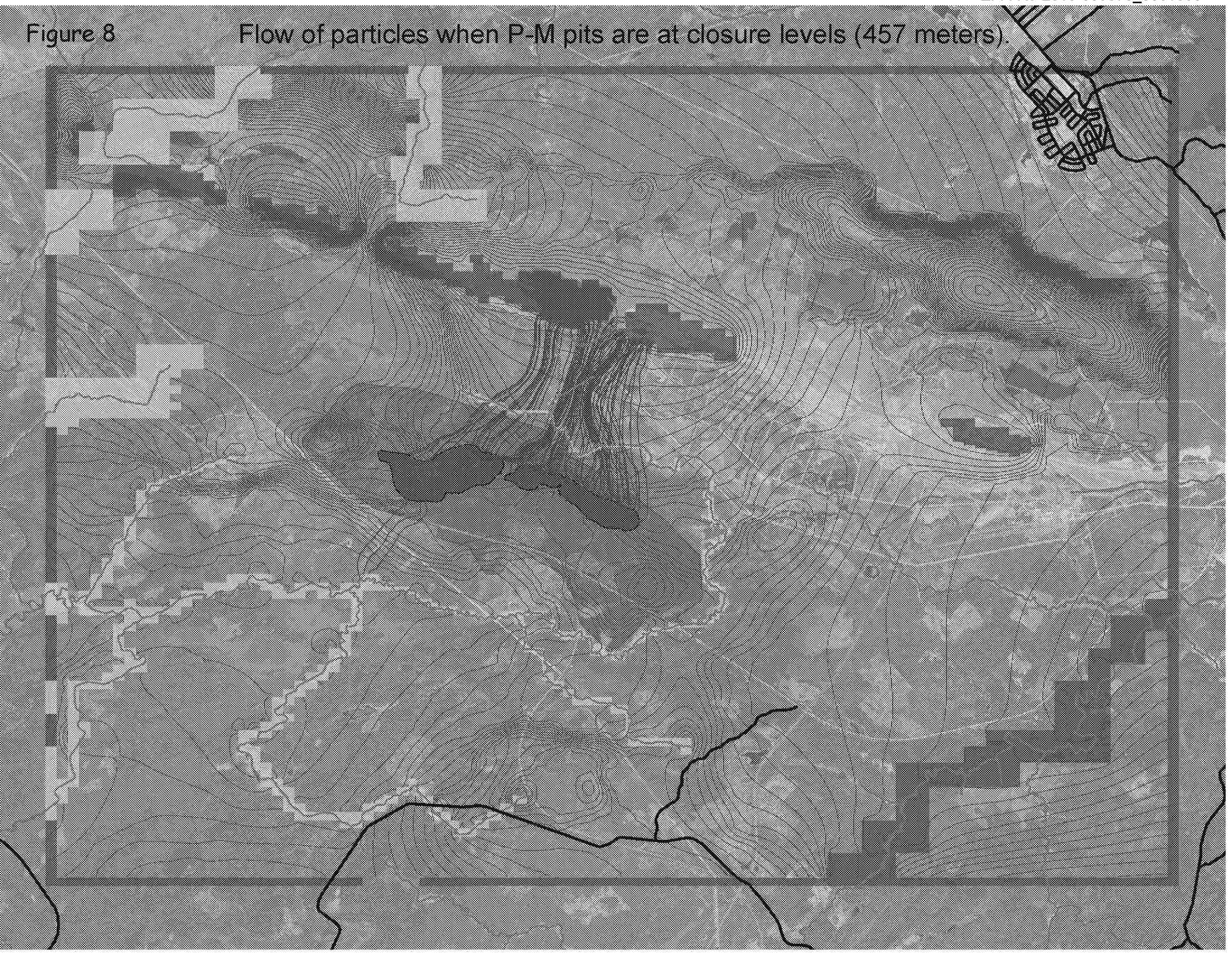
