Eagle Mine
a subsidiary of lundin mining

2014 Annual Mining and Reclamation Report
Humboldt Mill
Mine Permit MP 01 2010

March 15, 2015

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Acronyms and Abbreviations

AEM	Advanced Ecological Management
BMPs	Best Management Practices
CLO	Concentrate Load Out Building
COSA	Coarse Ore Storage Area
DO	dissolved oxygen
Eagle	Eagle Mine, LLC.
gpd	gallons per day
gpm	gallons per minute
HDPE	High Density Polyethylene
HTDF	Humboldt Tailings Disposal Facility
KEL	Kennecott Eagle Land
KME	King and MacGregor Environmental
LEPC	Local Emergency Planning Committee
yd^3	cubic yards
MCHD	Marquette County Health Department
MCL	maximum contaminant level
MDEQ	Michigan Department of Environmental Quality
MPC	Minerals Processing Corporation
MRR	Mining and Reclamation Report
MSB	Mill Services Building
µg/L	micrograms per liter
mg/L	milligrams per liter
MNFI	Michigan Natural Features Inventory
MRR	Mining and Reclamation Report
NPDES	National Pollution Discharge Elimination System
NREPA	Natural Resources & Environmental Protection Act
NTU	Nephelometric Turbidity Units
ORP	Oxidation Reduction Potential
PCB	Polychlorinated biphenyl
PIPP	Pollution incident Prevention Plan
SESC	Soil Erosion and Sedimentation Control
SERC	State Emergency Response Commission
SPCC	Spill Prevention Contamination Controls
SWMP	Storm water Management Plan
SWPPP	Storm water Pollution Prevention Plan
t	metric ton (tonne)
T&E	Threatened & Endangered
UPL	Upper Prediction Limit
US EPA	United States Environmental Protection Agency
WTP	Water Treatment Plan

1. Document Preparers and Qualifications

This Mining and Reclamation Report (MRR) was prepared by the Eagle Mine-Humboldt Mill Environmental Department and incorporates information prepared by other qualified professionals. Table 1 provides a listing of the individuals and organizations who were responsible for the preparation of this MRR as well as those who contributed information for inclusion in the report.

Table 1. Document Preparation – List of Contributors

Organization	Name	Title
Individuals responsible for the preparation of the report		
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2. Introduction

Eagle Mine officially began the remediation and reconstruction of the Humboldt Mill located in Humboldt Township in October 2008. Processing of ore from the Eagle Mine commenced in September 2014. Due to the commencement of milling operations, Eagle Mine is required per Part 632 to submit an annual Mining and Reclamation Report as detailed in R 425.501.

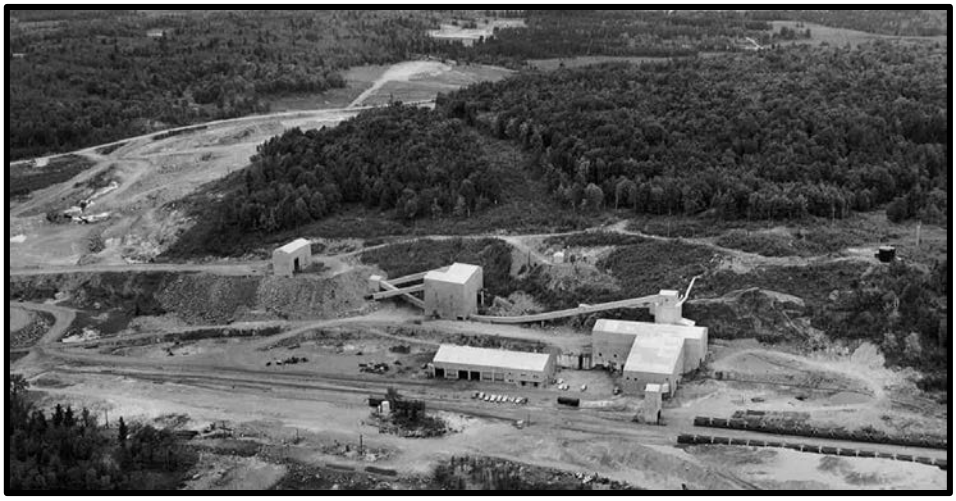
The MRR is required to provide a description of mining and reclamation activities, updated contingency plan, monitoring results, tonnage of material processed, and a list of incident reports that created, or may create a threat to the environment, natural resources, or public health and safety at the Eagle Mine Site. In addition, this MRR will also provide a mill site project construction status update to memorialize all that has been completed and the decisions and/or modifications that have been approved throughout the process.

3. Mill History & Redevelopment

The Humboldt Mill facility was originally constructed in 1954 as a joint venture between Cleveland Cliffs Iron Company to concentrate low grade iron ore from the Humboldt Mine. The Humboldt Mine was developed in two stages over its life, beginning in 1954 with underground ore removal, followed by open pit extraction. A total of approximately 12 million cubic yards of rock was removed from the mine during mining operations. Upon cessation of mining in 1970, dewatering of the open pit mine was discontinued and the pit was allowed to fill with water. At that time the maximum depth of the mine was approximately 350 ft. The surface area of the resultant body of water, now referred to as the Humboldt Tailings Disposal Facility (HTDF), is approximately 67 acres.

Humboldt Open Pit Mine, June 1967

Adjacent to the Humboldt Mine, the ore processing facility incorporated crushing, grinding, and flotation units to concentrate the iron ore. A grate kiln pellet facility was added in 1960. The mill operated until about 1970. At that time the mine was closed but the mill was converted to a hematite concentrate regrind with upgraded circuits using two ball mills and an elutriation process. The pellet facility continued to operate, processing the hematite concentrate and excess concentrate from the nearby Republic Mine. Operations continued until about 1979 when ore deliveries from Republic ceased.



Humboldt Mill Processing Plant, circa 1950's

In the early 1980's, Callahan Mining Corporation developed the Ropes Gold Mine about 10 miles east of the Humboldt Mill site. Callahan Mining Corporation purchased parts of the Humboldt Mill facility, with the exception of the pelletizing process. The mill was converted to gold ore processing which began in July 1985. The mill operated until 1989 when the Ropes Mine was closed. During the processing of the Ropes ore, residual process tailings, that contained sulfide minerals, were placed in the HTDF. Approximately 1.82 million tons of tailings (160 feet) from the Ropes Mine are contained and treated in the HTDF.

In 1995, Minerals Processing Corporation (MPC) purchased the Humboldt Mill property (excluding the HTDF) from Callahan to provide custom milling services. MPC intermittently operated some sections of the mill for custom dry grind contracts until it was closed in the late 1990s.

Kennecott Eagle Land, LLC (KEL), purchased the Humboldt Mill property from MPC in September 2008. In 2011, KEL acquired the Humboldt Mill Tailings Disposal Facility (HTDF) and surrounding property from Callahan Mining Corporation. Kennecott Eagle Minerals Company (i.e. Rio Tinto) applied and was awarded a Part 632 Mining Permit (MP 01 2010) on February 9, 2010. Additional permits required for construction and operations of the Humboldt Mill were obtained from 2010 through 2014. On July 17, 2013 the name of the mine changed from Rio Tinto Eagle Mine LLC to Eagle Mine LLC after Lundin Mining Corporation purchased 100% membership interest in the project. In a letter dated July 3, 2013 the Michigan Department of Environmental Quality (MDEQ) Office of Oil, Gas, and Minerals acknowledged the transaction and determined that no transfer of permits was required under the terms of Part 632, Nonferrous Metallic Minerals, of the Natural Resources Environmental Protection Act, 1994 PA 451, as amended.

3.1 Redevelopment

Based on the past site uses, the property retains an environmental legacy and is therefore classified as a brownfield site by the State of Michigan. One aspect of brownfield redevelopment is Due Care which is designed so contaminated properties can be safely redeveloped. Due care measures ensure that that existing contamination on a property does not cause unacceptable risks and is not exacerbated. In addition, Eagle entered into an Administrative Agreement and Covenant Not to Sue with the Michigan Department of Environmental Quality in May 2011. Eagle agreed to voluntarily

undertake certain environmental response activities designed to address soil and groundwater impact at the mill site which pre-date Eagle's ownership and operations at the site. Eagle agreed to delineate the extent of underground storage tank contamination, abandon unnecessary monitoring wells, and spend 1.3 million dollars to remove 15,000 tons of waste. To date, Eagle has spent approximately five million dollars on clean-up efforts with more than 25,000 tons of material being removed from the site. The following is a summary of the materials removed from the site.

Table 3.1 Materials Removed From the Humboldt Site During Redevelopment

Location	Quantity Removed	Units
Buried Pyrite Trench	8,089	tons
Former Crude Ore Stockpile	467	tons
Former Pyrite Stockpile	6,741	tons
Former Concentrate Stockpile	243	tons
Former Leach Residue Stockpile	3,366	tons
Cyanide, Liquid	49,476	gallons
Cyanide, Solid	175	tons
Asbestos	151	yards
PCB, Liquid	18.7	tons

Source: Humboldt Mill Waste Manifests

In addition to those items listed in the table above a significant volume of oils, greases, lab and processing chemicals, wastewater, pcb light ballasts, and scrap metal were also removed from the site.

Humboldt Mill Prior to Redevelopment, 2011

Humboldt Mill - Prior to Cleanup, 2010

4. Site Development and Construction Status

Initial construction began in 2011 with clearing, grubbing and excavating soils to accommodate future facilities and site features. Because the Humboldt Mill site is defined as a "facility" under Part 201 of P.A. 451, a site-specific soil relocation procedure was developed and mandated to conform with Section 324.20120c(6) of this regulation. This procedure ensured that the proper data and information was recorded to satisfy all requirements. Information required includes: Date of relocation, areas moved from and relocated to, soil characterization data (if applicable) and correspondence regarding the relocation event.

The majority of material (soil, rock, concrete, etc.) relocated onsite was moved to a central relocation area north of the secondary crusher building. A total of approximately 236,000 cubic yards (yd^3) of material was relocated on site between 2011 and 2014, with approximately 7,600 yd^3 of that being concrete from former foundations. 46,000 yd^3 was graded or relocated for features such as road base or the tailings line platform. Onsite relocation resulted in a cost savings from minimizing handling and landfill fees, but also conserved landfill space and eliminated the need for large haul trucks to travel on public roadways.

4.1 Soil Stockpiling and Erosion Control Measures

Soil Erosion and Sediment Control (SESC) measures have been fully implemented in accordance with Part 91 (NREPA, 1994 PA 451, as amended) around the site. To ensure the integrity of the installed controls, they are inspected on a weekly basis (except during frozen conditions) and after a 0.5" rain event or greater. Any issues identified are immediately addressed by onsite staff. Eagle environmental staff conduct the inspections and maintain the proper SESC and storm water certifications. Inspections are recorded in a logbook maintained at the mill administrative office.

During construction, best management practices were implemented onsite and included grading; roughening, seeding, and mulching; silt fencing or straw waddles around the site perimeter; and water on travel ways to control dust. As the majority of construction activities concluded in 2014, any exposed soil was seeded and mulched to encourage vegetative growth and reduce potential wind/water erosion. In addition, more permanent measures are being evaluated for implementation in the spring of 2015. These may include additional site grading, swales, and additional vegetative control measures.

4.2 Site Grading and Storm Water Control

The site grading plan was designed to direct storm water run-off to one of two locations; the HTDF or storm water retention basin. A series of catch basins have been installed along the length of the main facility from the rail spur to the guard house which direct storm water to the HTDF. Water which falls south of the main site access road, is directed to the storm water retention pond via a drainage ditch or series of catch basins in the administrative building parking lot. A copy of the Humboldt Mill Storm Water Drainage map is included in Appendix A.

The Storm Water Monitoring Plan was drafted in August 2010 and approved by the Michigan Department of Environmental Quality Water Resources Division in September 2010. The results of the short-term storm water characterization study outlined in the Monitoring Plan was submitted to the MDEQ in June 2014.

The Humboldt Mill currently has two storm water general permits, one which covers the main mill facility (MIS0058649) and a second which covers the HTDF (MIS0058649). Due to historical operations, the Humboldt Mill property is a "facility" as defined under Part 201 of Michigan's Natural Resources and Environmental Protection Act (NREPA) 1994 Michigan P.A. 451, as amended. Residuals from historic mining operations are present at the site and are expected to contact storm water, which could potentially be discharged from the mill areas via storm water drainage.

A storm water monitoring program (SWMP) was required under both the Part 632 mining permit and National Pollution Discharge Elimination System Wastewater Discharge Permit (NPDES). In an effort to limit redundancy, during negotiation of the Part 632 permit, MDEQ suggested that a single storm water monitoring plan be developed to fulfill both the NPDES storm water and Part 632 surface water monitoring requirements. On May 29, 2009, Eagle formally agreed in writing (Response to Comment No. C2) to the MDEQ's approach to combine storm water monitoring components from the NPDES and Part 632 permits into one inclusive monitoring plan.

A storm water pollution prevention plan (SWPPP) has been developed for both active storm water permits as required under Part I.B of Michigan's National Pollutant Discharge Elimination System (NPDES) General Permit for Storm Water Discharges and in accordance with good engineering practices. The SWPPPs describes the facility and its operations, identifies potential sources of storm water pollution at the facility, recommends appropriate best management practices (BMPs) or pollution control measures to reduce the discharge of pollutants in storm water runoff, and provides for periodic inspections of pollution control measures and annual review of this SWPPPs.

4.3 Site Modifications and Amendments

During final design of the Humboldt Mill site, modifications were implemented to improve overall environmental control, safety and project efficiency. These modifications were communicated to the MDEQ in the form of Part 632 mine permit amendment requests or notifications and approved by MDEQ as minor modifications to the permit. The structures that were constructed through 2014 are necessary to support ore processing and provide additional environmental protection.

In September 2011, prior to the commencement of permanent surface facilities construction, an amendment request was submitted to relocate the substation from north of the Mill Services building to east of the concentrator building. In addition, an amendment request was also submitted on May

17, 2012 to construct the Area 100 electrical building and administrative office and relocation of the employee parking lot, water treatment plant and guardhouse. The amendments were approved on December 1, 2011 and July 26, 2012 respectively. The primary purpose for relocating these facilities was for optimal environmental control of site water, reduction of underground piping, and safer traffic patterns.

On December 9, 2013, a request was submitted to lower the water level of the HTDF in preparation of operations in late 2014 and on February 7, 2014 a request to approve the cut-off wall for operation was submitted and approved by the Department on March 3, 2014.

A full summary of all permit amendment requests, along with additional submittals and approvals, can be found in Table 4.3 below.

A site map reflecting the approved relocations can be found in Appendix B.

Table 4.3 Amendments, Submittals, and Approvals

Y 2011 - 2014	Description	Approval
05/17/11	Executed the Covenant-Not-To-Sue with State of Michigan	NA
09/30/11	Request to relocate substation*	12/01/11
03/12	Final cutoff wall characterization report and basis of design	05/14/12
05/17/12	Request to relocate structures (WTP, etc) on site	07/26/12
11/22/13	Request to lower water level in HTDF (MDEQ response: no permit required)	12/09/13
12/20/13	Submitted final WTP designs to MDEQ	NA
02/07/14	Request to approve cutoff wall for operations	03/03/14
02/17/14	Submitted Environmental Monitoring Plans	06/04/14
05/30/14	Request to modify surface water metals analytical requirements	06/04/14
06/20/14	Submitted compliance monitoring well network construction information	NA
03/05/14	Submitted Malfunction Abatement Plan – Air Permit	NA
06/30/14	Submitted Pollution Incident Prevention Plan	NA
06/2014	Notification of Commencement of Milling	NA

*denotes an amendment

5. Construction

Initial construction, in the form of environmental remediation and cleanup inside the Humboldt Mill, began in October 2008 and was subsequently stopped the next month as all construction activities were put on hold. Construction remained on hold throughout 2009 as the project was redesigned to handle 2,000 metric tonnes per day. Remediation restarted in 2010 and continued steadily until May 2012 when it was slowed for the remainder of the year. In February 2013, the project was halted, but was released for construction in June 2013 when Lundin purchased the project. As construction of a facility or functional area was completed, commissioning commenced. Commissioning occurred between June – September 2014 with final completion of major construction and contractor demobilization occurring in October 2014.

Construction included the following:

- Site Grading and Paving
- Transfer Building, equipment , and conveyors
- Secondary Crusher Building, equipment, and conveyors
- Coarse Ore Storage Area, Primary Crusher and equipment, and conveyor
- Administrative office facility and parking
- Guard house at main entrance
- Water Treatment Plant
- HTDF Cut-off Wall
- Renovation and build out of existing Concentrator Building,
- Renovation of existing Mill Services Building for mill personnel, testing and quality laboratories, site vehicle maintenance/service shop, equipment rooms, and machine shops.

The following table lists the square footage of the main mill facilities and construction timeline.

Table 5. Square Footage and Construction Timeline of Key Facilities

Facility	Area (FT^2)	Construction Started	Construction Completed
Coarse Ore Storage Area (COSA) - Includes crusher pit	34,464	April 2013	October 2014
Secondary Crusher Building	6,000	April 2013	October 2014
Transfer Building	708	April 2013	October 2014
Concentrator Building	53,052	April 2013	October 2014
Water Treatment Plant (WTP)	11,050	September 2013	June 2014
Concentrate Load Out Building (CLO)	17,280	April 2013	October 2014
Mine Services Building (MSB)	33,000	April 2012	September 2014
Administrative Building	12,240	April 2012	September 2012

Humboldt Mill, July 2013

Humboldt Mill, September 2013

Humboldt Mill, April 2014

Humboldt Mill, September 2014

5.1 Facility Construction

Construction at the mill included the engineering, design, and construction of the WTP, COSA, Secondary Crusher, transfer building, CLO, and Administrative building and reuse and refurbishment of the existing ball mills and incline conveyor from the transfer building to the fine ore bin area. The existing concentrator and mill services buildings were refurbished and upgraded to meet current requirements. At the peak of construction, more than 500 craft were working onsite in order to complete the project on schedule.

5.1.1 Water Treatment Plant

In December 2013, final WTP designs were submitted to MDEQ for review, and approval. Construction of the WTP commenced in September 2013. Commissioning began in June 2014 and the first discharge of treated water to the wetland occurred on August 25, 2014. All documents and information required per the State of Michigan issued National Pollutant Discharge Elimination System (NPDES) Permit (MI0058649) were submitted, and if applicable, approved by MDEQ.

Water Treatment Plant, September 2014

5.1.2 Coarse Ore Storage Area (COSA)

The COSA is a 34,500 square feet facility that is used to store mined ore that has been transported from the mine site and is awaiting processing. The COSA is an enclosed building with the exception of two roll-up doors on the east and west ends of the building that allows entrance and exit of the haul trucks off-loading ore from the Eagle Mine Site and one additional roll-up door on the east end that allows additional access to the facility. The COSA contains a rock breaker that is mounted adjacent to the primary crusher and is used to reduce oversized rocks entering the system. The primary jaw crusher reduces the size of the ore from run-of-mine to minus 100 millimeters and is equipped with a water spray to suppress dust.

In addition, in accordance with mining permit condition E-4, the COSA is equipped with a water hose to manually wash the ore trucks, if necessary, prior to leaving the facility. All wash water is collected in the COSA sump and pumped to the HTDF via the storm drain, for eventual treatment in the water treatment facility.

Coarse Ore Storage Area, September 2014

5.1.3 Secondary/Tertiary Crusher

Crushed material is conveyed from the primary crusher to the 6,000 square foot secondary crusher building via an enclosed conveyor. In the secondary crusher, the primary crushed ore is screened with pieces greater than minus 12 mm in size being sent to the secondary cone crusher. Pieces smaller than minus 12 mm are sent to the transfer building discharge conveyor. After crushing, the material is again screened and if found to be oversized is sent to the tertiary cone crusher. Once material is crushed to less than minus 12 mm in size it is sent to the covered discharge conveyor to the fine ore bins. All air exhausted from the secondary crusher building is vented through a baghouse dust collector. The equipment is maintained in accordance with manufacturer's specifications and the Humboldt Mill Permit to Install (405-08) issued by the MDEQ Air Quality Division.

Crushing Circuit – Secondary & Tertiary Crushers and Transfer Building, September 2014

5.1.4 Fine Ore Bins

There are three 2,000 tonne capacity fine ore bins in which the crushed ore is stored prior to being introduced into the grinding process. The bins are fed through a series of diverter gates and conveyors to drop points. Particulate emissions from the bins and drop points are controlled by a baghouse dust collector which is also regulated under the Humboldt Mill Permit to Install (405-08) issued by the MDEQ Air Quality Division.

5.1.5 Concentrator Building

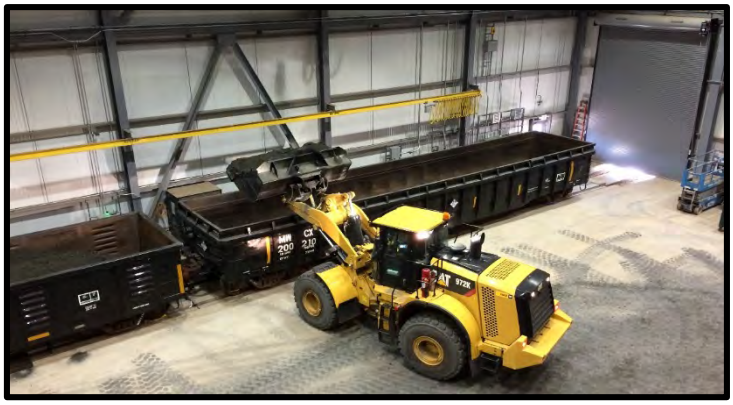
The concentrator building is a 53,000 square foot facility in which ore processing occurs. The fine ore is made into a slurry by addition of water before entering the grinding process which consists of two refurbished ball mills which grind the ore to a size of 80% passing 80 microns. The material then enters a flotation process where the copper and nickel are separated. The concentrate from the flotation circuits enters the concentrate thickeners where it is thickened and pumped to agitated stock tanks, one for nickel and one for copper. Concentrate from the stock tanks is pumped to automatic pressure filters where the moisture content will be reduced to approximately 15%. The concentrate filter cake from the pressure filters discharge directly to the concentrate load out building.

Concentrator and Concentrate Load-out Buildings, September 2014

5.1.6 Concentrate Load Out

The CLO is a 17,000 square foot facility in which the nickel and copper concentrate is stored until it is loaded into railcars. The building is fully enclosed with the exception of two roll-up doors on the east and west ends that allow for the entrance and exit of rail cars. Railcars are loaded using front end loaders in accordance with the Concentrate Loadout Operations Standard Operating Procedure (SOP). All railcars are covered and as noted in the CLO SOP, cleaned of dust and debris, using a broom, prior to leaving the facility.

The nickel sulfide concentrate, stored in the CLO, has been identified as potentially self-heating. Operators closely monitor the material for oxidation using an infrared laser gun thermometer. Material exhibiting signs of self-heating is immediately compacted or exposed and spread out depending on the situation.



Loading Concentrate into Railcars, September 2014

5.1.7 Tailings Management

From the flotation circuit, tailings is dewatered to approximately 60% solids. Tailings slurry is then pumped via double walled high density polyethylene (HDPE) pipe to the HTDF where it is sub-aqueously disposed to one of three discharge points. Disposal of tailings in the HTDF is authorized by the Inland Lakes and Streams Permit that was originally issued in 2010 and renewed in September 2014. The tailings flow rate is continually monitored and recorded in accordance with mining permit condition F-8.

HTDF Tailings Management, September 2014

5.1.8 Cut-off Wall

Prior to the construction of the cut-off wall, water was allowed to exit the HTDF via surface and subsurface drainage into the wetlands and underlying glacial outwash at the north end of the pit. In order to ensure that virtually all water released from the HTDF is treated, and in accordance with the Mining Permit, a low permeability cut-off wall was constructed on the north end of the HTDF. Construction of the cut-off wall began in the summer of 2012 and was approved for operations by the Department in February 2014. The cut-off wall extends approximately 2,234 lineal feet and is keyed into the bedrock outcrop near elevation 1,543 feet above mean sea level (MSL).

Construction of the cut-off wall was performed between August 2012 and September 2013 and included both the installation of a soil bentonite slurry wall and grouting of high permeability material below that wall. The work was in accordance with the design and standards approved by MDEQ in May 2012. Hydraulic gradient performance testing was conducted by Golder and Associates and North Jackson Company. Based on the results of the performance testing, MDEQ approved the cutoff wall for operations on March 23, 2014.

Additional characterization of the cut-off wall and possible grouting will continue as operations occur to support Eagle's final closure plan and ensure no perpetual care.

Cut-off Wall Construction, September 2013

5.1.9 On-Site Utilities

In 2010, an agreement was signed with WE Energies to provide the power necessary to complete construction of the mill and axillary facilities. A second agreement was signed with UPPCO to provide power to the mill during operations. A substation was required to be constructed; Eagle poured the concrete foundation and UPPCO furnished and installed the equipment.

The Humboldt Mill is serviced by a Type IIb non-transient potable water system and Type III industrial water well both of which were installed in the fall of 2012. The wells were registered in October 2013 with the MDEQ through the Water Withdrawal Assessment Tool for an aggregate total capacity of 140 gpm (70 gpm potable, 70 gpm industrial). Water use from the potable and mine services wells is reported to the MDEQ by April 1 of each year. In early 2014, an arsenic treatment system was added

to the potable water system due to arsenic levels that were greater than the Maximum Contaminant Level (MCL) set by the Michigan Safe Drinking Water Act.

The Humboldt Mill uses a septic system to treat sanitary water from shower and bathroom facilities. Installation of the septic system was completed in the summer of 2012.

5.1.10 Miscellaneous

Eagle completed construction of ancillary facilities including the administrative building in 2012 and guard house, rail spur, catch basins, site grading, and paving in 2014. In addition, a permanent chain link fence delineating the property boundary was partially installed in 2013 and completed in the fall of 2014 after the conclusion of construction.

Administrative Office, September 2014

6. Processing Activities and Data Report

Commissioning of the mill processing equipment began in June 2014 and included individually testing each piece of equipment. Once all of the pieces in a functional area were tested, commissioning of a system or circuit could occur. Commissioning concluded with the handover of the mill from construction to operations on September 18, 2014. Five days later, on September 23, 2014, the mill was officially operating and producing concentrate. The commencement of milling activities initiated all monitoring programs per the Part 632 Mining Permit. A description of the monitoring activities can be found in Section 9 of this report.

6.1 Processing Report

In 2014, nearly 185,000 dry tonnes of ore was transported from the Eagle Mine to the mill by over the road haul trucks. Crushing of ore began in August 2014 with the remainder of milling operations beginning in September 2014. Table 6.1 below summarizes the dry tonnes of ore crushed and milled and the total volume of nickel and copper concentrate produced in 2014.

Table 6.1 Volume of Ore Crushed, Milled, and Concentrate Produced in 2014

Month	Ore Crushed (dry tonnes)	Ore Milled (dry tonnes)	Copper Concentrate Produced (dry tonnes)	Nickel Concentrate Produced (dry tonnes)
August	6,303	0	0	0
September	30,187	36,110	633	1,791
October	55,666	52,351	2,713	9,097
November	35,053	34,598	2,393	5,771
December	51,300	50,590	2,906	12,480
2014 Annual Total	**178,508**	**173,648**	**8,644**	**29,138**

Source: Mill Operations Year End Reconciled Report

In 2014, 8,593 dry tonnes of copper and 28,742 dry tonnes of nickel were shipped offsite via rail. Mineral Range manages rail shipments from the Humboldt Mill to the Ishpeming Rail Yard and from there Canadian National (CN) transports the material to its final destination.

First rail cars leaving mill site, October 1, 2014

6.1.1 Tailings

Tailings are the waste material that is generated when processing ore. At the Humboldt Mill, tailings are subaqueously disposed in the HTDF which is an industry best practice to minimize the risk of oxidation of sulfide bearing material. The tailings slurry is comprised of finely ground waste rock, water, and process effluents and is deposited in the HTDF via a double-walled high density polyethylene (HDPE) pipeline. At the shoreline of the HTDF, the pipeline splits and the tailings can be routed to one of three subaqueous outfalls located in either the north, middle, or southern portion of the HTDF. Multiple outfalls allows for better control of the thickness of tailings in an area and optimizes the storage volume that is available. In 2014, 85,574,563 gallons of tailings slurry was routed to the northern outfall at an average rate of 468 gallons per minute.

The Metallic Minerals Lease (No. M-00589) requires the lessee to furnish a mill waste reject report on an annual basis. In 2014, 1,035 tonnes of nickel and 256 tonnes of copper were deposited in the HTDF as tailings.

In accordance with permit condition, F-7, an annual bathymetry survey was conducted in order to accurately monitor tailings placement and calculate changes in HTDF water storage. Since 2014 marked the start of operations, two surveys were completed; the first was a baseline survey conducted in the summer prior to the start of operations and a second was conducted in November after operations commenced. A copy of both bathymetry surveys are available in Appendix C.

7. Site Water Usage, Treatment and Discharge

Three separate water sources supply the facility with either potable or process water which is necessary for operational activities to occur. The site water balance is comprised of process water, precipitation, groundwater infiltration, and stormwater runoff all of which is captured in the HTDF and treated by the WTP before discharging to a nearby wetland.

7.1 Supply Water Sources and Use

Three separate sources supply water to the mill site to support various operational activities. These sources include the potable well, industrial well, and reclaim water from the HTDF. Utilizing the detailed water use logs maintained on site, the following summary of average water use from each source has been compiled.

The potable well is used to supply potable water to the facility. Potable water may also be utilized to replenish the fire water tank and to supplement process water requirements. In 2014, approximately 6.6 million gallons of water was drawn from the potable water well.

The industrial well is primarily used to replenish the fire water tank and to supplement process water requirements. In 2014, approximately 4.3 million gallons of water was utilized from the industrial well.

The third source of water at the mill site is the reclaim water which pumped from the HTDF. This water is used throughout the process with the volume not consumed being recycled back to the HTDF via tailings. Reclaim water is used whenever possible in the process as it encourages recycling, reduces reliance on well water, and minimizes the volume of new water entering the HTDF which helps maintain the site water balance. In 2014, approximately 76 million gallons of reclaim water was pumped from the HTDF for use in processing ore. With the exception of approximately 836,000 gallons of water that was contained in the concentrate and shipped offsite, the remainder of the water was recycled back to the HTDF for eventual reuse or treatment by the WTP.

7.2 Water Treatment Plant Operations and Discharge

Operations at the WTP began with commissioning during August 2014. During this phase of start-up, all water treated in the plant was recycled back to the HTDF. Discharge from the WTP commenced on August 25, 2014 when tailings from commissioning were first deposited in the HTDF.

Effluent discharges to the wetland are regulated under the NPDES permit MI0058649 with analytical results and discharge volume reported to the MDEQ on a monthly basis through the e2 electronic reporting system. Table 7.2 below summarizes the monthly flow rate from the WTP to the wetland in 2014.

Table 7.2 Volume of Water Discharged from the WTP in 2014

Month	Volume of Water Discharged (Million Gallons)
August	7.11
September	23.42
October	20.82
November	21.17
December	23.76
Total	**96.28**

Source: WTP Operators log

During the week of September 15, 2014 the Mill WTP toxicity test results exceeded the allowable toxicity concentration. A new sample was immediately collected and a new toxicity test started which reported results within allowable ranges. Results of the investigation concluded that the harmful effects were likely due to chlorine that was left in the system after cleaning of the ultrafiltration units. Chlorine levels are now being monitored following a cleaning and water is diverted back to the tailings facility if the chlorine is above a specified level. Two inline chlorine analyzers were installed in January 2015 to continuously monitor the chlorine levels and automatically divert water to the tailings facility if it is outside of a specified value. Appropriate verbal and written notifications per the NPDES Permit were provided to MDEQ Water Resources Division.

The water treatment process generates one waste stream; filter press. The filter press waste stream is dewatered solids from the clarifier and is primarily comprised of iron, calcium, and magnesium. Waste characterization samples are required by the landfill prior to acceptance of the material. Samples from the filter press waste stream were sent to ALS Laboratory for analysis and results indicate the waste stream is non-hazardous. From September through December 2014 approximately 14 tonnes of filter press waste was disposed at the Marquette County Landfill.

