# RS 10 – Hydrogeological – Drill Hole Monitoring and Data Collection – Phase 2 Hydrogeologic Investigation – Phase II PolyMet NorthMet Mine Site RS-10

#### **Table of Contents**

Exe	cutive	e Summary	iii
1.0		Introduction	1
1.0	11	Background	1
	1.1	Mine Site Setting	1
	1.2	Scope of Work	1
	1.4	Report Organization	2
2.0		Field Activities and Data Collection	3
	2.1	Well Installation	
		2.1.1 Pumping Wells	
		2.1.2 Observation Wells	4
	2.2	Aquifer Performance Testing	4
		2.2.1 P-1 Test	5
		2.2.2 P-2 Test	6
		2.2.3 P-3 Test	6
		2.2.4 P-4 Test	7
	2.3	Groundwater Sampling	8
3.0		Field Investigation Observations and Results	9
	3.1	Aquifer Test Results	9
	3.2	Analytical Results	11
		3.2.1 Analytical Data	11
		3.2.2 Quality Assurance	11
4.0		Summary	13
Ref	erence	25	14

#### List of Tables

Table 1	Well Construction Information
Table 2	Groundwater Analytical Parameters with Analysis Method
Table 3	Aquifer Test Results
Table 4	Analytical Data Summary

#### List of Figures

Figure 1	Site Location Map
Figure 2	Pumping and Observation Well Locations
Figure 3	Drawdown Data from P-3 Pumping Test
Figure 4	Schematic Cross Section through P-3 Pumping Test Wells

#### List of Appendices

- Appendix A Well Logs
- Appendix B AQTESOLV Results
- Appendix C Groundwater Analytical Data Reports

#### Supplemental Electronic Data

Aquifer Test Groundwater Elevation Data

# **Executive Summary**

A second hydrogeologic investigation was conducted at the PolyMet mine site. The objective of this investigation was to determine the hydraulic properties and water quality of the Virginia Formation. Four 6-inch diameter pumping wells and five 2-inch diameter observation wells were installed near the contact between the Virginia Formation and the Duluth Complex, near the northern boundary of the proposed PolyMet mine pits. A pumping test was conducted at each pumping well, three 36 hour tests and one 96 hour test. During and following the test, water levels in the pumping well and observation wells were recorded. This data was analyzed using conventional analytical methods to determine hydraulic properties of the Virginia Formation. Hydraulic conductivities calculated from the measured water level data ranged from .0024 to 1.0 ft/day. The geometric mean was 0.17 ft/day.

Following at least 12 hours of pumping, a groundwater sample was collected from each of the pumping tests wells. Groundwater samples were analyzed for total metals, dissolved metals, and general chemistry parameters. This data is needed to help predict the water quality in the mine pits during operation and during closure. Since the discharge or treatment of the mine pit water in not yet determined, analytical results were compared to the Minnesota Surface Water Quality Class 2B Chronic and the Lake Superior Basin Water Quality Class 2B Chronic criteria for comparison. The only water quality exceedences were for nitrogen (ammonia as N) from wells P-2 and P-4. The presence of ammonia nitrogen in the samples likely indicates that there is a hydraulic connection between the bedrock aquifer and th3e surficial aquifer. A third hydrogeologic investigation at the mine site is planned to further investigate this possible connection.

This report has been prepared for PolyMet Mining Corporation (PolyMet) by Barr Engineering Company (Barr) to document the results of the Phase II Hydrogeologic Investigation that was conducted at the PolyMet NorthMet mine site (the Mine Site) (Figure 1). This work was done, in part, to fulfill the requirements of the October 25, 2005, NorthMet Mine and Ore Processing Facilities Project Final Scoping Decision. The objectives of this study were to provide information on the hydrogeologic characteristics of the Virginia Formation at the Mine Site and the chemical characteristics of the groundwater within this unit.

# 1.1 Background

A scoping Environmental Assessment Worksheet (EAW) was submitted in June 2005 for PolyMet's proposed NorthMet Mine and Ore Processing Facilities located near Hoyt Lakes, Minnesota. PolyMet plans to excavate and process the low-grade polymetallic, disseminated, magmatic sulfide NorthMet deposit in northeastern Minnesota, approximately 6 miles south of the town of Babbitt and about 2 miles south of the operating Northshore Mining Company taconite open pit. Project plans call for the excavation of up to 32,000 tons of ore per day, using open-pit mining methods. Overburden and waste rock will be stripped and stockpiled. Processing of the ore will take place at the existing Cliffs Erie processing plant.

On October 25, 2005, the Minnesota Department of Natural Resources (DNR), in co-operation with the United States Army Corps of Engineer (USACE) and the United States Forest Service (USFS), published the final scoping decision for the project. Section 3.3.4 of that report discussed the need for the Phase I and Phase II hydrogeologic studies. The Phase I Hydrogeologic Investigation accessed the ability of the Duluth Complex and the surficial sediments at the Mine Site to transmit water into the proposed NorthMet pit. Water-quality samples were also collected to assist in the evaluation and estimation of mine-pit dewatering water quality. The results of this investigation were presented in the Hydrogeologic Investigation-PolyMet NorthMet Mine Site report (RS-02) (Barr, 2006).

## 1.2 Mine Site Setting

The NorthMet deposit is located in the Duluth Complex, a large mafic intrusion that was emplaced into flood basalts along a portion of the Middle Proterozoic Midcontinent Rift System. The NorthMet

1

deposit is situated along the western edge of the Complex within the Partridge River intrusion, which has been subdivided into a least seven igneous stratigraphic units on the basis of drill core evaluations. All of these igneous layers exhibit a shallow dip (10°-25°) to the south-southeast. Underlying the Complex at NorthMet is the sedimentary Lower Proterozoic (1.8 million year old) Virginia Formation, which, in turn, is underlain by the Biwabik Iron Formation (BIF). The BIF will not be intersected in mining operations. The Virginia Formation may be intersected along the northern footwall of the pit. The investigation presented in this report focused on the aquifer properties of the Virginia Formation. The Duluth Complex, along with the surficial sediment, was the focus of the Phase I Hydrogeologic Investigation (RS-02) (Barr, 2006).

#### 1.3 Scope of Work

The hydrogeologic investigation presented in this report was designed to aid in the characterization of the Virginia Formation at the Mine Site. Four pumping test wells and five observation wells were advanced into the Virginia Formation along the northern boundary of the Mine Site. Three 36-hour and one 96-hour pumping tests were conducted. In addition, a groundwater sample was collected from each pumping well to assist in the evaluation and estimation of mine pit dewatering water quality. All work presented here was done in accordance with the *Hydrogeologic Investigation Work Plan for the PolyMet NorthMet Mine Site – Phase II* (Work Plan) (Barr, 2005), except where noted.

#### 1.4 Report Organization

This report is organized into four sections, including this introduction. Section 2 summarized the field activities and data collection; Section 3 presents the field investigation observations and results, including the results of the groundwater sampling; and Section 4 provides the investigation summary.

Understanding the ability of the Virginia Formation to transmit water into the proposed mine pit (or pits) and the chemical characteristics of that water is critical to understanding both the overall quality and quantity of water that can be expected to flow into the pit(s). The information collected as part of this investigation will be used in conjunction with data collected during the Phase I Investigation (RS-02) and data collected during future investigations to help predict the total volume of water the mine pit will collect. The results of this work will be presented in *Hydrology – Mine Water Model and Balance* (RS-21).

### 2.1 Well Installation

#### 2.1.1 Pumping Wells

Four pumping wells (P-1 through P-4) were installed by WDC Exploration and Wells using a combination of STRATEX<sup>®</sup> and air rotary techniques. Wells were installed near the proposed locations provided in the Work Plan (Figure 2), with the exception of P-4 which was moved to the northeast in order to ensure placement in the Virginia Formation and outside of the proposed mine pit footprint. Well construction information is shown in Table 1 and well logs are included in Appendix A. The remaining three wells were placed as far north towards the Virginia Formation as site conditions (i.e. roads and wetlands) would permit. However, it was not possible to locate all of the wells in areas where the Virginia Formation is the uppermost bedrock unit. Well construction information is the uppermost bedrock unit. Well construction information is the uppermost bedrock unit. Well construction

At each well location, a 12-inch diameter borehole was drilled at least ten feet into bedrock using the STRATEX<sup>®</sup> drilling method. This method consists of a non-rotating casing (12-inch diameter) that is driven into the ground by a pneumatic down-hole hammer in conjunction with a retractable, underreaming carbide drill bit. A six-inch diameter black steel casing was placed in the hole and the annulus was grouted with neat cement. After the grout had set (a minimum of 24 hours), the 6-inch diameter borehole was completed using the air rotary method. Wells P-1, P-2 and P-3 were completed to a depth of 610 feet. Well P-4 was terminated at 485 feet, where soft formation conditions (from 462-485 feet) prohibited further borehole advancement. Wells were developed by airlifting.

#### 2.1.2 Observation Wells

Five observation wells (Ob-1 through Ob-5) were installed by WDC Exploration and Wells using air rotary techniques. In addition, an unsuccessful boring (the seal between unconsolidated sediments and open interval was lost) at the Ob-3 location was converted to an observation well (Ob-3a). This observation well is discussed in further detail below. Wells were installed near the proposed locations provided in the Work Plan, with the exception of Ob-5 which was moved along with pumping well P-4. Similar to the pumping wells, the observation wells were placed as far north towards the Virginia Formation as site conditions (i.e. roads and wetlands) would permit. However, it was not possible to locate all of the wells in areas where the Virginia Formation is the uppermost bedrock unit. Well construction information is shown in Table 1 and well logs are included in Appendix A.

At each observation well location, a 4-inch diameter black steel casing was driven at least ten feet into bedrock, with the exception of well Ob-4. The work plan specified that the casing was to be set one foot into bedrock, as was done at well Ob-4. Following the completion of Ob-4, it was determined that the casing needed to be set at least ten feet into bedrock in order to help avoid setting the casing into a large boulder. After driving the casing, the 4-inch diameter borehole was completed using the air-rotary method. All wells were completed to a depth of 100 feet. Wells were developed by airlifting.

When attempting to drill well Ob-3, the casing seal was broken during drilling. It was determined that rather than try and regain a seal, the boring would be "abandoned" and re-drilled several feet away. However, rather than abandoning the borehole, it was left open and permitted as an additional observation well, called Ob-3a. This well was completed to a depth of 50 feet.

### 2.2 Aquifer Performance Testing

Aquifer performance tests were conducted in each of the four pumping wells. Rather than performing a separate step-drawdown test to determine an appropriate pumping rate, the step-drawdown test was conducted at the beginning of the 36- or 96-hour test. The pumping phase of three tests, one each in wells P-1, P-2, and P-4, were run for 36 hours. The pumping phase of the test in P-3 was run for 96 hours. Originally, the 96 hour test was planned for well P-1 due to the presence of a nearby wetland piezometer. However, because the pumping tests were conducted in the winter rather than during the summer as originally planned, the wetland piezometer was frozen

and was not useable. In addition, information gathered during drilling suggested that the yield from well P-1 would be low and the 96-hour test would be better suited for a higher yielding well.

Water levels from pumping and observation wells were measured automatically using miniTroll data logging probes (miniTrolls) manufactured by In Situ, Inc. The miniTrolls automatically record and correct water levels for changes in barometric pressure.

#### 2.2.1 P-1 Test

A 36-hour pumping test was conducted in well P-1. MiniTrolls were installed in P-1 and Ob-1 prior to the beginning of the test. The miniTrolls collected water level and temperature data every five minutes throughout the pumping and recovery portions of the test.

A temporary pump was placed in the well at a depth of 400 feet below ground surface. An inline flow meter was used to measure pumping rates. Discharge was routed via hoses 500 feet to a down-slope upland (i.e. non-wetland) area.

At the beginning of the test, the pumping rate (6-9 gallons per minute [gpm]) was much higher than the well yield, and the rate was quickly scaled back to 4.2 gpm. After pumping at this rate for roughly 30 minutes, the pumping rate was scaled back to approximately 2 gpm. Six and a half hours into the test, it was determined that the well would not be able to sustain this rate and the rate was set at 1.2 gpm, where it remained for the duration of the test. The pumping schedule is summarized below:

Time since Pumping	Pumping
Began (minutes)	Rate (gpm)
0-24	6-9
24-77	4.2
77-385	2.2
385-2195	1.2
2195	0

Thirty-six hours after pumping began, the pump was turned off and water levels were allowed to recover for 36 hours, after which time the pump and miniTrolls were removed. Water level data from the miniTrolls is included as supplemental electronic data.

#### 2.2.2 P-2 Test

A 36-hour pumping test was conducted in well P-2. MiniTrolls were installed in P-2 and Ob-2 prior to the beginning of the test. Water-level data were collected every two minutes throughout the pumping and recovery portions of the test. A temporary pump was placed in P-2 at a depth of 400 feet below ground surface. Discharge, measured using a five-gallon bucket and stopwatch, was routed 500 feet to a down-slope upland area. Discharge distance was decreased from the distance specified in the work plan due to frozen ground conditions that prohibited the infiltration of the discharge water.

The pumping rate was initially set at 4 gpm. After 22 minutes, water levels had stabilized and the pumping rate was increased to 15gpm. The pumping rate was again increased after 72 total minutes of pumping to 32 gpm. At 194 minutes of pumping, the rate was decreased to 28 gpm to assure that the well would not pump dry before 36 hours of pumping. The pumping schedule is summarized below:

Time since Pumping	Pumping
Began (minutes)	Rate (gpm)
0-22	4
22-72	15
72-194	32
194-2155	28
2155	0

After thirty-six hours of pumping, the pump was turned off and water levels were allowed to recover. The pump and miniTrolls were removed after nine hours of recovery when water levels had recovered at least 90% of the final drawdown. Water level data from the miniTrolls is included as supplemental electronic data.

#### 2.2.3 P-3 Test

A 96 hour pumping test was conducted in well P-3. MiniTrolls were installed in wells P-3, Ob-3, Ob-3a, and a preexisting water supply well, #717971, prior to the beginning of the test. Water-level data were collected every five minutes throughout the pumping and recovery portions of the test. A temporary pump was placed in well P-3 at a depth of 400 feet. Discharge, measured using an in-line flow meter, was routed 700 feet to a down-slope upland area. The discharge distance was decreased

from the distance specified in the work plan due to frozen ground conditions that prohibited the infiltration of the discharge water. The pumping schedule for the test is summarized below:

Time since Pumping	Pumping
Began (minutes)	Rate (gpm)
0-55	0-4*
55-105	23
105-160	37
160-5800	41
5800	0

\*Problems with the pump resulted in the pump cycling on and off at approximately 4 gpm for the first 40 minutes of the test.

After 96 hours of pumping, the pump was turned off and water levels were allowed to recover. The pump and miniTrolls were removed after twenty hours. Water level data from the miniTrolls is included as supplemental electronic data.

#### 2.2.4 P-4 Test

A 35-hour pumping test was conducted in well P-4. The test was originally supposed to last for thirty-six hours, however the pump was accidentally turned off one hour early. MiniTrolls were installed in P-4, Ob-4 and Ob-5 prior to the beginning of the test. Water-level data were collected every five minutes throughout the pumping and recovery portions of the test. A temporary pump was placed in P-4 at a depth of 400 feet below ground surface. Discharge, measured using a five-gallon bucket and stopwatch, was routed 1000 feet to a down-slope upland area.

The pumping rate was initially set at 5 gpm. After 22 minutes, the pumping rate was increased to 20 gpm. After 120 minutes of pumping at lower rates, the pump was set at 40 gpm, where it stayed for the reminder of the test. The pumping schedule is summarized below:

Time since Pumping	Pumping
Began (minutes)	Rate (gpm)
0-22	5
22-82	20
82-120	27
120-2115	40
2115	0

After 35 hours of pumping, the pump was turned off and water levels were allowed to recover. The pump and miniTrolls were removed after eleven hours of recovery when water levels had recovered at least 90% of final drawdown. Water level data from the miniTrolls is included as supplemental electronic data.

#### 2.3 Groundwater Sampling

Following at least 12 hours of pumping, groundwater samples were collected from each of the pumping test wells. Samples were collected from a sampling port located on the discharge line, near where it came out of the well. Prior to collecting the sample, water was allowed to flow out of the sampling port for several minutes. Samples were collected by the Barr geologist on site, with assistance from a WDC representative. Groundwater samples were collected and placed into laboratory-supplied containers and submitted to Northeast Technical Services (Virginia, Minnesota) for laboratory analysis for total metals, dissolved metals, and general chemistry parameters. Groundwater laboratory parameters and analysis methods are provided in Table 2.

Due to the delayed start of this investigation in relationship to the mineral exploration drilling at the Site, it was not possible to collect groundwater samples from exploratory boreholes in the Duluth Complex, as originally proposed in the Work Plan.

### 3.1 Aquifer Test Results

The aquifer test data were analyzed using conventional analytic methods. These methods are used to obtain estimates of the hydrostratigraphic unit's transmissivity/hydraulic conductivity and storage properties. All of these methods have assumptions, such as the assumptions of a hydrostratigraphic unit of infinite areal extent, homogeneity, and isotropy. Some methods have additional or modifying assumptions. For some tests data, multiple analytic methods were used to estimate transmissivity/hydraulic conductivity and storage – different estimates may result from the application of different methods. All analyses were done using the computer code AQTESOLV for Windows (Duffield, 2003).

The pumping test data were analyzed using the Moench method (1984) for drawdown in an unconfined, fractured aquifer with slab shaped blocks (Appendix B). The Moench method is an analytical solution for predicting water-level displacements in response to pumping in a fractured aquifer assuming a double-porosity model with slab-shaped matrix blocks with fracture skin and wellbore skin. The Moench method assumes the aquifer has infinite areal extent, uniform thickness, and consists of a double porosity system with low-permeability, primary porosity blocks and high-permeability, secondary porosity fissures. The skin parameter allows for modeling of additional (or less) resistance to flow between the blocks and fractures and between the wellbore and fractures. The effects of wellbore storage, partial penetration and variable pumping rates are included in the analysis. For each test, an aquifer thickness equal to the depth of the pumping well was assumed. The Moench method solves for the hydraulic conductivity and storage for both the fractures and the rock matrix and provides information on the wellbore skin and fracture skin.