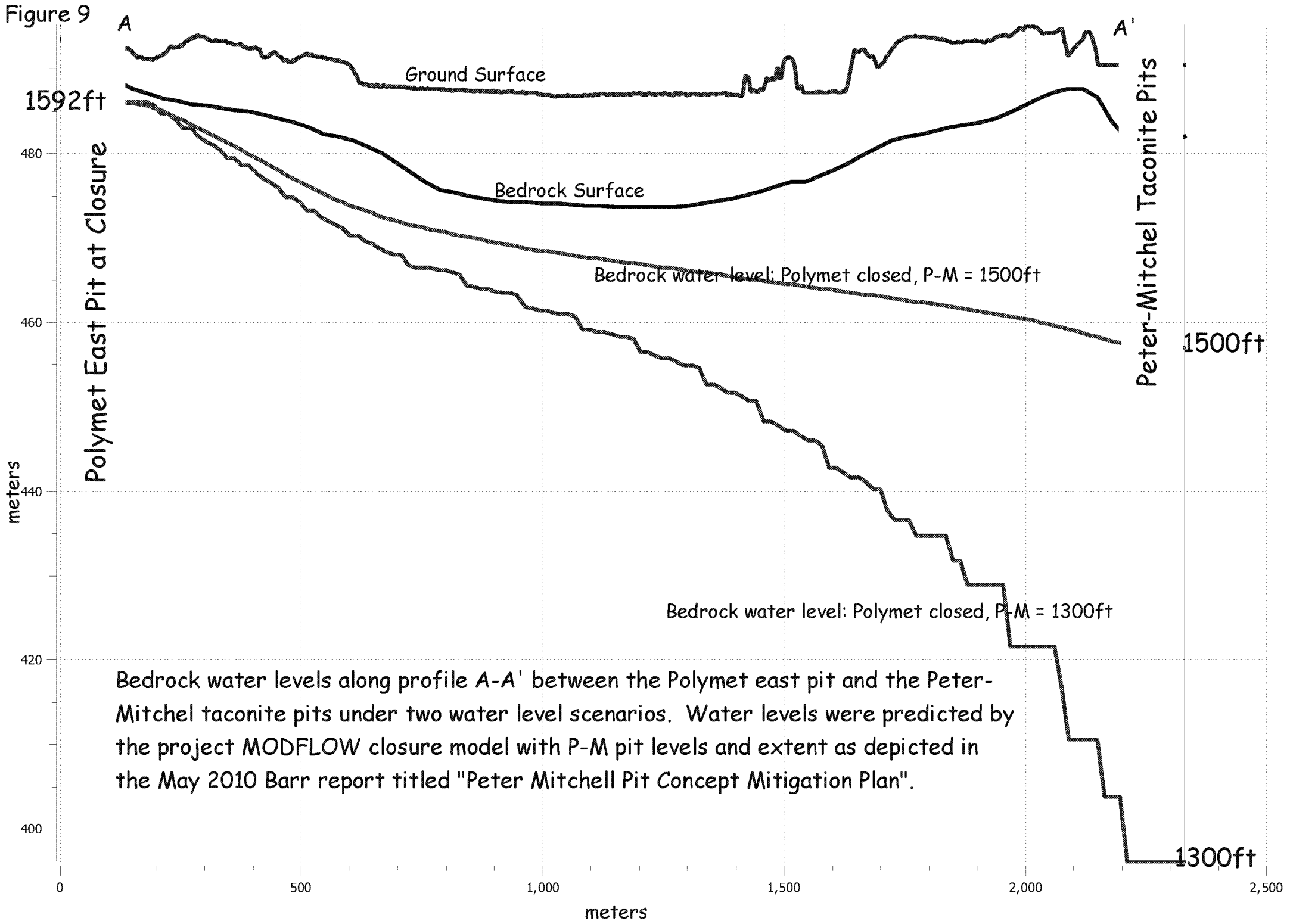