Water Treatment Plant Ultrafiltration Units, August 2014

7.3 Water Balance

As stated above, the main components of the water balance are process water, precipitation, groundwater infiltration, and storm water runoff all of which is captured in the HTDF and treated by the WTP before discharging to a nearby wetland. Permit condition F-2 requires that the site water

balance is updated on a quarterly basis to ensure the water level of the HTDF is managed in a manner that minimizes risk to the environment. Eagle intends to operate the HTDF at a water elevation between 1529 – 1534 MSL and has developed a water balance spreadsheet that takes into account historical seasonal precipitation and groundwater infiltration rates, calculated storm water runoff rates, process water use, and WTP discharge rates. This information is used to track HTDF water elevations, predict seasonal fluctuations in the HTDF water level and to help determine if operational adjustments are necessary. HTDF water levels are recorded at least weekly by Environmental Department staff and updated in the spreadsheet to ensure that the water balance is being maintained in the predicted manner. In the event that deviations in the predicted levels occur, a review of water inputs will be conducted to determine where the gap exists and what operational changes need to occur in order to maintain the predicted water level. A summary of the 2014 HTDF water levels and current water balance graph is included in Appendix D.

8. Materials Handling

8.1 Fuel Handling

There are currently no permanent fuel storage tanks onsite. At this time, a fuel provider comes to site daily and fuels all mobile equipment. Eagle also has one light duty truck, equipped with a diesel tank that may also be used to re-fuel equipment when necessary.

8.2 Bulk Chemical Handling and Storage

Due to the type and volume of chemicals required for operations, various plans and reporting requirements were necessary upon initial receipt of the products. These obligations include preparation of the Pollution Incident Prevention Plan (PIPP), Spill Prevention Control & Countermeasures Plan (SPCC) and SARA Title III, Tier II Reporting.

The PIPP was developed in accordance with administrative rule R324.2006(2) of Part 31, Water Resources Protection of NREPA, 1994 PA 451 as amended and the facility's Mining Permit. The document details the types, quantities, and location of chemicals stored onsite as well as spill procedures and emergency contact information. A copy of the PIPP was provided to the MDEQ, the Marquette County Local Emergency Planning Committee, and the Marquette County Health Department in June 2014.

A Spill Prevention Control and Countermeasures Plan was also developed in July 2013 as required by 40 CFR Part 112 and the Mining Permit. Like the PIPP, this plan outlines the locations of fuel and petroleum product storage and details spill response and emergency action plans related to the discharge of such products.

In addition to the plans listed above, the Michigan SARA Title III Program requires reporting of onsite chemicals being stored above certain threshold quantities. Due to the volume of chemicals stored at the WTP and concentrator building, an initial Tier II Update Report was submitted in August 2014 via the online Tier II Reporting System to the State Emergency Response Commission (SERC). Copies of the report were also mailed to the Marquette County Local Emergency Planning Committee (LEPC) and Humboldt Township Fire Department.

In 2014, the Humboldt Mill had zero reportable spills under the Part 5 Rules of Part 31, Water Resources Protection of NREPA, 1994 PA 451 as amended (Spillage of Oil and Polluting Materials).

9. Monitoring Activities

Several permit required monitoring activities commenced in 2014 with the start of milling operations. Many of these activities will provide the final baseline analysis of conditions and are discussed below.

9.1 Water Quality Monitoring

A significant amount of surface water and groundwater quality monitoring is required both on and surrounding the mill site. Following is a summary of the water quality monitoring activities.

9.1.1 Quarterly Groundwater Quality Monitoring

Groundwater quality is monitored through a network of monitoring wells located inside the perimeter fence line of the mill site. A map of the well locations can be found in Appendix E. With the exception of a few wells that were installed in 2008, the majority of the wells located near the cut-off wall were installed from October 2013 through January 2014. Monitoring wells located near mill facilities were not installed until later, April through August 2014, due to construction activities occurring at locations selected for monitoring well installation.

The commencement of mill processing in September 2014 initiated the first round of quarterly groundwater monitoring which was completed in November 2014. Samples were collected in accordance with the Eagle Project Quality Assurance Project Plan and Standard Operating Procedures (North Jackson, 2004a and 2004b) and the results are summarized and compared to benchmarks in the tables found in Appendix F.

Benchmark Calculations

In 2014, two sets of benchmarks were calculated for all mine permit groundwater monitoring locations based on the guidance provided by the MP 01 2010 and Part 632. The benchmark that is used for screening monitoring data is the lower of the two values. Due to the required statistical nature of these benchmark values, the accuracy will improve over time as the quantity of data that becomes available increases. If data collected during future monitoring events is deemed to be representative of baseline conditions it may be incorporated into the benchmark calculations. Following is a description of the current calculated benchmarks:

- Upper prediction limit (UPL) benchmark: Per reporting requirements under R 426.406(6) and General Condition L2 of MP 01 2010, the UPL has been developed as the upper threshold limit for increased monitoring and is based on a statistical analysis of qualified baseline data. Data outliers are not included in the baseline information. The UPL benchmark represents a value that is two standard deviations above the long-term average. Again, as the data set increases over time, the long term average and standard deviations may need to be adjusted for improved accuracy.
- Maximum contaminant level (MCL) derived benchmark: Per reporting requirements under R 426.406(7a), the MCL benchmark was developed as an upper threshold action limit and represents the value ½ way between the long-term average and the drinking water standard

(MCL) determined by US EPA. These values may also be reviewed and adjusted as the data set increases over time.

Monitoring Results

Twenty-four monitoring well samples were collected during the Q4 2014 sampling event. Samples were collected using low-flow sampling techniques, and field parameters (DO, ORP, pH, specific conductivity, temperature, turbidity) are collected and analyzed using a flow-through cell and YSI probe. In accordance with Permit Condition J-9, samples are analyzed for parameters specified in Table 5-2 of the Mining Permit Application. Table 5-2 prescribes a long parameter list that is collected annually (Eagle will collect annual parameter list in Q2) and a short list that is analyzed for the remaining three quarters. Since operations started in Q4, the short parameter list was analyzed for samples collected in November 2014. All samples are shipped overnight to TriMatrix Laboratories in Grand Rapids, Michigan, for analysis.

The following is a summary of observations and events that occurred in 2014:

- Due to turbidity levels that exceeded 3 NTU, fourteen monitoring locations required field filtering of metals and major cation samples and therefore the values are reported as dissolved concentrations. The remaining locations reported turbidity below 3 NTU and are reported as total concentrations. The sample summary denotes whether the sample values are total or dissolved.
- Four of the monitoring locations (i.e. MW-702 UFB, MW-703 UFB, HW-1L, and HW-1U LLA) are very slow to recharge and are pumped down in advance of sampling in order to ensure that the samples collected are representative of the groundwater at the monitoring location. Locations MW-702, MW-703, and HW-1L take approximately one month to recover while HW-1U takes approximately four months to recover due to the tight formation in which it is located.
- The majority of parameters analyzed reported values below the analytical reporting limit and calculated benchmark, and are listed as non-detect.
- The majority of the results that reported results outside benchmarks were either at or just above the calculated value. The benchmarks are based on a very small sample set of three to five results most of which were collected in 2014 during monthly sampling events that occurred after well installation was completed. This limited data set does not take into account any seasonal variation that may be seen in the wells nor has enough time passed to evaluate natural variability that may occur after well installation. In many cases, the benchmark is set at the default of four times the reporting limit due to all non-detect results. All results will continue to be closely monitored for changes and as more data is collected trend analysis will be completed as required by MP 01 2010 special condition L2.

A summary of sample results and benchmark deviations can be found in Appendix F.

9.1.2 Quarterly Surface Water Quality Monitoring

In accordance with special permit condition, J-10, eight surface water monitoring locations are sampled on a quarterly basis. Four locations are associated with surface water resources in the subwatershed containing the HTDF and four are associated with the subwatershed of the milling facility. The monitoring locations in the subwatershed of the HTDF includes one location in Wetland EE and three locations on the Middle Branch of the Escanaba River, one of which, MER001, is outside the influence of the HTDF and is therefore considered a reference monitoring location. The monitoring locations in the subwatershed of the mill includes a drainage structure downgradient of the mill and three locations on the Black River. Again one of the three locations, WBR001, on the Black River is outside the influence of the milling facility and is considered a reference monitoring point for the subwatershed containing the mill. A map of the surface water sampling locations is found in Appendix G.

The commencement of mill processing in September 2014 initiated the first round of quarterly surface water monitoring which was completed in Q4 2014. Samples were collected in accordance with the Eagle Project Quality Assurance Project Plan and Standard Operating Procedures (North Jackson, 2004a and 2004b) and the results are summarized and compared to benchmarks in the tables found in Appendix H.

Benchmark Calculations

Similar to the groundwater benchmarks discussed in section 9.1.1, upper prediction limits (UPLs) were calculated for all surface water monitoring locations based on the guidance provided by MP 01 2010 and Part 632. The UPL, which follows Part 632 R 426.406 (6), was calculated by adding two standard deviations to the baseline mean. MP 01 2010 L2 also requires that seasonal variation be accounted for when calculating benchmarks. To date, a large enough sample set has not been collected during each of the four seasons and therefore are not incorporated into the current benchmarks. As additional samples are collected, the benchmarks will be recalculated to account for seasonal variation as required by MP 01 2010 L2. Until that time, benchmarks are based on baseline data collected in February, May, July, and October 2008 and May, July, and September 2014.

Monitoring Results

The first round of surface water sampling was conducted in November 2014, at seven of the eight locations listed above. Location HMP-009 was unable to be sampled due to low water levels. The Humboldt Mill Surface Water and Sediment Monitoring Plan prescribes a long parameter list that is collected annually (Eagle will collect annual parameter list in Q2) and a short list that is analyzed for the remaining three quarters. Since operations started in Q4, the short parameter list was analyzed for samples collected in November 2014. In addition to the grab samples, field measurements (DO, pH, specific conductivity, temperature) were collected and determined through the use of an YSI probe. The stream stage and flow measurements were obtained, where conditions allowed, using a wading rod and current meter. All water quality samples were shipped overnight to TriMatrix Laboratories in Grand Rapids, Michigan, for analysis.

Following is a summary of the 2014 events that occurred.

- Each of the monitoring locations sampled in Q4 reported results for pH that were below established benchmarks and greater than benchmarks for selenium. Lower pH and higher

selenium results were seen throughout the monitoring network, including the reference locations and therefore are not likely attributable to mill operations.

- All monitoring locations sampled in Q4 on the Main Branch of the Escanaba River (MER) reported results for zinc that were greater than established benchmarks. Since zinc was detected at the reference location as well as compliance points, the deviations are not likely due to mill operations.
- Compliance monitoring location WBR-002 reported detections of cobalt, copper, lead, and total suspended solids that were greater than established benchmarks. This location is downgradient of surface water monitoring location HMWQ-004 and therefore if results were attributable to mill operations they would likely be present at HMWQ-004 as well, which they are not.

As reported above, the benchmarks were calculated using all baseline data available and do not take into account seasonal variation at this time. A large enough sample set was not available to complete the statistical analysis for each of the four seasons. As additional samples are collected, the benchmarks will be recalculated to account for seasonal variation as required by MP 01 2010 L2. Until that time, benchmarks are based on all baseline data available for the monitoring location and therefore should be considered estimated values.

A complete list of results and applicable benchmarks are found in Appendix H.

9.2 Sediment Sampling

Sediment monitoring is required to be conducted on a biannual basis for parameters listed in Table 2 of the Humboldt Mill Surface Water and Sediment Monitoring Plan. Seven monitoring locations have been identified and are co-located with surface water monitoring stations. They include reference stations MER-001 and WBR-001, HTDF-sub watershed monitoring stations MER-002, MER-003 and HMP-009 and Mill-sub watershed monitoring stations HMWQ-004 and WBR-003. One baseline sample was collected in May 2014 prior to the start of operations. The first operational samples will be collected in 2015.

9.3 Regional Hydrologic Monitoring

9.3.1 Continuous Groundwater Elevations

Monitoring wells MW-701, MW-702, MW-703, MW-704, HYG-1, HW-2, HW-1U, HW-1L, HW-8U are instrumented with continuous water level meters and downloaded quarterly by Golder & Associates field technicians. Permit condition F-9 requires that water levels are continuously monitored in Wetland EE and the HTDF. A stilling well is being installed in the HTDF in the spring of 2015 in order to continuously monitor HTDF water levels. Currently water level readings are recorded on a weekly basis using a staff gage installed on the north end of the HTDF. A map of monitoring locations can be found in Appendix E.

Special Condition F-9a requires continuous monitoring of water levels on each side of the cutoff wall and a comparison of the gradient changes actually measured versus earlier predictions. During the application process, the operating level of the HTDF was expected to be approximately five feet higher

than the elevation of the wetland outside of the containment area. Therefore, a significant change in water elevations between the inside and outside of the cutoff wall was expected. Following construction of the cutoff wall, those predicted changes were measured in the field and submitted with a request to begin operations. It was anticipated that this approach would be used throughout operations because of the water elevation difference and water management plan.

However, to ensure operational flexibility and as an additional contingency for extra storage capacity in the case of severe wet weather events, WTP shutdown, or other issue, the water management plan was modified and the operating water level was revised to ten feet lower than originally planned. This brings the operational HTDF water level to an elevation less than the wetland located on the outside of the containment area. Therefore, the predicted gradient measurements originally calculated with a high HTDF elevation can no longer be used as measurement of effectiveness of the cutoff wall. In addition, the water elevation cannot be compared in the reverse direction due to outside influences on the water levels in the wetland.

Another requirement to ensure an effective cutoff wall is to monitor the chemical signatures between the HTDF water, groundwater wells within the containment area and the water results from the groundwater wells outside the containment area. This will continue to be the method utilized to verify the integrity of the cutoff wall and is discussed in Section 9.4 below. If at any time during operations the water level rises to levels above the elevation of the downstream wetland, gradient changes will again be measured and discussed.

The continuous readings have been plotted in order to easily visualize the variations that have occurred since their installation in September 2014. Copies of groundwater hydrographs are located in Appendix I. Unfortunately, due to the short time frame in which the meters have been operational, seasonal variation is still largely unknown. The shallow wells are more strongly influenced by natural infiltration (i.e. rainfall and snowmelt) and recharge typically occurs during limited times of the year; spring and late fall. During those periods rainfall tends to be longer duration and lower intensity which facilitates groundwater recharge. Cooler weather and less vegetation in the spring and late fall results in greater recharge while high temperatures and thick vegetation decrease recharge. During winter when the ground is frozen, recharge is almost non-existent. For the shallow wells strongly influenced by precipitation, the water levels generally increase with the onset of spring melt, decrease slightly in the summer, increase during the fall rainy season, and then decline again in the winter as there is little to no recharge during frozen conditions. A review of the hydrographs found the following:

- The hydrographs clearly illustrate when the wells are pumped down in advance of, or during, sampling and the rate in which they recharge.
- In general, the water levels remained fairly consistent over the course of the last quarter.
- HW-1L, HW-1U LLA, MW-702 UFB, and MW-703 UFB are located in a tight formation and are very slow to recharge. HW-1L, MW-702 UFB, and MW-703 UFB took approximately one month to recharge and HW-1U LLA took almost four months to fully recharge.
- As expected, HTDF surface water elevations were consistently lower than monitoring well water elevations, with the exception of HW-1L and HW-1U LLA that are located in a tight formation and are very slow to recharge.

- Some of the shallower, quaternary aquifer wells displayed signs of seasonal influence as groundwater elevations decreased as frozen conditions set-in.

9.3.2 Continuous Surface Water Monitoring

In accordance with permit condition F-9, Wetland EE is required to be instrumented with a meter to continuously monitor water levels. However due to the construction of the cut-off wall, recharge is now primarily based on precipitation (i.e. rain and snow melt). Due to this change, continuous measurements or water quality samples could not be collected in the fall of 2014 due to limited water in the wetland. When adequate water is available for continuous water level readings and sample collection, monitoring will resume.

9.4 Cut-Off Wall Water Quality Review

In accordance with permit condition F-9, Eagle is required to monitor the effectiveness of the cut-off wall in terms of hydraulic containment. This is best accomplished by review of water levels and chemical signatures between the leachate (i.e. MW-701 and MW-702) and compliance monitoring wells (MW-703, MW-704). Focus of the review is on water levels in the quaternary unconsolidated formation (QAL) and chemical signature in the upper fractured bedrock zone (UFB).

Leachate wells are located on the south side of the containment wall and should show similar water levels and chemical signatures of the HTDF. The compliance wells are downgradient of the leachate wells and are located on the north side of the containment wall and should be outside the influence of the HTDF.

Chemical Signature Review

- The majority of the parameters were non-detect at each of the leachate and compliance monitoring locations.
- A large variation in iron, manganese, and hardness results was present between the leachate and compliance monitoring locations.
- In the quaternary unconsolidated formation, the iron and manganese results were significantly higher at compliance location MW-704 than were reported at leachate well MW-701. The opposite is true when reviewing results from the upper fracture bedrock zone where iron and manganese were significantly higher at MW-701.
- At leachate location MW-702 QAL manganese, calcium, sodium, and hardness were greater than results reported at compliance location MW-703 QAL.
- Iron was greater at leachate location MW-702 UFB than compared to compliance monitoring location MW-703 UFB.

Water Level Review

- There is a distinct difference in groundwater elevations between MW-702 QAL and MW-703 QAL. As expected due to the operating level of the HTDF, compliance monitoring location MW-703 QAL, has a groundwater elevation that is approximately five feet greater than

leachate well MW-702 QAL. The groundwater elevation at MW-702 QAL closely mimics the groundwater elevation of the HTDF.

- As predicted due to the operating level of the HTDF, compliance monitoring location MW-703 UFB has a groundwater elevation that is slightly greater than leachate well MW-702 UFB. Groundwater elevations at MW-702 UFB trend closely with HTDF water levels.
- The groundwater elevation at MW-701 QAL and UFB closely followed that of the HTDF, while the groundwater elevations at MW-704 QAL and UFB steady declined as the winter progressed. It appears that this well is strongly influenced by natural infiltration (i.e. rain and snow melt) which is lacking during the winter months due to frozen conditions. Groundwater elevations should begin to increase again as snowmelt commences.

Based on the review of the chemical signature and groundwater elevations of the leachate and compliance monitoring wells there is enough evidence to prove that the cut-off wall is functioning as expected. The variability in the detected parameters, difference in reported results, and groundwater elevations all demonstrate that the effectiveness and integrity of the containment wall are intact.

9.5 Biological Monitoring

The final baseline biological monitoring events were conducted during 2014. Monitoring events included surveys of birds, large and small mammals, frogs, toads, fish and macro invertebrates and smallmouth bass metal tissue monitoring. Results from each survey have been compiled into annual reports which are available upon request. A brief summary of each survey is provided below.

9.5.1 Flora and Fauna Report

The 2014, King & MacGregor Environmental, Inc. (KME) continued their ecological investigation of birds, large and small mammals, and frogs and toads within the study area. This was the final baseline survey to be completed and encompasses the areas in and around the Humboldt Mill site. Previous surveys were completed by KME in 2007 and 2008. Table 9.5.1 below outlines the type and duration of the surveys that were conducted in 2014.

Table 9.5.1 Type and Duration of 2014 Ecological Investigation

Survey Type	Survey Date
Birds	June 12-13, 26, September 17-18
Small Mammals	September 16-18
Large Mammals	May - September
Toads/Frogs	May 28, June 9
Threatened and Endangered Species	May – September

The wildlife and plant species identified during the 2014 surveys within the Study Area are similar to those identified during previous KME surveys. Following is a summary of the survey results:

- A combined total of 738 birds representing 57 species were observed during the 2014 (June and September) surveys. In June, the Red-winged blackbird and American robin were the most abundant birds observed, while the Canada goose was the most abundant species observed during the September 2014 survey. The bird species identified during the 2014 bird

surveys are similar to those bird species identified in previous surveys conducted within the Study Area and are consistent with the bird species expected to be found in the habitats present.

- Twenty-nine small mammals representing eight species were collected during the September survey period. The most common small mammal identified during the survey was the deer mouse. No threatened, endangered, or special concern small mammals were observed during any of the surveys. The small mammals encountered within the Study Area during the 2014 surveys are typical of those expected in the habitats present and are consistent with previous survey results.
- Whitetail deer tracks were observed throughout the study area and coyote vocalizations were heard during the 2014 frog and toad surveys. The large mammal species detected during the 2014 surveys are two regionally common large mammal species and are expected to utilize the habitats present.
- Four frog species were heard during the survey; none of which are threatened or endangered. All five of the sampling points exhibited use by frogs for breeding. The most frequently heard species in 2014 was the northern spring peeper. The frog species identified are typical of those expected in the habitats present in the Study Area. The 2014 survey results are similar to those of previous years.

9.5.2 Threatened and Endangered Species

The Michigan Natural Features Inventory (MNFI) maintains a database of rare plants and animals in Michigan. KME requested a Rare Species Review to determine if any protected species had been found within 1.5 miles of the Study Area. The MNFI review returned the following species:

Table 9.5.2 MNFI Review Results of Study Area

Species	Classification
Canada rice grass	State threatened species
American bittern	State special concern species
Bald eagle	State special concern species
osprey	State special concern species
Great blue heron rookery	Rare natural feature

In accordance with Michigan Department of Natural Resources (MDNR) guidelines (MDNR 2001), KME surveyed for any MNFI listed species and their habitats during the appropriate season. Following are the results of the T&E species survey:

- Canada grass was not observed in 2014 and is not expected to occur in the study area due to the lack of suitable habitat.
- A total of five American bittern observations were made during the 2014 bird surveys at Survey points 4 & 5. The species appears to tolerate the current activities as Survey Point 4 is immediately adjacent to the Mill site and County Road 601.

- Although suitable habitat for bald eagles and osprey is present in the study area, no birds were directly observed in 2014.
- The great blue heron rookery was occupied by ten breeding pairs and appears to be robust and unaffected by the presence of the mill.

Canada Rice Survey Point, June 2014

Survey Point 8 – East View, September 2014

9.5.3 Fisheries and Macro Invertebrate Report

The June 2014, the fisheries and macro invertebrate annual surveys were conducted by Advanced Ecological Management (AEM). This was the final baseline study to be completed prior to the start of operations. Previous surveys were completed in 2006 through 2008. A total of six stations were surveyed during the summer of 2014, including two stations on the Middle Branch of the Escanaba River, one station on a tributary of the Middle Branch of the Escanaba, one station on an unnamed tributary of the Black River, one station in Wetland Complex EE located northeast of the HTDF, and Lake Lory.

To characterize the quality of the streams within the vicinity of the mill, flowing and wadable water bodies were sampled according to the MDEQ Surface Water Quality Division *Procedure #51 Survey Protocols for Wadable Rivers*. The P-51 is a rapid bioassessment protocol that is used to evaluate stream quality based on fish, macroinvertebrates, and stream habitat characteristics. Surface waters were sampled to characterize the fish communities and to provide a general description of the surface-water aquatic habitat. Lake Lory and Wetland Complex EE were sampled using a variety of aquatic sampling methods, including the use of electroshocking gear, nets, and a sediment grabbing device to collect macroinvertebrates from unwadable water bodies.

A summary of the fish, macroinvertebrate, and habitat ratings for the four stream stations are displayed in Table 9.5.3 below. Ratings were similar to previous baseline studies with all four stations being reported as “poor” fish communities and acceptable” macroinvertebrate communities. Stream habitat was considered “excellent” in all stations except Station 5, where habitat was rated as “good”.

Table 9.5.3 2014 Habitat Ratings

	Station 1	Station 5	Station MBER1	Station MBER2
Fish Community	Poor	Poor	Poor	Poor
Macroinvertebrate Community	Acceptable	Acceptable	Acceptable	Acceptable
Stream Habitat	Excellent	Good	Excellent	Excellent

The fish community in Lake Lory was predominately comprised of warm water species such as perch, bluegill, largemouth bass, and white suckers, and the fish community in Wetland Complex EE was comprised of fathead minnows.

No threatened or endangered fish species were observed in any of the four stream stations, Lake Lory, or Wetland Complex EE (Michigan Natural Features Inventory, 2014).

A copy of the 2014 Humboldt Mill Aquatic Survey Report is available upon request.

MBER1 Downstream Extent, June 2014

9.5.4 Fish Tissue Survey

A baseline smallmouth bass metals survey was conducted in June 2014 by AEM. Information from this survey was intended to provide one year of baseline data regarding metals concentrations within smallmouth bass that were collected from the project vicinity. Two lakes were selected for the survey; Lake Lory which is located within the vicinity of the Humboldt Mill and Squaw Lake which was selected as the reference lake outside of the influence of the Mill. Smallmouth bass collections for metals analyses were conducted in accordance with the MDEQ Nonferrous Metallic Mineral Mining Permit Number: MP O1 2007, following the GLEAS *Procedure #31 Fish Collection and Processing Procedure* (MDEQ, 1997).

Ten smallmouth bass were collected from each Lake Lory and Squaw Lake for metals analyses on June 8, 2014. Nine out of ten smallmouth bass in Lake Lory were males and four out of ten smallmouth bass in Squaw Lake were males. Among all metal parameters measured in smallmouth bass fillets, average metals contents for iron, manganese, selenium, and strontium were higher in Lake Lory smallmouth bass than the average metals content of smallmouth bass in Squaw Lake. Average nickel content of smallmouth bass livers from Lake Lory were higher than was observed in Squaw Lake smallmouth bass.

A table summarizing the metal results can be found in the 2014 Humboldt Mill Smallmouth Bass Metals Report which is available upon request.

9.6 Miscellaneous Monitoring

9.6.1 Berms and Embankments

During the application process, it was expected that a containment berm would be required in order to ensure that the HTDF would have the capacity to manage a 24 hour, 100 year storm event. As such, permit condition F-12 was included in the mining permit which required monthly monitoring of the berm. The assumption was that with the berm would make the surface elevation of the cut-off wall at least 1543 MSL and with an operating water elevation of 1541 MSL would be enough capacity to contain a 24 hour, 100 year storm event as it would require 1.2 feet of added storage capacity. Since the application was submitted operational changes have occurred, the actual top elevation of the cutoff wall is still 1543 MSL, but the current operating level is significantly lower at approximately 1532 MSL. Our current operating level allows enough capacity to contain at least nine back to back 24 hour, 100 year storm events and therefore an additional containment berm is no longer necessary.

9.6.2 Impermeable Surface Inspections

The impermeable surfaces monitoring plan, found in Appendix J, was finalized in December 2014 and outlines the requirements of integrity monitoring of surfaces exposed to ore, process water, and chemicals. Areas inspected include sumps and floors of the COSA, concentrator building, CLO, and WTP.

Monitoring began in December 2014 and in accordance with the monitoring plan will be conducted on a monthly basis. With the exception of the WTP all facilities noted in the monitoring plan were inspected as required. Floors are inspected for cracks and general condition and the sumps are evaluated for any areas of cracking, piting, or other surface deficiencies, and accumulation of material. All inspection results are recorded on the impermeable surface inspection form by Environmental Department staff and stored in the compliance binder at the Humboldt Mill administrative office. Any issues identified during the inspections are immediately reported and fixed by onsite staff. Follow-up inspections are completed to ensure the repairs were made.

No items were identified during the December 2014 inspection that required repair.

9.6.3 Tailings Line Inspection

In accordance with Mining Permit Condition E-12, the double-walled high density polyethylene (HDPE) pipeline is monitored by operators through a computer interface using pressure readings as an indicator of pipeline integrity. A drop or increase in the pressure reading would indicate that a leak or blockage had occurred. In addition, the tailings lines are equipped with a leak detection system; any water released into the outer piping would drain to the shore vault and trigger an alarm. The shore vault is also visually inspected twice per day (once per shift) by operators. In addition, the Environmental Department also visually inspects the lines on a weekly basis. All inspection results are recorded on the Tailings Line inspection form by Environmental Department staff and stored in the compliance binder at the Humboldt Mill administrative office. During the winter months, snow generally covers the lines which makes visual inspection difficult. However, the lines continue to be monitored for signs of ice build-up which would be indicative of a leak. Any concerns identified during the inspections would be immediately reported to the Mill operations and maintenance departments who would complete any necessary repairs.

9.6.4 Geochemistry Program

Due to the fall start of operations, there is no analytical data to report for 2014. However in accordance with permit condition J-22, a tailings study is currently being conducted to confirm the tailings behavior in a submerged partially oxygenated environment. The study is scheduled to be conducted over 1.5 years and data collected will be used in a geochemical model of the HTDF.

Mining permit condition F-1 also requires ongoing characterization of the geochemistry and limnology of the HTDF. No data was collected in 2014, but Eagle intends to develop a monitoring plan in 2015 in order to meet the requirements of this condition.

10. Reclamation Activities

No reclamation projects were completed in 2014 as construction continued throughout the site. In addition, there are currently no plans to conduct reclamation in 2015. The Department will be notified, in advance, if any activities do commence in 2015.

11. Contingency Plan Update

An updated contingency plan can be found in Appendix K. This plan will also be submitted to the Local Emergency Management Coordinator.

12. Financial Assurance Update

Updated reclamation costs can be found in Appendix L. It is understood that MDEQ will notify Eagle if these updated costs require re-negotiation of the current bond for financial assurance.

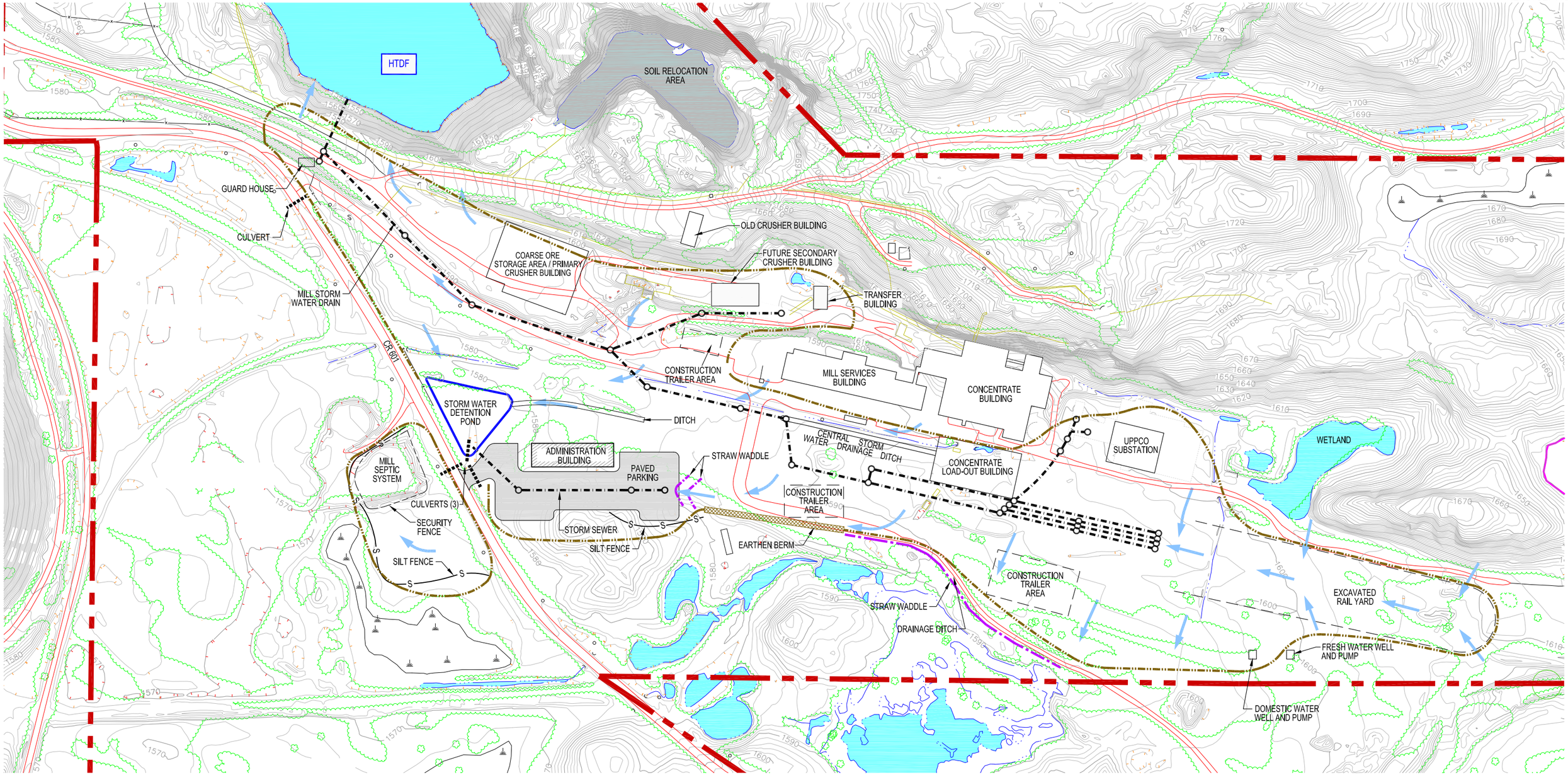
13. Organizational Information

An updated organization report can be found in Appendix M.