There was no measurable drawdown observed at Ob-4 during the P-3 or P-4 pumping tests and, as such, there was no analysis for this well. Measured drawdowns in observation wells Ob-1 and Ob-5 were very small (less than 0.2 feet). There is uncertainty in analyzing such small drawdowns because small changes in water levels from outside influences (i.e. diurnal effects, regional water level changes, transducer slip, barometric pressure changes, etc.) may have substantial effects on predicted aquifer properties if these outside influences cannot be adequately filtered from the data. Because of this, these data were not analyzed. Following the completion of drilling and the pumping tests, it was

determined that Ob-2 is located entirely within the Duluth Complex. As such, data from this test were not analyzed.

Recovery period data from many of the wells were also analyzed separately using the Theis (1935) recovery method (Appendix B). The Theis recovery method estimates transmissivity and the apparent ratio of storage coefficient following pumping to storage coefficient during pumping from residual displacement data collected during the recovery phase of a pumping test. The Theis recovery method can be used for unconfined confined aquifers and partially penetrating wells as long as late time data is used for the analysis (Kruseman and deRidder, 2000). Recovery data from wells P-2, P-3, Ob-3, Ob-3a, #717971, and P-4 were analyzed using this method. Recovery data in wells P-1, P-2, Ob-1 and Ob-5 did not meet the criteria of the method and were not analyzed. Transmissivities were converted to hydraulic conductivities using the thickness of the Virginia Formation in the pumping well as the assumed aquifer thickness.

As indicated in Table 3, the hydraulic conductivities determined using both the Moench method and the Theis method range over several orders of magnitude, from 0.0024 to 1.0 ft/day. In general, hydraulic conductivities determined from the recovery data for each well were slightly higher (by a factor of 1 to 5) than the hydraulic conductivities determined using the Moench method. The geometric mean of all hydraulic conductivity values is 0.17 ft/day. Drawdown data from all four pumping wells indicated that bilinear flow conditions (i.e. fracture flow conditions) likely exist, however bilinear flow was not observed at any of the observation wells.

The 96-hour pumping test conducted at P-3 had some unexpected results. Figure 3 shows the drawdown curves for all wells monitored during this test. As stated previously, while drilling Ob-3a, the seal between the open interval of the well and the unconsolidated material was broken. During the initial periods of the pumping test, water was observed seeping into the well from the base of the casing. However, after several hours, this seepage was no longer observed. Because of the observed change in seepage into the well, the early drawdown data from Ob-3a were not used. There was significantly more drawdown in Ob-3a (total well depth of 50 feet) than at Ob-3 (total well depth of 100 feet) which is less than 20 feet away (see Figure 4). In addition, there was more drawdown in #717971 (total well depth of 260 feet) than at Ob-3 which is more than 200 feet closer to the pumping well than #717971. Despite these differences in drawdown, analysis of the data from all of the wells resulted in similar aquifer properties (see Table 3). However, no single set of aquifer properties could match all of the data.

#### 3.2 Analytical Results

#### 3.2.1 Analytical Data

Groundwater samples were collected from the four pumping wells (P-1, P-2, P-3 and P-4) in December 2005 and January 2006. The analytical results are presented in Table 4. Since the discharge or treatment of the mine pit water is not yet determined, analytical results are compared to the Minnesota Surface Water Quality Class 2B Chronic and the Lake Superior Basin Water Quality Class 2B Chronic criteria for comparison. The Minnesota Surface Water Quality Class 2B Chronic standards are designed to be protective of surface water used for recreation and support cool or warm water sport or commercial fish and associated aquatic life. Class 2B surface water is not protected as a drinking water source. The Lake Superior Basin water quality standards protect Class 2B waters within the Lake Superior watershed. Because a receiving water has not been identified at this time, a hardness of 50 mg/l was used to derive the criteria.

The water samples from wells P-2 and P-4 exceeded the nitrogen (ammonia as N) criteria (270 ug/L and 110 ug/L respectively). The presence of ammonia nitrogen in the samples likely indicates that there is a hydraulic connection between the bedrock aquifer and the surficial aquifer; however, the nature of this connection can not be determined at this time. There were no other exceedences. The sample collected from P-1 has an elevated level of sulfate (1,200 mg/L) compared to the other samples. Only the sample from P-4 had measurable amounts of mercury (0.0007 ug/L), which are below the criteria of 0.0013 ug/L.

#### 3.2.2 Quality Assurance

A quality assurance and quality control review was performed on the analytical results from the sampling event. This review was performed in accordance with the Barr Engineering Standard Operating Procedure for data validation, which is based on *The National Functional Guidelines for Organic and Inorganic Data Review* (EPA 1999/2004). All methyl mercury analysis was performed by Frontier Geosciences, Inc. located in Seattle, Washington and all other analysis was performed by Northeast Technical Services located in Virginia, Minnesota.

Only data for methyl mercury were evaluated for the samples collected on December 22, 2005 and January 5, 2006; no additional quality assurance data were provided for any other analyses from these samples.

Field, trip and method blank data showed multiple detections of methyl mercury for both sampling events. Only one of the samples had a detection of methyl mercury above the detection limit (P-2). Since this detection was within 5 times the blank value, the detection was qualified and should be considered a potential false positive value. No other qualifiers were applied based on blank data.

Technical holding times were evaluated for each sample and target parameter, based on the EPA recommendations listed in *40 CFR SW8-46 Test Methods for Evaluating Hazardous Waste*. All holding times were met for the all samples in submitted to both laboratories. Northeast Technical Services did not indicate any issues with their QA/QC parameters in the reports provided for the analyzed samples.

All of the data met the data project requirements and is deemed acceptable for the purposes of this project with the above mentioned qualifications.

The purpose of the Phase II Hydrogeologic Investigation was to gather information on the ability of the Virginia Formation to transmit water to the proposed NorthMet pit, to characterize the quality of the water found in this formation.

To help determine the aquifer characteristics of the Virginia Formation, four pumping tests were conducted in wells open primarily to this formation. These wells were spaced along the contact of the Virginia Formation and the Duluth Complex at the mine site, focusing primarily on the eastern portion of the site. Hydraulic conductivity values determined from these tests had a range of three orders of magnitude, from 0.0024 ft/day – 1.0 ft/day. The geometric mean of the values is 0.17 ft/day.

Water quality from the pumping test wells was relatively uniform across the site. Two wells (P-2 and P-4) exceeded the 2B chronic criteria for ammonia nitrogen; there were no other exceedences of 2B chronic criteria. The sample at P-1 showed elevated sulfate concentrations relative to the other wells. All wells had low level mercury levels below the 2B chronic criteria.

- Barr Engineering Company, 2006. Hydrogeologic Investigation PolyMet NorthMet Mine Site, November, 2006.
- Barr Engineering Company, 2005. Hydrogeologic Investigation Work Plan for the PolyMet NorthMet Mine Site Phase II, October, 2005
- Duffield, G.M., 2003. AQUTESOLV for Windows Ver.3.50. HydroSOLVE, Inc., Reston, Virginia.
- Kruseman, G.P. and N.A. deRidder, 2000. Analysis and Evaluation of Pumping Test Data (2nd ed.), Publication 47, Intern. Inst. for Land Reclamation and Improvement, Wageningen, The Netherlands, 370p.
- Moench, A.F., 1984, Double-Porosity Models for Fissured Groundwater Reservoir with Fracture Skin, Water Resources Research, vol. 20, no. 7, pp. 831-846.
- Theis, C.V., 1935. The Relation Between Lowering of the Piezometric Surface and the Rate and Duration of Discharge of a Well Using Groundwater Storage, Trans. Amer. Geophys. Union, Vol. 16, pp. 519-524.

**Tables** 

# Table 1Well Construction InformationPolyMet Mining, Inc.

	Well Construction			Geology			
Location	Well Diameter (inches)	Casing Depth (ft)	Total Depth (ft)	Depth to Bedrock (ft BGS)	Duluth Complex Interval (ft BGS) <sup>2</sup>	Virginia Formation Interval (ft BGS) <sup>2</sup>	
P-1	12	27	610	11	11-105	105-610	
P-2	12	27	610	12	12-170	170-610	
P-3	12	27	610	17		17-610	
P-4	12	46	485	7		7-485	
Ob-1	4	21	100	8	8-100		
Ob-2	4	18	100	6	6-100		
Ob-3	4	21	100	7		7-100	
Ob-3a	4	17	50	7		7-100	
Water Well <sup>1</sup>	6	19	260	8	8-160	160-260	
Ob-4	4	7	100	6		6-100	
Ob-5	4	18	100	7		7-100	

Notes:

BGS = Below ground surface

<sup>1</sup> Not installed as part of Phase II Hydrogeologic Investiation, Unique Well <sup>#</sup>717972

<sup>2</sup> Stratigraphy based on 3D geologic model of the site and not drill cuttings.

# Table 2Groundwater AnalyticalParameters with Analysis MethodPolyMet Mining, Inc.

Description	Method
Alkalinity, Total as CaCO3	EPA 310.1
Carbon, Total Organic	EPA 415.1
Chemical Oxygen Demand	STD METH 5220D, 18TH ED
Chloride	EPA 325.2
Cyanide Total	EPA 335.2
Fluoride	EPA 340.1
Hardness, Total (calculated)	EPA 200.7
Nitrogen, Ammonia	EPA 350.1
Nitrogen, Nitrate + Nitrite	EPA 353.2
pH	EPA 150.1
Phosphorus, Total	EPA 365.2
Sulfate	EPA 375.4
Aluminum, Total	EPA 200.7
Aluminum, Dissolved	EPA 200.7
Antimony, Total	EPA 204.2
Arsenic, Total	EPA 200.8
Barium, Total	EPA 200.7
Beryllium, Total	EPA 210.2
Boron, Total	EPA 200.7
Cadmium, Total	EPA 213.2
Cadmium, Dissolved	EPA 213.2
Calcium, Total	EPA 200.7
Chromium, Total	EPA 218.2
Chromium, Dissolved	EPA 218.2
Cobalt, Total	EPA 219.2

Description	Method
Copper, Total	EPA 220.2
Copper, Dissolved	EPA 220.2
Iron, Total	EPA 200.7
Lead, Total	EPA 7421
Magnesium, Total	EPA 200.7
Manganese, Total	EPA 200.7
Mercury, Low Level Total	EPA 1631E
Methyl Mercury, Total	EPA 1631E
Molybdenum, Total	EPA 246.2
Molybdenum, Dissolved	EPA 246.2
Nickel, Total	EPA 249.2
Nickel, Dissolved	EPA 249.2
Palladium, Total	EPA 200.7
Platinum, Total	EPA 200.7
Potassium, Total	EPA 200.7
Selenium, Total	EPA 270.2
Selenium, Dissolved	EPA 270.2
Silver, Total	EPA 272.2
Silver, Dissolved	EPA 272.2
Sodium, Total	EPA 200.7
Strontium, Total	EPA 200.7
Thallium, Total	EPA 279.2
Titanium, Total	EPA 283.2
Zinc, Total	EPA 200.7
Zinc, Dissolved	EPA 200.7

# Table 3Aquifer Test ResultsPolyMet Mining, Inc.

		Pumping Data (Moench Method)	Recovery Data (Theis Method)		All Data
Pumping Well	Observation Well	Hydraulic Conductivity of Fractures (ft/day)	Transmissivity (ft <sup>2</sup> /day)	Hydraulic Conductivity (ft/day)	Hydraulic Conductivity Geometric Mean (ft/day)
P-1	P-1	0.0024			0.0024
P-2	P-2	0.072			0.072
P-3	P-3	0.40	489	0.82	0.57
P-3	Ob-3	0.46	627	1.0	0.68
P-3	Ob-3a	0.27	530	0.88	0.49
P-3	Water Well	0.16	483	0.81	0.36
P-4	P-4	0.33	154	0.32	0.33
-				Maximum	0.68
				Minimum	0.0024
				Geo. Mean	0.17

# Table 4 Analytical Data Summary Polymet Mining, Inc. (concentrations in ug/L, unless noted otherwise)

T	MNI C	D 1	D 4	n 2	D 4
Location	MIN Surface	P-1	P-2	P-3	P-4
Date	Water Class	1/5/2006	12/22/2005	1/5/2006	12/22/2005
Dup	2B Chronic (1)				
Exceedance Key	Bold				
General Parameters					
Alkalinity, total, mg/L		<10	98.5	97.2	69.2
Chemical Oxygen Demand, mg/L		<10	<10	485	17
Chloride, mg/L	230	6.6	1.8	2.1	<0.5
Cyanide		<20	<20	<20 *	<20
Fluoride, mg/L		1.1	0.53	0.64	0.35
Hardness, total, mg/L		15	56.5	113	76.2
Nitrate + Nitrite		<100	<100	<100	<100
Nitrogen, ammonia as N	40	<100	270	<100	110
Phosphorus total		<100	110	<100	<100
Sulfate. mg/L		1200	10.5	32.9	14.1
nH_standard units	6 5-9 0 PH	8.5	7.8	66	8.1
Carbon total organic mg/I		2.3	2.4	7.6	2.2
Total Matals		2.5	2.4	7.0	2.2
Aluminum	125	50.1	-25	-25	57.2
Antimony	21	J7.1	~2.5	~25	-2
Amonio	52	22	0	2	57
Arsenic	55	2.2	<2	<2	3.7 
Darium Domilium		<10	<10	<10	<10
Beryllium		<0.2	<0.2	<0.2	<0.2
Boron		518	170	/0.3	<u> </u>
	0.00 HD	<0.2	<0.2	<0.2	<0.2
		6200	11600	20400	17700
Chromium	TI CR6	1.9	<1	1.2	<1
Cobalt	5.0	<1	<1	<1	<1
Copper	5.2 HD	<2	<2	<2	<2
Iron		100	140	4370	190
	1.3 HD	<1	<1	<1	<1
Magnesium		<2000	6700	15000	/800
Manganese		10	20	140	60
Mercury	0.0013	<0.0005	<0.0005	<0.0005	0.0007
Mercury methyl		<0.000025	0.000059 b	<0.000025	<0.000025
Molybdenum		<5	<5	<5	34.5
Nickel	29 HD	<2	<2	<2	<2
Palladium		<0.1	<0.1	0.3	<0.1
Platinum		<0.02	< 0.02	<0.02	<0.02
Potassium		1200	1100	2100	1700
Selenium	5.0	<2	<2	<2	<2
Silver	1.0 HD	<1	<1	<1	<1
Sodium		43900	24300	7500	4400
Strontium		33.4	37.9	75.2	45.5
Thallium	0.56	<2	<2	<2	<2
Titanium		<10	<10	<10	<10
Zinc	59 HD	17.9	<10	11.3	<10
Dissolved Metals					
Aluminum, dissolved		<25	<25	<25	<25
Cadmium, dissolved		<0.2	<0.2	<0.2	<0.2
Chromium, dissolved		<1	<1	<1	<1
Copper, dissolved		<2	<2	<2	<2
Molybdenum dissolved		<5	<5	<5	28.9
Nickel, dissolved		<2	<2	<2	<2
Selenium, dissolved		<2	<2	<2	<2
Silver, dissolved		<1	<1	<1	<1
Zinc, dissolved		<25	<10	<25	<10

# Table 4 Analytical Data Summary Polymet Mining, Inc. (concentrations in ug/L, unless noted otherwise)

- No criteria.
   Criteria represents most conservative value as noted in Minnesota Rules Chapter 7050.0222 and 7052.0100.
- \* Estimated value, QA/QC criteria not met.
- b Potential false positive value based on blank data validation procedure.
- CR6 Value represents the criteria for Chromium, hexavalent.
- HD Hardness dependent. The specific analyte should be referenced in Minnesota Rules Chapter 7050.0222 and 7052.0100 for specific exp. calculations. The values reported are assuming a hardness of 50 mg/L.
- PH Not less than 6.5 nor greater than 9.0.

Figures



Figure 1

SITE LOCATION MAP PolyMet Mining, Inc. Hoyt Lakes, Minnesota

Railroads

----- Existing

Proposed

Access Roads

Project Boundaries







- Approximate contact between Duluth Complex and Virginia Formation



- Observation Wells

Allen, Babbitt, Babbitt SW, and Isaac Lake 7.5 Minute USGS Quadrangles



(Mine features based on August 2006 design)

Figure 2

PUMPING AND OBSERVATION WELL LOCATIONS PolyMet Mining, Inc. Hoyt Lakes, Minnesota



Figure 3 Measured Drawdowns During P-3 Pumping Test PolyMet Mining, Inc.