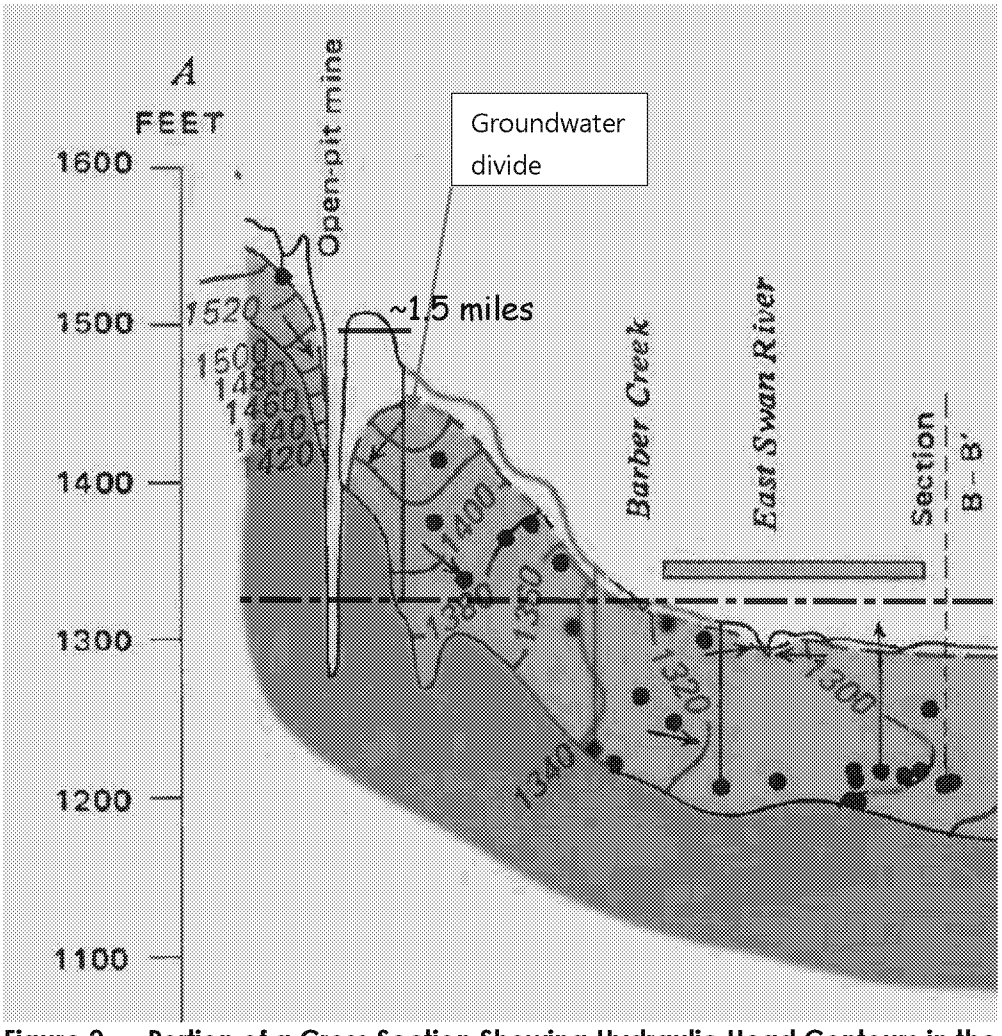
Figure 8 - A map of particles (water) moving from the Polymet pit areas to the P-M pits. This scoping level modeling used the Polymet base MODFLOW model with P-M pits set to their long-term level of 457 meters (1500 ft). Because the upper Partridge River would be unable to supply unlimited water to the aquifer, discharge from the upper Partridge River to the groundwater system is prevented in this model run.
Particles were added to the surficial aquifer and allowed to travel in the direction that the aquifer carried them. These particle tracks originate in the area of the proposed Polymet pits and end at the P-M taconite pits. A few particles leave the Polymet west pit area and travel to the Partridge River because the S-W corner of the Polymet west pit is on the south side of the watertable divide.