Appendix A

Humboldt Mill

Storm Water Drainage Map



NOTES:

1. TOPOGRAPHIC AND PLANIMETRIC DATA SUPPLIED BY AERO-METRIC ENGINEERING, SHEBOYGAN, WISCONSIN. DATE OF PHOTOGRAPHY: APRIL 27, 2006.
2. CONTOUR INTERVAL BASED ON NORTH AMERICAN VERTICAL DATUM OF 1988. HORIZONTAL DATUM BASED ON NAD 83/96. HORIZONTAL COORDINATES BASED ON MICHIGAN STATE PLANE.
3. SITE LOCATION: PROJECT SITE WITHIN SECTIONS 2 AND 11, T47N, R29W, HUMBOLDT TOWNSHIP, MARQUETTE COUNTY, MICHIGAN.
4. CONTOUR INTERVAL SHOWN IS 10 FOOT.

LEGEND

- EXISTING ELEV. CONTOUR IN FEET
- PAVED ROAD
- UNPAVED ROAD
- TRAIL
- STORM WATER DRAIN
- CATCH BASIN
- TREE
- TREE LINE
- FENCE
- SURFACE WATER
- SWAMP/WETLAND
- CULVERT
- STREAM/LAKE
- BUILDING
- EAGLE MINE, LLC PROPERTY BOUNDARY
- STORM WATER FLOW DIRECTION
- STRAW WADDLE
- SILT FENCE
- CONSTRUCTION AREA BOUNDARY – EXPOSED SOIL

NORTH

0 60 120 240
SCALE IN FEET

HORIZON ENVIRONMENTAL

Eagle Mine, LLC
Humboldt Township, Marquette County, Michigan

HUMBOLDT MILL SITE STORM WATER MAP

PROJECT NUMBER: KEX-0102

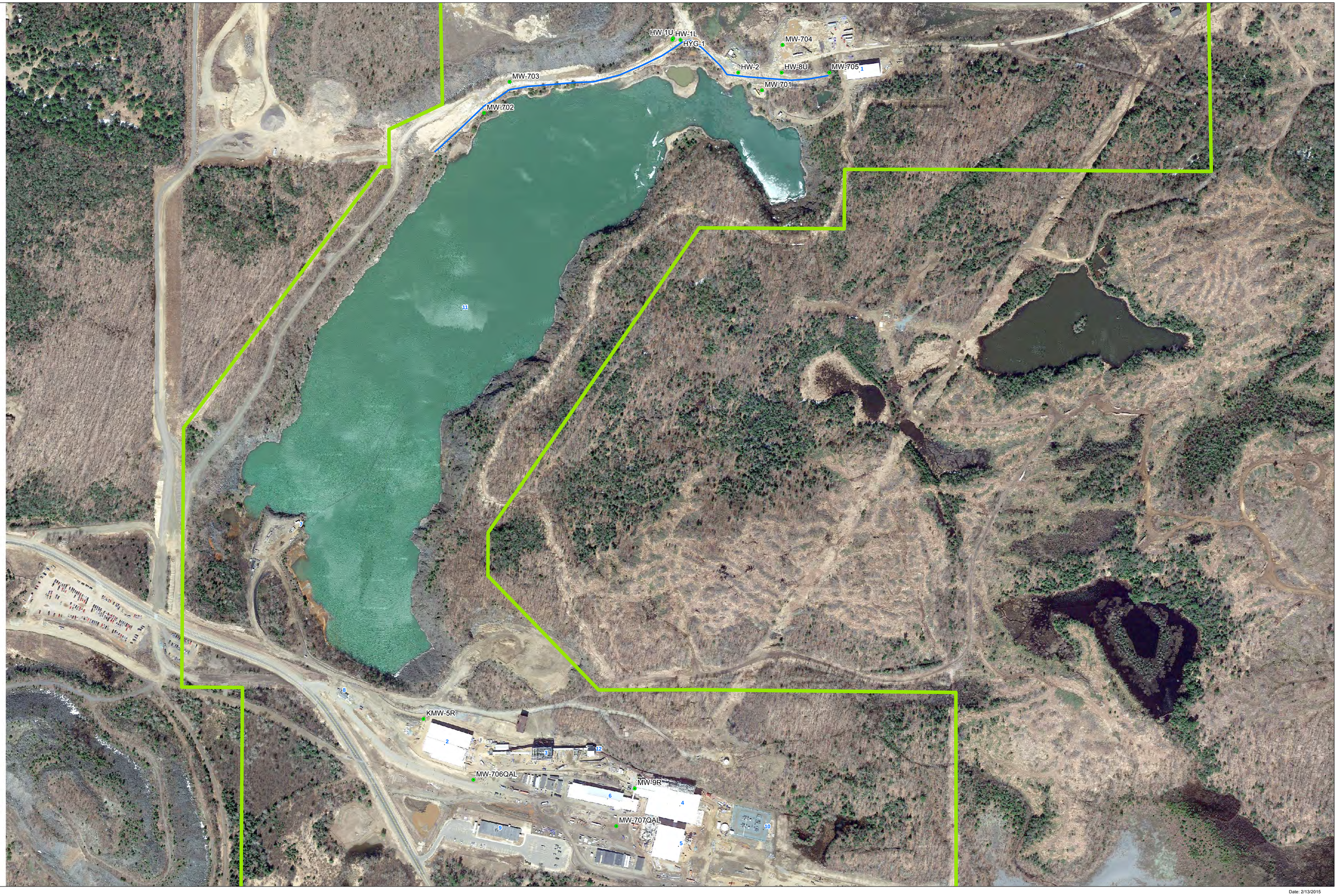
FIGURE: 2

JUNE 2014

Appendix B

Humboldt Mill Aerial Map

Eagle Mine LLC Humboldt Mill Monitoring Map



Date: 2/13/2015

Legend

- Cut Off Wall
- Eagle Mine LLC Ownership
- Humboldt Mill Part 632 Wells

1 - Water Treatment Plant
2 - Coarse Ore Storage Building
3 - Secondary Crusher
4 - Concentrator
5 - Concentrate Loadout Facility
6 - Mill Services Building
7 - Tailings Pump House
8 - Guardhouse
9 - Administration Building
10 - UPPCO Powerstation
11 - Humboldt Tailings Disposal Facility
12 - Transfer Building

0 0.05 0.1 0.2 0.3 0.4 0.5 Miles

N W E S

Appendix C

Humboldt Tailings Disposal Facility

Bathymetry Maps

GRAPHIC SCALE: 1 inch = 150 feet

0 75 150 300 450

Intermediate Contour = 5'
Index Contour = 25'

TriMedia
Environmental & Engineering

Eagle Mine - Humboldt Mill
2014 Bathymetric Survey
Champion, MI
Summer Baseline

DATE	DESCRIPTION	ISSUED

DESIGNED:
DRAWN: JWM
CHECKED: PGC
APPROVED: GWM

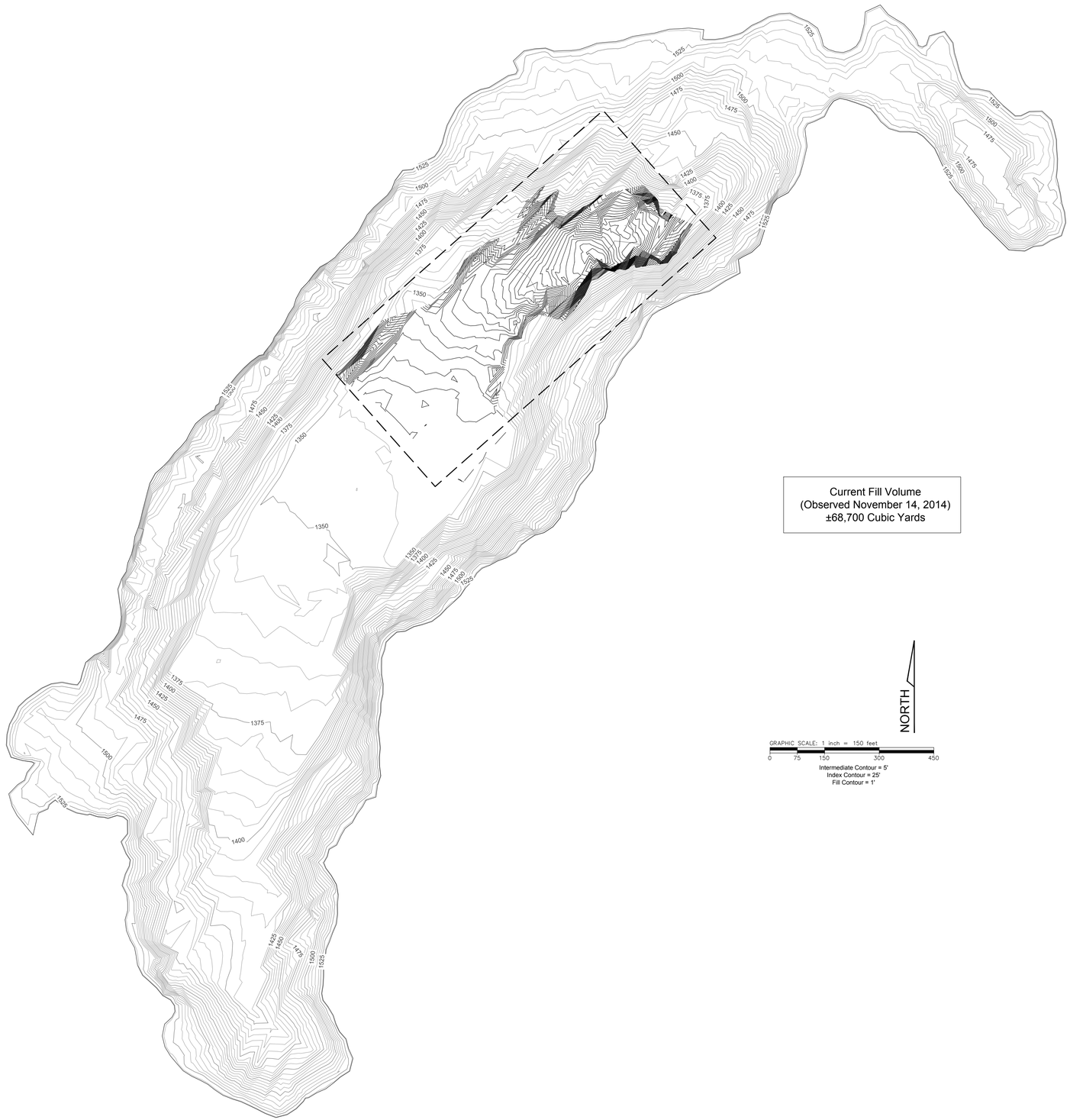
TRIMEDIA
JOB NUMBER:
2014-100

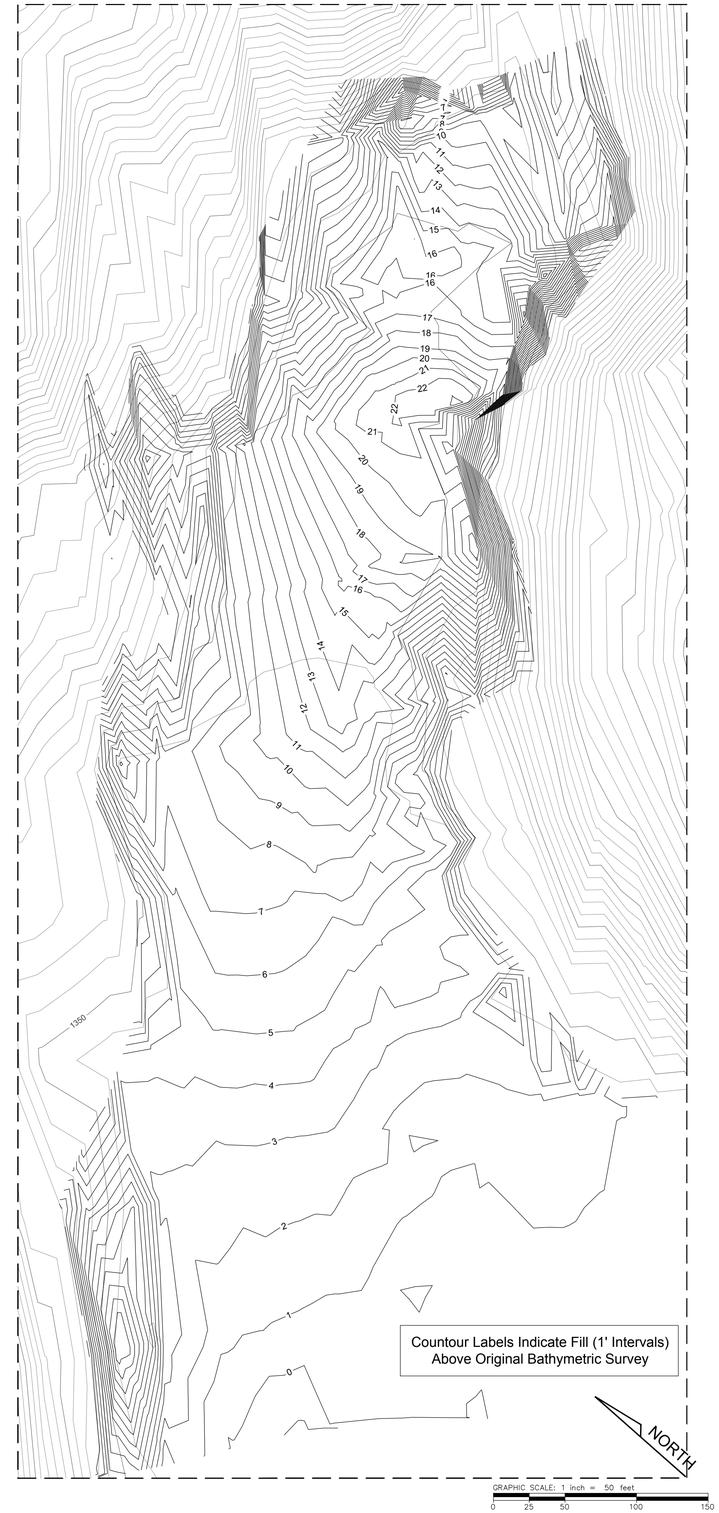
SHEET TITLE:

Existing
Conditions

SHEET NUMBER:

1.0





TriMedia
Environmental & Engineering

Eagle Mine - Humboldt Mill
2014 Bathymetric Survey
Champion, MI
November 2014 Operational Data

DATE	DESCRIPTION	ISSUED

DESIGNED:
DRAWN: JWM
CHECKED: PGC
APPROVED: GWM

TRIMEDIA
JOB NUMBER:
2014-100

SHEET TITLE:
Tailings Basin
Product Fill Map

SHEET NUMBER:
1.0

G:\Projects\2014\2014-100 Eagle Mine - Bathymetric Surveying\Drawings\2014-100 Humboldt Tailings Basin CutFill.dwg

Appendix D

HTDF Surface Water Elevations

&

Water Balance Graph

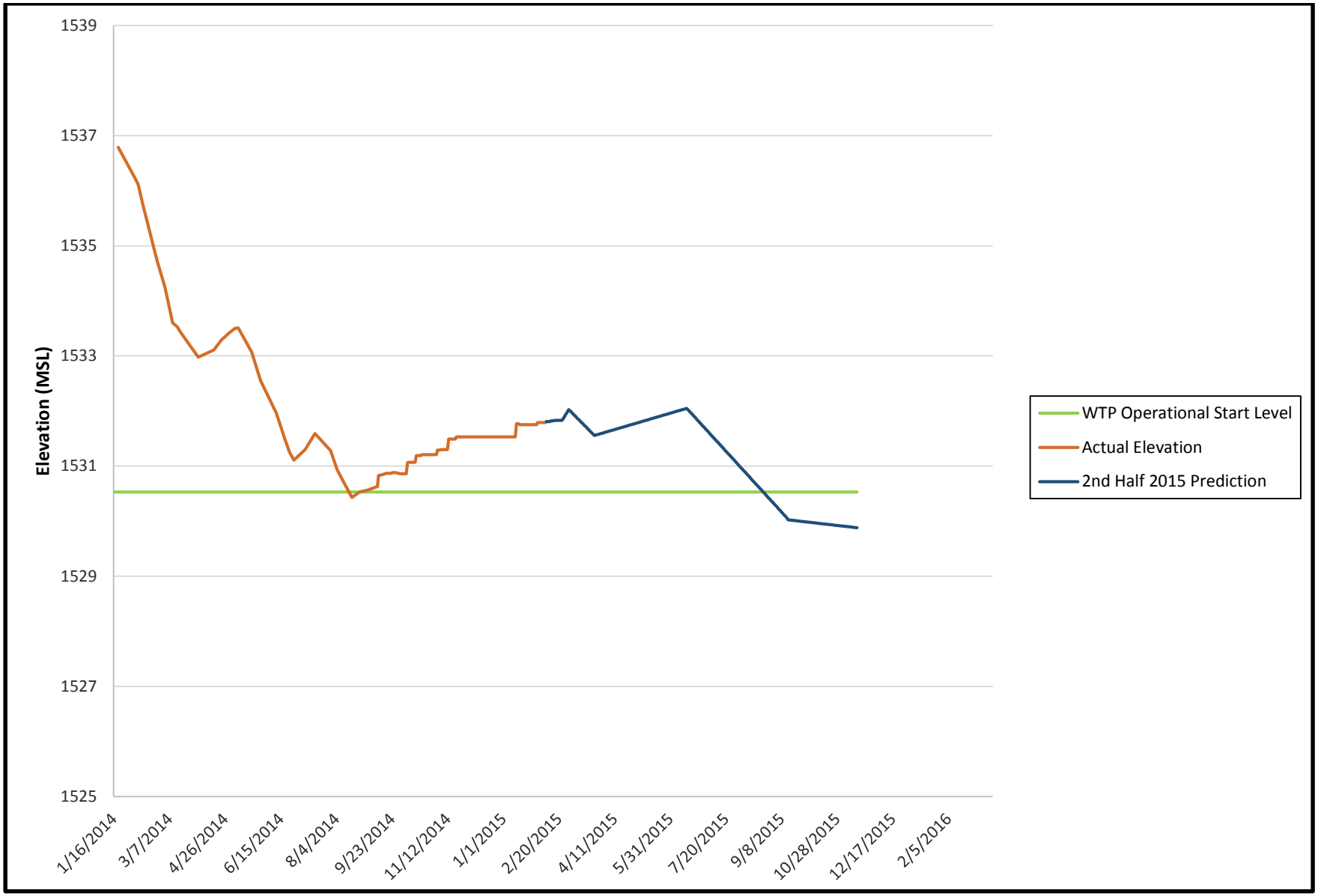
HTDF Water Elevation Data
2014 Discrete Measurements
Humboldt Mill

Date	HTDF Water Elevation (MSL)
1/2/2014	1537.57
1/9/2014	1537.53
1/13/2014	1537.5
1/16/2014	1536.89
1/17/2014	1536.87
1/20/2014	1536.79
1/21/2014	1536.77
1/22/2014	1536.73
1/23/2014	1536.71
1/24/2014	1536.67
1/30/2014	1536.37
2/3/2014	1536.31
2/7/2014	1536.12
2/11/2014	1535.76
2/15/2014	1535.53
2/21/2014	1533.31
2/28/2014	1533.12
3/3/2014	1534.25
3/10/2014	1533.6
3/14/2014	1533.53
3/17/2014	1533.43
3/21/2014	1533.31
3/28/2014	1533.12
4/2/2014	1532.97
4/8/2014	1532.72
4/16/2014	1533.11
4/21/2014	1533.25
4/23/2014	1533.29
4/30/2014	1533.42
5/2/2014	1533.45
5/5/2014	1533.50
5/8/2014	1533.51
5/11/2014	1533.43
5/12/2014	1533.41
5/16/2014	1533.23
5/19/2014	1533.07
5/20/2014	1533.07
5/27/2014	1532.62
5/28/2014	1532.55
6/1/2014	1532.33
6/2/2014	1532.39
6/3/2014	1532.45
6/4/2014	1532.45

Date	HTDF Water Elevation (MSL)
6/5/2014	1532.39
6/7/2014	1532.17
6/11/2014	1531.97
6/16/2014	1531.67
6/20/2014	1531.48
6/23/2014	1531.25
6/24/2014	1531.25
6/27/2014	1531.11
6/30/2014	1531.25
7/2/2014	1531.3
7/3/2014	1531.31
7/7/2014	1531.57
7/8/2014	1531.57
7/9/2014	1531.57
7/10/2014	1531.53
7/11/2014	1531.53
7/16/2014	1531.59
7/19/2014	1531.55
7/20/2014	1531.53
7/21/2014	1531.49
7/22/2014	1531.45
7/24/2014	1531.41
7/29/2014	1531.29
7/30/2014	1531.28
7/31/2014	1531.22
8/1/2014	1531.17
8/3/2014	1531.05
8/4/2014	1530.97
8/5/2014	1530.93
8/11/2014	1530.67
8/12/2014	1530.61
8/13/2014	1530.56
8/18/2014	1530.43
8/20/2014	1530.48
8/22/2014	1530.43
8/23/2014	1530.5
8/25/2014	1530.53
8/28/2014	1530.53
9/2/2014	1530.57
9/10/2014	1530.63
9/11/2014	1530.83
9/12/2014	1530.83
9/18/2014	1530.87

Date	HTDF Water Elevation (MSL)
9/19/2014	1530.87
9/22/2014	1530.87
9/24/2014	1530.88
9/25/2014	1530.88
9/26/2014	1530.89
10/1/2014	1530.86
10/7/2014	1531.06
10/8/2014	1531.07
10/15/2014	1531.19
10/17/2014	1531.19
10/20/2014	1531.21
10/21/2014	1531.21
11/3/2014	1531.29
11/6/2014	1531.3
11/13/2014	1531.49
11/20/2014	1531.53
12/15/2014	1531.31

2014 Surface Water Elevations
Water Balance and 2015 Predicted Water Levels
Humboldt Mill



Appendix E

Humboldt Mill

Groundwater Monitoring Well Location Map

CUT-OFF WALL MONITORING WELL NETWORK LOCATIONS

Legend

- Monitoring Well
- Leachate Monitoring Well per R425.406(5)(a)
- Compliance Monitoring Well per R425.406(5)(b)
- Containment Wall
- Estimated Limit of Aquifer
- Flow Divide
- Highway
- Bedrock Outcrop

Reference

Data provided by: Eagle Mine and North Jackson Company
Projection & Datum: UTM NAD 83 Zone 16N
Aerial Photo: 2006

0 200 400 Feet

1:3,500

Eagle Mine
a subsidiary of lundin mining

North Jackson Company
ENVIRONMENTAL SCIENCE & ENGINEERING

LEGEND

New Compliance Monitoring Wells

NOTES

1. SCALE OF AERIAL IMAGERY IS APPROXIMATE.
2. THIS FIGURE HAS BEEN TRANSLATED AND SCALED TO THE HORIZONTAL DATUM NAD83 MICHIGAN STATE PLANE COORDINATE SYSTEM.
3. FOR REFERENCE PURPOSES ONLY. NOT TO BE USED FOR REPORTING.

REFERENCE

1. BASE MAP TAKEN FROM GOOGLE EARTH, 2014

CLIENT
EAGLE MINE
HUMBOLDT MILL

PROJECT
GROUNDWATER MONTIORING

TITLE
EAGLE MINE HUMBOLDT MILL COMPLIANCE MONITORING LOCATIONS

DRAFT

CONSULTANT

Golder Associates

YYYY-MM-DD	2014-08-14
PREPARED	CJS
DESIGN	CJS
REVIEW	MAC
APPROVED	GJD

PROJECT 1401484 | Rev. 0 | FIGURE **01**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM:
1 in
0
Path: C:\Users\CSlacey\Documents\Eagle\1401484 Eagle Mill Monitoring\GIS\Eagle Mill MW Location Map Portrait.mxd

Appendix F

Humboldt Mill

Groundwater Monitoring Well Results

&

Benchmark Summary Table

Humboldt Mill
2014 Mine Permit Groundwater Monitoring
Benchmark Comparison Summary

Location	Location Classification	Q4
HW-1L	Monitoring	
HW-1U LLA	Monitoring	
HW-1U UFB	Monitoring	
HW-2	Monitoring	ammonia, sodium
HW-8U	Monitoring	sulfate
HYG-1	Monitoring	alkalinity bicarbonate, calcium, chloride, hardness, magnesium, mercury, potassium, sodium
KMW-5R	COSA	zinc
MW-701 QAL	Leachate	chloride
MW-701 UFB	Leachate	magnesium
MW-702 QAL	Leachate	pH
MW-702 UFB	Leachate	pH, managanese
MW-703 QAL	Compliance	
MW-703 UFB	Compliance	pH
MW-703 LLA	Compliance	
MW-703-DBA	Compliance	potassium
MW-704 QAL	Compliance	ammonia, arsenic, mercury
MW-704 UFB	Compliance	calcium, hardness
MW-704 LLA	Compliance	potassium
MW-704 DBA	Compliance	zinc
MW-705 QAL	Cut-off Wall Key in Well	
MW-705 UFB	Cut-off Wall Key in Well	
MW-706 QAL	Mill Services Building/Secondary Crusher	pH
MW-707 QAL	Concentrator/CLO	alkalinity bicarbonate, hardness
MW-9R	Concentrator	pH

Parameters listed in this table had values reported that were equal to or greater than a site-specific benchmark.

Blank data cells indicate that no benchmark deviations occurred at the location during the specified sampling quarter.

2014
Mine Permit Groundwater Quality Monitoring Data
HW-1L (Monitoring)
Humboldt Mill

Parameter	Unit	Recom-mended Benchmark 2014	Q4 2014 11/19/14[D]	
Field				
D.O.[1]	ppm	--	**2.9**	
ORP	mV	--	**-160**	
pH	SU	8.97-9.97	**8.97**	
Specific Conductance	mS/cm	--	**0.22**	
Temperature	°C	--	**5.1**	
Turbidity	NTU	--	**8.5**	
Water Elevation	ft MSL	--	**1507.54**	
Metals				
Aluminum	ug/L	--	--	
Antimony	ug/L	--	--	
Arsenic	ug/L	20 (p)	< 5.0	
Barium	ug/L	--	--	
Beryllium	ug/L	--	--	
Boron	ug/L	--	--	
Cadmium	ug/L	--	--	
Chromium	ug/L	--	--	
Cobalt	ug/L	--	--	
Copper	ug/L	16 (p)	< 4.0	
Iron	ug/L	1134	**1100**	
Lead	ug/L	12 (p)	< 3.0	
Lithium	ug/L	23	< 50	
Manganese	ug/L	--	--	
Mercury	ng/L	4.0 (p)	< 1.0	
Molybdenum	ug/L	--	--	
Nickel	ug/L	80 (p)	< 20	
Selenium	ug/L	--	--	
Silver	ug/L	--	--	
Thallium	ug/L	--	--	
Vanadium	ug/L	--	--	
Zinc	ug/L	11	< 10	
Major Anions				
Alkalinity, Bicarbonate	mg/L	117	**81**	
Alkalinity, Carbonate	mg/L	14	< 2.0	
Chloride	mg/L	52	**44**	
Fluoride	mg/L	4.0 (p)	< 1.0	
Nitrogen, Ammonia	mg/L	0.04	<0.03	
Nitrogen, Nitrate	mg/L	0.40 (p)	< 0.1	
Nitrogen, Nitrite	mg/L	0.40 (p)	< 0.1	
Sulfate	mg/L	24	**19**	
Sulfide	mg/L	0.80 (p)	< 0.20	
Major Cations				
Calcium	mg/L	35	**23**	
Magnesium	mg/L	17	**9.9**	
Potassium	mg/L	11	**1.9**	
Sodium	mg/L	27	**24**	
General				
Hardness	mg/L	157	**108**	

2014
Mine Permit Groundwater Quality Monitoring Data
HW-1U LLA (Monitoring)
Humboldt Mill

Parameter	Unit	Recom-mended Benchmark 2014	Q4 2014 11/19/14[D]	
Field				
D.O.[1]	ppm	--	**1.6**	
ORP	mV	--	**-174**	
pH	SU	8.55-9.55	**9.22**	
Specific Conductance	mS/cm	--	**0.23**	
Temperature	°C	--	**6.0**	
Turbidity	NTU	--	**14**	
Water Elevation	ft MSL	--	**1489.22**	
Metals				
Aluminum	ug/L	--	--	
Antimony	ug/L	--	--	
Arsenic	ug/L	20 (p)	< 5.0	
Barium	ug/L	--	--	
Beryllium	ug/L	--	--	
Boron	ug/L	--	--	
Cadmium	ug/L	--	--	
Chromium	ug/L	--	--	
Cobalt	ug/L	--	--	
Copper	ug/L	16 (p)	**4.1**	
Iron	ug/L	800 (p)	< 200	
Lead	ug/L	12 (p)	< 3.0	
Lithium	ug/L	--	--	
Manganese	ug/L	200 (p)	< 50	
Mercury	ng/L	4.0 (p)	< 1.0	
Molybdenum	ug/L	--	--	
Nickel	ug/L	80 (p)	< 20	
Selenium	ug/L	--	--	
Silver	ug/L	--	--	
Thallium	ug/L	--	--	
Vanadium	ug/L	--	--	
Zinc	ug/L	40 (p)	< 10	
Major Anions				
Alkalinity, Bicarbonate	mg/L	125	**110**	
Alkalinity, Carbonate	mg/L	66	< 2.0	
Chloride	mg/L	40 (p)	**23**	
Fluoride	mg/L	4.0 (p)	< 1.0	
Nitrogen, Ammonia	mg/L	0.1 (p)	**0.05**	
Nitrogen, Nitrate	mg/L	0.40 (p)	<0.1	
Nitrogen, Nitrite	mg/L	0.40 (p)	<0.1	
Sulfate	mg/L	58	**42**	
Sulfide	mg/L	0.36	< 0.20	
Major Cations				
Calcium	mg/L	29	**25**	
Magnesium	mg/L	15	**10**	
Potassium	mg/L	50	**6.2**	
Sodium	mg/L	33	**32**	
General				
Hardness	mg/L	132	**113**	

2014
Mine Permit Groundwater Quality Monitoring Data
HW-1U UFB (Monitoring)
Humboldt Mill

Parameter	Unit	Recom-mended Benchmark 2014	Q4 2014 11/19/14[D]	
Field				
D.O.[1]	ppm	--	**2.0**	
ORP	mV	--	**166**	
pH	SU	8.37-9.37	**9.29**	
Specific Conductance	mS/cm	--	**0.33**	
Temperature	°C	--	**5.2**	
Turbidity	NTU	--	**4.7**	
Water Elevation	ft MSL	--	**1532.15**	
Metals				
Aluminum	ug/L	--	--	
Antimony	ug/L	--	--	
Arsenic	ug/L	11	< 5.0	
Barium	ug/L	--	--	
Beryllium	ug/L	--	--	
Boron	ug/L	--	--	
Cadmium	ug/L	--	--	
Chromium	ug/L	--	--	
Cobalt	ug/L	--	--	
Copper	ug/L	16 (p)	< 4.0	
Iron	ug/L	800 (p)	< 200	
Lead	ug/L	12 (p)	< 3.0	
Lithium	ug/L	--	--	
Manganese	ug/L	75	< 50	
Mercury	ng/L	4.0 (p)	< 1.0	
Molybdenum	ug/L	--	--	
Nickel	ug/L	80 (p)	< 20	
Selenium	ug/L	--	--	
Silver	ug/L	--	--	
Thallium	ug/L	--	--	
Vanadium	ug/L	--	--	
Zinc	ug/L	40 (p)	< 10	
Major Anions				
Alkalinity, Bicarbonate	mg/L	127	**110**	
Alkalinity, Carbonate	mg/L	14	**9.7**	
Chloride	mg/L	121	**71**	
Fluoride	mg/L	4.0 (p)	< 1.0	
Nitrogen, Ammonia	mg/L	0.12 (p)	<0.03	
Nitrogen, Nitrate	mg/L	0.67	<0.1	
Nitrogen, Nitrite	mg/L	0.40 (p)	<0.1	
Sulfate	mg/L	76	**36**	
Sulfide	mg/L	1.3	< 4.0	
Major Cations				
Calcium	mg/L	46	**14**	
Magnesium	mg/L	17	**11**	
Potassium	mg/L	22	**16**	
Sodium	mg/L	91	**66**	
General				
Hardness	mg/L	189	**91**	

2014
Mine Permit Groundwater Quality Monitoring Data
HW-2 (Monitoring)
Humboldt Mill

Parameter	Unit	Recom-mended Benchmark 2014	Q4 2014 11/6/14[D]	
Field				
D.O.[1]	ppm	--	**1.9**	
ORP	mV	--	**-166**	
pH	SU	7.73-8.73	**8.54**	
Specific Conductance	mS/cm	--	**0.31**	
Temperature	°C	--	**8.0**	
Turbidity	NTU	--	**7.2**	
Water Elevation	ft MSL	--	**1531.70**	
Metals				
Aluminum	ug/L	--	--	
Antimony	ug/L	--	--	
Arsenic	ug/L	20 (p)	< 5.0	
Barium	ug/L	--	--	
Beryllium	ug/L	--	--	
Boron	ug/L	--	--	
Cadmium	ug/L	--	--	
Chromium	ug/L	--	--	
Cobalt	ug/L	--	--	
Copper	ug/L	16 (p)	< 4.0	
Iron	ug/L	3401	**940**	
Lead	ug/L	12 (p)	< 3.0	
Lithium	ug/L	--	--	
Manganese	ug/L	324	**80**	
Mercury	ng/L	1.3	< 1.00	
Molybdenum	ug/L	--	--	
Nickel	ug/L	80 (p)	< 20	
Selenium	ug/L	--	--	
Silver	ug/L	--	--	
Thallium	ug/L	--	--	
Vanadium	ug/L	--	--	
Zinc	ug/L	40 (p)	< 10	
Major Anions				
Alkalinity, Bicarbonate	mg/L	145	**130**	
Alkalinity, Carbonate	mg/L	8.0 (p)	< 2.0	
Chloride	mg/L	25	**14**	
Fluoride	mg/L	4.0 (p)	< 1.0	
Nitrogen, Ammonia	mg/L	0.05	**0.05**	
Nitrogen, Nitrate	mg/L	0.40 (p)	<0.1	
Nitrogen, Nitrite	mg/L	0.40 (p)	<0.1	
Sulfate	mg/L	135	**120**	
Sulfide	mg/L	0.47	< 0.20	
Major Cations				
Calcium	mg/L	72	**60**	
Magnesium	mg/L	28	**23**	
Potassium	mg/L	7.1	**4.1**	
Sodium	mg/L	15	**16**	
General				
Hardness	mg/L	277	**239**	

Explanations of abbreviations are included on the final page of this table.