Appendices

Appendix A

WELL LOCATION						M	IINNESOTA UNIQUE WELL NO.
County Name	a second seco			Vinnesot	a Statutes, Chapter 103I		736114
St. Louis	No Bange No	Section No Fr	action		WELL DEPTH (completed)	Date Work Cor	mpleted
	1 3	2 870	J. CR.	NGL C	646 ·····		2/17/05
GPS	dogroos m	inutes se	econds	2.4 94 74 200	DRILLING METHOD		
LOCATION: Longitude	degrees m	inutes se	econds	#32,538-01. 	Cable Tool	Driven.	Dug
House Number, Street Name, City, and	d Zip Code of Well Loo	ation or	Fire Numbe	r	vstratex		
AnnerionkNatib	Ma\$5705e	st		4	DRILLING FLUID	WELL HYDROF	RACTURED?
Show exact location of well in section	grid with "X"	Sketch	n map of well howing prope	l location. erty lines,	None	FROM	ft. TO
N	SEE	ATTACHE	roads and	buildings	USE	Monitoring Environ. Bore Hole Irrigation Dewatering	Heating/Cooling  Industry/Commercial  Remediat  Hou F DIAM
W E E E E E E E E E E E E E E E E E E E	Mile				Steel	Drive Shoe?	Vélded -
					CASING DIAMETER	WEIGHT	
S S		4 6 	·······		6in_to27ft	19	lbs /ftin to
I Mile	·····			en tre deserver Tre deserver Tre deserver	in toft.		lbs/ft6_ in to61_
PROPERTY OWNER'S NAME/COMP	ANYNAME				in. to ft.		lbs./ftin. to E
Superior Natio	onal fore	St.	Labove		SCREEN None		
Property owner's making address in un	nerent man wen locali				Туре	[FROM	
318 Forestry	Rd.				Slot/Gauze	Length	······································
Aurora, MN 55	765	a second and			Set between ft. and	ft. FITTING	GS
					STATIC WATER LEVEL		Antanian
					ft w belowa	bove land surface Date t	measured 2/1//05
WELL OWNER'S NAME/COMPANY N	AME	and the second sec	· · · · · · · · · · · · · · · · · · ·	· · · · · · · · · · · · · · · · · · ·	500 th offer	7 3.6 bre pu	umping <b>1 2</b> g n
Dol.Mat Minin	- Tha		<sup>1</sup>		WELL HEAD COMPLETION	<b>10</b> 113.pd	amping <b>s_g_</b> 9P
Well owner's mailing address it dillere	h fhan property owne	rs address indicated	above		Pitless adapter manufacturer		Model
Howt Lakes. M	N 55705				At-grade (Environmental Wells and	Boring ONLY)	X 12 III above grade
trat a conserve a sec					GROUTING INFORMATION		
					Grout material Service Neat of	NO ement [_] Bentonite [_] C	Concrete 🦳 High Solids Bentonite
					from	0 to 27 ft	yds. [¥tba
					- from	to ft	yds [_] ba
GEOLOGICAL MATERIALS	COLOR	MATERIAL	FROM	TÖ	from	to ft.	yds ba
					- NEAREST KNOWN SOURCE OF CO	NTAMINATION	
Overburden	Brown	Soft	0	7	None feet	dir	rectiont
					Well disinfected upon completion	Yes Xino	
Rocky Clay	Brown	Hard/S	oft7	11	The installed		
* ~					Manufacturarie namo		
Bedrock	Red/Gra	y/Bk Har	<u>d 11</u>	_27	Madul number	HP	Volte
						HF	Volis
Bedrock	Black	Hard	27	440	Length of drop pipe	II. Capa	Unity9+
				C	ABANDONED WELLS	e E Heciprocating L	Jet   ]
Bedrock	Wht/Blk	Hard	440	610	Dage property have any net in use on	d not sealed wall(a)	Ves / ++No
					VARIANCE	u not sealed well(S)	
					Was a variance granted from the MDF	for this well?	{ J∎No TN#
					WELL CONTRACTOR CERTIFICATIO	N	· · · · · · · · · · · · · · · · · · ·
		·			This well was drilled under my supervious of the information contained in this repo	ision and in accordance wi rt is true to the best of my	itn ivlinnesota Rules, Chapter 4725. knowledge.
Use a s	econd sheet, if needed	1					
REMARKS, ELEVATION, SOURCE.C	DF DATA, etc.				WDC Explorati	on & Wells	s <u>49653</u>
					Licensee Business Name	$\mathbf{i}$	Lic. or Reg. No.
P1						)	
					Authorized Papersontative Signature	mh	<u>1+31+06</u> Date
					Autonzeu nepresentative signature		Duit
					Mark Green/Ch	ris Fuhs	
IMPORTANT - FILE WIT	H PROPERTY I	APERS -	7001	1 A	Name of Driller		
WELL OW	NER COPY		301	14			HE-01205-08 (Rev. 5

ала. Ъс

				L ANI	BORING RECORD
		وروارية فيتعدين والمراجع		Minnesot	a Statutes, Chapter 103I
SC. LOUIS Township Name Township	No. Range No.	Section NoFra	action	a na anti-	WELL DEPTH (completed) Date Work Completed
Babbitt 59	) 13	2 S	E SE	NW	610 <sup>***</sup> 610 <sup>****</sup> 12/13/05
GPS Latitude (	legrees mir	ules se	conds	<del></del>	DRILLING METHOD
Longilude	logrees mir	iutes sei	conds		Auger Solary Jetted
House Number, Street Name, City, and	Zip Code of Well Loca	tion	Fire Numbe	۲ <b>۲</b>	DRILLING FLUID WELL HYDROFRACTURED?
HOYE Lakes, MI Show exact location of well in section	arid with "X".	Sketch	map of wel	l location	EBOM ft TO
N		Sh	iowing prop roads and	erty lines, buildings	USE Honitoring Heating/Cooling
	See	ATTACHE	D		Domestic     Domestic
	Mile				Velded
- - 1 Mile	· · · · · · · · · · · · · · · · · · ·				12 in to $27$ ft. $12$ ibs/ft $12$ ibs/ft $12$ in to $27$
PROPERTY OWNER'S NAME/COMPA	NY NAME		· · · · · · · · · · · · · · ·	<u></u>	in to ft. lbs./ft. in to '
Sumerior Natio	nal Fore	<t< td=""><td></td><td></td><td></td></t<>			
Property owner's mailing address if diff	erent than well location	address indicated	above.		MakeFROM_27 ft. TO_610f
318 Forestry M	Rđ.				Type Diam
Aurora, MN 55	705		· · · · · · · · ·		Set betweenft andft. FITTINGS
					STATIC WATER LEVEL
		and the second secon	tana ara-tan	a sa ang	ft. below above land surface Date measured 12/13/05
WELL OWNER'S NAME/COMPANY N	AME			· · · · · · · ·	PUMPING LEVEL (below land surface)
PolyMat Mining	Thá	<b>11 11 11 11 11 11 11 11 11 11 11 11 11 </b>			ft_after30hrs_pumping20gpr
Well owner's mailing address if differen	it than property owners	address indicated a	above		Pitless adapter manufacturer Model
PO Box 475	- 1 <sup>2</sup> - 1 <sup>2</sup>		•		Heref Casing Protection [33] 12 in. above grade
Hoyt Lakes, MI	1 55705				
					Grout material
					from 0 to 27 ft 23 dyds. 😿 bag
		HARDNESS OF		то	from toft yds.   bag
GEOLOGICAL MATERIALS	COLOR	MATERIAL	FROM	10	NEAREST KNOWN SOURCE OF CONTAMINATION
Clay/Rock	Blk/Brn	Sft/H	0	12	Well disinfected upon completion TYes
Podroak	Dod/D1k	Uand	12	27	РИМР
Dearoak	NGU/DIN	naru	1 6	21	XNot installed Date installed
Bedrock	Black	Hard	27	540	Manufacturer's name
					Modeł number HP Volts
Bedrock	Reddish	Hard	540	610	Length of drop pipe ft Capacity g.p.r
Bedrock	Reddish	Hard	540	610	Length of drop pipeft     Capacityg.p.r       Type:     Submersible     LS. Turbine       Reciprocating     Jet       DRANDONED     WELLS
Bedrock	Reddish	Hard	540	610	Length of drop pipeft       Capacityg.p.r         Type:       Submersible       L.S. Turbine       Reciprocating       Jet
Bedrock	Reddish	Hard	540	610	Length of drop pipeft       Capacityg p I         Type:  Submersible [LS Turbine [Reciprocating [] Jet []
Bedrock	Reddish	Hard	540	610	Length of drop pipeft Capacityg.p.r Type: ]_Submersible [   L.S. Turbine   Reciprocating [ ] Jet   ABANDONED WELLS Does property have any not in use and not scaled well(s)   ] Yes [ No VARIANCE Was a variance granted from the MDH for this woll?   Yes [ XNo TN#
Bedrock	Reddish	Hard	540	610	Length of drop pipeft       Capacityg.p.r         Type:       Submersible       L.S. Turbine       Reciprocating       Jet
Bedrock	Reddish	Hard	540	610	Length of drop pipeft       Capacityg.p.t         Type:       Submersible       L.S. Turbine       Reciprocating       Jet
Bedrock	Reddish	Hard	540	610	Length of drop pipe       ft       Capacity       g.p.r         Type:       Submersible       L.S. Turbine       Reciprocating       Jet
Bedrock Use a se REMARKS, ELEVATION, SOURCE O	Reddish	Hard	540	610	Length of drop pipe       ft       Capacity       g p I         Type:       Submersible       LS Turbine       Reciprocating       Jet
Bedrock Use a se REMARKS, ELEVATION, SOURCE O	Reddish	Hard	540	610	Length of drop pipeft       Capacityg.p.i         Type:       Submersible       L.S. Turbine       Reciprocating       Jet
Bedrock Use a se REMARKS, ELEVATION, SOURCE O P2	Reddish	Hard	540	610	Length of drop pipe       ft Capacity       g p         Type:       Submersible       LS Turbine       Reciprocating       Jet
Bedrock Use a se REMARKS, ELEVATION, SOURCE O P2	Reddish	Hard	540	610	Length of drop pipe       ft Capacity       g.p.         Type:       Submersible       L.S. Turbine       Reciprocating       Jet         ABANDONED WELLS         Does property have any not in use and not scaled well(s)       Yes       No         VARIANCE         Was a variance granted from the MDH for this well?       Yes       No         VARIANCE         Well CONTRACTOR CERTIFICATION         This well was drilled under my supervision and in accordance with Minnesota Rules, Chapter 4725         The information contained in this report is true to the best of my knowledge.         WDC Explortion & Wells       49653         Licensee Business Name       Lic. or Reg No.         Authorized Representative Signature       Date         Mark Green/Chris Fubs       Date
Bedrock Use a se REMARKS, ELEVATION, SOURCE O P2	Reddish	Hard	540	610	Length of drop pipe       ft Capacity       g p.         Type:       Submersible       LS Turbine       Reciprocating       Jet         ABANDONED WELLS         Does property have any not in use and not scaled well(s)       Yes       No         VARIANCE         Was a variance granted from the MDH for this well?       Yes       No         VARIANCE         Well CONTRACTOR CERTIFICATION         This well was drilled under my supervision and in accordance with Minnesota Rules, Chapter 4725         The information contained in this report is true to the best of my knowledge.         WDC Explortion & Wells       49653         Licensee Business Name       Lic. or Reg No.         Authorized Representative Signature       Date         Mark Green/Chris Fuhs       Name of Driller

WELL LOCATION			· · · · ·	يند N	IINNESOT			MINNESOTA UNIC	QUE WELL NO.
County Name			1	WE	LL AN	D BORING RECORD		7361	16
St. Louis	bin No R		Section No	Fraction		WELL DEBTH (completed)	Date Work	Completed	
Babbitt 5	9	<u>13</u>	NE2SW	NE S	W NE	610	<u></u> <u>11</u> .	12/10/05	
GPS LOCATION: Latitude Longitude House Number, Street Name, City, i	degrees degrees and Zip Code	mir mir of Well Loca	nutes nutes ttion	seconds seconds or Fire Nu	nber	DRILLING METHOD	Driven	└_ Dug ☐ Jetted	
Hout Labos	MN 55.	705	a Maria Jing			DRILLING FLUID		ROFRACTURED?	Yes XNo
Show exact location of well in section	on grid with ">	<". (".	e	Sketch map of Showing p	well location roperty lines	,	FROM	ft. TO	f
N	P	lease	see	attac	and building hed	SUSE	★ Monitoring         ☐ Environ. Bore Hol         ☐ Irrigation         ☐ Dewatcring	le [_] Heating/ le [_] Industry/ [_] Remedia [	Cooling Commercial al
WE	Mile					Steel	Drive Shoe?   Ye	welded	
s							WEIGHT	n - (t)	10
						in to fi			5 in to 514
PROPERTY OWNER'S NAME/COM	MPANY NAME	1			• • • • • • • • •	in. to [	L	lbs./ft	in. to1
Superior Nat	ional	Fore	st			SCREEN_None	OPEN H	OLE	
Property owner's mailing address if	different than	well location	n address indi	cated above		Make	FROM	<u>27</u> ft. TO	<u>610</u> #
318 Forestry	Road					Slot/Gauze	Leng	th	
Aurora, MN 5	5705	1				Set between ft and		INGS	
							above land ourfood De	to manuful 12	/10/05
		· · · · ·	· · · · · · · · · · · · · · · · · · ·		· · · · · · · · · · · · ·	PUMPING LEVEL (below land surface			
WELL OWNER'S NAME/COMPAN	Y NAME			• • • • • • • • • • • • • • • • • • •		700ft_after	96hrs	. pumping41	g.p.r
PolyMet Mini	ng, I	nc perty owners	address indi	cated above		WELL HEAD COMPLETION		Model	
70 75 475						Casing Protection		12 in. above	grade
PO BOX 475	MM SS	705				GROUTING INFORMATION	Boring ONLY)		
noye bakes,	Lars JJ	100				Well grouted Yes Grout material Y Neat of	No œment ∫ ∃Bentonite	Concrete 🗌 High	Solids Bentonite
						from	to27	ft <b>23</b>	🔄 🔄 yds. 🛛 👷 bag
· · · · · · · · · · · · · · · · · · ·				S OF		from	to	ft	_ ∐ yds.
GEOLOGICAL MATERIALS	CO	OLOR	MATERIA	AL FRO	м то	from		ft	ydsbag
				* .		None feet		direction	tvo
Sand	Br	own	Soft	-	0	Well disinfected upon completion	Yes 🔀 No		9P
~ 5			**	3	2	PUMP			
Rock	×e	<u>a</u>	Harc	2	3	Not installed Date installed	. <u></u> .		
Sand/Gravel_	Br	own	Soft		5 10	Manufacturer's name			
						Model number	HP	Volts	
Sand	Br	own	Medi	Lum 1	0 1	Turne:	i Beciprocating	Jet []	<u> </u>
Bodrock	רם	ack	Hord		7 2	ABANDONED WELLS	E Incorprocating [		
DOULOUS	01	aun	uart	PT	1 60-	Does property have any not in use ar	nd not sealed well(s)	Yes XNo	
Bedrock	Bl	ack	Hard	3 2	7 4	VARIANCE			
		•	 	,   .	0	Was a variance granted from the MD	H for this well? [] Ye	s 🔀 No TN#	
Bedrock	B1	ack	Medi	Lum 4	2 131	This well was drilled under my superv The information contained in this repo	ision and in accordance ort is true to the best of :	e with Minnesota Rule my knowledge.	es, Chapter 4725.
Bedrock Use a	a second shi	<b>Bile Re</b> ded	Hard	3 13	0 61			1.1	10000
REMARKS, ELEVATION, SOURCE	= OF DATA, et	с				Licensee Business Name	lon & Wel	Lic or Rea. No.	19033
							)		
23						Mare ho	und-	1.3	1-06
						Authorized Representative Signatur	e	Date	
						Chris Fuhs			
IMPORTANT - FILE W	ITH PROP	PERTY P	APERS	726	110	Name of Driller			
WELL OV	NNER CO	PY		130					HE-01205-08 (Rev. 5/0

WELL LOCATION County Name			MINN WELL	IESOTA <b>_ ANE</b> linnesota	DEPARTMENT OF HEALTH D BORING RECORD I Statutes, Chapter 1031		<u>міппезота un</u> 736	ique well no. 1 1 7
Township Name Township N	lo. Range No	Section No. Fr	action		WELL DEPTH (completed)	Date Work	Completed	
Rabbitt 59	13	2 5	ENE	NE4	485	" 1	2/18/05	
GPS Latitude de	arees mir	nutes se	econds		DRILLING METHOD		( ) -	
LOCATION: Longitude de	grees mir	nutess	econds		Cable Tool	Driven	UDug	L .
House Number, Street Name, City, and Z	Zip Code of Well Loca	ation or	Fire Number		x Stattex			
Hout Takas MN	55705	an, dependent			DRILLING FLUID	WELL HYD	ROFRACTURED?	Yes 👷 No
Show exact location of well in section gr	id with "X"	Sketcl	map of well	location	None	FROM	ft. TO	ft.
N			roads and I	ouildings	USE	Monitoring	- Heating	J/Cooling
	Please s	ee atta	ched		Domestic     Domestic     Noncommunity PWS     Community PWS CASING	Environ. Bore Ho	es No	y/Commercial ial HOLE DIAM
	ile				Steel	Threaded	X Welded	
		- <b>-</b>			CASING DIAMETER	WEIGHT		
S S				• •	6 <sub>in to</sub> 46 <sub>ft.</sub>	19	lbs./ft	12 in to 46 ft.
— 1 Mile — 1	1						lbs /ft_	6 in to 485
PROPERTY OWNER'S NAME/COMPAN	IY NAME				in. to ft.	· · · · · · · · · · · · · · · · · · ·	lbs./ft.	in. toft.
					SCREEN None	OPEN H	HOLE	
Superior Natio	rent than well location	n address indicated	l above.		Make	EBOM	<b>46</b> ft. TO	5 <b>485</b> ft.
			· · · · · · · · · · · · ·		Туре	Diar	n	
318 Forestry H	load		1999 - 1999 - 1999 - 1999 - 1999 - 1999 - 1999 - 1999 - 1999 - 1999 - 1999 - 1999 - 1999 - 1999 - 1999 - 1999 -		Slot/Gauze	Leng	gth	
Aurora, MN 557	05				Set between ft and	ft FITT	rings	
		$\frac{1}{r} = \frac{1}{r} + \frac{1}{r} + \frac{1}{r}$			STATIC WATER LEVEL			Alan Inr
				4 - 1 - 1 M		bove land surface D	ate measured	2/18/05
WELL OWNER'S NAME/COMPANY NA	ME				PUMPING LEVEL (below land surface)	) D.C.		<b>A</b>
					ft_after	<u>30 hr</u>	s. pumping 4	<b>U</b> g.p.m
Well owner's mailing address if different	han property owners	address indicated	above		WELL HEAD COMPLETION		Model	
		a sector and from the			Casing Protection		12 in above	e grade
PO Box 475				ана ала ала ала ала	[_] At-grade (Environmental Wells and	Boring ONLY)		
Hoyt Lakes, MN	55705				Well grouted Strategy Yes	No		4 
					Grout material 🛛 🛣 Neat ce	ement 🗌 Bentonite [	_} Concrete	Solids Bentonite
					from	U to 40	ft. 21	🔤 🗌 yds. 🛛 🕱 bags
· · · · · ·			1		from	to	_ ft	yds. 🛄 bags
GEOLOGICAL MATERIALS	COLOR	MATERIAL	FROM.	то	from	to	_ ft	_ 🗌 yds. 📋 bags
					NEAREST KNOWN SOURCE OF CO	NTAMINATION		
				E	Nonefeet		_direction	type
Sand	Ked/BIK	SOIL	U U		Well disinfected upon completion	Yes 🕱 No		
· · · ·	777 1- 1 Manua	77.0.00	E	7	PUMP			
Rock Boulders	BIR/Gry	naru		/	XNot installed Date installed			
	. 5m	**	~	16	Manufacturer's name			
Boulder Bedro	<u>mray</u>	Haro	'	10	Model number	HP_	Volts	
			1	40	Length of drop pine	ft C	Capacity	a.p.m
Boulder Bedrk	Rea/Gry	Hard	10	19		n. C		
			الدغر	يەبو <sub>يە</sub> بو	ABANDONED WELLS	<ul> <li>Ineciprocating</li> </ul>	1Jet	
Boulder Bedrk	Gray	Hard	19	25				
	× .				Does property have any not in use and	I not sealed well(s)	Yes LXNo	
Boulder Bedrk	Red/Gry	Med/Han	<b>r</b> a 25	26		_	(Teacher	
	3				Was a variance granted from the MDH	for this well? Ye	es XNo TN#	
Bedrock	Gray	Hard	26	46	This well was drilled under my supervi	sion and in accordanc	e with Minnesota Ru	les, Chapter 4725.
					The information contained in this report	rt is true to the best of	my knowledge	
Graphite Use a sec	ona the fit his needed	Black	462	485	5775 CL 173	tan o ta-	11~	10652
HEMARKS, ELEVATION, SOURCE OF	DAIA, etc.				WDC Explorat	LOH & WE.	LLS	42033
					Licensee Business Name		LIC. OF HEG. NO	
P4							ŧ	01
					Authorized Banzasantativa Signatura	h-	<u> </u>	<u>· UO</u>
					Autorized nepresentative signature		Date	-
					Mark Green/C	hris Fub	S	
MPORTANT - FILE WITH	PROPERTY PA	PERS -	0.0.0	A	Name of Driller		, ``	
WELL OWNER	R COPY		361	11				HE-01205-08 (Rev. 5/02

nan in in the stat

7.