Figure 9



Bedrock water levels along profile A-A' between the Polymet east pit and the Peter-Mitchel taconite pits under two water level scenarios. Water levels were predicted by the project MODFLOW closure model with P-M pit levels and extent as depicted in the May 2010 Barr report titled "Peter Mitchell Pit Concept Mitigation Plan".

Figure 10. From Barr 2015-07-04 memo titled: Response to Cooperating Agency Comments Related to Peter Mitchell Pit – Version 3



Note: Polymet E. pit is 1.2 miles from P-M

Figure 2 Portion of a Cross Section Showing Hydraulic Head Contours in the Drift Aquifer Adjacent to an Open-pit Mine (from Cross-section A-A' of Reference (2)). *The portion shown has a length of approximately 17 miles*

Figure 11. From Barr 2015-07-04 memo titled: Response to Cooperating Agency Comments Related to Peter Mitchell Pit – Version 3

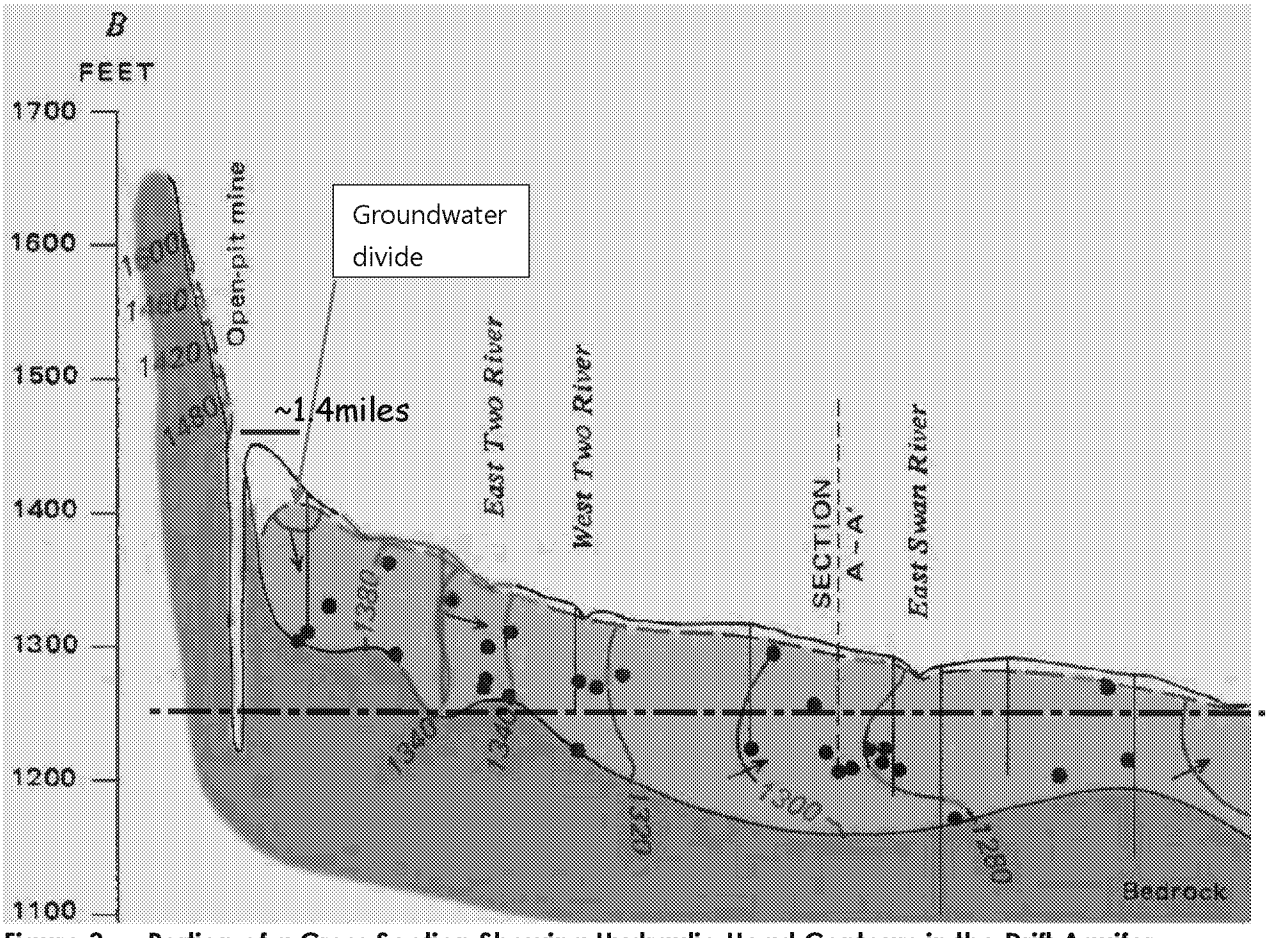


Figure 3 Portion of a Cross Section Showing Hydraulic Head Contours in the Drift Aquifer Adjacent to an Open-pit Mine (from Cross-Section B-B' of Reference (2)]). *The portion shown has a length of approximately 22 miles*

Figure 12

Monitoring Well

Groundwater Elevation Contours (Ft)[1]

Streams/Rivers

Mine Site

[1]Inferred water table contours were developed using a combination of measured groundwater elevations in site monitoring wells and contours from the Mine Site MODFLOW model.