2014
Mine Permit Groundwater Quality Monitoring Data
HW-8U (Monitoring)
Humboldt Mill

Parameter	Unit	Recom-mended Benchmark 2014	Q4 2014 11/19/14[T]	
Field				
D.O.[1]	ppm	--	**1.9**	
ORP	mV	--	**-92.4**	
pH	SU	6.44-7.44	**6.79**	
Specific Conductance	mS/cm	--	**0.19**	
Temperature	°C	--	**5.5**	
Turbidity	NTU	--	**1.8**	
Water Elevation	ft MSL	--	**1533.26**	
Metals				
Aluminum	ug/L	--	--	
Antimony	ug/L	--	--	
Arsenic	ug/L	20 (p)	< 5.0	
Barium	ug/L	--	--	
Beryllium	ug/L	--	--	
Boron	ug/L	--	--	
Cadmium	ug/L	--	--	
Chromium	ug/L	--	--	
Cobalt	ug/L	--	--	
Copper	ug/L	16 (p)	< 4.0	
Iron	ug/L	27125	**15000**	
Lead	ug/L	12 (p)	< 3.0	
Lithium	ug/L	--	--	
Manganese	ug/L	5498	**4100**	
Mercury	ng/L	4.0 (p)	< 1.0	
Molybdenum	ug/L	--	--	
Nickel	ug/L	80 (p)	< 20	
Selenium	ug/L	--	--	
Silver	ug/L	--	--	
Thallium	ug/L	--	--	
Vanadium	ug/L	--	--	
Zinc	ug/L	26	**16**	
Major Anions				
Alkalinity, Bicarbonate	mg/L	237	**160**	
Alkalinity, Carbonate	mg/L	8.0 (p)	< 2.0	
Chloride	mg/L	40 (p)	< 10	
Fluoride	mg/L	4.0 (p)	< 1.0	
Nitrogen, Ammonia	mg/L	0.04	<0.03	
Nitrogen, Nitrate	mg/L	0.10	<0.1	
Nitrogen, Nitrite	mg/L	0.40 (p)	<0.1	
Sulfate	mg/L	2.6	**2.6**	
Sulfide	mg/L	0.80 (p)	< 0.20	
Major Cations				
Calcium	mg/L	53	**34**	
Magnesium	mg/L	22	**14**	
Potassium	mg/L	4.1	**2.7**	
Sodium	mg/L	4.4	**3.1**	
General				
Hardness	mg/L	224	**159**	

2014
Mine Permit Groundwater Quality Monitoring Data
HYG-1 (Monitoring)
Humboldt Mill

Parameter	Unit	Recom-mended Benchmark 2014	Q4 2014 11/6/14[T]	
Field				
D.O.[1]	ppm	--	**2.3**	
ORP	mV	--	**20.7**	
pH	SU	6.25-7.25	**6.68**	
Specific Conductance	mS/cm	--	**0.40**	
Temperature	°C	--	**9.1**	
Turbidity	NTU	--	**0.82**	
Water Elevation	ft MSL	--	**1532.81**	
Metals				
Aluminum	ug/L	--	--	
Antimony	ug/L	8.3	--	
Arsenic	ug/L	20 (p)	< 5.0	
Barium	ug/L	--	--	
Beryllium	ug/L	--	--	
Boron	ug/L	--	--	
Cadmium	ug/L	--	--	
Chromium	ug/L	--	--	
Cobalt	ug/L	--	--	
Copper	ug/L	4.4	< 4.0	
Iron	ug/L	800 (p)	< 200	
Lead	ug/L	12 (p)	< 3.0	
Lithium	ug/L	--	--	
Manganese	ug/L	286	**150**	
Mercury	ng/L	6.2	**21**	
Molybdenum	ug/L	--	--	
Nickel	ug/L	80 (p)	< 20	
Selenium	ug/L	--	--	
Silver	ug/L	--	--	
Thallium	ug/L	--	--	
Vanadium	ug/L	--	--	
Zinc	ug/L	19	**10**	
Major Anions				
Alkalinity, Bicarbonate	mg/L	157	**290**	
Alkalinity, Carbonate	mg/L	8.0 (p)	< 2.0	
Chloride	mg/L	12	**12**	
Fluoride	mg/L	4.0 (p)	< 1.0	
Nitrogen, Ammonia	mg/L	0.38	**0.33**	
Nitrogen, Nitrate	mg/L	0.26	<0.1	
Nitrogen, Nitrite	mg/L	0.40 (p)	<0.1	
Sulfate	mg/L	98	**51**	
Sulfide	mg/L	0.80 (p)	< 0.20	
Major Cations				
Calcium	mg/L	52	**54**	
Magnesium	mg/L	28	**28**	
Potassium	mg/L	8.4	**10**	
Sodium	mg/L	14	**48**	
General				
Hardness	mg/L	230	**247**	

2014
Mine Permit Groundwater Quality Monitoring Data
KMW-5R (COSA)
Humboldt Mill

Parameter	Unit	Recom-mended Benchmark 2014	Q4 2014 11/20/14[D]	
Field				
D.O.[1]	ppm	--	**5.1**	
ORP	mV	--	**-34.5**	
pH	SU	6.70-7.70	**6.96**	
Specific Conductance	mS/cm	--	**0.35**	
Temperature	°C	--	**6.0**	
Turbidity	NTU	--	**12.2**	
Water Elevation	ft MSL	--	**1559.13**	
Metals				
Aluminum	ug/L	--	--	
Antimony	ug/L	--	--	
Arsenic	ug/L	6.0	< 5.0	
Barium	ug/L	--	--	
Beryllium	ug/L	--	--	
Boron	ug/L	--	--	
Cadmium	ug/L	--	--	
Chromium	ug/L	--	--	
Cobalt	ug/L	--	--	
Copper	ug/L	15	< 4.0	
Iron	ug/L	33432	**930**	
Lead	ug/L	4.8	< 3.0	
Lithium	ug/L	--	--	
Manganese	ug/L	2815	**2700**	
Mercury	ng/L	2.1	< 1.0	
Molybdenum	ug/L	--	--	
Nickel	ug/L	80 (p)	< 20	
Selenium	ug/L	--	--	
Silver	ug/L	--	--	
Thallium	ug/L	--	--	
Vanadium	ug/L	--	--	
Zinc	ug/L	19	**22**	
Major Anions				
Alkalinity, Bicarbonate	mg/L	486	**360**	
Alkalinity, Carbonate	mg/L	3.3	< 2.0	
Chloride	mg/L	139	**110**	
Fluoride	mg/L	4.0 (p)	< 1.0	
Nitrogen, Ammonia	mg/L	0.76	**28**	
Nitrogen, Nitrate	mg/L	0.11	<0.1	
Nitrogen, Nitrite	mg/L	0.06	<0.1	
Sulfate	mg/L	123	**75**	
Sulfide	mg/L	3.9	< 0.20	
Major Cations				
Calcium	mg/L	169	**150**	
Magnesium	mg/L	67	**59**	
Potassium	mg/L	9.1	**7.9**	
Sodium	mg/L	50	**3.8**	
General				
Hardness	mg/L	800	**598**	

2014
Mine Permit Groundwater Quality Monitoring Data
MW-701 QAL (Leachate)
Humboldt Mill

Parameter	Unit	Recom-mended Benchmark 2014	Q4 2014 11/6/14[T]	
Field				
D.O.[1]	ppm	--	**3.1**	
ORP	mV	--	**43.7**	
pH	SU	5.82-6.82	**6.1**	
Specific Conductance	mS/cm	--	**0.18**	
Temperature	°C	--	**8.4**	
Turbidity	NTU	--	**1.2**	
Water Elevation	ft MSL	--	**1531.94**	
Metals				
Aluminum	ug/L	--	--	
Antimony	ug/L	--	--	
Arsenic	ug/L	20 (p)	< 5.0	
Barium	ug/L	--	--	
Beryllium	ug/L	--	--	
Boron	ug/L	--	--	
Cadmium	ug/L	--	--	
Chromium	ug/L	--	--	
Cobalt	ug/L	--	--	
Copper	ug/L	16 (p)	< 4.0	
Iron	ug/L	459	< 200	
Lead	ug/L	12 (p)	< 3.0	
Lithium	ug/L	--	--	
Manganese	ug/L	4801	**1800**	
Mercury	ng/L	11	**1.4**	
Molybdenum	ug/L	--	--	
Nickel	ug/L	80 (p)	< 20	
Selenium	ug/L	--	--	
Silver	ug/L	--	--	
Thallium	ug/L	--	--	
Vanadium	ug/L	--	--	
Zinc	ug/L	40 (p)	< 10	
Major Anions				
Alkalinity, Bicarbonate	mg/L	189	**54**	
Alkalinity, Carbonate	mg/L	8.0 (p)	< 2.0	
Chloride	mg/L	19	**21**	
Fluoride	mg/L	4.0 (p)	< 1.0	
Nitrogen, Ammonia	mg/L	0.39	**0.03**	
Nitrogen, Nitrate	mg/L	3.1	**0.63**	
Nitrogen, Nitrite	mg/L	0.40 (p)	<0.1	
Sulfate	mg/L	110	**48**	
Sulfide	mg/L	0.22	< 0.20	
Major Cations				
Calcium	mg/L	57	**25**	
Magnesium	mg/L	26	**10**	
Potassium	mg/L	9.2	**6.6**	
Sodium	mg/L	14	**8.3**	
General				
Hardness	mg/L	272	**115**	

Explanations of abbreviations are included on the final page of this table.

2014
Mine Permit Groundwater Quality Monitoring Data
MW-701 UFB (Leachate)
Humboldt Mill

Parameter	Unit	Recom-mended Benchmark 2014	Q4 2014 11/6/14[D]	
Field				
D.O.[1]	ppm	--	**1.9**	
ORP	mV	--	**-155**	
pH	SU	7.18-8.18	**7.54**	
Specific Conductance	mS/cm	--	**0.21**	
Temperature	°C	--	**7.4**	
Turbidity	NTU	--	**14**	
Water Elevation	ft MSL	--	**1532.11**	
Metals				
Aluminum	ug/L	--	--	
Antimony	ug/L	--	--	
Arsenic	ug/L	20 (p)	< 5.0	
Barium	ug/L	--	--	
Beryllium	ug/L	--	--	
Boron	ug/L	--	--	
Cadmium	ug/L	--	--	
Chromium	ug/L	--	--	
Cobalt	ug/L	--	--	
Copper	ug/L	30	< 4.0	
Iron	ug/L	27405	**19000**	
Lead	ug/L	12 (p)	< 3.0	
Lithium	ug/L	--	--	
Manganese	ug/L	6881	**2800**	
Mercury	ng/L	4.0 (p)	< 1.0	
Molybdenum	ug/L	--	--	
Nickel	ug/L	80 (p)	< 20	
Selenium	ug/L	--	--	
Silver	ug/L	--	--	
Thallium	ug/L	--	--	
Vanadium	ug/L	--	--	
Zinc	ug/L	26	< 10	
Major Anions				
Alkalinity, Bicarbonate	mg/L	172	**150**	
Alkalinity, Carbonate	mg/L	18	< 2.0	
Chloride	mg/L	43	< 10	
Fluoride	mg/L	4.0 (p)	< 1.0	
Nitrogen, Ammonia	mg/L	1.6	<0.03	
Nitrogen, Nitrate	mg/L	0.40 (p)	<0.1	
Nitrogen, Nitrite	mg/L	0.40 (p)	<0.1	
Sulfate	mg/L	80	**17**	
Sulfide	mg/L	1.7	< 0.20	
Major Cations				
Calcium	mg/L	40	**38**	
Magnesium	mg/L	16	**16**	
Potassium	mg/L	13	**4.0**	
Sodium	mg/L	56	**6.7**	
General				
Hardness	mg/L	163	**156**	

2014
Mine Permit Groundwater Quality Monitoring Data
MW-702 QAL (Leachate)
Humboldt Mill

Parameter	Unit	Recom-mended Benchmark 2014	Q4 2014 11/6/14[D]	
Field				
D.O.[1]	ppm	--	**3.6**	
ORP	mV	--	**-27.8**	
pH	SU	9.76-10.76	**9.17**	
Specific Conductance	mS/cm	--	**0.29**	
Temperature	°C	--	**7.2**	
Turbidity	NTU	--	**7.4**	
Water Elevation	ft MSL	--	**1531.32**	
Metals				
Aluminum	ug/L	--	--	
Antimony	ug/L	--	--	
Arsenic	ug/L	7.5	< 5.0	
Barium	ug/L	155	--	
Beryllium	ug/L	--	--	
Boron	ug/L	--	--	
Cadmium	ug/L	--	--	
Chromium	ug/L	--	--	
Cobalt	ug/L	--	--	
Copper	ug/L	16 (p)	< 4.0	
Iron	ug/L	386	< 200	
Lead	ug/L	12 (p)	< 3.0	
Lithium	ug/L	--	--	
Manganese	ug/L	717	**410**	
Mercury	ng/L	4.0 (p)	< 1.0	
Molybdenum	ug/L	--	--	
Nickel	ug/L	80 (p)	< 20	
Selenium	ug/L	--	--	
Silver	ug/L	--	--	
Thallium	ug/L	--	--	
Vanadium	ug/L	12	--	
Zinc	ug/L	40 (p)	< 10	
Major Anions				
Alkalinity, Bicarbonate	mg/L	194	**100**	
Alkalinity, Carbonate	mg/L	54	**2.0**	
Chloride	mg/L	12	< 10	
Fluoride	mg/L	4.0 (p)	< 1.0	
Nitrogen, Ammonia	mg/L	0.03	<0.03	
Nitrogen, Nitrate	mg/L	1.8	**0.63**	
Nitrogen, Nitrite	mg/L	0.12	<0.1	
Sulfate	mg/L	148	**97**	
Sulfide	mg/L	0.80 (p)	< 0.20	
Major Cations				
Calcium	mg/L	99	**49**	
Magnesium	mg/L	17	**12**	
Potassium	mg/L	36	**7.9**	
Sodium	mg/L	42	**17**	
General				
Hardness	mg/L	286	**175**	

2014
Mine Permit Groundwater Quality Monitoring Data
MW-702 UFB (Leachate)
Humboldt Mill

Parameter	Unit	Recom-mended Benchmark 2014	Q4 2014 11/19/14[D]	
Field				
D.O.[1]	ppm	--	**2.2**	
ORP	mV	--	**-21.7**	
pH	SU	8.51-9.51	**7.18**	
Specific Conductance	mS/cm	--	**0.18**	
Temperature	°C	--	**6.8**	
Turbidity	NTU	--	**3.8**	
Water Elevation	ft MSL	--	**1529.71**	
Metals				
Aluminum	ug/L	--	--	
Antimony	ug/L	--	--	
Arsenic	ug/L	20 (p)	< 5.0	
Barium	ug/L	--	--	
Beryllium	ug/L	--	--	
Boron	ug/L	--	--	
Cadmium	ug/L	--	--	
Chromium	ug/L	--	--	
Cobalt	ug/L	--	--	
Copper	ug/L	16 (p)	< 4.0	
Iron	ug/L	2484	**1700**	
Lead	ug/L	12 (p)	< 3.0	
Lithium	ug/L	--	--	
Manganese	ug/L	126	**130**	
Mercury	ng/L	4.0 (p)	< 1.0	
Molybdenum	ug/L	--	--	
Nickel	ug/L	80 (p)	< 20	
Selenium	ug/L	--	--	
Silver	ug/L	--	--	
Thallium	ug/L	--	--	
Vanadium	ug/L	--	--	
Zinc	ug/L	66	< 10	
Major Anions				
Alkalinity, Bicarbonate	mg/L	125	**91**	
Alkalinity, Carbonate	mg/L	15	< 2.0	
Chloride	mg/L	40 (p)	< 10	
Fluoride	mg/L	4.0 (p)	< 1.0	
Nitrogen, Ammonia	mg/L	0.12 (p)	<0.03	
Nitrogen, Nitrate	mg/L	0.40 (p)	<0.1	
Nitrogen, Nitrite	mg/L	0.40 (p)	<0.1	
Sulfate	mg/L	36	**32**	
Sulfide	mg/L	0.80 (p)	< 0.20	
Major Cations				
Calcium	mg/L	49	**28**	
Magnesium	mg/L	14	**8.9**	
Potassium	mg/L	22	**3.8**	
Sodium	mg/L	8.0	**2.9**	
General				
Hardness	mg/L	160	**115**	

2014
Mine Permit Groundwater Quality Monitoring Data
MW-703 QAL (Compliance)
Humboldt Mill

Parameter	Unit	Recom-mended Benchmark 2014	Q4 2014 11/6/14[D]	
Field				
D.O.[1]	ppm	--	**4.9**	
ORP	mV	--	**-15.7**	
pH	SU	7.19-8.19	**7.24**	
Specific Conductance	mS/cm	--	**0.13**	
Temperature	°C	--	**6.8**	
Turbidity	NTU	--	**7.0**	
Water Elevation	ft MSL	--	**1535.62**	
Metals				
Aluminum	ug/L	--	--	
Antimony	ug/L	--	--	
Arsenic	ug/L	20 (p)	< 5.0	
Barium	ug/L	--	--	
Beryllium	ug/L	--	--	
Boron	ug/L	--	--	
Cadmium	ug/L	--	--	
Chromium	ug/L	--	--	
Cobalt	ug/L	--	--	
Copper	ug/L	16 (p)	< 4.0	
Iron	ug/L	255	< 200	
Lead	ug/L	12 (p)	< 3.0	
Lithium	ug/L	--	--	
Manganese	ug/L	105	< 50	
Mercury	ng/L	4.0 (p)	< 1.0	
Molybdenum	ug/L	--	--	
Nickel	ug/L	80 (p)	< 20	
Selenium	ug/L	--	--	
Silver	ug/L	--	--	
Thallium	ug/L	--	--	
Vanadium	ug/L	--	--	
Zinc	ug/L	40 (p)	< 10	
Major Anions				
Alkalinity, Bicarbonate	mg/L	100	**74**	
Alkalinity, Carbonate	mg/L	8.0 (p)	< 2.0	
Chloride	mg/L	40 (p)	< 10	
Fluoride	mg/L	131	< 1.0	
Nitrogen, Ammonia	mg/L	0.12 (p)	<0.03	
Nitrogen, Nitrate	mg/L	0.22	0.21	
Nitrogen, Nitrite	mg/L	0.40 (p)	<0.1	
Sulfate	mg/L	50	**24**	
Sulfide	mg/L	0.30	< 0.20	
Major Cations				
Calcium	mg/L	40	**23**	
Magnesium	mg/L	11	**8.1**	
Potassium	mg/L	3.1	**2.0**	
Sodium	mg/L	10	**4.9**	
General				
Hardness	mg/L	136	**91**	

2014
Mine Permit Groundwater Quality Monitoring Data
MW-703 UFB (Compliance)
Humboldt Mill

Parameter	Unit	Recom-mended Benchmark 2014	Q4 2014 11/19/14[D]	
Field				
D.O.[1]	ppm	--	**2.5**	
ORP	mV	--	**-65.7**	
pH	SU	8.28-9.28	**7.57**	
Specific Conductance	mS/cm	--	**0.17**	
Temperature	°C	--	**5.8**	
Turbidity	NTU	--	**3.3**	
Water Elevation	ft MSL	--	**1533.31**	
Metals				
Aluminum	ug/L	--	--	
Antimony	ug/L	--	--	
Arsenic	ug/L	20 (p)	< 5.0	
Barium	ug/L	--	--	
Beryllium	ug/L	--	--	
Boron	ug/L	--	--	
Cadmium	ug/L	--	--	
Chromium	ug/L	--	--	
Cobalt	ug/L	--	--	
Copper	ug/L	16 (p)	< 4.0	
Iron	ug/L	2441	**1000**	
Lead	ug/L	12 (p)	< 3.0	
Lithium	ug/L	--	--	
Manganese	ug/L	194	**150**	
Mercury	ng/L	4.0 (p)	< 1.0	
Molybdenum	ug/L	--	--	
Nickel	ug/L	80 (p)	< 20	
Selenium	ug/L	--	--	
Silver	ug/L	--	--	
Thallium	ug/L	--	--	
Vanadium	ug/L	--	--	
Zinc	ug/L	14	< 10	
Major Anions				
Alkalinity, Bicarbonate	mg/L	127	**81**	
Alkalinity, Carbonate	mg/L	28	< 2.0	
Chloride	mg/L	40 (p)	< 10	
Fluoride	mg/L	4.0 (p)	< 1.0	
Nitrogen, Ammonia	mg/L	0.47	<0.03	
Nitrogen, Nitrate	mg/L	0.4 (p)	<0.1	
Nitrogen, Nitrite	mg/L	0.4 (p)	<0.1	
Sulfate	mg/L	53	**41**	
Sulfide	mg/L	0.80 (p)	< 0.20	
Major Cations				
Calcium	mg/L	53	**31**	
Magnesium	mg/L	17	**10**	
Potassium	mg/L	5.9	**2.6**	
Sodium	mg/L	35	**3.0**	
General				
Hardness	mg/L	193	**137**	

2014
Mine Permit Groundwater Quality Monitoring Data
MW-703 LLA (Compliance)
Humboldt Mill

Parameter	Unit	Recom-mended Benchmark 2014	Q4 2014 11/19/14[T]	
Field				
D.O.[1]	ppm	--	**1.9**	
ORP	mV	--	**-320**	
pH	SU	8.21-9.21	**9.08**	
Specific Conductance	mS/cm	--	**0.26**	
Temperature	°C	--	**6.0**	
Turbidity	NTU	--	**1.9**	
Water Elevation	ft MSL	--	**1533.20**	
Metals				
Aluminum	ug/L	--	--	
Antimony	ug/L	--	--	
Arsenic	ug/L	20 (p)	< 5.0	
Barium	ug/L	--	--	
Beryllium	ug/L	--	--	
Boron	ug/L	--	--	
Cadmium	ug/L	--	--	
Chromium	ug/L	--	--	
Cobalt	ug/L	--	--	
Copper	ug/L	16 (p)	< 4.0	
Iron	ug/L	2966	**1000**	
Lead	ug/L	12 (p)	< 3.0	
Lithium	ug/L	30	--	
Manganese	ug/L	101	**60**	
Mercury	ng/L	4.0 (p)	< 1.0	
Molybdenum	ug/L	--	--	
Nickel	ug/L	80 (p)	< 20	
Selenium	ug/L	--	--	
Silver	ug/L	--	--	
Thallium	ug/L	--	--	
Vanadium	ug/L	--	--	
Zinc	ug/L	40+	**14**	
Major Anions				
Alkalinity, Bicarbonate	mg/L	84	**73**	
Alkalinity, Carbonate	mg/L	4.0	< 2.0	
Chloride	mg/L	124	**61**	
Fluoride	mg/L	4.0 (p)	< 1.0	
Nitrogen, Ammonia	mg/L	0.08	<0.03	
Nitrogen, Nitrate	mg/L	0.40 (p)	<0.1	
Nitrogen, Nitrite	mg/L	0.40 (p)	<0.1	
Sulfate	mg/L	44	**30**	
Sulfide	mg/L	0.80 (p)	< 0.20	
Major Cations				
Calcium	mg/L	39	**25**	
Magnesium	mg/L	13	**9.6**	
Potassium	mg/L	9.7	**5.7**	
Sodium	mg/L	67	**30**	
General				
Hardness	mg/L	138	**114**	

2014
Mine Permit Groundwater Quality Monitoring Data
MW-703 DBA (Compliance)
Humboldt Mill

Parameter	Unit	Recom-mended Benchmark 2014	Q4 2014 11/19/14[T]	
Field				
D.O.[1]	ppm	--	**1.7**	
ORP	mV	--	**-260**	
pH	SU	8.67-9.67	**9.46**	
Specific Conductance	mS/cm	--	**0.17**	
Temperature	°C	--	**4.3**	
Turbidity	NTU	--	**1.1**	
Water Elevation	ft MSL	--	**1532.70**	
Metals				
Aluminum	ug/L	--	--	
Antimony	ug/L	--	--	
Arsenic	ug/L	20 (p)	< 5.0	
Barium	ug/L	--	--	
Beryllium	ug/L	--	--	
Boron	ug/L	--	--	
Cadmium	ug/L	--	--	
Chromium	ug/L	--	--	
Cobalt	ug/L	--	--	
Copper	ug/L	16 (p)	< 4.0	
Iron	ug/L	2738	< 200	
Lead	ug/L	12 (p)	< 3.0	
Lithium	ug/L	17	--	
Manganese	ug/L	60	< 50	
Mercury	ng/L	4.0 (p)	< 1.0	
Molybdenum	ug/L	--	--	
Nickel	ug/L	80 (p)	< 20	
Selenium	ug/L	--	--	
Silver	ug/L	--	--	
Thallium	ug/L	--	--	
Vanadium	ug/L	--	--	
Zinc	ug/L	22	< 10	
Major Anions				
Alkalinity, Bicarbonate	mg/L	74	**64**	
Alkalinity, Carbonate	mg/L	27	**14**	
Chloride	mg/L	20	**19**	
Fluoride	mg/L	4.0 (p)	< 1.0	
Nitrogen, Ammonia	mg/L	0.12	<0.03	
Nitrogen, Nitrate	mg/L	0.11	<0.1	
Nitrogen, Nitrite	mg/L	0.40 (p)	<0.1	
Sulfate	mg/L	91	**30**	
Sulfide	mg/L	0.80 (p)	< 0.20	
Major Cations				
Calcium	mg/L	29	**14**	
Magnesium	mg/L	17	**12**	
Potassium	mg/L	15	**16**	
Sodium	mg/L	14	**12**	
General				
Hardness	mg/L	137	**89**	

Explanations of abbreviations are included on the final page of this table.