 $\alpha_{i,k_1}^{i_1}, \ldots, \alpha_{i_k}^{i_k}, \ldots,$ 

			1			
VELL LOCATION						MINNESOTA UNIQUE WELL NO.
ounty Name				L ANI	a Statutes, Chapter 103I	736121
St. Louis	lo Bange No	Section No.	ction		WELL DEPTH (completed) Date Work C	ompleted
Robbitt 50	13		у. Ц	· · · · ·	100 <sup>n</sup> 12	/5/05
iPS OCATION: Latitude N de	grees 47 m	inutes3_7 se	conds	87	DRILLING METHOD	
Longitude M de	grees 91 m	inutes <b>58</b> se	conds	567	L Cable Tool X Driven	Jetted
louse Number, Street Name, City, and Z	Zip Code of Well Lo	ation or	Fire Numbe	r 		DEBACTUBED? Ves VN0
Hoyt Lakes, MN	<u>55705</u> id with "X"	Sketch	map of well	location	None	ft TO
N		Sh	owing prope roads and	erty lines, buildings		Heating/Cooling
	Plases	see atta	ched		Onestic     Demestic     Demestic     Demestic     Demestic     Demestic     Demestic     Demestic	☐ Industry/Commercial
	میہ جنوعاتیا میں شد ا	and the second sec			Community PWS Dewatering	
W ET					CASING Drive Shoe?	
	ilo					
					CASING DIAMETER WEIGHT	
<u> </u>	And the second				in to ft1	lbs./ft4 in. to106
1 Mile		an tara ta aga a a			in. toft.	lbs./ft in. to
ROPERTY OWNER'S NAME/COMPAN	IY NAME		3		in. to ft	lbs./ft in. to
-Superior Natio	mal For	ast —	4		SCREEN_NONeOPEN HO	LE 480
roperty owner's mailing address if differ	rent than well locati	on address indicated	abové		Make FROM	21 it. to 100
318 Forestry R	load		a para ana		Slot/Gauze Length	
Aurora, MN 557	05				Set between ft and ft FITTIN	GS
						12/5/05
		····.	\$		PUMPING LEVEL (below and surface)	measured 127 J
ELL OWNER'S NAME/COMPANY NAI	ME	n an	ng sana na mara ang sana Sana sana sana sana Sana sana sana sana sana sana sana sana		100 ft, after .5 brs p	pumpingg.p.n
PolyMet Mining	, Inc.	ro address indicated	abayo		WELL HEAD COMPLETION	
ven owner's maning address in unerend	than property owne	s address indicated i	above.	·	Casing Protection	_ Model
PO Box 475	EFTAR				At-grade (Environmental Wells and Boring ONLY)	
HOYL LAKES, MN	55705				Well grouted Yes No	
					Grout material Neat cement Bentonite	Concrete     High Solids Bentonite 12   Lyds IV bad
					from toft	yds. [] bags
GEOLOGICAL MATERIALS	COLOR	HARDNESS OF MATERIAL	FROM	ТО	from to ft	yds. 🗍 bag
	2 				NEAREST KNOWN SOURCE OF CONTAMINATION	
Deals (Cana	Decres	Flowed	· ^	. 0	None feet d	irectiontype
_KOCK/Sang	isrown	naru		0	Well disinfected upon completion Yes XNo	
Rock	Gray	Hard	8	100	TOWN	
	**				Manufacturar's name	······································
					Model number HP	Volts
					1 ength of drop pipe ft. Cap	acity q.p.r
					Type: Submersible Subme	Jet []
					ABANDONED WELLS	
					Does property have any not in use and not sealed well(s)	Yes XNo
					VARIANCE	
					Was a variance granted from the MDH for this well? [] Yes	XNo TN#
					This well was drilled under my supervision and in accordance v	vith Minnesota Rules, Chapter 4725.
					A COMPANY AND A CO	
	and sheet if roade	/				, knowledge.
Use a seco REMARKS, ELEVATION, SOURCE OF	ond sheet, if necder DATA, etc.	1			WDC Exploration & Well	s 49653
Use a sec REMARKS, ELEVATION, SOURCE OF	ond sheet, if needed DATA, etc.	1			WDC Exploration & Well	s 49653 Lic or Reg. No.
Use a seed REMARKS, ELEVATION, SOURCE OF T OB1	ond sheet, if needed DATA, etc.	1			WDC Exploration & Well	s 49653 Lic. or Reg. No
Usc a sec REMARKS, ELEVATION, SOURCE OF OB1	ond sheet, if necder DATA, etc.	1			WDC Exploration & Well	s 49653 Lic or Reg. No 1 - 31 - 06 Date
Use a sec REMARKS, ELEVATION, SOURCE OF OB1	ond sheet, if needed DATA, etc.	y			WDC Exploration & Well	<b>s 49653</b> Lic. or Reg. No. 
Uso a sec Bemariks, elevation, source of <b>OB1</b>	ond sheet, if neede DATA, etc.	9			WDC Exploration & Well Licensee Business Name Authorized Representative Signature Chris Fuhs	<b>s 49653</b> Lic or Reg. No 1 - <u>31 - Olo</u> Date

St. Louis Township Name Township Name Township Name Township Name Babbitt GPS LOCATION: LatitudeM deg LocAtitudeM deg L	Ange No 13 rees 47 mini- p Code of Well Loc 55705 d with X <sup>*</sup> lease s o Y NAME al Force	Section No 2 Inutes 37 Inutes 57 Inu	Fraction % % seconds _4 seconds 5 or Fire Number teh map of well Showing properads and ached	finnesot	A Statutes, Chapter 103I WELL DEPTH (completed)	Date W     The second sec	YDROFRACTURED Hole Indu Yes [x] No [X] Welded	I 2 U
St. Louis         Fownship Name       Township Ni         Babbitt       59         GPS       LongitudeM deg         LOCATION:       LatitudeN deg         House Number, Street Name, City, and Zit       MN         Show exact location of well in section grid       P         W	Pange No 13 rees 47 mi rees 91 mi p Code of Well Loc 55705 d with X" 1ease s o Y NAME al Force	Section No 2 inutes 37 inutes 57 ation Ske ee atta	Fraction y y seconds 4 seconds 5 or Fire Numbe Thowing properoads and ached	43 38 location rty lines, buildings	WELL DEPTH (completed)  100 DRILLING METHOD Cable Toot Auger DRILLING FLUID NONE USE Domestic Noncommunity PWS CASING X Steel Plastic	Date W     The second sec	orik Completed         12/2/05         Du         Jei         YDROFRACTURED         ft T         Hole         Indu         Ren         IX         Ves         Xes         Welded	ig tted ?   Yes 1 No O ting/Cooling istry/Commercial hedial }B HOLE DIAM.
Babbitt Babbitt Babbitt S9 GPS LOCATION: LatitudeM deg LongitudeW deg House Number, Street Name, City, and Zi Hoyt Lakes, MN Show exact location of well in section griv	rees 47 mi rees 91 mi p Code of Well Loc 55705 d with X 1ease s	ee atta	x y seconds 4 seconds 5 or Fire Number toh map of well Showing properoads and ached	43 38 location rty lines, buildings		I  Vertical and the second se	12/2/05	ig tted ? ☐ Yes Ist No O istry/Cooling istry/Cooling istry/Commercial redial }B HOLE DIAM.
Babbitt 59 GPS Latitude deg LOCATION: Latitude deg Longitude deg House Number, Street Name, City, and Z Hoyt Lakes, MN Show exact location of well in section grid N N N N N N N N N N N N N	13       prees     47       prees     91       p Code of Well Loc       55705       d with X"       1ease       s	2 nutes 37 ation Ske	4 % seconds 4 or Fire Number the map of well Showing properoads and ached	VA 43 38 location rty lines, buildings	DRILLING METHOD  Cable Tool Auger  DRILLING FLUID  None USE Domestic Noncommunity PWS CASING X Steel Plastic	WELL H FROM Environ Bore Irrigation Dewatering Drive Shoe?	12/2/05           Du           yDROFRACTURED'           ft T           Hole           Indu           Ren           13           Yes           X Welded	ig tted ?   Yes 1 No O ting/Cooling istry/Commercial redial PB HOLE DIAM.
LOCATION: Latitude _ M deg Longitude _ W deg House Number, Street Name, City, and Z HOYT Lakes, MN Show exact location of well in section grid N Show exact location of well in section grid N W	rees <u>4</u> mi rees <u>91</u> mi p Code of Well Loc <u>55705</u> d with X". <b>1ease s</b> o Y NAME <b>al Fore</b> and then well loced	nules <u>37</u> alion Ske ee atta	seconds _4 seconds _5 or Fire Numbe tach map of well Showing prope roads and ached	43 38 location rty lines, buildings	Cable Toot Auger Auger DRILLING FLUID USE Domestic Noncommunity PWS CASING X Steel Plastic Plastic	Kotary     Kotary     WELL H     FROM_     FROM_     Invigation     Dewatering     Drive Shoe? [     Threaded	Du     Jei     YDROFRACTURED     ft T     ft Hea     lole lindu     Ren     ix C     Yes ix No     XWelded	rg tted O ting/Cooling istry/Commercial redial B HOLE DIAM.
Hoyt Lakes, MN Show exact location of well in section gri W W Hoyt Lakes, MN Show exact location of well in section gri P W W How exact location of well in section gri P W W How exact location of well in section gri P W W How exact location of well in section gri F W W How exact location of well in section gri F W How exact location of well in section gri F W How exact location of well in section gri F F W How exact location of well in section gri F F W How exact location of well in section gri F F F How exact location of well in section gri F F F How exact location of well in section gri F F F How exact location of well in section gri F F F F F F F F F F F F F	Source of white Lee SSTOS I with X" I case s I case s NAME	ske ee atta	tch map of well Showing prope roads and ached	location. rty lines, buildings	DRILLING FLUID	WELL H FROM Environ Bore Irrigation Dewatering Drive Shoe? [ Threaded	YDROFRACTURED ft T Hole Indu Ren Yes [3] No X Welded	P Yes H No
Hoyc Lakes, MN Show exact location of well in section griph Show exact location of well in section griph W Image: Show exact location of well in section griph P W Image: Show exact location of well in section griph P Image: Show exact location of well in section griph Image: Show exact location of well in the section griph Image: Show exact location of well in the section griph Image: Show exact location of well in the section griph Image: Show exact location of well in the section griph Image: Show exact location of well in the section griph Image: Show exact location of well in the section griph Image: Show exact location of well in the section griph Image: Show exact location of well in the section griph Image: Show exact l	1 ease s lease s v NAME	ské ee atta	tch map of well showing prope roads and ached	location. erty lines, buildings	INONE USE Domestic Noncommunity PWS CASING X Steel Plastic	FROM_ Monitoring Environ Bore Irrigation Dewatering Drive Shoe? Threaded	ft T   ] Hea Hole   Indu   Ren   X _ C ] Yes [ X No   X Welded	O istry/Commercial edial <b>)B</b> HOLE DIAM.
PROPERTY OWNER'S NAME/COMPAN Property owner's mailing address if differ 318 Forestry Ro Aurora MN 5570	Iease s	ee atta	Showing properioads and	rty lines, buildings	USE Domestic Noncommunity PWS CASING X Steel Plastic	Monitoring Monitoring Inviron Bore Irrigation Dewatering Drive Shoe?	] Hea Hole   Indu   Ren   ½ _C ] Yes [½] No   ¾ Welded	ting/Cooling istry/Commercial nedial )B HOLE DIAM.
PROPERTY OWNER'S NAME/COMPAN Property owner's mailing address if differ 318 Forestry Ro Aurora MN 5570	o Y NAME and Force			nang aganta ang ang ang ang Tang Tang Tang Tang Tang Tang Tang T	CASING	Drive Shoe? [_	∫Yes [ <mark>væ]</mark> No [ <b>væ</b> ]Welded	HOLE DIAM.
PROPERTY OWNER'S NAME/COMPAN Superior Nation Property owner's mailing address if differ 318 Forestry Ro Aurora MN 5570	Y NAME					WEIGHT		
PROPERTY OWNER'S NAME/COMPAN Superior Nation Property owner's mailing address if differ 318 Forestry Ro Aurora, MN 5570	Y NAME					WEIGINI 4 1		1 10
PROPERTY OWNER'S NAME/COMPAN Superior Nation Property owner's mailing address if differ 318 Forestry Ro Aurora, MN 5570	Y NAME	· · · · · · · · · · · · · · · · · · ·			in. to 10 ft	<u>1 1</u>	lbs./f	
Superior Nation Property owner's mailing address if differ 318 Forestry Ro Aurora, MN 5570	al Fore				in to ft		1057f	t in. to
Property owner's mailing address if differ 318 Forestry Ro Aurora, MN 5570	ant than well location	<u>~</u> +		a sharan ji	SCREEN NONS	OPE	N HOLE	
318 Forestry Ro Aurora, MN 5570	can than won loodid	SL. on address Indica	ted above		Make	FRO	M_18ft.	то_100
Aurora, MN 5570	ađ				Туре	E	Diam	
	ς 5				Slot/Gauze	L	ength	· · · · · · · · · · · · · · · ·
an a	•				STATIC WATER LEVEL			· · · · · · · · · · · · · · · · · · ·
					fttbelow [] a	bove land surface	Date measured	12/2/05
	AIT				PUMPING LEVEL (below land surface	)		
WELL OWNER'S NAME/COMPANY NAM	ле				ft alter	.5	_hrs. pumping	<b>1</b> g.p
PolyMet Mining,	han property owne	rs address indicat	ted above		WELL HEAD COMPLETION		Model	
Hoyt Lakes, MN	55705				GROUTING INFORMATION Well grouted [] Yes [ Grout material ] Neat c from_	XNo cment [_] Bentonit	e [_] Concrete [_] F ft	High Solids Bentonite
GEOLOGICAL MATERIALS	COLOR	HARDNESS ( MATERIAL	DF FROM	TO	from		ft ft	. [_] yds. [_] ba  ] yds [_] ba
					Nono	NTAMINATION		
Rock/Sand	Brown	Hard	0	6		Voc <b>V</b>	direction	ty
•					PUMP			
Rock	Gray	Hard	6	100	Not installed Date installed			
			* .		Manufacturer's name			
				· · · -	 Model number	Н	P Volts_	
		-			Length of drop pipe	ft	Capacity	g.¢
					Type: Submersible LS Turbin	e 🗌 Reciprocatin	g [_] Jet []	······································
					Does property have any not in use an	d not sealed well(s)	) 🗌 Yes 🕱 No	
	· · · · · · · · · · · · · · · · · · ·				Was a variance granted from the MDI	for this well?	]Yes [❤No TN#	
					WELL CONTRACTOR CERTIFICATIO	N	ance with Minnesofa	Bules Chanter 4725
					The information contained in this repo	rt is true to the bes	ance with winnesota st of my knowledge	
Use a sec	ond sheet, if neede	d						40000
REMARKS, ELEVATION, SOURCE OF	DATA, etc.				WDC         Explorati           Licensee Business Name	on & We	LLS Lic or Reg	49653 No.
OB2					Authorized Representative Signature		l	<u>- 31 - 06</u> Date
					Chris Fuhs		- - -	
		······································						
WELL LOCATION			MINNE WELL Min	SOTA ANI anesota	DEPARTMENT OF HEALTHMINNESOTA UNIQUE WELL NO.D BORING RECORD736123a Statutes, Chapter 1031736123			
--	------------------------------	--	--	---	--			
St. Louis	makin Na Danga N	Costion No	Fraction	<u>, ,</u>	WELL DEPTH (completed)			
To ~ h & t + +		3 3 3 3 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5			100 12/1/05			
GPS Latitudo M	dogroos A7	minutes 37	seconds 557	7	DRILLING METHOD			
LOCATION Longitude	degrees <b>91</b>	minutes <u>58</u>	seconds 14(	)	Cable Tool Driven Dug Auger Rotary Jetted			
Track Talena	MAN REJAE				DRILLING FLUID WELL HYDROFRACTURED?			
Bhow exact location of well in se	ection and with "X"	S	ketch map of well loo	cation	Nana FROM (LTO (			
Show exact restation of wear in or		,	Showing property roads and bui	/ lines, ildinas	USE			
N	Please	see att	ached		CASING     Domestic     Operation     Community PWS     Dewatering     CASING     Device Stag2, 1=1 Voc.     No.     No.     HOLE DIAM.			
W	E Mile	· · · · · · · · ·			Steel   Threaded   Weided			
			Č.		CASING DIAMETER WEIGHT			
<u>Lilili</u> S					4 in to 21 ft 11 lbs/ft 4 in to 10			
	-1		andar an		in to ft lbs/ft in to f			
PROPERTY OWNER'S NAME/C	COMPANY NAME		<u></u>		in to ft Bo /0 in to to			
	. In 2	• • • • • • • • • • • • • • • • • • •	έ					
Superior Na	s if different than well los	1.951	ated above		SCHEEN WULLS			
roperty owners mailing audres	s in unjerent thath well loc	anon address mult			Type [FROM ft. TO			
318 Forestr	y Road				Slot/Gauze			
Aurora, MN	55705				Set betweenft_andft_FITTINGS			
					STATIC WATER LEVEL			
		n de la construction de la construcción de la construcción de la construcción de la construcción de la constru La construcción de la construcción d		a de la composición d	9 It. Abelow above land surface Date measured 12/1/05			
					PUMPING LEVEL (below land surface)			
VELL OWNER'S NAME/COMP/	ANY NAME				100 ft. after . 5 hrs pumping 1g p.n			
PolyMet Min	Ming, Inc.				WELL HEAD COMPLETION			
Well owner's mailing address if a	different than property ow	mers address indic	ated above.		Pitless adapter manufacturerModel			
PO Box 475		1	2 		Casing Protection List 12 in above grade			
Novt Lakes.	MN 55705	- 			GROUTING INFORMATION			
			:		Well grouted 🔄 Yes 🙀 No			
	122				Grout material   Neat cement   Bentonite   Concretc   High Solids Bentonite			
					fromtottjydsbag			
		HABDNESS	OF		fromtottyds.   jbag			
GEOLOGICAL MATERIAL	S COLOR	MATERIA	L FROM	. то				
					NEAREST KNOWN SOURCE OF CONTAININATION			
Depla / Come	0-0-0-0	77		~7	INOTE feet			
_KOCK/Sano	DLOW!	naro			Well disinfected upon completion Yes XNo			
					PUMP			
Rock	Gray	Hard		100	Not installed Date installed			
					Manufacturer's name			
		· .		<u> </u>	Model number HP Volts			
					Length of drop nine ft Capacity g p			
					Type: Submersible L LS. Turbine Heciprocating J Jet ABANDONED WELLS			
					Does property have any not in use and not sealed woll(s) Yes			
					VARIANCE			
					Was a variance granted from the MDH for this well? Use XNo TN#			
فمحمص فلأرقب ويحتدد ومنتصر والمراجع					WELL CONTRACTOR CERTIFICATION			
1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1		-			This weil was arried under my supervision and in accordance with Minnesota Rules, Chapter 4725. The information contained in this report is true to the best of my knowledge.			
115	se a second sheet. if nee	ded						
REMARKS, ELEVATION, SOUF	RCE OF DATA, etc.				WDC Exploration & Wells 49653			
					Licensee Business Name Lic. or Reg. No.			
OB3					Mark 1-31-06			
					Authorized Representative Signature Date			
					Chris Fuhs			
IMPORTANT - FILE W	VITH PROPERTY	PAPERS	70010	0	Name of Driller			
WELL O	WNER COPY		13012	3	HE-01205-08 (Bey, 5/0			