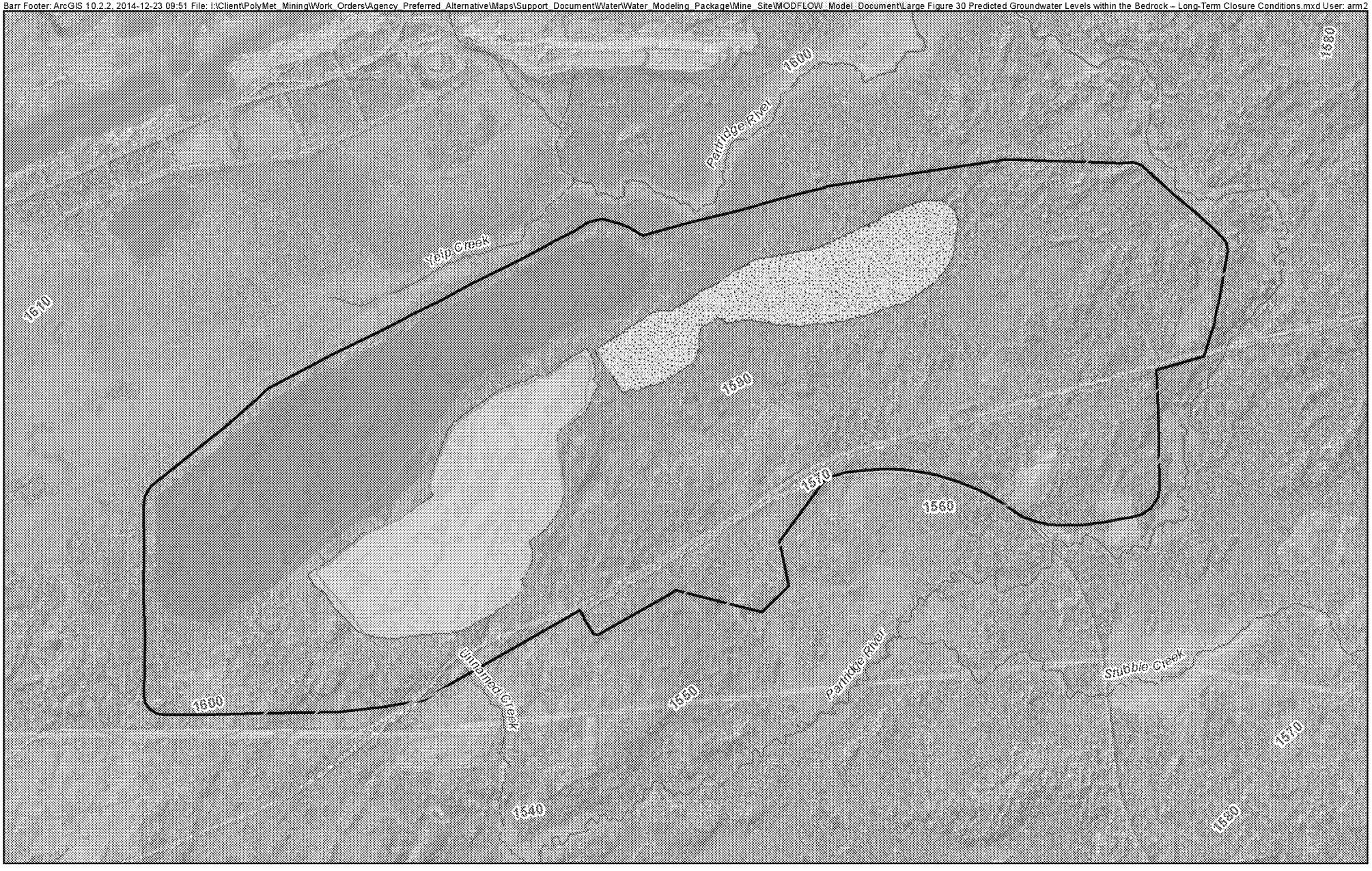
0 750 1,500 3,000

Feet

Large Figure 14
INFERRED GROUNDWATER CONTOURS
SURFICIAL AQUIFER, CURRENT CONDITIONS
NorthMet Project
Poly Met Mining Inc.
Hoyt Lakes, MN

Figure 13

Barr Footer: ArcGIS 10.2.2, 2014-12-23 09:51 File: I:\Client\PolyMet_Mining\Work_Orders\Agency_Preferred_Alternative\Maps\Support_Document\Water\Water_Modeling_Package\Mine_Site\MODFLOW_Model_Document\Large Figure 30 Predicted Groundwater Levels within the Bedrock – Long-Term Closure Conditions.mxd User: arm2



Simulated Piezometric Surface (feet)
Contour Interval = 10 feet

Project Areas

Covered Stockpile

West Pit

East Pit Wetland

0 1,250 2,500 5,000
Feet

Large Figure 30
PREDICTED GROUNDWATER LEVELS
WITHIN THE BEDROCK –
LONG-TERM CLOSURE CONDITIONS
NorthMet Project
Poly Met Mining, Inc.