2014
Mine Permit Groundwater Quality Monitoring Data
MW-704 QAL (Compliance)
Humboldt Mill

Parameter	Unit	Recom-mended Benchmark 2014	Q4 2014 11/6/14[T]	
Field				
D.O.[1]	ppm	--	**2.5**	
ORP	mV	--	**-9.8**	
pH	SU	5.49-6.49	**6.07**	
Specific Conductance	mS/cm	--	**0.27**	
Temperature	°C	--	**9.1**	
Turbidity	NTU	--	**1.1**	
Water Elevation	ft MSL	--	**1533.01**	
Metals				
Aluminum	ug/L	--	--	
Antimony	ug/L	--	--	
Arsenic	ug/L	24	**25**	
Barium	ug/L	--	--	
Beryllium	ug/L	--	--	
Boron	ug/L	--	--	
Cadmium	ug/L	--	--	
Chromium	ug/L	--	--	
Cobalt	ug/L	--	--	
Copper	ug/L	16 (p)	< 4.0	
Iron	ug/L	37038	**27000**	
Lead	ug/L	12 (p)	< 3.0	
Lithium	ug/L	--	--	
Manganese	ug/L	7914	**7200**	
Mercury	ng/L	6.0	**6.9**	
Molybdenum	ug/L	--	--	
Nickel	ug/L	80 (p)	< 20	
Selenium	ug/L	--	--	
Silver	ug/L	--	--	
Thallium	ug/L	--	--	
Vanadium	ug/L	--	--	
Zinc	ug/L	44 (p)	**11**	
Major Anions				
Alkalinity, Bicarbonate	mg/L	241	**160**	
Alkalinity, Carbonate	mg/L	8.0 (p)	< 2.0	
Chloride	mg/L	18	**14**	
Fluoride	mg/L	4.0 (p)	< 1.0	
Nitrogen, Ammonia	mg/L	0.04	**0.06**	
Nitrogen, Nitrate	mg/L	0.17	<0.1	
Nitrogen, Nitrite	mg/L	0.40 (p)	<0.1	
Sulfate	mg/L	23	**9.8**	
Sulfide	mg/L	0.80 (p)	< 0.20	
Major Cations				
Calcium	mg/L	51	**35**	
Magnesium	mg/L	9.0	**7.2**	
Potassium	mg/L	3.1	**3.0**	
Sodium	mg/L	27	**19**	
General				
Hardness	mg/L	185	**124**	

2014
Mine Permit Groundwater Quality Monitoring Data
MW-704 UFB (Compliance)
Humboldt Mill

Parameter	Unit	Recom-mended Benchmark 2014	Q4 2014 11/6/14[D]	
Field				
D.O.[1]	ppm	--	**1.8**	
ORP	mV	--	**108**	
pH	SU	6.39-7.39	**7.28**	
Specific Conductance	mS/cm	--	**0.23**	
Temperature	°C	--	**7.8**	
Turbidity	NTU	--	**8.3**	
Water Elevation	ft MSL	--	**1533.28**	
Metals				
Aluminum	ug/L	--	--	
Antimony	ug/L	--	--	
Arsenic	ug/L	20 (p)	< 5.0	
Barium	ug/L	--	--	
Beryllium	ug/L	--	--	
Boron	ug/L	--	--	
Cadmium	ug/L	--	--	
Chromium	ug/L	--	--	
Cobalt	ug/L	--	--	
Copper	ug/L	5.0	< 4.0	
Iron	ug/L	23040	**3500**	
Lead	ug/L	4.0	< 3.0	
Lithium	ug/L	--	--	
Manganese	ug/L	618	**570**	
Mercury	ng/L	2.0+	**1.2**	
Molybdenum	ug/L	--	--	
Nickel	ug/L	80 (p)	< 20	
Selenium	ug/L	--	--	
Silver	ug/L	--	--	
Thallium	ug/L	--	--	
Vanadium	ug/L	--	--	
Zinc	ug/L	15	< 10	
Major Anions				
Alkalinity, Bicarbonate	mg/L	181	**180**	
Alkalinity, Carbonate	mg/L	8.0 (p)	< 2.0	
Chloride	mg/L	18	**13**	
Fluoride	mg/L	4.0 (p)	< 1.0	
Nitrogen, Ammonia	mg/L	0.27	**0.09**	
Nitrogen, Nitrate	mg/L	0.40 (p)	<0.1	
Nitrogen, Nitrite	mg/L	0.14	<0.1	
Sulfate	mg/L	38	**5.1**	
Sulfide	mg/L	1.6 (p)	< 0.40	
Major Cations				
Calcium	mg/L	38	**38**	
Magnesium	mg/L	7.0	**6.4**	
Potassium	mg/L	4.0	**3.3**	
Sodium	mg/L	65	**31**	
General				
Hardness	mg/L	106	**121**	

2014
Mine Permit Groundwater Quality Monitoring Data
MW-704 LLA (Compliance)
Humboldt Mill

Parameter	Unit	Recom-mended Benchmark 2014	Q4 2014 11/19/14[D]	
Field				
D.O.[1]	ppm	--	**1.4**	
ORP	mV	--	**-273**	
pH	SU	8.24-9.24	**9.01**	
Specific Conductance	mS/cm	--	**0.14**	
Temperature	°C	--	**5.8**	
Turbidity	NTU	--	**5.2**	
Water Elevation	ft MSL	--	**1531.21**	
Metals				
Aluminum	ug/L	--	--	
Antimony	ug/L	--	--	
Arsenic	ug/L	20 (p)	< 5.0	
Barium	ug/L	--	--	
Beryllium	ug/L	--	--	
Boron	ug/L	--	--	
Cadmium	ug/L	--	--	
Chromium	ug/L	--	--	
Cobalt	ug/L	--	--	
Copper	ug/L	16 (p)	< 4.0	
Iron	ug/L	4974	**890**	
Lead	ug/L	12 (p)	< 3.0	
Lithium	ug/L	--	--	
Manganese	ug/L	90	< 50	
Mercury	ng/L	4.0 (p)	< 1.0	
Molybdenum	ug/L	--	--	
Nickel	ug/L	80 (p)	< 20	
Selenium	ug/L	--	--	
Silver	ug/L	--	--	
Thallium	ug/L	--	--	
Vanadium	ug/L	--	--	
Zinc	ug/L	11	< 10	
Major Anions				
Alkalinity, Bicarbonate	mg/L	132	**94**	
Alkalinity, Carbonate	mg/L	10	**5.8**	
Chloride	mg/L	40 (p)	< 10	
Fluoride	mg/L	4.0 (p)	< 1.0	
Nitrogen, Ammonia	mg/L	0.12 (p)	<0.03	
Nitrogen, Nitrate	mg/L	0.40 (p)	<0.1	
Nitrogen, Nitrite	mg/L	0.40 (p)	<0.1	
Sulfate	mg/L	23	**12**	
Sulfide	mg/L	0.80 (p)	< 0.20	
Major Cations				
Calcium	mg/L	33	**17**	
Magnesium	mg/L	17	**12**	
Potassium	mg/L	5.0	**6.2**	
Sodium	mg/L	5.0	**4.5**	
General				
Hardness	mg/L	149	**96**	

2014
Mine Permit Groundwater Quality Monitoring Data
MW-704 DBA (Compliance)
Humboldt Mill

Parameter	Unit	Recom-mended Benchmark 2014	Q4 2014 11/19/14[T]	
Field				
D.O.[1]	ppm	--	**3.1**	
ORP	mV	--	**-150**	
pH	SU	8.63-9.63	**9.18**	
Specific Conductance	mS/cm	--	**0.13**	
Temperature	°C	--	**4.7**	
Turbidity	NTU	--	**2.2**	
Water Elevation	ft MSL	--	**1533.44**	
Metals				
Aluminum	ug/L	--	--	
Antimony	ug/L	--	--	
Arsenic	ug/L	20 (p)	< 5.0	
Barium	ug/L	--	--	
Beryllium	ug/L	--	--	
Boron	ug/L	1480	--	
Cadmium	ug/L	--	--	
Chromium	ug/L	--	--	
Cobalt	ug/L	--	--	
Copper	ug/L	16 (p)	< 4.0	
Iron	ug/L	9645	**620**	
Lead	ug/L	12 (p)	< 3.0	
Lithium	ug/L	--	--	
Manganese	ug/L	58	< 50	
Mercury	ng/L	4.0 (p)	< 1.0	
Molybdenum	ug/L	--	--	
Nickel	ug/L	80 (p)	< 20	
Selenium	ug/L	--	--	
Silver	ug/L	--	--	
Thallium	ug/L	--	--	
Vanadium	ug/L	--	--	
Zinc	ug/L	11	**11**	
Major Anions				
Alkalinity, Bicarbonate	mg/L	129	**100**	
Alkalinity, Carbonate	mg/L	32	**9.7**	
Chloride	mg/L	40 (p)	< 10	
Fluoride	mg/L	4.0 (p)	< 1.0	
Nitrogen, Ammonia	mg/L	0.04	<0.03	
Nitrogen, Nitrate	mg/L	0.40 (p)	<0.1	
Nitrogen, Nitrite	mg/L	0.40 (p)	<0.1	
Sulfate	mg/L	6.0	**2.0**	
Sulfide	mg/L	0.80 (p)	< 0.20	
Major Cations				
Calcium	mg/L	27	**20**	
Magnesium	mg/L	14	**10**	
Potassium	mg/L	4.0	**2.7**	
Sodium	mg/L	14	**11**	
General				
Hardness	mg/L	111	**96**	

2014
Mine Permit Groundwater Quality Monitoring Data
MW-705 QAL (Cutoff Wall Key-In)
Humboldt Mill

Parameter	Unit	Recom-mended Benchmark 2014	Q4 2014 11/6/14[T]	
Field				
D.O.[1]	ppm	--	**2.9**	
ORP	mV	--	**-17.3**	
pH	SU	5.62-6.62	**6.33**	
Specific Conductance	mS/cm	--	**0.16**	
Temperature	°C	--	**9.0**	
Turbidity	NTU	--	**1.2**	
Water Elevation	ft MSL	--	**1535.26**	
Metals				
Aluminum	ug/L	--	--	
Antimony	ug/L	--	--	
Arsenic	ug/L	20 (p)	< 5.0	
Barium	ug/L	--	--	
Beryllium	ug/L	--	--	
Boron	ug/L	--	--	
Cadmium	ug/L	--	--	
Chromium	ug/L	--	--	
Cobalt	ug/L	--	--	
Copper	ug/L	16 (p)	< 4.0	
Iron	ug/L	14081	**7700**	
Lead	ug/L	12 (p)	< 3.0	
Lithium	ug/L	--	--	
Manganese	ug/L	1674	**890**	
Mercury	ng/L	1.0	< 1.0	
Molybdenum	ug/L	--	--	
Nickel	ug/L	80 (p)	< 20	
Selenium	ug/L	--	--	
Silver	ug/L	--	--	
Thallium	ug/L	--	--	
Vanadium	ug/L	--	--	
Zinc	ug/L	174	**25**	
Major Anions				
Alkalinity, Bicarbonate	mg/L	94	**63**	
Alkalinity, Carbonate	mg/L	8.0 (p)	< 2.0	
Chloride	mg/L	66	**25**	
Fluoride	mg/L	4.0 (p)	< 1.0	
Nitrogen, Ammonia	mg/L	0.10	**0.07**	
Nitrogen, Nitrate	mg/L	0.40 (p)	<0.1	
Nitrogen, Nitrite	mg/L	0.40 (p)	<0.1	
Sulfate	mg/L	6.0	**5.5**	
Sulfide	mg/L	0.80 (p)	< 0.20	
Major Cations				
Calcium	mg/L	27	**17**	
Magnesium	mg/L	13	**7.7**	
Potassium	mg/L	3.0	**2.6**	
Sodium	mg/L	17	**9.9**	
General				
Hardness	mg/L	115	**77**	

2014
Mine Permit Groundwater Quality Monitoring Data
MW-705 UFB (Cutoff Wall Key-In)
Humboldt Mill

Parameter	Unit	Recom-mended Benchmark 2014	Q4 2014 11/20/14[D]	
Field				
D.O.[1]	ppm	--	**3.8**	
ORP	mV	--	**-60**	
pH	SU	6.72-7.72	**7.02**	
Specific Conductance	mS/cm	--	**0.15**	
Temperature	°C	--	**7.3**	
Turbidity	NTU	--	**60**	
Water Elevation	ft MSL	--	**1534.88**	
Metals				
Aluminum	ug/L	--	--	
Antimony	ug/L	--	--	
Arsenic	ug/L	20 (p)	< 5.0	
Barium	ug/L	--	--	
Beryllium	ug/L	--	--	
Boron	ug/L	--	--	
Cadmium	ug/L	--	--	
Chromium	ug/L	--	--	
Cobalt	ug/L	--	--	
Copper	ug/L	16 (p)	< 4.0	
Iron	ug/L	11214	**9300**	
Lead	ug/L	12 (p)	< 3.0	
Lithium	ug/L	--	--	
Manganese	ug/L	866	**840**	
Mercury	ng/L	4.0 (p)	< 1.0	
Molybdenum	ug/L	--	--	
Nickel	ug/L	80 (p)	< 20	
Selenium	ug/L	--	--	
Silver	ug/L	--	--	
Thallium	ug/L	--	--	
Vanadium	ug/L	--	--	
Zinc	ug/L	17	< 10	
Major Anions				
Alkalinity, Bicarbonate	mg/L	103	**85**	
Alkalinity, Carbonate	mg/L	8.0 (p)	< 2.0	
Chloride	mg/L	40 (p)	< 10	
Fluoride	mg/L	4.0 (p)	< 1.0	
Nitrogen, Ammonia	mg/L	0.12 (p)	<0.03	
Nitrogen, Nitrate	mg/L	0.40 (p)	<0.1	
Nitrogen, Nitrite	mg/L	0.40 (p)	<0.1	
Sulfate	mg/L	15	**9.4**	
Sulfide	mg/L	0.80 (p)	< 0.20	
Major Cations				
Calcium	mg/L	26	**18**	
Magnesium	mg/L	12	**9.0**	
Potassium	mg/L	4.0	**3.3**	
Sodium	mg/L	3.0	**2.5**	
General				
Hardness	mg/L	111	**92**	

2014
Mine Permit Groundwater Quality Monitoring Data
MW-706 QAL (MSB & Crusher)
Humboldt Mill

Parameter	Unit	Recom-mended Benchmark 2014	Q4 2014 11/6/14[T]	
Field				
D.O.[1]	ppm	--	**2.5**	
ORP	mV	--	**-18.4**	
pH	SU	6.24-7.24	**6.23**	
Specific Conductance	mS/cm	--	**0.55**	
Temperature	°C	--	**7.8**	
Turbidity	NTU	--	**2.5**	
Water Elevation	ft MSL	--	**1561.18**	
Metals				
Aluminum	ug/L	--	--	
Antimony	ug/L	--	--	
Arsenic	ug/L	16	**10**	
Barium	ug/L	--	--	
Beryllium	ug/L	--	--	
Boron	ug/L	--	--	
Cadmium	ug/L	--	--	
Chromium	ug/L	--	--	
Cobalt	ug/L	--	--	
Copper	ug/L	16 (p)	< 4.0	
Iron	ug/L	10846	**6700**	
Lead	ug/L	12 (p)	< 3.0	
Lithium	ug/L	--	--	
Manganese	ug/L	27225	**22000**	
Mercury	ng/L	4.0 (p)	< 1.0	
Molybdenum	ug/L	--	--	
Nickel	ug/L	100 (p)	**21**	
Selenium	ug/L	--	--	
Silver	ug/L	--	--	
Thallium	ug/L	--	--	
Vanadium	ug/L	--	--	
Zinc	ug/L	55	**12**	
Major Anions				
Alkalinity, Bicarbonate	mg/L	153	**100**	
Alkalinity, Carbonate	mg/L	8.0 (p)	< 2.0	
Chloride	mg/L	105	**97**	
Fluoride	mg/L	4.0 (p)	< 1.0	
Nitrogen, Ammonia	mg/L	1.4	**0.39**	
Nitrogen, Nitrate	mg/L	0.4 (p)	<0.1	
Nitrogen, Nitrite	mg/L	0.4 (p)	<0.1	
Sulfate	mg/L	479	**340**	
Sulfide	mg/L	0.80 (p)	< 0.20	
Major Cations				
Calcium	mg/L	183	**110**	
Magnesium	mg/L	56	**37**	
Potassium	mg/L	6.0	**4.6**	
Sodium	mg/L	234	**38**	
General				
Hardness	mg/L	609	**503**	

2014
Mine Permit Groundwater Quality Monitoring Data
MW-707 QAL (Concentrator & CLO)
Humboldt Mill

Parameter	Unit	Recom-mended Benchmark 2014	Q4 2014 11/6/14[T]	
Field				
D.O.[1]	ppm	--	**3.3**	
ORP	mV	--	**-58.8**	
pH	SU	6.30-7.30	**6.65**	
Specific Conductance	mS/cm	--	**0.19**	
Temperature	°C	--	**8.0**	
Turbidity	NTU	--	**1.3**	
Water Elevation	ft MSL	--	**1583.60**	
Metals				
Aluminum	ug/L	--	--	
Antimony	ug/L	--	--	
Arsenic	ug/L	20 (p)	< 5.0	
Barium	ug/L	--	--	
Beryllium	ug/L	--	--	
Boron	ug/L	--	--	
Cadmium	ug/L	--	--	
Chromium	ug/L	--	--	
Cobalt	ug/L	--	--	
Copper	ug/L	16 (p)	< 4.0	
Iron	ug/L	7493	**6400**	
Lead	ug/L	12 (p)	< 3.0	
Lithium	ug/L	--	--	
Manganese	ug/L	1189	**1000**	
Mercury	ng/L	4.0 (p)	< 1.0	
Molybdenum	ug/L	--	--	
Nickel	ug/L	80 (p)	< 20	
Selenium	ug/L	--	--	
Silver	ug/L	--	--	
Thallium	ug/L	--	--	
Vanadium	ug/L	--	--	
Zinc	ug/L	19	< 10	
Major Anions				
Alkalinity, Bicarbonate	mg/L	150	**150**	
Alkalinity, Carbonate	mg/L	8.0 (p)	< 2.0	
Chloride	mg/L	40 (p)	< 10	
Fluoride	mg/L	4.0 (p)	< 1.0	
Nitrogen, Ammonia	mg/L	0.34	**0.28**	
Nitrogen, Nitrate	mg/L	0.40 (p)	<0.1	
Nitrogen, Nitrite	mg/L	0.40 (p)	<0.1	
Sulfate	mg/L	8.0	**7.4**	
Sulfide	mg/L	0.80 (p)	< 0.20	
Major Cations				
Calcium	mg/L	51	**40**	
Magnesium	mg/L	15	**12**	
Potassium	mg/L	3.0	**2.6**	
Sodium	mg/L	4.0	**3.1**	
General				
Hardness	mg/L	149	**149**	

2014
Mine Permit Groundwater Quality Monitoring Data
MW-9R (Concentrator)
Humboldt Mill

Parameter	Unit	Recom-mended Benchmark 2014	Q4 2014 11/20/14[D]	
Field				
D.O.[1]	ppm	--	**4.1**	
ORP	mV	--	**40.2**	
pH	SU	5.44-6.44	**6.52**	
Specific Conductance	mS/cm	--	**0.51**	
Temperature	°C	--	**7.0**	
Turbidity	NTU	--	**19**	
Water Elevation	ft MSL	--	**1594.53**	
Metals				
Aluminum	ug/L	--	--	
Antimony	ug/L	--	--	
Arsenic	ug/L	25	< 5.0	
Barium	ug/L	--	--	
Beryllium	ug/L	--	--	
Boron	ug/L	--	--	
Cadmium	ug/L		--	
Chromium	ug/L		--	
Cobalt	ug/L	--	--	
Copper	ug/L	5.0	< 4.0	
Iron	ug/L	25558	**3800**	
Lead	ug/L	0.04	< 3.0	
Lithium	ug/L	--	--	
Manganese	ug/L	1694	**370**	
Mercury	ng/L	1.0	< 1.0	
Molybdenum	ug/L	--	--	
Nickel	ug/L	89	**31**	
Selenium	ug/L	--	--	
Silver	ug/L	--	--	
Thallium	ug/L	--	--	
Vanadium	ug/L	--	--	
Zinc	ug/L	25	**17**	
Major Anions				
Alkalinity, Bicarbonate	mg/L	137	**58**	
Alkalinity, Carbonate	mg/L	2.0	< 2.0	
Chloride	mg/L	711	**130**	
Fluoride	mg/L	4.0 (p)	< 1.0	
Nitrogen, Ammonia	mg/L	0.36	**0.08**	
Nitrogen, Nitrate	mg/L	1.0	**0.29**	
Nitrogen, Nitrite	mg/L	0.07	<0.1	
Sulfate	mg/L	343	**320**	
Sulfide	mg/L	1.0	< 0.20	
Major Cations				
Calcium	mg/L	123	**120**	
Magnesium	mg/L	48	**42**	
Potassium	mg/L	8.0	**4.6**	
Sodium	mg/L	289	**47**	
General				
Hardness	mg/L	510	**473**	

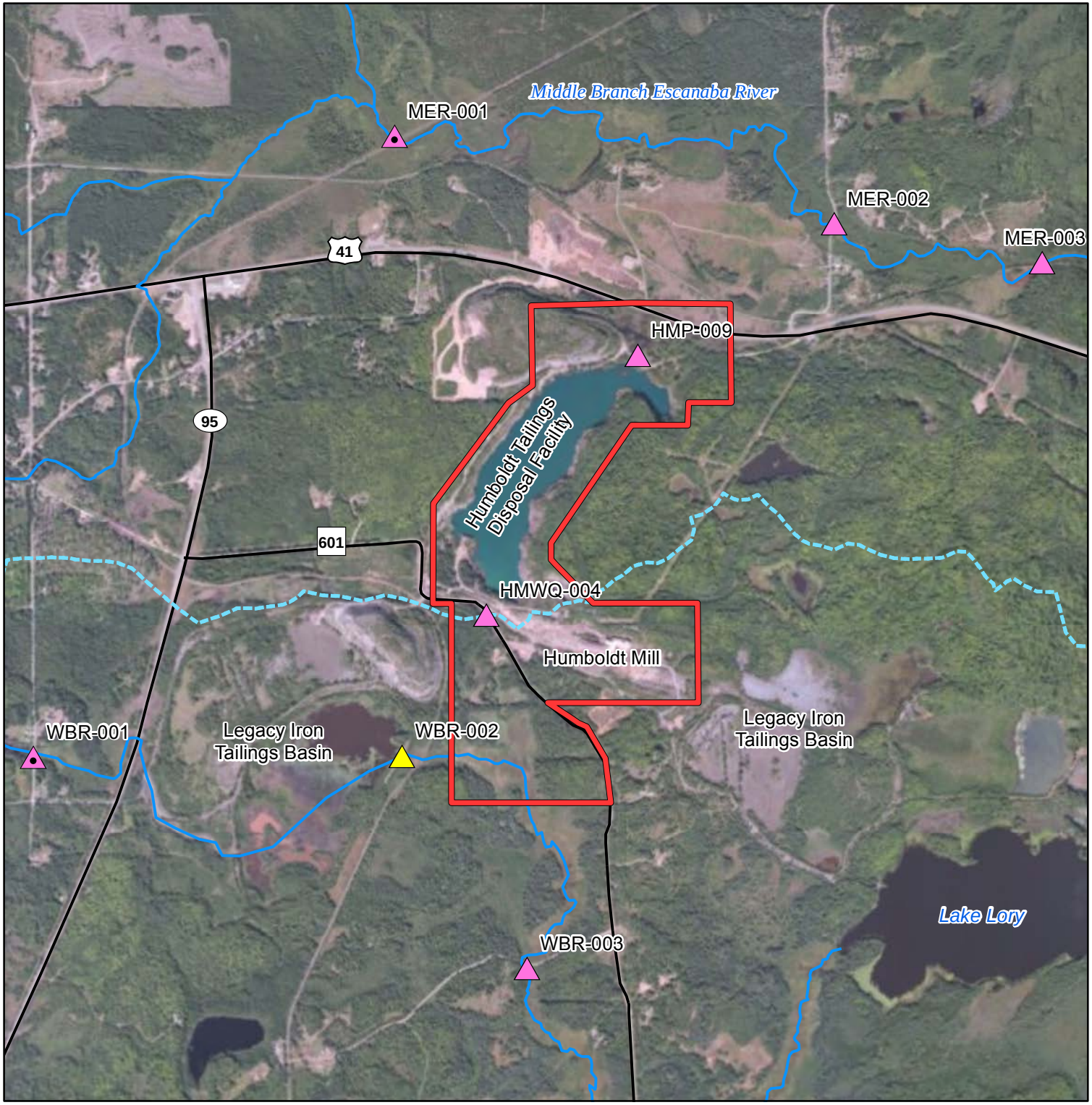
2014
Mine Permit Groundwater Quality Monitoring Data
Abbreviations & Data Qualifiers
Humboldt Mill

Notes:
Benchmarks are calculated based on guidance from Eagles Mine's Development of Site Specific Benchmarks for Mine Permit Water Quality Monitoring.
Results in **bold** text indicate that the parameter was detected at a level greater than the laboratory reporting limit.
Highlighted Cell = Value is equal to or above site-specific benchmark. An exceedance occurs if there are 2 consecutive sampling events with a value equal to or greater than the benchmark at a compliance monitoring location.
(p) = Due to less than two detections in baseline dataset, benchmark defaulted to four times the reporting limit.
--Denotes no benchmark required or parameter was not required to be collected during the sampling quarter.
T = Sample was not filtered and all values are total concentrations.
D = Samples for metals and major cation parameters were filtered and values are dissolved concentrations.

Appendix G

Humboldt Mill

Surface water Location Map



HUMBOLDT MILL PROPOSED SURFACE WATER AND SEDIMENT MONITORING LOCATIONS

Legend

- Reference Monitoring Station
- Proposed Surface Water Monitoring Location
- Proposed Surface Water and Sediment Monitoring Location
- Road
- River
- Watershed Boundary
- Humboldt Mill Property

Reference:

Data provided by: Eagle Mine, ESRI, and North Jackson Company

Projection & Datum: NAD 1927 UTM Zone 16N

Aerial Photo: 2010

0 2,000 4,000 Feet

1:32,000

Eagle Mine
a subsidiary of lundin mining

North Jackson Company
ENVIRONMENTAL SCIENCE & ENGINEERING

Figure 1

Appendix H

Humboldt Mill

Surface Water Results

&

Benchmark Summary Table

Humboldt Mill
2014 Mine Permit Surface Water Monitoring
Benchmark Comparison Summary

Location	Location Classification	Q4
HMP-009	Compliance - HTDF subwatershed	Not Sampled
HMWQ-004	Compliance - Mill subwatershed	pH, selenium
MER-001	Reference - HTDF subwatershed	pH, cobalt, copper, lead, selenium, zinc, total suspended solids
MER-002	Compliance - HTDF subwatershed	pH, selenium, zinc
MER-003	Compliance - HTDF subwatershed	pH, selenium, zinc
WBR-001	Reference - Mill subwatershed	pH, selenium
WBR-002	Compliance - Mill subwatershed	pH, cobalt, copper, lead, selenium, total suspended solids
WBR-003	Compliance - Mill subwatershed	pH, selenium

Parameters listed in this table had values reported that were equal to or greater than a site-specific benchmark.

2014
Mine Permit Surface Water Quality Monitoring Data
HMP-009 (Compliance)
Humboldt Mill

Parameter	Unit	Recom-mended Benchmark 2014	Q4 2014 11/10/14[T]	
Field				
D.O.[1]	ppm	--	NM	
ORP	mV	--	NM	
pH	SU	7.03-8.03	NM	
Specific Conductance	µS/cm @ 25°C	--	NM	
Temperature	°C	--	NM	
Turbidity	NTU	--	NM	
Flow	cfs	--	NM	
Metals				
Aluminum	ug/L	4.0 (p)	--	
Antimony	ug/L	11.5	--	
Arsenic	ug/L	2.2	NM	
Barium	ug/L	27	--	
Beryllium	ug/L	0.67	--	
Boron	ug/L	113	--	
Cadmium	ug/L	0.1	NM	
Chromium	ug/L	1.3	--	
Cobalt	ug/L	3.0	NM	
Copper	ug/L	7.9	NM	
Iron	ug/L	1620	NM	
Lead	ug/L	1.0	--	
Lithium	ug/L	5.3	--	
Manganese	ug/L	337	NM	
Mercury	ng/L	1.1	NM	
Molybdenum	ug/L	13	--	
Nickel	ug/L	17	NM	
Selenium	ug/L	0.36	NM	
Silver	ug/L	0.12	--	
Thallium	ug/L	0.68	--	
Vanadium	ug/L	1.7	--	
Zinc	ug/L	6.1	NM	
Major Anions				
Alkalinity, Bicarbonate	mg/L	124	NM	
Alkalinity, Carbonate	mg/L	2.0	NM	
Chloride	mg/L	15	NM	
Fluoride	mg/L	0.41	NM	
Nitrogen, Ammonia	mg/L	2.0 (P)	NM	
Nitrogen, Nitrate	mg/L	2.5	NM	
Nitrogen, Nitrite	mg/L	0.34	NM	
Sulfate	mg/L	138	NM	
Sulfide	mg/L	3.0	NM	
Major Cations				
Calcium	mg/L	68	NM	
Magnesium	mg/L	26	NM	
Potassium	mg/L	9.4	NM	
Sodium	mg/L	15	NM	
General				
Hardness	mg/L	251	NM	
Total Dissolved Solids	mg/L	361	NM	
Total Suspended Solids	mg/L	13	NM	

Explanations of abbreviations are included on the final page of this table.

2014
Mine Permit Surface Water Quality Monitoring Data
HMWQ-004 (Compliance)
Humboldt Mill

Parameter	Unit	Recom-mended Benchmark 2014	Q4 2014 11/10/14[T]	
Field				
D.O.[1]	ppm	--	**14.0**	
ORP	mV	--	**192**	
pH	SU	5.69-6.69	**3.64**	
Specific Conductance	mmhos	--	**0.11**	
Temperature	°C	--	**1.5**	
Turbidity	NTU	--	**5.7**	
Flow	cfs	--	NM	
Metals				
Aluminum	ug/L	4.0 (p)	--	
Antimony	ug/L	2.3	--	
Arsenic	ug/L	35	**2.7**	
Barium	ug/L	118	--	
Beryllium	ug/L	4.0 (p)	--	
Boron	ug/L	36	--	
Cadmium	ug/L	0.10	**0.059**	
Chromium	ug/L	14	--	
Cobalt	ug/L	3.0	**2.6**	
Copper	ug/L	11	**5.2**	
Iron	ug/L	73,409	**14000**	
Lead	ug/L	2.1	--	
Lithium	ug/L	16	--	
Manganese	ug/L	2541	**610**	
Mercury	ng/L	43	**22**	
Molybdenum	ug/L	4.7	--	
Nickel	ug/L	5.6	**2.9**	
Selenium	ug/L	0.44	**0.71**	
Silver	ug/L	0.35	--	
Thallium	ug/L	4.0 (P)	--	
Vanadium	ug/L	39	--	
Zinc	ug/L	44	**37**	
Major Anions				
Alkalinity, Bicarbonate	mg/L	68	**21**	
Alkalinity, Carbonate	mg/L	8.0 (P)	< 2.0	
Chloride	mg/L	68	**12**	
Fluoride	mg/L	0.23	< 0.10	
Nitrogen, Ammonia	mg/L	1.9	0.70	
Nitrogen, Nitrate	mg/L	2.0 (P)	< 0.50	
Nitrogen, Nitrite	mg/L	2.0 (P)	< 0.50	
Sulfate	mg/L	4.0 (P)	< 1.0	
Sulfide	mg/L	20 (P)	< 5.0	
Major Cations				
Calcium	mg/L	21	**9.3**	
Magnesium	mg/L	8.1	**3.0**	
Potassium	mg/L	3.3	**1.5**	
Sodium	mg/L	49	**3.8**	
General				
Hardness	mg/L	88	**60**	
Total Dissolved Solids	mg/L	209	**144**	
Total Suspended Solids	mg/L	353	**94**	

2014
Mine Permit Surface Water Quality Monitoring Data
MER-001 (Reference)
Humboldt Mill

Parameter	Unit	Recom-mended Benchmark 2014	Q4 2014 11/10/14[T]	
Field				
D.O.[1]	ppm	--	**0.26**	
ORP	mV	--	**137**	
pH	SU	6.11-7.11	**5.22**	
Specific Conductance	mmhos	--	**80**	
Temperature	°C	--	**2.7**	
Turbidity	NTU	--	**4.5**	
Flow	cfs	--	NM	
Metals				
Aluminum	ug/L	4.0 (p)	--	
Antimony	ug/L	0.73	--	
Arsenic	ug/L	3.4	**1.6**	
Barium	ug/L	12	--	
Beryllium	ug/L	0.73	--	
Boron	ug/L	14.8	--	
Cadmium	ug/L	0.10	**0.02**	
Chromium	ug/L	1.2	--	
Cobalt	ug/L	0.42	**0.42**	
Copper	ug/L	0.86	**1.2**	
Iron	ug/L	3255	**1900**	
Lead	ug/L	0.35	**0.57**	
Lithium	ug/L	5.7	--	
Manganese	ug/L	226	**98**	
Mercury	ng/L	8.5	**3.2**	
Molybdenum	ug/L	1.0	--	
Nickel	ug/L	1.0	**0.68**	
Selenium	ug/L	0.19	**0.45**	
Silver	ug/L	0.12	--	
Thallium	ug/L	0.75	--	
Vanadium	ug/L	1.5	--	
Zinc	ug/L	2.6	**4.5**	
Major Anions				
Alkalinity, Bicarbonate	mg/L	50	**14**	
Alkalinity, Carbonate	mg/L	2.0	< 2.0	
Chloride	mg/L	13	**7.0**	
Fluoride	mg/L	0.19	< 0.10	
Nitrogen, Ammonia	mg/L	2.0 (P)	< 0.50	
Nitrogen, Nitrate	mg/L	0.34	< 0.50	
Nitrogen, Nitrite	mg/L	0.36	< 0.50	
Sulfate	mg/L	10	< 1.0	
Sulfide	mg/L	3.2	< 5.0	
Major Cations				
Calcium	mg/L	15	**5.9**	
Magnesium	mg/L	4.1	**1.8**	
Potassium	mg/L	1.0	**0.74**	
Sodium	mg/L	6.9	**3.9**	
General				
Hardness	mg/L	56	**22**	
Total Dissolved Solids	mg/L	111	**54**	
Total Suspended Solids	mg/L	4.0	**20**	

Explanations of abbreviations are included on the final page of this table.