IC 140-0020

 $\mathcal{Z}_{i}^{*} \geq$ 

WELL LOCATION	· . ···			NESOTA		MINNESOTA UNIQUE WELL NO.
County Name			WEL	L ANI	a Statutes, Chapter 1031	7361.22
St. Louis Township Name	No Bange Ne	Section No. Fr	action		WELL DEPTH (completed) Date	Work Completed
	13		1/ 1/		п 50	12/6/05
GPS Latitude N (	tegrees <b>&amp; 7</b> min	utes <b>37</b> se	econds 5	59	DRILLING METHOD	
LOCATION: Longitude M	degrees <u>91</u> min	utes <b>57</b> se	econds 1	39	Cable Tool Shorten	Uug
House Number, Street Name, City, and	Zip Code of Well Locat	tion or	Fire Numbe	er		
Hoyt Lakes, MN	55705	Sketch	map of wel	Llocation		
Show exact location of wearin section	gha waa x .	Sł	howing prop roads and	erty lines, buildings		It TO
	Please	see at	tache	d	Domestic Domestic Frivion. Bo Noncommunity PWS Irrigation Community PWS Dewatering	re Hole    Industry/Commercial Remodial OB
w	Mile	- 10 - 17 - 18 - 18 - 18 - 18 - 18 - 18 - 18		9 tore a g	CASING Drive Shoe?	Yes No
	N				CASING DIAMETER WEIGHT	
S	landari dari dari dari dari dari dari dari	aanse terra (j			4 in to 17 ft 1	1lbs /ft in to0
		· . }			in. to ft	lbs /ft in to
	wal 13				In. to ft.	lbs./rt. j in. to EN HOLE
SUPERIOF MACIC Property owner's mailing address if dif	ferent than well location	address indicated	above	1. 	Make FR	ом <u>17</u> (т. то <u>50</u>
318 Forestry F	load	aan oo aa ah			Type	Diam.
Aurora, MN 557	05	n na santanta n Santanta na santanta na santa Santanta na santanta na sant			Stot/Gauze	FITTINGS
					STATIC WATER LEVEL	
	÷.	e me e magn			ft   telowabove land surface	e Date measured <u>12/6/05</u>
WELL OWNER'S NAME/COMPANY N	AME	: 		•••	PUMPING LEVEL (below land surface)	<b></b>
PolvMet_MTning	. Inc.				WELL HEAD COMPLETION	hrs. pumping <b>3_</b> g.p.r
Well owner's mailing address if differer	it than property owners	address indicated	above.		Pitless adapter manufacturer	Model
PO Box 475					[] Gasing Protection         [] At-grade (Environmental Wells and Boring ONLY)	12 in. above grade
Hoyt Lakes, MN	55705	1			GROUTING INFORMATION Well grouted Yes	· · · · · · · · · · · · · · · · · · ·
					Grout material [] Neat cement ] Bentor	ite Concrete   High Solids Bentonite
					from to	ft [])yds [] bag
GEOLOGICAL MATERIALS	COLOR	HARDNESS OF	FROM	то	from to	ft yds.
				· · · · · · · · · · · · · · · · · · ·	NEAREST KNOWN SOURCE OF CONTAMINATION	
Rock/Sand	Brown	Med/H	0	7	None feet	directiontyp
					PUMP	
Rock	Gray	Hard	7	50	XNot installed Date installed	
					Manufacturer's name	
. <u></u>					Model number	HP Volts
		54c			Length of drop pipe	t Capacityg.p
					Type: Submersible SLS Turbine Reciprocati	ng [_] Jet
					Does property have any not in use and not sealed well( VARIANCE	s) Tyes XNo
		· · · · · · · · · · · · · · · · · · ·			Was a variance granted from the MDH for this well?	Yes [XNo TN#
					WELL CONTRACTOR CERTIFICATION	dance with Minneeota Rules. Chaptor 4705
		4			The information contained in this report is true to the be	st of my knowledge.
	cond sheet, if needed	·			MDC Evolopation 8 M	110 10552
TEMATINO, LEEVATION, SOUNCE O	- DAIA, 610.				Licensee Business Name	Lic. or Reg. No.
بر دید میں						
UB3A					Authorized Representative Signature	1-31-06 Date
					Chric Enhe	
	H PROPERTY P	APERS 7	361	22	Name of Driller	
WELL OWN				- K K	l	HE-01205-08 (Rev. 5/

.

... 2. 

WELL LOCATION				ΙΕSOTA ΛΝΓ			MINNESOTA UN	NQUE WELL NO.
County Name		, here the second second second second		linnesoti	a Statutes, Chapter 103I		736	118
St. Louis Township Name Township	No. Range No	Section No. Fra	iction	end an tai an sai di An an an an an sai di	WELL DEPTH (completed)	Date	Work Completed	
Babbitt 59	13	2. June 1997 - 1	y <sub>4</sub>	94	100		11/19/05	j
GPS LOCATION: Latitude N	degrees <b>47</b> m	inutes 37 see	conds 63	3		++ Driver	. [] Dua	
Longitude M	degrees 91 m	inutes <u>56</u> so	conds <u>99</u>	28		Rotary	[ ] Jette	d
House Number, Street Name, City, and		ation	ine Namber		DRILLING FLUID	WELL	HYDROFRACTURED?	🗌 Yes 🕱 No
Show exact location of well in section	grid with "X"	Sketch	map of well	location.	None	FROM	ft. TO	1
N		sa sa sa sa sa sa Sn	roads and	rty lines, buildings	USE	Monitoring	[]] Heatin	g/Cooling
	Please	see atta	ched		Domestic	Environ Bo Irrigation	re Hole 🔄 Industi	ry/Commercial dial
					CASING	Dewatering	<u>xo_x</u>	B HOLE DIAM.
W E T					Steel	Drive Shoe?	Yes [] No	
	Mile				Plastic			
	_				CASING DIAMETER	WEIGHT		
S	· · · · · · · · · · · · · · · · · · ·			n na san sa	4 in to 7 ft	11	lbs /ft	4in_to_10
		·····			in toft		lbs./ft	in to
PROPERTY OWNER'S NAME/COMP					in. to ft.	OF	Ibs./ft.   PEN HOLE	in. to
Superior Nati Property owner's mailing address if di	onal For	est on address indicated	above				iom <b>7</b> ft T	o <b>100</b>
218 Forestry	Road				Туре		Diam	
Aurora. MN 55	705				Slot/Gauzeft_and	ft	Length	
					STATIC WATER LEVEL			
		and a second			12	ove land surfac	c Date measured 1	1/19/05
WELL OWNER'S NAME/COMPANY N	JAME				PUMPING LEVEL (below land surface)	20		
DoluMat Minir					ft_after	. 5	hrs. pumping	g.p.
Well owner's mailing address if differe	nt than property owne	rs address indicated a	above.		Pitless adapter manufacturer		Model	· · · · · · · · · · · · · · · · · · ·
PO Box 475					Casing Protection     At-grade (Environmental Wells and B	oring ONLY)	<b>X</b> 12 in abov	e grade
Hoyt Lakes, M	IN 55705				GROUTING INFORMATION	•No		
					Grout material Seat cerr	nent []] Bentor	nite 🔲 Concrete 📋 Higl	h Solids Bentonite
					from	to	ft	yds.   bag
GEOLOGICAL MATERIALS	COLOR	HARDNESS OF	FROM	TO	from .	to	ft	yds.     baş []]yds.     baş
		MATERIAL			NEAREST KNOWN SOURCE OF CONT	FAMINATION		
					None feet		direction	ty
Topsoil	Black	Sort	0_	2_	Well disinfected upon completion	es LXNo		
Clav/Sand	Brown	Medium	2	6				
					X Not installed Date installed			•::
Rock	Gray	Hard	6	100	Model number		HP Volts	
					Length of drop pipe		ft Capacity	g.p
					Type:	Reciprocat	ing []] Jet []	
					ABANDONED WELLS			
· · · ·	-				Does property have any not in use and r	not sealed well	s)   Yes 🔀 No	
					VARIANCE		man isteration	
					Was a variance granted from the MDH fe WELL CONTRACTOR CERTIFICATION	or this well?	Yes   <b>X</b> No  N#	
			··· ·		This well was drilled under my supervision The information contained in this report	on and in accor is true to the be	rdance with Minnesota Ru est of my knowledge.	iles, Chapter 4725.
Use a se	econd sheet, if needec	1						· · · · · ·
REMARKS, ELEVATION, SOURCE O	F DATA, etc.	• • • • • • • •			WDC Exploratio	n & We	ells 4	9653
					Licensee Business Name		LIC OF HEG. NO	
OB4					mo		1 - 3	1-06
					Authorized Representative Signature		Dat	e
					Chris Pube			
IMPORTANT - FILE WIT	H PROPERTY F	PAPERS -	004	10	Name of Driller			
WELL OWN	IER COPY	(	361	Tδ			- 	HE-01205-08 (Rev. 5/0

IC 140-0020

WELL LOCATION			MIN	INESOTA	DEPARTMENT OF HEALTH	MINNESOTA UNIQUE WELL NO.
County Name			WEL		D BORING RECORD	736119
St. Louis		Section No. 1	raction			Mark Completed
	1 No. 1 Nalige (No.	<b>1</b> 0ection110	Taction	· · · · · · · · ·		11/20/05
GPS Latitude N	degrees <b>47</b> m	inutes 37 is	econds 7	03	DRILLING METHOD	11/20/05
LOCATION: Longitude W (	degrees <u>91</u> m	inutes 56 s	econds _6	<b>17</b>	Cable Tool X Driven	Dug Jetted
Work Tokon M	M SETAS				DRILLING FLUID	HYDROFRACTURED?   Yes 🔀 No
Show exact location of well in section	grid with "X"	Sketc	h map of we Showing prop	Il location erty lines,	None FROM	ft TO ft
	Please	see atta	ached	i bunungs	Monitoring     Monitoring     Domestic     Noncommunity PWS     Dewatering	Heating/Cooling     Hole     Hole     Hole     Remedial     X     OB
E -	Mile				CASING Drive Shoe?	Yes No HOLE DIAM.
					CASING DIAMETER WEIGHT	
1 Mile	l.	در ویتورو این در م			4 in to 18 ft 11	
PROPERTY OWNER'S NAME/COMPA			·····	· · · · · · · · · ·		lbs./ft in to
		· · · · · · · · · · · · · · · · · · ·			In to tt.	Ibs./tt.   in. tott EN HOLE
Property owner's mailing address if diff	ferent than well location	esc n'address indicated	above.	· · · · · · ·	Make FR	ом <b>18</b> ft. то <b>100</b> ft.
318 Forestry	Road		lan an an t		Туре	Diam
Aurora, MN 55	705		( 1		Stot/Gauze	Length FITTINGS
-	a second a s		2 6 1		STATIC WATER LEVEL	
		a an			13ft X below above land surface	Date measured 11/20/05
WELL OWNER'S NAME/COMPANY N	AME			· · · · · · · · · · · · ·	PUMPING LEVEL (below land surface)	1 5
PolyMet Minin	a. Inc	,			WELL HEAD COMPLETION	hrs. pumpingi • • • g p m
Well owner's mailing address if differen	it than property owner	s address indicated	above		Pitless adapter manufacturer	Model
PO Box 475					At-grade (Environmental Wells and Boring ONLY)	
Hoyt Lakes, M	N 55705				GROUTING INFORMATION Well grouted Types 🕅 No	
	2 2 2				Grout material U Neat cement Bentoni	te 📋 Concrete 🛄 High Solids Bentonite
	N				from to	ft []vds. []bags
GEOLOGICAL MATERIALS	COLOR	HARDNESS OF	FROM	то	fromto	ft [] yds. [] bags
-	· · · · · · · · · · · · · · · · · · ·				NEAREST KNOWN SOURCE OF CONTAMINATION	
Topsoil	Black	Soft	0	1	None fect Well disinfected upon completion Sec XNo	directiontype
Clay/Sand	Brown	Medium	1	7	PUMP	
The second se	C	¥7		100	Manufacturer's name	
ROCK	Gray	naro	1	100	Model number H	IPVolts
					Length of drop pipe ft	. Capacity
					Type: Submersible LS Turbine Reciprocation	g] Jet
					Does property have any not in use and not sealed well(s VARIANCE	) Yes XNo
					Was a variance granted from the MDH for this well?	Yes XNo TN#
		· · · ·			This well was drilled under my supervision and in accord The information contained in this report is true to the bes	ance with Minnesota Rules, Chapter 4725. st of my knowledge
Use a se	 cond sheet, if needed	-				
REMARKS, ELEVATION, SOURCE OF	F DATA, etc.	· · · · · · · · · ·	_	_	WDC Exploration & We	<u>11s 49653</u>
					Licensee Business Name	LIC. or Heg. No.
ØB5			د		Authorized Representative Signature	1-31-06 Date
			5		Chris Fuhs	
IMPORTANT - FILE WITH WELL OWNE	PROPERTY PA	PERS 7	361	19	Name of Driller	15.01006 00 (Dov. 5100)
				· · · · ·	1	The 01205-00 (nev. 5/02)

IC 140-0020

Appendix B



## **Aquifer Test Analysis Plots**









Time, t/t'



Time, t/t'







Appendix C



#### MDH Laboratory # 027-137-157

Sample ID: \$053561327 Pro	oject #: 6845	Sample	r: Client	Тур	e: Grab		
Client: Barr Engineering		Status: NTS COC No	Status: Normal Matrix: Liquid NTS COC No: 63700				
Descript: PolyMet		Sampled	Sampled: 12/22/200511:00 AM				
Location: P-2		Completed	1:02/07/2006				
Notes:	ETA 1 0 2006				· · · · · · · · · · · · · · · · · · ·		
	FED IG 2000		- 1.0	69.6 19			
	CINEERING	20	23/69	~ E @ #~ ;			
EN	Givening	~.					
Δηρινέο	Analysis Date	Rosult	Unite	PI	Method		
Allealinity Total as CoCO2	12/20/2005	09.5	mg/I	10	210.1		
Aluminum	12/30/2003	98	nig/L	10	200.7		
Antimony	1/0/2006	<23	ug/L ug/L	23	200.7		
Arconio	1/4/2000	< 2	ug/L	2	204.2		
Arseine Barium	12/29/2003	<10	ug/L	10			
Baryllium	1/0/2006	< 10	ug/L	0.2	210.2		
Boron	1/5/2006	-0.2	ug/L	35	210.2		
Cadmium	1/0/2000		ug/L	0.2	213.2		
Calcium	1/3/2000	-0.2	ug/L	0.2	215.2		
Chlorido	1/4/2000	1 9	mg/L	2	200.7		
Chromium	1/0/2000		ng/L	1	218.2		
Cobalt	12/30/2005	<1	ug/L	1	210.2		
COD	1/4/2006	< 10	mg/I	10	SM 5220-D		
Copper	12/31/2005	< ?	ng/L ng/I	2	220.2		
Cvanide	1/3/2006	< 0.02	mg/L	$\frac{2}{0.02}$	335.2		
Fluoride	1/4/2006	0.53	mg/L	0.02	340.2		
Hardness (Calculated)	1/9/2006	56.5	mg/L	1	200.7		
Iron	1/4/2006	0.14	mg/L	0.05	200.7		
Lead	12/30/2005	<1	ug/L	1	239.2		
Magnesium	1/4/2006	6.7	mg/L	2	200.7		
Manganese	1/4/2006	0.02	mg/L	0.01	200.7		
Mercury, Low Level	1/6/2006	< 0.5	ng/L	0.5	1631E		

Approved By:

Project Manager:

Analyses were performed by methods approved by the U.S. Environmental Protection Agency and the Minnesota Department of Health.