2014
Mine Permit Surface Water Quality Monitoring Data
MER-002 (Compliance)
Humboldt Mill

Parameter	Unit	Recom-mended Benchmark 2014	Q4 2014 11/10/14[T]	
Field				
D.O.[1]	ppm	--	**12.2**	
ORP	mV	--	**159**	
pH	SU	5.95-6.95	**5.43**	
Specific Conductance	mmhos	--	**0.08**	
Temperature	°C	--	**2.9**	
Turbidity	NTU	--	**3.8**	
Flow	cfs	--	**92**	
Metals				
Aluminum	ug/L	4.0 (p)	--	
Antimony	ug/L	0.72	--	
Arsenic	ug/L	5.1	<1.0	
Barium	ug/L	20	--	
Beryllium	ug/L	0.73	--	
Boron	ug/L	14	--	
Cadmium	ug/L	0.09	**0.01**	e
Chromium	ug/L	1.2	--	
Cobalt	ug/L	0.65	**0.14**	
Copper	ug/L	0.90	**0.62**	
Iron	ug/L	6440	**1100**	
Lead	ug/L	0.37	**0.15**	
Lithium	ug/L	5.7	--	
Manganese	ug/L	560	**57**	
Mercury	ng/L	7.5	**3.3**	
Molybdenum	ug/L	0.73	--	
Nickel	ug/L	1.2	**0.35**	
Selenium	ug/L	0.19	**0.27**	
Silver	ug/L	0.12	--	
Thallium	ug/L	0.73	--	
Vanadium	ug/L	3.0	--	
Zinc	ug/L	3.0	**3.7**	
Major Anions				
Alkalinity, Bicarbonate	mg/L	53	**15**	
Alkalinity, Carbonate	mg/L	2.0	< 2.0	
Chloride	mg/L	16	**5.3**	
Fluoride	mg/L	0.19	< 0.10	
Nitrogen, Ammonia	mg/L	2.0 (P)	< 0.50	
Nitrogen, Nitrate	mg/L	0.40	< 0.50	
Nitrogen, Nitrite	mg/L	0.37	< 0.50	
Sulfate	mg/L	14	< 1.0	
Sulfide	mg/L	3.2	< 5.0	
Major Cations				
Calcium	mg/L	18	**5.9**	
Magnesium	mg/L	4.9	**1.7**	
Potassium	mg/L	1.2	**0.68**	
Sodium	mg/L	9.4	**3.2**	
General				
Hardness	mg/L	67	**18**	
Total Dissolved Solids	mg/L	125	**56**	
Total Suspended Solids	mg/L	12	< 3.3	

Explanations of abbreviations are included on the final page of this table.

2014
Mine Permit Surface Water Quality Monitoring Data
MER-003 (Compliance)
Humboldt Mill

Parameter	Unit	Recom-mended Benchmark 2014	Q4 2014 11/10/14[T]	
Field				
D.O.[1]	ppm	--	**12.2**	
ORP	mV	--	**149**	
pH	SU	5.97-6.97	**5.69**	
Specific Conductance	mmhos	--	**0.08**	
Temperature	°C	--	**2.9**	
Turbidity	NTU	--	**6**	
Flow	cfs	--	NM	
Metals				
Aluminum	ug/L	4.0 (p)	--	
Antimony	ug/L	0.70	--	
Arsenic	ug/L	3.3	< 1.0	
Barium	ug/L	15	--	
Beryllium	ug/L	0.73	--	
Boron	ug/L	15	--	
Cadmium	ug/L	0.09	**0.01**	e
Chromium	ug/L	0.85	--	
Cobalt	ug/L	0.65	**0.18**	
Copper	ug/L	0.92	**0.62**	
Iron	ug/L	4268	**1200**	
Lead	ug/L	0.35	**0.16**	
Lithium	ug/L	5.7	--	
Manganese	ug/L	280	**62**	
Mercury	ng/L	7.6	**3.4**	
Molybdenum	ug/L	0.80	--	
Nickel	ug/L	1.3	**0.37**	
Selenium	ug/L	0.20	**0.41**	
Silver	ug/L	0.12	--	
Thallium	ug/L	0.70	--	
Vanadium	ug/L	1.2	--	
Zinc	ug/L	2.9	**4.8**	
Major Anions				
Alkalinity, Bicarbonate	mg/L	56	**16**	
Alkalinity, Carbonate	mg/L	2.0	< 2.0	
Chloride	mg/L	19	**6.1**	
Fluoride	mg/L	0.29	< 0.10	
Nitrogen, Ammonia	mg/L	2.0 (P)	< 0.50	
Nitrogen, Nitrate	mg/L	0.34	< 0.50	
Nitrogen, Nitrite	mg/L	0.37	< 0.50	
Sulfate	mg/L	16	< 1.0	
Sulfide	mg/L	3.2	< 5.0	
Major Cations				
Calcium	mg/L	19	**6.0**	
Magnesium	mg/L	5.3	**1.9**	
Potassium	mg/L	1.4	**0.66**	
Sodium	mg/L	11	**3.6**	
General				
Hardness	mg/L	71	**25**	
Total Dissolved Solids	mg/L	141	**64**	
Total Suspended Solids	mg/L	3.1	< 3.3	

Explanations of abbreviations are included on the final page of this table.

2014
Mine Permit Surface Water Quality Monitoring Data
WBR-001 (Reference)
Humboldt Mill

Parameter	Unit	Recom-mended Benchmark 2014	Q4 2014 11/10/14[T]	
Field				
D.O.[1]	ppm	--	**12.9**	
ORP	mV	--	**153**	
pH	SU	4.98-5.98	**4.72**	
Specific Conductance	mmhos	--	**0.22**	
Temperature	°C	--	**2.4**	
Turbidity	NTU	--	**4**	
Flow	cfs	--	NM	
Metals				
Aluminum	ug/L	4.0 (p)	--	
Antimony	ug/L	0.70	--	
Arsenic	ug/L	8.7	**1.3**	
Barium	ug/L	26	--	
Beryllium	ug/L	0.73	--	
Boron	ug/L	12.7	--	
Cadmium	ug/L	0.06	**0.03**	
Chromium	ug/L	2.7	--	
Cobalt	ug/L	0.85	**0.28**	
Copper	ug/L	1.0	**0.63**	
Iron	ug/L	11056	**1600**	
Lead	ug/L	1.8	**0.64**	
Lithium	ug/L	8.6	--	
Manganese	ug/L	641	**87**	
Mercury	ng/L	17.0	**5.5**	
Molybdenum	ug/L	8.1	--	
Nickel	ug/L	1.9	**0.60**	
Selenium	ug/L	0.33	**0.33**	
Silver	ug/L	0.12	--	
Thallium	ug/L	0.70	--	
Vanadium	ug/L	4.2	--	
Zinc	ug/L	9.2	**7.3**	
Major Anions				
Alkalinity, Bicarbonate	mg/L	15	**4.9**	
Alkalinity, Carbonate	mg/L	2.0	< 2.0	
Chloride	mg/L	24	**19**	
Fluoride	mg/L	0.26	< 0.10	
Nitrogen, Ammonia	mg/L	0.78	< 0.50	
Nitrogen, Nitrate	mg/L	0.34	< 0.50	
Nitrogen, Nitrite	mg/L	0.37	< 0.50	
Sulfate	mg/L	9.3	< 1.0	
Sulfide	mg/L	3.2	< 5.0	
Major Cations				
Calcium	mg/L	8.3	**4.7**	
Magnesium	mg/L	3.3	**1.9**	
Potassium	mg/L	2.6	**1.1**	
Sodium	mg/L	11	**8.4**	
General				
Hardness	mg/L	38	**20**	
Total Dissolved Solids	mg/L	204	**96**	
Total Suspended Solids	mg/L	34	< 3.3	

Explanations of abbreviations are included on the final page of this table.

2014
Mine Permit Surface Water Quality Monitoring Data
WBR-002 (Compliance)
Humboldt Mill

Parameter	Unit	Recom-mended Benchmark 2014	Q4 2014 11/10/14[T]	
Field				
D.O.[1]	ppm	--	**11.6**	
ORP	mV	--	**84.3**	
pH	SU	6.26-7.26	**5.96**	
Specific Conductance	mmhos	--	**0.17**	
Temperature	°C	--	**3.5**	
Turbidity	NTU	--	**32**	
Flow	cfs	--	NM	
Metals				
Aluminum	ug/L	4.0 (p)	--	
Antimony	ug/L	0.72	--	
Arsenic	ug/L	10	**3.9**	
Barium	ug/L	19	--	
Beryllium	ug/L	0.73	--	
Boron	ug/L	18	--	
Cadmium	ug/L	0.09	< 0.020	
Chromium	ug/L	10	--	
Cobalt	ug/L	0.80	**0.85**	
Copper	ug/L	1.3	**1.4**	
Iron	ug/L	15593	**6700**	
Lead	ug/L	0.25	**0.38**	
Lithium	ug/L	5.6	--	
Manganese	ug/L	1295	**330**	
Mercury	ng/L	4.3	**1.7**	
Molybdenum	ug/L	2.8	--	
Nickel	ug/L	1.9	**1.6**	
Selenium	ug/L	0.18	**0.37**	
Silver	ug/L	0.12	--	
Thallium	ug/L	0.72	--	
Vanadium	ug/L	0.8	--	
Zinc	ug/L	4.5	**2.8**	
Major Anions				
Alkalinity, Bicarbonate	mg/L	41	**16**	
Alkalinity, Carbonate	mg/L	2.0	< 2.0	
Chloride	mg/L	56	**25**	
Fluoride	mg/L	0.31	< 0.10	
Nitrogen, Ammonia	mg/L	0.61	< 0.50	
Nitrogen, Nitrate	mg/L	0.36	< 0.50	
Nitrogen, Nitrite	mg/L	0.37	< 0.50	
Sulfate	mg/L	10	< 1.0	
Sulfide	mg/L	3.2	< 5.0	
Major Cations				
Calcium	mg/L	13	**6.9**	
Magnesium	mg/L	5.8	**3.2**	
Potassium	mg/L	2.7	**1.5**	
Sodium	mg/L	28	**18**	
General				
Hardness	mg/L	56	32	
Total Dissolved Solids	mg/L	182	94	
Total Suspended Solids	mg/L	9.8	14	

2014
Mine Permit Surface Water Quality Monitoring Data
WBR-003 (Compliance)
Humboldt Mill

Parameter	Unit	Recom-mended Benchmark 2014	Q4 2014 11/10/14[T]	
Field				
D.O.[1]	ppm	--	**12.8**	
ORP	mV	--	**213**	
pH	SU	6.05-7.05	**4.3**	
Specific Conductance	mmhos	--	**0.17**	
Temperature	°C	--	**2.5**	
Turbidity	NTU	--	**12**	
Flow	cfs	--	NM	
Metals				
Aluminum	ug/L	4.0 (p)	--	
Antimony	ug/L	0.70	--	
Arsenic	ug/L	4.4	**1.1**	
Barium	ug/L	19	--	
Beryllium	ug/L	0.70	--	
Boron	ug/L	19	--	
Cadmium	ug/L	0.09	<0.02	
Chromium	ug/L	0.74	--	
Cobalt	ug/L	1.2	**0.12**	
Copper	ug/L	1.0	**0.52**	
Iron	ug/L	11315	**2300**	
Lead	ug/L	0.44	**0.15**	
Lithium	ug/L	5.5	--	
Manganese	ug/L	2101	**41**	
Mercury	ng/L	6.0	**1.3**	
Molybdenum	ug/L	1.9	--	
Nickel	ug/L	1.8	**0.55**	
Selenium	ug/L	0.19	**0.31**	
Silver	ug/L	0.12	--	
Thallium	ug/L	0.72	--	
Vanadium	ug/L	0.82	--	
Zinc	ug/L	10	**2.4**	
Major Anions				
Alkalinity, Bicarbonate	mg/L	56	**14**	
Alkalinity, Carbonate	mg/L	2.0	< 2.0	
Chloride	mg/L	43	**30**	
Fluoride	mg/L	0.34	< 0.10	
Nitrogen, Ammonia	mg/L	2.0 (P)	< 0.50	
Nitrogen, Nitrate	mg/L	0.30	< 0.50	
Nitrogen, Nitrite	mg/L	0.37	< 0.50	
Sulfate	mg/L	14	< 1.0	
Sulfide	mg/L	3.2	< 5.0	
Major Cations				
Calcium	mg/L	16	**6.5**	
Magnesium	mg/L	6.6	**3.1**	
Potassium	mg/L	2.0	**1.3**	
Sodium	mg/L	21	**15**	
General				
Hardness	mg/L	69	**30**	
Total Dissolved Solids	mg/L	184	**88**	
Total Suspended Solids	mg/L	15	< 3.3	

Explanations of abbreviations are included on the final page of this table.

2014
Mine Permit Surface Water Quality Monitoring Data
Abbreviations & Data Qualifiers
Humboldt Mill

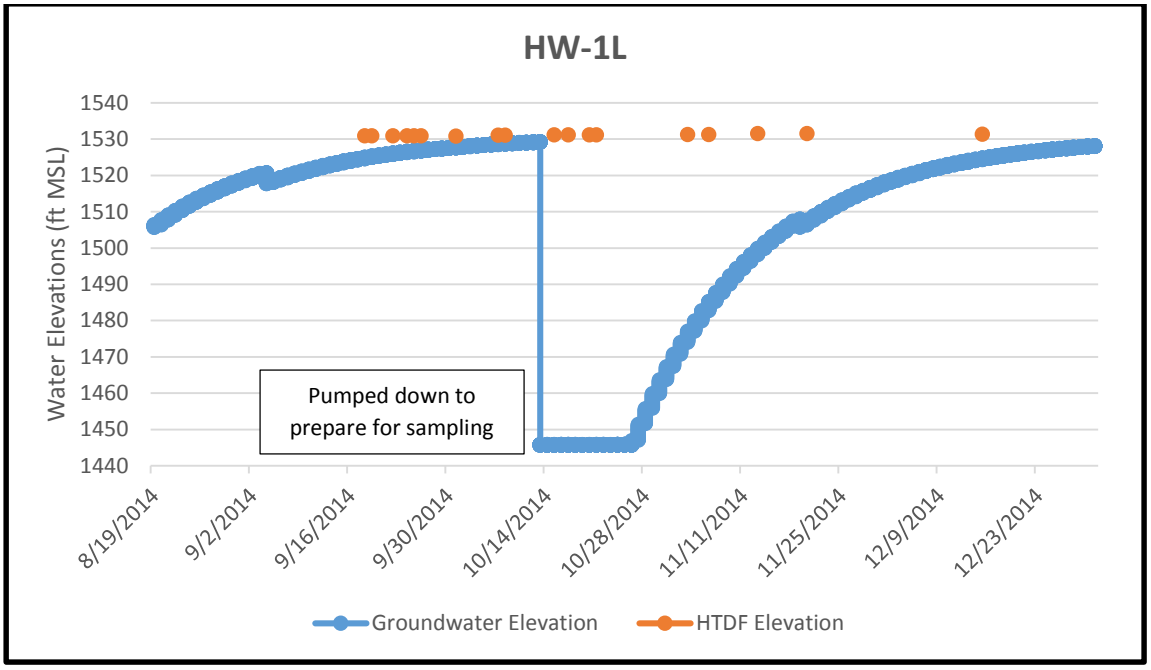
Notes:
Benchmarks are calculated based on guidance from Eagles Mine's Development of Site Specific Benchmarks for Mine Permit Water Quality Monitoring.
Results in **bold** text indicate that the parameter was detected at a level greater than the laboratory reporting limit.
Highlighted Cell = Value is equal to or above site-specific benchmark. An exceedance occurs if there are 2 consecutive sampling events with a value equal to or greater than the benchmark at a compliance monitoring location.
(p) = Due to less than two detections in baseline dataset, benchmark defaulted to four times the reporting limit.
--Denotes no benchmark required or parameter was not required to be collected during the sampling quarter.
e = estimated value. The laboratory statement of data qualifications indicates that a quality control limit for this parameter was exceeded.
NM = Not measured.

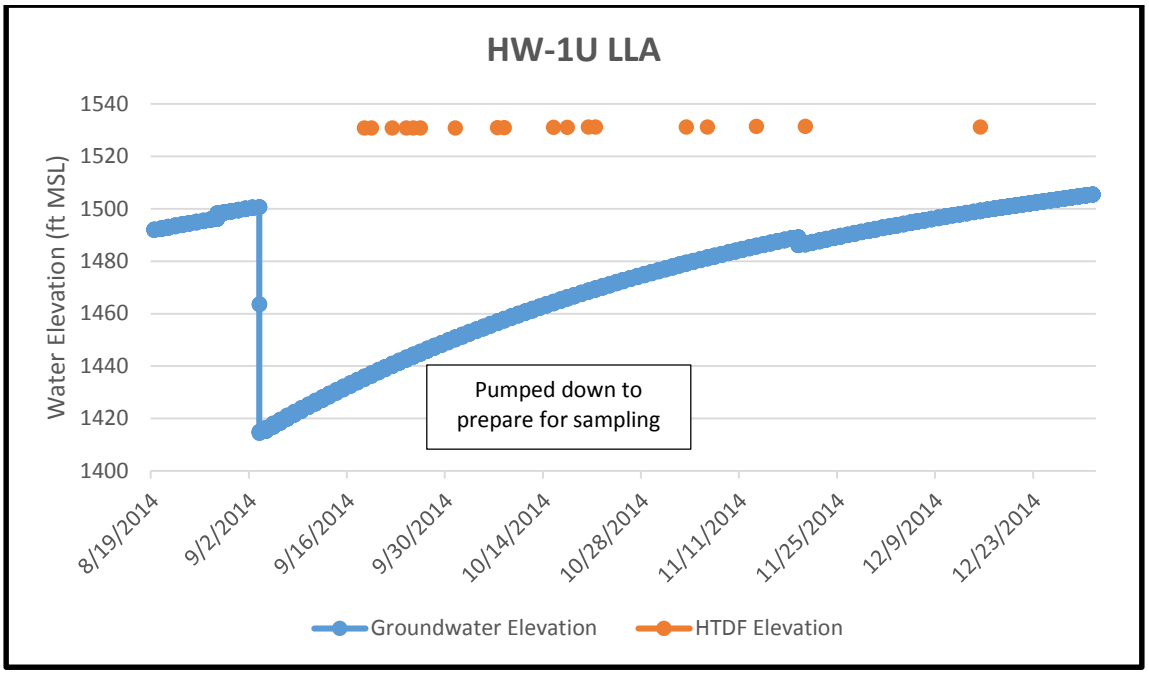
Appendix I

Humboldt Mill

Groundwater Hydrographs

2014 Groundwater Hydrographs
Humboldt Mill





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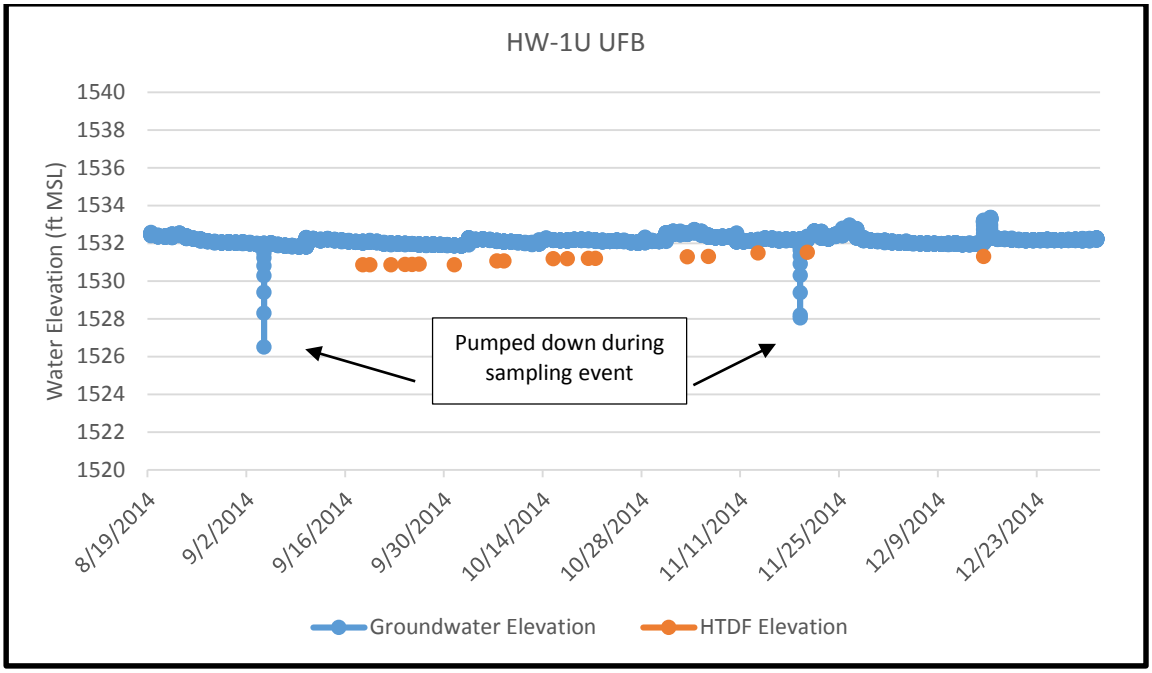
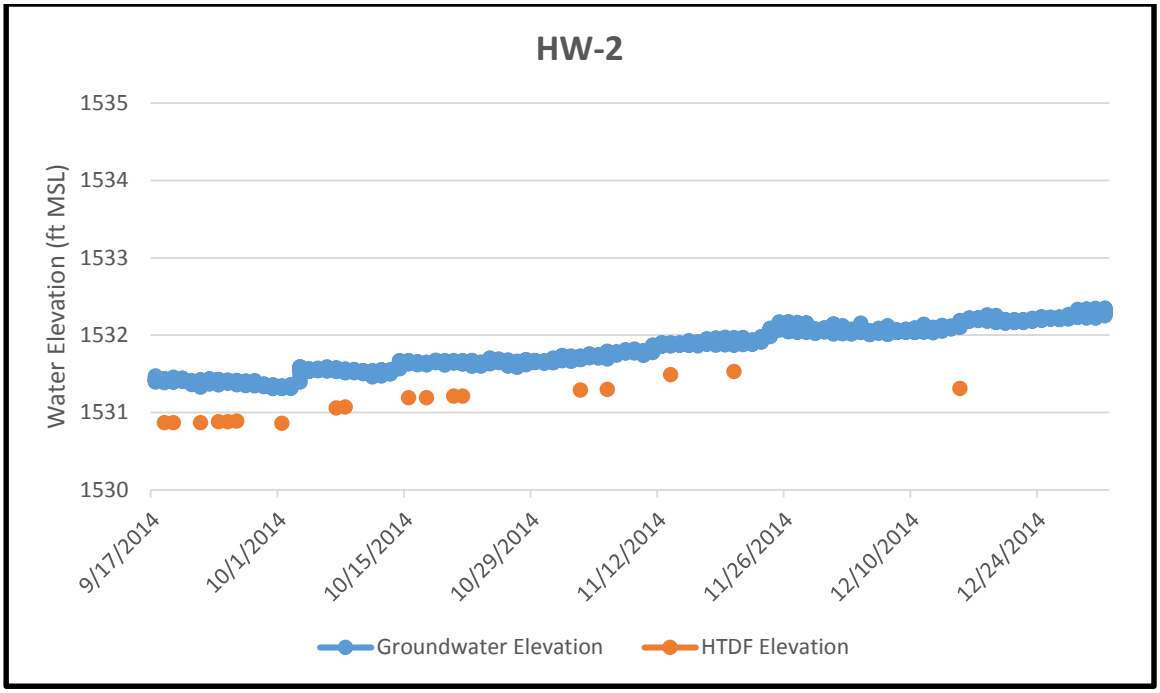
Humboldt Mill





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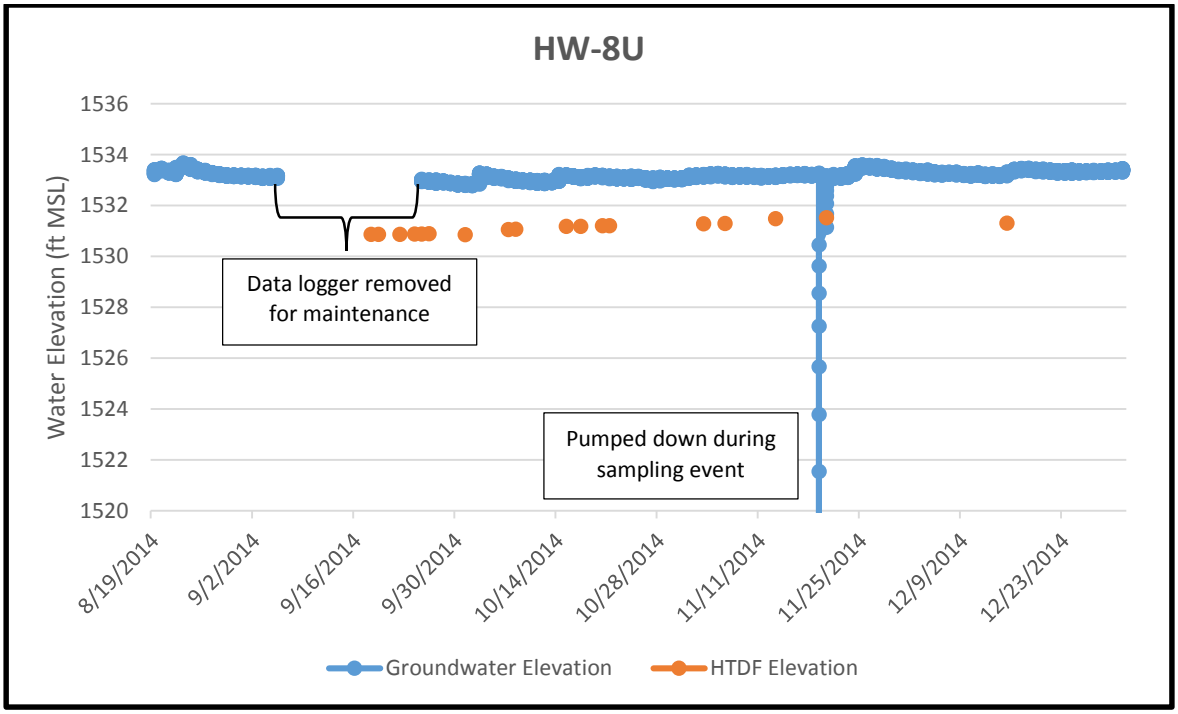

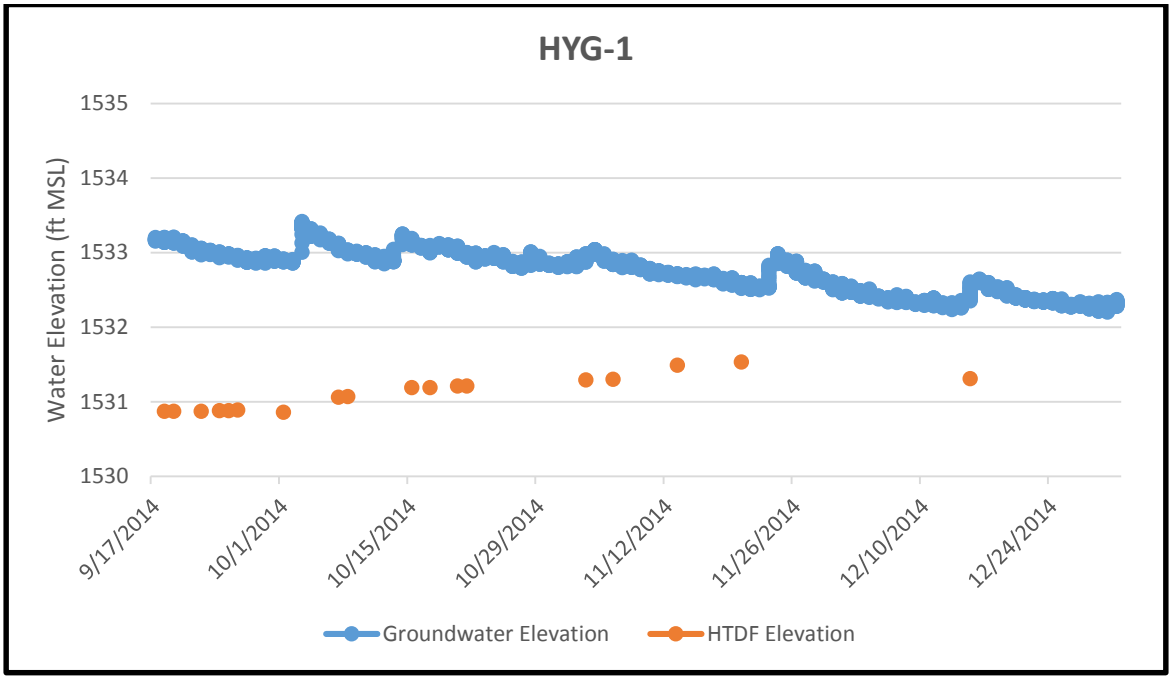

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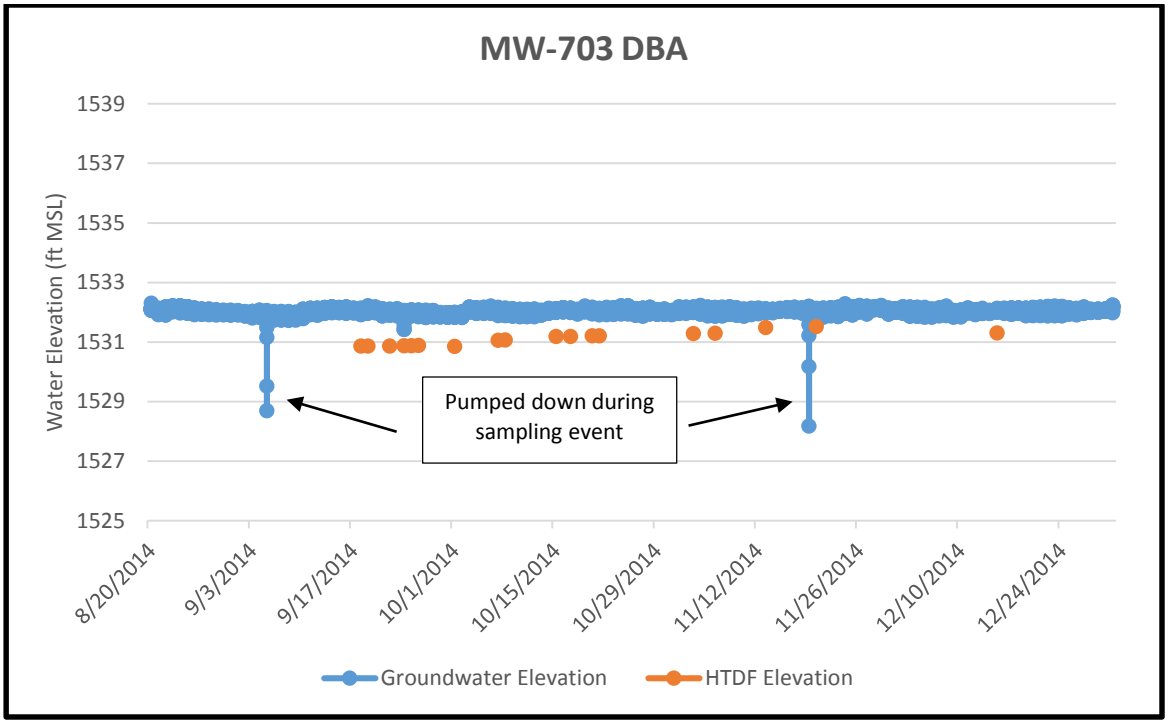