Northeast Technical Services, Inc. makes no warranty except that the analysis has been made upon the samples received in accordance with generally accepted testing laboratory principles and practices. The results of the analysis may not be characteristic of the whole from which the sample was taken. This warranty is in lieu of all other warranties either expressed or implied.

Tuesday, February 07, 2006

NTS Laboratory Data Base System



MDH Laboratory # 027-137-157

Sample ID:	S053561327	Project #:	6845	Sampler: Client	Type: Grab	
Client:	Barr Engineeri	ng		Status: Normal	Matrix: Liquid	
Study: Descript:	PolyMet			Sampled: 12/22/200511	:00 AM	
Location:	P-2			Completed: 02/07/2006		
Notes:						

Analyte	Analysis Date	Result	Units	RL	Method
Mercury, Methyl	1/24/2006	0.059	ng/L	0.02	1631E
Molybdenum, GF	1/4/2006	< 5	ug/L	5	246.2
Nickel	12/31/2005	< 2	ug/L	2	249.2
Nitrogen, Ammonia	12/30/2005	0.27	mg/L	0.1	350.1
Nitrogen, Nitrate + Nitrite	12/29/2005	< 0.1	mg/L	0.1	353.2
Palladium	1/4/2006	< 0.1	ug/L	0.1	200.8
рН	12/22/2005	7.8	SU	0.1	150.1
Phosphorous, Total	12/23/2005	0.11	mg/L	0.1	365.4
Platinum	1/4/2006	< 0.02	ug/L	0.02	200.8
Potassium	1/6/2006	1.1	mg/L	0.2	200.7
Selenium, GF	12/29/2005	<2	ug/L	2	270.2
Silver, GF	12/30/2005	< 1	ug/L	1	272.2
Sodium	1/4/2006	24.3	mg/L	2	200.7
Strontium	1/4/2006	37.9	ug/L	10	200.7
Sulfate	1/12/2006	10.5	mg/L	1	375.4
Thallium	12/31/2005	<2	ug/L	2	279.2
Titanium	1/4/2006	< 10	ug/L	10	283.2
ТОС	12/22/2005	2.4	mg/L	1	415.1
Zinc	1/4/2006	<10	ug/L	10	200.7

Approved By:

Project Manager:

Analyses were performed by methods approved by the U.S. Environmental Protection Agency and the Minnesota Department of Health.

Northeast Technical Services, Inc. makes no warranty except that the analysis has been made upon the samples received in accordance with generally accepted testing laboratory principles and practices. The results of the analysis may not be characteristic of the whole from which the sample was taken. This warranty is in lieu of all other warranties either expressed or implied.

Tuesday, February 07, 2006

NTS Laboratory Data Base System



#### MDH Laboratory # 027-137-157

Sample ID:S053561341Client:Barr EngineeringStudy:ConsultantDescript:PolyMetLocation:P-4Notes:	Sample Status NTS COC No Sampleo Completed	r: Client : Normal o: 63700 1: 12/22/2005 d: 02/07/2006	Type: Grab Matrix: Liquid [1:30 AM		
Analyte	Analysis Date	Result	Units	RL	Method
Alkalinity, Total as CaCO3	12/30/2005	69.2	mg/L	10	310.1
Aluminum	1/6/2006	57.2	ug/L	25	200.7
Antimony	1/4/2006	< 3	ug/L	3	204.2
Arsenic	12/29/2005	5.7	ug/L	2	206.2
Barium	1/6/2006	< 10	ug/L	10	6010B/200.7
Beryllium	1/3/2006	< 0.2	ug/L	0.2	210.2
Boron	1/6/2006	55	ug/L	35	200.7
Cadmium	1/3/2006	< 0.2	ug/L	0.2	213.2
Calcium	1/4/2006	17.7	mg/L	2	200.7
Chloride	1/6/2006	< 0.5	mg/L	0.5	325.2
Chromium	12/30/2005	< 1	ug/L	1	218.2
Cobalt	12/30/2005	< 1	ug/L	1	219.2

17

< 2

1/3/2006 0.02 < 0.02 mg/L Cyanide Fluoride 1/4/2006 0.35 mg/L 0.1 1/9/2006 Hardness (Calculated) 76.2 mg/L 1 0.05 1/4/2006 0.19 mg/L Iron 12/30/2005 1 <1 ug/L Lead 2 1/4/2006 7.8 Magnesium mg/L 0.01 1/4/2006 mg/L Manganese 0.06 0.7 0.5 1/6/2006 ng/L Mercury, Low Level

1/4/2006

12/31/2005

Approved By:

COD

Copper

Project Manager:

Analyses were performed by methods approved by the U.S. Environmental Protection Agency and the Minnesota Department of Health.

Northeast Technical Services, Inc. makes no warranty except that the analysis has been made upon the samples received in accordance with generally accepted testing laboratory principles and practices. The results of the analysis may not be characteristic of the whole from which the sample was taken. This warranty is in lieu of all other warranties either expressed or implied.

Tuesday, February 07, 2006

NTS Laboratory Data Base System

SM 5220-D

220.2

335.2

340.2

200.7

200.7

239.2

200.7

200.7

1631E

10

2

mg/L

ug/L



#### MDH Laboratory # 027-137-157

Sample ID:S053561341PClient:Barr EngineeringStudy:ConsultantDescript:PolyMetLocation:P-4Notes:	Sample Status NTS COC No Sampled Completed	r: Client : Normal : 63700 I: 12/22/20051 I: 02/07/2006	Type: Grab Matrix: Liquid 11:30 AM		
Analyte	Analysis Date	Result	Units	RL	Method
Mercury, Methyl	1/12/2006	< 0.025	ng/L	0.025	1631E
Molybdenum, GF	1/4/2006	34.5	ug/L	5	246.2
Nickel	12/31/2005	<2	ug/L	2	249.2
Nitrogen, Ammonia	12/30/2005	0.11	mg/L	0.1	350.1
Nitrogen, Nitrate + Nitrite	12/29/2005	< 0.1	mg/L	0.1	353.2
Palladium	1/4/2006	< 0.1	ug/L	0.1	200.8
pH	12/22/2005	8.1	SU	0.1	150.1
	12/23/2005	< 0.1	mg/L	0.1	365.4
Platinum	1/4/2006	< 0.02	ug/L	0.02	200.8
Potassium	1/6/2006	1.7	mg/L	0.2	200.7
Selenium, GF	12/29/2005	<2	ug/L	2	270.2
Silver, GF	12/30/2005	< 1	ug/L	1	272.2
Sodium	1/4/2006	4.4	mg/L	2	200.7
Strontium	1/4/2006	45.5	ug/L	10	200.7
Sulfate	1/12/2006	14.1	mg/L	1	375.4

Approved By:

Thallium

Titanium

TOC

Zine

Project Manager:

12/31/2005

1/4/2006

12/22/2005

1/4/2006

Analyses were performed by methods approved by the U.S. Environmental Protection Agency and the Minnesota Department of Health.

Northeast Technical Services, Inc. makes no warranty except that the analysis has been made upon the samples received in accordance with generally accepted testing laboratory principles and practices. The results of the analysis may not be characteristic of the whole from which the sample was taken. This warranty is in lieu of all other warranties either expressed or implied.

<2

<10

<10

2.2

ug/L

ug/L

mg/L

ug/L

2

10

1

10

Tuesday, February 07, 2006

NTS Laboratory Data Base System

279.2

283.2

415.1

200.7



MDH Laboratory # 027-137-157

Sample ID Client: Study: Descript: Location:	S053561342Project #:6845Sampler: ClientBarr EngineeringStatus: NormalConsultantNTS COC No: 63700PolyMetSampled: 12/22/2005P-2 Trip BlankCompleted: 02/07/2006			lient Type: Grab rmal Matrix: Liquid 700 22/2005 /07/2006			
Notes:							
	Analyte	Analy	sis Date	Result	Units	RL	Method
Mercury, I	Methyl	1/24	/2006	0.035	ng/L	0.02	1631E

Approved By:

Project Manager:

 $(\gamma)$ 

Analyses were performed by methods approved by the U.S. Environmental Protection Agency and the Minnesota Department of Health.

Northeast Technical Services, Inc. makes no warranty except that the analysis has been made upon the samples received in accordance with generally accepted testing laboratory principles and practices. The results of the analysis may not be characteristic of the whole from which the sample was taken. This warranty is in lieu of all other warranties either expressed or implied.

Tuesday, February 07, 2006

NTS Laboratory Data Base System

Page 5 of 10



MDH Laboratory # 027-137-157

Sample ID:S053561343Project #:6845Client:Barr EngineeringStudy:ConsultantDescript:PolyMetLocation:P-4 Trip Blank			Sample Status NTS COC No Sampleo Completed	r: Client : Normal ): 63700 l: 12/22/2005 d: 02/07/2006	Type: Matrix:	Type: Grab Matrix: Liquid		
Notes:								
	Analyte	Analysis Date	Result	Units	RL	Method		
Mercury, I	Methyl	1/24/2006	< 0.025	ng/L	0.025	1631E		

Approved By:

Project Manager:

Analyses were performed by methods approved by the U.S. Environmental Protection Agency and the Minnesota Department of Health.

Northeast Technical Services, Inc. makes no warranty except that the analysis has been made upon the samples received in accordance with generally accepted testing laboratory principles and practices. The results of the analysis may not be characteristic of the whole from which the sample was taken. This warranty is in lieu of all other warranties either expressed or implied.

Tuesday, February 07, 2006

NTS Laboratory Data Base System

Page 6 of 10



MDH Laboratory # 027-137-157

Sample ID: Client: Study: Descript: Location:	Sample ID:S053561344Project #:6845Client:Barr EngineeringStudy:ConsultantDescript:PolyMetLocation:P-4 Field Blank			Sam Sta NTS COC Samp Comple	pler: Client tus: Normal No: 63700 bled: 12/22/2005 eted: 01/06/2006	Type Matri:	∺ Grab x: Liquid
Notes:							
	Analyte	Analy	sis Date	Result	Units	RL	Method
Mercury, I	LL Field Blank	1/6	/2006	0.3	ng/L	0.2	1631E

Approved By:

Project Manager:

Analyses were performed by methods approved by the U.S. Environmental Protection Agency and the Minnesota Department of Health.

Northeast Technical Services, Inc. makes no warranty except that the analysis has been made upon the samples received in accordance with generally accepted testing laboratory principles and practices. The results of the analysis may not be characteristic of the whole from which the sample was taken. This warranty is in lieu of all other warranties either expressed or implied.

Tuesday, February 07, 2006

NTS Laboratory Data Base System

Page 7 of 10



### MDH Laboratory # 027-137-157

Sample ID:       S053561346       Project #: 6845         Client:       Barr Engineering         Study:       Consultant         Descript:       PolyMet         Location:       P-4         Notes:       Image: Consultant		Sampler Status: NTS COC No: Sampled: Completed	: Client Normal :63700 :12/22/20051 :01/10/2006	Type Matri	9: Grab - Filtered x: Liquid
Analyte	Analysis Date	Result	Units	RL	Method
Aluminum	12/29/2005	<25	ug/L	25	200.7
Cadmium	1/10/2006	< 0.2	ug/L	0.2	213.2
Chromium	1/5/2006	< 1	ug/L	1	218.2
Copper	12/29/2005	<2	ug/L	2	220.2
Molybdenum, GF	1/5/2006	28.9	ug/L	5	246.2
Nickel	12/29/2005	< 2	ug/L	2	249.2
Selenium, GF	12/29/2005	< 2	ug/L	2	270.2
Silver, GF	1/5/2006	< 1	ug/L	1	272.2
Zinc	12/29/2005	<10	ug/L	10	200.7

Approved By:

Project Manager:

Analyses were performed by methods approved by the U.S. Environmental Protection Agency and the Minnesota Department of Health.

Northeast Technical Services, Inc. makes no warranty except that the analysis has been made upon the samples received in accordance with generally accepted testing laboratory principles and practices. The results of the analysis may not be characteristic of the whole from which the sample was taken. This warranty is in lieu of all other warranties either expressed or implied.

Tuesday, February 07, 2006

NTS Laboratory Data Base System

Page 8 of 10



MDH Laboratory # 027-137-157

Sample ID:S05356134AProject #:Client:Barr EngineeringStudy:ConsultantDescript:PolyMetLocation:P-2 Field Blank		Project #: 6845 ng k	Sampl Statu NTS COC N Sample Complete	er: Client s: Normal o: 63700 d: 12/22/2005 ed: 01/06/2006	Type: Grab Matrix: Liquid					
Notes:										
	Analyte	Analysis Date	Result	Units	RL	Method				
Mercury, I	L Field Blank	1/6/2006	0.4	ng/L	0.2	<u>1631E</u>				

Approved By:

Project Manager.

Analyses were performed by methods approved by the U.S. Environmental Protection Agency and the Minnesota Department of Health.

Northeast Technical Services, Inc. makes no warranty except that the analysis has been made upon the samples received in accordance with generally accepted testing laboratory principles and practices. The results of the analysis may not be characteristic of the whole from which the sample was taken. This warranty is in lieu of all other warranties either expressed or implied.

Tuesday, February 07, 2006

NTS Laboratory Data Base System



#### MDH Laboratory # 027-137-157

Sample ID: S05356134B	Project #: 6845	Sample	er: Client	Тур	9: Grab - Filtered		
Client: Barr Engineeri Study: Consultant Descript: PolyMet Location: P-2	ng	Status: Normal Matrix: Liquid NTS COC No: 63700 Sampled: 12/22/200511:00 AM Completed: 01/10/2006					
Notes:							
Analyte	Analysis Date	Result	Units	RL	Method		
Aluminum	12/29/2005	<25	ug/L	25	200.7		
Cadmium	1/10/2006	< 0.2	ug/L	0.2	213.2		
Chromium	1/5/2006	< 1	ug/L	1	218.2		
Copper	12/29/2005	<2	ug/L	2	220.2		
Molybdenum, GF	1/5/2006	< 5	ug/L	5	246.2		
Nickel	12/29/2005	<2	ug/L	2	249.2		
Selenium, GF	12/29/2005	<2	ug/L	2	270.2		
Silver, GF	1/5/2006	< 1	ug/L	1	272.2		
Zinc	12/29/2005	< 10	ug/L	10	200.7		

Approved By:

Project Manager:

Analyses were performed by methods approved by the U.S. Environmental Protection Agency and the Minnesota Department of Health.

Northeast Technical Services, Inc. makes no warranty except that the analysis has been made upon the samples received in accordance with generally accepted testing laboratory principles and practices. The results of the analysis may not be characteristic of the whole from which the sample was taken. This warranty is in lieu of all other warranties either expressed or implied.

Tuesday, February 07, 2006

NTS Laboratory Data Base System

Page 10 of 10



# Frontier GeoSciences Inc.

414 Pontius Ave N Seattle, WA 98109

206-622-6960 fax 206-622-6870

#### February 02, 2006

Laura Lubahn Northeast Technical Services 315 Chestnut Street P.O. Box 1142 Virginia, MN 55792

#### Dear Ms. Lubahn,

Enclosed are the results for methyl Hg in the water samples collected on December 22, 2005. The samples were received by Frontier GeoSciences in good condition on December 23, 2005 within a sealed cooler at a temperature of 1.8°C.

Immediately following sample receipt, the samples for methyl mercury were preserved to 0.4% (v/v) hydrochloric acid and placed in a refrigerated storage unit with a temperature below 4°C. Methyl mercury in water analysis was determined by distillation, aqueous phase ethylation, isothermal GC separation, and CVAFS detection according to Frontier's standard operating procedure (SOP) FGS-070. The samples were analyzed in two batches, designated as Batch A and Batch B. Batch A was analyzed in January 12, 2006 and Batch B was analyzed on January 24, 2006.

As a measure of the continuing sensitivity of the instrument Continuing Calibration Verification standards (CCVs) are run after every ten samples. During the analysis of Batch A the second CCV fell below the established control limits of 80-120%. Sample S053561341, the matrix duplicate and the matrix spike were reported from this run because they were analyzed prior to the first CCV, which was within the control limits. The matrix spike duplicate was analyzed after the first, passing CCV and before the second, failing CCV however it is reported because the spike recovery is well with control limits. All other samples are reported from Batch B.

There were no other analytical QC issues associated with this report.