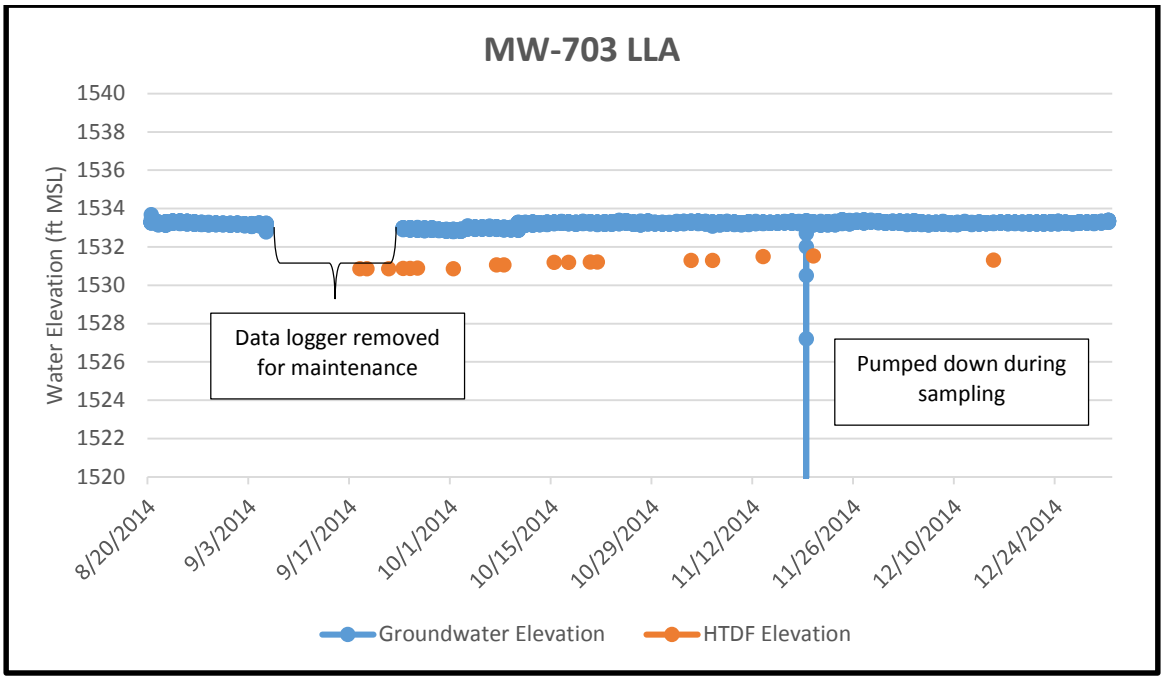

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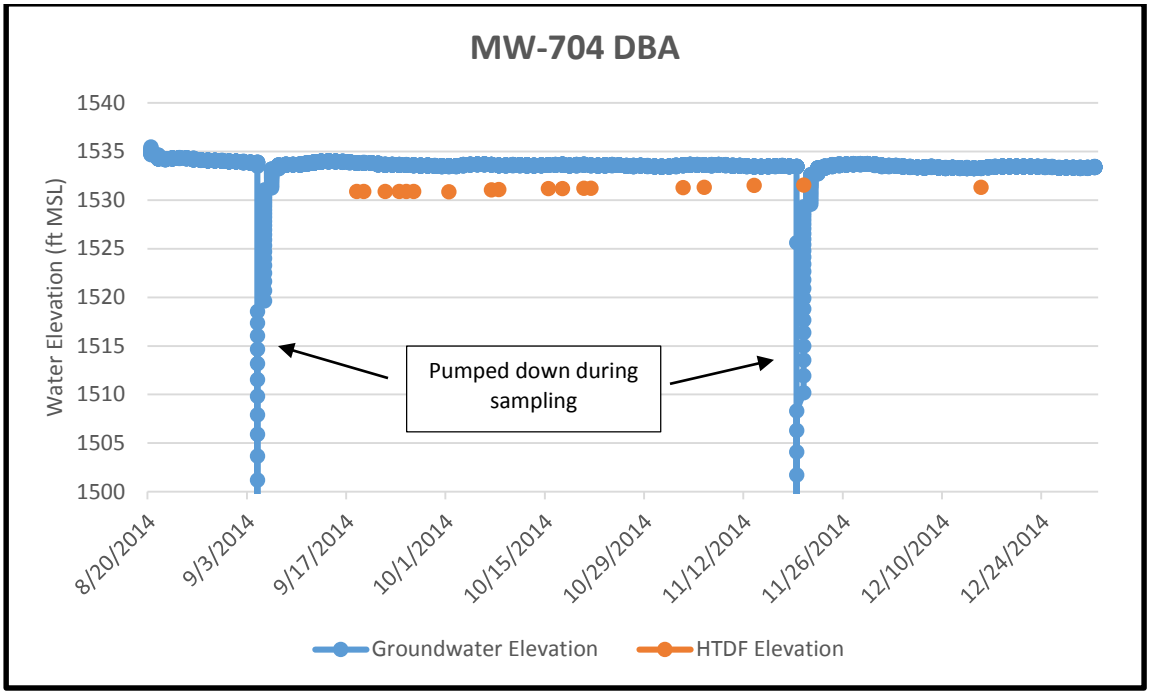

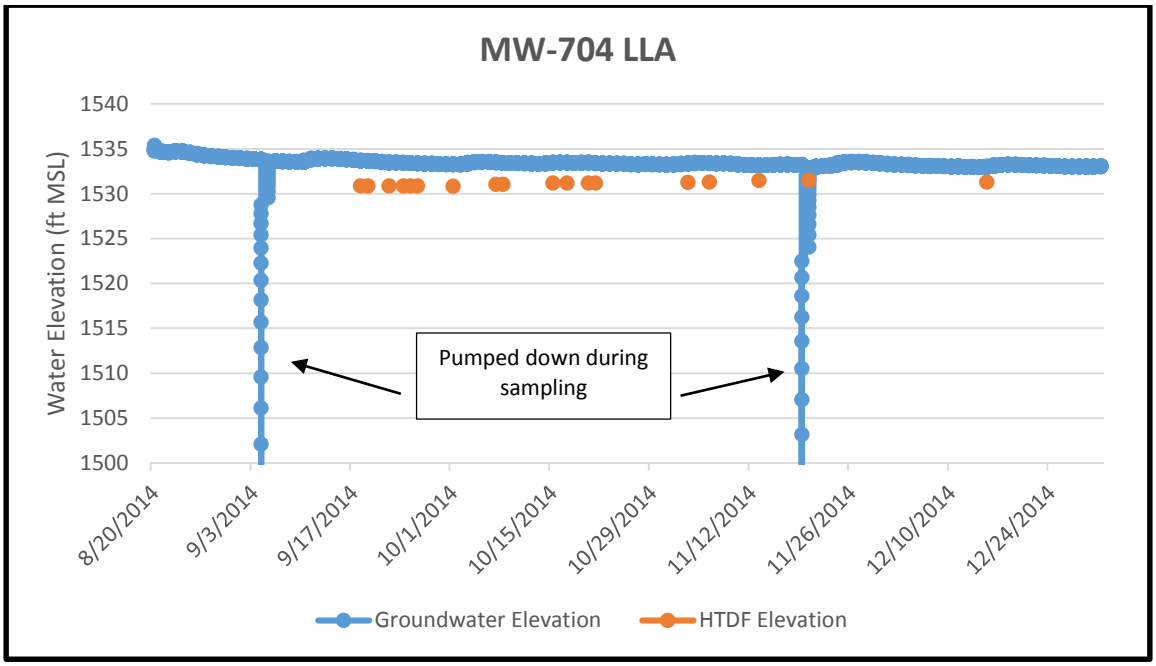

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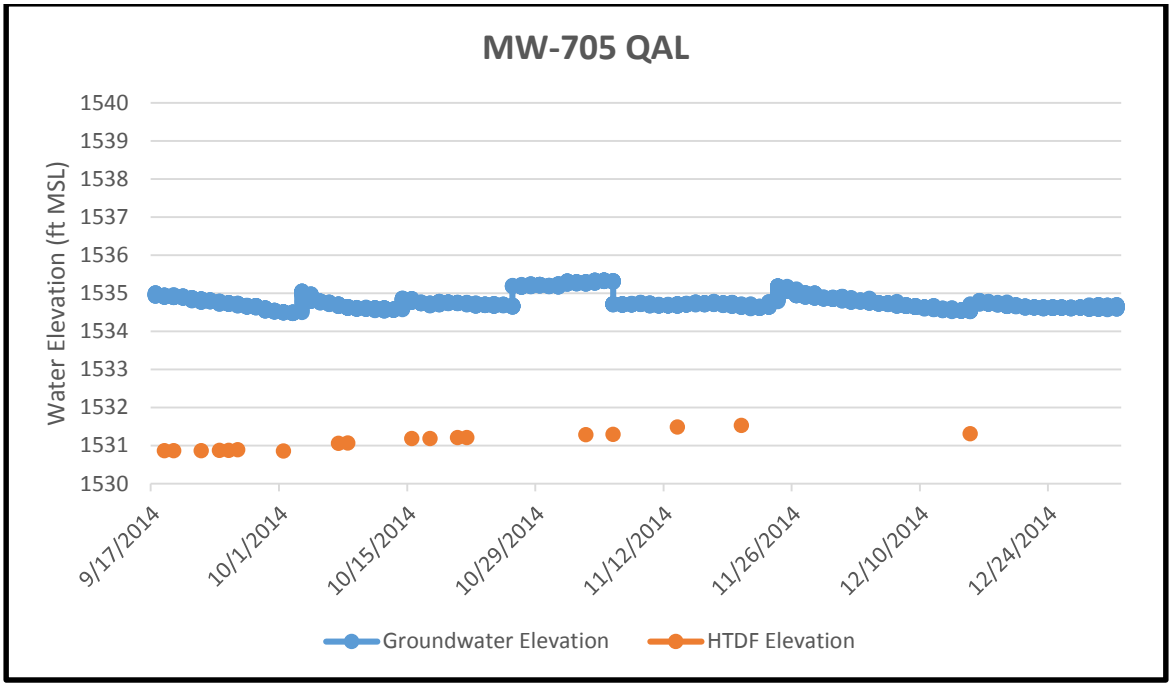

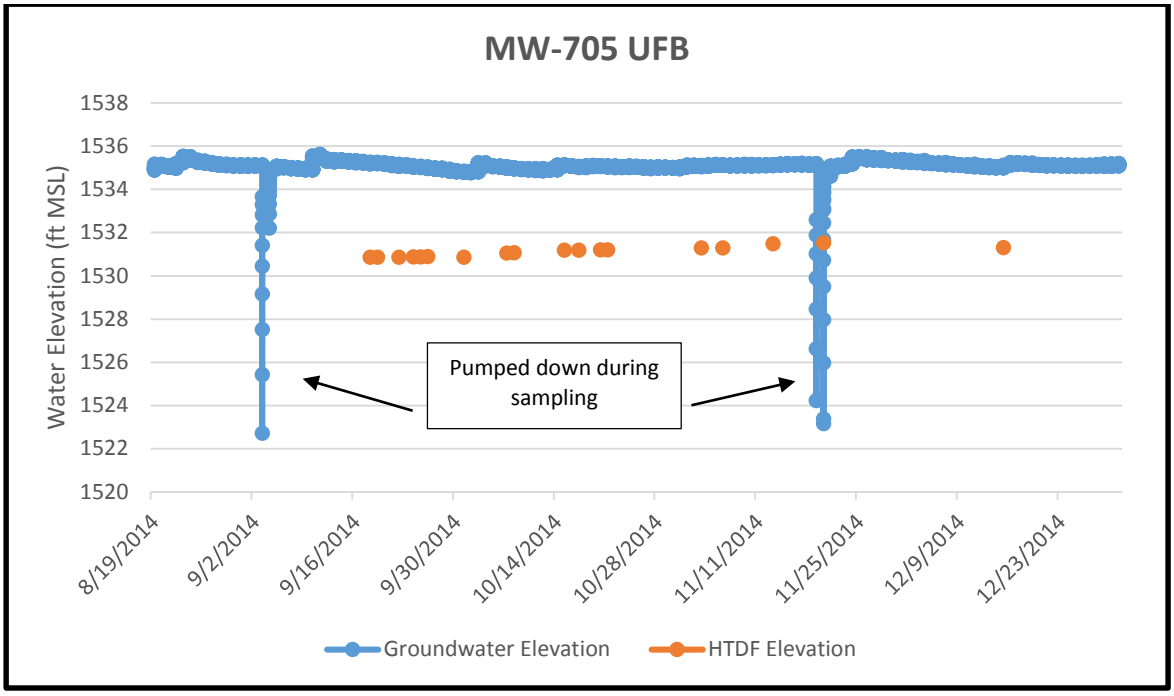

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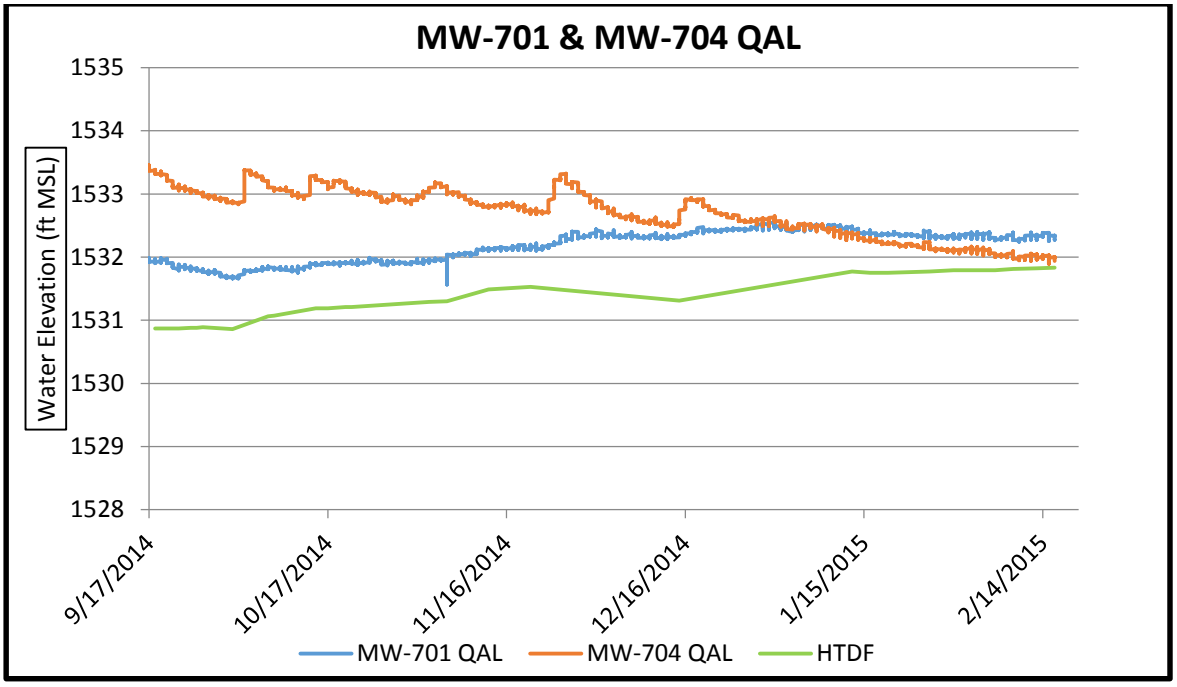

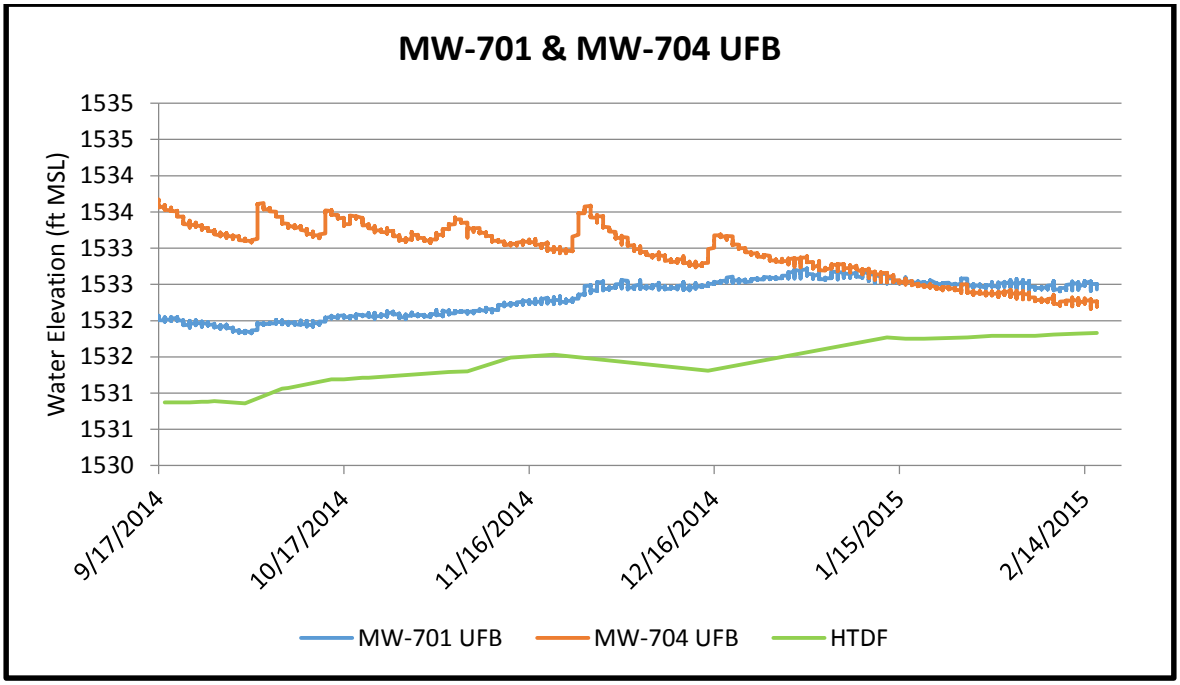

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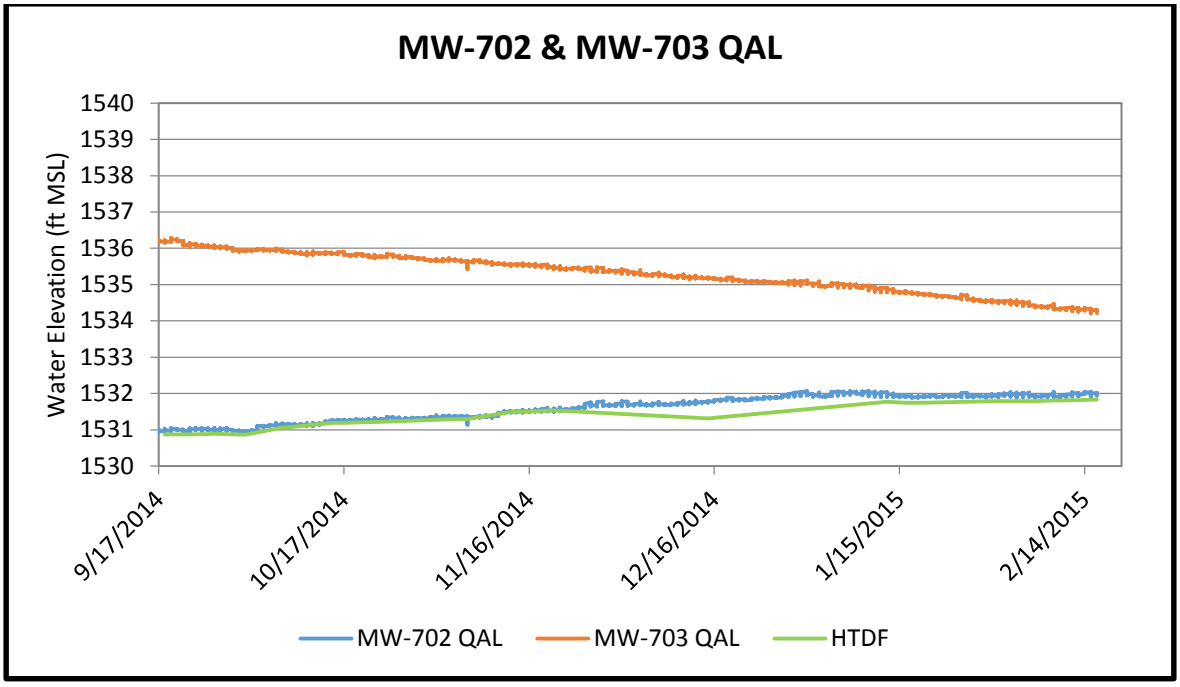

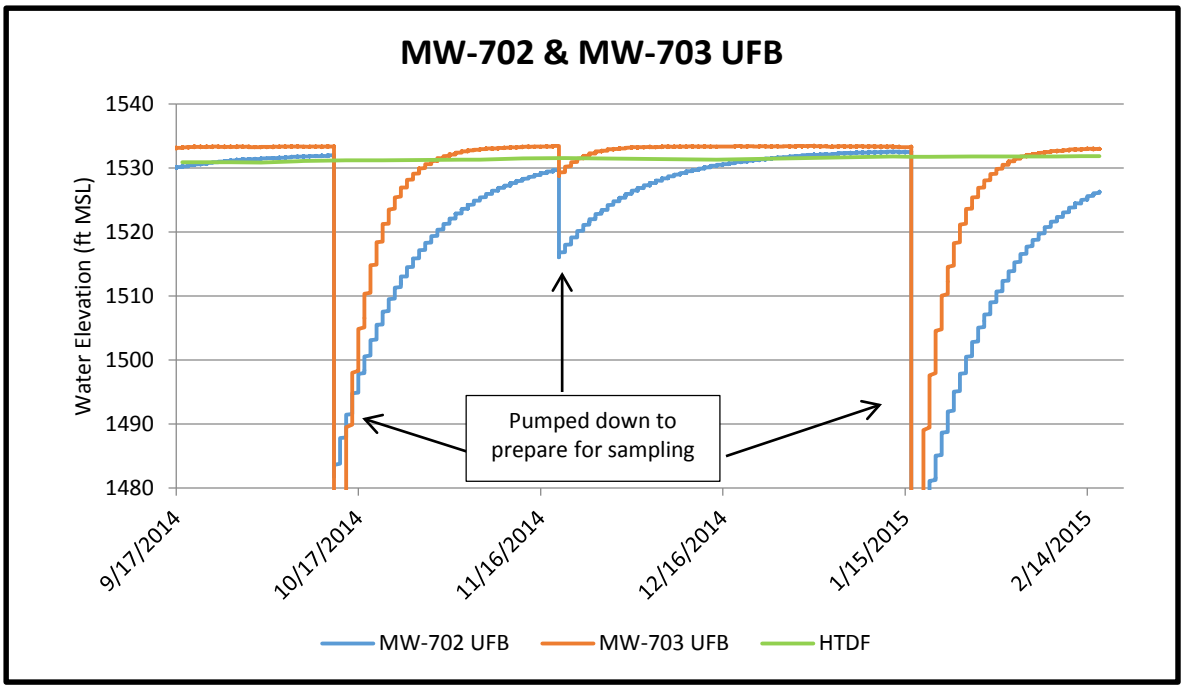

Appendix J

Humboldt Mill

Impermeable Surface Monitoring Plan

Eagle Mine

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Humboldt Mill

Impermeable Surface Inspection and Surface Repair Plan

01 December 2014

Adapted from: Foth Infrastructure & Environment, LLC Humboldt Mill Impermeable Surface Inspection and Surface Repair Plan, December 2007, for Kennecott Eagle Minerals.

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1. Impermeable Surface Inspection and Surface Repair Plan

1.1. Introduction

This Impermeable Surface Inspection and Surface Repair Plan has been prepared to address integrity monitoring of impermeable surfaces that will be exposed to process water or sulfide bearing materials. The monitoring plan includes frequency of inspection and action plans for surface repair, along with sample inspection log documenting the date of inspection, identification of the inspector, results, and required follow-up action. Inspections will be conducted by the Environmental Department with copies of inspection logs being uploaded to the Environmental Share Drive.

Figure 1 indicates impermeable surface areas with potential for exposure of reactive materials to the environment. Areas covered under this plan includes:

- Coarse Ore Storage Area (COSA)
- Crushing Circuit
- Water Treatment Plant (WTP)
- Concentrate Load-Out Area (CLO)
- Concentrator Building
- Floor Sumps

2. Impermeable Surface Descriptions and Use

2.1. COSA

The COSA is used to store mined ore that is awaiting processing. The COSA is an enclosed building with the exception of two roll-up doors on the east and west ends of the building that allows entrance and exit of the haul trucks off-loading ore from the Eagle Mine Site. In addition, there is one additional roll-up door on the east end that allows additional access to the facility. The floor of the COSA is constructed of reinforced concrete sloping towards a sump which collects the contact water. The area in which ore is off-loaded has been reinforced with steel plating to minimize damage to the concrete surfaces. Any collected contact water is manually pumped to the Humboldt Tailings Disposal Facility (HTDF), via the storm drain, for eventual treatment in the water treatment facility.

2.2. Crushing Circuit

The crushing circuit is comprised of the secondary and tertiary crushers, and conveyors that are housed in the secondary crusher and transfer buildings. The buildings are enclosed and the floors are constructed of concrete. Floor sumps are located on the lower level of the buildings and any water that is collected is routed to the concentrator buildings for eventual disposal in the HTDF.

2.3. WTP

The WTP will treat water from the HTDF prior to discharge to the nearby wetland. The building is enclosed and the floor is constructed of concrete. The floors are sloped to direct spills/water to the main sump which is coated with corrosion resistant epoxy.

2.4. CLO

The CLO is the facility in which the nickel and copper concentrate is stored until it is loaded into railcars using front-end loaders. The building is fully enclosed with the exception if two roll-up doors on the east and west ends that allow for the entrance and exit of rail cars. The floor of the load-out structure is constructed of reinforced concrete.

2.5. Concentrator Building

The concentrator building is the facility in which ore processing occurs. It is a fully enclosed building with a reinforced concrete floor. Process overflows are routed to the tailings thickener for eventual disposal in the HTDF.

2.6. Floor Sumps

Floor sumps are located throughout the process including the COSA, Secondary Crusher building, Concentrator building, CLO, lime silo and near the concentrate thickener tanks. All water captured by the sumps is either pumped to the HTDF for disposal or introduced back into the process depending on the location. All sumps are made of concrete and covered with steel grating.

3. Site Inspections and Monitoring

3.1. COSA

Due to operational activities, minor cracking and separation of the floor slab from the foundation wall may occur over time. In order to prevent liquid release through cracks in the concrete floor slab, the Environmental Department will conduct monthly inspections of the COSA floor slab during time period when ore is stored in the facility. Areas in the COSA which do not contain ore will be inspected and repaired as necessary. The ore will then be moved to the previously inspected areas and the exposed portion of the floor inspected and repaired as necessary. Staging of inspections as described herein will be performed until the entire COSA floor is evaluated. All portions of the floor may not be able to be inspected each month due to the volume of material stored in the COSA. To evaluate the sump, any standing water will be removed and the sump will be inspected for any areas of cracking, piting, or other surface deficiencies. Environmental personnel will complete monthly inspection logs outlining dates of inspection, identification of the inspector, results, and required follow-up action. A sample inspection log is included in Appendix A.

3.2. Crushing Circuit

Environmental personnel will conduct monthly inspections of the concrete floors and sumps located in the Secondary Crusher and Transfer buildings. Any cracks that develop will be filled with epoxy. To evaluate the sumps, any liquid will be evacuated to the facility process and the sump will be inspected for any areas of cracking, piting, or other surface deficiencies. The accumulation of material in the sumps will also be evaluated and reported to operations if cleaning is required. Environmental personnel will complete monthly inspection logs outlining dates of inspection, identification of the inspector, results, and required follow-up action.

3.3. WTP

Environmental personnel will provide monthly inspections of the WTP floor slab. Any cracks that develop will be filled with epoxy. To evaluate the sumps, any liquid will be evacuated to the facility process and the sump will be inspected for any areas of cracking, piting, or other surface deficiencies. Environmental personnel will complete monthly inspection logs outlining dates of inspection, identification of the inspector, results, and required follow-up action.

3.4. CLO

Due to operational activities, minor cracking and separation of the floor slab from the foundation wall may occur over time. In order to prevent liquid release through cracks in the concrete floor slab, the Environmental Department will conduct monthly inspections of the CLO floor slab during the time period when concentrate is stored in the facility. Inspections will be conducted in areas in the CLO which do not contain concentrate. Therefore inspections may be completed in a staged approach as concentrate is removed from the facility and new areas of the floor are exposed. All portions of the floor may not be able to be inspected each month due to the volume of material stored in the CLO. To evaluate the sump, any standing water will be removed and the sump will be inspected for any areas of cracking, piting, or other surface deficiencies. Environmental personnel will complete monthly inspection logs outlining dates of inspection, identification of the inspector, results, and required follow-up action.

3.5. Concentrator Building

Environmental personnel will provide monthly inspections of the Concentrator building floor slab. Any cracks that develop will be filled with epoxy. To evaluate the sumps, any liquid will be evacuated to the facility process and the sump will be inspected for any areas of cracking, piting, or other surface deficiencies. Depending on the location and weather conditions, some sumps may not be evaluated on a monthly basis. Environmental personnel will complete monthly inspection logs outlining dates of inspection, identification of the inspector, results, and required follow-up action.

3.6. Floor Sumps

All floor sumps not previously referenced above, will be inspected monthly by environmental personnel. The sumps will be inspected for cracks, piting, or other surface deficiencies with all information recorded in the monthly inspections logs. In addition, the inspector will make a

determination of their general condition and whether or not clean-out of solids is necessary. Depending on the location and weather conditions, some sumps may not be evaluated on a monthly basis.

4. Repair Methods

4.1. Concrete Areas

Once identified, cracks that have the potential to provide a conduit for contact water transmittal will be sealed by methods appropriate to their size. Based on the size of the crack, repairs will be conducted by one of two methods: routing and epoxy toweling, and epoxy grouting. Cracks that are less than 1/8 inch wide will be considered Class 1 cracks; greater than 1/8 inch in width will be considered class 2 cracks.

Class 1 cracks will be repaired by routing and epoxy toweling. Routing of the crack consist of routing the crack with a concrete saw or other hand pneumatic tool, to open the crack sufficiently to receive the sealant. A minimum routed width of ¼ inch is desirable since smaller openings are difficult to fill. The surface of the routed crack will be cleaned and allowed to dry. Epoxy sealing will then be toweled into the crack. Separation of the floor slab from the perimeter of the wall/foundation will generally be treated as Class 1 cracks and filled by epoxy toweling.

Class 2 cracks will be repaired by epoxy injection. This method generally consists of drilling holes at close intervals in the crack and injecting epoxy under pressure. This fills the crack entirely to provide a good seal.
Larger areas where mechanical damage has occurred may require removal and replacement with new concrete. In these areas, the damaged area will be cut and removed, new reinforcement bars drilled and grouted into existing concrete, and a new section of concrete placed.

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Impermeable Surface Inspection Form

COSA – Floor

Date:	**Inspector's Name:**
Inspection Results:	
Recommended Actions:	
Follow-up of Previous Actions:	

Crushing Circuit (Secondary Crusher & Transfer Buildings) – Floor

Date:	**Inspector's Name:**
Inspection Results:	
Recommended Actions:	
Follow-up of Previous Actions:	

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Impermeable Surface Inspection Form

WTP – Floor & Sump(s)

Date:	**Inspector's Name:**
Inspection Results:	
Recommended Actions:	
Follow-up of Previous Actions:	

CLO – Floor

Date:	**Inspector's Name:**
Inspection Results:	
Recommended Actions:	
Follow-up of Previous Actions:	

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Impermeable Surface Inspection Form

Concentrator Building – Floor

Date:	**Inspector's Name:**
Inspection Results:	
Recommended Actions:	
Follow-up of Previous Actions:	

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Impermeable Surface Inspection Form

Floor Sumps

Sump ID	Location	Clean-out Required (Y/N)	General Condition – Acceptable (Y/N)	Comments

Appendix K

Humboldt Mill

Updated Contingency Plan

1 Contingency Plan

This contingency plan addresses requirements defined in R 425.205. This includes a qualitative assessment of the risk to public health and safety or the environment (HSE risks) associated with potential accidents or failures involving activities with the Eagle Project. Engineering or operational controls to protect human health and the environment are discussed in Section 4 and Section 5 of this document. The focus of this contingency plan is on possible HSE risks and contingency measures. Possible HSE risks to on- site workers will be addressed by Eagle Mine through HSE procedures in accordance with Occupational Safety and Health Administration (OSHA) and Mine Safety and Health Administration (MSHA) requirements.