Please feel free to contact me with any questions regarding this report.

incerely aner Stephanie Grant for

Kristina Spadafora Project Manager StephanieG@FrontierGeoSciences.com

Innovative Solutions • Environmental Research • Analytical Services www.FrontierGeoSciences.com

# **Methyl Mercury Results for NTS**

Reported: February 02, 2006

Frontier Geosciences Inc., 414 Pontius Ave. N, Seattle WA 98109

Sample ID	Batch	Date collected	MeHg ng/L
S053561343	В	12/22/05	< 0.025
S053561342	В	12/22/05	0.035
S053561341	A	12/22/05	< 0.025
S053561327	В	12/22/05	0.059
Reporting Lin	nit		0.025

# Methyl Mercury Results for NTS

Reported: February 02, 2006

Frontier Geosciences Inc., 414 Pontius Ave. N, Seattle WA 98109

## Quality Control Data - Preparation Blank Report

Analyte (ng/L)	PBW1	PBW2	PBW3	Mean	Std Dev	R.L
MeHg Batch A	0.014	0.007	0.015	0.012	0.004	0.025
MeHg Batch B	0.000	0.009	0.003	0.004	0.005	0.025

St. Dev. = Standard Deviation

R.L.= Reporting Limit

Quality Control Data - Certified Reference Material Report

Analyte (ng/L)	CRM Identity	Cert. Value	Obs. Value	% Rec.
MeHg Batch A	DORM - 2	4470	5340	119.5
MeHg Batch B	DORM - 2	4470	4096	91.6

CRM Identity = Certified reference material identity

Cert. Value = Certified value

Obs. Value = Experimental result

% Rec. = Percent recovery

# Methyl Mercury Results for NTS

Reported: February 02, 2006

Frontier Geosciences Inc., 414 Pontius Ave. N, Seattle WA 98109

# Quality Control Data - Duplicate Report

Analyte (ng/L)	Sample QC'd	Rep. 1	Rep. 2	Mean	RPD
MeHg Batch A	S053561341	<0.025	<0.025	NC	NC
MeHg Batch B	S053561343	<0.025	< 0.025	NC	NC

RPD = Relative Percent Difference

Quality Control Data - Matrix Spike / Matrix Spike Duplicate Report

Analyte (ng/L)	Sample QC'd	Mean	Spike Level	MS	% Rec.	Spike Level	MSD	% Rec.	RPD
MeHg Batch A	S053561341	< 0.025	2.000	1.903	95.2	2.000	1.903	95.2	0.0
MeHg Batch B	S053561342	0.035	2.000	1.952	95.9	2.000	1.948	95.7	0.2

MS = Matrix Spike

MSD = Matrix Spike Duplicate

Fos notes: FEDEX UPS 125597111555051324 Cooker Temp: 0.0 °C VTSR: 7:00 am Cocseel= yes Temp Blank temp: 1.8 °C intect Client specific containers

	-	101120120	2010	unan-1	m.				С	onta	ainer	s	
Custody N	lame:	Silooder						ΓΤ	Τ	7	Τ	Τ	$\square$
Samplers Si	gnature:									/			/
Sample ID	Co	lected	T ·	Гуре	Location	Tota	#						Remarks
053561343	12/22/2005		Grab		P-4 Trip Blank				1				Methyl Mercury
053561342	12/22/2005		Grab		P-2 Trip Blank				1				Methyl Mercury
6053561341	12/22/2005	11:30:00 AM	Grab		P-4				1				Methyl Mercury
053561327	12/22/2005	11:00:00 AM	Grab		P-2	1			1				Methyl Mercury
			1										
			<u> </u>										
							ľ						
	1			_		1							
			1					Ī					
			1				į.		Γ				
	1	1	1						Γ				
			1-						Γ				
			1			1			Γ	Ī			
Boling	Lished By:	(Signature)	Data	Time	Received By: (Signature)	Receiv	ed By:	(Sian	ature	)   [	Date	Tim	e Received By: (Signatu
/ Reiniu	uisneu by.	(Signature)	205	12 050	SMar	FA	-5	(			17-7	3 7/	0
Reling	uished By:	(Signature)	Date	Time	Received By: (Signature)	Relinquish	ed By:	(Sign	ature	) [	Date	Tim	e Received By: (Signatu
Relinq	uished By:	(Signature)	Date	Time	Received for Laboratory By:	(Signature)	Date	Tirr	ne	Rem	narks		
	Releas	ing Agency:					I	!	_	Split	Samp	ole	
	NTS												
	315 (	Chestnut St	reet										Signature
	POP	Rox 1142									] Ac	cepted	Decline
	Virai	nia	MN	5570	2.				L				12/22/2005 1:55

		Northeast Technical St 315 Chestnut Street P.O. Box 1142 Virginia, Minnesota 55 Phone: 218-741-4290 Fax: 218-742-1010	ervices, Inc. 792	F	EC EB 1	( 200 200 Ring	ed) 6 AIN 60.	OF CL	JSTO	DY RI	coc ECOR	:# <u>(</u>	03J	<u>c</u> O	Pag Dati	e of e Due:
	Client Information Client: Barr Engineer Contact Person: Ward Su Address: 4700 W. 77 Edina, MN Phone: 952-832-260 Fax: 952-822-260 Project Information: 23/69.862 004 00	Ing     Address:       Wanson     Address:       Invoice to:     Invoice to:       00     Address:       1     Address:	Ward : 4700 Ed:na , Tina Í (same	Swans W 7 MN Pint as ab	>n ₹™5± 55435											
	Lab Use Only		Collec	tion		Matrix		Type	Filtered			Analys	is Requ	iired	11	Comments
	Laboratory ID	Sample Description	Date	Time	Liquid	Solid	Other	Grab Cor	np			1			1	
134B	S053561327	P-2	12/22	11:00	X			X			_					See lables on
1241.1	1341	P-4	12/22	11:30	K			R								Jars and 12/22
12101	, , , , , , , , , , , , , , , , , , , ,															email to R Store
	1210															D. ZIB
	1342	P-2 Trip BLK														From I fint Lycar
		P-2 Field BUC														
	1343	P-4 TripBUL										-	l			M Wissolved
	1344	P-4 Field BLK														metals need
																to be filteres
																in Lab
												-				
										+						
									<u> </u>			<u> </u>				
	Sampled By:	Date 12/22/05 Received	By:			ate ime		Receive	d tor Labo	THOMAS	s.		Time /	<u>~%?-0</u> 2:50	Misc. Lab	Information
	Relinquished By:	Date 12/22/05 Received	By:		D	ate		Tempera	ature on A	arrival	5.7				1	
		ilme 12:50				nite		On	109	<u></u>	Uer De	yrees Ce	ISIUS	<u> </u>		

Description	Method	<b>Detection Limit</b>
Alkalinity, Total as CaCO3	EPA 310.1	10 mg/L
Carbon, Total Organic	EPA 415.1	1 mg/L
Chemical Oxygen Demand	STD METH 5220D, 18TH ED	10 mg/L
Chloride	EPA 325.2	0.5 mg/L
Cyanide Total	EPA 335.2	0.02 mg/L
Fluoride	EPA 340.1	0.1 mg/L
Hardness, Total (calculated)	EPA 200.7	1 mg/L
Nitrogen, Ammonia	EPA 350.1	0.1 mg/L
Nitrogen, Nitrate + Nitrite	EPA 353.2	0.1 mg/L
рН	EPA 150.1	0.1 SU
Phosphorus, Total	EPA 365.2	0.1 mg/L
Sulfate	EPA 375.4	1 mg/L
Aluminum, Total	EPA 200.7	25
Aluminum, Dissolved	EPA 200.7	25
Antimony, Total	EPA 204.2	3
Arsenic, Total	EPA 200.8	2
Barium, Total	EPA 200.7	10
Beryllium, Total	EPA 210.2	0.2
Boron, Total	EPA 200.7	35
Cadmium, Total	EPA 213.2	0.2
Cadmium, Dissolved	EPA 213.2	0.2
Calcium, Total	EPA 200.7	0.5 mg/L
Chromium, Total	EPA 218.2	1
Chromium, Dissolved	EPA 218.2	1
Cobalt, Total	EPA 219.2	1
Copper, Total	EPA 220.2	2
Copper, Dissolved	EPA 220.2	2
Iron, Total	EPA 200.7	0.05 mg/L
Lead, Total	EPA 7421	1
Magnesium, Total	EPA 200.7	0.5 mg/L
Manganese, Total	EPA 200.7	0.03 mg/L
Mercury, Low Level Total	EPA 1631E	2 ng/L
Methyl Mercury, Total	EPA 1631E	0.02 ng/L
Molybdenum, Total	EPA 246.2	5
Molybdenum, Dissolved	EPA 246.2	5
Nickel, Total	EPA 249.2	2

 Table 1. Proposed Parameters for Groundwater Sample Analysis. Detection limits in ug/L

 unless otherwise noted.

Description	Method	Detection Lim
Nickel, Dissolved	EPA 249.2	2
Palladium, Total	EPA 200.7	25
Platinum, Total	EPA 200.7	25
Potassium, Total	EPA 200.7	1 mg/L
Selenium, Total	EPA 270.2	2
Selenium, Dissolved	EPA 270.2	2
Silver, Total	EPA 272.2	1
Silver, Dissolved	EPA 272.2	1
Sodium, Total	EPA 200.7	0.5 mg/L
Strontium, Total	EPA 200.7	4
Thallium, Total	EPA 279.2	2
Titanium, Total	EPA 283.2	10
Zinc, Total	EPA 200.7	10
Zinc, Dissolved	EPA 200.7	10



MDH Laboratory # 027-137-157

Sample ID:S060051350ProductClient:Barr EngineeringStudy:ConsultantDescript:PolyMetLocation:P-1	bject #:   6845	Sampler Status: NTS COC No: Sampled: Completed	Client Normal 63931 1/5/2006 1 :02/07/2006	Type Matri 1:50 AM	ə: Grab ix: Liquid
Notes: FE3 10 2006 ENGINÉERING CO. 23/69-862					
Analyte	Analysis Date	Result	Units	RL	Method
Alkalinity, Total as CaCO3	1/10/2006	< 10	mg/L	10	310.1
Aluminum	1/10/2006	59.1	ug/L	25	200.7
Antimony	1/19/2006	< 3	ug/L	3	204.2
Arsenic	1/10/2006	2.2	ug/L	2	206.2
Barium	1/10/2006	< 10	ug/L	10	<u>6010B/200.7</u>
Beryllium	1/18/2006	< 0.2	ug/L	0.2	210.2
Boron	1/10/2006	518	ug/L	35	200.7
Cadmium	1/18/2006	< 0.2	ug/L	0.2	213.2
Calcium	1/10/2006	6.2	mg/L	2	200.7
Chloride	1/6/2006	6.6	mg/L	0.5	325.2
Chromium	1/17/2006	1.9	ug/L	1	218.2
Cobalt	1/17/2006	< 1	ug/L	1	219.2
COD	1/19/2006	< 10	mg/L	10	SM 5220-D
Copper	1/19/2006	<2	ug/L	2	220.2
Cyanide	1/11/2006	< 0.02	mg/L	0.02	335.2
Fluoride	1/13/2006	1.1	mg/L	0.1	300.0
Hardness (Calculated)	1/18/2006	15	mg/L	1	200.7
Iron	1/10/2006	0.1	mg/L	0.05	200.7
Lead	1/17/2006	< 1	ug/L	1	239.2
Magnesium	1/10/2006	<2	mg/L	2	200.7
Manganese	1/10/2006	0.01	mg/L	0.01	200.7
Mercury, Low Level	1/16/2006	< 0.5	ng/L	0.5	1631E

Approved By:

Project Manager:

Analyses were performed by methods approved by the U.S. Environmental Protection Agency and the Minnesota Department of Health.

Northeast Technical Services, Inc. makes no warranty except that the analysis has been made upon the samples received in accordance with generally accepted testing laboratory principles and practices. The results of the analysis may not be characteristic of the whole from which the sample was taken. This warranty is in lieu of all other warranties either expressed or implied.

Tuesday, February 07, 2006

NTS Laboratory Data Base System

Page 1 of 10



MDH Laboratory # 027-137-157

Sample ID	: S060051350 Project #: 6845	Sampler: Client Type: Grab
Client: Study:	Barr Engineering Consultant	Status: Normal Matrix: Liquid NTS COC No: 63931
Descript:	PolyMet	Sampled: 1/5/2006 11:50 AM
Location:	P-1	Completed: 02/07/2006
Notes:		

Analyte	Analysis Date	Result	Units	RL	Method
Mercury, Methyl	1/5/2006	< 0.025	ng/L	0.025	1631E
Molybdenum, GF	1/11/2006	< 5	ug/L	5	246.2
Nickel	1/19/2006	<2	ug/L	2	249.2
Nitrogen, Ammonia	1/11/2006	< 0.1	mg/L	0.1	350.1
Nitrogen, Nitrate + Nitrite	1/10/2006	< 0.1	mg/L	0.1	353.2
Palladium	1/12/2006	< 0.1	ug/L	0.1	200.8
рН	1/5/2006	8.5	SU	0.1	150.1
Phosphorous, Total	1/12/2006	< 0.1	mg/L	0.1	365.4
Platinum	1/12/2006	< 0.02	ug/L	0.02	200.8
Potassium	1/10/2006	1.2	mg/L	0.2	200.7
Selenium, GF	1/10/2006	<2	ug/L	2	270.2
Silver	1/17/2006	< 1	ug/L	1	272.2
Sodium	1/10/2006	43.9	mg/L	10	200.7
Strontium	1/10/2006	33.4	ug/L	5	200.7
Sulfate	1/30/2006	1200	mg/L	1	375.4
Thallium	1/19/2006	<2	ug/L	2	279.2
Titanium	1/18/2006	< 10	ug/L	10	283.2
тос	1/10/2006	2.3	mg/L	1	415.1
Zinc	1/10/2006	17.9	ug/L	10	200.7

Approved By:

Project Manager:

Analyses were performed by methods approved by the U.S. Environmental Protection Agency and the Minnesota Department of Health.

Northeast Technical Services, Inc. makes no warranty except that the analysis has been made upon the samples received in accordance with generally accepted testing laboratory principles and practices. The results of the analysis may not be characteristic of the whole from which the sample was taken. This warranty is in lieu of all other warranties either expressed or implied.

Tuesday, February 07, 2006

NTS Laboratory Data Base System

Page 2 of 10



MDH Laboratory # 027-137-157

Sample ID:	S060051355 Project #: 6845	Sampler: Client	Type: Grab
Client:	Barr Engineering	Status: Normal	Matrix: Liquid
Study:	Consultant	NTS COC No: 63931	
Descript:	PolyMet	Sampled: 1/5/2006	11:15 AM
Location:	P-3	Completed: 02/07/2006	

Notes:

\* Cyanide analyzed at MVTL Laboratories.

Analyte	Analysis Date	Result	Units	RL	Method
Alkalinity, Total as CaCO3	1/10/2006	97.2	mg/L	10	310.1
Aluminum	1/10/2006	<25	ug/L	25	200.7
Antimony	1/19/2006	< 3	ug/L	3	204.2
Arsenic	1/10/2006	<2	ug/L	2	206.2
Barium	1/10/2006	< 10	ug/L	10	6010B/200.7
Beryllium	1/18/2006	< 0.2	ug/L	0.2	210.2
Boron	1/10/2006	76.3	ug/L	35	200.7
Cadmium	1/18/2006	< 0.2	ug/L	0.2	213.2
Calcium	1/10/2006	20.4	mg/L	2	200.7
Chloride	1/6/2006	2.1	mg/L	0.5	325.2
Chromium	1/17/2006	1.2	ug/L	1	218.2
Cobalt	1/17/2006	< 1	ug/L	1	219.2
COD	1/19/2006	485	mg/L	10	SM 5220-D
Copper	1/19/2006	<2	ug/L	2	220.2
Cyanide	1/11/2006	*< 0.02	mg/L	0.02	335.2
Fluoride	1/31/2006	0.64	mg/L	0.05	300.0
Hardness (Calculated)	1/18/2006	113	mg/L	1	200.7
Iron	1/10/2006	4.37	mg/L	0.25	200.7
Lead	1/17/2006	< 1	ug/L	1	239.2
Magnesium	1/10/2006	15	mg/L	2	200.7
Manganese	1/10/2006	0.14	mg/L	0.01	200.7
Mercury, Low Level	1/16/2006	< 0.5	ng/L	0.5	1631E

Approved By:

SMJ Project Manager:

Analyses were performed by methods approved by the U.S. Environmental Protection Agency and the Minnesota Department of Health.

Northeast Technical Services, Inc. makes no warranty except that the analysis has been made upon the samples received in accordance with generally accepted testing laboratory principles and practices. The results of the analysis may not be characteristic of the whole from which the sample was taken. This warranty is in lieu of all other warranties either expressed or implied.

Tuesday, February 07, 2006

NTS Laboratory Data Base System

Page 3 of 10


#### MDH Laboratory # 027-137-157

Sample ID:	S060051355	Project #: 6845	Sampler: Client	Type: Grab
Client: Study:	Barr Engineerin	ng	Status: Normal NTS COC No: 63931	Matrix: Liquid
Descript:	PolyMet		Sampled: 1/5/2006	11:15 AM
Location:	P-3		Completed:02/07/2000	)

Notes:

\* Cyanide analyzed at MVTL Laboratories.

Analyte	Analysis Date	Result	Units	RL	Method
Mercury, Methyl	1/5/2006	< 0.025	ng/L	0.025	1631E
Molybdenum, GF	1/11/2006	< 5	ug/L	5	246.2
Nickel	1/19/2006	< 2	ug/L	2	249.2
Nitrogen, Ammonia	1/11/2006	< 0.1	mg/L	0.1	350.1
Nitrogen, Nitrate + Nitrite	1/10/2006	< 0.1	mg/L	0.1	353.2
Palladium	1/1/121	0.3	ug/L	0.1	200.8
рН	1/5/2006	6.6	SU	0.1	150.1
Phosphorous, Total	1/12/2006	< 0.1	mg/L	0.1	365.4
Platinum	1/12/2006	< 0.02	ug/L	0.02	200.8
Potassium	1/10/2006	2.1	mg/L	0.2	200.7
Selenium, GF	1/10/2006	<2	ug/L	2	270.2
Silver	1/17/2006	< 1	ug/L	1	272.2
Sodium	1/10/2006	7.5	mg/L	2	200.7
Strontium	1/10/2006	75.2	ug/L	5	200.7
Sulfate	1/30/2006	32.9	mg/L	1	375.4
Thallium	1/19/2006	<2	ug/L	2	279.2
Titanium	1/18/2006	< 10	ug/L	10	283.2
тос	1/10/2006	7.6	mg/L	1	415.1
Zinc	1/10/2006	11.3	ug/L	10	200.7

Approved By:

IYYU Project Manager:

Analyses were performed by methods approved by the U.S. Environmental Protection Agency and the Minnesota Department of Health.

Northeast Technical Services, Inc. makes no warranty except that the analysis has been made upon the samples received in accordance with generally accepted testing laboratory principles and practices. The results of the analysis may not be characteristic of the whole from which the sample was taken. This warranty is in lieu of all other warranties either expressed or implied.

Tuesday, February 07, 2006

NTS Laboratory Data Base System

Page 4 of 10



MDH Laboratory # 027-137-157

ient <b>Type</b> : Grab - Filtered
rmal Matrix: Liquid 31
/2006 11:50 AM 18/2006

Analyte	Analysis Date	Result	Units	RL	Method
Aluminum	1/11/2006	< 25	ug/L	25	200.7
Cadmium	1/10/2006	< 0.2	ug/L	0.2	213.2
Chromium	1/14/2006	< 1	ug/L	1	218.2
Copper	1/14/2006	<2	ug/L	2	220.2
Molybdenum, GF	1/17/2006	<5	ug/L	5	246.2
Nickel	1/14/2006	< 2	ug/L	2	249.2
Selenium, GF	1/10/2006	<2	ug/L	2	270.2
Silver	1/14/2006	< 1	ug/L	1	272.2
Zinc	1/6/2006	< 25	ug/L	25	200.7

Approved By:

\_\_\_\_\_\_ Project Manager:

Analyses were performed by methods approved by the U.S. Environmental Protection Agency and the Minnesota Department of Health.

Northeast Technical Services, Inc. makes no warranty except that the analysis has been made upon the samples received in accordance with generally accepted testing laboratory principles and practices. The results of the analysis may not be characteristic of the whole from which the sample was taken. This warranty is in lieu of all other warranties either expressed or implied.

Tuesday, February 07, 2006

NTS Laboratory Data Base System

Page 5 of 10



#### MDH Laboratory # 027-137-157

Sample ID	S060051359 P	roject #: 684	Sampler: Client	<b>Type:</b> Grab - Filtered
Client: Study: Descript: Location:	Barr Engineering Consultant PolyMet P-3		Status: Normal NTS COC No: 63931 Sampled: 1/5/2006 Completed: 01/17/200	Matrix: Liquid 11:15 AM 16
Notes:				

Analyte	Analysis Date	Result	Units	RL	Method
Aluminum	1/11/2006	<25	ug/L	25	200.7
Cadmium	1/10/2006	< 0.2	ug/L	0.2	213.2
Chromium	1/14/2006	< 1	ug/L	1	218.2
Copper	1/14/2006	<2	ug/L	2	220.2
Molybdenum, GF	1/17/2006	< 5	ug/L	5	246.2
Nickel	1/14/2006	<2	ug/L	2	249.2
Selenium, GF	1/10/2006	<2	ug/L	2	270.2
Silver	1/14/2006	< 1	ug/L	1	272.2
Zinc	1/6/2006	< 25	ug/L	25	200.7

Approved By:

Project Manager:

Analyses were performed by methods approved by the U.S. Environmental Protection Agency and the Minnesota Department of Health.

Northeast Technical Services, Inc. makes no warranty except that the analysis has been made upon the samples received in accordance with generally accepted testing laboratory principles and practices. The results of the analysis may not be characteristic of the whole from which the sample was taken. This warranty is in lieu of all other warranties either expressed or implied.

Tuesday, February 07, 2006

NTS Laboratory Data Base System

Page 6 of 10



MDH Laboratory # 027-137-157

Sample ID: Client: Study: Descript: Location:	S06005135A Barr Engineerin Consultant PolyMet P-1 Field Blank	Project #: 6845	Sample Status NTS COC No Sampled Completed	r: Client : Normal : 63931 l: 1/5/2006 d: 01/18/2006	Type Matri 11:50 AM	: Grab - Filtered x: Liquid	
Notes:							
	Analyte	Analysis Date	Result	Units	RL	Method	
Mercury, l	LL Field Blank	1/16/2006	0.3	ng/L	0.2	1631E	

Approved By:

Project Manager:

Analyses were performed by methods approved by the U.S. Environmental Protection Agency and the Minnesota Department of Health.

Northeast Technical Services, Inc. makes no warranty except that the analysis has been made upon the samples received in accordance with generally accepted testing laboratory principles and practices. The results of the analysis may not be characteristic of the whole from which the sample was taken. This warranty is in lieu of all other warranties either expressed or implied.

Tuesday, February 07, 2006

NTS Laboratory Data Base System



MDH Laboratory # 027-137-157

Sample ID: Client: Study: Descript: Location:	S060051401 Barr Engineeri Consultant PolyMet P-3 Field Blank	Project #: ng	6845	Sa S NTS CC Sar Com	mpler: Client tatus: Normal DC No: 63931 npled: 1/5/2006 pleted: 01/18/200	Ty Mat 11:15 AN 6	pe: Grab - Filtered trix: Liquid I
Notes:							
	Analyte	Analy	sis Date	Result	Units	RL	Method
Mercury, I	L Field Blank	1/16	5/2006	< 0.2	ng/L	0.2	1631E

Approved By:

Project Manager:

CA

Analyses were performed by methods approved by the U.S. Environmental Protection Agency and the Minnesota Department of Health.

Northeast Technical Services, Inc. makes no warranty except that the analysis has been made upon the samples received in accordance with generally accepted testing laboratory principles and practices. The results of the analysis may not be characteristic of the whole from which the sample was taken. This warranty is in lieu of all other warranties either expressed or implied.

Tuesday, February 07, 2006

NTS Laboratory Data Base System

Page 8 of 10



MDH Laboratory # 027-137-157

Sample ID: Client: Study: Descript: Location:	S060051402 Barr Engineerin Consultant PolyMet P-3 Trip Blank	Project #: 6845	Sampler Status: NTS COC No Sampled Completed	© Client Normal 63931 1/5/2006 02/07/2006	Type Matrix 11:15 AM	: Grab - Filtered x: Liquid	
Notes:							
	Analyte	Analysis Date	Result	Units	RL	Method	
Mercury, N	Aethyl	1/5/2006	< 0.025	ng/L	0.025	1631E	

Approved By:

Project Manager:

Analyses were performed by methods approved by the U.S. Environmental Protection Agency and the Minnesota Department of Health.

Northeast Technical Services, Inc. makes no warranty except that the analysis has been made upon the samples received in accordance with generally accepted testing laboratory principles and practices. The results of the analysis may not be characteristic of the whole from which the sample was taken. This warranty is in lieu of all other warranties either expressed or implied.

Tuesday, February 07, 2006

NTS Laboratory Data Base System

Page 9 of 10



MDH Laboratory # 027-137-157

Sample ID: Client: Study: Descript: Location:	S06005140A Barr Engineerin Consultant PolyMet P-1 Trip Blank	Project #: 6845 ng	Sample Status NTS COC No Sampled Completed	r: Client : Normal : 63931 : 1/5/2006 1:02/07/200	Type: Matrix 11:50 AM 6	: Grab - Filtered :: Liquid
Notes:						
	Analyte	Analysis Date	Result	Units	RL	Method
Mercury, <b>N</b>	Aethyl	1/5/2006	< 0.025	ng/L	0.025	1631E

Approved By:

Project Manager:

Analyses were performed by methods approved by the U.S. Environmental Protection Agency and the Minnesota Department of Health.

Northeast Technical Services, Inc. makes no warranty except that the analysis has been made upon the samples received in accordance with generally accepted testing laboratory principles and practices. The results of the analysis may not be characteristic of the whole from which the sample was taken. This warranty is in lieu of all other warranties either expressed or implied.

Tuesday, February 07, 2006

NTS Laboratory Data Base System



# Frontier GeoSciences Inc.

414 Pontius Ave N Seattle, WA 98109

206-622-6960 fax 206-622-6870

#### February 02, 2006

Laura Lubahn Northeast Technical Services 315 Chestnut Street P.O. Box 1142 Virginia, MN 55792

Dear Ms. Lubahn,

Enclosed are the results for methyl Hg in the water samples collected on January 05, 2006. The samples were received by Frontier GeoSciences in good condition on January 06, 2006 within a sealed cooler at a temperature of 0.2°C.

Immediately following sample receipt, the samples for methyl mercury were preserved to 0.4% (v/v) hydrochloric acid and placed in a refrigerated storage unit with a temperature below 4°C. Methyl mercury in water analysis was determined by distillation, aqueous phase ethylation, isothermal GC separation, and CVAFS detection according to Frontier's standard operating procedure (SOP) FGS-070. The samples were analyzed on January 24, 2006.

There were no analytical issues associated with the report.

Please feel free to contact me with any questions regarding this report.

Sincerely,

Stephanie Grant for Kristina Spadafora Project Manager StephanieG@FrontierGeoSciences.com

Custody N	amo: N	ISHARAS	elete	#6202					Co	ontaine	ers		
Cusiouy N						· ·	Γ	Τ	Τ	77		ΓΙ	•
Samplers Sig	jnature:									/ /			
Sample ID	Co	llected		Туре	Location	Total	¥						Remarks
06005140A	1/5/2006	11:50:00 AM	Grab	- Filtered	P-1 Trip Blank							. N	lethyl Mercury
6060051402	1/5/2006	11:15:00 AM	Grab	- Filtered	P-3 Trip Blank							M	lethyl Mercury
060051355	1/5/2006	11:15:00 AM	Grab		P-3							M	lethyl Mercury
060051350	1/5/2006	11:50:00 AM	Grab		P-1							N	lethyl Mercury
		1											
											Ļļ		
Relindu	ished By:	(Signature)	Date	Time	Received By: (Signature)	Relinquishe	d By:	(Signa	ture)	Date	Tin	ie R	eceived By: (Signatur
Relinqu	lished By:	(Signature)	Date	Time	Received By: (Signature)	Relinquishe	d By:	(Signa	ture)	Date	Tim	ie R	eceived By: (Signatur
Relinqu	lished By:	(Signature)	Date	Time	Received for Laboratory By:	(Signature) こナモー S	Date 1/06/0	Time 10:J	5	Remarks	nle		
	Releas	ing Agency:		,	// /					ipin ouri	P.0		
	NTS			1		8.0							
	315 C	Chestnut Str	eet	ζ.	ooler lemp: 0,2	-C			.	<b>^</b> .		Sign	ature
	PO B	30x 1142		(	Coc seal: Intact Decline								

# **Methyl Mercury Results for NTS**

Reported: February 02, 2006

Frontier Geosciences Inc., 414 Pontius Ave. N, Seattle WA 98109

Sample ID	Date collected	MeHg ng/L
S06005140A	01/05/06	< 0.025
S060051402	01/05/06	< 0.025
S060051355	01/05/06	< 0.025
S060051350	01/05/06	< 0.025
Reporting Lim	nit	0.025

## Methyl Mercury Results for NTS

Reported: February 02, 2006

Frontier Geosciences Inc., 414 Pontius Ave. N, Seattle WA 98109

#### Quality Control Data - Preparation Blank Report

Analyte (ng/L)	PBW1	PBW2	PBW3	Mean	Std Dev	R.L
MeHg	0.000	0.009	0.003	0.004	0.005	0.025

St. Dev. = Standard Deviation

R.L.= Reporting Limit

Quality Control Data - Certified Reference Material Report

Analyte (ng/L)	CRM Identity	Cert. Value	Obs. Value	% Rec.
MeHg	DORM - 2	4470	4100	91.7

CRM Identity = Certified reference material identity

Cert. Value = Certified value

Obs. Value = Experimental result

% Rec. = Percent recovery

# Methyl Mercury Results for NTS

Reported: February 02, 2006

Frontier Geosciences Inc., 414 Pontius Ave. N, Seattle WA 98109

#### Quality Control Data - Duplicate Report

Analyte (ng/L)	Sample QC'd	<b>Rep.</b> 1	Rep. 2	Mean	RPD
MeHg	8053561343	< 0.025	< 0.025	NC	NC

RPD = Relative Percent Difference

Quality Control Data - Matrix Spike / Matrix Spike Duplicate Report

Analyte (ng/L)	Sample QC'd	Mean	Spike Level	MS	% Rec.	Spike Level	MSD	% Rec.	RPD
MeHg	Batch QC	0.035	2.000	1.952	95.9	2.000	1.948	95.7	0.2

MS = Matrix Spike

MSD = Matrix Spike Duplicate

RECEIVED



Northeast Technical Services, Inc.

315 Chestnut Street P.O. Box 1142 Virginia, Minnesota 55792 Phone: 218-741-4290 Fax: 218-742-1010

ENGINEERING CO.

FEB 1 0 2006

# coc# <u>[0393</u>]

Page \_\_\_\_\_ of \_\_\_\_ Date Due: \_\_\_\_\_

## CHAIN OF CUSTODY RECORD

Client Information Client: Barr Ene Contact Person: Tina Address: Too W Minneapolis Phone: 952-832 Fax: 952-832 Project Information:	Pint Pint 77th St , MN 55435 - 2692 - 2601	Report to: Address: Invoice to: Address:	Tin San Tin San	a Prince	i'st	<b>c</b>					4	early ses list									
Lab Use Only			Coll	ection		Matrix		Ту	pe	Filtered			Analy	sis R	equire	d			C	Comments	
Laboratory ID	Sample Descript	tion	Date	Time	Liquid	. Solid	Other	Grab	Comp												
1354	<u>P=1</u>		06	11:50	×			$\widehat{}$		$\times$	$\mathbf{X}$										
1359	<u> </u>		06	11:15				×							-						
135A	P-1 Evid Bla	av						<b> </b>													
1401	DZ SIPIA R	lanz											-								
1404	P-1 TOR	ICUNY																			
	P.Z. TAAR	KINK					   .														
1702	1-3 MILD	MIN							· .										·~		
									 						+					·	
																					-
Sampled By:	Date	Received E	<u> </u> Зу:		<u> </u>	Date		l. Rec	eived fo	or Labor	l ator∳, B	⊥ V∕		Date	1.5.0	210	NTS	Project	# (	0845	
Jere Mohr	Time	_				ĩime				Ø	K/	<u>108</u>	<u>li</u>	Time	13:02	25	Misc	. Lab In	formatio	n	
Rotinguished By:	Date 1/5/06	Received E	3y:			Date Time		Tem	iperatu	re on Ar	ríva¥ C	2,9	Degraat	`olouuo							
yna oon				<b></b> ,		THE			Un lo	<u> </u>	,	<u>~·)</u>	Jegrees (	eisius			<u> </u>				

Description	Method	Detection Limit
Alkalinity, Total as CaCO3	EPA 310.1	10 mg/L
Carbon, Total Organic	EPA 415.1	1 mg/L
Chemical Oxygen Demand	STD METH 5220D, 18TH ED	10 mg/L
Chloride	EPA 325.2	0.5 mg/L
Cyanide Total	EPA 335.2	0.02 mg/L
Fluoride	EPA 340.1	0.1 mg/L
Hardness, Total (calculated)	EPA 200.7	1 mg/L
Nitrogen, Ammonia	EPA 350.1	0.1 mg/L
Nitrogen, Nitrate + Nitrite	EPA 353.2	0.1 mg/L
рН	EPA 150.1	0.1 SU
Phosphorus, Total	EPA 365.2	0.1 mg/L
Sulfate	EPA 375.4	1 mg/L
Aluminum, Total	EPA 200.7	25
Aluminum, Dissolved	EPA 200.7	25
Antimony, Total	EPA 204.2	3
Arsenic, Total	EPA 200.8	2
Barium, Total	EPA 200.7	10
Beryllium, Total	EPA 210.2	0.2
Boron, Total	EPA 200.7	35
Cadmium, Total	EPA 213.2	0.2
Cadmium, Dissolved	EPA 213.2	0.2
Calcium, Total	EPA 200.7	0.5 mg/L
Chromium, Total	EPA 218.2	1
Chromium, Dissolved	EPA 218.2	1
Cobalt, Total	EPA 219.2	1
Copper, Total	EPA 220.2	2
Copper, Dissolved	EPA 220.2	2
Iron, Total	EPA 200.7	0.05 mg/L
Lead, Total	EPA 7421	1
Magnesium, Total	EPA 200.7	0.5 mg/L
Manganese, Total	EPA 200.7	0.03 mg/L
Mercury, Low Level Total	EPA 1631E	2 ng/L
Methyl Mercury, Total	EPA 1631E	0.02 ng/L
Molybdenum, Total	EPA 246.2	5
Molybdenum, Dissolved	EPA 246.2	5
Nickel, Total	EPA 249.2	2

 Table 1. Proposed Parameters for Groundwater Sample Analysis. Detection limits in ug/L

 unless otherwise noted.

Description	Method	<b>Detection Limit</b>
Nickel, Dissolved	EPA 249.2	2
Palladium, Total	EPA 200.7	25
Platinum, Total	EPA 200.7	25
Potassium, Total	EPA 200.7	1 mg/L
Selenium, Total	EPA 270.2	2
Selenium, Dissolved	EPA 270.2	2
Silver, Total	EPA 272.2	1
Silver, Dissolved	EPA 272.2	1
Sodium, Total	EPA 200.7	0.5 mg/L
Strontium, Total	EPA 200.7	4
Thallium, Total	EPA 279.2	2
Titanium, Total	EPA 283.2	10
Zinc, Total	EPA 200.7	10
Zinc, Dissolved	EPA 200.7	10