The Humboldt Mill involves processing ore, as well as storing and treating by-products of that process. Eagle Mine milling, storage, and treatment facilities have been designed, constructed, and operated in a manner that is protective of the environment through the use of proven technologies and engineering practices.

1.1 Contingency Items

This contingency plan addresses the items listed below in this Section in accordance with R 425.205 (1)(a)(i) - (xii).

- Release or threat of release of toxic or acid-forming materials
- Storage, transportation and handling of explosives
- Fuel storage and distribution
- Fires
- Wastewater collection and treatment system
- Air emissions
- Spills of hazardous substances
- Other natural risks defined in the EIA
- Power disruption, and
- Leaks from containment systems for stockpiles or disposal and storage facilities.

For each contingency item, a description of the risk is provided, followed by a qualitative assessment of the risk(s) to the environment or public health and safety. Next, the response measures to be taken in the event of an accident or failure are described.

1.1.1 Release of Toxic or Acid-Forming Materials

Potentially reactive materials generated as a result of processing operations include ore concentrate and tailings. Both materials have the potential to leach metals constituents when exposed to air and water. As described in the following sub-sections, handling and temporary storage of both the ore concentrate and tailings have been carefully considered in the design of the Humboldt Mill so as to prevent the uncontrolled release of acid rock drainage (ARD).

1.1.1.1 Coarse Ore Storage Area (COSA) and Concentrate Load-Out (CLO) Areas

Potential environmental risks associated with the COSA is the release of contact water to the environment via cracks in the floor areas or collection sumps. The COSA is a steel sided building with a full roof that is used for temporary storage of stockpiled coarse ore that has been transported from the mine and is awaiting crushing. The COSA has a concrete floor that is sloped to a floor drain that collects any contact water associated with the ore. This contact water is collected in an epoxy lined sump in the COSA and is pumped to the Humboldt Tailings Disposal Facility (HTDF) for eventual treatment by the water treatment plant.

Contingency planning for this facility includes timely repair of cracks in the floors and walls that could allow the release of material into the environment. An impermeable surface inspection plan has been developed and describes procedures for routine impermeable surface inspections, preventative and remedial actions as well as documentation procedures. Also, in accordance with Air Permit (No. 405-08) all overhead doors must be closed during loading or unloading of ore and a watering program is in place to minimize the generation of dust.

1.1.1.2 Concentrate Load-Out (CLO)

Potential environmental risks associated with the CLO is the release of acid generating material via track out and fugitive emissions. The CLO is a steel sided building with a full roof that is used for temporary storage of stockpiled nickel and copper concentrate prior to loading the material into railcars destined for customers. The CLO has concrete floors and does not contain any floor drains as water use is discouraged in this area.

Contingency planning for this facility includes timely repair of cracks in the floors and walls that could allow the release of material into the environment. An impermeable surface inspection plan has been developed and describes procedures for routine impermeable surface inspections, preventative and remedial actions as well as documentation procedures. Also, in accordance with Air Permit (No. 405-08) all overhead doors must be closed during loading operations and a sweeping program in place to minimize the generation of dust and track out of material. Track out is also managed in accordance with procedures outlined in an operations Standard operating procedure.

1.1.1.3 Humboldt Tailings Disposal Facility (HTDF)

Potential contaminant release from the HTDF could be waters having elevated metal concentrations that impact surface water or groundwater quality. The HTDF is a former open pit mine that was allowed to fill with water. Process tailings are sub-aqueously disposed which is industry best practice for materials that could be potentially acid generating. The anoxic environment minimizes the potential for generation of ARD. The HTDF was originally comprised of bedrock walls on three sides and alluvial soils on the north end in which water was allowed to naturally flow into the nearby wetland. A cut-off wall has been installed on the north end to prevent the release of water from the HTDF through the alluvial soils. Therefore, groundwater quality surrounding the HTDF will not be influenced by HTDF operations. Natural discharges from the HTDF have been essentially eliminated and any water that leaves the HTDF must now pass through the water treatment plant prior to discharge into the environment. Surface water discharge from the HTDF will be treated through the water treatment plant prior to discharge to a nearby wetland. In addition, the installation of the cut-off wall in the alluvial soils along the north perimeter of the HTDF will prevent release to the groundwater.

Groundwater seeps from the HTDF will not occur due to the low permeability of the surrounding Precambrian geologic formation. Furthermore, groundwater and surface water quality and elevations/flow will be routinely monitored in accordance with the Part 632 Mining and NPDES permits and will quickly identify changes to surrounding water quality that would be indicative of groundwater release from the HTDF. Contingency planning from an unlikely groundwater release from the HTDF includes:

- Identify the nature and extent of the release,
- Implement additional monitoring to ascertain extent of release,
- Develop a remedial action plan to bring facility back into compliance,
- Implement remedial action plan.

Specific details of the remedial action plan would be developed based upon the nature of the release and with agreements with the MDEQ.

Eagle will monitor water quality in the HTDF during operations and post-closure. The WTP and associated infrastructure will remain in place for five years after tailings disposal has ceased. If monitoring indicated that there are elevated metals in the HTDF that could impact surface water one of the following treatment options may be implemented:

- Continue the treatment of the HTDF water through the WTP until water quality conditions in the HTDF meet surface water standards; and/or
- Amend the HTDF with appropriate reagents to reduce elevated metal parameters in order to meet surface water standards.

Specific reagents and application rate(s) would be identified upon determination of elevated metal parameters of concern. Past phosphate seeding of HTDF by previous owners was shown to be effective for nickel concentration reduction. Alum could also be used as a flocculent to enhance metal precipitation thereby improving water quality.

1.1.1.4 Tailings Transport System

Tailings are transported to the HTDF via slurry contained within a double-cased HDPE pipe conveyance system. The pipe conveyance system consists of a 4-in diameter carrier pipe within an 8-in outer containment pipe. Two tailings lines are available for use, but only one is utilized at a time. In addition, the tailings lines are equipped with a leak detection system; any water released into the outer piping would drain to the shore vault and trigger an alarm, notifying operations of a potential system breach. The shore vault is also visually inspected twice per day (once per shift) by operators and the Environmental Department checks the tailings lines for signs of leakage once per week.

If a breach is identified, the slurry pumps will be shut-down until the source of breach is identified and repaired. The contingency plan for moving tailings to the HTDF facility is to use the second set of tailings lines that are already in place. In the event both lines were down, they could either be pumped into a truck with a sealed cargo area or the tailings will be held within the plant thickener vessel until the pipeline is repaired.

1.1.2 Storage, Transportation and Handling of Chemicals

Potential risks associated with chemical use include surface and groundwater quality impacts. Chemicals are brought to the site by certified chemical haulers, meeting MDOT transportation requirements. Storage of these chemicals are provided in secure locations within building(s) or outdoor bulk storage silos designed for that application. Transferring chemicals is conducted by qualified site personnel. Bulk granular products are conveyed pneumatically to the storage silos. Specific procedures for chemical storage and emergency response procedures are included in the facilities Pollution Incident Prevention Plan (PIPP).

Because chemicals will be stored in secure areas, the potential for release into the environment is very remote. If a breach of contaminant vessel does occur, the chemical will be contained within the secondary containment area. The spill or release will be immediately cleaned using appropriate methods specified in the Material Safety Data Sheets (MSDS). MSDS will be maintained on-site for all chemicals.

1.1.3 Fuel Storage and Distribution

There are currently no permanent fuel storage tanks onsite. At this time, a fuel provider comes to site daily and fuels all mobile equipment. Eagle also has one light duty truck, equipped with a diesel tank that may also be used to re-fuel equipment when necessary.

In general, fuel spills and leaks will be minimized by the following measures:

- A Spill Prevention Control and Countermeasures Plan (SPCC) has been written and implemented.
- Training of personnel responsible for handling fuel in proper procedures and emergency response;
- Regular equipment inspections and documentation of findings, and
- Staging of on-site emergency response equipment to quickly respond to unanticipated spills or leaks.

Specific procedures have been prepared as part of the project's SPCC Plan. In addition, a PIPP has been prepared which addresses potential spillage of fuels and other polluting materials.

Diesel fuel, gasoline, and propane (fuels) are transported to the Eagle Project by tanker truck from local petroleum distributors. The probability of an accidental release during transportation will be dependent on the location of the supplier(s) and the frequency of shipment. A fuel release resulting from a vehicular accident during transportation is judged to be a low probability event. Transport of fuel in tanker trucks does not pose an unusual risk to the region since tanker trucks currently travel to the region on a regular basis to deliver fuels to gasoline stations located in the communities surrounding the Eagle Mine.

Three potential release events associated with the surface-stored fuels are a bulk tank failure, mishandling/leaking hoses, and a construction/reclamation phase release.

<u>Mishandling/Leaking Hoses</u> - A release might result from leaking hoses or valves, or from operator mishandling. This type of release is likely to be small in volume and is judged to be a low probability event given that operators will be trained to manage these types of potential releases. These small spills will be cleaned up by using on-site spill response equipment such as absorbent materials and/or removing impacted soils.

Construction/Reclamation Phase Release - A major fuel spill during the construction or reclamation phases could occur from a mobile storage tank failure or mishandling of fuels. Such a release is also considered to be a low probability event given that operators will be trained to manage these types of potential releases and all tanks are required to have secondary containment. As with mishandling or leaking hoses, these small spills will be cleaned up by using on-site spill response equipment such as absorbent materials and/or removing impacted soils.

Absorptive materials may be used initially to contain a potential spill. After the initial response, soil impacted with residual fuel would be addressed. Remedial efforts could include, if necessary, the removal of soil to preclude migration of fuel to groundwater or surface water. The project's PIPP and SPCC plans addresses fueling operations, fuel spill prevention measures, inspections, training, security, spill reporting, and equipment needs. In addition standard operating procedures have been developed which cover fueling operations and spill response activities. All responses to a fuel spill, both large and small, will follow the guidelines dictated by the spill response plan and be reported internally. The tanks will be inspected regularly, and records of spills will be kept and reported to MDEQ and other agencies as required.

Contingency plans for responding to fuel spills from tanker trucks are required of all mobile transport owners as dictated by Department of Transportation (DOT) regulation 49 CFR 130. These response plans require appropriate personnel training and the development of procedures for timely response to spills. The plan must identify who will respond to the spill and describe the response actions to potential releases, including the complete loss of cargo. The plan must also list the names and addresses of regulatory contacts to be notified in the event of a release.

1.1.4 Fires

Surface fires can be started by a variety of causes including vehicular accidents, accidental ignition of fuels or flammable chemical reagents, and lightning strikes. Smoking is only allowed in designated areas on the site. Contingency measures include having the required safety equipment, appropriate personnel training and standard operating procedures. Given these measures, uncontrolled or large surface fires are considered a low probability event with negligible risk.

Because the Humboldt Mill is situated in a forested region, forest fires started off-site could potentially impact the mill site. The cleared area in the vicinity of the surface facilities serves as a fire break to protect surface facilities. Contingency measures discussed below can be implemented in the event of an off-site forest fire.

In order to minimize the risk of a fire on-site, stringent safety standards are being followed during both the construction and operation phases of surface facilities. All vehicles/equipment are required to be equipped with fire extinguishers and all personnel trained in their use. Water pipelines and network of fire hydrants have been installed throughout the site and additional fire extinguishers are also located in high risk areas. On-site firefighting equipment includes an above ground water storage tank and distribution system for fire suppression.

Contingency planning for managing materials that oxidize includes training equipment operators on the material characteristics. Because the concentrate is only present for short periods of time in either the mill building or concentrate load-out building, and given that the concentrate will have a moisture content of at least 15%, the likelihood of an oxidation is very remote. Material exhibiting signs of self-heating is immediately compacted or exposed and spread out depending on the situation.

1.1.5 Wastewater Collection and Treatment

The major source of water from the facility requiring treatment is the planned discharge from the HTDF. The HTDF provides wastewater storage and equalization capacity. Water from the HTDF is conveyed to the WTP which is comprised of several unit processes, including: metals precipitation and ultra-filtration. The final product water is discharged to a nearby wetland area. This discharge is authorized by the State of Michigan under an NPDES permit.

The water treatment system is designed to handle various process upset conditions such as power disruption (Section 1.1.10) or maintenance of the various process units. The effluent is continually monitored for key indicator parameters to verify the proper operation. Effluent not meeting treatment requirements is pumped back to the HTDF for re-treatment. The water level of the HTDF is maintained at a level that provides ample storage capacity that would allow for sufficient time to correct a process upset condition. Potential hazards and chemical reagents associated with the WTP are discussed in Section 1.1.8.

1.1.7 Air Emissions

The construction, operation and reclamation phases of the project will be performed in a manner to minimize the potential for accidents or failures that could result in off-site air quality impacts. All phases of the project will incorporate a combination of operating and work practices, maintenance practices, emission controls and engineering design to minimize potential accidents or failures. Below is a description of identified areas of risk and associated contingency measures that may be required. As part of a comprehensive environmental control plan, these contingency measures will assist in minimizing air impacts to the surrounding area.

1.1.7.1 Air Emissions During Operations

During operation of the mine, potential emissions from the facility will be controlled as detailed in the project's current Michigan Air Use Permit (No. 405-08). These controls include use of building enclosures for material handling, installation of dust collection or suppression systems such as baghouses or water sprays to control dust during ore crushing and transfer operations and following prescribed preventive maintenance procedures for the facility. Tailings generated during the milling process are slurried to the HTDF and therefore will not generate particulate matter. Ore brought from off-site is transported in covered trucks to minimize dust emissions. Below is a more detailed discussion of potential airborne risks associated with proposed operations at the facility.

To minimize dust emissions from the COSA and concentrate load-out building, these areas are fully enclosed. Water sprays are used at the primary crusher, rock breaker, and conveyor transfer points located in the conveyor transfer station and mill building.

Fabric filter baghouses are used throughout the facility to minimize emissions of dust. Bag houses are located in the Secondary Crusher building and the Fine Ore Bins. Two insertable filter systems are installed in the transfer building. Baghouse malfunction is a possibility and can include a bag break or offset and excessive dust loading. These potential malfunctions are addressed in the malfunction prevention and abatement plan. The plan includes regular inspections and maintenance activities of dust collection and suppression systems which is accomplished through monitoring of pressure drop across the bags, monitoring of gas flow, and visual observations of stack emissions to assess opacity per permit conditions. In the event the monitoring program indicates a malfunction, a thorough investigation of the cause will occur. If necessary, ore processing operations will be shut down until the problem is corrected.

During facility operations, Eagle Mine will utilize certain pieces of mobile equipment to move material about the site. Equipment includes front end loaders, product haul trucks, and miscellaneous delivery trucks. Although the movement of most vehicles across the site is on asphalt surfaces, a comprehensive on-site watering program has been developed to control potential fugitive sources of dust. While the watering program is closely monitored, if excessive dust emissions should occur, the facility will take appropriate corrective action, which may include intensifying and/or adjusting the watering program to properly address the problem.

1.1.7.2 Air Emissions during Reclamation

Once milling operations are completed at the site, reclamation will commence in accordance with R 425.204. Similar to construction activities, there is a moderate risk fugitive dust emissions could be released during certain re-vegetation activities and during temporary storage of materials in stockpiles. Similar to controls employed during the construction phase, areas that are reclaimed will be re-vegetated to stabilize soil and reduce dust emissions. If severe wind or an excessive rain event reduces the effectiveness of these protective measures, appropriate action will take place as soon as possible to restore vegetated areas to their previous effectiveness and replace covers as necessary.

To the extent necessary, areas being reclaimed will be kept in a wet state by continuing the watering program. It is anticipated this program should minimize the possibility of excessive dust associated with mobile equipment. In the event fugitive dust is identified as an issue, corrective action will determine the cause of the problem and appropriate action will occur.

1.1.8 Spills of Hazardous Substances

Chemical reagents onsite are primarily used for the ore flotation and water treatment plant processes. Table 1.1.8 includes a list of reagents being used onsite along with the approximate usage rates, method of transportation to the site, and the type of shipping container.

Table 1.1.8 Chemical Reagents Used at the Water Treatment Plant & Mill Building

Item No.	Chemical Name	Trade Name	CAS No.	Storage Volumes	Storage Areas
1	Ferric Chloride 40%	Hydrex 3250	7705-08-0	1500 gal	WTP chemical storage Bldg lines C4
2	Hydrochloric acid 35%	Muratic Acid	7647-01-0	450 gal	WTP chemical storage Bldg lines D6
5	Sodium bisulfite 30%	sodium bisulfite	7631-90-5	300 gal	WTP chemical storage Bldg lines D4
3	Sodium hypochlorite	Chlorine Bleach	7681-52-9	500 gal	WTP chemical storage Bldg lines D4
4	Sodium hydroxide 25%	sodium hydroxide	1310-73-2	4,000 gal	WTP chemical storage Bldg lines D5
5	Polymer anionic emulsion	Hydrex 6521	64742-47-8	100 gal	WTP chemical storage Bldg lines C5
6	Polyethylenemine dithiocarbamate	Hydrex 6909	189326-02-1	1,300 gal	WTP chemical storage Bldg lines C5
7	Deparim	CMC	9004-32-4	20 tons	Reagent storage area
8	Calcium Oxide	High Calcium Quick Lime	1305-78-8	39 tons	Lime silo
9	Magnafloc 338	Flocculant	Unknown	2 tons	Reagent storage area
10	Methyl isobutyl carbinol (MIBC)	Flomin F500 Frother	108-11-2	2.2 tons	MIBC tank
11	Sodium isopropyl xanthane (SIPX)	SIPX	140-93-2	15 tons	Reagent storage area
12	Sodium carbonate	Soda Ash	497-19-8	54 tons	Soda ash silo
13	Sodium sulfite	Disodium sulfite	7757-83-7	25 tons	Reagent storage area

Chemical storage and delivery systems follow current standards that are designed to prevent and to contain spills. All use areas and indoor storage areas were designed, constructed and/or protected to prevent run-on and run-off to surface or groundwater. This includes development of secondary containment areas for liquids. The secondary containment area is constructed of materials that are compatible with and impervious to the liquids that are being stored. A release in the WTP or concentrator building from the associated piping would be contained within the contained plant area, neutralized, and sent to the HTDF for disposal. Absorbent materials are available to contain acid or caustic spills. Eagle Mine has an emergency response contractor on call to immediately respond to environmental incidents, assist with clean-up efforts, and conduct environmental monitoring associated with any spills.

Spill containment measures for chemical storage and handling will reduce the risk of a spill from impacting the environment. Due to the low volatility of these chemicals, fugitive emissions from the WTP or concentrator building to the atmosphere during a spill incident are likely to be negligible. Off-site exposures are not expected. It is therefore anticipated that management and handling of WTP and processing reagents will not pose a significant risk to human health or the environment.

1.1.9 Other Natural Risks

Earthquakes – The Upper Peninsula of Michigan is in a seismically stable area. The USGS seismic impact zone maps show the maximum horizontal acceleration to be less than 0.1 g in 250 years at 90% probability. Therefore, the mine site is not located in a seismic impact zone and the risk of an earthquake is minimal. Therefore, no contingency measures are discussed in this section.

Floods - High precipitation events have been discussed previously in sections that describe the CWBs, NCWIBs and the TDRSA. Section 4 and Section 7 also discuss the proposed handling of surface water runoff to control erosion during each phase of mine construction, operation and reclamation. High precipitation could also lead to the failure of erosion control structures. The impacts of such an event would be localized erosion. Contingency measures to control erosion include sandbag sediment barriers and temporary diversion berms. Long term or off-site impacts would not be expected. Failed erosion control structures would be repaired or rebuilt. Impacts from high precipitation are reversible and off-site impacts are not expected to occur. Given the considerable planning and engineering efforts to manage high precipitation events, the risk posed by high precipitation is considered negligible.

Severe Thunderstorms or Tornadoes – Severe thunderstorms or tornadoes are addressed in the emergency procedures developed for the mine site. Certain buildings are designated shelters in the event of severe weather. Evacuation procedures are part of the on- site training of all employees.

Blizzard – The mill site will be designed to accommodate the winter conditions anticipated in the Upper Peninsula of Michigan. The Marquette County Road Commission is responsible for maintaining roadways near the Humboldt Mill. If road conditions deteriorate beyond the capability of the county or township maintenance equipment, Eagle will have provisions to keep workers housed on-site for extended periods, as needed.

Forest Fires – Forest fires were discussed in Section 1.1.4.

1.1.10 Power Disruption

Electrical power for the project is provided by the Upper Peninsula Power Company. The facility is presently served by a 34 kV overhead electric utility feeder. In the unlikely event that power is disrupted, a back-up generator is on-site to power essential facilities needs including the tailings slurry pump and concentrate and tailings thickeners.

In the event the WTP would need to be temporarily shut down during power disruptions, the water level of the HTDF is maintained at a level that provides enough capacity to store water for an extended period of time if necessary.

1.2 Emergency Procedures

This section includes the emergency notification procedures and contacts for the Humboldt Mill Site. In accordance with R 425.205(2), a copy of this contingency plan will be provided to each emergency management coordinator having jurisdiction over the affected area at the time the application is submitted to the MDEQ.

Emergency Notification Procedures – An emergency will be defined as any unusual event or circumstance that endangers life, health, property or the environment. Eagle Mine has adopted an Incident Command System (ICS) structure to respond to such emergencies. The ICS structure allows key individuals to take immediate responsibility and control of the situation and ensures appropriate public authorities, safety agencies and the general public are notified, depending on the nature of the emergency. A brief description of the ICS structure is as follows:

- Incident Commander (IC): The General Manager at the facility will be designated the IC and will be responsible to ensure that emergency response actions are carried out in an appropriate and timely manner. The IC will ensure that appropriate resources are available, ensure the incident is secured, and release resources in an orderly manner. The IC will also ensure appropriate notification is made to all required regulatory agencies and necessary emergency response agencies.

- Safety Officer: The facility safety officer and staff are responsible for ongoing review of ICS structures and will monitor activities in response to any emergencies. During an emergency, the safety officer will manage special situations that expose responders to hazards, coordinate emergency response personnel, mine rescue teams, fire response, and ensure relevant emergency equipment is available for emergency service. This individual will also work with the IC to ensure appropriate personnel are made available to respond to the situation.

- Environmental Officer: The facility environmental manager will be responsible for managing any environmental aspects of an emergency situation. This individual will coordinate with the IC to ensure environmental impact is minimized, determine the type of response that is needed and act as a liaison between environmental agencies and mine site personnel.

- Public Relations Officer: The facility human relations manager will be responsible for managing all contacts with the public and will coordinate with the IC and the safety and environmental officers to provide appropriate information to the general public. This individual will also meet all arriving outside response agencies and pass on instructions from the IC. This individual will also immediately notify families of employees injured or affected.

Evacuation Procedures – While the immediate surrounding area is sparsely populated, if it is necessary to evacuate the general public, this activity will be handled in conjunction with emergency response agencies. The Public Relations Officer will be responsible for this notification, working with other site personnel, including the IC safety and environmental officers.

In the event evacuation of mill personnel is required, Eagle Mine has developed emergency response procedures for all surface facilities. All evacuation procedures were developed in compliance with MSHA regulations.

Emergency Equipment – Emergency equipment includes but is not be limited to the following:

- ABC Rechargeable fire extinguishers
- Radios
- First aid kits, stretchers, backboards, and appropriate medical supplies
- Gas detection monitors that detect 5 gases and LEL.
- Spill Kits (hydrocarbon and chemical)
- Certified EMT's Basic and Paramedics are on site at all times to respond in the event of an emergency.

This equipment is located at the surface facilities. Fire extinguishers are located at appropriate locations throughout the facility, in accordance with MSHA requirements. Surface facility personnel are also equipped with radios for general communications and emergencies. Other emergency response equipment is located at appropriate and convenient locations for easy access for response personnel.

Phone Numbers – Emergency telephone numbers are included for site and emergency response agencies, as required by R 425.205(1)(c). They are as follows:

- Operator and Emergency Management Coordinator: Mike Welch – (906) 339-7052

- Local Ambulance Services: UP Health Systems Bell. Contact Security at Extension 7016, or by radio using the Emergency Channel to alert on site responders. Dial 911.

- Hospitals: UPHealth Sytems Marquette – (906) 225-3560
  UP Health Systems Bell (906) 485-2200

- Local Fire Departments: Humboldt Township - 911

- Local Police: Marquette County Central Dispatch – 911 [(906) 475-9912 non-emergency]
  Marquette County Sheriff Department – (906) 225-8435
  Michigan State Police – (906) 475-9922 (direct line)

- MDEQ Marquette Office – (906) 228-4853

- Pollution Emergency Alerting System (in Michigan) - 1-800-292-4706

- Federal Agencies: EPA Region 5 Environmental Hotline – 1-800-621-8431
  EPA National Response Center – 1-800-424-8802
  MSHA North Central District – (218) 720-5448
  MDNR Marquette Field Office – (906) 228-6561

- Humboldt Township Supervisor: Tom Prophet - (906) 339-4477

1.3 Testing of Contingency Plan

During the course of each year, the facility will test the effectiveness of the Contingency Plan. Conducting an effective test will be comprised of two components. The first component will include participation in adequate training programs on emergency response procedures for those individuals that will be involved in responding to emergencies. These individuals will include the Incident Commander, Safety Officer, Environmental Officer, Public Relations Officer and other individuals designated to respond to fires and participate in mine rescue. Individuals will receive appropriate information with respect to their specific roles, including procedures and use of certain emergency response equipment.

The second component of an effective Contingency Plan will be to conduct mock field tests. At least one mock field test will be performed each year. The Safety Officer will work with the Environmental Officer and the Incident Commander to first define the situation that will be tested. The types of test situations may include responding to a release of a hazardous substance, responding to a fire (aboveground or underground) or responding to a natural disaster such as a tornado. A list of objectives will be developed for planning and evaluating each identified test situation. A date and time will then be established to carry out the test. Local emergency response officials may be involved, depending on the type of situation selected.

Once the test is completed, members of the ICS team and other Eagle Mine officials will evaluate the effectiveness of the response and make recommendations to improve the system. These recommendations will then be incorporated into a revision of the facility Contingency Plan.

Appendix L

Humboldt Mill

Financial Assurance Update

EAGLE MINE LLC CLOSURE AND POST-CLOSURE COST ESTIMATE

	Description	Units	Humboldt Mill	Eagle Mine	Totals	Comments
1	Operation / Site		Humboldt Mill	Eagle Mine		
2	Business Unit		Eagle Mine LLC	Eagle Mine LLC		
3	Functional Currency		USD	USD		
4	Current Day Cost		2014	2014		
5	Expected Operations Completion Date		2022	2022		8.5 years of operations from late 2014 through mid-year (i.e., summer) 2022
6	Expected Closure Completion Date		2024	2024		Minor closure activities to commence mid-year 2021; 2 years of full-time closure activities from mid-year 2022 through mid-year 2024
7	Expected Post-Closure Completion Date		2027	2027		3 years of post-closure activities from mid-year 2024 through 2027
8	Post-Closure Monitoring Completion Date		2044	2044		20 years of post-closure monitoring from through 2044
	Closure Costs					
A	Structural and Equipment Demolition	LS	$ 3,857,433	$ 1,847,081	$ 5,704,514	Includes shut down and removal of equipment utilities; removal of salvageable material from buildings; removal of equipment within buildings; and demolition of structures and buildings to grade
B	Slab and Foundation Excavation	LS	$ 1,229,574	$ 1,035,513	$ 2,265,086	Break-out the slab and foundations (assumes average building slabs of 1 ft and average foundations of 2-3 ft (4-ft max.)) and transport and dispose off-site
C	Equipment and Facilities Decontamination	5%	$ 176,681	$ 89,423	$ 266,103	Assumes 5% of demolition cost for wash-down of equipment and facilities prior to demolition
D	Demolition Debris Transport and Off-site Disposal	LS	$ 258,318	$ 285,634	$ 543,952	Transport & off-site disposal of generated demolition debris (non-slab & foundation)
E	Asphalt and Concrete Removal, Transport and Off-site Disposal	LS	$ 472,742	$ 1,507,438	$ 1,980,180	Asphalt and concrete transport and off-site disposal costs (includes excavation, load, transfer to off-site disposal, and cover to grade)
F	Remediation & Reclamation	LS	$ 545,366	$ 981,989	$ 1,527,355	Subsurface remediation and reclamation costs
G	EPCM (A through F)	10%	$ 654,000	$ 574,700	$ 1,228,700	Engineering, Procurement & Construction Management
H	Monitoring	LS	$ 523,333	$ 1,117,333	$ 1,640,667	2 years based on current annual environmental monitoring budget
I	WTP Operation Labor	LS	$ 520,080	$ 520,080	$ 1,040,160	2 years of wages/benefits based on HR closure costs
J	WTP Operation Materials / Supplies	LS	$ 2,679,920	$ 879,920	$ 3,559,840	2 years of reagents, power, and materials based on operations costs
	Subtotal (A through J)		$ 10,917,447	$ 8,839,110	$ 19,756,557	
	Post-Closure Costs					
K	Monitoring	LS	$ 3,797,000	$ 9,004,000	$ 12,801,000	20 years based on current annual environmental monitoring budget
L	Monitoring System Abandonment	LS	$ 99,965	$ 106,594	$ 206,559	Abandonment of monitoring wells at completion of post-closure monitoring
M	WTP Operation Labor	LS	$ 780,120	$ 780,120	$ 1,560,240	3 years of wages/benefits based on HR closure costs
N	WTP Operation Materials / Supplies	LS	$ 4,019,880	$ 1,319,880	$ 5,339,760	3 years of reagents, power, and materials based on operations costs
	Subtotal (K through N)		$ 8,696,965	$ 11,210,594	$ 19,907,559	
	Total for Project		$ 19,614,412	$ 20,049,704	$ 39,664,116	
O	Contingency (A through N)	10%	$ 1,961,441	$ 2,004,970	$ 3,966,412	Contingency costs for data gaps and unknowns
	Total for Project (includes O)		**$ 21,575,853**	**$ 22,054,675**	**$ 43,630,527**	

Appendix M

Humboldt Mill

Organizational Report

Eagle Mine
a subsidiary of lundin mining

Eagle Mine
4547 County Road 601
Champion, MI 49814, US
P 906-339-7000
F 906-339-7005

Organizational Information

Eagle Mine LLC

March 7, 2014

Registered Address: Eagle Mine LLC
1209 Orange Street
Wilmington, DE 19801

Business Address: Eagle Mine LLC
4547 County Road 601
Champion, MI 49814

Board of Directors

Inkster, Marie	70 Rose Way Markham, ON L3P 3S6 Canada
McRae, Paul M.	11 Pulborough Road Wandsworth London SW18 5UN United Kingdom
Welch, Michael J.	4547 County Road 601 Champion, MI 49814

EAGLE MINE LLC
OFFICERS
SCHEDULE B

Name	Office	Residential Address	Date Appointed
INKSTER, V. Marie	President	70 Rose Way Markham, ON L3P 3S6	July 17, 2013
ROSE, Benjamin D.	Chief Financial Officer	4547 County Road 601 Champion, MI 49814 USA	August 12, 2013
MAGIE, Jinhee	Treasurer	1487 Briarwood Crescent Oakville, ON L6J 2S8	July 17, 2013
DUNCAN, Lesley R.	Interim Secretary	9 Crestwood Dr. Scarborough, ON M1E 1E6	December 4, 2014
WELCH, Mike	General Manager	25 Oak Hill Drive Marquette, Michigan, USA 49855	January 30, 2014